MARROW ED8

Surgery

Comprehensive Question Bank

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Fluids, Electrolytes & Nutrition

Question 1:

What is the normal urine output in adults?

a) 400 mL/day

b) 700 mL/day

c) 1500 mL/day

d) 2500 mL/day

Question 2:

Which parameter is the best guide to monitor the adequacy of fluid resuscitation in a patient?

a) Central venous pressure

b) Urine output

c) Blood pressure

d) Oxygen saturation

Question 3:

A surgery resident during the rounds advised the intern to monitor the burns patient for adequate fluid resuscitation and also instructed him to give a bolus of 10 mL/kg body weight if the patient showed signs of hypoperfusion. All of the following are indications to give bolus fluid, except:

a) Tachycardia

b) Low haematocrit

c) Restlessness

d) Cool peripheries

Question 4:

What is the source of endogenous fluids in the body?

a) Consumed liquids

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b) Reduction of solid foodstuff

c) Oxidation of solid foodstuff

d) Both A and C

Question 5:

A patient with a stab wound to the abdomen underwent an emergency laparotomy. After the damaged intestine was resected, less than 100 cm of jejunum remained and a jejunostomy was made. Which of the following is not true?

a) The patient is a net secretor

b) Water intake should be less than a litre a day

c) Ensure adequate resuscitation with hypotonic fluids

d) Anti-secretory drugs should be administered

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Question 6:

A patient with Crohn's disease has multiple skip lesions in the intestine. Surgical resection of damaged areas is being planned. Removal of which part will cause steatorrhoea?

a) Duodenum

b) Jejunum

c) Ileum

d) Caecum

Question 7:

A 66-year-old diabetic patient with a frail built comes to the OPD. His wife is concerned about his recent weight loss and lack of appetite. Which parameters will you consider while assessing his malnutrition using MUST?

a) 1,3,4,5

b) 1,2,3,4

c) 2,3,4,5

d) 1,2,3,5

Question 8:

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What is the best position for a conscious patient to be in during the insertion of a Ryle's tube?

a) Supine with neck flexion

b) Supine with neck extension

c) Sitting with neck flexion

d) Sitting with neck extension

Question 9:

A patient in your ward is to be started on enteral nutrition. All of the following can be used as means of delivery, except:

a) Sip feeding

b) PEG

c) Nasojejunal tube

d) PICC

Question 10:

A young female patient with dysphagia is started on enteral nutrition. Which of the following complications is least likely to occur in this patient?

a) Constipation

b) Diarrhoea

c) Aspiration pneumonia

d) Hypoglycaemia

Question 11:

Which dietary component is lacking in patients started on TPN?

a) Lipids

b) Carbohydrates

c) Fibers

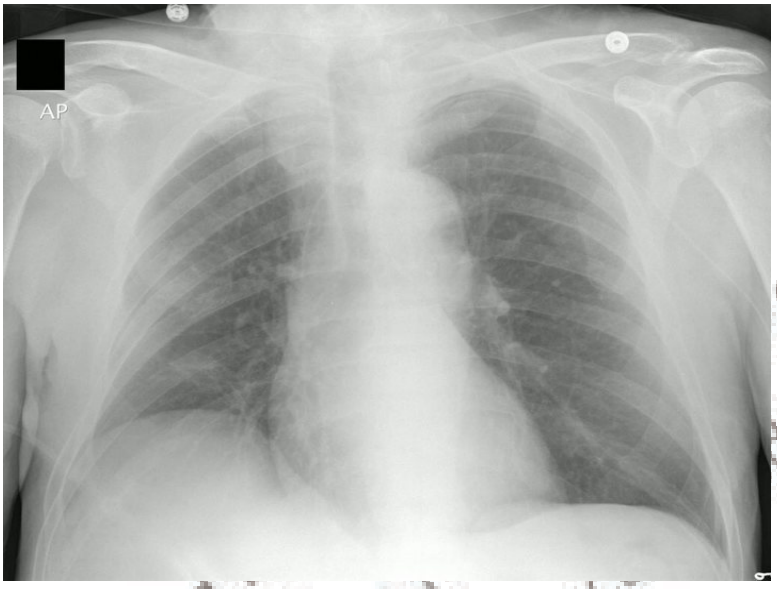
d) Proteins

Question 12:

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A peripherally inserted central catheter line(PICC) was placed in a patient to provide parenteral nutrition. Following the insertion, a chest X-ray was taken, which appeared as shown in the image below. Which of the following is the ideal position of the tip of this catheter?



a) Subclavian vein

b) Internal jugular vein

c) Superior vena cava

d) Inferior vena cava

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Question 13:

You are asked to place a central line for providing parenteral nutrition to a critically ill patient. Which vein is the most suitable?

a) Subclavian vein

b) External jugular vein

c) Brachial vein

d) Internal jugular vein

Question 14:

A patient has been on total parenteral nutrition via a central venous catheter for 5 weeks. All of the following should be done, except:

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a) Monitor for any signs of sudden glucose intolerance

b) Electrolytes must be checked every 2-3 days

c) LFT, BUN must be done once weekly

d) Change central venous catheter tube every two weeks

Question 15:

A patient on total parenteral nutrition may develop a deficiency of _____

a) Vitamin B12

b) Folic acid

c) Amino acids

d) Zinc

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Question 16:

Which of the following fluids contain lactate?

a) Hetastarch

b) Haemacel

c) Hartmann's solution

d) Gelofusine

Question 17:

What is the earliest sign of post-operative volume overload in a patient?

a) Distended neck veins

b) Peripheral oedema

c) Weight gain

d) Increased cardiac output

Question 18:

Ileus is common in patients that have conditions associated with _____

a) Volume deficit

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b) Volume excess

c) Both A and B

d) Bowel edema

Question 19:

Which electrolyte abnormality is expected in patients experiencing a post-operative rise in ADH?

a) Hyperkalemia

b) Hypokalemia

c) Hypernatremia

d) Hyponatremia

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Question 20:

Which of the following is not an important cause of hypokalemia?

a) Hyperaldosteronism

b) Diarrhoea

c) High nasogastric output

d) Metabolic acidosis

Question 21:

A patient with pancreatitis is most likely to have which of the following electrolyte abnormalities ?

a) Hypercalcemia

b) Hypocalcemia

c) Hypernatremia

d) Hyperkalemia

Question 22:

A cachexic patient with a BMI of 14 was brought to a nursing care facility. Calorie-rich food through a nasogastric tube was started. On day 3 of therapy, the patient suddenly developed a

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seizure. An ECG showed dysrhythmia. Which of the following findings is most likely?

a) Hypophosphatemia, hypocalcemia, hypomagnesemia

b) Hypophosphatemia, hypokalemia, hypercalcemia

c) Hypocalcemia, hyperphosphatemia, hypokalemia

d) Hypomagnesemia, hyponatremia, hyperkalemia

Question 23:

Which of the following is not true regarding the Enhanced recovery after surgery (ERAS) protocol?

a) Early planned physiotherapy and mobilization

b) It can be used after colorectal surgery

c) Waiting for one week to start oral feeding

d) Discharge planning is started before the patient is even admitted to hospital

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Answer Key

Question No.	Correct Option
1	c
2	b
3	b
4	c
5	c
6	c
7	a
8	c
9	d
10	d
11	c
12	c
13	a
14	d
15	d

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16	c
17	c
18	a
19	d
20	d
21	b
22	a
23	c

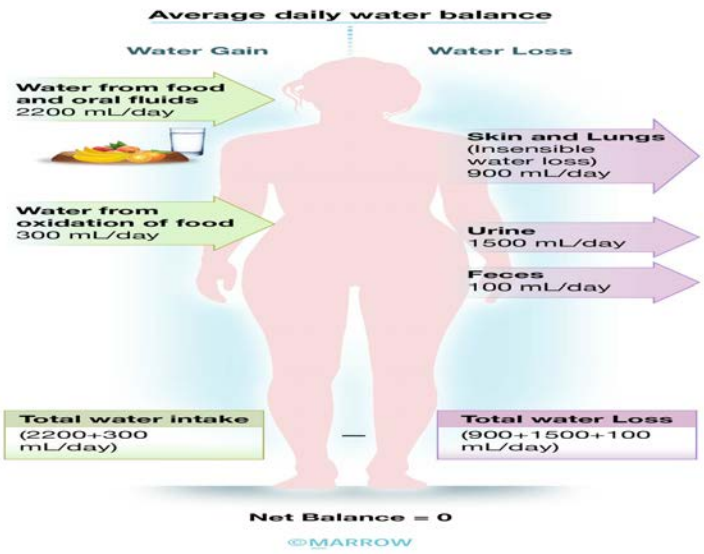
Detailed Explanations

Solution to Question 1:

The average normal urine output is approximately 1500 mL/day. A minimum urine output of 400 mL/day is essential to excrete the end products of protein metabolism.

Fluid loss occurs mainly by four routes:

- Lungs: Approximately 400 mL of water is lost in expired air every 24 hours.
- Skin: In a temperate climate the loss is between 600 and 1000 mL/day.
- Urine: The normal urine output is approximately 1500 mL/day.
- Faeces: About 60 and 150 mL of water are lost daily in patients with normal bowel function.



Solution to Question 2:

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Urine output is the best measure of organ perfusion and the best monitor for adequacy of fluid resuscitation.

Adequate end-organ perfusion is best indicated by urine output of >0.5 to 1 mL/kg/h. However, it does not give a minute-to-minute value.

The level of consciousness is an important marker for cerebral perfusion.

The only clinical indicators of perfusion of the gastrointestinal tract and muscular beds are measures of lactic acidosis (lactate and base deficit) and mixed venous oxygen saturation.

Other options:

Option A: Central venous pressure (CVP) is the mean pressure in the superior vena cava, used for estimation of preload and right atrial pressure. Normal CVP ranges from 2 to 7 mm Hg (3 to 9 cm H2O). A sick or injured patient with a CVP <3 mm Hg is presumed to be volume depleted and may be given fluids with relative safety. However, CVP is unreliable in assessing volume status or left ventricular function with respect to resusitation.

Options C and D: Blood pressure and oxygen saturation do not reflect body fluid levels.

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Solution to Question 3:

A low hematocrit does not indicate a need for fluid resuscitation.

Instead, a high hematocrit is an indicator of hypoperfusion.

Urine output is the best measure to monitor for the adequacy of fluid resuscitation. Urine output should be between 0.5 and 1.0 mL/kg body weight per hour. If the urine output is below this, the infusion rate should be increased by 50%. If the urine output is inadequate and the patient is showing signs of hypoperfusion, then a bolus of 10 mL/kg body weight should be given.

Signs of hypoperfusion include:

• Restlessness with tachycardia,

• Cool peripheries

• High hematocrit

Solution to Question 4:

The source of endogenous fluids for the body is due to oxidation of solid foodstuff.

Fluid is derived from both exogenous and endogenous fluids.

• Exogenous fluids- Water from beverages, water from food, etc

• Endogenous fluids- Water released during oxidation of solid foodstuff

Eg: Glucose + $O_2 \rightarrow CO_2 + H_2O + ATP$

The amount of endogenous fluids formed is normally less than 500 ml in 24 hours. However, during starvation, this amount is supplemented by water released from the breakdown of body

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Solution to Question 5:

Net secretors are patients that have less than 100 cm of residual jejunum and a jejunostomy. They should not be given hypotonic fluids.

The total amount of hypotonic fluids (water) is restricted to less than a liter a day. They are encouraged to take glucose and saline replacement solutions. Solutions that have a sodium concentration of at least 90 mmol/L (e.g.WHO cholera solution) are given. Antisecretory drugs which include H2-receptor antagonists, proton pump inhibitors, and the somatostatin analog octreotide, are also used.

The patients with short bowel syndrome who have had a jejunostomy and more than 200 cm of small bowel resected, are divided into two groups:

• Net absorbers- These patients have more than 100 cm of residual jejunum. They absorb more water and sodium from the diet that passes through the stoma. These patients can be managed without supplementary parenteral fluids.

• Net secretors- These patients have less than 100 cm of residual jejunum. As they lose water and sodium from their stoma, these patients require supplements.

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Solution to Question 6:

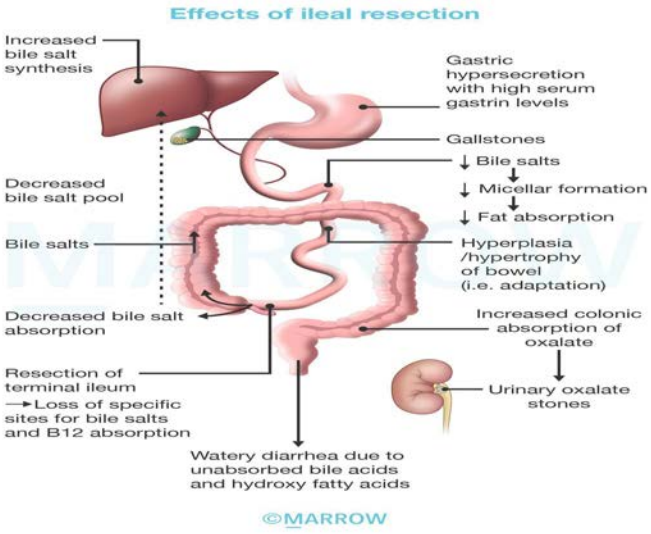
Ileal resection may lead to steatorrhoea.

The ileum is the only site of absorption of vitamin B12 and bile salts. Following resection of the ileum, the loss of bile salts increases and is not met by an increase in synthesis. Depletion of the bile salt pool results in fat malabsorption that presents with steatorrhea.

The efficiency of water absorption in the jejunum is 44% and in the is ileum 70%. Resection of ileum causes reduced conservation of fluid. Loss of bile salts into the colon affects colonic mucosa, causing a reduction in salt and water absorption, which increases stool losses.

Small bowel motility is three times slower in the ileum than in the jejunum. In addition, the ileocaecal valve may slow the transit. Resection of the ileum results in a significant enhancement of gastric motility and acceleration of intestinal transit.

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Solution to Question 7:

Age is not a criterion used in MUST.

Malnutrition Universal Screening Tool (MUST) is a five-step screening tool to identify malnourished adults or adults at risk of malnutrition.

Solution to Question 8:

The best position for a conscious patient to be in during the insertion of Ryle's tube (RT) is sitting with neck flexion. The described position helps in directing the RT towards the esophagus and also prevents it from coiling in the oropharynx or entering the trachea.

RT, also known as nasogastric (NG) tube, measures 120-125 cm. It has 4 markings at 40cm (cardia), 50cm (body), 60cm (pylorus), and 70 cm (duodenum) to indicate the approximate position after the placement.

Indications for NG tube:

• Feeding in patients with dysphagia, decreased appetite, or those who are nil per os (NPO) for medical or surgical reasons.

• Aspiration of gastric fluid

• Gastric decompression in cases of intestinal obstruction and paralytic ileus.

• Zollinger-Ellison syndrome

• Bowel irrigation

The absolute contraindications for an NG tube are severe midface trauma, recent nasal surgery, and basilar skull fractures

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Steps for the correct insertion of RT in an adult:

• Examination of the patient's nostril for any anatomical abnormalities and then instillation with 10 ml of 1% lignocaine

• NEX method is used to measure the length of the RT: Place the exit port of the tube at the tip of the nose. Extend the tube to the earlobe, and then to the xiphisternum.

• The patient is asked to sit upright with partial neck flexion. The tip of the Ryle's tube is lubricated and passed along the floor of the nasal passage until a resistance is felt(corresponds to nasopharynx)

• The patient is subsequently asked to swallow water to guide the tube through the esophagus into the stomach until the marked length (based on the NEX method).

• NG tube is finally taped to secure it in place.

Confirmation of the correct position is done by:

• Auscultation in the epigastric area while injecting a bolus of air

• X-ray chest to locate the lead markers

• Aspiration of contents and subsequently confirming gastric origin (pH <6 indicates gastric placement)



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Solution to Question 9:

A peripherally inserted central venous catheter (PICC) line is used for providing parenteral nutrition.

The term enteral feeding means the delivery of nutrients into the gastrointestinal tract. This can be achieved with oral supplements (sip feeding) or with a variety of tube-feeding techniques such as nasogastric tubes (Ryle's), fine-bore feeding tubes, surgical or percutaneous endoscopic gastrostomy (PEG).

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Solution to Question 10:

The complication least likely to occur in a patient with enteral feeding is hypoglycemia.

Metabolic complications related to decreased or increased feeding are commonly seen in total parenteral nutrition.

Complications of enteral nutrition

1. Tube-related (most common):

• Malposition

• Displacement

• Blockage

• Breakage/leakage

• Local complications (e.g. erosion of skin/mucosa)

2. Gastrointestinal:

• Diarrhoea

• Bloating, nausea, vomiting

• Abdominal cramps

• Aspiration

• Constipation

3. Metabolic/biochemical:

• Electrolyte disorders

• Vitamin, mineral, trace element deficiencies

• Drug interactions

4. Infective:

• Exogenous (handling contamination)

• Endogenous (patient)

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Solution to Question 11:

Fibers are not included in total parenteral nutrition.

Total enteral or parenteral nutrition necessitates the provision of the macronutrients, carbohydrates, fat and protein, together with vitamins, trace elements, electrolytes, and water.

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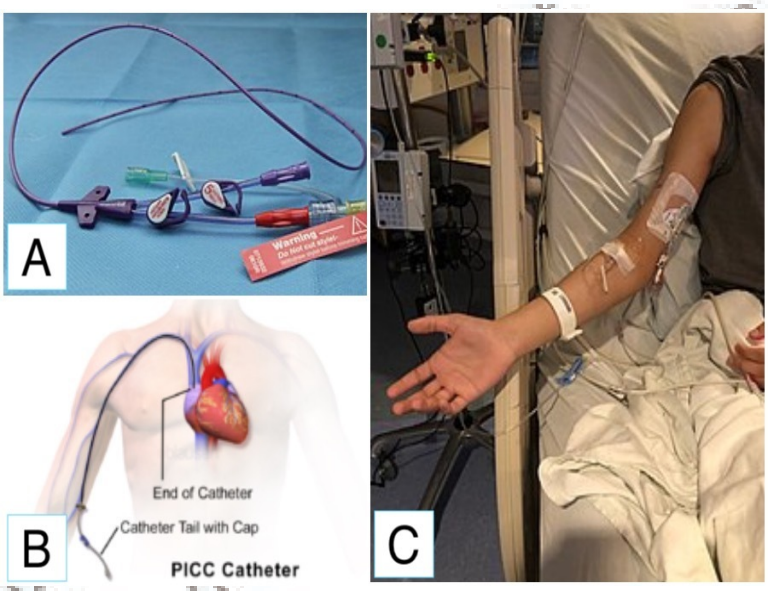
Solution to Question 12:

The ideal position of the tip of a peripherally inserted central catheter (PICC) line, is superior vena cava.

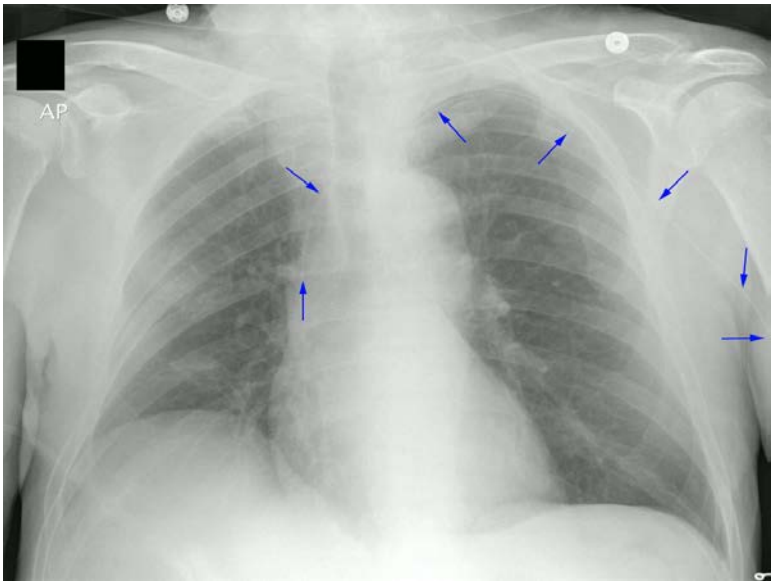
Peripherally inserted central catheters are commonly used for providing parenteral nutrition therapy. They are inserted through veins in the upper arm, and guided into the central venous system, such that the tip of the catheter enters the superior vena cava. A chest X-ray is taken to confirm the position of the tip.

PICC lines have the advantage of minimizing inconvenience to the patients and clinicians. However, if the patient develops thrombophlebitis, the PICC line may be destroyed.

The image below shows (A) a typical PICC line (B) an illustration showing insertion of PICC line (C) a patient with PICC line inserted through the upper arm.



The image below shows the chest X-ray confirming the position of the tip of the PICC line (arrows), in the superior vena cava.



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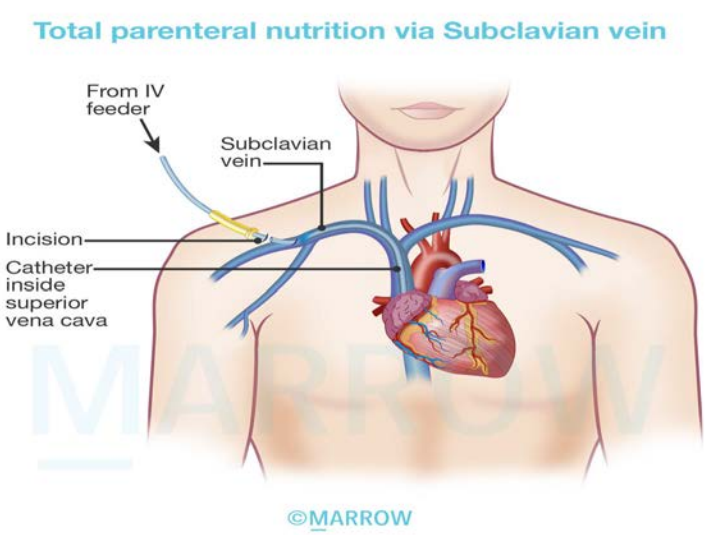
Solution to Question 13:

The subclavian vein is considered the most suitable vein for parenteral nutrition, as the catheter lies flat on the chest wall, which optimizes nursing care. Moreover, the rate of infection with subclavian venous access is lowest when compared to jugular access and femoral access.

Disadvantages of subclavian vein central venous access:

• Subclavian vein stenosis

• Pneumothorax



Solution to Question 14:

A central venous catheter is changed only if the infection is suspected or the catheter is blocked. It need not be changed every 2 weeks.

Total parenteral nutrition (TPN), also referred to as central parenteral nutrition, requires access to a large-diameter vein to deliver the entire nutritional requirements of the individual.

The dextrose content of the solution given is high (15% to 25%). All macronutrients and micronutrients are deliverable by this route.

To monitor or prevent complications, the following steps may be taken:

• Infections

• Use subclavian vein preferably

• Monitor development of glucose intolerance as it is the earliest sign of systemic sepsis

• Metabolic complications

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• BUN and LFTs weekly

• Serum electrolytes every 2-3 days

• Intestinal atrophy

• Provide at least some nutrients enterally if feasible

Solution to Question 15:

A patient on total parenteral nutrition (TPN) may develop a deficiency of zinc, among others.

The commencement of TPN may precipitate or accentuate underlying nutrient deficiency by encouraging anabolism.

Complications of TPN:

• Infections

• Highest risk - femoral vein

• Lowest risk - subclavian vein

• Metabolic complications

• CO_2 retention and respiratory insufficiency due to excess calorie infusion

• Hepatic steatosis and marked glycogen deposition

• Cholestasis and gallstones

• Intestinal atrophy

• Mucosal atrophy

• Bacterial overgrowth

• Impaired gut immunity

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Solution to Question 16:

Ringer's lactate (sodium lactate solution) or Hartmann's solution is a mixture of sodium chloride, sodium lactate, potassium chloride, and calcium chloride in water.

It is used for replacing fluids and electrolytes in those who have low blood volume or low blood pressure and to treat metabolic acidosis in cases other than those caused by lactic acidosis. It is also used to wash the eye following a chemical burn.

The following table shows the composition of crystalloid and colloid solutions in (mmol/L).

*Composition of Gelofusine is incorrect in Bailey 27th edition.

Solution	Na	K	Ca	Cl	Lactate	Colloid
Hartmann's	131	5	2	111	29	

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Solution	Na	K	Ca	Cl	Lactate	Colloid
Normal saline (0.9% NaCl)	154			154		
Dextrose saline (4% dextrose in 0.18% saline)	30			30		
Gelofusine*	154			120		Gelatin 4%
Haemacel	145	5.1	<1	145		Polygelin 75 g/L
Hetastarch						Hydroxyethyl starch 6%

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Solution to Question 17:

The earliest sign of volume overload in a patient is weight gain.

The administration of isotonic fluids in excess of actual needs commonly results in excess volume expansion. This may be due to the overestimation of third-space losses or due to ongoing GI losses that are difficult to measure accurately.

The average postoperative patient who is not receiving nutritional support should lose approximately 0.11 to 0.23 kg/day from catabolism.

Other signs of volume overload include:

Cardiac:

• Increased cardiac output

• Increased central venous pressure

• Distended neck veins

• Murmur

GI: Bowel edema

Pulmonary: Pulmonary edema

Solution to Question 18:

Ileus may occur in conditions associated with volume deficit.

Ileus is a disruption of the normal propulsive ability of the gastrointestinal tract. The term is usually restricted to those disruptions caused by the failure of peristalsis, rather than by mechanical obstruction. Hypoperfusion to the bowel in a volume deficit state may result in ileus.

The following table shows various signs and symptoms, in general, in conditions associated with volume deficit or overload.

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System	Volume deficit	Volume overload
General	Weight loss,Decreased skin turgor	Weight gain,Peripheral edema
Cardiac	Tachycardia, orthostasis/hypotension,Collapsed neck veins	Increased cardiac output and central venous pressure,Distended neck veins,Murmurs
Renal	Oliguria, Azotemia	Nothing specific
GI	Ileus	Bowel edema
Pulmonary	Nothing specific	Pulmonary edema

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Solution to Question 19:

The post-operative rise in ADH (Antidiuretic hormone) may result in hyponatremia.

Postoperative patients are usually prone to increased secretion of ADH, which causes an increase in reabsorption of free water from the kidneys resulting in volume expansion and hyponatremia.

Dilutional hyponatremia occurs when there is an excess of extracellular water relative to sodium. However, it is self-limiting as both hyponatremia and volume expansion causes a decrease in ADH secretion.

Solution to Question 20:

Hypokalemia may occur as a result of metabolic alkalosis, not metabolic acidosis.

The following are various causes of hypokalemia:

• Inadequate intake

• Diet, potassium-free intravenous fluids, potassium deficient TPN

• Excessive potassium excretion

• Hyperaldosteronism

• Medications

• Potassium losses

• Direct loss of potassium from GI fluid (diarrhea)

• Renal loss of potassium (to conserve sodium in response to gastric losses)

• Metabolic

• Intracellular potassium shifts from metabolic alkalosis or insulin therapy

Vomiting leads to hypokalemia via complex pathogenesis. The gastric fluid itself contains little potassium, approximately 10 mEq/L. However, vomiting produces volume depletion and metabolic alkalosis.

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Volume depletion leads to secondary hyperaldosteronism leads to enhanced cortical collecting tubule secretion of potassium in response to enhanced sodium reabsorption. Metabolic alkalosis further increases potassium secretion by the collecting tubule due to the decreased availability of hydrogen ions.

Solution to Question 21:

Pancreatitis may lead to hypocalcemia.

This is because inflammation of the pancreas, may lead to sequestration of the calcium via chelation with free fatty acids.

Other causes of hypocalcemia:

- Massive soft tissue infections such as necrotizing fasciitis
- Renal failure
- Pancreatic and small bowel fistulas
- Hypoparathyroidism
- Toxic shock syndrome
- Abnormalities in magnesium levels
- Tumor lysis syndrome

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Solution to Question 22:

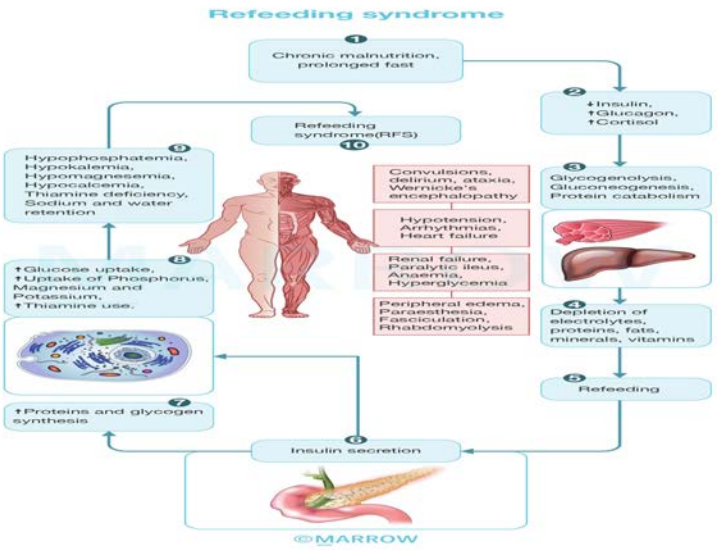
The clinical scenario is suggestive of refeeding syndrome which results in hypophosphatemia, hypocalcemia, and hypomagnesemia.

Refeeding syndrome is a potentially fatal condition that may occur due to rapid and excessive feeding of patients with severe underlying malnutrition due to starvation, alcoholism, delayed nutritional support, anorexia nervosa, or massive weight loss in obese patients.

With refeeding, a shift in metabolism from fat to carbohydrate substrate stimulates insulin release, which results in the cellular uptake of electrolytes, particularly phosphate, magnesium, potassium, and calcium. These electrolyte disorders can result in altered myocardial function, arrhythmias, deteriorating respiratory function, liver dysfunction, seizures, confusion, coma, tetany, and death.

Severe hyperglycemia may result from blunted basal insulin secretion. It can occur with either enteral or parenteral nutrition but is more common with the latter.

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Solution to Question 23:

Waiting for one week to start oral feeding is not a part of the ERAS protocol.

Enhanced recovery after surgery (ERAS) is an approach designed to speed the clinical recovery of the patient and reduce the cost and length of stay in the patient.

It is achieved by optimizing the patient's health before surgery and then delivering evidence-based best care in the perioperative period. It includes:

- Early planned physiotherapy and mobilisation
- Early oral hydration and nourishment
- Adequate pain control using regular paracetamol, NSAIDs, epidural and nerve blocks
- Discharge planning is started before the patient is admitted to hospital and involves support from stoma care nurses, physiotherapist.
- Early removal of ryles tube and early feeding techniques

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Shock and Blood Transfusion

Question 1:

Which of the following is the most common type of shock:

a) Hypovolemic

b) Cardiogenic

c) Obstructive

d) Distributive

Question 2:

A patient is treated for hypovolemic shock following a motor vehicle collision. Which of the following is not a compensatory mechanism that is anticipated to occur in this patient?

a) Reduced perfusion to the skin

b) Reduced perfusion to the kidneys

c) Reduced perfusion to the GI tract

d) Reduced perfusion to the muscles

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Question 3:

A 35-year-old male patient was brought to the emergency department following a road traffic accident. On examination, he had multiple injuries over his body and was found to be in class II hemorrhagic shock. The percentage of blood loss would be between:

a) 5–15%

b) 10–20%

c) 15–30%

d) 20–40%

Question 4:

Following a road traffic accident, a 23-year-old man presents with breathlessness. On examination, he has hypotension and distended neck veins. On auscultation, muffled heart

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sounds are heard. What is this condition primarily associated with?

a) Hypovolemic shock

b) Cardiogenic shock

c) Obstructive shock

d) Distributive shock

Question 5:

A 35-year-old man sustained a spinal cord injury as a result of a road traffic accident. On examination, his blood pressure is found to be 90/60 mmHg. All of the following findings can be seen in the patient except?

a) Tachycardia

b) Warm extremities

c) Decreased venous return

d) Increased vascular capacitance

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Question 6:

Modified shock index is calculated using?

a) HR/SBP

b) HR/DBP

c) HR/MAP

d) PR/SBP

Question 7:

The peripheral vascular resistance is decreased in _____

a) Hypovolemic shock

b) Cardiogenic shock

c) Obstructive shock

d) Distributive shock

Question 8:

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A patient who was admitted with third-degree burns presents with light-headedness and oliguria on the third day of admission. On examination, the peripheries are warm and capillary refill is brisk. His pulse rate is 138/min. In which of the following types of shock do you see this presentation?

a) Hypovolemic shock

b) Septic shock

c) Cardiogenic shock

d) Endocrine shock

Question 9:

An 82-year-old man with a history of recurrent urinary tract infection presents with fever, tachypnea, and tachycardia. On examination, he appears confused and has hypotension. Which of the following is used as the initial treatment for his condition?

a) Vasopressors

b) Blood transfusion

c) Crystalloids

d) Inotropic agents

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Question 10:

You are a medical officer at the blood bank and receive several units of packed RBCs, platelets, fresh frozen plasma, and cryoprecipitate following a blood donation camp. Which among the following components would you want to use at the earliest?

a) Packed RBCs

b) Fresh frozen plasma

c) Cryoprecipitate

d) Platelets

Question 11:

A patient with a history of esophageal varices presents with hematemesis. What is the optimal level of hemoglobin to be maintained in this patient through blood transfusions?

a) 7 gm/dL

b) 6 gm/dL

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c) 9 gm/dL

d) 8 gm/dL

Question 12:

A 33-year-old male patient was transfused with 2 units of fresh frozen plasma following a road traffic accident. Within 2 hours of the transfusion, he became breathless and his oxygen saturation dropped to 88%. Chest X-ray showed batwing appearance. This condition occurs due to which of the following?

a) Preformed cytokines

b) Infusion of contaminated blood

c) Anti-HLA Ab

d) Preformed IgM Ab to ABO Ag

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Question 13:

A 60-year-old male who is on warfarin prophylaxis for atrial fibrillation presents with massive uncontrolled haemorrhage following a fall from height. Which of the following blood components can be used for emergency reversal of warfarin therapy in this patient?

a) Cryoprecipitate

b) Prothrombin complex concentrates

c) Fresh-frozen plasma

d) Platelets

Question 14:

Cryoprecipitate is stored at a temperature of _____

a) -20 °C

b) -30 °C

c) -40 °C

d) -50 °C

Question 15:

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A 22-year-old male patient was brought to the emergency room following a road traffic accident. Upon arrival, the patient was unconscious with blood pressure of 90/64 mmHg and a pulse rate of 139 per minute. He was immediately transfused with 4 units of packed RBCs. All of the following complications can occur in this patient except:

a) Hypercalcemia

b) Hyperkalemia

c) Hypokalemia

d) Metabolic alkalosis

Question 16:

A young patient is brought to the emergency room following a motorcycle collision. On examination, the patient is drowsy and has decreased blood pressure due to bleeding from multiple injuries. 1 unit of packed RBCs has been obtained from the blood bank. What is the correct procedure for blood transfusion?

a) The blood should be brought to room temperature before the transfusion

b) Transfusion should be started within one hour of removal from the refrigerator

c) Transfusion of PRBC should be completed within 4 hours

d) The rate of transfusion of PRBC is 50mL per hour

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Question 17:

A patient with a road traffic accident presented to the emergency room and requires a large amount of fluids to be transfused. Which of the following IV cannula is preferred?

a) Green

b) Blue

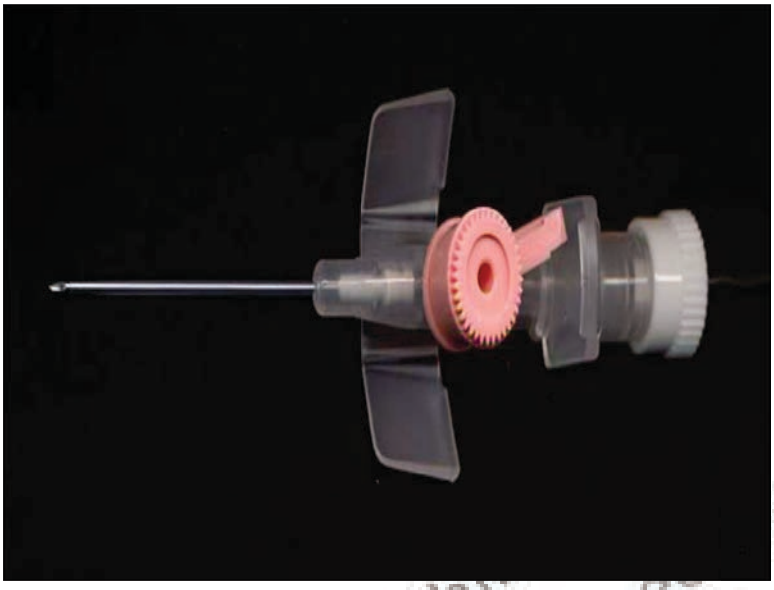
c) Pink

d) Grey

Question 18:

What is the size of the cannula shown in the below image?

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a) 16 G

b) 18 G

c) 20 G

d) 22 G

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Question 19:

Which of the following is not a component of qSOFA?

a) Respiratory rate ° 22/min

b) Systolic BP ≤100 mm Hg

c) Altered mental status

d) Bilateral pupillary reflex

Question 20:

All of the following are features of SIRS except:

a) Temperature > 38 degrees Celsius

b) Respiratory Rate > 20/minute and PaCO2 <35 mmHg

c) Pulse rate > 90/minute

d) WBC > 12000/mm3 or < 4000/mm3

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Answer Key

Question No.	Correct Option
1	a
2	b
3	c
4	c
5	a
6	c
7	d
8	b
9	c
10	d
11	d
12	c
13	b
14	b
15	a
16	c
17	d
18	c
19	d
20	b

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Detailed Explanations

Solution to Question 1:

Hypovolemic shock is the most common type of shock and to some degree is a component of all other types of shock.

Shock is defined as a systemic state of low tissue perfusion which is inadequate for normal cellular respiration.

Shock can be classified as follows:

Shock	Inciting mechanism
Hypovolemic shock	Reduced circulating blood volume(eg., hemorrhage, dehydration)

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Shock	Inciting mechanism
Cardiogenic shock	Failure of the cardiac pump(eg., myocardial infarction, cardiac dysrhythmias)
Obstructive shock	Mechanical obstruction of cardiac filling(eg., cardiac tamponade, tension pneumothorax)
Distributive shock	Systemic vasodilation leading to organ hypoperfusion(eg., anaphylaxis due to histamine release, sepsis due to the release of bacterial products, spinal cord injury due to sympathetic failure)
Endocrine shock	Combination of hypovolemic, cardiogenic or distributive shock.(eg., hypo and hyperthyroidism, adrenal insufficiency)

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Solution to Question 2:

The compensatory mechanism in shock reduces the perfusion to the skin, muscle and gastrointestinal tract and not to the kidney.

As shock progresses, the body's cardiovascular and endocrine compensatory responses reduce the blood flow to non-essential organs by vasoconstriction. This occurs in order to preserve preload and flow to the kidneys, lungs and brain.

Solution to Question 3:

The percentage of blood loss in class II hemorrhagic shock is 15–30%, which amounts to a loss of 750–1500 mL of blood.

The class II hemorrhagic shock is considered as a mild shock with heart rate more than 100. It is associated with orthostatic hypotension, and the patient is usually anxious at this stage.

Solution to Question 4:

The given clinical scenario of Beck's triad (hypotension, distended neck veins, and muffled heart sounds) is seen in cardiac tamponade. Shock due to cardiac tamponade is primarily an example of obstructive shock.

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Obstructive shock is characterized by a reduction in preload due to mechanical obstruction of the cardiac filling of the left and/or right sides of the heart, which in turn leads to fall in cardiac output. Common causes of obstructive shock include:

• Cardiac tamponade

• Tension pneumothorax

• Massive pulmonary embolus or air embolus

Cardiogenic shock is due to primary failure of the heart to pump blood. It may be due to myocardial depression as a result of infarction, cardiomyopathy, blunt myocardial injury. Patients with cardiac tamponade may eventually develop cardiogenic shock as the myocardium is stressed against the obstruction.

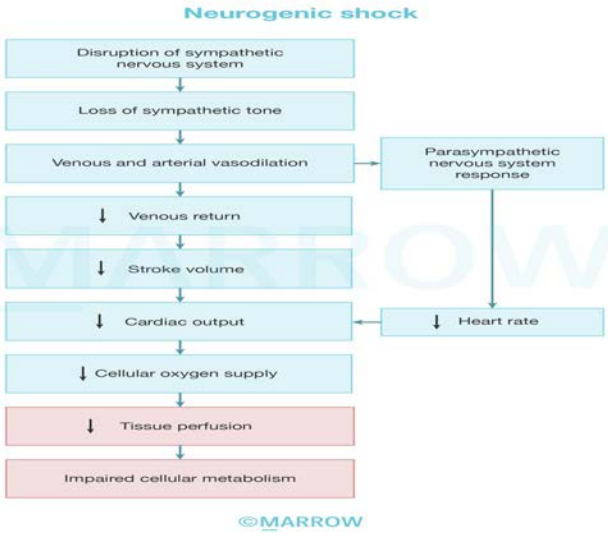
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Solution to Question 5:

The clinical scenario of the presence of hypotension associated with the spinal cord injury is suggestive of neurogenic shock. It is associated with bradycardia and not tachycardia.

Neurogenic shock refers to reduced tissue perfusion due to loss of vasomotor tone to peripheral arterial beds.

Neurogenic shock is usually secondary to spinal cord injuries due to vertebral body fractures of the cervical or high thoracic region that disrupts the sympathetic regulation of peripheral vascular tone. Loss of vasoconstrictor impulses results in increased vascular capacitance, decreased venous return and decreased cardiac output.



The classic description of neurogenic shock consists of:

• Hypotension associated with bradycardia (absence of reflexive tachycardia due to disrupted sympathetic discharge)

• Warm extremities (due to loss of peripheral vasoconstriction)

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• Motor and sensory deficits indicative of a spinal cord injury

• Radiographic evidence of a vertebral column fracture

Solution to Question 6:

• Modified shock index = HR/MAP

• Original shock index = HR/SBP

The shock index is a hemodynamic stability indicator. In patients with shock, it is a better predictor of mortality than blood pressure or heart rate alone. A shock index >0.9 is indicative of higher mortality.

The modified shock index is a more sensitive indicator of tissue perfusion than the original shock index. In critically ill patients, the DBP decreases earlier than SBP, hence, the modified shock index using MAP is better suited to assess the severity of shock.

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Solution to Question 7:

The peripheral vascular resistance is decreased in distributive shock.

It is the condition of reduced oxygen delivery where the primary physiologic disturbance is a reduction in systemic vascular resistance. It is unique among the types of shock in that there is a compensatory increase in cardiac output. The most common cause of distributive shock is sepsis.

The causes of vasodilatation in various types of distributive shock:

The following Table shows cardiovascular and metabolic characteristics of different types of shock.

Type of distributive shock	Cause of vasodilatation
Septic shock	Release of bacterial products (endotoxin) and the activatio n of cellular and humoral co mponents of the immune sys tem.
Anaphylactic shock	Histamine release
Neurogenic shock (spinal cor d injury)	Failure of sympathetic outflo w and adequate vascular tone

	Hypovole mia	Cardioge nic	Obstructi ve	Distributive
Cardiac output	Low	Low	Low	High (in septic and anaphyla ctic shock)Low (in neurogeni c shock)
Vascular resistance	High	High	High	Low

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	Hypovolemia	Cardiogenic	Obstructive	Distributive
Venous pressure	Low	High	High	Low
Mixed venous saturation	Low	Low	Low	High
Base deficit	High	High	High	High

Solution to Question 8:

The given clinical presentation is seen in septic shock.

In distributive (septic) shock, the peripheries are warm and capillary refill will be brisk, despite the profound shock.

In early stages (compensated stage) of septic shock, the patient has clammy, warm peripheries. The latter is a distinct feature from other types of shock where peripheral vasoconstriction leads to cold peripheries. The patient will have decreased vascular resistance, inadequate afterload, abnormally high cardiac output, and tachycardia.

In the later stages (uncompensated phase) of septic shock, there is reduced venous return, preload, and reduced cardiac output with low blood pressure.

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Solution to Question 9:

The given clinical scenario is suggestive of septic shock. Crystalloids are the initial fluid of choice in the resuscitation of severe sepsis and septic shock.

Septic shock is also known as vasodilatory shock (But remember vasopressors are not the first line).

Management protocol for septic shock:

Step 1: Immediate evaluation - Securing the airway (if indicated) and correcting hypoxemia and establishing venous access for the early administration of fluids and antibiotics are priorities in the management of patients with sepsis and septic shock.

Step 2: Initial resuscitative therapy - aggressive administration of intravenous fluids (IVF), usually crystalloids are given at 30 mL/kg (actual body weight) within the first three hours following the presentation. Empirical antibiotic therapy started within first hour.

Step 3: Intravenous vasopressors are useful in patients who remain hypotensive despite adequate fluid resuscitation or who develop cardiogenic pulmonary edema.

Vasopressor agents such as phenylephrine, noradrenaline are indicated in distributive shock states which include septic shock, neurogenic shock, etc. where there is peripheral vasodilatation, and a low systemic vascular resistance, leading to hypotension. But they are not the first-line treatment.

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Solution to Question 10:

Platelets have a shelf life of only 5 days and hence they have to be used at the earliest.

They are usually stored on a special agitator at 20–24 °C. They are given to the patients with thrombocytopenia or with platelet dysfunction who are bleeding or undergoing surgery.

Packed cells (PRBCs) are stored in a SAG-M solution (saline–adenine–glucose–mannitol) and has a shelf life of 42 days at 2–6 °C. (Older storage regimens included storage in CPD – citrate–phosphate–dextrose solutions which have a shelf life of 2–3 weeks.)

Fresh frozen plasma (FFP) is stored at –40 to –50°C, while cryoprecipitate is stored at -30°C, and both have a shelf life of one years.

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Solution to Question 11:

The optimal level of Hb to be maintained, in this case, is 8 gm/dL.

The indications for blood transfusion are as follows:

• Acute blood loss: To replace circulating volume and maintain oxygen delivery.

• Perioperative anemia: To ensure adequate oxygen delivery during the perioperative phase.

• Symptomatic chronic anemia: without hemorrhage or impending surgery.

Haemoglobin level (g/dL)	Indications
<6	Probably will benefit from transfusion
6–8	Transfusion unlikely to be of benefit in the absence ofbleedingor impending surgery
>8	No indication for transfusion in the absence of other risk factors

Solution to Question 12:

The given clinical scenario is suggestive of transfusion-related acute lung injury (TRALI). The presence of antibodies against the Human Leukocyte antigen (Anti-HLA Ab) in the donor blood is implicated in the development of TRALI.

TRALI is defined as an acute lung injury that is temporally related to blood transfusion and causes non-cardiogenic pulmonary edema. It occurs within the first six hours following a transfusion. Screening for HLA antibodies has been introduced to prevent TRALI.

TRALI usually results from the transfusion of donor plasma that contains high-titer anti-HLA class II antibodies that bind to recipient leukocytes. The leukocytes aggregate in the pulmonary

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vasculature and release mediators that increase capillary permeability. Testing the donor's plasma for anti-HLA antibodies can support this diagnosis.

The implicated donors are frequently multiparous women. The transfusion of plasma from male and nulliparous women donors reduces the risk of TRALI.

Solution to Question 13:

Prothrombin Complex Concentrates (PCCs) are indicated for the emergency reversal of anticoagulant (warfarin) therapy in uncontrolled hemorrhage.

PCCs are highly purified concentrates prepared from pooled plasma. They contain factors II, IX and X. Factor VII may be included or produced separately.

Fresh frozen plasma and platelets are used in management of coagulopathy. Fresh frozen plasma is used if prothrombin time (PT) or partial thromboplastin time (PTT) >1.5 times normal. Platelets are transfused if platelet count <50 x103/ul.

However, in the presence of non-surgical haemorrhage these tests take time to arrange and may underestimate the degree of coagulopathy.

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Solution to Question 14:

Cryoprecipitate is a supernatant precipitate of FFP (fresh frozen plasma) and is rich in factor VIII and fibrinogen.

It is stored at –30 °C and has a shelf life of two years. It is given in low fibrinogen states or factor VIII deficiency.

Solution to Question 15:

The complication of massive transfusion includes hypocalcemia, not hypercalcemia.

The lethal triad of massive transfusion includes acidosis, hypothermia, and coagulopathy. Other complications which can be seen in massive transfusion are:

- Hypocalcaemia
- Hyperkalemia
- Hypokalemia
- Hypomagnesemia

Solution to Question 16:

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The transfusion of packed RBCs (PRBC) should be completed within a maximum period of 4 hours after the removal from the blood fridge.

There is an increased risk of bacterial proliferation and loss of the function of blood components after they are removed from the storage temperatures. Hence, the transfusion should be started within 30 minutes of receiving the components from the blood bank. The packed RBCs should be infused at a rate of 100-150mL/hour. Warming of blood is not needed when the transfusion is at normal rates. The transfusion should be completed within a maximum period of 4 hours.

Duration times for transfusion		
Blood products	Start transfusion	Complete transfusion
Whole blood / PRBC	Within 30 minutes of removing from refrigerator	≤ 4 hoursDiscard unit if this period is exceeded
Platelet concentrate	Immediately	Within 30 minutes
Fresh frozen plasma	As soon as possible	Within 30 minutes
Cryoprecipitate	As soon as possible	Within 30 minutes

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Solution to Question 17:

Grey coloured IV cannula is required for this patient in order to transfuse large amount of fluids.

The ATLS 10th edition guidelines state that 2 cannulae of atleast 18G should be used to gain vascular access in trauma patients. In this scenario requiring large fluid transfusions, the grey (16G) cannula would be preferable to the green (18G) cannula due to the higher flow rate.

Solution to Question 18:

The given cannula is 20 gauge IV cannula as its color code is pink.

Solution to Question 19:

Sepsis is defined as a “life-threatening organ dysfunction due to a dysregulated host response to infection.” It lies in the continuous spectrum between infection and septic shock.

qSOFA score (quickSOFA) is a bedside prompt that may identify patients with suspected infection who are at greater risk for a poor outcome outside the intensive care unit (ICU).

It uses three criteria, assigning one point each for

• low blood pressure (SBP≤100 mmHg),

• high respiratory rate (° 22 breaths per min)

• altered mentation (Glasgow coma scale, <15).

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The score ranges from 0 to 3 points. The presence of 2 or more qSOFA points is a simple prompt to identify infected patients outside the ICU who are likely to develop sepsis.

The primary method to evaluate the risk of organ dysfunction (sepsis) in patients with suspected infection is by determining the Sequential (sepsis-related) organ failure assessment (SOFA) score; which includes assessment of:

• Circulation - Systolic BP & need for vasopressors; platelet count

• Respiration - PaO2/FiO2 & need for mechanical ventilation

• Mentation - Glasgow Coma Score

• Hepatic function - Bilirubin

• Renal function - Creatinine

Organ dysfunction is identified by a SOFA score of ° 2

The SOFA score is limited by its requirement of multiple laboratory tests which makes it complex and time-consuming. In order to simplify the scoring process, the "Sepsis - 3" task force recommended the quick sepsis-related organ dysfunction assessment "qSOFA" score.

SOFA Vs qSOFA :

• SOFA is a more comprehensive and accurate scoring system which is particulary superior to qSOFA in the ICU setting.

• qSOFA is a simplified derivative of SOFA for bedside assessment of individuals at risk for sepsis particularly useful outside the ICU. setting (i.e. ward / emergency department). However, note that it was originally designed as predictive tool that calculates the risk of death from sepsis rather than a diagnostic tool.

Thereby, the best description of sepsis based on "Sepsis -3" task force recommendations would be :

• Suspected or documented infection with SOFA score ° 2 Or

• Suspected or documented infection with qSOFA score ° 2

Another score that has been used is the NEWS(National Early Warning Score). It ranges from 0 to 20 and is based on respiratory rate, oxygen saturation, use of supplemental O2, temperature, systolic blood pressure, pulse rate and level of consciousness. ° 5 out of 20 is considered a positive score.

Other scoring systems for sepsis:

The Systemic Inflammatory Response Syndrome (SIRS) score is no longer recommended as is it not specific to infection.

The Logistic Organ Dysfunction System (LODS) score is not recommended as it is complex and has too many variables.

Solution to Question 20:

Respiratory Rate > 20/minute or (Not and) PaCO2 < 32 mmHg (Not <35 mmHg) would be a feature of SIRS (Systemic inflammatory response syndrome).

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Systemic inflammatory response syndrome (SIRS) is an exaggerated defense response of the body to a noxious stressor (infection, trauma, surgery, acute inflammation, ischemia, or reperfusion) to localize and then eliminate the endogenous or exogenous source of the insult.

SIRS is diagnosed when any two of the following are present:

• Hyperthermia (>38 Degree Celsius) or Hypothermia (<36 Degree Celsius)

• Tachypnoea (>20/min) or PaCO2 < 32 mmHg

• Tachycardia (>90/min)

• White cell count >12 x 109/liter or <4 x 109/liter or >10% Band forms

Sepsis is SIRS with a documented infection.

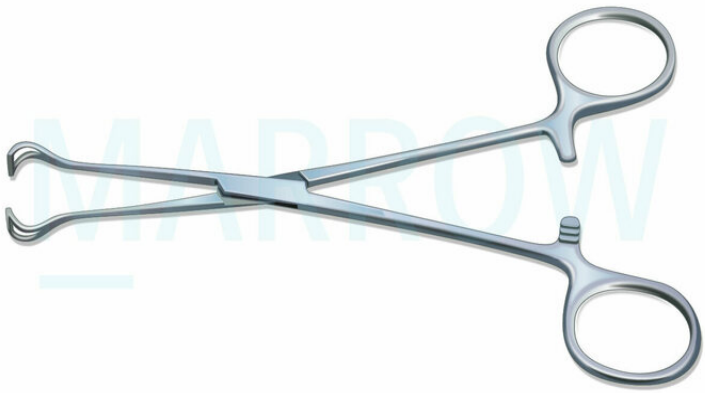
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Instruments & Sutures

Question 1:

Identify the instrument:



a) Allis tissue forceps

b) Babcock's forceps

c) Lane's tissue holding forceps

d) Kocher's hemostatic forceps

Question 2:

For which of the following would you use the instrument shown in the image?

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a) 1,2 and 4

b) 1 and 3

c) 3,4 and 5

d) 1,2 and 3

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Question 3:

You notice your surgery resident use the given instrument to remove gall stones. Identify the instrument.



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a) Sponge holding forceps

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b) Desjardin's choledocholithotomy forceps

c) Blake's gall stone forceps

d) Tischler forceps

Question 4:

For what purpose would you use the instrument shown in the image?



a) To carry out blunt dissection

b) To clamp bleeding vessels

c) To hold structures like bowel

d) To hold tough tissue like skin and fascia

Question 5:

Identify the instrument:

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a) Doyen's retractor

b) Doyen's mouth gag

c) Doyen's intestinal occlusion clamp

d) Joll's thyroid retractor

Question 6:

Identify the instrument given in the image below:



a) Deaver's retractor

b) Morris retractor

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c) Czerney's retractor

d) Double hook retractor

Question 7:

Which of the following instruments would be best suited to retract the liver out of the field of operation while performing an open cholecystectomy?



a) 2

b) 1

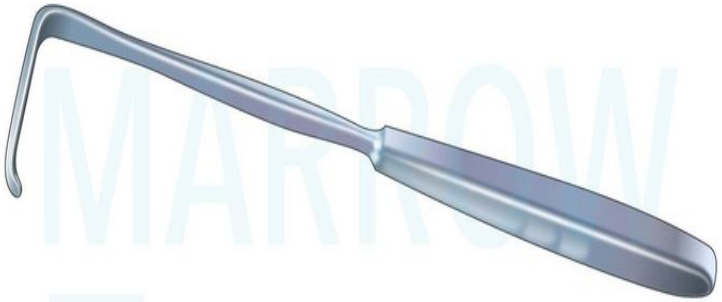
c) 4

d) 3

Question 8:

During thyroidectomy, the given instrument was used to retract the strap muscles. Identify the instrument:

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a) Langenbeck retractor

b) Dyball retractor

c) Travers retractor

d) Goligher retractor

Question 9:

Identify the given instrument.



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a) Wedge osteotome

b) Kocher's thyroid dissector

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c) Periosteal elevator

d) Uterine curette

Question 10:

What is the size of the given blade used for incision and drainage of a superficial abscess?



a) 10

b) 11

c) 22

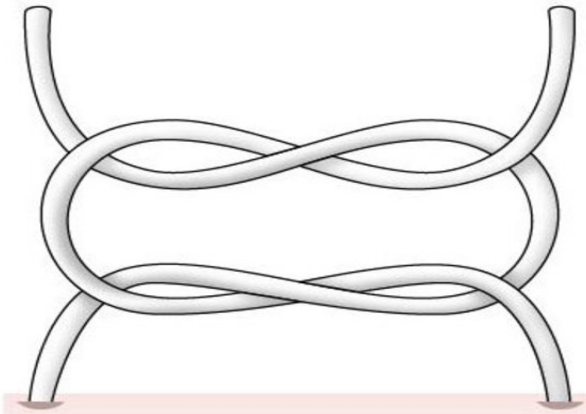
d) 15

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Question 11:

The type of knot seen in the image is:

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a) Half hitch knot

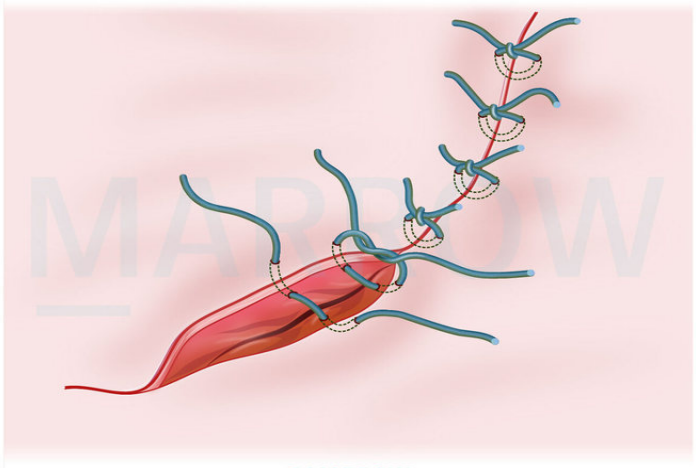
b) Reef knot

c) Surgeon's knot

d) Crossed half hitch knot

Question 12:

A man presents to the emergency with a clean lacerated wound on his forearm. You use the given suturing technique to close his wound. Which of the following statements is false?



a) This technique has the least cut through rate

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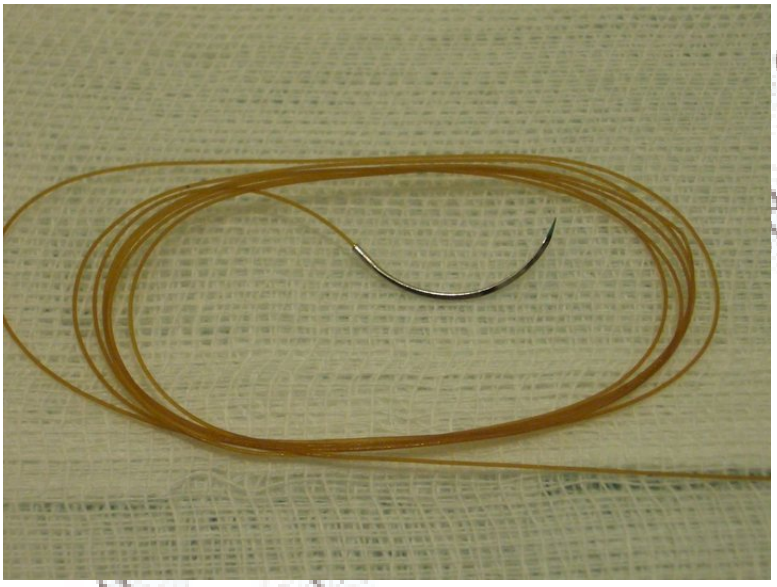
b) The wound edges should be everted

c) Interrupted sutures are used to approximate the wound

d) After the first bite, the needle should emerge at the of center the wound

Question 13:

During an intra-oral procedure, the resident uses the given suture material to place sutures on the soft palate. What is this suture material called?



a) Vicryl

b) Silk

c) Plain catgut

d) Prolene

Question 14:

Which of the following is true about chromic catgut?

a) It is made from cat gut

b) It is made from rabbit gut

c) It is absorbed by enzymatic degradation and macrophage phagocytosis

d) It is tanned with nickel salts to improve handling and to resist degradation in tissue

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Question 15:

A young man presented to the ER with a facial injury following a fight with his brother. On examination, there is a 2 cm linear lacerated wound over his right cheek. The best method of management would be:

a) Simple suture with poliglecaprone

b) Subcuticular suture with poliglecaprone

c) Simple suture with polypropylene

d) Subcuticular suture with polypropylene

Question 16:

A 25-year-old male patient presented to the emergency department with an injured femoral artery following a stab injury to the right thigh. Which of the following suture materials would be ideal for the repair of the artery?

a) Poliglecaprone

b) Polypropylene

c) Polyglactin

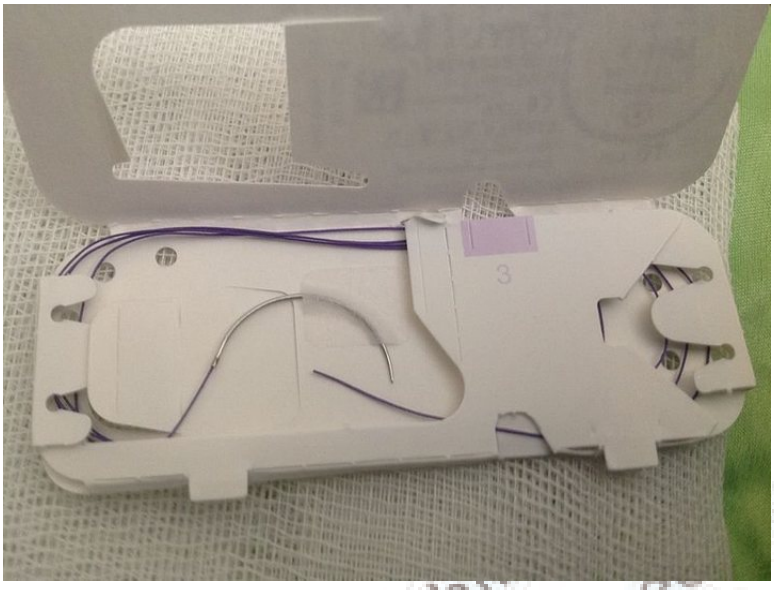
d) Nylon

Question 17:

The surgeon requests the given suture material while performing a bladder repair. Which of the following statements is true regarding it?

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a) It is made of polyglycolic acid

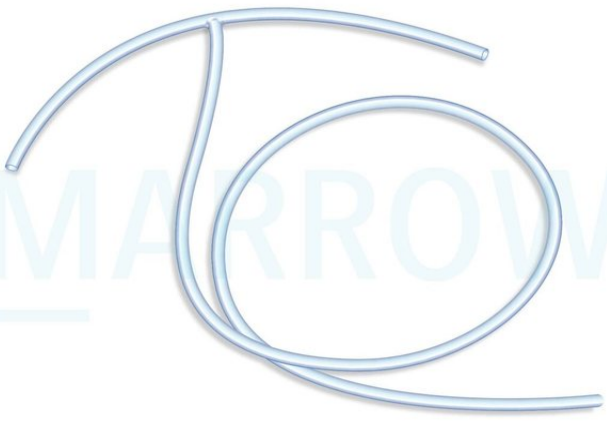
b) It is a dyed monofilament

c) Absorption by hydrolysis

d) Complete absorption by 30 days

Question 18:

After which procedure will you use the tube shown in the image?



a) Choledochotomy

b) Ureterosigmoidostomy

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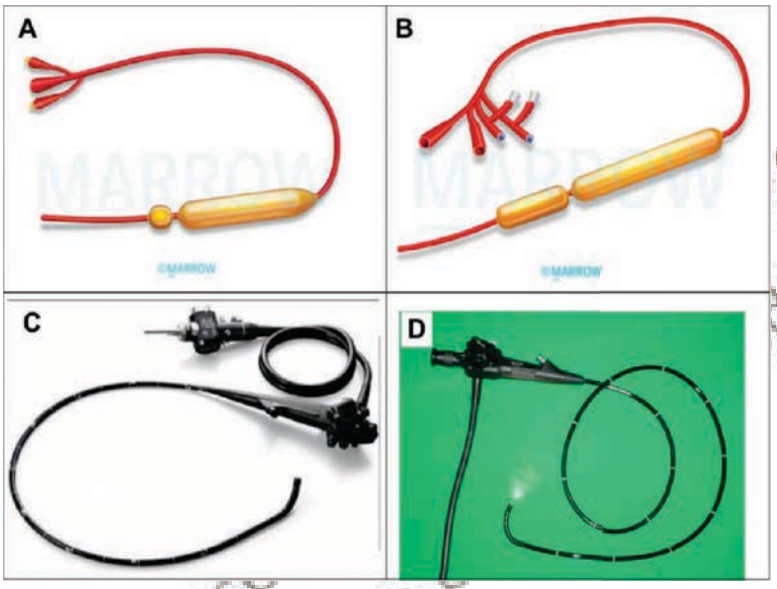
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c) Mastectomy

d) Thyroidectomy

Question 19:

Which of the following are used to stop esophageal variceal bleed?



a) A, B, C and D

b) A and B only

c) A, B and C

d) A, B and D

Question 20:

A patient has the catheter shown below inserted for draining a large liver abscess. All of the following statements are true except:

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a) It is a self retaining catheter

b) It may be introduced into the urethra to relieve bladder retention

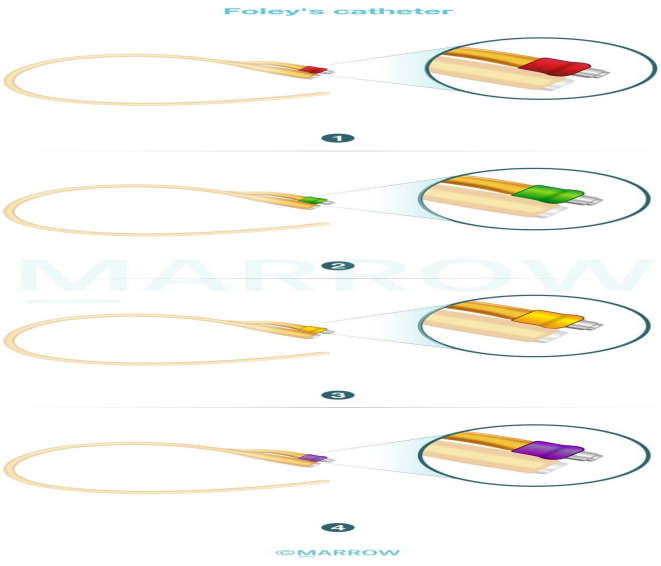
c) It can be placed percutaneously through an existing nephrostomy

d) It is radio-opaque

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Question 21:

You are an intern asked to catheterize a patient using a 16F Foley's catheter. You are unable to catheterize the patient and decide to use a slightly smaller catheter. The ward sister gives you the following four fresh catheters. Which one would you choose instead?



a) 4

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b) 3

c) 2

d) 1

Question 22:

Which of the following statements is true regarding Foley catheter?

a) French in foleys catheter refers to external diameter

b) Silicone foleys can be kept for maximum of 2 weeks

c) Three way foleys is used for instrumentation

d) If there is peri-urethral leakage of urine after inserting a foleys, first deflating the balloon is tried

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Question 23:

Identify the instrument:



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a) Aneurysm needle

b) Veress needle

c) Tracheal dilator

d) Urethral dilator

Question 24:

Sold by @itachibot

Which of the following is false regarding laparoscopic surgery?

a) Hasson approach preferred in patients with prior abdominal surgery

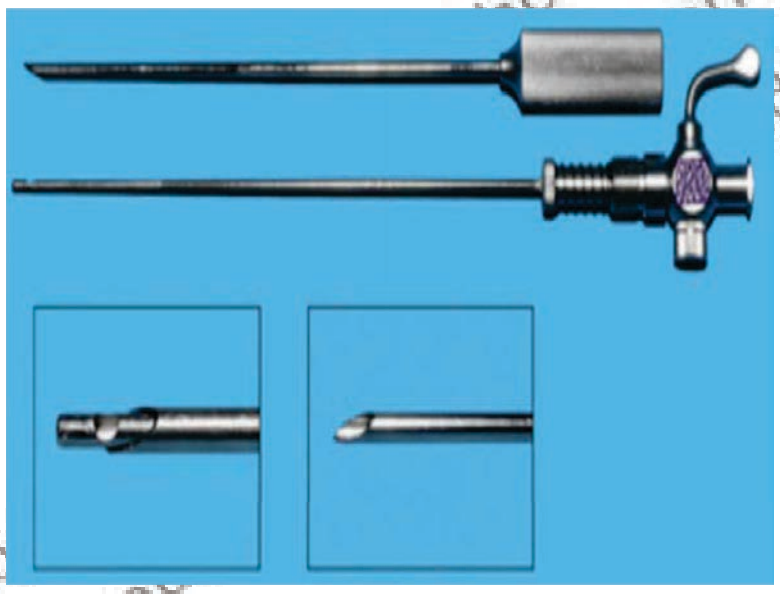
b) Monopolar diathermy is more effective in preventing electrosurgical injury

c) Heparin can be used routinely in irrigation fluid during laparoscopic surgery

d) Oral feeding can be initiated after 4-6 hours following an uneventful recovery period

Question 25:

While assisting on laparoscopic cholecystectomy, you notice the given instruments are used to create a pneumoperitoneum. Select the true statement:



a) Proper placement of the needle can be seen by reaspirating injected saline

b) The insufflation rate is 8-10 liters/min

c) It is the most widely used open technique for creating pneumoperitoneum

d) It involves blind puncture of the peritoneum

Question 26:

Identify the following instrument.

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a) Rectal temperature probe

b) NAVA catheter

c) Swan-ganz catheter

d) CVP transducer

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Question 27:

Identify the instrument.



a) Ziegler knife

b) McMillan scalpel

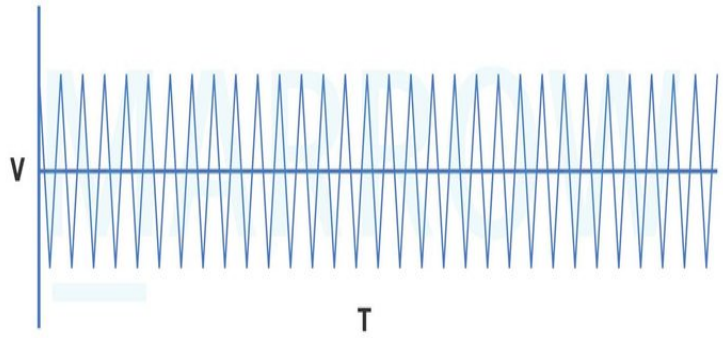
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c) Ballenger swivel knife

d) Humby's knife

Question 28:

Which mode does the following waveform of cautery represent?



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a) Fulguration

b) Cutting

c) Coagulation

d) Blend

Question 29:

Identify the following instrument?

Sold by @itachibot



a) Unipolar cautery

b) Bipolar cautery

c) Harmonic scalpel

d) Ligasure

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Question 30:

Which of the following is the principle behind the wound-healing procedure shown in the image below?



a) Negative pressure wound therapy

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b) Positive pressure wound therapy

c) Foam therapy

d) Sponge therapy

Question 31:

The following drain is placed after mastectomy. Identify the type of drain.



a) Open

b) Closed

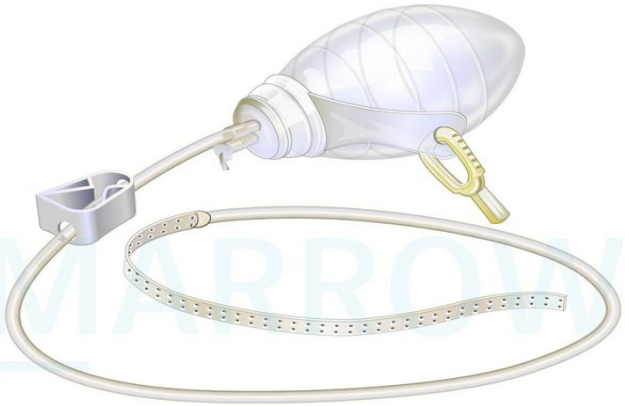
c) Semi open

d) Semi closed

Question 32:

The instrument given in the image is:

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a) Hemovac

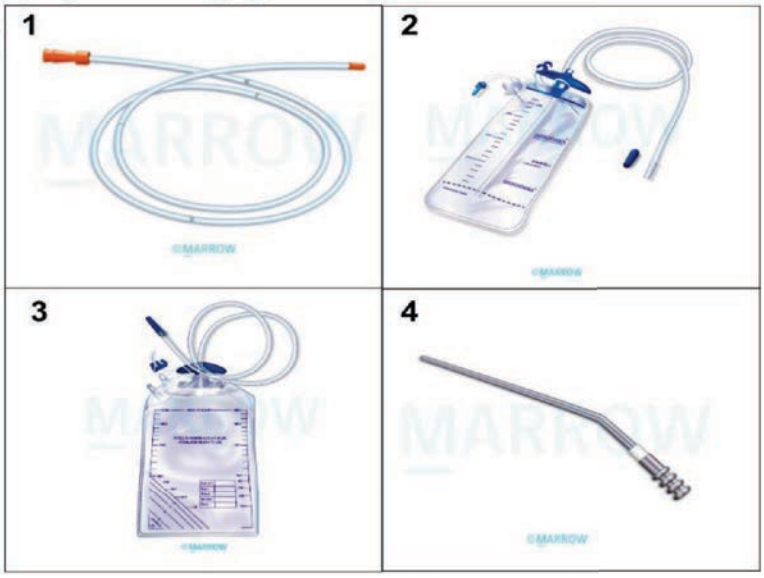
b) Jackson-Pratt drain

c) Minivac

d) Corrugated drain

Question 33:

Match the following:



a) 1-D, 2-C, 3-A, 4-B

b) 1-B, 2-C, 3-A, 4-D

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c) 1-D, 2-A, 3-C, 4-B

d) 1-B, 2-A, 3-C, 4-D

Question 34:

The instrument shown in the image is used for screening a 50-year-old patient with a family history of rectal cancer. Till which structure can this instrument visualize?



a) Anal canal

b) Sigmoid colon

c) Splenic flexure

d) Teminal ileum

Question 35:

The position of the patient in the image shown below is known as:

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a) Lloyd Davis position

b) Jack knife position

c) Trendelenberg position

d) Reverse trendelenberg position

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Question 36:

Which of the following is a false statement regarding robotic surgery?

a) It is associated with less blood loss compared to laparoscopic surgery

b) Robotic surgery cuts down the operating time significantly

c) The learning curve is longer with robotic surgery

d) It is associated with a shorter length of hospital stay

Answer Key

Question No.	Correct Option
1	b
2	b
3	b
4	a
5	b

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6	b
7	b
8	a
9	b
10	b
11	b
12	a
13	c
14	c
15	b
16	b
17	c
18	a
19	a
20	b
21	c
22	a
23	b
24	b
25	d
26	a
27	d
28	b
29	a
30	a
31	b
32	b
33	b
34	c
35	d
36	b

Detailed Explanations

Solution to Question 1:

The image shows Babcock's forceps.

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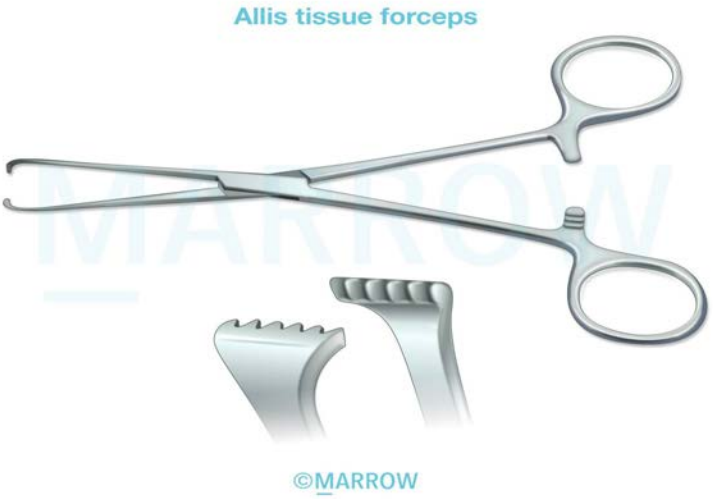
In Babcock's forceps, the distal part of the distal blade is curved with a triangular fenestra which allows soft tissues to bulge out. The tip is non-traumatic with transverse serrations. It has a lock in the proximal part.

It is used to hold tubular structures such as parts of the bowel, fallopian tube, appendix, ureter, etc.



Option A: Allis tissue forceps have distal blades, not opposing each other. The tip has got teeth in each blade that are opposing. There is a lock in the proximal part.

It is used to hold skin flaps, fascia, aponeurosis, and the bladder wall.



Option C: Lane's tissue holding forceps have got stout and thick distal blades with oval fenestrae. It has an opposing tooth on the tip and a lock in the proximal part.

It is used to hold bulky and tough structures and lymph nodes.

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Option D: Kocher's hemostatic forceps - It is identified by the opposing tooth on the tip and serrations in the distal blades.

It is used to hold pedicles, tough structures, and cut ends of muscles. It is also used to hold ribs during rib dissection, gauze for blunt dissection, and resected bowel.



Solution to Question 2:

The image shows a sponge holding forceps. It is used to:

- Clean skin with a swab dipped in antiseptic solution during all operations
- Remove laminated membrane and daughter cysts during operation of hydatid cyst.
- Hold the fundus and Hartmann's pouch of gall bladder during cholecystectomy

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• Swab an abscess cavity

• Hold the cervix during cerclage.

Sponge holding forceps

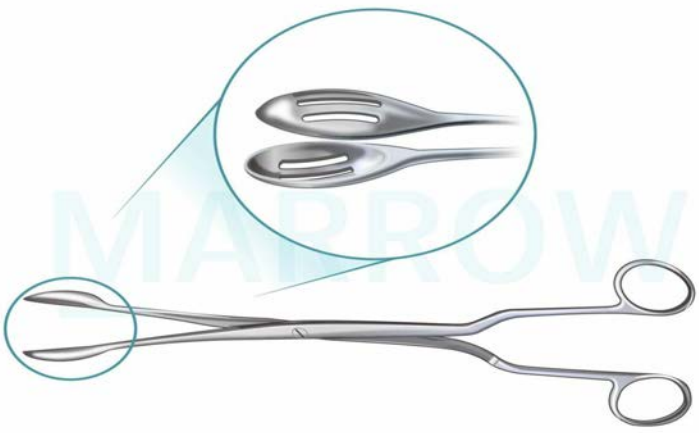


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Ovum forceps is shown below. It is used to grasp products of conception and prevent the crushing of the conceptus. They have no catch and the blades are slightly bent and fenestrated. The absence of catch minimizes uterine injury if accidentally caught.

It is introduced with the blades closed and opened up inside the uterine cavity to grasp the products. The instrument is taken out with a slight rotatory movement. The rotatory movement not only facilitates detachment of the products from the uterine wall, but also minimizes the injury of the uterine wall if accidentally grasped.

Ovum Forceps



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Pile holding forceps are used to hold haemorrhoids.

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Pile holding forceps



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Cord holding forceps are typically used to hold spermatic cords.

Cord holding forceps



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Solution to Question 3:

The above instrument is Desjardin's choledocholithotomy forceps and is used for bile duct stone removal. It may also be used during the removal of kidney, ureteric, or bladder stones.

This is a long and slender instrument. There are finger bows but no catch. The shaft is curved. The blades are small, without serrations, and fenestrated centrally.

Solution to Question 4:

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The above image is of Lister's sinus forceps which are used for blunt dissection.

It is used during Hilton's method of abscess drainage to break the bacterial loculi.

It is also used for inserting or removing packing in the sinus cavity.



Solution to Question 5:

Doyen's mouth gag is used to keep the mouth open for intraoral surgery when retraction of the tongue is not required or desirable. Mostly used for tongue surgery. It is applied on one side of the mouth on the molar teeth.



Option A: Doyen's retractor is used to retract the abdominal wall in abdominal and pelvic surgeries to expose the field of operation.

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Doyen's retractor



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Option C: Doyen's intestinal occlusion clamp is used for resection and anastomosis of the intestine in cases of:

- Strangulated hernia
- Accidental injuries to the gut
- Intestinal growths
- Gastric/intestinal bypass surgeries

Doyen's intestinal occlusion clamp

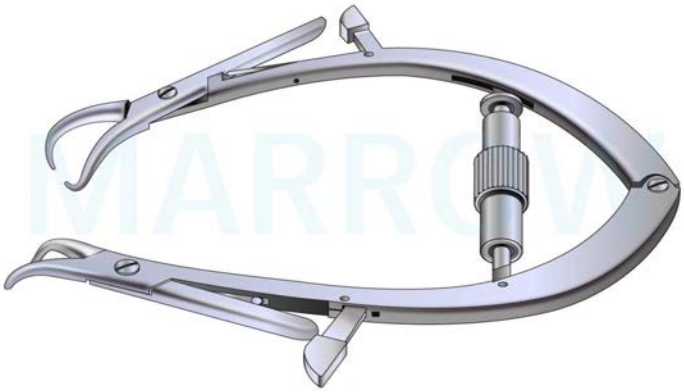


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Option D: Joll's thyroid retractor is a self-retaining retractor used in thyroid surgeries to retract skin.

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Joll's thyroid retractor



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Solution to Question 6:

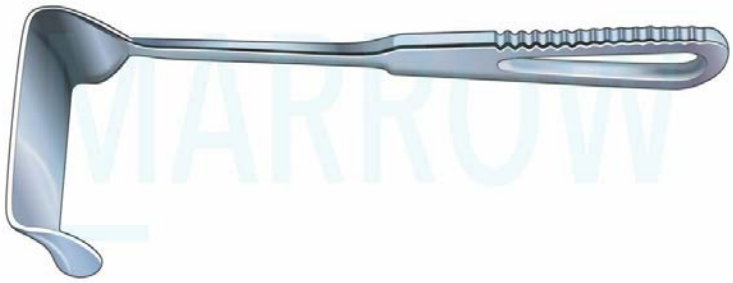
The given image shows a Morris retractor with a single, flat transversely curved blade and a blunt projecting ridge with backward projection.

Morris retractor can be single or double-bladed. It is used to retract abdominal wall incisions, loin incisions, subcostal wounds or any wounds in depth.

It can be used to improve visibility on one side of an incision. Thus, it is valuable during the initial phase of a laparotomy.

If yc...

Morris Retractor



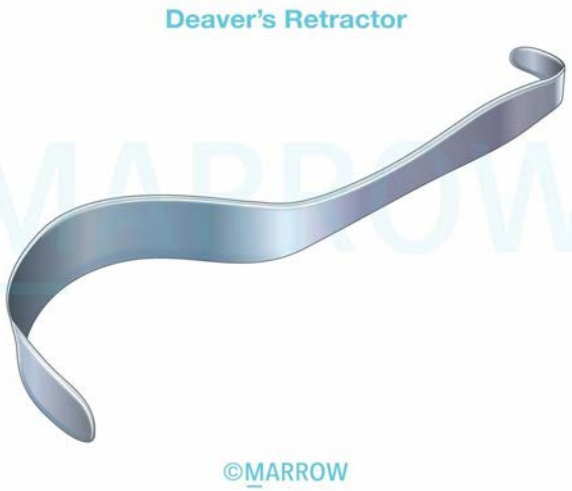
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Other options:

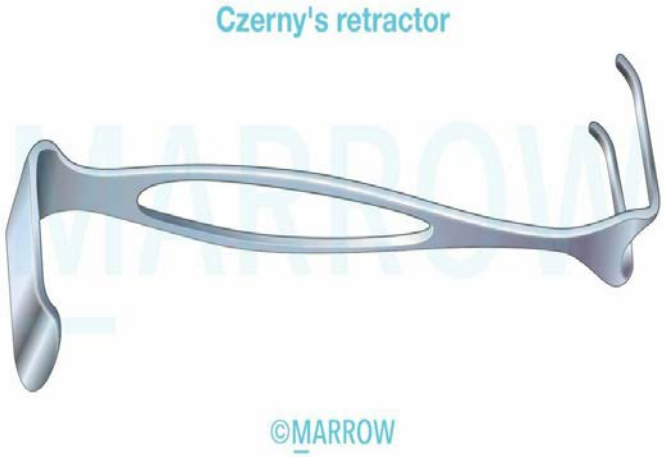
Option A: Deaver's retractor is a question mark-shaped stout, atraumatic retractor with a broad, gently curved long blade. It is used to retract the abdominal wall and viscera. Moist mops should

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be kept underneath prior to placing this retractor. It is used for major abdominal surgeries, bladder surgeries and lumbar sympathectomy.



Option C: Czerny's retractor is a superficial retractor with a thick and small blade on one side and a biflanged hook on the other side in opposite directions. It is used in hernia surgery and laparotomy, especially during closure.



Option D: Double-hook retractor consists of two hooks with a handle. It is used in excision of swellings like lipoma, neurofibroma and cyst. It is also used to hold the skin flaps when raising them.

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Double hook Retractor



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Solution to Question 7:

The Deaver's retractor would be most useful in cholecystectomy as it is specifically designed for holding the liver up and out of the way.

Deaver's retractor is used carefully to avoid damaging the liver. Some surgeons protect the liver with an abdominal pack before placing the blade on top.

Deaver's Retractor



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Doyen's retractor - It is used to retract the abdominal wall as well as the bladder for proper exposure of the lower uterine segment during a cesarian section.

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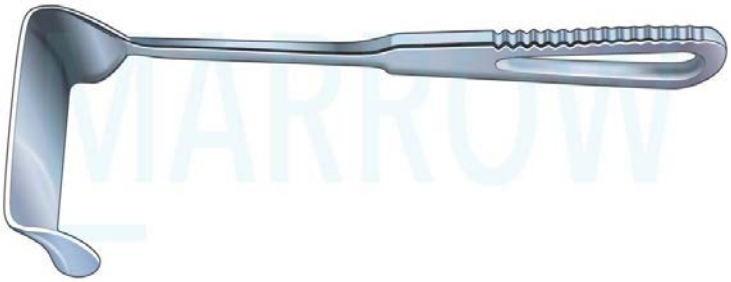
Doyen's retractor



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Morris retractor is a large retractor useful for providing maximum exposure in large incisions e.g., abdominal incisions. It can be used to improve visibility on one side of an incision. Thus, it is valuable during the initial phase of a laparotomy.

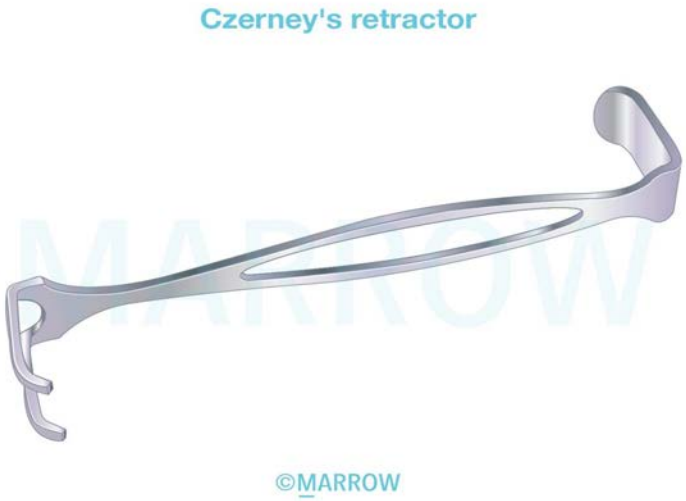
Morris Retractor



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Czerny's retractor - This is a double-ended retractor used to retract wound edges for intermediate-type procedures. One end has a blade with a lip which helps to retract without the edge slipping. The other end has two prongs and helps to retract the ends of an incision.

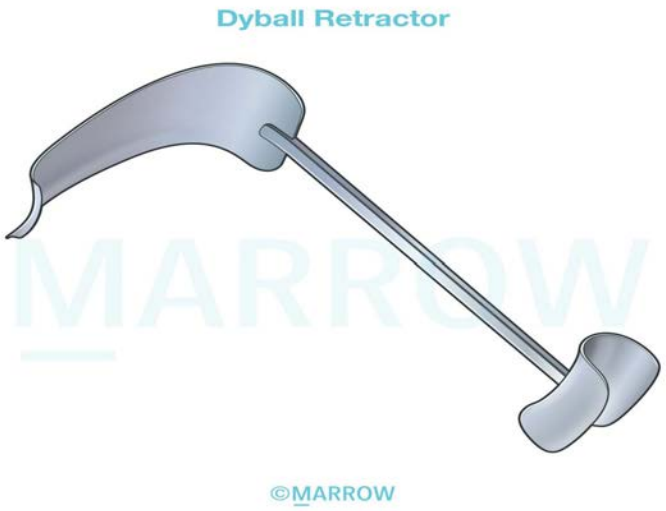
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Solution to Question 8:

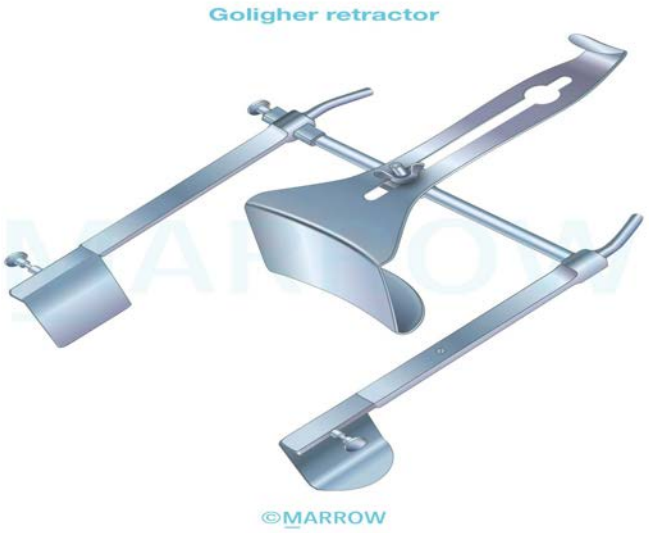
The above image is that of a Langenbeck retractor. It is used for holding open wounds, as in an open appendicectomy.

Option B: Dyball retractor is used in major abdominal surgeries to retract deeper parts of the abdominal wall, bladder, or uterus while operating on the rectum and entering the rectovesical or rectouterine pouch. It has a lip at the bottom of the blade to prevent slippage. Care should be taken when it is used to retract the liver as it may damage the liver parenchyma.



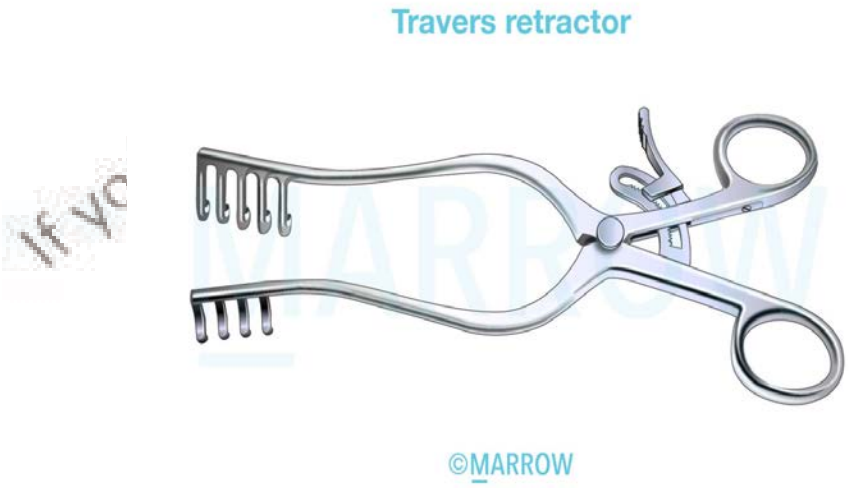
Option C: Goligher retractor is a self-retaining retractor used in operations on the sigmoid colon and rectum, such as anterior resection and the upper end of abdominoperineal resection. The retractor is inserted with the side blades to separate the edges of the abdominal wall. The central blade is then inserted to keep the small bowel away from the operation site.

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Option D: Travers retractor is a self-retaining retractor used for intermediate-type operations, such as:

- Herniorrhaphy
- Groin dissection for varicose veins
- Femoral embolectomy.



Solution to Question 9:

The image shows Kocher's thyroid dissector which is used during a thyroidectomy to dissect the upper pole of the thyroid.

The instrument is blunt and therefore damage to the superior thyroid artery or external laryngeal nerve is unlikely.

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Solution to Question 10:

The size of the surgical blade shown is the 11-size blade (stab knife) that has a triangular shape with an oblique edge and a sharp-pointed tip.

Uses:

• Incision and drainage (I & D) of an abscess

• Insertion of drains and arteriotomy.

Other options:

Option A: The 10-size blade is used for skin incisions. It has a curved cutting edge that tapers to a pointed tip.

Option C: The 22-size blade is often used for abdominal incisions. It has a flat, unsharpened back edge and a curved front cutting edge.

Option D: The 15-size blade is used for minor surgical procedures (lipoma excision) and precise skin incisions. It is a smaller blade with a small cutting edge.



Solution to Question 11:

The given image shows the suture material exiting the knot is on the same side as the entry i.e no cross-over is seen. This is seen in a reef knot.

A knot is a fastening made of threads intertwined together or on themselves. Each knot consists of- 2 half-hitches placed in sequential throws. Squaring refers to tightening the knot/half-hitch in a manner that the threads lay flat due to the alternating direction of half-hitches in adjacent layers.

Types of knots:

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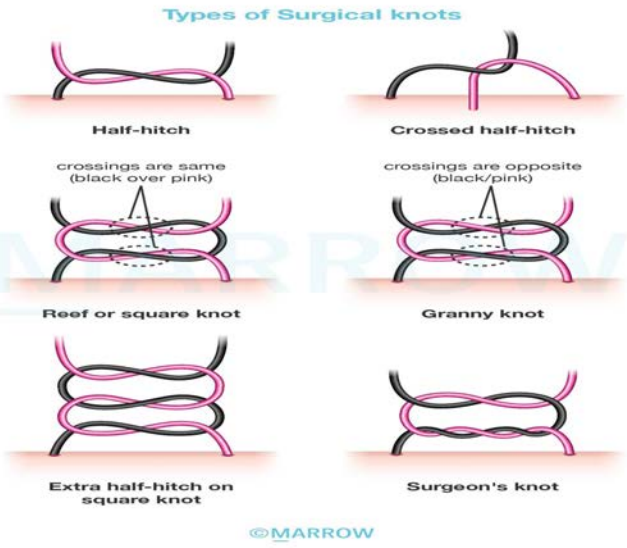
• Granny knot: half-hitch over a half-hitch in the same direction. It has better-holding power than half-hitch

• Reef knot: half-hitch followed by a second half-hitch after squaring.

• Triple throw knot: Reef knot with another half-hitch knot for added security. Knots made with prolene sutures require 6-8 throws to prevent slippage.

• Surgeon's knot: Modification of the reef knot with two half-hitches in the first layer.

• Slip knot: Modification of either granny/reef knot formed when one end of the thread is kept taut while tightening the knot.



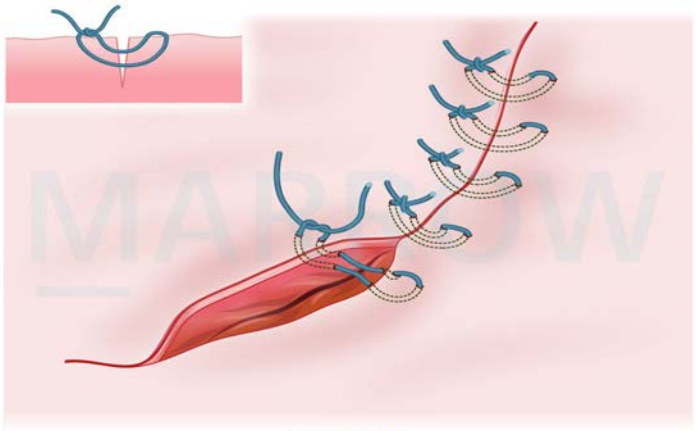
Solution to Question 12:

The given image shows interrupted sutures. Horizontal mattress sutures, not interrupted sutures, have the least cut-through rate.

In mattress suture, the initial suture is inserted as an interrupted suture, but then the needle either moves horizontally or vertically and traverses both edges of the wound once again as seen in the picture.

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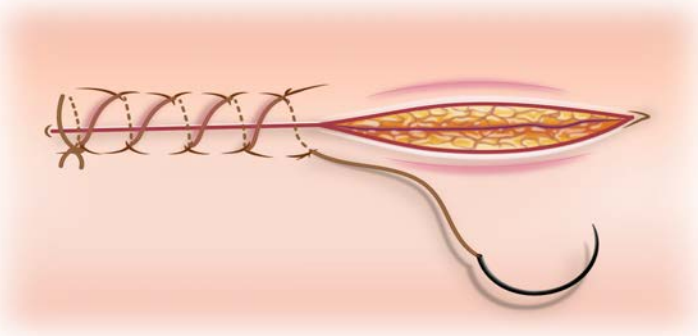
Mattress suture



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Continuous suture: For a continuous suture, the first suture is inserted in an identical manner to an interrupted suture, but the rest of the sutures are inserted in a continuous manner until the far end of the wound is reached.

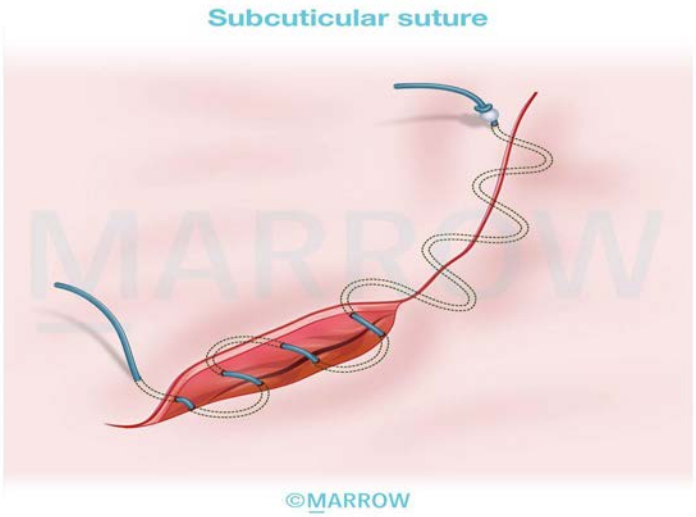
Continuous suture



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Subcuticular sutures: Small bites of the subcuticular tissues are taken on alternate sites of the wound and then gently pulled together thus approximating the wound edges without the risk of the cross-hatched markings of interrupted sutures.

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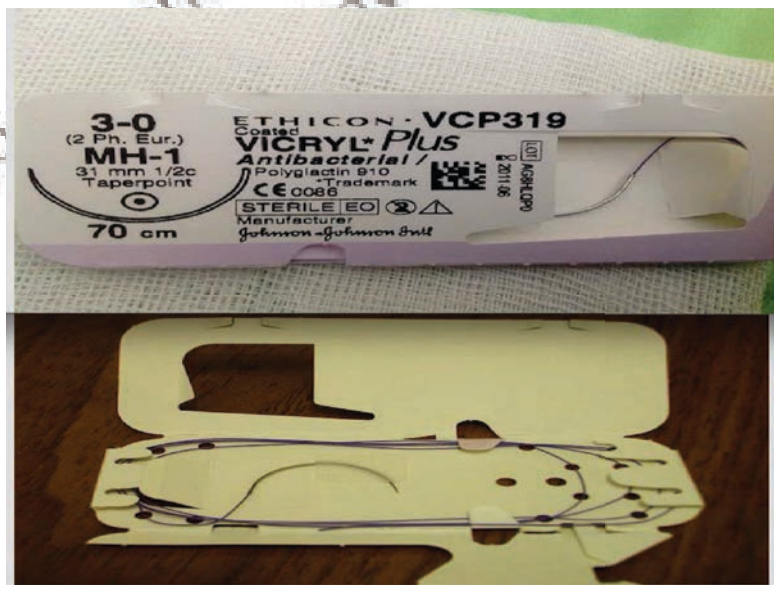
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Solution to Question 13:

The suture material shown in the image is plain catgut. It is a yellowish absorbable suture material.

Chromic catgut is brownish in colour.

Vicryl is a violet-coloured absorbable suture material.



Silk is a black-coloured, multifilament, natural, braided, and non-absorbable suture material. It is derived from the cocoon of the silkworm larva.

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Prolene is a blue coloured, monofilament, non-absorbable suture.



Solution to Question 14:

Chromic catgut is absorbed through macrophage phagocytosis and enzymatic degradation within 90 days.

It is made from collagen derived from healthy sheep or cattle. It is then tanned with chromium salts to improve handling and resist degradation in tissue.

The tensile strength lasts for 21-28 days. It has a moderate tissue reaction as compared to plain catgut, which has a high tissue reactivity.

It is used to ligate superficial vessels, suture subcutaneous tissues, and is used for stomas and other tissues that heal rapidly. It is not used in tissues that heal slowly and require prolonged

Sold by @itachibot

support.

Solution to Question 15:

The best method for the management of face laceration is a subcuticular suture with poliglecaprone (monocryl).

Subcuticular sutures are used in the areas of the skin where the cosmetic appearance is important. The suture material is taken from the subcuticular layer and the edges are gently pulled together. The wound heals with minimal scarring.

Solution to Question 16:

Polypropylene (prolene), a non-absorbable monofilament, is the ideal suture material used for vascular anastomoses.

Vascular anastomosis requires an accurate and watertight closure. A non-absorbable material that provides tensile strength for a longer period is best suited. The material should also be non-braided to avoid platelet adherence to the suture material.

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Solution to Question 17:

The image given is of polyglactin (vicryl). It is absorbed by hydrolysis. Complete absorption occurs by 60–90 days.

It is a violet, braided multifilament absorbable suture. It is a copolymer of lactide and glycolide in a ratio of 90:10, coated with polyglactin and calcium stearate.

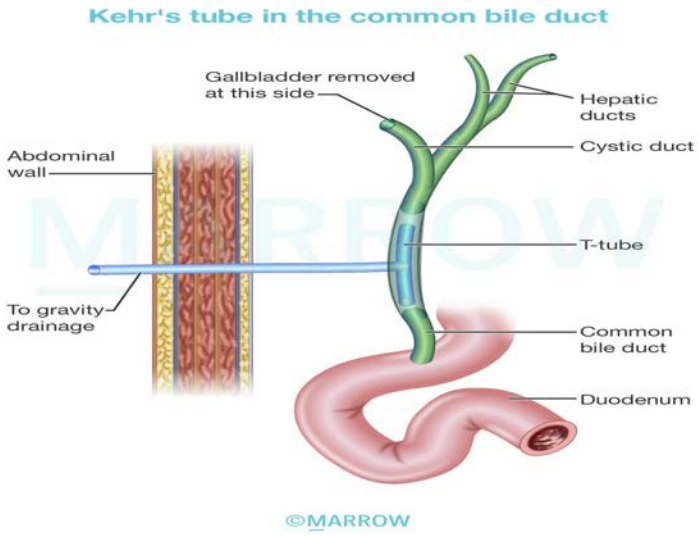
It is used mostly for gut anastomoses, vascular ligatures, subcuticular wound closures, and ophthalmic surgeries.

Solution to Question 18:

The image shows Kehr's T tube used after choledochotomy.

The horizontal limb is placed in the common bile duct while the vertical limb is brought out like a drain.

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It allows bile to drain while the sphincter of Oddi is in spasm postoperatively. Once the sphincter relaxes, bile drains normally down the bile duct and into the duodenum.

Common bile duct T-tubes should remain in for 10 days. The 10-day period is required to minimize the risk of biliary peritonitis.

Once the T-tube cholangiogram has shown that there is a free flow of bile into the duodenum and that there are no retained stones, it is removed. Some surgeons like to clamp the T-tube prior to removal. Residual obstruction may be amenable to stone extraction via the T-tube.

Solution to Question 19:

All the given options can be used to stop esophageal variceal bleeding.

Image A shows the Sengstaken-Blakemore tube. It has 3 lumens - one aspiration port and 2 inflation balloons. They are:

• Gastric aspiration port

• Gastric balloon port

• Esophageal balloon port

The gastric balloon is inflated and tension is applied to the gastroesophageal junction. If this does not control the haemorrhage, the esophageal balloon is inflated as well, compressing the venous plexus between them. Only gastric contents can be aspirated.

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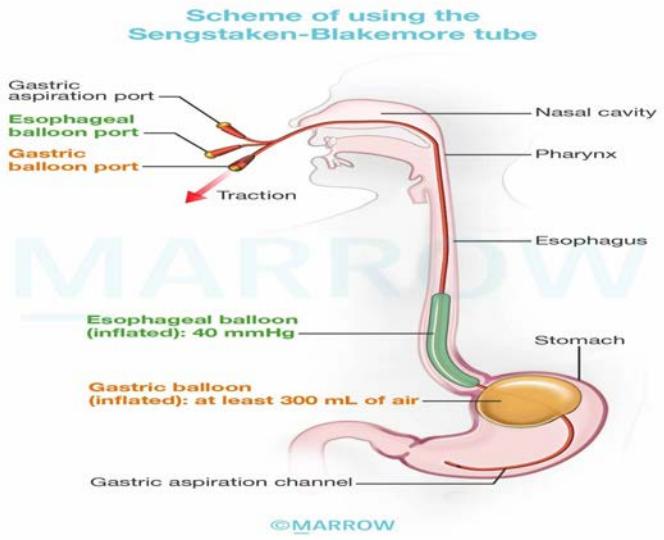
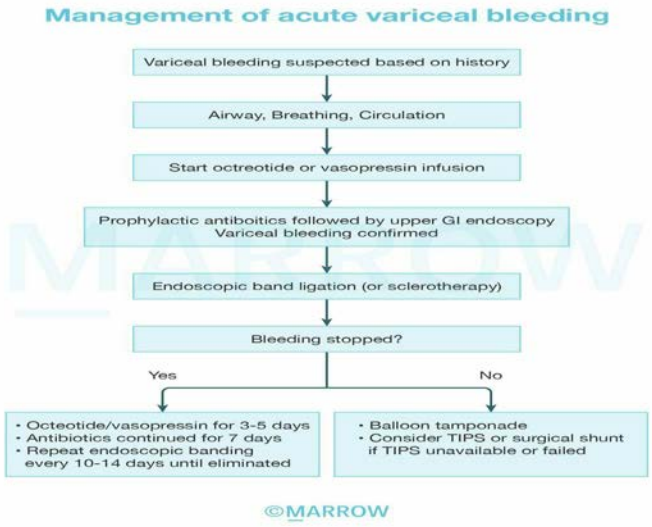


Image B shows the Minnesota tube. It has 4 openings - 2 inflation tubes and 2 suction tubes i.e. both gastric and oesophageal aspiration ports are present, which allows the aspiration of both gastric and esophageal contents.

Images C and D both show an upper GI endoscope. They are used to identify the source of bleeding and once identified, sclerotherapy and endoscopic variceal banding are performed, which have been shown to control hemorrhage effectively.

Banding has a lower rate of complications. If bleeding does not stop by banding/sclerotherapy, balloon tamponade should be tried.

The protocol for the management of esophageal varices is given below.



Solution to Question 20:

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A Malecot catheter is never introduced per-urethrally.

It is a self-retaining catheter with an umbrella or flower tip. It contains sulfur, hence is radio-opaque. It can be sterilized by boiling.

Uses:

- Suprapubic cystostomy
- Perinephric abscess
- Pyonephrosis
- Cabot's nephrostomy
- Subphrenic abscess
- Cholecystotomy
- Infected pseudocyst of pancreas
- Amoebic liver abscess
- Gastrostomy.



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Solution to Question 21:

The Foley's catheter having a green coloured ring in the ballon port is of size 14 F. If there is difficulty in catheterization, then a lower French number should be preferred.

The French scale refers to the external diameter of the catheter, and 1Fr is 0.3 mm in diameter.

Solution to Question 22:

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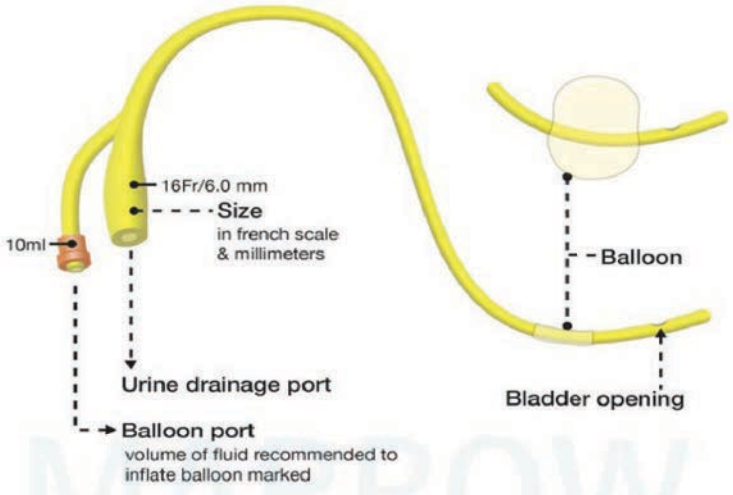
French with respect to Foley catheter refers to the external diameter of the catheter, and 1Fr is 0.3 mm in diameter.

Option B: Latex Foley catheter can be kept for one week whereas silicone Foley catheter can be kept for up to 6 weeks (some studies say 2-3 months).

Option C: Three-way Foley catheter, shown below, is used for irrigation and helps in preventing clot retention following surgeries like TURP.



Option D: If there is peri-urethral leakage of urine after inserting a Foley, inflating the balloon slightly more or using a larger-sized Foley are the corrective measures.



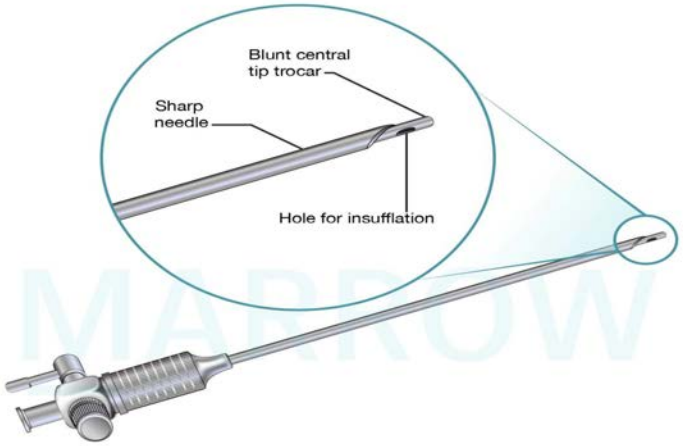
Solution to Question 23:

Veress needle is used to produce pneumoperitoneum in laparoscopic surgery.

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A blunt trocar is passed through the sharp needle.

Insufflation of the abdomen is accomplished with a Veress needle held at its serrated collar with the thumb and forefinger. Since the linea alba is fused to the umbilicus, the abdominal wall is grasped with fingers or a penetrating towel clip to elevate it away from the underlying structures.



©MARROW



Option A: An aneurysm needle (shown below) is used to catch small vessels and nerves.

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Aneurysm needle



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Option C: Tracheal dilator is used to keep the tracheostomy open.

Tracheal dilator



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Option D: Urethral dilator is used to dilate urethra.

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Solution to Question 24:

Bipolar diathermy is more effective than monopolar diathermy in preventing electrosurgical injury during laparoscopic surgery.

Option A: During laparoscopic surgery, an artificial pneumoperitoneum is produced by insufflation of the abdominal cavity with CO_2 through a temporary port created by carefully perforating the abdominal wall and peritoneum. As a common practice, blind insertion of a Veress needle is performed to enter the peritoneal cavity.

However, in patients with prior abdominal surgeries, there is a higher chance of bowel adhesions and bowel wall injury during blind insertion of veress needle. Therefore the Hasson approach is used for direct visualization while establishing the intraperitoneal access.

Option C: Clot formation may take place during laparoscopic surgery as a result of intraoperative bleeding. The routine use of 5000–7000 units of heparin per liter of irrigation fluid helps to avoid the formation of clots.

Option D: If there is no contraindication for enteral feeding (e.g bowel resection) and no sign of ileus postoperatively, oral feeding can be initiated 4-6 hours after surgery. Initially, a liquid diet is initiated, and if well-tolerated light meals can be initiated.

Solution to Question 25:

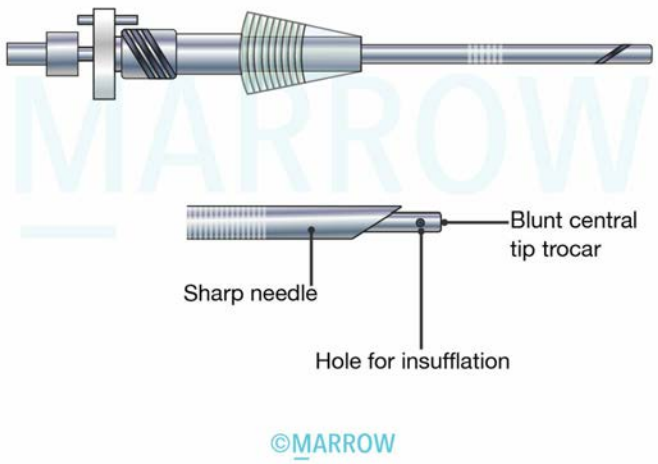
The image is that of a Veress needle and trocar which is involved in blind puncture of the peritoneum.

There are two methods used for the creation of a pneumoperitoneum:

- Closed method
- Open method

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The closed method using the Veress needle has a small but significant potential for intestinal or vascular injury on the introduction of the needle or trocar. Proper placement of the needle can be determined by the inability to re-aspirate injected saline. The normal insufflation rate is 4-6 litres/min.



The use of the open technique for creating a pneumoperitoneum avoids the morbidity related to a blind puncture.

To achieve this, a 1 cm vertical or transverse incision is made at the level of the umbilicus, stay sutures are applied, and the fascia is dissected. Free penetration into the abdominal cavity is confirmed by the gentle introduction of a finger. A Hasson trocar, shown below, is inserted and anchored, and pneumoperitoneum is created. This is the Hasson or modified Hasson approach.

This method is preferred for patients who have undergone previous abdominal surgeries as the small bowel may be adherent to the undersurface of the abdominal wound.



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Solution to Question 26:

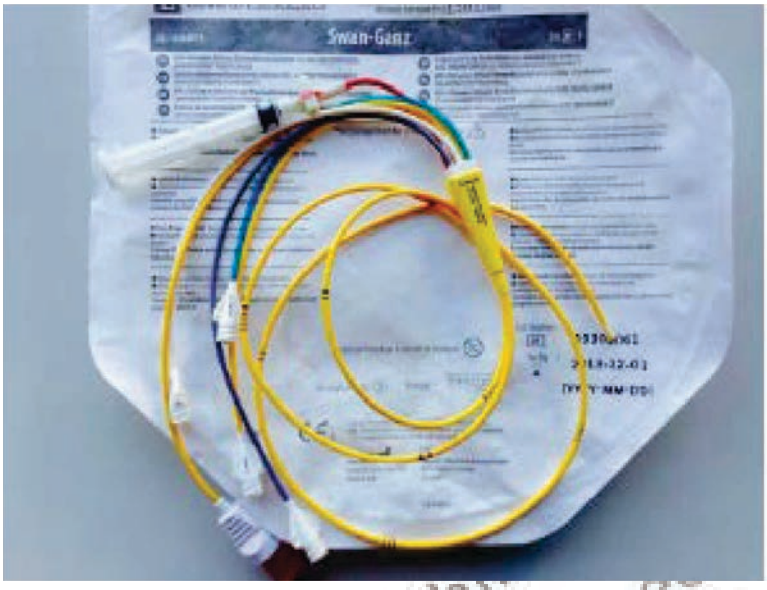
The image shows a rectal temperature probe.

Option B: NAVA is Neurally Adjusted Ventilatory Assist is a mode of mechanical ventilation. The NAVA catheter detects electrical activity signalling on the diaphragm.



Option C: Swan Ganz catheter / Pulmonary artery catheter is used for right heart catheterization.

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Option D: A CVP transducer is used in critical care settings to monitor the central venous pressure. It is connected to a central venous line and a monitor.

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Solution to Question 27:

The image shows a Humby's knife.

This instrument is used to harvest a split skin graft. The average thickness of the graft obtained from a Humby's knife is 0.3 mm.



Solution to Question 28:

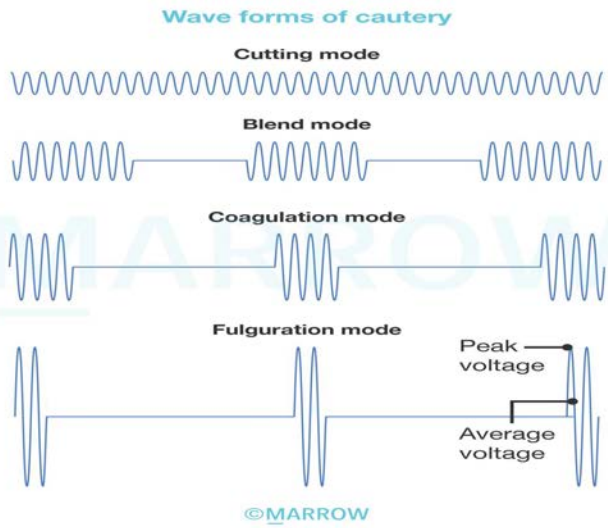
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Cutting is a mode of diathermy/electrosurgery. The cut current is a low voltage, continuous waveform. Cutting occurs when sufficient heat is applied to the tissue to cause cell water to explode into steam.

Coagulation is the sealing of blood vessels. In coagulation, a heating effect leads to cell death by dehydration and protein denaturation.

Blend is the combination of cutting and coagulation.

Fulguration refers to destructive coagulation of tissues with charring. The diathermy matching is set to coagulation and a higher effective voltage is used to make larger sparks jump an air gap thus fulgurating the tissues.



Solution to Question 29:

The given instrument is a unipolar cautery/monopolar cautery.

Other options:

Option B: The bipolar cautery contains two tips, unlike unipolar cautery which has only one tip. The current flows between these two tips and hence it does not need a return electrode, unlike the unipolar cautery.

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Option C: The harmonic scalpel (shown below) is a surgical instrument used to simultaneously cut and cauterize tissue. Ultrasonic energy is used in Harmonic scalpel where ultrasonic energy is converted to mechanical energy at the active blade.



Option D: LigaSure vessel sealing system (shown below) is a bipolar apparatus for sealing vascular tissue. It applies a high coaptive pressure during the generation of tissue temperature under 1000°C, hydrogen cross-links are first ruptured and then renatured, resulting in a vascular seal that has high tensile strength.

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Solution to Question 30:

The given image shows negative pressure wound therapy using a vacuum-assisted closure (VAC) device to promote healing in chronic wounds.

Principle: An intermittent negative pressure of -125 mmHg hastens debridement and formation of granulation tissue in chronic wounds.

Indications: Chronic wounds (such as diabetic foot ulcers, stage III and IV pressure ulcers), traumatic wounds, flaps and grafts, and dehisced incisions.

Contraindications:

- Exposed vital structures (organs, blood vessels, or vascular grafts)
- Preexisting infection
- Inadequate debridement of devitalized soft tissue or bone increases the risk of infection.
- The presence of malignancy (Marjolin's ulcer).
- An allergic reaction towards the adhesive used to maintain the vacuum seal.

Though not an absolute contraindication, there is no appreciable benefit for ischemic wounds.

Solution to Question 31:

The Romo Vac drain, depicted in the image, is a closed type of drain commonly used after mastectomy.

Drains are placed at surgical sites to freely collect the air or fluids that may accumulate. This enhances wound healing by preventing the formation of unnecessary cavities. Drains are prophylactic in elective surgeries and therapeutic in emergency surgeries. Drains can be -

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• Open - They are based on the principle of gravity

• Semi-open - Their action is based on capillary effect

• Closed - They carry out their actions through suction

Suction drains are commonly used in chest, breast, abdominal, thyroid, and plastic surgeries. They remove intraperitoneal secretions, anastomotic leaks, and blood from hemorrhage at the surgical site. Romo Vac drain is a negative suction drain closed drain kept in the subcutaneous tissue. Romo Vac drain is indicated in modified radical mastectomy, subcutaneous swelling excision, and amputations.

Special types of drains:

• Chest drains are connected to an underwater seal to aid the exit of air from the pleural cavity. They are used in pneumothorax, pleural effusion, and hemothorax.

• After surgical exploration of the bile duct, the sphincter of Oddi goes into spasm. To facilitate drainage of bile, a T tube may be used.

Drain insertion site care: The site of insertion of the drain is kept clean by drying and patting the drain insertion site with a clean towel after bath. The dressing is changed daily with folded gauze pieces placed below and above the drain site.

Removal of drains: The catheter at the site is milked for residual collections. It is then clamped and the suture holding the catheter is cut. The tube is then gently pulled out and any clots at the perforation end are removed. The time of removal of drains for various conditions is as given below.

• Drains used in surgeries like thyroidectomy are usually removed within 24 hours. Their main purpose is to cover postoperative bleeding.

• In a mastectomy, a drain is placed for 5 days to collect serous collections.

• Drains used to cover the colorectal anastomoses are placed for 5-7 days.

• Common bile duct T-tube drains are usually placed for 10 days.

• Drains for infections are removed when the infection subsides or when the content of the drain is minimal.

After the drain is removed, a folded gauze is placed over the drain insertion area. The dressing can be removed after 24 hours. The patient may be given an antibiotic ointment to apply over the area for a week.

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Solution to Question 32:

The given image is of a Jackson-Pratt drain.

Drains are placed at surgical sites to freely drain the air or fluids that may accumulate. They promote wound healing by preventing the formation of unnecessary cavities. Drains can be:

• Open : They are based on the principle of gravity

• Semi-open : Their action is based on capillary effect

• Closed : They carry out their actions through suction

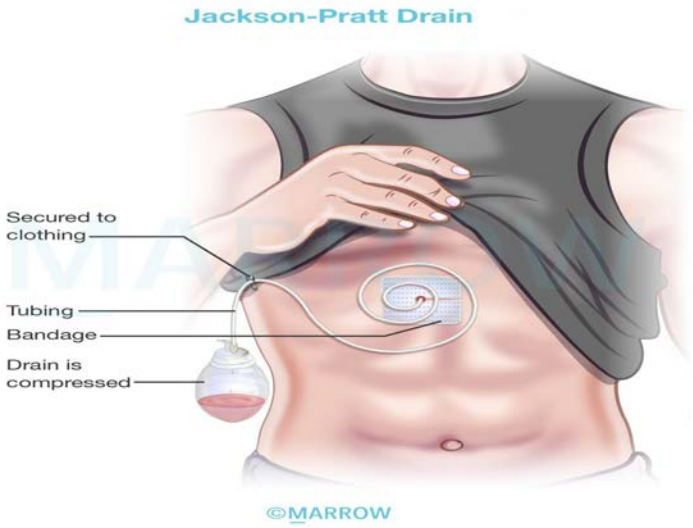
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Jackson-pratt drain is a closed, air-tight drainage system that operates by self-suction. The drain is sutured in place on the skin at the site of insertion to promote stability. There are two main parts to a JP drain:

• Hollow tube

• Collection bulb

The drain should be emptied as often as possible to allow the bulb to be compressed fully in order to maintain suction. This is usually done every 4-6 hours the first few days.



Other options:

Option A: Hemovac is also a closed type of suction drain which can typically handle larger amounts of fluid than the JP drain.

Option C: Minivac is a closed wound drainage system under negative pressure used in minor surgeries.

Option D: Corrugated drain is an open drainage system to remove excess fluid from the operated site.

Solution to Question 33:

1-B, 2-C, 3-A, 4-D is the correct option.

Urine bags are used for the collection of urine. They are usually attached to a Foley catheter placed to drain the bladder.

An underwater seal bag is used for the collection of fluid from the thoracic cavity. It acts as a one-way valve. This system allows air to leave the pleural cavity, but it cannot be drawn back in by the negative pressure that is created in the intrathoracic cavity.

Nasogastric tube/Ryle's tube is used for nasogastric feeding/stomach wash/aspiration.

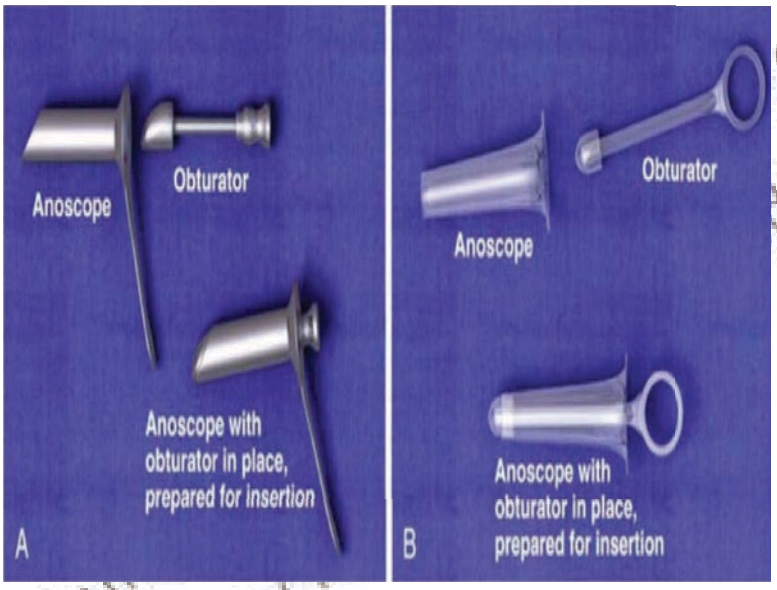
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A metallic suction cannula is used to clear the operative field by suctioning secretions, blood, and fluid.

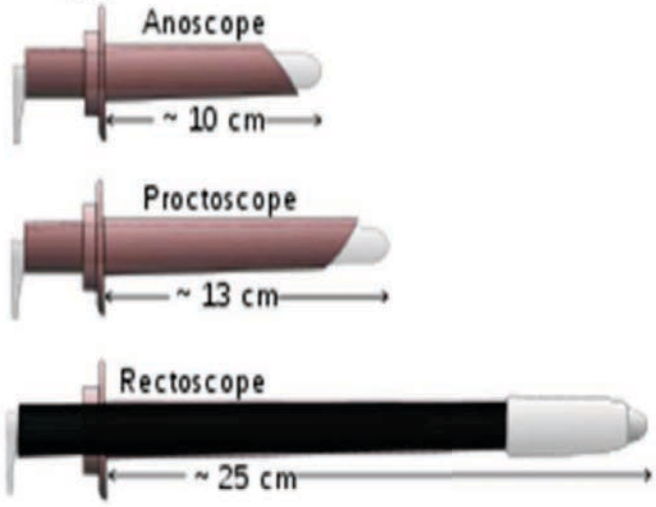
Solution to Question 34:

The image shows a flexible sigmoidoscope which allows visualization till the splenic flexure. It measures 60 cm. Factors like the mobility and redundancy of the sigmoid colon can limit the extent of the examination.

Option A: An anoscope measures 8-10 cm in length and is used to visualize the anal canal.



Option B: The rigid rectoscope is useful for examination of the rectum and distal sigmoid colon. It is occasionally used therapeutically. The standard rectoscope is 25 cm in length.



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Option D: Colonoscopes measure 100 to 160 cm in length and are capable of examining the entire colon and terminal ileum. Complete oral bowel preparation is necessary for colonoscopy. Sedation is required due to the duration and discomfort of the procedure.

Solution to Question 35:

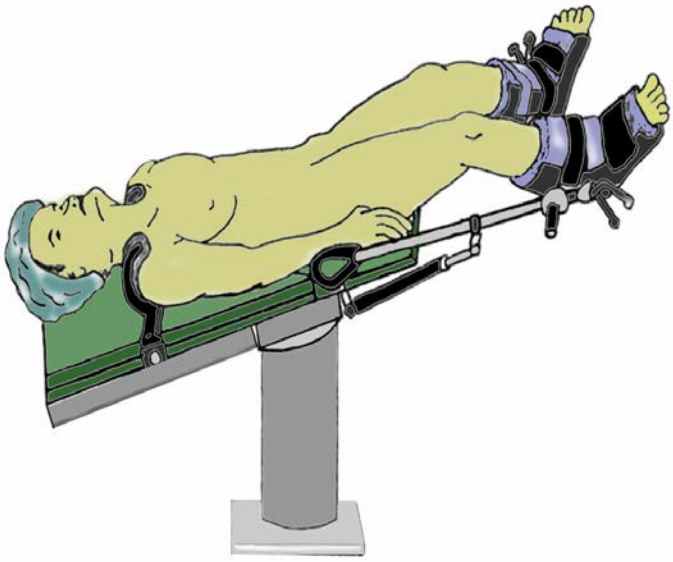
The above image shows a reverse Trendelenburg position, where the patient's head is elevated 15 - 30 degrees higher than the feet. It is named so, as the position is reverse of the Trendelenburg position, where the head end is lower and the feet are at a higher level.

The Trendelenburg and reverse Trendelenburg positions are used in surgeries that are required to move the abdominal viscera, such as the small bowel, away from the operative field. Restraints and sideboards are placed to prevent the patient from sliding from the bed.

In laparoscopic cholecystectomy, the patient is placed in a reverse Trendelenburg position slightly rotated to the left. This exposes the fundus of the gallbladder which is retracted towards the diaphragm.

Other options:

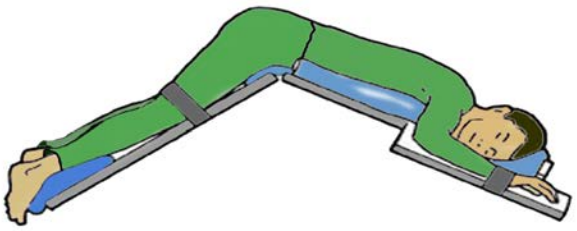
Option A: Lloyd Davies's position is a 30-degree Trendelenburg position with the hips flexed at 15 degrees. It is used for rectal and anal canal surgeries like low anterior resection and abdominoperineal resection. It can cause compartment syndrome of the calves.



Option B: Jackknife position is a modified prone position where the patient's hips are supported on a pillow and the table is flexed at a 90-degree angle with the head and feet at a lower level. It is not used anymore due to the chest compression causing impaired ventilation leading to positional asphyxia. It was used for hemorrhoids and fissure surgery.

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The image below shows commonly used patient positions in the operating room:



Solution to Question 36:

Even though robotic surgery has multiple advantages, the operating time is increased significantly compared to laparoscopic or open surgery.

Advantages of robotic surgery include:

- 3D vision
- Tremor reduction
- Scaling of movements
- Finer dissection and suturing

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• Less intraoperative bleeding

• Reduction in the length of hospital stay

• Reduction of wound complications

Disadvantages of robotic surgery include:

• More expensive than other minimally invasive procedures

• Longer operative time

• Longer learning curve

• Loss of tactile feedback



Da Vinci system for robotic surgery

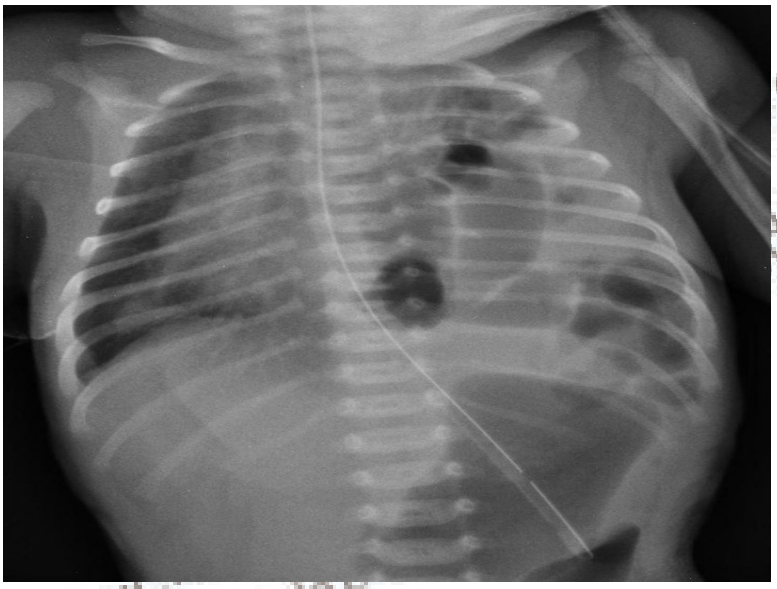
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Paediatric Surgery

Question 1:

An infant delivered at full-term by normal vaginal delivery, presented with respiratory distress immediately after birth. Chest X-ray showed the following picture. What is the probable diagnosis?



a) Hyaline membrane disease

b) Meconium aspiration syndrome

c) Congenital diaphragmatic hernia

d) Transient tachypnea of the newborn

Question 2:

Which of the following statements is false regarding congenital diaphragmatic hernia?

a) Most CDH defects occur on the left side

b) Occurs due to failure of closure of the pleuroperitoneal canal in the developing fetus

c) Pulmonary hypoplasia and pulmonary hypertension significantly affects the prognosis

d) The posterolateral variant of this hernia is known as Morgagni hernia

Question 3:

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Most common organ that herniates in Morgagni's hernia is _____

a) Spleen

b) Liver

c) Stomach

d) Transverse colon

Question 4:

What is not true regarding a Bochdalek hernia?

a) Early respiratory distress leading to early diagnosis and treatment is a good prognostic sign

b) The contents of hernial sac commonly includes retroperitoneal fat, left kidney or spleen

c) The condition is diagnosed prenatally by ultrasonography.

d) Pericardial cyst is a differential diagnosis.

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Question 5:

Which of the following is the most common Gastrointestinal atresia?

a) Duodenal atresia

b) Colonic atresia

c) Ileal atresia

d) Jejunal atresia

Question 6:

A 3-day-old neonate presented with recurrent bilious vomiting. An X-ray erect abdomen is given below. What is the next best step in managing this condition?

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a) CT abdomen

b) Gastrograffin follow-through

c) USG abdomen

d) Explorative laparotomy

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Question 7:

Bishop-Koop anastomosis is done for which of the following conditions?

a) Meconium ileus

b) Jejunal atresia

c) Duodenal atresia

d) Hirschprung's disease

Question 8:

An infant presents with copious bilious vomiting and abdominal distension on the 5th day of life. He had not passed meconium for the first 3 days after birth. An abdominal radiograph shows the presence of dilated bowel loops. What is the gold standard investigation for the given condition?

a) MRI

b) Contrast enema

c) Rectal biopsy

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d) Rectal manometry

Question 9:

A 2-year-old child is brought to the casualty with severe abdominal pain. On performing emergency exploratory laparotomy, the following finding is noted. Which of the following statements is false regarding this condition?



a) Can be a lead point for intussusception

b) The most common presenting symptom is bleeding in younger children

c) It is a false diverticulum which extends from the anti-mesenteric side

d) Most common heterotopic tissue is gastric mucosa

Question 10:

A surgery resident is examining a child born with the following defect. Which of the following statements regarding this defect is false?

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a) The central defect of the abdominal wall may be more than 4 cm

b) This defect is usually not associated with other congenital anomalies

c) The overlying sac is made of amnion and peritoneum

d) This defect is a component of the Cantrell's pentalogy

Question 11:

A 19-year-old lady delivered a neonate with the following defect. Which of the following statements about the defect is false?



a) The defect is generally located to the right of the umbilical cord

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b) Herniation of liver is commonly associated with this condition

c) The incidence of this defect is more in preterm babies

d) Serial reduction of eviscerated intestines maybe done for management

Question 12:

The most common extracranial solid tumour in infants and children is _____.

a) Neuroblastoma

b) Nephroblastoma

c) Medulloblastoma

d) Rhabdomyosarcoma

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Question 13:

The most common site of rhabdomyosarcoma in children is _____.

a) Genitourinary tract

b) Head and neck

c) Extremities

d) Abdomen

Question 14:

The most common malignant brain tumor in children is _____.

a) Pilocytic astrocytoma

b) Oligodendroglioma

c) Ependymoma

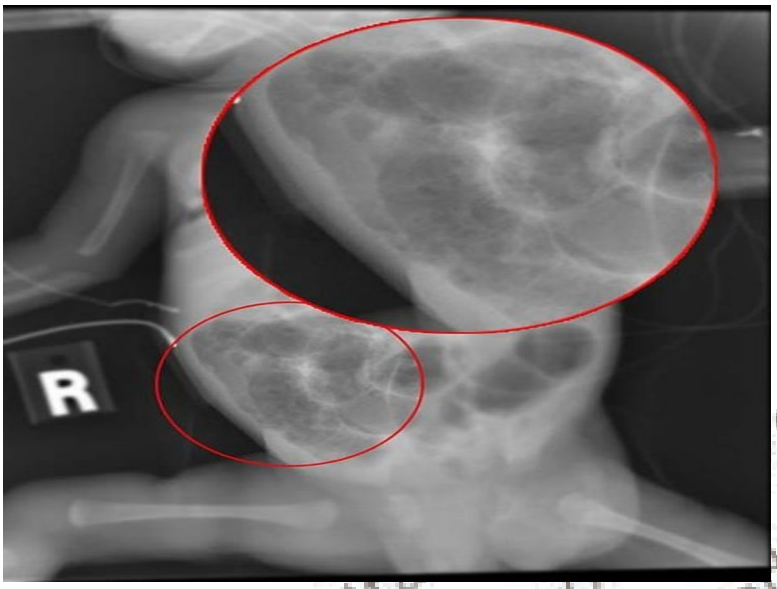
d) Medulloblastoma

Question 15:

A female baby born at 30 weeks of gestation was admitted to NICU for prematurity and respiratory distress. She was placed on CPAP and enteric feeds were started. On day 5 of admission, she became lethargic and there was distension of the abdomen. A plain radiograph of the abdomen shows the following findings. Which statement about the

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condition is false?



a) Antenatal steroids have shown to reduce the occurrence of this condition

b) The radiograph depicts pneumatosis intestinalis

c) Modified Bell's staging can be used for this condition

d) Surgery is the treatment of choice for all stages

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Question 16:

A 5-year-old child presents with jaundice and abdominal pain. On examination, there is a palpable mass in the right hypochondrium. MRCP reveals multiple dilatations limited to the intrahepatic bile ducts. Which of the following statements about this condition is false?

a) Todani classification is used for this condition

b) This condition is also known as Caroli's disease

c) Central dot sign is a characteristic CT finding associated with this condition

d) Endoscopic sphincterotomy followed by surveillance is the treatment of choice

Question 17:

A 10-year-old child came with complaints of pain over the right lower quadrant and lower back pain. On examination, the patient had pain over the right side of the hip on passive extension with a mass in the right lumbar region pointing towards the groin. What is the most probable diagnosis?

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a) Pyelonephritis

b) Psoas abscess

c) Appendicitis

d) Torsion of right undescended testis

Question 18:

A 3-year child is brought to the pediatrician for the evaluation of the lateral neck mass. On examination, a painless, soft, fluctuating mass is found in the lateral side of the neck, as shown in the image. The slip sign is negative, and the swelling is brilliantly transilluminant. What is the most likely diagnosis?



a) Cystic hygroma

b) Branchial cyst

c) Lipoma

d) Cervical lymphadenopathy

Question 19:

The most common location of cystic hygroma is _____.

a) Axilla

b) Posterior triangle of neck

c) Anterior triangle of neck

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d) Superior mediastinum

Question 20:

A 15-year-old girl presented with a slow-growing, rubbery, non-tender swelling on the side of the neck as shown in the image. Examination shows the presence of freckles and skin patches over the face and trunk. What is the most likely diagnosis?



a) Cystic hygroma

b) Chemodectoma

c) Neural tumor

d) Lipoma

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Question 21:

A first-born, 5-weeks-old male infant presents with non-bilious projectile vomiting. The abdominal radiograph shows the following finding. Which of the following will be the preferred investigation in this case?

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a) CT abdomen

b) Ultrasound examination

c) Barium studies

d) Rectal manometry

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Question 22:

A 2-month-old baby is brought to the outpatient department for a facial defect. On examination, the following findings were noticed. The soft and the hard palate are intact. Which of the following is the most appropriate management in this child?



a) Cleft lip repair immediately

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b) Cleft lip repair at 9 to 12 months

c) Cleft lip repair at 4 to 6 months

d) Cleft lip repair at 12-15 months

Answer Key

Question No.	Correct Option
1	c
2	d
3	d
4	a
5	a
6	b
7	a
8	c
9	c
10	b
11	b
12	a
13	b
14	d
15	d
16	d
17	b
18	a
19	b
20	c
21	b
22	c

Detailed Explanations

Solution to Question 1:

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The above X-ray chest shows intra-thoracic bowel shadows along with mediastinal shift suggestive of congenital diaphragmatic hernia.

The common clinical presentation is as follows:

• Respiratory distress

• Dextrocardia

• Scaphoid abdomen

Prenatal diagnosis is done by ultrasonography. Lung-to-head ratio (LHR) is used to assess severity in patients with left-sided CDH. An LHR value of <1 is associated with a very poor prognosis, whereas an LHR >1.4 predicts a more favourable outcome.

Option A: Hyaline membrane disease is a syndrome in premature infants caused by developmental insufficiency of pulmonary surfactant production and structural immaturity in the lungs.

Option B: Meconium aspiration syndrome is the aspiration of meconium-stained amniotic fluid, which can occur before, during or immediately after birth. Meconium is the first intestinal discharge from newborns, a viscous, dark-green substance composed of intestinal epithelial cells, lanugo, mucus, and intestinal secretions.

Option D: During normal delivery, the compression of the rib cage while passing through the mother's vaginal canal helps to remove fluid from the lungs. However, newborns who are delivered via cesarean birth may have excess fluid in the lungs and therefore be hypoxic and develop transient tachypnea.

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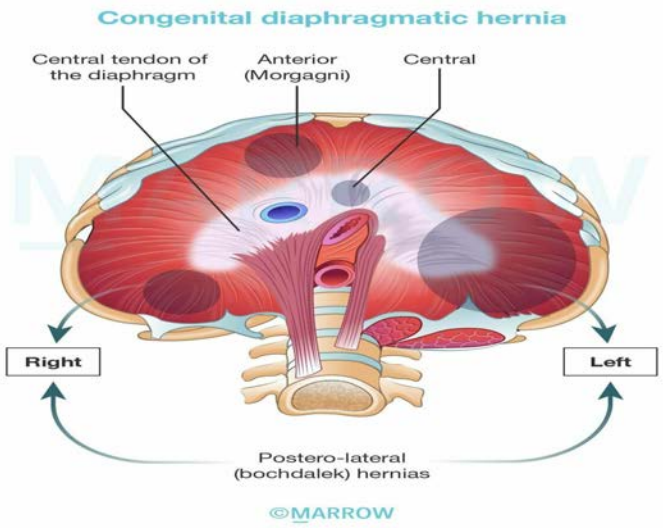
Solution to Question 2:

The posterolateral variant of congenital diaphragmatic hernia (CDH) is known as Bochdalek hernia while the anteromedian variant is called Morgagni hernia.

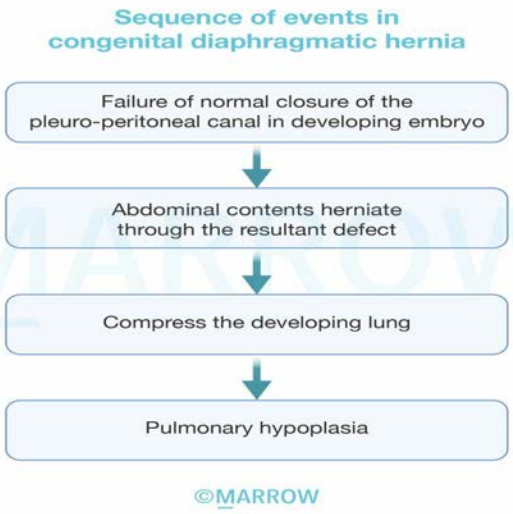
Congenital diaphragmatic hernia results from the failure of closure of the pleuroperitoneal canal in the developing fetus.

Typically in CDH, there is a left-sided posterolateral diaphragmatic defect allowing herniation of abdominal viscera into the chest. 80% of CDH develops on the left side.

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The following sequence of events in CDH leads to the development of pulmonary hypoplasia.



Pulmonary hypertension and pulmonary hypoplasia are the most important prognostic factors in congenital diaphragmatic hernia.

Other poor prognostic indicators in CDH :

• The presence of liver in the thoracic cavity

• Early respiratory distress, within 24 h after birth

• Need for extracorporeal membrane oxygenation

• Herniation to the contralateral lung (right-sided hernia)

•

Treatment of congenital diaphragmatic hernia:

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Variable period of time (24-72 hours) is to be allowed for stabilization before surgical repair. Immediate respiratory support should be provided, including rapid endotracheal intubation and sedation.

Bag and mask ventilation is contraindicated in newborns with congenital diaphragmatic hernia because it causes distension of the stomach which in turn may limit the expansion of the already hypoplastic lung.

During surgery, the viscera are reduced into the abdominal cavity, and the posterolateral defect in the diaphragm is closed using interrupted, nonabsorbable sutures. In most cases (80%-90%), a hernia sac is not present. If identified, it is excised at the time of repair.

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Solution to Question 3:

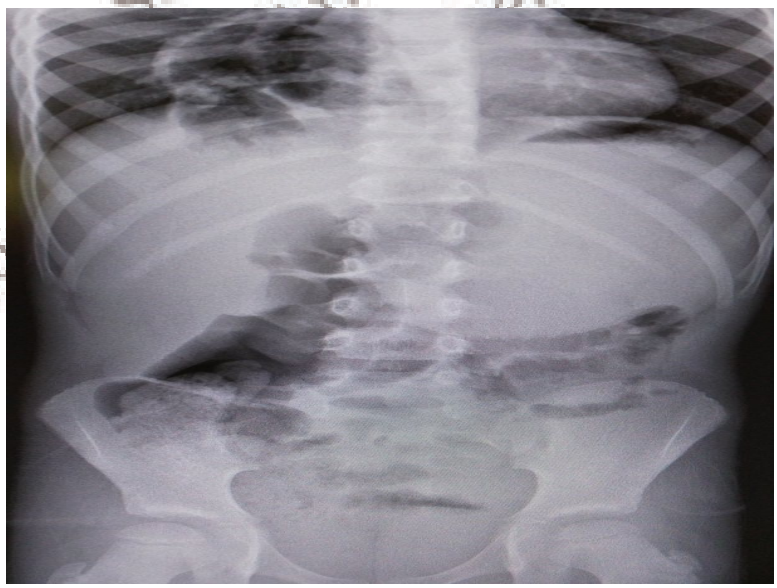
The transverse colon is the most common herniating structure in a Morgagni hernia.

Morgagni Hernia:

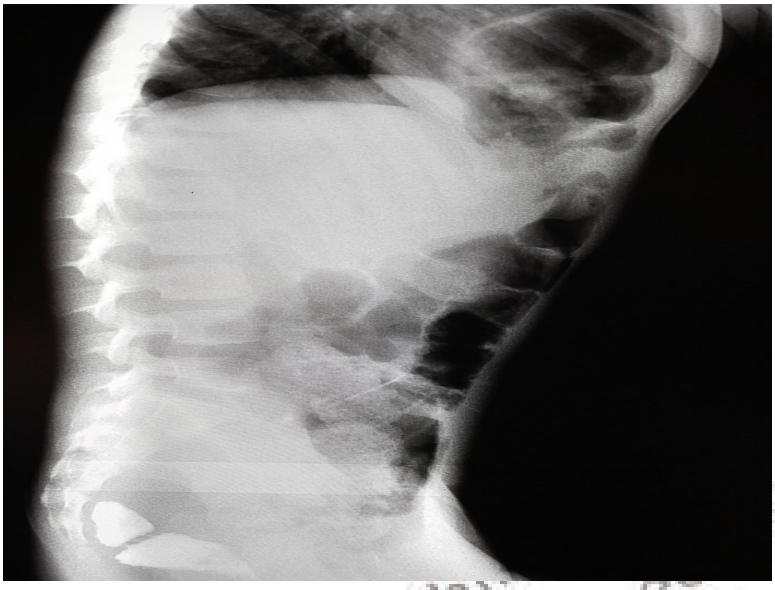
• A hernia in the anterior part of the diaphragm with a defect between the sternal and costal attachments

• The most commonly involved viscus is the transverse colon.

Morgagni hernia:



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Solution to Question 4:

Early respiratory distress, within 6 hours of birth, is thought to be a poor prognostic sign.

Features of a Bochdalek hernia:

• Respiratory distress is a cardinal sign in infants with a congenital diaphragmatic hernia (CDH).

• Early respiratory distress, within 6 hr after birth, is thought to be a poor prognostic sign.

• Children with CDH may also have a scaphoid abdomen and increased chest wall diameter.

• Bowel sounds may also be heard in the chest, with a bilateral decrease in breath sounds.

• The point of maximal cardiac impulse may be displaced away from the side of a hernia if a mediastinal shift has occurred.

• Retroperitoneal fat, left kidney, spleen or only the omentum commonly herniates through the defect. If the defect is large, most abdominal contents including stomach may herniate.

Diagnosis:

• Chest radiography and passage of a nasal gastric tube confirm the diagnosis.

• CDH can be diagnosed on prenatal ultrasonography (between 16 and 24 weeks of gestation)

• High-speed fetal magnetic resonance imaging (MRI) can further define the lesion.

Ultrasonography findings:

• Polyhydramnios

• Chest mass

• Mediastinal shift

• Gastric bubble or a liver in the thoracic cavity

• Fetal hydrops

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Differential diagnosis:

• Eventration

• Cystic lung lesion (pulmonary sequestration or cystic adenomatoid Malformation)

• Group B streptococcal sepsis: associated with delayed onset of symptoms and a CDH often on the right side.

• Pneumothorax: always occurs on contralateral to the side of CDH.

Treatment:

Variable period of time (24-72 hours) to allow for stabilization before surgical repair

The viscera are reduced into the abdominal cavity, and the posterolateral defect in the diaphragm is closed using interrupted, nonabsorbable sutures.

In most cases (80%-90%), a hernia sac is not present. If identified, it is excised at the time of repair.

Conventional mechanical ventilation, high-frequency oscillatory ventilation (HFOV), and extracorporeal membrane oxygenation (ECMO) are the 3 main strategies to support respiratory failure in the newborn with CDH.

Good relative indicators of stability are as follows:

• Requirement for conventional ventilation only

• Low peak inspiratory pressure

• Fio2 <50

If the defect is too large, a porous polytetrafluoroethylene (Gore-Tex) patch is used.

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Solution to Question 5:

The most common Gastrointestinal atresia is duodenal atresia (60%) followed by jejunal and ileal atresia (20%). Colonic atresia is the least common type (7-10%).

Duodenal atresias are commonly associated with chromosomal abnormalities such as Down syndrome. It occurs approximately in 1/10,000 births.

Solution to Question 6:

Explanation:

The given clinical history with an x-ray showing a triple bubble sign is suggestive of jejunal atresia. The next best step is to perform a contrast study to localize the site of obstruction.

Small bowel atresias present with intestinal obstruction soon after birth.

• Bilious vomiting is the dominant feature in jejunal atresia

• Abdominal distension is more prominent in ileal atresia

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A small amount of pale meconium may be passed, despite the atresia.

Plain abdomen radiographs in a jejunal/ileal atresia case will show multiple air-fluid levels and dilated loops. They don't reliably distinguish small and large bowels in neonates and hence contrast studies are often required to localize the obstruction.

Water-soluble enemas (Gastrogaffin, Hypaque) are particularly useful in differentiating atresia from meconium ileus and Hirschsprung disease. Contrast studies also help to rule out distal intestinal obstruction and occasionally may act therapeutically to relieve obstructions.

In most cases of jejunal/ileal atresia, the distal end of the dilated proximal small bowel is resected and a primary end-to-end anastomosis is done. If the proximal bowel is extremely dilated, it may need to be tapered to the distal bowel before anastomosis.

Other options:

Option A: CT is not recommended for neonates owing to the harmful effects of radiation.

Option C: USG abdomen does not help to localize the site of obstruction and is more useful in the diagnosis of intussusception, where there is an abdominal mass.

Option D: Explorative laparotomy is not done for diagnosing intestinal atresias.

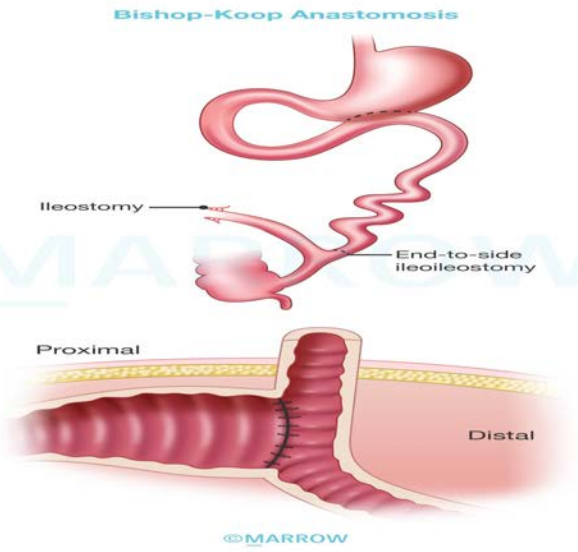
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Solution to Question 7:

Bishop-Koop Anastomosis and Mikulicz enterostomy are done for meconium ileus.

Meconium ileus (also known as DIOS - Distal Intestinal Obstructive Syndrome) is defined as intestinal obstruction due to inspissated meconium within the terminal ileum.

In the Bishop-Koop procedure, the proximal distended limb is joined to the side of the distal small bowel. This is vented by a 'chimney' to the abdominal wall. The Bishop–Koop operation with its irrigating stoma is now only rarely used.



• Ramstedt pyloromyotomy is the standard operation for hypertrophic pyloric stenosis.

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• Kasai procedure is done for biliary atresia.

• Duhamel, Soave, Swenson procedures are done in Hirschsprung's disease.

Solution to Question 8:

The clinical scenario is suggestive of Hirschsprung's disease. A rectal biopsy is the gold standard for the diagnosis of Hirschsprung's disease.

A rectal biopsy 2 cm above the dentate line is the ideal area for a biopsy.

Hirschsprung's disease is a developmental disorder characterized by the absence of ganglion cells in the myenteric (Auerbach) plexus and submucosal (Meissner) plexus. Most infants present with abdominal distention and bilious emesis with failure to pass meconium within the first 24 hours of life.

The initial investigation is a contrast enema. The area between the dilated and contracted segments is referred to as the transition zone. The affected part shows the absence of ganglion cells and hypertrophy of nerve trunks in the rectal biopsy.

Other investigations for Hirschsprung's disease include:

• Water-soluble contrast enema - shows the presence of contracted aganglionic rectum, transition zone, and a dilated normally innervated colon.

• Anorectal manometry - shows the failure of the relaxation of the internal anal sphincter.

Definitive surgeries for Hirschsprung disease are as follows:

• Swenson procedure, where aganglionic bowel is removed and a coloanal anastomosis is performed.

• Duhamel procedure, where the aganglionic rectal stump is left in place and the ganglionated normal colon is pulled posterior.

• Soave procedure, where endorectal mucosal dissection is done within the aganglionic distal rectum. The ganglionated normal colon is pulled through the remnant muscular cuff, and a coloanal anastomosis is performed.

Solution to Question 9:

Meckel's diverticulum is a true diverticulum, which extends from the antimesenteric side of the small bowel. The diverticula which contain all the layers of the intestine are called true diverticula.

Meckel's diverticulum is caused by a failure of normal regression of the vitelline duct that develops during weeks 5-7 of gestation.

The rule of 2's (Mnemonic for Meckel's diverticulum) :

• 2 types of heterotopic mucosa (gastric & pancreatic)

• 2% incidence

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• located within 2 feet of the ileocecal valve

• approximately 2 inches in length

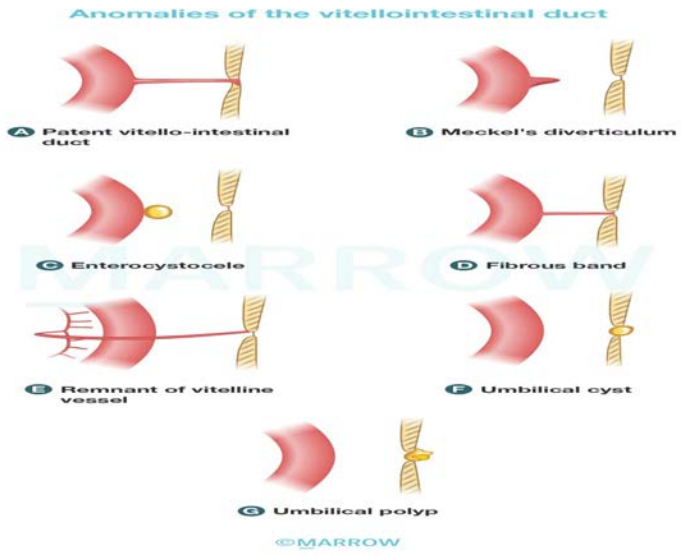
• Usually symptomatic by 2 years of age

The most common presentation is painless, massive, lower GI bleed in children younger than 5 years. Meckel's diverticulum can be the lead point for ileoileal or ileocolic intussusception.

A bleeding Meckel's diverticulum may be confirmed by a 99 mTc-pertechnetate isotope scan to detect ectopic gastric mucosa.

Surgical treatment is the definitive therapy for Meckel's diverticulum. A simple V-shaped diverticulectomy with transverse closure of the ileum is the ideal surgical approach.

The following diagram shows the various anomalies that arise as a result of the failure of normal regression of vitellointestinal duct:



Solution to Question 10:

Omphalocele is usually associated with other congenital anomalies whereas gastroschisis is rarely associated with other congenital anomalies.

Omphalocele refers to a congenital defect of the abdominal wall in which the bowel and solid viscera are covered by the peritoneum and amniotic membrane.

• During normal development of the human embryo, the midgut herniates outward through the umbilical ring and continues to grow.

• Between 10th-12th week of gestation, the midgut returns to the coelomic cavity and undergoes proper rotation and fixation, along with the closure of the umbilical ring.

• If the intestine fails to return, the infant is born with the abdominal contents protruding directly through the umbilical ring, with an intact sac covering the abdominal viscera, termed an omphalocele.

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The sac is composed of an outer layer of amnion and an inner layer of peritoneum. It is seen in omphalocele and not in gastroschisis. Omphalocele can vary from a small defect with intestinal contents to a giant omphalocele in which the abdominal wall defect measures 4 cm or more in diameter. It may even contain liver.

Omphalocele occurs in association with special syndromes such as:

• There is a 60% to 70% incidence of associated anomalies, especially cardiac anomalies (20–40% of cases) and chromosomal abnormalities.

• Exstrophy of the cloaca (vesicointestinal fissure)

• The Beckwith-Wiedemann constellation of anomalies (macroglossia, macrosomia, hypoglycemia, and visceromegaly and omphalocele)

• The Cantrell's pentalogy (lower thoracic wall malformations like cleft sternum, ectopia cordis, epigastric omphalocele, anterior midline diaphragmatic hernia, and cardiac anomalies).

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Solution to Question 11:

The above image shows gastroschisis. Herniation of the liver is more commonly seen with omphalocele than gastroschisis.

Gastroschisis represents a congenital anomaly characterized by a defect in the anterior abdominal wall. The abdominal contents protrude through this defect. It is the most common anomaly seen in babies born to mothers under 20 years of age. Unlike omphalocele, there is no overlying sac and the size of the defect is usually <4 cm.

An orogastric tube is placed to decompress the stomach. For primary closure, bowel loops are reduced, fascia and skin are approximated.

If the viscera cannot be reduced into the abdomen, a silo is placed at the bedside as shown in the image. The eviscerated intestines are reduced serially during 5 to 7 days, followed by operative fascial closure.



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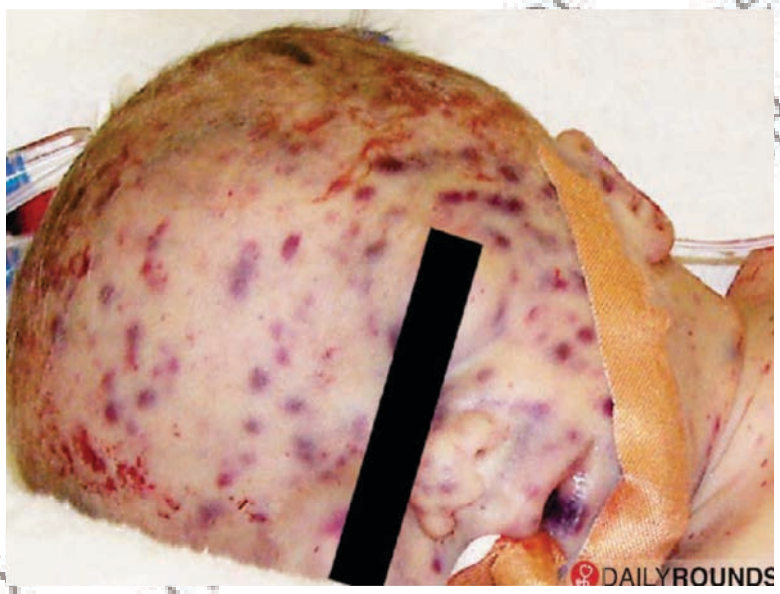
Solution to Question 12:

Neuroblastoma is the most common extracranial solid tumour of childhood. While brain tumours are the most common solid tumour of childhood.

Neuroblastoma is a malignancy of neuroblast cells in the adrenal medulla or sympathetic ganglia and typically presents as an abdominal or paravertebral mass. Raccoon eyes (periorbital ecchymoses) are seen in neuroblastoma due to orbital metastasis.

Shimada classification is used for classifying neuroblastoma.

Blue subcutaneous nodules represent skin dissemination of tumour and are associated with the blueberry muffin syndrome.



Solution to Question 13:

The most common site of rhabdomyosarcoma in children is the head and neck.

Rhabdomyosarcoma is the most common pediatric soft tissue sarcoma and accounts for approximately 3.5% of childhood cancers.

These tumours may occur at virtually any anatomic site but are usually found in the head and neck (25%), genitourinary tract (24%), extremities (19%) and orbit (9%). Retroperitoneum and other sites account for the remainder of primary sites.

Rhabdomyosarcomas are the most common soft tissue tumors among children younger than 15 years and can occur at any site comprised of striated muscle.

Rhabdomyosarcoma is classified into three types - embryonal, alveolar, and pleomorphic. Embryonal rhabdomyosarcoma is the most common type.

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Solution to Question 14:

Medulloblastoma is the most common malignant brain tumour in children.

They are usually midline. Most of them occur in the cerebellum and present with symptoms of increased ICP.

Most common tumours in children:

• Brain tumours are the most common solid tumours.

• Pilocytic astrocytoma is the most common brain tumour (usually not malignant).

• Neuroblastoma is the most common extracranial solid tumour.

• Rhabdomyosarcomas are the most common soft tissue tumours.

Solution to Question 15:

The clinical scenario and radiological findings are indicative of necrotizing enterocolitis (NEC). The absolute indication for operative management of NEC is the presence of intestinal perforation. Milder cases can be treated with gut rest, antibiotics, and parenteral nutrition.

The radiograph shows the presence of multiple air bubbles within the bowel wall. This is called pneumatosis intestinalis and is a pathognomonic sign suggestive of necrotizing enterocolitis.

Necrotizing enterocolitis is the necrosis of a portion of the bowel and is the most common gastrointestinal surgical emergency in the neonatal period. The single most important risk factor is prematurity. Other contributing factors are enteral feeding, ischemia, and infection. Administration of antenatal steroids is known to reduce the occurrence of NEC.

It usually occurs in the first few days of life after the initiation of the enteral feeds. Some clinical features include:

• Lethargy

• Feeding intolerance

• Bloody stools

• Abdominal distension

• Abdominal tenderness.

The radiograph may show pneumatosis intestinalis, portal venous gas, ascites, and the presence of free air.

The modified Bell's criteria is used for staging the severity of NEC.

Solution to Question 16:

The given clinical scenario is suggestive of Caroli's disease (type V choledochal cyst). Liver transplantation is the preferred treatment of choice here.

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Choledochal cysts are cystic dilations of the common bile duct (CBD). They present with a triad of jaundice, a palpable upper quadrant mass, and abdominal pain.

There are mainly five types of choledochal cysts. The original classification for choledochal cysts by Alonso–Lej, has been modified by Todani.

MRCP is the investigation of choice. The beaded appearance of intrahepatic bile ducts on HIDA scan and central dot sign on CT are characteristic findings associated with Caroli's disease.

The arrows in the image given below are pointing to the central dot sign.



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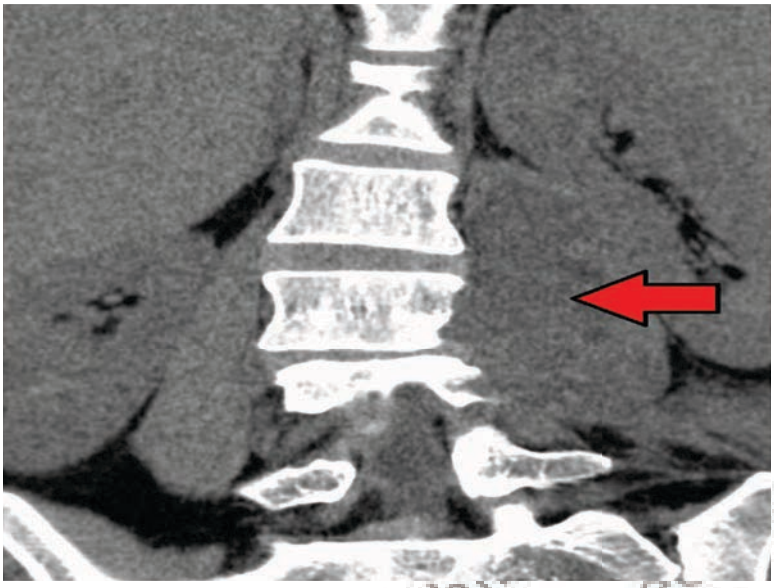
Solution to Question 17:

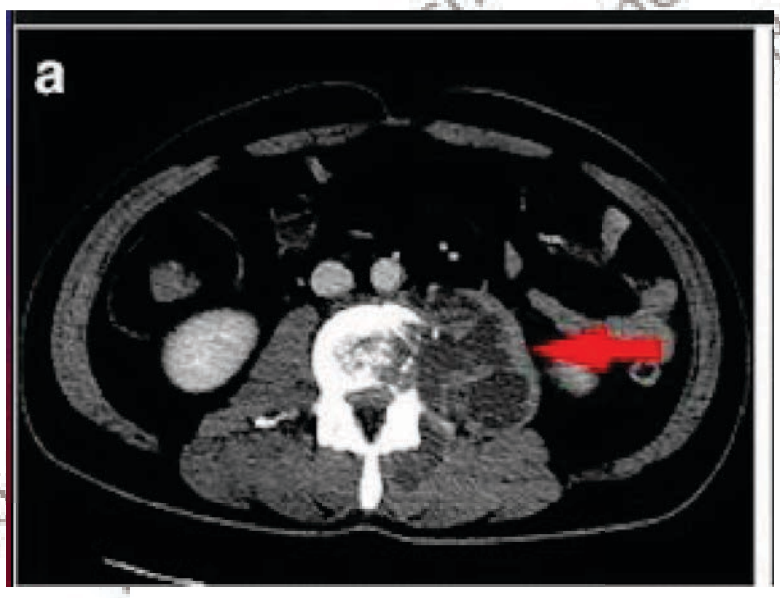
The given clinical history of lower back pain, mass in the right lumbar region pointing towards the groin and pain on passive extension of the ipsilateral hip is suggestive of a psoas abscess.

Psoas abscess is a retroperitoneal abscess, caused due to various etiologies. Previously, tuberculosis of the spine was the most common cause secondary to spreading infection from the digestive or urinary tract, which can cause psoas abscess. Nowadays, Crohn's disease is the most common cause. Patients present with flank pain, fever and chills, malaise and weight loss. They can have referred pain to the hip, groin or knee. When the swelling extends across the groin and below the inguinal ligament along the course of the iliopsoas, it becomes cross fluctuant across the inguinal ligament.

Imaging is done by a CT scan, which shows a low-density mass with surrounding inflammation and infiltration of surrounding fat and gas or air-fluid levels.

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Treatment is done by percutaneous CT-guided drainage and appropriate antibiotics.

Other options:

Option A: Pyelonephritis is usually associated with a history of urinary tract infection and sudden onset of pain in the flank and hypochondrium, not the lumbar region.

Option C: Appendicitis (retrocaecal) can present with pain on passive extension of the hip (psoas sign), but the presence of a mass in the right lumbar region pointing towards the groin makes it an unlikely diagnosis.

Option D: Testicular torsion is a surgical emergency condition presenting with sudden onset pain in the scrotum, groin and lower abdomen, tenderness, redness and edema of the scrotal skin.

Solution to Question 18:

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A soft, painless, brilliantly transilluminant, fluctuating mass found in the posterior part of the neck in a child, is most likely to be a cystic hygroma.

Cystic hygroma is a lymph-filled sac that results from the obstruction of the lymph vessels during their development. It is most commonly present in the posterior triangle of the neck. The mass may be apparent at birth or may appear in early childhood due to the increased accumulation of lymph. Since the sac is filled with lymph, it is soft, fluctuating, and brilliantly transilluminant.

Treatment:

• Aspiration of the contents, followed by excision once the sac or capsule gets thickened by fibrous tissue.

• Single cysts can be treated with sclerosing therapy. Commonly used sclerosants include OK–432 or Picibanil, which is a mixture of group A Streptococcus pyogenes strain, pure ethanol, interferon alpha-2a, and doxycycline.

• Complete excision is done in case of multiple cysts.

Option B: A branchial cleft cyst also presents as soft fluctuant swelling. It is present in the anterior neck and at the junction of the upper third and middle third of the sternocleidomastoid muscle.

Option C: Lipoma is less commonly seen in children. The swelling is non-fluctuant and when palpated, the edge slips under the finger. This is known as the slip sign.

Option D: Cervical lymphadenopathy is seen in children with infections of the parotid and upper respiratory tract infections. On palpation, they are firm and non-fluctuant.

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Solution to Question 19:

Cystic hygroma, also known as cystic lymphangioma and macrocystic lymphatic malformation, is a congenital multiloculated lymphatic lesion that can arise anywhere but is classically found in the left posterior triangle of the neck.

The other common sites are the axillary, mediastinal, inguinal, and retroperitoneal regions. It occurs as a result of sequestration or obstruction of developing lymph vessels. The cysts are lined by endothelium and filled with lymph.

The image below shows a newborn with cystic hygroma on the right side of the neck.

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Solution to Question 20:

A lateral neck mass in a pediatric patient, which is non-tender and present in association with freckles, and hyperpigmented skin patches (cafe-au-lait spots) is suggestive of neural tumor i.e. neurofibroma.

Neurofibroma is a benign tumor arising from the connective tissue of the nerve containing ectodermal, neural and mesodermal connective tissue components. It can be single or multiple. It is the most common intradural extramedullary spinal tumor. Neurofibromas can be local, generalized (von Recklinghausen's disease) or plexiform types. Patients present with mild pain or a painless swelling usually in the subcutaneous or cutaneous plane with tingling, numbness and paraesthesia along the distribution of the nerve. Complications of neurofibroma include cystic degeneration, erosion into deeper planes, cord compression and paralysis (spinal neurofibroma) and sarcomatous changes.

Treatment is excision under general or regional anesthesia. Indications for surgery in neurofibroma include symptomatic patients (pain and pressure symptoms), cosmetic problems and malignant transformation (5%).

Option A: Cystic hygroma is a type of congenital lymphangioma. This swelling is soft and partially compressible, which shows positive fluctuation and translucency test.

Option B: Chemodectoma or carotid body tumor is a rare tumor, most commonly present in the fifth decade and there is an association with pheochromocytoma. These patients usually present with a slowly enlarging, painless lump at the carotid bifurcation.

Option D: A lipoma is a soft painless swelling. It shows the characteristic slip sign and is freely mobile.

Solution to Question 21:

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The given clinical vignette and the radiographic image showing the presence of an enlarged gastric gas bubble (single bubble) are suggestive of congenital hypertrophic pyloric stenosis (CHPS). Ultrasound examination is the investigation of choice for this condition.

Congenital hypertrophic pyloric stenosis (CHPS) is characterized by abnormal thickening of the pylorus muscles in the stomach leading to gastric outlet obstruction. First-born male infants are at the highest risk.

Infants usually present with

• Projectile, non-bilious vomiting due to gastric outlet obstruction, most commonly between 3 and 6 weeks of age.

• Olive-shaped mass palpable in the right upper quadrant or epigastrium.

• Visible peristalsis after feeding, moving from left to right, followed by projectile vomiting.

• Metabolic abnormalities include hypokalemic, hypochloremic, metabolic alkalosis with paradoxical aciduria.

Ultrasound examination confirms the diagnosis of congenital hypertrophic pyloric stenosis (CHPS) in the majority of cases. The diagnostic criteria for pyloric stenosis are a muscle thickness of ° 4 mm and a pyloric length of ° 16 mm.

Ultrasound signs seen in Congenital Hypertrophic Pyloric stenosis are:

• Target sign (Hypoechoic thickened pyloric muscle with a hyperechoic central mucosa)

• Cervix sign

• Nipple sign.

• Antral nipple sign

The child should be rehydrated and the metabolic abnormality has to be corrected before proceeding to surgery. The Ramstedt pyloromyotomy is the standard surgical procedure for its treatment.



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The ultrasound image given above shows hypertrophied pylorus resembling that of the uterine cervix (cervix sign) and double-layered hypertrophic mucosa protruding into the stomach, (Nipple sign).



The ultrasound image given above shows redundant pyloric mucosa protruding into the antrum - Antral nipple sign.

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Solution to Question 22:

The given clinical image is that of a child with a cleft lip on the left side. The most appropriate management for this patient would be a cleft lip repair at 4-6 months.

Etiology of the cleft lip can include familial, protein and vitamin deficiency, rubella infection, radiation, chromosomal abnormalities, maternal epilepsy and drug intake during pregnancy (steroids/eptoin/diazepam)

Majority of the cases are unilateral and cleft lip alone is uncommon.

Millard Criteria (Rule of 10) is used to undertake surgery for cleft lip.

- 10 pound in weight
- 10 weeks old
- 10g% Hemoglobin

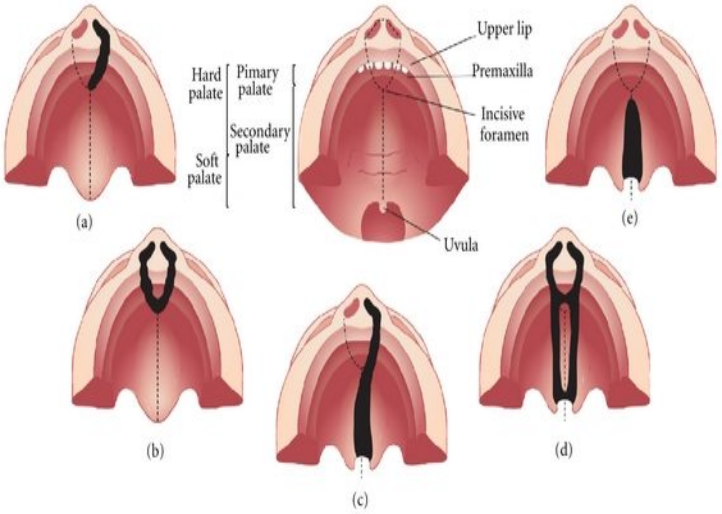
Millard cleft lip repair by rotating the local nasolabial flaps is done.

The most appropriate management for this patient would be cleft lip repair at 4 to 6 months.

According to Delaire timing of cleft surgery - unilateral cleft lip alone can be operated in one stage operation and is done at 4-6 months.

The different types of facial clefts are shown below:

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- Unilateral cleft lip with alveolar involvement
- Bilateral cleft lip with alveolar involvement
- Unilateral cleft lip associated with cleft palate
- Bilateral cleft lip and palate
- Cleft palate only

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Trauma - Scores, Investigations and Assessment

Question 1:

Which of the following is not expected to increase as an immediate response to surgical stress or trauma?

a) ACTH

b) TNF α

c) GH

d) Insulin

Question 2:

Following a mass casualty, how would you triage the following patients?

a) 1-A, 2-B, 3-C, 4-D

b) 1-B, 2-A, 3-D, 4-C

c) 1-C, 2-A, 3-D, 4-B

d) 1-D, 2-C, 3-B, 4-A

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Question 3:

The components of the Revised Trauma Score (RTS) include which of the following:

a) 2, 4 and 5

b) 1, 3 and 5

c) 1, 2 and 4

d) 2, 3 and 4

Question 4:

Trauma and Injury Severity Score (TRISS) includes which of the following components?

a) GCS + BP + RR

b) RTS + ISS + age

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c) RTS + ISS + GCS

d) RTS + GCS + BP

Question 5:

A 22-year-old man sustained a roller crush injury of his left arm up to mid-humerus and was brought to the casualty. The duty orthopedician uses the MESS score to decide about limb salvage. The score does not include which of the following?

a) Age of the patient

b) Ischemia

c) Neurogenic injury

d) Energy of injury

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Question 6:

Diagnostic peritoneal lavage is being done in a patient with suspected hemoperitoneum. Which of the following statements is not true?

a) Presence of more than 100,000 RBCs/mm3 is a positive finding

b) Presence of more than 200 white cells/mm3 is a positive finding

c) Aspiration of at least 10 mL of gross blood is an indication for laparotomy

d) Amylase levels more than 175 units/dL is a positive finding

Question 7:

A 32-year-old professional boxer was brought to the emergency department following a blow to the abdomen. On examination, his vitals were normal, and his abdomen was tender on palpation. Which among the following is the best modality to assess the injury to the abdominal organs for this patient?

a) FAST

b) Explorative laparotomy

c) CECT scan

d) USG Abdomen

Question 8:

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A young man is brought to the trauma unit following a road traffic accident. He is hemodynamically unstable. As an adjunct to the primary survey, the managing surgeon decides to do a FAST. Which of the following areas would not be visualized in this procedure?

a) Right upper quadrant

b) Left upper quadrant

c) Left lower quadrant

d) Sub-xiphoid area

Question 9:

Which of the following describes the correct sequence of evaluation in the FAST technique?

a) Pericardial sac → Perihepatic region → Perisplenic region → Pelvis

b) Perihepatic region → Perisplenic region → Pelvis → Pericardial sac

c) Pelvis → Pericardial sac → Perisplenic region → Perihepatic region

d) Perisplenic region → Perihepatic region → Pericardial sac → Pelvis

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Question 10:

A patient with a history of blunt trauma is brought to the casualty and an eFAST examination is performed. Which of the following statements about the investigation is false?

a) B-lines indicate a normal ultrasonographic finding of the lung

b) Stratosphere sign seen in M-mode USG is indicative of pneumothorax

c) It can be reliably used to detect less than 100 mL of free blood

d) It is unreliable for the assessment of the retroperitoneum

Question 11:

An intensivist is evaluating a patient for brain stem death in the ICU. Presence of which of the following features should not be misinterpreted as evidence for normal brainstem function in this patient?

a) 2, 4 and 5

b) 1,2 and 3

c) 2, 3 and 5

d) 1, 3 and 4

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Question 12:

Which of the following is false regarding imaging in the primary survey of a trauma patient?

a) Hemodynamically unstable patient should not be sent for CT scan

b) All patients should have chest X-ray PA view only

c) X-ray of the pelvis is essential in primary survery

d) X-rays in primary survey must also be done in pregnant women

Question 13:

Which of the following is not a part of the primary survey?

a) Measuring blood pressure

b) Removing clothes to inspect for wounds

c) Taking CT scan of the patient

d) Checking airway patency

Question 14:

A patient who sustained an RTA was brought to the ER in a semiconscious state. He makes incoherent sounds, withdraws from painful stimuli, and opens his eyes to painful stimuli. Calculate his GCS score.

a) 8

b) 9

c) 7

d) 10

Question 15:

A patient who was admitted after a road traffic accident is put on mechanical ventilation. He opens his eyes on verbal command and moves all four limbs spontaneously. Calculate his GCS.

a) Eyes-2, Verbal-1, Motor-5

b) Eyes-2, Verbal-NT, Motor-5

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c) Eyes-3, Verbal-1, Motor-6

d) Eyes-3, Verbal-NT, Motor-6

Question 16:

Which of the following is considered balanced resuscitation?

a) Maintaining airway, breathing and circulation

b) Allow permissible hypotension

c) Maintain ph by ensuring acid-base balance

d) Fluid resuscitation by giving colloids and crystalloids

Question 17:

Which of the following drugs have a significant role in the mortality reduction of trauma patients based on the CRASH-2 trial?

a) Adrenaline

b) Tranexamic acid

c) Noradrenaline

d) Dobutamine

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Question 18:

In a patient with massive haemorrhage, damage control surgery is being performed. What does this consist of?

a) 1,2 and 5

b) 1,2,3,4,5

c) 1,2,3 and 4

d) 1,2 and 3

Question 19:

A young man sustained multiple injuries following a road traffic accident. On examination, his pulse rate is 100/min and BP is 85/60 mmHg. He is diagnosed with pelvic fracture and is suspected to have retroperitoneal hemorrhage. Which of the following statements is true?

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a) Coagulopathy is corrected in phase II of damage control surgery

b) Definitive repair of injuries is done 12-24 hours after phase III

c) Internal iliac artery ligation is done in phase II

d) Hypothermia and acidosis are corrected in phase I

Question 20:

Which of the following is not a component of the trauma triad of death?

a) Hypothermia

b) Shock

c) Acidosis

d) Coagulopathy

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Answer Key

Question No.	Correct Option
1	d
2	b
3	c
4	b
5	c
6	b
7	c
8	c
9	a
10	c
11	d
12	b
13	c
14	a
15	d
16	b
17	b
18	d

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19	a
20	b

Detailed Explanations

Solution to Question 1:

Insulin levels in plasma are decreased in the immediate ebb phase of surgical stress or trauma.

There are three phases in the physiological response to injury:

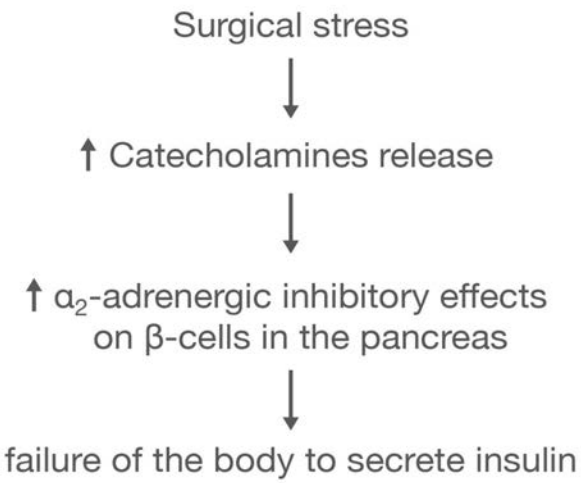
• Ebb phase

• Flow phase

• Recovery phase.

The ebb phase begins at the time of injury and is characterized by hypovolemia and decreased basal metabolic rate. The predominant hormones regulating the ebb phase are catecholamines, cortisol, and aldosterone.

The following mechanism leads to a reduction in insulin secretion during this phase:



Pro-inflammatory cytokines like interleukin-1, tumour necrosis factor α, IL-6 and IL-8 are produced within the first 24 hours of injury.

In the later flow phase, insulin secretion begins to normalize i.e., relatively increases. However, insulin resistance by target cells occurs because of a defect in the insulin receptor/intracellular signalling pathway.

Thus, the perioperative period is characterized by a state of functional insulin deficiency.

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Solution to Question 2:

The patients should be triaged as follows:

Triage means 'to sort'. It is done to categorize the need for priority of patients in cases of mass casualties.

START triage scheme stands for Simple Triage And Rapid Treatment.

Patient	Triage color cod e
A patient with tension pneu mothorax	Red
A patient with 95% third-deg ree burns	Black
A patient with a laceration on the forehead	Green
A patient with a degloving inj ury	Yellow

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Solution to Question 3:

The Revised Trauma Score (RTS) is a physiologic scoring system based on the initial vital signs of a trauma patient.

Revised Trauma Score (RTS) includes :

- Glasgow coma scale
- Respiratory rate
- Systolic BP

The score range is 0–12. A lower score indicates a higher severity of injury.

Solution to Question 4:

TRISS (Trauma and Injury Severity Score) includes :

- Injury Severity Score (ISS)
- Revised Trauma Score (RTS)
- Age
- Mechanism of injury (blunt/penetrating).

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Solution to Question 5:

Neurogenic injury is not included in the Mangled Extremity Severity Score (MESS).

The Mangled Extremity Severity Score (MESS) is useful in deciding about limb salvage.

The components of the Mangled Extremity Severity score are:

• The energy that caused the injury, skeletal and soft tissue injury

• Limb ischemia

• Shock

• Age of the patient.

Solution to Question 6:

The presence of more than 500 white cells/mm3 in blunt trauma indicates a positive finding of diagnostic peritoneal lavage.

Diagnostic peritoneal lavage detects the presence of intraperitoneal blood. Its use has decreased to virtually nil at many centres with the advent of the FAST examination.

Indications for diagnostic peritoneal lavage are:

• Abdominal pain or tenderness

• Low abdominal rib fractures

• Unexplained hypotension

• Spinal or pelvic fractures

• Paraplegia or quadriplegia

• Assessment hampered by altered mental status due to neurologic injury or intoxication.

Procedure:

It is performed through a small infraumbilical incision with the placement of the catheter under direct vision. The supraumbilical approach is indicated in pregnant patients and those with pelvic fractures. Aspiration of at least 10 mL of gross blood is an indication for laparotomy.

If no blood is aspirated, a catheter is placed and 1 L of Ringer lactate solution is instilled into the peritoneal cavity and then allowed to drain by gravity. At least 200 mL of lavage fluid should be recovered to allow for accurate interpretation.

Disadvantages:

• Neither qualitative nor quantitative

• Cannot identify the source of hemorrhage

• Relatively small amounts of intraperitoneal bleeding may result in a positive study

• May not detect small and large injuries to the diaphragm

• Cannot rule out injury to the bowel or retroperitoneal organs.

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Solution to Question 7:

A contrast-enhanced CT scan is the best diagnostic modality (gold standard) for stable patients with blunt trauma to the abdomen.

It is a non-invasive and sensitive investigation. It can identify haemorrhage, intraabdominal as well as retroperitoneal organ injury. However, performing CECT is time-consuming (when compared to FAST) and therefore it can be used only in stable patients.

FAST ultrasound is a limited examination directed to look for intraperitoneal fluid or pericardial injury as a marker of the underlying injury. The best imaging modality for hemodynamically unstable patients with blunt trauma of the abdomen is FAST.

Solution to Question 8:

The left lower quadrant is not assessed in FAST examination.

FAST (Focused Assessment with Sonography for Trauma) is a rapid diagnostic examination to assess patients with potential thoracoabdominal injuries.

FAST also stands for Focussed abdominal sonography for trauma. However, since FAST is not only used to assess abdominal injuries but also to assess haemopericardium in cases of pericardial injuries, the expansion Focussed assessment with sonography for trauma is preferred. It can be performed within 2-4 minutes.

Technique of FAST examination:

With the patient in the supine position, a 3.5-5.0 MHz convex transducer is used.

Four regions may be scanned:

• Subxiphoid transverse view - To assess for pericardial effusion and left lobe liver injuries

• Longitudinal view of the right upper quadrant - To assess for right liver injuries, right kidney injury, and Morrison's pouch.

• Longitudinal view of the left upper quadrant - To assess for splenic injury and left kidney injury.

• Transverse and longitudinal views of the suprapubic region - To assess the bladder and pouch of Douglas.

In an extended FAST or eFAST scan, left and right thoracic views are used to assess for pneumothorax and haemothorax.

Solution to Question 9:

The correct sequence of evaluation in the FAST technique is Pericardial sac → Perihepatic region → Perisplenic region → Pelvis.

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Solution to Question 10:

FAST is not reliable in detecting less than 100 mL of free blood.

Disadvantages of FAST:

• Does not directly identify injury to hollow viscus

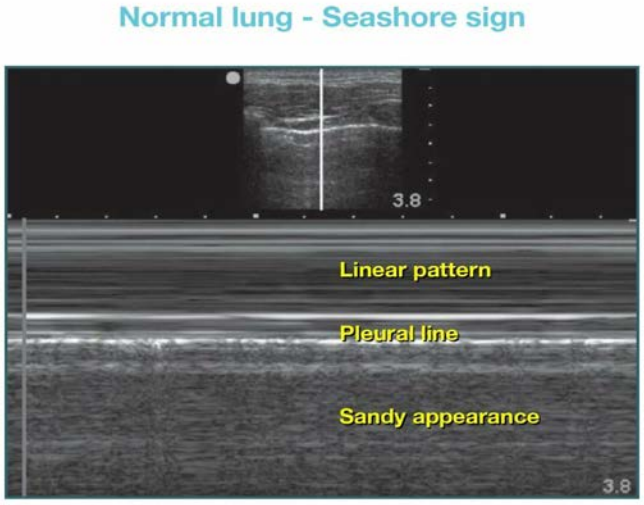
• Cannot reliably exclude injury in penetrating trauma

• Unreliable for the assessment of the retroperitoneum.

B-lines or "comet trails" are echogenic bright linear reflections beneath the pleura that are usually lost with any air between the probe and the lung tissue.

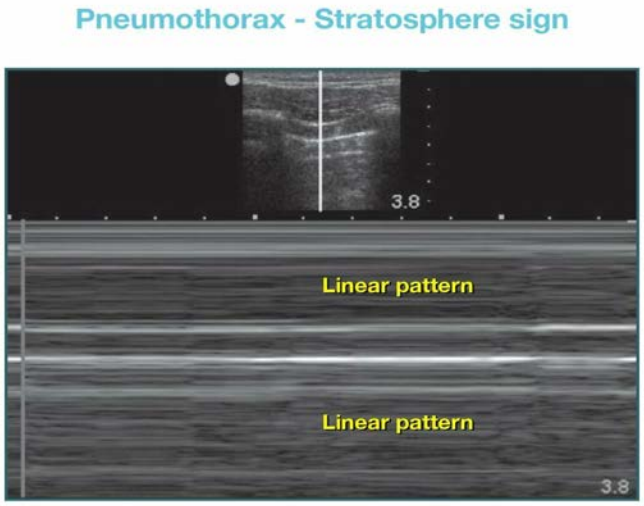
B-lines' are expected in normal aerated lung and are visualized moving along with the sliding pleura. Excessive 'B-lines', especially in the anterior lung, are abnormal and are usually indicative of interstitial edema.

Therefore, the presence of B-lines along with seashore sign indicates the absence of pneumothorax. The image below shows the seashore sign.



Barcode sign which is also known as the stratosphere sign and lack of sliding movement in the lungs diagnosed by an M-mode USG is suggestive of pneumothorax.

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Solution to Question 11:

Babinski reflex, tachycardia, and normal systolic blood pressure can be occasionally seen in patients with brain stem death. So, this should not be misinterpreted as evidence for normal brainstem function

Brain death is not characterized by decerebrate or decorticate posturing, which is a brain-originating motor response.

Brainstem death is defined as the irreversible loss of cerebral and brain-stem function.

Ideal criteria for brain stem death contain three essential elements:

• Widespread cortical destruction that is re■ected by deep coma and unresponsiveness to all forms of stimulation

• Global brainstem damage demonstrated by absent pupillary light reaction and by the loss of oculovestibular and corneal re■exes

• Destruction of the medulla manifested by complete and irreversible apnea.

Brainstem death entails testing twice, by two clinicians, to demonstrate the absence of:

• Response to pain

• Respiratory drive (apnea despite arterial PCO_2 ° 60 mm Hg)

• Pupillary light reflex

• Corneal reflex

• Vestibulo-ocular reflex

• Oculo-cephalic reflex

The following manifestations are occasionally seen in brain dead patients and should not be misinterpreted as evidence for brainstem function:

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• Normal systolic blood pressure >100 mmHg

• Movements originating from the spinal cord or peripheral nerve may occur

• Sweating, flushing, tachycardia

• Deep tendon reflexes, superficial abdominal reflexes, triple flexion response

• Babinski reflex

• Spontaneous movements of limbs other than pathologic flexion or extension response

• Respiratory-like movements (shoulder elevation and adduction, back-arching, intercostal expansion without significant tidal volumes).

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Solution to Question 12:

Chest X-ray and X-ray pelvis are taken in AP view in the adjuncts to the primary survey of a trauma patient.

Solution to Question 13:

Taking a CT scan of the patient is a part of secondary survey.

Primary survey identifies and manages the most immediately life-threatening pathologies first.

The secondary survey includes investigations that help identify all other injuries, excluding the apparent ones. This includes X-rays of the spine and extremities and a CT of the abdomen, head, chest, and spine.

Solution to Question 14:

The GCS score in this patient is 8.

Withdraws from pain = 4

Incoherent sounds = 2

Opens eyes to painful stimuli = 2

Total GCS score = 4 + 2 + 2 = 8.

Solution to Question 15:

The patients GCS is Eyes-3, Verbal-NT, Motor-6.

It is calculated as follows:

• Eye opening: Opening to verbal command - 3

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• Verbal response: In the case of endotracheal intubation, the verbal response score is noted as NT (non-testable)

• Motor respone: Movement of all 4 limbs spontaneously - 6

Total GCS score is not recorded since one of the components is non-testable.

Solution to Question 16:

Permissive hypotension is a part of balanced resuscitation in trauma management to avoid bleeding.

Damage control resuscitation (DCR) i.e. balanced resuscitation is used in the settings of major trauma. It aims to control hemorrhage and prevent coagulopathy prior to the development of the trauma triad of death (hypothermia, acidosis, and coagulopathy). The components of DCR include:

• Permissive hypotension until definitive surgical control

• Minimize crystalloid based resuscitation

• Early use of blood products (PRBCs, FFP, platelets, cryoprecipitate) in the ratio of 1:1:1

• Use of hemostatic agents such as tranexamic acid, recombinant factor 7a, prothrombin complex concentrates

DCR has the following advantages:

• Minimizes the impact of trauma-induced coagulopathy

• Limits blood product waste

• Reduces the complications that occur with aggressive crystalloid resuscitation.

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Solution to Question 17:

The CRASH-2 trial has shown mortality reduction in bleeding trauma patients by early usage of tranexamic acid (preferably within the first 3 hours) with a loading dose of 1 g over 10 minutes and then infusion of 1 g over 8 hours.

Solution to Question 18:

Damage Control Surgery refers to performing limited surgical intervention in order to arrest hemorrhage, control sepsis, and protect from further injury.

This concept of tailoring the operation to match the patient's physiology and staged procedures to prevent physiological exhaustion is called Damage Control Surgery.

Furthermore, definitive repairs are delayed and not until the patient is hemodynamically stable and physiologically capable of sustaining the procedure. Crystalloid and colloid infusions are

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limited in order to avoid dilutional coagulopathy.

The term Damage Control Surgery is borrowed from the military, which ensures the continued functioning of a damaged ship above conducting complete repairs which would prevent a rapid return to battle.

Solution to Question 19:

Coagulopathy is corrected in phase II of Damage Control Surgery.

Damage control surgery is minimal intervention done to stabilize the patient and do the definite surgery later. It centers on coordinating staged operative interventions with periods of aggressive resuscitation to salvage trauma patients sustaining major injuries.

It consists of three phases:

• Phase I - Initial Exploration: This phase consists of an initial operative exploration to attain rapid control of active haemorrhage and contamination.

• Phase II - Secondary Resuscitation: This phase focuses on secondary resuscitation to correct hypothermia, coagulopathy, and acidosis.

• Phase III - Definitive Operation: It consists of planned re-exploration and definitive repair of injuries. This phase typically occurs 48 to 72 hours following initial and after successful secondary resuscitation.

Solution to Question 20:

Shock is not considered to be a component of the trauma triad of death.

The trauma triad of death is a combination of clinical features that are seen in exsanguinating trauma patients and contribute to the majority of trauma-related mortality and morbidities. The triad includes:

• Hypothermia

• Coagulopathy

• Acidosis

During the resuscitation phase of trauma, adequate precautions should be taken to prevent the development of these features.

• Hypothermia is prevented by maintenance of ambient temperature within the patient's room, usage of prewarmed iv fluids, blankets, etc.

• Coagulopathy can be prevented by judicious use of i.v crystalloids (<1-1.5 Lit), early initiation of blood and blood products, usage of tranexamic acid, etc.

• Acidosis can be prevented by correction of shock, ensuring adequate oxygenation, usage of sodium bicarbonate, etc.

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Trauma - Spinal, Thoracic and Abdominal Injuries

Question 1:

All of the following can be done to transport a polytrauma patient who is conscious except?

a) Strap their thorax, abdomen and lower limbs on a stretcher

b) Place in prone position to prevent aspiration

c) Put patient on lateral position and shift him immediately

d) Roll the patient onto a hard board

Question 2:

A man met with a road traffic accident, which resulted in paralysis of both his upper and lower limbs. He has not passed urine and tenderness is elicited in the cervical region. What will you advise regarding radiography?

a) The patient should not be shifted and portable x-ray machine should be used after neck stabilization.

b) Instruct the radiographer to take cervical and chest x-ray.

c) Instruct the radiographer to take cervical x-ray AP and lateral view without any cervical support.

d) Order a cervical x-ray and shift the patient from the trolley by himself.

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Question 3:

A 25-year-old construction worker sustained an injury to his neck after falling from the tenth floor of a construction site. The first aid team that rushed to his rescue log rolled him. According to ATLS, what is the minimum number of people required for log-rolling this patient?

a) 3

b) 4

c) 5

d) 6

Question 4:

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Which of the following statements about acute spinal injury is false?

a) Hypotension in acute spinal injury is due to the loss of parasympathetic tone

b) Immediate respiratory suppression can occur due to the involvement of the phrenic nerve

c) Canadian C-Spine rule and NEXUS help to determine the need for radiographic evaluation

d) Patients with neurological deficits should be removed from the backboard as soon as possible

Question 5:

A 20-year-old college student sustained a superficial injury to his neck during a bar fight. What is the probable cause of sudden death in this patient?

a) Injury to phrenic nerve

b) Air embolism through external jugular vein

c) Bleeding from subclavian artery

d) Injury to trachea

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Question 6:

A 30-year-old man presented to the emergency department after suffering injuries in the neck during an armed robbery. On examination, several bleeding lacerated injuries are visible at the front and lateral aspects of the neck. Which of the following is not an indication for immediate surgical exploration?

a) Pulsatile bleeding

b) Respiratory distress

c) Fluid responsive hemorrhagic shock

d) Air bubbling from penetrating injury

Question 7:

A 38-year-old man was brought to the emergency department after suffering a stab injury to the lower chest. On presentation, he had bradycardia and hypotension which did not improve despite IV fluid administration. Chest radiography showed clear lung fields. What is the next step in management?

a) eFAST

b) Tube thoracostomy

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c) CECT chest

d) CECT abdomen

Question 8:

eFAST is least helpful in diagnosing which of the following conditions?

a) Pericardial Effusion

b) Pneumothorax

c) Retroperitoneal hematoma

d) Haemothorax

Question 9:

A 30-year-old man is rushed to the emergency department following a high-speed road traffic collision. His heart rate is 124 beats/min and BP is 78/56 mmHg on the right arm, and 64/50 mmHg on the left arm. A portable chest x-ray shows a widened mediastinum but normal lung and cardiac silhouette. Which of the following is the investigation of choice for this patient?

a) Transesophageal echocardiography

b) CT angiography

c) MR angiography

d) Transthoracic echocardiography

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Question 10:

A young man was rushed to the casualty with multiple rib fractures. On examination, you notice a paradoxical movement of the chest, and the patient is diagnosed with respiratory failure. How would you manage him?

a) Chest tube drainage

b) Oxygen administration

c) IPPV

d) Internal operative fixation of the fractures segments

Question 11:

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A 30-year-old man involved in a road traffic accident says that his bike handle hit the right side of his chest. On palpation, he had tenderness in the right upper chest. Chest radiograph shows a fracture in the right third rib. Which of the following should you not do while managing him?

a) Provide opioid analgesia

b) Advise deep breathing

c) Advise frequent coughing

d) Strapping over the affected rib

Question 12:

A 40-year-old female presents to the ER with a history of RTA. On examination, GCS is 15/15, heart rate = 110/min, BP = 90/60 mmHg, and there is elevated JVP. The right chest is hyperresonant on percussion with decreased breath sounds. The left chest appears normal. But the patient is dyspneic and ecchymosis is noted over the chest wall. The abdomen was soft. The probable diagnosis is:

a) Cardiac tamponade

b) Tension pneumothorax

c) Pericardial effusion

d) Massive hemothorax

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Question 13:

A 20-year-old patient presented to the ER with tension pneumothorax following a road traffic accident. What is the first line of management?

a) Insert wide bore needle in 5th ICS anterior to the mid-axillary line

b) Insert wide bore needle in 5th ICS in the mid-clavicular line

c) Insert wide bore needle in 2nd ICS in the mid-axillary line

d) Insert wide bore needle in 2nd ICS in the mid-clavicular line

Question 14:

An intern placed an intercostal drainage tube in a patient. Which of the following steps is incorrect?

a) Identified 5th intercostal space anterior to mid axillary line to place the tube

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b) Inserted tube along the lower border of upper rib

c) Directed tube posteriorly to prevent injury

d) Incised and digitally explored

Question 15:

Proper functioning of ICD tube is indicated by _____.

a) Continuous air bubbles coming out of the underwater drain

b) Oscillation of water column in the tube

c) Chest X-ray

d) Auscultation

Question 16:

A 40-year old man is brought to the emergency room with a stab injury to his chest. On examination, the patient is found to be hemodynamically unstable. His neck veins are engorged and heart sounds are muffled. Which of the following statements about the patient is false?

a) Cardiac tamponade is likely to be present

b) The entry wound is sealed on all 4 sides with an occlusive dressing if pneumothorax is suspected

c) eFAST is done to confirm blood in pericardial sac

d) Needle pericardiocentesis is not recommended

Question 17:

In a blast injury, which of the following organs is least vulnerable to the blast wave?

a) GI tract

b) Lungs

c) Liver

d) Ear drum

Question 18:

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Following a motor vehicle collision, a 30-year-old male sustained blunt trauma to his abdomen. What is the organ most likely to be injured?

a) Liver

b) Spleen

c) Jejunum

d) Mesentery

Question 19:

A 30-year-old man stabbed his elder brother using a knife over a property dispute. Which is the most common organ that is likely to be injured in this patient?

a) Spleen

b) Liver

c) Small intestine

d) Mesentery

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Question 20:

A landlord who was stabbed in his abdomen by one of his tenants for demanding rent was brought to the casualty. He was taken up for laparotomy which revealed a severely injured cecum. What is the best management option for this patient?

a) Catheter tube cecostomy

b) Right hemicolectomy with ileocolostomy

c) Transverse colostomy

d) End loop sigmoid colostomy

Question 21:

A patient is shifted for emergency laparotomy for the management of an intra-abdominal haemorrhage, following a road traffic accident. Intraoperatively, you find an active bleed from the liver. Which of the following techniques will you use to control the bleed?

a) Clamping the hepatic artery

b) Occluding the portal vein

c) Clamping the hepatic veins

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d) Clamping the hepatoduodenal ligament

Question 22:

A patient develops abdominal compartment syndrome following an emergency laparotomy. Which of the following is false about this condition?

a) Decreased central venous pressure

b) Increased heart rate

c) Increased systemic vascular resistance

d) Decreased GFR

Question 23:

Which of the following statements about abdominal compartment syndrome is false?

a) Hypercarbia and respiratory acidosis

b) Hypoxia due to increased peak inspiratory pressure

c) Hypotension due to decrease in venous return

d) Oliguria due to ureter obstruction

Question 24:

You are evaluating a patient in the burns unit, who had sustained third-degree burns to her abdomen and lower limbs (BSA of 30%). She had received 9 liters of Ringer's lactate at a primary center. On examination, extensive abdominal eschars are seen. BP - 84/50 mmHg, HR - 118 bpm and urine output has been less than 15 ml for the past 2 hours. The ventilator shows a peak airway pressure of 42 cm H2O. What is the most appropriate next step?

a) Administration of dobutamine

b) Measurement of bladder pressure

c) Diuresis with furosemide

d) Increase PEEP

Question 25:

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A patient is admitted to the intensive care unit following a trauma to the abdomen. His intraabdominal pressure is found to be 24 mmHg. What is the grade of abdominal hypertension?

a) Grade I

b) Grade II

c) Grade III

d) Grade IV

Question 26:

Following a road traffic accident, a child presents with abdominal pain. On examination, vitals are stable and tenderness is present in the left lumbar region. Which is the best investigation of choice for this patient?

a) Contrast enhanced CT scan

b) Retrograde urethrogram

c) Wait and watch

d) Emergency laparotomy

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Question 27:

A trauma patient suffers a renal laceration with urine extravasation. He is managed conservatively. However, after a few days, he presents with a urinoma. The next best management for this patient would be?

a) Ureteral stenting

b) Surgical repair and exploration

c) Observation

d) Percutaneous drainage

Question 28:

While performing emergency laparotomy for an unstable RTA case with blunt abdominal trauma, the surgeon notices a hematoma around the left kidney. What will be the next step in the management of this patient?

a) Single-shot intravenous pyelography

b) Contrast-enhanced computed tomography

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c) Ultrasonography of the abdomen

d) Direct renal exploration

Question 29:

An 8-year-old child presents with grade 2 splenic injury following blunt trauma to the abdomen. On examination, there are no signs of bleeding. Which of the following is the most appropriate management for this child?

a) Conservative management

b) Splenectomy

c) Embolization

d) Splenorrhaphy

Question 30:

Which of the following is a correct statement regarding retroperitoneal trauma?

a) All zone 1 injury to be treated conservatively

b) Zone 3 injury whether blunt or penetrative should always be explored

c) Zone 2 injury with expanding hematoma should be treated surgically

d) Mattox maneuver is when the ascending colon is mobilized to the right to visualise the aorta

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Question 31:

A young male patient is taken up for laparotomy following a stab injury. Pringle's maneuver is done. Which of the following statements is false about this maneuver?

a) It is used to differentiate between hepatic arterial and hepatic venous bleed

b) Arterial bleed persists on performing the maneuver

c) Hepatic pedicle is compressed at the epiploic foramen

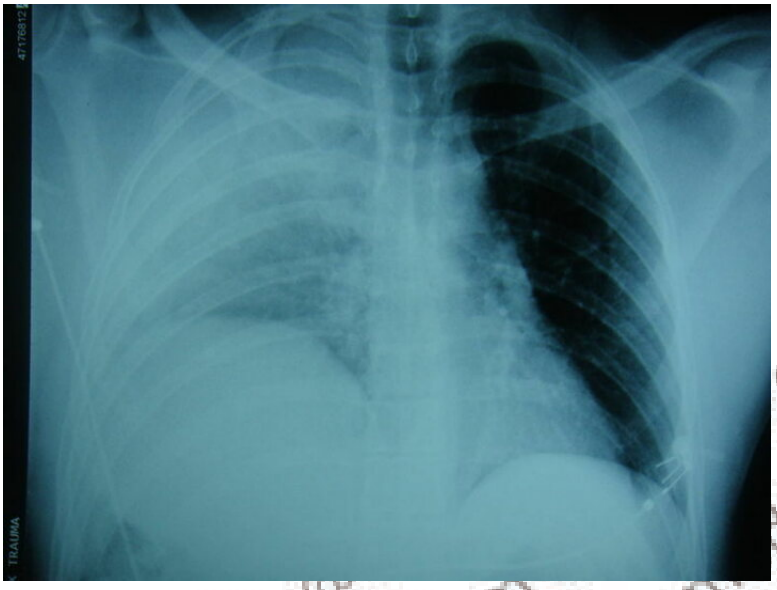
d) Prolonged application of pressure can lead to hepatic necrosis

Question 32:

An elderly lady presents to the trauma care centre following a motor vehicle collision. She complains of chest pain and abdominal pain. On examination, breath sounds are decreased

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on the right side. X ray chest revealed the following finding. Which of the following statements is false regarding the management of this patient?



a) Most accurate evaluation of this condition is by VATS

b) Operative repair is indicated in all cases

c) In case of penetrating injury, repair can be done via thoracic incision

d) The defect must be closed with polypropylene sutures

Question 33:

A 17-year-old boy is brought to the ED after being involved in a high-speed motorcycle collision. He is hypotensive with a systolic pressure of 60 mm Hg. A FAST scan is positive. At laparotomy, he is found to have a large amount of bleeding from behind the liver with hollow-viscous perforation. Temporary application of a Pringle manoeuvre does not control the bleeding. However, laparotomy packs are placed, and the bleeding appears to slow down. The systolic blood pressure fails to increase even after aggressive resuscitation. The patient's pH is 7.06 and his temperature is 34°C. What would be the next best step in the management of this patient?

a) Ligate the hepatic arteries

b) Hepatectomy

c) Hepatic artery embolization

d) Shift to ICU to resuscitate

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Answer Key

Question No.	Correct Option
1	c
2	a
3	b
4	a
5	b
6	c
7	a
8	c
9	a
10	c
11	d
12	b
13	a
14	b
15	b
16	b
17	c
18	b
19	b
20	b
21	d
22	a
23	d
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26	a
27	a
28	a
29	a
30	c
31	b
32	c
33	d

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Detailed Explanations

Solution to Question 1:

Patients with polytrauma are shifted into a supine or prone position (not in a lateral position) by laying them over a firm surface to restrict spinal movement.

As per ATLS guidelines, in patients with trauma, airway management is first done along with cervical spine stabilization. All trauma patients until proven otherwise are considered to have an injured vertebral column.

The patients are placed supine on a firm surface without rotating or bending the spinal column and a rigid cervical collar (philadelphia collar) is applied. Aspiration can be prevented by putting the patient in the prone position and strapping can be done to provide further stabilization.



Long spine boards with straps are helpful in the rapid transport of the patient from one place to another. The patient can be put on the long spine board by log-rolling (a technique where four people hold the patient and roll the patient like a log without allowing rotation or bending of the spine).

Conscious and alert patient indirectly means that they don't need intubation and their airway is patent. If the patient is unconscious always check the airway and if needed, endotracheal intubation must be done immediately by various methods. Preferably by direct laryngoscopy and intubation.

Solution to Question 2:

The given clinical situation suggests a cervical spine injury due to trauma. The patient should not be shifted and a portable X-ray machine should be used for radiography after neck stabilization.

Management in a trauma patient with a suspected cervical fracture involves the following steps:

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• Spinal immobilization with a rigid cervical collar and a long spine board is the immediate step in the management of blunt/penetrating cervical trauma cases.

• It is followed by a gross assessment of spinal cord function by eliciting extremity movement. Tenderness over the injured vertebrae or the presence of a deformity is indicative of an associated fracture.

• Imaging is done by X-ray or CT. Portable X-ray machines are preferred to avoid further injury while mobilizing the patient. They are useful in visualizing thoracic and lumbar vertebrae but not the cervicothoracic junction. Cervical CT has been made the modality of choice in most emergency departments owing to the high quality of images that can be obtained.

Solution to Question 3:

The 10th edition of ATLS recommends at least 4 people for the safe manoeuvre of log-roll in patients suffering from trauma.

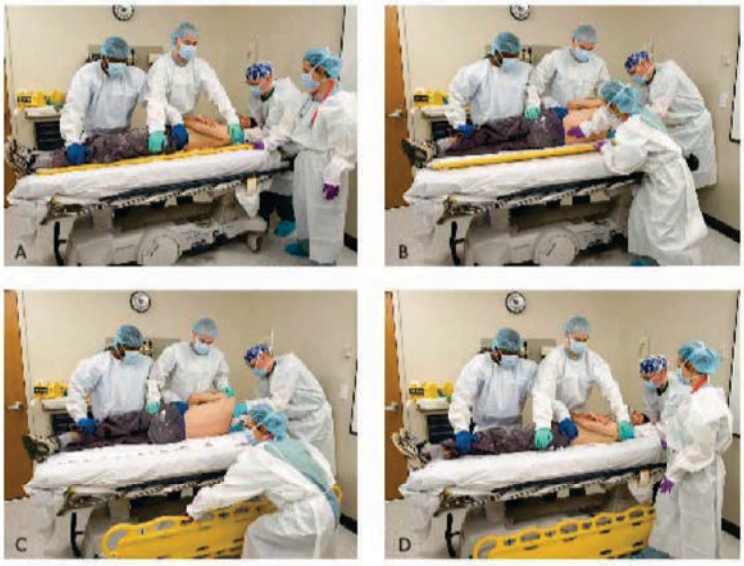
• The first person is assigned to restrict the motion of the head and neck.

• The second person is positioned on the same side of the patient's torso. He manually prevents segmental rotation, flexion, extension, lateral bending, or sagging of the chest or abdomen while transferring the patient.

• The third person is responsible for moving the patient's legs.

• The fourth person removes the backboard and examines the back.

Note: In a patient known to have a fracture of the extremities, a minimum of 5 people are required to safely perform the log-roll manoeuvre.



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Solution to Question 4:

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Hypotension in acute spinal injury is due to loss of sympathetic tone.

The classic presentation of neurogenic shock is hypotension in the setting of warm, well-perfused extremities in a paralyzed patient. This condition requires intravascular volume expansion and vasopressor support.

Option B: High cervical spinal cord injury (SCIs) may have immediate respiratory suppression. This requires airway management and ventilatory support because of paresis of the phrenic nerves. Hypoventilation can occur from paralysis of the intercostal muscles (injury to the lower cervical or upper thoracic spinal cord) or the diaphragm (injury to C3 to C5).

Option C: Canadian C-Spine rule and NEXUS are validated clinical decision tools to help determine the need for radiographic evaluation and to clinically clear the cervical spine.

NEXUS criteria: There are five criteria included under NEXUS. If a trauma patient meets all five criteria, then no radiography is required and the cervical c-spine collar may be removed. However, if any one of the criteria is met then radiography is done to evaluate further.

The NEXUS criteria include:

• No posterior midline cervical spinal tenderness

• No evidence of intoxication

• A normal level of alertness

• No focal neurologic deficit

• No painful distracting injuries

Option D: Patients with or without neurological deficits should be removed from the backboard as soon as possible. A patient who is allowed to lie on the hardboard for more than 2 hours is at high risk for pressure ulcers.

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Solution to Question 5:

Air embolism through the external jugular vein is a cause of sudden death in patients with superficial neck injury.

All other structures are deeper structures, hence are not involved much in superficial injuries of the neck.

Solution to Question 6:

Fluid responsive hemorrhagic shock is not an indication for immediate surgical intervention.

The following are the indications for immediate surgical exploration of neck trauma. They are also known as the hard signs of neck trauma:

• Pulsatile bleeding

• Expanding hematoma

• Air bubbling from penetrating injury

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• Absent radial pulse

• Respiratory distress

• Presence of neurological deficit

• Fluid resistant hemorrhagic shock

• Audible bruit or palpable thrill

• Signs of stroke/ cerebral ischemia

The presence of any of these hard signs indicates major neurovascular/ airway injury and is an indication for surgical exploration of the trauma region as soon as possible.

Neck trauma is classified based on the different regions of the neck.

• Zone I: thoracic inlet to cricoid, associated with maximum mortality. It contains large vascular structures as well as the trachea and esophagus.

• Zone II: cricoid cartilage to the angle of mandible, most commonly prone to injury and most easily accessible for surgery. It contains the carotid and vertebral arteries, jugular veins, and structures of the aerodigestive tract.

• Zone III: angle of the mandible to the base of the skull. Structures within zone III include blood vessels that are difficult to expose surgically.

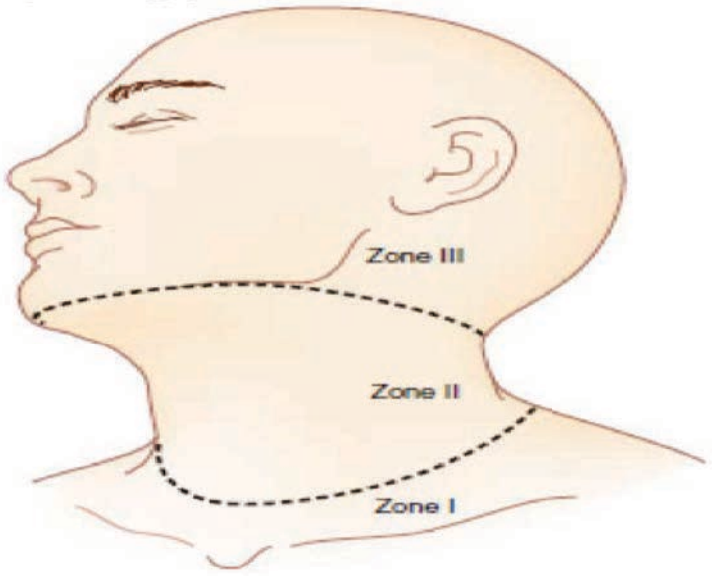
Management:

• If the patient is hemodynamically unstable: neck exploration

• If the patient is stable:

• Zone II injury: Conservative management

• Zone I and Zone III: Angiography and angioembolisation are indicated. If it fails then neck exploration should be done.



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Solution to Question 7:

The given clinical scenario of a patient with a stab injury and hypotension not responding to IV fluids indicates persistent hypotension due to ongoing hemorrhage and the next step in the management is to perform an eFAST.

Cardiogenic shock or hemorrhagic shock are the most likely causes of persistent hypotension in a trauma patient. Ultrasound evaluation using eFAST to look for pericardium, pleural cavities, and abdomen in combination with plain radiographs of the chest and pelvis will usually identify the source of the bleed.

In patients with persistent hypotension due to blunt trauma, the pelvis should be wrapped in a sheet for stabilization until radiography can be done.

Evaluation of CVP or ultrasound of the IVC may further assist in distinguishing between cardiogenic and hypovolemic shock.

It is mostly fatal if not controlled, and requires immediate management. Blood and plasma transfusions are provided in a ratio of 2:1. Patients with persistent hypotension requiring surgical intervention include:

• Blunt trauma and massive hemothorax

• Penetrating trauma

• Hemoperitoneum

• Gunshot injuries to the chest or abdomen

• Penetrating weapon remaining in place.

Other options:

Options C and D: CECT can be done only when the patient is hemodynamically stable.

Option B: Tube thoracostomy has no role in this patient's management since the X-ray shows clear lung fields.

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Solution to Question 8:

Among the given options, eFAST(extended Focused Assessment with Sonography in Trauma) is least useful in diagnosing retroperitoneal hematoma as the sensitivity of ultrasound for detecting retroperitoneal hematomas is extremely poor.

FAST is a rapid, noninvasive bedside test that uses sonography to detect free fluid in the abdomen and assess patients for potential thoracoabdominal injuries.

Technique:

• The patient is placed in a supine position

• With a 3.5-5.0 MHz convex transducer the following regions are scanned :

• Subxiphoid transverse view: assess for pericardial effusion and left lobe liver injuries

• Longitudinal view of the right upper quadrant: assess for right liver injuries, right kidney injury, and Morison pouch

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• Longitudinal view of the left upper quadrant: assess for splenic injury and left kidney injury

• Transverse and longitudinal views of the suprapubic region: assess the bladder and pouch of Douglas

eFAST stands for extended FAST and incorporates Left and right thoracic views to assess for pneumothorax and haemothorax.

Computed Tomography (CT Scan) is the investigation of choice for retroperitoneal injury, but it can only be done in a hemodynamically stable patient.

Solution to Question 9:

The given clinical vignette is suggestive of aortic injury. The investigation of choice in this hemodynamically unstable patient is transesophageal echocardiography (TEE). In hemodynamically stable patients, the investigation of choice is CECT or CT angiogram.

Traumatic aortic injuries are commonly seen in deceleration injuries (e.g. road traffic accidents). The most common site of aortic injury is the isthmus, near the attachment of ligamentum arteriosum.

Clinical features of aortic injuries:

• Hypotension

• Difference in blood pressure in bilateral limbs

• Absent pulse in the unilateral limb

• Widened mediastinum on chest x-ray

Management

• Volume replacement: fluid therapy and blood transfusion

• Permissive hypotension: Beta-blockers, such as esmolol

• Immediate surgical repair:

• Endovascular stenting, or

• Open surgical repair with Dacron graft

Solution to Question 10:

The given scenario is suggestive of flail chest with respiratory failure. Management of this condition is IPPV (invasive positive pressure ventilation).

A flail chest occurs when a segment of the chest wall does not have bony continuity with the rest of the thoracic cage. This condition results from blunt trauma associated with multiple rib fractures i.e., 2 adjacent ribs or 3 or more ribs fractured in two or more places.

The blunt force required to disrupt the integrity of the thoracic cage typically produces an underlying pulmonary contusion as well.

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On inspiration, the loose segment of the chest wall is displaced inwards, and therefore, less air moves into the lungs. On expiration, the segment moves outwards. This is known as paradoxical respiration.

The diagnosis is made clinically, not by radiography. To confirm, the paradoxical motion of a chest wall segment can be observed for several respiratory cycles and during coughing.

Voluntary splinting as a result of pain, mechanically impaired chest wall movement, and the associated lung contusion are all causes of hypoxia and respiratory failure. The patient is also at high risk of developing a pneumothorax or hemothorax.

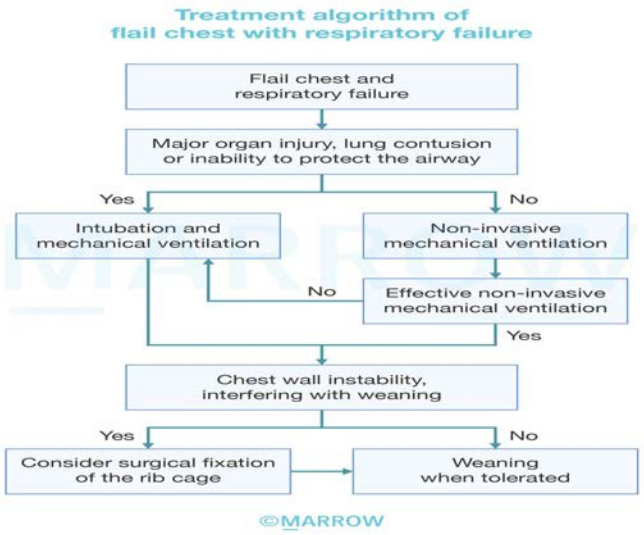
Treatment:

• Chest strapping or splinting should be avoided.

• Currently, treatment consists of oxygen administration, adequate analgesia (including opiates) or epidural analgesia, and physiotherapy.

• IPPV (Intermittent Positive Pressure Ventilation) is reserved for patients developing respiratory failure despite adequate analgesia and oxygen.

Treatment algorithm of treatment of flail chest with respiratory failure:



Solution to Question 11:

The clinical scenario is suggestive of a rib fracture. Strapping is not done for rib fractures because it prevents the patient from taking deep breaths. This can lead to lung collapse.

The vital step in the management of rib fractures is to reduce pain and prevent the development of pneumonia. Rib fracture causes intense pain during breathing and increases the risk of pulmonary infections as the patient is not able to cough forcefully.

In mild to moderate cases, pain can be managed by intravenous opioids. In severe cases, patients may require epidural analgesia.

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In addition to adequate analgesia, chest physiotherapy like deep breathing, frequent coughing, incentive spirometry should be encouraged in these patients. This prevents the development of pneumonia and lung collapse. When chest wall injuries result in respiratory failure, mechanical ventilation should be provided.

Solution to Question 12:

The given clinical scenario of trauma with decreased breath sounds and a hyper-resonant note on percussion indicates pneumothorax. The presence of tachycardia, hypotension and elevated JVP is suggestive of tension pneumothorax.

Tension pneumothorax develops when there is a parietal or visceral pleural tear. This tear acts as a one-way valve i.e. air enters the pleural space from the lung or chest wall during inspiration but has no way to escape during expiration, leading to the collapse of the affected lung.

It is characterized by chest pain, tachypnoea, acute dyspnea, sudden onset hemodynamic compromise (tachycardia, hypotension, low O_2 saturation, loss of consciousness), neck vein distention, tracheal deviation away from the side of injury, decreased chest movements on the affected side, hyper-resonance on percussion on the affected side and absent or decreased breath sounds on the affected side.

Tension pneumothorax is a clinical diagnosis, and treatment should never be delayed awaiting radiological confirmation.

Management includes:

• Immediate management: Needle decompression or needle thoracostomy with a wide bore needle in the 5th intercostal space anterior to the mid-axillary line. In the pediatric age group, the needle thoracostomy location is at the 2nd intercostal space in the mid-clavicular line.

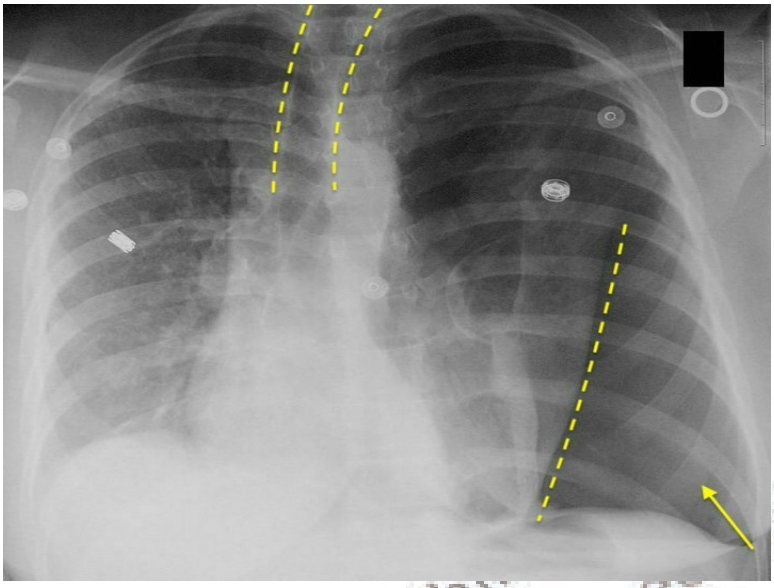
• Definitive management: Tube thoracostomy or chest tube insertion in the 5th intercostal space in the triangle of safety.

The triangle of safety is bounded anteriorly by the lateral border of the pectoralis major, posteriorly by latissmus dorsi and inferiorly by a horizontal line at the level of the nipple.

The X-ray below shows a left-sided tension pneumothorax. There is a large, well-demarcated area devoid of lung markings on the left side. The yellow arrows are pointing to the tracheal deviation and the mediastinal shift to the right side.

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Other options:

Options A: Pericardial tamponade can mimic tension pneumothorax, but the absence of a tympanic note on percussion rules out its possibility. A patient with pericardial tamponade can present with hypotension, raised JVP, and muffled heart sounds (Beck's triad), with normal breath sounds and no tracheal shift.

Option C: Dullness in percussion at the base of the left inferior angle of scapula in conjunction with tubular breath sounds (Ewart's sign), chest pain that improves while sitting upright and worsens when lying down and pulsus paradoxus are indicative of pericardial effusion. Pericardial effusion develops into tamponade when the effusion leads to increased pressure, impairing ventricular filling and reducing cardiac output.

Option D: Massive hemothorax is the accumulation of >1500 ml of blood or one-third or more of the patient's blood volume in the chest cavity. The patient will have collapsed neck veins, decreased breath sounds and a dull note on percussion.

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Solution to Question 13:

Insertion of a wide-bore needle in the 5th intercostal space anterior to the mid-axillary line is the first-line management in adults with tension pneumothorax.

Management of tension pneumothorax:

• Immediate management: Needle decompression or needle thoracostomy i.e. insertion of a wide-bore needle in the 5th ICS anterior to the midaxillary line

• Definitive management: Tube thoracostomy or chest tube insertion in the 5th ICS in the triangle of safety

If a sucking wound is present, the immediate step is to cover the wound with gauze pieces and tape on 3 sides. Following this, chest tube is inserted away from the site of the wound.

Note: According to ATLS 10th edition

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• In adults, needle thoracostomy or needle decompression location is changed to 5th ICS anterior to the midaxillary line from 2nd ICS midclavicular line.

• In the pediatric age group, the needle thoracostomy location remains at the 2nd ICS midclavicular line.

This update was recommended since chest wall thickness influences the likelihood of success with needle decompression. Inserting needle in 5th ICS anterior to the midaxillary line had better outcomes.

Solution to Question 14:

An intercostal tube (ICD) is placed along the upper border of the lower rib at the 5th intercostal space (ICS) to prevent damage to the neurovascular bundle. Hence, option B is incorrect.

Chest tube insertion (thoracostomy) is indicated in pneumothorax, hemothorax, chylothorax, and pleural effusion in order to drain air/fluid from the pleural space.

The triangle of safety, usually in the 5th intercostal space, is the safest site for chest tube insertion, it is bound by:

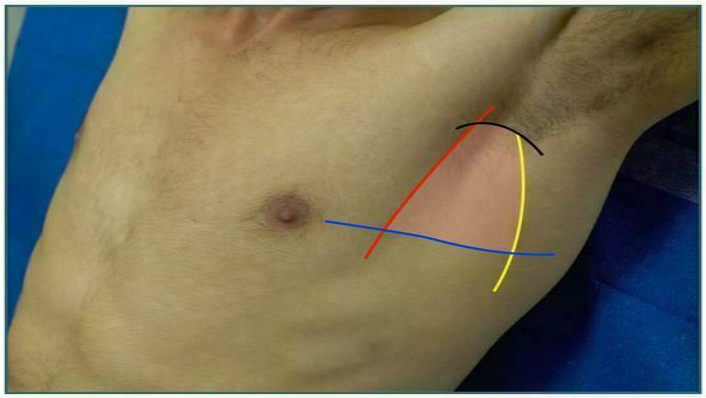
• anterior to the midaxillary line

• above the horizontal line marked by the level of the nipple

• below and lateral to the pectoralis major muscle

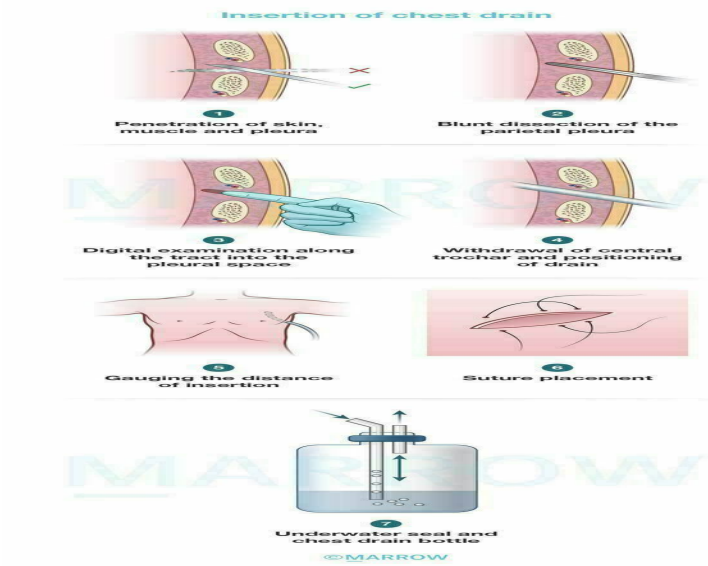
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Triangle of safety



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Contraindications include pulmonary adhesions, pulmonary trauma, coagulopathy, and diaphragmatic hernia.

Complications of this procedure:

• Infection at the site of insertion

• Unintentional injury to the lung - hemothorax

• Intercostal nerve/ vessel injury

• Subcutaneous hematoma/ emphysema

Solution to Question 15:

Oscillation of the water column level (moving up and down during respiration) within the tube in the water seal chamber is indicative of a functioning (patent) ICD tube.

During spontaneous respiration, the water level rises with inspiration and falls with expiration. Whereas during positive pressure ventilation, the opposite occurs. This oscillation is also known as tidaling.

Other options:

Option A: Continous bubbling indicates an air leak in the drainage system, which should be corrected

Option B: Chest X-ray is useful for assessing the position of the ICD tube inside the chest, not its functioning.

Option C: Auscultation is not useful for assessing the functioning of an ICD tube.

Solution to Question 16:

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The given clinical scenario of hemodynamic instability and muffled heart sounds are suggestive of cardiac tamponade. The entry wound is sealed on only 3 sides with an occlusive dressing if a pneumothorax is suspected.

When there is a pneumothorax with a sucking wound, the immediate step is to cover the wound with gauze pieces and tape on 3 sides.

As the patient breathes in, the dressing occludes the wound, preventing air from entering into the thoracic cavity. During exhalation, the open end of the dressing allows air to escape from the pleural space. This is known as a flutter-valve effect.

Following this, a chest tube is inserted away from the site of the wound.



Cardiac tamponade must be differentiated from tension pneumothorax in a patient with hemodynamic instability and distended neck veins.

Cardiac tamponade is characterized by Beck's triad:

• Muffled heart sounds

• Distended neck veins

• Hypotension

Tension pneumothorax is characterized by absent breath sounds and hyper resonance on percussion on the affected side. These are not present in a patient with cardiac tamponade.

Diagnosis of cardiac tamponade can be done by eFAST which shows fluid in the pericardial sac.

• Definitive management - emergency thoracotomy or sternotomy

Solution to Question 17:

In a blast injury, the liver is the least vulnerable to blast wave (primary blast) injury.

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Blast injury is a complex type of physical trauma resulting from direct or indirect exposure to an explosion. Primary blast injuries result from the rapid overpressure or shock waves produced by an explosion. These injuries result from the dramatic changes in barometric pressure projecting outwards from the point of detonation. They predominantly cause damage to air-filled hollow organs of the body from rapid pressure change (barotrauma). This includes the middle ear, lungs, and GIT.

The most sensitive and most frequently injured hollow organs are the tympanic membranes > lungs. Blast damage to the lungs is the most common cause of life-threatening injury following an explosion.

Solid organs are the most resistant to blast injuries as the parenchymal disruption requires very high levels of overpressure.

Classification of blast injuries:

Classification	Explanation	Injury type	Examples
Primary blast	Due to air pressure from the blast	Shockwave (overpressure)	Tympanic membraneinjury, blast lung, intestinal blast inj ury
Secondary blas t	Fragments from the blast, fo llowing a detonation	Penetrating/fragmentation	Allpenetratinginjuries
Tertiary blast	Gross movements of persons, objects, or infrastructure by the blast wind	Blunt trauma	Blunt and crushinjuries. Tra umatic amputation.
Quaternary bl ast	Miscellaneous causes	Exposure to explosive produ cts or toxic substances	Burns, inhalation injury
Quinary blast	Theintentional additionof bi ological or radioactive mater ial to the explosive device	Environmental contaminant s	Radiationsickness,infection.

Solution to Question 18:

The spleen is the most common organ involved in blunt trauma injury of the abdomen.

In blunt trauma, organs that cannot yield to impact by elastic deformation are most likely to be injured, namely, the solid organs (liver, spleen, and kidneys).

For penetrating trauma, organs with the largest surface area when viewed from the front are most prone to injury (small bowel, liver, and colon). Additionally, since bullets and knives usually follow straight lines, adjacent structures are commonly injured (e.g., the pancreas and duodenum).

Deceleration injures the pedicled organs by shearing the organs from their points of attachment to the retroperitoneum (intestines and kidney).

The most commonly injured bowel in cases of blunt trauma of the abdomen is jejunum.

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Solution to Question 19:

The liver is the most common organ to be injured in penetrating stab injury of the abdomen. It is due to its anterior location, size and fragile parenchyma.

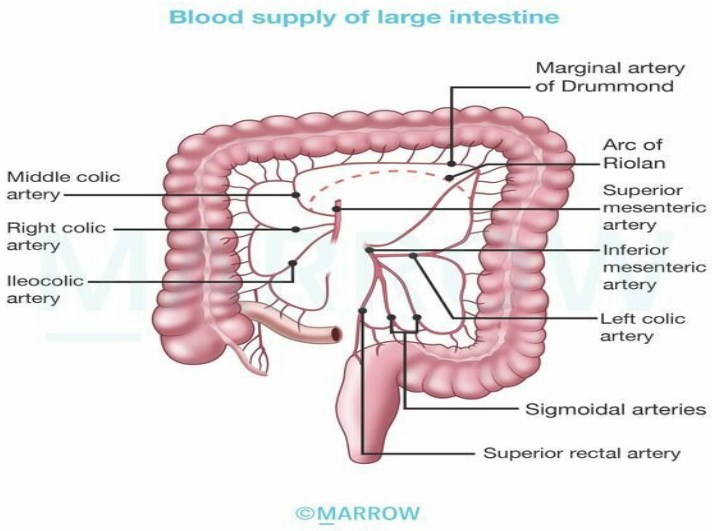
The most common organ injured in blunt trauma to the abdomen is spleen > liver.

The most common organ injured in gunshot injury is the small intestine > colon.

Solution to Question 20:

The best management option for this patient is right hemicolectomy with ileocolostomy.

Injuries proximal to the middle colic artery are best managed by this procedure.



Injuries distal to the middle colic artery require segmental resection with colocolostomy anastomosis. Immediate anastomosis should be avoided in patients with shock due to the high incidence of leaks following the procedure. In such patients, colostomy and delayed primary anastomosis should be done.

Option A: Catheter tube cecostomy is of therapeutic value in refractory colonic pseudo-obstruction, cecal volvulus, or distal colonic obstruction.

Option C: Transverse colostomy is generally done in patients with distal obstruction for temporary fecal diversion.

Option D: An end-loop sigmoid colostomy is an ideal stoma for distal fecal diversion for incontinence or in association with complex anorectal procedures.

Solution to Question 21:

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The hepatoduodenal ligament can be clamped to decrease active hemorrhage from the liver. This is called Pringle's maneuver.

This maneuver applies pressure on the portal triad which contains bile duct, portal vein and hepatic artery. This helps distinguish hepatic arterial and portal venous bleeding from hepatic vein bleeding. Hepatic venous bleed will persist with the hepatoduodenal ligament clamped. The liver laceration can then be explored and any actively bleeding vessels controlled with suture ligation.

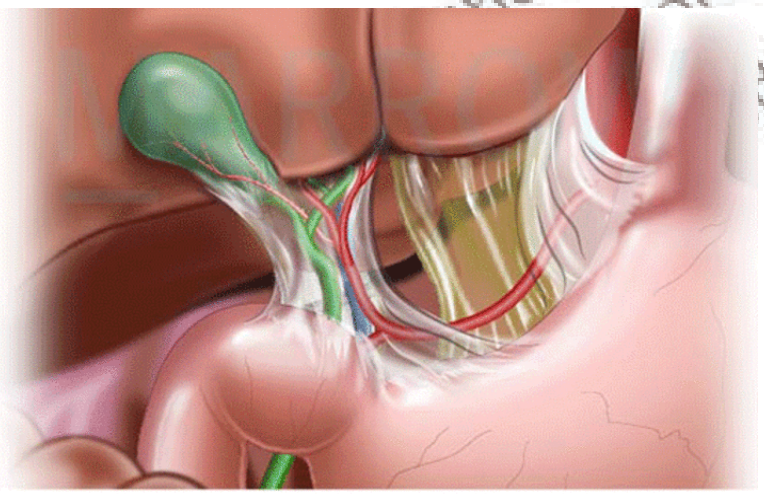
4 P's in the management of liver injuries are:

• Push - compression of the edges of the laceration

• Pringle - applying pressure on the portal triad

• Plug the defects with silicon tubes

• Pack - apply packs in and around the liver to arrest bleeding.



Solution to Question 22:

Central venous pressure (CVP) increases due to inferior vena cava (IVC) and portal vein compression in abdominal compartment syndrome.

Abdominal Compartment Syndrome (ACS) is defined as increased intra-abdominal pressure (IAP) >20 mm Hg resulting in compression of abdominal structures (Normal IAP = 5-7 mmHg and intraabdominal hypertension IAP ° 12 mmHg).

This produces fatal complications due to pulmonary failure and mesenteric vascular compromise. Elevated intra-abdominal pressure leads to a decrease in venous return resulting in decreased cardiac output. An increase in heart rate partly compensates this.

Systemic vascular resistance (afterload) is increased by the compression of both the aorta and systemic vasculature. This also leads to an increase in renal vascular resistance leading to a reduced glomerular filtration rate.

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Causes of primary ACS include:

• Abdominal trauma

• Hemorrhage

• Intestinal obstruction

• Retroperitoneal hematoma

Causes of secondary ACS include:

• Pregnancy

• Ascites

• Ileus

• Intra-abdominal sepsis

• Large-volume fluid replacement (greater than 3L)

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Solution to Question 23:

Oliguria is due to reduced renal blood flow.

An increase in renal vascular resistance leads to a reduction in glomerular filtration rate and impaired urine output.

Abdominal compartment syndrome is characterized by :

• A sudden increase in intraabdominal pressure

• Increased peak inspiratory pressure

• Hypercarbia and respiratory acidosis

• Decreased urinary output – due to reduced renal blood flow

• Hypotension - secondary to decreased venous return to the heart.

Solution to Question 24:

The given clinical scenario is suggestive of abdominal compartment syndrome (ACS). Measurement of bladder pressure using a urinary bladder catheter is the next best step in the management of this patient.

The oliguria and hypotension in isolation could be suggestive of under-resuscitation. However, the history of large volume fluid administration, presence of abdominal eschars along with very high peak airway pressures should raise the suspicion for ACS.

Abdominal compartment syndrome refers to an elevation of intra-abdominal pressure > 20mmHg with associated organ compression and dysfunction:

• Compression of the IVC leads to decreased cardiac output, and consequent increase in systemic vascular resistance, leading to hypotension.

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• Cephalad displacement of the diaphragm results in decreased thoracic volumes and results in elevated peak and plateau pressures.

• Renal compression can lead to increased renal vascular resistance, decreased GFR and low urine output.

Measurement of bladder (intravesical) pressure is the standard method to screen for intra-abdominal hypertension (IAH) and abdominal compartment syndrome.

Note: Direct methods such as pressure transducers and intraperitoneal catheters are more accurate but are limited by their invasiveness.

Grade of Intra-abdominal hy pertension (IAH)	Intra-abdominal pressure (IA P)
Grade I	12–15 mmHg
Grade II	16–20 mmHg
Grade III	21–25 mmHg
Grade IV	>25 mmHg

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Solution to Question 25:

Intraabdominal pressure (IAP) of 24 mm Hg falls under grade III of intra-abdominal hypertension (IAH).

Normal intraabdominal pressure is 5 to 7 mmHg. Any acute process in the abdomen such as trauma, intestinal perforation, peritonitis, or acute pancreatitis can increase the intra-abdominal pressure. Increased abdominal pressure can diminish the blood flow to the abdominal organs and decrease the venous return to the heart.

Measurement of bladder (intravesical) pressure is the standard method to screen for intra-abdominal hypertension (IAH) and abdominal compartment syndrome.

Grade III intra-abdominal hypertension is associated with hypoxia, ARDS and serious complications. It is associated with abdominal compartment syndrome which is defined as a sustained IAP >20 mmHg associated with organ dysfunction/failure.

Grade of Intra-abdominal hy pertension (IAH)	Intra-abdominal pressure (IA P)
Grade I	12–15 mmHg
Grade II	16–20 mmHg
Grade III	21–25 mmHg
Grade IV	>25 mmHg

Solution to Question 26:

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The given clinical vignette with abdominal pain and tenderness in the left lumbar region following a road traffic accident is suggestive of blunt renal trauma. The investigation of choice is CECT in a hemodynamically stable patient.

Blunt trauma is the main cause of renal injuries and is self-limiting. Radiological investigations are indicated when there is gross haematuria, shock in combination with microscopic haematuria, pediatric renal trauma, and penetrating injuries.

CECT is the investigation of choice. It assesses the extent of the injury, showing laceration, extravasation, surrounding hemorrhage, and vessel injury. It also shows non-renal injuries and effectively stages renal pedicle injuries. Arterial occlusion will manifest as rim enhancement of the normal renal contour.

Blunt trauma is mostly treated conservatively. Most of the penetrating injuries require surgical renal exploration.

Absolute indications for surgical intervention in renal trauma are:

• Massive hemorrhage

• Renal pedicle avulsion (grade 5 injury)

• Expanding, pulsatile, or uncontained retroperitoneal hematoma

Relative indications are:

• Large laceration of the renal pelvis or avulsion of the ureteropelvic junction

• Bowel or pancreatic injuries

• Persistent urinary leakage, postinjury urinoma, or perinephric abscess

• Complete renal artery thrombosis of both kidneys

• Renal hypertension

Exploratory laparotomy is recommended in stable patients with penetrating renal injuries.

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Solution to Question 27:

The patient with a history of grade IV renal injury (renal laceration with urine extravasation) who develops a persistent urinoma (a mass formed by encapsulated extravasated urine) should be managed with the placement of an internal ureteral stent.

In patients not cured by ureteral stenting, percutaneous nephrostomy or transcutaneous drain may be required.

Management of renal injuries

Blunt trauma is the main cause of renal injuries and is self-limiting. Blunt trauma is mostly treated conservatively. Most penetrating injuries require surgical renal exploration.

• Grading of injury through CECT

• If hemodynamically stable

• Conservative management - Bedrest & hemodynamic monitoring

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• In grade IV, a repeat CT scan to ensure the extravasation of urine has resolved.

• If hemodynamically unstable

• Surgical exploration and repair

• In grade V, nephrectomy.

Solution to Question 28:

The next step in the surgical management of the patient found to have a hematoma around the kidney, intraoperatively, will be a single-shot intravenous pyelography (IVP).

If immediate operative exploration for other injuries is required, renal injury staging can be performed while the patient is still in the operating room, using single-shot IVP. It is useful in assessing the function of the kidneys and the extent of the injury. If the IVP is abnormal or the hematoma is pulsatile, then renal exploration should be performed.

Note: CECT is the method of choice for staging a patient with hemodynamically stable renal trauma presenting at the emergency room.

Solution to Question 29:

Conservative management is the most appropriate management in this child.

Selective Non-Operative Management (SNOM) is usually followed in:

• Stable patients with no active bleeding

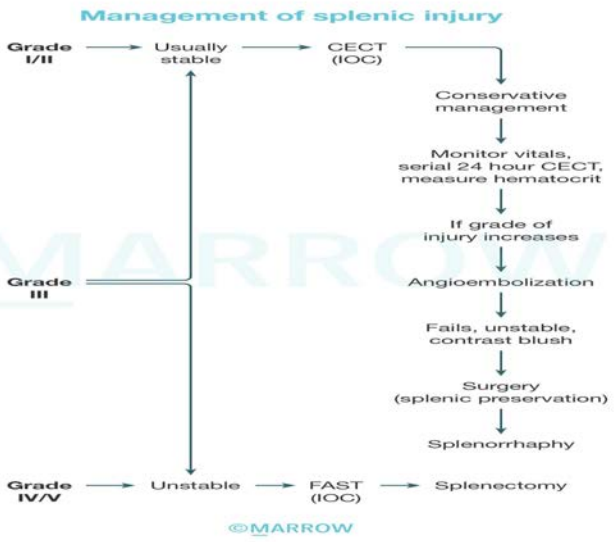
• Patients younger than 55 years of age

• Patients with grade I, II, III injuries.

Any patient who is hemodynamically unstable, has active bleeding, and has grade IV and V splenic injury should be managed by surgery.

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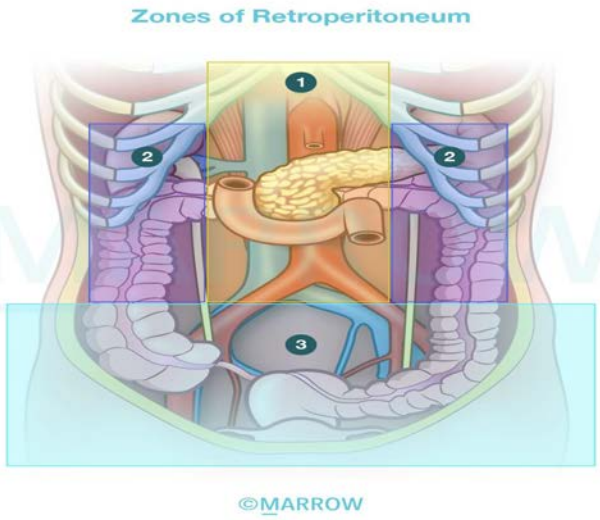
Solution to Question 30:

A zone 2 retroperitoneal injury with expanding hematoma should be treated surgically.

Zone of retroperitoneal injury	Type of viscera	Differential management
Zone 1	Central	Always explored, after proximo-distal vascular control
Zone 2	Lateral	Only explored if the hematoma is pulsatile or expanding, else conservative/ angioembolization
Zone 3	Pelvic	Only explored if the hematoma is pulsatile or expanding, else conservative/ angioembolization

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Surgical exploration is done in cases of penetrating injuries to any zone.

Other options:

Option A: Zone 1 injuries are always explored.

Option B: Depending on the situation, zone 3 injuries can be managed with surgical exploration or conservatively.

Option D: Mattox manoeuvre is left medial visceral rotation to expose the aorta, while the Cattell-Braasch manoeuvre is done by right medial visceral rotation to expose IVC.

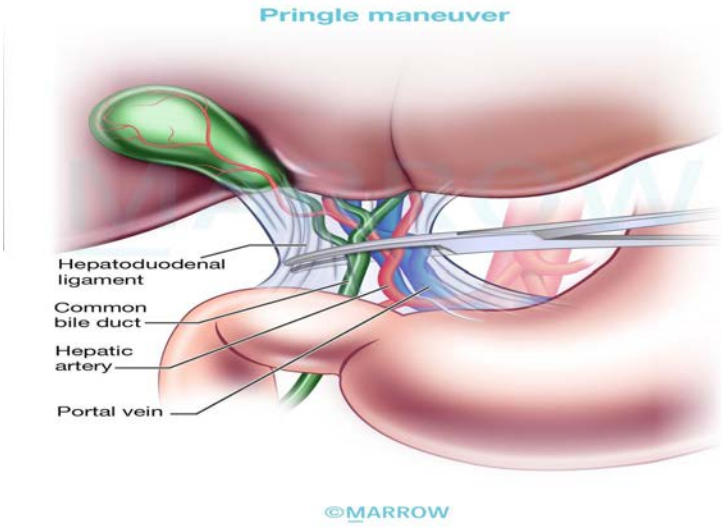
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Solution to Question 31:

Pringle maneuver may be required for the treatment of liver laceration. Hepatic venous bleed persists on performing this maneuver.

When there is severe bleeding from the liver, this maneuver is a viable adjunct to slow blood flow enough to visualize liver injury. The hepatoduodenal ligament is clamped at the epiploic foramen or the foramen of Winslow. This applies pressure on the portal triad that contains bile duct, portal vein and hepatic artery. This helps to distinguish hepatic arterial and portal venous bleeding from hepatic vein bleeding. Hepatic venous bleed will persist when the hepatoduodenal ligament clamped. The liver laceration can then be explored and any actively bleeding vessels controlled with suture ligation.

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4 P's in the management of liver injuries are:

- Push - compression of the edges of the laceration
- Pringle - applying pressure on the portal triad
- Plug the defects with silicon tubes
- Pack - apply packs in and around the liver to arrest bleeding.

Prolonged intraoperative use of Pringle maneuver can lead to hepatic ischemia and necrosis.

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Solution to Question 32:

The given clinical history and X-ray image showing obliteration of the diaphragmatic outline are suggestive of traumatic diaphragmatic injury in this patient. Penetrating diaphragmatic injury must be repaired via the abdomen and not the thorax, to rule out penetrating hollow viscus injury.

Patients with diaphragmatic injury are generally asymptomatic. Chest X ray after the insertion of a nasogastric tube may help in identifying the herniation of the stomach in the thoracic cavity. However, the most accurate evaluation is by video assisted thoracoscopy (VATS) or laparoscopy. Abdominal contents may get herniated into the chest and get strangulated later. This is associated with high mortality. Hence, operative repair is indicated in all patients. The defect is closed with running 1-0 polypropylene suture.

Solution to Question 33:

This patient has a blunt trauma abdomen. He is hypothermic and he is battling acidosis. Thus, he should be subjected to damage control surgery and must be shifted to ICU for further resuscitation.

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Damage control surgery is minimal intervention done to stabilize the patient and do the definite surgery later. It centers on coordinating staged operative interventions with periods of aggressive resuscitation to salvage trauma patients sustaining major injuries.

3 Phases :

Phase I (Initial Exploration) -

This phase consists of an initial operative exploration to attain rapid control of active hemorrhage and contamination.

Phase II (Secondary Resuscitation) -

This phase focuses on secondary resuscitation to correct hypothermia, coagulopathy, and acidosis.

Phase III (Definitive Operation) -

It consists of planned re-exploration and definitive repair of injuries. This phase typically occurs 48 to 72 hours following initial and after successful secondary resuscitation.

Pringle's manoeuvre can be performed to decrease the active haemorrhage from the liver in a liver laceration. It is done by applying pressure on the portal triad at the Foramen of Winslow. The pressure can be applied either digitally or with the use of a soft clamp.

Rapid control of the vessels entering the porta hepatis can be obtained by compressing them in the free edge of the lesser omentum.

Porta hepatis is a deep, transverse fissure that is situated on the inferior surface of the right lobe of the liver.

Structures entering at porta hepatis:

• Portal vein

• Hepatic artery

• Hepatic nervous plexus

Structures exiting the porta hepatis:

• Right and left hepatic bile ducts

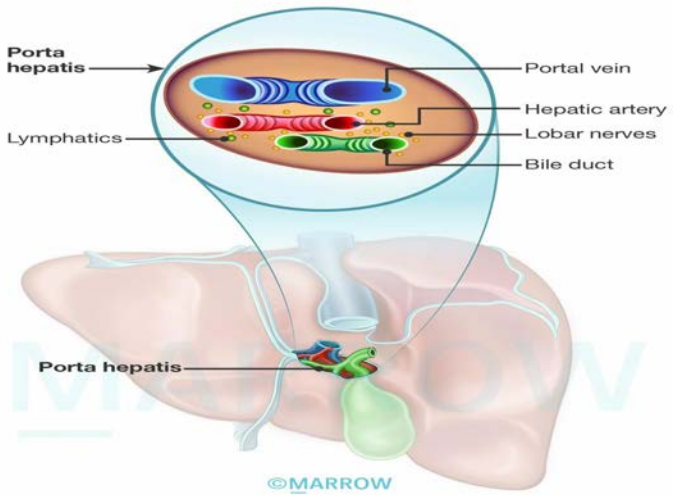
• Lymphatics

The images attached below shows the porta hepatis and the gif demonstrates the pringles manoeuvre.

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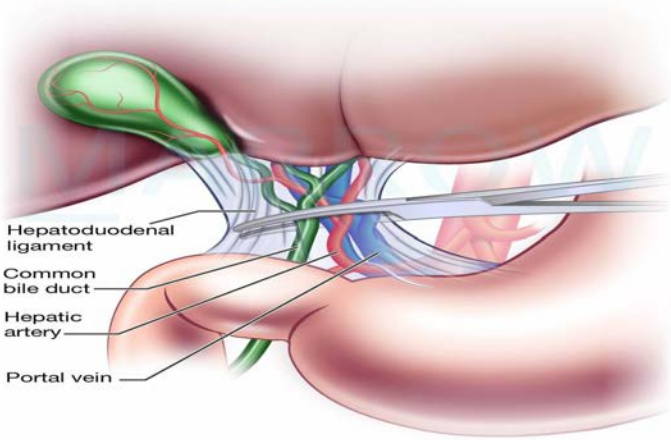
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Porta hepatis

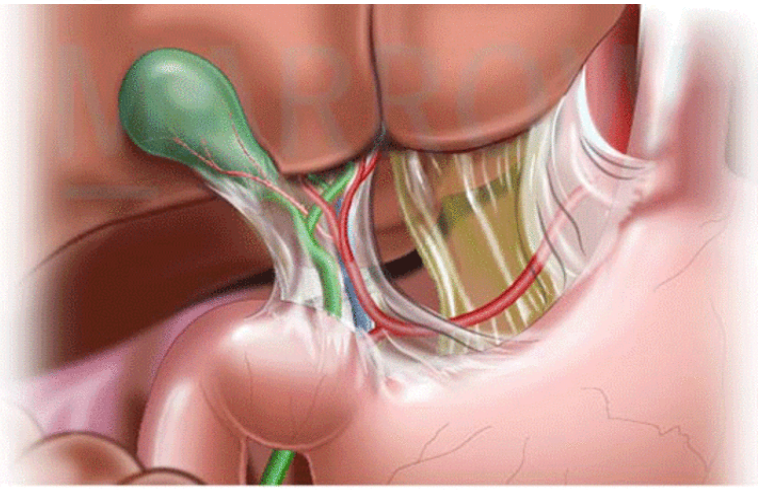


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Pringle maneuver



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4 P's in the management of liver injuries are:

• Push- Compression of the edges of the laceration

• Pringle- Applying pressure on the portal triad

• Plug the defects with silicon tubes

• Pack- Apply packs in and around the liver to arrest bleeding

General guidelines for the management of blunt trauma to the liver:

• Patients who are haemodynamically unstable will require an immediate laparotomy for damage control resuscitation.

• For the patient who is haemodynamically stable, imaging by CT should be performed to further evaluate the nature of the injury.

• Most patients with a blunt liver injury who are haemodynamically stable can be managed conservatively.

• The indication for discontinuing conservative treatment is the development of haemodynamic instability, evidence of ongoing blood loss despite correction of any underlying coagulopathy and the development of signs of generalised peritonitis.

• Interventional radiology has an important role in the management of liver trauma and embolisation to control hepatic artery bleeding is safe and effective in a stable patient with no evidence of hollow viscus perforation.

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Breast - Anatomy, Congenital and Benign Diseases

Question 1:

Which of the following hormones will stimulate lobular development of the breast?

a) Estrogen

b) Progesterone

c) Estrogen and progesterone

d) Prolactin

Question 2:

Which of the following is not true regarding lymphatic drainage of the breast?

a) The axillary nodes receive approximately 85% of the drainage.

b) The lateral group is located along the axillary vein.

c) The anterior group drains most of the breast.

d) Lymph nodes are divided on the basis of their relation to the pectoralis major.

Question 3:

A 55-year-old woman presented to the OPD with a 4 x 2 cm painless lump in the left breast. She is planned for a mastectomy. Sentinel lymph node biopsy done showed involvement of level 1 lymph nodes. Which of the following lymph nodes will not be affected in her case?

a) Posterior

b) Lateral

c) Subscapular

d) Interpectoral

Question 4:

During a routine antenatal checkup, a pregnant woman in her third trimester is noticed to have accessory nipples. Which of the following does this condition refer to?

a) Polymazia

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b) Polythelia

c) Symmastia

d) Supernumerary mazia

Question 5:

Which of the following is not true regarding accessory breast tissue?

a) It is associated with Poland's syndrome

b) Most frequently involves the axilla

c) It develops along the line of Schultz

d) It is also known as polymazia

Question 6:

All of the following statements about amazia are true except _____.

a) Amazia may be associated with Poland's syndrome

b) Amazia is the absence of the nipple.

c) Amazia is often the result of surgical intervention.

d) Amazia may be caused by radiation therapy.

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Question 7:

Which of the following will you not see in a patient with Poland's syndrome?

a) Athelia with the absence of the pectoralis major

b) Amastia with the absence of pectoralis major

c) Abnormally short, webbed fingers

d) Loss of costal cartilage

Question 8:

A 45-year-old woman presents to the clinic with pain over the lateral aspect of her right breast for the past 5 days. Examination finding is as shown in the image. Which of the following is the likely diagnosis?

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a) Tietze's disease

b) Zuska disease

c) Mondor's disease

d) Stewart–Treves syndrome

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Question 9:

Which of the following is the commonest cause of pathological nipple discharge in a non-lactating woman?

a) Duct ectasia

b) Intraductal papilloma

c) Paget's disease of breast

d) Galactorrhea

Question 10:

A chronic smoker presented with complaints of intermittent discharge from bilateral nipples for the past few months. On compression of her breast during the examination, a discharge was observed as shown below. Which of the following is the most likely diagnosis?

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a) Duct ectasia

b) Intraductal papilloma

c) Fibrocystic disease

d) Nipple infection

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Question 11:

What is the best method of management in a patient with recurrent episodes of multiple duct ectasia?

a) Microdochectomy

b) Hadfield's operation

c) Wide excision involving the affected ducts

d) Simple mastectomy

Question 12:

Amongst the following, the most common cause of blood-stained nipple discharge from a single duct is:

a) Intraductal carcinoma

b) Duct ectasia

c) Intraductal papilloma

d) Fibrocystic disease

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Question 13:

A probe is inserted into the duct from which the nipple discharge is emerging. A tennis racquet incision is made and the flap is dissected to reach the duct. The duct is then excised. This procedure is known as?

a) Macrodochectomy

b) Microdochectomy

c) Cone excision

d) Wide excision of the lactiferous duct.

Question 14:

Which of the following aberration of normal development and involution of breast tissue is present in patients with fibroadenoma?

a) Stromal development

b) Lobular involution

c) Lobular development

d) Duct Involution

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Question 15:

A 19-year-old girl presents with a lump in her right breast for the past 6 months. On examination, the lump is around 1 x1 cm in size, firm, and freely movable on the breast tissue. Ultrasound shows the presence of a circumscribed oval lobulated mass. Which of the following is not true regarding the given condition?

a) Peak incidence is in second decade

b) It has a biphasic morphology

c) Mammography may show egg-shell calcification

d) It is a form of ANDI

Question 16:

A giant fibroadenoma has a diameter greater than _____

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a) 5 cm

b) 10 cm

c) 15 mm

d) 20 mm

Question 17:

A 45-year-old woman presented with a lump in the left breast as shown in the image below. Biopsy done revealed increased stromal cellularity with typical leaflike architecture. Which of the following is false about this condition?



a) Usually benign

b) Metastasizes to axillary lymph nodes

c) Treatment is wide excision with margin

d) Originates from hormonally responsive stromal cells of the breast

Question 18:

A breastfeeding mother presented to the clinic with fever and breast pain for the past 2 days. The affected breast appears as shown in the image below. There is extreme tenderness on palpation. Which of the following is the most common source for the organism causing this condition?

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a) Maternal skin flora

b) Breast pump

c) Infant's nasopharynx

d) Infant's skin flora

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Question 19:

A female patient presents with a breast abscess. An aspiration was attempted under antibiotic cover which failed to reveal any aspirate. What is the next step in management?

a) Incision and Drainage

b) Continue antibiotics only

c) A second attempt at aspiration

d) Stop antibiotics as no aspirate was collected

Question 20:

A 37- year-old woman presented to the clinic with a breast lump. Clinical examination and ultrasound revealed the presence of a single large cyst in her right breast. On aspirating the cyst, you find blood-stained fluid. What will be the next best step in the management of this patient?

a) Wait for refilling and reattempt aspiration

b) Excision of the cyst

c) Analgesia and antibiotics

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d) Perform mammogram to rule out carcinoma

Question 21:

Physiological gynecomastia is not seen in which of the following?

a) Neonates

b) Adolescents

c) Elderly

d) Obese individuals

Question 22:

A 32-year-old woman has been experiencing breast pain for the past 6 months. The pain is present just before her menstrual period. Breast examination and mammography are normal. All of the following medications/supplements can help in reducing the pain except:

a) Danazol

b) Evening primrose oil

c) Caffeine

d) Tamoxifen

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Question 23:

A breastfeeding mother presented to the clinic with a gradually progressive painless breast lump. On examination, a well-circumscribed and freely mobile mass was palpable. USG showed a solitary, well-defined, anechoic lesion with thin, echogenic walls. Aspiration revealed a white fluid. What is the best treatment option for this condition?

a) Excisional Biopsy

b) USG guided fine-needle aspiration

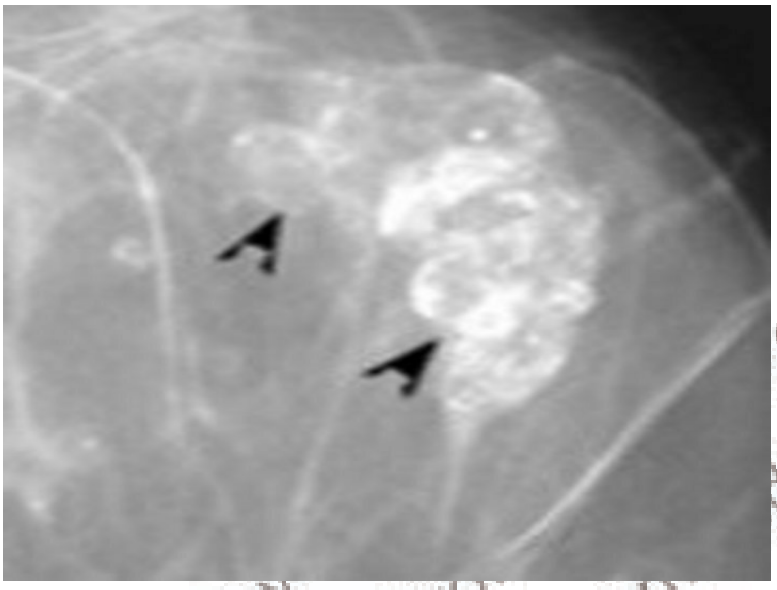
c) Incision and drainage

d) Trial of antibiotic therapy

Question 24:

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A 30-year-old female footballer presented with complaints of a lump in the breast. On examination, a hard, irregular lump was palpated. Mammography revealed calcifications as shown below. Which of the following conditions is she most likely to have?



a) Fat necrosis

b) Carcinoma

c) Papilloma

d) Blue-dome cysts

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Answer Key

Question No.	Correct Option
1	b
2	d
3	d
4	b
5	a
6	b
7	a
8	c
9	a
10	a
11	b

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12	c
13	b
14	c
15	c
16	a
17	b
18	c
19	c
20	b
21	d
22	c
23	b
24	a

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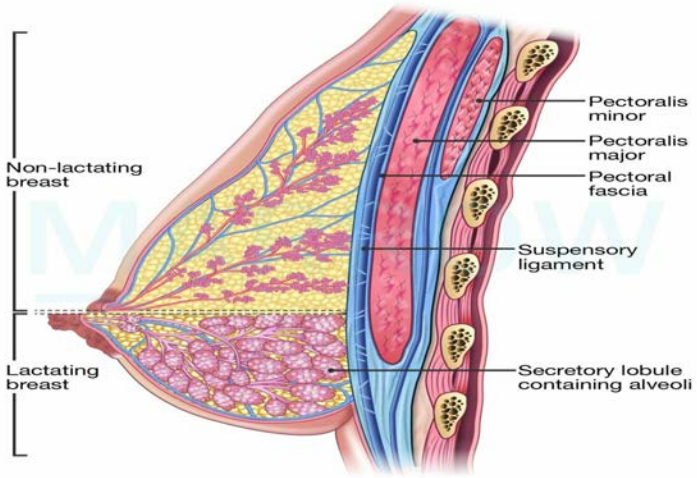
Detailed Explanations

Solution to Question 1:

Progesterone stimulates lobular development of the breast and differentiation of the epithelium.

Hormone	Action
Estrogen	Ductal development
Progesterone	Lobular development and differentiation of the epithelium
Prolactin	Lactogenesis
Oxytocin	Milk ejection

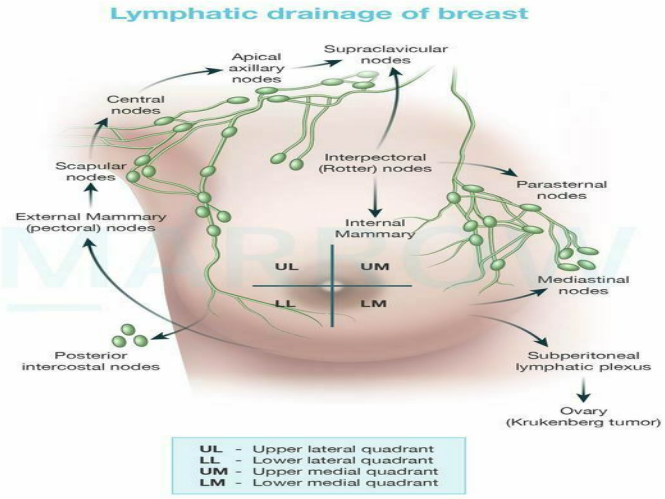
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Solution to Question 2:

Lymph nodes are divided on the basis of their relation to the pectoralis minor, not the pectoralis major.

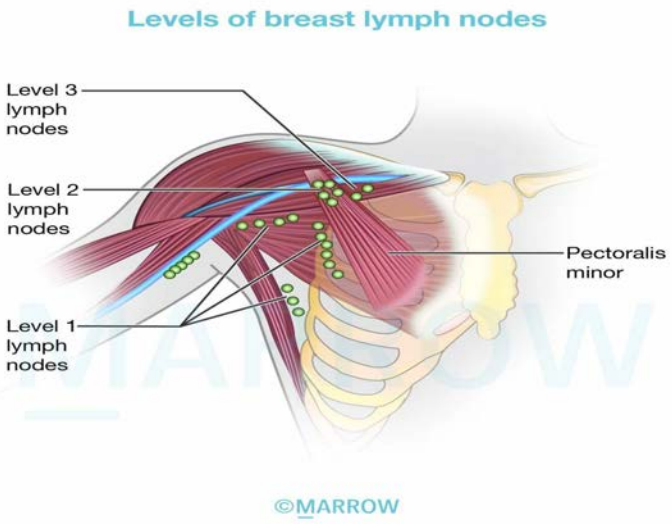


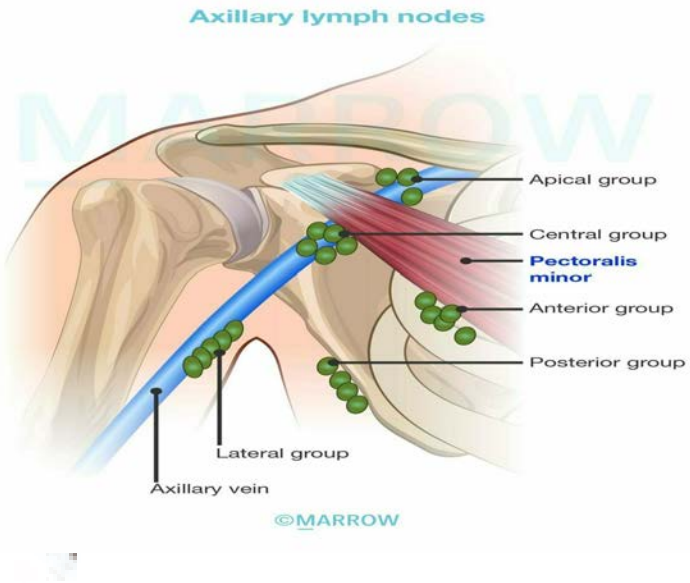
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Solution to Question 3:

Interpectoral lymph nodes are level 2 axillary lymph nodes. Level 1 axillary lymph nodes include anterior, lateral, and posterior/subscapular nodes.

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Solution to Question 4:

Polythelia or supernumerary nipples refer to the presence of accessory nipples.

Polymastia or polymazia is a congenital anomaly with the presence of accessory breast tissue.

Symmastia is a condition characterized by webbing between the breasts, at the midline.

Supernumerary mazia is the presence of accessory breasts with a complete ductal system, areola, and nipple in addition to two normal breasts.

Note: Athelia refers to the absence of nipples, and amastia refers to the congenital absence of the breast and nipple.

The image below shows a third nipple below the left breast:

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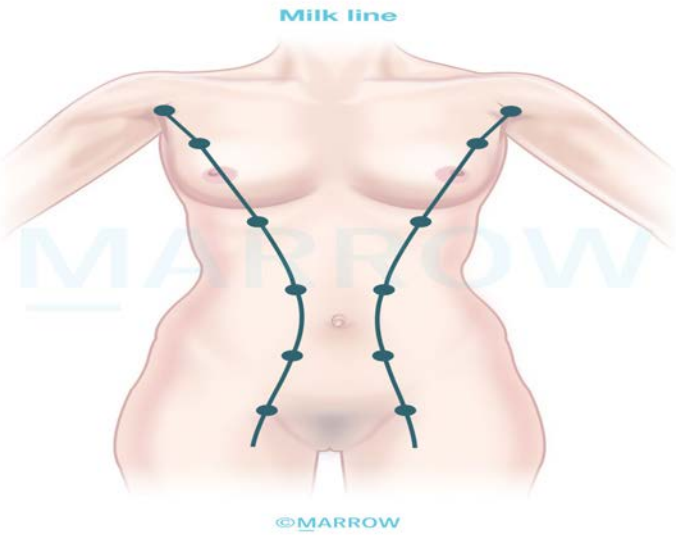
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Solution to Question 5:

Poland's syndrome is not associated with accessory breast tissue. It is associated with amastia with the absence of the sternal portion of the pectoralis major muscle.

Polymastia or polymazia is a congenital anomaly in which there is presence of accessory breast tissue. Axilla is the most frequent site for accessory breast tissue along the line of Schultz. Accessory breast tissue develops along the milk line/ line of Schultz, which appears by the 6th week of embryonic development. The milk line extends from the axilla to the inguinal region. It is ectodermal in origin.

The image below shows the milk line/ line of Schultz:



The image below shows accessory breast tissue in the right axilla:

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Solution to Question 6:

Amazia is a condition wherein the breast tissue is absent, but the nipple-areolar complex is present. It results from iatrogenic causes such as radiation, excision of a misdiagnosed infantile or childhood mass that actually represented breast buds or incision and drainage of a suspected abscess.

Note: Amastia is the congenital absence of the breast and nipple. Athelia is the absence of the nipple.

Solution to Question 7:

Athelia with absence of pectoralis major is not associated with Poland's syndrome.

Poland's syndrome is associated with unilateral:

• Amastia with the absence of the sternal portion of the pectoralis major muscle

• Abnormalities of the chest wall muscles

• Loss of costal cartilage

• Digital abnormalities such as brachysyndactyly, which is the abnormal shortness of the fingers or toes combined with webbing between the adjacent digits

In some cases, associated skeletal abnormalities, such as underdeveloped or absent upper ribs, underdeveloped forearm bones, and elevation of the shoulder blade (Sprengel deformity) may also be present.

Note: Poland's syndrome is a constellation of anomalies with varying clinical presentations. Patients with this syndrome can present with amazia (absence of one or both of the mammary glands) or amastia (complete absence of breast tissue, nipple, and areola) in addition to any or all

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of the above-mentioned abnormalities.



Solution to Question 8:

The given clinical scenario is suggestive of Mondor's disease. The image shows the presence of a subcutaneous cord and a narrow shallow groove along the side of the cord.

Mondor's disease is the thrombophlebitis of the superficial veins of the breast and anterior chest wall. The most commonly involved vein is the lateral thoracic vein. Patients usually present with pain along the lateral chest wall and a tender, firm cord below the breast. It is a benign condition and gets resolved on its own within 4-6 weeks. Warm compresses and anti-inflammatory medicines can be used to reduce pain. If the symptoms persist despite medications, the affected segment of the vein can be excised.

Option A: Tietze's syndrome is a benign inflammation of one or more costal cartilages.

Option B: Zuska disease is the subcutaneous abscess of the breast tissue beneath the areola of the nipple. It is also called a subareolar abscess.

Option D: Stewart–Treves Syndrome is characterized by lymphangiosarcoma in chronic long-standing lymphedema following mastectomy.

Solution to Question 9:

The most common cause of nipple discharge in a non-lactating woman is duct ectasia. The discharge is usually black or greenish in color.

Option B: Intraductal papilloma is the most common cause of bloody nipple discharge. It is a true polyp of the epithelium-lined ducts of the breast. Contrary to what one might expect, they are not associated with an increased risk of breast cancer.

Option C: Paget's disease of the breast can present with discharge from the surface of the nipple.

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Option D: Galactorrhea is the milk production from breasts unrelated to pregnancy or lactation.

Solution to Question 10:

The most likely diagnosis of a patient with greenish discharge from multiple ducts is duct ectasia.

Duct ectasia is the dilatation of breast ducts. It is the most common cause of nipple discharge in non-lactating women. This condition is associated with smoking and diabetes. The initial stage of this disease consists of dilatation of one or more lactiferous ducts. These ducts get filled with stagnant brown or green-colored secretions. In the later stages, the accumulation of fluid in the lactiferous ducts leads to infection and inflammation, causing periductal mastitis. Patients may present with nipple discharge, abscess, fistula, or nipple retraction.

Treatment includes:

• Initial stages - oral antibiotics, needle aspiration, or incision and drainage of the abscess

• Recurrent episodes - Hadfield operation (cone excision of multiple ducts)

• A single duct involvement - microdochectomy.

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Solution to Question 11:

The best method of management in a patient with multiple duct ectasia is to perform Hadfield's operation. This operation consists of the excision of all the major lactiferous ducts.

The initial stages of duct ectasia can be managed by oral antibiotics, needle aspiration, or incision and drainage of the abscess. Recurrent episodes of infection are best managed by Hadfield operation. If a single duct is involved, then microdochectomy is performed.

Solution to Question 12:

Ductal papilloma is the most common cause of blood-stained nipple discharge from a single duct.

Solitary intraductal papillomas are true polyps of the ducts which are usually small (<1 cm) but may grow to 4-5 cm. They are often associated with bloody nipple discharge. They do not have malignant potential. Treatment is by excision.

Note: The most common cause of blood-stained discharge from multiple ducts is carcinoma.

Solution to Question 13:

Microdochectomy is the excision of the entire lactiferous duct (single duct disease). It is done for duct papilloma.

Microdochectomy:

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• In a duct papilloma where no palpable mass is present, the duct is expressed to observe the discharge.

• A fine probe or stiff nylon suture is gently inserted into the duct, and the probe is secured to the nipple skin using silk sutures to prevent displacement during the procedure.

• A tennis racquet shaped incision is made to elevate the skin flaps, and the duct with the probe is excised along with the skin flap for 5 cm until the papilloma is identified (The papilloma will always be located within 5 cm from the duct orifice).

• The wound is closed without a drain, and a compression bandage is applied.

It is ideal to rule out DCIS by frozen section biopsy.

Cone excision and wide excision are done under major duct excision (Adair-Haldfield operation). It is done for duct ectasias with multiple duct involvement and multiple papillomas.

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Solution to Question 14:

In fibroadenoma, aberration of normal lobular development is present.

It arises from hyperplasia of a single lobule and presents as a well-circumscribed, smooth, firm, non-tender, solitary, freely mobile mass (mouse in the breast). It is a biphasic tumor consisting of fibroblastic stroma and epithelium-lined gland.

ANDI Classification of benign breast disorders:

Normal	Disorders
Early reproductive years (15-25 yrs)	
Lobular development	Fibroadenoma
Stromal development	Adolescent hypertrophy (Gig antomastia)
Nipple eversion	Nipple inversion (subareolar abscess, Mammary duct fistu la)
Later reproductive years (25-40 yrs)	
Cyclical changes in menstrua tion	Cyclical mastalgia
Involution (35-55 yrs)	
Lobular involution	Macrocysts, sclerosing lesion s
Duct involution	Dilation (duct ectasia)Scleros is (nipple retraction)
Epithelial turnover	Epithelial hyperplasia (with a typia)

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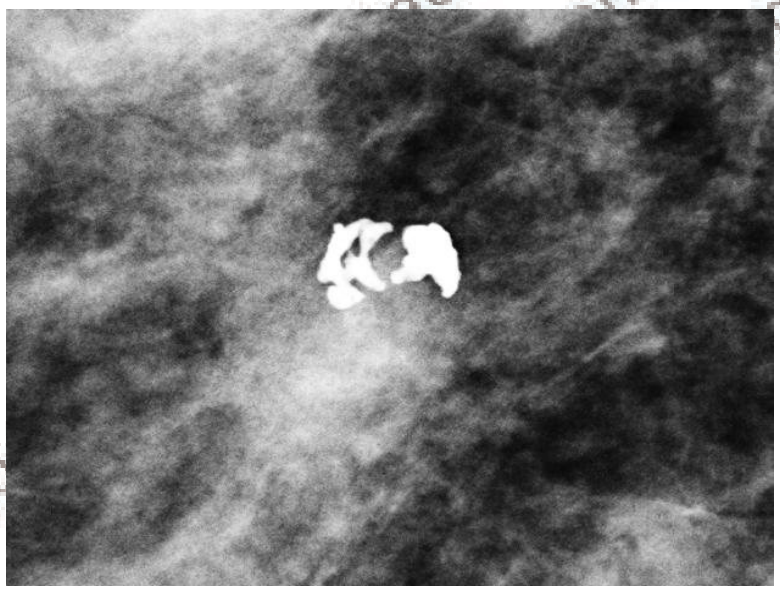
Solution to Question 15:

The clinical scenario is suggestive of fibroadenoma. Mammography may show the presence of popcorn calcification. Eggshell calcification can be seen in traumatic fat necrosis.

Fibroadenoma is a form of aberrations of normal development and involution of the breast (ANDI). The most common age group affected is 15-25 years (early reproductive period) with a peak incidence in the second decade. It arises from hyperplasia of a single lobule and presents as a well-circumscribed, smooth, firm, non-tender, solitary, freely mobile mass (mouse in the breast). It is a biphasic tumor consisting of fibroblastic stroma and epithelium-lined gland. Excision is not advised unless there is suspicious histology on FNAC.

Giant fibroadenoma is more than 5cm in size and is common in adolescent girls. It requires excision by submammary incision.

The image below shows popcorn calcification on mammography:



Solution to Question 16:

Giant fibroadenomas are over 5 cm in diameter and occasionally occur during puberty. They are often rapidly growing but are similar to smaller fibroadenomas and are enucleated through a submammary incision.

Solution to Question 17:

The given clinical scenario and histopathology report point to malignant cystosarcoma phyllodes, which metastasize via the bloodstream. Metastasis to lymph nodes is rare.

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Phyllodes tumor also known as a sero-cystic disease of Brodie or cystosarcoma phyllodes, originates from hormonally responsive stromal cells of the breast. It is usually a benign condition and affects women >40 years of age, but can be seen in younger women. Sometimes, may develop malignant transformation.

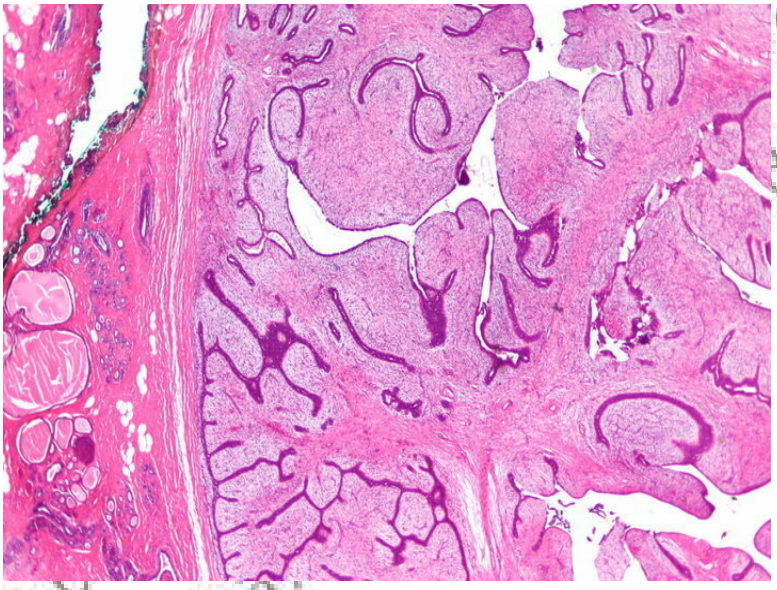
Clinical features:

• Large, sometimes massive, with an unevenly bosselated surface

• Ulceration of overlying skin occurs because of pressure necrosis

• Remains mobile on the chest wall

There is no role of FNAC in phyllodes tumor. Histopathology of the lump biopsy shows increased stromal cellularity, overgrowth, and typical leaflike architecture.



Tumors are treated by excision with margins of at least 2 cm to prevent local recurrence.

Large or malignant phyllodes tumors may require a mastectomy. The axillary dissection is not recommended because axillary lymph nodes rarely get involved.

Note: Malignant phyllodes tumors contain liposarcomatous or rhabdomyosarcomatous elements rather than fibrosarcomatous elements.

Solution to Question 18:

The given scenario is suggestive of lactational mastitis. The most common source of infection is from the infant's nasopharynx.

Lactational mastitis is most commonly caused by Staphylococcus aureus present in the infant's nasopharynx. The organism enters the breast tissue through cracked nipples and multiplies in the stagnant breast milk. Patients present with fever with a firm, red, tender, and swollen quadrant of the unilateral breast.

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Painful breasts must be managed by the use of analgesics. Breastfeeding should be continued if the pain is less severe. Antibiotics like flucloxacillin, co-amoxiclav are used to treat the infection. If the patient develops an abscess, then the abscess has to be drained by aspiration or incision.

	Bacterial mastitis	Breast abscess
Condition	Localized inflammation due t o ascending infection or infec tion due to milk stasis	Occurs as a complication of mastitis, with pus formation
Symptoms	Dull pain	Throbbing pain
Signs (if any)	Tenderness, erythema	Point tenderness, erythema, i nduration of skin (if chronic) lymphadenopathy,fluctuation test +ve
Managemen t	Analgesics, antibiotics	Analgesics, aspiration of pus, antibiotics

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Solution to Question 19:

In a patient with a breast abscess, the next step after a failed aspiration is to attempt aspiration once again under antibiotic cover.

Incision and drainage is not preferred, as it can potentially interfere with breastfeeding, and delicate structures such as ducts, lobules, and tubules may be injured, possibly leading to a non-healing milk fistula.

A breast abscess is a complication of acute mastitis, which is more common in new mothers at the beginning of lactation (lactational mastitis). Non-lactational mastitis is more common in diabetic, immunosuppressed people and people predisposed by duct ectasia and periareolar infections.

Clinical features of a breast abscess include:

• Fever and malaise

• Localized pain and tenderness

• Redness and swelling of the affected breast

• Positive fluctuation test.

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An ultrasonogram of the affected breast is performed to confirm the abscess, and treatment proceeds as follows:

• Analgesics, antipyretics, and breast support for pain and fever relief.

• Aspiration is performed under antibiotic cover, and the pus is cultured. If aspiration proves unsuccessful, it should be reattempted after a few days.

• Incision and drainage should be considered in cases of:

• Mastitis unresponsive to antibiotics for 48 hours.

• Brawny induration.

• Progressive mastitis with persistent fever

Note:

	Bacterial mastitis	Breast abscess
Condition	Localized inflammation due to ascending infection or infection due to milk stasis	Occurs as a complication of mastitisPus formation
Symptoms	Dullpain	Throbbingpain
Signs (if any)	TendernessErythema	Point tendernessErythemaInduration of skin(if chronic)LymphadenopathyFluctuation test +vePus pointmay be present
Management	AnalgesicsAntibiotics (Dicloxacillin500 mg every 6 hours orally; Erythromycin if allergic to penicillin)Adequate breast support	AnalgesicsAdequate breast supportAspiration of Pus under antibiotic cover; repeated aspirations if requiredIncision & drainage

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Solution to Question 20:

The next step in management is the excision of the cyst.

Treatment of breast cyst:

• If the aspirate is clear (non-blood stained) or if the cyst resolves completely then no further treatment is required.

• If the aspirate is blood-stained or if the cyst recurs, then a core biopsy or local excision should be performed. The resulting tissue should be sent for histopathology for the exclusion of cystadenocarcinoma, especially in elderly women.

Solution to Question 21:

Physiological gynecomastia is not seen in obese males. In obese men, increased fat deposition over the breasts is referred to as pseudo-gynecomastia.

Gynecomastia is defined as ° 2 cm subareolar breast tissue. It can be physiological or pathological.

Physiologic gynecomastia occurs during three phases of life:

• Neonatal period

• Adolescence

• Senescence

Common to each of these phases is an excess of circulating estrogens in relation to circulating testosterone. Neonatal gynecomastia is caused by the action of placental estrogens on neonatal breast tissues. In adolescence, there is an excess of estradiol relative to testosterone. In senescence, the circulating testosterone level falls, resulting in relative hyperestrogenism.

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Solution to Question 22:

The clinical scenario is suggestive of cyclical mastalgia. Caffeine is not useful in reducing pain. On the contrary, caffeine has to be avoided to reduce pain.

Medications that can be used to treat mastalgia are evening primrose oil, danazol, and tamoxifen.

Solution to Question 23:

The given clinical scenario is suggestive of galactocele. The best treatment option for this condition is USG guided fine-needle aspiration.

A galactocele is a milk-filled cavity in the breast of a woman who is usually lactating. It can be caused due to lactation problems, prolactin stimulation by drugs, or duct obstruction.

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It presents as a palpable, round, well-circumscribed, and freely mobile mass with no fever, pain, or inflammation. It is usually subareolar and unilateral.

USG guided fine-needle aspiration is both diagnostic and therapeutic. It will show thick milky white secretion confirming the diagnosis. Aspiration resolves galactocele in most cases. Surgery is done for infected cysts or recurrent cases.

Antibiotic therapy is not needed if the galactocele is not infected.

Solution to Question 24:

In the given scenario, palpable mass and egg-shell calcifications on mammography in a young woman are suggestive of fat necrosis. It mimics breast carcinoma clinically and mammographically but has no malignant potential.

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Carcinoma Breast - Risk Factors and Types

Question 1:

Which one of the following pathological features has a higher risk of developing into invasive breast carcinoma?

a) Squamous metaplasia

b) Ductal papillomatosis

c) Atypical ductal hyperplasia

d) Sclerosing adenosis

Question 2:

A woman with a family history of breast and ovarian cancers underwent genetic testing. She is found to have a BRCA1 gene mutation. Which of the following is she at risk of developing?

a) Melanoma along with breast cancer

b) Well differentiated breast cancer

c) Post menopausal breast cancer

d) Triple receptor negative breast cancer

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Question 3:

Which of the following does not increase the risk of breast carcinoma in women?

a) 1, 3 & 4

b) 2 & 4

c) Only 3

d) 1, 3 & 5

Question 4:

The most common location of breast carcinoma is the _____.

a) Upper outer quadrant

b) Lower outer quadrant

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c) Upper inner quadrant

d) Lower inner quadrant

Question 5:

A woman presented to the clinic with redness and itching over the left breast as shown in the image below. Histopathology showed large pale vacuolated cells with round nuclei in the epithelium. What is the most likely diagnosis?



a) Phyllodes tumor

b) Paget's disease of the breast

c) Inflammatory breast carcinoma

d) Chronic eczema

Question 6:

Which is the most common variant of breast carcinoma?

a) Lobular carcinoma

b) Ductal carcinoma

c) Tubular carcinoma

d) Medullary carcinoma

Question 7:

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Which of the following is not true regarding breast carcinoma?

a) Cutaneous oedema in inflammatory carcinoma is the result of blockage of the sub-dermal lymphatics with carcinoma cells

b) Mucinous carcinomas are usually hormone negative

c) Calcifications are frequently associated with ductal carcinoma in situ

d) Lobular carcinoma in situ is multi centric and bilateral

Question 8:

Arrange the following subtypes of breast carcinomas according to the best to worst prognosis?

a) 1, 5, 2, 4, 3

b) 2, 1, 5, 3, 4

c) 2, 1, 3, 4, 5

d) 1, 2, 3, 5, 4

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Question 9:

A 40-year-old woman presents with complaints of swelling of the right breast over the past 15 days. On examination, there was local rise of temperature, and the swelling was mobile over the chest wall. What is the likely diagnosis?



a) Inflammatory carcinoma

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b) Giant fibroadenoma

c) Phyllodes tumor

d) Galactocele

Question 10:

A postmenopausal lady came to the clinic with complaints of breast pain and a lump in her right breast for the past 2 months. On examination, the breast appears as shown in the image. What is the most likely cause for this finding?



a) Infiltration of Cooper's ligaments

b) Obstruction of subcutaneous lymphatics

c) Infiltration of lactiferous duct

d) Infiltration of the pectoralis muscle

Question 11:

A middle-aged woman presented with a painless lump in the breast. Mammography done showed suspicious microcalcifications. USG-guided core biopsy revealed large cells with cytoplasmic mucoid globules and neighborhood calcifications. There is no invasion into the basement membrane and fibrovascular stroma. What is the most likely diagnosis?

a) Ductal carcinoma in situ

b) Paget's disease of the breast

c) Lobular carcinoma in situ

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d) Phyllodes tumor

Question 12:

Which of the following is most likely in a woman with bilateral and multicentric breast lumps?

a) Ductal carcinoma in situ (DCIS)

b) Lobular carcinoma in situ (LCIS)

c) Mucinous carcinoma

d) Papillary carcinoma

Question 13:

An annual screening mammogram done for a middle-aged woman showed clusters of microcalcifications. Stereotactic trucut biopsy revealed a comedo growth pattern. What is the most likely diagnosis?

a) Ductal carcinoma in-situ

b) Lobular carcinoma in-situ

c) Medullary carcinoma

d) Inflammatory carcinoma

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Question 14:

A woman with BRCA1 gene mutation presented with lumps in both breasts and enlarged axillary lymphadenopathy. She gives a history of breast cancer in her sister. MRI and trucut biopsy done confirmed the diagnosis of medullary carcinoma of the breast. Which of the following statements is true regarding the given condition?

a) Lymph node enlargement can be due to reactive hyperplasia

b) It is a slow growing tumor

c) Tamoxifen can be used in the treatment

d) Has poorer prognosis than invasive lobular carcinoma

Question 15:

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A male patient who presented with a lump in his right breast is diagnosed to have breast carcinoma. Which of the following is true regarding the given condition?

a) The prognosis is worse than in females

b) Infiltrating ductal carcinoma is the most common type

c) Associated with BRCA 1 mutation

d) Tamoxifen is not effective in treatment

Question 16:

A 35-year-old woman is worried about developing breast cancer. Her mother and sister had developed breast cancer at the age of 30 years and 32 years respectively. She has 2 daughters. After evaluation, she is found to have a BRCA-1 gene mutation. Which of the following methods will you suggest for the maximum risk reduction of developing carcinoma breast in this patient?

a) Close surveillance with MRI every 6 months

b) Tamoxifen chemoprophylaxis

c) Prophylactic mastectomy

d) Prophylactic mastectomy with bilateral salpingo-oophorectomy

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Answer Key

Question No.	Correct Option
1	c
2	d
3	d
4	a
5	b
6	b
7	b
8	b
9	a
10	b
11	c
12	b

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13	a
14	a
15	b
16	d

Detailed Explanations

Solution to Question 1:

Atypical hyperplasia has a higher risk of developing into invasive breast carcinoma.

Solution to Question 2:

Individuals with BRCA1 mutations are likely to develop triple receptor-negative and high-grade breast carcinomas.

Solution to Question 3:

Early age of first pregnancy, breastfeeding, and multiparity are protective factors for carcinoma of the breast. This is due to a reduction in the overall number of ovulatory cycles thereby reducing the duration of estrogen's action on the breast tissues.

Solution to Question 4:

The upper outer quadrant of the breast has a greater volume of tissue and is the most common site of breast carcinoma.

Solution to Question 5:

The clinical picture and histology are suggestive of Paget's disease of the breast.

Paget's disease is a rare type of cancer involving the nipple-areolar complex, often with an underlying in-situ or invasive ductal carcinoma. It presents as a chronic, eczematous eruption of the nipple which may progress to ulceration. Paget disease of the breast is often mistaken for eczema.

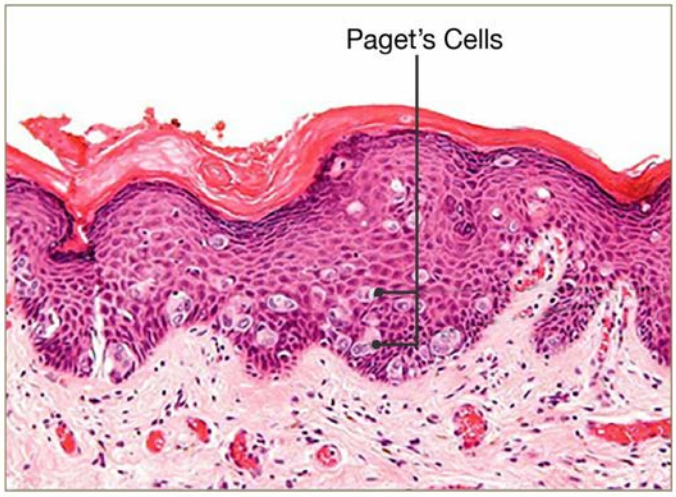
A nipple biopsy specimen of Paget's disease will show a population of cells that are identical to the underlying malignant cells. The presence of large, pale, vacuolated cells (Paget cells) with round or oval nuclei are pathognomonic for this condition.

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Depending on the type and extent of underlying malignancy, it can be treated with lumpectomy or mastectomy.

	Paget's disease	Eczema
Laterality	Unilateral	Bilateral
Age group	Menopausal women	Lactating women
Edges	Distinct	Indistinct
Vesicles	Absent	Present
Nipple	Usually destroyed	Usually intact
Lump	Usually present	No underlying lump



Note: Histologically, Paget's disease can be confused with superficial spreading melanoma, particularly if they have incorporated melanin from adjacent epidermis. Paget's disease shows positive immunostaining with carcinoembryonic antigen (CEA), while superficial spreading melanoma is positive for S-100 antigen.

Solution to Question 6:

Invasive ductal carcinoma (not otherwise specified) is the most common variant of breast carcinoma. It is also known as infiltrating ductal carcinoma.

Solution to Question 7:

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Mucinous carcinoma is usually hormone-positive (90%). It is also called colloid carcinoma. It is a low-grade tumor with a good prognosis. It typically presents as a bulky mass in the elderly.

Option A: Pathologic hallmark of inflammatory carcinoma is a painful, swollen breast, which is warm with cutaneous edema due to blockage of subdermal lymphatics with carcinoma cells.

Option C: Calcification is usually associated with ductal carcinoma in-situ (DCIS). It is the most common malignancy detected in screening mammograms.

Option D: Lobular carcinoma in situ (LCIS) is mainly multicentric (sometimes multifocal) and bilateral.

Solution to Question 8:

Tubular carcinoma has the best prognosis. Inflammatory carcinoma has the worst prognosis.

Order of breast carcinomas from best to worst prognosis:

• Tubular carcinoma (Best prognosis)

• Adenocystic

• Cribriform carcinoma

• Papillary carcinoma

• Medullary carcinoma

• Invasive lobular carcinoma

• Invasive ductal carcinoma (NOS)*

• Inflammatory carcinoma breast (Worst prognosis)

NOS- Not otherwise specified

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Solution to Question 9:

In the given scenario, the rapid onset of the disease and the examination findings are suggestive of inflammatory carcinoma of the breast.

Inflammatory breast cancer is the most aggressive subtype of breast cancer. It mimics acute mastitis. The hallmark of inflammatory breast carcinoma is the diffuse tumor involvement of the dermal lymphatics within the breast and the overlying skin, often without a discrete underlying tumor mass (peau d' orange appearance). The patient presents with rapidly progressive swelling of the breast, warmth, erythema and edema. A breast lump may or may not be present.

A diagnosis of inflammatory breast carcinoma should be suspected when a patient with rapidly progressive swelling with inflammatory skin changes does not respond to antibiotics. The imaging features with ultrasound and a mammograph is non-specific due to the underlying erythema and edema. A biopsy should be done to confirm the diagnosis.

Treatment includes combined-modality treatment:

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• Neoadjuvant chemotherapy

• Mastectomy

• Radiation therapy

• Hormonal therapy- for ER-positive tumors

• Trastuzumab for HER-2-positive tumors

Option B: Giant fibroadenomas occasionally occur during puberty. These are benign solid encapsulated slow-growing tumors over 5 cm in diameter. It presents as a painless lump in the breast. They are managed by excision via a submammary incision.

Option C: Phyllodes tumors usually occur in women over the age of 40 years but can appear in younger women. Phyllodes tumor is mostly benign even though it is also called cystosarcoma phyllodes. It presents as a large tumor with an unevenly bosselated surface. They are usually mobile over the chest wall despite their large size. This tumor does not infiltrate the skin. Nipple retraction is not seen in this condition. Benign lesions can be treated with enucleation or wide local excision. Massive tumours, recurrent tumours and malignant lesions are treated with a mastectomy.

Option D: Galactocele are the most common benign breast lesions in lactating women. It is a cystic enlargement of the mammary gland containing milk. They are mostly detected during lactation or in the third trimester of pregnancy but rarely, may also present after stopping breastfeeding. Clinically, the mass is usually firm and non-tender and presents as a solid tumour-like lesion on physical examination. The patient usually notes the lesion during lactation or some period after lactation. Needle aspiration, followed by excision should it recur, is the standard method of treating galactocele.

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Solution to Question 10:

In the given image, the orange peel-like appearance, also called as peau d'orange is caused by cutaneous lymphatic edema, due to the obstruction of subcutaneous lymphatics. It is the hallmark of inflammatory carcinoma.

Option A: Infiltration of Cooper's ligaments leads to dimpling of the skin.

Option C: Infiltration of the lactiferous ducts leads to nipple retraction.

Cancer-en-cuirasse is an aggressive form of cancer, where there is cutaneous and subcutaneous infiltration of the cancer cells.

Note: While Peau d'orange indicates skin involvement, dimpling of the skin and nipple retraction do not indicate skin involvement.

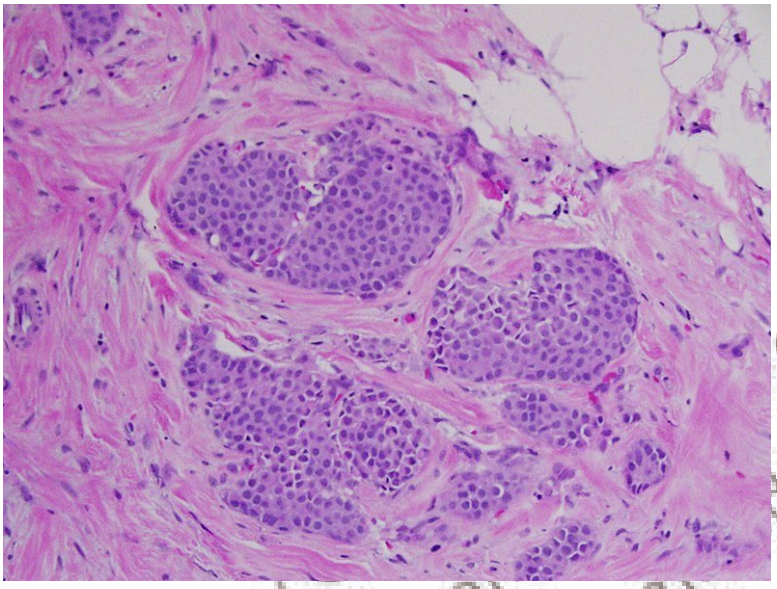
Solution to Question 11:

The presence of large cells with cytoplasmic mucoid globules with an intact basement membrane, and neighborhood calcifications are characteristic of lobular carcinoma in situ (LCIS).

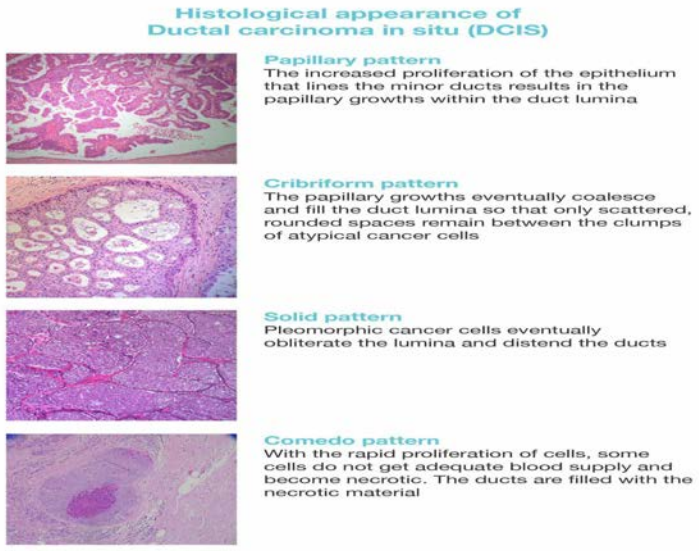
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Lobular carcinoma in-situ is usually detected as an incidental finding on evaluation of either a mass lesion or abnormalities on mammography.

The slide below shows cytoplasmic mucoid globules seen in lobular carcinoma in situ.

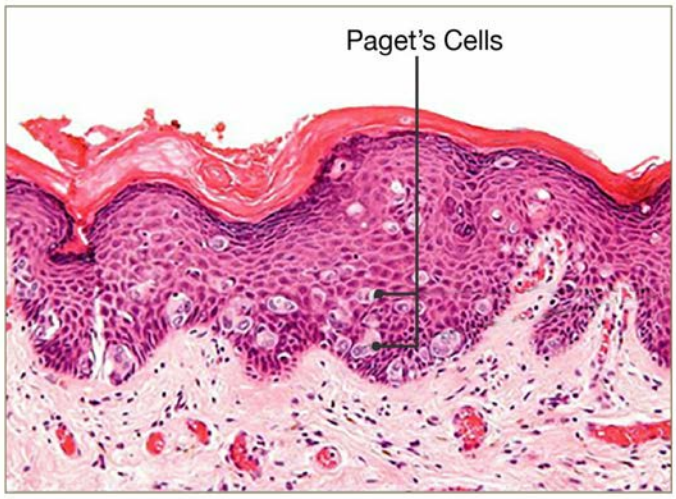


Option A: Ductal carcinoma in situ (DCIS) can have various histological appearances like solid, comedo, papillary cribriform, etc

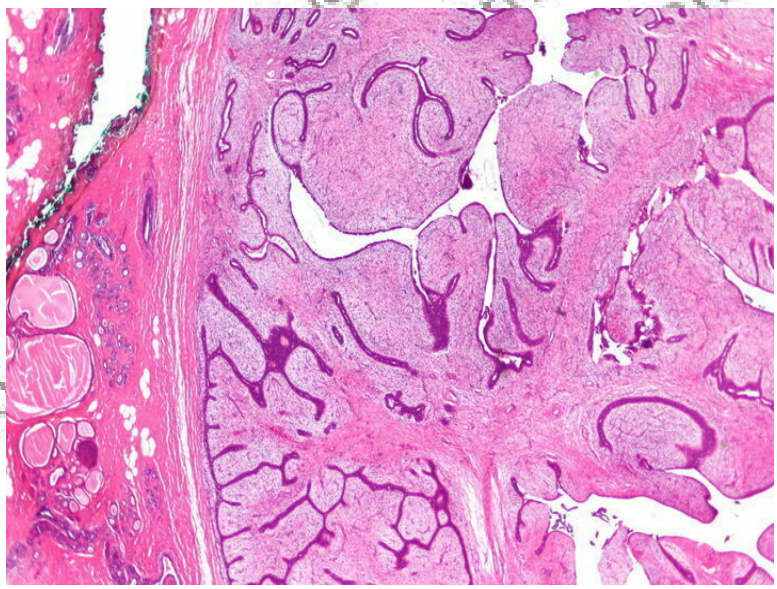


Option B: Histology of Paget's disease of the breast shows the presence of large pale vacuolated cells (Paget cells) in the rete pegs of the epithelium.

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Option D: Histology of phyllodes tumor consists of nodules of proliferating stromal cells, that are covered by epithelium. This resembles a leaf and is hence termed as phyllodes.



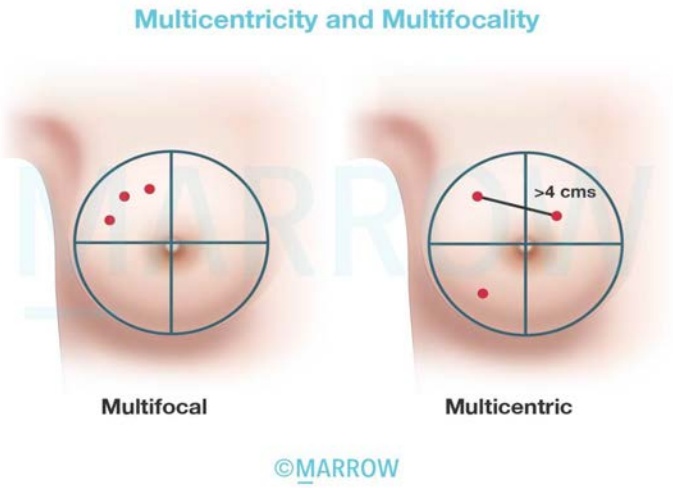
Solution to Question 12:

Bilaterality and multicentricity are most commonly associated with lobular carcinoma in situ (LCIS).

LCIS occurs bilaterally in 50 - 70% of cases. Multicentricity is seen in 60 - 90% of patients with LCIS.

Multicentricity refers to the occurrence of second breast cancer outside the breast quadrant of the primary cancer (or at least 4 cm away). Multifocality refers to the occurrence of a second cancer within the same breast quadrant as the primary cancer (or within 4 cm of it).

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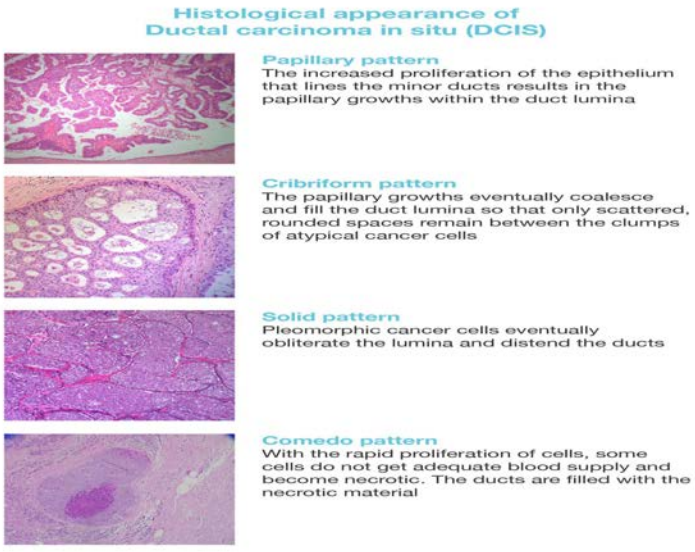
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Solution to Question 13:

The presence of microcalcifications on mammography and comedo pattern on histology is suggestive of ductal carcinoma in situ (DCIS).

Treatment:

- Breast conservation surgery with radiotherapy or,
- Simple mastectomy- least loco-regional recurrence
- No role of chemotherapy
- If ER, PR +ve- hormonal therapy



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Comedo subtype refers to the presence of necrosis. It implies that the tumor cells are growing rapidly and the blood vessel is not able to supply all the malignant cells. On the contrary, non-comedo subtype implies that the tumor is growing slowly and the blood vessel is able to supply all the cells. Therefore, the comedo subtypes are of high-grade DCIS.

Solution to Question 14:

Medullary carcinoma of the breast is associated with intense lymphocyte proliferation. Therefore, the lymph node enlargement can be due to reactive hyperplasia rather than the spread of the cancer cells to the lymph nodes.

Medullary carcinoma is a common type of breast cancer associated with BRCA1 gene mutation. Bilateral tumors are common when family history is present. The tumor can enlarge rapidly due to necrosis and hemorrhage. The majority of the tumors are triple-negative (ER/PR/Her-2 negative).

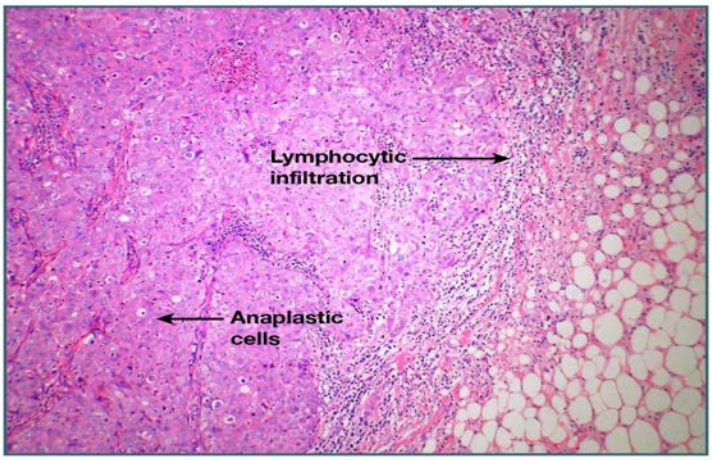
Histopathology consists of:

• A dense lymphoreticular infiltration composed predominantly of lymphocytes and plasma cells

• A sheet-like growth pattern of anaplastic cells with absent ductal or lobular differentiation

It has a better prognosis than invasive ductal or invasive lobular carcinoma.

Histology of medullary carcinoma breast



Solution to Question 15:

Infiltrating ductal carcinoma is the most common type of breast cancer seen in men.

Breast cancer in men accounts for less than 1% of all breast cancers. The peak incidence is between 60-70 years of age. Majority of the patients present with a hard mass in the breast. Important risk factors are:

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• BRCA2 mutation

• Radiation exposure

• Estrogen therapy

• Testicular feminizing syndrome

• Klinefelter syndrome

Diagnosis of male breast carcinoma is similar to females which involves a clinical examination, imaging, and tissue biopsy. Grading, treatment, and prognosis are the same as female breast cancer. The majority of male breast cancers are hormone receptor-positive and hence tamoxifen is used in the treatment.

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Solution to Question 16:

Prophylactic mastectomy with bilateral salpingo-oophorectomy will provide maximum risk reduction in this patient with a complete family, a positive gene mutation, and positive family history.

Breast cancer risk reduction techniques:

• Lifestyle modification: Low-calorie diet, daily exercise, no smoking, no drinking, etc.

• More frequent screening every 6-12 months with mammogram +- MRI

• Chemoprevention: Preferred in women >35 years of age in patients who are ER/PR positive. Given for 5-10 years.

• SERMS (selective estrogen receptor modulators) - Tamoxifen and raloxifene - have adverse effects. If a patient on tamoxifen develops abnormal uterine bleeding, the drug needs to be stopped.

• Aromatase Inhibitors (AIs): Better tolerated than SERMs have a low risk of cardiovascular and endometrial complications. They are used only in post-menopausal women.

• Risk-reduction surgeries: done in patients with gene mutations or patients with first-degree relatives with breast cancers. Provides >90% risk-reduction. Preferred in patients who have completed their family. Best results when done < 40 years of age.

• Bilateral mastectomy

• Salpingo-oophorectomy: preferred in patients with BRCA1/2 mutations to prevent the risk of ovarian cancer too.

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Investigations in Breast diseases

Question 1:

What is the recommended age for starting screening mammography?

a) 40 years

b) 45 years

c) 50 years

d) 55 years

Question 2:

Which of the following is false regarding screening mammography?

a) Sensitivity of the test will increase with her age.

b) It is best performed in the 2nd half of her menstrual cycle.

c) Mediolateral oblique view will show the greatest volume of her breast tissue.

d) Craniocaudal view will provide better visualization of the medial aspect of her breast.

Question 3:

A 50-year-old woman underwent screening mammography. Which of the following findings in her mammogram is least suggestive of a malignancy?

a) Irregular mass

b) Wide halo

c) Macrocalcification

d) Spiculated margins

Question 4:

Which pattern of microcalcification seen in a patient's mammography report would indicate the maximum risk of malignancy?

a) Cluster microcalcification

b) Diffuse microcalcification

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c) Segmental microcalcification

d) Regional microcalcification

Question 5:

Match the following types of calcifications with the diseases they are associated with.

a) A-iii B-ii C-i D-iv

b) A-iv B-iii C-ii D-i

c) A-i B-iii C-ii D-iv

d) A-ii B-iv C-iii D-i

Question 6:

A 58-year-old woman presents with complaints of a painless lump in her left breast which she noticed during a routine self-examination. On palpation, a hard lump with irregular margins and enlarged left axillary lymph nodes were found. Which among the following is the best modality to detect malignancy in her case?

a) 2D mammography

b) Digital mammography

c) Tomosynthesis with conventional mammography

d) Full-field digital mammography

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Question 7:

A mammogram done for a 45-year-old female patient with a breast lump was reported as BIRADS category 0. What is it suggestive of?

a) Negative

b) Incomplete

c) Probably benign

d) Suspicious abnormality

Question 8:

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A 48-year-old woman with a lump in her right breast was advised to undergo mammography which was reported as BIRADS 3. What will be the appropriate next step of management in this patient?

a) Trucut biopsy

b) Routine annual screening

c) MRI breast

d) Follow-up every 6 months for 2 years

Question 9:

An anxious 45-year-old woman presented with complaints of a lump over her left breast for 2 months. The patient underwent mammography, and the lump was categorized as BIRADS 4a. What is the likelihood of her lesion being malignant?

a) 80-95 %

b) 60-80%

c) 11- 50%

d) 2-10%

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Question 10:

A 36-year-old pregnant lady was referred to the surgery OPD at 12 weeks of gestation with a lump in her right breast for the past 1 month. On examination, a lump of 2 x 1 cm size was palpated in the upper outer quadrant of the breast. Which of the following investigations would you initially advise her for the assessment of the breast lump?

a) Conventional mammography

b) Ultrasonography

c) MRI

d) Tomosynthesis with 2D mammography

Question 11:

A USG can detect lymph node metastases in a patient with breast cancer and clinically negative lymph nodes by what percentage?

a) 50 – 60%

b) 10 – 20%

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c) 20 – 30%

d) 30 – 50%

Question 12:

Which of the following features on USG will not be suggestive of breast malignancy?

a) Thin echogenic pseudo-capsule

b) Hypo-echoic lesion

c) Central vascularity

d) Lump will be taller than wider

Question 13:

A young female patient presents to the clinic with a painless lump in her right breast. She underwent breast augmentation surgery 3 years back. Which of the following will be the best investigation to assess the breast tissue in this patient?

a) Tomosynthesis

b) Ultrasonography

c) Magnetic resonance imaging

d) Computed tomography

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Question 14:

A 40-year-old woman with an elder sister with BRCA1 gene mutation presented to the OPD with a normal mammography report. Which of the following is the next preferred investigation to further evaluate this patient?

a) USG

b) MRI

c) Trucut biopsy

d) Repeat mammography after 6 months

Question 15:

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A postmenopausal woman who was on HRT for the past 2 years, presented with a 4 x 3cm lump over the upper outer quadrant of the left breast. On examination, a peau d'orange appearance was seen and a hard and fixed lump was palpated over the breast. Which of the following is the investigation of choice to confirm the diagnosis in this patient?

a) Excisional biopsy

b) Trucut biopsy

c) Fine-needle aspiration cytology

d) Tomosynthesis with 2D mammography

Question 16:

As a surgery resident, which of the following will you perform in a patient with suspected breast malignancy as part of the triple assessment?

a) 1,2, 3 and 4

b) 2, 3 and 4

c) 1, 2 and 3

d) 1, 3 and 4

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Question 17:

An actress with bilateral silicone breast implants presents for regular follow-up. On radiological evaluation, she was found to have signs suggestive of intracapsular breast implant rupture. Which of the following named signs will you see on imaging?

a) 1, 2, 3 & 4

b) 2 & 5

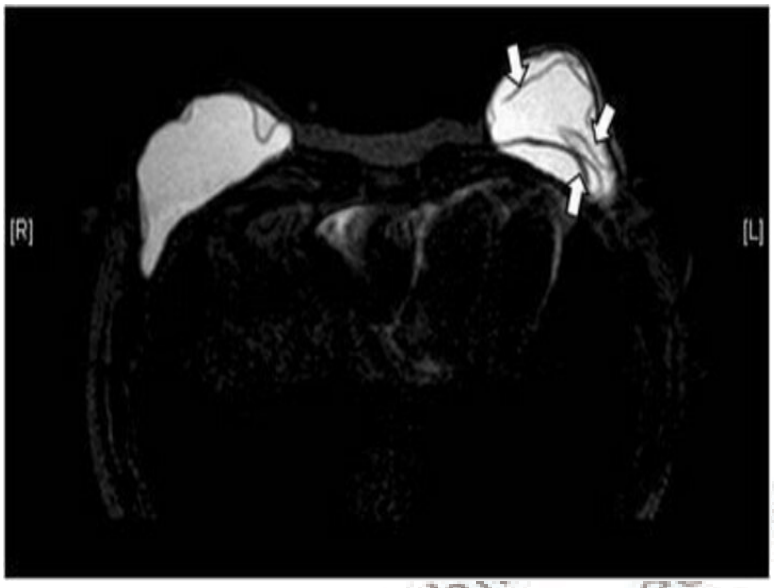
c) 1 & 4

d) 1, 3 & 5

Question 18:

A woman came with complaints of breast pain following surgery. Her MRI is shown below. What is the likely diagnosis?

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a) Extra-capsular silicone rupture

b) Contracture and calcification

c) Intra-capsular silicone rupture

d) Breast abscess

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Question 19:

A 50-year-old female patient presents with a 4*3cm irregular mass in the upper outer quadrant of the right breast, which is not fixed to the skin or the chest wall. A lymph node of 2cm is palpated in the right axilla. No mass is palpated in the opposite breast. Which of the following investigations would you perform on this patient?

a) 1, 2, 3 & 4

b) 1, 2 & 3

c) 1, 3 & 4

d) 1 & 3

Question 20:

A 22-year-old woman is found to have the BRCA1 mutation. She got herself tested after her mother's death due to breast cancer with a BRCA1 mutation. At what age and with which modality would you start breast cancer screening in this patient?

a) 40 years - Mammogram

b) 40 years - MRI

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c) 25 years - USG

d) 25 years - MRI + Mammogram

Question 21:

A young woman with a distant breast cancer relative comes to you in the clinic. You are advising her to practice self-examination of her breasts. Which of the following statements is incorrect regarding this practice?

a) It should be done once a month, every month

b) Ideally, be done between the 3rd to 6th day of the menstrual cycle

c) It should only be done while standing

d) The examination should be done by using the middle three fingerpads

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Answer Key

Question No.	Correct Option
1	a
2	b
3	c
4	a
5	b
6	c
7	b
8	d
9	d
10	b
11	a
12	a
13	c
14	b
15	b
16	a
17	c
18	c

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19	c
20	d
21	c

Detailed Explanations

Solution to Question 1:

The recommended age for women to start annual screening mammography is 40 years of age.

• Until 44 years of age, it is her individual choice to decide on whether she wants screening mammography or not.

• For ages between 45 and 49 years, it is mandatory to get annual breast screening done.

• After the age of 50 years, it is advised that women get a second yearly screening done.

Solution to Question 2:

Mammography is best performed in the 1st half of the menstrual cycle, as breast tissue is less dense in the follicular phase. Also, in the 2nd half of the menstrual cycle, since ovulation occurs and there is a chance for pregnancy, the radiation can potentially affect the embryo.

The sensitivity of mammography increases with age, as the breast tissue becomes less dense.

It involves 2 standard views:

• Mediolateral oblique (MLO) view- covers a greater volume of breast tissue, including the upper outer quadrant and the axillary tail of Spence.

• Craniocaudal (CC) view- provides better visualization of the medial aspect of the breast.

Mammography uses low-voltage, high-amperage X-rays. The radiation dose from mammography is around 0.1 cGy per study.

Solution to Question 3:

Macrocalcification in a lesion is least suggestive of a malignancy. It is commonly seen in benign breast disorders. Microcalcification (<0.5 mm in diameter) is suggestive of malignancy.

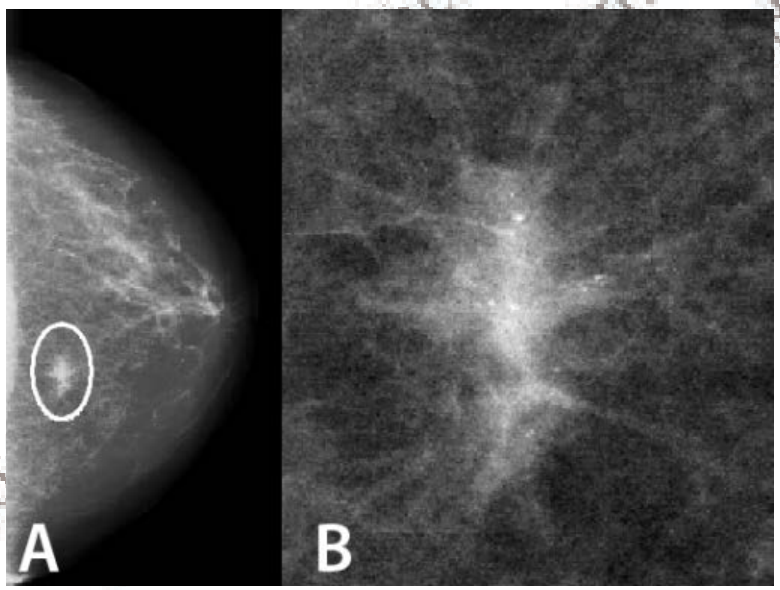
Table: Mammographic appearance of benign and malignant masses

Below is an image showing a malignant breast mass with ill-defined, spiculated margins and microcalcifications.

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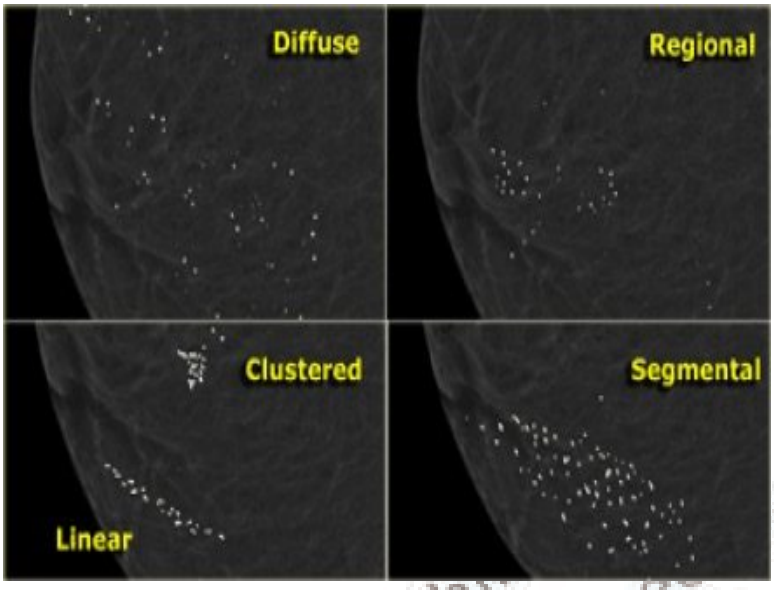
	Benign	Malignant
Opacity	Low densityHomogenousSmooth marginThin halo	High densityNot homogenousIll-defined margin, irregular stellate spiculated margin, comet tailWide halo
Calcification	Macrocalcification (>0.5 mm)	Microcalcification (<0.5 mm)
Breast parenchyma	Normal	Architectural distortion
Nipple/areola	Normal	Retraction
Skin	Normal	Thickening
Cooper ligaments	Normal	Thickening, increase in number
Ducts	Normal	Focal dilatation
Subcutaneous and mammary space	Normal	Obliteration



Solution to Question 4:

Cluster microcalcification in mammography indicates the maximum risk of malignancy.

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Solution to Question 5:

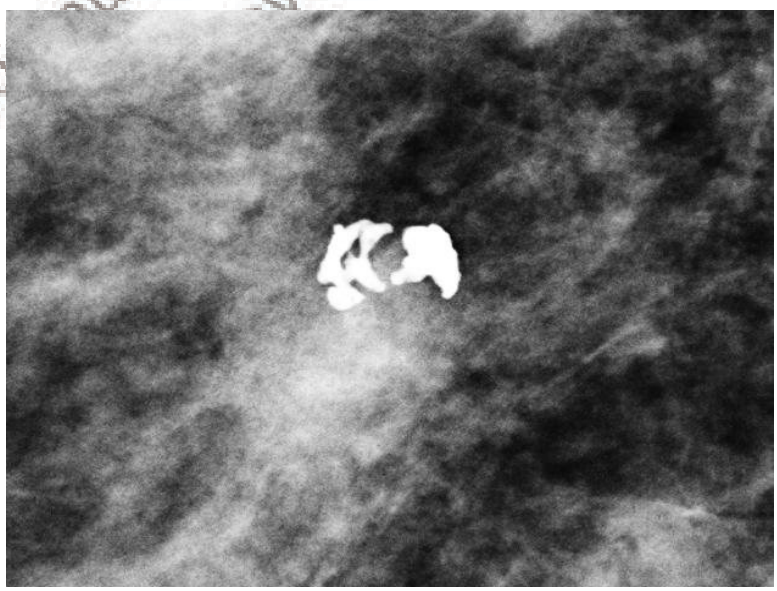
Popcorn calcification is seen in fibroadenoma.

Lead-pipe/egg-shell calcification is seen in traumatic fat necrosis.

Broken-needle type of calcification is seen in duct ectasia.

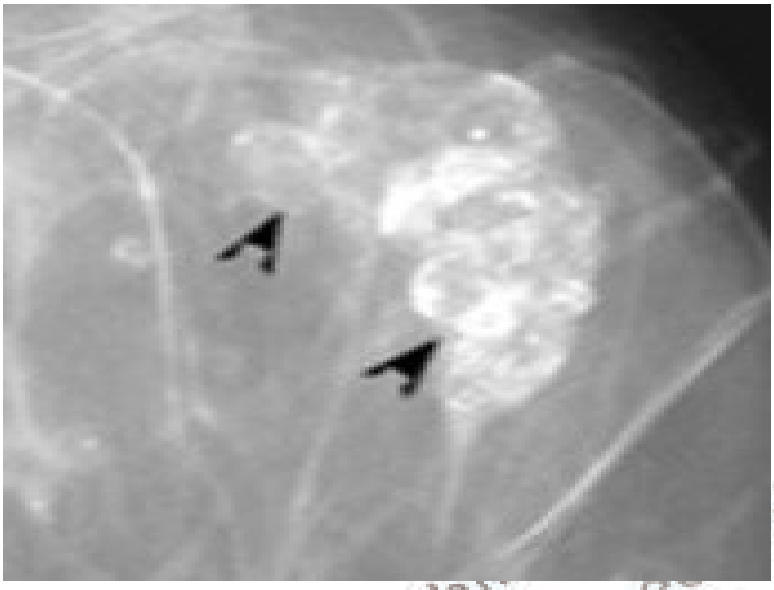
Tea-cup calcification is seen in fibrocystic disease.

Popcorn calcification:

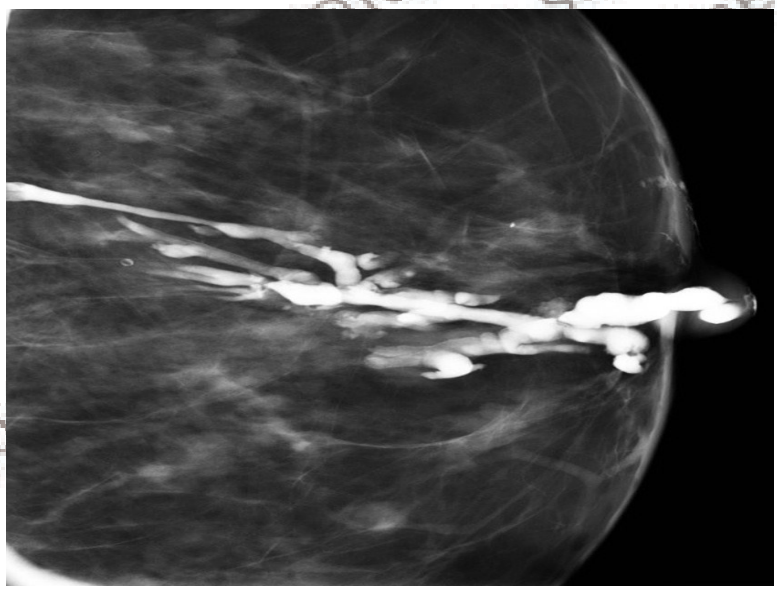


Lead-pipe/egg-shell calcification:

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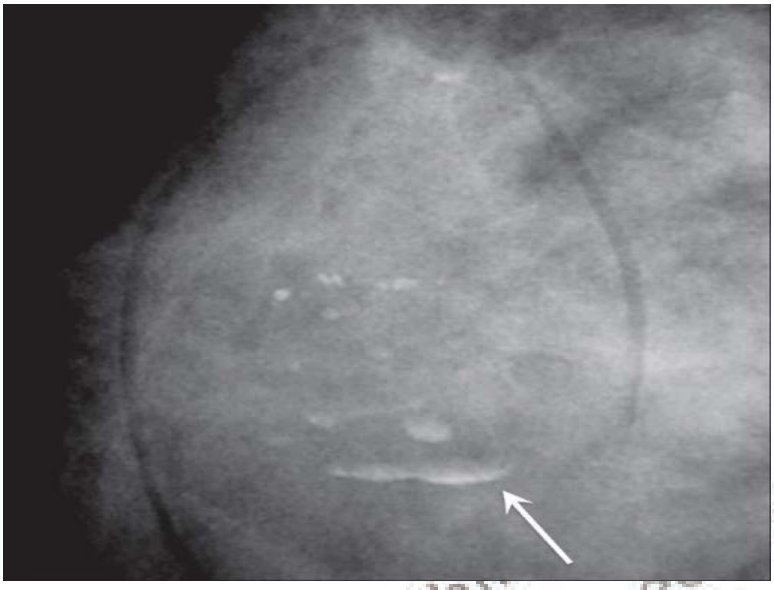


Broken-needle type of calcification:



Tea-cup calcification:

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Solution to Question 6:

Tomosynthesis (3D mammography) performed along with conventional 2D mammography is the best investigation among the given options to detect breast carcinoma.

Breast Tomosynthesis is typically performed in conjunction with conventional mammography. Hence, the radiation dose is doubled. However, the accuracy is improved and false positives are lesser. It can be used for dense breasts and those with high-risk factors.

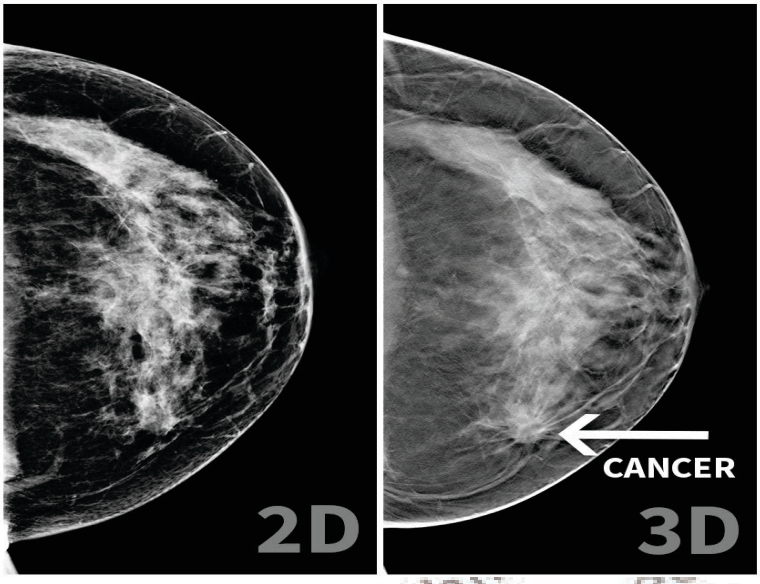
Screen-film mammography is the conventional 2D mammography.

Digital mammography/full-field digital mammography uses digital technology instead of films. The diagnostic accuracy is similar to that of screen-film mammography. A minor advantage is the greater accuracy in predicting lesions in dense breasts.

Note: Overall, the best modality for detecting breast carcinoma is MRI.

The below image shows a comparison of 2D mammogram vs. 3D mammogram:

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Solution to Question 7:

Category/score 0 in BIRADS suggests an incomplete assessment.

All breast imaging should be reported by BIRADS (breast imaging-reporting and data system).

Solution to Question 8:

A BIRADS score of 3 means that it is probably a benign lesion. The next appropriate step is to follow up with this patient every 6 months for the next 2 years.

During this period, the score can either downgrade to BIRADS 2 or upgrade to BIRADS 4 or 5.

Solution to Question 9:

There is a 2-10% likelihood for a lesion with BIRADS 4a to be malignant.

BIRADS Categories/Grades

Grades 1 and 2: 0% chance of being malignant.

Grade 3: >0% but ≤2% chance of being malignant

Grade 4:

• 4a: >2 to ≤10% chance of being malignant

• 4b: >10 to ≤50% chance of being malignant

• 4c: >50 to <95% chance of being malignant

Grade 5: ° 95% chance of being malignant

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Solution to Question 10:

Ultrasonography (USG) is the preferred initial investigation in pregnant women who present with a breast lump. It can differentiate between solid and cystic lesions of the breast and is able to detect abnormal axillary lymph nodes. USG is preferred in women with dense breast tissue such as:

• Pregnant women

• Lactating women

• Young women (less than 40 years old)

Conventional Mammography/ Tomosynthesis with 2D mammography is less useful in pregnant women due to the increased density of breast tissue.

MRI is not the initial investigation used for the assessment of breast lumps. It can be used in cases where metastasis or spread to other breasts is suspected.

Solution to Question 11:

A USG can detect lymph node metastasis in a patient with clinically negative lymph nodes by 50-60%.

The clinical determination of axillary lymph node metastases has an accuracy of only 33%.

Ultrasound (USG) is more sensitive than physical examination alone in determining axillary lymph node involvement during the preliminary staging of breast carcinoma.

Fine-needle aspiration cytology (FNAC) or core biopsy of sonographically indeterminate or suspicious lymph nodes can provide a more definitive diagnosis than USG alone.

Ultrasonography can also be utilized to image the regional lymph nodes in patients with breast cancer. The sensitivity for the status of axillary nodes ranges from 35% to 82% and specificity ranges from 73% to 97%.

The features of a lymph node involved with cancer on USG include:

• Cortical thickening

• Change in shape of the node to a more circular appearance

• Size larger than 10 mm

• Absence of a fatty hilum

• Hypoechoic internal echoes

Solution to Question 12:

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Malignant breast lump on USG, has an ill-defined echogenic halo, is hypoechoic, and the lump will be taller than wider. Benign breast lumps have a thin echogenic pseudo-capsule on USG.

Solution to Question 13:

Magnetic resonance imaging (MRI) is the best investigation to assess breast tissue in a patient with a breast implant.

MRI of the breast is also used in:

• Screening of high-risk individuals with a positive family history.

• Assessing loco-regional spread (multifocality and multicentricity) of carcinoma.

• To differentiate scar from recurrence in women who have had breast conservation surgery for breast cancer.

Option A: Tomosynthesis is not preferred, as radio-opaque implants are usually compressed together with the breast tissue, obscuring the visibility and thereby reducing its sensitivity.

Option B: Ultrasonography is used as an initial investigation in the evaluation of breast abnormalities in patients with breast implants.

Option D: Computed tomography is not routinely used in the evaluation of breast lumps.

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Solution to Question 14:

In the given scenario, since the patient is at high risk for breast malignancy (first degree relative with BRCA1 gene mutation), MRI followed by trucut biopsy will be the appropriate next step for further evaluation.

MRI is helpful in the screening of high-risk individuals and is the most sensitive imaging modality. However, it should be done after initial radiological evaluation, in case the results are inconclusive.

American Cancer Society Risk Criteria for Breast Magnetic Resonance Imaging Screening:

Women at high lifetime risk (≈20%-25% or greater) of breast cancer-

• Known BRCA1 or BRCA2 gene mutation

• First-degree relatives with BRCA1 or BRCA2 gene mutation, but have not had genetic testing themselves.

• Radiation therapy to the chest between the ages of 10 and 30 years

• Li-Fraumeni syndrome or Cowden syndrome or a first-degree relative with one of these syndromes.

Women with a personal history of breast cancer, ductal carcinoma in situ, lobular carcinoma in situ, atypical ductal hyperplasia, or atypical lobular hyperplasia, are at a moderately increased lifetime risk for breast cancer.

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Options A & D: Breast tomosynthesis or repeat mammography is not preferred as the next investigation in high-risk patients.

Option C: Trucut biopsy will be done following MRI in high-risk patients.

Solution to Question 15:

The history and physical examination point towards a diagnosis of breast malignancy. The investigation of choice for confirmation of breast carcinoma is trucut biopsy/core-needle biopsy. An excisional biopsy can be done, in case it is inconclusive.

Trucut needle biopsy permits the analysis of breast tissue architecture. A 14 G- 16 G needle is used. The advantages include a low complication rate, minimal scarring, and a lower cost as compared to excisional breast biopsy.

Fine-needle aspiration cytology (FNAC) is a cytological investigation and, hence, not the investigation of choice. A 22-30 G needle is used for FNAC.

Trucut biopsy is preferred over FNAC as it:

• Allows a definitive preoperative diagnosis

• Differentiates between DCIS and invasive disease

• Allows the tumor to be stained for receptor status, which is important for starting neoadjuvant therapy.

Image-guided biopsy is used only in the case of non-palpable lesions.

Solution to Question 16:

Triple assessment in relation to breast carcinoma includes the following:

• Clinical assessment includes both history and clinical examination

• Radiological imaging, including ultrasonography (USG) and/or mammography

• Histopathological examination (HPE), including fine-needle aspiration cytology (FNAC) and/or Tru-Cut biopsy

The positive predictive value of the triple assessment is 99.9%.

Note: Bailey & Love 27th Ed mentions that clinical assessment, radiological imaging, and HPE constitute triple assessment. However, clinical assessment includes both history and clinical examination. Hence, history is a part of the triple assessment.

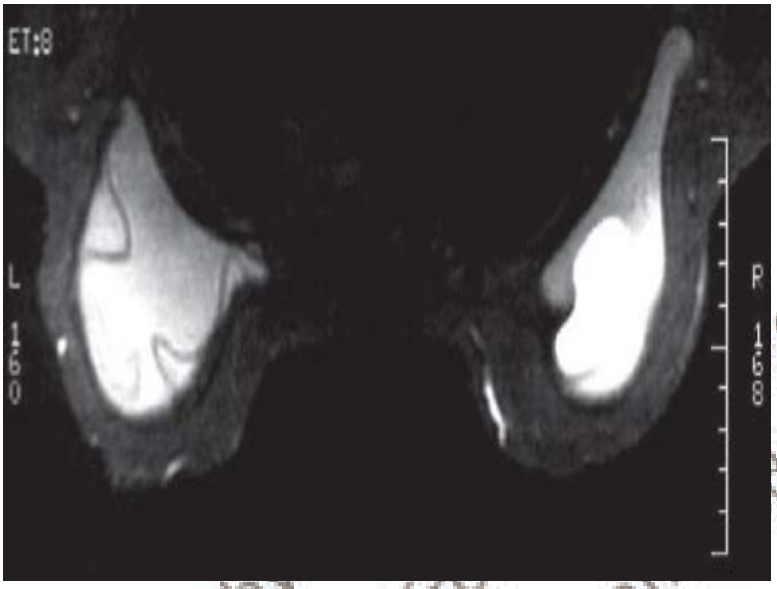
Solution to Question 17:

Linguine sign (on MRI) and Stepladder sign (on USG) are specific for intracapsular breast implant rupture.

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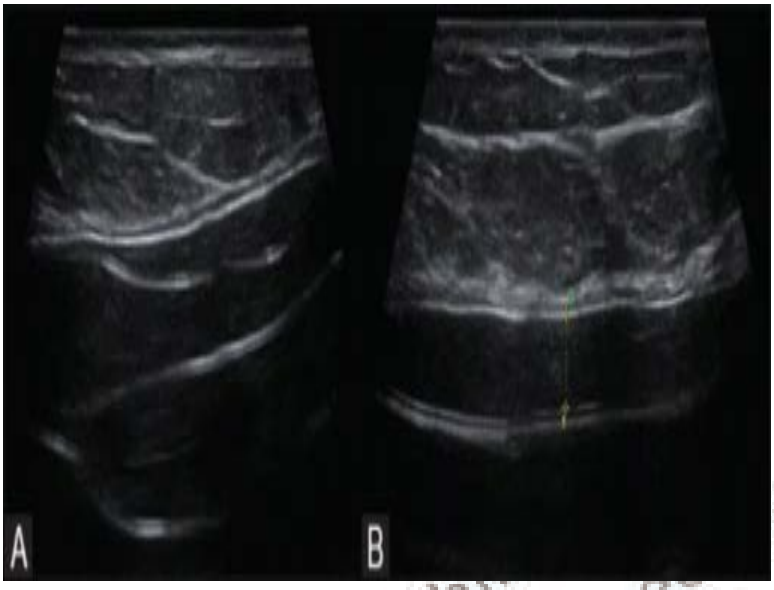
After implantation of a silicone or saline breast implant, a fibrous capsule (scar) forms around the implant shell. In an intracapsular rupture, the contents of the implant are contained by the fibrous scar, while the free-floating shell appears as a group of wavy lines (like the Italian linguine pasta as shown below). Hence, this has been termed the "linguine sign".





Stepladder sign (seen on USG) is identified as multiple, discontinuous, parallel, linear echoes in the lumen as shown below.

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Snowstorm sign (seen on USG) is seen in extracapsular rupture of breast implant.

Comet tail sign is a finding that can be seen on chest CT. The comet-tail sign is produced by the distortion of vessels and bronchi that lead to an adjacent area of round atelectasis, which is the mass. The bronchovascular bundles appear to be pulled into the mass and resemble a comet tail.

Note: Detection of intracapsular silicone ruptures is almost impossible on mammography.

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Solution to Question 18:

The above image shows curvilinear hypointense lines (arrows) in the left breast implant indicative of the collapsed shell floating in the silicone gel. This is called the linguine sign that is seen in intra-capsular rupture of a breast implant.

After implantation of a silicone or saline breast implant, a fibrous capsule (scar) forms around the implant shell. In an intracapsular rupture, the contents of the implant are contained by the fibrous scar, while the shell appears as a group of wavy lines.

This has been termed the "linguine sign" and has been most commonly described with MR imaging.

Multiple hyperintense foci on T2-weighted images are sometimes found within the implant lumen. These findings are referred to as the salad oil sign or droplet sign.

Indications for breast MRI:

• Screening for DCIS in high-risk patients

• Evaluation of breast implants

• Evaluation of breast scar tissue versus recurrent tumors.

Ultrasound is the preferred modality of imaging in suspected cases of extracapsular rupture. The snowstorm sign on USG is seen in extracapsular rupture.

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Solution to Question 19:

The given clinical scenario is suggestive of breast malignancy with locoregional spread with unlikely distant metastasis. For further evaluation of this lesion, bilateral mammography, a biopsy of the breast mass and a USG-guided biopsy of the suspicious lymph node need to be performed in order to determine staging and decide on further management.

Statement 2: PET Scan is usually performed in advanced cases of breast cancer. It is not routinely used in the assessment of locoregional disease.

Statement 1: Diagnostic mammography is used to evaluate women with abnormal findings such as a breast mass or nipple discharge. Mammography is more accurate than clinical examination for the detection of early breast cancers. Mammographic features suggestive of breast cancer include a solid mass with or without stellate features, microcalcifications, irregular soft tissue shadow, spiculations and duct distortion.

Statement 3: Pathological diagnosis of carcinoma is made by a core needle biopsy (tru-cut biopsy) or fine-needle aspiration before any type of treatment is started.

Statement 4: The presence or absence of axillary lymph node involvement in breast cancer is one of the most important prognostic factors for determining staging and treatment. Ultrasound-guided lymph node biopsy should be done in patients with suspicious or clinically palpable lymph nodes.

Ultrasound features suggestive of breast cancer include a hypoechoic, irregular mass with indistinct, angulated or spiculated margins, acoustic shadowing, ductal extension and a branched pattern of mass.

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Solution to Question 20:

Patients with BRCA mutations or positive known first-degree family history are considered high-risk patients. These patients need to undergo annual screening MRI + Mammogram from the age of 25yrs.

Patients with a family history of breast cancer but no known gene mutation should also start screening before 40 years. Screening should begin 10 years before the earliest age of diagnosis of breast cancer in the first-degree relative. E.g- If the mother was detected with breast cancer at 40 years of age, the daughter should start screening by the age of 30 years.

High-risk patients for breast cancer:

• Women with a known BRCA1 or BRCA2 mutation

• Two first-degree relatives with breast cancers with or without gene mutations

• Women with a history of chest irradiation between the ages of 10 and 30

• 2 or more cases of breast cancer < 50 years old in the family

• Mutation (or a first-degree relative with a mutation) in the TP53 or PTEN genes

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Solution to Question 21:

Self-examination of breasts can be done while standing or lying down.

It should be ideally be done once a month, every month between the 3rd to 6th day of the menstrual cycle. If the periods are irregular or the patient is post-menopausal, then the patient can pick any day of the month.

It can be done any time of the day while showering, dressing, standing, or lying down at night.

Steps of the self-examination:

• Visual inspection: See for any abnormalities, like shape, size, dimpling, puckering of the skin, nipple discharge, etc.

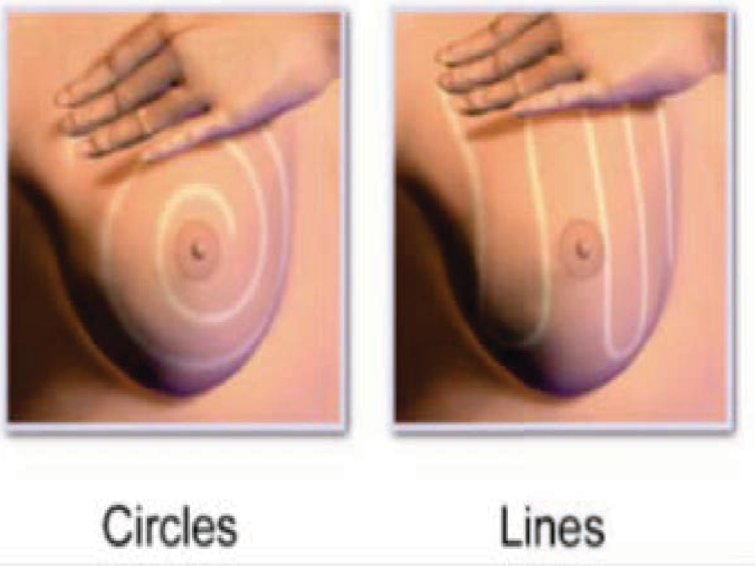
• Manual inspection: It is done by using the middle three fingerpads. Feel for any lumps. Techniques used are (either one of them):

• Horizontal stripes method

• Vertical stripes method

• Dial clock method

Be sure to check under the areola and press the nipple gently to check for any discharge.



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Carcinoma Breast - Staging, Prognosis & Molecular Types

Question 1:

Tis classification is used for the staging of:

a) 1 and 2

b) 1, 2 and 4

c) 1 and 3

d) 3, 4 and 5

Question 2:

A postmenopausal lady presented with painless lumps in the right breast. On examination, two lumps of size 6 x 2 cm and 4 x 1 cm were palpated in the upper outer quadrant. Ipsilateral mobile axillary lymph nodes were felt. On evaluation, there was no distant metastasis. What is the TNM staging of this tumor?

a) T3 N1 M0

b) T1 N1 M0

c) T3 N2 M0

d) T2 N2 M0

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Question 3:

A woman came with a 4 x 3 cm lump over the right breast. On examination, the breast appears as shown below. Ipsilateral supraclavicular lymph nodes are palpable with fixed axillary nodes on the left side. What is the most appropriate tumor staging?

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a) T2 N2a M0

b) T4a N3c M0

c) T2 N3c M1

d) T4d N3c M1

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Question 4:

A middle-aged woman presented to the clinic with a 7 x 3 cm lump in the upper outer quadrant of the right breast. On palpation, the lump was found to be fixed to the pectoralis major muscle. What is the T staging of the tumor in this patient?

a) T4b

b) T3

c) T4a

d) T4c

Question 5:

During immunohistochemistry for ER, PR status, staining of what percentage of cells indicates positivity?

a) 10%

b) 5%

c) 1%

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d) 50%

Question 6:

A trucut biopsy is obtained from a woman who presented with a breast lump. The biopsy confirms the presence of mucinous carcinoma. Immunohistochemistry shows ER, PR and HER2/neu positive. What is the molecular subtype of breast cancer in this patient?

a) Luminal A type

b) Basal type

c) Luminal B type

d) Her 2 type

Question 7:

In breast cancer patients, FISH for gene amplification will be done based on which of the following IHC staining for Her-2/neu?

a) 1+

b) 2+

c) 3+

d) Gene Amplification is done irrespective of Her 2 Neu status

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Question 8:

Which of the following is true about Oncotype Dx, a molecular test used for breast cancer?

a) Used for hormone receptor–negative cancers

b) Is a 21-gene assay

c) Helpful in predicting the advantage of adding radiotherapy

d) Used for lymph node–positive cancers

Question 9:

After performing Oncotype Dx for a breast tumor, a low recurrence score is obtained. Which of the following is true regarding management in this patient?

a) Tumor resection with chemotherapy should be done

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b) Brachytherapy with chemotherapy should be done

c) Chemotherapy should be used along with hormonal therapy

d) There is no advantage in adding chemotherapy

Question 10:

Which of the following is not related to breast carcinoma?

a) Nottingham prognostic index

b) Gail and Claus models

c) Van Nuys prognostic index

d) MACIS prognostic index

Question 11:

Which of the following is the most important prognostic factor in a patient with breast carcinoma?

a) Size of the tumor

b) Axillary lymph node involvement

c) Involvement of skin over the breast

d) Receptor status

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Question 12:

The Van Nuys grading system for ductal carcinoma in situ does not include:

a) Age of the patient

b) Size of the tumor

c) Hormone receptor staining

d) Presence of microcalcification

Question 13:

A 42-year-old woman presented with a history of painless breast lump measuring 6.2 X 4.5 cm in the left upper outer quadrant and no axillary nodes. Core cut biopsy showed ductal carcinoma in situ. She underwent tumor resection with adequate margins and postoperative

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HPE showed DCIS with intermediate-grade necrosis and with 6-mm clearance on margins. What is the next step of treatment?

a) No additional treatment

b) Adjuvant radiotherapy

c) Adjuvant chemotherapy

d) Adjuvant chemoradiotherapy

Answer Key

Question No.	Correct Option
1	c
2	a
3	d
4	b
5	c
6	c
7	b
8	b
9	d
10	d
11	b
12	c
13	b

Detailed Explanations

Solution to Question 1:

Tis classification is used for the staging of ductal carcinoma in situ and Paget's disease only.

Tis means carcinoma in-situ.

• Tis (DCIS) - includes ductal carcinoma in situ (DCIS)

• Tis (Paget) - includes Paget's disease of the nipple NOT associated with evident invasive carcinoma and/or carcinoma in situ (DCIS) in the underlying breast parenchyma

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According to the latest American Joint Committee on Cancer (AJCC) classification system (8th edition), lobular carcinoma in situ (LCIS) is not included in Tis since it is a benign entity.

LCIS is considered a proliferative disease that has a risk of developing breast carcinoma in the future, and hence, it is not included in the classification system. Pleomorphic LCIS is also considered a benign condition.

Solution to Question 2:

TNM staging of the tumor is T3 N1 M0.

In the given scenario:

• The bigger lump is 6 cm in size - T3

• Ipsilateral mobile axillary lymph nodes - N1

• No distant metastasis - M0.

In tumor size assessment, the greatest dimension is taken into consideration. For example, in a 6 x 2 cm lump, 6 cm is taken into account, and the tumor is classified as T3 (>5 cm). If 2 lumps are present in the same breast, staging is according to the bigger lump. If lumps are present in bilateral breasts, separate staging is done for both the lumps.

Any contralateral lymph node involvement is considered as distant metastasis.

Solution to Question 3:

TNM staging in the given scenario is T4d N3c M1.

• Tumour of any size with typical skin changes involving > 1/3 of breast- T4d (Inflammatory breast carcinoma)

• Ipsilateral supraclavicular lymph node involvement - N3c

• Involvement of any contralateral lymph nodes indicates distant metastasis - M1

Solution to Question 4:

In the given scenario, as the lump is 7 cm in size, the T stage of the tumor is T3 (>5 cm).

Irrelevant to the size of the tumor, if the tumor shows extension to the chest wall or skin, it is classified as T4.

However, there are two exceptions:

• Invasion or adherence to pectoralis muscle in the absence of chest wall involvement does not qualify as T4

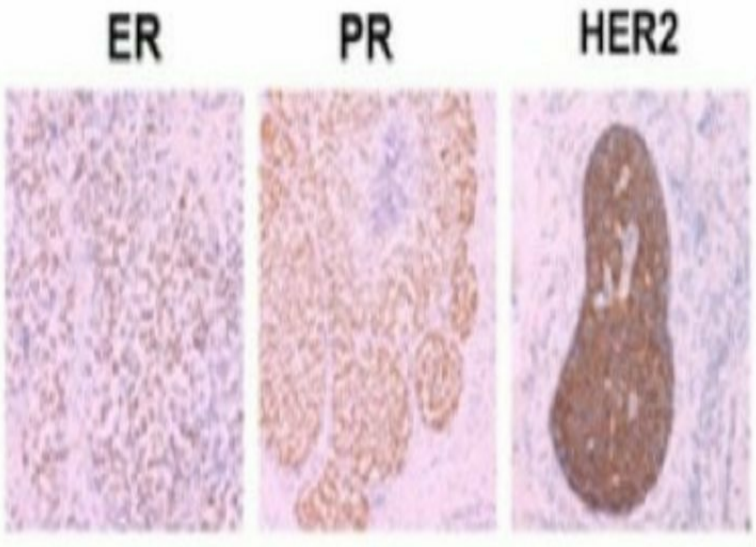
• Involvement of the dermis alone does not qualify as T4

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Solution to Question 5:

The staining of ° 1% of cells is considered positive. Expression of estrogen receptor (ER) and progesterone receptor (PR) in breast cancer cells is mainly assessed by immunohistochemistry.



Solution to Question 6:

Breast cancer with ER, PR +ve and HER2/neu +ve status will be classified as luminal B type. It is also known as triple-positive cancer.

Along with ER, PR, and HER2/neu, a proliferation index known as the Ki67 index is also used.

Molecular classification of cancers :

Type	Properties
Normal-like	Normal histologyER, PR+ve , HER2/neu-ve
Luminal A (most common/best prognosis)	ER, PR+ve,HER2/neu-ve(Low Ki)
Luminal B	ER, PR+ve, HER2/neu-ve, Ki-67-HighER, PR+ve, HER2/neu+ve, Ki-67Any
Basal cell (worst prognosis)	Triple-negative(High Ki), Positive for myoepithelial markers - EGFR, CK 5,6,17
HER2-enriched type	ER & PR–ve,HER2/neu+ve

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Solution to Question 7:

Fluorescence in situ hybridization (FISH) should be performed in all cases of breast tumors with an immunohistochemistry (IHC) score of 2+.

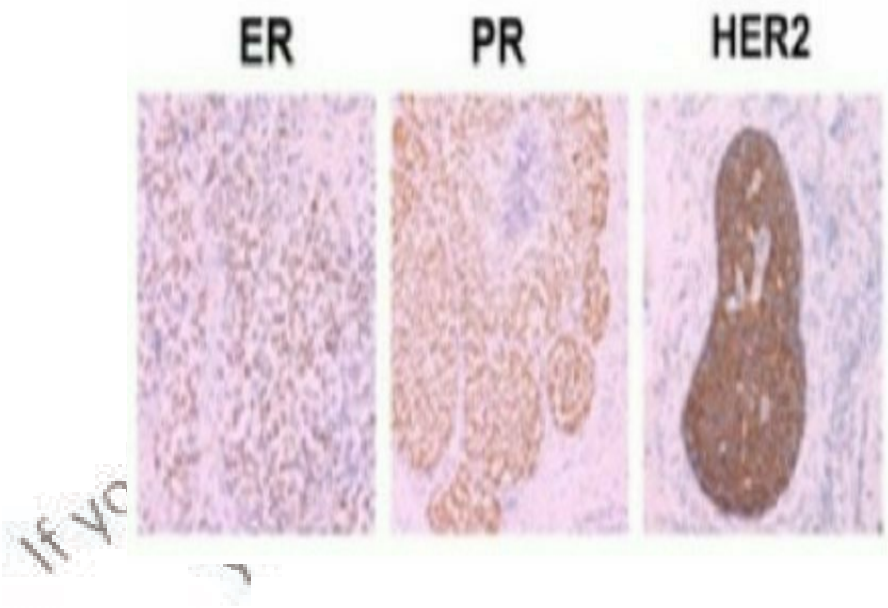
Expression of estrogen receptor (ER), progesterone receptor (PR), and HER2/neu in breast cancer cells is mainly assessed by immunohistochemistry. HER2/neu IHC interpretation:

• 1+ = Negative

• 2+ = Equivocal - FISH is done to differentiate whether the tumor cells are positive or negative for HER2/neu expression

• 3+ = Positive HER2/neu- complete circumferential membrane staining in >10% of tumor cells

The given image shows HER2/neu, ER, and PR positivity.



Solution to Question 8:

Oncotype Dx assay is a molecular test based on the assessment of 21 genes.

Higher scores predict increased benefits from chemotherapy. On the other hand, lower scores in this assay predict lesser benefit from chemotherapy and increased benefit from endocrine therapy.

It is used for patients with lymph node-negative, ER-positive breast cancer.

Solution to Question 9:

A low recurrence score after Oncotype Dx suggests that there is no survival advantage of adding chemotherapy.

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A high recurrence score, on the other hand, suggests that chemotherapy should be added.

Solution to Question 10:

MACIS is not used in breast cancer. It is a prognostic index for thyroid cancer.

The Nottingham prognostic index, Gail and Claus models, and Van Nuys prognostic index are all associated with breast cancer assessment.

Van Nuys prognostic index is used to identify patients with duct carcinoma in situ (DCIS) who do not need radiation therapy. This grading system is based on the following parameters:

- Patient's age
- DCIS nuclear grade and presence of microcalcification
- Size of the lesion
- Width of the surgical margin

The Nottingham prognostic index segregates the patients into four groups and is used to predict the 5-year survival. It helps to formulate treatment plans.

Nottingham Prognostic Index = (0.2 × Tumor size in cm) + grade + nodes

The Gail and Claus models are used for assessing the risk of development of breast carcinoma. It includes the following parameters:

- Number of first-degree relatives with carcinoma breast
- Age at menarche
- Age at first live birth
- Number of breast biopsies

Claus model provides individual estimates of breast cancer risk according to the decade of life, based on the presence of first- and second-degree relatives with breast cancer and their age at diagnosis.

Note: Neither the Gail model nor the Claus model accounts for the risk associated with mutations in the breast cancer susceptibility genes BRCA1 and BRCA2.

Solution to Question 11:

Axillary lymph node status is the most important determinant in the staging and prognosis of women with breast cancer.

In axillary node-negative breast cancer, ER, PR receptor status becomes the most important prognostic factor.

Solution to Question 12:

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Staining for estrogen and progesterone receptors is not part of the Van Nuys system used for grading DCIS.

The components of the Van Nuys prognostic index (VNPI) are as follows:

• Size of the tumor

• Extent of resection margin

• Histological variant of DCIS - based on nuclear grade, presence of necrosis, presence of microcalcification

• Age of the patient

Patients with a high score in this grading system benefit from radiotherapy after excision, whereas those with low-grade and completely excised tumors, need no further treatment.

A score ranging from 1 (lesions with the best prognosis) to 3 (lesions with the worst prognosis) is given for each of the four prognostic predictors. Total scores range from 4 (least likely to recur) to 12 (most likely to recur).

Note: The type of microcalcification seen on imaging, helps in determining the nuclear grade of DCIS. While the linear branching type of microcalcification is associated with high nuclear grade, fine granular type is associated with low nuclear grade.

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Silverstein Van Nuys prognostic index for DCIS

Parameters	Score 1	Score 2	Score 3
Size(mm)	≤15	16-40	°41
Margin(mm)	°10	1-9	<1
Class	Grade 1 or 2 without necrosis	Grade 1 or 2 with necrosis	Grade 3 with or without necrosis
Age(years)	>60	40-60	<40

Scores 4-7 with >3mm margin:Excision aloneScore 7 with < 3 mm margin, score 8 with > 3mm margin, score 9 with >5mm margin:Excision with RTScore 9 with < 5mm margin & score 10,11,12:Mastectomy

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Solution to Question 13:

According to Silverstein Van Nuys prognostic index for DCIS, the total score is 9. Hence, the patient would require adjuvant radiotherapy.

Age: 42 years (score 2), size: 62mm (score 3), clearance margin: 6mm (score 2) with intermediate-grade necrotic features (score 2).

Silverstein Van Nuys prognostic index for DCIS:

Treatment:

• Scores 4-6 with >3mm margin: Excision alone

• Score 7 with < 3 mm margin, score 8 with > 3mm margin, score 9 with >5mm margin: Excision with RT

• Score 9 with < 5mm margin & score 10-12: Mastectomy

If the patient is ER/PR+, adjuvant hormonal therapy with tamoxifen or an aromatase inhibitor is indicated. Current data does not support the use of HER-2-directed therapy in DCIS.

Indications for adjuvant radiotherapy in breast cancer:

• Locally advanced breast cancers (T3, T4, N1, N2, N3)

• Following breast conservation surgery

• After mastectomy if tumor size ° 5 cm, skin or chest wall involvement, lymphovascular invasion and axillary node-positive for metastasis.

Post-treatment surveillance after treatment for DCIS includes history, physical examination, and routine mammography (if applicable).

Parameters	Score 1	Score 2	Score 3
Age (years)	° 61	40-60	<40
Size (mm)	≤15 mm	16-40 mm	>40 mm
Margin (mm)	° 10 mm	1-9 mm	<1 mm
Class (grade and necrosis)	Grades 1 and 2no necrosis	Grades 1 or 2with necrosis	Grade 3 with or without necrosis

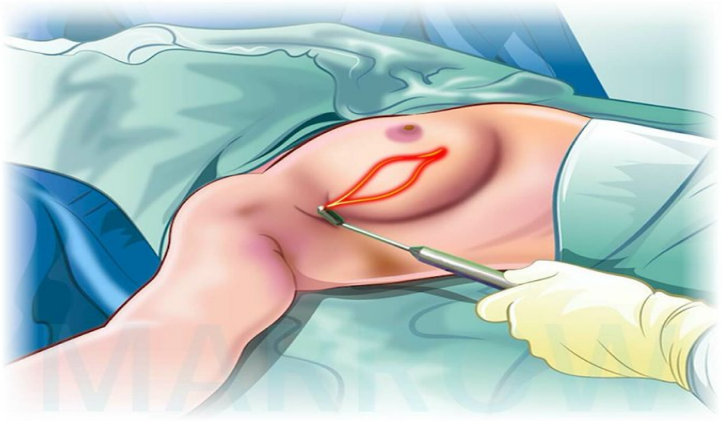
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Carcinoma Breast - Treatment

Question 1:

What procedure is depicted in the image?



a) Brachytherapy

b) Lateral pectoral block

c) USG-guided biopsy

d) Sentinel lymph node biopsy

Question 2:

Which of the following is true regarding sentinel lymph node biopsy in a patient with a T2 N1 M0 breast tumour?

a) If biopsy is positive, then axillary dissection is not done

b) If biopsy is negative, then axillary dissection is done

c) If biopsy is positive then tumour free margin should be > 2 cm

d) It is not indicated

Question 3:

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A 40-year-old woman presents with a lump in her right breast. On examination, a 3 cm palpable mass is felt in the right upper quadrant of the right breast. A mammogram is suggestive of a malignant lesion. Biopsy confirmed invasive ductal carcinoma with no nodal involvement. How will you manage this patient?

a) Modified radical mastectomy

b) Adjuvant chemotherapy with mastectomy

c) Breast conservation therapy with adjuvant radiotherapy

d) Modified radical mastectomy with adjuvant radiotherapy

Question 4:

Breast conservative surgery can be performed in which of the following patients with breast carcinoma?

a) 2, 3, 4 and 5

b) 1, 3 and 4

c) 2 and 3

d) Only 1

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Question 5:

A patient with early breast carcinoma of stage T3 N0 M0 does not want to undergo mastectomy. What is the next best treatment of choice in her case?

a) Breast conservation surgery followed by radiation therapy

b) Chemotherapy alone since mastectomy is the only option

c) Neoadjuvant chemotherapy followed by breast conservation surgery

d) Mastectomy only since it is a large operable tumour

Question 6:

You are assisting in a modified radical mastectomy. Which of the following steps will not be done by the operating surgeon during this procedure?

a) Removal of pectoralis major muscle

b) Level 2 axillary lymph nodes dissection

c) Removal of nipple-areola complex

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d) Removal of pectoral fascia

Question 7:

In patients with which of the following features of tumor involvement should you not perform radical mastectomy?

a) Pectoralis major involvement

b) Distant metastasis

c) Axillary lymph node involvement

d) Inter pectoral lymph node involvement

Question 8:

Which of the following structures will not be removed while performing radical mastectomy in patients with breast carcinoma?

a) Pectoralis major

b) Pectoralis minor

c) Axillary lymph nodes

d) Supraclavicular lymph nodes

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Question 9:

A 50-year-old patient underwent a modified radical mastectomy for breast cancer. A drain was inserted at the site of the surgery. When can the drain be removed?

a) 24 hr output <100 cc

b) Output <100 cc for 2 consecutive days

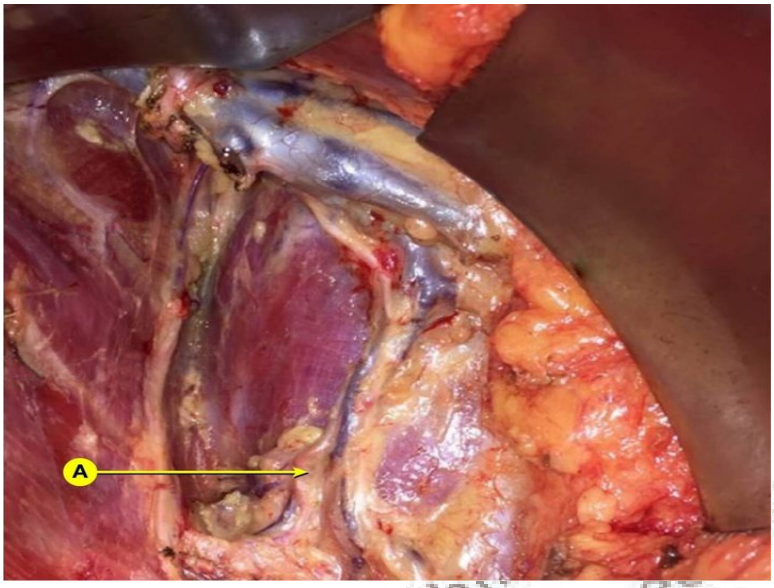
c) 24 hr output <30-40 cc

d) Output <30-40 cc for 2 consecutive days

Question 10:

The following image shows the boundaries of axillary lymph node dissection. The inferior boundary marked as ‘A’ denotes _____.

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a) Axillary vein

b) Thoracodorsal pedicle

c) Angular vein

d) Costococlavicular ligament

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Question 11:

Which of the following is the most common complication of mastectomy?

a) Seroma

b) Lymphedema

c) Intercostobrachial nerve damage

d) Wound infection

Question 12:

After modified radical mastectomy, a patient complained of loss of sensation over the medial aspect of the right upper arm. The nerve most likely damaged is _____.

a) Intercostobrachial nerve

b) Axillary nerve

c) Medial cutaneous nerve of arm

d) Long thoracic nerve

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Question 13:

A patient underwent surgery for breast carcinoma. She now presents with painless swelling involving the arm as shown in the image below. What is the most likely diagnosis?



a) Lymphedema

b) Lymphangiosarcoma

c) Venous thrombosis

d) Cellulitis

Question 14:

A patient presented with acute worsening of edema of the left hand, which was present for the past 5 years. Her surgical history was relevant for a radical mastectomy with radiation therapy for left-sided breast carcinoma. On examination, the limb appears as shown below. What is the likely diagnosis in this patient?

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a) Teitze syndrome

b) Stewart-Treves syndrome

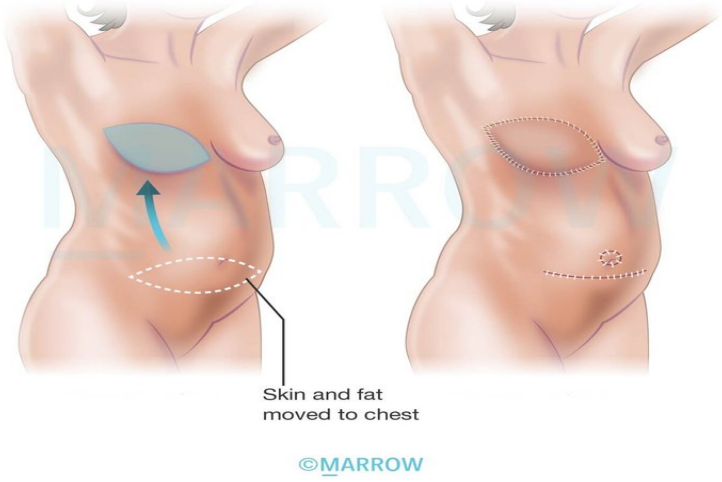
c) Rhabdomyosarcoma

d) Milroy's Disease

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Question 15:

Identify the flap shown in the image used for breast reconstruction.



a) Deep inferior epigastric perforator flap

b) Transverse rectus abdominis myocutaneous flap

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c) Lattisimus dorsi flap

d) External oblique flap

Question 16:

Which of the following is the gold standard flap used in breast reconstruction with autogenous tissue?

a) Deep inferior epigastric perforators flap

b) Latissimus dorsi musculocutaneous flap

c) Transverse rectus abdominis myocutaneous flap

d) Thoracoepigastric flap

Question 17:

Which of the following will you not add as part of the chemotherapeutic regime for a patient with breast cancer?

a) Only 5

b) 1, 3 and 4

c) 2 and 5

d) 3, 4 and 5

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Question 18:

All are aromatase inhibitors used in the treatment of breast cancer except _____.

a) Letrozole

b) Anastrozole

c) Exemastane

d) Fulvestrant

Question 19:

A woman presented to the OPD with a painless lump in the left breast. Biopsy confirmed the presence of ductal carcinoma. Immunohistochemistry showed ER +ve, PR +ve, and HER2/neu -ve. Which of the following is the latest drug approved for treating this condition?

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a) Herceptin

b) Palbociclib

c) Buparlisib

d) Ipatasertib

Question 20:

What is the drug used for estrogen dependant breast cancer?

a) Estrogen

b) Clomiphene citrate

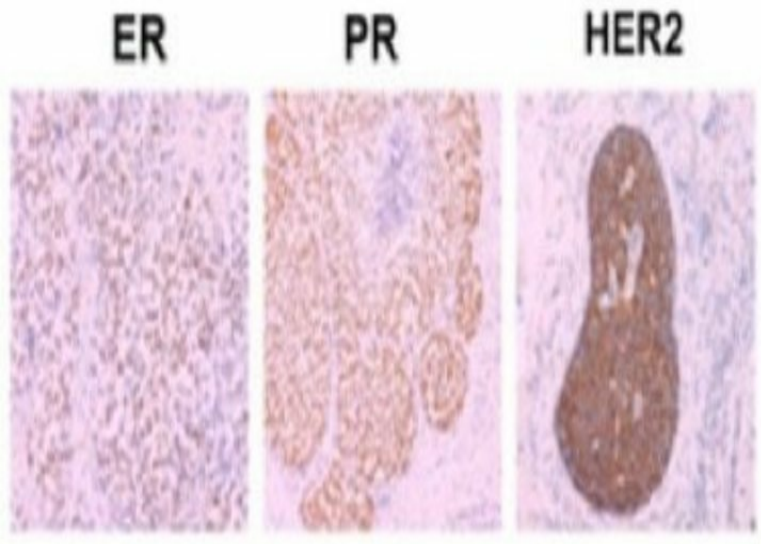
c) Tamoxifen

d) Adriamycin

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Question 21:

A middle-aged woman underwent a trucut biopsy for the suspicion of malignancy on a mammogram. Microscopy showed the presence of invasive breast carcinoma. IHC staining of the tumor is given below. Which of the following drugs will you add along with chemotherapeutic agents for treating this patient?



a) Tamoxifen

b) Tamoxifen + Trastuzumab

c) Fulvestrant

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d) Palbociclib

Question 22:

A 60 yr old woman underwent a simple mastectomy followed by radiation therapy for ER/PR positive breast cancer. Which of the following is the most appropriate drug to be given to her to prevent the recurrence of breast cancer?

a) No drug is effective to prevent recurrence

b) Tamoxifen

c) Trastuzumab

d) Anastrozole

Question 23:

Which of the following is not true about accelerated partial breast irradiation?

a) Irradiation is delivered only at the lumpectomy site

b) Only suitable for women older than or equal to 65 years of age

c) It is used for low-risk DCIS patients

d) It is suitable if surgical margins are negative by ° 2 mm

Question 24:

A postmenopausal woman presented with a 4 cm lump in her left breast. Clinical and radiological examination revealed ipsilateral fixed axillary lymph node involvement without distant metastasis. Histopathology confirms invasive breast carcinoma. Immunohistochemistry is positive for ER, PR but negative for HER-2/Neu. What is the best method of management for this patient?

a) 2 and 4

b) 2, 3 and 5

c) 1, 2,3 and 4

d) 1, 2, 3 and 5

Question 25:

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A 41-year-old woman underwent treatment for breast cancer of 1.2 X 1 cm with positive axillary nodes. She completed radiotherapy and chemotherapy and is now receiving tamoxifen. How would you follow up this patient?

a) Annual mammogram

b) Regular checking of LFT once in 6 months

c) Follow-up with tumour markers once in 6 months

d) Yearly bone scans

Question 26:

Post-operative radiotherapy is given in a patient with breast carcinoma mainly to _____.

a) Prevent metastasis

b) Induce ablation of the remnant cancer tissue

c) Prevent recurrence

d) Induce ablation of the affected nodes

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Question 27:

Which of the following is the most likely site for hematogenous spread in a patient with breast carcinoma?

a) Lumbar vertebrae

b) Skull

c) Thoracic vertebrae

d) Femur

Question 28:

A pregnant woman at 11-weeks of gestational age presents with a painless lump in the upper quadrant of her left breast. Ultrasound and trucut biopsy revealed the presence of invasive ductal carcinoma. What is the next best step in the management of this patient?

a) Perform immediate breast conservation therapy

b) Perform mastectomy and start chemotherapy immediately after delivery

c) Mastectomy followed by hormonal therapy in the second and third trimester

d) Mastectomy followed by chemotherapy in the second and third trimester

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Question 29:

A 45-year-old woman presented with back pain that was worse during the night. After evaluation, she was diagnosed with a recurrence of ER/PR+ breast cancer with bony metastasis. Which of the following would be the first-line treatment for this patient?

a) Radiotherapy

b) Chemotherapy + Surgery

c) Chemotherapy + Hormonal Therapy

d) Hormonal therapy

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Answer Key

Question No.	Correct Option
1	d
2	d
3	c
4	d
5	c
6	a
7	b
8	d
9	d
10	c
11	a
12	a
13	a
14	b
15	a
16	a
17	c
18	d
19	b
20	c

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21	b
22	d
23	b
24	d
25	a
26	c
27	a
28	d
29	d

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Detailed Explanations

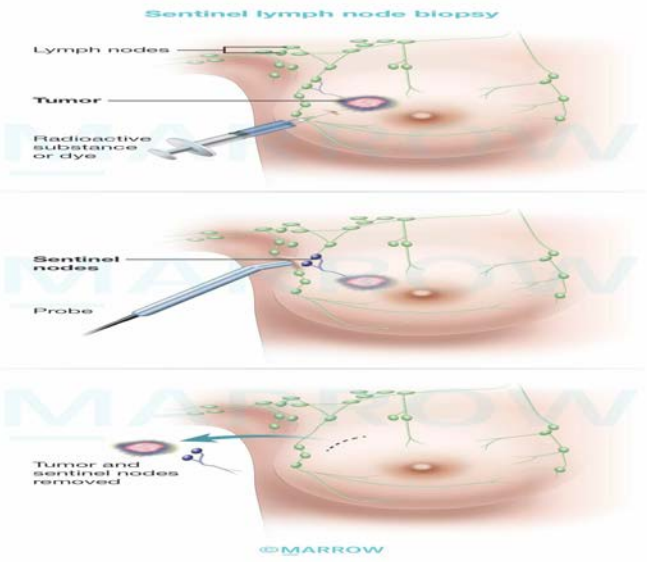
Solution to Question 1:

The image shows a sentinel lymph node biopsy using a gamma camera.

The sentinel lymph node is the first draining lymph node. SLNB was first described in penile cancer by Cabana. Sentinel lymph node biopsy is only done on node-negative tumors.

Methylene blue dye or radioisotope i.e., technetium-labeled albumin is injected into breast tissue (or subdermal tissue) at the site of the primary tumor or at the subareolar position. The sentinel node is identified as a blue node or as a radioactive node (using a gamma camera). The frozen section biopsy is sent to the pathologist for identification of cancer cells. If the biopsy is positive for cancer cells, then axillary dissection is simultaneously performed.

Note: The combination of blue dye and technetium-labeled colloid has been reported to improve the detection of sentinel lymph nodes. Newer techniques involve the use of a fluorescent or magnetic tracer instead of the radiolabelled dye.



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Solution to Question 2:

Sentinel lymph node biopsy is only done in node-negative tumors. It is not done in N1 stage tumors.

Solution to Question 3:

This patient has stage T2 breast carcinoma. These patients are managed with breast conservation therapy with adjuvant radiotherapy.

Indications of breast conservation surgery (BCS):

- DCIS/Tis tumors
- T1-2 tumors
- No contraindication for adjuvant radiotherapy
- Excision with clear margins is possible
- Who does not want a mastectomy
- Locally advanced tumors with excellent response to neoadjuvant chemotherapy.

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Solution to Question 4:

Breast conservation surgery can be done in a post-partum woman.

Breast cancer diagnosed during the second or third trimester can be managed with breast conservation surgery followed by adjuvant chemotherapy.

For breast cancer diagnosed late in the third trimester, breast conservation surgery can be performed, deferring breast irradiation until after delivery.

Breast cancer diagnosed during the first trimester should be treated with mastectomy. Breast conservation surgery is contraindicated in the first trimester since post-operative radiotherapy cannot be deferred for a long time and chemotherapy is contraindicated in the first trimester.

Solution to Question 5:

According to the clinical scenario, neoadjuvant chemotherapy followed by breast conservation surgery (BCS) is the next best treatment.

Stage T3 N0 M0 tumors are lesions of size >5 cm and are considered as large operable breast cancer (LOBC). The best management for such tumors is mastectomy.

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In case the patient is not willing for mastectomy, the next best treatment is neoadjuvant chemotherapy to shrink the tumor, followed by breast conservation surgery.

Solution to Question 6:

Pectoralis major is not removed in modified radical mastectomy.

Structures removed in modified radical mastectomy:

- Whole breast tissue
- The skin over the breast tissue
- Nipple-areola complex
- Pectoral fascia
- Levels I, II, ± III axillary lymph nodes

The pectoralis minor muscle is either cut (Patey's, Scanlon's modification) or retracted (Auchincloss).

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Solution to Question 7:

Distant metastasis is a contraindication for radical mastectomy.

Excision of the breast, the pectoralis major and minor muscles, and all axillary lymph nodes constitute radical mastectomy. It is seldom performed given that it causes substantial morbidity due to shoulder joint restriction, pain, significant upper limb lymphedema, and chest wall deformity, with no survival advantage when compared to less radical surgery. In the case of distant metastases, less radical surgery is of no benefit either.

Solution to Question 8:

Supraclavicular lymph nodes are not removed in radical mastectomy.

In Halsted radical mastectomy, the following structures are removed:

- All breast tissue and skin
- Nipple-areolar complex
- Pectoralis major and pectoralis minor muscles
- Level I, II, and III axillary lymph nodes.

Solution to Question 9:

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The drain after mastectomy is removed when the output is <30-40 cc for 2 consecutive days.

The closed system suction drains are put in to prevent the formation of seroma. It is the most common complication of mastectomy and axillary lymph node dissection.

Solution to Question 10:

The space of axillary lymph node dissection is inferiorly bounded by the angular vein (marked as 'A').

Boundaries of axillary lymph node dissection (ALND):

• Superior - Axillary vein

• Lateral - Thoracodorsal pedicle

• Medial - Costoclavicular ligament (Halstead ligament)

• Inferior - Angular vein

Indications for ALND:

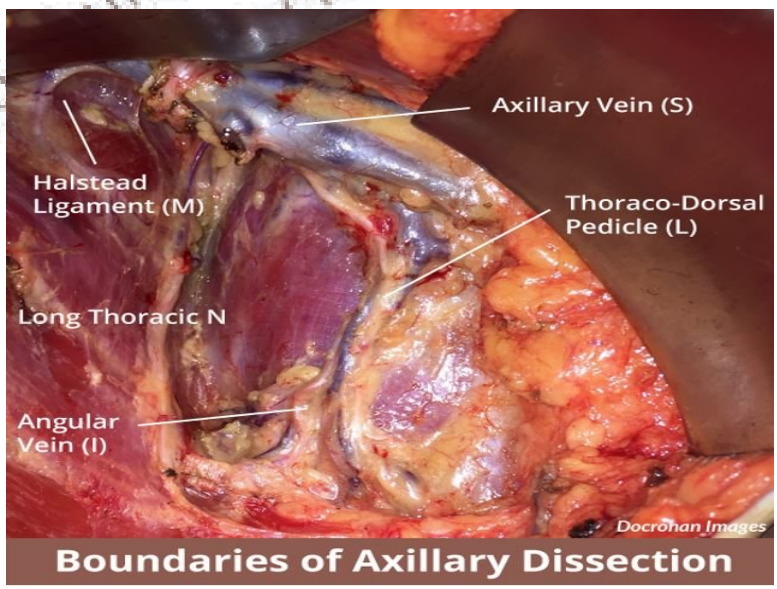
• Locally advanced (T4a, b, c) or inflammatory breast cancer

• Metastatic disease in axillary lymph node(s) proven by needle biopsy, clinically palpable or nonpalpable nodes which are abnormal on imaging

Structures preserved during ALND:

• Lateral and medial pectoral nerves

• Thoracodorsal pedicle



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The most common complication post-mastectomy is the development of a seroma.

Seroma is a collection of fluid in a surgically created cavity, that results from the transection of vessels and lymphatics. It presents as a localized, well-circumscribed swelling with discomfort. The fluid is clear, yellow, and viscous.

Placement of closed suction drains that obliterate the space between the pectoralis major and skin flap is used to prevent seromas.

Other complications include:

• Wound infection

• Skin flap breakdown or necrosis

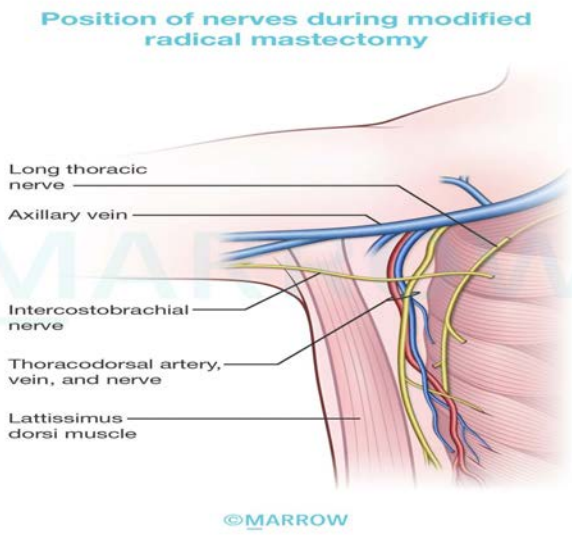
• Lymphedema

• Hemorrhage

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Solution to Question 12:

Resection of the intercostobrachial nerve (ICBN) causes loss of sensation over the medial aspect of the upper arm. The intercostobrachial nerve is the lateral cutaneous branch of the second intercostal nerve.



Solution to Question 13:

The generalized swelling of the left arm of the patient post-surgery for breast carcinoma is suggestive of post-mastectomy lymphedema.

Lymphoedema occurs when interstitial fluid accumulates due to defective lymphatic drainage. It is a common complication of breast cancer treatment, involving axillary lymph node dissection and radiotherapy. Sentinel lymph node dissection (SLND) reduces the risk of

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lymphedema significantly.

Clinical signs and symptoms are observed in the ipsilateral arm. A significant increase in limb size due to swelling is seen. Other symptoms are heaviness, tightness, numbness, tingling, limb fatigue, and reduced limb mobility.

Diagnosis is predominantly based on the clinical swelling of the arm. The girth of the affected arm >2 centimetres than the normal limb, a 200-mL or more increase in limb volume, or a 5% or greater limb volume change are other diagnostic criteria.

Management:

• Limb elevation, elastic arm stockings, and pneumatic compression devices to reduce swelling.

• Using a low-pH water-based moisturizer to prevent dry skin caused by excess fluid accumulation.

• Manual lymphatic drainage (MLD) by a therapist followed by simple lymphatic drainage (SLD) by the patient daily aids interstitial fluid evacuation.

• Surgical options include lymphaticovenular anastomosis, liposuction, and debulking.

Other options:

Option B: Stewart-Treves syndrome refers to lymphangiosarcoma seen in chronic long-standing lymphedema following mastectomy (more than 10 years). They present as single/multiple bluish-red skin and subcutaneous nodules. They can ulcerate and hemorrhage.

Option C: Axillary venous thrombosis or Paget-Schrotter disease is seen in patients doing rigorous exercise and in weightlifters. The compression of the subclavian vein at the thoracic outlet causes painful swelling of the arm.

Option D: Cellulitis (lymphangitis) is a bacterial infection of the skin and subcutaneous tissue. It is characterized by a painful area of erythematous and edematous tissue.

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Solution to Question 14:

The clinical scenario and image are suggestive of Stewart–Treves syndrome.

The development of angiosarcoma after a combination of postmastectomy lymphedema and radiation therapy is known as Stewart–Treves syndrome. It can arise de-novo or in association with post-mastectomy lymphedema. It presents with acute worsening of edema with subcutaneous nodules which are hemorrhagic or ulcerative.

Treatment is preoperative chemotherapy and radiotherapy followed by surgical excision (radical amputation of arm). The prognosis is poor.

Option A: Tietze syndrome is an inflammatory condition characterized by chest pain and swelling of the cartilage around the ribs at the costochondral junction.

Option C: Rhabdomyosarcoma is a rare type of cancer that affects the muscle tissue, mostly in children and adolescents.

Option D: Milroy's disease is a familial disease, caused by congenital abnormalities in the lymphatic system. Disruption of the normal drainage of lymph leads to fluid accumulation

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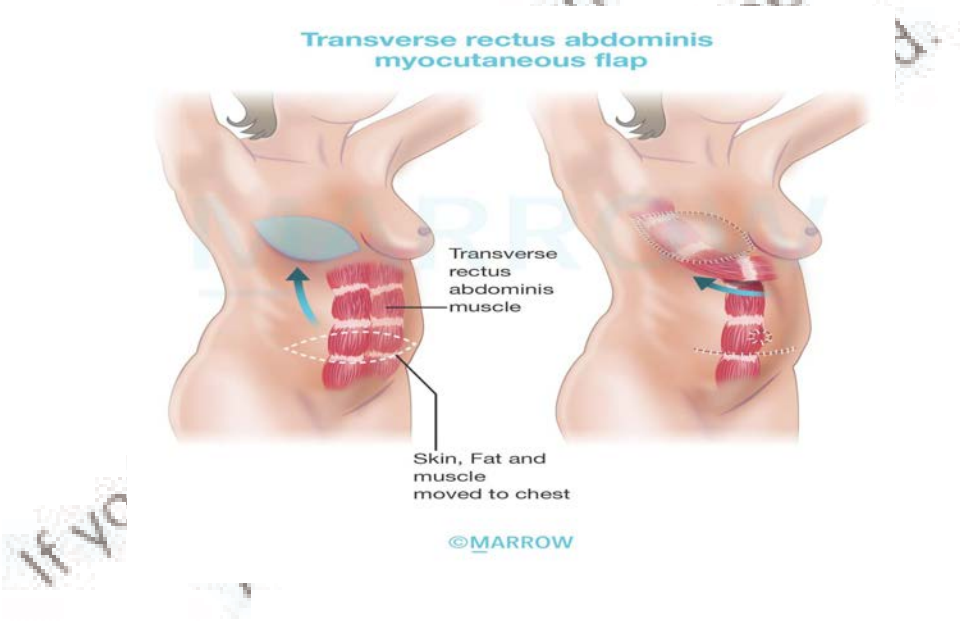
and hypertrophy of soft tissues.

Solution to Question 15:

The image shows a deep inferior epigastric perforator (DIEP) flap. It is a free flap and a variant of TRAM flap where only the skin and fat are moved to the chest.

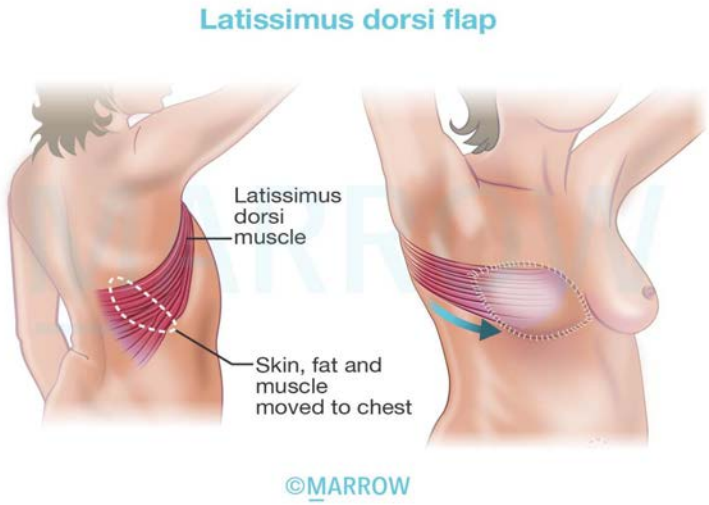
Transverse rectus abdominis myocutaneous (TRAM) flap is either based on the superior or inferior epigastric artery or both (supercharged TRAM). In a TRAM flap, the skin, fat, and rectus muscle are moved to the chest.

If robust DIEA perforators are identified with a good caliber and dissection can be performed without dividing the muscle, a DIEP flap is preferred. Otherwise, if small-caliber perforators are encountered and not aligned over the medial or lateral row, a TRAM flap is performed to ensure flap viability.



Option C: Latissimus dorsi (LD) flap is an axial flap based on the thoracodorsal pedicle.

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DIEP flap, TRAM flap, and LD flap are autogenous tissues used in breast reconstruction.

Solution to Question 16:

The gold standard in breast reconstruction with autogenous tissue is the deep inferior epigastric perforator (DIEP) flap.

In DIEP flap, using a microvascular technique, only subcutaneous fat and skin are taken, and no muscle is removed. As the muscle is spared, there is a decreased risk of abdominal wall weakness and its associated complications.

Lattismus dorsi flap (LD flap) - does not provide the bulk necessary and an implant is usually required.

Transverse rectus abdominis myocutaneous flap (TRAM flap):

• Skin, fat, and muscle are moved to the chest.

• It is the most commonly used flap.

• It provides good cosmesis and bulk. An implant is usually not required.

• Since the rectus abdominis muscle is excised in the procedure, it can lead to abdominal wall weakness and hernias.

The easiest type of reconstruction is using a silicone gel implant under the pectoralis major muscle. Capsular contraction is a dreaded complication of silicone implants.

In breast reconstruction surgeries, the timing of reconstruction may be immediate or delayed. Impediments to immediate reconstruction include insufficient theatre time and a lack of experienced reconstructive surgeons. In addition, if the patient is likely to need post-op radiotherapy, then a delayed reconstruction using a flap often gives better results.

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Solution to Question 17:

Fludarabine and vincristine are not used in chemotherapy for carcinoma breast.

The present chemotherapy regimen used is ACT regimen, i.e., adriamycin, cyclophosphamide, and taxane (paclitaxel). It comprises 4 cycles of AC followed by 4 cycles of T.

Earlier regimens that are less commonly used currently are as follows:

• CAF – Cyclophosphamide, Adriamycin, 5-Fluorouracil

• CMF – Cyclophosphamide, Methotrexate, 5-Fluorouracil

Indications for chemotherapy in carcinoma breast:

• Lymph nodes positive

• Lymph nodes negative but tumor size of >1 cm

• Lymph nodes negative and tumor size of >0.5 cm with

• Blood vessel/Lymph vessel invasion

• ER/PR –ve

• Her-2/neu overexpression

• High grade

• Triple-negative breast carcinoma

• High recurrence score after Oncotype Dx.

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Solution to Question 18:

Fulvestrant is a selective estrogen-receptor down regulator (SERD).

Selective aromatase inhibitors include:

• Anastrozole

• Exemestane

• Letrozole

They are used for the treatment of breast cancer in postmenopausal women. Selective aromatase inhibitors block the conversion of the hormone androstenedione into estrone by inhibiting the aromatase enzyme. This is the main mechanism of the production of estrogen in postmenopausal women.

Solution to Question 19:

Palbociclib is the newest drug approved for metastatic, hormone receptor–positive, HER-2/neu-negative breast cancer.

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It is used along with fulvestrant, a selective estrogen-receptor downregulator (SERD) based on the PALOMA 3 trial.

Solution to Question 20:

Tamoxifen is a selective estrogen receptor modulator (SERM) that is mainly used for estrogen receptor-positive breast cancers in pre-menopausal women.

It exhibits selective agonistic and antagonistic activity for ER receptors (ERα and ERβ):

• Agonist activity at the uterus, bone, liver, and pituitary

• Antagonist activity in breast and blood vessels

Uses:

• Part of the primary treatment regimen for estrogen receptor-positive (ER+) breast cancers in pre-menopausal women

• Adjuvant therapy after breast conservative surgery to prevent a recurrence

• Tamoxifen also is effective (a 40%–50% reduction in tumor incidence) in preventing ER+ breast cancer in women at increased risk.

Adverse effects:

• Vasomotor symptoms (hot flashes) and sweating

• Endometrial cancer

• Increased risk of thromboembolic events

• Fatty liver disease

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Solution to Question 21:

The immunohistochemistry staining shown in the above image is ER+, PR+, and HER2+, which is triple positive or luminal type B. Chemotherapy along with endocrine therapy, and trastuzumab is the adjuvant treatment of choice.

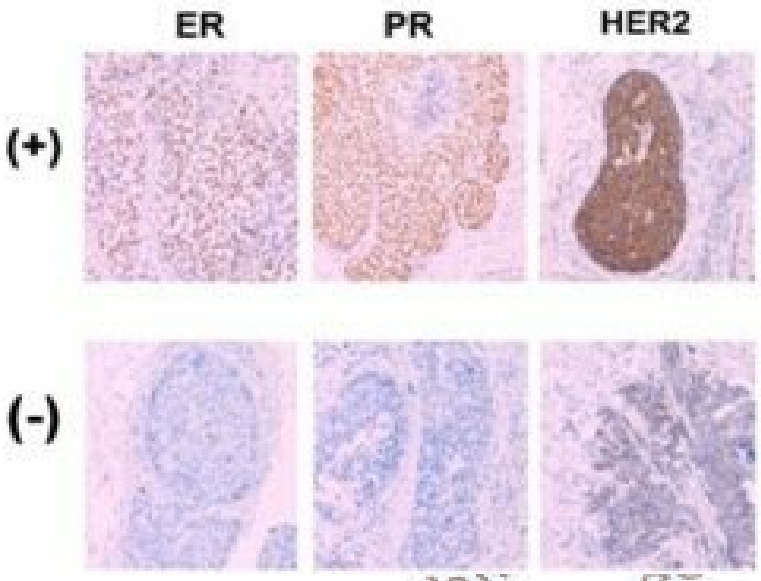
Positive immunohistochemistry staining is indicated by the presence of brown-colored tissue.

• The Estrogen receptor (ER) and Progesterone receptor (PR) are both nuclear receptors, hence, the nucleus is stained brown if positive.

• The human epidermal growth factor receptor type 2 (HER2) is a membrane receptor, hence the cell membrane is stained brown if positive.

The image below shows positive and negative staining for ER, PR, and HER2.

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The adjuvant treatment modalities currently in practice include:

• Endocrine treatment such as tamoxifen or ovarian suppression. It is given for patients with tumors that are hormone receptor-positive (either ER+ or PR+).

• Anti-HER2 therapy with trastuzumab (humanized monoclonal antibody). It is given for patients with tumors that are HER2 overexpressing.

• Chemotherapy is given for hormone negative, HER2+, and ER+ tumors.

The table below shows the summary of the adjuvant treatment approach:

Note: Palbociclib is used along with hormone therapy in ER +ve, PR +ve, HER2/neu -ve tumors.

	Tumor hormone receptor sta tus (ER,PR)	
Tumor HER2/neu st atus	Positive	Negative
Positive	Endocrine therapy + chemot herapy + trastuzumab	Chemotherapy + trastuzu mab
Negative	Endocrine therapy ± chemot herapy	Chemotherapy

Solution to Question 22:

Anastrozole is an aromatase inhibitor and it is the drug of choice for the prevention of recurrence of ER/PR positive breast cancer in post-menopausal women (usually >50 years). It is given for 10 years.

Tamoxifen is a selective estrogen receptor modulator (SERM) and it is the drug of choice for preventing recurrence in pre-menopausal women. It has an agonistic action on the endometrium, leading to an increased risk of endometrial cancers. Hence, it is not used in post-menopausal

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women.

Trastuzumab is a her2/neu receptor antagonist. It is given in patients with her2/neu status positive. It would not be effective in this patient.

Solution to Question 23:

Accelerated partial breast irradiation (APBI) is a localized form of radiation delivered after lumpectomy to only the part of the breast where the tumor was removed. According to the updated guidelines, patients of age greater than or equal to 50 years are considered suitable for APBI.

Patients of age <40 years are considered unsuitable, while those between 40 and 49 years of age are included in the cautionary group.

According to the recent American Society for Radiation Oncology (ASTRO) guidelines, the following patients are considered suitable for APBI:

- Patients of age 50 years or older
- Patients with low-risk DCIS. Low-risk DCIS includes patients satisfying the following criteria-
- Screen-detected disease
- Low to intermediate nuclear grade
- Tumor size ≤ 2.5 cm
- Surgical resection with margins negative by ° 3mm
- Patients with surgical margins negative by ° 2mm

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Solution to Question 24:

The best method of management in this patient is neoadjuvant chemotherapy, mastectomy, radiation therapy, and letrozole.

Step 1: Evaluate the TNM staging and stage grouping of the tumor

- Tumor size 4cm - T2
- Ipsilateral fixed axillary lymph nodes are positive - N2a
- No distant metastasis - M0

T2N2M0 belongs to the stage group IIIA which is considered locally advanced breast cancer (LABC). They are treated by neoadjuvant chemotherapy, mastectomy, and radiation therapy.

Step 2: Evaluate the receptor status

The immunohistochemistry is positive for estrogen and progesterone receptors. Therefore the patient has to be started with hormonal therapy with drugs like letrozole, anastrozole, tamoxifen etc.

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Trastuzumab / Herceptin is a HER-2/Neu blocker and as the patient is HER2/Neu negative, it would not be effective.

Solution to Question 25:

Follow-up of patients after treatment of breast cancer consists of a physical examination once in 3-6 months for the first 3 years and an annual mammogram.

Mammography is the only imaging modality necessary for follow-up after breast cancer surgery. There is currently no role for tumor markers, serum investigations, or any other imaging studies like bone scans in routine follow-ups.

Guidelines for follow-up after primary treatment:

Physical examination: every 3-6 months for the first 3 years, every 6-12 months for years 4 and 5, and annually thereafter.

Mammography: initially, 6 months after surgery, and thereafter, annually.

Breast self-examination: Monthly

Pelvic examination: Annually in patients taking tamoxifen

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Solution to Question 26:

The main aim of radiotherapy in breast cancer is to prevent local recurrence.

Radiotherapy is mainly given in the following cases:

- Positive lymph nodes
- After breast conservation surgery.

Solution to Question 27:

Lumbar vertebrae, followed by the femur and thoracic vertebrae, are the most common sites for hematogenous spread of carcinoma breast. Bone metastases in breast cancer are more osteolytic than osteoblastic.

The most common bony sites of blood-borne metastases are as follows:

- Lumbar vertebrae
- Femur
- Thoracic vertebrae
- Ribs
- Skull

Note: In prostate cancer, the bone metastases are more osteoblastic than osteolytic.

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Solution to Question 28:

Mastectomy followed by chemotherapy in the second and third trimester is the best step of management in a pregnant woman diagnosed to have breast cancer in the first trimester.

Pregnancy-associated breast cancer is defined as breast cancer that is diagnosed during pregnancy or within 1 year postpartum. It is the most common non-gynecologic malignancy associated with pregnancy. Most patients present with a painless mass in the breast with or without bloody nipple discharge.

Diagnosis is done by ultrasonography and tissue biopsy.

Treatment of breast cancer in pregnancy involves:

• Mastectomy in any trimester along with chemotherapy in the second and third trimesters.

• Radiotherapy and hormonal therapies are absolutely contraindicated during pregnancy because of teratogenicity. They can be initiated after delivery.

• Since radiotherapy is a component of breast conservation therapy, it is contraindicated in the first trimester of pregnancy. However, breast-conserving lumpectomy and axillary lymph node dissection with chemotherapy can be done in the second and third trimesters of pregnancy followed by radiation after delivery.

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Solution to Question 29:

The given patient has metastatic breast cancer with bony metastasis. Hormone therapy is the first-line treatment for these patients due to its minimal side effects. It is particularly useful for bony metastasis.

In premenopausal women, tamoxifen, and in post-menopausal women, anastrozole is preferred.

Chemotherapy is added to the regimen in the following scenarios:

• Young woman

• Visceral metastasis

• Rapidly growing tumors

• Failure of hormonal therapy

Surgery and radiotherapy are sometimes added to the regimen for palliative measures.

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Benign Lesions of Thyroid

Question 1:

What is the most common site for a thyroglossal cyst?

a) Suprahyoid

b) Infrahyoid

c) At the level of the hyoid

d) Floor of the mouth

Question 2:

A 25-year-old patient presented with neck swelling which moves with deglutition as shown below. What is your diagnosis?



a) Branchial cyst

b) Cystic hygroma

c) Thyroglossal cyst

d) Cervical lymphadenopathy

Question 3:

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A child with a midline swelling on the neck is being prepared for a Sistrunk procedure. Along with en bloc cystectomy, which of the following structures will be resected?

a) Thyroglossal tract and part of thyroid

b) Central hyoid bone and thyroglossal tract

c) Thyroglossal tract only

d) Thyroglossal tract and associated cervical lymph nodes

Question 4:

A patient with a nodule of the neck presents to the surgery OPD. A junior resident performs the following method to palpate it. Identify the procedure shown in the video below.



a) Lahey's method

b) Crile's method

c) Kocher's method

d) Pemberton's method

Question 5:

A patient with a solitary, 2x3 cm, nodular thyroid swelling came to your clinic with a recent report that showed elevated T4 and normal TSH levels. What is the next best step in management?

a) Fine needle aspiration cytology (FNAC)

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b) Ultrasound

c) Thyroid autoantibodies

d) Radioactive iodine uptake test (RAIU)

Question 6:

FNAC report of a patient with discrete thyroid swelling shows a Thy2 lesion. What do you infer from this report?

a) Follicular lesion

b) Non-neoplastic lesion

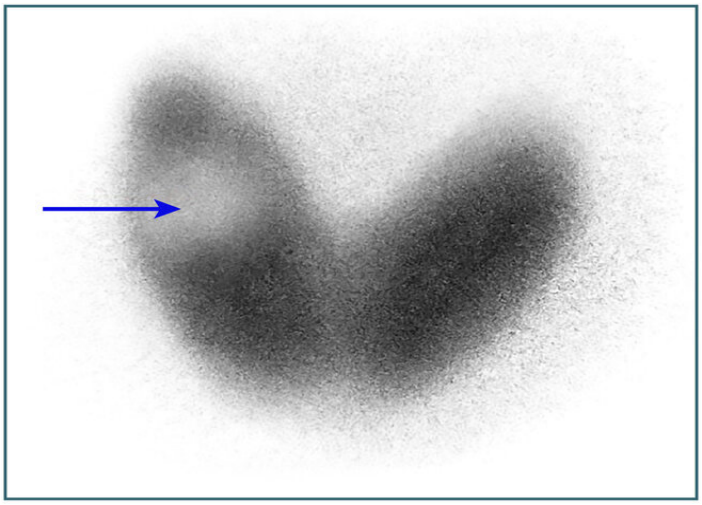
c) Lesion suspicious of malignancy

d) Cystic lesion

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Question 7:

A 22-year-old student with a nodular thyroid swelling undergoes a radionuclide scan. What is the risk of malignancy of the pathology given below?



a) 5%

b) 50%

c) 10%

d) 20%

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Question 8:

A young male patient presents with a discrete thyroid swelling. USG reveals an isolated cystic swelling of the gland. Which of the following statements correctly expresses the risk of malignancy in this patient?

a) 6%

b) 12%

c) 24%

d) 48%

Question 9:

A patient scheduled for a thyroid radionuclide scan had consumed an I^{123} containing pill at around 6 AM. What is the half-life of this drug?

a) 12-14 hours

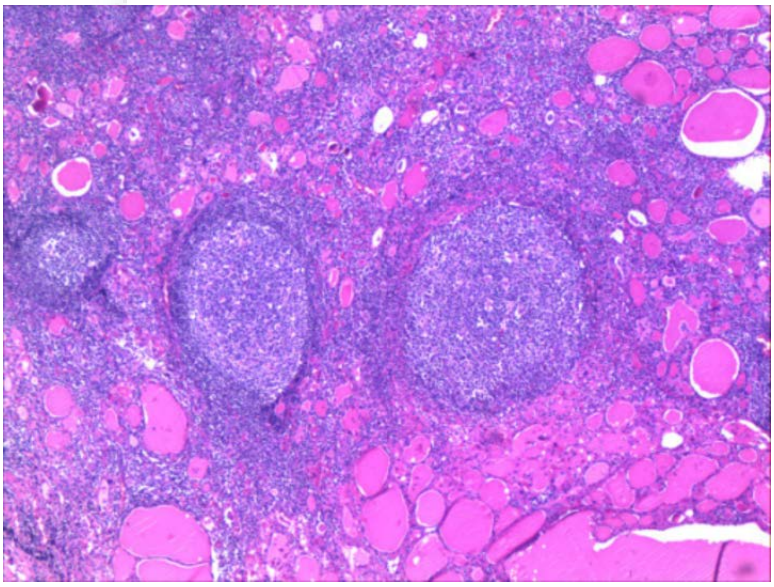
b) 20-24 hours

c) 4-6 hours

d) 8-10 days

Question 10:

A patient presents with a painless swelling of the neck. The histology of the tissue is as given in the image below. What is the diagnosis?



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a) Medullary carcinoma

b) Non Hodgkin's lymphoma

c) Grave's disease

d) Hashimoto's thyroiditis

Question 11:

A middle-aged female patient presented with malaise, fever, and painful neck swelling. She had recently recovered from an episode of upper respiratory tract infection. Lab reports show slightly elevated T4 and ESR was 100 mm/hr. What is the most appropriate management option for this patient?

a) Antibiotics

b) Antiviral

c) NSAIDS

d) Antithyroid drugs

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Question 12:

A 45-year-old lady, with a painless neck swelling, presented with palpitations and weight loss. Thyroid function tests revealed elevated T3 and T4, low TSH, and negative TSH-R Ab. Iodine scan showed multiple thyroid nodules with increased iodine uptake. Initial anti-thyroid treatment was given. What is the next step of management?

a) Long-term antithyroid medication

b) Sub-total thyroidectomy

c) Radioactive iodine

d) Near- total thyroidectomy

Question 13:

What will be the most likely associated condition with increased TSH and low T4 levels?

a) Hypoparathyroidism

b) Pituitary Adenoma

c) Grave's disease

d) Hashimoto's thyroiditis

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Question 14:

A 50-year-old hypothyroid female patient presents with a painless, hard anterior neck mass, which progresses over weeks to years associated with dysphagia. Physical examination reveals a hard, “woody” thyroid gland with fixation to the surrounding tissues. Which of the following investigations will confirm the provisional diagnosis?

a) CECT

b) RAI uptake scan

c) FNAC

d) Open biopsy

Question 15:

The commonest surgical approach to a retrosternal goiter is via:

a) Neck

b) Chest

c) Median sternotomy

d) None of the above

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Question 16:

Which of the following statements is true about retrosternal goitre?

a) Operated in all patients regardless of symptoms

b) Sternal incision is always required to operate

c) It receives blood supply from the thoracodorsal artery

d) Most of the retrosternal goitres can be removed by a neck incision

Question 17:

Which of the following patients with thyroid swellings is least likely to require surgery?

a) A 22 year old woman with FNAC report of Bethesda category IV

b) A 66 year old man with a positive Pemberton’s sign

c) A 58 year old man with an FNAC report of Thy2

d) A 16 year old girl with recurrence of thyroid cyst

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Question 18:

Pick from the following the usual cause of thyroid storm in thyroidectomy:

a) Rough handling of thyroid during surgery

b) Due to parathyroid gland

c) Inadequate patient preparation

d) Infections

Question 19:

A patient with toxic adenoma is being prepared for surgery. Which of the following statements is wrong regarding this?

a) Iodine may be given pre-operatively with carbimazole

b) Beta blockers administered pre-operatively must be continued post operatively

c) Nadolol is given in a once daily regimen pre-operatively

d) The last dose of carbimazole must be given 24 hours before surgery

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Question 20:

A 60-year-old man was posted for Hartley-Dunhill procedure. What is done in this procedure?

a) Total resection of lobes on one side, with partial resection on the other side

b) Partial resection of each lobe removing the bulk of the gland

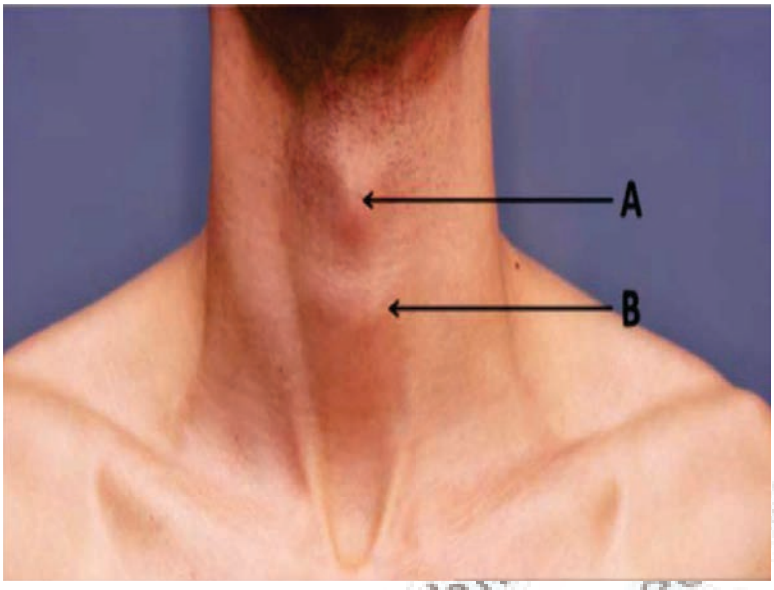
c) Total resection of one lobe with partial resection of three lobes

d) Resection of two lobes with the removal of the isthmus

Question 21:

You are performing thyroidectomy in a patient with thyroid neoplasia. Where will you make the Kocher's incision?

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a) 1 cm below A

b) 1 cm above A

c) 1 cm below B

d) 1 cm above B

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Question 22:

At which of the following points is the recurrent laryngeal nerve at the highest risk for injury during thyroid surgery?

a) At the level of Berry's ligament as it enters the larynx

b) In the tracheoesophageal groove as it forms one side of the Beahrs triangle

c) Under the tubercle of Zuckerkandl on the posterolateral portion of the gland

d) As the nerve loops around the aorta

Question 23:

In the post-op recovery room, a patient who had undergone a thyroidectomy suddenly experienced dyspnea with stridor. He was immediately sent back to the OT. What is the most likely cause for the patient's condition?

a) Diaphragmatic paralysis due to hypocalcemia

b) Thyrotoxicosis causing uncontrolled atrial fibrillation

c) Venous embolism

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d) Development of hematoma

Question 24:

A patient who had undergone a retro-oesophagal goitre resection was found to have partial ptosis and loss of hemifacial sweating. What is the most likely diagnosis?

a) Transient hypocalcemia

b) Horner's syndrome

c) Recurrent laryngeal nerves injury

d) Post operative hematoma

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Answer Key

Question No.	Correct Option
1	b
2	c
3	b
4	a
5	b
6	b
7	d
8	c
9	a
10	d
11	c
12	d
13	d
14	d
15	a
16	d
17	c
18	c
19	d
20	a

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21	c
22	a
23	d
24	b

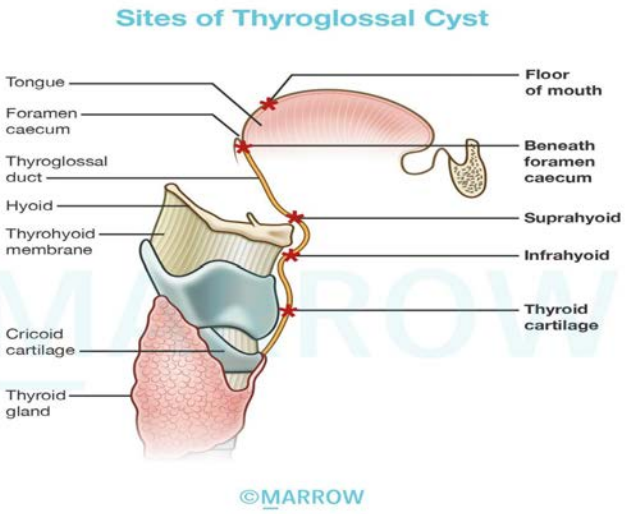
Detailed Explanations

Solution to Question 1:

The most common site for thyroglossal cyst is infrahyoid region.

It can occur anywhere along the migratory course of the duct:

- Infrahyoid (most common site)
- Region of thyroid cartilage
- Suprahyoid
- Floor of mouth
- Beneath foramen caecum



A thyroglossal duct cyst is a congenital midline neck swelling that typically presents during childhood. Normally, the thyroglossal duct regresses once the thyroid gland has completely descended. If it fails to regress, a thyroglossal duct cyst is formed.

It can be differentiated from other midline neck swellings by the following features:

- Can be moved sideways but not vertically
- Moves with both deglutition and tongue protrusion

Surgical management of a thyroglossal cyst is via Sistrunk procedure.

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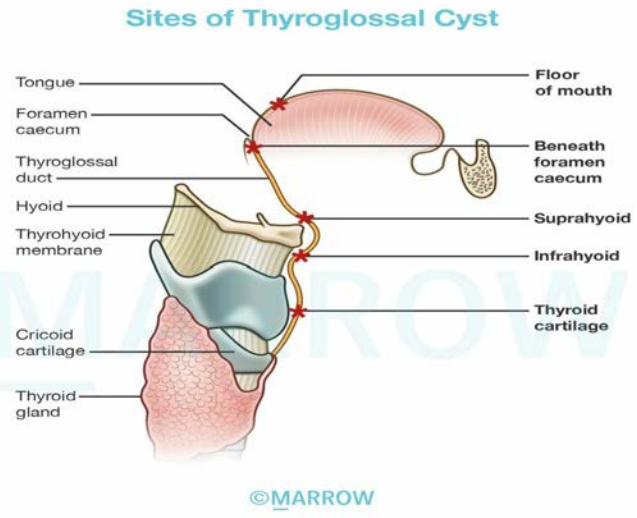
Note: Presence of thyroid in the midline posterior 1/3rd of tongue is called lingual thyroid. It is due to failure of descent of the thyroglossal duct during development.

Solution to Question 2:

A thyroglossal cyst is the only midline neck swelling that moves with deglutition. This is because the thyroid gland is fixed to the hyoid.

Thyroglossal duct cyst:

It is a congenital midline neck swelling that typically presents during childhood often noticed after an upper respiratory infection. It represents the persistence of the track of the thyroid gland and can be found adjacent to the midline. The thyroid gland descends early in fetal life from the base of the tongue towards its position in the lower neck. At the time of descent, the hyoid bone has not been formed and the track of the thyroid gland is variable, passing in front, through, or behind the eventual position of the hyoid body.



Clinical features of thyroglossal cyst:

• Classically the cyst moves upwards on swallowing and on tongue protrusion. This indicates attachment to the hyoid bone.

• Swelling is smooth, soft, fluctuant (cystic), nontender, mobile, often transilluminant.

• Thyroid fossa is empty, if there is no thyroid in the normal location.

Complications of thyroglossal cyst:

• The most common complication is infection.

• Thyroglossal fistula is an acquired condition that either follows infection of the cyst which bursts open or due to inadequate removal of the cyst.

• 1% of thyroglossal duct cysts are found to be malignant of which the most common type of cancer is papillary (85%).

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Neck swellings that move with deglutition are:

• Thyroid swellings

• Subhyoid bursitis

• Dermoid cysts attached to the hyoid bone

However, only the thyroglossal cyst moves with tongue protrusion. This is because the duct extends from the foramen caecum of the tongue to the isthmus of the gland.

Sistrunk's operation is performed to excise the cyst and prevent a recurrence. It involves the excision of the whole thyroglossal tract, involving removal of the body of the hyoid bone, and suprahyoid tract through the tongue base to the vallecula at the site of the primitive foramen caecum along with the core of tissue on either side.

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Solution to Question 3:

Sistrunk operation involves en bloc cystectomy with excision of the entire thyroglossal tract till the base of the tongue along with the central hyoid bone.

It is the procedure of choice for the surgical management of thyroglossal duct cysts. It is done to prevent recurrence and malignant transformation.

The most common malignancy in thyroglossal cysts is papillary thyroid carcinoma. In such a case, Sistrunk operation with total thyroidectomy is considered.

Solution to Question 4:

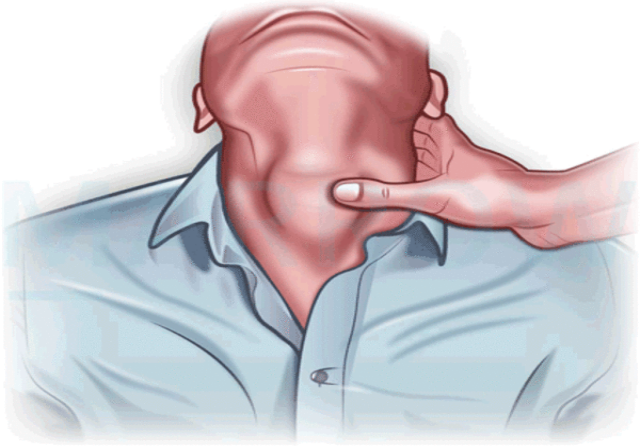
The video depicts Lahey's method of palpation of the left lobe of the thyroid gland.

In Lahey's method, for palpating the left lobe, the examiner initially pushes the right lobe medially with the left hand, and then using the right hand, the border and consistency of the left lobe is palpated.

Other options:

Option B: In Crile's method the patient is asked to swallow, while the examiner palpates the gland with the thumb. This gives a clear indication regarding the slight enlargement of the thyroid gland or small nodules.

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Option C: Kocher's method is done to demonstrate the pressure effect of the thyroid gland on the trachea or larynx. Lateral compression will result in stridor.

Option D: Pemberton's sign (not method), is engorgement of neck veins when the patient is asked to raise their hands above the head and the arms should touch the ears. It is seen in patients with retrosternal goiter.

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Solution to Question 5:

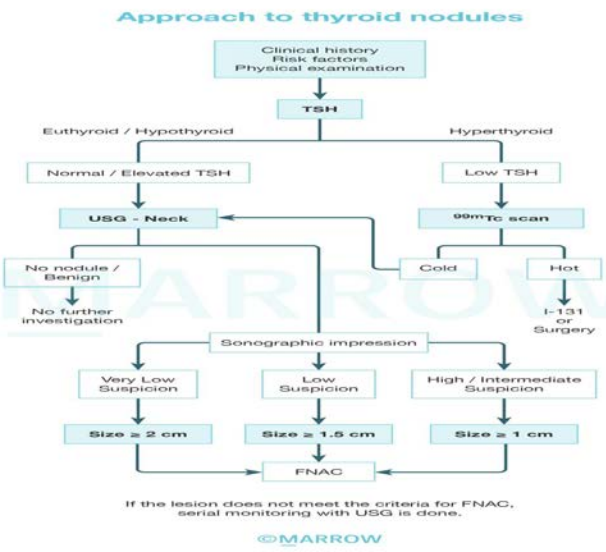
Ultrasonography is the next best step in the evaluation of a euthyroid (normal TSH) patient with a solitary thyroid nodule. USG is a non-invasive and inexpensive way to stratify the risk of the nodule into benign or malignant tissue.

Benign nodules are easily compressible and can be seen to deform by applying pressure with the probe while performing USG. Malignant nodules tend to be hard and firm.

Ultrasound findings of a nodule that are considered suspicious of malignancy include:

- Microcalcifications
- Hypervascularity
- Infiltrative margins
- Hypoechoic compared with surrounding parenchyma

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Solution to Question 6:

FNAC report of Thy2 indicates a non-neoplastic lesion.

Fine-needle aspiration cytology reporting according to Royal College of Pathologists UK:

Another cytology reporting system is "The Bethesda System for Reporting Thyroid Cytopathology" (TBSRTC):

Category	Lesion
Thy1	Non-diagnostic
Thy1c	Non-diagnostic cystic
Thy2	Non-neoplastic
Thy3	Follicular
Thy4	Suspicious for malignancy
Thy5	Malignant

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The 2023 Bethesda System for Reporting Thyroid Cytopathology

Bethesda class	Diagnostic category	Management
I	Nondiagnostic	Repeat FNA with ultrasound guidance
II	Benign	Clinical and ultrasound follow up
III	Atypia of undetermined significance Specify if AUS-nuclear atypia or AUS-other	Repeat FNA, molecular testing, diagnostic lobectomy, or surveillance
IV	Follicular neoplasm Follicular neoplasm-oncocytic follicular neoplasm*	Molecular testing+, hemithyroidectomy or lobectomy
V	Suspicious for malignancy	Molecular testing+, lobectomy or near total thyroidectomy
VI	Malignant	Lobectomy or near total thyroidectomy

* Previously called Hurthle cell neoplasm
\+ Molecular testing can be performed to assess the type of surgery to be performed (lobectomy or total thyroidectomy)

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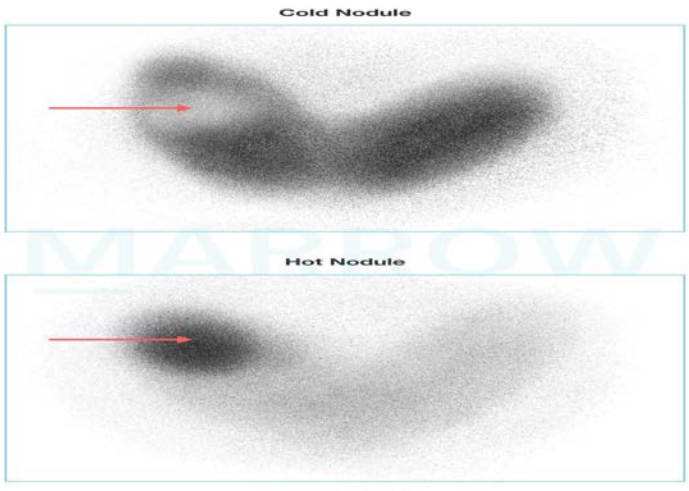
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Solution to Question 7:

The pathology on the scan shows decreased iodine uptake by a cold thyroid nodule. It is associated with around 20% risk of malignancy.

A thyroid scan is used in patients with hyperthyroidism with low or normal TSH.

Thyroid scan Cold vs. Hot nodule

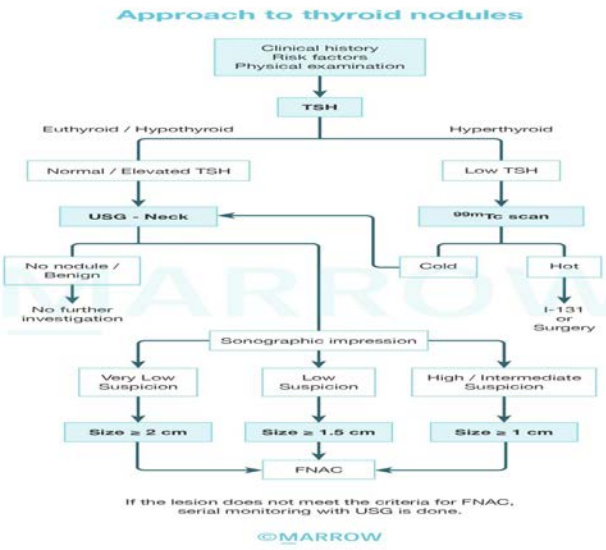


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Hot nodules indicate increased function of the gland and are rarely malignant. They are managed with either I131 or surgery. The risk of malignancy is higher with “cold” lesions (15-20%) as compared to “warm” lesions (<5%).

Cold nodules need to be further evaluated using USG as they pose a higher risk of malignancy.

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Solution to Question 8:

Isolated cystic swellings are malignant in 24% of males.

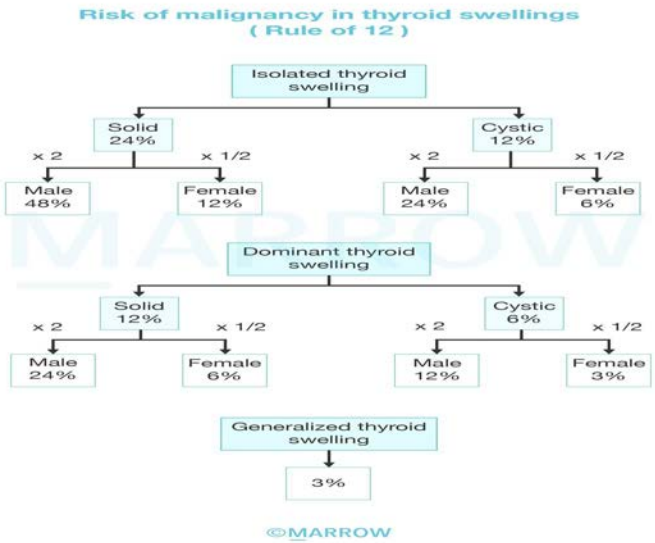
The general rule of thumb is that the risk of malignancy is greater in:

• Isolated > dominant swellings

• Solid > cystic

• Men > women

The risk of malignancy in thyroid swellings, given by the rule of twelve, is depicted below. The risk of cancer in thyroid swelling can be expressed as a factor of 12.



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Solution to Question 9:

The half-life of I123 is 12-14 hours.

Isotopes of Iodine such as Iodine-123 (123I) and Iodine-131 (131I) are used to image the thyroid gland.

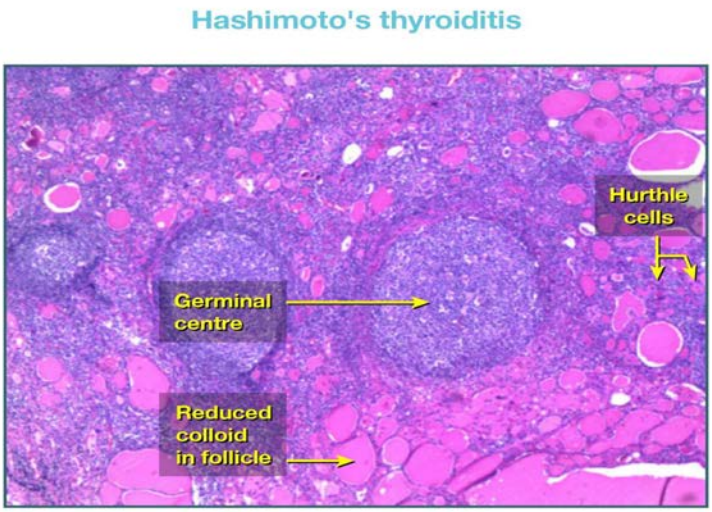
Iodine radioisotope	I123	I131
Half-life	12- 14 hours	8-10 days
Radiation exposure	Low	High
Radiation emission	Gamma rays	Beta and Gamma rays
Uses	Imaging of lingual thyroidsAnatomical and physiological function of thyroid	Screening and treatment of patients with differentiated thyroid cancers for metastatic disease

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Solution to Question 10:

The slide shows the histopathology of Hashimoto thyroiditis, with:

- Follicular destruction
- Reduced colloid with increased interstitial connective tissue
- Small lymphocyte and plasma cell infiltration
- A well-developed germinal centre may be seen
- Hurthle (Askanazy) cells that have abundant eosinophilic granular cytoplasm lining the follicles



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Hashimoto's thyroiditis is the most common cause of hypothyroidism in iodine-sufficient areas. It is also known as struma lymphomatosa or lymphocytic thyroiditis. It is an autoimmune disease that results in the destruction of the thyroid gland and gradual & progressive thyroid failure.

Clinical features:

• Most prevalent between 45-65 years of age

• More common in females

• Painless enlargement of the thyroid

• Hashitoxicosis: When the auto-antibodies attack and damage the follicles, there is a sudden release of thyroid hormones from these follicles. This leads to a transient phase of thyrotoxicosis.

• Hypothyroidism: Since the follicles are damaged and cannot form the hormones anymore, these patients tend to be in a state of hypothyroidism.

Diagnosis:

• T3 and T4 are low

• TSH is raised

• Autoantibodies against:

• Thyroid receptors

• Thyroid peroxidase (TPO)

• Thyroglobulin

These patients are managed with thyroid hormone replacement therapy.

In patients with long-standing goiter, there is a risk of compressive features and the development of thyroid lymphoma. Such cases can be treated with total thyroidectomy. It may also predispose to papillary thyroid carcinoma.

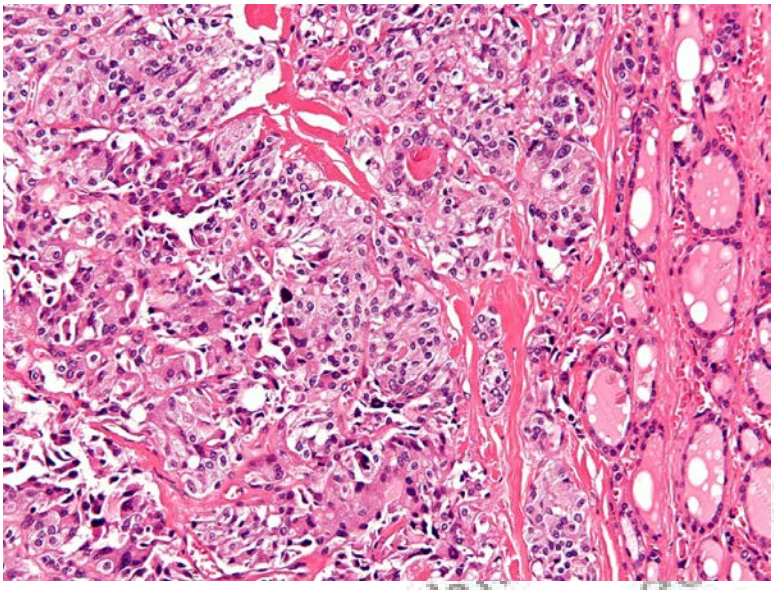
Other options:

Option A: Histological features of medullary carcinoma of the thyroid include polygonal to spindle-shaped cells in the form of nests, trabeculae or follicles. Small, round anaplastic cells may be found in some cases and amyloid deposits derived from calcitonin polypeptides are present in the stroma.

The given slide below shows medullary carcinoma of thyroid:

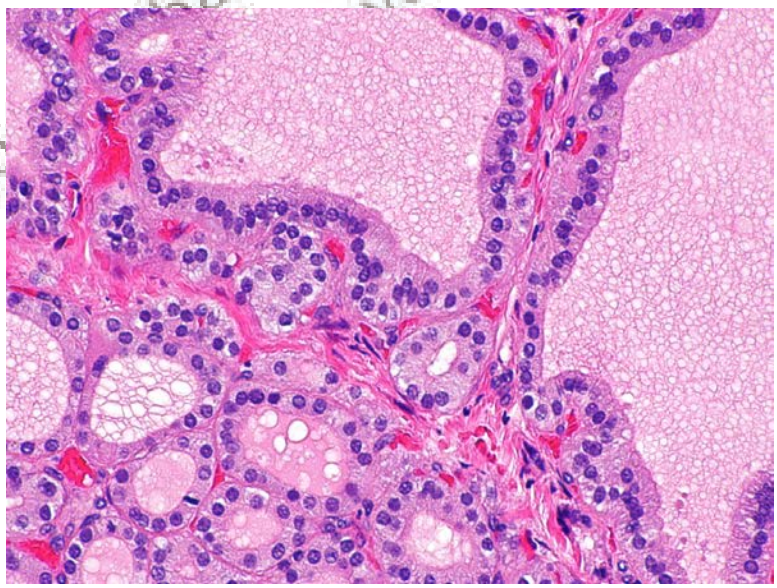
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Option C: Grave's disease is an autoimmune disorder characterized by hyperthyroidism due to circulating autoantibodies. The thyroid-stimulating immunoglobulins bind to the TSH receptors, causing overgrowth of the thyroid gland and increased thyroid hormone synthesis. Histologically, there is acinar cell hypertrophy and hyperplasia with the absence of normal colloid in the tall columnar epithelium (normally the epithelium is flat with colloid). Lymphoid infiltrates, consisting predominantly of T cells, along with scattered B cells and mature plasma cells, are present throughout the interstitium. Germinal centers are common.

The given slide below shows Grave's disease:



Solution to Question 11:

The given clinical scenario is suggestive of De Quervain's thyroiditis for which NSAIDs is the treatment of choice. In this condition, T_3, T_4 and thyroglobulin may be raised due to the release

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of preformed hormones from the destructed follicles.

De Quervain's thyroiditis (subacute or viral thyroiditis) is a granulomatous enlargement of the thyroid gland, usually following a viral infection. It is an inflammatory condition and not an infection as the thyroid gland is inherently resistant to infection due to its extensive blood and lymphatic supply, high iodide content, and fibrous capsule.

It predominantly occurs in women between the ages of 30-40 years. The condition is self-limiting, and management is symptomatic i.e. aspirin and other non-steroidal anti-inflammatory drugs are used for pain relief, but steroids may be indicated in more severe cases.

Note: Acute suppurative thyroiditis mimics De Quervain's thyroiditis in that it is often preceded by a pyogenic upper respiratory tract infection or otitis media. However, acute suppurative thyroiditis is more common in children.

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Solution to Question 12:

The given clinical scenario is suggestive of toxic multinodular goitre. The next step of management once a euthyroid state is achieved is a near-total thyroidectomy.

Toxic nodular goiters are often large, uncomfortable, and are prone to recurrence. In a developing country like India, a near-total thyroidectomy eliminates the risk of recurrence and simplifies follow-up. However, it causes immediate thyroid failure and necessitates lifelong thyroxine replacement.

Option A: Toxic multinodular goitres may show a decreased response to antithyroid drugs or may even enlarge further. Therefore, surgical management is recommended.

Option B: Sub-total thyroidectomy has chances of recurrence and hence cannot be a definitive therapy.

Option C: Large goiters show decreased response to radioactive iodine and the chances of recurrence are also high.

Solution to Question 13:

Increased TSH and low T4 levels are seen in primary hypothyroidism. Hashimoto's thyroiditis is the only cause of primary hypothyroidism in the given options.

Hashimoto's thyroiditis is an autoimmune disease that results in the destruction of the thyroid gland and gradual & progressive thyroid failure. It is the most common cause of primary hypothyroidism in iodine-sufficient areas. They also have autoantibodies against thyroid receptors, thyroid peroxidase and thyroglobulin.

Other options:

Option A: Hypoparathyroidism is generally not associated with hypothyroidism, except in certain congenital multisystem disorders such as DiGeorge's syndrome.

Option C: Grave's disease is the most common cause of hyperthyroidism. It is an autoimmune disorder caused due to autoantibodies against the TSH receptor. There will be elevated T3 and T4

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levels with low TSH levels.

Option B: A TSH-producing pituitary adenoma can have increased TSH levels, but there will be elevated T3, T4 levels as well.

Solution to Question 14:

The given clinical scenario is suggestive of Riedel's thyroiditis, which is confirmed by an open thyroid biopsy.

FNAC is inadequate due to the firm and fibrous nature of the gland.

Riedel's thyroiditis is invasive autoimmune fibrous thyroiditis where thyroid gland tissue is replaced by fibrous tissue. It is an IgG4-related systemic disease characterized by:

• Elevated serum IgG4 levels

• Lymphoplasmacytic infiltrate

• Abundance of IgG4 bearing plasma cells

It is associated with other focal sclerosing syndromes including mediastinal, retroperitoneal, periorbital, retro-orbital fibrosis, and sclerosing cholangitis.

Clinical features:

• Occurs predominantly in women between 30-60 years

• Painless, hard anterior neck mass

• Progresses over weeks to years to produce symptoms of compression:

• Dysphagia

• Dyspnea

• Choking

• Hoarseness

• Symptoms of hypothyroidism and hypoparathyroidism as the gland is replaced by fibrous tissue

• Physical examination reveals a hard, "woody" thyroid gland with fixation to surrounding tissues

Treatment includes surgery, high-dose steroids, tamoxifen, and thyroxine replacement.

Solution to Question 15:

The commonest surgical approach to a retrosternal goiter is via the neck and the most common type of goitre approached is the secondary retrosternal goiter.

A goiter is considered to be retrosternal if at least 50% of the thyroid tissue is located intrathoracically. They can be primary or secondary.

Retrosternal goiter presents with dyspnoea, stridor, and dilated neck veins. Pemberton's sign (venous congestion of the neck on the raising of hands above the head) is seen.

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Contrast-enhanced computed tomography (CECT) of the neck is performed to assess the location of the thyroid. The definitive treatment is surgical excision of the ectopic thyroid.

Other options:

Option B & C: Median sternotomy (via chest) is indicated in:

• Primary mediastinal goiter

• Malignant retrosternal goiter

• Very large retrosternal goiter

• Recurrence in the mediastinum

	Primary retrosternal goiter	Secondaryretrosternal goiter
Occurrence	1%	Majorityof retrosternal goiters
Origin	Arise fromectopic thyroid tissuein the chestNo connection with the thyroid tissue in the neck	Arise from thedownward extension of cervical thyroid tissualong the fascial planes of the neck
Blood supply	Intrathoracicblood vessels	Superior and inferior thyroid arteries

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Solution to Question 16:

Most of the retrosternal goiters can be removed by neck incision (transcervical approach).

Retrosternal goitre is defined as having >50% of the goiter below the suprasternal notch. It can be either primary or secondary.

• Primary: rare and arises from ectopic thyroid tissue in the mediastinum; receives blood supply from intrathoracic blood vessels. It is not related to thyroid tissue in the neck.

• Secondary: they are the most common type; an extension of enlarged thyroid from the neck, usually arising from the lower pole of nodular goitre. It receives its blood supply from superior and inferior thyroid vessels.

The majority of patients are asymptomatic or have minimal symptoms. If the gland enlarges within the thoracic inlet, the pressure may lead to dysphagia, tracheal compression, and eventually airway symptoms. Pemberton sign can be positive (facial flushing and dilatation of cervical veins upon raising the arms above the head).

CECT neck and thorax is the investigation of choice.

Over 95% of retrosternal goiters can be removed via a transcervical incision since they are an extension from thyroid tissue in the neck.

Other options:

Option A: Surgical removal of the retrosternal goiter is indicated in patients with significant airway compression, and in young patients who have symptoms such as dyspnoea or dysphagia.

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Option B: Median sternotomy approach is indicated in:

• Primary mediastinal goiter

• Malignant retrosternal goitre

• Very large retrosternal goiter

• Recurrence in the mediastinum

For a primary mediastinal goiter whose boundaries are completely within the chest, resection is often achieved through median sternotomy or thoracotomy to ensure that the vessels supplying the tumor are properly ligated. Removing the tumor through a cervical approach can result in uncontrolled bleeding and is generally avoided.

Option C: Blood supply to the retrosternal goiter is from the thyroid vessels (secondary retrosternal goiter).

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Solution to Question 17:

FNAC report of Thy2 i.e. non-neoplastic is not an indication for surgery.

Indications for surgical management of thyroid swellings include:

• Neoplasia: FNAC positive Thy3–5 and clinical suspicion

• Age

• Male sex

• Hard texture

• Fixity

• Recurrent laryngeal nerve palsy

• Lymphadenopathy

• Recurrent cyst

• Toxic adenoma

• Pressure symptoms

• Cosmesis

• Patient's wishes

Solution to Question 18:

The usual cause of thyroid storm in thyroidectomy is inadequate patient preparation before surgery. Patient preparation pre-operatively involves ensuring a euthyroid state.

Rough handling of the thyroid in thyroidectomy does not cause a thyroid storm. Though a significant amount of thyroglobulin is stored in the acinar cells, they are inactive unless converted to thyroxine (T3 and T4).

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Solution to Question 19:

The last dose of carbimazole may be given the evening before surgery.

Toxic adenoma is a benign functioning thyroid tumour, which usually presents as a toxic solitary nodule. It is an autonomously functioning tumour that does not respond to TSH. Treatment involves antithyroid drugs or radioactive iodine. This is followed by hemithyroidectomy as the surrounding normal thyroid tissue regains normal function.

Traditional preparation of a thyrotoxic patient aims to make the patient biochemically euthyroid. There are two methods of preparation that can be used:

• Carbimazole 30-40 mg per day is the drug of choice. When euthyroid (after 8-12 weeks), the dose may be reduced. Beta-blockers, if used preoperatively, must be given on the morning of surgery and continued for a week post-op.

• Propranolol 40 mg TDS or a longer-acting nadolol 160 mg once daily may be given to achieve beta-blockade. It is important to continue treatment up to 7 days postoperatively.

Iodine may be given with carbimazole or a beta-blocker 10 days before the operation. It produces transient remission and reduces thyroid vascularity.

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Solution to Question 20:

Hartley Dunhill procedure involves total lobectomy on the affected side with sub total resection on the less affected side.

Indication: Asymmetrical multinodular goiters especially in older patients.

Solution to Question 21:

The structures marked as "A" and "B" in the above image are thyroid cartilage and cricoid cartilage respectively. A Kocher transverse collar incision is typically 3 to 5 cm in length and is placed parallel to a natural skin crease 1 cm below the cricoid cartilage, which is marked as "B".

Rose position is preferred for thyroid surgery. The patient is supine with a towel roll below the shoulder to enable neck extension of 30 degrees. The advantage is a blood-less field as there is decreased venous congestion. However, there is an increased risk of air embolism.

Solution to Question 22:

The point at which the recurrent laryngeal nerve (RLN) is at the highest risk for injury during thyroid surgery is at its entry point into the larynx. This point is at the cricothyroid joint, at the level of Berry's ligament.

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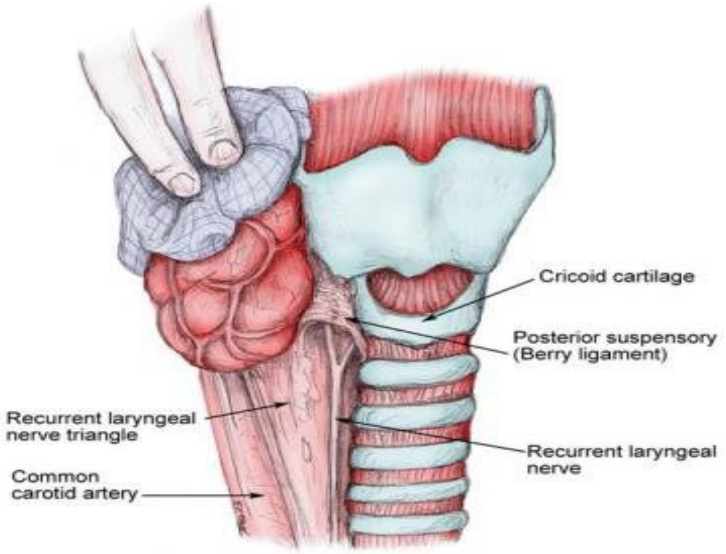
The recurrent laryngeal nerve is a branch of the vagus nerve. On the left, it recurs over the arch of aorta, and on the right over the subclavian artery.

Beahrs' triangle or recurrent laryngeal nerve triangle is formed by:

• Common carotid artery

• Inferior thyroid arteries

• Recurrent laryngeal nerve



Note: On the left side, the nerve has more distance in which to reach the transesophageal groove. Hence it runs in a medial plane. On the right, there is less distance and the nerve runs more obliquely to reach the groove.

Solution to Question 23:

Development of a hematoma post-thyroidectomy may lead to venous edema of the larynx. This can cause airway obstruction and respiratory distress. It is evacuated promptly at bedside or through surgical re-exploration.

Complications of thyroidectomy:

• Haemorrhage - most common complication overall

• Nerve injury

• External laryngeal nerve - hoarseness (more common)

• Recurrent laryngeal nerve - hoarseness if unilateral, life-threatening aspiration and aphonia if bilateral

• Respiratory obstruction

• Laryngeal edema - most common cause of respiratory obstruction

• Bilateral recurrent laryngeal nerve palsy

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- Laryngomalacia
- Tension hematoma
- Hypoparathyroidism - infarction of parathyroids
- Thyroid storm - inadequately prepared for surgery
- Hypothyroidism
- Recurrent thyrotoxicosis
- Wound infection, stitch granuloma, keloid

Option C: Venous embolism typically occurs after a prolonged period of immobilization.

Solution to Question 24:

The given clinical scenario is suggestive of Horner's syndrome.

The cervical sympathetic trunk is at risk of injury in invasive thyroid cancers and retro-esophageal goitres and may result in Horner's syndrome.

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Thyroid Malignancies

Question 1:

What is the first investigation you would advise to a patient with a large thyroid swelling?

a) Ultrasound of the neck

b) FNAC

c) Biochemical function of the thyroid

d) Radioiodine uptake

Question 2:

A patient presents with a 2.5 cm neck swelling which is firm, non-tender, and moves on swallowing. TSH, T3, and T4 levels are normal. An ultrasound reports the swelling to be cystic and regular with low suspicion for malignancy. What is the next step in the management of this patient?

a) Perform an fine needle aspiration biopsy

b) Perform a Radioiodine uptake test

c) Prepare for resection of nodule

d) Reassure the patient and monitor periodically

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Question 3:

FNAC is useful in all types of thyroid cancers except _____

a) Medullary

b) Papillary

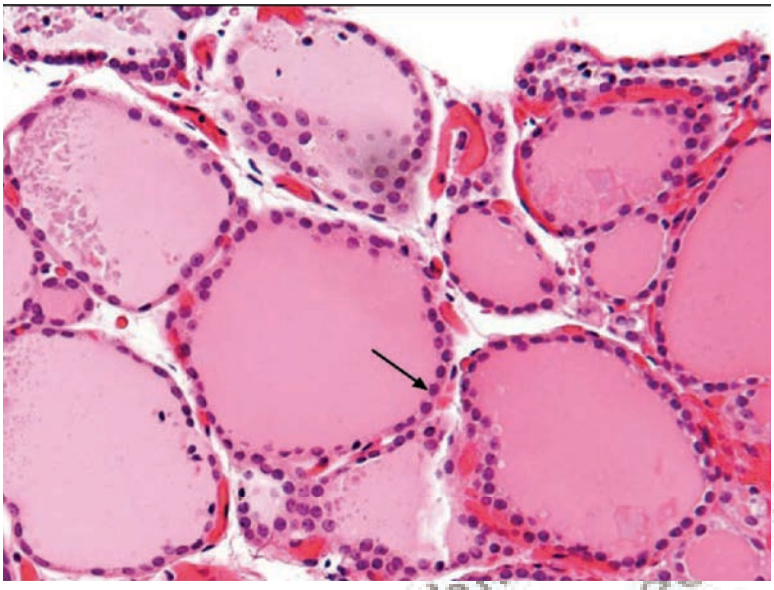
c) Follicular

d) Anaplastic

Question 4:

Which of the following carcinomas of the thyroid arise from the marked cells?

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a) 1,4,5

b) 2,3

c) 2,3,4

d) 1,2,3,4

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Question 5:

What is the most common thyroid malignancy in iodine-deficient regions?

a) Papillary

b) Anaplastic

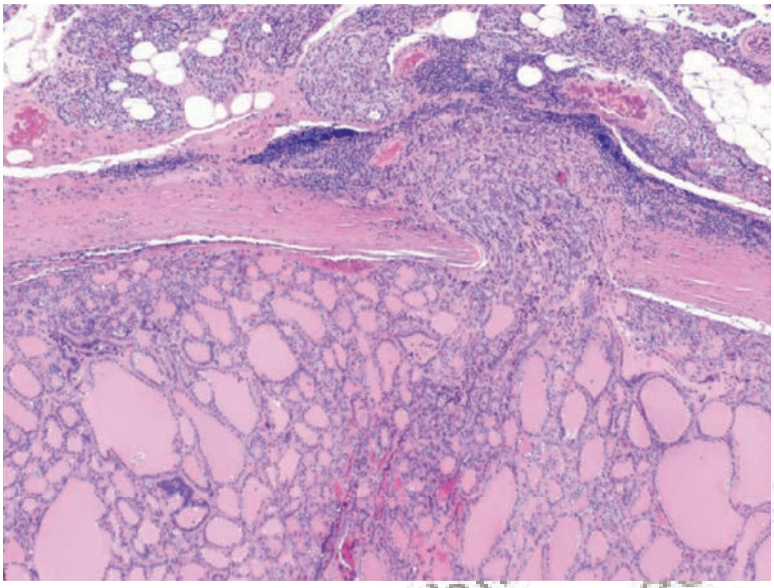
c) Follicular

d) Medullary

Question 6:

A 58-year-old man with a Thy3 lesion on FNAC was posted for hemithyroidectomy. Histopathology of the frozen section is given below. What is the next step of management?

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a) No further procedure is required

b) Perform a total thyroidectomy

c) Perform RAI ablation

d) Perform central neck dissection

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Question 7:

All of the following statements are true about follicular thyroid carcinoma except:

a) Thyroglobulin levels can be used to monitor patients for recurrence

b) Hematogenous spread is more common than lymphatic spread

c) Osteoblastic bone metastasis is seen

d) Mortality rate is twice that of papillary thyroid carcinoma

Question 8:

A patient with a unilateral thyroid mass was diagnosed to have follicular thyroid carcinoma with involvement of level VI cervical lymph nodes. What is the appropriate management?

a) Hemithyroidectomy with radioactive iodine ablation

b) Hemithyroidectomy with lateral neck dissection

c) Total thyroidectomy with modified radical neck dissection

d) Total thyroidectomy with central neck dissection

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Question 9:

A patient presented with a thyroid nodule. The USG showed an irregular hypoechoic mass with microcalcifications. Lymph nodes were not involved. FNAC showed a follicular neoplasm with predominantly Hurthle cells. Intra-op frozen section confirms capsular invasion. What is the most appropriate management?

a) Total thyroidectomy central neck dissection

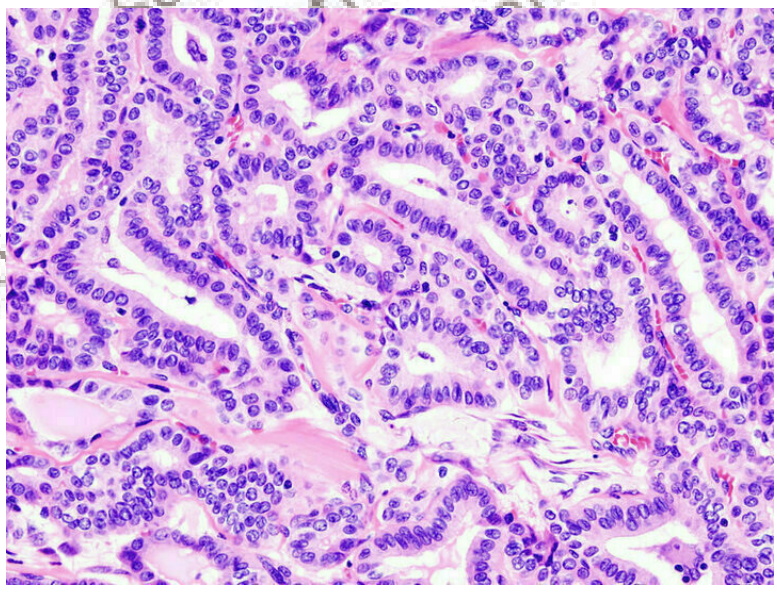
b) Total thyroidectomy

c) Hemithyroidectomy

d) Hemithyroidectomy with radioiodine ablation

Question 10:

A 32-year-old woman came to the surgeon with a thyroid swelling that had developed a year ago. On examination, the swelling was 3 cm in size, firm and immobile. Further, lymphadenopathy was present. A biopsy of the swelling is given below. Which of the following is incorrect regarding management and post-op care in this condition?



a) Calcium supplementation is given post-operatively

b) Prophylactic neck dissection is done

c) Thyroxine is withheld after the surgery

d) Hemithyroidectomy is performed

Question 11:

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Which of the following describes lateral aberrant thyroid?

a) Defective development of the fourth pharyngeal pouch

b) Metastatic thyroid cancer in lymph nodes

c) Hyperplastic growth of thyroid tissue

d) Cystic swelling of the thyroglossal duct

Question 12:

Which type of thyroid cancer has the best prognosis?

a) Medullary carcinoma

b) Follicular carcinoma

c) Papillary carcinoma

d) Hurthle cell carcinoma

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Question 13:

A 45-year-old man came to the surgery OPD with a midline neck swelling. He does not have any other complaints. The patient had received chemoradiation for Hodgkin's lymphoma nearly 20 years ago. On palpation, the mass is about 3 cm in size, non-tender, hard, fixed, and seems to arise from the right lobe of the thyroid. TSH levels were raised. A radioiodine uptake study showed cold nodule. What is the most likely diagnosis?

a) Anaplastic thyroid cancer

b) Thyroid lymphoma

c) Papillary thyroid cancer

d) Medullary thyroid cancer

Question 14:

A 45-year-old patient presents with diffuse enlargement of the thyroid gland. Laboratory studies reveal low T3, T4, high TSH and the presence of anti-TPO antibodies. FNAC from the gland shows enlarged cells with abundant eosinophilic cytoplasm. Which of the following malignancies is commonly associated with this condition?

a) Follicular carcinoma

b) Anaplastic carcinoma

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c) Thyroid lymphoma

d) Hurthle cell carcinoma

Question 15:

A 72-year-old woman has a history of papillary thyroid carcinoma left untreated for 2 years. She complains that the rapid enlargement in her neck swelling over the last month has made it difficult for her to swallow and talk. What is the most likely diagnosis?

a) Local invasion of the surrounding structures

b) Progression to Hurthle cell carcinoma

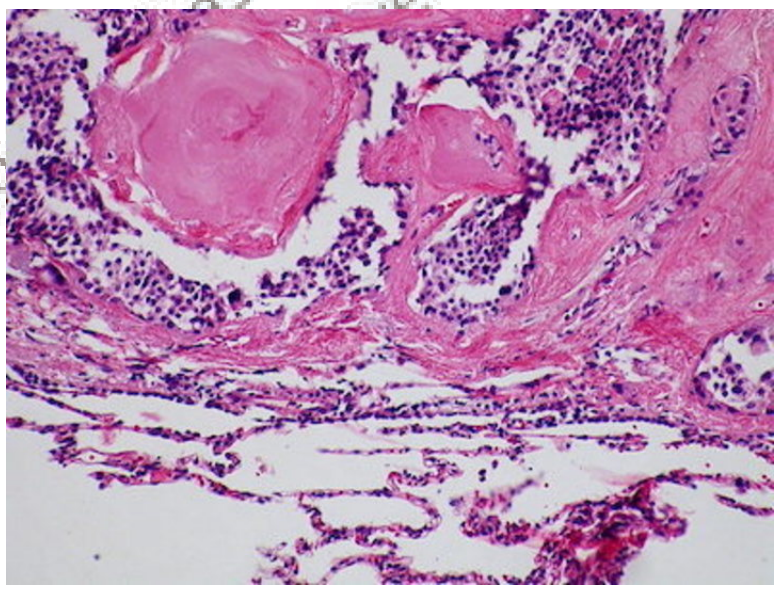
c) Conversion to follicular thyroid cancer

d) Anaplastic thyroid cancer

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Question 16:

A 34-year-old woman was brought in a dehydrated state and complains of loose stools. On examination, a tender neck swelling was found which was found to be present for 1 year. Histopathology of the swelling shows the following finding. What is the most likely diagnosis?



a) Medullary thyroid carcinoma

b) Systemic amyloidosis

c) Thyroid lymphoma

d) Papillary thyroid carcinoma

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Question 17:

Choose the substances secreted by medullary thyroid carcinoma:

a) 1,2

b) 2,3,4

c) 1,3,4,5

d) 1,2,3,5

Question 18:

A patient with medullary thyroid carcinoma is posted for surgery. He is nearly 6.5 ft tall, with a slender build and elongated digits. What is the screening test that should be done pre-operatively?

a) MRI-Brain

b) Serum calcium

c) Urinary catecholamines

d) IGF-1 assay

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Question 19:

A patient is diagnosed with medullary thyroid carcinoma. Which of the following could be used to screen the rest of her family?

a) Pentagastrin

b) Histaminadases

c) Prostaglandin E2 and F2 alpha

d) Serotonin

Question 20:

A 32-year-old female was diagnosed with medullary thyroid carcinoma. On USG paratracheal lymph node involvement was found. What is the best method of management of this patient?

a) Total thyroidectomy with central neck dissection

b) Total thyroidectomy with central neck dissection and RAI ablation

c) Total thyroidectomy with modified radical and central neck dissection

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d) Total thyroidectomy with lateral and central neck dissection

Question 21:

Prophylactic thyroidectomy is indicated in patients with which of the following features:

a) Long standing thyroglossal cyst

b) Marfanoid habitus, multiple neuromas on the lip and familial pheochromocytoma,

c) Dense lymphatic infiltration of the thyroid detected on FNAC

d) Upregulation of BRAF

Question 22:

What is the most common site of distant metastasis in patients with medullary thyroid carcinoma?

a) Liver

b) Bone

c) Lung

d) Adrenal

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Question 23:

Which of the following statements is false about the 8th edition AJCC staging of thyroid neoplasms?

a) In DTC, distant metastasis is IVB

b) In staging, age barrier is 55 years

c) T3a includes minor extrathyroidal extension

d) N1a includes level VI and VII

Question 24:

Which of the following will not be a treatment option for a pregnant patient with papillary thyroid carcinoma?

a) Total Thyroidectomy

b) Total Thyroidectomy plus Lymph node dissection

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c) Radioiodine ablation of thyroid

d) Right Hemithyroidectomy

Question 25:

A patient with papillary thyroid carcinoma underwent total thyroidectomy with central neck dissection, a month ago. At present, a whole-body iodine scan is positive. What is the next step in management?

a) Re-exploration of thyroid gland

b) Radio-iodine ablation

c) USG-neck

d) Bi-annual follow-up

Question 26:

A whole-body iodine scan is not useful in patients with which thyroid malignancy?

a) Papillary thyroid cancer

b) Anaplastic thyroid cancer

c) Medullary thyroid cancer

d) Follicular thyroid cancer

Question 27:

Which of the following scales consider the completeness of surgical resection to determine the prognosis of a patient with thyroid cancer?

a) AMES

b) AGES

c) MACIS

d) TNM

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Answer Key

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Question No.	Correct Option
1	c
2	a
3	c
4	d
5	c
6	b
7	c
8	d
9	a
10	d
11	b
12	c
13	c
14	c
15	d
16	a
17	d
18	c
19	a
20	c
21	b
22	a
23	c
24	c
25	b
26	c
27	c

Detailed Explanations

Solution to Question 1:

Assessing the biochemical function of the thyroid i.e. thyroid function test (TFT) is the first investigation done in any thyroid condition.

Assessment of TSH, T3, and T4 is done. However, TSH is most helpful in determining the management plan, especially in patients with thyroid nodules who clinically appear to be

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euthyroid.

Modalities for evaluation of thyroid swelling include:

- Laboratory evaluation
- TSH
- T3
- T4
- Thyroid imaging
- Ultrasound
- Radioisotope scanning
- CT/MRI
- Biopsy techniques
- Fine needle aspiration biopsy (FNAB)
- Tru-cut/core-needle biopsy

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Solution to Question 2:

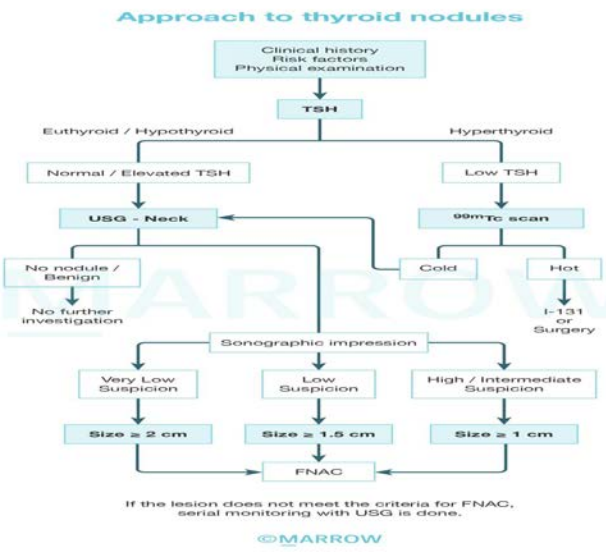
Fine needle aspiration (FNA) biopsy needs to be performed for further evaluation of the nodule.

In cases where the FNAC is inconclusive, tru-cut or open biopsy can be done. However, this is rarely required.

FNAC reporting systems are given as:

Royal College of Pathologists, UK classification	Bethesda Criteria	Description	Usual Management
Thy 1Thy 1c	I	Nondiagnostic or unsatisfactory	Repeat FNA with image guidance
Thy 2	II	Benign	Clinical follow-up
Thy 3	III	Atypia of undetermined significance/follicular lesion of undetermined significance	Repeat FNA or lobectomy
IV	Follicular neoplasm or suspicious for follicular neoplasm	Lobectomy	
Thy 4	V	Suspicious for malignancy	Lobectomy or total thyroidectomy
Thy 5	VI	Malignant	Total thyroidectomy

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Solution to Question 3:

FNAC is not useful in the diagnosis of follicular carcinoma of thyroid as it cannot differentiate between benign and malignant follicular lesion. Trucut biopsy is used to differentiate between them as follicular thyroid malignancy is defined by capsular and vascular invasion.

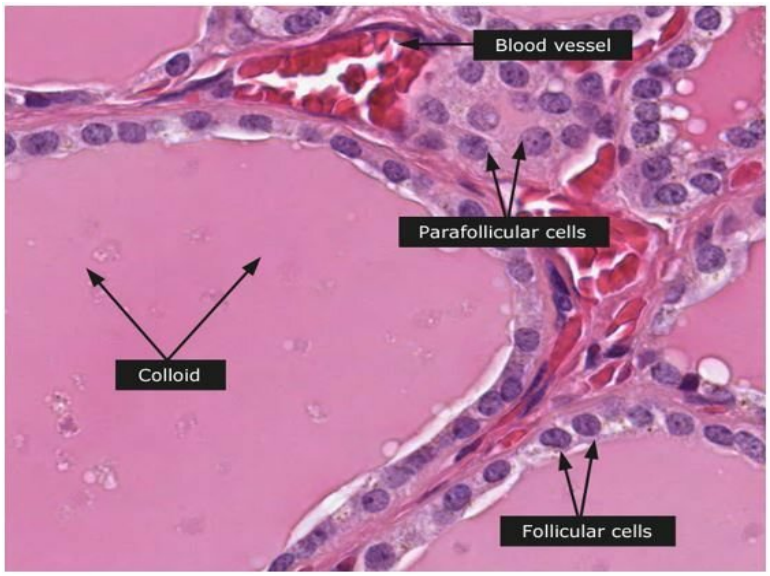
Limitations of FNAC in thyroid disorders:

- Cannot distinguish between follicular carcinoma and adenoma
- Cannot distinguish between Hurthle cell carcinoma and adenoma
- Not useful in Reidel's thyroiditis

Solution to Question 4:

The cell marked in the image is a follicular cell of the thyroid gland. Papillary, follicular, and anaplastic thyroid carcinoma are all cancers of the follicular epithelium of the thyroid. Hurthle cell carcinoma is a variant of follicular thyroid carcinoma.

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Classification of thyroid neoplasms:

- Benign - Follicular adenoma
- Malignant

	Origin	Type
Primary	Follicular epitheliu m	DifferentiatedPapillaryFollicu lar
Poorly-differentiatedAnaplast ic		
Parafollicular cells	Medullary	
Lymphoid cells	Lymphoma	
Secondary	Metastatic	
Local infiltration		

Solution to Question 5:

Follicular thyroid carcinoma is the most common thyroid malignancy in iodine-deficient areas.

Papillary thyroid carcinoma is the most common thyroid malignancy in iodine-sufficient areas, children, and radiation-exposed areas.

Solution to Question 6:

Capsular invasion as seen in the image confirms the presence of follicular carcinoma. Hence, total thyroidectomy is the recommended management.

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As FNAC shows Thy3 lesion which is a follicular neoplasm, the frozen section of the excised specimen has to be evaluated. The presence of capsular or vascular invasion confirms the presence of follicular carcinoma.

Surgical management of differentiated thyroid cancers (DTCs) is as follows:

Extent of cancer	Surgery done
Low-risk DTC(Fulfilling all 5 of the following conditions)< 40 years (better prognosis)Unifocal lesionSize < 2 cmNo lymphovascular invasionNo capsular invasion	Hemithyroidectomy
High-risk DTC without LN involvement(not fulfilling any of the above 5 conditions)	Total thyroidectomy
High-risk DTC + level VI LN involved	Total thyroidectomy + Central neck dissection
High-risk DTC + other cervical LNs involved	Total thyroidectomy + Modified radical neck dissection

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Solution to Question 7:

Osteolytic bone metastasis is seen in follicular thyroid carcinoma and not osteoblastic lesions.

Thyroglobulin trends may be used to monitor patients with differentiated thyroid cancer for a recurrence. Following total thyroidectomy, thyroglobulin levels must be undetectable.

All thyroid carcinoma, except medullary thyroid carcinoma, have osteolytic bony metastasis. Medullary thyroid cancer has osteoblastic bony metastasis.

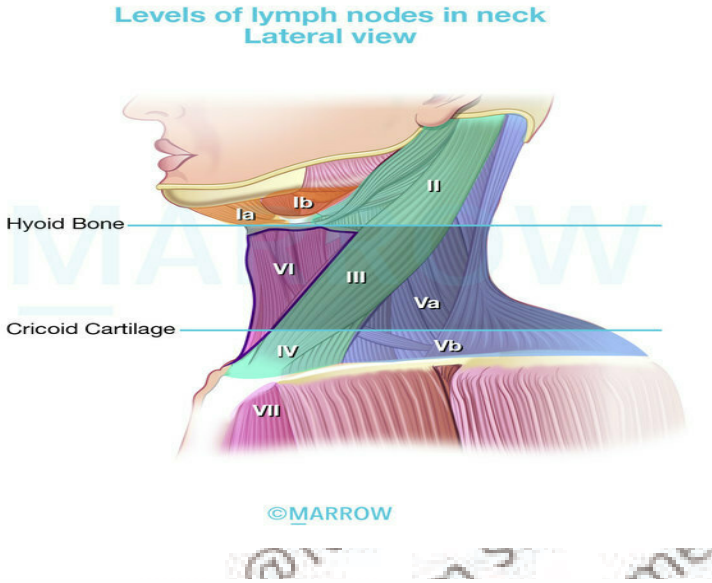
Differentiated thyroid carcinomas (papillary & follicular):

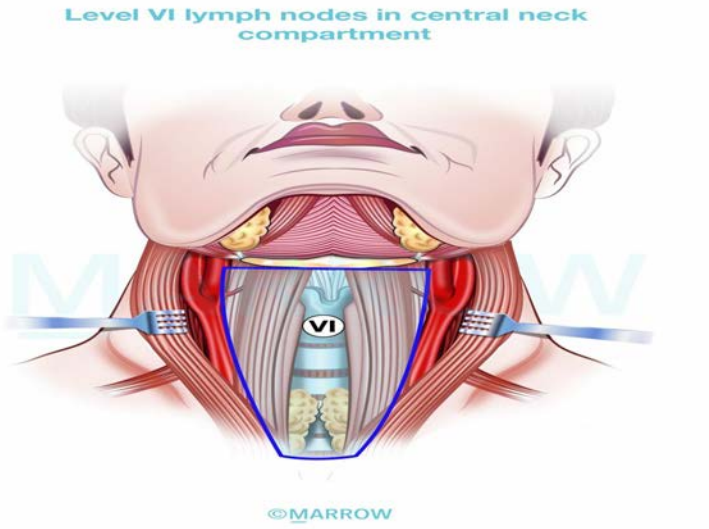
	Papillary carcinoma	Follicular carcinoma
Incidence	Most common	2nd most common
Past history	Radiation exposure	Long-standing goitre
Risk factor	Iodine-sufficientareas	Iodine-deficientareas
Metastatic spread via	Lymphatics> Hematogenous	Hematogenous> Lymphatics
Diagnosis by FNAC	Useful	Not useful
Prognosis	More favourable	Less favourable

Solution to Question 8:

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Patients with follicular thyroid carcinoma with level VI lymph node involvement are managed by total thyroidectomy with central neck dissection.





Surgical management of differentiated thyroid cancers (DTCs) is as follows:

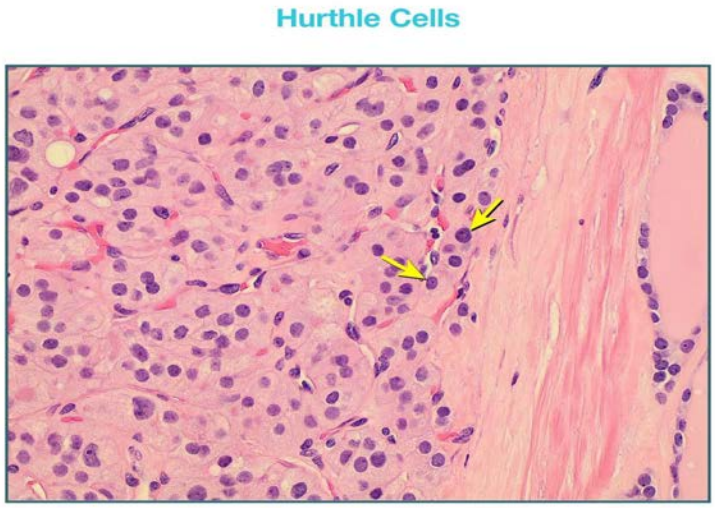
Extent of cancer	Surgery done
Low-risk DTC(Fulfilling all 5 of the following conditions)< 40 years (better prognosis)Unifocal lesionSize < 2 cmNo lymphovascular invasionNo capsular invasion	Hemithyroidectomy
High- risk DTC without LN involvement(not fulfilling all of the above 5 conditions)	Total thyroidectomy

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Extent of cancer	Surgery done
High-risk DTC + level VI LN involved	Total thyroidectomy + Central neck dissection
High-risk DTC + other LNs involved	Total thyroidectomy + Modified radical neck dissection

Solution to Question 9:

The given clinical scenario is suggestive of Hurthle cell follicular carcinoma. The most appropriate management is total thyroidectomy with prophylactic central neck dissection. Hurthle cell carcinoma is a variant of follicular thyroid carcinoma.



As compared to follicular thyroid cancer, it has a poorer prognosis as it is more likely to metastasize. It is often bilateral and multifocal. The histological picture consists of predominantly oxyphil (Hurthle, Askanazy) cells containing abundant mitochondria. It cannot be diagnosed solely by FNAC as these cancers are characterized by vascular & capsular invasion.

Surgical management of Hurthle cell carcinoma:

Extent of cancer	Surgery done
Unilateral Hurthle cell adenoma	Hemithyroidectomy
Bilateral involvement without level VI LNs involvement	Total thyroidectomy +Central neck dissection (prophylactic)
Hurthle cell carcinoma with level VI LNs involved	Total thyroidectomy + Central neck dissection (therapeutic)
Hurthle cell carcinoma with other LNs involved	Total thyroidectomy + Modified radical neck dissection

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Solution to Question 10:

The given histological image depicts papillary formation with a fibrovascular stalk, characteristic orphan annie eye nuclei and psammoma bodies, diagnostic of papillary carcinoma of the thyroid.

Total thyroidectomy with central neck dissection would be the appropriate management in this condition, because there is lymphadenopathy, although the tumour size is less than 4 cm.

Surgical management of differentiated thyroid cancers (DTCs) is as follows:

The other options:

Option 1: Post thyroidectomy, calcium supplementation is given to all patients to prevent hypocalcemia.

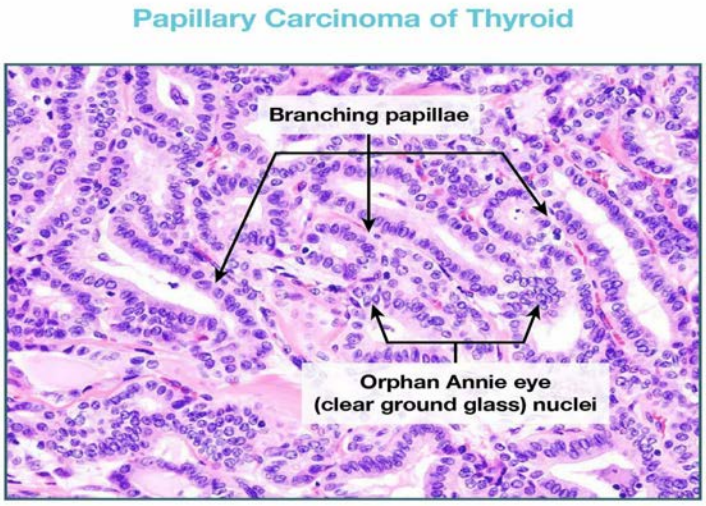
Option 2: Prophylactic neck dissection is done for papillary carcinoma thyroid

Option 3: Thyroid hormone replacement is not given to patients who are to receive radioactive iodine therapy within 2 to 3 weeks of surgery. The absence of thyroid hormones raises the TSH, which stimulates the radioactive iodine uptake.

Extent of cancer	Surgery done
Low-risk DTC(Fulfilling all 5 of the following conditions)< 40 years (better prognosis)Unifocal lesionSize ~ 1-4 cmNo lymphovascular invasionNo capsular invasion	Hemithyroidectomy
High-risk DTC without LN involvement /not fulfilling any of the above 5 conditions	Total thyroidectomy
High-risk DTC + level VI LN involved	Total thyroidectomy + Central neck dissection
High-risk DTC + other LNs involved	Total thyroidectomy + Modified radical neck dissection

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Solution to Question 11:

Lateral aberrant thyroid almost always represents metastatic thyroid cancer in lymph nodes.

Thyroid tissue situated lateral to the carotid sheath and jugular vein found along the course of the thyroglossal duct was previously termed lateral aberrant thyroid. It is associated with papillary thyroid cancer in the ipsilateral thyroid lobe.

The image given below shows the lateral aberrant thyroid.



Solution to Question 12:

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Patients with papillary thyroid carcinoma have an excellent prognosis with a >95% 10-year survival rate.

Solution to Question 13:

The history of radiation therapy to the head and neck for Hodkin's lymphoma and a cold nodule on radioiodine uptake scan are suggestive of papillary thyroid cancer.

Radiation exposure is an identifiable aetiological factor in the development of differentiated thyroid cancer (follicular and papillary thyroid cancer). The most important factor, however, is irradiation of the thyroid before 5 years of age.

Thyroid lymphomas are non-Hodgkin's B-cell lymphomas. They present with B-symptoms like fever, night sweats, and weight loss in addition to neck swelling. Thus, thyroid lymphoma is an unlikely diagnosis. Thyroid lymphomas often develop in the setting of lymphocytic infiltration.

Solution to Question 14:

The clinical case scenario is suggestive of Hashimoto's thyroiditis. Thyroid lymphoma or malignant lymphoma is associated with long-standing Hashimoto's thyroiditis.

Thyroid lymphomas are usually non-Hodgkin's lymphomas, often associated with long-standing Hashimoto's thyroiditis (autoimmune lymphocytic thyroiditis).

The clinical features include: B - symptoms i.e. fever, night sweats, and weight loss

As FNAC cannot characterize lymphoma, Tru-Cut biopsy is preferred. Chemotherapy and radiation therapy are often sufficient. Total thyroidectomy is indicated only in residual/recurrent disease.

A chemotherapy regimen (RCHOP) is the first line of management.

R - Rituximab

C - Cyclophosphamide

H - Hydroxydaunorubicin (Adriamycin)

O - Oncovin (Vincristine)

P - Prednisolone

Solution to Question 15:

An elderly woman with rapidly enlarging neck mass and dysphagia in the setting of an untreated papillary carcinoma suggests a diagnosis of anaplastic thyroid cancer.

Anaplastic thyroid cancer, a poorly differentiated thyroid carcinoma, is the most aggressive cancer and has the worst prognosis of all thyroid malignancies.

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It usually occurs in elderly females. The typical manifestation is an with rapidly enlarging neck mass, dysphagia, and cervical tenderness. Patients usually have a history of untreated differentiated thyroid carcinoma (DTC). Local invasion to the recurrent laryngeal nerve (RLN) causes hoarseness. It may also cause tracheal obstruction. Distant metastasis is more common in the lungs via the hematogenous route.

Diagnosis is made by FNAC. However, trucut/open biopsy is frequently used to confirm the diagnosis in cases of doubt.

Management:

• If metastasis is absent: Total thyroidectomy + LN dissection

• If metastasis is present: Palliative care with chemotherapy and radiotherapy

• If tracheal obstruction: Isthmectomy to relieve obstruction

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Solution to Question 16:

The given clinical scenario is suggestive of medullary thyroid carcinoma (MTC). Histopathology shows the presence of amyloid deposits that are derived from the altered calcitonin molecules.

Medullary thyroid carcinoma is a tumor of parafollicular or C cells of the thyroid gland. They are derived from the neural crest cells of the ultimobranchial bodies.

Most of the MTCs occur sporadically. However, around a quarter of the cancers are associated with familial MTC, MEN2A, and MEN2B.

Patients with sporadic MTC present at an older age, whereas patients with familial MTC usually present at a younger age. Features of MTC include:

• Painful neck mass with cervical lymphadenopathy

• Dysphagia, dysphonia or dyspnea if locally invaded

• Diarrhoea due to increased intestinal motility by serotonin

• Cushingoid habitus due to ectopic ACTH production

• Metastasis is blood-borne

• Microscopically, they consist of sheets of neoplastic cells separated by collagen and amyloid stroma

It is diagnosed by careful family history, physical examination, raised calcitonin, CEA levels, and fine-needle aspiration biopsy of the mass.

Total thyroidectomy with central neck node dissection is the treatment of choice in MTC patients. External beam radiotherapy can be used in patients with unresectable tumors. Targeted therapy can be considered using vandetanib, sorafenib, sunitinib, and cabozantinib.

Prophylactic total thyroidectomy should be considered within 5years of age in MEN2A mutation and within 1year of age in MEN2B mutation.

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Solution to Question 17:

Medullary thyroid tumors secrete calcitonin, serotonin, histaminadases, and CEA (carcinoembryonic antigen).

Solution to Question 18:

This patient with medullary thyroid carcinoma and features of marfanoid habitus (very tall patient with long, slender fingers and toes) is suggestive of MEN 2B syndrome. Such patients are to be screened for pheochromocytoma by measuring urinary catecholamines.

Pheochromocytoma, if present, should be treated first, and then MTC is to be treated next.

A thyroid swelling with elevated calcitonin indicates a medullary thyroid carcinoma (MTC). MTC can either be sporadic (80%) or familial (RET gene mutation). In case of familial medullary thyroid carcinoma, stimulation with pentagastrin increases the release of calcitonin. This can be used for the screening of medullary thyroid carcinoma.

MTC can be inherited as a part of autosomal dominant (AD) syndromes such as:

- Familial MTC
- MEN 2A
- MEN 2B

Prophylactic total thyroidectomy should be considered within 5years of age in MEN2A mutation and within 1year of age in MEN2B mutation.

Note: Serum calcium is measured to screen for parathyroid adenoma in MEN 2A.

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Solution to Question 19:

Screening of patients with familial MTC was historically done using pentagastrin stimulation test for calcitonin levels to make the diagnosis.

Pentagastrin is a synthetic gastrin analogue. It acts on the CCK-B/gastrin receptor of the C cells and increases the basal rate of calcitonin secretion.

Basal calcitonin level = total C cell mass x rate of secretion.

Medullary thyroid tumors secrete calcitonin and carcinoembryonic antigen (CEA), but also other peptides such as calcitonin gene-related peptide, histaminadases, prostaglandins E2 and F2α, and serotonin.

Another test that can be used for screening is calcium-stimulated calcitonin levels.

Solution to Question 20:

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Medullary thyroid carcinoma (MTC) with Level VI or paratracheal lymph node involvement is managed with total thyroidectomy with central neck dissection and modified radical neck dissection.

Surgical management of MTC is as follows:

Note: Prophylactic neck dissection is not routinely performed in papillary or follicular carcinoma.

Extent of cancer	Surgery done
MTC without LN involvement	Total thyroidectomy + Central neck dissection (prophylactic)
MTC + level VI LN involved	Total thyroidectomy + Central neck dissection (therapeutic) + Modified radical neck dissection (prophylactic)
MTC + other LNs involved	Total thyroidectomy + Central neck dissection + Modified radical neck dissection (therapeutic)

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Solution to Question 21:

Prophylactic thyroidectomy is indicated in MEN 2B syndrome as they can develop medullary thyroid carcinoma. This syndrome manifests as:

- Pheochromocytoma
- Marfanoid habitus
- Mucosal neuromas
- Medullary thyroid cancer.

Medullary thyroid carcinoma (MTC) can be inherited as familial MTC, MEN 2A or MEN 2B syndromes. These conditions are autosomal dominant and occur due to RET proto-oncogene mutation. As almost all cases of MEN 2B develop medullary thyroid cancer, a prophylactic thyroidectomy may be performed even during infancy.

Option A: The most common malignancy in thyroglossal cysts is papillary thyroid carcinoma. In such a case, Sistrunk operation with total thyroidectomy is considered.

Option C: Hashimoto's thyroiditis shows dense lymphatic infiltration of the thyroid detected on FNAC which is treated with thyroxine. However, total thyroidectomy is performed in malignant transformation to thyroid lymphoma.

Option D: Upregulation of BRAF is associated with papillary thyroid carcinoma.

Solution to Question 22:

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Liver metastasis is more common in medullary thyroid carcinoma.

Type of thyroid cancer	Most common distant site
Papillary	Lungs
Follicular	Bones
Medullary	Liver
Anaplastic	Lungs

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Solution to Question 23:

Minor extrathyroidal extension detected only on histological examination is removed from the definition of T3 disease and therefore has no impact on either T category or overall stage.

Differentiated Thyroid Cancer:

• The age cutoff used for staging is increased from 45 to 55 years of age at diagnosis.

• N1 disease no longer upstages a patient to stage III. If < 55 years of age at diagnosis, N1 disease is stage I. If ° 55 years of age, N1 disease is stage II.

• T3a is a new category for tumors > 4 cm confined to the thyroid gland

• T3b is a new category for tumors of any size demonstrating gross extrathyroidal extension into strap muscles (sternohyoid, sternothyroid, thyrohyoid or omohyoid muscles)

• Level VII lymph nodes, previously classified as lateral neck lymph nodes (N1b) is re-classified as central neck lymph nodes (N1a) to be more anatomically consistent and because level VII presented significant coding difficulties for tumor registrars, clinicians and researchers.

• In differentiated thyroid cancer, the presence of distant metastases (M1) in older patients is classified as IVB disease rather than IVC disease. Distant metastasis in anaplastic thyroid cancer continues to be classified as IVC disease.

Minimal or occult/microcarcinoma are tumors 1 cm or less in size. They have no evidence of local invasiveness through the thyroid capsule or angioinvasion. Occult malignancies are usually not associated with lymph node metastases. However, about 25% of patients with these tumors have associated occult lymph node metastases. These are nonpalpable and are found incidentally at operative and histologic examinations or at autopsy.

Anaplastic :

• Unlike previous editions where all anaplastic thyroid cancers were classified as T4 disease, anaplastic cancers now use the same T definitions as differentiated thyroid cancer.

• Intrathyroidal disease (T1-3a) is stage IVA

• Gross extrathyroidal extension(T3b,T4) or cervical lymph node metastases (N1) is stage IVB

• Distant metastases (M1) are stage IVC

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TNM staging	7th AJCC (2010)	8th AJCC (2018)
Primary tumor(pT)		
TX	Cannot be assessed	-do-
T0	No evidence of cancer	-do-
T1	Tumour ≤ 2 cm, intrathyroid alT1a: ≤1 cm, intrathyroidalT 1b:1-2 cm, intrathyroidal	-do-
T2	2-4 cm, intrathyroidal	-do-
T3	>4 cm limited to the thyroid or any size with minimal extr athyroidal extension (muscle, soft tissue)	T3a:Tumor>4 cm limited to t he thyroidT3b: Gross extrath yroidal extensioninvading onl ystrap muscles(sternohyoid, s ternothyroid, thyrohyoid or o mohyoid muscles) from a tu mour of any size
T4	T4a Invades subcutaneous tis sue, larynx, trachea, esophag us, or RLNT4b Invades preve rtebral fascia or encases caro tid or mediastinal vessels	-do-
Regional lymph nodes (p N)		
NX	Regional lymph nodes cannot be assessed	-do-
N0	No lymph node metastasis	-do-
N1a	Positive in level VI; unilateral or bilateral disease	Metastasis to level VI or VII; unilateral or bilateral disease
N1b	Metastasis to unilateral, bilat eral or contralateral lateral n eck lymph nodes (levels I, II, III, IV or V) or retropharynge al lymph nodes	-do-
Distant metastasis (pM)		
M0	No Distant metastasis	-do-
M1	Distant metastasis present	-do-

TNM CLASSIFICATION of T hyroid tumours		
PAPILLARY OR FOLLICULA R TUMORS		
Stage	TNM AJCC 7thedition	TNM AJCC 8thedition
	<45 y	<55 y
I	Any T, any N, M0	-do-
II	Any T, any N, M1	-do-

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TNM CLASSIFICATION of T hyroid tumours		
	° 45 y	>55 y
I	T1, No, Mo	T1-2, No, Mo
II	T2, No, Mo	T1-2,N1, MoT3,any N, Mo
III	T3, No, MoT1–3, N1a, Mo	T4a, any N, Mo
IV A	T4a, No-1a, MoT1-4a, N1b, Mo	T4b, any N, Mo
IV B	T4b, any N, Mo	any T, any N, M1
IV C	Any T, any N, M1	- deleted-
MEDULLARY THYROID CA NCER		
Stage	TNM AJCC 7thedition	TNM AJCC 8thedition
I	T1, No, Mo	-do-
II	T2–3, No, Mo	-do-
III	T1–3, N1a, Mo	-do-
IV A	T4a, any N, Mo;T1-3, N1b, Mo	-do-
IV B	T4b, any N, Mo	-do-
IV C	Any T, any N, M1	-do-

ANAPLASTIC C ANCER		
Stage	TNM AJCC 7thedi tion	TNM AJCC 8thedition
IV A	T4a, Any N, Mo	T1-3a, No,Mo
IV B	T4b, Any N, Mo	T1-3a,N1, Mo;T3b, Any N, M o;T4, Any N, Mo
IV C	Any T, Any N, M1	-do-

Solution to Question 24:

Radioiodine ablation of thyroid is contraindicated in pregnant women due to risk of radiation exposure to the fetus.

Therapeutic uses for radioactive iodine

• In primary thyrotoxicosis after 45 years.

• In autonomous toxic nodule after 45 years, it is useful as remaining gland still will function adequately after radiotherapy.

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• In follicular carcinoma of thyroid, after total thyroidectomy, if there are secondaries elsewhere in the body, as in bones or lungs, then I131 is given.

Solution to Question 25:

Radio-iodine ablation is undertaken when a whole-body iodine scan is positive after a total thyroidectomy for any differentiated thyroid cancer (papillary or follicular carcinoma).

The presence of any metastatic or residual thyroid tissue after total thyroidectomy can be detected by observing the uptake of radio-iodine in the entire body. To achieve effective uptake of radio-iodine, TSH levels need to be greatly increased, for example, by withdrawing thyroxine after the surgery for 4-6 weeks.

A positive whole-body iodine scan after total thyroidectomy indicates that there is either a metastatic or residual disease present. These patients are treated with I131 for radio-iodine ablation.

A negative scan means there is no metastasis or residual thyroid tissue. They are followed up regularly with serum thyroglobulin, TSH and USG-neck.

If the tumour is resistant to radioiodine ablation, EBRT (external beam radiotherapy) is done.

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Solution to Question 26:

After a total thyroidectomy, a whole-body iodine scan is not useful for detecting residual thyroid tissue or metastasis in medullary thyroid carcinoma.

Medullary thyroid carcinoma is a tumour of parafollicular or C cells. These cells which are derived from neural crest cells, do not take up iodine.

A whole-body iodine scan is useful in thyroid tumours derived from follicular cells that take up iodine.

Solution to Question 27:

MACIS scale includes completeness of the original surgical resection to determine the prognosis of the thyroid cancer.

Prognostic indicators of well differentiated thyroid cancers:

• AGES system - Age, histologic Grade, Extrathyroidal invasion, and metastases and tumor Size.

• AMES system - Age (men <40 years old, women <50 years old), Metastases, Extrathyroidal spread, and Size of tumors (< or >5 cm).

• DAMES - DNA aneuploidy + AMES

• GAMES - Grade + AMES

• TNM staging - Tumor, Nodal status, Metastases.

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• MACIS scale (postop modification) - distant Metastases, Age at presentation (<40 or >40 years old), Completeness of original surgical resection, extrathyroidal Invasion, and Size of original lesion (in centimeters).

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The Parathyroids

Question 1:

While performing a subtotal thyroidectomy, accidental ligation of which artery can potentially lead to hypoparathyroidism?

a) Superior thyroid artery

b) Inferior thyroid artery

c) Ascending cervical artery

d) Ascending pharyngeal artery

Question 2:

Identify the correct pair based on their embryological development.

a) Thymus, Inferior parathyroid gland - Third pharyngeal pouch

b) Thymus, Superior parathyroid gland - Fourth pharyngeal pouch

c) Superior and Inferior parathyroid gland - Third pharyngeal arch

d) Thymus, Superior parathyroid gland - Fourth pharyngeal arch

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Question 3:

Which of the following is the most common site of ectopic parathyroid gland?

a) Mediastinal

b) Intrathyroidal

c) Intrathymic

d) Paraesophageal

Question 4:

What is the most common cause of hypercalcemia in hospitalized patients?

a) Hypervitaminosis D

b) Malignancy

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c) Parathyroid adenoma

d) Parathyroid hyperplasia

Question 5:

What is the most common cause of primary hyperparathyroidism?

a) Single adenoma

b) Multiple adenoma

c) Hyperplasia

d) Carcinoma

Question 6:

Lab investigations in a patient with fatigue and colicky abdominal pains show elevated PTH and calcium, and low serum phosphate. Which of the following ophthalmic findings is pathognomonic of this condition?

a) Kayser Fleischer rings

b) Band keratopathy

c) Ocular chrysiasis

d) Hudson-Stahli line

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Question 7:

During a clinical trial, it was found that some individuals who showed radioactive uptake on Sestamibi scan, showed no other evidence of hyperparathyroidism. They were instead found to be suffering from a Hurthle cell nodule of the thyroid gland. Which of the following radioactive tracer tests could be used to rule out the false positives?

a) Ga-68 Dotatate

b) Iodine-131 MIBG

c) Tc-99m Pertechnetate

d) Tc-99m Medronate

Question 8:

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A patient presents with polyuria, polydipsia, lethargy and abdominal pain. He had an X-ray taken a few days ago, which is given below. Which of the following investigations would not be useful in arriving at a diagnosis?



a) Nuclear sestamibi scan

b) Ultrasonography of neck

c) Dual-energy radiographic absorptiometry

d) Angiography of renal arteries

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Question 9:

In a patient with asymptomatic primary hyperparathyroidism, when will you perform parathyroidectomy?

a) If bone mineral density of > 2.5 SD above peak bone mass

b) If age >50 years

c) In the presence of hypercalciuria but absence of nephrolithiasis

d) If creatinine clearance is reduced by 30%

Question 10:

A 55-year-old lady with a history of multiple pathological fractures and renal stones was diagnosed with parathyroid hyperplasia involving all four glands. Which of the following treatment modalities will you use to treat her?

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a) Complete removal of all four glands alone

b) Complete removal of three glands with a partial resection of the least affected gland

c) Partial resection of the affected glands with autotransplantation of the least affected gland

d) Brachytherapy with PTH supplementation

Question 11:

Autotransplantation was done after total parathyroidectomy in a patient with hyperplasia of all 4 parathyroid glands. Which of the following best describes this procedure?

a) Heterotopic

b) Orthotopic

c) Auxiliary

d) Isograft

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Question 12:

Parathyroid gland post surgery is commonly transferred to:

a) Triceps

b) Biceps

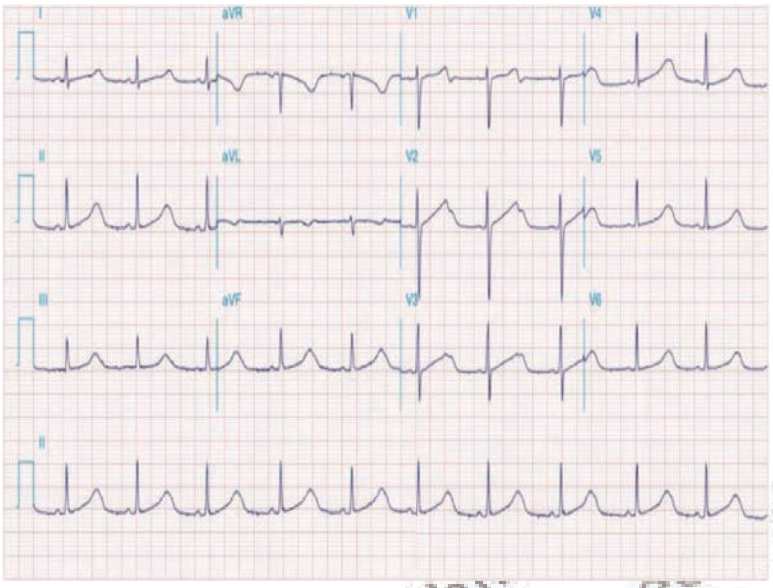
c) Sartorius

d) Brachioradialis

Question 13:

A 40-year-old woman presents with complaints of numbness around the lips and a tingling sensation in her fingers. She underwent parathyroidectomy for hyperparathyroidism one year ago. An ECG was done and is given below. What will be your immediate management?

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a) Beta blockers

b) Teriparatide

c) IV Bisphosphonates

d) IV Calcium gluconate

Question 14:

Which of the following statements is false about secondary hyperparathyroidism?

a) Lithium intake may cause secondary hyperparathyroidism

b) Calciphylaxis is seen in early stages

c) Multiple gland affliction is common

d) Transcervical thymectomy is indicated

Question 15:

A 45-year-old patient with chronic renal failure presents to the OPD with complaints of recent onset pain in her feet. Blood investigation showed elevated PTH levels and normal serum calcium values. All of the following mechanisms contribute to elevated PTH in this patient except _____

a) Stimulation of parathyroid cells by hyperphosphatemia

b) Increased secretion of FGF-23 by osteocytes

c) Reduced expression of Vitamin D receptors and CaSR (calcium-sensing receptor) in bones

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d) Interference with parathyroid kinase C signal transduction pathway and Wnt pathway

Question 16:

A 32-year-old female patient is undergoing focussed parathyroidectomy for parathyroid adenoma. According to the Miami criteria, for the resection to be considered adequate, the intraoperative drop in parathyroid hormone should be _____.

a) More than one third the maximum preoperative value in 10min

b) More than one third the maximum preoperative value in half an 30 min

c) More than half the maximum preoperative value in 10min

d) More than half the maximum preoperative value in 30 min

Question 17:

A 30-year-old woman presented with complaints of fatigue, vomiting, abdominal cramps and bone pain. She had undergone total parathyroidectomy and heterotopic autotransplantation for the same complaints 8 months ago. Sestamibi scan was done and found to be normal. What is the next step in management?

a) Perform Casanova test

b) Post her for bilateral neck exploration

c) Post her for radiotherapy

d) Label her as persistent hyperparathyroidism and start her on medical management

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Question 18:

All of the following are indications for surgical intervention of tertiary hyperparathyroidism except ____

a) Reduced serum phosphate

b) Nephrocalcinosis

c) Nodular hyperplasia of the parathyroid gland

d) Impaired graft function

Question 19:

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A 75-year-old lady with type 2 diabetes mellitus, hypertension, and end-stage renal disease on hemodialysis presents with hypercalcemia, hyperphosphatemia, and elevated PTH. What is the treatment of choice in this condition?

a) Total parathyroidectomy without autotransplantation

b) Subtotal parathyroidectomy

c) Minimally invasive focussed parathyroidectomy

d) Medical management with cinacalcet

Question 20:

A 41-year-old man with a history of treatment for Hodgkin's lymphoma in childhood presents with severe abdominal cramps and right flank pain. He has a firm 2x2cm mass in the front of his neck. He has a Calcium of 15.2 mg/dl, normal TSH, markedly elevated PTH, and PGP9.5+ on immunohistochemistry. What is the leading cause of mortality in his condition?

a) Metastasis

b) Cardiovascular disease

c) Tracheal compression

d) Hypercalcemia

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Question 21:

In patients with parathyroid carcinoma, which of the following treatment modalities would you not consider?

a) Radiation therapy

b) Azidothymidine

c) En-bloc excision of the tumor and ipsilateral thyroid lobe with MRND

d) Etelcalcetide

Question 22:

A 34-year-old man presents with severe hypercalcemia. His father had similar complaints and was found to have hyperparathyroid-jaw tumour syndrome. Which of the following is pathognomonic of his condition?

a) Cystic mandibular lesions

b) Ossifying jaw fibromas

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c) Osteitis fibrosa cystica

d) Mandibular granulomas

Answer Key

Question No.	Correct Option
1	b
2	a
3	d
4	b
5	a
6	b
7	c
8	d
9	d
10	b
11	a
12	d
13	d
14	b
15	d
16	c
17	a
18	a
19	b
20	d
21	d
22	b

Detailed Explanations

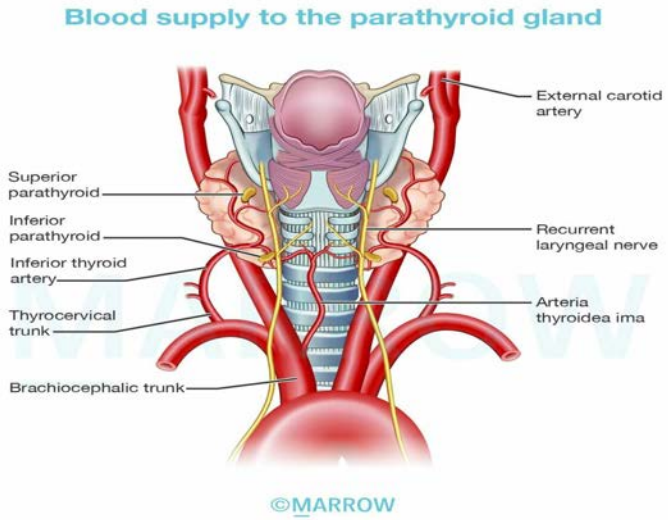
Solution to Question 1:

Truncal ligation of the inferior thyroid artery can potentially result in hypoparathyroidism. Both superior and inferior parathyroid glands receive their blood from the

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inferior thyroid artery which arises from the subclavian arteries.Hence during thyroidectomy, only capsular branches closer to the thyroid gland should be ligated.

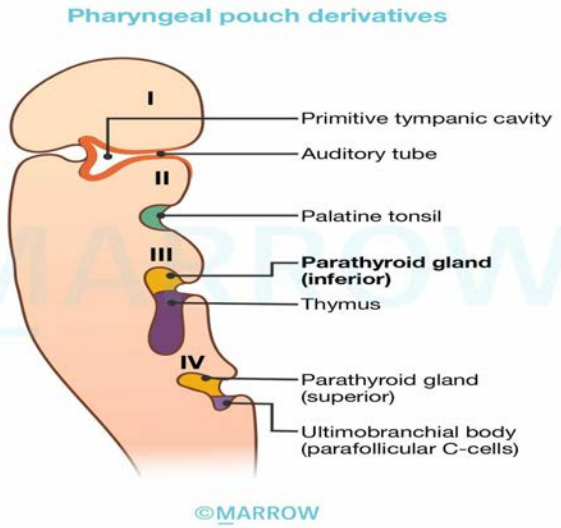
The inferior parathyroid glands may have a variable blood supply, from either the ascending branch of the inferior thyroid arteries or the thyroid ima artery.



Solution to Question 2:

The thymus and inferior parathyroid glands originate from the third pharyngeal pouch. They migrate from the upper neck to the mediastinum during embryonic development. Inferior parathyroid glands have more variation in their anatomical position due to a long descent.

The superior parathyroid glands originate from the fourth pharyngeal pouch. They are more constant in their position.



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Solution to Question 3:

The most common site of the ectopic parathyroid gland is paraesophageal.

The common sites of ectopic parathyroid glands are

• Paraesophageal - most common

• Mediastinal

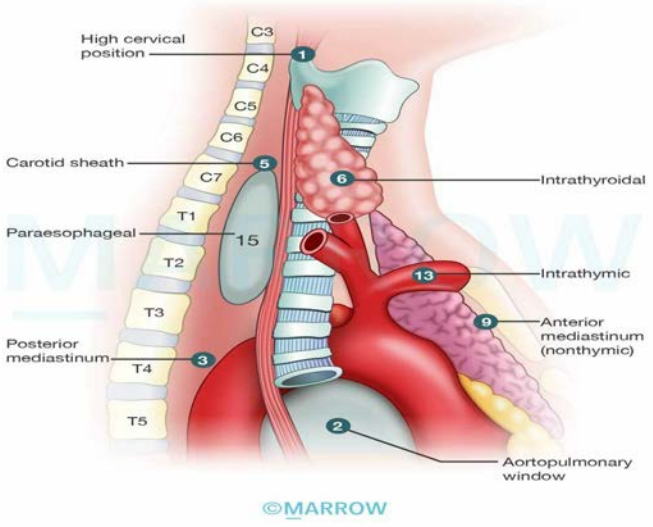
• Intrathymic

• Intrathyroidal

• Carotid sheath

• High cervical or undescended

Ectopic parathyroid is the most common cause of persistent or recurrent hyperparathyroidism. In such cases, treatment involves surgical removal of the gland.



Solution to Question 4:

Cancer is the most common cause of hypercalcemia in hospitalized patients, whereas hyperparathyroidism is the most common cause of hypercalcemia detected incidentally in outpatients. The causes of hypercalcemia in cancer :

• Cancers affecting bone like multiple myeloma, leukemia, bony metastasis - cause the bone to break down which releases excess calcium into the blood

• Pseudohyperparathyroidism - tumours producing parathyroid hormone-related peptide (PTHrP) cause the bone to release calcium into the blood. The most common carcinoma associated is squamous cell carcinoma of lung.

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• Cancers affecting kidneys - failure to remove excess calcium from the blood

• Dehydration caused by nausea and vomiting - difficult for the kidneys to remove calcium from the blood properly

• Lack of physical activity - causes bone breakdown, releasing calcium into the blood

Solution to Question 5:

A single adenoma is the most common cause of primary hyperparathyroidism. They are most often located in the inferior parathyroid glands.

Primary hyperparathyroidism is due to excess or non-suppressed PTH secretion from the following:

• Single parathyroid adenoma

• Multiple adenomas

• Hyperplasia

• Carcinoma

Sporadic primary hyperparathyroidism (HPT) is more common than familial (MEN syndrome/ familial HPT/ Familial HPT with jaw tumor syndrome). Women are affected more commonly than men.

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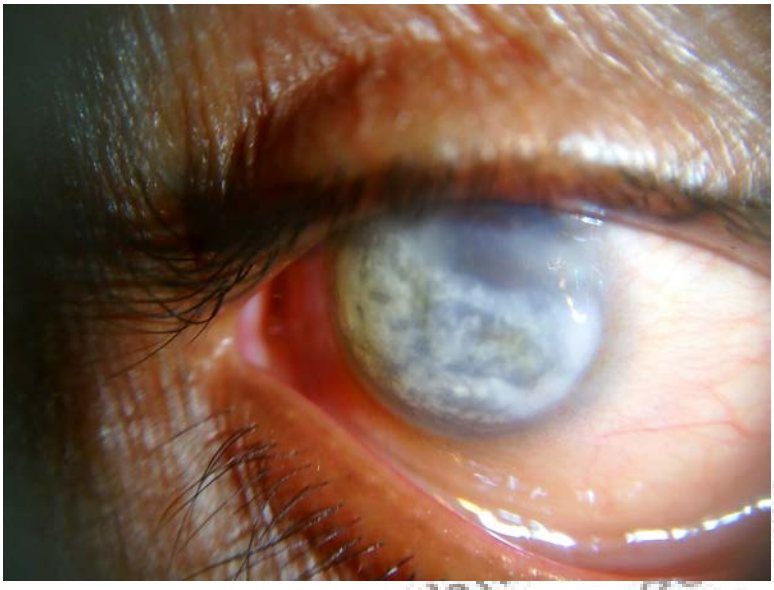
Solution to Question 6:

The given clinical scenario is suggestive of primary hyperparathyroidism. Band keratopathy is pathognomonic of this condition. It is due to the deposition of calcium phosphate crystals in the cornea.

In patients with elevated PTH, calcium and phosphate levels are measured. Elevated calcium and decreased phosphate levels are suggestive of primary hyperparathyroidism. Normal calcium and elevated phosphate levels are suggestive of secondary hyperparathyroidism.

The image given below shows band keratopathy.

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Option A: Kayser Fleischer rings are brownish-yellow rings in the corneoscleral junction due to the deposition of copper in the cornea.

Option C: Ocular chrysiasis is the deposition of gold in the cornea, after repeated parenteral administration of gold salts.

Option D: Hudson Stahli line is a superficial brown line at the junction of the upper 2/3 and lower 1/3 of the cornea in an otherwise normal cornea. It is attributed to the deposition of iron.

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Solution to Question 7:

A thyroid-specific tracer like 99Tc-Pertechnetate and subsequent subtraction images could be used to rule out the false positives caused by the solid thyroid nodules such as Hurthle cell nodule.

The Sestamibi scanning is a nuclear-based imaging test used to localize the parathyroid glands. Sestamibi is a monovalent lipophilic cation that accumulates in mitochondria. Due to this, there is a difference in the rate at which it gets washed out depending upon the number of mitochondria in each tissue. Parathyroid adenomas often have a high concentration of oxyphilic cells with high mitochondrial content and they retain tracers and have a slower washout compared to the normal glands.

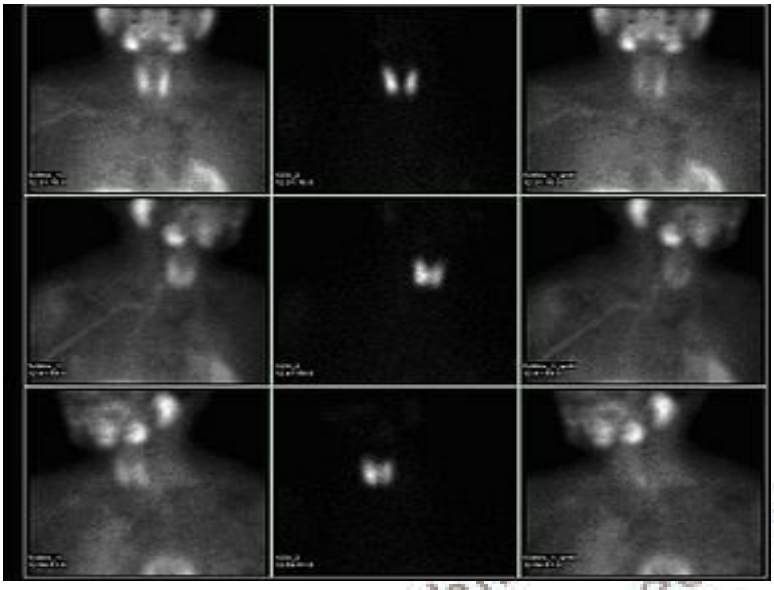
In patients with nodular goiter or functional tumors of the thyroid gland, increased uptake of sestamibi by the thyroid gland makes parathyroid visualization difficult. There are two primary techniques to differentiate sestamibi uptake by abnormal parathyroid and thyroid tissue:

• Dual-isotope subtraction imaging (with sestamibi and either iodine-123 or 99mTc pertechnetate) - 99mTc pertechnetate is taken up only by the thyroid. The 99mTc pertechnetate scintigram is then digitally subtracted from the sestamibi scan to allow parathyroid localization.

• Single-isotope dual-phase imaging (with sestamibi alone with early and delayed imaging) - since the rate of washout from the hyperfunctioning parathyroid gland is slower when compared to the thyroid gland.

The image given below shows the dual-isotope subtraction imaging.

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Solution to Question 8:

The given clinical scenario with the X-ray showing nephrocalcinosis is suggestive of primary hyperparathyroidism. Angiography of renal arteries is not a useful investigation for hyperparathyroidism.

Nephrocalcinosis occurs in this condition due to hypercalcemia. It decreases renal concentrating ability, which may cause polyuria and polydipsia.

Clinical features of hyperparathyroidism:

- Bones:
- Pathological fractures
- Subperiosteal bone resorption - 2nd and 3rd digits, most common in radial aspect
- Salt and pepper skull
- Osteitis fibrosa cystica or VonReckling Hausen's disease of bone
- Stones
- Multiple and recurrent renal stones - most common
- Nephrocalcinosis
- Abdominal groans - colicky due to pancreatitis
- Psychiatric overtones - raised PTH causing CNS depression and psychiatric symptoms
- Band keratopathy
- Features of hypercalcemia -
- Vomiting
- Confusion

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• ECG changes: increased PR interval, shortened QT interval

The image given below shows salt and pepper skull seen in hyperparathyroidism.



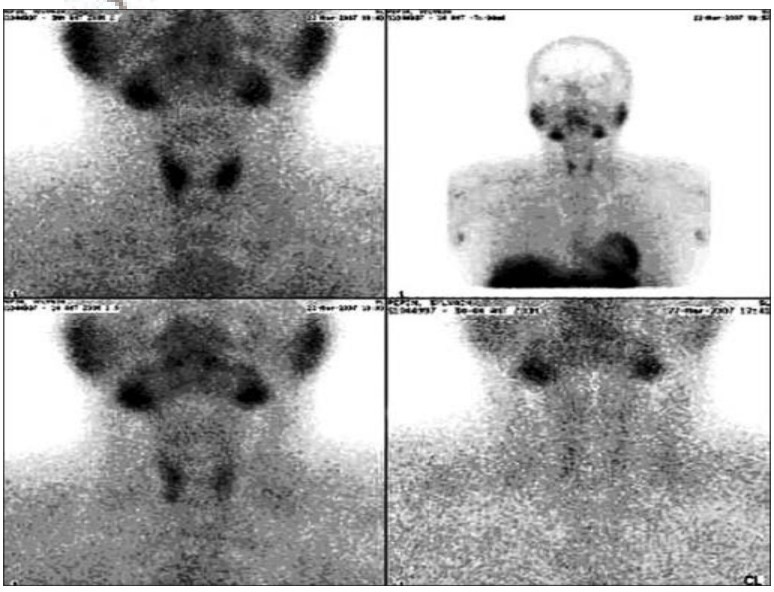
Investigations done in primary hyperparathyroidism:

• Ultrasonography of the neck is a safe and widely used technique for the localization of abnormal parathyroid glands.

• Nuclear medicine scanning with radiolabeled Sestamibi is also a widely used technique. Sestamibi accumulates in parathyroid adenomas. This radionuclide is concentrated in the thyroid and parathyroid tissue but usually washes out of normal thyroid tissue in under an hour. It persists in abnormal parathyroid tissue.

• Dual-energy radiographic absorptiometry is a useful tool to demonstrate skeletal involvement in primary hyperparathyroidism.

The image given below shows a radiolabeled Sestamibi scan.



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Solution to Question 9:

Reduction in creatinine clearance by 30% is an indication for parathyroidectomy in patients with asymptomatic primary hyperparathyroidism.

Solution to Question 10:

Hyperplasia involving all four parathyroid glands is treated by complete removal of three glands with partial resection of the least affected gland (Subtotal parathyroidectomy). Total cervical parathyroidectomy with heterotropic transplantation can also be done in this patient.

Modes of treatment for parathyroid hyperplasia:

• Subtotal parathyroidectomy - The affected glands are completely removed and the least affected gland is partially resected. The remnants left behind should ideally be 30 mg. A lower gland is preferred because its location reduces the risk of injury to the recurrent laryngeal nerve.

• Total parathyroidectomy with heterotopic transplantation - All 4 parathyroid glands are removed and parathyroid tissue is immediately transplanted to the non-dominant forearm. Pockets are made in the belly of the brachioradialis muscle, and one to two pieces of parathyroid tissue measuring 1 mm each are placed into each pocket. A total of 12 to 14 pieces are transplanted.

Complications of parathyroidectomy include:

• Persistent or recurrent hyperparathyroidism

• Hypoparathyroidism

• Hungry bone syndrome

• Injury to recurrent laryngeal nerve

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Solution to Question 11:

Parathyroid is transplanted heterotopically i.e. organ is implanted in another anatomic location.

In total parathyroidectomy, all 4 parathyroid glands are removed and parathyroid tissue is immediately transplanted to the brachioradialis muscle in the non-dominant forearm.

Solution to Question 12:

The parathyroid is commonly transferred to the brachioradialis muscle post-surgery. This will facilitate easy removal if there is disease recurrence after surgery.

Parathyroidectomy is indicated in:

• Symptomatic primary hyperparathyroidism (HPT):

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• Asymptomatic primary HPT with:

• raise in serum calcium >1mg/dl of the normal range

• >400 mg urinary calcium in 24-hour urine test

• < -2.5 Z-score of bone mineral density

• Age <50yr and failed medical treatment

• Severe cases of secondary HPT

Parathyroidectomy is performed in neck hyperextension (semi-Fowler position). The thyroid gland is mobilized, and the parathyroid gland with adenoma is identified and resected. The parathyroid tissue is transplanted to the non-dominant forearm.

Pockets are made in the belly of the brachioradialis muscle, and one to two pieces of parathyroid tissue measuring 1 mm each are placed into each pocket. A total of 12 to 14 pieces are transplanted. This is a type of heterotopic transplant.

Miami criteria (confirm the absence of another hyperactive parathyroid): A drop of parathyroid hormone intraoperatively, to more than half the maximum value at 10 minutes postresection is considered an adequate resection in a parathyroid adenoma. However, if there is no drop in PTH level, then a multi-gland disease is suspected and the surgery is converted to a bilateral neck exploration.

Complications of parathyroidectomy include:

• Persistent or recurrent hyperparathyroidism

• Hypoparathyroidism (presenting as hypocalcemia)

• Hungry bone syndrome

• Injury to the recurrent laryngeal nerve

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Solution to Question 13:

The given clinical scenario and ECG showing a prolonged QT interval (QT interval more than 0.43 seconds) is suggestive of hungry bone syndrome i.e. hypocalcemia post parathyroidectomy. Acute symptomatic presentation of hypocalcemia is treated with IV calcium gluconate.

Symptoms and signs of hypocalcemia:

• Mild circumoral or digital numbness

• Paresthesia

• Laryngeal spasms

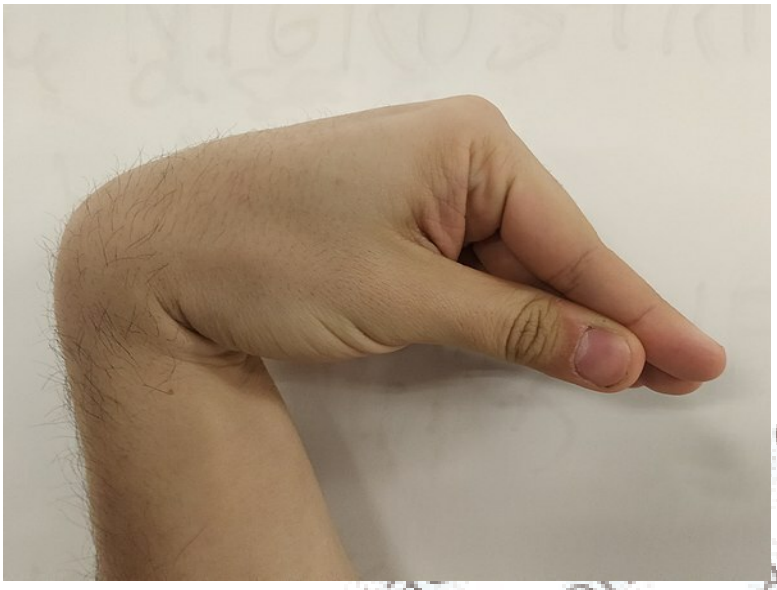
• Cardiac arrhythmias

• Chvostek sign: This is elicited by gently tapping over the facial nerve in front of the tragus of the ear. There is hyperexcitability of the facial muscles, manifesting as a contraction of the muscles.

• Trousseau's sign: This is elicited by making the forearm ischemic by applying a sphygmomanometer cuff to the arm and keeping the pressure above systolic blood pressure (SBP) for 5 minutes. The hand goes into a painful carpopedal spasm and assumes the accoucheur's hand

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position. (shown in the image below)



Acute symptomatic hypocalcemia is an emergency and must be treated with:

• 10 ml of 10% calcium gluconate is given slowly through intravenous route

• Calcium and vitamin D replacement is given orally

• Magnesium supplementation may also be required due to the synergistic actions of calcium and magnesium

The continuous need for calcium or vitamin D, 1-year postoperatively is called permanent hypoparathyroidism.

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Solution to Question 14:

Calciphylaxis (calcific uremic arteriolopathy) is a disseminated calcification seen late in the course of secondary hyperparathyroidism.

In calciphylaxis, the underlying calcification in the vascular and arteriolar walls → ischemic necrosis → ulceration and gangrene → sepsis → death.

It presents as an expanding cutaneous lesion which is predominantly seen in the extremities and lower abdomen. Prognosis is poor and an urgent parathyroidectomy is shown to increase median survival.

Causes of secondary hyperparathyroidism:

• Chronic renal failure (most common)

• Vitamin D3 deficiency

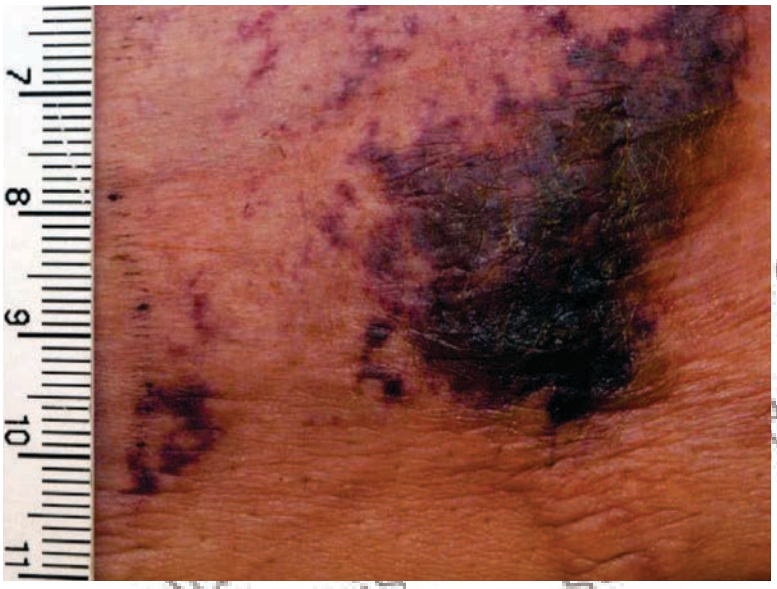
• GI malabsorption

• Lithium intake

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To minimize the risk of missing parathyroid glands, transcervical thymectomy should be considered as a routine part of total parathyroidectomy with autotransplantation and subtotal parathyroidectomy. In addition, careful cervical exploration for secondary hyperparathyroidism should be carried out.

The image below shows calciphylaxis.



Solution to Question 15:

The clinical scenario described here showing elevated PTH and normal calcium levels is that of secondary hyperparathyroidism due to renal failure. Interference with parathyroid kinase C signal transduction pathway and Wnt pathway is the proposed mechanism of secondary hyperparathyroidism in the setting of lithium consumption and not renal hyperparathyroidism.

Causes for increased PTH in secondary hyperparathyroidism due to renal failure:

• Abnormal renal tubular reabsorption → hyperphosphatemia → stimulation of parathyroid cells → elevated PTH

• Increased FGF-23 secretion from osteocytes → decreased 1,25 dihydroxyvitamin D → decreased intestinal absorption of calcium → elevated PTH

• Normally, ECF calcium controls PTH secretion by interacting with CaSR. Stimulation of CaSR by high calcium suppresses PTH secretion. In chronic renal disease, there is reduced expression of Vitamin D and CaSR by bones → increased skeletal resistance to PTH → elevated PTH.

Solution to Question 16:

Drop of parathyroid hormone to more than half the maximum value at 10 min postresection is considered an adequate resection in a parathyroid adenoma by the Miami criteria.

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Most of the patients with primary hyperparathyroidism have single adenoma, and therefore undergo a focused or minimally invasive parathyroidectomy, where the localized abnormal parathyroid gland is removed. Once the gland is removed, the surgeon can ensure that there is no other hyperactive gland remaining by performing an intraoperative PTH assay for Miami criteria.

It is based on the principle that the half-life of the PTH is 3-5 minutes. In a single-gland disease, once the gland is removed the PTH levels should drop to >50% of the preoperative PTH level within 10 minutes. However, if there is no drop in PTH level, then a multi-gland disease is suspected and the surgery is converted to a bilateral neck exploration.

Solution to Question 17:

The given clinical scenario is suggestive of recurrent hyperparathyroidism which could be due to recurrence in the neck or graft (graft hyperplasia). The next step would be to perform Casnova test to differentiate between them, as Sestamibi scan has ruled out ectopic parathyroid.

Casanova test involves selective venous sampling for PTH levels from neck veins and brachial veins. If PTH from the brachial venous sample is >20 times that of neck vein sample, graft hyperplasia is confirmed.

Persistent parathyroidism is defined as hypercalcemia that fails to resolve after parathyroidectomy i.e. within 6 weeks of surgery. Recurrent parathyroidism is hyperparathyroidism that occurs after an intervening period of at least 6 months of biochemically documented normocalcemia. Causes of persistent/recurrent hyperparathyroidism include:

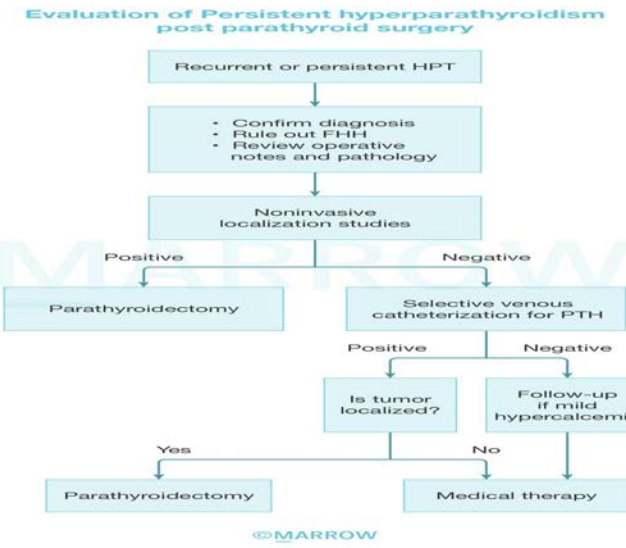
- Ectopic parathyroid
- Unrecognized hyperplasia - graft site hyperplasia
- Missed adenoma in normal position
- Incomplete resection
- Familial hyperparathyroidism
- MEN-1 syndrome

The image below summarises the management protocol for a case of persistent/recurrent hyperparathyroidism.

*FHH stands for Familial hypocalciuric hypercalcemia

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Solution to Question 18:

Reduced serum phosphate is not an indication for surgical intervention in tertiary hyperparathyroidism.

Renal transplantation in patients with chronic kidney diseases may be associated with autonomous functioning of the parathyroid gland. This is called tertiary hyperparathyroidism where there is hypercalcemic hyperparathyroidism.

The indications for surgical intervention in tertiary hyperparathyroidism are as follows :

• Subacute severe hypercalcaemia (>3 mmol/L)

• Impaired graft function

• Nodular hyperplasia of the parathyroid gland(s)

• Progressive symptoms for >2 years following transplantation

• Worsening bone disease - pain, fractures, bone loss

• Renal stones/nephrocalcinosis

• Soft tissue or vascular calcifications

Solution to Question 19:

The patient's long-standing renal failure and elevated calcium, phosphate, and PTH are suggestive of tertiary hyperparathyroidism. This form of hyperparathyroidism can be life-threatening, and all patients with it should be referred for surgical intervention.

The surgical procedure of choice for tertiary hyperparathyroidism is subtotal parathyroidectomy. In subtotal parathyroidectomy, the affected glands are completely removed and the least affected

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gland is partially resected.

Option A: Total parathyroidectomy without an autograft is not a treatment option due to the postoperative and persistent difficulties in managing the associated hypocalcemia.

Option C: Minimally invasive approaches commonly refer to the removal of a localized abnormal parathyroid gland through an incision less than 3cm in length. It is based on the principle that over 80% of individuals with primary hyperparathyroidism have a single adenoma. It is contraindicated in multi-glandular disease, lithium-induced hyperparathyroidism, and hyperparathyroidism associated with familial syndromes.

Option D: Cinacalcet is a calcimimetic used in the treatment of secondary hyperparathyroidism. The use of calcimimetics in tertiary hyperparathyroidism remains controversial and has not been approved for this indication.

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Solution to Question 20:

The patient presents with symptoms suggestive of primary hyperparathyroidism. With early-onset, neck mass, and positive IHC for PGP9.5+, it is concerning for parathyroid cancer. Hypercalcemia is the leading cause of morbidity and mortality in patients with parathyroid cancer.

Parathyroid cancer is a rare malignancy and makes up 1% of cases of primary hyperparathyroidism. History of prior neck radiation is considered to be a risk factor. Patients usually present a decade earlier than primary hyperparathyroidism (5th - 6th decade), with an equal preponderance in males and females. Patients may present with a neck mass and severely elevated calcium and PTH levels.

Treatment is focused on controlling hypercalcemia and surgery is the mainstay.

Option B: Cardiovascular disease is a major contributing cause of mortality in patients with hyperthyroidism and chronic kidney disease.

Solution to Question 21:

Etelcalcetide has no role in the treatment of parathyroid carcinoma. It is ineffective.

Etelcalcetide is a calcium-sensing receptor agonist used to treat secondary hyperparathyroidism in adult patients with chronic kidney disease undergoing dialysis.

Treatment modalities for parathyroid carcinoma:

• Surgical - Bilateral neck exploration + En-bloc excision of the tumor and ipsilateral thyroid lobe with/without MRND (Modified radical neck dissection) in presence of lymph node metastasis.

• Pharmacological:

• Cinacalcet hydrochloride, a calcimimetic, can reduce PTH levels by directly binding to the CaSR (calcium-sensing receptor) cells on the parathyroid gland; used to control hypercalcemia in refractory parathyroid carcinoma.

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• Azidothymidine (telomerase inhibitor)

• Octreotide

• Anti-parathyroid hormone immunotherapy

• Radiation therapy - for unresectable disease or for palliation of bone metastases

Risk factors for parathyroid carcinoma incude:

• Radiation exposure

• Hyperparathyroidism jaw bone syndrome

• HPRT gene or parafibromin inactivation

Solution to Question 22:

Ossifying jaw fibromas are a pathognomonic feature of hyperparathyroid-jaw tumour syndrome. It arises due to inactivating mutations in the HRPT2 gene on chromosome 1 q21-32, encoding parafibromin.

It is a rare cause of primary hyperparathyroidism with an early onset (32 years) which presents with severe hypercalcemia. It is associated with an increased risk of parathyroid carcinoma and other conditions like polycystic kidney disease. Surgical intervention may be considered to remove all enlarged glands.

Osteitis fibrosa cystica is a feature of hyperparathyroidism but is not considered pathognomonic of any condition.

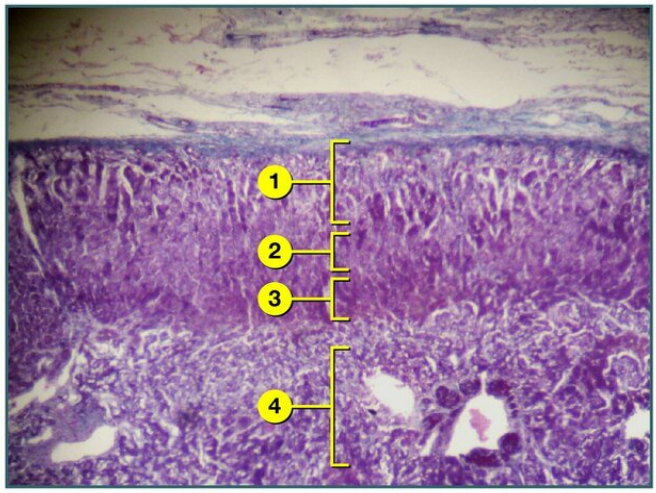
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The Adrenals

Question 1:

Which of the following conditions is correctly matched with its layer of origin?



a) 1- Pheochromocytoma

b) 2- ACTH- independent Cushing's syndrome

c) 3- Neuroblastoma

d) 4- Conn's syndrome

Question 2:

An adrenal incidentaloma was detected in a patient who underwent evaluation for renal calculi. Which of the following statements are true regarding this condition?

a) The majority of these adrenal masses are functional tumours

b) The likelihood of the adrenal mass being an adrenocortical carcinoma is independent of the size of the mass

c) Non-functional tumours >2cm are resected

d) The only indication for biopsy of this adrenal mass is to confirm adrenal gland metastasis

Question 3:

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A patient being evaluated for primary aldosteronism underwent selective adrenal venous sampling. A comparison of the samples obtained from both the adrenal veins showed a significant difference in the aldosterone-cortisol ratio. What is the preferred line of treatment for this patient?

a) Conservative management with MRI surveillance

b) Unilateral laparoscopic adrenalectomy

c) Medical treatment with spironolactone and supplemental antihypertensives

d) Subtotal adrenal resection

Question 4:

You are asked to perform sequential adrenal vein sampling in a patient with bilateral adrenal hyperplasia. Which of the following is the correct sequence of veins that you will go through to test the left adrenal gland?

a) Femoral vein→IVC→right renal vein→right adrenal vein

b) Femoral vein→IVC→left renal vein→left adrenal vein

c) Femoral vein→IVC→left adrenal vein

d) Femoral vein→IVC→left gonadal vein→left adrenal vein

Question 5:

A patient was found to have an elevated 24-hour urinary cortisol level and elevated ACTH. On administration of high-dose dexamethasone, ACTH levels were suppressed. MRI of the pituitary gland shows no enlargement. What is the next best step?

a) CT scan of the chest and abdomen

b) CT scan/ MRI to assess the adrenals

c) Venous sampling from the inferior petrosal sinus

d) Plasma corticotropin-releasing hormone levels measurement

Question 6:

A patient with Cushing's syndrome presents with deep vein thrombosis. Which of the following mechanisms do not contribute to this?

a) Increased factor VIII

b) Increased vWF

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c) Decreased fibrinolysis

d) Increased factor V

Question 7:

Bilateral adrenalectomy is advised in all of the following conditions except

a) Bilateral ACTH-independent disease

b) Ectopic ACTH-dependent Cushing's syndrome

c) Unlocalised primary tumour of the adrenals

d) Adrenal incidentaloma with size >4 cm

Question 8:

A 57-year-old male patient has undergone unilateral adrenalectomy for Cushing's syndrome and you have been asked to start him on cortisol supplementation, post-surgery. What is the rationale behind it?

a) Remaining adrenal gland has insufficient reserve

b) Contralateral adrenal gland is suppressed by prolonged cortisol over-secretion

c) Insufficient secretion of ACTH

d) To prevent Waterhouse-Fridercihsen syndrome

Question 9:

A patient presented to the OPD with complaints of new-onset hyperpigmentation of the skin. He had undergone bilateral adrenalectomy for Cushing's disease 2 years ago. Which of the following statements is not true regarding his current condition?

a) It is characterized by elevated ACTH

b) Glucocorticoid replacement has to be continued

c) First-line of management is pharmacological

d) Screening is done using brain MRI

Question 10:

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Pheochromocytoma is a ten percent tumor. Which of the following statements is false about pheochromocytoma?

a) 10% of pheochromocytomas are extra-adrenal

b) 10% of pheochromocytomas are unilateral

c) 10% of pheochromocytomas are malignant

d) 10% of pheochromocytomas are seen in children

Question 11:

A 40-year-old male patient admitted for evaluation of treatment-resistant hypertension and paroxysmal palpitations was found to have elevated metanephrines on urine screen. What is the next best step in the clinical management of this patient?

a) Imaging study with an MRI scan

b) Medical pre-treatment with phenoxybenzamine followed by laparoscopic resection

c) Imaging study with a contrast CT scan

d) Imaging study with 123 Iodine-MIBG

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Question 12:

Germline mutations of which of the following genes is not associated with hereditary pheochromocytoma?

a) RET proto-oncogene

b) Succinate dehydrogenase complex

c) NF2 gene

d) VHL gene

Question 13:

A 15-year-old boy undergoes bilateral adrenalectomy for phaeochromocytoma. On the third postoperative day, the boy feels lethargic and tired. Blood pressure is 80/60 mm Hg, there is no sign of bleed. What could be the cause of this?

a) Addisonian crisis

b) SIADH

c) Diabetes insipidus

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d) Cerebral salt wasting disease

Question 14:

Neuroblastoma can originate in all of the following except

a) Organ of Zuckerkandl

b) Paraspinal sympathetic ganglia

c) Adrenal medulla

d) Adrenal cortex

Question 15:

A 2-year-old girl child with failure to thrive was found to have a palpable, firm, irregular abdominal mass that crossed the midline. CT revealed a calcified mass near the left kidney which on biopsy showed Homer-Wright pseudorosettes. Which of the following is not true regarding this condition?

a) 70% patients present with metastasis at diagnosis

b) Urine homovanillic acid is used for screening

c) Amplification of N-myc gene is a good prognostic factor

d) Abdominal mass is a common presentation of the condition

Question 16:

What is the most common presentation of adrenal carcinoma?

a) Abdominal mass

b) Cushing syndrome

c) Pain

d) Hypertension

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Answer Key

Question No.	Correct Option

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1	b
2	d
3	b
4	b
5	c
6	d
7	d
8	b
9	c
10	b
11	a
12	c
13	a
14	d
15	c
16	b

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Detailed Explanations

Solution to Question 1:

The area marked '2' depicts the zona fasciculata, which secretes glucocorticoids. In ACTH-independent Cushing's syndrome, excess cortisol is produced from this layer.

Parts of the adrenal glands:

• The adrenal cortex is arranged in a zonal configuration in three zones -

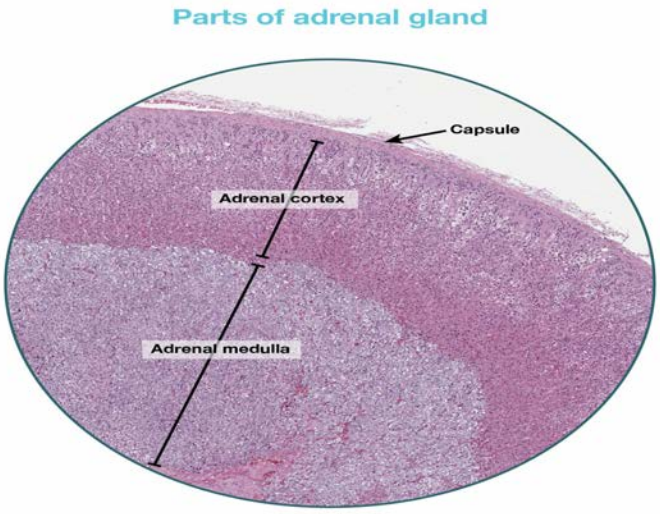
• Outer zona glomerulosa- secretes mineralocorticoids (aldosterone)

• Middle zona fasciculata- secretes glucocorticoids (cortisol, corticosterone)

• Inner zona reticularis- secretes androgens (dehydroepiandrosterone)

• The adrenal medulla- stores and secretes catecholamines (epinephrine, norepinephrine)

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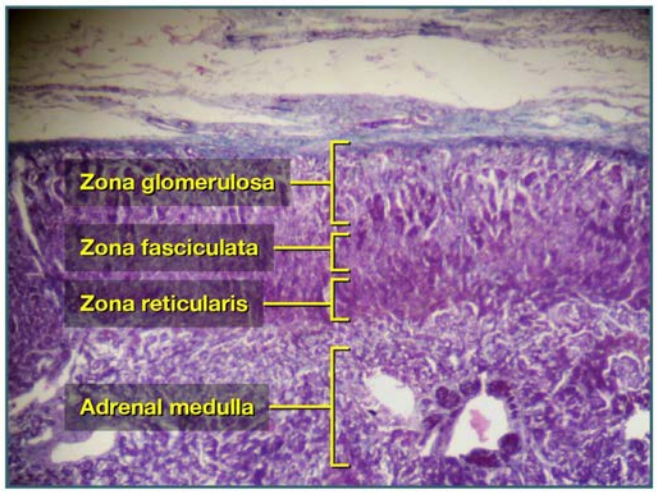
On histological examination, the different layers are identified as:

• Outer zona glomerulosa - small, compact cells

• Central zona fasciculata - larger lipid-rich cells arranged in radial columns

• Inner zona reticularis - pigmented, compact cells

• Adrenal medulla - thin layer of large chromaffin cells



Option A: Pheochromocytoma is a catecholamine producing tumour derived from chromaffin cells and arises from the adrenal medulla.

Option C: In Conn's syndrome, excess aldosterone is secreted from zona glomerulosa.

Option D: Neuroblastoma arises from the adrenal medulla.

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Solution to Question 2:

The only indication for an adrenal gland biopsy is to confirm adrenal gland metastasis.

An adrenal incidentaloma is defined as a clinically unapparent adrenal lesion that is incidentally detected on imaging performed for indications other than evaluation for adrenal disease. The majority of these lesions are non-functional tumours i.e. benign. The likelihood of an adrenal mass being an adrenocortical carcinoma increases with the size of the mass (25% chance if size >4 cm).

Incidentalomas are evaluated to classify them as functional and non-functional. Non-functional incidentalomas <4cm are managed conservatively with MRI surveillance every 3-6 months. If >4cm, laparoscopic adrenalectomy is done.

Note: An adrenal mass should never be biopsied until a pheochromocytoma has been biochemically excluded.

Solution to Question 3:

During selective adrenal vein sampling, a significant difference in the aldosterone-cortisol ratio on one side indicates unilateral hyperaldosteronism. In this case, unilateral laparoscopic adrenalectomy is the treatment of choice.

Primary hyperaldosteronism (PHA) is characterized by hypersecretion of aldosterone with suppressed plasma renin levels (due to the negative feedback). The most frequent cause of PHA is unilateral adenoma.

CT or MRI is used to detect the tumour. In a patient with bilateral micronodular hyperplasia, there could be a unilateral non-functioning tumour. Selective adrenal vein sampling can be done to differentiate between unilateral and bilateral disease.

Conservative management with 3-6 months of MRI surveillance is done in non-functional adrenal tumours of < 4cm.

Medical management is done in patients with bilateral disease, the commonly implemented therapeutic approach is treatment with spironolactone and antihypertensive medication.

Surgical management is done in unilateral and asymmetrical bilateral disease by unilateral laparoscopic adrenalectomy. A subtotal resection can be considered in the case of a typical single Conn's adenoma. However, it is not superior to unilateral adrenalectomy.

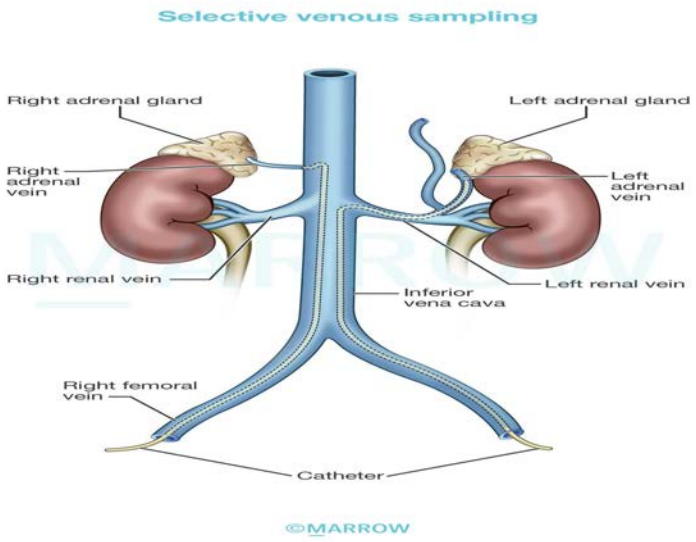
Solution to Question 4:

The correct sequence encountered during sequential venous sampling is femoral vein→IVC→left renal vein→left adrenal vein.

On the right side, the order is femoral vein→IVC→right adrenal vein.

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Solution to Question 5:

The given scenario of elevated ACTH levels that respond to high-dose dexamethasone suppression test is indicative of a pituitary source of hypercortisolism. Since the MRI pituitary is inconclusive, the next best step is to perform a venous sampling from the inferior petrosal sinus.

The stepwise approach to hypercortisolism is as follows:

• Confirmation: This includes 2 steps:

• Tests to detect hypercortisolism (° 2 abnormal test results):

• Midnight salivary or serum cortisol

• 24-hour urinary free cortisol excretion

• Overnight dexamethasone suppression test (DST)

• Low dose DST

• Test to rule out pseudo Cushing's syndrome:

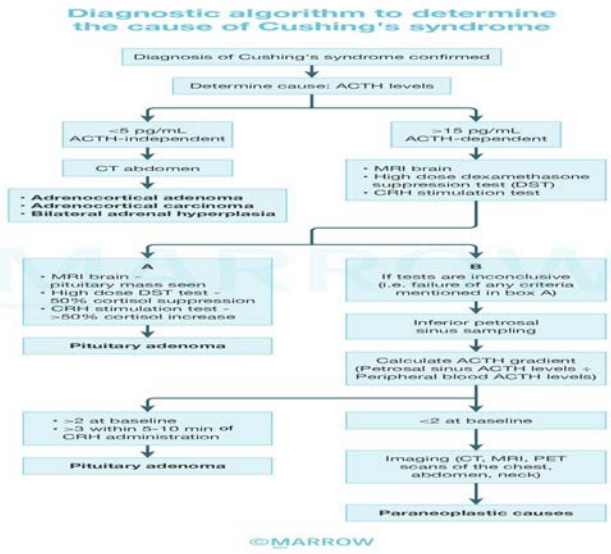
• Low-dose DST + CRH stimulation test

• Identifying the source

• Localizing the lesion

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Solution to Question 6:

Increased factor V does not contribute to the risk of thromboembolic complications like DVT in a patient with Cushing's Syndrome.

There is increased factor VIII, vWF, and decreased fibrinolysis in Cushing's syndrome patients which causes an increased risk of developing thromboembolic complications.

Patients with Cushing's Syndrome are at a greater risk of acquiring hospital-acquired infection, thromboembolic and myocardial complications. Therefore, prophylactic anticoagulants and antibiotics constitute an essential component of pre-operative management.

Solution to Question 7:

Unilateral adrenalectomy is done in adrenal incidentaloma with a size >4cm.

Bilateral adrenalectomy is advised in:

• Bilateral ACTH-independent disease

• Ectopic ACTH-dependent Cushing's Syndrome

• Irresectable or unlocalized primary tumor

Adrenalectomy is done as a surgical measure in severe hypercortisolism or Cushing's disease. The adrenalectomy can be unilateral or bilateral depending on whether the tumor autonomously secrete hormones that could have a detrimental effect on health or If the adrenal mass benign or malignant.

Solution to Question 8:

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The rationale behind cortisol supplementation after the surgical removal of the adenoma is that there is suppression of the contralateral adrenal gland by the pre-operative elevated cortisol levels. This causes primary adrenal insufficiency.

Patients undergoing unilateral adrenalectomy typically require exogenous steroids for up to a year, which is usually the duration the remaining adrenal gland takes to recover adequate function. In bilateral adrenalectomy, steroids are required indefinitely, and patients may also require mineralocorticoid replacement therapy.

Option A: The remaining adrenal gland usually has sufficient reserve to maintain homeostasis.

Option C: A deficiency of ACTH causes secondary adrenal insufficiency. However, the adrenal insufficiency post adrenalectomy is primary i.e due to the hyposecretion of cortisol from the gland itself.

Option D: Waterhouse–Friderichsen syndrome is a bilateral adrenal infarction associated with meningococcal sepsis and is rapidly fatal unless immediately treated.

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Solution to Question 9:

The given clinical scenario of new-onset hyperpigmentation post-adrenalectomy is suggestive of Nelson's syndrome. The first-line and definitive management is surgical resection of the pituitary adenoma.

Nelson's syndrome is a rare complication of total bilateral adrenalectomy (TBA). TBA is a procedure used to control hypercortisolism in Cushing's disease (due to ACTH-secreting pituitary adenoma) when resection of the primary tumor is not possible.

The loss of feedback inhibition of the hypothalamic-pituitary-adrenal axis following TBA increases CRH. This leads to stimulation of ACTH-secreting corticotroph cells, causing enlargement of the original pituitary tumor or formation of a new one.

Nelson's syndrome is associated with a clinical triad of:

• Hyperpigmentation

• Excessive ACTH secretion

• Corticotroph adenoma

Screening is done with fasting plasma ACTH levels and MRI brain performed at regular intervals. Prophylactic pituitary irradiation may be recommended to prevent its incidence. The primary treatment is transsphenoidal surgery. Patients will also require life-long glucocorticoid replacement, as they do not produce cortisol.

The use of steroidogenic inhibitors in the treatment of Cushing's disease has decreased the need for bilateral adrenalectomy these days.

Solution to Question 10:

10% of pheochromocytomas are bilateral.

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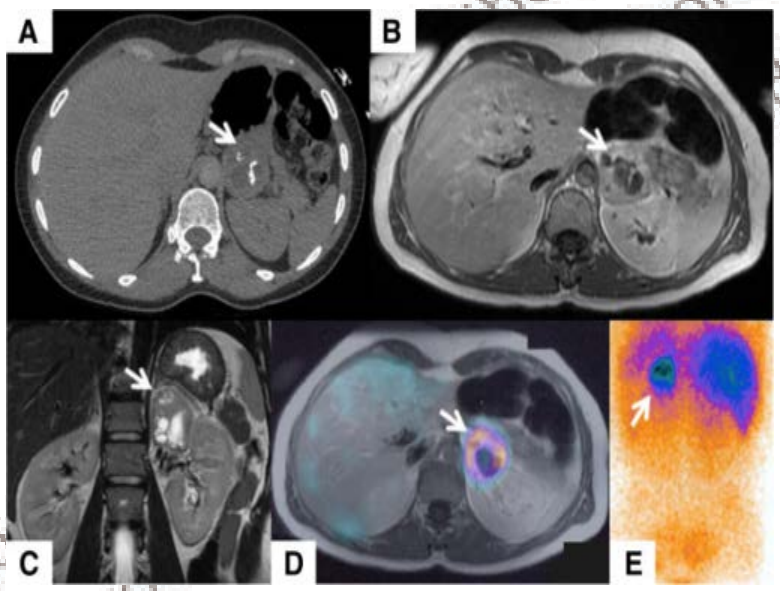
Solution to Question 11:

In this scenario, the elevated urinary metanephrines point towards the diagnosis of pheochromocytoma. Hence, the next best step is an MRI to localise the site of the tumour.

MRI is preferred for the localization of pathologies because contrast media used for CT scans can provoke paroxysms. Classically, pheochromocytomas show a 'Swiss cheese' configuration.

123 Iodine-MIBG (metaiodobenzylguanidine) single-photon emission computed tomography (SPECT) is essential for the detection of multiple extra-adrenal tumours and metastases, but PET scan using FDG or DOPA is more sensitive in detecting metastatic foci.

The image given below shows MRI (marked B and C) and high uptake on 123I-mIBG scintigraphy (marked D and E)



Laparoscopic resection is now a routine in the treatment of pheochromocytoma.

An α-adrenoreceptor blocker, phenoxybenzamine, is used pre-operatively to block excess catecholamine and its consequences during surgery. β-blocker is added if there is tachycardia or arrythmia.

Solution to Question 12:

Germline mutation in NF2 gene is associated with neurofibromatosis type 2, and not hereditary pheochromocytoma. Hereditary pheochromocytomas are associated with NF1 germline mutations.

Pheochromocytomas can occur in isolation or can be associated with hereditary tumor syndromes with the specific germline mutations such as:

• Neurofibromatosis type 1 - mutation in NF1 gene

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• Familial paraganglioma syndrome - mutations within succinate dehydrogenase complex subunit B (SDHB), SDHD, SDHC genes

• Multiple endocrine neoplasia type 2 (MEN 2) - activating germline mutations of RET proto-oncogene

• Von Hippel-Lindau syndrome - mutations in VHL gene

Solution to Question 13:

The given clinical scenario of hypotension with no presence of bleeding and bilateral adrenalectomy is suggestive of an Addisonian crisis. It is a life-threatening condition caused due to sudden insufficiency of adrenal hormones.

Acute adrenal insufficiency (adrenal or addisonian's crisis) is a medical emergency caused due to a precipitating illness unmasking insufficiency or trauma or severe sepsis causing adrenal hemorrhage (Waterhouse-Friderichsen syndrome) or surgical removal of the glands. It presents with non-specific symptoms such as shock with fever, nausea, vomiting, abdominal pain, hypocalcemia and electrolyte imbalances. It may be often misdiagnosed as an acute abdominal emergency.

Adrenal insufficiency can be primary (due to adrenal pathology), secondary (due to pituitary pathology- lack of ACTH) or tertiary (due to hypothalamus pathology- lack of CRH).

Autoimmune adrenalitis is the most common cause of primary adrenal insufficiency worldwide.

Tuberculosis is the most common cause of primary adrenal insufficiency in India.

Adrenal crisis requires immediate intervention owing to its high mortality rate. Immediate rehydration is initiated with a saline infusion at 1 litre/hr with continuous cardiac monitoring. Glucocorticoid replacement is initiated with an initial bolus injection of hydrocortisone 100 mg followed by 200 mg over 24 hours, preferably by continuous infusion or alternatively by IV or IM injections. Mineralocorticoid replacement is initiated once the daily dose of hydrocortisone has been reduced to <50 mg, since hydrocortisone at higher doses provides sufficient stimulation of mineralocorticoids.

Solution to Question 14:

Neuroblastoma does not originate in the adrenal cortex.

Neuroblastoma is an embryonal tumour of the sympathetic nervous system. These tumours arise during fetal or early postnatal life from sympathetic cells derived from the neural crest. Therefore, tumours can originate anywhere along the path which neural crest cells migrate, including:

• Adrenal medulla - most common site

• Paraspinal sympathetic ganglia

• Sympathetic para ganglia such as the organ of Zuckerkandl

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Note: Neuroblastoma is the most common abdominal (extradural) tumour in children and the most common overall tumour in infants.

Solution to Question 15:

The above clinical scenario is suggestive of neuroblastoma and amplification of N-myc gene is an indicator of poor prognosis.

Neuroblastoma arises from the adrenal medulla. Homovanillic acid (HVA) and vanillylmandelic acid(VMA) are elevated in the urine of approximately 95% of patients and are used to diagnose and monitor this tumor.

Clinical features:

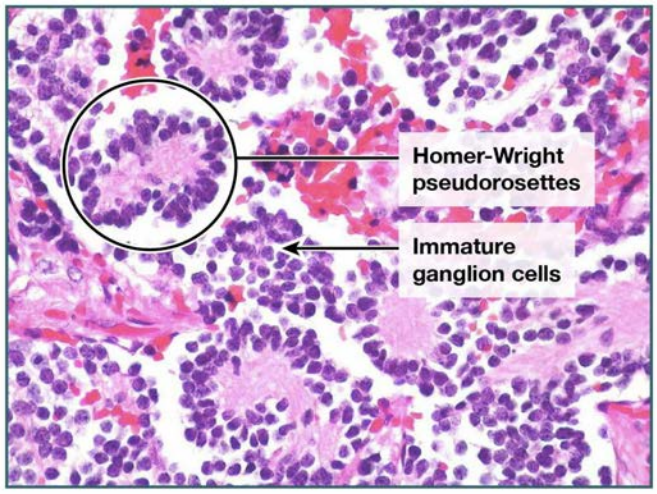
• Abdominal mass (retroperitoneal or hepatic)

• Periorbital ecchymoses ("raccoon eyes," from periorbital ecchymosis caused by orbital metastases)

• Opsoclonus myoclonus syndrome

• Hypertension - due to secretion of catecholamines

Metastatic disease is present in more than 70% of patients at presentation.



Histopathology is the gold standard for diagnosis. Histologically, classic neuroblastomas are composed of small, immature ganglion cells with dark nuclei. Typically, Homer-Wright pseudorosettes can be found which are tumour cells concentrically arranged about a central space filled with neuropil.

The mainstay of treatment is resection of the tumour and chemotherapy.

Solution to Question 16:

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The most common presentation in patients with adrenal carcinoma is Cushing's syndrome due to excess cortisol.

Patients with non-functioning tumours frequently complain of abdominal discomfort or back pain (large tumours).

Mc Farlane classification is used for staging adrenal carcinoma. Treatment involves complete resection of tumour and chemotherapy.

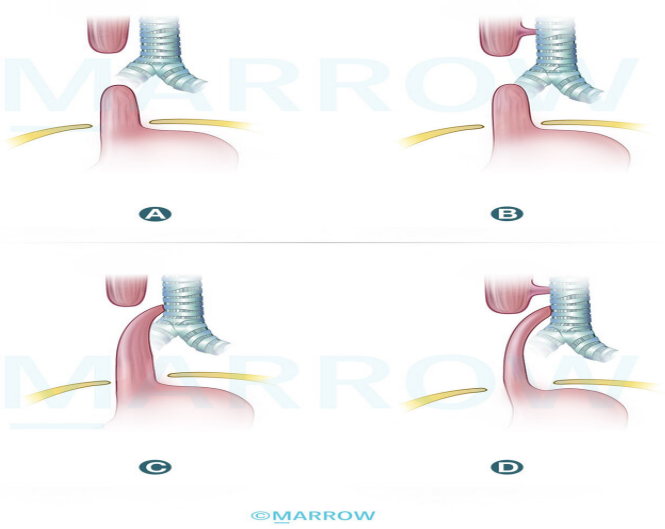
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Esophagus - Congenital, Motility & Inflammatory Disorders

Question 1:

A full-term infant with a history of polyhydramnios in utero presents with respiratory distress soon after birth. On examination, the child has frothing of saliva and the resident suspects tracheoesophageal fistula. What is the most common type of fistula likely to be present in this child?



a) A

b) B

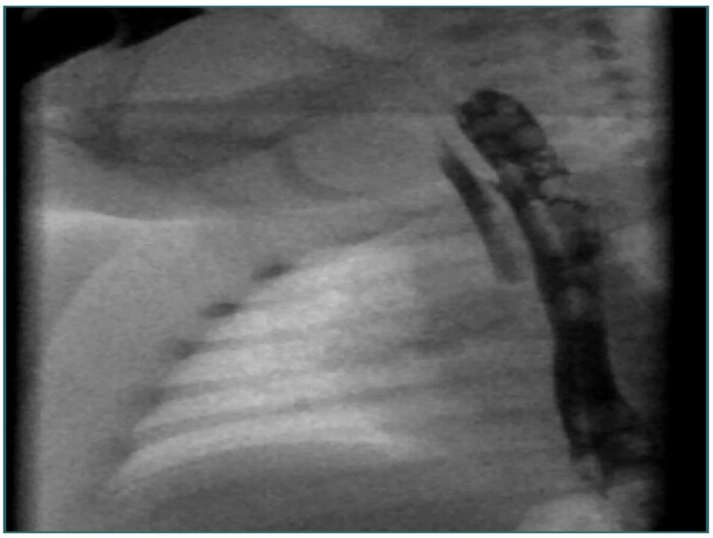
c) C

d) D

Question 2:

A neonate was brought by his mother with complaints of regurgitation of the feeds given to him. The nasogastric tube could not be passed to the stomach. Radiograph is shown below. The birth weight of the neonate was 2.7kg. There is no current evidence of pneumonia. What is the most suitable management in this case?

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a) Gastrostomy under antibiotic coverage

b) Cameron Haight surgery

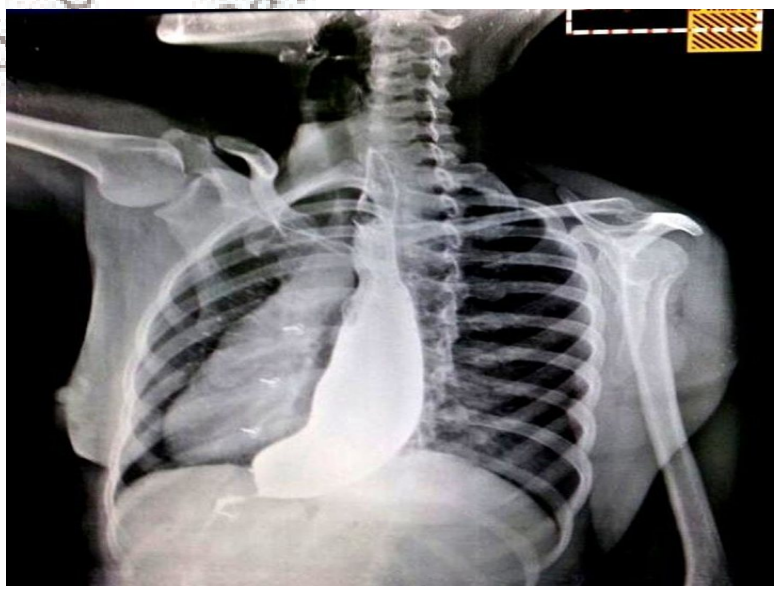
c) Conservative management

d) Flourish device placement

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Question 3:

What is the following image of a barium swallow suggestive of?



a) Achalasia cardia

b) Diffuse esophageal spasm (DES)

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c) Nutcracker esophagus

d) Hypertensive lower esophageal sphincter

Question 4:

In which of the following conditions is normal peristalsis not seen?

a) Achalasia cardia

b) Diffuse esophageal spasm (DES)

c) Nutcracker esophagus

d) Hypertensive lower esophageal sphincter

Question 5:

A young woman was admitted with chief complaints of dysphagia since adulthood which worsened in the last three months followed by odynophagia, nausea, and vomiting of undigested food. Her barium swallow shows features suspicious of achalasia and she is advised to undergo esophageal manometry. Which of the following will not be seen?

a) High LES pressure

b) Incomplete LES relaxation

c) Decreased esophageal baseline pressure

d) Absent peristalsis of the esophageal body

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Question 6:

Which of the following is true about Chicago classification?

a) The classification is based on readings obtained by classic manometry

b) Type III is spastic achlasia

c) Type l achalasia exhibits panoesophageal pressurization pattern

d) Per oral endoscopic myotomy is the definitive treatment for type I achalasia

Question 7:

A 32-year-old male was diagnosed with achalasia cardia. High-resolution manometry revealed massive, simultaneous, high-pressure contractions of the distal oesophagus. According to the

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■Chicago classification, the patient has which type of achalasia?

a) Type II

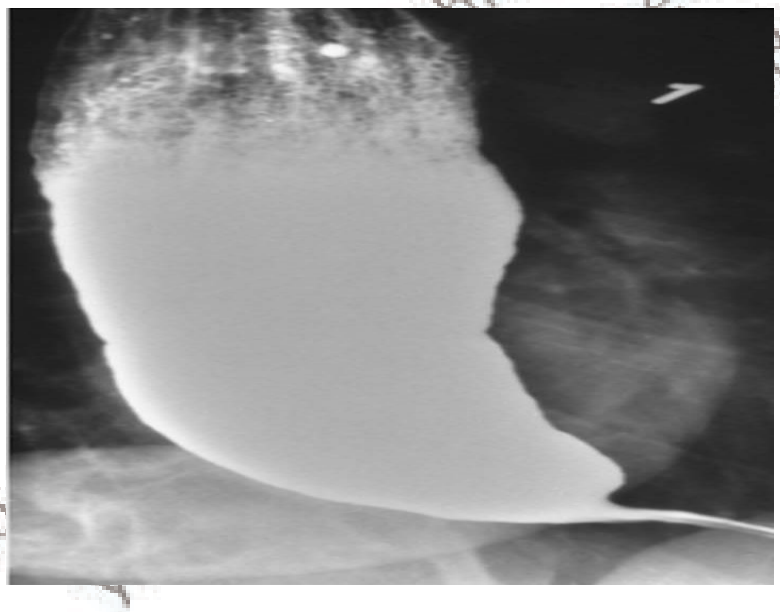
b) Type I

c) Type IV

d) Type III

Question 8:

A 50-year-old woman presented with long-standing complaints of dysphagia which was getting worse for the past 4 months. A barium swallow was performed and it showed the following finding. Which of the following is the definitive treatment of this condition?



a) Calcium channel blockers

b) Botulinum toxin injection

c) Pneumatic dilation

d) Heller myotomy

Question 9:

Which of the following esophageal carcinomas is most likely to develop in patients with long-standing achalasia cardia?

a) Adenocarcinoma

b) Squamous cell carcinoma

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c) Small cell carcinoma

d) Carcinoid tumor

Question 10:

In which of the following conditions is peroral endoscopic myotomy done?

a) Achalasia cardia

b) Gastroesophageal reflux disease

c) Zenker's diverticulum

d) Hypertrophic pyloric stenosis

Question 11:

A patient presented with complaints of crushing chest pain radiating to the jaw and dysphagia. It starts whenever he has ice cream and he takes sublingual nitroglycerin which provides him relief. He underwent manometry which showed simultaneous multi-peaked contractions of high amplitude (>120 mm Hg). What is the most probable diagnosis?

a) Achalasia cardia

b) Diffuse esophageal spasm

c) Hypertensive lower esophageal sphincter

d) Nutcracker esophagus

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Question 12:

A patient with dysphagia was evaluated with a barium swallow as given in the image. Which of the following is false regarding the management of this condition?

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a) Calcium channel blockers and nitrates are first line therapy

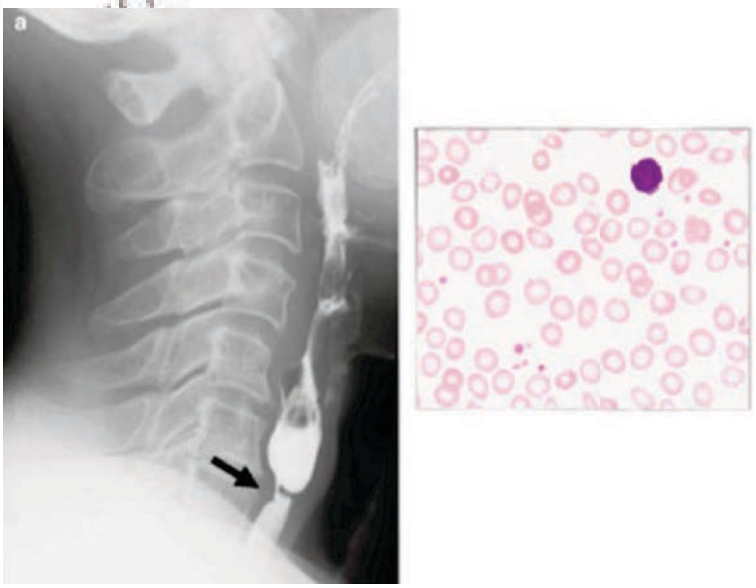
b) Pneumatic dilatation only provides short term relief

c) Myotomy of only the affected segment is done

d) Endoscopic botulinum injection is given when medical therapy is contraindicated

Question 13:

A 72-year-old female patient presented to the hospital with complaints of difficulty swallowing and generalised weakness for 4 months. Peripheral smear revealed the following and an esophagography was done as given below. What is the most probable diagnosis?



a) Zenkers' diverticulum

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b) Esophageal carcinoma

c) Diffuse esophageal spasm

d) Plummer-Vinson syndrome

Question 14:

A 22-year-old male presented with intermittent dysphagia for the past 3 months. Barium swallow showed the following characteristic appearance. What is the most probable diagnosis?



a) Plummer-Vinson syndrome

b) Schatzki's ring

c) Diffuse esophageal spasm

d) Carcinoma esophagus

Question 15:

A 20-year-old woman presented with a 1-year history of nonprogressive dysphagia for solids with no previous similar episodes. Barium swallow revealed fixed narrowing of the esophagus at the level of the aortic arch. CT angiography revealed the following. Which anomaly is most commonly seen in this condition?

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a) Aberrant right subclavian artery

b) Aberrant left subclavian artery

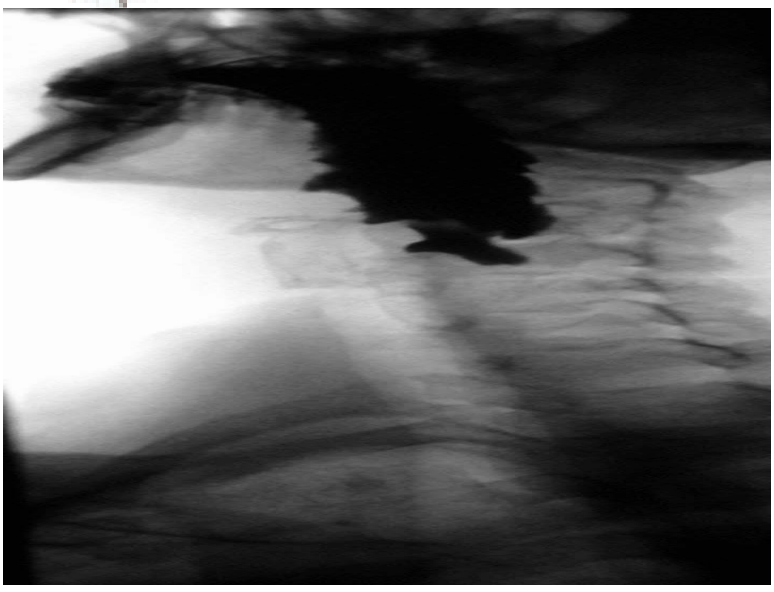
c) Aberrant left vertebral artery

d) Aberrant innominate artery

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Question 16:

A 65-year-old man presents with halitosis and swelling in the lateral aspect of the neck. He also complained of persistent cough and regurgitation of food remnants shortly after consumption. He underwent a barium swallow which is given below. Which of the following is false regarding this condition?



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a) It is a pulsion diverticulum

b) Occurs in the midline posteriorly and as sac enlarges lies on the left side

c) Dohlman's procedure is indicated when size > 2-5 cm

d) Herniates through the thyropharyngeus and cricothyroid muscle

Question 17:

Which among the following is a true esophageal diverticulum?

a) Zenker's diverticula

b) Mid esophageal diverticula

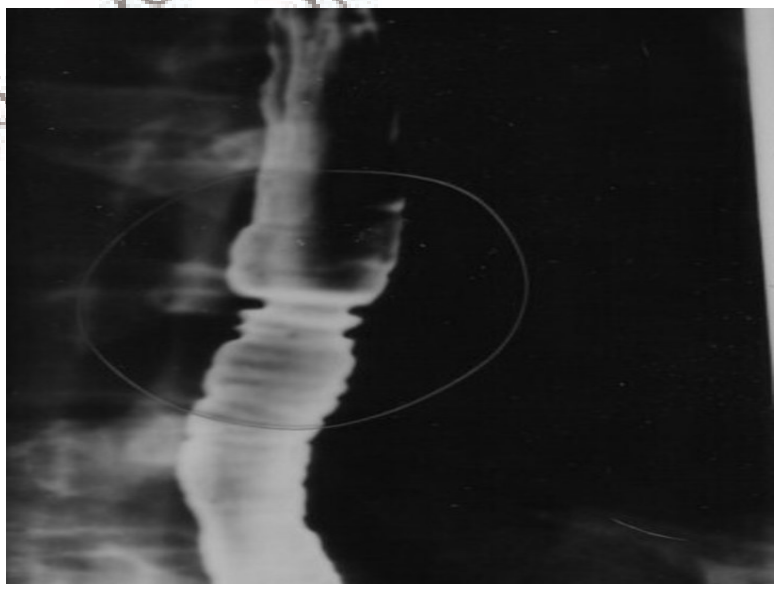
c) Hypopharyngeal diverticula

d) Epiphrenic diverticula

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Question 18:

A man presented with complaints of chest pain and a feeling of food getting stuck in the esophagus, after a meal. He has asthma and is under treatment. PPIs were prescribed but it did not resolve the problem so a barium swallow was done and showed the following. What is the likely diagnosis?



a) Eosinophilic esophagitis

b) Schatzki ring

c) Plummer-Vinson syndrome

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d) Esophageal carcinoma

Question 19:

A 40-year-old woman was brought to the emergency department after the ingestion of a large amount of household cleaning liquid. She complained of a burning sensation in the throat and severe abdominal pain. She has a history of depression for the past 1 year. Which of the following is false regarding this condition?

a) It is a risk factor for esophageal carcinoma

b) Early endoscopic evaluation is recommended to assess the grade of mucosal injury

c) Prophylactic antibiotics improve the clinical outcome

d) Acids only cause superficial damage to the esophagus

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Question 20:

What is the most common site for pill-induced esophagitis?

a) Upper esophagus

b) Mid-esophagus

c) Lower esophagus

d) Gastro esophageal junction

Question 21:

Esophageal endoscopy of a patient reveals the presence of serpiginous ulcers. This finding indicates:

a) CMV esophagitis

b) Candida esophagitis

c) Herpetic esophagitis

d) Radiation esophagitis

Question 22:

A middle-aged man presented to the emergency department with upper abdominal pain after having a heavy meal. On clinical examination, upper abdominal tenderness was noted. On

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chest radiography widening of the mediastinum with pneumomediastinum was seen. What is the probable diagnosis?

a) Spontaneous perforation of esophagus

b) Perforation of peptic ulcer

c) Foreign body in esophagus

d) Rupture of emphysematous bulla of lung

Question 23:

A 45-year-old man was brought to the casualty with a history of severe chest pain radiating to the back and difficulty in breathing following several episodes of vomiting. PR- 110bpm and BP- 80/50 mm of Hg. On examination, there is palpable crepitus over the chest wall. Which of the following statements is false regarding this condition?

a) Most common in lower third of esophagus

b) Iohexol is used as contrast agent

c) Cervical esophagostomy and gastrostomy is done in early presentation

d) Most common cause of mortality is mediastinitis

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Question 24:

A 47-year-old woman underwent endoscopy for the evaluation of dysphagia. After the procedure, she developed severe chest pain radiating to the back and respiratory distress. What is the initial investigation you will perform on this patient to identify the cause?

a) CT Chest

b) Contrast esophagogram

c) Endoscopy

d) Chest X-ray

Question 25:

Which of the following cases of esophageal perforation will you not manage surgically?

a) Crepitus in the neck and difficulty breathing after nasogastric tube insertion

b) Severe chest pain and breathing difficulty following several episodes of vomiting

c) Septic shock due to pyothorax and mediastinitis on left side of lower esophagus

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d) Epigastric pain radiating to the shoulder with air under the diaphragm

Question 26:

A 48-year-old woman presented with dysphagia and postprandial chest pain that is relieved on loud belching. On examination, the patient had pallor. Chest radiography showed an intrathoracic gas bubble. Which of the following is the most probable diagnosis?

a) Achalasia cardia

b) Carcinoma esophagus

c) Hiatus hernia

d) Esophageal perforation

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Answer Key

Question No.	Correct Option
1	c
2	b
3	a
4	a
5	c
6	b
7	d
8	d
9	b
10	a
11	b
12	c
13	d
14	b
15	a
16	d
17	b
18	a
19	c

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20	b
21	a
22	a
23	c
24	b
25	a
26	c

Detailed Explanations

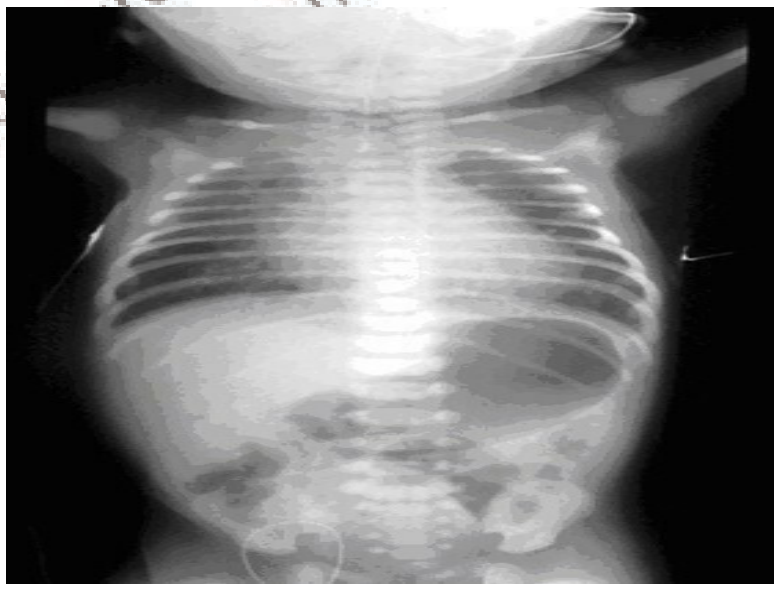
Solution to Question 1:

Type C is the commonest variety of tracheo-esophageal fistula (TEF).

A tracheoesophageal fistula is an abnormal communication between the esophagus and trachea. Type C lesion is associated with proximal esophageal atresia and distal TEF. The proximal blind pouch ends approximately at the distance of one or two vertebral bodies from the distal TEF.

Tracheoesophageal fistula is associated with VACTERL (vertebral, anorectal, cardiac, tracheal, esophageal, renal, and limb) anomalies.

Drooling of saliva, inability to pass a nasogastric tube and history of polyhydramnios suggest a diagnosis of oesophagal atresia with or without TEF. This can be confirmed with a chest X-ray image showing a coiled nasogastric tube in the oesophagal pouch as shown in the image below.



Solution to Question 2:

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The above scenario along with the radiograph is suggestive of a type-E or H-type tracheoesophageal fistula (TEF). The management for this case would be Cameron Haight's surgery.

Management of TEF is based on Waterson's criteria:

Diagnosis of TEF:

Confirmatory - Contrast study (Iohexol)

Investigation of choice for H-type - Combined tracheo-esophagoscopy

Definitive surgery for:

• Types B, C, D, and E - Cameron Haight surgery

• Type A - Anastomosis with/without gastrostomy

Category	Weight/Comorbidities	Management
A	Birth weight > 2.5kg	Definitive surgery
B	Birth weight 1.8-2.5kg or pneumonia or congenital anomaly	Needs stabilization before surgeryAntibiotics + Build up nutrition
C	Birth weight < 1.8kg or severe pneumonia or congenital anomaly	Staged repairAntibiotics + gastrostomy

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Solution to Question 3:

The image shows a markedly dilated esophagus and characteristic bird's beak appearance (distal narrowing), which is suggestive of achalasia cardia.

Achalasia cardia is caused due to the degeneration of the neurons in the myenteric plexus of the esophagus. This degeneration results in the failure of relaxation of the lower esophageal sphincter (LES) on swallowing.

The patients present with a classic triad of dysphagia, regurgitation, and weight loss. The dysphagia initially begins with liquid foods and then progresses to solid foods. As the food gets accumulated in the esophagus, patients may complain of halitosis. With further progression of the disease, the patients may develop pneumonia, lung abscess, etc.

The initial diagnosis is made by barium swallow or endoscopy, which shows the presence of dilated esophagus due to the constriction of the lower esophageal sphincter (bird-beak appearance). The gold standard test to confirm achalasia cardia is esophageal manometry.

Solution to Question 4:

Achalasia cardia does not show normal peristalsis.

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Manometric features of achalasia cardia are as follows:

• Incomplete lower esophageal sphincter relaxation

• Aperistalsis of the esophageal body

• Elevated LES pressure

Diffuse esophageal spasm is characterized by simultaneous multi-peaked contractions of the esophagus. The contractions are spontaneous and may be of abnormally high amplitude (>120 mmHg) or long duration. Intermittent normal peristalsis is seen.

Nutcracker esophagus is characterized by high amplitude (° 180 mmHg) contractions with an increased mean duration. The peristaltic sequence is normal.

Hypertensive lower esophageal sphincter is characterized by elevated LES pressure (° 26 mmHg). Normal peristalsis is seen in the body of the esophagus.

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Solution to Question 5:

There is increased esophageal baseline pressure in achalasia cardia.

Manometric features of achalasia cardia are as follows:

• Incomplete lower esophageal sphincter (LES) relaxation

• Absent peristalsis of the esophageal body

• Elevated LES pressure

• Increased intraesophageal baseline pressures relative to the gastric baseline pressure

High-resolution manometry (HRM) is a gastrointestinal motility diagnostic system that measures intraluminal pressure activity in the gastrointestinal tract using a series of closely spaced pressure sensors. For a manometry system to be classified as high-resolution instead of classic, the pressure sensors must be spaced at most 1 cm apart.

Solution to Question 6:

Type III achalasia in Chicago classification is also known as spastic achalasia. Achalasia cardia is a motility disorder of the esophagus in which the LES (lower esophageal sphincter) fails to relax due to loss of ganglion in the myenteric plexus.

Chicago classification of esophageal motility divides achalasia cardia into 3 types. This classification is based on the readings obtained by high-resolution manometry (HRM).

Type I achalasia cardia does not show pressurization pattern.

Treatment options:

• Pneumatic dilatation

• Laparoscopic myotomy

• POEM (per-oral endoscopic myotomy)

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The definitive treatment for Achalasia is surgical myotomy (Hellers myotomy) + fundoplication.

Solution to Question 7:

The given features are suggestive of type III achalasia cardia.

Type III achalasia cardia is characterised by massive, simultaneous, high-pressure contractions of the distal esophagus.

Achalasia cardia occurs due to the loss of inhibitory ganglion cells in the myenteric plexus of GIT. During swallowing, the food bolus normally triggers a primary peristaltic wave, which is responsible for carrying the bolus to the stomach, accompanied by the relaxation of the lower esophageal sphincter (LES) to allow esophageal emptying into the stomach.

Achalasia is characterized by a disruption of this normal process. Failure of relaxation of the LES causes an elevated median integrated relaxation pressure and a complete failure of peristalsis. The esophagus becomes progressively more tortuous, leading to a megaesophagus.

Solution to Question 8:

The patient likely has achalasia cardia and the definitive treatment is Heller's myotomy. Surgical management is the first-line treatment modality.

Achalasia or 'failure to relax' in Greek occurs due to the lack of ganglion cells in the myenteric plexus (Auerbach's). The lower esophageal sphincter (LES) fails to relax leading to dysphagia, regurgitation of food, and progressive dilation of the esophagus proximal to the constriction.

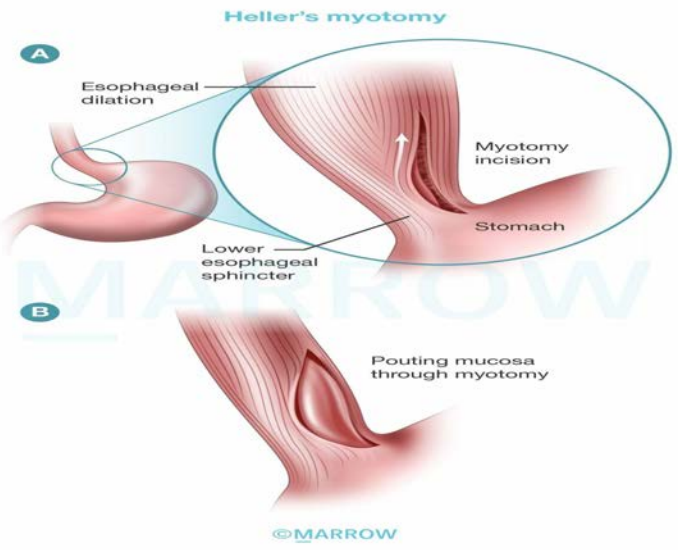
Barium radiology shows hold-up in the distal esophagus, abnormal contractions in the oesophageal body, and a tapering stricture in the distal esophagus often described as a ‘bird’s beak’.

Laparoscopic Heller's myotomy is the procedure of choice. Here, the muscles of the lower esophagus and cardia are cut. However, this can cause iatrogenic gastroesophageal reflux (GERD) due to damage to the lower esophageal sphincter (LES). Thus, newer techniques involve a partial fundoplication like Dor's procedure to reinforce the sphincter and reduce GERD symptoms.

Endoscopic myotomy is a newer, alternate procedure. Here, a submucosal tunnel is formed in the mid esophagus region that allows a long myotomy.

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Option A: Calcium channel blockers can be given in the initial stages of the disease. They relieve the chest pressure that occurs around mealtimes. However, they are not permanent treatments and can be used while waiting for surgery.

Option B: Botulinum toxin injection can be used as a treatment in patients who may not be candidates for surgery or dilatation. Limitations to botulinum toxin injections are that the effect is short-lived (6-12 months) and patients often require multiple treatments.

Option C: Pneumatic dilatation of the LES has is successful in 75% of patients. It involves using a balloon to stretch the LES and improve competence. It requires multiple sessions and has a low risk of esophageal perforation.

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Solution to Question 9:

The most common type of carcinoma associated with this condition is squamous cell carcinoma.

Achalasia is a premalignant condition. It becomes malignant due to long-standing, retained, undigested fermenting food in the body of the esophagus, causing mucosal irritation.

Adenocarcinoma may also arise in the setting of achalasia but is less common as compared to SCC.

Small cell carcinoma is a rare type of neuroendocrine esophageal carcinoma more common in the lower esophagus. It is very aggressive and the 5-year survival rate is 8%.

Carcinoid tumors are slow-growing tumors of neuroendocrine cells that form in the GI tract, mainly in the rectum, small intestine, or appendix.

Solution to Question 10:

Peroral endoscopic myotomy (POEM) is used in achalasia cardia.

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Treatment options:

• Pneumatic dilatation

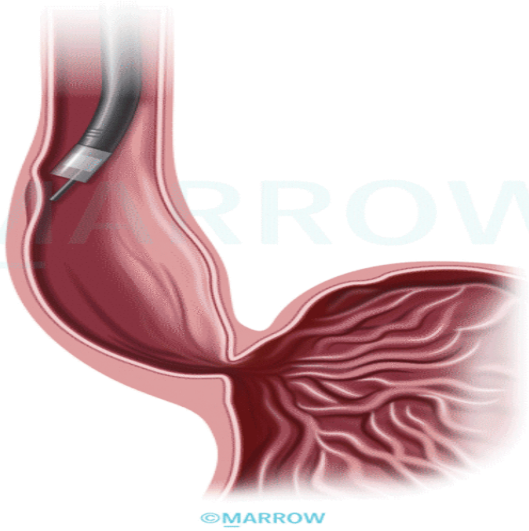
• Laparoscopic myotomy

• POEM (per-oral endoscopic myotomy)

With the use of an operating endoscope, the mucosa of the esophagus is divided around the mid to the distal third, and a submucosal tunnel is created.

Through this tunnel, the muscular layer of the distal esophagus, lower esophageal sphincter (LES), and cardia are visualized and divided, effectively performing an endoscopic myotomy.

The major downside of POEM is that an effective anti-reflux valve cannot be created, exposing the patient to a 40%–50% risk of post-procedural gastroesophageal reflux disease (GERD).



Solution to Question 11:

The above clinical scenario with episodes triggered by cold foods and manometric findings are suggestive of a diffuse esophageal spasm (DES).

Diffuse esophageal spasm is a hypermotility disorder of the esophagus. It is caused by spontaneous, abnormal contractions seen more in the distal two-thirds of the esophageal body. It is more common in women.

Patients usually present with dysphagia and chest pain. Pathologically, there is marked hypertrophy of the circular muscles. It is often triggered by cold foods. It mimics symptoms of myocardial infarction and also shows improvement when sublingual nitroglycerin is administered. It causes smooth muscle relaxation of the esophagus.

A barium swallow shows a corkscrew esophagus. However, manometry (high-resolution manometry is preferred) is the gold standard test for diagnosis. In classic manometry, if there are simultaneous, multi-peaked contractions of high amplitude (>120 mmHg) or long duration (>2.5 seconds) it is suggestive of diffuse esophageal spasm.

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On high-resolution manometry, a DCI (distal contractile integral) >450 mmHg is suggestive of DES. The distal contractile integral (DCI) is an index of contractile vigor in high-resolution manometry, calculated as the product of amplitude, duration, and span of the distal esophageal contraction.

Hypertensive lower esophageal sphincter - It is achalasia in evolution. Shows increased LES pressure but normal peristalsis.

Nutcracker's esophagus - It is the most common motility disorder of the esophagus. In conventional manometry, it shows a high-amplitude peristaltic contraction (>180mmHg) and a longer duration of contraction (>7sec).

In high-resolution manometry, a DCI > 8000mmHg is suggestive of nutcracker's esophagus.

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Solution to Question 12:

The given image is suggestive of diffuse esophageal spasm (DES). Myotomy involves the entire length of the affected segment along with a margin of several centimeters to the spastic region to prevent remnants of spasticity.

First-line therapy is with calcium channel blockers and nitrates. Endoscopic botulinum toxin injection and pneumatic dilation are second-line therapies. Calcium-channel antagonists, vasodilators, and endoscopic dilatation have only transient effects.

Botulinum toxin injection is also considered an effective and low-risk procedure but for short-term symptom relief. Pneumatic dilation is targeted at the exact anatomic site of narrowing.

Surgical treatment includes extended myotomy of the esophageal body or peroral endoscopic myotomy. Peroral endoscopic myotomy (POEM) is a safe and effective treatment for patients, especially those who are refractory to medical therapy.

Solution to Question 13:

The above clinical scenario with microcytic hypochromic anemia and characteristic esophagogram is suggestive of Plummer-Vinson syndrome.

Plummer-Vinson syndrome/Paterson–Kelly syndrome has a triad of:

• Post-cricoid webs

• Dysphagia

• Iron-deficiency anemia

The webs are made up of fibrovascular stroma and esophageal epithelium. Glossitis, angular stomatitis, koilonychia are also associated with this condition.

Laboratory investigations reveal microcytic-hypochromic blood picture and barium esophagography or esophagogastroduodenoscopy(EGD) will help detect post-cricoid webs.

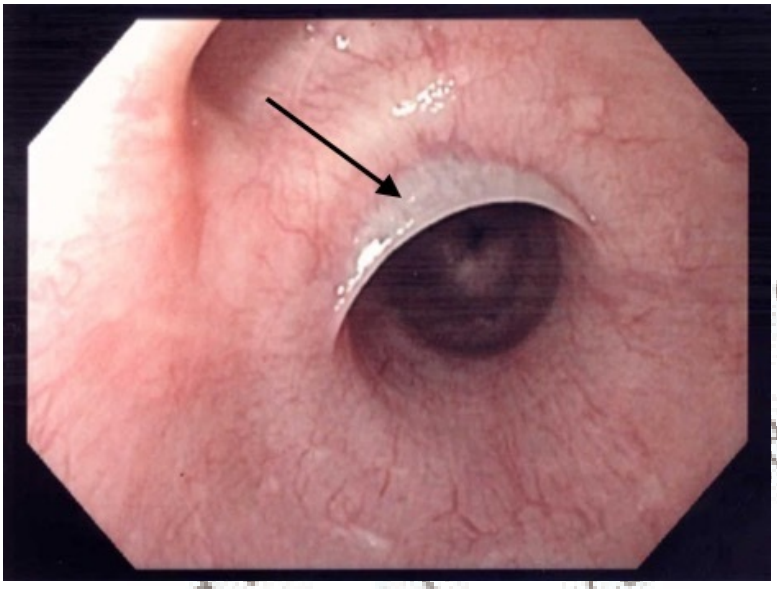
Treatment includes correcting the iron-deficiency anemia which may improve dysphagia and pain. Esophageal bougies can be used during upper endoscopy to dilate the post-cricoid webs and allow

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normal swallowing and passage of food.

Complications include the risk of perforation during dilatation and also malignant transformation into squamous cell carcinoma.

The image below shows endoscopic appearance of post-cricoid web.

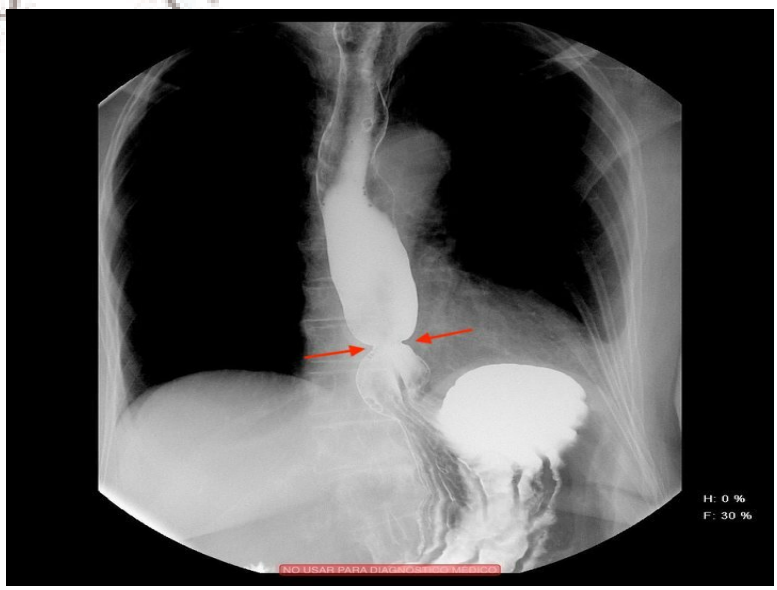


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Solution to Question 14:

The above clinical scenario is suggestive of Schatzki's ring.

The barium swallow shows a thin circumferential ring in the distal esophagus, which is suggestive of Schatzki's ring.



Schatzki's ring is a benign condition wherein there is a concentric, fibrous thickening and narrowing of the gastroesophageal junction (GEJ), with squamous epithelium above and

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columnar cells below.

Schatzki's ring is made up of mucosal and submucosal layers. It causes dysphagia and is associated with gastroesophageal reflux disorder (GERD). It is most commonly seen in the lower third of the esophagus.

Treatment is endoscopic dilation with antireflux therapy and repeated dilation is often necessary. Persistent strictures should always raise suspicion for malignant disease.

The image below shows endoscopic appearance of the Schatzki's ring.



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Solution to Question 15:

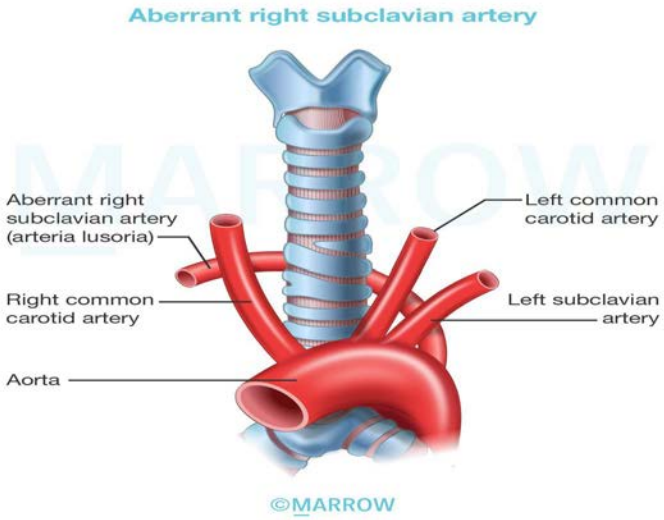
The above image shows the origin of the aberrant right subclavian artery (red arrow) causing extrinsic compression of the esophagus that is suggestive of dysphagia lusoria.

In dysphagia lusoria, the right subclavian artery arises as the fourth branch of the aortic arch instead of branching from the brachiocephalic artery. It then courses behind the esophagus to supply blood to the right arm. This causes pressure on the esophagus and results in dysphagia.

It is diagnosed by CT angiography. A barium swallow shows fixed narrowing of the esophagus at the level of the aortic arch without mucosal abnormality.

Treatment is surgical repair either by reconstruction or ligation of the aberrant right subclavian artery.

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Solution to Question 16:

The above scenario is suggestive of a Zenker's diverticulum or pharyngeal pouch. It is caused due to herniation of mucosa and submucosa through the space between thyropharyngeus and cricopharyngeus. This space is known as Killian's triangle, which is a weak area between two parts of the inferior constrictor in the posterior pharyngeal wall.

It is a pulsion diverticulum, formed due to increased intraluminal pressure forcing mucosa and submucosa to herniate.

A small Zenker's diverticulum < 2cm is managed by diverticulectomy and cricopharyngeal myotomy.

Large diverticulum > 2-5cm is treated by endoscopic diverticulopexy (Dohlman's procedure) or by a diverticulectomy with cricopharyngeal myotomy.

Solution to Question 17:

Mid esophageal diverticula is a true diverticula. It involves all three layers of the esophageal wall such as mucosa, submucosa, and muscularis.

Esophageal diverticula are herniations of the esophagus that extend into neighbouring structures. They occur as a result of primary motor disturbance or abnormality of the esophageal sphincters.

They are classified based on their location into:

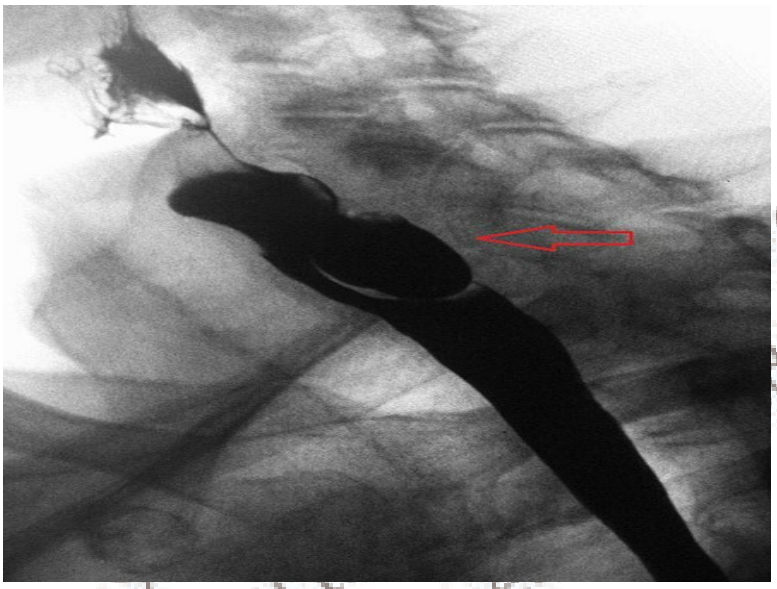
- Zenker's diverticulum (hypopharyngeal)
- Mid esophageal (parabronchial)
- Epiphrenic (supradiaphragmatic)

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Epiphrenic and Zenker's diverticula are false diverticula involving herniation of only the mucosa and submucosa through the muscular layer of the esophagus.

Midesophageal diverticula may be caused by traction on the esophagus from adjacent inflammation and fibrosis (classically tuberculosis). They are most common on the right side due to an overabundance of structures in the left mid-thoracic region.

Zenker's diverticulum:



Epiphrenic diverticula as 1 and 2:



Solution to Question 18:

The above clinical scenario and imaging findings are suggestive of eosinophilic esophagitis.

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Eosinophilic esophagitis is an idiopathic condition commonly affecting the proximal one-third of the esophagus. There is migration of eosinophils to the esophagus and they contribute to extensive tissue damage and inflammation.

Clinical features include swallowing difficulty, food impaction, vomiting, and heartburn.

Barium swallow shows the presence of a series of rings in the esophagus which is suggestive of eosinophilic esophagitis. These rings appear as stripes on the cat and is also known as the feline esophagus.

Feline esophagus:



The definitive diagnosis requires biopsy with a histologic finding of >15–20 eosinophils per high-power field.

Treatment includes oral corticosteroids and immunotherapy.

Solution to Question 19:

Prophylactic antibiotics have not been shown to improve the clinical outcome of acute corrosive esophagitis and are not recommended.

Corrosive esophagitis is caused due to the ingestion of alkali or acid and can be accidental or from attempted suicide.

The injury caused by alkali ingestion is deeper due to the process of saponification of fats and dehydration. The injury caused by acids is more superficial because they cause coagulative necrosis with eschar formation, which prevents the deeper penetration of the acid.

The acids also cause severe pylorospasm and therefore more gastric damage compared to alkali due to the accumulation of the contents in the antrum.

Severe corrosive injury may lead to esophageal perforation, bleeding, stricture, and death. It is a risk factor for esophageal carcinoma. Therefore, early endoscopic evaluation is recommended to assess mucosal injuries even if there is no signs of oral injury.

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Management of corrosive esophagitis:

- Hemodynamic stabilization and management of patient's airway
- Endoscopic evaluation of injuries
- Surgical management includes laparotomy and
- Esophageal stenting and jejunostomy for limited hemorrhage and superficial ulceration
- Esophagogastric resection and jejunostomy for extensive necrosis.

Solution to Question 20:

The most common site for pill-induced esophagitis is in the mid esophagus near the crossing of aorta or carina. These structures externally compress the esophagus and prevent the movement of the pills.

Pill-induced esophagitis is caused when the pill lodges within the lumen of the esophagus. This pill causes direct damage to the mucosa. The risk factors for pill-induced esophagitis include poor pill-taking habits, consuming inadequate liquids, and lying down immediately after consuming the pill.

Drugs causing esophagitis are:

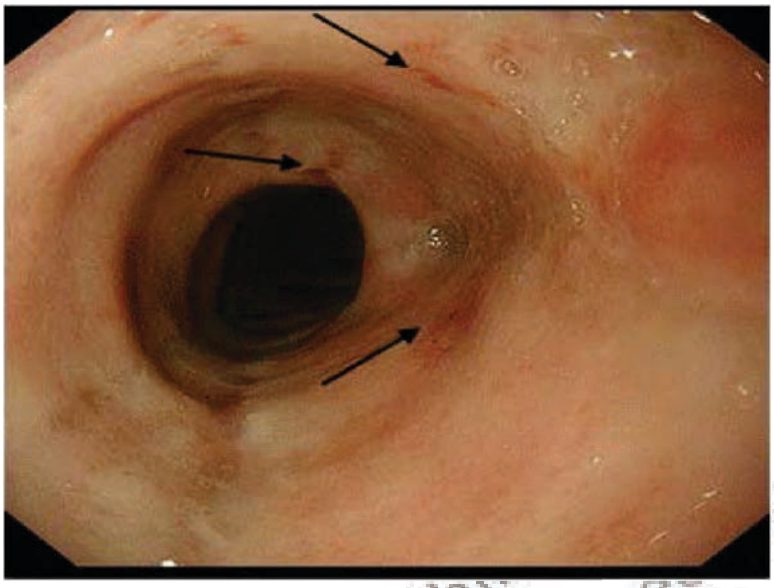
- Doxycycline
- Quinidine
- Phenytoin
- NSAIDs
- Bisphosphonates

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Solution to Question 21:

The image showing serpiginous ulcers in the otherwise normal mucosa of the distal esophagus is suggestive of cytomegaloviral esophagitis.

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Solution to Question 22:

The clinical scenario points to a diagnosis of spontaneous perforation of the esophagus.

In a perforated peptic ulcer, patients develop sudden onset severe generalized abdominal pain, tenderness, and board-like rigidity and an erect plain chest X-ray shows gas under the diaphragm (Option B). The foreign body in the esophagus can be asymptomatic or may present with perforation after ingestion. The radiopaque foreign body can be seen with a chest X-ray (Option C). Rupture of emphysematous bullae of the lung will lead to secondary pneumothorax, which manifests as chest pain and dyspnoea. A plain chest X-ray shows air in the thorax, and the mediastinum is pushed to the opposite side (Option D).

Spontaneous perforation of the esophagus needs immediate diagnosis and intervention due to the higher mortality associated with it. The most common site of perforation is the lower esophagus towards the left esophageal cavity.

Causes:

• Iatrogenic perforation (most common)

• Boerhaave's syndrome (spontaneous emetogenic perforation)

• Sharp foreign body

• Corrosive ingestion

• Esophageal carcinoma

It usually manifests as severe pain in the chest or abdomen after a meal or after a bout of drinking, commonly associated with dyspnoea. On clinical examination, there is rigidity and tenderness in the upper abdomen. The diagnosis is usually confirmed by a chest radiograph which shows pneumomediastinum, pneumoperitoneum, and pneumothorax. Subcutaneous emphysema can be seen in Boerhaave's syndrome. Patients with sepsis will have a fever, tachycardia and tachypnea.

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Treatment includes adequate drainage, antibiotics, closure of the perforation site if possible and supportive measures.

Solution to Question 23:

The above clinical scenario points to Boerhaave's syndrome. Primary closure is done in stable patients presenting within 24 hrs and not cervical esophagostomy with gastrostomy.

Boerhaave syndrome is the spontaneous perforation of the esophagus caused due to episodes of vomiting. During vomiting, the pressure in the esophagus rises rapidly and the esophagus ruptures at the weakest point. They usually have a history of heavy meal intake and alcohol abuse.

Clinical features include Mackler's triad:

• Retching

• Chest pain

• Subcutaneous emphysema

The diagnosis is made by contrast esophagogram(iohexol) in unstable patients or contrast-enhanced CT scan, in stable patients.

Treatment includes primary closure within 12 hours of the injury for a better prognosis. If the patient is unstable or presents late, the perforated part is resected and cervical esophagostomy is performed. A T-tube is placed into the esophagus along with appropriately located drains and a feeding jejunostomy or gastrostomy is performed for nutrition.

Most common cause of mortality in Boerhaave syndrome is mediastinitis (40% to 50%).

Solution to Question 24:

The clinical scenario is suggestive of esophageal perforation following endoscopy. The initial investigation that is performed in this condition is a contrast esophagogram which will show the extravasation of the contrast.

Water-soluble contrast (iohexol) should be used instead of barium contrast to prevent barium-related inflammation of the mediastinum if there is perforation.

If the esophagogram is normal, contrast-enhanced CT is useful in identifying the injury. If the radiological investigations are normal and suspicion of esophageal perforation is high, then endoscopy can be performed to confirm the diagnosis.

Solution to Question 25:

The patient with crepitus in the neck and difficulty breathing after nasogastric tube insertion most likely has perforation of the cervical esophagus. Instrumental perforations in the cervical esophagus are usually small and can nearly always be managed conservatively.

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Esophageal perforation is mostly due to spontaneous or iatrogenic causes. Iatrogenic instrument-induced perforation is the most common cause of esophageal perforation and is most common in the cervical esophagus in the cricopharyngeal area.

Clinical features include pain as the most common presentation. Crepitus may be present. Hamman sign is heard during auscultation which is a crunching, rasping sound, synchronous with the heartbeat.

Investigations include:

• X-ray chest

• CT scan

• Esophagogram

• Thoracentesis

• Serum amylase level may be raised.

Treatment is primary closure within 24 hours of injury and conservative treatment in selected cases.

Complications of esophageal perforation are pneumothorax and empyema (most common in the left side of the chest and bilateral in 10% of cases).

Option B: The patient with severe chest pain and breathing difficulty following several episodes of vomiting most likely has Boerhaave syndrome which affects the lower third of the esophagus and requires primary closure within 24 hours of the injury for a better prognosis.

Option C: Patients presenting with septic shock due to an infection in the chest (pyothorax or mediastinitis) following an esophageal perforation require emergency surgical stenting, debridement, or drainage.

Option D: The presence of epigastric pain radiating to the shoulders with air under the diaphragm point to a diagnosis of abdominal esophagus perforation. It requires immediate surgical intervention to restore the integrity of the esophagus.

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Consideration for interventio n in esophageal perforation	
Indications for non-operative management	Indications for operative ma nagement
Small septic load	Large septic load
Minimal cardiovascular upset	Septic shock
Confinedtomediastinum	Pleura breached
Perforation ofcervical esopha gus	Perforation of the abdominal esophagus
Perforation by flexible endos cope	Boerhaave's syndrome

Solution to Question 26:

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The above clinical scenario is suggestive of a hiatus hernia. Hiatus hernia is the protrusion of any abdominal structure other than the esophagus into the thoracic cavity through a widening of the hiatus of the diaphragm.

Type 1 - sliding hernia:

Gastroesophageal junction or cardia migrates into the thoracic cavity. The length of intra abdominal esophagus is reduced leading to GERD. Most of the patients are asymptomatic. The treatment of choice in symptomatic patients is fundoplication.

Type 2 - rolling hiatus hernia:

Gastroesophageal junction or cardia is normal but a portion of the stomach migrates into the thoracic cavity. The length of intra abdominal esophagus remains the same in a true rolling hiatus hernia.

Clinical features:

• Chest pain or fullness relieved on belching.

• Dysphagia.

• Longitudinal ulcers (Cameron's ulcer) that bleeds, leading to anemia.

Surgical reduction of hernia and tightening of diaphragmatic crura is the best treatment modality even in asymptomatic patients to avoid life-threatening complications like volvulus.

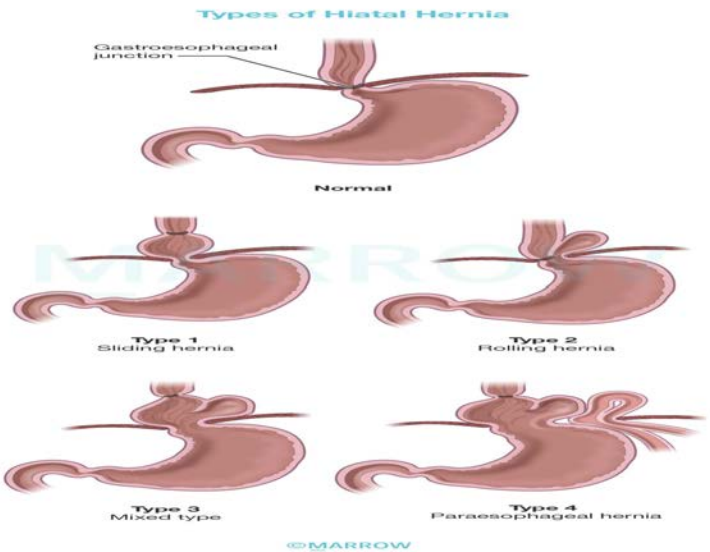
Type 3 - mixed hiatus hernia:

A combination of sliding and rolling hiatus hernia. Treatment is the same as rolling hiatus hernia.

Type 4 hiatus hernia:

Other contents of GIT herniates into the thoracic cavity. Eg: Colon.

CT with oral contrast is the best method of diagnosis of hiatus hernia. It highlights gastric anatomy and also helps to identify other structures involved. Chest X-ray shows an intrathoracic gas bubble.



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Esophagus - GERD & Carcinoma

Question 1:

What is the most important pathophysiological factor implicated in GERD?

a) Hiatus hernia

b) Frequent transient LES relaxation

c) LES hypotension

d) Delayed gastric emptying

Question 2:

Which of the following foods will you recommend to a patient to reduce symptoms of GERD?

a) Coffee

b) Protein rich meal

c) High fat natural cheese

d) Peppermint

Question 3:

A 45-year-old male patient presented with a feeling of fullness and sensation of a lump in the throat for the past 3 weeks. He has no other complaints like weight loss or dysphagia. Rigid endoscopy showed no growth or foreign body in the throat. Which of the following statements is false regarding this condition?

a) Lump in the throat only felt during swallowing

b) Association with anxiety

c) Does not interfere with eating or drinking

d) Often attributable to GERD

Question 4:

A 67-year-old man presented to the physician with complaints of heartburn and a sour taste in the mouth for the past 1 year. He was prescribed proton pump inhibitors, but the

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symptoms did not improve. What is the immediate next step in the management of this patient?

a) Endoscopy

b) 24-hour pH recording

c) Esophageal manometry

d) H.pylori antibody testing

Question 5:

A 48-year-old woman presented with dysphagia and postprandial chest pain that is relieved by loud belching. On examination, the patient had pallor. Chest radiography showed an intrathoracic gas bubble. What is the investigation of choice for this condition?

a) Barium meal follow-through

b) Barium meal upper GI series

c) CT scan with oral contrast

d) Upper GI endoscopy

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Question 6:

What is the most common complication of Nissen's fundoplication?

a) Esophageal injury

b) Achalasia cardia

c) Gas-bloat syndrome

d) Pneumothorax

Question 7:

The fundus is wrapped (270 degrees) around the posterior aspect of the esophagus in which of the following corrective procedures for GERD?

a) Nissen fundoplication

b) Toupet fundoplication

c) Watson fundoplication

d) Dor fundoplication

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Question 8:

What is the most common benign tumor of the esophagus?

a) Leiomyoma

b) Adenoma

c) Squamous papillomas

d) Hemangioma

Question 9:

Which of the following is not a risk factor for developing squamous cell carcinoma of the esophagus?

a) Plummer- Vinson syndrome

b) Ingestion of alkali/caustic substances

c) Human papillomavirus

d) Barrett's esophagus

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Question 10:

Which of the following is not true about Barrett's esophagus?

a) It is the intestinal metaplasia of esophagus

b) Mucus secreting foveolar cells are characteristic

c) Alician blue is used in the staining of biopsy specimen

d) It is a reversible cell adaptation

Question 11:

Investigation of choice for cardia metaplasia in Barrett's esophagus is

a) Endoscopic with lugol's iodine

b) Endoscopy with methylene blue

c) Endoscopy with oral contrast

d) Endoscopic ultrasonography

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Question 12:

Endoscopic biopsy of a patient with GERD revealed high-grade dysplasia of esophageal mucosa proximal to the GE junction. What is the appropriate management for this patient?

a) Radiofrequency ablation and 6 monthly follow up

b) No intervention now and follow up every 2 years

c) Argon photocoagulation and 3 monthly follow up

d) Laparoscopic esophagectomy

Question 13:

An 80-year-old male patient was recently diagnosed with adenocarcinoma of the esophagus. The tumor is present in the distal esophagus, within 1 to 5 cm above the gastroesophageal junction. According to the Siewert classification, which type does this tumor belong to?

a) Type II

b) Type IV

c) Type I

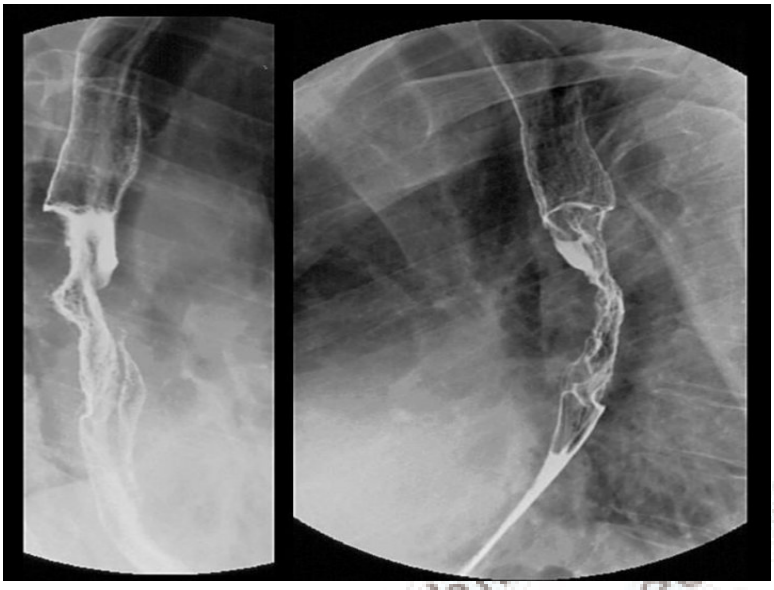
d) Type III

Question 14:

An elderly male presented with significant weight loss and an inability to swallow food. A barium swallow was done and showed the following. Which of the following statements is false regarding this condition?

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a) Dysphagia is the most common symptom

b) T1a tumor is restricted to sub mucosa

c) Barium swallow shows rat tail appearance

d) Flexible endoscopy with biopsy is used to confirm diagnosis

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Question 15:

What is the blood supply of the conduit in gastric pull up done during esophagectomy?

a) Right gastric and right gastroepiploic arteries

b) Right gastric and left gastroepiploic arteries

c) Left gastric and right gastroepiploic arteries

d) Left gastric and left gastroepiploic arteries

Question 16:

A 50-year-old man is diagnosed with esophageal carcinoma. Radiological investigations show a 2 cm tumor in the middle part of the esophagus. The tumor extends up to the submucosa with the involvement of mediastinal lymph nodes, there is no distant metastasis. What is the best treatment modality in his case?

a) Endoscopic mucosal resection

b) Chemotherapy

c) Chemoradiation followed by esophagectomy

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d) Esophageal stent placement

Question 17:

A 60-year-old woman presented with a history of dysphagia and weight loss for the past 1 year. Endoscopic ultrasonography done showed a tumor of size 4 cm in the mid esophagus above the aortic arch. Which of the following is the best approach?

a) Mckeown's esophagectomy

b) Ivor Lewis esophatectomy

c) Orringer's esophagectomy

d) Transhiatal esophagectomy

Question 18:

An male patient with stage IV esophageal carcinoma is taken up for esophageal stent insertion as a palliative measure. Which of the following is the most common complication of this procedure?

a) Severe reflux

b) Perforation

c) Migration

d) Odynophagia

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Question 19:

AIMS65 score is used to predict mortality rate in patients with which of the following?

a) Upper GI bleed

b) Lower GI bleed

c) Carcinoma esophagus

d) Carcinoma Rectum

Answer Key

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Question No.	Correct Option
1	b
2	b
3	a
4	a
5	c
6	c
7	b
8	a
9	d
10	b
11	b
12	c
13	c
14	b
15	a
16	c
17	a
18	c
19	a

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Detailed Explanations

Solution to Question 1:

Frequent transient lower esophageal sphincter (LES) relaxation accounts for more than 90% of the cases of gastroesophageal reflux disease (GERD).

Gastroesophageal reflux disease (GERD) is a condition that develops when there is a retrograde flow of stomach contents back into the esophagus. It can present as non-erosive reflux disease or erosive esophagitis.

A hiatal hernia is the next common cause of GERD. Factors contributing to the high pressure in the LES zone:

Factors contributing to the high pressure in the LES zone:

• Intrinsic musculature of the distal esophagus and sling fibers of the cardia of stomach which are in tonic contraction

• During inspiration, the anterposterior diameter of the crural opening of diaphragm is decreased (increases LES pressure)

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• Transmitted pressure of the abdominal cavity on the LES zone

Solution to Question 2:

Protein increases the lower esophageal sphincter (LES) pressure, thereby allowing the closure of the sphincter and reducing reflux.

Other options:

Option A: Chocolate and coffee both contain methylxanthine, which causes muscles to relax and lowers the LES pressure. In addition, coffee can stimulate gastric secretions, which can promote reflux.

Option C: Fatty foods have been found to delay gastric emptying and decrease the LES pressure, thereby prolonging the esophageal exposure time to the stomach acid and the volume available for reflux.

Option D: Alcohol, mint, citrus, tomatoes, and/or carbonated beverages may cause further irritation to the damaged esophageal mucosa but have not been found to cause reflux themselves.

Solution to Question 3:

The above clinical scenario points to a diagnosis of globus hystericus. It is a feeling of fullness or lump in the throat that is felt always and not only when swallowing.

Globus hystericus or globus pharyngeus is a persistent abnormal sensation in the throat in the absence of any observable pathology. The exact cause of globus sensation is uncertain. The sensation is often relieved by the act of swallowing and it does not interfere with eating and drinking.

Examination and investigations may be carried out to exclude any other underlying problem. It is often attributable to GERD. Reassurance that there is no serious underlying problem may be all that is needed in terms of treatment.

Solution to Question 4:

This is a case of dyspepsia not responding to PPIs. So the best management for this patient is endoscopy.

In case of an unexplained dyspepsia

• If the patient is >60 years - Endoscopy is the investigation of choice

• If the patient is <60 years - A test for H.pylori infection is done (stool antigen and urease breath test) and eradication treatment is given. Endoscopy is done only if any one of the alarming signs are present.

Alarming signs

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• Odynophagia or dysphagia

• Unexplained weight loss

• Massive GI bleeding

• Recurrent vomiting

• Jaundice

• Palpable mass or adenopathy

• Family history of GI malignancy

Solution to Question 5:

The given clinical scenario with X-ray findings showing a retrocardiac gas bubble are consistent with the diagnosis of a hiatus hernia. A CT scan with oral contrast is the best method of diagnosis. It highlights the gastric anatomy but also helps to identify other structures involved in the hiatal hernia.

Hiatus hernia is the protrusion of any abdominal structure other than the esophagus into the thoracic cavity through a widening of the hiatus of the diaphragm.

Types of hiatus hernia:

Type 1- sliding hernia

Gastroesophageal junction or cardia migrates into the thoracic cavity. The length of intra abdominal esophagus is reduced leading to GERD. Most of the patients are asymptomatic. The treatment of choice in symptomatic patients is fundoplication.

Type 2- rolling hiatus hernia:

Gastroesophageal junction or cardia is normal but a portion of the stomach migrates into the thoracic cavity. The length of the intraabdominal esophagus remains the same in a true rolling hiatus hernia.

Clinical features:

• Chest pain or fullness relieved on belching.

• Dysphagia.

• Longitudinal ulcers (Cameron's ulcer) that bleed lead to anemia.

Surgical reduction of hernia and tightening of diaphragmatic crura is the best treatment modality even in asymptomatic patients to avoid life-threatening complications like volvulus.

Type 3- mixed hiatus hernia:

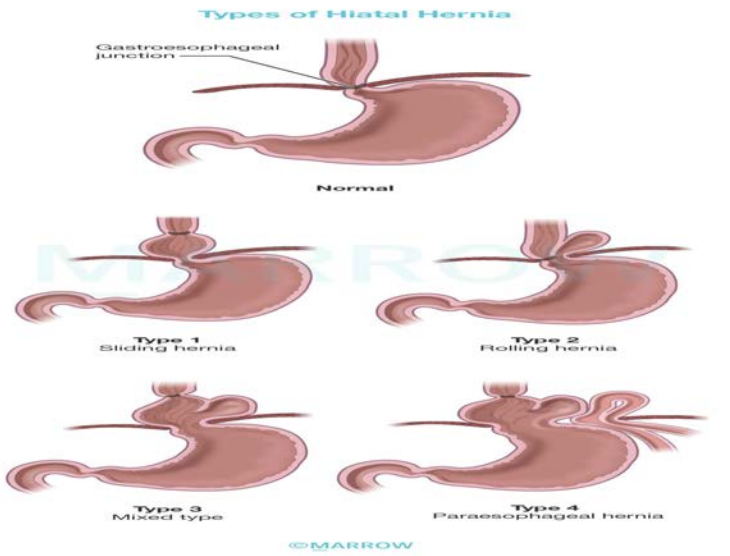
A combination of sliding and rolling hiatus hernia. Treatment is the same as rolling hiatus hernia.

Type 4 hiatus hernia:

Other contents of GIT herniates into the thoracic cavity. Eg: Colon.

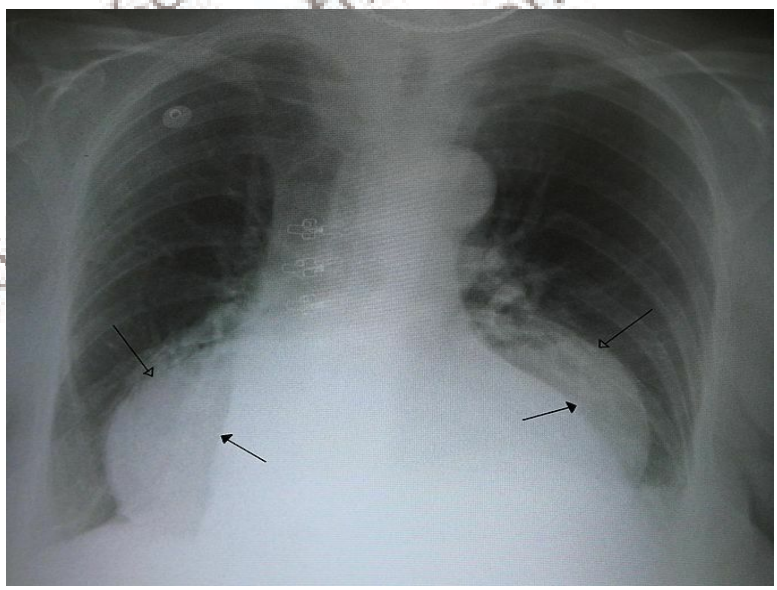
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Note: This is a controversial question as some books give barium swallow as the investigation of choice for hiatal hernia. But Bailey's 28th edition clearly mentions that a CT scan with oral contrast is the answer.

The image below shows a retrocardiac gas bubble on an X-ray that is consistent with hiatus hernia.

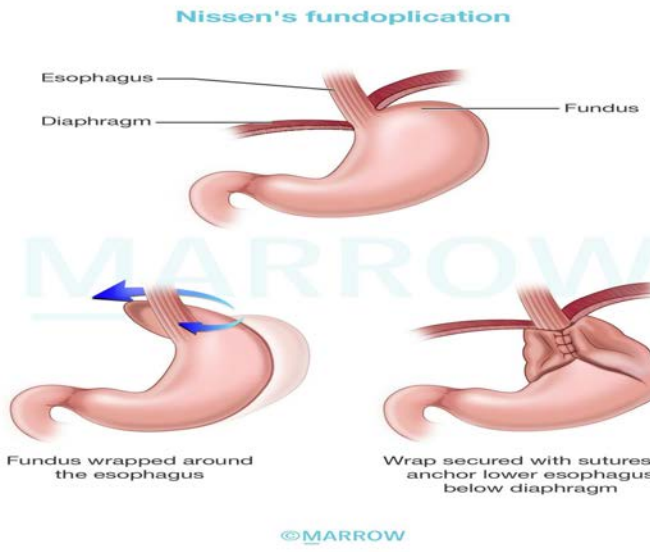


Solution to Question 6:

The most common complication of Nissen's fundoplication is gas-bloat syndrome.

Fundoplication is the procedure in which the fundus of the stomach is wrapped around the lower end of the esophagus.

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After this procedure, most patients are unable to belch gas from the stomach into the esophagus. This causes increased gas in the stomach resulting in bloating sensation, abdominal discomfort, and flatulence. This is known as gas bloat syndrome and occurs more commonly with Nissen total fundoplication.

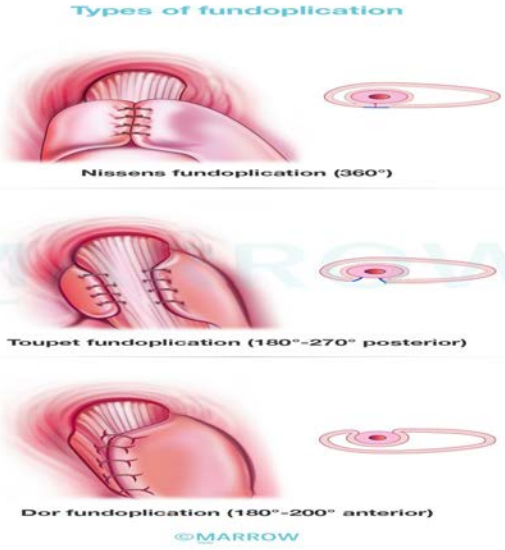
Pneumothorax is the most common complication that occurs intraoperatively.

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Solution to Question 7:

Partial posterior fundoplication between 180 to 270 degrees is called Toupet fundoplication.

It is used in the surgical management of GERD. Partial anterior fundoplication is Dor's fundoplication and total fundoplication is Nissen's fundoplication.



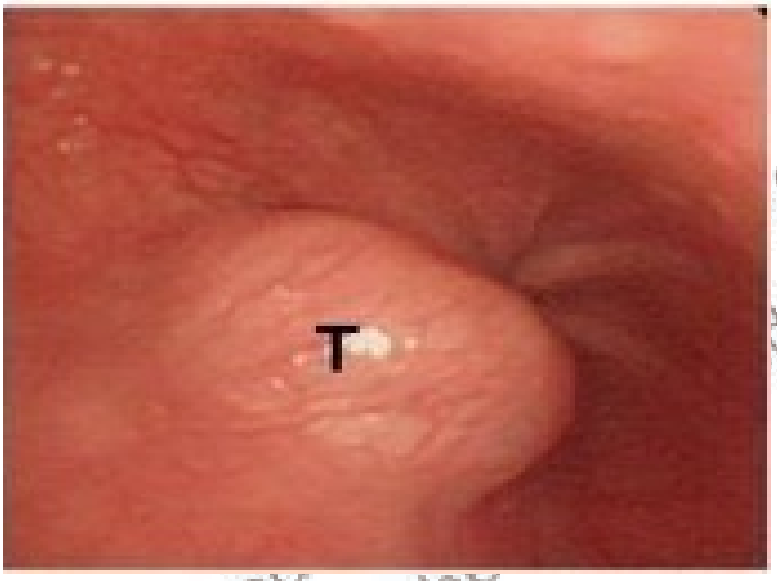
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Solution to Question 8:

Leiomyomas are the most common benign tumors of the esophagus.

Leiomyomas are benign tumors that arise from the muscularis propria. They are found in the mid to distal esophagus.

They are more common in males and small, asymptomatic lesions are observed, while symptomatic lesions are enucleated.



Solution to Question 9:

Barrett's esophagus is a risk factor for adenocarcinoma of the lower end of the esophagus, not for squamous cell carcinoma.

Squamous cell carcinoma is the most common type of esophageal carcinoma.

Risk factors for SCC:

• Tobacco

• Alcohol

• HPV

• Plummer–Vinson syndrome

• Achalasia

• Tylosis

• Caustic ingestion

Risk factors for adenocarcinoma:

• Barrett's esophagus

• GERD

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• Smoking

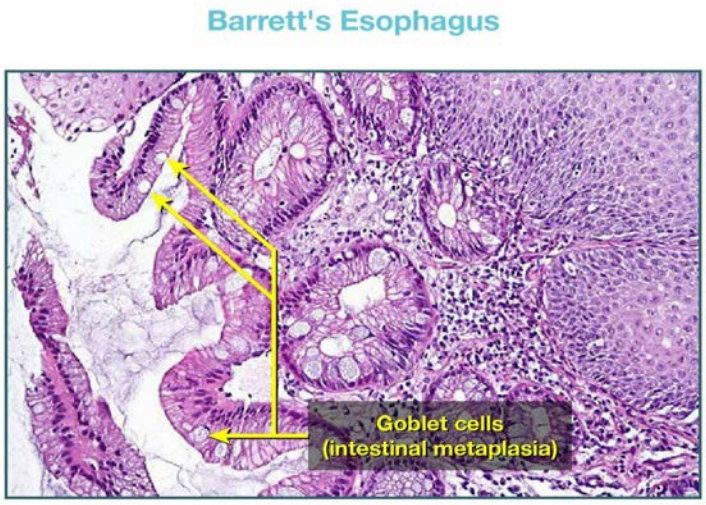
• Obesity

Solution to Question 10:

Mucus-secreting goblet cells (not foveolar cells) are characteristic of Barrett's esophagus, as there is intestinal metaplasia of the esophagus. Foveolar cells are the mucus-secreting cells in the stomach.

Barrett's esophagus is a complication of chronic gastroesophageal reflux disease (GERD), and it is estimated to occur in about 10% of individuals with symptomatic GERD. Symptoms include heartburn, regurgitation and sometimes dysphagia. Obese white men over the age of 60 years represent the highest-risk group.

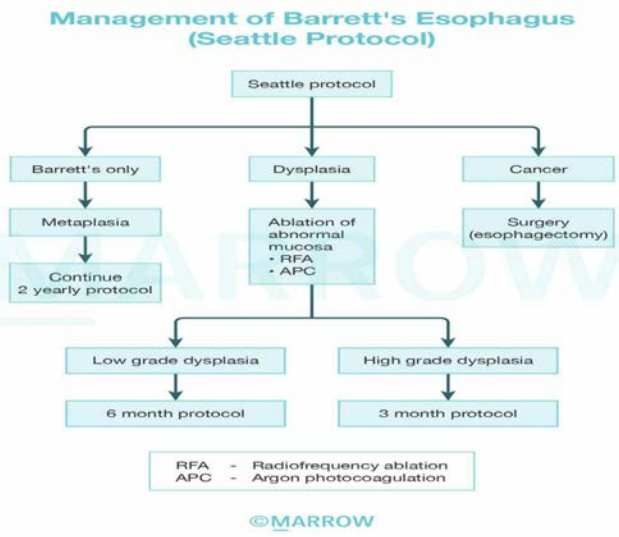
Intestinal metaplasia in the esophagus occurs due to chronic irritation of the esophagus in GERD (option A) since intestinal epithelium is better suited to handling gastric acid exposure. Hence, mucus-secreting goblet cells are characteristic of Barrett's esophagus. Since all metaplasia are reversible, Barrett's esophagus is also reversible (option D). Only 0.2 to 1% of Barrett's esophagus leads to dysplasia and adenocarcinoma.



Alician blue is used in the staining of the biopsy specimen, as it stains the goblet cells (option C). Mucicarmine is the specific stain.

Seattle protocol is used for the management of Barrett's esophagus.

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Solution to Question 11:

The investigation of choice for Barrett's esophagus showing cardia metaplasia is endoscopy with methylene blue.

Barrett's esophagus is a metaplastic change (squamous to columnar change) in the lower end of the esophagus as a result of long-standing gastroesophageal reflux disease.

Barrett's esophagus can be-

• Classical Barrett's esophagus - > 3cm of columnar epithelium in the distal esophagus.

• Short segment Barrett's esophagus - < 3cm of columnar epithelium in the distal esophagus.

• Cardia metaplasia - microscopic Barrett's in the GE junction. In cardia metaplasia due to lack of macroscopic changes, an endoscopic biopsy is difficult. So chromoendoscopy is the ideal investigation. Here mucosa is first stained by methylene blue to highlight abnormal mucosa.

Investigation of choice: endoscopic biopsy

Management: Seattle protocol is ideally followed to detect early dysplastic changes in Barrett's esophagus. Here a 4 quadrant biopsy specimen is taken 1- 2 cm apart throughout the area of intestinal metaplasia.

• No signs of dysplasia - continue 2 yearly surveillance.

• Low-grade dysplasia - APC or RFA or EMR followed by 6 monthly surveillance.

• High-grade dysplasia - APC or RFA or EMR followed by 3 monthly surveillance.

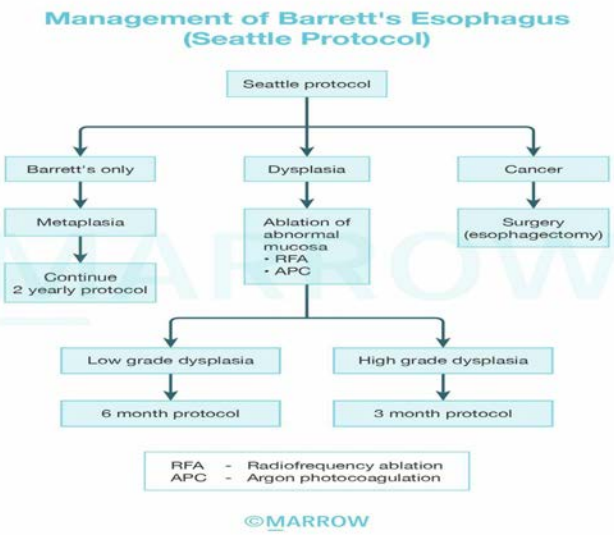
APC - Argon photo coagulation

RFA - Radiofrequency ablation

EMR - Endoscopic mucosal resection

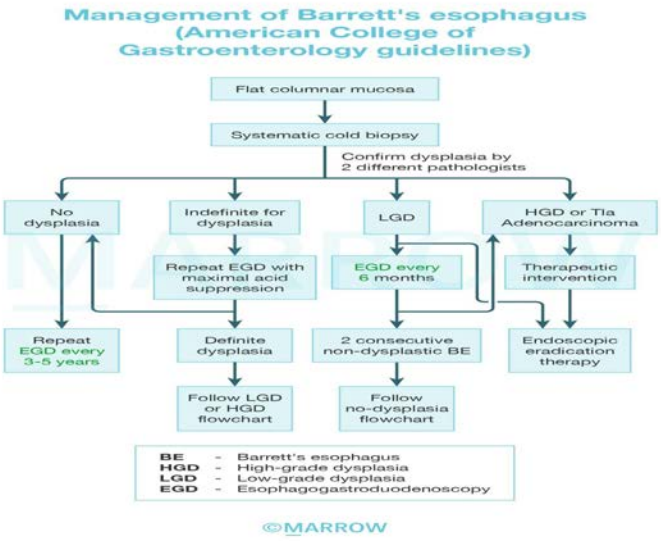
Lugol's iodine is used for squamous cell carcinoma.

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Solution to Question 12:

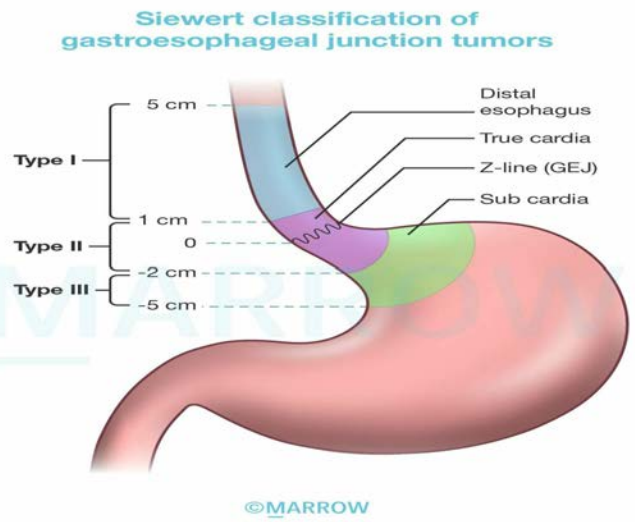
Ablation of abnormal mucosa and 3 monthly endoscopic protocol is the appropriate management in cases of high-grade dysplasia of esophageal mucosa due to GERD.



Solution to Question 13:

Siewert type I lesions include tumors of the distal esophagus with the center located within 1 - 5 cm above the anatomic esophagogastric junction.

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Solution to Question 14:

The above clinical scenario with rat-tail appearance on barium swallow is suggestive of esophageal carcinoma. T1a tumor is restricted to the muscularis mucosa.

Esophageal carcinoma is more commonly seen in men. Tobacco use and alcohol are strong risk factors. Adenocarcinoma and squamous cell carcinoma of the esophagus are the two most common types.

Clinical features include:

- Dysphagia (most common)
- Regurgitation
- Vomiting
- Odynophagia
- Weight loss

In the advanced stage, there can be hoarseness of voice due to recurrent laryngeal nerve palsy, horner's syndrome, chronic spinal pain, and diaphragmatic paralysis.

Flexible endoscopy with biopsy is preferred for confirmation of diagnosis. Other Investigations include barium swallow which shows a rat-tail appearance due to irregular narrowing or ulceration. Contrast-enhanced CT and PET can be used to assess distant metastasis. Endoscopic ultrasonography (EUS) is the investigation of choice to assess tumor invasion and lymph node metastasis.

TNM staging:

Primary Tumor (T)	
TX	Tumor cannot be assessed

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Primary Tumor (T)	
T0	No evidence of tumor
Tis	High-grade dysplasia
T1	Tumor invades the musculari s mucosa (T1a)or submucosa (T1b)
T2	Tumor invades into but not b eyond the muscularis propria
T3	Tumor invades the adventitia
T4a	Tumor invades adjacent struc tures that are usually resecta ble(diaphragm and pericardi um)
T4b	Tumor invades unresectable structures
Regional Lymph Nodes (N)	
NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node met astasis
N1	Metastasis in 1-2 regional ly mph nodes
N2	Metastasis in 3-6 regional ly mph nodes
N3	Metastasis in °7 regional lym ph nodes
Distant Metastasis (M)	
M0	No distant metastasis
M1	Distant metastasis

Solution to Question 15:

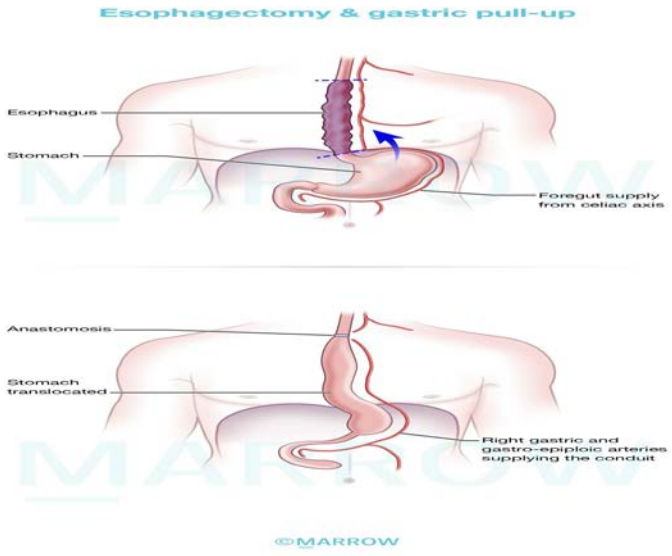
The blood supply to the gastric conduit is based on the right gastric and right gastroepiploic arteries.

A gastric pull-up is done during esophagectomy for esophageal carcinoma. It is a surgical procedure where the stomach is pulled up into the thoracic cavity that now acts as a new passage (conduit) instead of the esophagus.

During the esophagectomy, the proximal stomach and lymph nodes are typically resected along with the segment of the esophagus. The gastric conduit is then fashioned by tubularization of the stomach. The right gastroepiploic artery is preserved and the other arteries are ligated to make ample length and mobility for the conduit.

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It is of utmost importance the right gastroepiploic artery is preserved as ischemia to the stomach will result in anastomotic leakage, stricture, and even dehiscence. The rich supply of submucosal vascular networks can preserve the stomach on this single vessel.



Approaches of esophagectomy:

1. Mckeown approach

• Done for upper 1/3rd and mid 1/3rd tumors (above aortic arch)

• Anastomosis site is in the neck

• Three incisions made (abdominal, thoracic, and left neck)

2. Transhiatal approach (Orringer)

• Done for tumor of lower 1/3rd and mid 1/3rd of the esophagus

• Anastomosis site is in the neck

• The most common complication is atelectasis and mortality is due to an anastomotic leak

3. Ivor lewis approach

• Done for mid 1/3rd(below aortic arch) and lower 1/3rd esophagus tumors

• Anastomosis site is in the thorax

Solution to Question 16:

Chemoradiation followed by esophagectomy is the best treatment modality for tumors extending to the submucosa (T1b) with regional lymph node involvement (N1).

EMR (endoscopic mucosal resection) is done for small tumors confined to the mucosa, with no lymph node involvement. (T1aN0)

Esophagectomy ± chemoradiation is done when the tumor extends into the submucosa, with no lymph node involvement.

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Chemoradiation followed by esophagectomy is done for tumors extending into the submucosa or beyond with lymph node enlargement

Chemoradiation therapy alone is done as a palliative measure in case of advanced esophageal carcinoma or in those patients unfit for surgery.

Esophageal stent placement is done in patients with advanced cancer and severe dysphagia that is not resolved by chemoradiation therapy. SEMS (self-expanding metallic stent) is the treatment of choice in malignant tracheoesophageal fistula.

Solution to Question 17:

The best surgical approach for a mid-esophageal carcinoma above the aortic arch is Mckeown's esophagectomy.

Approaches of esophagectomy:

1. Mckeown's approach

• Done for upper 1/3rd and mid 1/3rd tumors (above aortic arch)

• Anastomosis site is in the neck

• Three incisions were made (abdominal, thoracic, and left neck)

2. Transhiatal approach (Orringer's approach)

• Done for tumor of lower 1/3rd and mid 1/3rd of the esophagus

• Anastomosis site is in the neck

3. Ivor Lewis approach

• Done for mid 1/3rd(below aortic arch) and lower 1/3rd esophagus tumors

• Anastomosis site is in the thorax

• The most common complication is atelectasis

• The most common cause of mortality is due to an anastomotic leak leading to mediastinitis.

In esophagectomy, a proximal margin of 10cm and a distal margin of 5cm is taken.

Solution to Question 18:

The most common complication of placing a stent in the esophagus is the migration of the stent.

Palliative treatment in advanced stages of esophageal carcinoma includes esophageal stent placement, enteral nutrition support, or the use of chemotherapy and radiation.

Complications of esophageal stent placement:

• Migration of stent (most common)

• Odynophagia

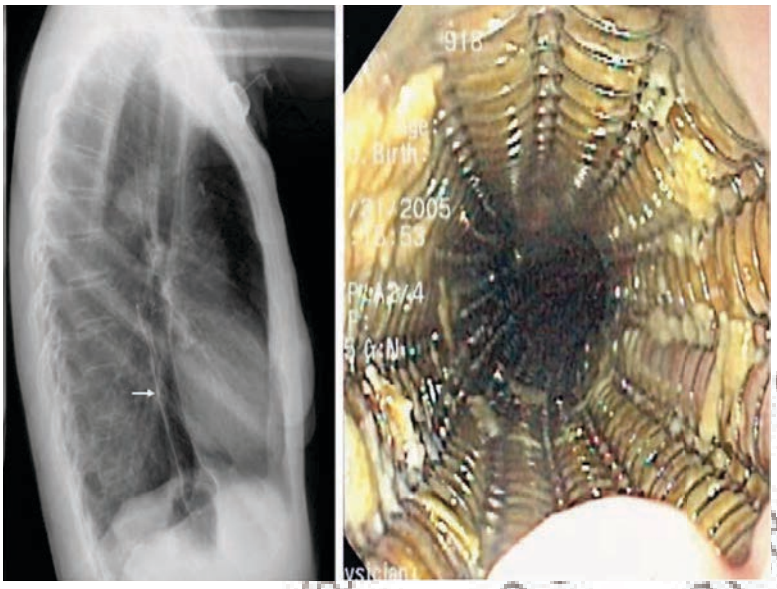
• Tumour ingrowth and overgrowth

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• Chest pain

• Severe reflux



Solution to Question 19:

AIMS65 score is a simple risk score that predicts the mortality rate in patients with upper GI haemorrhage.

AIMS65 score	
Variable	Score
Albumin <3 g/dlINR >1.5AlteredMental statusSystolic BP <90mmHgAge>65years	11111
Score>2consideredhigh risk	

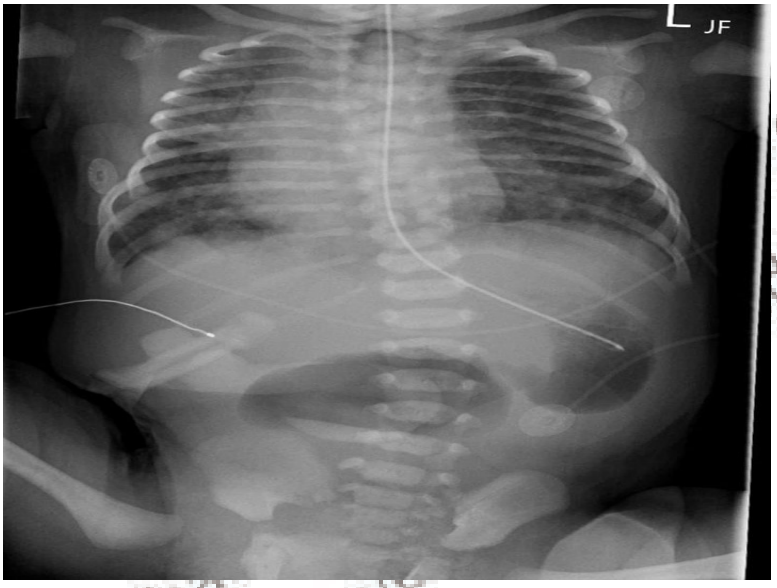
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Stomach and Duodenum

Question 1:

A neonate presented with features of intestinal obstruction. The X-ray showed the following image. What is the probable diagnosis?



a) Jejunoileal atresia

b) Esophageal atresia

c) Duodenal atresia

d) Colonic atresia

Question 2:

An infant with Edward's syndrome presents with the following radiological finding. Which of the following is false about this condition?

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a) More common in boys

b) Mostly presents as vomiting within 1 week

c) Erythromycin exposure in the first 2 weeks of life can lead to this condition

d) Palpation of the pyloric olive is pathognomonic for this condition

Question 3:

An abdominal mass in a patient with congenital hypertrophic pyloric stenosis is best seen _____.

a) During feeding

b) Soon after birth

c) During palpation over the left hypochondrium

d) During palpation over the epigastrium

Question 4:

A child is diagnosed with congenital hypertrophic pyloric stenosis. Which among the following statements is true regarding her condition?

a) 2 and 4

b) 1, 3 and 5

c) 1, 3, 4 and 5

d) 1, 2 and 3

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Question 5:

Which part of the GIT is most sensitive to ischemia following a hypovolemic insult?

a) Griffith point

b) Sudeck point

c) Terminal ileum

d) Stomach

Question 6:

What is the most common cause of upper GI bleeding?

a) Esophageal varices

b) Peptic ulcer

c) Gastric erosions

d) NSAID induced gastritis

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Question 7:

A 35-year-old man came with complaints of dark-colored stools to the OPD. After undergoing endoscopy, the patient was diagnosed with an upper GI bleed. Which of the following structures is used as a demarcation point to differentiate it from a lower GI bleed?

a) Ampulla of Vater

b) Ligament of Treitz

c) Superior duodenal flexure

d) Ileocaecal junction

Question 8:

A 45-year-old chronic alcoholic, with a history of binge drinking and multiple episodes of vomiting, presents with hematemesis. On endoscopy, a longitudinal mucosal tear is found in the gastroesophageal junction. What is the most likely diagnosis?

a) Boerhaave syndrome

b) Mallory-Weiss tear

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c) Gastric antral vascular ectasia

d) Dieulafoy lesion

Question 9:

A 25-year-old male patient presented to the OPD with complaints of increasing heartburn and dyspepsia for the past several months. He was prescribed PPIs for one month but he has no relief. You perform a urea breath test which is found to be positive. What is the most likely diagnosis?

a) Type A gastritis

b) Type B gastritis

c) Reflux gastritis

d) Erosive gastritis

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Question 10:

Which of the following causes gastritis in patients with AIDS?

a) Histoplasmosis

b) Cryptosporidiosis

c) Cytomegalovirus

d) Isospora belli

Question 11:

What is the most common site of gastric ulcer?

a) Lesser curvature near incisura

b) Greater curvature

c) Fundus

d) Prepyloric

Question 12:

Which type of gastric ulcer has increased gastric acid levels?

a) Type I

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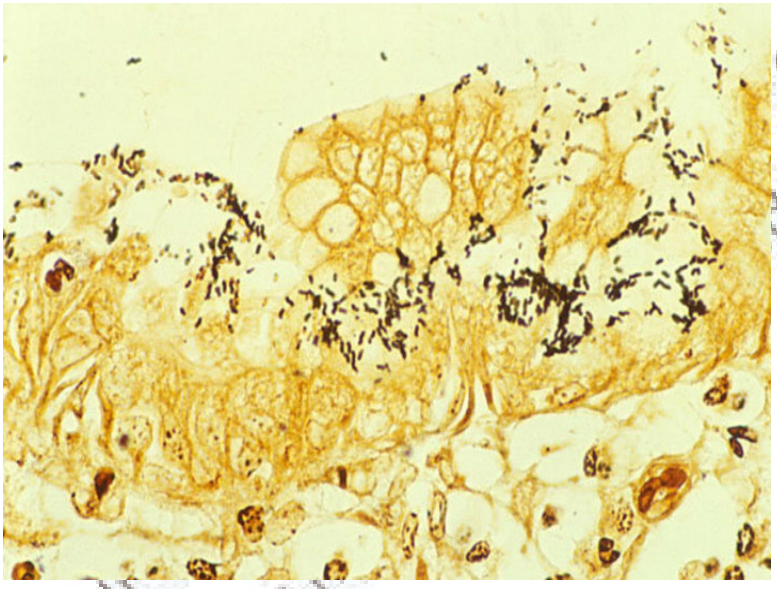
b) Type IV

c) Type V

d) Type III

Question 13:

A biopsy was obtained from a patient with chronic peptic ulcer disease. The pathological slide is given below. Identify the false statement regarding the causative agent of this condition.



a) Causes hypogastrinemia

b) Causes the most common type of gastritis

c) Associated with causation of gastric MALToma

d) Considered by WHO as class I carcinogen

Question 14:

What is the most common complication that you expect in patients suffering from peptic ulcer disease?

a) Bleeding

b) Obstruction

c) Perforation

d) Malignant transformation

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Question 15:

Which of the following is used for the classification of the endoscopic appearance of bleeding peptic ulcers in a patient with peptic ulcer disease?

a) Forrest classification

b) Blatchford score

c) Rockall score

d) Bismuth classification

Question 16:

Which of the following is the most commonly involved vessel in patients with bleeding peptic ulcers on the posterior wall?

a) Left gastric artery

b) Right gastroepiploic artery

c) Gastroduodenal artery

d) Left gastroepiploic artery

Question 17:

A 23-year-old woman was admitted to the burns ward with an involvement of 45% of the body surface area. She is at an increased risk of developing ulcers in which of the following parts of the stomach?

a) Fundus

b) Body

c) Lesser curvature

d) Greater curvature

Question 18:

A 42-year-old man is brought to the emergency room with complaints of severe abdominal pain. On examination, his vitals are stable and there is abdominal rigidity and tenderness. The erect X-ray of the abdomen is suggestive of pneumoperitoneum and the patient is posted for emergency laparotomy. It reveals the presence of a perforated type I gastric ulcer. How will you manage this patient?

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a) Perform distal gastrectomy with Billroth I anastomosis

b) Closure of the perforation with Graham's patch repair

c) Perform truncal vagotomy and antrectomy

d) Perform truncal vagotomy with gastrojejunostomy

Question 19:

Kelling-Madlener procedure is done for _____

a) Type lll gastric ulcer

b) Type lV gastric ulcer

c) Type l gastric ulcer

d) Type ll gastric ulcer

Question 20:

A 25-year-old man on SSRI presented with hematemesis and abdominal pain. An endoscopy was performed immediately which showed an actively bleeding ulcer of size 2cm in the posterior wall of the duodenum. What is the next best step in the management of this patient?

a) Electrocoagulation

b) Graham's patch repair

c) Duodenostomy

d) PPI + endoscopic monitoring

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Question 21:

Which of the following is the preferred approach for treating a patient who has a duodenal ulcer with a perforation of 2.5cm?

a) Primary closure and buttress with well-vascularised omentum

b) Graham patch repair

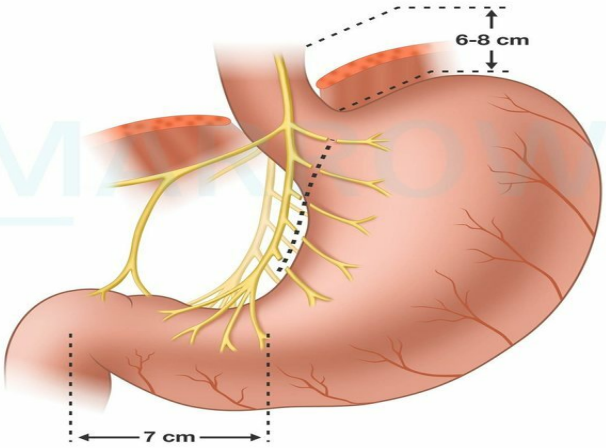
c) Closure of defect and gastrojejunostomy

d) Managed conservatively

Question 22:

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Which of the following is false about the type of vagotomy shown in the image below?



a) Ulcer recurrence rate is highest

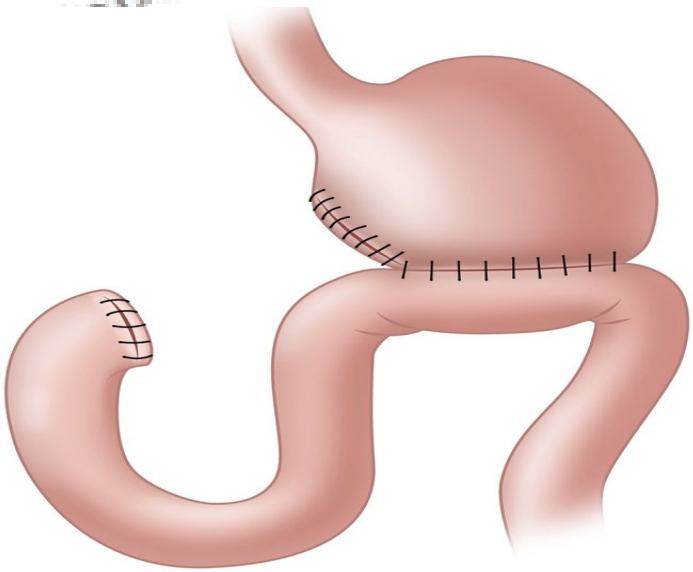
b) Acid reduction is maximum

c) Nerve of Latarjet is spared

d) Postoperative complications are minimum

Question 23:

Identify the surgical procedure shown below.



a) Billroth I gastrectomy

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b) Billroth II gastrectomy

c) Braun's modification of Billroth II

d) Roux-en Y gastrojejunostomy

Question 24:

A 40-year-old man presents to the ER with severe abdominal pain. Guarding is present on per abdomen examination. HR is 110bpm and BP is 88/60mmHg. Erect abdominal X-ray is shown below. Which of the following would you proceed with, for managing this case?



a) 2,3

b) 1,4

c) 3,4,5

d) 1,2,5

Question 25:

A 54-year-old man presented with acute onset of abdominal pain, fever, and vomiting. Examination revealed tenderness over the right iliac fossa. USG showed gas around the right kidney. What is the most likely diagnosis?

a) Appendicitis

b) Perforated duodenal ulcer

c) Cholecystitis

d) Pancreatitis

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Question 26:

A 30-year-old actress who underwent Roux-en-Y gastric bypass surgery for obesity, presents with complaints of sweating, palpitations, epigastric fullness, and loose stools which start immediately after meals. Which of the following would you not associate with her condition?

a) It is precipitated by carbohydrate rich food.

b) It is more common after partial gastrectomy with the Billroth II reconstruction.

c) It results in hypoglycemia.

d) It is relieved by lying down.

Question 27:

A patient presented to the casualty with severe upper abdominal pain and recurrent retching with minimal vomiting. A nasogastric tube insertion was tried but it was unsuccessful. A chest X-ray showed diffuse distension of bowel loops and a left-sided diaphragmatic defect. Which of the following statements regarding this condition is false?

a) Mesenteroaxial type is more common

b) Organoaxial type is associated with a diaphragmatic defect

c) Surgery is performed through a transabdominal approach

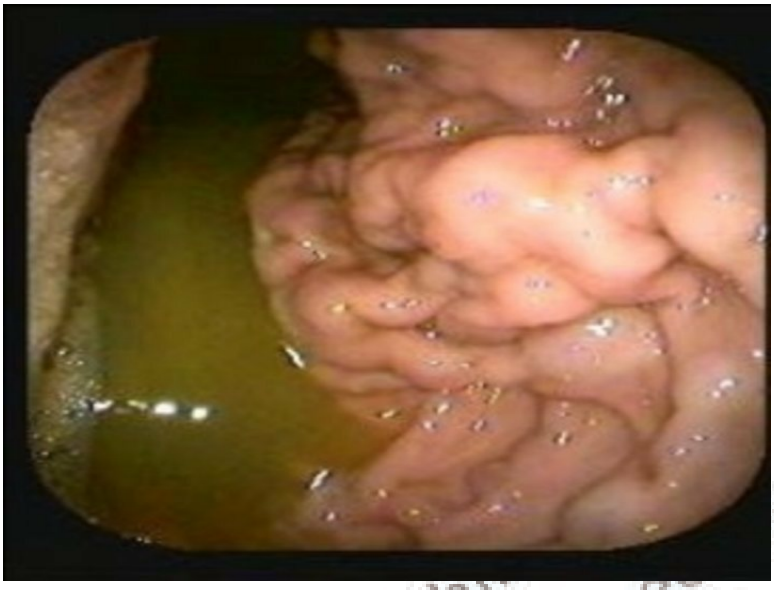
d) Borchardt triad is seen

Question 28:

A 40-year-old male presented to the OPD with complaints of abdominal pain, diarrhea, loss of appetite, and loss of weight. On examination, the patient had peripheral edema and ascites. Laboratory studies showed decreased serum albumin but normal serum levels of transaminases and gastrin. Upper GI endoscopy showed the following appearance of the stomach. Which of the following is true about the condition?

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a) No malignant potential

b) Gastrectomy is the treatment of choice in severe cases

c) Caused by overexpression of TNF alpha

d) Characterized by hyperchlorhydria

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Answer Key

Question No.	Correct Option
1	c
2	b
3	a
4	b
5	d
6	b
7	b
8	b
9	b
10	b
11	a
12	d
13	a
14	a

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15	a
16	c
17	a
18	a
19	b
20	a
21	b
22	b
23	b
24	a
25	b
26	c
27	a
28	b

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Detailed Explanations

Solution to Question 1:

The above plain abdominal radiograph shows a typical double-bubble sign suggestive of duodenal atresia.

The double-bubble represents dilatation of the stomach and the proximal duodenum.

Duodenal atresia is often associated with trisomy 21/Down syndrome, prematurity, maternal polyhydramnios, cardiac malformations, and malformations of the hepatobiliary system.

It is caused due to failure of recanalization or partial recanalization of the duodenum or failure of vacuolization of the duodenum from its solid cord stage. The anatomic variants are as follows:

• Type I:

• most common

• mucosal web with intact muscle wall (so-called windsock deformity)

• Type II:

• two ends separated by a fibrous cord, but muscle continuity present

• Type III:

• complete separation of two ends with a gap within the duodenum

Clinical features:

• Obstructive features such as

• bilious emesis (due to duodenal obstruction distal to the ampulla of Vater)

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• postprandial emesis

• upper abdominal distension with a scaphoid lower abdomen

• Delayed passage of meconium

Abdominal radiographs show the double-bubble sign. If distal air is present, an upper GI contrast study should be considered to exclude midgut volvulus.

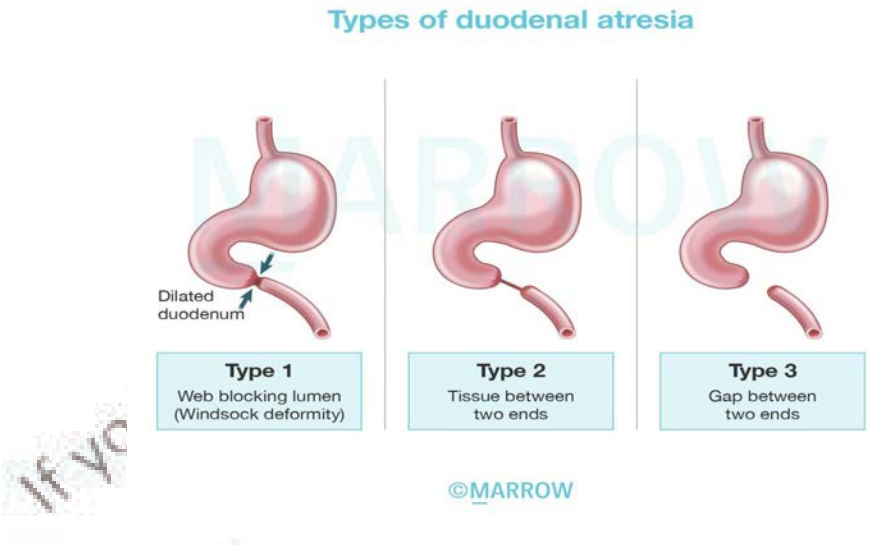
Treatment:

• The initial treatment of infants with duodenal atresia includes nasogastric or orogastric decompression.

• IV fluids and parenteral nutrition are started to prevent acid-base imbalance.

• Echocardiography, renal ultrasound, and radiology of the chest and spine should be performed to evaluate for associated anomalies.

• Definitive correction of the atresia is done by duodenoduodenostomy. This procedure is also preferred in cases of the concomitant or isolated annular pancreas.



Solution to Question 2:

The radiographic image showing the presence of an enlarged gastric gas bubble (single bubble) is suggestive of congenital hypertrophic pyloric stenosis (CHPS). It most commonly presents with non-bilious projectile vomiting between 2-8 weeks of age and is only rarely seen after 13 weeks.

Hypertrophy of the circular muscle of the pylorus results in constriction and obstruction of the gastric outlet. First-born male infants are at the highest risk.

Risk factors for congenital hypertrophic pyloric stenosis:

• Turner syndrome

• Edwards syndrome

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• Erythromycin or azithromycin exposure in the first 2 weeks of life either orally or via mother's milk.

Palpation of the olive-shaped mass in the epigastrium is considered pathognomonic.

USG criteria for diagnosing hypertrophic pyloric stenosis - pyloric muscle thickness of >3-4 mm or a pyloric length >15-18 mm in the presence of functional gastric outlet obstruction is diagnostic.

Solution to Question 3:

In a child with congenital hypertrophic pyloric stenosis (CHPS), the abdominal mass is best seen during test feed in the right upper quadrant.

Hypertrophic pyloric stenosis most presents with non-bilious projectile vomiting. It is common between 2 and 8 weeks of age. Hypertrophy of the circular muscle of the pylorus results in constriction and obstruction of the gastric outlet. Male infants are at a higher risk.

Clinically, when the infant is given a test feed, an olive-shaped mass is palpable in the right upper quadrant and visible peristalsis is usually observed moving from left to right across the abdomen.

Infants with hypertrophic pyloric stenosis develop a characteristic metabolic abnormality- hypochloraemic hypokalaemic metabolic alkalosis. Persistent vomiting results in loss of hydrochloric acid leading to the development of metabolic alkalosis (due to loss of H+) and hypochloremia (due to loss of Cl-).

All infants with congenital hypertrophic pyloric stenosis are evaluated with an ultrasound (investigation of choice). It confirms the diagnosis in the majority of cases.

Management: Rehydration and metabolic correction prior to definitive surgery - Ramstedt's pyloromyotomy.

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Solution to Question 4:

Congenital hypertrophic pyloric stenosis (CHPS) most commonly presents with non-bilious projectile vomiting. It is common between 2-8 weeks of age.

When the infant is given a test feed, visible peristalsis is usually observed moving from left to right, followed by projectile vomiting.

Infants with hypertrophic pyloric stenosis develop a characteristic metabolic abnormality i.e hypokalemic hypochloremic metabolic alkalosis with paradoxical aciduria.

Persistent vomiting results in loss of hydrochloric acid leading to the development of metabolic alkalosis (due to loss of H+) and hypochloremia (due to loss of Cl-). The kidneys try to compensate for alkalosis by secreting Na+ and HCO3-. However, the loss of sodium stimulates the secretion of aldosterone via the RAAS pathway. The aldosterone causes active reabsorption of sodium in exchange for K+ and H+ ions. Loss of potassium ions leads to the development of hypokalemia. Loss of H+ ions in urine lowers the urinary pH resulting in aciduria. It is called paradoxical aciduria, since the body initially lost H+ ions due to loss of HCl, and instead of

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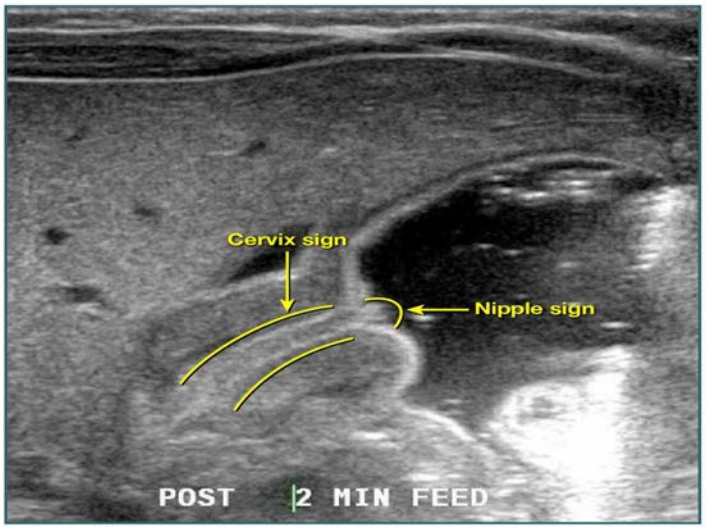
compensating that loss, the body is losing more H+ ions through urine.

The cervix sign and nipple sign are signs of CHPS seen on ultrasonography:

• Double-layered hypertrophic mucosa protrudes into the stomach, creating the so-called nipple sign.

• The sonographic appearance of the hypertrophied pylorus resembles that of the uterine cervix and is sometimes referred to as the cervix sign.

The given ultrasound image shows thickened pylorus, with cervix sign and nipple sign.



Treatment:

• The child should be rehydrated and the metabolic abnormality has to be corrected preoperatively.

• The Ramstedt pyloromyotomy is the standard surgical procedure for its treatment.

Solution to Question 5:

Tonometry studies have shown that of all the parts of the gastrointestinal tract (GIT), the stomach is most sensitive to ischemia following a hypovolemic insult and is also the slowest to recover.

This may explain the high incidence of stress ulceration in the stomach.

The Griffiths point (or Griffiths critical point) refers to the site of watershed anastomosis between the ascending left colic artery and the marginal artery of Drummond occurring in the region of the splenic flexure. Most anatomy texts describe its location as two-thirds along the transverse colon.

The Sudeck point (or Sudeck critical point) refers to a specific location in the arterial supply of the rectosigmoid junction, namely the origin of the last sigmoid arterial branch from the inferior mesenteric artery (IMA).

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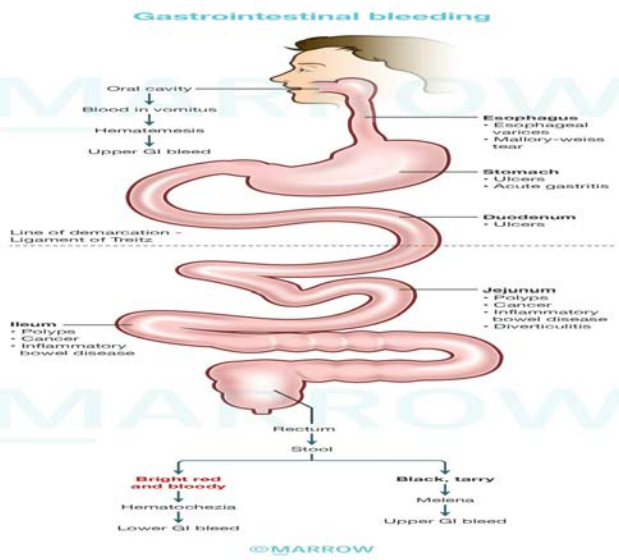
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Solution to Question 6:

The most common cause of upper GI bleeding is peptic ulcer.

The causes of upper GI bleed in decreasing order of frequency:

- Ulcers
- Esophageal (6%)
- Gastric (21%)
- Duodenal (33%)
- Erosions
- Mallory–Weiss tear
- Esophageal varices
- Tumour
- Vascular lesions

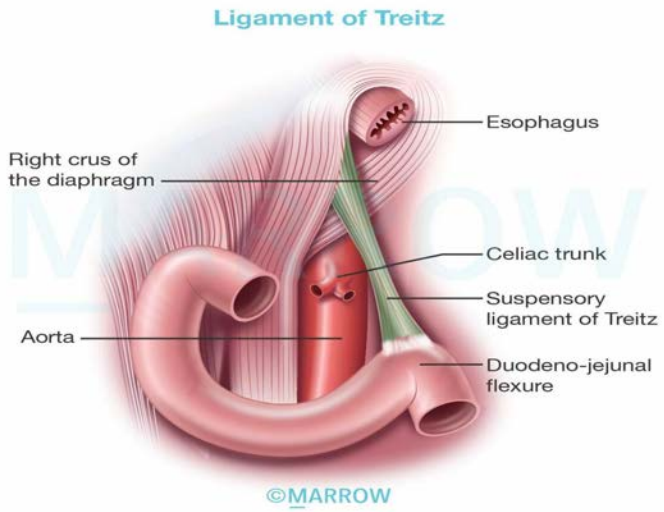


Solution to Question 7:

The ligament of Treitz is used as the demarcation point to differentiate between upper gastrointestinal bleeding and lower gastrointestinal bleeding. It is a part of the duodenojejunal junction.

Upper GI bleeding refers to bleeding proximal to the ligament of Treitz, and lower GI bleeding refers to bleeding distal to the ligament of Treitz.

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Solution to Question 8:

The given clinical scenario is suggestive of Mallory Weiss tear. It is due to a longitudinal tear in mucosa or submucosa of the gastroesophageal junction.

It is most commonly seen in alcoholics, following forceful vomiting, retching, coughing, or straining. The left gastric artery is the most common vessel to bleed. The investigation of choice is endoscopy.

Management of Mallory Weiss tear

• Conservative, as it is usually is self-limiting.

• Endoscopic electrocoagulation or sclerosant therapy.

• Angiographic embolization - if endoscopy fails.

• High gastrotomy - if all these maneuvers fail.

Boerhaave syndrome is characterized by spontaneous perforation of the esophagus. Here all layers are involved. Clinical features include Mackler's triad

• Retching

• Chest pain

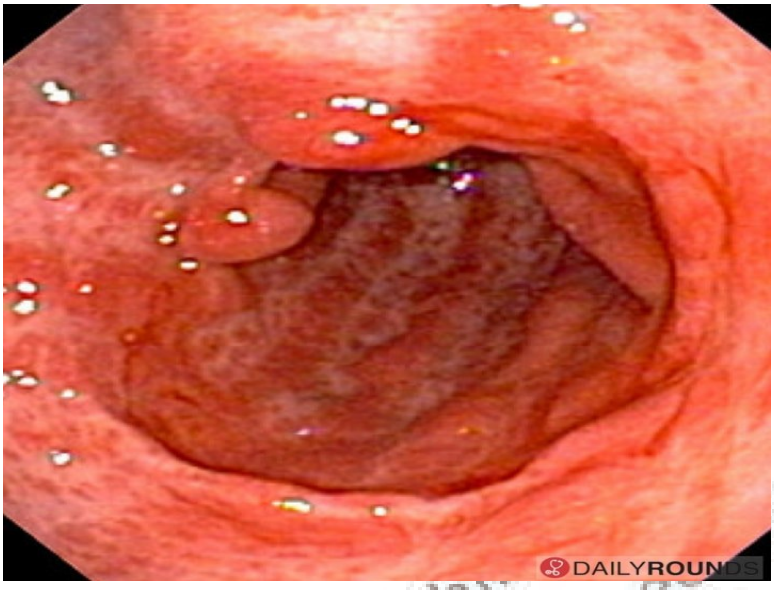
• Subcutaneous emphysema

Gastric Antral Vascular Ectasia (GAVE) is characterized by dilated venules in the submucosa of the antrum.

On endoscopy: Watermelon stomach.

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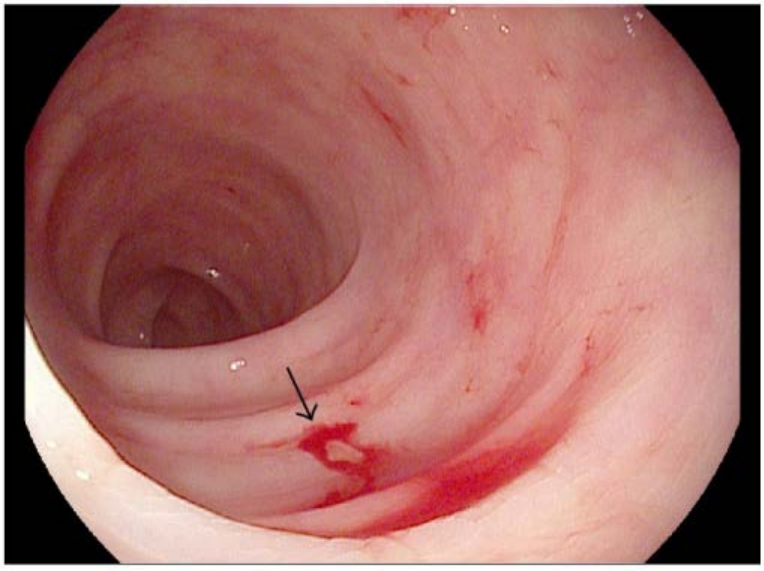


Management of GAVE

• Endoscopic argon photocoagulation (APC)

• If persistent - antrectomy.

Dieulafoy lesion is a vascular malformation (dilated submucosal arterioles) that is seen along the lesser curvature of the stomach. The investigation of choice is endoscopy.



Management of Dieulafoy lesion:

• Endoscopic electrocoagulation or sclerosant therapy

• Angiographic embolization.

Solution to Question 9:

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The given clinical scenario and the positive urea breath test are suggestive of a Helicobacter pylori infection which is most commonly associated with Type B gastritis.

Type B gastritis usually affects the antrum. Intestinal metaplasia associated with chronic pan-gastritis and atrophy is seen. It has greater potential for malignancy as compared to Type A gastritis.

Type A gastritis affects the fundus with antral sparing. Its features can be easily remembered by 4 'A's:

• Autoimmune condition - has circulating antibodies to parietal cells

• Atrophy of parietal cell mass

• Achlorhydria - causes chronic hypergastrinemia and microadenomas of enterochromaffin-like (ECL) cells

• Anemia - leads to pernicious anemia, due to malabsorption of Vit B12 (as the intrinsic factor is also produced by parietal cells)

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Solution to Question 10:

Acquired immunodeficiency syndrome (AIDS) gastritis is secondary to infection with cryptosporidiosis.

Other specific types of gastritis:

• Eosinophilic gastritis appears to have an allergic basis and is treated with steroids and cromoglycate.

• Granulomatous gastritis is seen rarely in Crohn's disease and also may be associated with tuberculosis.

• Phlegmonous gastritis is a rare bacterial infection of the stomach, found in patients with severe intercurrent illnesses.

Solution to Question 11:

The most common site of gastric ulcer is the lesser curvature near incisura.

Approximately 60% of ulcers are in this location and are classified as type I gastric ulcers.

These ulcers are generally not associated with excessive acid secretion and may occur with low to normal acid output.

Solution to Question 12:

Gastric ulcers of Types II (gastric body with duodenal ulcer) and III (prepyloric) are associated with increased gastric acid levels.

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Solution to Question 13:

The given slide shows the GI mucosa, stained with Warthin-Starry silver stain, infected with Helicobacter pylori. H. pylori cause hypergastrinemia.

The ammonia released by H. pylori acts on the antral G-cells and releases gastrin. This is responsible for hypergastrinemia in these patients resulting in type B gastritis (the most common type of gastritis).

Urea breath test and antibodies to H. pylori help us with diagnosis. The gold standard investigation for H. pylori is a tissue biopsy.

H. pylori is classified by the WHO as a class I carcinogen because of the production of certain cytotoxins, notably the Cag A and Vac A, which are implicated in gastritis, peptic ulceration, and cancer.

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Solution to Question 14:

The most common complication of peptic ulcer disease is bleeding, followed by perforation and obstruction.

The most common site for perforation of peptic ulcers is the first part of the duodenum.

Complications of peptic ulcers are

• Bleeding - It is the most common complication of posterior duodenal ulcer.

• Perforation - It is the most common complication of anterior duodenal ulcer and gastric ulcer.

• Obstruction

• Hour-glass deformity of the stomach - Large long-standing gastric ulcers can lead to fibrosis. fibrosis if present can cause hourglass constriction of the stomach. Barium meal shows double pouched stomach.

• Tea-pot deformity (handbag stomach) - It is caused by cicatrization and shortening of the lesser curvature.

• An ulcer can erode posteriorly into the pancreas and anteriorly into the liver.

• Malignancy.

Solution to Question 15:

Forrest classification is used for classifying the endoscopic appearance of bleeding peptic ulcers. It stratifies the risk of rebleeding based on observed stigmata of recent hemorrhage.

Forrest classification is clinically very significant as it provides prognostic information to the surgeon about the need for endoscopic therapeutic intervention and the risk of rebleeding.

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Option B: The Glasgow–Blatchford bleeding score (GBS) is a screening tool to assess the likelihood that a patient with acute upper gastrointestinal bleeding (UGIB) will need medical intervention such as a blood transfusion or endoscopic intervention. It incorporates the patient's blood urea level, hemoglobin level, blood pressure, and other clinical parameters.

Option C: Rockall score assesses the risk of rebleeding and in-hospital mortality in patients with an upper GI bleed.

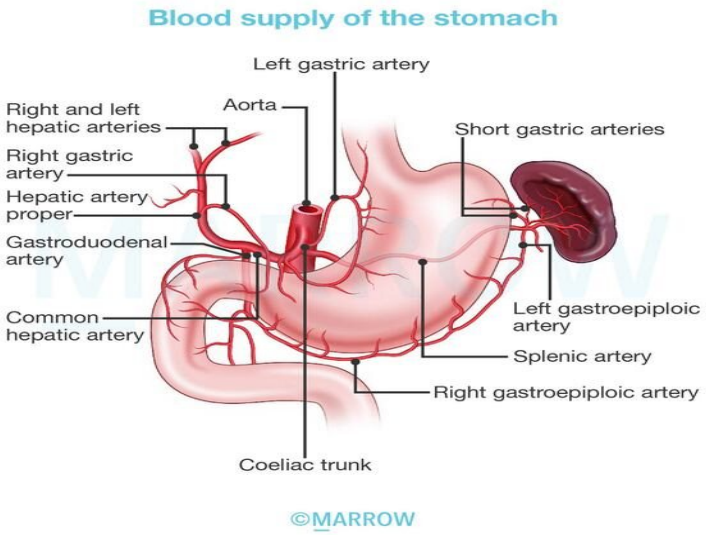
Option D: The Bismuth–Corlette classification system provides an anatomic description of the tumor location and longitudinal extension in the biliary tree.

Stigmata of Recent Hemorrhage	Forrest Classification
Active Spurting	I A
Active Oozing	I B
Non-bleeding vessel	II A
Adherent Clot	II B
Flat Pigmented Spot	II C
Clean Based Ulcer	III

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Solution to Question 16:

The most common vessel responsible for bleeding in peptic ulcer disease is the gastroduodenal artery. Ulcers located in the posterior wall can erode the mucosa and the gastroduodenal artery, leading to hematemesis and melena.



Solution to Question 17:

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A patient with burn is at risk of developing Curling's ulcers (stress ulcers). Stress ulcers in the stomach are located most commonly in the fundus.

Stress gastritis occurs after a physical trauma, shock, sepsis, hemorrhage, or respiratory failure. It is characterized by multiple superficial (non-ulcerating) erosions that begin in the proximal or acid-secreting portion of the stomach and progress distally. They are almost always seen in the fundus of the stomach and usually develop within 1 to 2 days after a traumatic event.

The stress-induced splanchnic vasoconstriction causes systemic hypotension and reduced blood flow leading to mucosal injury.

On microscopic examination, they appear as wedge-shaped mucosal hemorrhages, with coagulation necrosis of the superficial mucosal cells. Stress ulcers present as painless upper GI bleeds.

Note: Cushing ulcers arise in individuals with intracranial disease. They occur in the stomach, duodenum, and esophagus and carry a high incidence of perforation. They occur due to gastric acid hypersecretion from direct vagal nerve stimulation.

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Solution to Question 18:

In stable patients without operative risks, Perforated type I gastric ulcers are best managed by distal gastrectomy with Billroth I anastomosis (with or without vagotomy).

If the patient is hemodynamically unstable or unfit for surgery, simple patch repair with biopsy preferred.

Type of Gastric Ulcer	Management
Type I	Distal gastrectomy
Type II and III	Distal gastrectomy + Vagotomy
Type IV	Csendes procedureorPauchet procedureorKelling - Madlener procedure

Solution to Question 19:

The Kelling-Madlener procedure is done for type lV Gastric ulcers.

Surgical management of type lV gastric ulcer

• Kelling-Madlener procedure - involves antrectomy and excision of gastric ulcer.

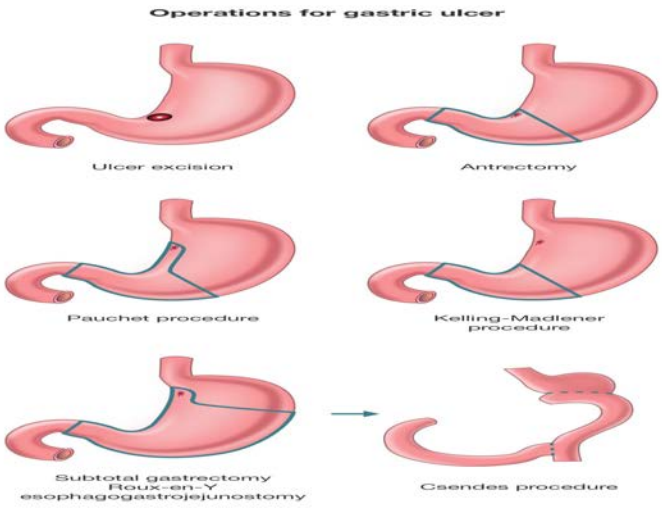
• Pauchet's procedure - involves distal gastrectomy with a selective sleeve-like extension to the lesser curvature to remove the ulcer.

• Csendes Procedure- subtotal gastrectomy with sleeve-like extension to the lesser curvature.

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Management of gastric ulcer

Types of gastric ulcer	Management
Type l	Distal gastrectomy
Type ll & lll	Distal gastrectomy + Vagotomy
Type lV	Pauchet's procedureOrKelling-Madlener's procedureOrCsendes procedure



Solution to Question 20:

The next best step to manage the above scenario is endoscopic electrocoagulation.

Management of bleeding peptic ulcer

For actively bleeding ulcers or non-bleeding visible vessels,

• Endoscopic therapy with a combination of epinephrine injection and electrocoagulation is done. Surgery is done only when 2 attempts of endoscopic therapy fail.

• Surgical management includes duodenostomy and under-running of the vessel. Duodenal ulcers also show a good response to acid-reducing surgery or vagotomy.

Medical management includes PPIs and H.pylori eradication therapy.

Solution to Question 21:

The preferred treatment of perforations between 1–3 cm in size is a Graham patch repair.

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Treatment of perforated duodenal ulcer:

• <1 cm: Primary closure + buttress with well-vascularised omentum

• 1–3 cm: Graham patch repair

• >3 cm: Closure of defect using omentum or jejunal serosa + pyloric exclusion + gastrojejunostomy

Solution to Question 22:

The picture depicts Highly Selective Vagotomy (HSV). Post-procedure acid reduction is minimum in HSV.

It involves resection of crowfoot branches, 6cm from the gastroesophageal junction but stopped 7cm from the pylorus. The nerve of Latarjet from the anterior and posterior vagal trunk supplies the acid pepsin areas of the stomach. It is spared in HSV. Usually, the motor branch to the pylorus is also preserved.

There are 3 types of vagotomy

• Highly selective vagotomy

• Truncal vagotomy + gastrojejunostomy

• Truncal vagotomy + antrectomy.

Highly selective vagotomy

• Acid reduction is minimum.

• Highest ulcer recurrence rate.

• Minimum postoperative complications.

Truncal vagotomy + antrectomy

• Acid reduction is maximum.

• Least ulcer recurrence rate.

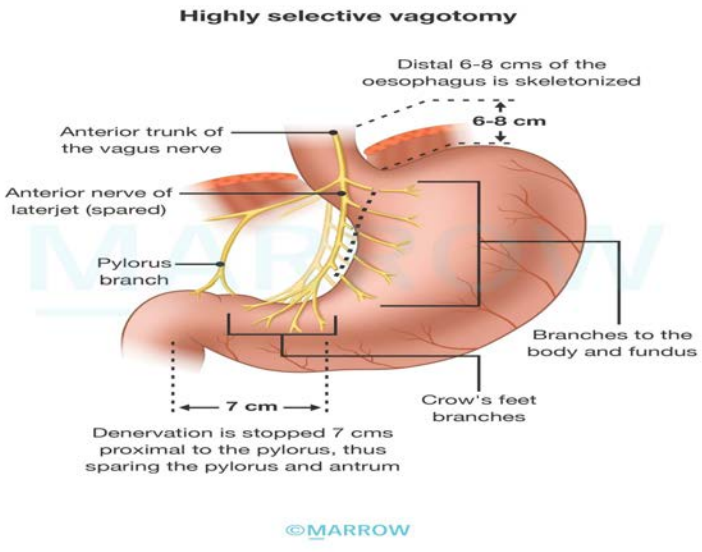
• Maximum postoperative complications.

Note: Vagal nerves are motor to the stomach and denervation of the antro-pyloro-duodenal segment results in gastric stasis after truncal vagotomy. Hence, a drainage procedure, most commonly Heineke–Mikulicz pyloroplasty or gastrojejunostomy is done along with vagotomy.

The criminal nerve of Grassi is a branch of the posterior vagal trunk that arises at the gastroesophageal junction and supplies the fundus of the stomach. It is called a criminal nerve because it is often missed during vagotomy procedures and can result in recurrent peptic ulcer disease.

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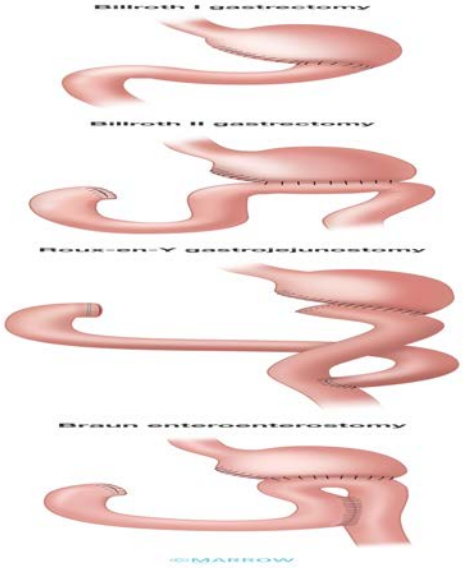
Solution to Question 23:

The procedure illustrated in the image is Billroth II gastrectomy. Following resection, the distal end of the stomach is narrowed by the closure of the lesser curve aspect of the remnant. The greater curve aspect is then anastomosed, usually in a retro-colic fashion, to the jejunum.

Option A: In Billroth I gastrectomy, the lower half of the stomach is removed, and the cut end of the stomach is anastomosed to the first part of the duodenum.

Option C: Braun modification of classical Billroth II gastrectomy is Billroth II reconstruction with jejunojejunostomy.

Option D: Roux-en Y gastrojejunostomy is a gastric bypass surgery where a loop of jejunum is anastomosed to a proximal gastric pouch.



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Solution to Question 24:

The given clinical scenario and erect X-ray abdomen showing gas under the diaphragm (pneumoperitoneum) is suggestive of gastrointestinal perforation. It is managed by initial resuscitation with IV fluids followed by exploratory laparotomy. It is a surgical emergency.

Management includes:

• Adequate preoperative resuscitation with intravenous fluids followed by correction of electrolyte imbalance, instituting broad-spectrum intravenous antibiotics and

• Early surgical intervention/laparotomy to address the cause for pneumoperitoneum and stop further contamination of the peritoneal cavity.

Solution to Question 25:

The given clinical scenario is suggestive of pneumoretroperitoneum caused by a perforated duodenal ulcer.

Posterior duodenal ulcer perforates into the retroperitoneum, and the contents leak through the right paracolic gutter into the right iliac fossa, mimicking appendicitis. This is called Valentino syndrome.

On USG, gas can be seen around the right kidney known as the renal veil sign.

Solution to Question 26:

The clinical scenario is suggestive of early dumping syndrome. Hypoglycemia■ does not occur in early dumping syndrome. Hypoglycemia is seen in late dumping syndrome secondary to raised insulin levels.

Dumping syndrome is a complication occurring post gastrectomy. It can be early or late.

Early dumping syndrome is due to the high osmotic load that reaches the small bowel, leading to sequestration of fluid from the circulation into the gastrointestinal tract (GIT). This fluid shift induces autonomic responses. It is characterized by more GI and fewer cardiovascular effects such as:

• Epigastric fullness

• Sweating

• Lightheadedness

• Tachycardia

• Diarrhea

Symptoms are aggravated by having more food and relieved by lying down.

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Late dumping syndrome is due to an increase in insulin levels and secondary hypoglycemia. This hypoglycemia causes a catecholamine surge, which results in predominantly cardiovascular effects such as:

• Diaphoresis

• Tremulousness

• Light-headedness

• Tachycardia

• Confusion

The symptoms are aggravated by exercise and relieved by having food.

The principal treatment for both types of dumping syndrome is dietary manipulation. Meals based on fat and protein are known to work the best. Octreotide before meals is useful.

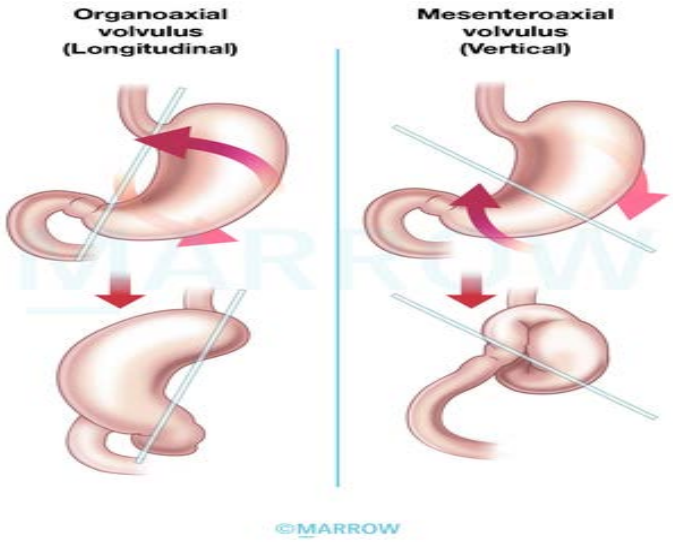
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Solution to Question 27:

The given clinical scenario is suggestive of gastric volvulus. Organoaxial gastric volvulus is more common (66%) than mesenteroaxial volvulus (33%).

Organoaxial gastric volvulus: Torsion occurs along the longitudinal axis of the stomach and often occurs acutely. It is associated with a diaphragmatic defect.

Mesenteroaxial gastric volvulus: Torsion occurs along the vertical axis. It is partial (<180 degrees) and recurrent. It is not associated with a diaphragmatic defect.



The Borchardt triad is seen in gastric volvulus:

• Sudden-onset severe upper abdominal pain

• Recurrent retching with production of little vomitus

• Inability to pass a nasogastric (NG) tube

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Management involves reduction and uncoiling of the stomach through a transabdominal approach.

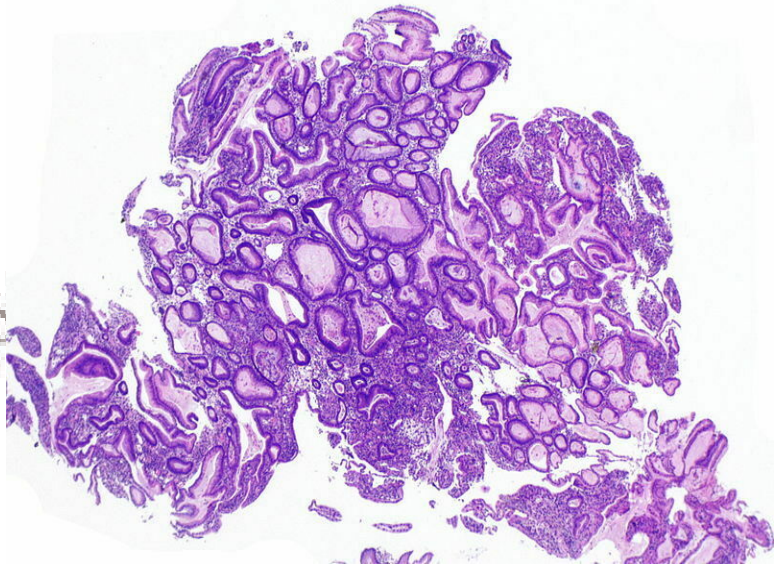
Solution to Question 28:

The given clinical scenario and the image showing the presence of hypertrophied gastric mucosal folds are characteristic of Menetrier's disease. Gastrectomy is the treatment of choice in severe cases of Menetrier's disease.

Menetrier's disease is a premalignant condition. The disease seems to be caused by overexpression of transforming growth factor-alpha i.e., TGF-alpha (not TNF-alpha), which stimulates the EGFR pathway, resulting in increased proliferation of mucus cells/foveolar hyperplasia. This results in gross hypertrophy of the gastric mucosal folds, mucus production, and hypochlorhydria. The antrum is usually spared.

There is a loss of albumin (up to 10 g/day), across the gastric mucosa leading to hypoproteinemia. Secondary symptoms include weight loss, diarrhea, and peripheral edema.

Histologically, it is characterized by hyperplasia of foveolar mucous cells. The glands are cystically dilated and elongated with a corkscrew-like appearance as shown in the image below.



Cetuximab, an EGFR inhibitory antibody, is now considered the first-line treatment for Menetrier's disease, leaving total gastrectomy for severe disease with persistent and substantial protein loss refractory to cetuximab.

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Carcinoma Stomach

Question 1:

Which of the following factors will increase the risk of a patient developing gastric carcinoma?

a) Aspirin

b) Eating refrigerated food

c) Female sex

d) Cigarette smoking

Question 2:

What is the most common site of gastric adenocarcinoma in the Asian population?

a) Cardia

b) Body

c) Antrum

d) Fundus

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Question 3:

A man presents to the hospital with a 3-day history of haematemesis. Upper GI endoscopy reveals multiple gastric polyps and a positive urease breath test. Which type of polyp is he most likely to have?

a) Inflammatory

b) Hamartomatous

c) Hyperplastic

d) Adenomatous

Question 4:

An elderly patient who presented with abdominal discomfort and weight loss was diagnosed with type I gastric cancer according to Lauren's classification. Which of the following is not

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true regarding this condition?

a) More well differentiated

b) Associated with gastric atrophy

c) Lymphatic spread

d) More common in men

Question 5:

Which of the following genetic mutations is least likely to be seen in a patient with an intestinal type of gastric cancer?

a) Mutation in β-catenin

b) Loss of heterozygosity in the APC gene

c) Under expression of transforming growth factor α

d) Loss of heterozygosity at the bcl-2 gene

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Question 6:

A man, presented with multiple episodes of non-bilious vomiting containing undigested food particles within one-hour post meals. On physical examination, he was found to be anemic and cachexic. CECT abdomen revealed diffuse infiltration of a neoplastic growth into the stomach wall. What Bormann's classification does this tumor belong to?

a) Type I

b) Type II

c) Type III

d) Type IV

Question 7:

A patient was found to have a tumor extending up to 1cm below the gastroesophageal junction on EUS. According to the Siewert classification, which stage of carcinoma does she have?

a) Type I

b) Type II

c) Type III

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d) Type IV

Question 8:

A woman presented to the gastroenterology OPD with significant weight loss, fatigue, and a bloating sensation for the past 8 months. A detailed workup was done, and she was diagnosed with early gastric carcinoma. All of the following structures can be involved in this stage except:

a) Muscularis mucosa

b) Submucosa

c) Muscularis propria

d) Lymph nodes

Question 9:

An Asian man who is a known smoker presented to the OPD with dysphagia, nausea, and loss of appetite. Endoscopy revealed a tumor arising from the stomach. Which of the following statements is false regarding TNM staging for this condition?

a) In T4 lesions, tumor perforates the serosa.

b) Metastasis in 1-5 lymph nodes is N1 disease.

c) Tumor invades adjacent organs in T4 lesions.

d) Metastasis in > 15 lymph nodes is N3b.

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Question 10:

A positive Troisier's sign refers to the involvement of which of the following?

a) Right supraclavicular lymph nodes

b) Left supraclavicular lymph nodes

c) Internal mammary lymph nodes

d) Tracheo- bronchial lymph nodes

Question 11:

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A male patient who was diagnosed with early gastric cancer is planned for endoscopic mucosal resection. Which of the following features would make him a poor candidate for this procedure?

a) Tumor measuring 1.5 cm

b) Ulceration of the tumor

c) Tumor limited to the mucosa

d) Moderately well- differentiated tumor

Question 12:

According to the Japanese classification for gastric carcinoma, which of the following is the level 5 lymph node?

a) Lesser curvature nodes

b) Supra-pyloric nodes

c) Left para-tracheal nodes

d) Right para-cardial nodes

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Question 13:

A patient with gastric adenocarcinoma is posted for surgery. What is the extent of negative margin you should remove around the tumor for this patient?

a) 3 cm

b) 5 cm

c) 8.5 cm

d) 10 cm

Question 14:

A patient presented with vague abdominal pain and feeling of a lump in the abdomen for the past 1 year. He was found to have a tumor arising from the stomach on CT scan. Biopsy of the lesion showed tumor cells positive for CD117 and CD34. What is the most likely origin of the tumor?

a) Paneth cells

b) Interstitial cells of Cajal

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c) Goblet cells

d) Intestinal stem cells

Question 15:

Which of the following is not a component of Carney's triad?

a) Extra-adrenal paraganglioma

b) Pulmonary chondroma

c) Pancreatic adenocarcinoma

d) GIST

Question 16:

A 45-year-old man presents with epigastric pain and intermittent vomiting for 2 months. He was inadequately treated for H. pylori infection 3 months back. The patient is HIV positive and is on ART for the same. Endoscopy reveals a fungating mass arising from the stomach. Biopsy of the lesion shows tumor cells positive for CD20. Which of the following is false regarding this tumor?

a) Stomach is the most common organ involved.

b) Most common type is NHL.

c) Fundus is the most common site involved

d) It is associated with H. pylori infections

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Question 17:

Which of the following is not an indication for surgery in a patient with gastric lymphoma?

a) Bleeding

b) Obstruction

c) Symptomatic residual disease

d) Intractable pain

Question 18:

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A woman underwent a total gastrectomy 5 months ago for gastric carcinoma. Which of the following is the most common metabolic complication expected in her?

a) Iron deficiency anemia

b) Vitamin B12 deficiency

c) Osteoporosis

d) Osteomalacia

Question 19:

A 50-year-old male presented with upper GI bleeding, abdominal pain, and a palpable abdominal mass. An endoscopic biopsy revealed a 5 cm tumor, with a high mitotic rate and c-KIT positivity in the body of the stomach. Which of the following is the best treatment of choice?

a) Surgical resection + surveillance

b) Surgical resection + imatinib

c) Surgical resection + D2 gastrectomy

d) Surgical resection + cisplatin

Question 20:

The gastrectomy specimen of a 56-year-old woman who underwent total gastrectomy showed HER2/neu positivity. Which among the following is the drug of choice for the treatment of this patient?

a) Tegafur

b) Trastuzumab

c) Pembrolizumab

d) Oteracil

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Answer Key

Question No.	Correct Option
1	d
2	c

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3	c
4	c
5	c
6	d
7	b
8	c
9	b
10	b
11	b
12	b
13	b
14	b
15	c
16	c
17	d
18	a
19	b
20	b

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Detailed Explanations

Solution to Question 1:

Cigarette smoking is a risk factor for gastric carcinoma.

Aspirin, which is a COX inhibitor, is protective against gastric cancer.

Eating refrigerated food has reduced the need for salting of food for preservation, and thus reduced the incidence of gastric cancer.

Males are more commonly affected as compared to females.

Solution to Question 2:

The most common site of gastric adenocarcinoma in the Asian population is the antrum. This is because H. pylori infections are relatively more prevalent in Asian countries and are associated with carcinoma of the body and distal stomach than the proximal stomach.

However, in western countries, the proximal stomach is the most common site. This is attributed to a lesser prevalence of untreated H.pylori infections and a greater burden of chronic GERD and obesity in western countries.

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Solution to Question 3:

The given history and investigations are suggestive of Helicobacter pylori infection. The polyps most commonly associated with H. pylori infection are hyperplastic polyps.

Hyperplastic polyps usually regress following H. pylori eradication therapy.

Benign gastric polyps are classified into two groups:

• Neoplastic:

• Adenoma

• Fundic gastric polyp

• Non- neoplastic:

• Hyperplastic polyp (most common)

• Inflammatory polyp

• Hamartomatous polyp

Note: The terms hyperplastic polyp and metaplastic polyp refer to the same lesion, however, 'hyperplastic polyp' is a preferred term.

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Solution to Question 4:

Type I gastric cancer is associated with hematogenous spread.

Lauren's system classifies gastric cancer pathology as either type I (intestinal) or type II (diffuse), based on differences in etiology, epidemiology, and pathology. Intestinal type of gastric cancer shows hematogenous spread, whereas diffuse-type shows transmural and lymphatic spread.

Solution to Question 5:

In the intestinal type of gastric cancer, several growth factors may be overexpressed, including transforming growth factor α, the epidermal growth factor, and vascular endothelial growth factor (VEGF).

Molecular pathologies seen in Intestinal type:

• Mutation or loss of heterozygosity in the APC gene or in β-catenin

• Inactivation of p53

• Loss of heterozygosity at the BCL-2 gene

• Microsatellite instability

Molecular pathologies seen in diffuse-type:

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• Mutation of E- cadherin

• Inactivation of p53

Solution to Question 6:

The history and investigation findings are suggestive of gastric outlet obstruction caused by a diffusely infiltrating type of gastric carcinoma. This is commonly known as linitis plastica and it is classified as type IV in Bormann's classification system.

Solution to Question 7:

The patient is likely to have a Siewert type II lesion. This include tumors with the center located 1 cm above and 2 cm below the GE junction.

• Type I: Adenocarcinoma of the distal esophagus - the epicenter of the lesion is 1-5 cm above GEJ

• Type II: Adenocarcinoma of the cardia - the epicenter of the lesion is up to 1 cm above and 2 cm below GEJ

• Type III: Subcardial type adenocarcinoma - the epicenter of the lesion is 2-5 cm below GEJ

Solution to Question 8:

In early gastric cancer, there is no involvement of muscularis propria.

Gastric cancer can be classified as early and advanced gastric cancer, based on the extent of involvement.

Early gastric cancer involves:

• Mucosa (including muscularis mucosa)

• Submucosa

• +/- lymph nodes

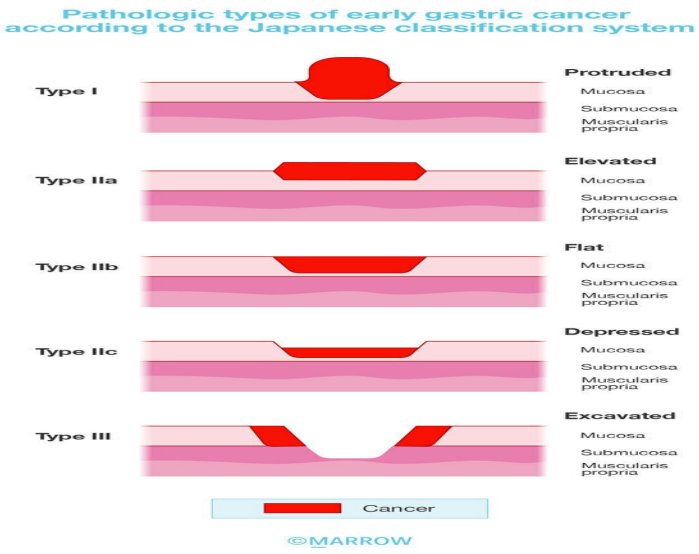
Advanced gastric cancer involves:

• Muscularis layer

• +/- adjacent structures

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Solution to Question 9:

The clinical features and endoscopy findings point to a diagnosis of gastric carcinoma. According to TNM staging of gastric carcinoma, N1 disease refers to metastasis to 1-2 regional lymph nodes.

Solution to Question 10:

Troisier's sign refers to the enlargement of left supraclavicular lymph nodes, which is also known as Virchow nodes. It is seen in patients with gastric cancer metastasis, caused by the spread of the tumor via the thoracic duct into the left supraclavicular lymph nodes. It is a sign of advanced cancer.

It is one of the atypical presentations of gastric carcinoma. Other atypical presentations of gastric carcinoma include

- Sister Mary Joseph nodule
- Due to periumbilical metastasis.
- See in both gastric cancer (most common) and ovarian cancer.
- Krukenberg's tumor
- Bilateral ovarian metastasis
- Due to retrograde lymphatic spread
- Irish nodule
- Left axillary lymphadenopathy.
- Blumer shelf nodules
- Pelvic metastasis into the pouch of Douglas/ retrovesical pouch

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• Sign of advanced gastric carcinoma

• Felt on digital palpation

• Trosseau syndrome

• Migratory thrombophlebitis

• Leser Trelet sign

• Multiple seborrheic keratoses

• Resolves after gastrectomy

• Tripe palms

• Hyperkeratosis palm.

The image below shows an elderly man with left supraclavicular lymph nodes enlarged.



Solution to Question 11:

Endoscopic mucosal resection for gastric cancer should not be performed in case of ulcerated gastric cancer.

Indications for endoscopic resection of early gastric cancer:

• Tumor smaller than 2cm

• Tumor limited to the mucosa

• No lymphovascular invasion

• No ulceration

• Well or moderately well-differentiated histopathology.

If any of these are not fulfilled, then gastrectomy with lymph node dissection is indicated.

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For a proximal gastric carcinoma a total gastrectomy is done and for distal gastric carcinoma, subtotal gastrectomy is ideal. For advanced carcinoma gastrectomy can be done as a palliative treatment.

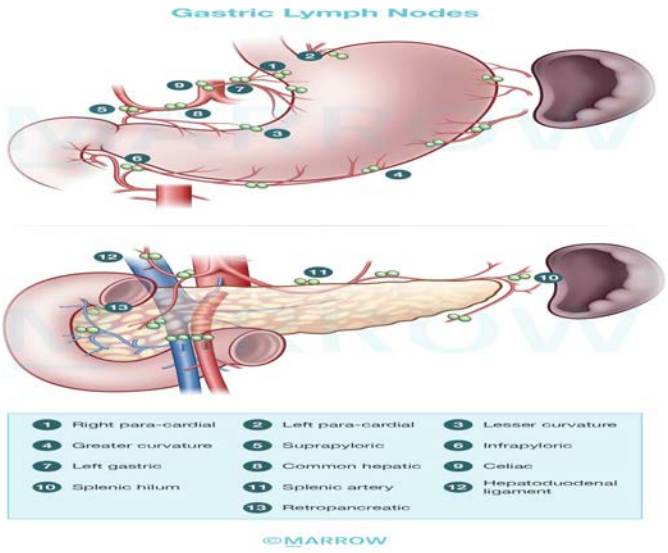
Solution to Question 12:

Suprapyloric nodes are the level 5 gastric lymph nodes.

The japanese classification for gastric carcinoma (JCGC) staging system divided lymph nodes into 16 groups based on the likelihood of metastasis from the primary tumor and removal of lymph nodes during gastrectomy.

The surgery for gastric cancer involves the removal of the primary tumor and lymph nodes. Depending on the extent of lymph node stations removed, the surgery may be either D1 or D2 gastrectomy.

D1 gastrectomy involves the removal of lymph node stations 1-6. D2 gastrectomy involves the removal of lymph node stations 1-11.



Solution to Question 13:

In surgical resection of gastric cancer, at least 5cm of negative margin should be removed around the tumor.

Solution to Question 14:

The clinical and histopathological features are suggestive of gastrointestinal stromal tumor (GIST). They arise from the interstitial cells of Cajal.

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Solution to Question 15:

Carney's triad does not include pancreatic adenocarcinoma.

Carney's triad consists of:

• Extra-adrenal paraganglioma

• Gastrointestinal stromal tumor

• Pulmonary chondroma

Solution to Question 16:

The given clinical scenario points to a diagnosis of gastric lymphoma.

The most common type of gastric lymphoma is non-Hodgkin's lymphoma (NHL). Among NHL, the most common type is diffuse large B-cell lymphoma (DLBCL) (55%), followed by gastric mucosa-associated lymphoid tissue (MALT) lymphoma, Burkitt lymphoma, mantle cell and follicular lymphoma.

Immunodeficiencies and H. pylori infections are risk factors for the development of primary diffuse large B-cell lymphoma.

The antrum is the most common site for gastric lymphoma. The stomach is the most common organ to develop lymphoma in the GI system.

Treatment:

• Combined modality - chemotherapy, surgery, and/or radiotherapy

• The most common chemotherapeutic combination for DLBCL is R-CHOP [Rituximab, Cyclophosphamide, Hydroxydaunomycin (doxorubicin), Oncovin (vincristine), prednisone].

Solution to Question 17:

Intractable pain is not an indication for surgery in the case of gastric lymphoma.

Indications for surgery in gastric lymphoma:

• Patients with symptomatic recurrence or treatment failure

• Patients who develop complications, such as bleeding, gastric outlet obstruction, and perforation

Solution to Question 18:

The most common metabolic complication seen after gastrectomy is iron deficiency anemia.

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Although absorption of iron occurs primarily in the duodenum and proximal jejunum, it needs an optimum acidic environment for absorption. Hence, due to a combination of decreased iron intake, impaired iron absorption, and chronic blood loss, there is iron deficiency anemia. The addition of iron supplements to the patient's diet corrects iron deficiency anemia.

Complications of gastrectomy:

• Dumping syndrome: early and late

• Nutritional deficiencies- Iron deficiency anemia (most common), Vit B12 deficiency, and osteoporosis

• Diarrhea

• Duodenal stump leak/blow out

• Bile reflux gastritis and esophagitis

• Gall stones

• Roux syndrome

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Solution to Question 19:

The given clinical scenario is suggestive of GIST with a high risk of malignancy (high mitotic rate). The best treatment modality in the given scenario is surgical resection (with negative margin) followed by imatinib. Imatinib is a tyrosine-kinase inhibitor.

Option A: Surgical resection + surveillance is done for GIST with a low risk of malignancy. The risk of malignancy is determined by 2 factors - the size of the tumor and mitotic index.

Option C: Lymphadenectomy (D2 gastrectomy) is not done in GIST as it does not show lymph node metastasis.

Option D: GIST is radioresistant and does not respond to conventional chemotherapy. It only responds to imatinib. If imatinib resistant, sunitinib or sorafenib is given.

Solution to Question 20:

Trastuzumab is the drug of choice in carcinoma stomach with HER2/neu mutation. Trastuzumab is a HER2 receptor antagonist.

Chemotherapy options in carcinoma stomach:

• With HER2/neu mutation - Trastuzumab/Herceptin

• With PD-L1 gene mutation - Pembrolizumab

• Oral chemotherapy drugs:

• Tegafur

• Oteracil

• Gimeracil

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• Conventional chemotherapy drugs used are 5-fluorouracil and cisplatin.

Chemotherapy is offered for patients with lymph node-positive disease and advanced gastric carcinoma (T3 and beyond) as part of palliative treatment.

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Metabolic & Bariatric Surgery

Question 1:

A 35-year-old female patient of asian ethnicity with a BMI of 34 kg/m² has decided to seek surgical options to reduce her weight. She has multiple comorbidities. Which of the following would make her unsuitable for bariatric surgery?

a) Coronary artery disease

b) BMI below cut-off for surgery

c) Severe depression

d) Pickwickian syndrome

Question 2:

Which of the following is not a contraindication for bariatric surgery?

a) Failure to lose weight despite psychotherapy

b) Drug addiction

c) Bulimia nervosa

d) Unsupportive social and home environment

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Question 3:

For a patient being considered for bariatric surgery, which of the following will you not include when calculating the Obesity Surgery-Mortality risk score (OS-MRS score)?

a) Age

b) Type-2 DM

c) BMI

d) Gender

Question 4:

A 40-year-old male patient with a BMI of 42 kg/m² with central obesity is scheduled to undergo bariatric surgery. As preparation for surgery, he is advised to follow a

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low-carbohydrate, low-fat, and moderate-protein meal, for two weeks. On follow-up, he is found to be non-compliant with the diet. What is the next best step?

a) Parenteral nutrition for 1 week

b) Psychological re-evaluation

c) Liquid diet for 1 week

d) Re-assurance and follow-up

Question 5:

Which of the following is not a bariatric surgery?

a) Roux-en-Y gastrojejunostomy

b) Biliopancreatic diversion (BPD)

c) Pyloric exclusion with gastrojejunostomy

d) Duodenal switch (DS)

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Question 6:

Which of the following is a reversible bariatric surgery?

a) Laparoscopic gastric banding

b) Laparoscopic Roux-en-Y gastric bypass

c) Laparoscopic sleeve gastrectomy

d) Laparoscopic biliopancreatic diversion

Question 7:

In recent years, what is the most commonly performed bariatric surgery?

a) Roux-en-Y gastric bypass

b) Biliopancreatic diversion

c) Laparoscopic gastric banding

d) Sleeve gastrectomy

Question 8:

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A 40-year-old woman with diabetes and a BMI of 46 kg/m² underwent laparoscopic sleeve gastrectomy (LSG). On the second postoperative day, she developed fever, tachycardia, and blood reports show leucocytosis. What is the next best step in her management?

a) Send blood for culture and sensitivity

b) USG abdomen to locate the septic focus

c) Re-exploration

d) Contrast enhanced CT abdomen

Question 9:

Which of the following statements is true regarding Roux-en-Y gastric bypass in bariatric surgery?

a) Gastric pouch is created at the lesser curvature.

b) Biliary limb is 100-150 cm in length

c) It is a purely restrictive type of procedure.

d) A Y-ileoileostomy is performed

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Question 10:

A 38-year-old woman presented to the casualty with vomiting and severe colicky pain in the abdomen for the past 48 hours. She had undergone a weight reduction surgery six months ago and had achieved around 30% weight loss. Her plain X-ray abdomen is given below. Which of the following bariatric procedures was most likely done in this patient?



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a) Sleeve gastrectomy

b) Laparoscopic adjustable gastric banding

c) Laparoscopic Roux-en-Y gastric bypass

d) Endoluminal stapling

Question 11:

A patient who previously underwent biliopancreatic diversion surgery has been having excessive malabsorption and is now being planned for a revisional procedure to increase the length of the common channel. What is the usual length of the common channel?

a) 100 cm

b) 50 cm

c) 150 cm

d) 75 cm

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Question 12:

Which of the following is not a surgical step that will be done during a duodenal switch procedure?

a) Gastroduodenostomy

b) Cholecystectomy

c) Duododenoileostomy

d) Sleeve gastrectomy

Question 13:

What is the most common cause of death in patients who undergo bariatric surgery?

a) Pulmonary embolism

b) Anastomotic leak

c) Sepsis

d) Intra-abdominal bleed

Question 14:

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In patients who undergo gastric bypass surgery (bariatric surgery), what is the 3-year percentage of diabetes remission?

a) 50 %

b) 33 %

c) 20 %

d) 60 %

Answer Key

Question No.	Correct Option
1	c
2	a
3	b
4	b
5	c
6	a
7	d
8	d
9	a
10	c
11	b
12	a
13	a
14	a

Detailed Explanations

Solution to Question 1:

Severe depression would make her unsuitable for bariatric surgery. The patient should be psychologically stable before undergoing bariatric surgery.

Psychological instability makes the patient incapable of understanding the implications of the procedure. It becomes difficult for the patient to understand the lifestyle changes necessary for optimal outcomes.

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The indications for bariatric surgery as per international standards as well as the modifications specific for Asian and Indian populations are as follows:

The criteria for Asian and Indian patients has been modified by reducing the BMI by 2.5 points. This modification takes into account the geographical differences in food, lifestyle, and genetic make-up of patients.

International criteria	Asian-specific modification i n BMI
1.BMI ° 40 kg/m2regardless of obesity-related comorbiditi es	BMI °37.5kg/m2
2. BMI ° 35 kg/m2with obesit y-related comorbidities, such asHypertensionType 2 DMCo ronary artery disease (CAD)D yslipidemiaObstructive sleep apnea (OSA): Pickwickian sy ndromeArthritis and function al impairment	BMI °32.5kg/m2
3. Has failed to lose weight d espite:Lifestyle modifications PharmacotherapyPsychother apy	
4. Is psychologically stable	
5. Motivated and capable of u nderstanding lifestyle change s	

Solution to Question 2:

Failure to lose weight by an obese patient despite psychotherapy, pharmacotherapy, and lifestyle modifications is an indication for metabolic surgery.

Potential contraindications to metabolic and bariatric surgery include:

• Severe medical disease making anesthesia or surgery prohibitively risky (American Society of Anesthesiologists class IV)

• Mentally incompetent to understand the procedure

• Inability or unwillingness to change lifestyle postoperatively

• Drug, alcohol, or other addiction (including smoking)

• Active problem of bulimia or other eating disorder

• Psychological instability (schizophrenia, severe depression)

• Unsupportive home environment

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Solution to Question 3:

Type-2 Diabetes mellitus (DM) is not a component of the Obesity Surgery-Mortality Risk Score (OS-MRS).

Edmonton Obesity Staging System (EOSS) and Obesity Surgery-Mortality Risk Score (OS-MRS) are used to discuss with patients the likely prognosis without surgery, and the risk of complications.

Obesity Surgery-Mortality Risk Score (OS-MRS):

Note: Uncontrolled diabetes is considered a risk factor, as in any other surgery. However, it is not considered under the OS-MRS scoring system.

Risk factor	Score
Age ° 45 yr	1
BMI ° 50	1
Male gender	1
Hypertension	1
DVT(Deep Vein Thrombosis) / PE(Pulmonary Embolism)	1

Risk Category	Score	Post-op mortality
A (Low)	0-1	0.3
B (Moderate)	2-3	1.7
C (High)	4-5	3.2

Solution to Question 4:

Psychological re-evaluation is necessary to address the underlying psychological blocks in a patient who is unable to comply with the diet.

Morbidly obese individuals, especially those with central obesity, have large livers that make surgery impossible. Liver shrinkage diet helps reduce the size of the liver. This allows mobility for the surgeon and increases the chances of a safer procedure.

Liver shrinkage diet:

• Low-carbohydrate, low-fat and moderate protein diet

• Started at least 2 weeks prior to the surgery

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The ability to comply with the diet and lose weight suggests that the patient is willing to make an effort to adopt lifestyle modifications. Failure to do so must arouse suspicion of important underlying psychological blocks, which need addressing.

Solution to Question 5:

Pyloric exclusion with gastrojejunostomy is not a bariatric surgery. It is a technique used in the repair of duodenal and pancreatic injuries.

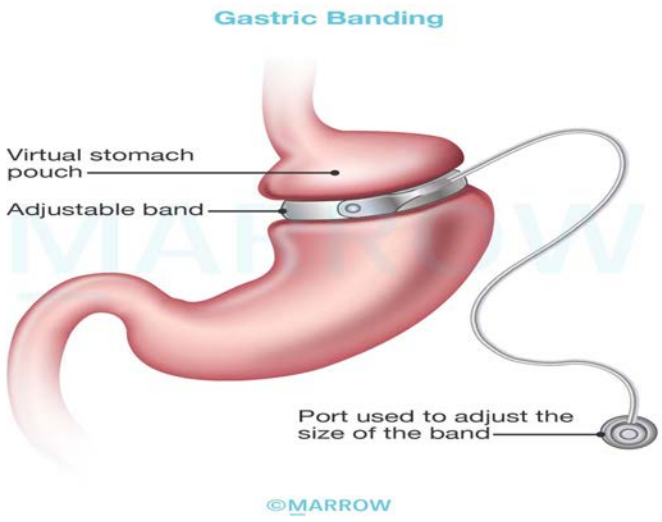
Based on their mechanism of action, bariatric surgeries are categorized as follows:

Mechanism of action	Common procedures
Purely Restrictive	Laparoscopic adjustable gastric bandingSleeve gastrectomy Intragastric balloon placement
Predominantly Malabsorptive	Biliopancreatic diversion (BPD)Duodenal switch (DS)
Restrictive + Malabsorptive	Roux-en-Y gastrojejunostomy (gastric bypass)

Solution to Question 6:

Laparoscopic gastric banding and intra-gastric balloon placement surgeries are considered to be reversible bariatric surgeries.

It is because the gastric band or the intragastric balloon can be removed once the desired weight loss or metabolic benefit is achieved.



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An inflatable band is placed just below the GE junction

↓

A small virtual stomach pouch is created

↓

Reduces hunger (probably vagally mediated)

↓

Reduced consumption of food

↓

Weight loss

Complications of LAGB include:

• Prolapse / Slippage (most common)

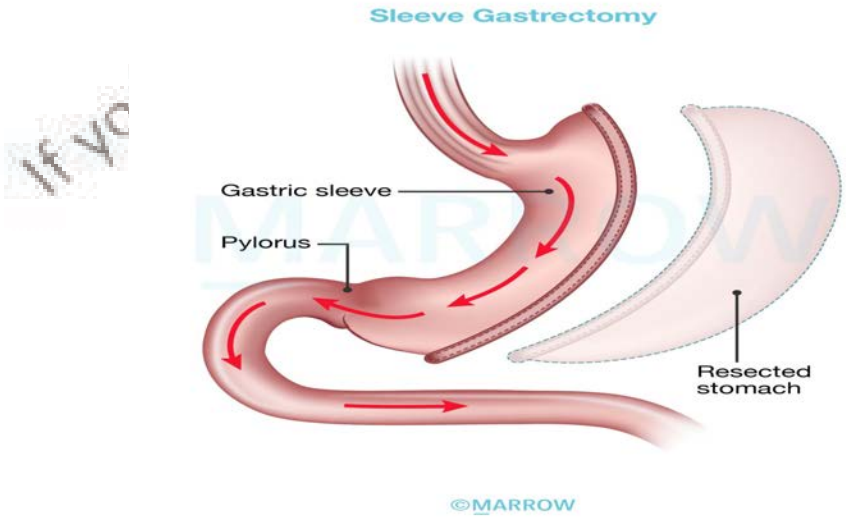
• Band erosion of the stomach wall and rupture

• Increased risk of DVT and pulmonary embolism (highest risk within 1 month of surgery), managed with early ambulation, pressure stockings and LMWH.

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Solution to Question 7:

Sleeve gastrectomy is the most commonly performed bariatric surgery, in recent years.



A vertical sleeve is created, resecting most of the greater curvature

↓

Restriction of stomach capacity

↓

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Early satiety

↓

Reduced consumption of food

↓

Weight loss

Advantages of sleeve gastrectomy:

• Less challenging procedure

• Preservation of pylorus (avoids gastric dumping)

• No need for serial adjustments (as seen with gastric banding)

• Reduction in internal hernias (as seen with Roux-en-Y gastric bypass)

Complications of sleeve gastrectomy:

• Bleed from the staple line

• Leakage from staple line (close to the angle of His)

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Solution to Question 8:

The given clinical scenario of fever, tachycardia, and leucocytosis in a postoperative patient of LSG should raise suspicion for leak along the gastric staple line. The next best step in the management of this patient is to perform a contrast-enhanced CT.

Leaks following LSG most commonly occur in the proximal third of the stomach, close to the angle of His. Early leaks are due to tissue trauma and staple misfire, and late leaks are usually due to ischemia and high intragastric pressure.

Management of the leak involves providing nutritional support to the patient and adequate drainage. Once the leak is diagnosed, the patient should be kept nil per oral.

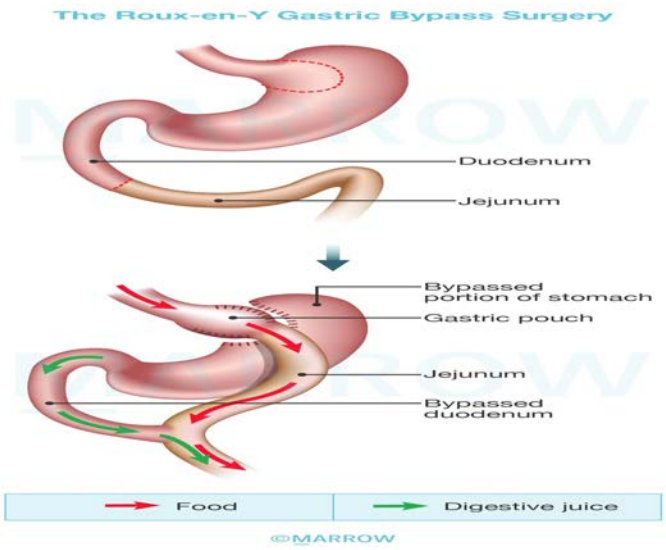
Total parenteral nutrition and antibiotic therapy should be started in the patient. Drainage can be done either by CT-guided percutaneous catheter placement, endoscopic stenting, or operative procedures.

Note: Obstructive sleep apnea (OSA) is a risk factor for an anastomotic leak. Treatment with continuous positive airway pressure might reduce this risk.

Solution to Question 9:

Gastric pouch is created at the lesser curvature in Roux-en-Y gastric bypass.

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A small proximal gastric pouch is created at the lesser curvature

↓

Create a shorter biliary limb of 30 - 50 cm (duodenum);

Create a longer Roux limb of 75 - 150 cm (jejunum)

↓

Bowel continuity is restored by a Y - jejunojejunostomy

↓

Restrictive + Malabsorptive mechanism

↓

Weight loss

Note:

Biliary limb is usually kept short (30-50 cm) in order to reduce vitamin and mineral deficiencies.

Solution to Question 10:

The given clinical scenario and radiograph (dilated bowel segments with valvulae conniventes in the left upper quadrant) are suggestive of small bowel obstruction. Bariatric surgery, specifically, Roux-en-Y gastric bypass surgery is associated with the creation of mesenteric defects. The small bowel can herniate through these defects (internal hernia) and get strangulated, resulting in bowel obstruction.

In addition, as the person loses weight (due to the bariatric procedure), the protective, space-occupying effect of the mesenteric fat is lost and hernia spaces open up, further increasing the risk of internal hernia. The laparoscopic procedure has a higher risk compared to open surgery since fewer adhesions form to tether small-bowel loops and prevent them from

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herniating.

Adequate closure of the mesenteric defects by the surgeon at the time of operation significantly reduces the risk of internal hernia.

Other complications specific to Roux-en-Y gastric bypass:

• Nutritional deficiencies: iron (most common), folate, Vitamin A, D, K and B12

• Anastomosis site leak

• Bleeding from the site of gastrojejunostomy

• Dumping syndrome

• Marginal ulcers

• Increased risk of DVT and pulmonary embolism

Option A: Sleeve gastrectomy is often complicated by staple line leak.

Option B: Laparoscopic adjustable gastric banding is associated with band slippage and erosion.

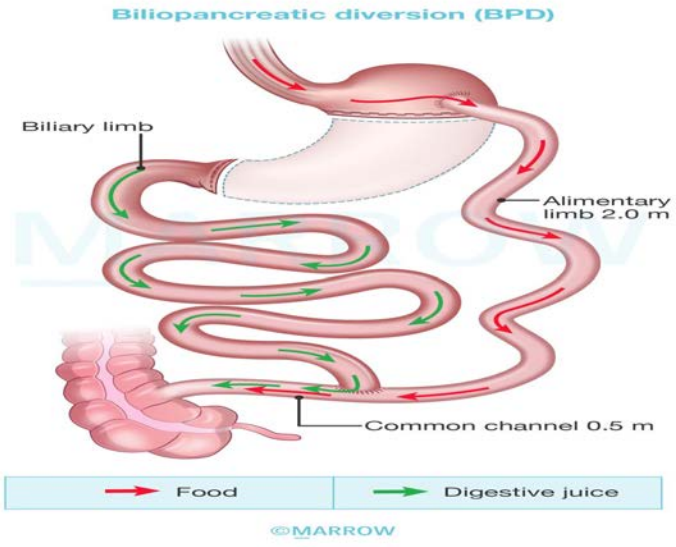
Option D: Endoluminal stapling is also used to create a gastric sleeve. It is associated with postoperative nausea, vomiting, abdominal pain, and transient dysphagia.

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Solution to Question 11:

The usual length of the common channel in biliopancreatic diversion (BPD) is 50 cm (0.5 m). Revisions increase common channel by up to 150 cm.

The length of the common channel plays a significant role in the amount of weight loss achieved with BPD procedure. A shorter common channel implies a greater length of the bypassed small bowel. This induces more malabsorption and thereby greater weight loss.



Distal hemigastrectomy is performed to create a residual gastric pouch

↓

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Terminal ileum is divided 250 cm proximal to the ileocecal valve

↓

Gastroileostomy: Proximal anastomosis between the distal end of divided ileum and residual gastric pouch

↓

Ileoileostomy: Distal anastomosis between the proximal end of divided ileum and terminal ileum

↓

A common channel of 50 cm is established

↓

Malabsorption

↓

Weight loss

Prophylactic cholecystectomy is usually performed since there is an increased incidence of gallstones due to malabsorption of bile salts.

Complications of biliopancreatic diversion surgery:

• Anastomosis site leak

• Nutritional deficiencies: Iron; folate; vitamins A, D, K, and B12

• Marginal ulcers

• Bleeding

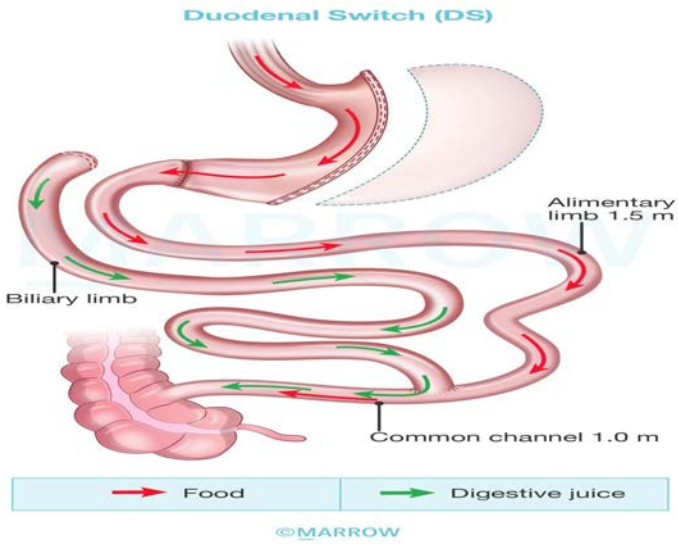
• Increased risk of DVT and pulmonary embolism (maximum risk within 1 month of surgery), managed with early ambulation, pressure stocking, and LMWH

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Solution to Question 12:

In duodenal switch (DS) surgery, gastroduodenostomy is not performed.

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Sleeve gastrectomy is performed

↓

Duodenum is divided 2 cm beyond the pylorus;

Terminal ileum is divided 250 cm proximal to the ileocecal valve

↓

Duodenoileostomy: Proximal anastomosis between the distal end of divided ileum and duodenum

↓

Ileoileostomy: Distal anastomosis between the proximal end of divided ileum and terminal ileum

↓

A common channel of 100 cm is established

↓

Malabsorption

↓

Weight loss

Prophylactic cholecystectomy is usually performed since there is an increased incidence of gallstones due to malabsorption of bile salts.

Complications of duodenal switch surgery:

• Anastomosis site leak and bleeding

• Nutritional deficiencies - Iron, folate, Vitamin A, D, K and B12

• Increased risk of DVT and pulmonary embolism (maximum risk within 1 month of surgery) - managed with early ambulation, pressure stocking, and LMWH In comparison to BPD, the incidence of marginal ulcers is negligible

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Solution to Question 13:

Pulmonary embolism is the most common cause of death in patients of bariatric surgery.

Pathogenesis:

Obesity

↓

Increased levels of plasminogen activator inhibitor-1

↓

Blocks conversion of plasminogen to plasmin

↓

Decreased fibrinolytic activity

↓

Hypercoagulable state

↓

Increased risk for VTE

Morbidly obese patients are physically inactive. Restricted mobility post-surgery potentiates this risk of developing deep vein thrombosis.

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Solution to Question 14:

The 3-year percentage of diabetes remission for gastric bypass surgery is 50%.

Different Bariatric surgeries and their Outcomes :

	Protein/Calorie Malabsorption	3 year % Excess Weight Loss (EWL)	3 yr % Diabetes remission
Gastric band	No	40 -50 %	20 %
Gastric bypass	No	50 - 60 %	50 %
Sleeve gastrectomy	No	50 - 60 %	50 %
Biliopancreatic diversion / Duodenal switch	Yes	70 -80 %	80 %

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Small Intestine

Question 1:

Which of the following statements is false regarding the surgical anatomy of the small intestine?

a) The duodenum is demarcated from the jejunum by the ligament of Treitz.

b) The ileum makes up three-fifths of the small intestine.

c) The blood supply to the jejunum may have four or five separate arcades with shorter vasa recta

d) The jejunum has a larger circumference, is thicker than the ileum

Question 2:

In a plain X-ray of the abdomen, the small bowel is said to be dilated if the diameter is more than _____.

a) 2 cm

b) 3 cm

c) 4 cm

d) 5 cm

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Question 3:

In a suspected case of bowel obstruction, the presence of which of the following helps you to distinguish the small intestine from the large intestine?

a) Appendices epiploicae

b) Valvule conniventes

c) Tenia coli

d) Haustrations

Question 4:

A 42-year-old man with past history of inguinal hernia presented with sudden onset of severe abdominal pain that started 4 hours ago. His abdomen was tender and rigid along with a

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lump in the inguinal region with purplish skin changes. Which of the following is the ideal management for this patient?

a) Resuscitative measures and arrange for immediate laparotomy

b) Conservative management with a nasogastric tube and IV fluid, assessment every 24 hrs

c) Perform an oral contrast study, followed by pneumatic decompression

d) Endoscopic decompression

Question 5:

A surgeon sees a necrotic bowel when operating on a child for an inguinal hernia. What is true about the resection and anastomosis of the bowel?

a) The surgeon must use chromic catgut

b) The surgeon must not include the submucosa in the sutures

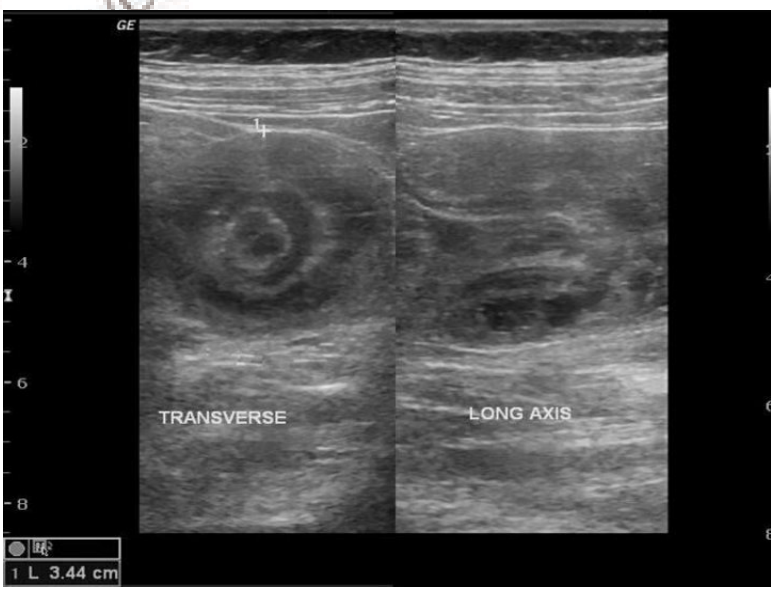
c) The surgeon must use the single-layer, extramucosal suture technique

d) The surgeon must use the single-layer seromuscular suture technique

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Question 6:

A 5-year-old child who underwent an appendicectomy is brought to the emergency with abdominal distension and vomiting. The mother tells that the child passed stools that looked like currant jelly. The ultrasound finding is shown below. What is the most likely location of this pathology in this child?



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a) Colocolic

b) Rectosigmoid

c) Ileoileal

d) Ileocolic

Question 7:

A 3-day-old neonate presents with abdominal distension and bilious vomiting. An erect X-ray of the abdomen is done and shown below. The neonate is taken up for surgery and an apple-peel bowel with loss of dorsal mesentery is seen. Which type of ileal atresia has this feature?



a) Type 1

b) Type 2

c) Type 3

d) Type 4

Question 8:

A child with complaints of abdominal pain and vomiting for the past 24 hours associated with tenderness over McBurney's point undergoes open appendicectomy. However, during surgery, the appendix was found to be normal. On exploration of the ileum, the following finding is seen. Which of the following statements is false regarding this condition?

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a) It is a lead point for intussusception

b) Gastric mucosa is the most common heterotropic tissue

c) Arises at the mesenteric border

d) Located 60 cm proximal to ileocecal valve

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Question 9:

What is the most common presentation of Meckel's diverticulum?

a) Lower GI bleeding

b) Constipation

c) Diarrhea

d) Abdominal pain

Question 10:

Which of the following cannot be used to increase the sensitivity of the Tc-pertechnate scan in Meckel's diverticulum?

a) Glucagon

b) Pentagastrin

c) Cimetidine

d) Metoclopramide

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Question 11:

What will be the investigation of choice in a child suspected to have Meckel's diverticula?

a) Tc-99 radionuclide scan

b) Barium study

c) Enteroclysis

d) Endoscopy

Question 12:

While performing an inguinal hernia repair in a 3-year-old boy, you notice Meckel's diverticulum as the content of the hernial sac. What is this hernia called?

a) Amyand's hernia

b) Narath's hernia

c) Cloquet's hernia

d) Littre's hernia

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Question 13:

While performing a laparotomy, the surgeon incidentally notices a narrow-mouthed, thickened Meckel's diverticulum. What is the treatment of choice?

a) Resection of the diverticulum

b) Leave as such

c) Ligate at base

d) Resection with part of ileum

Question 14:

What is the most common site for acquired diverticula in the small intestine?

a) Duodenum

b) Jejunum

c) Proximal ileum

d) Distal ileum

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Question 15:

A 38-year-old man presents with dull aching abdominal pain for the past few weeks accompanied by loss of weight and appetite. A barium meal follow-through image is shown below. What is the most likely diagnosis?



a) Colon carcinoma

b) Intestinal lymphoma

c) Ileocecal tuberculosis

d) Crohn's disease

Question 16:

A respiratory therapist presents to the OPD with abdominal pain. He also complains of low-grade fever, night sweats, and loss of weight. You investigate him for intestinal tuberculosis. Which of the following radiological signs are expected to be seen in him?

a) 2, 4, 5

b) 3, 4, 5

c) 1, 2, 3

d) 1, 3, 4

Question 17:

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Match the following radiological signs in intestinal tuberculosis with their respective appearance:

a) 1 - C, 2 - B, 3 - D, 4 - A

b) 1 - C, 2 - D, 3 - A, 4 - B

c) 1 -D, 2 - A, 3 - B, 4 - C

d) 1 - B, 2 - A, 3 - D, 4 - C

Question 18:

A young man presented with pain abdomen, diarrhoea, and fever gradually increasing in a step ladder pattern over the past 2 weeks. A Widal test confirmed the diagnosis and he was admitted. A few days later, he developed intestinal perforation and was taken up for exploratory laparotomy. Which of the following findings would you see in this patient?

a) Longitudinal intestinal ulcers

b) Stricture formation

c) Pinpoint ulcers

d) Transverse intestinal ulcers

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Question 19:

A lady underwent a left hemicolectomy for colon cancer 5 days back. She now complains of abdominal discomfort and bloating. She is still unable to pass gas. On examination, the abdomen is distended and no bowel sounds are heard. X-ray shows gas-filled loops of the intestine with multiple air fluid levels. Which of the following will be part of the management plan of the patient?

a) 1, 3 and 4

b) 2 and 5

c) 2, 3 and 4

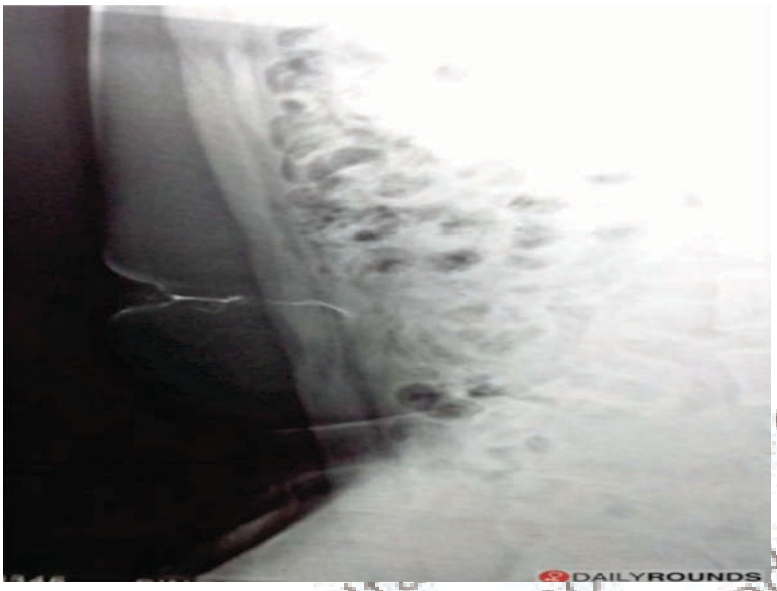
d) 3 and 5

Question 20:

A 22-year-old male presents with purulent discharge from the umbilicus. He underwent laparoscopic appendicectomy 6 months back. X-ray sinogram of the patient reveals an enterocutaneous fistula tract as shown below. Which of the following aids in the spontaneous

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closure of the fistula?



a) Epithelialization of track

b) Foreign body in the fistula tract

c) High output fistula

d) Fistula track length of 3 cms

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Question 21:

A 25-year-old man, who underwent exploratory laparotomy for acute abdomen develops a fever on the 5th postoperative day. The sutured site is erythematous and on the removal of two skin sutures, there is a leakage of gastrointestinal contents through the wound. An electrolyte panel done shows hyponatremia, hypokalemia, and metabolic acidosis. What is the probable diagnosis?

a) Gastric fistula

b) Duodenal fistula

c) Sigmoid fistula

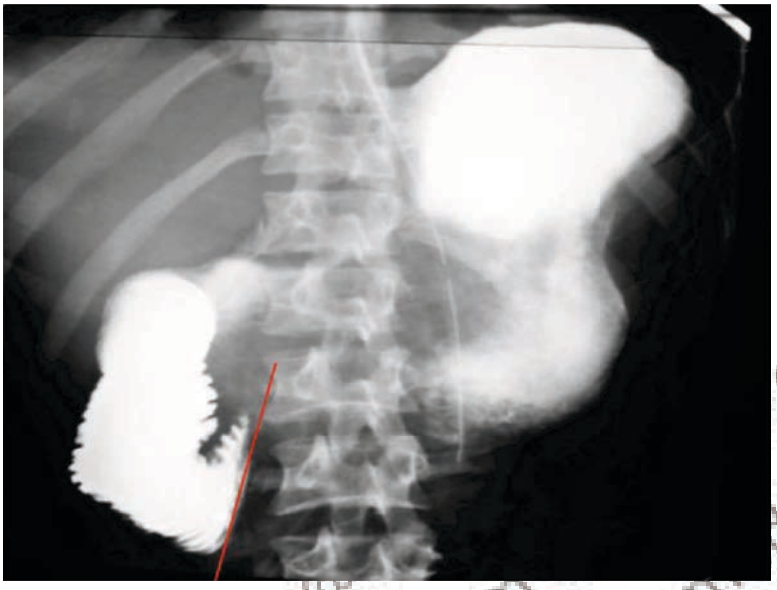
d) Ileal fistula

Question 22:

A 26-year-old bride-to-be presented with nausea, vomiting, and recurrent episodes of postprandial epigastric pain. She has lost nearly 25 kgs in the last 6 months to look good in her wedding dress. Proton pump inhibitors were tried but were unsuccessful. A barium meal

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follow-through of the patient is given below. Which of the following is false about her condition?



a) Weight gain is part of the management

b) Lying in prone position postprandially improves symptoms

c) Surgical management is by duodenojejunostomy

d) The second part of duodenum is commonly involved

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Question 23:

A young male, who wishes to pursue his higher studies abroad gets a chest X-ray done as a part of the immigration clearance. X-ray shows air under bilateral domes of the diaphragm. He is currently asymptomatic with normal vital signs. What is the most probable diagnosis?

a) Pneumatosis cystoides intestinalis

b) Diverticulosis

c) Perforated peptic ulcer

d) Band with Meckel's diverticulum

Question 24:

A 55-year-old man with IHD presents with sudden, severe, generalized abdominal pain and multiple episodes of vomiting. On examination, the pulse rate is 118bpm, rhythm is irregularly irregular, BP is 90/60 mmHg. The abdomen appears soft, non-distended, and bowel sounds are absent. Which of the following could be a likely diagnosis in this case?

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a) Acute severe pancreatitis

b) Ruptured aortic aneurysm

c) Acute mesenteric ischemia

d) Peptic ulcer perforation

Question 25:

What is the minimum dose of radiation that can cause radiation enteritis of the small intestine?

a) 3000 cGy

b) 4500 cGy

c) 6000 cGy

d) 7500 cGy

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Question 26:

A patient who is a known case of Crohn's disease underwent ileal resection for a stricture. Which of the following is not a part of the management of postoperative complications in this patient?

a) Folic acid administration

b) Serial transverse enteroplasty

c) Oral cholestyramine

d) Octreotide

Question 27:

Which of the following is true about the Tillaux sign?

a) Mass is felt in the periumbilical region

b) Mass is brilliantly transilluminant

c) Mass is mobile perpendicular to mesentery attachment line

d) Fluctuation is positive

Question 28:

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What is the investigation of choice in a patient suspected to have a small bowel tumor?

a) Enteroclysis

b) CT scan

c) Barium meal follow-through

d) MRI

Question 29:

A 45-year-old man presents with complaints of breathlessness, dull aching abdominal pain, and diarrhea. On examination, his face and chest appear flushed. CT scan of the abdomen shows a tumor in the terminal ileum with liver metastasis. An increased levels of 5-HIAA is seen in a 24-hour urinary sample. Which of the following is false regarding the management of this patient?

a) Surgery should be done as soon as the diagnosis is made.

b) MRI is the best method for staging of the disease.

c) Somatostatin analogues provide symptomatic relief.

d) Liver transplantation can be performed.

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Question 30:

Which of the following is a false statement about abdominal lymphoma?

a) MALT lymphoma is associated with H.pylori infection.

b) Primary small-intestinal lymphomas are most commonly located in the jejunum.

c) Lymphoma is the most common malignant neoplasm of spleen.

d) Stomach is the most common site for extranodal lymphoma.

Question 31:

Which of the following statements is false regarding lymphoma of the small intestine?

a) B-cell lymphomas are chemo-resistant

b) It is the most common tumour of the small intestine in children

c) Resection is indicated in all symptomatic patients

d) Burkitt's lymphoma affects the ileocaecal junction

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Answer Key

Question No.	Correct Option
1	c
2	b
3	b
4	a
5	c
6	c
7	c
8	c
9	a
10	d
11	a
12	d
13	a
14	a
15	c
16	d
17	a
18	a
19	c
20	d
21	b
22	d
23	a
24	c
25	b
26	a
27	c
28	a
29	b
30	b
31	a

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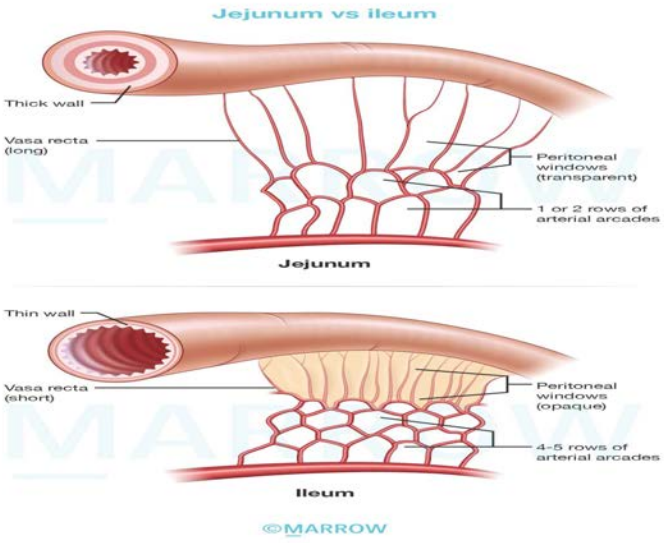
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Detailed Explanations

Solution to Question 1:

The jejunum receives its blood supply from long, straight vasa recta arising from only one or two arcades.

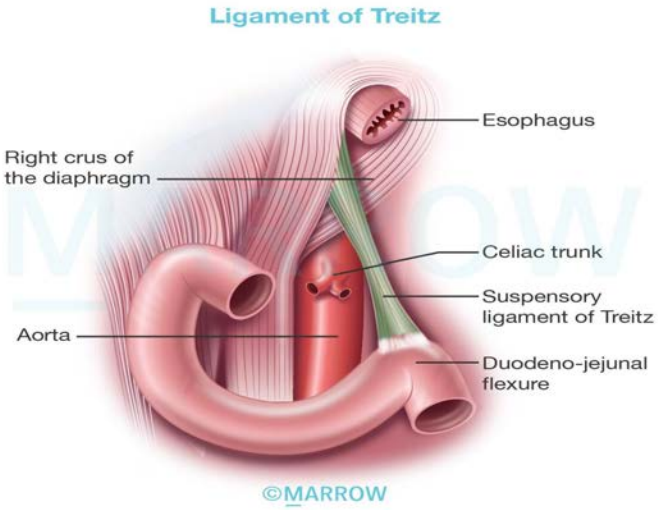
The blood supply to the ileum may have 4-5 separate arcades with shorter vasa recta.



The ligament of Treitz or the suspensory muscle of the duodenum is found at the junction of the duodenum and jejunum. It also forms the line of demarcation for gastrointestinal bleeding:

• Upper GI bleeding - refers to bleeding proximal to the ligament of Treitz

• Lower GI bleeding - refers to bleeding distal to the ligament of Treitz.



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Solution to Question 2:

The small bowel is said to be dilated if the diameter is more than 3 cm in a plain X-ray.

The following triad of findings is specific for small bowel obstruction on plain X-ray imaging of the abdomen:

• Dilated small bowel loops (>3 cm in diameter)

• Air-fluid levels seen on upright films

• A paucity of air in the colon.



Solution to Question 3:

The presence of valvule conniventes (plicae circulares) helps to distinguish the small intestine from the large intestine. They are prominent mucosal folds seen in the gross examination of the small intestine and are also visible radiographically. They are more prominent in the jejunum.

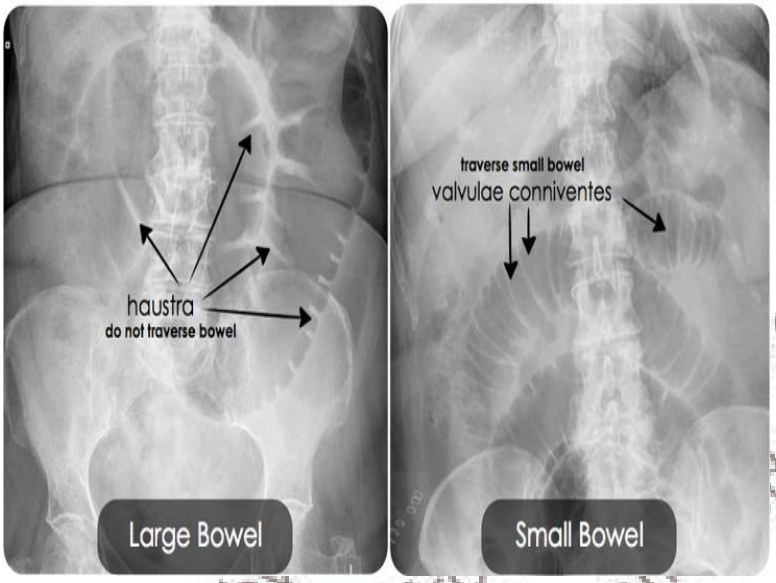
Radiological differences between small bowel and large bowel obstruction are:

Investigation of choice: CECT abdomen (adults); USG abdomen (children)

Radiological features	Small bowel	Large bowel
Valvulae conniventes	Present in jejunum	Absent
No of Loops	Many	Few
Distribution of loops	Central	Peripheral
Haustra	Absent	Present
Diameter	3-5 cm	>5 cm

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Radiological features	Small bowel	Large bowel
Solid faeces	Absent	Present



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Solution to Question 4:

The given clinical vignette is suggestive of intestinal obstruction, due to a strangulated inguinal hernia. The ideal management is exploratory laparotomy as soon as possible with ongoing resuscitative measures until surgery.

Bowel strangulation is a type of mechanical bowel obstruction, associated with complete cessation of blood supply leading to irreversible loss of viability of the affected bowel segment. Inguinal hernias, most commonly of non-reducible type, are associated with a high chance of strangulation and need urgent medical intervention.

Bowel strangulation can be suspected in the presence of

• constant severe abdominal pain,

• abdominal tenderness with rigidity and peritonism,

• signs of shock, and lack of response to conservative management.

• Reduced bowel wall enhancement on CT

When strangulation occurs in an external hernia, the lump is tense, tender, and irreducible with overlying skin changes (erythema or purplish discoloration).

Supportive management:

• IV fluids

• Nasogastric tube to decompress the bowel and reduce abdominal distention

• IV antibiotics (adequate coverage required for gram -ve and anaerobes)

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• Analgesia

Definitive management:

• Continue supportive management up to 72 hrs if suspicious of adhesions. Surgical exploration and adhesiolysis should be done if there is no improvement.

• Immediate surgical exploration and resection of non-viable gut segments if suspicious of any of the following:

• Obstructed external hernia

• Clinical features suspicious of intestinal strangulation

• Obstruction in a 'virgin' abdomen (i.e no prior history of intraabdominal surgery)

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Solution to Question 5:

The standard technique used currently for resection anastomosis of the bowel is a one-layer extra mucosal suture technique since it causes the least tissue necrosis and luminal narrowing. Interrupted and continuous single-layer suture techniques are adequate and safe.

The extra mucosal suture must also include the submucosa because this layer has a high collagen content and it is the most stable suture layer in all sections of the gastrointestinal tract.

Catgut has now been replaced with absorbable synthetic polymers. Stapling devices can be used when speed is required.

Solution to Question 6:

The clinical vignette and the USG showing the doughnut sign (target sign) are suggestive of postoperative intussusception and the most likely location is ileoileal in postoperative cases.

Intussusception occurs when a portion of the alimentary tract is telescoped into an adjacent segment. The most common location of intussusception is ileocolic. However, ileoileal is the most common location of intussusception postoperatively and in Henoch–Schönlein Purpura.

Causes of intussusception are:

• Idiopathic (most common cause in children)

• Pathological lead points such as enlarged submucosal Peyer's patch, lymphoma, intestinal polyp, leiomyomas, etc.

• Meckel's diverticulum

• A recent upper GI or respiratory infection, rotavirus vaccination has also shown some association with intussusception in children.

The characteristic clinical triad includes:

• Pain

• Palpable sausage-shaped mass

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• Red currant jelly stools

USG findings in intussusception include:

• Target sign (also known as the doughnut sign)- The appearance is generated by concentric alternating echogenic (submucosa and serosa) with hypoechogenic bands (muscularis propria).

• Pseudokidney sign: this is seen in the longitudinal section of the bowel:

• the edematous bowel resembles renal parenchyma and

• the mesentery which is dragged into the intussusception resembles the renal hilum.

• Crescent in a doughnut sign.

Barium enema shows the characteristic coiled spring appearance.

Treatment:

• Reduction of intussusception should be done immediately after the diagnosis.

• Radiologic hydrostatic reduction has a success rate of 80-95% in cases of ileocolic intussusception

• Surgical reduction is only done in the presence of refractory shock, suspected bowel necrosis or perforation, peritonitis, and multiple recurrences.



The above image shows the coiled spring appearance

Solution to Question 7:

The given image showing a triple bubble appearance and associated finding of apple-peel bowel with loss of dorsal mesentery is a feature of type 3 ileal atresia.

Small bowel atresias present with intestinal obstruction soon after birth. Bilious vomiting is the dominant feature in jejunal atresia whereas abdominal distension is more with ileal atresia.

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Plain abdominal radiographs show a variable number of dilated loops of bowel and fluid levels according to the level of obstruction.

• Jejunal/ileal atresia - Triple bubble appearance

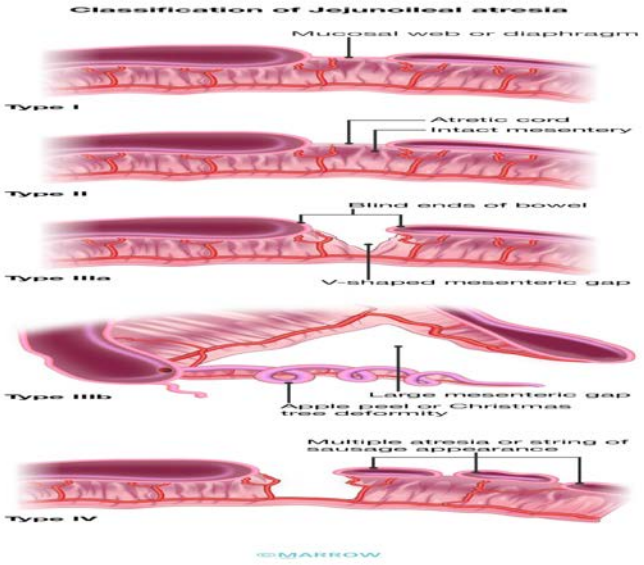
• Duodenal atresia - Double bubble appearance

A contrast study is the next best investigation to exclude other bowel anomalies.

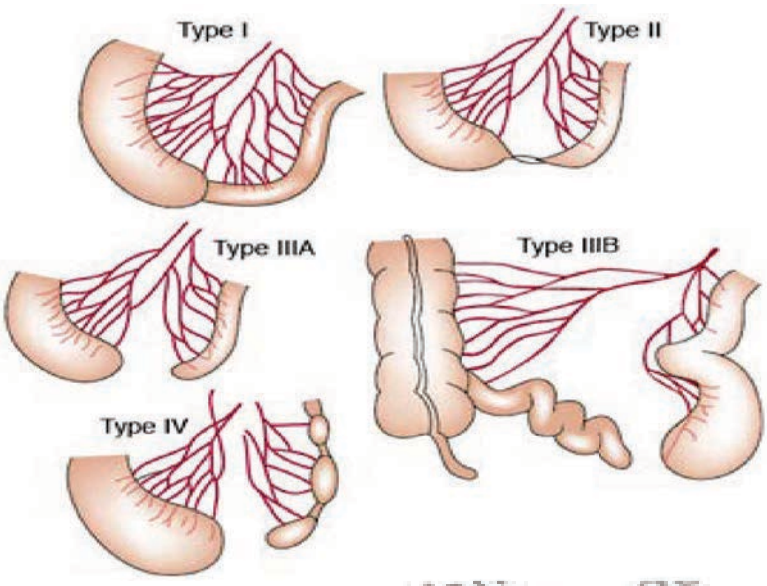
In jejunal/ileal atresia, the distal end of the dilated proximal small bowel is resected and a primary end-to-end anastomosis is possible. If the proximal bowel is extremely dilated, it may need to be tapered to the distal bowel before anastomosis.

Classification of Jejunoileal atresia:

Type	Feature
Type 1	Mucosal web or diaphragm
Type 2	With an atretic cord between two blind ends of bowel with intact mesentery
Type 3 a	Complete separation of the bl ind ends of the bowel by a V-shaped mesenteric gap
Type 3 b	Anapple peelorChristmas tre e deformitywith a large mese nteric gap
Type 4	Multiple atresias, with a strin g of sausage appearance



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Solution to Question 8:

The given scenario is suggestive of Meckel's diverticulitis. It arises from the antimesenteric border of the small intestine.

Meckel's diverticulum is the most commonly encountered congenital anomaly of the small intestine. Meckel's diverticulum is caused by a failure of normal regression of the vitelline duct or omphalomesenteric duct that develops during weeks 5 to 7 of gestation. It contains all 3 layers of the intestine and hence it is a true diverticulum.

It is located 45 to 60 cm proximal to the ileocecal valve. The most common heterotopic tissue within the Meckel's diverticulum is gastric mucosa (50%) followed by pancreatic mucosa(5%) and colonic mucosa.

Most Meckel's diverticula are benign and are incidentally discovered. Its clinical features include:

• Gastrointestinal bleeding (most common)

• Intestinal obstruction, which may occur as:

• Volvulus

• Intussusception (ileo-ileal or ileo-colic)

• Incarcerated Littre's hernia.

Complications of Meckel's diverticulum are:

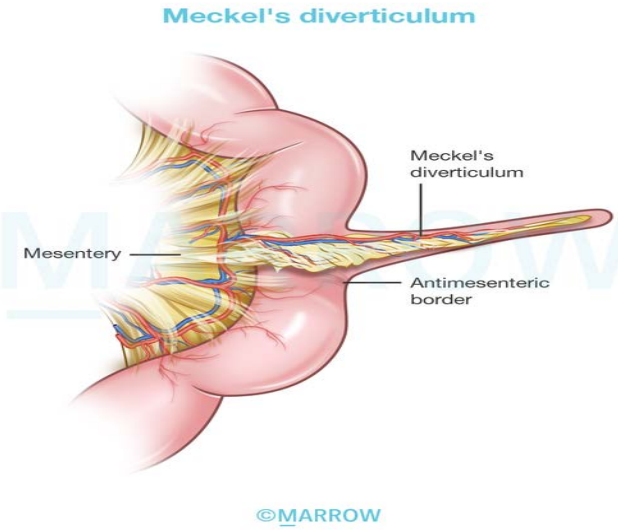
• Diverticulitis - presents like appendicitis

• Perforation - resembles a perforated duodenal ulcer

• Peritonitis

• Neoplasms - neuroendocrine tumour (most common) > adenocarcinoma > GIST > lymphoma.

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Solution to Question 9:

The most common presentation of Meckel's diverticulum is lower gastrointestinal bleeding.

Clinical features of Meckel's diverticulum include:

- Lower GI bleeding (most common in children and overall)
- Abdominal pain
- Vomiting

Another common presentation is an intestinal obstruction (most common in adults), which may occur due to:

- Volvulus
- Intussusception (ileo-ileal or ileo-colic)
- Incarcerated Littre's hernia.

Solution to Question 10:

Metoclopramide is not used to increase the sensitivity of the Tc-pertechnate scan in Meckel's diverticulum.

Metoclopramide stimulates gastric motility and decreases the time available for the uptake of Tc-pertechnate. Hence it reduces sensitivity.

99mTc-pertechnetate is preferentially taken up by the mucus-secreting cells of the gastric mucosa and ectopic gastric tissue.

The sensitivity of the Tc-pertechnate scan is increased by:

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• Glucagon: Relaxes the smooth muscles of the gastrointestinal tract. This decreases peristalsis, causing enhanced detection of the ectopic gastric mucosa in Meckel's diverticulum

• Pentagastrin: Potent stimulator of gastric secretions. Increases uptake and secretion of pertechnetate by the gastric mucosa

• Cimetidine: Increases radionuclide uptake, and decreases peptic secretion and the release of pertechnetate from the diverticular lumen. This results in higher radionuclide concentrations in the wall of the diverticulum.

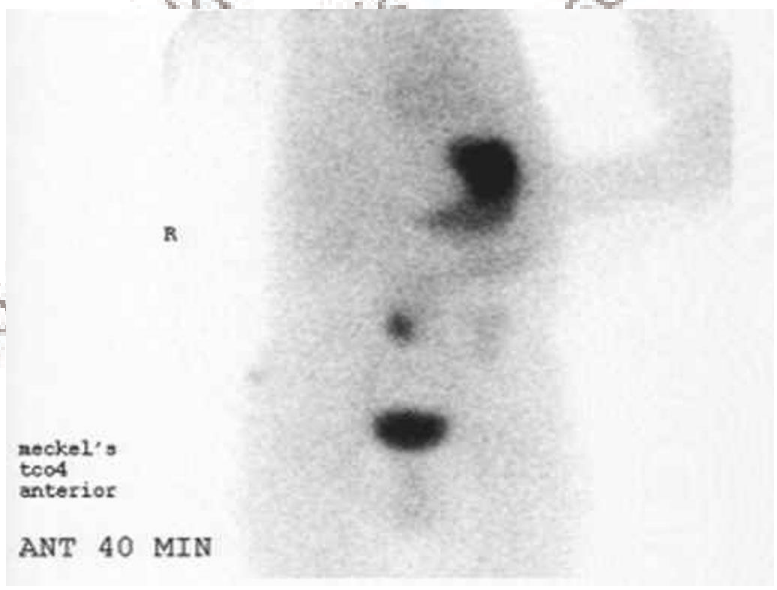
Solution to Question 11:

The investigation of choice in a child suspected to have Meckel's diverticulum is a 99mTc-pertechnetate radionuclide scan.

The radionucleotide is preferentially taken up by the mucus-secreting cells of the gastric mucosa and ectopic gastric tissue in the diverticulum.

In adults, there is a reduced prevalence of ectopic gastric mucosa. Hence it is less accurate and barium studies are preferred.

The image below depicts a 99mTc radionuclide scan showing Meckel's diverticulum.



Most of the Meckel's diverticula are discovered incidentally. In the absence of bleeding, Meckel's diverticula are rarely diagnosed prior to the time of surgical intervention.

Other investigations for Meckel's diverticulum:

• Angiography is used to locate the site of bleeding in an acute hemorrhage.

• CT scan has a very low sensitivity.

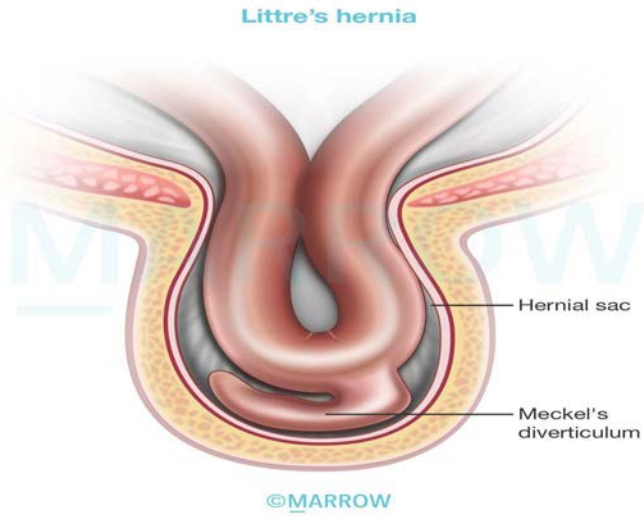
• Enteroclysis has an accuracy of 75% but is usually not applicable during acute presentations.

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Solution to Question 12:

Meckel's diverticulum found in inguinal or femoral hernial sacs is known as Littre's hernia. It can cause intestinal obstruction.



Option A: Amyand's hernia is an inguinal hernia in which the hernia sac contains a normal or acutely inflamed appendix.

Option B: Narath's hernia is seen in patients with congenital dislocation of the hip. It is a femoral hernia seen behind the femoral vessels.

Option C: Cloquet's hernia is a type of femoral hernia where the sac lies under the pectineus fascia.

Solution to Question 13:

In a narrow-mouthed, thickened Meckel's diverticulum, resection of the diverticulum is the treatment of choice.

When Meckel's diverticulum is found in the course of abdominal surgery:

• In cases of narrow-mouthed, thickened Meckel's diverticulum, resection of the diverticulum is the treatment of choice

• If it has a wide mouth and is not thickened, it can safely be left alone.

Rarely, Meckel's diverticulum is complicated by a meso-diverticular band, which is believed to be a remnant of a vitelline artery. In such symptomatic cases, the treatment is diverticulectomy with the removal of associated bands connecting the diverticulum to the abdominal wall or intestinal mesentery.

Segmental resection of the ileum that includes both the diverticulum and the adjacent ileal peptic ulcer should be performed if:

• There is bleeding from the diverticulum

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- The base is inflamed or perforated
- The diverticulum contains a tumour.

Solution to Question 14:

The most common site for acquired diverticula in the small intestine is the second part of the duodenum (Windsock's diverticulum).

The colon is the most common site for acquired/false diverticula overall, followed by the duodenum.

Meckel's diverticulum is the most common true congenital diverticulum of the small bowel.

A barium swallow showing a well-defined diverticulum in the second part of the duodenum (Windsock's diverticulum) is shown below.

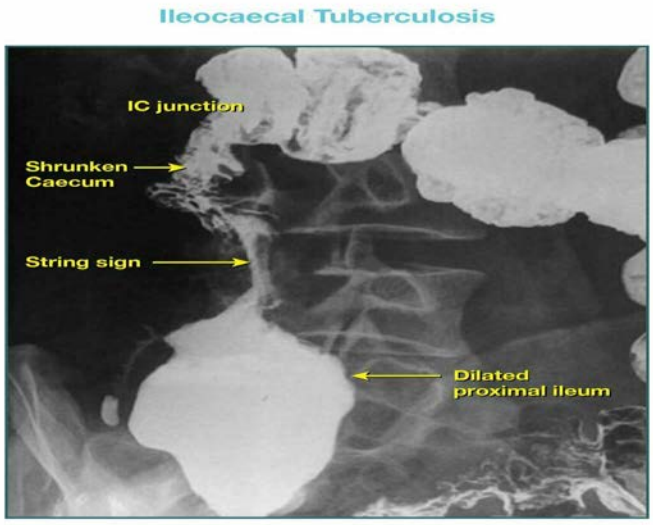


Solution to Question 15:

The given clinical scenario along with the barium study showing a shrunken caecum pulled-up away from the right iliac fossa is most likely suggestive of intestinal tuberculosis.

The most common site of intestinal tuberculosis is the distal ileum and cecum.

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The yellow color arrow marks indicate the shrunken caecum, stricturous narrowing of the terminal ileum and ileocaecal junction, and proximal ileal dilatation.

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Solution to Question 16:

Creeping fat sign and apple core sign are not the radiological findings seen in intestinal tuberculosis.

The creeping fat sign refers to the widely separated bowel loops due to fibrofatty proliferation seen in Crohn's disease.

The apple core sign describes a short segment irregular circumferential stricture of the large bowel that has abrupt shouldered margins resembling an apple core. This appearance is classically seen in a stenosing annular colon carcinoma.



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Solution to Question 17:

The correctly matched option is 1 - C, 2 - B, 3 - D, 4 - A.

Sign	Appearance
Sterlein sign	Narrowing of the terminal ileum with a shortened cecum
Gooseneck deformity	Loss of ileocecal angle with dilated terminal ileum
String sign	A persistent narrow stream of barium
Fleischner sign	Thickening of the valve lips, with narrowing of the terminal ileum

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Solution to Question 18:

Typhoid causes longitudinal ulcers.

Typhoid fever is caused by Salmonella typhi. It presents with step-ladder fever and abdominal pain after an incubation period of 10–20 days. Over the next week, the patient can develop:

• Distension

• Diarrhoea

• Splenomegaly

• Characteristic rose spots on the abdomen caused by a vasculitis

Surgical complications of typhoid are:

• Paralytic ileus

• Intestinal haemorrhage

• Free ileal perforation (characteristically occurs during the third week of the illness)

• Cholecystitis

• Longitudinal ulcers (usually situated in the distal ileum)

Diagnosis of typhoid is confirmed by culture of blood or stool.

Treatment is by antibiotics, usually chloramphenicol.

Perforation requires surgery to wash out and close the ulcer. Intestinal resection is usually avoided. In unstable patients, with evidence of septic shock, the bowel should be exteriorized and the perforation closed after recovery. Paratyphoid infection also resembles typhoid fever and is treated in a similar manner.

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Note: Transverse ulcers with stricture formation are seen in tuberculosis.

Solution to Question 19:

The given post-op scenario after 72 hours of laparotomy with no passage of flatus, absent bowel sounds, and X-ray findings are suggestive of paralytic ileus. Initiation of oral intake and emergency laparotomy is not done in paralytic ileus.

The return of normal motility post-surgery occurs in the following sequence:

Small intestine (within the first 24 hours) → Stomach (within 48 hours) → Colon (3 to 5 days).

Paralytic ileus is an adynamic/functional obstruction in which there is a failure of transmission of peristaltic waves. This is secondary to neuromuscular failure in the myenteric (Auerbach's) and submucous (Meissner's) plexuses. Since there are no rigorous contractions, there is no colicky pain.

The resultant stasis leads to the following clinical features:

• Abdominal distension - marked and tympanitic

• Effortless vomiting

• Absence of bowel sounds

• Absolute constipation

Paralytic ileus takes on clinical significance if any of the following are observed at 72 hours after laparotomy after handling of the bowel:

• No return of bowel sounds on auscultation

• No passage of flatus

Radiologically, the abdomen shows gas-filled loops of the intestine with multiple air fluid levels in an erect X-ray. A CT scan is more accurate for differentiating functional from mechanical obstruction

Paralytic ileus is managed by nasogastric tube decompression and restriction of oral intake until bowel sounds and the passage of flatus return. Electrolyte balance must be maintained.

Solution to Question 20:

The given clinical scenario and the X-ray sinogram showing a fistula tract connecting the skin opening and the small intestine are suggestive of an enterocutaneous fistula. In this case, it is most likely due to the umbilical port used during appendicectomy.

Fistula track length >2.5 cms is likely to heal. Enterocutaneous fistulas of length <2.5 cm are unlikely to heal and close.

Enterocutaneous fistulas are classified according to their location and volume of daily output. These factors determine the treatment and mortality rates. Proximal fistulas are associated with higher output, greater fluid and electrolyte loss. Distal fistulas tend to have lower output, making

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them easier to manage and more likely to close spontaneously.

Type of fistula	Output/day
High-output fistula	>500 mL
Intermediate fistula	200 - 500 mL
Low-output fistula	<200 mL

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Solution to Question 21:

The clinical scenario is suggestive of an enterocutaneous fistula. From the electrolyte panel showing hyponatremia, hypokalemia and metabolic acidosis, a diagnosis of duodenal fistula can be made.

The electrolyte abnormalities with gastric fistula are hypochloremia, hypokalemia, and metabolic alkalosis.

Enterocutaneous fistulas are classified according to their location and volume of daily output.

• Proximal fistulas are associated with higher output, greater fluid, and electrolyte loss, and greater loss of digestive capacity.

• Distal fistulas tend to have lower output, making them easier to manage and more likely to close spontaneously.

Although both gastric and duodenal fistulas are proximal fistulas, duodenal fistulas receive an additional 1 to 2 litres of enzymes, electrolytes, and water from the pancreatic and bile ducts. Hence duodenal fistulas are at greater risk for more electrolyte imbalance than gastric fistulas.

The management of enterocutaneous fistula is based on well-established principles known as SNAP which includes:

• S - Sepsis elimination and skin protection

• N - A period of parenteral nutrition may well be required

• A - Anatomical assessment

• P - Definitive planned surgery

Solution to Question 22:

The false statement about her condition is that the second part of the duodenum is commonly involved.

The given clinical scenario with rapid weight loss and the barium follow-through demonstrating dilation of the duodenum with an abrupt cut-off at its third part, coinciding with the line of the superior mesenteric artery is suggestive of superior mesenteric artery (SMA) syndrome. The third

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part of the duodenum is involved in SMA syndrome.

SMA syndrome (also known as Wilkie's syndrome) is usually seen in young asthenic women. It is a rare condition characterized by compression of the third portion of the duodenum by the SMA against fixed retroperitoneal structures.

SMA syndrome is associated with:

• Rapid childhood growth

• Profound weight loss

• Abdominal surgery

• Inflammatory diseases of the abdomen

• Short ligament of Treitz

• Immobilization in a cast that increases lordosis (cast syndrome)

Its clinical features include:

• Episodic vomiting

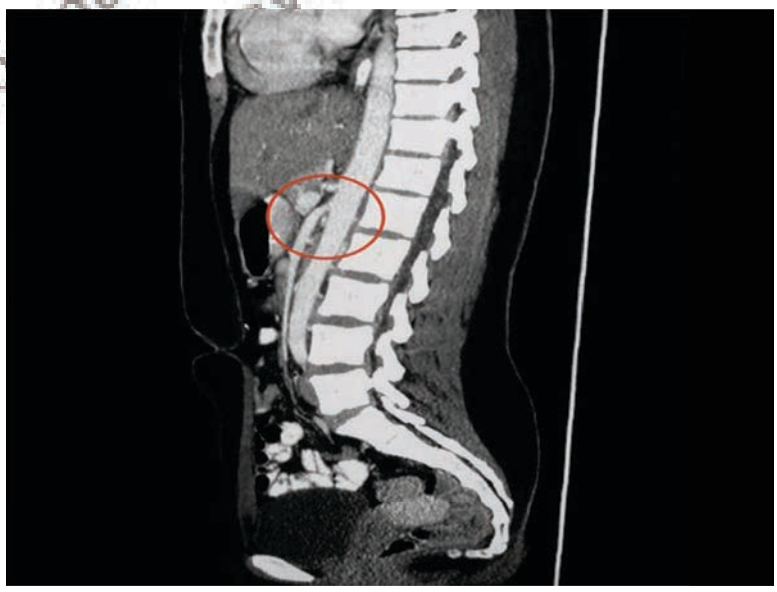
• Profound nausea

• Abdominal distention

• Postprandial epigastric pain

Upper gastrointestinal barium swallow or hypotonic duodenography demonstrates abrupt or near-total cut-off of the flow of barium from the duodenum to the jejunum. CT and magnetic resonance (MR) arteriography can also be used for additional anatomical detail.

The normal aortomesenteric angle is between 28-65 degrees. This is reduced to less than 25 degrees in SMA syndrome. A CT scan showing the reduced aortomesenteric angle is given below:



In SMA syndrome, initial conservative management includes:

• Frequent small feedings

• Lying in a prone position or on the left side postprandially

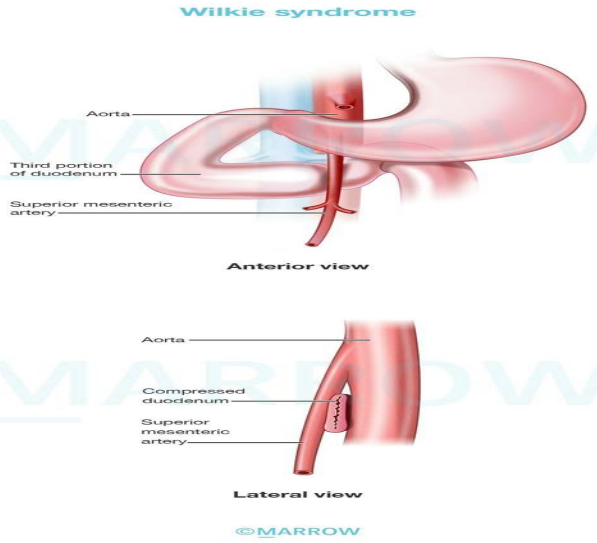
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• Weight gain (to increase mesenteric fat pad and thereby increase the aorto-mesenteric angle)

• Removal of a body cast in cast syndrome

Laparoscopic lysis of the ligament of Treitz is beneficial in few cases. If all the above treatments fail, duodenojejunostomy is done.



Solution to Question 23:

The given clinical scenario with an asymptomatic patient having air under the diaphragm without evidence of peritonitis (sterile pneumoperitoneum) is suggestive of pneumatosis intestinalis.

Pneumatosis intestinalis presents as multiple gas-filled cysts of the gastrointestinal tract. It is usually located in the subserosa, submucosa, and rarely the muscularis layer.

The common sites are jejunum > ileocecal region > colon. It represents one of the few cases of sterile pneumoperitoneum.

Pneumatosis in neonates is usually associated with necrotizing enterocolitis.

Predisposing factors include:

• Chronic obstructive pulmonary disease

• Immunocompromised state

• Inflammatory, obstructive, or infectious conditions of the intestine

• Endoscopy and jejunostomy

• Ischemia

• Diabetes

Patients can be asymptomatic. Symptoms if present, is usually nonspecific like:

• Diarrhoea

• Abdominal pain

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• Abdominal distention

• Nausea, vomiting

• Weight loss

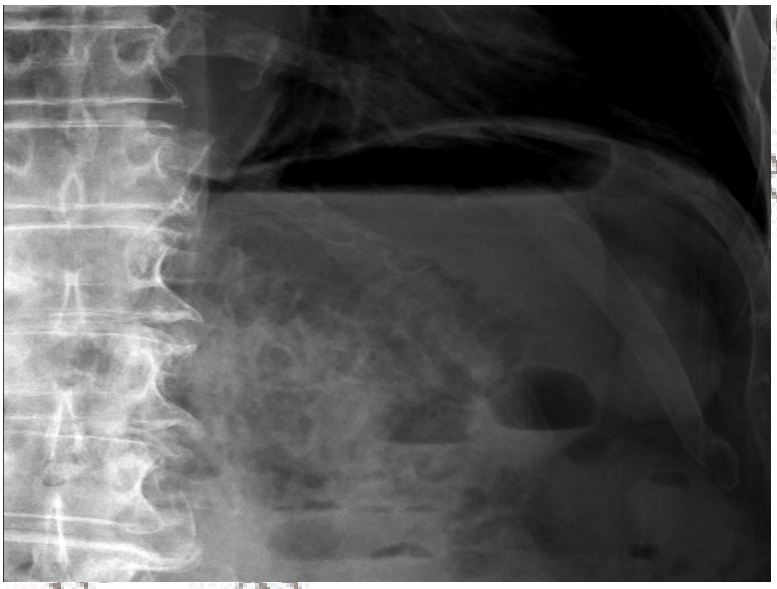
• Mucus in stool

Diagnosis can be made on the basis of:

• Plain X-ray showing radiolucent areas within the bowel wall (appear as grape-like clusters or tiny bubbles)

• Barium contrast

• CT studies



Treatment involves:

• Management of the uncomplicated primary disease.

• When symptoms demand treatment, the first line is intermittent high flow oxygen therapy, providing a concentration of 70% continuously for 5 days by nasal specula.

• The cysts may also resolve with antibiotics, particularly metronidazole.

• In resistant cases, maintenance treatment with sulfasalazine may be helpful. The prognosis in most patients is that of the underlying disease.

Solution to Question 24:

The given clinical scenario of a patient with sudden onset severe abdominal pain which is out-of-proportion to the physical examination findings along with atrial fibrillation is suggestive of acute mesenteric ischemia.

Mesenteric ischemia may be acute or chronic. The superior mesenteric artery (SMA) is most likely affected. An embolus is the most common cause of SMA occlusion. Possible sources for SMA

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emboisation include:

• Left atrium in atrial fibrillation

• Previous history of ischemic heart disease/myocardial infarction

• Vegetations on mitral and aortic valves associated with endocarditis

• An atheromatous plaque from an aortic aneurysm.

Other causes of mesenteric ischemia include:

• Atherosclerosis of mesenteric vessels

• Vasculitides

• Venous thrombosis in factor V Leiden mutation

• Non-occlusive mesenteric ischemia due to alterations in splanchnic blood flow.

The most important clue to an early diagnosis of acute mesenteric ischemia is the sudden onset of severe abdominal pain in a patient with atrial fibrillation or atherosclerosis. The pain is typically in the central abdomen and out of proportion to the physical findings.

Associated clinical features include nausea, vomiting, diarrhea, abdominal distension, peritonitis, and the passage of bloody stools.

The gold standard for the diagnosis of acute mesenteric ischemia is angiography, and management is laparotomy. The goal of operative exploration is to resect the compromised bowel and restore blood supply via embolectomy.

Other options:

Option B: A pulsatile abdominal mass is seen in the case of an abdominal aortic aneurysm. Acute pain and hypotension occur with rupture of the aneurysm, which requires an emergency operation.

Options A and D: Acute severe pancreatitis and peptic ulcer perforation have no association with atrial fibrillation. They usually present with pain over the upper abdomen associated with guarding and rigidity on examination.

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Solution to Question 25:

The minimum radiation dose in the small intestine that can cause radiation enteritis is 4500cGy.

Radiation enteritis is a common complication of radiation treatment aimed at the abdomen and pelvis. It causes diarrhea, nausea, vomiting, and stomach cramps.

The amount of radiation appears to correlate with the probability of the development of radiation enteritis. In general, serious late complications are unusual if the total radiation dosage is less than 4000 cGy. Morbidity risk increases with dosages exceeding 5000 cGy.

The table below shows various parts of GIT and the radiation doses that can cause enteritis.

Part of GIT	Radiation dose (in cGy)
Esophagus	6000 to 7500

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Part of GIT	Radiation dose (in cGy)
Stomach	4500 to 5000
Small intestine & colon	4500 to 6500
Rectum	5500 to 8000

Solution to Question 26:

Administration of folic acid is done in jejunal resection. Ileal resection causes vitamin B12 deficiency which requires administration of parenteral vitamin B12.

Extensive resection of the small intestine (<150 cm of remaining small intestine) can result in metabolic and nutritional consequences. This is known as short bowel syndrome. The presentation of the patient is dependent upon the site and extent of intestinal resection.

The ileum is the only site of absorption of vitamin B12 and bile salts. Following resection of the ileum, the loss of bile salts increases resulting in fat malabsorption and diarrhea. Other complications of resection include:

• Peptic ulcers - Due to gastric hypersecretion

• Cholelithiasis - Due to interruption of the enterohepatic cycle of bile salts

Initial treatment priorities include repletion of fluid and electrolytes lost in severe diarrhoea by initiating TPN. Long-term management involves:

• Administration of oral cholestyramine to bind with bile salts

• Dietary fat restriction

• Parenteral vitamin B12

• Proton pump inhibitors to lower gastric pH

• Octreotide to reduce the volume of GI secretions

• Antimotility agents such as loperamide hydrochloride to delay small-intestinal transit

Small intestine lengthening procedures done to increase absorption and transit time are:

• Longitudinal intestinal lengthening and tailoring procedure (LILT)

• Serial transverse enteroplasty procedure (STEP)

Intestinal transplantation is indicated only in complicated cases.

Solution to Question 27:

Tillaux's sign is said to be positive if the mass/swelling is mobile perpendicular to the mesentery attachment line. Tillaux's sign is seen in a mesenteric cyst.

Mesenteric cysts occur either in the small intestine (60%) or the colon (40%) and can be classified as the following:

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• Chylolymphatic (most common type)

• Enterogenous

• Urogenital remnant

• Dermoid

• Other causes: traumatic hematoma and cyst formation, tuberculous cold abscess of mesentery and hydatid cyst of the mesentery

They most commonly occur in adults with a mean age of 45 years. It is more common in females than males (2:1). The most common presentation is a painless abdominal swelling near the umbilicus, which is smooth and not moving with respiration with Tillaux's triad:

• Soft, smooth swelling in the umbilical region

• Freely mobile in a direction perpendicular to the mesentery (Tillaux's sign)

• Zone of resonance around the cyst

Other presentations include recurrent attacks of abdominal pain due to temporary impaction of a food bolus in a segment of the bowel narrowed by the cyst and vomiting.

Complications of mesenteric cyst include torsion, rupture, infection and hemorrhage into the cyst.

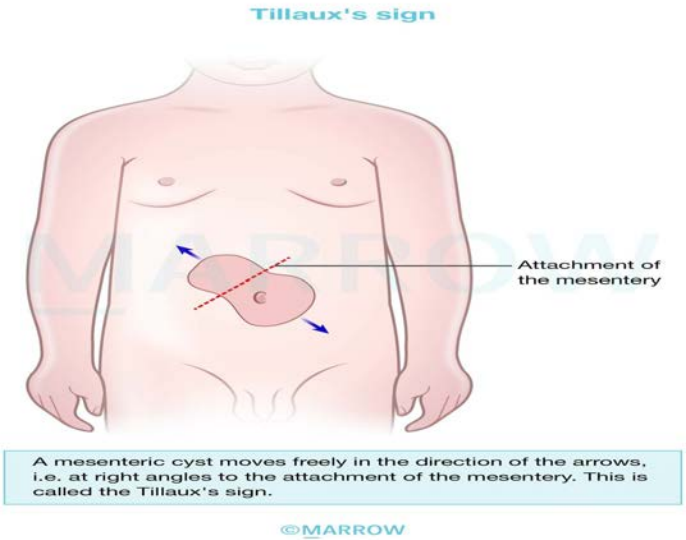
Ultrasonography and CT are used to demonstrate mesenteric cysts.

Treatment:

• Chlyolymphatic cyst is managed by enucleation.

• Enterogenous cyst is managed by removal of the cyst with resection of the adjacent bowel as it arises as a diverticulum or duplication from the adjacent bowel.

In cases where complete excision is not possible due to the close proximity to vital structures, partial excision or marsupialization should be performed.



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Solution to Question 28:

Enteroclysis is the investigation of choice in patients with small bowel tumours.

Enteroclysis is a barium study in which the contrast agent is put directly into the duodenum through a nasogastric tube.

Continued infusion of 500 to 1000 mL of thin barium sulfate and methylcellulose suspension is done and then viewed continuously with the use of either fluoroscopy or radiographs taken at frequent intervals. This technique is a double-contrast procedure that allows detailed imaging of the entire small intestine.

Enteroclysis has a sensitivity of over 90% in the detection of small bowel tumours and is the investigation of choice, particularly for tumours located in the distal small bowel.

Advantages of enteroclysis:

• The contrast is administered at a controlled rate directly in the small bowel, bypassing the regulatory action of the pylorus.

• The entire small bowel is demonstrated in a distended state, allowing better diagnosis. As a result of the dilatation, the following can be visualised:

• Mild strictures

• Small sinus tracts and fistulas

• Minimal extrinsic compressions

• Skip lesions

• Proximal and distal extent of diffuse diseases.

• The examination can be completed in 15–30 minutes, thus reducing patient waiting time.

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Solution to Question 29:

The given clinical scenario is suggestive of carcinoid syndrome caused by a carcinoid tumour. The best method for the staging of a carcinoid tumour is the octreotide scan.

They are neuroendocrine tumours of the gastrointestinal tract. They arise from the enterochromaffin cells. They metastasize early to the regional lymph nodes and the liver.

Abdominal symptoms include:

• Pain

• Abdominal distension

• Lower GI bleeding

Metastasis in these patients can cause increased production of serotonin leading to carcinoid syndrome with features like:

• Flushing

• Diarrhoea

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• Bronchospasm

• Cardiac symptoms because of stenosis and insufficiency of the cardiac valves

The diagnosis is made by an assessment of 5-hydroxy indole acetic acid (5-HIAA) in a 24-hour urine sample. It is positive in larger tumours only if metastases are present.

Ultrasonography, CT scan, and MRI may show the primary tumour and metastases. The best method for staging carcinoid tumours is by octreotide scan or somatostatin receptor scintigraphy (SRS).

Treatment:

• Somatostatin and its analogues are used in the symptomatic treatment of carcinoid syndrome.

• Surgery should be undertaken as soon as the diagnosis is made, even in the presence of liver metastases.

• Resection of the primary tumour and mesenteric lymph node metastases is done.

• In the presence of liver metastasis - liver resection, transarterial embolization (TAE), chemoembolization (TACE), chemotherapy, and liver transplantation can be done.

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Solution to Question 30:

Primary small-intestinal lymphomas are most commonly located in the ileum.

Option A:

Primary gastric lymphomas are derived from B-cells and classified as diffuse large B-cell lymphomas (DLBCL) and mucosa-associated lymphoid tissue (MALT). Both DLBCL and MALT are thought to be associated with chronic Helicobacter pylori infection. This linkage is better established for MALT, whereas the association between H. pylori infection and DLBCL is more controversial.

Option C:

Lymphoma is the most common malignant neoplasm of the spleen.

Option D:

Gastric lymphoma accounts for the majority of extranodal lymphomas, representing approximately 50–75% of primary gastrointestinal lymphomas.

Solution to Question 31:

B-cell lymphomas are chemo-sensitive. T-cell lymphomas are chemo-resistant.

Approximately one-third of GI lymphomas occur in the small bowel. In the small intestine, most commonly they are found in the ileum. In children <10 years, lymphomas are the most common intestinal neoplasm. In adults, they constitute up to 25% of small bowel malignant tumours.

Patients with celiac disease and immunodeficiency are at increased risk for the development of primary small intestine lymphomas.

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Clinical features include:

• Pain

• Weight loss

• Nausea

• Vomiting

• Bleeding

• Change in bowel habits

• Intestinal obstruction

Small intestine lymphomas are usually larger than 5 cm. They may extend into the mucosa. Microscopic examination shows diffuse infiltration of the intestinal wall.

In the absence of symptoms, they are often chemo-responsive and do not require surgery. In symptomatic patients, resection is indicated.

• B-cell lymphomas are more chemosensitive and have high remission rates, with or without surgery.

• T-cell lymphomas are more resistant to therapy and will progress to symptoms of obstruction or perforation if not resected.

Small intestine lymphomas cause complications like haemorrhage and perforation. The best prognostic indicator is a response to systemic therapy. The five-year survival rate is 50% to 60%

Note:

• The stomach (50–75%) is the most common site of lymphomas in the gastrointestinal system.

• Burkitt's lymphoma can aggressively affect the ileocaecal region.

• Lymphoma is the most common malignant neoplasm of the spleen.

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Large Intestine

Question 1:

Which of the following is the earliest sign in Crohn's disease?

a) Cobblestone appearance

b) Deep fissured ulcers

c) Rose-thorn appearance

d) Aphthous ulcers

Question 2:

Which of the following statements is true about Crohn's disease?

a) For effective treatment of a Crohn's mass, only antibiotics are prescribed.

b) Symptomatic relapse after surgery is not related to the presence of disease during resection.

c) The proximal ileum is most commonly involved in Crohn's disease.

d) On endoscopic examination, continuous lesions are visualised, which are diagnostic of Crohn's disease.

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Question 3:

A 40-year-old female patient presents with a 9-month history of weight loss, abdominal cramps, and intermittent diarrhea. On examination, a palpable mass in the right lower quadrant of the abdomen is found. Stool cultures are normal. Colonoscopy shows the presence of skip lesions. Biopsy showed the presence of non-caseating granulomas. What is the most likely diagnosis?

a) Crohn’s disease

b) Ulcerative colitis

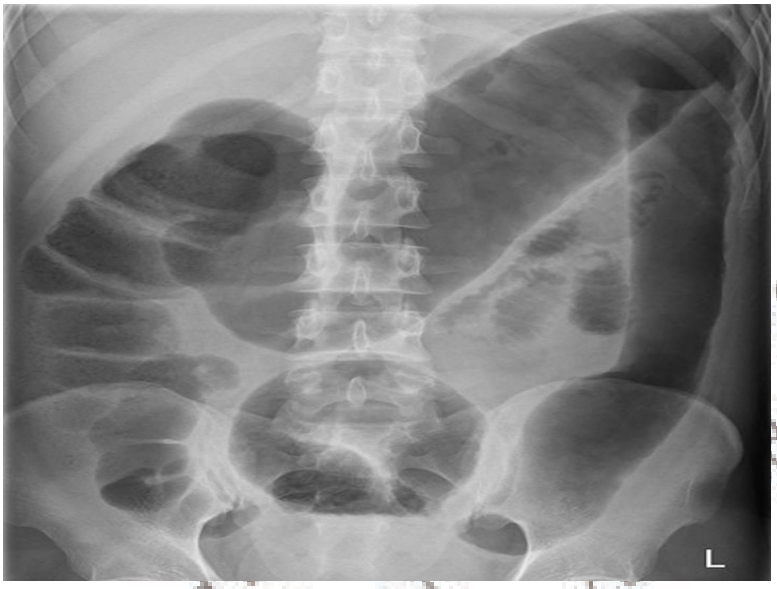
c) Ileocecal tuberculosis

d) Diverticulitis

Question 4:

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A 28-year-old patient was brought to the casualty ward with high fever and pain abdomen. He had a history of bloody diarrhea for several months. His past history was negative for long-term medications and previous surgeries. The abdominal X-ray image obtained is shown below. What is the most probable diagnosis?



a) Toxic megacolon

b) Volvulus

c) Ogilvie syndrome

d) Pneumatosis intestinalis

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Question 5:

You are doing an emergency laparotomy for a case of intestinal obstruction. Which organ will you first visualize to know if this is a case of small bowel or large bowel obstruction?

a) Ileum

b) Caecum

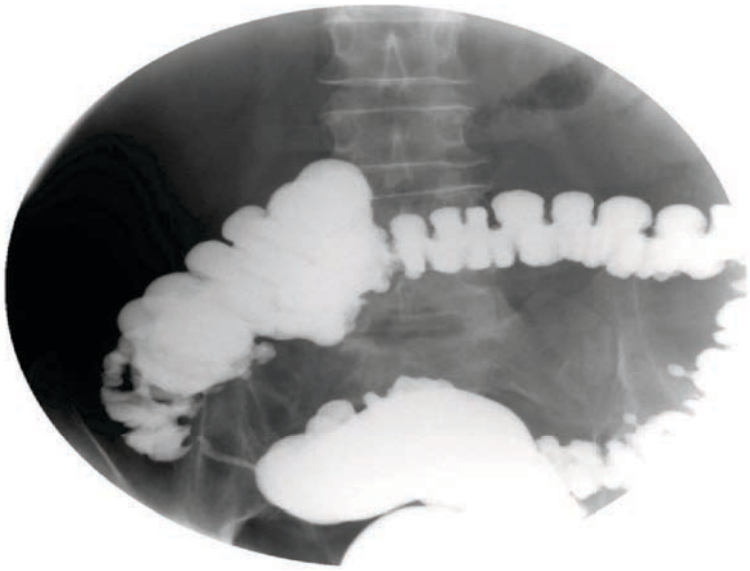
c) Jejunum

d) Sigmoid colon

Question 6:

A 55-year-old man presented to the OPD with complaints of intermittent constipation and a sense of heaviness in his lower abdomen. His barium enema film is given below. Which of the following statements is false about the pathology responsible for his condition?

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a) Commonly occurs along the mesenteric side of the colon

b) Sigmoid colon is the most common site

c) It is characterized by true diverticula

d) Causes formation of pulsion diverticula

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Question 7:

Which of the following is true regarding left-sided diverticulitis?

a) It is often an incidental finding during surgery

b) Appendicitis is an important differential diagnosis

c) Left sided diverticulitis is more common than right

d) The anatomical location is given by the Hinchey classification

Question 8:

A 38-year-old man is brought to the casualty with severe right lower quadrant abdominal pain for the last two days. You suspect right-sided diverticulitis due to the relatively long history and lack of migration of pain. However, your co-resident is convinced it is appendicitis. Which is the best investigation to rule in your diagnosis?

a) USG

b) Barium enema

c) CT scan

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d) Colonoscopy

Question 9:

While performing surgery on a patient who presented with clinical features suggestive of peritonitis, a diverticular perforation is seen along with fecal peritonitis. What is the Hinchey's stage?

a) Stage 1

b) Stage 2

c) Stage 3

d) Stage 4

Question 10:

A 70-year-old man with past history of diabetes mellitus, hypertension, and chronic constipation presented with right lower abdominal pain associated with fever. CT abdomen findings are suggestive of acute diverticulitis with 6 cm fluid accumulation in the paracolic region. What is the most appropriate management for this patient?

a) Oral antibiotics, bowel rest and continued monitoring

b) iv antibiotics, bowel rest, and continued monitoring

c) Laparotomy for abscess drainage and surgical resection

d) CT guided percutaneous drainage with iv antibiotics

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Question 11:

A 55-year-old man is brought to the casualty with a history of fever and abdominal pain. The pain was initially in the left lower quadrant for 2 days but is diffuse and severe for the past 4 hours. The erect X-ray of the chest showed the presence of pneumoperitoneum. Emergency laparotomy was performed. It showed the presence of perforated left-sided diverticulitis with fecal peritonitis. How will you manage the patient?

a) 1 and 2

b) 1 and 5

c) 2 and 4

d) 2 and 3

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Question 12:

An elderly male patient presents to the hospital with complaints of abdominal pain, increased frequency of micturition, and passing of air bubbles in urine. He was diagnosed with diverticulitis 2 years before and was treated with antibiotics. What is the most likely diagnosis?

a) Coloenteric fistula

b) Colocutaneous fistula

c) Colovesical fistula

d) Emphysematous cystitis

Question 13:

A CECT confirmed severe acute diverticulitis in a 34-year-old brought to the emergency with lower abdominal pain. A Foley's catheter was promptly placed to prevent a certain complication. Which of the following statements is false regarding the complication?

a) It may progress to pyelonephritis

b) Contrast enema is used to identify the course the pathology

c) Previous hysterectomy may increase the risk

d) It more commonly occurs in females

Question 14:

A patient presented with fever, diarrhea, and abdominal pain. She has a history of recent intensive care unit admission for sepsis which required prolonged antibiotic therapy. Sigmoidoscopy findings are given below. Choose the false statement regarding the given condition.

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a) Subtotal colectomy with end ileostomy is done in fulminant disease

b) IV vancomycin is used for treatment of recurrent disease

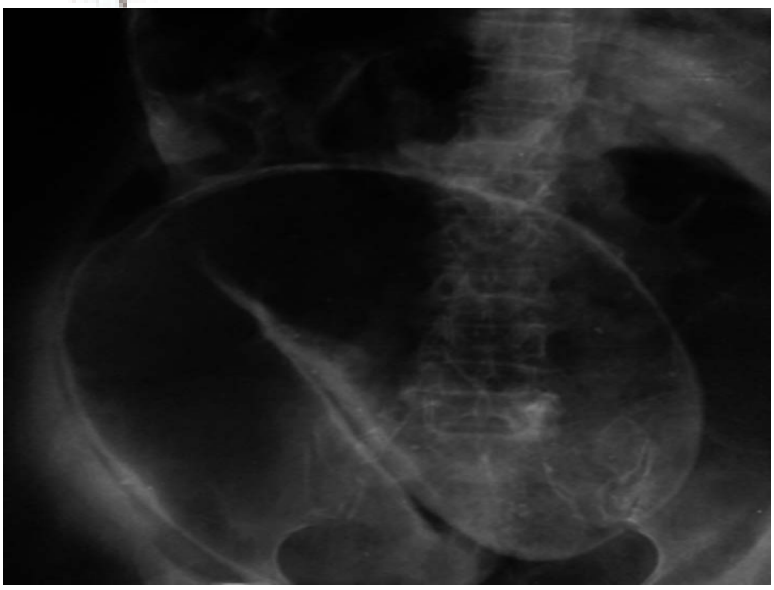
c) Fecal microbiota transplantation (FMT) is an emerging treatment option

d) Stool sample is used for PCR detection of toxins

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Question 15:

An elderly male patient is brought to the casualty with complaints of vomiting and severe abdominal pain. The abdomen appears grossly distended, is tender to touch, and percussion reveals hyper-resonance. His X-ray abdomen is shown in the image below. What is the next best step in the management of this patient?



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a) Urgent colonoscopy

b) Laparotomy followed by sigmoid resection alone

c) Laparotomy followed by Hartmann's procedure

d) Insertion of a rectal tube through a flexible sigmoidoscope

Question 16:

A lady is brought to the casualty department with a 2-day history of diffuse abdominal pain. She has had several episodes of bloody diarrhea for the past 8 hours and appears dehydrated. On examination, her pulse is feeble and BP is 80/55 mmHg. An abdominal x-ray shows the "thumbprinting sign." What could be the likely diagnosis?

a) Diverticulitis

b) Ischemic colitis

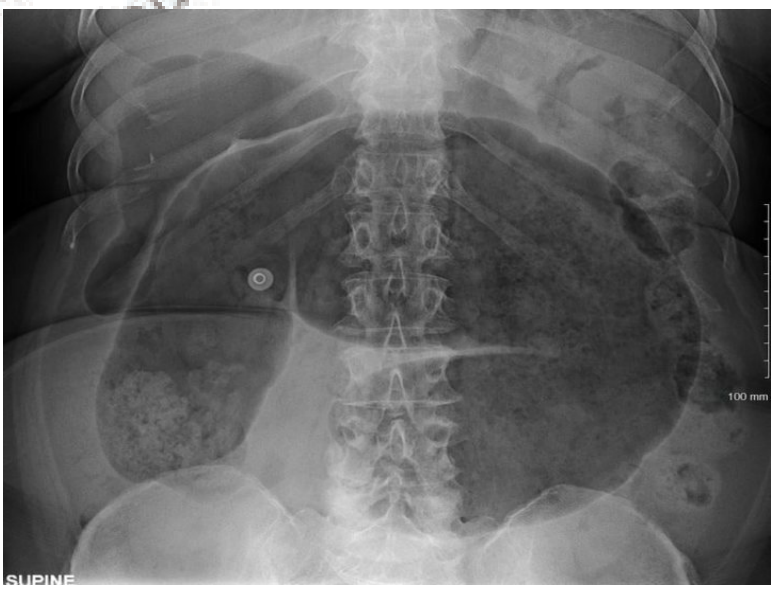
c) Pseudomembranous colitis

d) Both b & c

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Question 17:

A 44-year-old female patient presents to the casualty with complaints of sudden onset of pain in the abdomen. On examination, there is a palpable tympanic swelling in the left side of the abdomen. X-ray abdomen of the patient is given below. Which of the following is the most likely diagnosis?



a) Caecal volvulus

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b) Sigmoid volvulus

c) Toxic megacolon

d) Fecal retention

Question 18:

A middle-aged woman underwent an open repair of an abdominal aortic aneurysm. The procedure was uneventful. However, on the 2nd postoperative day, the patient developed symptoms of acute abdomen and bloody diarrhea with significant guarding. The patient was taken up for an exploratory laparotomy. Which of the following areas is most likely to be involved?

a) Caecum and ascending colon

b) Hepatic flexure

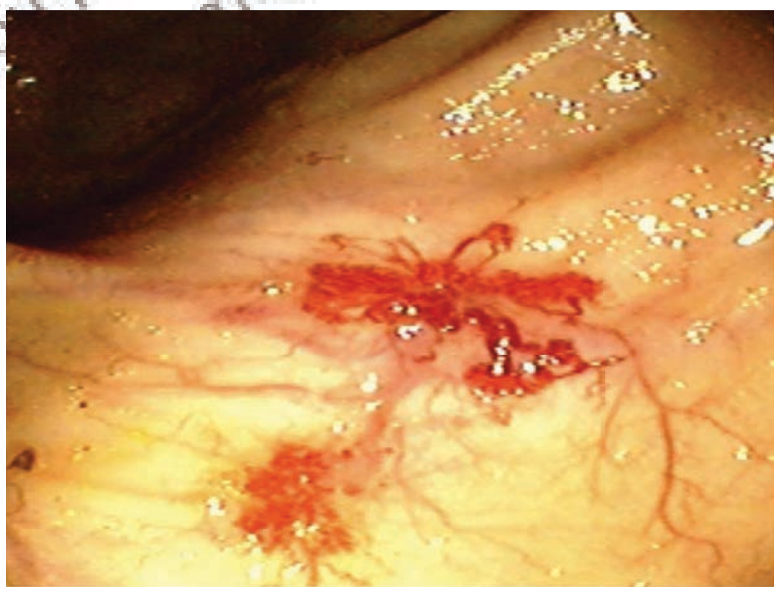
c) Splenic flexure

d) Sigmoid colon

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Question 19:

A patient had a painless episode of profuse per rectal bleeding. After initial stabilization, a colonoscopy was performed. The findings are given below. What is the most common site of this condition?



a) Cecum

b) Transverse colon

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c) Sigmoid colon

d) None of the above

Question 20:

A patient being evaluated for recurrent lower GI bleeding secondary to colonic angiodysplasia is suspected to have Heyde syndrome. What are the other common features associated with the condition?

a) Mitral stenosis and biliary cirrhosis

b) Mitral stenosis and hiatus hernia

c) Aortic stenosis and von Willebrand disease

d) PAH, cirrhosis, and tricuspid regurgitation

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Question 21:

A 4-month-old infant presented with constipation since birth. On a per rectal exam, a sudden release of feces was seen. A contrast enema showed a dilated descending colon leading to a constricted segment. Which of the following is involved in the pathogenesis of the disease?

a) GDNF

b) INF Alpha

c) TNF Alpha

d) TNF Beta

Question 22:

A neonate was brought to the pediatrician on day 5 of life with bilious vomiting and failure to pass meconium. On examination, the abdomen was distended. and X-Ray showed distended bowel loops. Due to suggestive family history, the resident suspected Hirschsprung's disease. What is the gold standard investigation for this condition?

a) USG

b) Barium enema

c) Rectal biopsy

d) Anorectal manometry

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Question 23:

From which of the following sites should a rectal biopsy be taken in order to confirm the diagnosis of Hirschsprung disease?

a) 1 cm above the dentate line

b) 2 cm above the dentate line

c) At the dentate line

d) 1 cm below the dentate line

Question 24:

All of the following are surgeries you may plan in a child with aganglionic megacolon, except?

a) Swenson

b) Duhamel

c) Heineke mikulicz

d) Soave

Question 25:

What is the most common problem that arises postoperatively following surgery for Hirschsprung's disease?

a) Constipation

b) Soiling

c) Enterocolitis

d) Incontinence

Question 26:

Up to what length from the anal verge will you be able to visualize through a flexible sigmoidoscope?

a) 60 cm

b) 70 cm

c) 80 cm

d) 90 cm

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Question 27:

Which structure would you trace to identify enlarged paracolic lymph nodes?

a) Bowel wall

b) Marginal artery

c) Main branches of the superior mesenteric artery

d) Named branches of inferior mesenteric artery

Question 28:

A 50-year-old man presents with 2 episodes of bleeding per rectum over the past 2 hours. His vitals are stable. Per rectal examination was normal except for trace evidence of fresh blood. Which of the following is the most appropriate intervention for this patient?

a) Colonoscopy

b) Esophagogastroduodenoscopy

c) Tagged RBC scan

d) Angiography with embolization

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Question 29:

A 56-year-old man with weight loss and pallor comes to the physician. A CBC and Fe studies indicate iron deficiency anemia. The patient denies any history of bleeding disorders or changes in diet. A guaiac test is advised. What parameter does it test?

a) Microscopic hematuria

b) Iron excretion in urine

c) Occult blood in stool

d) Iron malabsorption

Question 30:

99mTc-labeled red blood cell scan can be used to detect gastrointestinal bleeding as low as _____.

a) 0.1 mL/min

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b) 0.5 mL/min

c) 1 mL/min

d) 2 mL/min

Answer Key

Question No.	Correct Option
1	d
2	b
3	a
4	a
5	b
6	c
7	c
8	c
9	d
10	d
11	c
12	c
13	d
14	b
15	d
16	d
17	a
18	c
19	a
20	c
21	a
22	c
23	b
24	c
25	a
26	a
27	b
28	a

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29	c
30	a

Detailed Explanations

Solution to Question 1:

Aphthous ulcers, surrounded by a rim of erythematous mucosa, are the earliest lesions seen in a patient with Crohn's disease during endoscopy.

Crohn's colitis usually spares the rectum and is most severe in the ileocaecal region.

• In early Crohn's disease, small, punched-out aphthous ulcers are often seen (the result of submucosal lymphoid follicle expansion).

• In moderate disease, the aphthous ulcers coalesce into larger ulcers, which may take on the appearance of a star (stellate ulcers).

• As disease severity increases, submucosal edema and injury can result in cobblestoning of the mucosa (option A) and eventually the formation of serpiginous ulcers, which are typical findings in Crohn's disease.

Thorn-like extraluminal projections in barium studies are known as rose-thorn appearance, and are a typical sign of Crohn's disease. They represent deep penetrating linear ulcers or fissurings typically seen within stenosed terminal ileum with a thickened wall. (Options C and D)

Solution to Question 2:

Symptomatic relapse of Crohn's disease after surgery is not related to the presence of the disease during resection.

The course of the disease after surgery is unpredictable since surgery does not cure Crohn's disease. Instead, the probability of relapse increases with the time since resection.

Other options:

Option A: Antibiotics alone cannot treat a Crohn's mass effectively. Abscesses can be treated with metronidazole and ciprofloxacin and should also undergo drainage (and resection if needed).

Option C: The terminal ileum is most commonly involved in Crohn's disease.

Option D: On endoscopic examination, discontinuous "skip" lesions are visualized. These are irregular areas of inflamed mucosa that are ulcerated with mucopurulent exudate separated by intervening, normal-appearing intestinal mucosa.

Solution to Question 3:

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The clinical scenario and the biopsy showing the presence of non-caseating granulomas are diagnostic of Crohn's disease.

Solution to Question 4:

The clinical scenario and the radiograph are suggestive of toxic megacolon.

Toxic megacolon may present with fever, abdominal pain, and abdominal distension. Abdominal radiography shows transverse or right colonic dilation of >6 cm and loss of haustrations. It is usually associated with ulcerative colitis as indicated by history of chronic bloody diarrhoea.

It can be triggered by electrolyte imbalance and narcotics which interfere with gut motility. Features of secondary bacterial infecton and sepsis may be present. It can be complicated by intestinal perforation.

It usually resolves with supportive treatment (correcting electrolyte imbalance, fluids, and bowel rest) and medical therapy which includes glucocorticoids, anti-inflammatory drugs, and antibiotics. However, an urgent colectomy is indicated in patients who do not show signs of improvement.

Indications for urgent surgery include:

• Frank intraperitoneal peritonitis, secondary to perforation

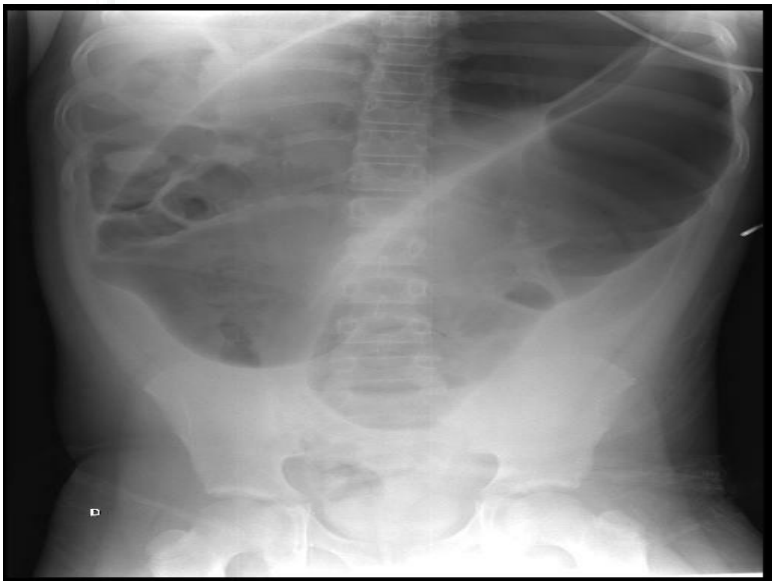
• Life-threatening hemorrhage or increasing transfusion requirements

• Worsening systemic toxicity

• Worsening colonic dilatation

Other options:

Option B: Volvulus occurs when the air-filled segment of the colon twists around the mesentery. The sigmoid colon is the most commonly involved part of the large intestine (90%). The patient can present with abdominal distension, nausea and vomiting. X-ray abdomen shows a bent inner tube or coffee bean appearance.



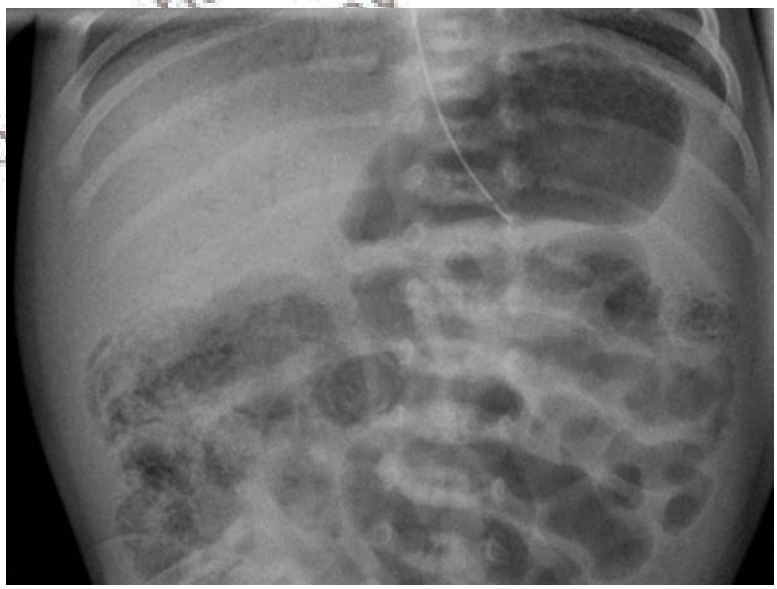
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Option C: Ogilvie syndrome, also known as colonic pseudo-obstruction is a functional disorder with colonic dilatation without mechanical obstruction. It occurs commonly in hospitalized patients and is associated with narcotics, bed rest and comorbid disease. X-ray shows dilatation of the colon (predominantly transverse colon) with absent mechanical obstruction.



Option D: Pneumatosis intestinalis is the presence of gas within the bowel wall seen in any part of the GI tract but most commonly in the jejunum. It is a pathognomic feature of necrotizing enterocolitis. X-ray of the abdomen will show intramural gas in the bowel.



Solution to Question 5:

The cecum is the first organ to be visualized to differentiate between the small and large bowel in cases of intestinal obstruction.

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Distension of the cecum will confirm large bowel involvement. The identification of a collapsed distal segment of the large bowel and its sequential proximal assessment will lead to the identification of the cause.

Solution to Question 6:

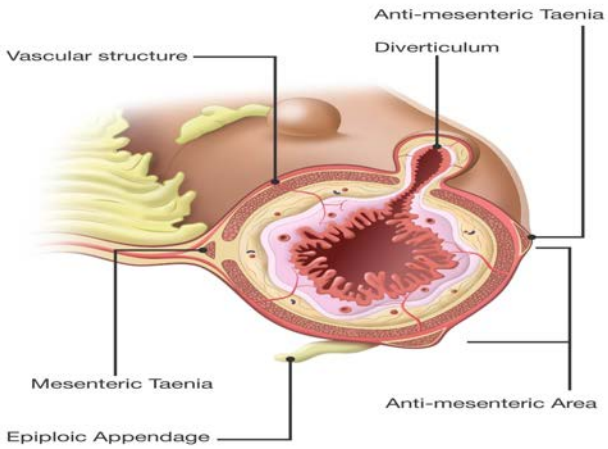
The given clinical scenario and X-ray film showing saw-toothed appearance of the colon are suggestive of colonic diverticulosis. They are false diverticula.

Diverticulosis refers to the herniation of the mucosa and muscularis mucosa through the colonic wall, usually at the point where the nutrient artery enters the colon (mesenteric side). The condition is usually asymptomatic until complications arise. They may be detected incidentally. On a barium X-ray, the colon with diverticular disease will have a saw-toothed appearance.

Colonic diverticula are more often acquired than congenital. They are common in developed countries that have a low fiber diet. A low fiber diet results in low stool volume. As the colon generates higher intraluminal pressure to propel smaller volumes of stools, low stool volumes cause an increase in colonic wall tension and segmentation of the colon.

Prolonged colonic contractions and high pressures (directed radially along the colonic wall) results in the formation of pulsion diverticula. The sigmoid colon is the most common site.

Note: True diverticulum involves the herniation of all the layers of the intestine whereas false diverticulum involves the herniation of only the mucosa and submucosa.



Solution to Question 7:

In the general population, left-sided diverticulitis is more common. The sigmoid colon (left colon) involvement is more common than the right colon involvement.

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Diverticulitis is the inflammation and infection of the diverticulum. It most commonly presents with

• left lower abdominal pain (often termed as left-sided appendicitis)

• fever

• a change in bowel habits

• anorexia, nausea

• urinary urgency if there is an associated inflammation of the bladder etc.

Right-sided diverticulitis occurs more often in younger patients of Asian descent than in other populations and presents with pain in the right lower quadrant. Patients presenting with these symptoms are often thought to have acute appendicitis, and often the diagnosis of right-sided diverticulitis is subsequently made in the operating room.

The Hinchey classification is used to describe the severity of the diverticular disease, complicated by perforation.

Hinchey classification:	
Stage 1	Mesenteric or pericolic abscess
Stage 2	Pelvic abscess
Stage 3	Purulent peritonitis
Stage 4	Fecal peritonitis

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Solution to Question 8:

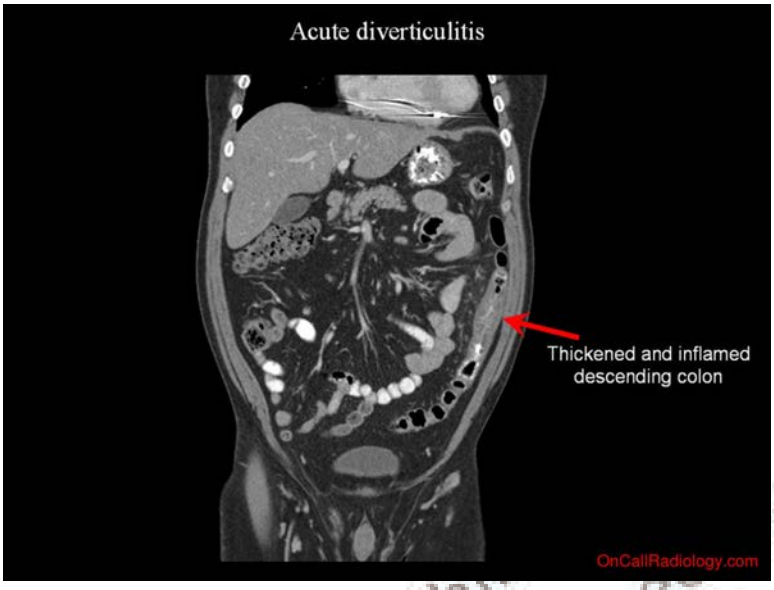
Computed tomography (CT) scan of the abdomen and pelvis is now considered by most to be the standard modality for the evaluation of acute diverticulitis.

Contrast enema studies are the most accurate way to find out the colonic diverticula. However, because of the risks of extravasation of barium from the perforation and aggravation of inflammation, it is avoided.

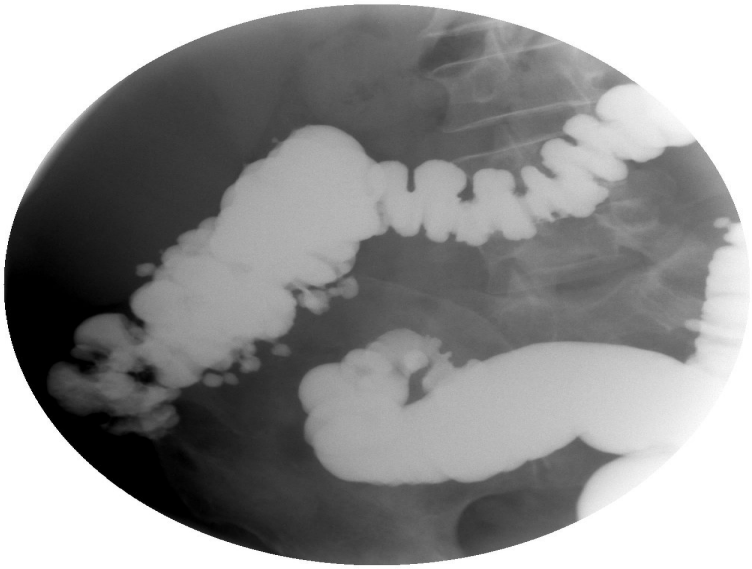
In contrast to barium enema, a CT scan demonstrates both the intraluminal and extracolonic manifestations of acute right-sided diverticulitis.

CT findings include pericolic soft tissue stranding, colonic wall thickening and pericolic fat infiltration (streaky fat).

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Barium enema in diverticulosis shows a saw-tooth appearance.



Solution to Question 9:

Fecal peritonitis belongs to grade 4 in the Hinchey classification.

Diverticulitis refers to the inflammation and infection associated with the diverticula. Hinchey classification is the most commonly used classification for the severity and complication of acute diverticulitis. It is used additionally to guide the overall management of acute diverticulitis.

Hinchey classification:	
Stage 1	Mesenteric or pericolic abscess

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Hinchey classification:	
Stage 2	Pelvic abscess
Stage 3	Purulent peritonitis
Stage 4	Fecal peritonitis

Solution to Question 10:

The elderly patient with multiple comorbidities and complicated acute diverticulitis (fluid collection >5 cm) should ideally be managed with CT-guided percutaneous drainage with iv antibiotics.

Acute diverticulitis management:

Outpatient care

• Initiated for young patients with no comorbidities

• It includes:

• Liquid diet

• Analgesia

• Regular follow-up

Inpatient care

• Should be initiated if CT shows complicated diverticulitis characterized by:

• Perforation

• Abscess formation

• Obstruction or

• Fistulization.

• Can also be initiated if CT shows uncomplicated diverticulitis but the patient is of high risk such as

• Sepsis at presentation

• Elderly patient

• Immunosuppression

• Presence of comorbidities

• Failure of outpatient care

• Inpatient care includes the following:

• Bowel rest

• IV fluids

• Broad-spectrum IV antibiotics

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• Antibiotic therapy can be continued with careful monitoring if fluid collection is <5 cm

• CT guided percutaneous drainage if antibiotic therapy fails or fluid collection is > 5 cm

• Surgical exploration and resection if there is perforation, obstruction, or fistulization

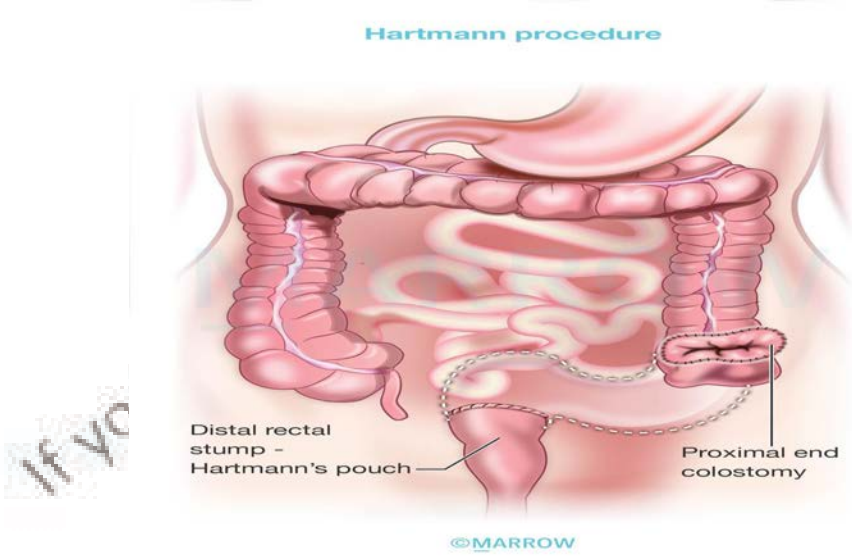
• Regular follow-up with imaging

Note: Oral antibiotics have no proven benefit in the outpatient management of acute uncomplicated diverticulitis.

Solution to Question 11:

The clinical scenario is suggestive of fecal peritonitis due to perforation of left-sided diverticulitis. This is managed by Hartmann's procedure. It involves segmental resection, a proximal-end colostomy, and closure of the rectal stump.

If the perforation of the diverticulitis leads to a localized pericolic abscess formation, then it is treated with antibiotics alone or along with percutaneous drainage.



Solution to Question 12:

The history of diverticulitis and pneumaturia point towards a diagnosis of colovesical fistula. The patients present with the symptoms of urinary tract infection caused by colonic flora, pneumaturia (air bubbles in urine), and fecaluria (foul-smelling and brownish material in the urine).

Complications of diverticular disease:

• Bleeding

• Perforation leading to a pericolic abscess or generalized peritonitis

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• Intestinal obstruction due to fibrosis

• Fistula formation (colovesical, coloenteric, colovaginal)

Emphysematous cystitis can also present with pneumaturia. It is caused by urinary tract infection (UTI) with a gas-forming organism, especially in people with diabetes or patients with urinary tract outflow obstruction.

Solution to Question 13:

The colovesical fistula is more common in men than in women because the uterus prevents the sigmoid from adhering to the bladder.

Hence, females who have undergone hysterectomy are at increased risk.

Clinical features of a colovesical fistula are:

• Pneumaturia (flatus in urine)

• Fecaluria (feces in urine)

• Suprapubic pain

• Dysuria

• Urgency

• Frequency

• Gross hematuria (rare)

Pneumaturia is usually appreciated toward the end of urination because the collection of gas usually sits at the top of the bladder. The finding pneumaturia or fecaluria is virtually pathognomonic for urinary tract fistulas, and patients presenting with this condition should be presumed to have a colovesical fistula and investigated accordingly.

Over time, cystitis associated with a colovesical fistula may evolve to pyelonephritis.

An abdominopelvic CT with oral or rectal contrast is the investigation of choice. A contrast enema may be used to identify the course of the fistula.

Solution to Question 14:

A history of diarrhea associated with prolonged antibiotic treatment and characteristic adherent pseudomembranes in the colon is highly suggestive of pseudomembranous colitis. Oral Fidaxomicin is commonly used in recurrent pseudomembranous colitis.

The causative antibiotic agent must be discontinued and infection control measures must be taken for all patients.

• Initial episode - non severe: WBC ≤15,000/mm3, Creatinine < 1.5 mg/dL

• Oral Fidaxomicin(drug of choice) or Vancomycin

• Oral Metronidazole can be given if Vancomycin/Fidaxomycin is not available

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• Initial episode - severe: >15,000/mm3, Creatinine >1.5 mg/dL

• Oral Fidaxomicin or Vancomycin

• Consider fecal microbiota transplantation

• Initial episode - fulminant

• Hypotension, ileus or megacolon

• Oral vancomycin and IV metronidazole

• Rectal Vancomycin can be used if ileus present

• Overwhelming sepsis, colonic perforation, or peritonitis

• Subtotal colectomy with end ileostomy

• First recurrence

• Repeat course of antibiotics for another 10-20 days

• Oral Fidaxomicin(drug of choice) or Vancomycin can be used.

• Repeated recurrence

• Consider fecal microbiota transplantation

Option A: Subtotal colectomy with end ileostomy is the procedure of choice for patients requiring surgery for severe colitis or toxic megacolon. It allows for disease control, stabilization, and preservation of reconstruction options for the future. Segmental colectomy, ileostomy, or colostomy alone does not address the pancolonic nature of the disease.

Option C: Fecal microbiota transplantation (FMT) is emerging as a promising treatment option for recurrent and recalcitrant C. difficile infection. Using FMT, donor stool is administered to the patient through one of a variety of described routes (nasogastric tube, colonoscopic lavage, or upper endoscopy) to restore colonic flora.

Option D: Pseudomembranous colitis is caused by Clostridium difficile which is a gram-positive, spore-forming anaerobic microorganism. The pathogenesis is mediated by the enterotoxins - toxin A and toxin B. They can be detected in the stool using PCR

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Solution to Question 15:

The given clinical scenario and the X-ray radiograph showing characteristic coffee bean appearance are highly suggestive of sigmoid volvulus. Non-operative decompression followed by insertion of a rectal tube through a rigid proctoscope or a flexible sigmoidoscope is the next best step in the management of this patient.

Sigmoid volvulus is a cause of large bowel obstruction and occurs when the sigmoid colon twists on the sigmoid mesocolon. Symptoms include constipation, abdominal bloating, nausea, and/or vomiting. Onset may be acute or chronic. It occurs more commonly in patients with a history of mental illness and chronic constipation.

X-ray abdomen shows a large, dilated loop of the colon, often with a few air-fluid levels. Specific signs include the coffee bean sign and the absence of rectal gas. CT may reveal large gas-filled loop without haustral markings, forming a closed-loop obstruction.

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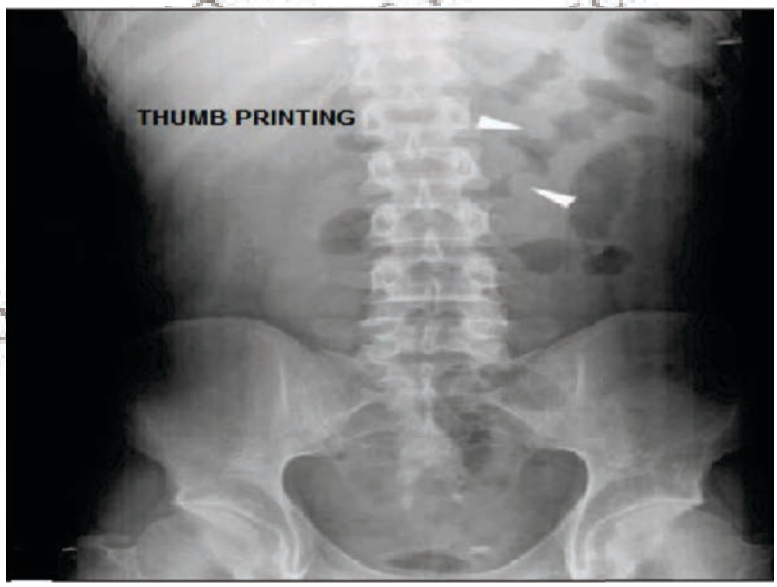
Non-operative decompression is successful in treating 90% of the patients. The rectal tube should be left in place for 1-2 days to allow complete decompression and to prevent immediate recurrence of the volvulus. This should be followed by bowel cleansing with cathartics and a complete colonoscopic examination. In patients with signs of colonic necrosis or in whom endoscopic detorsion has failed, sigmoid colectomy with the closure of the rectum and end colostomy (Hartmann procedure) maybe required. Even if detorsion of the sigmoid is successful, elective sigmoid resection is indicated to prevent recurrence.

Solution to Question 16:

The thumbprinting sign is seen in both ischemic colitis and pseudomembranous colitis.

Bowel wall "thumbprinting" (the appearance of thumbprint-shaped projections) is a radiological sign of submucosal thickening of the colonic wall. It can result from any process that leads to edema of the bowel wall, including pseudomembranous colitis, ischemic colitis, non-infective inflammatory bowel disease, other infective bowel diseases, as well as submucosal/intramural hemorrhage.

The plain abdomen x-ray given below shows submucosal thickening with crescentic margins of the colon described as "thumbprinting" sign.



Solution to Question 17:

The given clinical vignette and the X-ray findings are suggestive of caecal volvulus. It is differentiated from sigmoid volvulus as there is only a single air-fluid level and the apex of the volvulus pointing towards the left upper quadrant.

It is commonly seen in females in the 4th and 5th decade who can present with partial or complete intestinal obstruction. The clinical features include:

• Marked abdominal distention

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• Abdominal pain

• Obstipation

• Nausea and vomiting etc.

On examination, a palpable tympanic swelling in the midline or the left side may be seen. If there is strangulation or perforation of the obstructed bowel segment, peritoneal signs (rigidity, rebound tenderness etc.) can be present.

Radiological findings include caecal dilatation, single air-fluid level, and absence of gas in the distal colon. On X-ray abdomen, the apex of the cecal volvulus points towards the left upper quadrant (vs apex pointing towards the right upper quadrant in sigmoid volvulus)

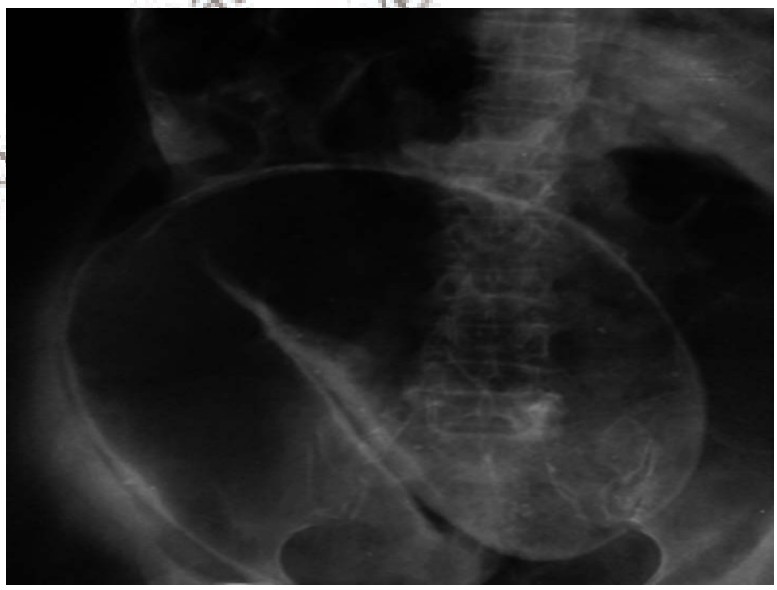
CECT abdomen is the investigation of choice that shows a whirl sign (also seen in the midgut volvulus).

Management of cecal volvulus includes supportive therapy with nasogastric tube, iv fluids, antibiotics etc. and early surgical intervention.

• Perforated or strangulated cecal volvulus should be treated with right hemicolectomy

• If there is no sign of perforation or strangulation, either cecopexy or right hemicolectomy can be performed.

Option B: Sigmoid volvulus (image shown below) is a cause of large bowel obstruction and occurs when the sigmoid colon twists on the sigmoid mesocolon. X-ray abdomen shows a large, dilated loop of the colon, often with a few air-fluid levels. Specific signs include the coffee bean sign and the absence of rectal gas. On X-ray abdomen, the apex of the sigmoid volvulus points towards the right upper quadrant.



Option C: Toxic megacolon (image shown below) is defined as the dilatation of the transverse colon to a diameter of more than 6 cm. It is usually associated with severe ulcerative colitis. It can be triggered by electrolyte imbalance and narcotics as they interfere with gut motility.

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Option D: Fecal retention is an accumulation of a large amount of stool within any bowel segment, most commonly within the colon usually due to chronic constipation. A colonic distention with fecal material is often called fecal loading on the radiograph. It can be complicated by fecal impaction and subsequent bowel obstruction.

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Solution to Question 18:

The given scenario is suggestive of ischemic colitis and it occurs most commonly at the splenic flexure.

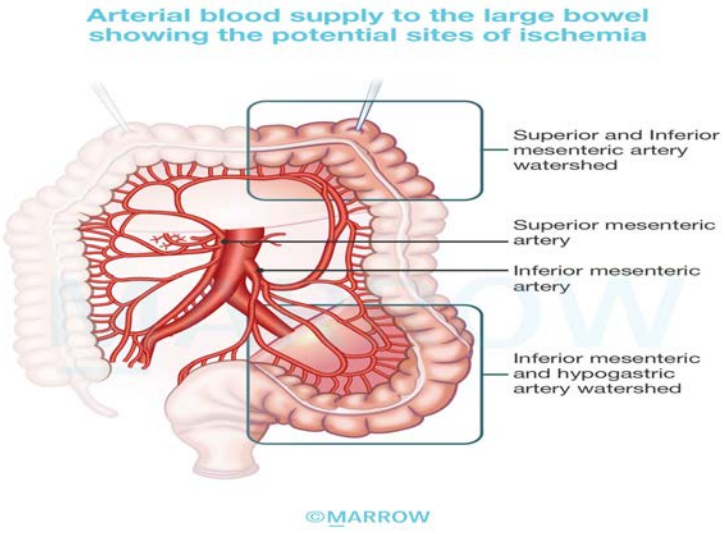
Ischemic colitis occurs due to interruption or decrease in colonic blood flow. It may occur with many different conditions, including embolism from cardiac disease, low-flow states such as congestive heart failure, sepsis, and vasopressor use. Major vascular surgery (both open and endovascular repair), especially involving the abdominal aorta, is a well-known risk factor for developing ischemic colitis.

Although any area of the colon may be affected, the watershed areas of the splenic flexure (Griffith's point) and the rectosigmoid (Sudeck's point) are the most prone to ischemia because of the often incomplete anastomoses of the marginal artery in these locations. The next most common area afflicted is the cecum, secondary to low blood flow in the terminal branches of the ileocolic artery.

Splenic flexure (also known as Griffith's point) is a watershed area between the superior and inferior mesenteric arteries.

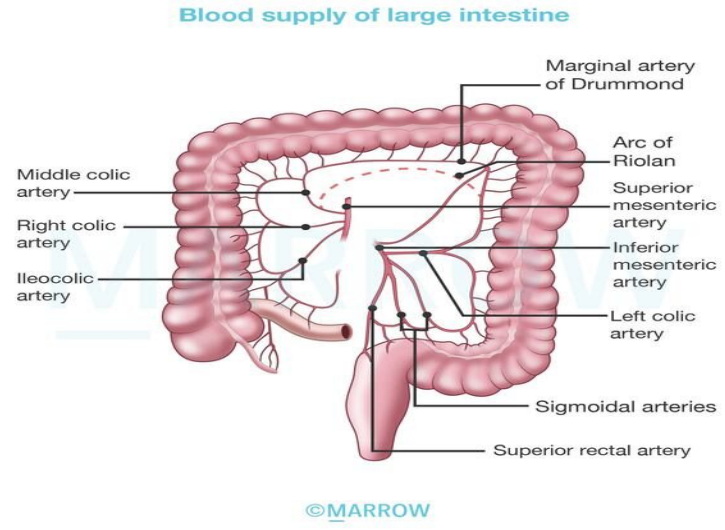
Sudeck point is a watershed area between the sigmoid arterial branch from the inferior mesenteric artery and the superior rectal artery (branch of Inferior mesentric artery).

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The marginal artery of Drummond runs parallel to the colon, connecting the SMA and IMA circulation - the majority of blood flow to the left and sigmoid colon in case of occlusion of the IMA.

Arc of Riolan is a variable collateral vessel that connects the SMA (middle colic vessel) to the IMA (left colic).



Solution to Question 19:

The clinical scenario and colonoscopy findings are suggestive of angiodysplasia. The cecum is the most common site of angiodysplasia followed by the colon.

In the colon the angiodysplasia can occur anywhere, however it is commonly found in the right colon than the transverse and the left colon.

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Solution to Question 20:

Heyde's syndrome is a multisystem disorder characterized by the clinical triad of:

• Aortic stenosis

• Gastrointestinal bleeding from angiodysplasia

• Acquired type 2 vWD (secondary to valvular stenosis, returns to normal once the valve is replaced)

Dilated mucosal and submucosal veins are usually seen on colonoscopy.

Solution to Question 21:

The given clinical scenario, with a positive blast sign (sudden release of feces on PR examination) and characteristic barium enema findings, are suggestive of Hirschsprung disease. Patients with Hirschsprung's disease have an increased frequency of mutations in certain genes such as glial cell line-derived neurotrophic factor (GCDNF).

GDNF promotes the survival, proliferation, and migration of neural crest cells in culture. GDNF is expressed in the gut in advance of migrating neural crest cells and is chemoattractive for neural crest cells in culture. Mutations are also seen its receptor Rearranged during Transfection (RET), or its coreceptor Gfra-1 (GDNF family receptor alpha-1).

Gene mutations in chromosomes 10 and 13, family history, and Down's syndrome are also factors associated with Hirschsprung's disease.

Solution to Question 22:

A rectal biopsy is the gold standard for the diagnosis of Hirschsprung disease.

It shows the following:

• Absent ganglia

• Hypertrophied nerve trunks

• Positive immunostaining for acetylcholinesterase

• Calretinin immunostaining (superior to acetylcholinesterase staining)

Anorectal manometry is an important screening tool. It shows the absence of rectoanal inhibitory reflex.

Solution to Question 23:

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The ideal site to obtain a rectal biopsy in a patient with Hirschsprung's disease is from a point that is at least 2 cm above the dentate line. The internal sphincter extends up to 2 cm above the dentate line. This region is normally devoid of ganglionic cells. Hence, biopsy in this region may lead to errors in the results.

Rectal biopsy is the gold standard investigation in patients with Hirschsprung's disease. It shows the presence of hypertrophied nerve trunks and the absence of ganglion cells.

Solution to Question 24:

Heineke-Mikulicz's operation is a type of pyloroplasty and is not done for aganglionic megacolon (Hirschsprung disease).

Surgery is the treatment of choice for Hirschsprung disease. A multi-stage approach may be adopted. A colostomy is done in the newborn period, followed by a definitive pull-through operation after the child is over 10 kgs.

Definitive surgeries for Hirschsprung disease are as follows:

- Swenson
- Duhamel
- Soave

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Solution to Question 25:

Constipation is the most common postoperative problem after surgery for Hirschsprung disease.

Other problems are soiling, incontinence, and postoperative enterocolitis.

Solution to Question 26:

Flexible sigmoidoscope is 60 cm in length and can be used to visualize the rectum and sigmoid colon.

Flexible sigmoidoscopy is a procedure involving the following steps:

A sigmoidoscope is inserted through the anus and the distal colonic mucosa (up to 60 cm from the anal verge) is visualized. Diagnostic or therapeutic maneuvers are performed, as needed.

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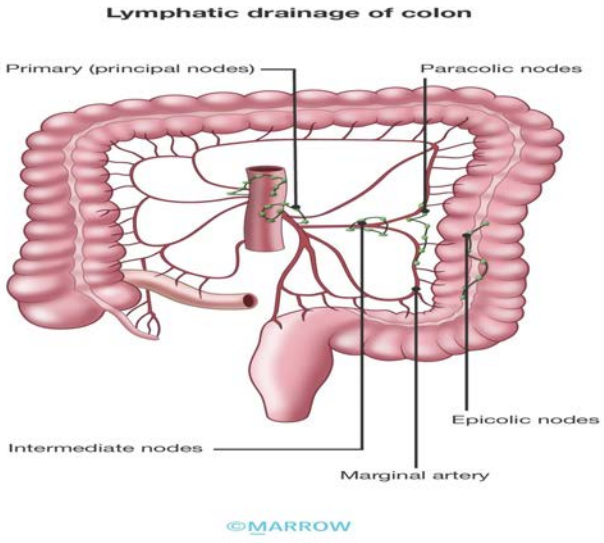


Scope	Length
Anoscope	8 cm
Proctoscope	15 cm
Rectoscope	25 cm
Flexible sigmoidoscope	60 cm
Colonoscope	100–160 cm

Solution to Question 27:

Paracolic lymph nodes are located along the marginal artery.

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Solution to Question 28:

In case of suspected lower GI bleeding or hematochezia, if the hemodynamic status of the patient is stable, colonoscopy with appropriate bowel preparation should be done at the earliest. A patient with hematochezia or fresh blood per rectum should be managed in the following way:

Hemodynamically unstable on initial assessment (or suspected massive UGI bleed):

• At first, resuscitation with iv fluids, blood transfusion, and volume replacement

• Perform EGD (Esophagogastroduodenoscopy)

• Consider getting gastro surgery/interventional radiology consult

• If a source is not found on EGD,

• Perform angiography ± embolization if still hemodynamically unstable

• Perform colonoscopy if the patient is hemodynamically stable or, if a source was not identified on initial angiography

• If colonoscopy did not identify a bleeding source, consider further evaluation with

• Capsule endoscopy

• Tagged red blood cell scan

• Repeat EGD, etc.

Hemodynamically stable on initial assessment:

• Bowel preparation and perform colonoscopy

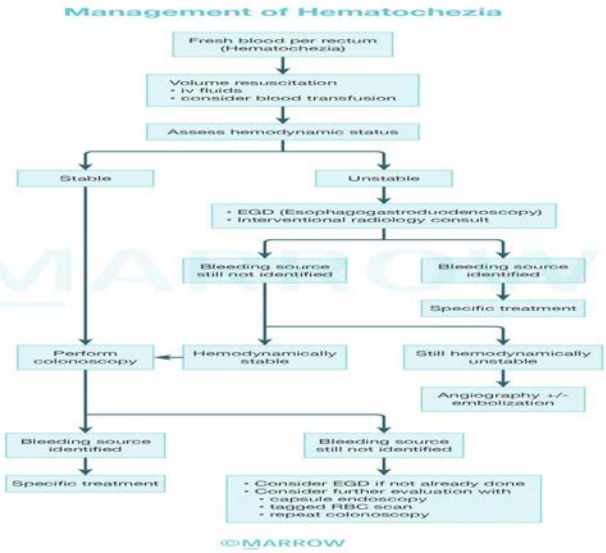
• If a source was not found on colonoscopy, EGD should be performed

• If a source was not found even on EGD, consider further evaluation with

• Capsule endoscopy

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- Tagged red blood cell scan
- Repeat colonoscopy, etc.



Solution to Question 29:

Guaiac test is used for testing occult blood in the stool. New-onset iron deficiency anemia in middle-aged men should be thoroughly evaluated for colorectal carcinoma, even in the absence of other symptoms.

Principle: Guaiac is a colorless organic compound that turns blue upon oxidation by oxidants, peroxidases, or pseudoperoxidase of hemoglobin.

The test is more sensitive for lower GI bleed.

Fecal hemoglobin must exceed 10 mg/g of stool (blood loss of 10 ml daily), for the test to be positive in 50% of the cases, although the test can be positive in some cases even if hemoglobin is <1mg/g of stool.

Solution to Question 30:

99mTc-labeled red blood cell scan can detect gastrointestinal bleeding as low as 0.1 mL/min.

Selective angiography, using the superior or inferior mesenteric artery, can detect hemorrhage in the range of 0.5 to 1.0 mL/min.

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Appendix

Question 1:

What is the most common anatomical position of the appendix?

a) Paracecal

b) Postileal

c) Retrocaecal

d) Pelvic

Question 2:

Which of the following is not true regarding the various anatomical positions of the appendix?

a) Tenderness may be elicited on the immediate right of the umbilicus in post-ileal appendicitis

b) The most common location of the base of the appendix is retro-caecal

c) An inflamed pelvic appendix may cause an increase in frequency of micturition

d) Post-ileal appendicitis may have diarrhoea as a presenting complaint

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Question 3:

During an appendectomy, the mesoappendix is divided and ligated. Which of the following is false about the major vessel ligated in this step?

a) It supplies only the appendix

b) It is a branch of upper division of the ileocolic artery

c) It is an end artery

d) Thrombosis is most common at the tip

Question 4:

While assisting a laparoscopic appendectomy, you observe the resident use the Fold of Treves as a guide while coagulating vessels in the mesoappendix. Which of the following best describes the anatomical landmark?

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a) Mucous membrane projecting into the ileal lumen

b) The ilio-cecal fold of the peritoneum

c) The fold of the mucous membrane around appendiceal orifice

d) The fold of the peritoneum over ascending colon

Question 5:

The CECT findings of a patient who presented with a positive McBurney's sign show a dilated appendix, appendicular wall thickening, and fat stranding. What is the initiating event that leads to his condition?

a) Bacterial invasion

b) Perforation

c) Luminal obstruction

d) Ischemia

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Question 6:

What is the earliest symptom in a patient with acute appendicitis?

a) Right lower quadrant pain

b) Periumbilical pain

c) Fever

d) Anorexia

Question 7:

A patient presents to the casualty with right lower abdominal pain, nausea, and fever. On examination, there is increased pain in the right lower quadrant when palpating the left lower quadrant. What is this sign is called?

a) Rovsing sign

b) Aaron sign

c) Dunphy's sign

d) McBurney's sign

Question 8:

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You are examining a patient suspected to have appendicitis. During the given manoeuvre, you notice that the patient has sharp right-sided abdominal pain. Which of the following statements is false?



a) This sign elicited is known as Psoas Sign

b) It is commonly associated with pelvic appendicitis

c) Flexion of the hip against resistance may be done instead

d) Pain is due to contact of inflamed appendix with the psoas muscle

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Question 9:

A young boy was brought to the casualty with a history of fever and abdominal pain. On examination, he was febrile and his pulse rate was 104 beats/min. The CT scan image is shown below. Which of the following signs is not seen in this disease?

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a) McBurney's tenderness

b) Rovsing's sign

c) Psoas sign

d) Ballance sign

Question 10:

A 9-year-old girl is brought to the casualty with a history of abdominal pain and vomiting for the past 4 hours. On examination, the patient is febrile. Rebound tenderness in the right iliac fossa is seen. Which among the following is the preferred imaging modality in this patient?

a) Contrast-enhanced CT scan

b) Ultrasound of the abdomen

c) Non-contrast enhanced CT

d) Erect X Ray of the abdomen

Question 11:

For which of the following criteria on the Alvarado system, will you assign 2 points to a patient with features of appendicitis?

a) 1, 2

b) 1, 3

c) 3, 5

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d) 4, 5

Question 12:

Which of the following organisms is most commonly isolated in patients presenting with perforated appendicitis?

a) Viridans streptococcus

b) Bacteroides thetaiotaomicron

c) Bacteroides fragilis

d) Peptostreptococcus

Question 13:

A patient presents with fever and right lower quadrant pain for the past week. On examination, tenderness and guarding in the right iliac fossa are present. An ill-defined abdominal mass is also palpated. CBC reveals leucocytosis. What is the next step in management?

a) Appendicectomy

b) Monitor and administer fluids

c) Incision and drainage

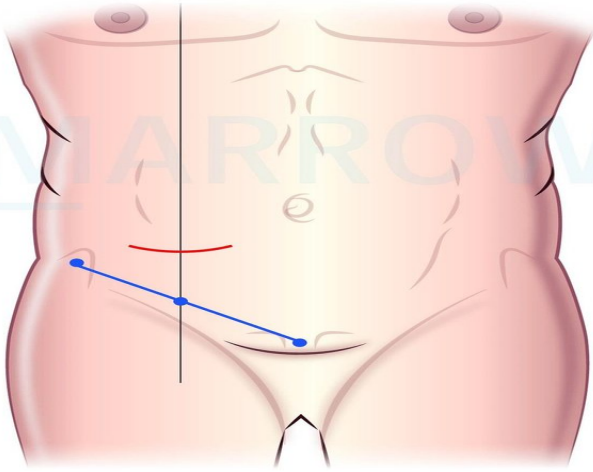
d) Exploratory laparotomy

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Question 14:

Identify the incision made on a patient while performing an appendicectomy.

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a) Gridiron incision

b) Lanz incision

c) Rutherford–Morison incision

d) Rockey–Davis incision

Question 15:

A surgeon performs an appendicectomy with a grid iron incision. He later converts the incision to Rutherford Morrison incision. Which of the following are cut?

a) 1, 3, 4

b) 2, 3, 4

c) 1, 2, 3

d) 1, 2, 4

Question 16:

As a surgical resident performing an appendectomy, what is the maximum stump size that you can leave behind in order to prevent stump appendicitis?

a) 1 mm

b) 2 mm

c) 5 mm

d) 4 mm

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Question 17:

A 19-year-old boy is taken up for open appendicectomy. Which of the combinations of the following instruments is best suited for his procedure?



a) 1, 2, 4, 7

b) 1, 2, 3

c) 1, 4, 6

d) 4, 5, 6, 7

Question 18:

What is the most common post-operative complication that may arise in patients who undergo an appendectomy ?

a) Wound infection

b) Intra-abdominal abscess

c) Paralytic ileus

d) Adhesive intestinal obstruction

Question 19:

What is the most common neoplasm of the appendix ?

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a) Adenocarcinoma

b) Carcinoid

c) Mucinous cystadenoma

d) Adenocarcinoid

Question 20:

Which of the following statements is false about carcinoid tumours of appendix?

a) Size appears to be the best predictor of malignant behavior and metastatic potential

b) Arise from Kulchitsky cells of the crypts of Lieberkühn

c) Most common location is the base of the appendix

d) Metastasis is rare

Question 21:

A 35-year-old female patient is admitted to the hospital for complaints of pain and tenderness in the right iliac fossa. She underwent an appendicectomy. A 2.5 cm tumor was encountered at the base of the appendix which was found to be carcinoid on histopathological examination. What is the next step in management?

a) No further treatment is required

b) Send the urine for 5- hydroxy indole acetic acid levels

c) Perform right hemicolectomy

d) Add chemotherapy following appendicectomy

Question 22:

Following an appendectomy, the specimen was sent for HPE. A well-circumscribed, yellowish tumor measuring 0.5 cm in diameter at the tip of the appendix was seen. The stained sections revealed a typical carcinoid tumor of the appendix. The specimen had a tumor-free margin on all sides. The base of the appendix, the mesoappendix, and nodes were not involved. What is the next step of management?

a) Observation

b) Right hemicolectomy

c) Chemotherapy

d) Radiotherapy

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Question 23:

A 6-year-old presented with right lower quadrant pain and fever for 1 day. An appendicitis was suspected and the patient was prepared for surgery. During the surgery, a normal appendix was found but mesenteric lymph nodes were enlarged. What is the most likely diagnosis?

a) Yersinia enterocolitica infection

b) E. coli infection

c) MALT

d) Streptococcus infection

Question 24:

A postmenopausal lady diagnosed with mucinous cystadenoma appendix is unwilling for surgery. A few weeks later, she complains of vague abdominal pain and progressive abdominal distension. Ultrasound reveals the presence of ascites. CT reveals a thickened peritoneum, multiple loculated fluid collections, and scalloping of the liver and spleen margin. Which of the following statements is false regarding her condition?

a) The patient is most likely suffering from disseminated peritoneal carcinomatosis

b) The histology of the appendiceal tumor is an important predictor of survival

c) Cytoreductive surgery with IPHC maybe required for management

d) This condition can also occur in patients with ovarian neoplasms

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Answer Key

Question No.	Correct Option
1	c
2	b
3	b
4	b
5	c
6	b
7	a

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8	b
9	d
10	b
11	b
12	c
13	b
14	b
15	c
16	c
17	c
18	a
19	b
20	c
21	c
22	a
23	a
24	a

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Detailed Explanations

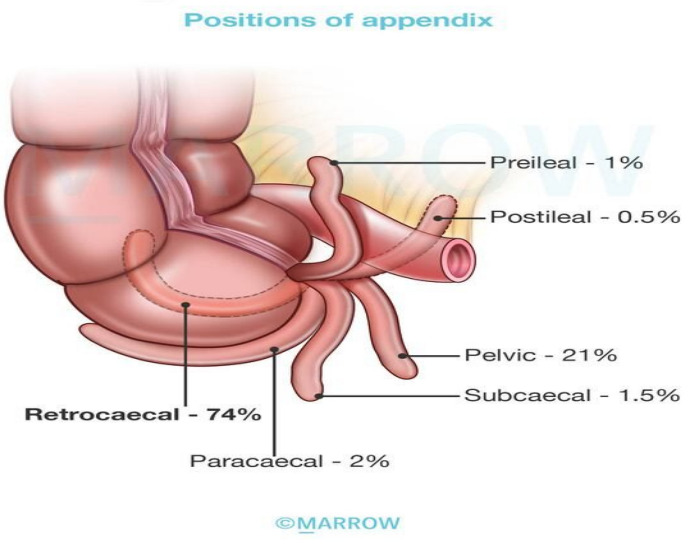
Solution to Question 1:

Retrocaecal is the most common position of the appendix.

Positions of appendix:

- Retrocaecal: 74%
- Pelvic: 21%
- Sub-cecal: 1.5%
- Pre-ileal: 1%
- Post-ileal: 0.5%

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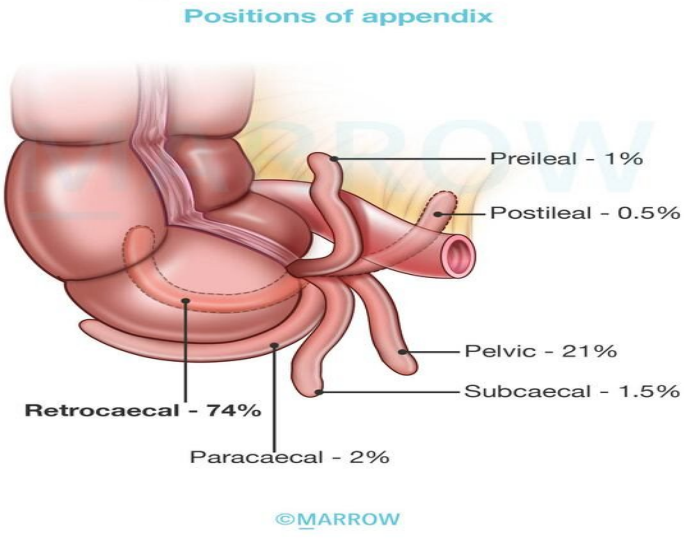


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Solution to Question 2:

The base of the appendix is found at the confluence of the three taeniae coli of the caecum. Its position is constant. Conversely, the tip of the appendix can be found in many positions (retrocaecal being the most common)

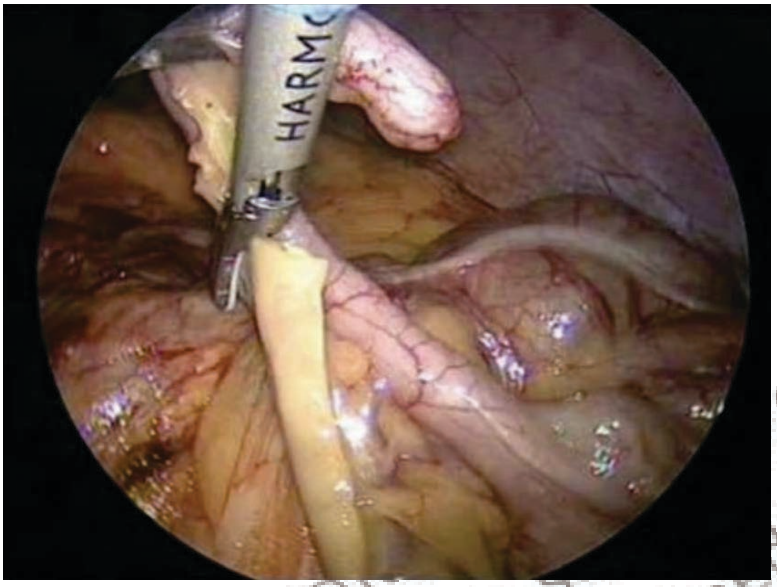
The taeniae coli fuse to form the longitudinal muscle coat of the appendix. During surgery, gentle traction at the taenia coli, leads the surgeon to the base of the appendix.



Solution to Question 3:

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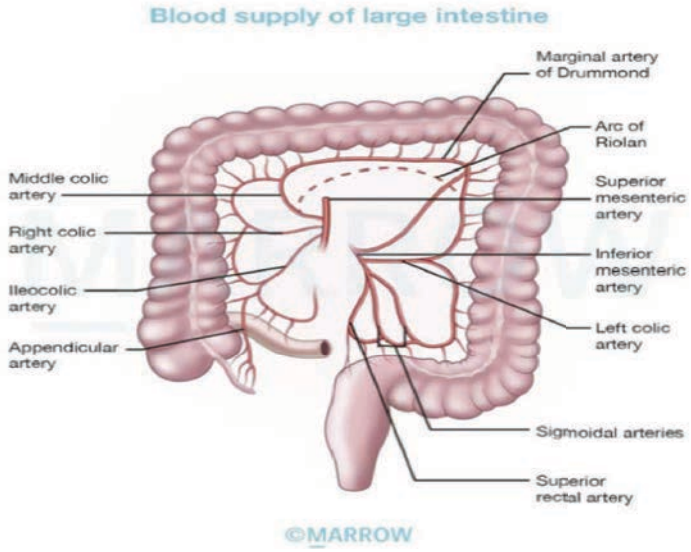
During appendectomy, the appendicular artery is the major vessel that is ligated when the mesoappendix is divided. It is a branch of the lower division of the ileocolic artery.



The appendicular artery transverses behind the terminal ileum and enters the mesoappendix away from the base of the appendix. It lies along the free border of the mesoappendix. The terminal part or the tip of the artery lies on the wall of the appendix and may become thrombosed in appendicitis, resulting in distal gangrene or necrosis.

It supplies only the appendix and is an end-artery.

An accessory appendicular artery called the artery of Seshachalam may be present. It anastomoses at the base of the appendix with a branch of the posterior cecal artery.

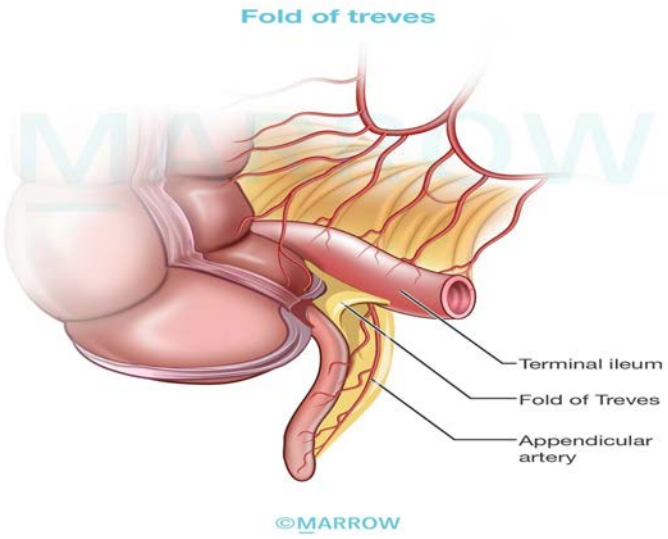


Solution to Question 4:

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Fold of Treves is an antimesenteric ileocecal fold of peritoneum.

A clinical aid useful for detecting the location of the appendix through small abdominal incisions is the identification of the fold of Treves. It marks the junction of the ileum and cecum. As it does not contain any vessel, it is referred to as the bloodless fold of Treves. It is also used as a guide to determine the extent of coagulation during an appendectomy. This prevents thermal injury to adjacent structures.



Jackson Membrane: Adhesion from the right abdominal wall to the anterior tenia of the ascending colon.

Gerlach valves: A mucosal fold covering the appendiceal orifice.

Solution to Question 5:

The clinical scenario is suggestive of appendicitis. The initiating event in the development of appendicitis is luminal obstruction.

Deep tenderness at McBurney's point, known as McBurney's sign, is a sign of acute appendicitis. McBurney's point is a point at one-third of the distance from the anterior superior iliac spine and umbilicus. It is where the appendix is commonly located.

Due to the relatively small diameter of the appendicular lumen, it is easily obstructed. Usually, due to fecoliths. This leads to the buildup of mucus secretions and air due to bacteria. With progressive dilation, venous drainage may get hampered, leading to full-thickness ischemia and perforation.

Obstructed lumen of appendix → Retained secretions with distension of lumen → Secretions get infected → Venous occlusion due to increased pressure → Bacterial translocation → Gangrene & perforation → Appendicular abscess

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Solution to Question 6:

Symptoms of acute appendicitis begin as periumbilical pain followed by anorexia and nausea.

Acute appendicitis begins with poorly localized colicky abdominal pain, first noticed in the periumbilical region. This is due to midgut visceral discomfort (T8 to T10 dermatomes) in response to appendiceal inflammation and obstruction.

Over the next 12-24 hours, it localises to the right lower quadrant due to local peritoneal inflammation.

Solution to Question 7:

The given triad of clinical features, namely fever, nausea and right lower abdominal pain is Murphy's triad. It is suggestive of acute appendicitis. Deep palpation of the left iliac fossa can cause pain in the right iliac fossa. This sign is called Rovsing's sign.

This pain is due to the backflow of gases from the colon into the inflamed right intestine when the left lower abdomen is palpated.

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Solution to Question 8:

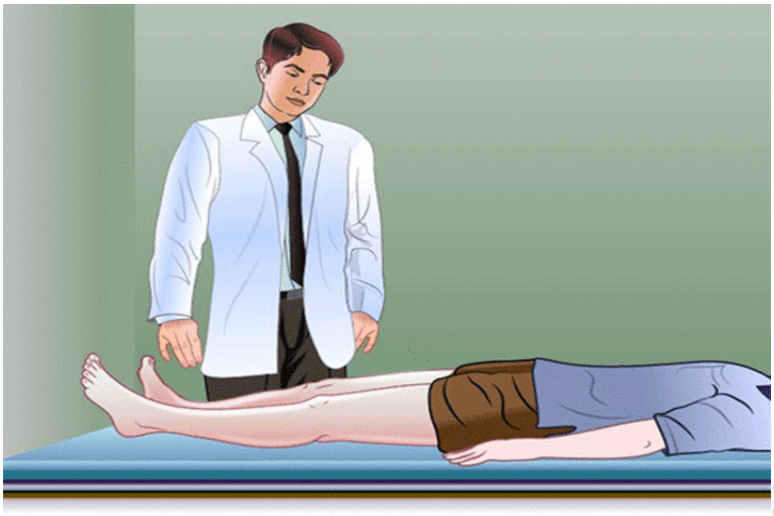
The manoeuvre in the given image shows hyperextension of the hip joint. It can induce abdominal pain when there is irritation of the psoas muscle by the inflamed appendix. This is known as the psoas sign and is commonly seen in retrocecal appendicitis.

Flexion of the hip against resistance also elicits the psoas sign.



Pain elicited on hip flexion and internal rotation is called the obturator sign. It is commonly seen in pelvic appendicitis.

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Solution to Question 9:

The patient's history and radiological findings are indicative of acute appendicitis. Ballance sign is not seen in acute appendicitis.

Findings on CT that are suggestive of acute appendicitis include:

• Appendiceal dilatation (>6 mm in diameter)

• Appendiceal wall thickening (>3 mm) and enhancement

Ballance sign is seen due to a ruptured spleen. The ballance sign is positive if there is a fixed dullness to percussion in the left flank and shifting dullness to percussion in the right flank. The fixed dullness is due to the presence of coagulated blood near the lacerated spleen while the shifting dullness is due to the presence of blood in the peritoneal cavity.

Option A: Deep tenderness at McBurney's point, known as McBurney's sign, is a sign of acute appendicitis. McBurney's point is a point at one-third of the distance from the anterior superior iliac spine and umbilicus.

Option B: Rovsing sign is seen in appendicitis. Deep palpation of the left iliac fossa may cause pain in the right iliac fossa.

Option C: Psoas sign is seen in appendicitis. Occasionally, an in■amed appendix lies on the psoas muscle, and the patient will lie with the right hip ■exed, for pain relief.

Solution to Question 10:

The clinical scenario is suggestive of acute appendicitis. In the pediatric population, ultrasound of the abdomen is the preferred imaging modality to identify the presence of an inflamed appendix. It avoids the risk of radiation exposure.

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In adults, the best imaging modality is a CT scan.

Solution to Question 11:

The Alvarado score is a clinical scoring system used in the diagnosis of appendicitis. In the Alvorado scoring system, leukocytosis ° 10 × 109 cells/L and tenderness right iliac fossa have two points.

Solution to Question 12:

Bacteroides fragilis is the most common anaerobe and Escherichia coli is the most common aerobe isolated from perforated appendicitis.

Type of bacteria	Patients (%)
Anaerobic Bacteria	
Bacteroides fragilis	80
Bacteroides thetaiotaomicron	61
Bilophila wadsworthia	55
Peptostreptococcusspp.	46
Aerobic Bacteria	
E. coli	77
Streptococcus viridians	43
Group D streptococci	27
Pseudomonas aeruginosa	18

Solution to Question 13:

In appendicular mass, the inflammatory process is already localized and any surgical intervention may be difficult and dangerous. Hence, if the general condition is satisfactory, the conservative Ochsner–Sherren regimen is used.

Solution to Question 14:

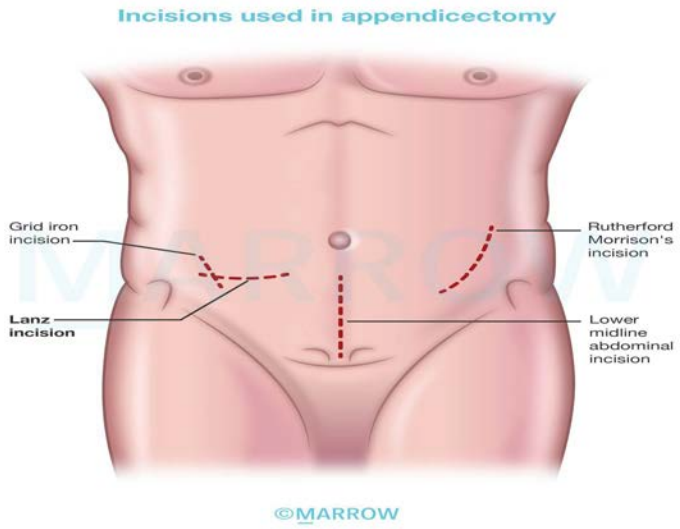
Lanz incision is a transverse skin crease incision for appendicitis 2 cm below the umbilicus, centered on the midclavicular–mid inguinal line

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Option A: Gridiron incision is an oblique muscle-splitting incision in the right lower quadrant. It is also called McBurney incision.

Option C: Rutherford–Morrison incision is an oblique muscle-cutting incision with its lower end over McBurney's point and extending obliquely upwards and laterally as necessary(Shown on the left side in the image for the sake of clarity)

Option D: Rockey–Davis incision is a transverse right lower quadrant incision.



Solution to Question 15:

The structures cut when the initial incision gridiron incision (McBurney's incision) is converted to the Rutherford Morrison incision are the external oblique, internal oblique, and transverse abdominis muscles.

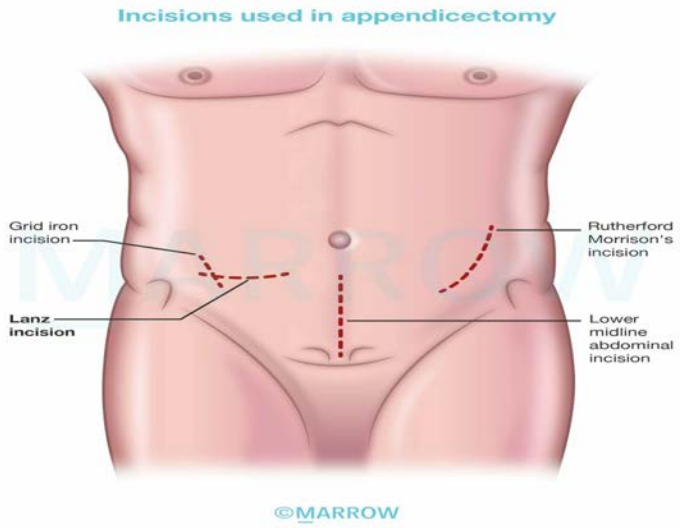
When the preoperative diagnosis is reasonably certain, the widely used incision for appendectomy is known as the gridiron incision. It is made perpendicular to a line connecting the anterior superior iliac spine to the umbilicus, with its center at McBurney's point. When better access is needed, the gridiron incision can be converted to a Rutherford Morison incision by extending the incision obliquely upwards and laterally.

Rutherford Morison's incision is suitable for a para- or retrocecal appendix that is fixed. It is an oblique muscle-cutting incision starting from McBurney's point and extending upward and laterally as needed. All layers (skin, subcutaneous tissues, external oblique, internal oblique, transversus abdominis, and the peritoneum) are divided along the incision line.

In recent years, the transverse skin crease (Lanz) incision has gained popularity due to improved exposure and ease of extension when necessary. This incision is placed approximately 2 cm below the umbilicus along the midclavicular-midinguinal line, with its length adjusted according to the patient's size and obesity. If required, the incision can be extended medially by retracting or dividing the rectus abdominis muscle (statement 4).

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When there is uncertainty in the diagnosis, especially in the presence of intestinal obstruction, a lower midline abdominal incision is preferred over a right lower paramedian incision.



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Solution to Question 16:

The residual appendiceal stump should be no longer than 5 mm, so as to minimize the possibility of stump appendicitis in the future.

Stump appendicitis is a complication that occurs after an appendectomy. It is caused by the inflammation of the residual appendiceal tissue after the appendix is removed. The clinical presentation of stump appendicitis is similar to acute appendicitis.

Factors predisposing for stump appendicitis:

• Inadequate identification of the appendicular base due to severe local inflammation

• Leaving a long stump due to fear of cecal injury or difficult dissection

• Local ulcerations due to fecoliths.

Solution to Question 17:

Babcock's forceps, 22 size blade, and Langenbeck retractor are used in open appendicectomy.

The image below shows Babcock's forceps, where:

• Distal part of distal blade is curved with a triangular fenestra which allows soft tissues to bulge out.

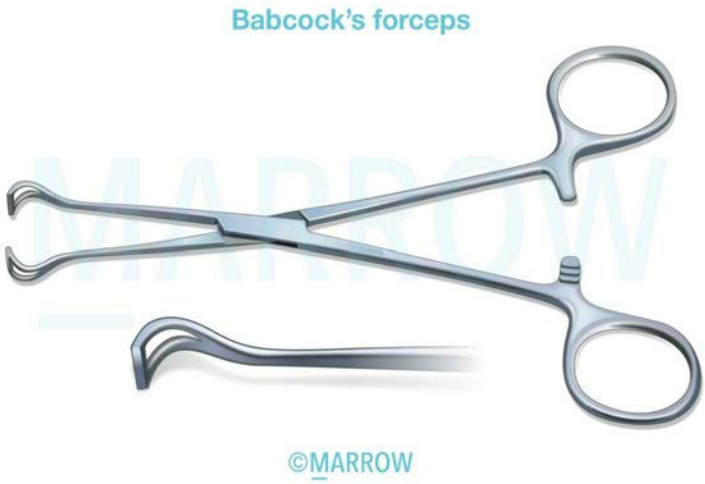
• Tip is non traumatic with transverse serrations on it.

• It has got a lock in proximal part.

Uses:

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• Hold any part of Bowel, Fallopian tube, Appendix, Ureter, Cord, etc.



The below image is that of a Langenbeck Retractor:

• Useful for holding open wounds, as in an open appendicectomy.

• Often used in pairs (one in each of the assistant's hands).

• The width of the lip of the retractors varies.



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The 11-blade is used for skin incisions (eg. incision and drainage) and arteriotomy

The 22-blade is often used for abdominal incisions

15-blade for minor surgical procedures.

Deaver's Retractor is specifically designed for holding the liver up out of the way during a cholecystectomy. It needs to be used carefully to avoid damaging the liver.



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Lane's tissue holding forceps



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Lane's tissue holding forceps

• It has got stout and thick distal blades with oval fenestra in each blade

• Apposing tooth in the tip

• Lock in proximal part

Uses:

• Hold bulky and tough structures, hold lymph nodes.

Tracheal dilator is used to keep tracheostomy open.

Tracheal dilator



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Solution to Question 18:

Wound infection is the most common postoperative complication of appendectomy.

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Solution to Question 19:

The most common neoplasm primarily identified in the appendix are carcinoid tumors.

They account for approximately 66% of all tumors of the appendix. They are detected in 0.3 to 0.9% of appendectomy specimens.

Adenocarcinoma of the appendix is very rare, accounting for 0.5% of all gastrointestinal cancers. The adenocarcinoma malignancies are three subtypes:

• Mucinous

• Colonic type

• Adenocarcinoid

Mucinous is the most common subtype whereas Adenocarcinoid is the rarest.

Solution to Question 20:

The most common location of the carcinoid tumour of the appendix is the tip of the appendix i.e., the distal third of the appendix.

A carcinoid tumour, also known as argentaffinoma, arises in argentaffin tissue (Kulchitsky cells of the crypts of Lieberkühn). It often presents with symptoms of subacute or recurrent appendicitis.

On gross examination, it is a moderately hard, yellow tumour between the intact mucosa and the peritoneum. Microscopically, tumour cells are small, arranged in small nests within the muscle, and have a characteristic pattern using immunohistochemical stain for chromogranin B.

Carcinoid tumours are the most common appendiceal tumours but they rarely metastasize.

Treatment includes appendicectomy. Indications for right hemicolectomy along with appendectomy are :

• Involvement of the cecal wall

• Tumour is 2 cm or more in size

• Lymph nodes are involved.

Solution to Question 21:

The carcinoid tumors of the appendix which are more than 2 cm in size are treated with right hemicolectomy.

Management of carcinoid tumors:

• <1 cm – Appendicectomy

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• 1-2 cms - Appendicectomy or right hemicolectomy depending on the individual tumor characteristics.

• >2 cm – Right hemicolectomy

Irrespective of size, it is recommended to perform a right hemicolectomy in:

• Carcinoids at the appendiceal base (<2 cm from the base)

• Lymphatic invasion or lymph node involvement

• Spread to the mesoappendix

• Tumor-positive resection margins

• Cellular pleomorphism with a high mitotic index.

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Solution to Question 22:

The size of the carcinoid tumour is 0.5 cm (<1 cm), the margins of the resected specimen are tumour free, and there is no involvement of appendix base, mesoappendix, or lymph nodes. The best management approach here is observation.

Carcinoid tumour may be detected in ~0.5% of appendectomy specimens. Appendectomy is adequate in the treatment of cases with a diameter of <1 cm and in those with a diameter of 1-2 cm without lymphovascular invasion.

If a tumour is found after appendicectomy:

• If it is an adenocarcinoma, perform right hemicolectomy.

• If it is a carcinoid tumour, treatment differs according to the tumour size:

• <1 cm – Observation

• 1–2 cm – Right hemicolectomy if a lymphovascular invasion is seen

• >2 cm – Right hemicolectomy

Right hemicolectomy treatment is indicated even in tumours < 2 cm in case of:

• Tumours localized at the base of the appendix

• Invasion of lymphatic ducts, serosa and mesoappendix

• Presence of regional lymph node metastasis

• Positive surgical margins

• Mucin production (mucinous carcinoid tumours)

• High mitotic fast cellular pleomorphism

Solution to Question 23:

Yersinia enterocolitica causes inflammation of the terminal ileum, appendix, and cecum, alongwith mesenteric lymphadenopathy. It is the most common differential diagnosis of acute

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appendicitis.

Acute mesenteric lymphadenitis manifests as acute right lower quadrant abdominal pain associated with mesenteric lymph node enlargement and a normal appendix. Diagnosis is made after exploration of the abdomen of a patient suspected of having acute appendicitis, which reveals a normal appendix and enlarged mesenteric lymph nodes. It usually occurs in children and young adults.

Solution to Question 24:

The given clinical scenario of a patient with mucinous cystadenoma appendix and imaging findings are suggestive of pseudomyxoma peritonei.

Pseudomyxoma peritonei refers to a condition of mucinous ascites arising due to the rupture of a mucinous tumor of appendix or ovary. It most commonly occurs in patients between 40-50 years of age. They are often asymptomatic or present with non-specific complaints like abdominal pain and distension.

Physical examination may reveal ascites with non shifting dullness and rarely, a palpable abdominal mass. CT scan may reveal accumulation of mucinous material and scalloped indentation of the visceral surfaces of the liver and spleen. The peritoneal surfaces may be thickened due to the solid components of the tumor. The histology of the primary appendiceal tumor is an important predictor of survival.

Management consists of extensive resection of the tumor (cytoreduction) and intraperitoneal heated chemotherapy (IPHC). Surgical management may include omentectomy, resection of the peritoneum and involved organs, appendectomy or a right hemicolectomy.

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Polyps and Colorectal Carcinoma

Question 1:

A 50-year-old woman underwent a screening colonoscopy. A single polyp is found, resected, and sent for histopathological examination. Which of the following biopsy findings will have the highest risk of malignancy?

a) Villous adenoma

b) Hyperplastic polyps

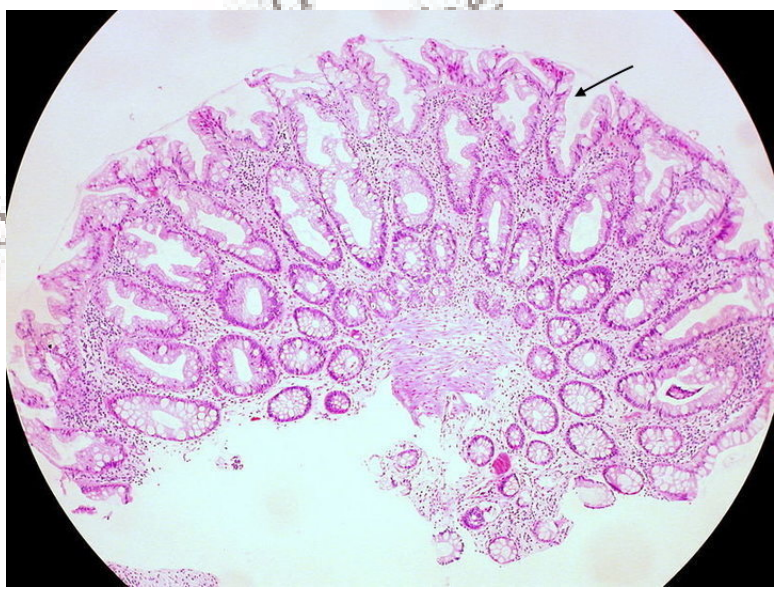
c) Inflammatory polyps

d) Tubular adenoma

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Question 2:

During a colonoscopy on a 58-year-old female patient, a smooth nodular polyp is found and excised. The microscopic image is given. Choose the incorrect statement regarding the polyp.



a) Most common type of polyp

b) More common in recto-sigmoid region

c) Usually seen in the 6th and 7th decade of life

d) Malignant transformation takes place within 5 years

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Question 3:

The biopsy of a polyp reported dysplasia up to the colonic submucosa. Classify this lesion using Haggitt's classification:

a) Level 1

b) Level 2

c) Level 3

d) Level 4

Question 4:

A 35-year-old patient undergoes a screening colonoscopy after his brother was diagnosed with colorectal cancer. Which of the following, if detected, does not indicate a risk of developing colon cancer?

a) Villous adenomas in the ascending colon

b) More than 100 polyps in the transverse and descending colon

c) Inflammatory polyps in the sigmoid colon and rectum

d) Sessile serrated adenomatous polyps in the sigmoid colon

Question 5:

A 12-year-old is brought to the emergency with features of intestinal obstruction. An ultrasound reveals a target sign, suggesting intussusception. On closer examination, her palm and oral mucosa are spotted with multiple 1-2 mm blue-gray macules. What is the most likely diagnosis?

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a) Turcot syndrome

b) Lynch syndrome

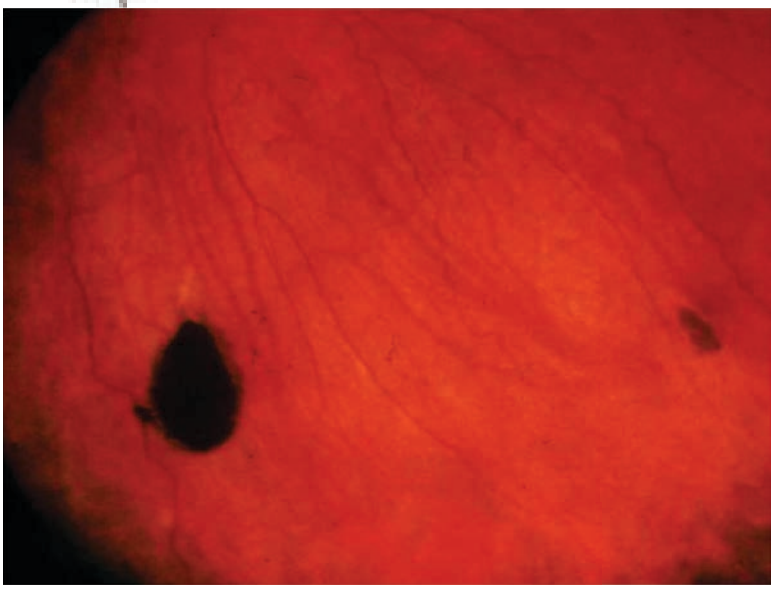
c) Peutz–Jegher's syndrome

d) Cowden syndrome

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Question 6:

Ophthalmoscopy performed on a 14-year-old boy had the given incidental finding. Family history revealed that his grandfather had colon cancer and an aunt was diagnosed with endometrial carcinoma. Genetic testing confirmed APC gene mutation. Which of the following is false about his condition?



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a) Condition can be passed on to his daughter in the future

b) Mutation of APC gene is on chromosome 15

c) 100-10,000s of colonic polyps may develop

d) Prophylactic surgery is indicated

Question 7:

All of the following are gastrointestinal manifestations seen in patients with FAP except:

a) Gastric and duodenal polyps

b) Fundal gland hyperplasia in gastric polyp

c) Ampullary carcinoma

d) Esophageal carcinoma

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Question 8:

Which of the following is not a component of Gardner's syndrome?

a) Desmoid tumors

b) Brain tumors

c) Osteomas

d) Dental abnormalities

Question 9:

Which of the following is the most common presentation of abdominal desmoid tumor?

a) Abdominal pain

b) Abdominal mass

c) Fever

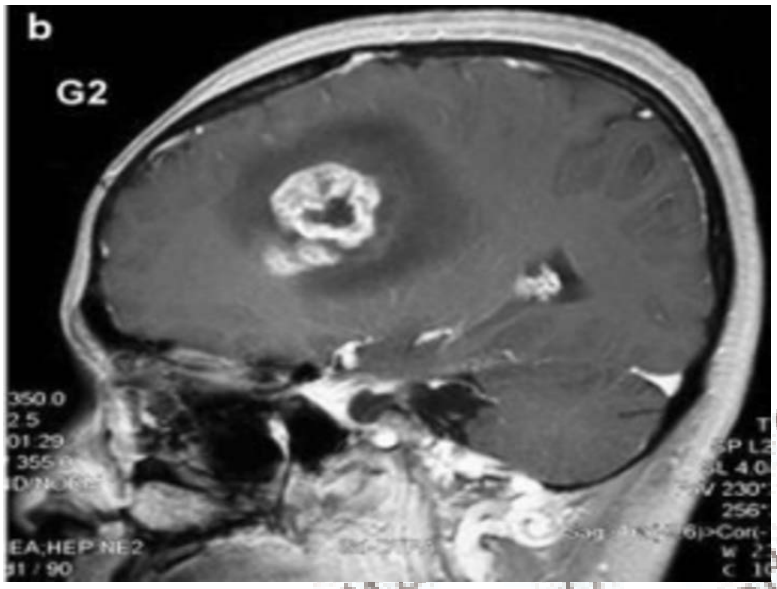
d) Rectal prolapse

Question 10:

A 29-year-old man was brought to the hospital with a history of headache and vomiting for the past 7 days and an episode of a tonic-clonic seizure. The image of the MRI scan is shown below. Colonoscopy revealed numerous polyps in the colon and the rectum which were found

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to be adenomatous on biopsy. What is the most likely diagnosis?



a) Familial adenomatous polyposis

b) Turcot's syndrome

c) Gardner's syndrome

d) Peutz-Jeghers syndrome

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Question 11:

Colonoscopy and biopsy on a 35-year-old man revealed hundreds of adenomatous polyps in the entire descending and sigmoid colon. Options for prophylactic surgery are discussed. Which of the following procedures will reduce the occurrence of malignancy the most?

a) Total colectomy with ileorectal anastomosis

b) Total colectomy with ileal pouch-anal anastomosis

c) Total proctocolectomy with ileal pouch-anal anastomosis

d) Total proctocolectomy with end ileostomy

Question 12:

A 40-year-old man was recently diagnosed and treated for an autosomal dominant disorder. The gross specimen of his resected colon is given in the image. What is the initial step in screening his 9-year-old child?

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a) Genetic testing for APC gene mutation

b) Genetic testing for MSH-6 gene mutation

c) Routine flexible sigmoidoscopy starting from 10 years of age

d) Routine colonoscopy starting from 10 years of age

Question 13:

Which among the following is true about Amsterdam criteria?

a) At least 3 successive generations affected

b) At least 2 or more first-degree relatives affected

c) At least one case diagnosed before 50 years of age

d) All of the above

Question 14:

What is the most common extra-colonic cancer in patients with a mutation in MMR genes?

a) Gastric carcinoma

b) Breast carcinoma

c) Endometrial carcinoma

d) Ovarian carcinoma

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Question 15:

Which among the following is false about colorectal carcinoma in HNPCC?

a) The onset of cancer occurs early

b) The progression of the carcinoma is slow

c) Mucinous adenocarcinoma is the most common type

d) Tumors predominantly develop in right sided colon

Question 16:

A 25-year-old man presented to the dermatologist's office with multiple small bumps on his forehead. Excisional biopsy findings are suggestive of multiple small sebaceous adenomas. Detailed family history reveals that his grandfather and brother have colon cancer while his aunt was diagnosed with rectal cancer. Which syndrome should be suspected?

a) Gardner's syndrome

b) Cowden's syndrome

c) Muir-Torre syndrome

d) Turcot's syndrome

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Question 17:

Which criteria is used to select patients for microsatellite instability (MSI) testing?

a) Amsterdam criteria

b) Revised Amsterdam criteria

c) Bethesda criteria

d) Lynch criteria

Question 18:

In which part of the colon does colorectal carcinoma most commonly develop?

a) Cecum

b) Sigmoid colon

c) Transverse colon

d) Right colon

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Question 19:

Which of the following are risk factors for colon carcinoma?

a) 2,4,5

b) 1,3,5

c) 1,2,3

d) 1,2,3,4

Question 20:

Which of the following dietary recommendation puts patients at risk of developing colon cancer?

a) High-calorie diet

b) Low-animal-fat diet

c) Selenium

d) Vitamin A

Question 21:

Which of the following colonoscopic findings has the highest risk of developing colorectal cancer?

a) A single pedunculated polyp

b) Multiple flat polyps

c) Multiple pedunculated polyps

d) A solitary flat rectal polyp

Question 22:

Mutations in which gene is responsible for malignant changes in late colonic adenomas?

a) APC

b) K-ras

c) p53

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d) DCC

Question 23:

Which of the following is the correctly matched set regarding risk category and colon cancer screening recommendation?

a) 1-C, 2-D, 3-B, 4-A

b) 1-D, 2-A, 3-C, 4-B

c) 1-C, 2-B, 3-A, 4-D

d) 1-B, 2-D, 3-A, 4-C

Question 24:

A 61-year-old man presents with complaints of fatigue and shortness of breath. He has conjunctival pallor and has lost significant weight over 3 months. A CBC reveals low haemoglobin and MCV. A stool occult blood test is positive. What is the next best step in evaluation?

a) Barium enema

b) Colonoscopy

c) MRI

d) CT scan

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Question 25:

A 55-year-old woman presents with abdominal pain and constipation. A barium enema reveals an apple core sign. In which part of the colon is such a growth commonly seen?

a) Left colon

b) Right colon

c) Transverse colon

d) Caecum

Question 26:

What is the most common presenting feature in patients with right sided colon cancer ?

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a) Diarrhoea

b) Anemia

c) Constipation

d) Abdominal pain

Question 27:

Which among the following statements is false about virtual colonoscopy as compared to conventional colonoscopy?

a) Virtual colonoscopy is less sensitive for small polyps

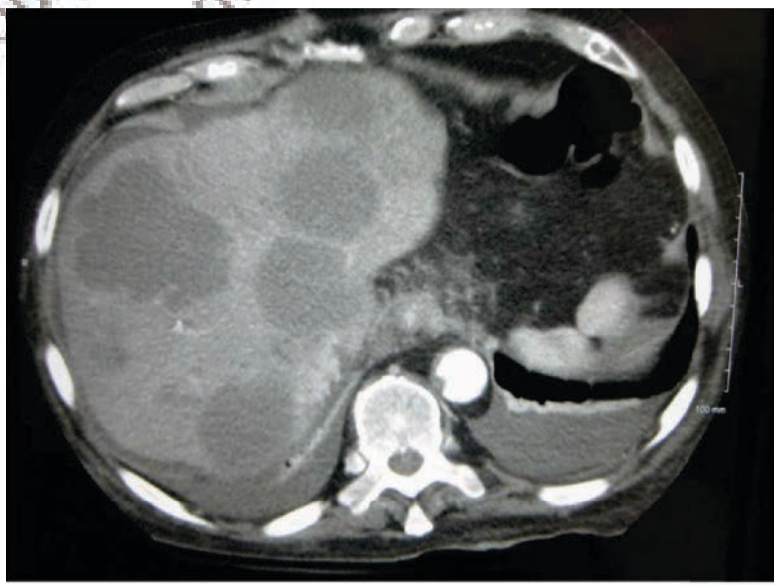
b) Provids a better image than conventional colonoscopy

c) Easier to take tissue biopsy during virtual colonoscopy

d) Less time consuming than conventional colonoscopy

Question 28:

A 50-year-old female presented with low-grade fever, easy fatiguability, and pain in the right hypochondrium. On examination, pallor and moderate hepatomegaly were present. A CT scan revealed non-enhancing masses. The biopsy showed adenocarcinoma, not of hepatic origin. A combination of IHC tests was done and was reported as CK 7 (-), CK20 (+). Which of the following is the most likely primary site of origin?



a) Ovary

b) Colon

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c) Pancreas

d) Lung

Question 29:

What is the most important prognostic factor in patients with colorectal carcinoma?

a) Site of lesion

b) Size of lesion

c) Stage of lesion

d) Age of patient

Question 30:

Choose the parameters used to stage colorectal carcinoma according to Duke's classification ?

a) 1, 3, 5

b) 3, 4

c) 1, 4

d) 1, 2, 3,4

Question 31:

The biopsy of a hemicolectomy specimen revealed an adenocarcinoma with colonic subserosa invasion. Deposits were found on the mesentery but lymph nodes were not involved. Further investigation on the patient did not indicate local or distant metastases. What is the stage of the tumor ?

a) T4b N0 M1c

b) T4a N2b M0

c) T3 N1c M0

d) T3 N0 M1

Question 32:

Match the following patients with colon cancer to the procedure that is best suited.

a) 1-A, 2-B, 3-C

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b) 1-C, 2-A, 3-B

c) 1-B, 2-A, 3-C

d) 1-B, 2-C, 3-A

Question 33:

A 60-year-old man was rushed to the ER with abdominal pain, obstipation, and altered mental status for the last 2 days. Physical examination and imaging findings are suggestive of perforated intestinal obstruction with peritonitis. After stabilization, he is immediately taken to the operating room, where a suspicious ascending colon mass is seen. Which of the following is the most appropriate management for this patient?

a) Right hemicolectomy with ileocolostomy

b) Resection and anastomosis

c) Hartmann's procedure

d) Endoluminal stent placement

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Question 34:

A 45-year-old man is diagnosed with stage II colorectal carcinoma located in the transverse colon. Which of the following is the surgical procedure of choice for this patient?

a) Right hemicolectomy

b) Transverse colectomy

c) Extended right hemicolectomy

d) Left hemicolectomy

Question 35:

A male patient presented with dull abdominal pain and rectal bleeding. On investigations, he was diagnosed with colon carcinoma. Which of the following statements is false regarding the management of colorectal carcinoma?

a) Stage III cancer is treated with surgical resection and chemotherapy

b) Stage II cancer with young age is an indication for chemotherapy

c) FOLFOX regimen is used for colorectal carcinoma

d) Immunotherapy is ineffective in metastatic colorectal carcinoma

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Question 36:

Which of the following is a false statement regarding different types of artificial stoma?

a) Output from an ileostomy is liquid in nature

b) In Hartmann procedure, a loop colostomy is formed

c) Skin excoriation is the most common complication of ileostomy

d) Parastomal herniation is more common in Loop colostomy

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Answer Key

Question No.	Correct Option
1	a
2	d
3	d
4	c
5	c
6	b
7	d
8	b
9	b
10	b
11	c
12	a
13	c
14	c
15	b
16	c
17	c
18	b
19	d
20	a
21	b
22	c
23	a
24	b

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25	a
26	b
27	c
28	b
29	c
30	c
31	c
32	d
33	a
34	c
35	d
36	b

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Detailed Explanations

Solution to Question 1:

Villous adenoma has the highest risk of malignancy.

Adenomatous polyps can be tubular, tubulovillous, and villous adenomas. Among these, tubular adenoma has the least risk and villous adenoma has the highest risk of malignancy.

Solution to Question 2:

Hyperplastic polyps, as seen in the histological picture, do not have malignant potential.

Elongated crypts, i.e., serrated (saw-toothed) or star-shaped appearance, is a characteristic feature of a hyperplastic polyp.

They are the most common type of colorectal polyps and are usually seen in the 6th and 7th decade of life. More than 90% occur in rectosigmoid region.

Solution to Question 3:

According to Haggitt's classification, a polyp invading the submucosa comes under level 4.

Solution to Question 4:

Inflammatory polyps are not premalignant.

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Inflammatory polyps (pseudopolyps) are found in cases of:

• Inflammatory bowel disease (most common)

• Amebic colitis

• Ischemic colitis

• Schistosomal colitis

Microscopic examination shows islands of normal, regenerating mucosa (the polyp) surrounded by areas of mucosal loss.



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Solution to Question 5:

The patient most likely has Peutz–Jeghers syndrome.

It is characterized by hamartomatous polyps of the intestinal tract (more commonly small intestine) and hyperpigmentation of the buccal mucosa, lips, and digits. In the given clinical scenario, the patient has had an intestinal intussusception. The numerous polyps in Peutz-Jeghers syndrome often serve as a lead point.

Option A: Turcot syndrome constitutes colorectal polyps and brain tumors (including cerebellar medulloblastoma and glioblastomas)

Option B: Lynch syndrome is also called hereditary nonpolyposis colon cancer (HNPCC). It is due to defective mismatch repair (MMR) of DNA.

Option D: Cowden syndrome is characterized by polyps of the stomach or colon, macrocephaly and benign tumors of thyroid, breast, and uterus.

Solution to Question 6:

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The given image showing a pigmented retina, the patient's family history and APC gene mutation is suggestive of familial adenomatous polyposis. Familial adenomatous polyposis is due to the mutation of APC gene located on the long arm of chromosome 5 (5q21), not 15.

Familial adenomatous polyposis (FAP) is autosomal dominant. It is characterized by the presence of >100 adenomatous polyps in colon and rectum. It usually manifests by the late 2nd or early 3rd decade. Although it accounts for 1% of all colorectal carcinoma, the risk of development of cancer is 100%.

CHRPE (Congenital hypertrophy of retinal pigment epthelium) is the earliest extra-colonic manifestation of FAP, present in up to 75% of patients.

Solution to Question 7:

Esophageal carcinoma is not associated with FAP

Familial adenomatous polyposis (FAP) is associated with gastric and duodenal polyps in approximately 50% of the affected individuals.

Most of the gastric polyps represent fundic gland hyperplasia and have limited malignant potential. Duodenal polyps are adenomatous in nature and premalignant.

Patients with FAP have an increased risk for duodenal ampullary cancer.

Solution to Question 8:

Gardner's syndrome does not include brain tumors.

Components of Gardner's syndrome:

• Osteomas: most common manifestation, most commonly in the mandible

• Polyposis colon

• Dental anomalies (supernumerary tooth, absent tooth, impacted tooth)

• Epidermal inclusion cysts

• Desmoid tumors

Note:

Turcot's syndrome includes brain tumor and colorectal polyps.

Solution to Question 9:

Explanation:

The most common presentation of an abdominal desmoid tumor is an abdominal mass.

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Desmoid tumors, also known as fibromatosis, aggressive fibromatosis or desmoid-type fibromatosis are locally aggressive tumors that lack metastatic potential. Desmoid tumors can be sporadic in origin or associated with familial adenomatous polyposis.

These tumors arise from fibro-aponeurotic tissue and typically are manifested as a slowly growing mass. They present as firm, non-painful, non-tender masses in the abdominal wall, shoulder, hip and limbs, mesentery, and pelvis. They are also associated with trauma, pregnancy, and oral contraceptive usage.

The investigation of choice for a desmoid tumor is MRI. It is superior to CT in defining the pattern and the extent of involvement and can determine recurrence after surgery. Diagnosis is established by a biopsy with immunohistochemistry, which stains positive for beta-catenin, actin and vimentin, and negative for desmin, cytokeratin and S-100.

Treatment:

• An initial observation is preferred for stable, asymptomatic, primary or recurrent desmoids, especially if surgery can cause high mortality.

• Surgical resection with negative margin clearance is reserved for patients with small abdominal wall tumors associated with pain or an increase in size.

• Tamoxifen and NSAIDs are used as first-line medical therapy. Other systemic treatment options are low-dose chemotherapy, tyrosinase kinase inhibitors, and full-dose chemotherapy

• Radiotherapy is preferred for candidates unfit for surgery, patients refusing surgery and when surgical resection is associated with high morbidity.

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Solution to Question 10:

In the given clinical scenario, the patient has numerous adenomatous polyps and a tumor in the brain. Therefore the most likely diagnosis is Turcot's syndrome. It is a variant of familial adenomatous polyposis.

Familial adenomatous polyposis (FAP) is an autosomal dominant condition and is caused due to the mutation in the APC gene located on chromosome 5.

Clinically, patients develop hundreds to thousands of adenomatous polyps in the colon and rectum. Some patients may also develop duodenal adenomas. The lifetime risk of developing colorectal carcinoma in these patients is 100%.

The treatment of the FAP includes total proctocolectomy with ileal pouch-anal anastomosis (IPAA).

Variants of FAP are:

• Gardner's syndrome- It is an autosomal dominant variant of FAP. In addition to colonic polyps the patients will have

• Osteomas of the mandible or skull

• Epidermal cysts

• Soft tissue tumors like desmoid tumor

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• Turcot's syndrome- In addition to the colonic polyps the patients will have central nervous system tumors (primary brain tumors).

Option D: Peutz-Jegher's syndrome is not related to familial adenomatous polyposis. It is an autosomal dominant disease characterized by

• Pigmentation of the mouth and lips

• Multiple hamartomatous polyps in the small and large intestine.

Solution to Question 11:

The clinical scenario is diagnostic of familial adenomatous polyposis syndrome. To prevent an occurrence of cancer, total proctocolectomy with ileal pouch-anal anastomosis is the management of choice. This procedure is usually accompanied by resection of the rectal mucosa.

Following surgery, the patient has to be routinely followed up for ileoanal-pouch surveillance. Upper GI endoscopy should also be performed to evaluate for the presence of duodenal adenomas.

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Solution to Question 12:

More than 100 colonic polyps are diagnostic of familial adenomatous polyposis syndrome and the initial step in screening the child syndrome is to perform genetic testing for APC gene mutation.

If screening is positive, flexible sigmoidoscopy or colonoscopy is done annually starting from 10 years of age.

If the APC testing is negative, then the risk of developing colorectal carcinoma in the relative is similar to the general population. The screening can be started from 50 years of age.

Solution to Question 13:

According to the Amsterdam criteria for hereditary nonpolyposis colorectal cancer (HNPCC), at least one case should be diagnosed before 50 years of age.

Option A: According to the Amsterdam criteria for a presumptive diagnosis of HNPCC, at least 2 (not 3) successive generations should be affected.

Option B: According to the Amsterdam criteria for a presumptive diagnosis of HNPCC, at least 3 relatives (not 2) with at least one being first-degree relatives should be affected.

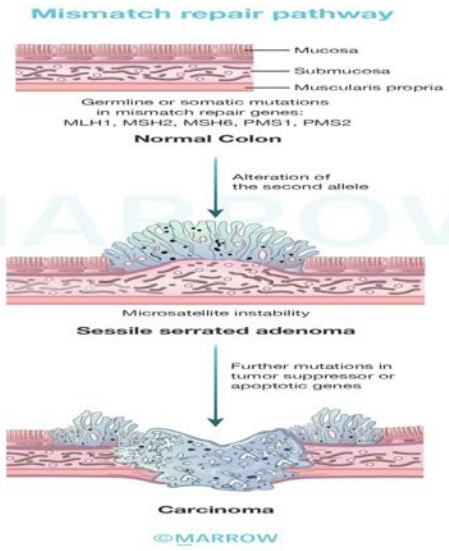
Solution to Question 14:

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Endometrial carcinoma is the most common extracolonic carcinoma in patients with mutated MMR genes.

Autosomal dominant mutation in DNA mismatch repair (MMR) genes, such as hMLH1, hMSH2, hMSH6, PMS1, and PMS2 lead to various cancers. This condition is known as Lynch Syndrome/HNPCC.

Gastric and ovarian carcinoma are also commonly found.



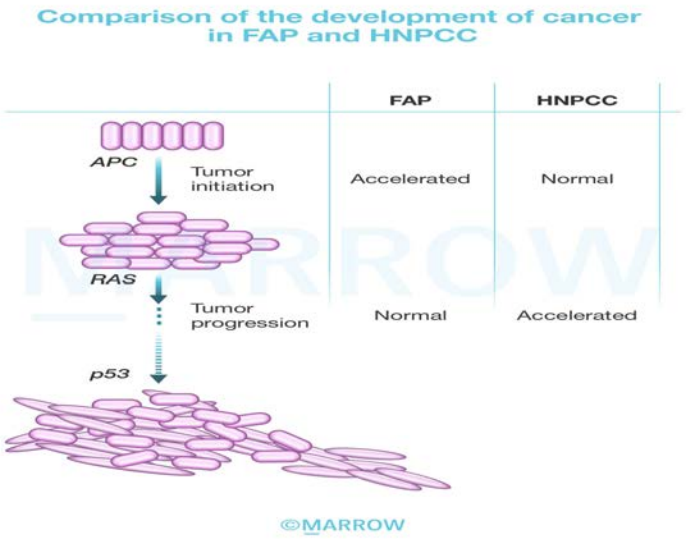
Solution to Question 15:

In hereditary nonpolyposis colorectal cancer (HNPCC), there is accelerated tumor progression and normal tumor initiation.

Accelerated tumor initiation is seen in familial adenomatous polyposis (FAP).

In Hereditary Non-polyposis Colorectal Cancer (HNPCC), the onset of cancer is at a relatively young age (mean, 44 years). Proximal distribution is more common and nearly 70% of cancers are located in the right colon. Mucinous or poorly differentiated (signet cell) adenocarcinoma predominate. There is an increased number of synchronous and metachronous cancers.
The outcome after surgery is relatively good.

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Solution to Question 16:

Multiple cutaneous sebaceous adenomas and a family history of various cancers are seen in Muir–Torre syndrome.

Muir–Torre variant of hereditary nonpolyposis colorectal cancer (HNPCC) may have:

- Sebaceous adenomas
- Keratoacanthomas
- Sebaceous epitheliomas
- Basal cell epitheliomas

Solution to Question 17:

Bethesda criteria is used to select patients for microsatellite instability testing.

Microsatellites are regions of repeated DNA that change in length (show instability) when mismatch repair is not functioning. Defects in mismatch repair genes (as in Lynch syndrome/HNPCC) leads to microsatellite instability.

Amsterdam criteria is used for a presumptive diagnosis of HNPCC in a family. Because the Amsterdam criteria do not include some patients with known germline MMR gene mutations, another set of guidelines, known as the Bethesda guidelines, was established to help decide whether or not a patient should undergo further molecular testing to rule out HNPCC.

Solution to Question 18:

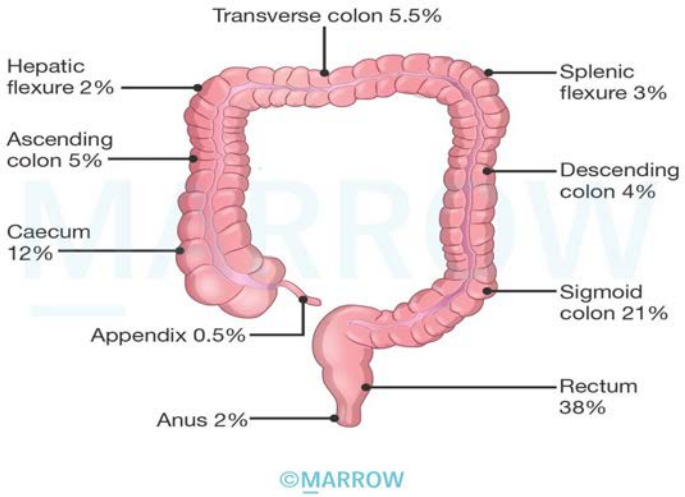
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In the colon, colorectal carcinoma most commonly develops in the sigmoid colon.

Overall, the most common site of colorectal carcinoma is the rectum.

The sites of development of colorectal carcinoma in order of frequency are:

- Rectum
- Sigmoid colon
- Caecum
- Transverse colon
- Ascending colon
- Descending colon
- Splenic flexure
- Hepatic flexure



Solution to Question 19:

Ulcerative colitis, familial adenomatous polyposis (FAP), cholecystectomy, ureterosigmoidostomy, and smoking are risk factors for colon cancer.

Solution to Question 20:

High-calorie, low-fiber, and high-animal-fat diet as well as alcohol consumption increase the risk of colon cancer.

Calcium, selenium, vitamins A, C, and E, carotenoids, and plant phenols are protective.

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Solution to Question 21:

Sessile/flat polyps are at a higher risk of malignancy compared to pedunculated polyps. Multiple polyps increase the risk of malignancy.

The probability of development of malignancy of a polyp depends on the following:

• Gross appearance of lesion: Sessile polyps are at higher risk for malignancy than pedunculated tumors.

• Histology: Villous > Tubulovillous > tubular

• Size: Polyps of size >2 cm are at higher risk.

Solution to Question 22:

p53 mutation is responsible for the transformation of late adenoma to carcinoma.

The earliest mutations in the adenoma-carcinoma sequence occur in the APC gene and the earliest phenotypic change is known as aberrant crypt formation.

The most consistent genetic aberrations within these cells abnormally result in the formation of short proteins known as APC truncations. They occur in the mutational cluster region of the gene, an area responsible for β-catenin binding.

Solution to Question 23:

Option A states the correctly matched pairs regarding risk category and colon cancer screening recommendation.

Current recommendation on colon cancer screening		
Risk category	Recommendation	
Patients at average risk	General population	Colonoscopyevery 10 yearsbe tween50 -75 years
Patients at higher risk	Diagnosis of colon cancer or adenomatous polyps inAny fi rst-degree relative at age <60 years° 2 first-degree relatives at age ° 60 years	Colonoscopy every 3-5 years starting atwhichever comes fi rstage 40 orat least 10 years before the relative's age of di agnosis
Inflammatory bowel disease (Crohn's disease or ulcerative colitis)	Colonoscopy every 1-2 years s tarting 8 years after diagnosi s	
Familial adenomatous polypo sis	Colonoscopyevery yearstartin g at the age of10-12 years	
Lynch syndrome (HNPCC)	Colonoscopy every 1-2 years s tarting at 20-25 years	

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Solution to Question 24:

The clinical scenario of an elderly patient with sudden onset anemia always warrants screening for colorectal cancer, as cancers in the right colon often manifest as melena and fatigue associated with anemia. Thus, the next best investigation is a colonoscopy.

Colonoscopy is the investigation of choice & gold standard for establishing the diagnosis of colon cancer.

It permits biopsy of the tumor to verify the diagnosis while allowing inspection of the entire colon to exclude metachronous polyps or cancers.

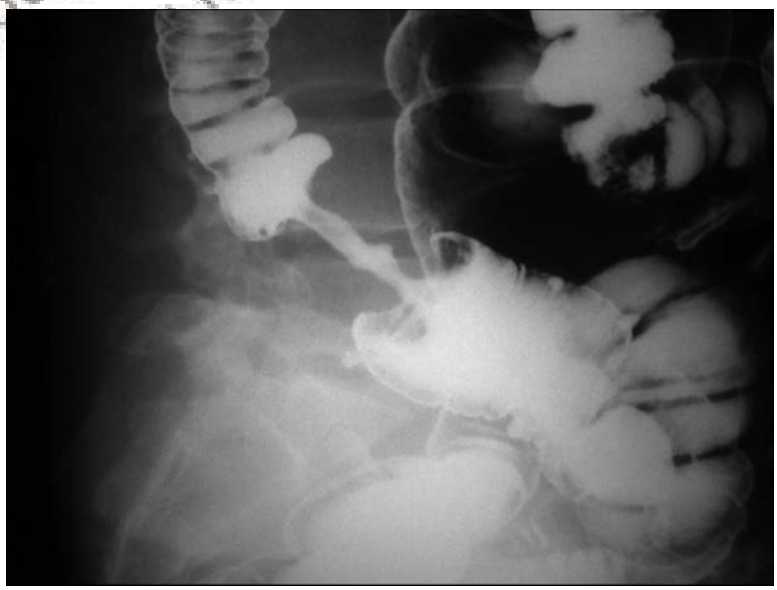
Colonoscopy is generally performed even after cancer is detected by barium enema, in order to obtain a biopsy specimen and to detect (and remove) small polyps that may have been missed in the contrast study.

Solution to Question 25:

Apple core sign on barium enema is suggestive of a constricting type of colon cancer that is more common on the left side. Ulcerative type is more common on the right side.

Most patients with left-sided colon cancers often present with increasing constipation while patients with right-sided colon cancer often present with melena and fatigue associated with anemia.

The apple core sign describes a short segment irregular circumferential stricture of the large bowel that has abrupt shouldered margins resembling an apple core.



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Solution to Question 26:

Anemia is the most common presenting feature in patients with right-sided colon cancer.

Cancers in the right colon are more often manifested as melena, fatigue associated with anemia, or abdominal pain (if the tumor is advanced).

Cancer of the left colon mainly presents with altered bowel habits, usually constipation and intestinal obstruction.

Solution to Question 27:

Virtual colonoscopy is a non-invasive technique and is not useful in taking biopsy.

Solution to Question 28:

Colorectal carcinoma is the most likely primary tumor for the given metastases. Among the given options, cytokeratin 7 is negative only in colon carcinoma.

The most common site of distant metastasis from colorectal cancer is the liver. These metastases arise from hematogenous spread via the portal venous system.The lung is the next most common site for metastasis.

Cytokeratin profiles of various primary tumors:

CK 7 positiveCK20 positive	CholangiocarcinomaOvarian mucinous carcinoma
CK 7positiveCK 20 negative	Breast carcinomaOvarian serous adenocarcinomaThyroid carcinomaPancreatic adenocarcinomaLung carcinoma
CK 7negativeCK 20positive	Colorectal adenocarcinomaMerkel cell carcinoma
CK 7 negativeCK 20 negative	Hepatocellular carcinomaRenal cell carcinomaProstatic adenocarcinomaSquamous cell carcinoma

Solution to Question 29:

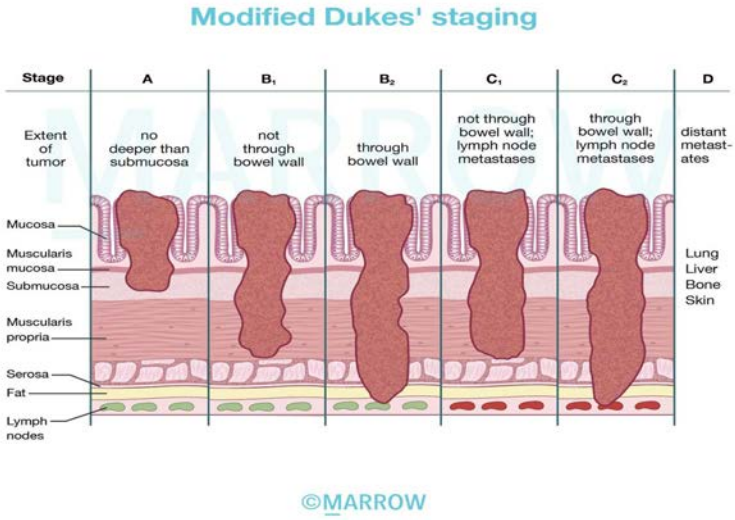
The most important determinant of prognosis for colorectal carcinoma is the tumour stage and, in particular, lymph node status. The T-stage (depth of invasion) is the single most significant predictor of lymph node spread.

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Solution to Question 30:

Duke's classification is based on the depth of tumor and lymph node status.



Solution to Question 31:

According to 8th American Joint Committee on Cancer (AJCC) classification of colorectal cancers, tumor deposits in the subserosa or mesentery are staged as N1c and tumor invading the subserosa without involvement of peritonealized organs is T3.

TNM staging	7th AJCC (2010)	8th AJCC (2018)
Primary tumor(pT)		
TX	Cannot be assessed	-do-
T0	No evidence of cancer	-do-
Tis	Carcinoma in situ	Carcinoma in situ,intramucosal carcinoma(involvement of lamina propria with no extension through muscularis mucosae)
T1	invades submucosa	-do-
T2	invades muscularis propria	-do-
T3	invades muscularis propria into subserosa or into nonperitonealized pericolic or perirectal tissues	-do-

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TNM staging	7th AJCC (2010)	8th AJCC (2018)
T4	invades other organs or tissues or perforates the visceral peritoneum of specimen	T4a:invades through visceral peritoneum (including gross perforation of the bowel and invasion of tumor through areas of inflammation to the surface of the visceral peritoneum)T4b:invades or adheres to other adjacent organs or structures
Regional lymph nodes (pN)		
NX	Regional lymph nodes cannot be assessed	-do-
N0	No lymph node metastasis	-do-
N1	1-3 pericolic or perirectal lymph nodes	N1a:1 regional lymph nodeN1b:2 - 3 regional lymph nodes N1c:no regional lymph nodes are positive but there aretumor depositsin the subserosa, mesentery or nonperitonealized pericolic or perirectal / mesorectal tissues
N2	Metastasis to > 4 pericolic or perirectal lymph nodes	N2a:4 - 6 regional lymph nodesN2b:>7 regional lymph nodes
Distant metastasis (pM)		
M0	No Distant metastasis	-do-
M1	Distant metastasis present	M1a: confined to 1 organ or site without peritoneal metastasisM1b:metastasis to>2 sites or organs is identified without peritoneal metastasisM1c:metastasis to the peritoneal surface is identified alone or with other site or organ metastases

Solution to Question 32:

All of the given procedures may be performed in a patient with colonic cancer presenting with features of left colonic obstruction. The most appropriate answer is 1-B,2-C,3-A.

In Hartmann's procedure, the segment of the colon containing the obstructing cancer is resected and closure of the distal sigmoid or rectum is performed. A colostomy is made. Later, intestinal continuity is re-established by the closure of the colostomy and fashioning a colorectal anastomosis.

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This procedure is preferred in patients when a resection and primary anastomosis cannot be performed immediately due to complications such as inflammation of the bowel, perforation, or peritonitis.

Resection and primary anastomosis is done in patients who are hemodynamically stable and have pliable, nonedematous, well-vascularized bowel.

In this procedure, the segment of the left colon containing the cancer is resected. The remaining colon is cleaned with saline lavage by inserting a catheter through the appendix or ileum into the cecum and irrigating the contents from the colon. Primary anastomosis between the prepared colon and rectum is fashioned subsequently, without the need for a temporary colostomy

Stent placement via colonoscope is a temporary measure to obtain time for bowel preparation for primary anastomosis. A stent that traverses the tumor is placed to relieve the obstruction. It is done in partial obstruction and is preferred in old and frail patients.

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Solution to Question 33:

The elderly man with ascending colon mass leading to perforated intestinal obstruction with peritonitis should ideally be treated with right hemicolectomy and ileocolostomy.

In case of suspected colorectal cancer presenting with intestinal obstruction the following surgeries are done:

• Right-sided lesion:

• A resection (right hemicolectomy) and anastomosis if the patient is stable

• Perforation with substantial contamination or if the patient is unstable: right hemicolectomy + ileocolostomy

• Left-sided lesion:

• Resection and anastomosis if the patient is stable

• Perforation with substantial contamination or if the patient is unstable: Hartmann procedure is done. Later, intestinal continuity is re-established by the closure of the colostomy and fashioning a colorectal anastomosis.

• Where endoscopic and radiological facilities are present an obstructing left-sided lesion can be treated with an expanding metal stent provided bowel perforation is absent.

Solution to Question 34:

Extended right hemicolectomy is the most appropriate surgical procedure for a neoplastic tumor in the transverse colon. This procedure involves resection of the

• Terminal ileum with Ileocecal junction

• Cecum

• Ascending colon

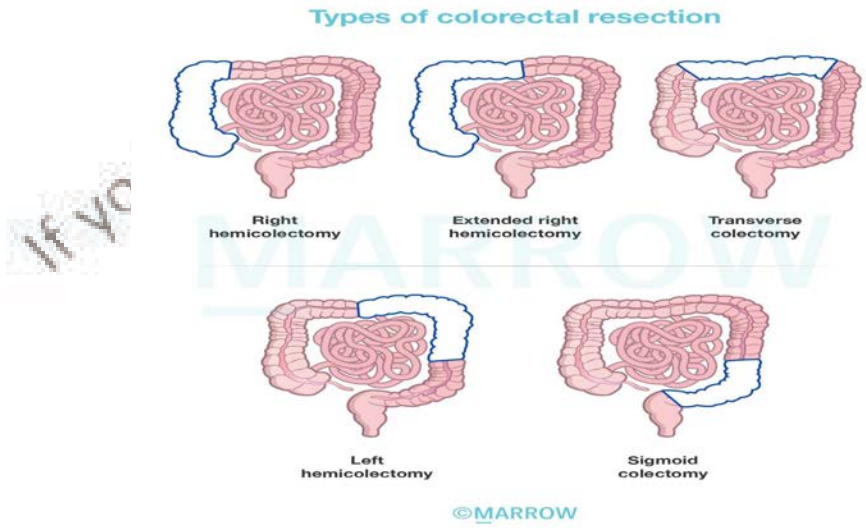
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• Hepatic flexure, and

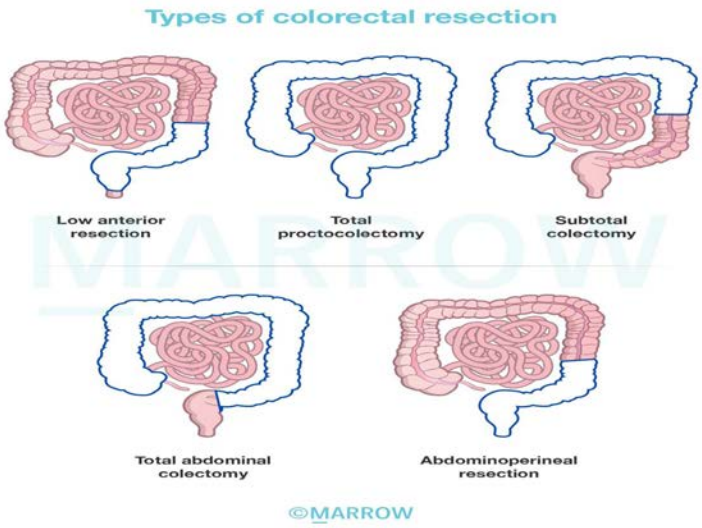
• Distal transverse colon

Very small and localized lesions in the transverse colon may be resected by transverse colectomy. However, this procedure is very uncommon.

Tumor location	Procedure of choice	Resected bowel segments
Cecum / Ascending colon / H epatic flexure	Right hemicolectomy	Terminal ileum with Ileoceca l junctionCecumAscending co lonHepatic flexure
Transverse colon / Hepatic fl exure	Extended right hemicolectom y	Terminal ileum with Ileoceca l junctionCecumAscending co lonHepatic flexureDistal tran sverse colonSplenic flexure m ay be resected based on the t umor location
Descending colon ± sigmoid colon	Left hemicolectomy	Transverse colon(left MCA te rritory)Splenic flexureDescen ding colon upto sigmoid colo n
Sigmoid colon	Sigmoid colectomy, or LAR (Low anterior resection)	Entire sigmoid colon and rect um is removedColoanal anast omosis is performed



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Solution to Question 35:

Immunotherapy is not ineffective in metastatic colorectal cancer. Metastatic or recurrent colorectal cancers are the indications for immunotherapy.

Monoclonal antibodies such as

• Bevacizumab (Anti-VEGF),

• Cetuximab (anti-EGFR),

• Panitumumab (anti-EGFR),

• Pembrolizumab (anti-PDL1),

• Nivolumab (anti-PDL), etc. are the commonly used immunotherapeutic drugs in colorectal carcinoma.

Option A: Surgical resection is indicated in all the stages of colon carcinoma. Management of Stage III colorectal carcinoma should also include chemotherapy, in addition to surgical resection. The stage-specific therapies are as follows:

Option B: Stage II cancer in young patients should be considered for chemotherapy. Treatment of stage II colon carcinoma is surgical resection of the cancerous mass. Adjuvant chemotherapy is indicated in patients with at least one poor prognostic indicator like:

• Young patients

• Inadequate lymph node excision(<12 lymph nodes)

• Poorly differentiated histology

• Positive margin of resection

• T4 lesions

• Bowel obstruction or perforation

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• Presence of perineural or lymphovascular invasion

Option C: FOLFOX is a chemotherapy regimen used for the treatment of colorectal cancer, made up of the drugs folinic acid, 5-fluorouracil, and oxaliplatin.

Stage	Management
Stage I:	Surgical resection
Stage II:	Surgical resectionAdjuvant chemotherapyinhigh-riskpatients (presence ofpoor prognostic factors)
Stage III:	Surgical resectionAdjuvant chemotherapy(folinic acid, 5-fluorouracil, oxaliplatin)
Stage IV:	Surgical resection with adjuvant chemotherapyRadiotherapyImmunotherapy (monoclonal antibodies)Palliative treatment in extensive metastasis.

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Solution to Question 36:

Colostomy formed during the Hartmann procedure is not a loop colostomy. It is an example of end-colostomy.

Artificial stomas are surgically created openings on the abdominal wall following certain types of surgeries, to serve as an alternate path for internal organs to drain externally. Ileostomy and colostomy are the two most common types of artificial stomas for the GI system.

Based on the structural pattern, stomas can be classified into different types:

• End stoma

• Loop stoma

• Double barrel stoma

End stoma is preferred as a permanent stoma. Loop and double barrel stomas are used as temporary stomas.

Complications of stoma include

• Skin excoriation (most common)

• Stoma infection

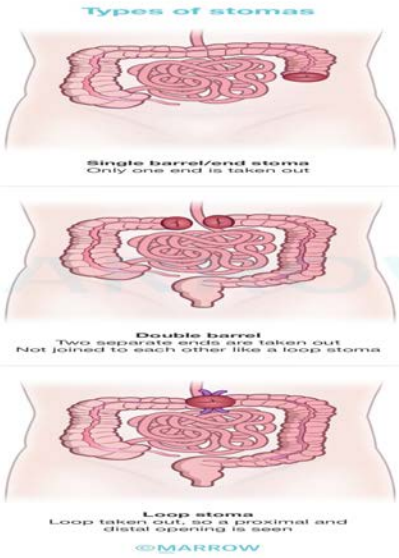
• Diarrhea

• Stoma leakage

• Parastomal herniation

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Ileostomy	Colostomy
Any portion of the entire ileum can be chosen for stoma creation	Only mobile parts of the colon (transverse colonandsigmoid colon) can be used
Gross appearance -marginof the stoma iselevated(pouting) from the skin	Gross appearance - at the same level as that of skin
The output isliquidin nature and therefore higher in volume	The output issemi-solid or solidin nature
Higher chance of skin excoriation and electrolyte imbalance	Easier to handle



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Rectum

Question 1:

The anorectal angle is formed by which muscle?

a) Puborectalis

b) Ischiocavernous

c) Deep transverse perinei

d) Bulbospongiosus

Question 2:

What is the length of the adult rectum?

a) 20-25 cm

b) 12-18 cm

c) 8-10 cm

d) 3-5 cm

Question 3:

Which fascial layer should be dissected to separate the rectum from the coccyx while operating on a patient with rectal adenocarcinoma?

a) Waldeyer's fascia

b) Denonvilliers' fascia

c) Buck's fascia

d) Scarpa's fascia

Question 4:

Up to what length of the patient's rectum will you be able to visualize while using a proctoscope?

a) 5 cm

b) 8 cm

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c) 10 cm

d) 20 cm

Question 5:

The instrument shown below will be least useful for examining patients with which of the following conditions?



a) Acute anal fissure

b) Carcinoma rectum

c) Hemorrhoids

d) Rectal polyp

Question 6:

An anxious mother rushed her 2-year-old child to the casualty when she noticed a red-coloured mass protruding from his anus. The mother gave a history of the child straining while passing stools for the past 2 weeks. There was no abdominal tenderness, and on local examination, a 6 cm mass with circumferential folds and slight edema was noted. How will you manage this child?

a) Thiersch operation

b) Delorme's operation

c) Altemeier's procedure

d) Conservative treatment

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Question 7:

Which of the following statements is not true regarding the management of patients with rectal prolapse?

a) Surgery is necessary for full-thickness rectal prolapse

b) Delorme's operation is done via the perineal approach

c) Ripstein's procedure is done via abdominal approach

d) Abdominal rectopexy is often preferred in high risk individuals

Question 8:

Which of the following is not true regarding solitary rectal ulcers?

a) Commonly seen on the posterior wall

b) Rectal bleeding Is a common presentation

c) Management is by STARR procedure

d) Colonoscopy with biopsy is the investigation of choice

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Question 9:

What is the radiological procedure of choice in patients suspected to have a solitary rectal ulcer?

a) MRI

b) Defecography

c) Endorectal USG

d) CT scan

Question 10:

What is the earliest manifestation in patients with rectal carcinoma?

a) Constipation

b) Per rectal bleeding

c) Tenesmus

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d) Spurious diarrhea

Question 11:

Which of the following staging systems is used for rectal carcinoma?

a) Duke's staging

b) Bloom-Richardson grading

c) Nevine staging

d) Robson staging

Question 12:

An elderly man with per-rectal bleeding is suspected to have rectal carcinoma. Which of the following is false regarding this condition?

a) Majority of the cancers are sporadic

b) Dose of radiation used for this tumor is 45 Gy

c) Dissection lateral to the endopelvic fascia investing the mesorectum causes local recurrence

d) Precise location of the tumor is determined with rigid proctosigmoidoscopy

Question 13:

Which of the following statements is false regarding rectal carcinoma?

a) Hartmann's operation is done in elderly debilitated patients

b) Adenocarcinoma is a rare variant of rectal carcinoma

c) Early morning spurious diarrhoea and tenesmus can occur

d) Growth confined to the rectal mucosa is stage A of modified Duke's staging

Question 14:

In patients with rectal carcinoma, what is the investigation of choice for assessment of perirectal nodes and the depth of penetration?

a) Ultrasonography

b) CT scan pelvis

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c) Endorectal MRI

d) Double-contrast barium enema

Question 15:

Which of the following is the most common site of blood-borne metastasis in patients with rectal carcinoma?

a) Liver

b) Lung

c) Adrenal

d) Brain

Question 16:

In a patient with rectal carcinoma, the tumour was found to invade through the muscularis propria into the perirectal tissues. Two lymph nodes near the tumour site were enlarged. Which of the following will be the appropriate modality of treatment in this patient?

a) Surgery

b) Surgery + adjuvant chemotherapy

c) Preoperative chemoradiation + radical resection

d) Palliative chemoradiation

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Question 17:

A patient with rectal carcinoma is posted under your unit for surgery. Which of the following correctly describes the margins of clearance that will be required in this surgery?

a) Proximal: 2cm, distal: 5cm, radial: 2cm

b) Proximal: 5 cm, distal: 2cm, radial: 5cm

c) Proximal: 2cm, distal: 10cm, radial: 5cm

d) Proximal:5cm, distal: 5cm, radial: 2cm

Question 18:

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A 55-year-old man presents to the clinic with a history of intermittent blood in stools for the past 3 months. After a detailed workup, he is diagnosed with rectal adenocarcinoma which is located 8 cm from the anal verge. There is no nodal or distant metastasis. Which of the following surgeries would you prefer in managing this patient?

a) Abdominoperineal resection

b) Hartmann's operation

c) Low anterior resection

d) Endoluminal stent

Question 19:

Transanal local excision can be done in rectal carcinoma patients with all of the following tumour features except ____.

a) Tumor within 8 cm of the anal verge

b) Tumor < 3 cm in size

c) Tumor involving less than 30% circumference

d) T2 tumor without lymph node involvement

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Question 20:

Which of the following chemotherapy regimens is used for treating patients with rectal carcinoma?

a) FOLFOX regimen

b) ABVD regimen

c) RCHOP regimen

d) MVAC regimen

Question 21:

An 80-year-old man with rectal carcinoma presented with features of intestinal obstruction. How will you manage this patient?

a) Hartmann’s operation

b) Anterior resection

c) Abdominoperineal resection

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d) Total mesorectal excision

Answer Key

Question No.	Correct Option
1	a
2	b
3	a
4	c
5	a
6	d
7	d
8	a
9	b
10	b
11	a
12	c
13	b
14	c
15	a
16	c
17	b
18	c
19	d
20	a
21	a

Detailed Explanations

Solution to Question 1:

The puborectalis muscle encircles the posterior and lateral aspects of the anorectal junction, creating the anorectal angle.

At rest, the anorectal angle is held at 90 - 100°. This becomes more acute (70 - 90°) during squeezing due to the contraction and shortening of the puborectalis muscle. This brings the

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anorectal junction higher and nearer to the pubic symphysis.

During straining and defecation, the anorectal angle becomes more obtuse (110 - 180°) due to relaxation of the puborectalis muscle.

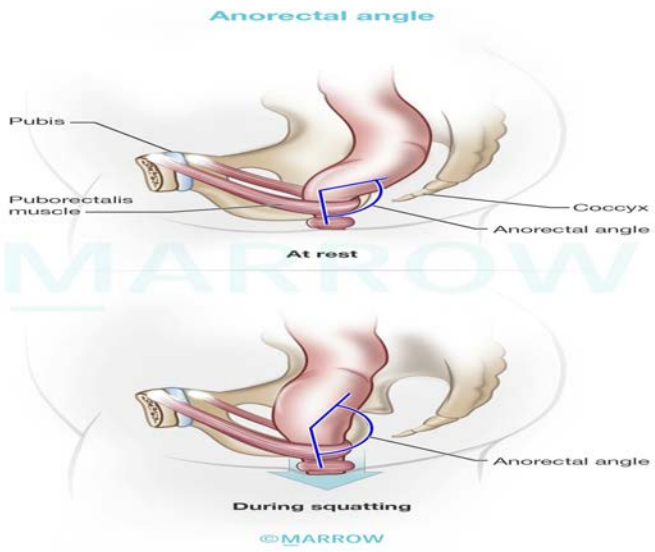
The anorectal ring is formed by the fusion of:

• Puborectalis

• Deep external anal sphincter

• Internal anal sphincter

Note: Anismus, is caused by a failure of the puborectalis and external anal sphincter to relax during defecation straining. This results in a failure of the anorectal angle to straighten during defecation.



Solution to Question 2:

The adult rectum is approximately 12–18 cm in length and is conventionally divided into three equal parts - the upper, middle and lower 1/3rd.

Solution to Question 3:

Waldeyer's fascia separates the rectum from the coccyx.

The lower third of the rectum is separated by the following:

• from the prostate or vagina anteriorly - by Denonvilliers' fascia

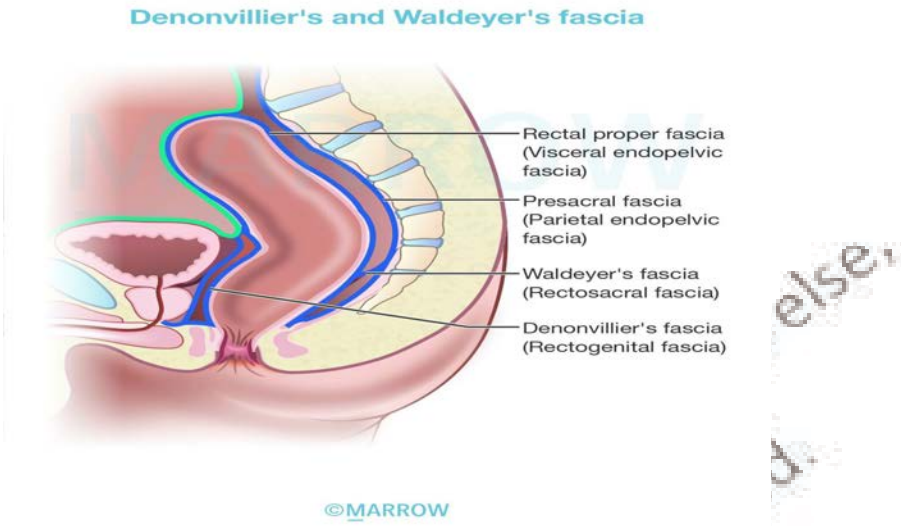
• from the coccyx and lower two sacral vertebrae- by Waldeyer's fascia

Waldeyer's fascia originates at the S2 to S4 level from the presacral parietal fascia and fuses with the rectal visceral fascia at the posterior aspect of the rectum. It divides the retrorectal space into

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superior and inferior compartments.

Identification and preservation of the presacral fascia play an important role in preventing complications and reducing local recurrences of rectal cancer.



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Solution to Question 4:

Proctoscopes can be used to inspect the anus, anorectal junction, and 10-15cm of the lower rectum.

Scope	Length
Anoscope	8 cm
Proctoscope	10–15 cm
Rigid Sigmoidoscope and Rectoscope	25 cm
Flexible sigmoidoscope	60 cm
Colonoscope	160 cm

Solution to Question 5:

The given image shows a proctoscope. It is not used for examining patients with anal fissures.

Due to pain, digital rectal examination and anoscopy are not performed immediately in an acute anal fissure. It is reserved for later when the symptoms resolve or the patient is in the operating room.

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Proctoscopy is indicated in patients with the following:

• Rectal bleeding

• Change in bowel habit, especially recurring attacks of diarrhea

• Pain or difficulty in defecation

• Lesions around the anal opening - abscesses, fistulae, discharge, ulcers, external hemorrhoids

• Rectal prolapse.

Solution to Question 6:

The given history and examination finding is suggestive of rectal prolapse. In children, the prolapse is usually mucosal and should be treated conservatively.

Rectal prolapse occurs when a mucosal or full-thickness layer of rectal tissue protrudes through the anal orifice.

Conservative treatment for rectal prolapse in children is to control:

• Diarrhea

• Worm infestation

• Malnutrition

Sclerotherapy can also be used.

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Solution to Question 7:

The perineal approach is often preferred in patients with high operative risk and limited life expectancy, i.e. in the elderly. It is associated with less morbidity but has a higher recurrence rate.

Abdominal approaches (laparoscopic, robotic, or open) are preferred for younger patients, particularly those with constipation or associated pelvic floor disorders.

Perineal procedures:

• Delorme's mucosectomy- involves mucosal stripping and muscle plication of the rectal prolapse using interrupted sutures. It is performed externally under regional or general anaesthesia.

• Thiersch's encirclement- a steel wire, or Silastic or nylon tape, is placed around the anal canal. Largely obsolete now due to problems with chronic perineal sepsis, anal stenosis, and obstructed defaecation

• Altemeier rectosigmoidectomy- involves removal of the prolapsed rectum and associated sigmoid colon, followed by which a coloanal anastomosis is created. It is often complicated by poor bowel control with faecal soiling secondary to the loss of rectal reservoir.

Abdominal procedures:

• Suture rectopexy

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• Mesh rectopexy

• Posterior (Well's and lvalon's)

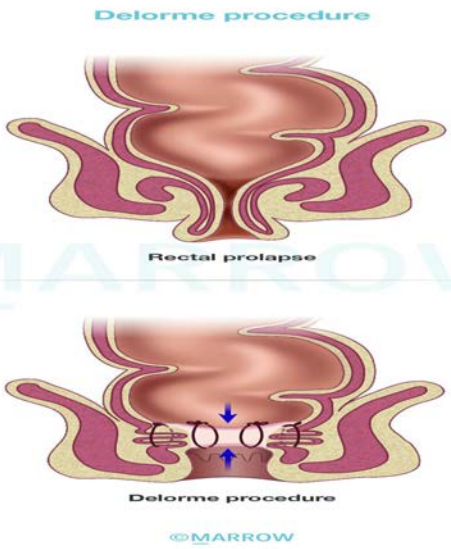
• Anterior (Ripstein's)

• Lateral (Orr-Loygue)

• Ventral

• Resection Rectopexy (Frykman–Goldberg)

The principle of all abdominal operations for rectal prolapse is to fix the rectum in its normal anatomical position.



Solution to Question 8:

A solitary rectal ulcer is usually located on the anterior rectal wall, 6-8 cm from the anal verge.

It commonly presents with rectal bleeding in the setting of chronic straining or constipation. Histology reveals a thick layer of fibrosis obliterating the lamina propria and a central fibrinous exudate.

Colonoscopy with biopsy is the investigation of choice for diagnostic evaluation, while defecography (proctography) is the radiologic procedure of choice.

Stapled trans-anal rectal resection(STARR procedure) is the management of choice.

Solution to Question 9:

Defecography (proctography) is the radiologic procedure of choice for diagnostic evaluation in solitary rectal ulcer syndrome (SRUS). Some common findings include:

• Full-thickness rectal prolapse

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• Internal prolapse

• Paradoxical puborectalis syndrome

• Thickened rectal folds

Defecography evaluates in real-time the morphology of the rectum and anal canal in a physiologic setting by injection of a thick barium paste into the rectum and its subsequent evacuation.

It is primarily performed for workup of patients with:

• Longstanding constipation

• Unexplained anal or rectal pain

• Residual sensation after defecation

• Suspected prolapse.

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Solution to Question 10:

Per-rectal bleeding is the earliest and most common symptom of rectal carcinoma.

Other symptoms of rectal carcinoma include:

• Mucus drainage

• Tenesmus

• Early morning diarrhoea

• Pain

• Weight loss.

Solution to Question 11:

Duke's staging is used in rectal carcinoma.

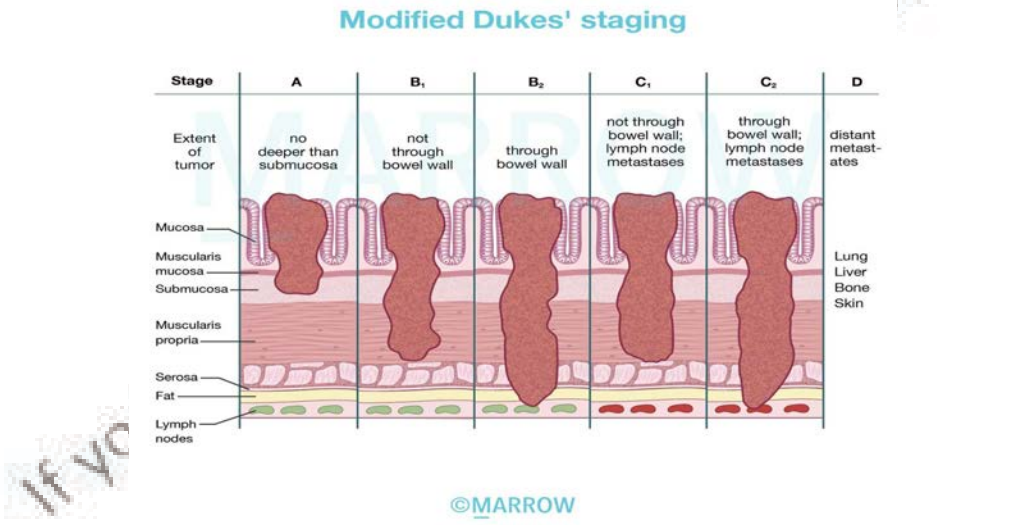
Modified Duke's classification

Astler-Coller's staging:

A	Growth limited to the rectal wall
B	Growth extending to extrarec tal tissues, but no lymphatic spreadB1: Invading submuco saB2: Invading muscle layer
C	Lymph node secondaries
D	Distant spread

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A	Intramucosal lesions
B1	Lesions extending into the muscularis propria, but not penetrating it, with negative nodes
B2	Lesions penetrating the muscularis propria, with negative nodes
C1	Lesions extending into the muscularis propria, but not penetrating it, with positive nodes
C2	Lesions penetrating the muscularis propria with positive nodes
D	Distant spread



Solution to Question 12:

Dissection medial (not lateral) to the endopelvic fascia investing the mesorectum causes local recurrence.

Dissection lateral to the avascular anatomic space, risks injury to the mixed autonomic nerves, causing impotence in men and bladder dysfunction in men and women.

Transmesorectal resection involves complete removal of the lymph node bearing mesorectum along with its intact enveloping fascia. It is a curative resection of rectal tumours of the middle and lower thirds of the rectum, either as part of Low Anterior Resection (LAR) or Abdominoperineal Resection (APR).

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Option A: The majority of colorectal cancers are sporadic. Approximately 5% of all colorectal cancers are attributed to familial adenomatous polyposis (FAP) and Lynch syndrome (hereditary non-polyposis colorectal cancer).

Option B: The large bowel can tolerate delivered radiation doses of up to 6000 cGy. However, a lower dose of 45 Gy is recommended for colorectal tumours. High levels of radiation targeted at colon tumours would include the small bowel in the treatment field. This results in complications such as radiation enteritis.

Option D: The precise location of the rectal tumour is determined using rigid proctosigmoidoscope or flexible sigmoidoscopy and biopsy. The other investigations used in rectal cancer include:

• Digital rectal examination - for assessing the depth of penetration

• Endorectal ultrasound or MRI - provides an accurate assessment of the extent of invasion of the bowel wall

• MRI with an endorectal coil - is the investigation of choice to assess the 'T' and 'N' stages

• CECT - for evaluation of metastasis.

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Solution to Question 13:

Adenocarcinoma is the most common variant of rectal carcinoma.

Colorectal cancer is:

• The second most common malignancy globally

• The second most common cancer in women

• The third most common cancer in men

• The fourth most common cause of death due to cancer.

Symptoms of rectal carcinoma include:

• Painless bleeding - earliest and most common

• Alteration of bowel habits - change in frequency and consistency of the stool

• Tenesmus - unable to pass a motion even when there is the sensation of needing to evacuate the bowel. It is suggestive of a tumor of the lower half of the rectum

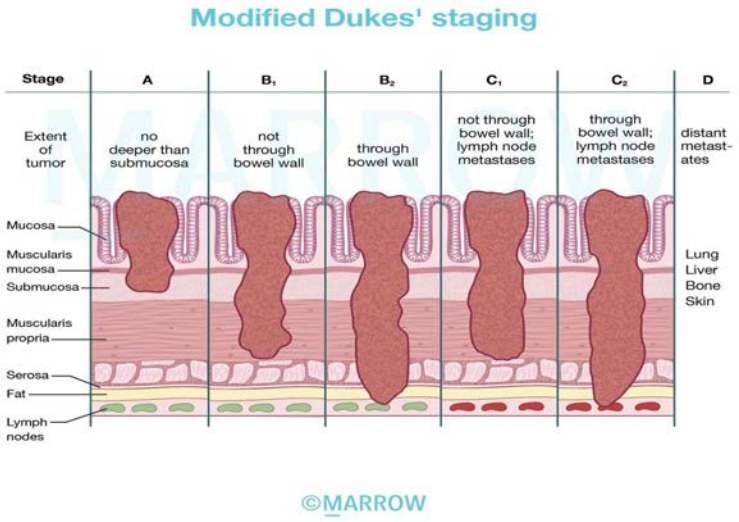
• Early morning bloody diarrhea (option C) - passage of blood and mucus in addition to feces. Pain and weight loss are usually late symptoms

Abdominal examination and digital rectal examination are used for the primary evaluation. Rigid sigmoidoscopy is performed to obtain a biopsy. A synchronous tumor (primary tumor with a different origin than the one currently investigated) is excluded by performing a colonoscopy.

Modified Duke's classification:

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A	Growth limited up to the rect al mucosa (option D)
B	B1: Tumor invading muscular is propria, no lymph node in vasion.B2: Tumors invading i nto or through serosa, no ly mph node invasion.
C	C1: The tumour did not excee d the bowel wall, lymph node metastasis.C2: Tumour exce eded the intestinal wall and l ymph node metastasis.
D	Distant metastasis



Surgery is the mainstay of management for rectal carcinoma. Non-operative management is offered to only those patients who have a complete clinical response to neoadjuvant.

The type of surgery depends on multiple factors (size, location, age of the patient, etc). However, the general consensus is:

• Early cancer (T1 and a few T2) is locally excised via the transanal approach.

• Most rectal cancer is treated by anterior resection and colorectal/coloanal anastomosis.

• Low extensive tumors are treated by laparoscopic abdominoperineal resection(APR) and permanent colostomy.

• Hartmann's operation (option A) is preferred in old and frail patients due to poor anal sphincter and postoperative incontinence.

Solution to Question 14:

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Endorectal-coil magnetic resonance imaging (MRI) is the best modality for predicting lymph node invasion and overall local staging.

It can identify involved perirectal nodes on the basis of characteristics other than size. It can also identify foci at sites not only within the mesorectum but also outside the mesorectal fascia, such as pelvic sidewalls, and can identify the depth of penetration.

Solution to Question 15:

The principal sites for blood-borne metastases in rectal carcinoma are the liver > lungs > adrenals.

Solution to Question 16:

In the above clinical scenario, the TNM staging is T3 N1b M0 (Stage IIIB), since:

• Tumor invasion through the muscularis propria into the perirectal tissues - T3

• Involvement of two lymph nodes - N1b

• No evidence of metastasis - M0

The treatment of choice for Stage III tumors is preoperative chemoradiation followed by radical resection.

Treatment of Rectal Carcinoma:

TNM staging for rectal carcinoma:

Stage	Treatment
Stage 0 (Tis, N0, M0)	Local excision
Stage I: Localized Rectal Carcinoma (T1–2, N0, M0)	Polypectomy with clear marginsRadical resection in high-risk patients with unfavourable histologic characteristics located in the distal third of the rectum
Stage II: Localized Rectal Carcinoma (T3–4, N0, M0)	Preoperative chemoradiation + radical resection
Stage III: Lymph Node Metastasis(Tany, N1, M0)	Preoperative chemoradiation + radical resection
Stage IV: Distant Metastasis (Tany, Nany, M1)	Palliative proceduresResection to control pain, bleeding, or tenesmus

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Stage	Definition
Primary tumor (T)	

Tx	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma in situ, intraepithelial or invasion of lamina propria
T1	Tumor invades submucosa
T2	Tumor invades muscularis propria
T3	Tumor invades through muscularis propria into the subserosa or into non-peritonealized pericolic or perirectal tissues
T4a	Tumor perforates visceral peritoneum
T4b	Tumor directly invades other organs or structures

Regional lymph nodes (N)

Nx	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis to 1-3 regional LNs
N1a	Metastasis in 1 regional LN
N1b	Metastasis in 2-3 regional LNs
N1c	Tumor deposits in the subserosa, mesentery, or non-peritonealized pericolic or perirectal tissues without regional LN metastasis
N2	Metastasis in 4 or more regional LNs

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Nx	Regional lymph nodes cannot be assessed
N2a	Metastasis in 4-6 regional LNs
N2b	Metastasis in 7 or more regional LNs

Distant metastasis (M)

M0	No distant metastasis
M1	Distant metastasis
M1a	Metastasis confined to one organ or site
M1b	Metastasis in more than one organ/site or the peritoneum

Staging based on TNM:

TNM	Stage
T1-2 N0	I
T3 N0	IIA
T4 N0	IIB
T1-2 N1	IIIA
T1-2 N2	IIIB
T3 N1	IIIB
T3 N2	IIIC
T4 N1-2	IIIC

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Solution to Question 17:

The margins of clearance required for the surgery of rectal carcinoma is:

• Proximal - 5 cm

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• Distal - 2 cm

• Radial- 5 cm (for the removal of mesorectal nodes)

Historically, a 5 cm clearance margin was the common practice. However, the 5 cm rule has been replaced by the 2 cm rule to help preserve the anal sphincters.

When a negative distal margin can be achieved by sparing the sphincter, a sphincter sparing surgery such as low anterior resection (LAR) is performed.

If it is not possible to achieve a negative distal margin and spare the sphincter (when the tumour is within 5cm of anal verge), abdominal perineal resection (APR) is done.

APR/LAR must include total mesorectal excision (TME) to ensure margin clearance and lymph node retrieval.

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Solution to Question 18:

Low anterior resection (LAR) is the preferred surgery in rectal carcinoma which is located at least 5 - 5.5 cm away from the anal verge.

It is not performed:

• If adequate margin could not be achieved even after preoperative chemoradiotherapy

• If the sphincters have to be sacrificed to achieve an adequate margin

• In patients who cannot tolerate low anastomosis.

In such cases, where anterior resection cannot be performed in distal rectal cancers, abdominoperineal resection (APR) is done.

APR/LAR must include total mesorectal excision (TME) to ensure margin clearance and lymph node retrieval.

Solution to Question 19:

T2 rectal cancers are managed by transabdominal resection.

Transanal local excision is recommended for selected T1, N0 early-stage cancers which fulfill the following criteria:

• Small (<3 cm), well- to moderately-differentiated tumors

• Tumors within 8 cm of the anal verge

• Tumors limited to <30% of the rectal circumference

• Tumors with no evidence of nodal involvement

• Full-thickness excision must be feasible.

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Solution to Question 20:

5-Fluorouracil-based regimens with leucovorin and oxaliplatin (FOLFOX) reduce recurrence and improve survival in patients with colorectal carcinoma.

Irinotecan (FOLFIRI regimen) is also used as a second-line chemotherapy agent. Adjuvant chemotherapy is routinely recommended in patients with lymph node involvement.

Option B: ABVD regimen is used for Hodgkin's lymphoma.

Option C: RCHOP regimen is used for B-cell Non-Hodgkin's lymphoma.

Option D: MVAC regimen is used for advanced bladder carcinoma.

Solution to Question 21:

Hartmann's operation is an excellent procedure in an elderly, frail patient in whom there is concern about anal sphincter function or the viability of an anastomosis.

Through an abdominal incision, the rectum is excised, the rectal stump is stapled closed and the proximal colon exteriorized as a permanent end colostomy.

Note: Endoluminal stenting is being increasingly used in patients with obstructing carcinomas. It can be either used as a palliative procedure or to relieve the obstruction. Only rectosigmoid and upper rectal tumours are suitable for stenting because stent impingement on the anorectum in low cancers can result in tenesmus.

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Anus and Anal Canal

Question 1:

Which of the following statements is false regarding the anatomy of the anal canal below the pectinate line?

a) Lymphatic drainage is to inguinal nodes

b) Innervation is by the inferior rectal nerves

c) Venous drainage is into the systemic circulation

d) Tumors are more likely to be adenocarcinoma

Question 2:

Which of the following are not true regarding external hemorrhoids?

a) Only 5

b) 2, 3 & 4

c) 3,& 5

d) 1, 2, & 4

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Question 3:

Which of the following will you not consider as a differential in a patient presenting with anorectal pain?

a) Anal fissure

b) Anal cancer

c) Internal hemorrhoids

d) Proctalgia fugax

Question 4:

A 45-year-old male patient presented to the OPD with complaints of painless bleeding during defecation. On examination, a pinkish mass appears at the anal orifice when the patient is asked to strain. It reduces spontaneously when the patient relaxes. What will be the grade of

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this hemorrhoid?

a) First-degree

b) Second-degree

c) Third-degree

d) Fourth-degree

Question 5:

A man presented with bleeding per rectum which he noticed after passing stools for the past 2 weeks. On straining, a reddish mass as shown in the image was seen protruding out of the anal canal. It did not reduce spontaneously and had to be manually reduced. What is the grade of hemorrhoids in this patient?



a) Fourth degree

b) Second degree

c) Third degree

d) First degree

Question 6:

In patients with which of the following conditions can injection sclerotherapy be ideally used?

a) Only 3

b) 2 & 4

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c) 1, 4, & 5

d) 2, 3, & 5

Question 7:

A 48-year-old man presents to the clinic with severe anorectal pain during and after defecation. The pain was present for 6 months but has increased in severity over the past 1 day. Examination finding is shown below. A per-rectal examination could not be performed due to pain. How will you manage this patient?



a) Analgesics and sitz bath

b) Evacuation under local anaesthesia

c) Ferguson hemorrhoidectomy

d) Sclerotherapy

Question 8:

What is the most common complication following hemorrhoidectomy?

a) Urinary retention

b) Fecal incontinence

c) Infection

d) Delayed hemorrhage

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Question 9:

A 35-year-old man came with complaints of chronic constipation, blood-streaked stools, and pain during defecation for 2 months. On examination, a sentinel tag was noted at the anal orifice. What is the most likely diagnosis?

a) Fistula in ano

b) Anal fissure

c) Hemorrhoids

d) Anal carcinoma

Question 10:

Which of the following is the most common location of anal fissures?

a) Anterior midline

b) Posterior midline

c) Right lateral

d) Left lateral

Question 11:

What is the procedure of choice in a patient with chronic anal fissure?

a) Milligan-Morgan procedure

b) Lateral internal sphincterotomy

c) Transanal resection

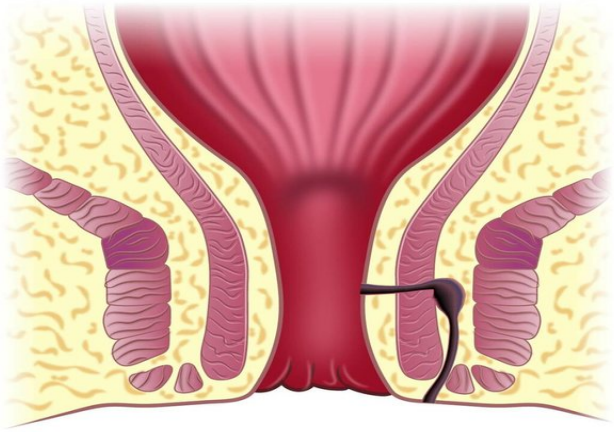
d) Altemeier's procedure

Question 12:

Which type of anal fistula is seen in this image?

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a) Intersphincteric

b) Trans-sphincteric

c) Supra-sphincteric

d) Extra-sphincteric

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Question 13:

A 40-year-old male patient presents to the clinic with a history of discharge from the perianal region for the past 1 week. On examination, an external opening was seen at 2 o'clock position around the anal orifice. On per rectal examination, an opening was palpable at 3 o'clock position at the dentate line. What is the gold standard investigation for assessing this patient?

a) CT

b) MRI

c) Endoanal USG

d) X-ray fistulogram

Question 14:

A patient presented with serous discharge from an opening located in the perianal region. On examination, the location of the external opening was at 8'O clock position. According to Goodsall's rule at what position from the dentate line will the internal opening be palpated in this patient?

a) 8'O clock

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b) 4'O clock

c) 1'O clock

d) 6'O clock

Question 15:

A known case of Crohn's disease presented to the clinic with a history of discharge from the anal region for the past 2 weeks. The patient underwent drainage of an ischiorectal abscess 2 months back. Clinical examination and imaging reveal the presence of a supra-sphincteric perianal fistula. How will you manage this patient?

a) Seton's technique

b) Fistulotomy

c) Lateral internal sphincterotomy

d) Simple fistulectomy

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Question 16:

Which of the following is the most common cause of anorectal suppuration?

a) Cryptoglandular infection

b) Crohn's disease

c) Tuberculosis

d) Malignancy

Question 17:

Which of the following is the most common type of anorectal abscess?

a) Sub-mucous

b) Pelvirectal

c) Perianal

d) Ischiorectal

Question 18:

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A jeep driver presented with a swelling in the natal cleft, with pain, difficulty in sitting, and occasional purulent discharge from the area. Examination finding is shown below. Which of the following is not true regarding this condition?



a) Recurrence is common

b) Hair follicles are seen in the wall of sinus

c) Hirsute habitus is a risk factor

d) Commonly seen between the ages of 15 and 40 years

Question 19:

Which of the following is not used in the treatment of pilonidal sinus diseases?

a) Only 5

b) 1 & 4

c) 2,3 & 5

d) 1, 2 & 4

Question 20:

An elderly female presented with severe persisting per rectal itching for the past 1 year, despite standard topical therapy. On examination, irregular eczematous lesions were seen at the anal orifice. Biopsy of the lesion revealed large vacuolated cells containing mucin. Which of the following is it likely to be?

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a) Squamous cell carcinoma in situ

b) Basal cell carcinoma

c) Intra-epithelial adenocarcinoma

d) Marginal anal cell carcinoma

Question 21:

Which of the following is true regarding squamous cell carcinoma of the anal canal?

a) Proctoscopy is the investigation of choice

b) Commonly metastasises to spine

c) Most common presentation is ano-rectal pain

d) Most common type of anal canal carcinoma

Question 22:

A 60-year-old man with bleeding per rectum is suspected to have squamous cell carcinoma of the anal canal. What is the treatment of choice for this condition?

a) Abdominoperineal resection

b) Nigro regimen

c) Wide local excision

d) Surgical excision with CO_2 laser treatment

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Question 23:

Which of the following is true about melanoma of the anal canal?

a) Wide local excision is done for tumors with sphincter involvement

b) Staged by depth or thickness of melanoma lesion

c) More common in males

d) Good 5-year survival rates

Answer Key

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Question No.	Correct Option
1	d
2	c
3	c
4	b
5	c
6	b
7	b
8	a
9	b
10	b
11	b
12	a
13	b
14	d
15	a
16	a
17	c
18	b
19	a
20	c
21	d
22	b
23	b

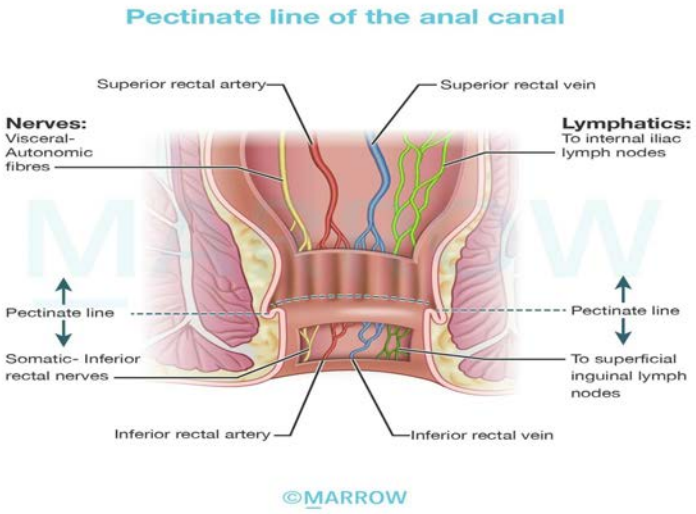
Detailed Explanations

Solution to Question 1:

Adenocarcinoma is more likely to be seen above the pectinate line. Tumors below the pectinate line are more likely to be squamous cell carcinoma.

The pectinate line is at the junction of the upper two-thirds and the lower one-third of the anal canal. Developmentally, it represents the hindgut–proctodeum junction. The part of the anal canal above this line developed from the hindgut and the part below developed from the proctodeum.

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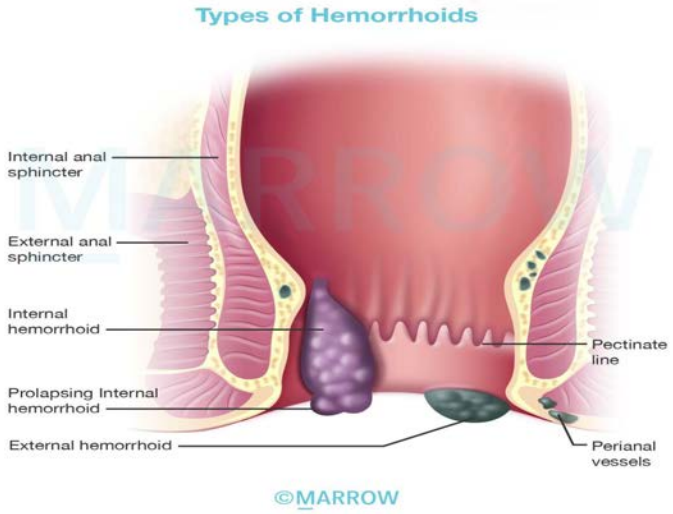
Solution to Question 2:

External hemorrhoids are painful, self-curing and covered by squamous epithelium. The branches of the superior rectal vein, located at 3, 7, and 11 o'clock positions in the anal canal are common sites for internal hemorrhoids. Banding is preferred for internal hemorrhoids.

Hemorrhoids are cushions of submucosal tissue containing venules, arterioles, smooth muscle fibres, and elastic connective tissue. They can be classified according to their location into 2 types:

- Internal Hemorrhoids
- External Hemorrhoids

Note: Repeated thrombosis leads to a semi-ripe black currant appearance of external hemorrhoids.



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Solution to Question 3:

Internal hemorrhoids are painless.

Causes of anorectal pain:

- External hemorrhoids
- Anal fissure
- Proctalgia fugax
- Levator ani syndrome
- Fistula in ano/anal abscess
- Inflammatory bowel disease
- Coccydynia
- Prostatitis
- Carcinoma anus/lower rectum

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Solution to Question 4:

Prolapse with spontaneous reduction is suggestive of second-degree hemorrhoids.

Solution to Question 5:

In the given scenario, as the prolapsed haemorrhoids required manual reduction, it is suggestive of third-degree haemorrhoids.

Solution to Question 6:

Injection sclerotherapy is ideal for the treatment of first and second-degree hemorrhoids (bleeding or spontaneously reducing hemorrhoids).

1 to 3 mL of a sclerosing solution (phenol in olive oil, sodium morrhuate, or quinine urea) is injected into the submucosa of each hemorrhoid. Complications of sclerotherapy include infection and fibrosis.

Solution to Question 7:

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The clinical features and the image are suggestive of thrombosed external hemorrhoids. Patients who present within 48 hours of thrombosis should undergo thrombus evacuation under local anesthesia. This procedure involves the removal of the clot with an elliptical incision on the skin.

After the initial 48-72 hours, pain typically plateaus and hence the patient is treated conservatively with analgesics and a sitz bath.

Grade1, grade 2, and some grade 3 hemorrhoids with only an internal component can be treated with simple procedures like rubber band ligation, sclerotherapy, infrared and laser coagulation, and cryotherapy.

Surgery is indicated in:

• Internal grade 3 or grade 4 hemorrhoids

• Hemorrhoids with a significant external component

• Early grade hemorrhoids not responding to simple procedures

Surgical procedures used in the removal of hemorrhoids are:

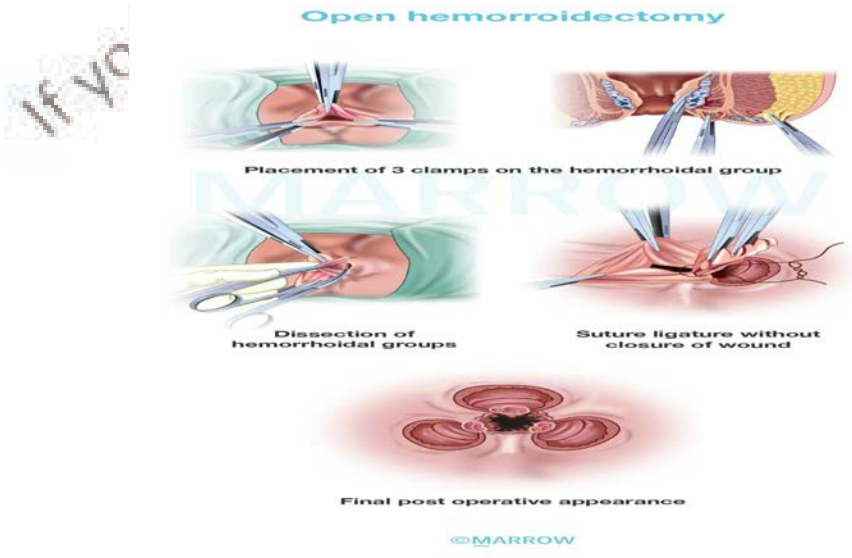
• Open (Milligan–Morgan) hemorrhoidectomy

• Closed (Ferguson) hemorrhoidectomy

• Stapled hemorrhoidopexy - is circumferential rectal mucosectomy. It is associated with reduced postoperative pain, faster recovery and shorter hospital stay

• Doppler-guided hemorrhoidal artery ligation

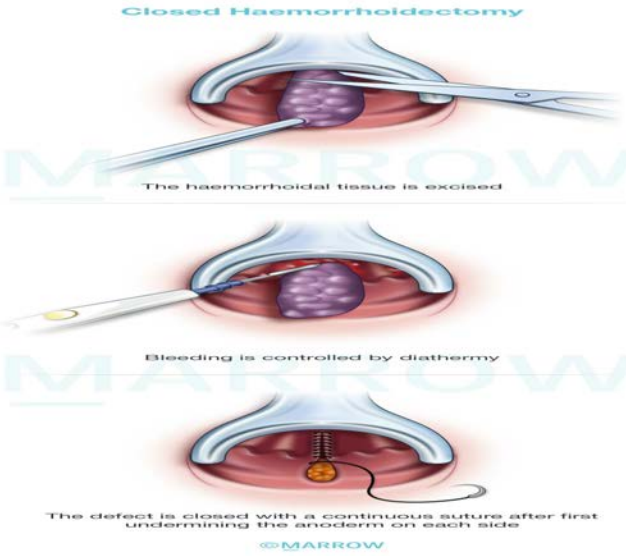
Open hemorrhoidectomy - Artery forceps are applied to the skin-covered external components of the hemorrhoid and traction is given to reveal the internal components. Dissection of the lateral pedicle is performed and finally, the pedicles are transfixed. Mucocutaneous bridges are left intact in this technique. The image below shows the procedure.



Closed hemorrhoidectomy - The hemorrhoid is excised with the overlying mucosa. The hemorrhoid is dissected from the underlying sphincter and the mucus defect is then closed. This technique is associated with higher chances of recurrence. This procedure is however quick to perform and less painful. The image below describes the procedure.

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Solution to Question 8:

Urinary retention is the most common complication following hemorrhoidectomy.

Conventional hemorrhoidectomy(open or closed technique), is considered to be an extremely painful procedure. Dysfunction of the detrusor muscle or the trigone in response to pain or distention of the anal canal or perineum has been postulated as the cause of urinary retention post hemorrhoidectomy.

Other complications include:

- Fecal incontinence
- Infection
- Delayed hemorrhage
- Stricture

Solution to Question 9:

In the given scenario, the presence of a sentinel tag is suggestive of chronic anal fissure.

An anal fissure is a linear or oval-shaped tear in the anal canal starting just below the dentate line extending to the anal verge. It can be acute or chronic.

Chronic anal fissures last for more than 6-8 weeks, and are frequently associated with a triad of findings:

- Sentinel tag
- Hypertrophied anal papillae at the upper end of the fissure in the anal canal
- Deep canoe-shaped ulcer

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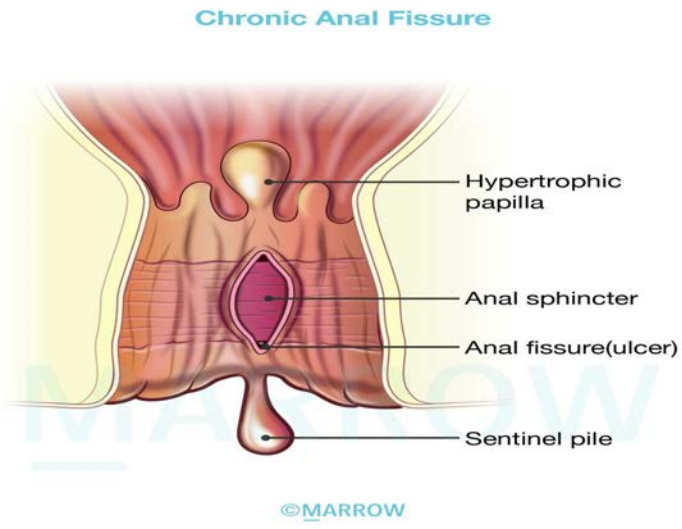
Acute fissures are shallow tears in the anoderm. They are associated with:

• Anal pain

• Spasm

• Bleeding with defecation

The below image shows features of a chronic anal fissure



Solution to Question 10:

Over 90% of fissures are located in the posterior midline, with the rest being located in the anterior midline of the anal canal.

The main hypothesis is that the posterior midline area may have decreased blood flow due to the configuration of the blood vessels of the anus. Also, the spasm of the internal anal sphincter may cause further reduction of the blood flow to the posterior anal canal.

Solution to Question 11:

Lateral internal sphincterotomy is the procedure of choice for chronic anal fissures.

Surgical therapy has traditionally been recommended for chronic anal fissures that have failed medical therapy. The aim of this procedure is to decrease the spasms of the internal sphincter by dividing a portion of the muscle. Approximately 30% of the muscle sphincter fibers are divided laterally using an open or closed technique.

The initial treatment of anal fissures includes:

• Frequent sitz baths

• Analgesics

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• Stool softeners

• High-fiber diet

If conservative management with dietary changes and laxatives fail, other options including topical analgesics such as 2% lidocaine jelly, topical nifedipine, topical nitroglycerin, or a combination of topical nifedipine and lidocaine can be attempted.

Option A: Miligan-Morgan procedure is an open hemorrhoidectomy

Option C: Transanal resection is used to remove early-stage rectal cancers in the lower rectum

Option D: Altermeier's procedure is used for rectal prolapse

Solution to Question 12:

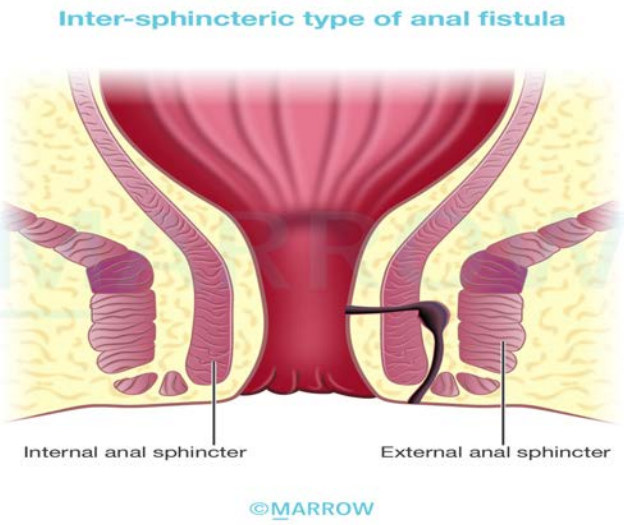
In the given image, the fistula traverses the internal sphincter and tracks down the space between the internal and external anal sphincters. Hence, it is an inter-sphincteric type of anal fistula. It is the most common anal fistula.

A fistula-in-ano is an epithelial-lined tract connecting the anal canal to the perianal skin. Patients usually complain of intermittent purulent discharge and pain. Anal fistulas can be simplex or complex fistulas.

• Simple fistulas- include a single tract, subcutaneous tract, and those that involve less than 30% of the external sphincter. They are easier to treat, and have lower chances of recurrence.

• Complex fistulas- include fistulas involving more than 30% of the external sphincter, with multiple tracts, recurrent fistulas, and those associated with other predisposing factors, such as Crohn disease and radiation treatment.

Fistulas can also be classified into high or low-lying fistulas, based on their location with respect to the puborectalis muscle.



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Solution to Question 13:

The given scenario is suggestive of an anal fistula. Magnetic resonance imaging (MRI) is the gold standard investigation for fistula imaging. It helps to identify the secondary extensions of the track, which when missed may cause persistence of the fistula.

Investigations available for fistula-in-ano are:

- Fistulogram
- Endoanal ultrasound
- MRI
- Computed tomography (CT) scan
- Endocoil MRI
- Hydrogen peroxide–enhanced 3-D endoanal ultrasonography

Solution to Question 14:

The given case scenario is suggestive of fistula-in-ano with external opening at 8'O clock position which implies that the external opening of the fistula is lying posterior to the midline. According to the Goodsall rule, fistulas with an external opening posteriorly track in a curvilinear fashion to the posterior midline. Hence, the fistulous tract opens internally at a 6'O clock position.

A fistula-in-ano is an abnormal hollow tract or cavity that is lined with granulation tissue and that connects a primary opening inside the anal canal to a secondary opening in the perianal skin.

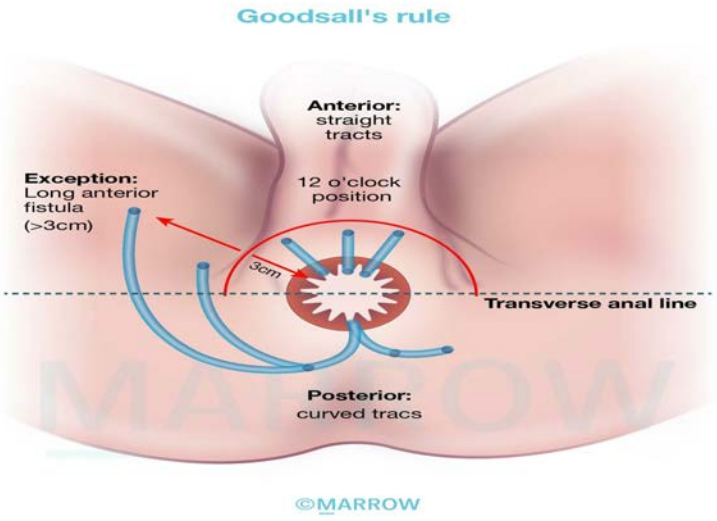
Goodsall's rule:

- Fistulas with an external opening anteriorly connect to the internal opening by a short, radial tract.
- Fistulas with an external opening posteriorly track in a curvilinear fashion to the posterior midline.

However, exceptions to this rule often occur. Fistulas with an anterior external opening greater than 3 cm from the anal margin usually track to the posterior midline

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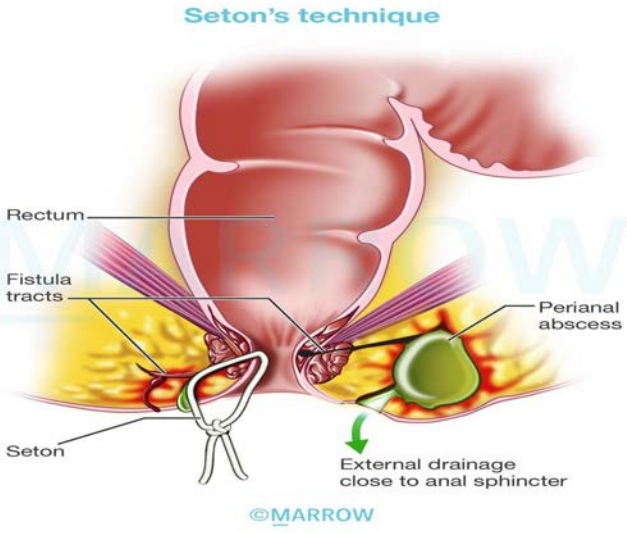
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Solution to Question 15:

In the given scenario, a history of Crohn's disease, recurrent anorectal abscess, and the imaging findings point towards a complex anal fistula. It will be managed using Seton's placement, which is done in two stages.

A seton is a drain placed through a fistula to maintain drainage and/or induce fibrosis. Setons can be classified as draining or cutting.



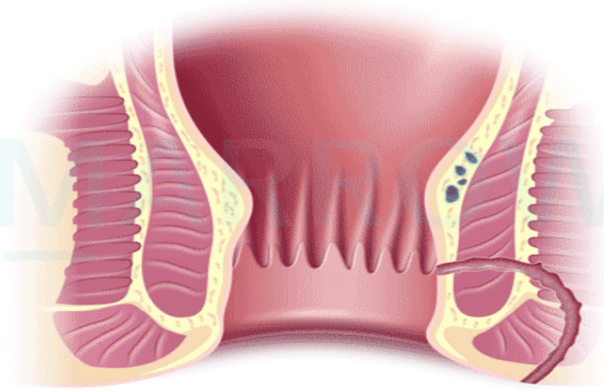
Cutting seton

A cutting seton has been used as a staged fistulectomy, especially in high trans-sphincteric fistulas. After the seton is passed during the primary surgery, it has to be tightened at regular intervals, till it cuts through completely.

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Loose/draining seton

In this method, the seton is placed to maintain drainage and create scar tissue around the sphincter so that its edges do not retract after cutting.



Option B: Fistulotomy involves opening the fistula tract and possibly dividing the sphincter muscle. It is very effective for simple fistulas with minimal sphincter involvement.

Option C: Lateral internal sphincterotomy is a technique used for chronic anal fissures.

Option D: In fistulectomy, the fistulous tract is cut out completely.

Other surgeries for fistula in-ano include:

• Endorectal advancement flap- involves closure of the internal opening of the tract, debridement of the tract, and mobilization of anorectal mucosa to cover the defect. It is usually done for complex fistulas.

• LIFT- Ligation of the intersphincteric fistula tract involves identification of the internal opening with suture ligation of the intersphincteric portion of the fistula. The tract and infected gland are then excised and the wound is debrided with curettage. It can be done for both simple and complex fistulas.

Solution to Question 16:

The most common cause of anorectal suppuration is nonspecific cryptoglandular infection.

Anorectal abscess originates from an infection arising in the cryptoglandular epithelium lining the anal canal. The increased incidence of ischio-rectal fossa infection is due to poor blood supply.

It may also be caused by other reasons such as:

• Crohn's disease

• Trauma

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• Immunodeficiency resulting from human immunodeficiency virus (HIV) infection or malignancy (both hematologic and anorectal cancer)

• Tuberculosis

• Hidradenitis suppurativa

Solution to Question 17:

A perianal abscess is the most common type of anorectal abscess.

Anorectal abscess refers to a collection of pus in the anal or rectal region. More commonly seen in men. There are four types of anorectal abscesses:

• Peri-anal (most common)

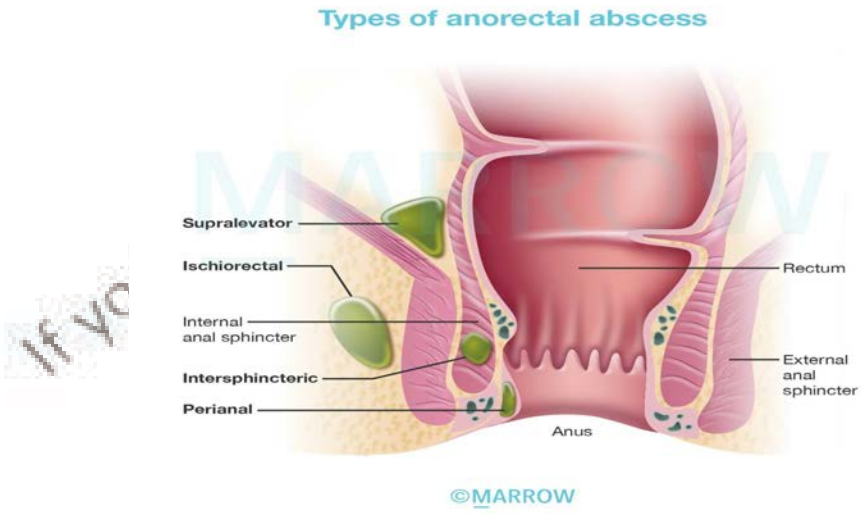
• Ischio-rectal

• Inter-sphincteric

• Supra-levator

Treatment: Drainage of pus + Antibiotics

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Solution to Question 18:

The given condition is a pilonidal sinus. Hair follicles have almost never been demonstrated in the walls of the sinus. The hair projecting from the sinus is dead hair, with its pointed ends directed towards the blind end of the sinus.

Pilonidal sinus disease is a disease of the inter-gluteal region, characterized by the formation of a sinus in the cleft of the buttocks. It is more common in males between 15-40 years of age.

Risk factors include:

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• Male sex

• Family history

• Being overweight or obese

• Trauma or irritation to the perianal region

• Occupations involving sitting for long periods- jeep/lorry drivers

• Hirsute habitus - thick body hair

• Poor hygiene

Sites involved:

• Natal cleft (most commonly)

• Interdigital cleft

• Face

• Axilla

Buttock friction and shearing forces in these areas allow broken hairs to enter the skin and create a subcutaneous, chronically infected midline track. An infected hair follicle can also form such a track. Secondary tracks can arise as openings, lined with granulation tissue and discharge.

Clinical features:

• Intermittent pain, swelling, and discharge at the base of the spine

• Abscess - due to a foreign-body-type reaction

Treatment

• Conservative treatment: Strict hygiene and regular shaving of hair in the area.

• Abscess:

• Rest, baths, local antiseptic dressings, and broad-spectrum antibiotics.

• If refractory to the above treatment- drainage with thorough curettage of granulation tissue and hair.

• Surgical techniques: Bascom's, Karydaki's procedures are for chronic pilonidal disease.

Recurrence is common even after adequate excision of the tract.

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Solution to Question 19:

Surgical approaches parallel to the natal cleft, and not along the natal cleft are preferred, to reduce chances of recurrence.

Pilonidal sinus disease treatment includes non-surgical and surgical approaches. The non-surgical approach includes conservative treatment with proper hygiene and regular shaving of hair in the area.

In case of an abscess- adequate rest, baths, local antiseptic dressings, and broad-spectrum antibiotics are advised.

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Surgical approaches for the management of pilonidal sinus disease include:

• Incision and drainage- for pilonidal abscess refractory to medical treatment

• Bascom's procedure- is a cleft lift procedure in which hair follicles parallel to the natal cleft are removed under local anesthesia

• Karydakis procedure- an ovoid area of pathologic tissue is excised parallel to the natal cleft and a fasciocutaneous flap is mobilized to cover the defect

• Limberg/ rhomboid flap- excises the pilonidal disease in a rhomboid shape and rotates a fasciocutaneous flap for wound closure

• Others- VY advancement flaps, and Z-plasty

The given image shows a Limberg/rhomboid flap done in pilonidal sinus surgery.



Solution to Question 20:

The given history and presence of large vacuolated cells (Paget cells) on biopsy is suggestive of Paget's disease of the anal canal. It is a rare intraepithelial adenocarcinoma.

Paget's disease is most commonly seen in areas with a high density of apocrine sweat glands, in elderly females. These can develop into an invasive cancer of the underlying apocrine glands.

Clinical features include intractable itching, burning, bleeding per rectally. 10% of the patients are asymptomatic. On examination, eczematous, well-demarcated plaque, with occasional ulceration and scaling can be seen.

On histology presence of Paget cells (large, vacuolated cells with mucin) confirms the diagnosis.

Treatment:

• Treatment of choice- complete excision

• Limited, noninvasive disease-wide local excision and closure of the defect with primary sutures or with V-Y advancement flaps

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• Invasive component- radical resection with abdominoperineal resection (APR)

• Medically unfit for surgery - topical 5-FU, imiquimod, cryotherapy, or argon beam laser therapy

• Recurrence- re-excision (as long as the disease remains noninvasive)

Note: Most common site of extra-mammary Paget's disease – anogenital region > axilla > eyelid. Perianal Paget's disease is usually associated with underlying visceral malignancy, most commonly colorectal adenocarcinoma.

Solution to Question 21:

Squamous cell carcinoma (SCC) is the most common anal canal carcinoma. SCC > Basal cell carcinoma >Melanoma

The median age at diagnosis for SCC is 60 years. Patients most commonly present with bleeding per rectum. Commonly metastasizes to the liver and lungs. The most common site of lymph node metastasis is to inguinal lymph nodes.

Risk Factors:

• Human papillomavirus (HPV) (types 16, 18, 31, 33) infection

• Human immunodeficiency virus (HIV) or immunosuppression

• Smoking

• Anal receptive intercourse

• Sexual promiscuity

• Anal intraepithelial neoplasia

• History of vulvar or cervical cancer

Diagnosis:

• Proctoscopy with biopsy- investigation of choice

• MRI- for local staging

• CT scan- to evaluate for distant metastasis

Treatment :

• Nigro regimen- chemoradiation is the treatment of choice

• If any residual tumor is left behind after chemoradiation, abdominoperineal resection (APR) is performed

8th AJCC: TNM Classification of Carcinoma of the Anal Canal and Anal Margin
Primary Tumor:

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8th AJCC: TNM Classification of Carcinoma of the Anal Canal and Anal Margin
Tis - high-grade squamous intraepithelial lesionT1 - 2 cm or lessT2 - >2 - 5 cmT3 - >5 cmT4 - invades adjacent organ, e.g. vagina, urethra, bladder. (invasion of the rectal wall, perirectal skin, subcutaneous tissue, or sphincter muscle is not included as T4).
Regional Nodes:
Regional lymph nodes include mesorectal, inguinal (superficial, deep), superior rectal (hemorrhoidal), external iliac, and internal iliac (hypogastric) groups.N0 - no regional lymph node metastasesN1a - inguinal, mesorectal, or internal iliac lymph nodesN1b - external iliac nodesN1c - external iliac nodes + N1a
Distant Metastases:
M0 - noM1 - yes
Stage grouping:
0 - TisI - T1 N0IIA - T2 N0IIB - T3 N0IIIA - T1-2 N1IIIB - T4 N0IIIC - T3-4 N1IV - M1

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Solution to Question 22:

Treatment of choice for squamous cell carcinoma of the anal canal is Nigro regimen/ chemoradiation.

A combination of 5-fluorouracil (5-FU) with mitomycin C/ cisplatin is followed by external beam radiation to the pelvis with a minimum dose of 45 Gy.

Solution to Question 23:

Anorectal melanoma is staged by the depth or thickness of the lesion.

Anal canal melanoma is more common in females. The tumor appears as small and polypoidal or large and ulcerating. Clinical features include:

• Anorectal bleeding, itching, pain, mass

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• Tenesmus, and changes in bowel habits

• Mesorectal lymph node metastases

• Inguinal lymphadenopathy

• Distant spread- to bones, lungs, and liver

Diagnosis is frequently made following hemorrhoidectomy or local excision of the perianal mass.

Treatment:

• Tumors without anal sphincter involvement- wide local excision with negative margins

• Large tumors invading sphincters- palliative APR

Regardless of stage, 5-year survival rates for anorectal melanoma are very poor, averaging at about 6%. The median survival time following diagnosis is 12–18 months.

Note: Most common sites of melanoma are skin >eye > anorectal region

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Hernia

Question 1:

Which of the following is a false statement regarding the inguinal canal?

a) Conjoint tendon forms a part of the posterior wall

b) Superficial ring is an opening in the external oblique aponeurosis

c) Deep ring is an opening in the transverse abdominis

d) Internal oblique forms both the anterior and superior walls

Question 2:

All of the following are contents of inguinal canal except _____.

a) 1,2,4 and 5

b) 2,3 and 5

c) 2 and 3

d) Only 3

Question 3:

Which of the following structures does not form the boundary of Hesselbach's triangle?

a) Inferior epigastric artery

b) Vas deferens

c) Rectus abdominis

d) Inguinal ligament

Question 4:

A resident while assisting a case of laparoscopic hernia repair observes the surgeon dissect certain anatomical landmarks to expose the triangle of doom. Which of the following does not form a boundary of this triangle?

a) Gonadal vessels

b) Vas deferens

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c) Cooper's ligament

d) Peritoneal reflection

Question 5:

Which of the following is true regarding inguinal hernia?

a) 1 and 3

b) 1 and 4

c) 2 and 3

d) 2 and 4

Question 6:

What is the most common type of hernia in females?

a) Femoral hernia

b) Direct inguinal hernia

c) Indirect inguinal hernia

d) Umbilical hernia

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Question 7:

A 45-year-old woman presents with a history of swelling in the right groin for the past 6 months. On examination, an irreducible hernia is present in the right groin. Which of the following structures would be helpful in identifying if the hernia is inguinal or femoral in origin?

a) Pubic symphysis

b) Pubic tubercle

c) Femoral artery

d) Inferior epigastric artery

Question 8:

An elderly male patient is diagnosed with direct inguinal hernia. Which of the following statements is true?

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a) The sac lies medial to the inferior epigastric artery

b) Cough impulse is felt on the index finger

c) Can descend till the bottom of scrotum

d) The neck is narrow and is prone for strangulation

Question 9:

Bubonocele is a type of _____.

a) Indirect inguinal hernia

b) Direct inguinal hernia

c) Femoral hernia

d) Umbilical hernia

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Question 10:

What is the most common serious complication expected to occur in patients with hernia?

a) Incarceration

b) Strangulation

c) Fistula formation

d) Obstruction

Question 11:

A patient presents with a hernia medial to the inferior epigastric artery. What is the most likely diagnosis and appropriate management for the same?

a) Direct hernia and Bassini repair

b) Direct hernia and Lichtenstein mesh repair

c) Indirect hernia and Bassini repair

d) Indirect hernia and Lichtenstein mesh repair

Question 12:

A 50-year-old obese male patient presented with bilateral, large inguinal hernias. He had been operated on for hernia twice in the past and is now posted for Stoppa's repair. Which of

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the following statements regarding this procedure is false?

a) This procedure refers to open preperitoneal hernia repair

b) The mesh is placed in the retromuscular space

c) The mesh needs to be sutured to the posterior rectus sheath in case of small defects

d) This procedure is based on the principle of Pascal's law

Question 13:

A 2-year-old boy was brought to the clinic with a history of a reducible and painless swelling in the right groin for the past 2 months. After the clinical and radiological investigations, the diagnosis of a right-sided inguinal hernia was made. The patient is posted for hernia repair surgery. Which of the following steps will not be done in this patient during the repair?

a) Opening of the hernial sac

b) Excision of the hernial sac

c) Transfixation of the neck

d) Repair of the inguinal ring

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Question 14:

Which of the following is the most appropriate mesh for use in hernioplasty?

a) Heavyweight with small pores

b) Heavyweight mesh with large pores

c) Lightweight mesh with small pores

d) Lightweight mesh with large pores

Question 15:

A patient operated for direct inguinal hernia developed sensory loss at the root of the penis and adjacent part of the scrotum. Which of the following nerves is most likely injured?

a) Ilioinguinal nerve

b) Iliohypogastric nerve

c) Genital branch of genitofemoral nerve

d) Femoral branch of genitofemoral nerve

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Question 16:

A 50-year-old male patient with chronic constipation is diagnosed with Type 7 Gilbert hernia. This refers to _____

a) Direct inguinal hernia

b) Indirect inguinal hernia

c) Femoral hernia

d) Umbilical hernia

Question 17:

Which of the following statements about femoral hernia is true?

a) It occurs exclusively in females

b) All femoral hernias should be repaired

c) It does not strangulate

d) Femoral vein lies medial to the sac

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Question 18:

Match the following surgeries for femoral hernia with their indications:

a) 1-A, 2-B, 3-C, 4-D

b) 1-C, 2-D, 3-B, 4-A

c) 1-B, 2-C, 3-A, 4-D

d) 1-B, 2-A, 3-D, 4-C

Question 19:

In Laugier's hernia, the opening is in the _____

a) Lacunar ligament

b) Conjoint tendon

c) External oblique

d) Peritoneum

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Question 20:

Which of the following statements about Spigelian hernia is false?

a) It occurs above the level of the arcuate line

b) The hernia sac is posterior to the external oblique aponeurosis

c) Most commonly presents as a painless mass

d) It is detected by USG/CT

Question 21:

While performing an elective hernia repair, the surgeon notices that the posterior wall of the hernia sac is formed by the sigmoid colon. What is this type of hernia known as?

a) Lumbar hernia

b) Sliding hernia

c) Spigelian hernia

d) Pantaloon hernia

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Question 22:

A middle-aged male patient underwent adrenalectomy for Cushing's syndrome one year back. He now presents with a history of chronic lower back pain. On examination, a partially reducible mass that increased in size during Valsalva maneuver was noticed on his lower back. Which of the following statements regarding the patient's condition is false?

a) Herniation may have occured through the Grynfelt's triangle

b) The inferior lumbar triangle is bound by the external oblique and latismus dorsi muscle

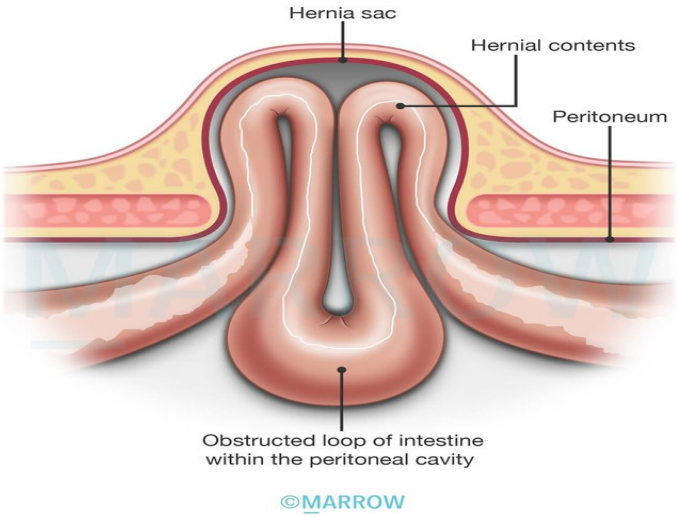
c) Herniation is relatively more common on the right side

d) Dowd Ponka technique is used for surgical repair

Question 23:

Which type of hernia is depicted in the following diagram?

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a) Richter's hernia

b) Littre's hernia

c) Petersen hernia

d) Maydl hernia

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Question 24:

A 25-year-old fit athlete presents to the OPD with complaints of nausea and heartburn. On examination, a soft, pea-sized swelling could be palpated on his abdomen. What is the likely diagnosis in this patient?

a) Umbilical hernia

b) Fatty hernia of linea alba

c) Incisional hernia

d) Paraduodenal hernia

Question 25:

An 83-year-old lady was brought to the OPD with a two-day history of nausea, thigh pain and obstipation. Her family reported a significant weight loss over the last year attributed to grieving over her son's death. On examination, there is no lump in her groin. But, she experiences pain along the anteromedial aspect of her thigh which is relieved by thigh flexion. Which of the following statements regarding her condition is true?

a) Femoral hernia is the most likely diagnosis

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b) Howship Romberg sign can be elicited

c) Transinguinal approach is preferred for surgery

d) These hernias are almost always interparietal

Question 26:

Hernia with hydrocele is known as _____.

a) Gibbon's hernia

b) Berger's hernia

c) Beclard's hernia

d) Ogilvie's hernia

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Question 27:

According to the European Hernia Society classification, M3 incisional hernia refers to:

a) Epigastric

b) Infraumbilical

c) Umbilical

d) Suprapubic

Question 28:

A young female patient who had been suffering from chronic abdominal pain is rushed to the casualty due to acute exacerbation. On further investigations, she is diagnosed with intestinal obstruction secondary to a paraduodenal hernia. Which of the following statements regarding the hernia is false?

a) Left-sided hernia is found in the fossa of Landzert

b) Right sided hernia is found in the fossa of Kolb

c) It is usually congenital

d) It is more common on the right side

Question 29:

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An infant who is diagnosed with congenital hypothyroidism presents with the following hernia. Which of the following statements is false regarding the management of this child?



a) The hernia may spontaneously resolve by 2 years of age

b) Surgical repair is indicated if the hernia persists for more than 5 years of age

c) Strangulation is a common complication associated with this hernia in this child

d) Mayo's procedure or mesh repair can be done for this hernia

Question 30:

A baby was born with a congenital defect as shown below. Which of the following statements is false regarding this condition?



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a) It is associated with trisomy 13

b) It is due to failure of physiological hernia to reduce before 7 weeks

c) Seen in term babies

d) Topical application of silver nitrate is done

Question 31:

A 3-month-old child presented with umbilical discharge. Abdomen examination was normal except for the below finding. The next step of management is?



a) MRI Abdomen

b) USG Abdomen

c) CECT

d) Exploratory laparotomy

Question 32:

Which of the following is the most commonly seen tumor in the retroperitoneal space?

a) Liposarcoma

b) Rhabdomyosarcoma

c) Synovial sarcoma

d) Neurofibroma

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Answer Key

Question No.	Correct Option
1	c
2	d
3	b
4	c
5	c
6	c
7	b
8	a
9	a
10	b
11	b
12	c
13	d
14	d
15	a
16	c
17	b
18	d
19	a
20	c
21	b
22	c
23	d
24	b
25	b
26	a
27	c
28	d
29	c
30	b
31	b

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32	a

Detailed Explanations

Solution to Question 1:

The deep inguinal ring is an opening in the fascia transversalis, not in the transversus abdominis.

Solution to Question 2:

The femoral branch of the genitofemoral nerve is not a content of the inguinal canal.

The contents of the inguinal canal include:

- Spermatic cord in males
- Round ligament in females
- Ilioinguinal nerve in both the sexes.

The contents of the spermatic cord include:

- Cremaster muscle fibers
- Testicular artery and accompanying veins
- Genital branch of the genitofemoral nerve
- Vas deferens
- Cremasteric vessels
- Lymphatics
- Processus vaginalis

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Solution to Question 3:

Vas deferens does not form the boundary of Hesselbach's triangle.

Hesselbach's triangle (also called the inguinal triangle) is a region of the deep part of the anterior abdominal wall.

Solution to Question 4:

Cooper's ligament does not form the boundary of the triangle of doom.

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Solution to Question 5:

The medial border of the triangle of doom is bounded by vas deferens and the medial border of the myopectineal orifice is bounded by the lateral border of rectus abdominis.

The triangle of doom is bounded:

• Medially by the vas deferens

• Laterally by the vessels of the spermatic cord (gonadal vessels)

• Inferiorly by peritoneal reflection

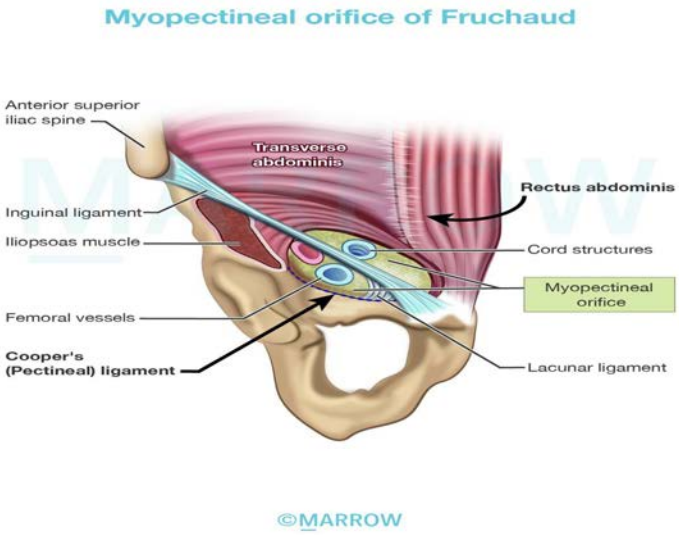
The myopectineal orifice is an osseo-myo-aponeurotic tunnel. It is through this tunnel that all groin hernias occur. It is bounded:

• Medially by the lateral border of the rectus sheath.

• Above by the arched fibers of the internal oblique and transversus abdominis muscle.

• Laterally by the iliopsoas muscle.

• Below by the pectin pubis and fascia covering it.



Solution to Question 6:

Indirect inguinal hernias are by far the most common type of hernia in women. It is the most common hernia regardless of gender.

In men, indirect hernias predominate over direct hernias at a ratio of 2:1. Femoral hernia and umbilical hernias are more common in females compared to males at ratios of 10:1 and 2:1, respectively. Although femoral hernias occur more frequently in women than in men, inguinal hernia remains the most common hernia in women.

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Solution to Question 7:

Pubic tubercle is used to differentiate between inguinal and femoral hernias.

Inguinal hernia is above and medial to the pubic tubercle.

Femoral hernia is below and lateral to the pubic tubercle.

Another structure that is useful in differentiating between inguinal and femoral hernia is inguinal ligament. An inguinal hernia leaves the abdominal cavity just above the inguinal ligament and a femoral hernia leaves just below the inguinal ligament.

Solution to Question 8:

The sac and contents of a direct hernia protrude through Hesselbach's triangle, i.e., medial to the inferior epigastric artery.

Solution to Question 9:

Bubonocele is a type of indirect inguinal hernia where the hernia is limited to the inguinal canal.

Indirect inguinal hernia is more common on the right side because of the delay in atrophy of the processus vaginalis after the normal slower descent of the right testis to the scrotum during fetal development.

Solution to Question 10:

Strangulation is the most common serious complication of a hernia.

An incarcerated hernia is a part of the intestine or abdominal tissue that becomes trapped in the sac of a hernia.An incarcerated hernia can lead to a bowel obstruction or strangulation. Obstruction is characterized by colicky abdominal pain, vomiting, abdominal distension and obstipation. Features of obstruction along with vascular compromise is seen in strangluation. Strangulation occurs in 1% to 3% of groin hernias. It is more common at the extremes of life.

Most strangulated hernias are indirect inguinal hernias. However, femoral hernias have the highest rate of strangulation (15% to 20%) of all hernias, and it is, therefore, recommended that all femoral hernias be repaired at the time of discovery. Tenderness is the first sign of strangulation.

The first step is the correction of hypovolemia. The treatment of choice is immediate surgery. The fundus is opened first during surgery.

Solution to Question 11:

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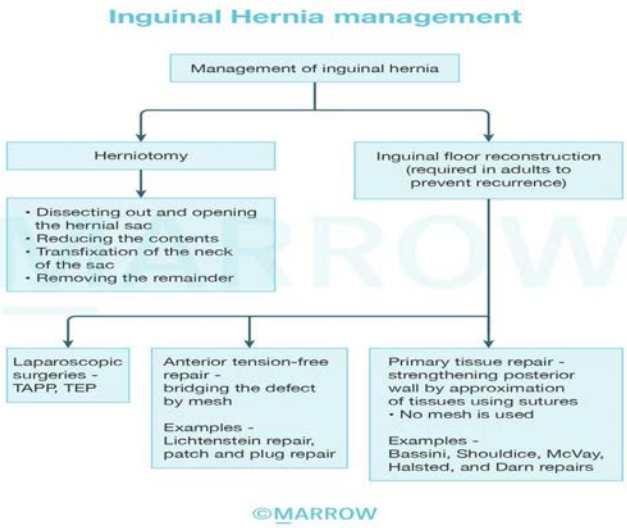
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The given clinical scenario of a hernia medial to the inferior epigastric artery is suggestive of a direct hernia, for which Lichtenstein mesh repair is the appropriate surgical method for its management.

The contents of a direct hernia protrude outward, forward, and medial to the inferior epigastric artery and the deep inguinal ring. Whereas, the contents of an indirect hernia protrude lateral to the inferior epigastric artery. The sac of an indirect inguinal hernia passes from the deep inguinal ring obliquely towards the superficial inguinal ring and then to the scrotum.

A direct hernia protrudes through the Hesselbach triangle, which is a zone of weakness for direct hernias.

A Lichtenstein mesh repair is currently one of the most frequently used methods for treating an inguinal hernia. It is done for the reconstruction of the inguinal floor in adults. It is an anterior tension-free mesh repair that reduces the chances of recurrence of a hernia. A piece of prosthetic nonabsorbable mesh is used to bridge the defect in this repair.



Other surgical methods used for the repair of an inguinal hernia are:

• Bassini repair - It is done for the reconstruction of the inguinal floor in adults. In this method, a mesh is not used. It is associated with a high recurrence and is not used frequently now. It is used only in cases of hernial strangulation and peritonitis where the use of a mesh is not preferred. It is performed by suturing the transversus abdominis and internal oblique musculoaponeurotic arches/conjoined tendon to the inguinal ligament.

• Shouldice repair - It is a multilayered repair, where the posterior wall of the inguinal canal is strengthened by continuous sutures. It involves double-breasting of the transversalis fascia. It is associated with a very low recurrence rate.

• Gilbert repair (plug and patch repair) - It is an extension of Lichtenstein's original mesh repair and has now become the most commonly performed primary anterior inguinal hernia repair. In this technique, a cone-shaped plug of polypropylene mesh is used. It is deployed like an upside-down umbrella when inserted into the internal inguinal ring to occlude the hernia

• McVay repair (Cooper's ligament repair) is used for the correction of direct inguinal hernia, large indirect hernia, recurrent hernia, femoral hernias (particularly suited for strangulated femoral

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hernias). In this method, the transversus abdominis aponeurosis is approximated to Cooper's ligament.

• Stoppa-Rives repair - It is used for the repair of large, recurrent, or bilateral hernias. In this method, a sub-umbilical midline incision is given to place a large mesh into the preperitoneal space.

• Herniotomy - It is used to treat inguinal hernia in a child which occurs due to the presence of a patent processus vaginalis. Therefore in herniotomy, the repair of the inguinal ring is not done.

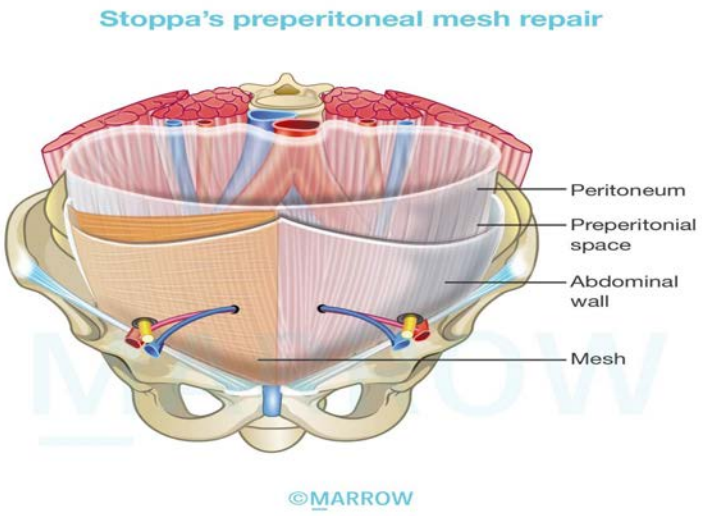
Solution to Question 12:

With smaller defects, the mesh does not need to be sutured in Stoppa's repair.

This is based on Pascal's law. Pascal's law states that any additional pressure exerted on an enclosed fluid mass is transmitted equally in all directions.The abdomen is an enclosed space and intra-abdominal pressure is distributed equally over the mesh, thereby keeping the mesh in place.

Stoppa's repair is an open preperitoneal mesh repair primarily indicated for large, recurrent, bilateral hernias.

In Stoppa's mesh repair, a large piece of mesh is placed in the retro muscular space, over the posterior rectus sheath or peritoneum. This mesh is not sutured in patients with small defects because it is held in place by intra-abdominal pressure (Pascal's law). This allows the eventual incorporation of the mesh with the surrounding tissues. Alternatively, in larger defects, the mesh can be secured laterally with several sutures.



Solution to Question 13:

Inguinal hernia in a child is treated by herniotomy. In this procedure, repair of the inguinal ring is not done.

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This is because the inguinal hernia in the pediatric population is due to the presence of patent processus vaginalis and not due to the weakening of the abdominal muscles or the ligaments.

Herniotomy involves either reduction of the hernial sac alone, or opening of the hernial sac, reduction of the contents, transfixation of the neck, and excision of the patent processus vaginalis/ hernial sac.

Solution to Question 14:

The most appropriate mesh used in hernioplasty is a lightweight mesh with large pores.

Lightweight meshes generally contain less material and induce a less-pronounced foreign body reaction and decreased inflammatory response, which results in better tissue incorporation, increased prosthesis compliance, and decreased patient discomfort and pain.

Meshes with large pores exhibit less inflammatory infiltrate, connective tissue, and scar bridging, which allows increased soft tissue ingrowth. They have greater elasticity and flexibility and also shrink less resulting in lesser adhesions, better tissue incorporation, and decreased patient discomfort and pain. So the best mesh type among the given options is lightweight mesh with large pores.

Meshes used in hernioplasty can be synthetic or biological depending on their composition.

Synthetic meshes are made from polypropylene, polyester, or PTFE (polytetrafluoroethylene).

PTFE meshes are hydrophobic with a lower risk of adhesion.

Biological meshes are acellular matrix materials derived from humans or animals and have lesser complications. But due to poor collagen deposition and absorption, they rapidly lose mechanical strength and hence their use is restricted to infected environments.

Note: To promote better tissue integration, a composite mesh was developed which combines the attributes of polypropylene and PTFE by layering the two substances on top of one another.

POLYPROPYLENE	POLYESTER	PTFE
monofilament	multifilament	solid
hydrophobic	hydrophilic	hydrophobic
rigid	elastic	rigid

Solution to Question 15:

Loss of sensation in the root of the penis and adjacent part of the scrotum is suggestive of an injury to the ilioinguinal nerve. It is most commonly injured within the inguinal canal in open hernia repair due to traction or thermal injury.

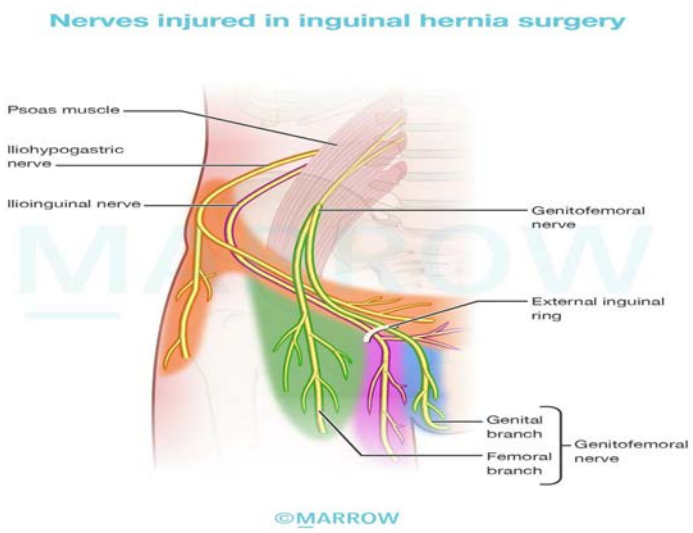
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The iliohypogastric nerve carries the sensory supply from the suprapubic area. Injury to this nerve in the right iliac fossa rarely causes sensory disturbances, as the suprapubic area has a rich nerve supply from other sources too. If the nerve is severed above the anterior superior iliac spine, it can lead to the weakened posterior wall of the inguinal canal resulting in direct inguinal hernia. Iliohypogastric nerve can also get injured following appendicectomy.

Injury to the genital branch of the genitofemoral nerve results in loss of sensation in the skin of the scrotum of males, and loss of sensation of the mons pubis and labia majora in females.

Injury to the femoral branch of the genitofemoral nerve causes hypoesthesia over the anterior thigh below the inguinal ligament.



Solution to Question 16:

Femoral hernia is classified under type 7 Gilbert hernia.

As per Nyhus classification system, femoral hernia is classified under type 3C.

Solution to Question 17:

All femoral hernias should be repaired and incarcerated femoral hernias should have the hernia sac contents examined for viability.

Option A: Femoral hernia occurs in both males and females, but it is more common in multiparous females. Femoral hernia is more common on the right side because of the tamponading effect of the sigmoid colon on the left femoral canal. This effect is absent on the right side.

Option C: The incidence of strangulation in femoral hernias is high because of the narrowness of the neck of the sac and rigidity of the femoral ring.

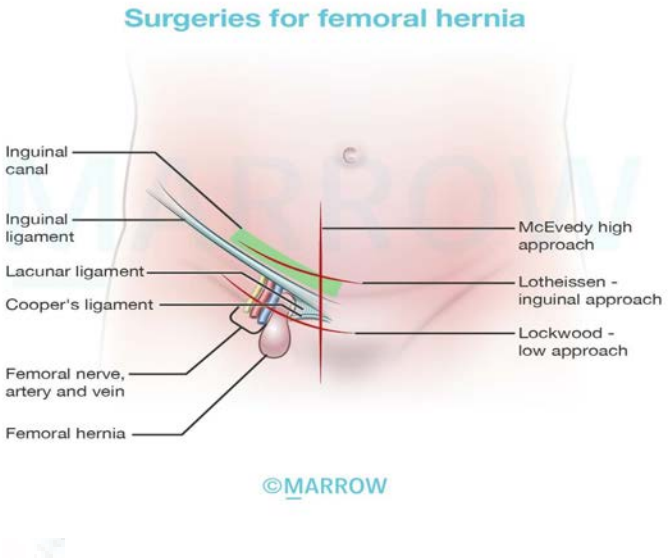
Option D: Femoral vein is situated lateral to a femoral hernia (femoral canal).

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Solution to Question 18:

The correct option is 1-B, 2-A, 3-D, 4-C.

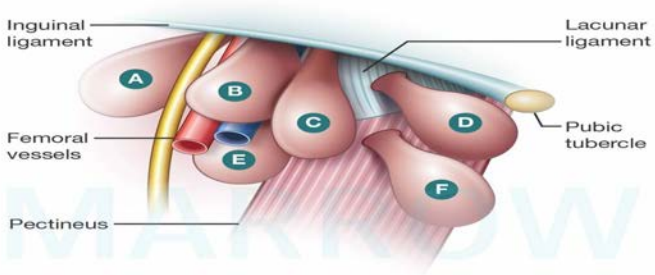
Surgery	Indication
1.Lockwood'ssurgery	B.Electiverepair
2.McEvedy'ssurgery	A. Presence of bowelinfarction
3.Lotheissen'ssurgery	D.Trans-inguinalapproach
4.McVay'ssurgery	C. For bothfemoralandinguinalhernia



Solution to Question 19:

Laugier's hernia is an atypical femoral hernia where the sac herniates through a gap in the lacunar (Gimbernat's) ligament.

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A Hesselbach's hernia
B Pre vascular / Velpeau's hernia
C Femoral hernia
D Laugier's hernia
E Serafini's / retrovascular hernia
F Cloquet's hernia

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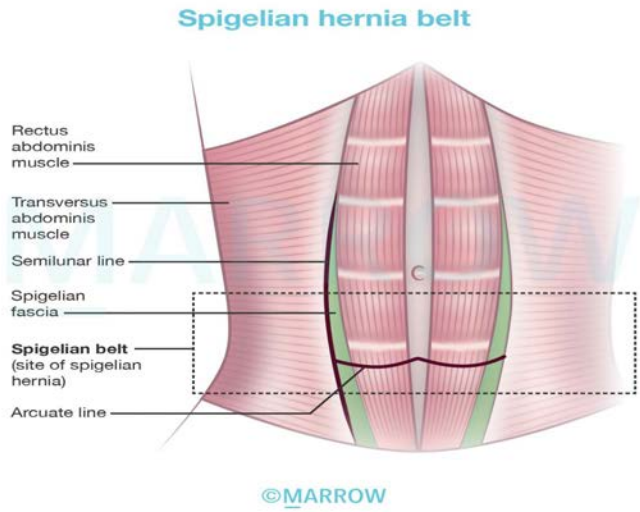
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Solution to Question 20:

Usually, Spigelian hernias do not present as a mass because it is beneath the intact external oblique aponeurosis.

The most common presentation in Spigelian hernia is pain.

There is a common misconception that they protrude below the arcuate line owing to the deficiency of the posterior rectus sheath at that level; but in fact, the defect is almost always above the arcuate line.



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Solution to Question 21:

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The given clinical scenario is that of a sliding hernia.

Sliding hernia occurs when an internal organ composes a portion of the wall of the hernia sac.

The most common viscus involved are as follows:

• Left side: sigmoid colon and its mesentery

• Right side: cecum

It is more common on the left side. Most sliding hernias are variants of indirect inguinal hernias. The primary danger associated with a sliding hernia is the failure to recognize the visceral component of the hernia sac resulting in injury to the bowel or bladder.

Option A: A lumbar hernia is a posterolateral body wall hernia where the bowel, omentum, or pre-peritoneal fat herniates through the lumbar triangles.

Option C: A Spigelian hernia occurs through slit-like defects in the anterior abdominal wall adjacent to the semilunar line. Most spigelian hernias occur in the lower abdomen where the posterior sheath is deficient. It is also called “spontaneous lateral ventral hernia” or “hernia of the semilunar line”.

Option D: A pantaloon hernia occurs when both a direct and an indirect hernia develop on the same side of the groin. The hernia is named pantaloon because the two hernia sacs are divided by epigastric vessels, and so they look like a pair of pants.

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Solution to Question 22:

The given clinical scenario is suggestive of an iatrogenic lumbar hernia which developed due to weakening of the posterior abdominal wall due to surgery. It occurs more commonly on the left side.

A lumbar hernia is a posterolateral body wall hernia where the bowel, omentum, or pre-peritoneal fat herniates through the lumbar triangles. Causes can be congenital, acquired, traumatic, or iatrogenic. It is frequently confused for lipomas, muscle strains, fibromas, abscesses, and kidney tumors.

Solution to Question 23:

The diagram shows Maydl’s hernia/Hernia-en-W/retrograde hernia, where 2 loops of the bowel remain in the hernia sac with the connecting loop inside the abdomen.

Option A: In Richter's hernia, a small portion of the antimesenteric wall of the intestine is trapped within the hernia. Strangulation can occur without the presence of intestinal obstruction. Clinically, it mimics gastroenteritis.

Option B: In Littre’s hernia, Meckel’s diverticulum is the content. Amyand’s hernia is an inguinal hernia in which the hernia sac contains a normal or acutely inflamed appendix.

Option C: Petersen hernia is caused by the herniation of intestinal loops through the defect between the small bowel limbs, the transverse mesocolon, and the retroperitoneum, after any type

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of gastrojejunostomy.

Solution to Question 24:

The likely diagnosis in this patient is epigastric hernia, also known as fatty hernia of linea alba.

Epigastric hernia is located between the xiphoid process and umbilicus, usually in the midline. It occurs more commonly in males. A soft midline swelling can be felt more easily than seen. Pain occurs due to the incarceration of the preperitoneal fat and may simulate peptic ulcer. There is no overlying sac.

Solution to Question 25:

The given clinical scenario and examination findings are suggestive of obturator hernia. Howship-Romberg sign can be seen in patients with obturator hernia.

Howship-Romberg sign refers to pain in the anteromedial aspect of the thigh due to compression of the obturator nerve that is relieved by thigh flexion.

Obturator hernia is also known as skinny old lady hernia and French hernia. It occurs more commonly in thin, elderly, debilitated females.

Predisposing factors are:

• Women with wider pelvis and more triangular obturator canal

• Malnutrition

• Chronic constipation

• Chronic obstructive pulmonary disease (COPD)

• Multiparity

• Ascites

• Kyphoscoliosis

Intestinal obstruction can occur.

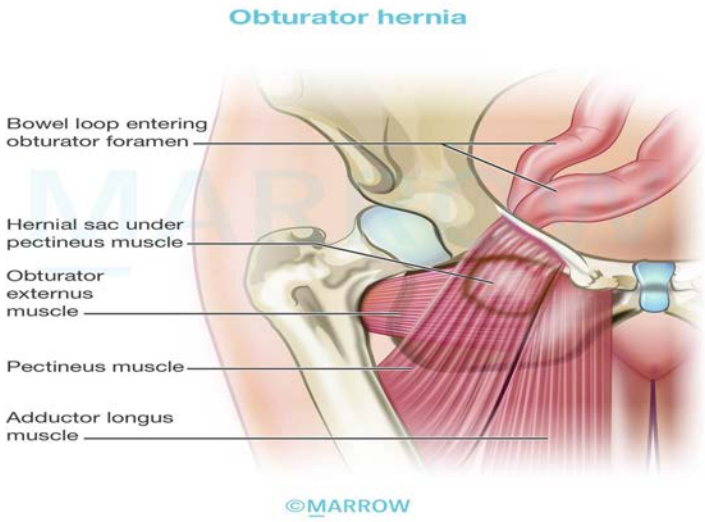
Option A: Femoral hernias commonly present as a small lump in the groin. They may be asymptomatic or present with strangulation in about 30% of patients.

Option C: A posterior approach, open or laparoscopic surgery is the treatment of choice. This approach provides direct access to the hernia.

Option D: Interparietal hernias are rare and occur when the sac lies between layers of the abdominal wall. These hernias most frequently occur in previous incisions. Spigelian hernias are almost always interparietal.

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Solution to Question 26:

Gibbon's hernia is a hernia with hydrocele.

Option B: Berger's hernia is hernia into the pouch of Douglas.

Option C: Beclard's hernia is femoral hernia through the opening of the saphenous vein.

Option D: Ogilvie's hernia is hernia through a defect in conjoint tendon just lateral to where it inserts with the rectus sheath.

Edward Gibbon, the author of "The Decline and Fall of the Roman Empire," was greatly embarrassed by a large hydrocele. The second time that it was tapped, it became infected, and Gibbon died a few days later. The hydrocele was associated with a large scrotal hernia which had probably been punctured.

Solution to Question 27:

According to the European Hernia Society classification, M3 incisional hernia refers to umbilical hernia.

According to the European Hernia Society classification of incisional hernias:

Midline incisional hernias are classified as-

Lateral incisional hernias are classified as-

M1	Subxiphoidal
M2	Epigastric
M3	Umbilical

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M1	Subxiphoidal
M4	Infraumbilical
M5	Suprapubic

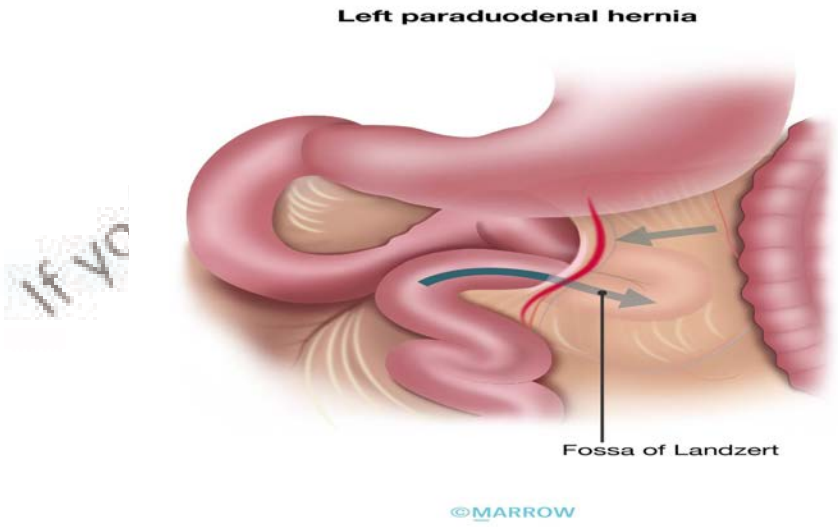
L1	Subcostal
L2	Flank
L3	Iliac
L4	Lumbar

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Solution to Question 28:

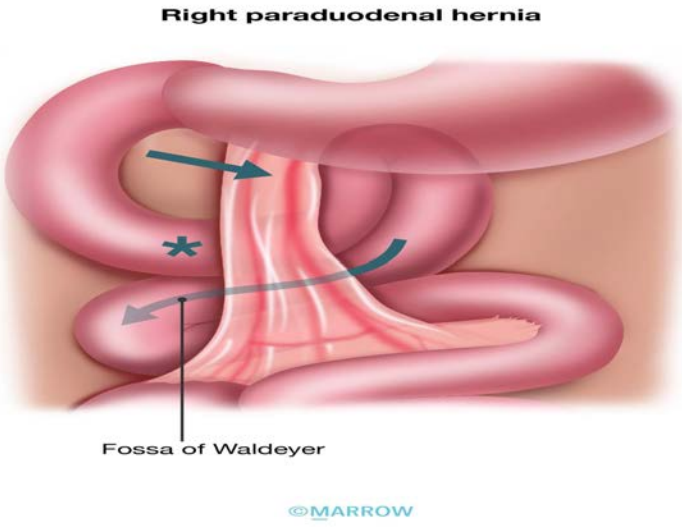
Paraduodenal hernia is more common on the left side (75%).

Option A: In Left-sided paraduodenal hernia, bowel herniates through the fossa of Landzert.



Option B: In right-sided paraduodenal hernia, bowel herniates through the fossa of Waldeyer/Kolb.

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Both the fossa of Landzert and the fossa of Waldeyer/Kolb are formed due to congenital mesenteric fusion defects.

Option C: Paraduodenal hernia is the most common internal hernia and they are usually congenital.

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Solution to Question 29:

The given clinical history of congenital hypothyroidism and the image showing a mass protruding out of the umbilicus are indicative of an umbilical hernia. Obstruction and strangulation are uncommon below the age of 3 years.

Mayo's operation is done for umbilical hernia. A small curved incision is made below the umbilicus and the neck of the sac is opened. The contents are returned to the peritoneal cavity and the redundant sac is excised after closing it. Defect in the linea alba is closed with interrupted sutures. Indications for surgery in umbilical hernia are:

- Defect size >2cm
- Persisting beyond 5 years
- Progressively enlarging after 2 years of age (usually regresses spontaneously by 2 years of age)
- Symptomatic
- Strangulated

In adults, defects up to 2cm in diameter may be sutured primarily with minimal tension. However, with larger defects, mesh reinforcement will be beneficial.

Solution to Question 30:

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The congenital defect showing herniation of the intestinal contents enclosed in a sac from the umbilicus is suggestive of omphalocele. It is due to the failure of the physiological hernia to reduce into the abdominal cavity before 10 weeks resulting in non-closure of the umbilical ring.

Physiological herniation of the midgut through the umbilicus occurs during the 5th week so as to accommodate the rapidly growing intestine and persists until the 10th week.

Omphalocele is seen in term babies and is usually associated with other congenital anomalies (e.g., trisomy 13, trisomy 18, or Beckwith-Wiedemann syndrome) and with increased levels of α-fetoprotein.

An omphalocele may contain the stomach, liver, and intestines. These contents are enclosed in a sac.

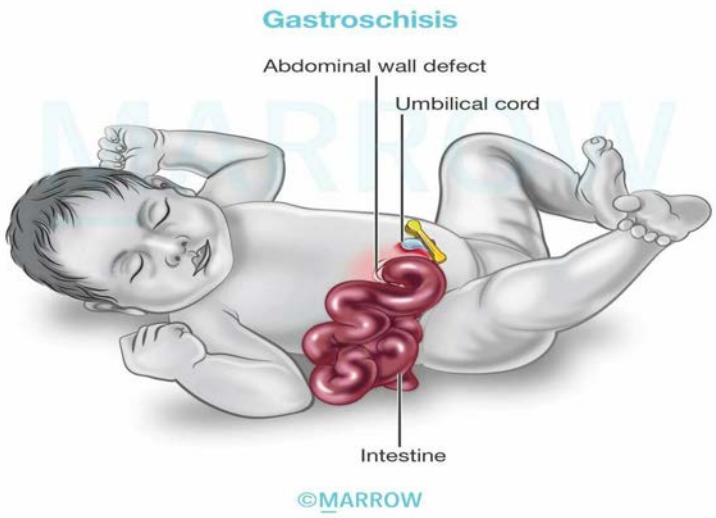
The treatment is as follows:

• Preservation of the intact sac with a sterile, moistened, saline gauze or transparent bowel bag.

• IV fluids should be started, along with gastric tube decompression and IV antibiotics.

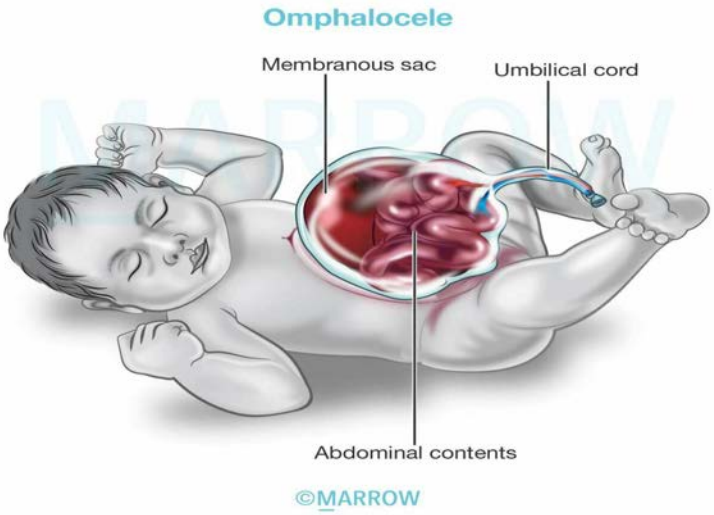
• Topical application of povidone-iodine ointment, merbromin (mercurochrome), or silver nitrate allows the sac to thicken and epithelialize gradually.

• Primary surgical closure is preferred for small to medium-sized defects.



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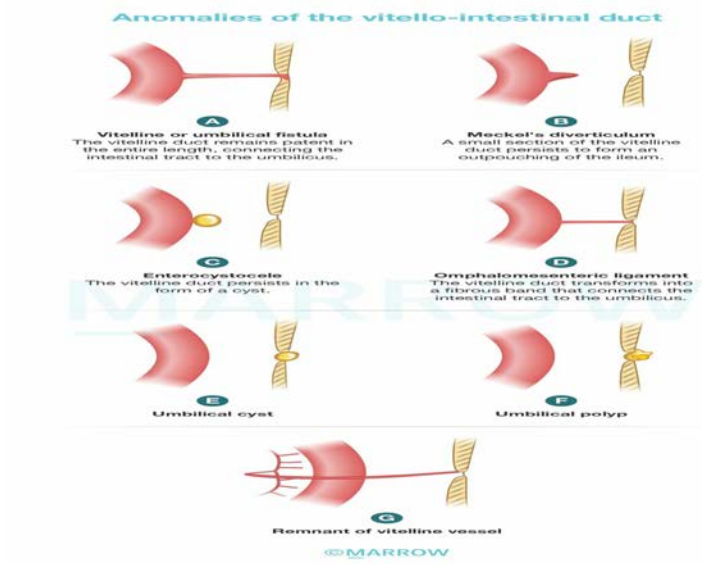
Solution to Question 31:

The given clinical image is that of a congenital umbilical anomaly such as patent urachus, urachal cyst, and vitelline cyst (resulting from the persistence of omphalomesenteric duct). The next best step is the USG abdomen to diagnose if the anomaly is cystic, fibrous or fistula and it's connections.

Omphalomesenteric duct abnormalities: Vitello intestinal duct or omphalomesenteric duct is the connection between the yolk sac and the midgut during embryonic life, which eventually gets obliterated. The persistence of the vitellointestinal duct leads to various abnormalities depending on which part of the duct remains patent.

- Persistence of the proximal intestinal end of the duct leads to Meckel's diverticula.
- Persistence of the distal end near the umbilicus leads to the umbilical polyp or sinus.
- Persistence of the distal end with mucus retention leads to the cyst, which may be associated with the intestine or the umbilicus by a fibrous band.
- A fully patent vitellointestinal duct can lead to an enterocutaneous fistula.

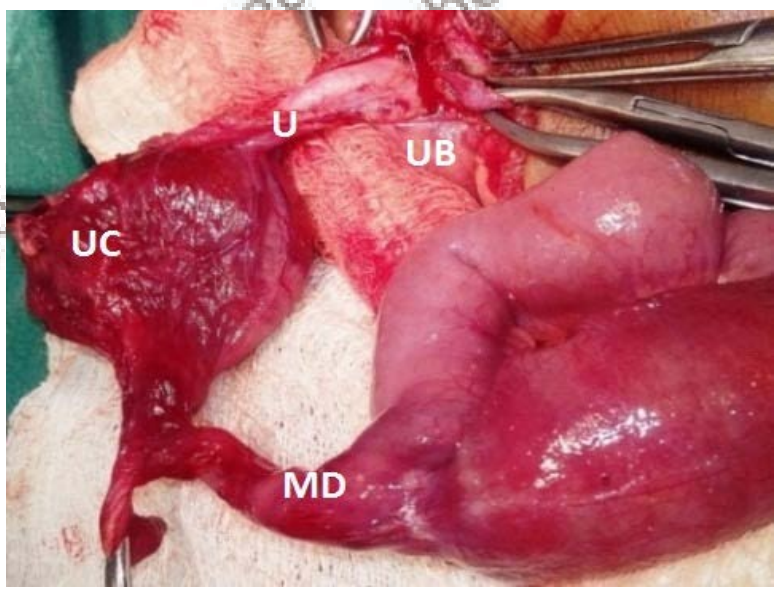
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Patent urachus occurs due to the failure of urachus to obliterate, resulting in a connection between the bladder and the umbilicus.

Urachal cyst occurs when the urachus fails to obliterate but there is no connection between the bladder and the umbilicus.

The given image below shows a urachal cyst (UC) attached to Meckel's diverticulum (MD) on one side and urinary bladder (UB) on the other side with a patent tract- urachus (U).



Solution to Question 32:

Liposarcoma is the most commonly seen tumor in retroperitoneal space.

Retroperitoneal tumors can be benign or malignant. Malignant retroperitoneal tumors may be mesodermal (75%), neuroectodermal (24%), or embryonic remnant (1%) in origin. Rarely it can

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be urologic or metastatic also. The order of frequency of primary retroperitoneal malignancy is as follows:

- Liposarcoma
- Leiomyosarcoma
- Rhabdomyosarcoma
- Fibrosarcoma
- Malignant nerve sheath tumors

Liposarcoma is composed of three histologic varieties (listed in order of decreasing frequency):

- Well-differentiated and undifferentiated liposarcoma
- Pleomorphic liposarcoma
- Myxoid/round cell liposarcoma

Among the three subtypes, pleomorphic liposarcoma is the most malignant and often metastasizes, while the well-differentiated is the least malignant. Myxoid liposarcoma has intermediate malignant behavior.

Diagnosis is confirmed by contrast-enhanced CT with CT of the chest to look for metastases.

Surgery is the main modality of treatment. Wide excision with complete en bloc dissection is done. Post-operative radiotherapy and chemotherapy are used as adjuvant methods. Radiotherapy is given at a dose of 5000 cGY, it can be external beam or intra-operative radiotherapy. Chemotherapeutic agents used are mesna, adriamycin, ifosfamide and dacarbazine (MAID regimen).

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Benign Conditions of Liver

Question 1:

Which of the following is a false statement regarding the anatomy of the liver?

a) Cantlie's line divides the liver functionally into two hemi-livers

b) The liver has 2 major and 2 minor fissures.

c) Three main hepatic veins divide the liver into four portal sectors

d) Each Couinaud's segment has its own vascular supply, biliary drainage and lymphatic drainage

Question 2:

A young patient presents with distension of the abdomen and yellowish discoloration of the eyes for the past 6 months. After a detailed workup, he is diagnosed with early-stage hepatocellular carcinoma in the left lobe of the liver. The surgeon decides to perform a left hemi-hepatectomy. Which of the following segments has to be removed in the patient?

a) I, II, III and IV

b) II and III only

c) II, III, and IV

d) I, III, IV and V

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Question 3:

What is the most common anomaly of the hepatic artery?

a) Independent origin of the right and left hepatic arteries from the cealic axis

b) Replaced right hepatic artery arising from the superior mesentric artery

c) Replaced left hepatic artery

d) Accessory right hepatic artery

Question 4:

The free hepatic venous pressure(FHVP) and wedged hepatic venous pressure(WHVP) of a patient, with suspected portal hypertension, are measured. How will the hepatic venous

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pressure gradient (HVPG) be determined from these values?

a) HVPG = WHVP – FHVP

b) HVPG = FHVP – WHVP

c) HVPG = FHVP + WHVP

d) HVPG = FHVP ÷ WHVP

Question 5:

Which of the following values indicate a normal portal venous pressure?

a) 1-3 mm of Hg

b) 3 - 5 mmHg

c) 5 – 10 mmHg

d) 10-12 mmHg

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Question 6:

All of the following are post-hepatic causes for portal hypertension, except_____

a) 2 and 4

b) 1,2 and 5

c) 1 and 3

d) 2,4 and 5

Question 7:

A patient who is a known case of chronic pancreatitis is diagnosed with splenic vein thrombosis. Which of the following is not true about this condition?

a) Endoscopy revealed gastric varices

b) USG abdomen showed normal liver and an enlarged spleen.

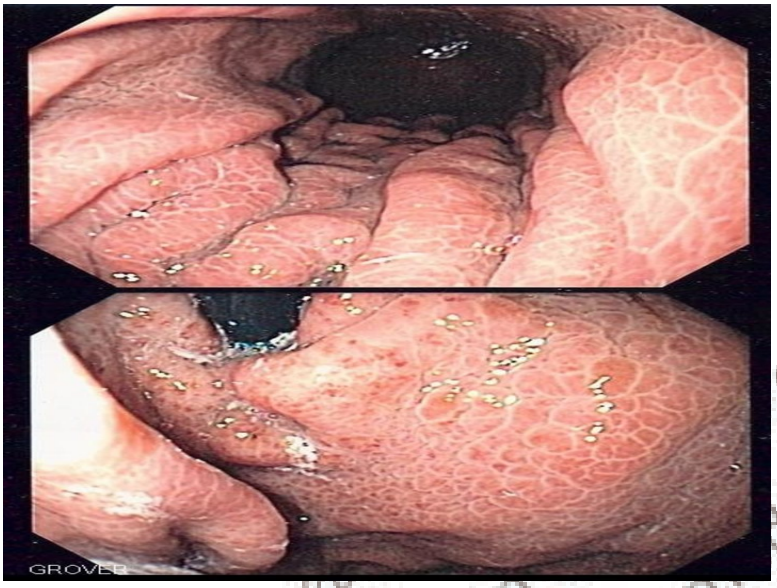
c) Portal vein pressure is normal

d) TIPSS is done as part of treatment

Question 8:

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An elderly patient with chronic black tarry stools underwent an upper GI endoscopy. Gastric mucosa appeared as shown below. What is the likely diagnosis?



a) Watermelon stomach

b) Portal hypertensive gastropathy

c) Menetrier's disease

d) Dieulafoy lesion

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Question 9:

Which of the following statements is false regarding Budd-Chiari syndrome?

a) Caudate lobe hypertrophy is seen in approximately 50% of the patients

b) Doppler ultrasonography is the initial investigation of choice

c) It becomes clinically significant when one or more major hepatic veins are obstructed

d) Oral contraceptive use is a risk factor

Question 10:

A 43-year-old woman presented to the hospital with complaints of abdominal pain and distension for the past 3 months. Her past medical records show that she has a JAK2 mutation and investigations revealed serum protein to be 3 g/dL and ascitic fluid protein to be 1.5 g/dL. Which of the following is false regarding this condition?

a) Anticoagulation is the mainstay of treatment

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b) Colour flow doppler is the initial investigation of choice

c) Surgical intervention is done in all cases

d) Ascites is a bad prognostic factor

Question 11:

A patient comes with active variceal bleeding. Which of the following is not done?

a) Platelet transfusion

b) Arrange pRBC

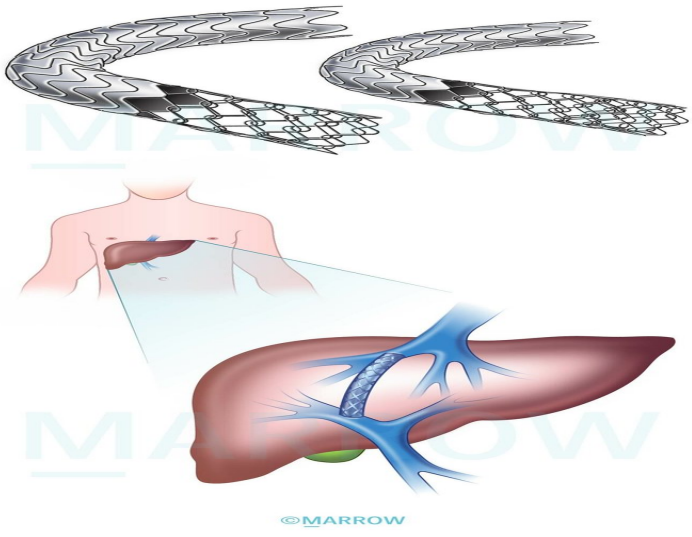
c) IV Octreotide

d) Urgent Endoscopy

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Question 12:

A 56-year-old patient with intractable ascites underwent a procedure as shown below. Identify the procedure.



a) Warren Shunt

b) Portocaval shunt

c) Transjugular Intrahepatic Portosystemic shunt

d) Linton Shunt

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Question 13:

A patient with liver cirrhosis is scheduled to undergo a laparotomy for a perforated appendix. According to the Child-Turcotte-Pugh score, which of the following parameters will you not use for this patient?

a) Ascites

b) INR

c) Encephalopathy

d) Creatinine

Question 14:

Which of the following is not a component of MELD score?

a) Creatinine

b) Serum Bilirubin

c) INR

d) Urea

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Question 15:

A 40-year-old male patient who was diagnosed with gangrenous appendix underwent an appendicectomy. On the second postoperative day, he developed fever, chills, jaundice, and right upper quadrant pain. Blood cultures revealed bacteremia and ultrasound abdomen revealed multiple hepatic abscesses. What is the most likely diagnosis?

a) Peliosis hepatis

b) Pylephlebitis

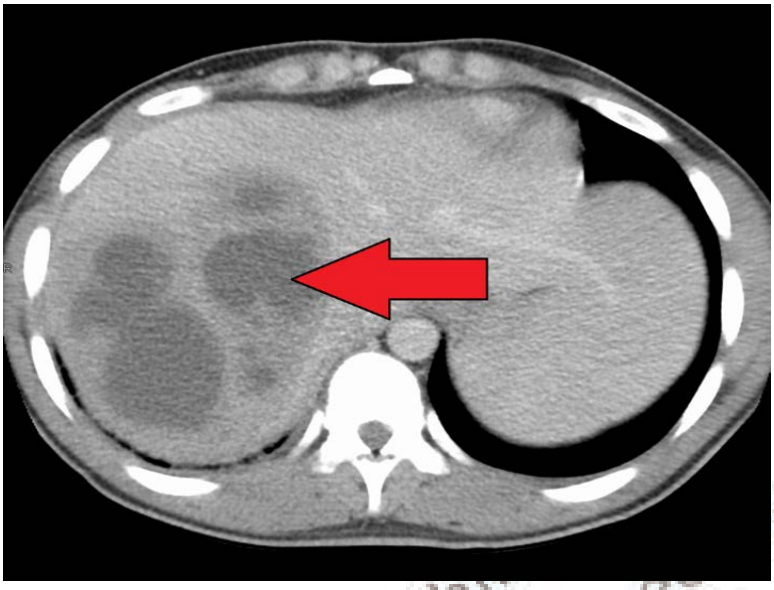
c) Hepatic necrotic nodule

d) Melioidosis

Question 16:

A 60-year-old male patient presented to the hospital with right upper quadrant pain and jaundice for the past 5 days. CT abdomen revealed the following finding and cultures of aspirate showed extensive bacterial growth. Which of the following is false regarding this condition?

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a) Anchovy sauce pus is seen on aspiration of abscess

b) Fever with chills is the most common presenting complaint

c) Eschericia coli and Klebsiella species are the most common organisms implicated

d) Ascending infection from the biliary tract is the most common route of spread

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Question 17:

Which of the following statements regarding investigations in a pyogenic liver abscess is true?

a) X-Ray findings are diagnostic.

b) USG shows hypoechoic lesion with poorly defined borders

c) Elevated ALP is the most common abnormal LFT.

d) PT and INR are normal

Question 18:

A healthy 55-year-old man presented with a 1-week history of fevers, chills, right upper quadrant tenderness, and hepatomegaly. CT was suggestive of a pyogenic liver abscess. Which of the following statements regarding management is true?

a) Empiric IV antibiotic therapy is first line

b) Percutaneous drainage is not routinely done

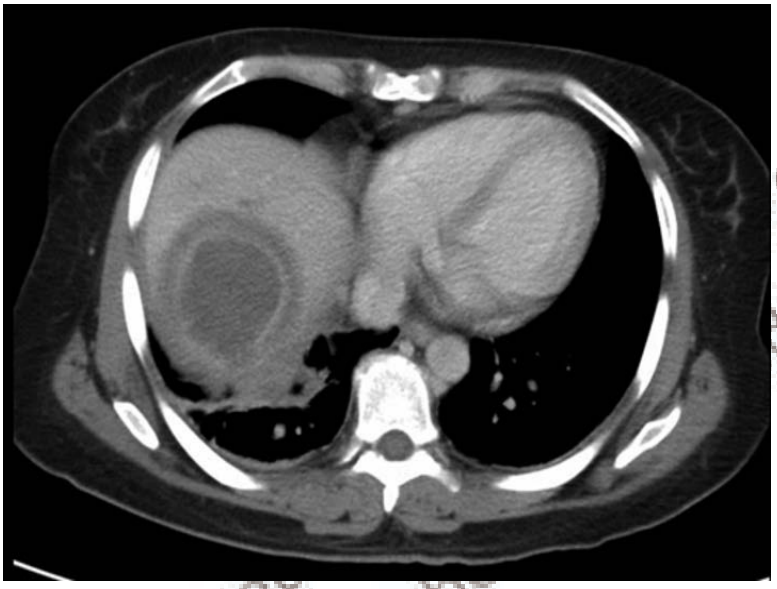
c) Open drainage is done with T-tube placement

d) Resection of the affected lobe is the treatment of choice

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Question 19:

A 35-year-old daily wage laborer presented with fever and abdominal pain for the past 1 week. Laboratory investigations showed anti-amoebic antibodies and CT abdomen showed the following. Which of the following is false regarding this condition?



a) Associated with alcohol consumption

b) Anchovy sauce pus is seen on aspiration

c) More common in females

d) Not usually associated with diarrhoea

Question 20:

Which of the following statements regarding amoebic liver abscess is false?

a) Culture of the aspirate is positive.

b) The diagnosis is based on the detection of antiamebic antibodies.

c) Management mainly consists of conservative treatment with metronidazole.

d) Technetium 99m scan is negative.

Question 21:

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Which of the following are not indications for percutaneous aspiration in a patient with a suspected amoebic liver abscess?

a) Uncertain diagnosis

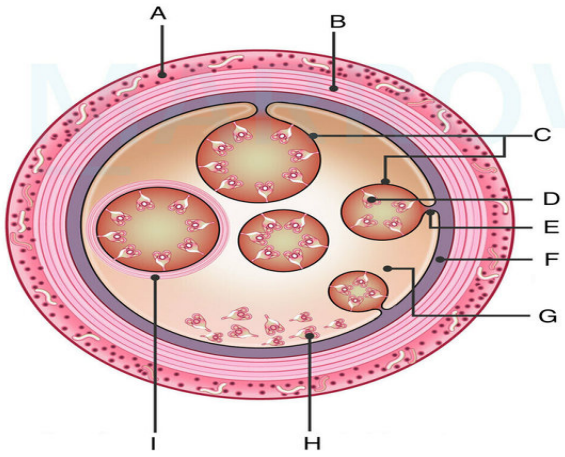
b) Left lobe abscess

c) Failure to respond to medical therapy

d) Abscess measuring 3 cm

Question 22:

In the given image, which of the following structures are matched correctly?



a) 4,5

b) 3,4,5

c) 1 and 5

d) 2 and 4

Question 23:

A patient was incidentally found to have a fluid filled cyst in his liver when he underwent a USG abdomen to check for renal calculi. It was later diagnosed as echinococcosis. Which of the following is false regarding this condition?

a) Dogs are definitive hosts

b) Rupture can lead to severe anaphylactic reaction

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c) It is usually asymptomatic

d) Echinococcus multilocularis is the most common causative agent

Question 24:

A young villager presents to the clinic with abdominal pain for the past 1 month. He mentions that he keeps sheep inside the house. On examination, you feel a firm mass in the right hypochondrium and a hepatic hydatid cyst is suspected. Which of the following investigations have the highest sensitivity in confirming the diagnosis?

a) USG

b) Casoni's test

c) CT scan

d) ELISA

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Question 25:

A patient is suspected to have a hydatid cyst of the liver. If imaging studies are performed, all of the following signs will denote detached or collapsed cyst except____

a) Serpent sign

b) Ball of wool sign

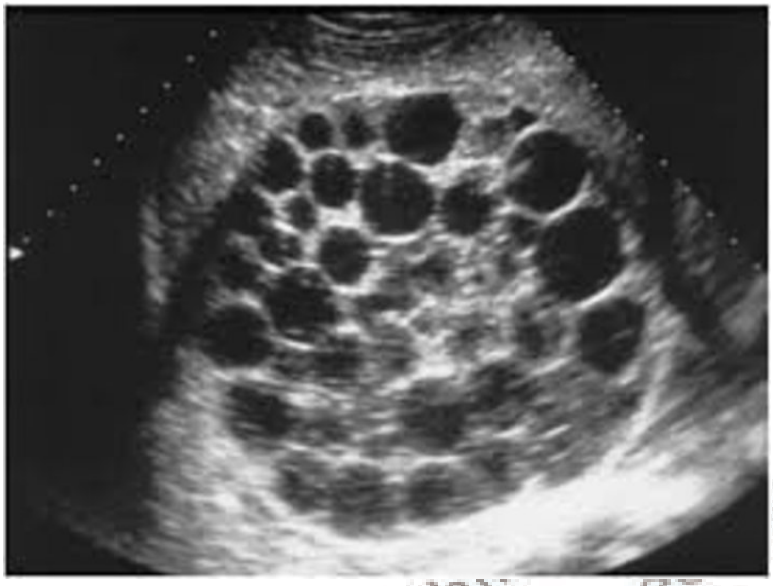
c) Water lily sign

d) Double line sign

Question 26:

A young sheep farmer presents to the OPD with pain in the right upper part of the abdomen. On examination, there is tenderness and enlargement of the liver. Abdominal ultrasound shows the following finding. As per the WHO classification of cystic echinococcosis, which class does this belong to?

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a) CE3B

b) CE2

c) CE3A

d) CE4

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Question 27:

A 45-year-old man presents with right upper quadrant pain for the last 6 weeks. On examination, a firm mass is palpable in the right hypochondrium region. CECT abdomen shows a 6 cm cystic structure in the right lobe of the liver along with water lily sign. Which of the following is the ideal management for him?

a) Laparoscopic cystectomy+ scolicidal agent instillation

b) Large bore percutaneous drainage

c) Albendazole therapy + PAIR

d) Careful observation with imaging every 6 months

Question 28:

Which of the following is a contraindication for performing PAIR technique in hydatid cyst disease?

a) Transitional cyst with detached membranes

b) Pregnant woman with CE1 hydatid cyst

c) Hydatid cyst with honeycomb appearance

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d) Cyst > 5 cm in different liver segments

Question 29:

A dog trainer presented to the hospital with a history of pain in the upper part of the abdomen. The surgeon decides to perform a percutaneous aspiration, injection, and reaspiration (PAIR) of the cyst after a 6 cm single hydatid cyst was detected. All of the following can be used as scolicidal agents in this procedure except?

a) Alcohol

b) Formalin

c) Sodium hypochlorite

d) Povidone iodine

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Question 30:

Capitonnage is used in the treatment of which of the following conditions?

a) Pyogenic liver abscess

b) Hepatic tuberculosis

c) Hydatid cyst

d) Polycystic disease of liver

Question 31:

Which of the following do not cause peliosis hepatis?

a) Analgesics

b) Bartonella infection

c) Anabolic steroids

d) Tamoxifen

Answer Key

Question No.	Correct Option

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1	b
2	c
3	b
4	a
5	c
6	d
7	d
8	b
9	c
10	c
11	a
12	c
13	d
14	d
15	b
16	a
17	c
18	a
19	c
20	a
21	d
22	a
23	d
24	c
25	d
26	b
27	c
28	c
29	b
30	c
31	a

Detailed Explanations

Solution to Question 1:

The liver has 3 major and 3 minor fissures.

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The major portal fissures (are not visible on the liver surface and run through the parenchyma)

• Middle/main portal fissure (Cantlie's line)

• extends from the midpoint of the gallbladder fossa at the inferior margin of the liver back to the midpoint of the inferior vena cava.

• Contains the middle hepatic vein

• Separates the liver into the right and left hemi-livers.

• Right portal fissure

• Contains the right hepatic vein

• Divides the liver into the right anterior/medial sector (segments V and VIII) and right posterior/lateral sector (segments VI and VII).

• Left portal fissure

• Contains the left hepatic vein

• Separates the left anterior/medial (segments IV) and left posterior/lateral sectors (Segment II and III)

The three minor fissures (are visible as physical clefts of the liver surface)

• Umbilical fissure or fissure for the ligamentum teres

• Venous fissure or fissure for the ligamentum venosum

• Fissure of gans or Rouvière's sulcus

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Solution to Question 2:

In the left hemi-hepatectomy (also called left hepatectomy) the segments marked as II, III, and IV should be removed.

Couinaud classification is the commonly used classification of the liver. It divides the liver is divided into eight segments. Each segment has its own vascular supply, biliary drainage, and lymphatic drainage. Segment I corresponds to the caudate lobe of the liver and segment IV corresponds to the quadrate lobe of the liver.

The Couinaud's Liver Segments are as follows:

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Term for surgical resection	Couinaud segments	Diagram (pertinent area is shaded)
Right hepatectomy or Right hemihepatectomy	5, 6, 7, 8	
Left hepatectomy or Left hemihepatectomy	2, 3, 4	
Right anterior sectionectomy	5, 8	
Right posterior sectionectomy	6, 7	
Left medial sectionectomy	4	
Left lateral sectionectomy	2,3	
Segmentectomy (e.g. segmentectomy 6)	Any one of 1-8	
Bisegmentectomy (e.g. bisegmentectomy 5,6)	Any two of 1-8 in continuity	

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Solution to Question 3:

The most common anomaly of the hepatic artery is replaced right hepatic artery arising from the superior mesenteric artery.

Normally, the common hepatic artery gives off the right and left hepatic arteries. A middle hepatic artery branches off from the proximal left hepatic artery.

The replaced right hepatic artery directly supplies the right lobe of the liver.

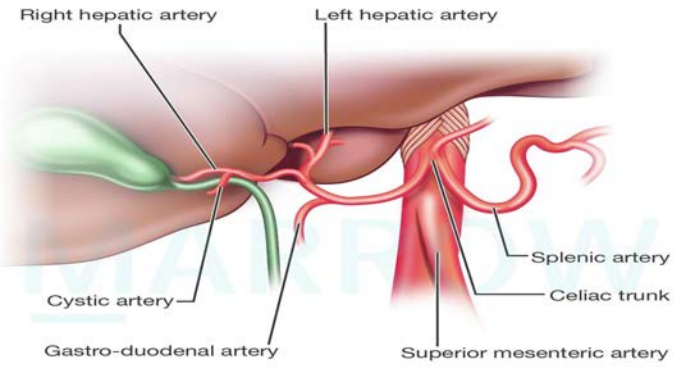
Surgical significance:

In individuals with replaced right hepatic artery, the diameter of the common hepatic artery is smaller. In liver transplant recipients, this can be a cause for the increased incidence of complications such as thrombosis.

Whereas, replaced right hepatic artery is a beneficial variant for donors undergoing donation of the right lobe of the liver. The replaced right hepatic artery provides a longer and larger graft thus reducing chances of thrombosis.

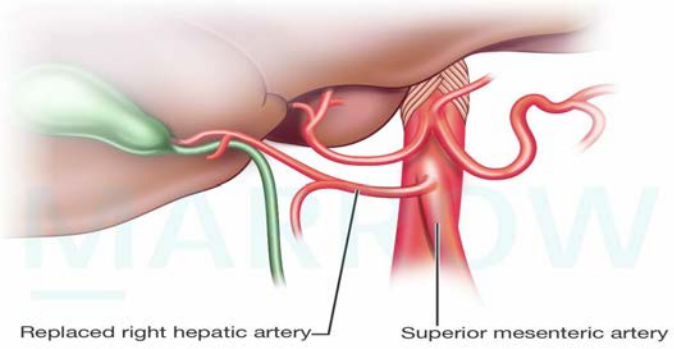
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Normal hepatic artery vasculature



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Replaced right hepatic artery



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Solution to Question 4:

Hepatic Venous Pressure Gradient is measured by subtracting Free Hepatic Venous Pressure from Wedged Hepatic Venous Pressure.

HVPG = WHVP – FHVP

Hepatic venous pressure gradient (HVPG) is the pressure gradient between the portal vein and the inferior vena cava (IVC). It is a measure of portal venous pressure. It can quantify the degree of portal hypertension due to sinusoidal resistance to blood flow.

The most accurate method of determining portal hypertension is by measuring HVPG. The most commonly used procedure involves placing a balloon catheter in the hepatic vein after a jugular vein puncture. The free hepatic venous pressure (FHVP) is measured with the balloon deflated, and the wedged hepatic venous pressure (WHVP) with the balloon inflated to occlude the hepatic

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vein.

Solution to Question 5:

The normal portal venous pressure is 5 to 10 mmHg.

Normal portal blood flow is 1 to 1.5 L/minute.

Hepatic venous pressure gradient (HVPG) is the difference between the wedge and free hepatic venous pressure, which is 1 to 5 mmHg.

HVPG interpretation:

• Normal HVPG is between 1 and 5 mmHg.

• Portal hypertension is present if the HVPG is ° 6 mmHg.

• Portal hypertension typically becomes clinically significant when the HVPG is ° 10 mmHg, at which point varices may develop.

• HVPG ° 12 mmHg, patients are at risk for variceal bleeding and the development of ascites.

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Solution to Question 6:

Splenomegaly is a pre-hepatic cause of portal hypertension. Sarcoidosis and primary biliary cholangitis are presinusoidal intrahepatic causes of portal hypertension.

Portal hypertension occurs when the pressure in the portal vein increases due to either increased resistance to blood flow secondary to fibrosis, active vasoconstriction, or hyperdynamic systemic circulation.

Solution to Question 7:

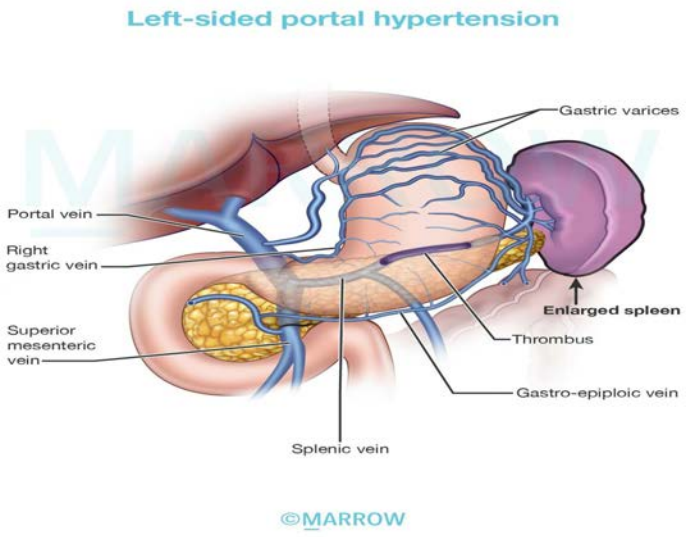
The above clinical scenario points to a case of splenic vein thrombosis which can cause left-sided portal hypertension. It is a pre-hepatic cause of portal hypertension. It is managed by splenectomy.

Splenic vein thrombosis can be due to pancreatic inflammation or neoplasms (acute or chronic pancreatitis, pseudocysts, and carcinomas) that extend outside the pancreas and invades the splenic vein. This causes increased pressure in the splenic vein leading to the formation of collaterals and ultimately gastric variceal hemorrhage (not esophageal varices).

Normal liver function tests, normal portal venous pressures, and splenomegaly are the distinguishing features from other forms of portal hypertension. The portal vein pressures remain normal as there is no obstruction of the hepatic venous vasculature.

Diagnosis is done by gastroscopy, liver function tests, ultrasound examination (with doppler), and contrast-enhanced CT scan of the abdomen. Treatment includes splenectomy and management of the primary pancreatic pathology.

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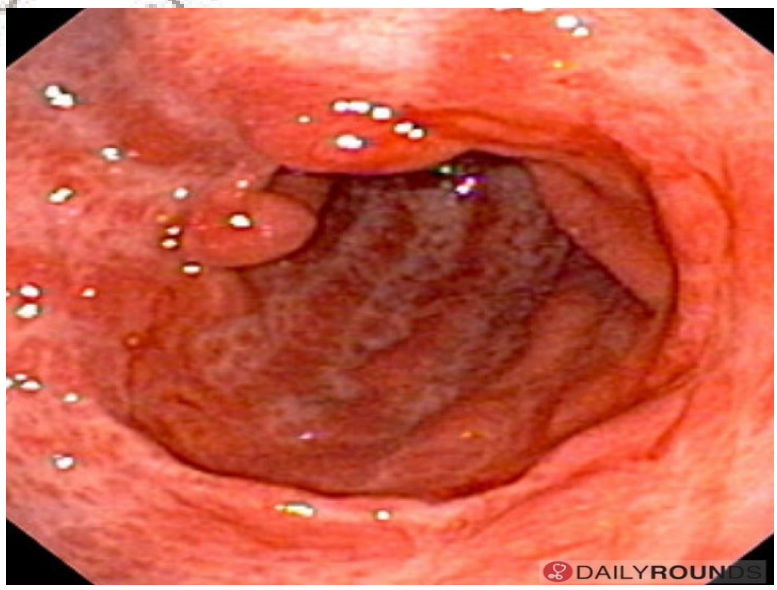
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Solution to Question 8:

The image shows the snake-skin appearance of the gastric mucosa, which is seen in cases of portal hypertensive gastropathy.

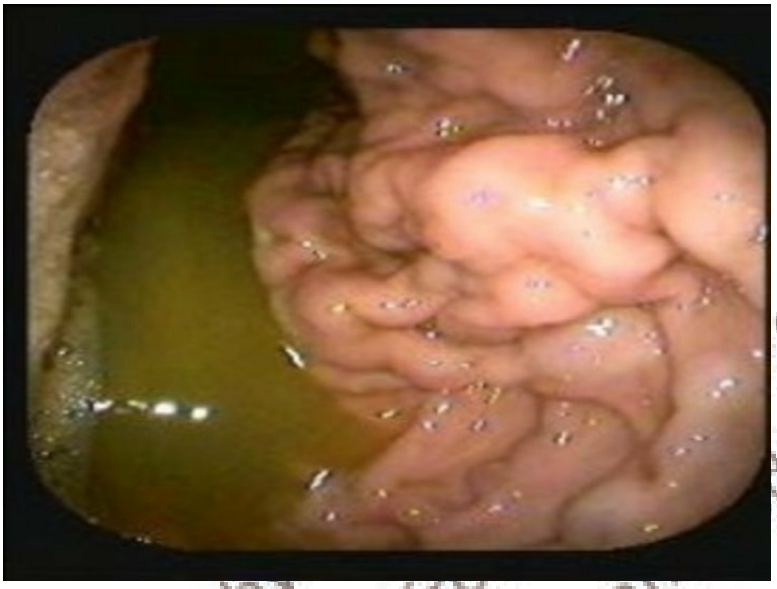
Portal hypertensive gastropathy is characterized by the diffuse dilation of the mucosal and submucosal venous plexus of the stomach associated with overlying gastritis.

Option A: Gastric antral vascular ectasia (GAVE) also known as watermelon stomach is a significant cause of acute or chronic gastrointestinal blood loss in the elderly, characterized endoscopically by watermelon stripes. It is associated with heterogeneous medical conditions, including hepatic, cardiac, and renal diseases.

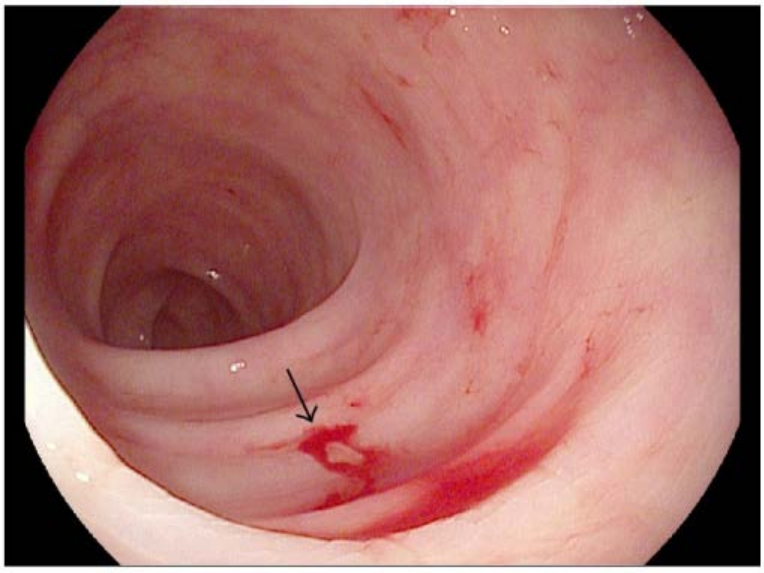


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Option C: Hypoproteinemic hypertrophic gastropathy also known as Menetrier's disease is a rare, acquired premalignant disease of the stomach characterized by massive gastric folds, little or no acid production, and excessive mucous production with resultant protein loss. The disorder is associated with excessive secretion of transforming growth factor-alpha.



Option D: Dieulafoy's lesion is a medical condition characterized by a large tortuous arteriole that erodes and bleeds and occurs most commonly in the stomach wall.



Solution to Question 9:

Budd–Chiari syndrome (BCS) is an uncommon congestive hepatopathy characterized by the obstruction of hepatic venous outflow and it becomes clinically significant when two or more major hepatic veins are obstructed.

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Types:

• Primary Budd–Chiari syndrome: when the obstructive process involves an endoluminal venous thrombosis.

• Secondary Budd–Chiari syndrome: when the veins are compressed or invaded by a neighboring lesion originating outside the vein.

Most common presentation: ascites and abdominal discomfort.

Risk factors include-Primary myeloproliferative disorders, anticardiolipin antibodies, hyperhomocysteinemia, and oral contraceptive use.

Caudate lobe hypertrophy is seen in approximately 50% of the cases and it is because the caudate lobe drains directly into the IVC.

Abdominal ultrasonography with color Doppler is the initial investigation of choice and can demonstrate the absence of hepatic vein flow, spider web hepatic veins, and collateral hepatic veins.

The definitive radiographic study is hepatic venography to determine the presence and extent of hepatic vein thrombus as well as measure inferior vena cava (IVC) pressures.

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Solution to Question 10:

The above clinical scenario describes a case of late budd-chiari syndrome and surgical interventions are not done in all cases of budd chiari syndrome.

SAAG = (serum albumin) – (ascitic fluid albumin)

= (3) - (1.5) = 1.5g/dL

As SAAG is >1.1g/dL(1.5g/dL) and ascitic fluid protein is < 2.5 g/dL, the most likely cause is late Budd-Chiari syndrome.Surgical interventions are done in those patients of Budd Chiari syndrome who are not responding to medical therapy.

Colour flow doppler is the initial investigation of choice.

Treatment:

• Initial treatment consists of medically managing the underlying disease process and preventing the extension of the hepatic vein thrombosis through systemic anticoagulation.

• The associated portal hypertension and ascites are managed in a manner similar to that in most cirrhotic patients.

• Radiologic and surgical intervention should be reserved for patients whose condition is nonresponsive to medical therapy. Percutaneous angioplasty and transjugular intrahepatic portosystemic shunt (TIPS), in combination with thrombolytic therapy, are the preferred strategies to restore the outflow of blood from the liver.

• Surgical shunting, particularly with the side-to-side portacaval shunt, turns the portal vein into a hepatic outflow tract.

Factors contributing to a bad prognosis in Budd-Chiari syndrome:

•

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Involvement of all three hepatic veins and/or portal vein

•

Presence of ascites

•

Older age at the time of presentation

•

High Child-Pugh score

•

Chronic disease at presentation

Note: JAK2 mutation points to a possibility of polycythemia vera predisposing the patient to hypercoagulable states and the formation of thrombus anywhere in the body. From the serum and ascitic protein values, we can calculate the SAAG (serum protein-ascitic protein).

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Solution to Question 11:

Platelet transfusion is not done in the case of active variceal bleeding unless coagulopathy is confirmed as the cause. Platelet transfusions are indicated only in patients with a platelet count of <50,000/microL or in patients with evidence of microvascular bleeding.

Variceal hemorrhage is a medical emergency. Varices usually present with the acute onset large-volume haematemesis, the lower esophagus being the most common site for variceal bleeding.

The sites for portosystemic anastomosis are:

• Left gastric vein to distal oesophageal veins: oesophageal and gastric variceal bleeding

• Superior rectal veins to Middle and inferior rectal veins: hemorrhoids and rectal bleeding

• Left branch of the portal vein to Periumbilical veins: caput-medusae

• The right branch of the portal vein to retroperitoneal veins draining into azygos, hemiazygos, lumbar, intercostal, and phrenic veins

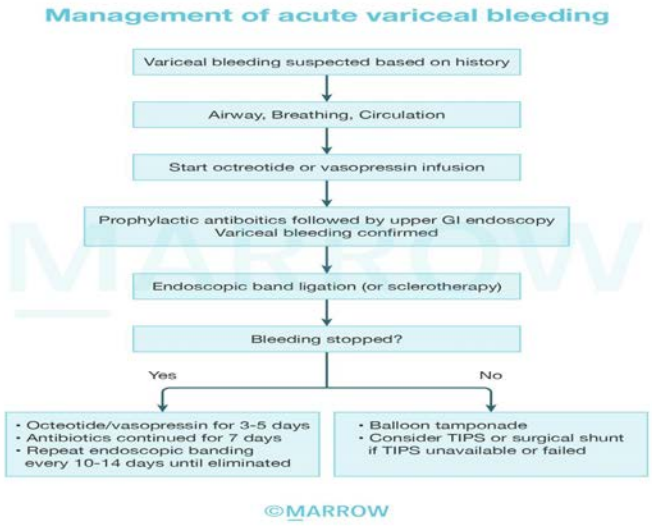
• Omental and colonic veins near hepatic and splenic ■exures to Retroperitoneal veins near hepatic and splenic ■exures

Medical management of variceal bleeding includes blood transfusion (option B) and drug therapy with somatostatin analogs like octreotide (option C). Short-term antibiotics like ceftriaxone are known to decrease bacterial infection and increase survival.

Surgical measures are preferred if medical management fails. They include balloon tamponade, endoscopic banding (option D), transjugular intrahepatic portosystemic shunt (TIPS), portosystemic shunts, splenectomy, and gastric revascularization

Note: Sugiura procedure is the non-shunt surgical management of refractory oesophageal variceal bleeding. It is a procedure of de-vascularizing the distal esophagus and stomach.

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Solution to Question 12:

The image shows the transjugular intrahepatic portosystemic shunt(TIPS) procedure with the viatorr device.

The main indication of TIPS is for variceal bleeds not responding to medical or endoscopic treatment, and intractable ascites.

The shunts are inserted under local anaesthetic, analgesia and sedation, using fluoroscopic guidance and ultrasonography. Via the internal jugular vein and superior venacava, a guidewire is inserted into a hepatic vein and through the hepatic parenchyma into a branch of the portal vein.

The main early complication of this technique is the perforation of the liver capsule and the main contraindication to TIPSS is portal vein occlusion.

Shunts for Portal Hypertension:

• Non- Selective Shunt- bowel and splenic blood is shunted

• Linton shunt (proximal lienorenal shunt with splenectomy)

• ECK fistula (portocaval shunt)

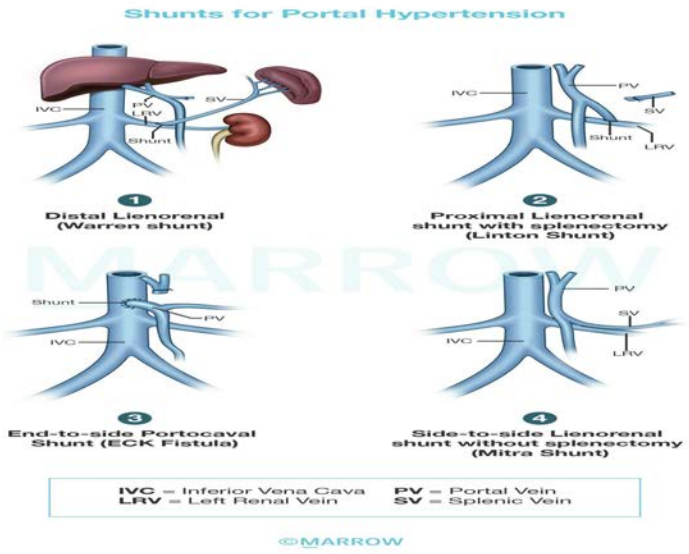
• Mitra shunt (splenorenal shunt)

• Selective Shunt- only splenic blood is shunted

• Warren shunt (distal lienorenal shunt)

• Inokuchi shunt

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Solution to Question 13:

Creatinine is not included in the Child–Turcotte–Pugh score or Child-Pugh scoring system.

It is used to assess the surgical mortality of cirrhotic patients undergoing intra-abdominal operations.

Solution to Question 14:

In MELD (model for end-stage liver disease) score, urea is not one of the components.

Solution to Question 15:

In the setting of existing appendicitis, the above clinical scenario points to a diagnosis of pylephlebitis (portal pyemia).

Pylephlebitis is thrombophlebitis of the portal venous system. It is a rare but very serious complication of intra-abdominal infections, such as gangrenous appendicitis, diverticulitis, etc. It spreads to the portal circulation via the mesenteric vein.

Clinical features are high fever, rigors, and jaundice and intrahepatic abscesses (often multiple) due to septicemia in the portal venous system. Treatment is with systemic antibiotics and percutaneous drainage of hepatic abscesses.

Option A: Peliosis hepatis is an uncommon vascular condition characterized by hemorrhagic dilatation of the hepatic sinusoids.

Option C: Hepatic necrotic nodules are usually small, solitary lesions, mainly located under the liver capsule of the right lobe. It is characterized by a necrotic central core surrounded by a dense

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hyalinized fibrotic capsule.

Option D: Melioidosis is an infectious disease caused by Burkholderia pseudomallei characterised by fever and multiple abscess formation in the lungs, liver, prostate, and spleen.

Solution to Question 16:

The given CT image shows cluster sign and the above clinical scenario is suggestive of pyogenic liver abscess. Anchovy sauce pus on aspiration is seen in amoebic liver abscess.

Pyogenic liver abscess is a polymicrobial infection seen more commonly in the elderly and immunocompromised. Ascending infection from the biliary tree (ascending suppurative cholangitis) is the most common route of spread.

The portal vein is the second most common source of infection leading to pylephlebitis (thrombophlebitis of the portal venous system causing portal pyemia) secondary to diverticulitis, appendicitis, pancreatitis, etc.

Organism:

• Most common in western countries: Escherichia coli

• Most common in Asian countries: Klebsiella pneumoniae

• Most common in children suffering from the chronic granulomatous disease: Staphylococcus

• Most common in gas-forming abscess: Klebsiella

Order of affected lobe: Right lobe (75%) > left lobe (20%) > caudate lobe (5%). Right lobe predilection might be due to preferential laminar blood flow.

Solution to Question 17:

Elevated serum alkaline phosphatase (ALP) level is the most common abnormal liver function test (LFT) in pyogenic liver abscess.

Laboratory features in pyogenic liver abscess:

• Non-specific findings such as leukocytosis, anemia

• Elevated ALP (most common), elevated bilirubin levels, increased prothrombin time (PT) and INR (chronic infection).

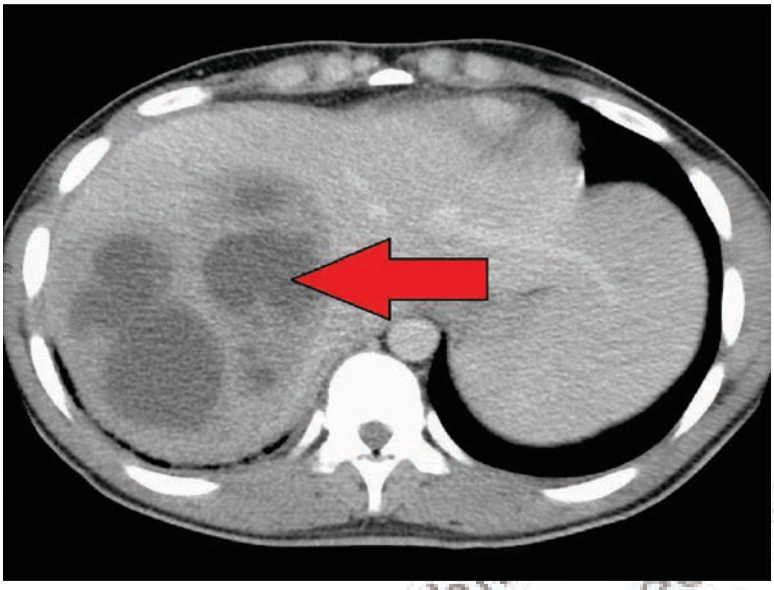
• Positive blood culture in 50% cases

Ultrasonography (USG) and computed tomography (CT) are investigations of choice . In ultrasound, pyogenic liver abscess appears as round or oval hypoechoic lesions with well defined borders and variable number of internal echoes. On CT, cluster sign is a feature of pyogenic hepatic abscesses.

Cluster sign in CT:

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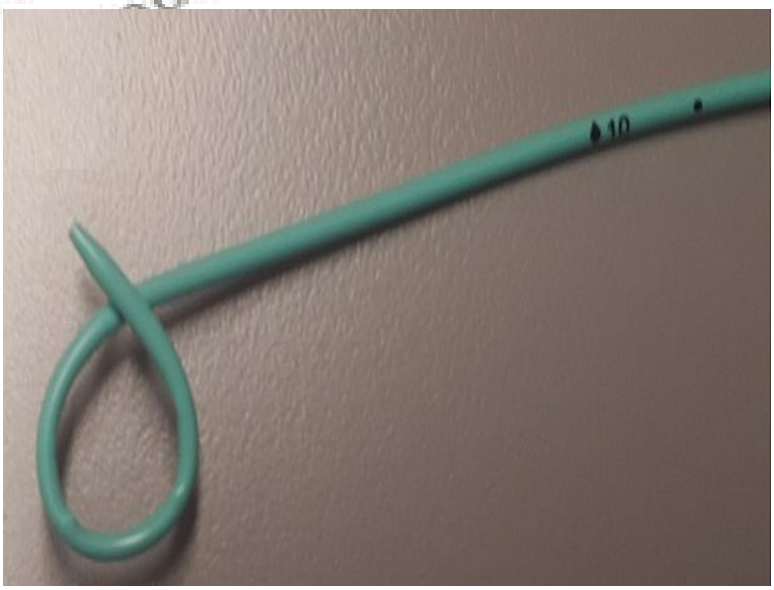
Solution to Question 18:

Empiric IV antibiotic therapy is the first-line treatment for pyogenic liver abscess.

Percutaneous drainage using a pigtail catheter is done routinely. It helps in the slow decompression of a cyst with viscous contents. It also has a lesser chance of dislodgement. Drainage tube catheter is placed under US/CT guidance into the liver abscess.

Surgical drainage using a laparoscopic or open approach is tried only when antibiotic therapy and percutaneous drainage fails. Open drainage is becoming less common at present. Liver resection is only occasionally required in severe hepatic destruction.

Pigtail catheter:



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Solution to Question 19:

The patient most likely has an amoebic liver abscess. It is more common in males than females (10:1).

Risk factors include:

• Males, 20-40 years of age

• Heavy alcohol consumption - liver becomes more susceptible

• Travel to an endemic area

• Poverty and cramped living conditions

• Impaired host immunity

• Colonic infection

The most common sites for amoebic liver abscesses are liver and paracaecal areas. The aspirate shows a characteristic anchovy sauce pus.

Even though this disease process is secondary to a colonic infection, the presence of diarrhoea is unusual.

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Solution to Question 20:

The culture of the amoebic abscess is usually sterile or negative.

The most useful laboratory evaluation is the measurement of circulating anti-amoebic antibodies, by enzyme immunoassay. The antibody can be present because of prior infection, and hence, detection of Entamoeba histolytica lectin antigen in the serum and liver abscess pus is more useful for acute infections than chronic infection.

Nuclear medicine studies, such as gallium scanning or technetium (99mTc) liver scans, can be helpful in differentiating pyogenic from amebic abscesses because amebic abscesses typically do not contain leukocytes and therefore do not light up on these scans.

The mainstay of treatment for amebic abscesses is metronidazole (750 mg orally, three times daily for 10 days), which is curative. Luminal agents such as iodoquinol, paromomycin, and diloxanide furoate can be administered into the cysts.

Solution to Question 21:

Percutaneous aspiration should be performed in amoebic liver abscess more than 5 cm.

Indications for percutaneous aspiration in amoebic liver abscess are:

• Large abscesses (>5 cm)

• Lack of response to medical therapy (in 5 days)

• Suspicion of superinfection

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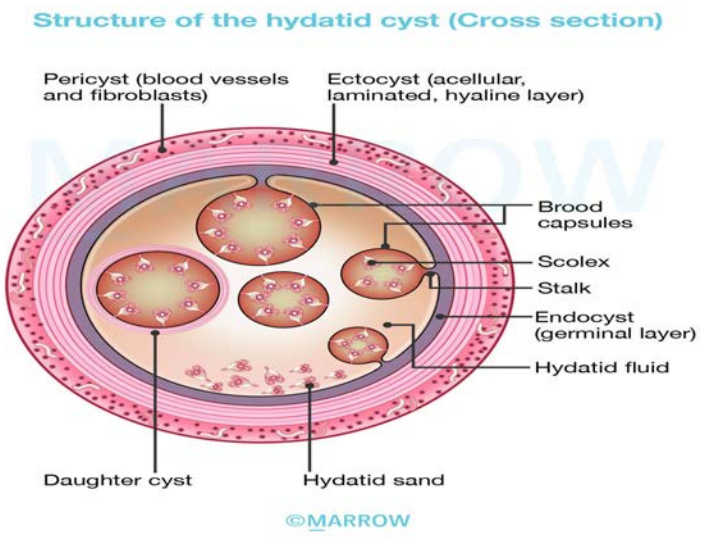
• Abscesses of the left lobe of the liver at risk for rupture into the pericardium

• Uncertain diagnosis

Laboratory investigations may reveal similar complete blood cell count and liver function test abnormalities in patients with amoebic liver abscesses and pyogenic liver abscesses. An elevated serum alkaline phosphatase (ALP) level is seen in both and is not specific.

Solution to Question 22:

F -Endocyst and H-Hydatid sand are matched correctly.



Hydatid disease or echinococcosis is a zoonotic infection caused by the Echinococcus species of flatworms. Its life cycle consists of sheep and dogs as hosts. Humans are accidental hosts.

A hydatid cyst usually develops three weeks after the infection. The cyst is surrounded by a fibrous capsule called pericyst that is derived from the host tissue.

The cyst wall is composed of two layers, ectocyst (outer gelatinous membrane), and endocyst (inner germinal membrane). Ectocyst is a laminated membrane, which is acellular. It helps in the passage of nutrients. The endocyst helps in producing the laminated membrane and scoleces.

The brood capsules are cellular masses in the hydatid fluid which consists of scoleces. In a definitive host, these scoleces develop into adult tapeworm while in the intermediate hosts these develop into new hydatid cysts. The brood capsules are attached to the endocyst by a pedicle or stalk.

The brood capsules may mature and detach from the mother cyst and become the daughter cysts, which are an exact replica of the mother cysts. The freed brood capsules and scoleces present in the hydatid fluid are called hydatid sand.

Solution to Question 23:

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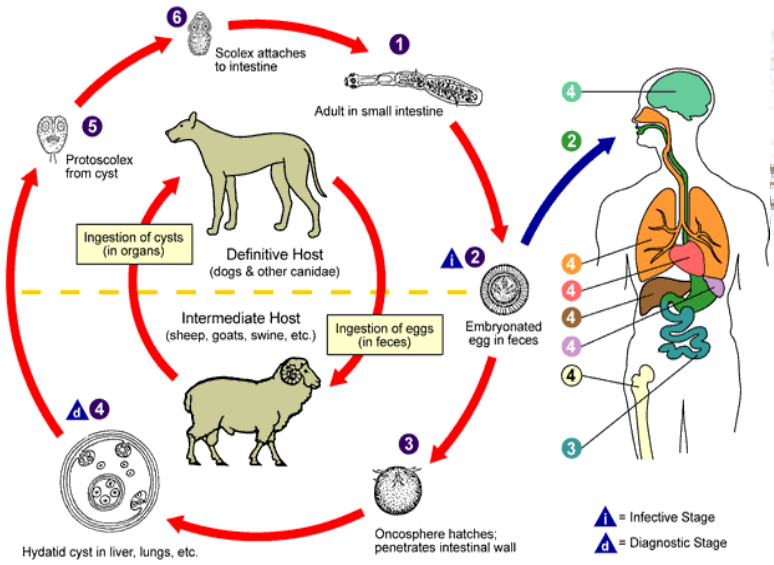
Echinococcus granulosus is the most common causative agent in hydatid cysts, while Echinococcus multilocularis and Echinococcus ligartus account for a small number of cases.

Dogs are the definitive hosts of E. granulosus. Sheep are the usual intermediate hosts, and humans are accidental intermediate hosts. Humans are end-stage hosts of the parasite since there is no human to human transmission.

The clinical presentation of a hydatid cyst is largely asymptomatic, until complications occur. The most common presenting symptoms are abdominal pain, dyspepsia, and vomiting. The most frequent sign is hepatomegaly.

Approximately 75% of hydatid cysts are located in the right lobe of the liver and are solitary.

The life cycle of Echinococcus:



Multiple hydatid cysts:



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Solution to Question 24:

Computed tomography (CT) scan is the best imaging modality for hydatid cyst. It shows the presence of a space-occupying lesion with a smooth outline with septa.

CT scan has an accuracy of 98% in the detection of hydatid cysts and higher sensitivity to demonstrate the daughter cysts and extra-hepatic cysts.

The indirect hemagglutination test and enzyme-linked immunosorbent assay (ELISA) have a sensitivity of 80% overall and are the initial screening tests of choice.

The Casoni test is a skin test used in the diagnosis of hydatid disease and involves the intradermal injection of 0.25 ml of sterilised fluid from hydatid cysts/human cysts. A wheal response occurring at the injection site within 20 minutes is considered positive (immediate hypersensitivity). The test is positive in less than 50% of patients with hydatid disease elsewhere in the body and false-positive results are also common so it's not preferred.

Note: First/Initial imaging test is USG, best imaging test is CT scan

CT scan showing multiple hydatid cysts with detached wavy membranes:



Solution to Question 25:

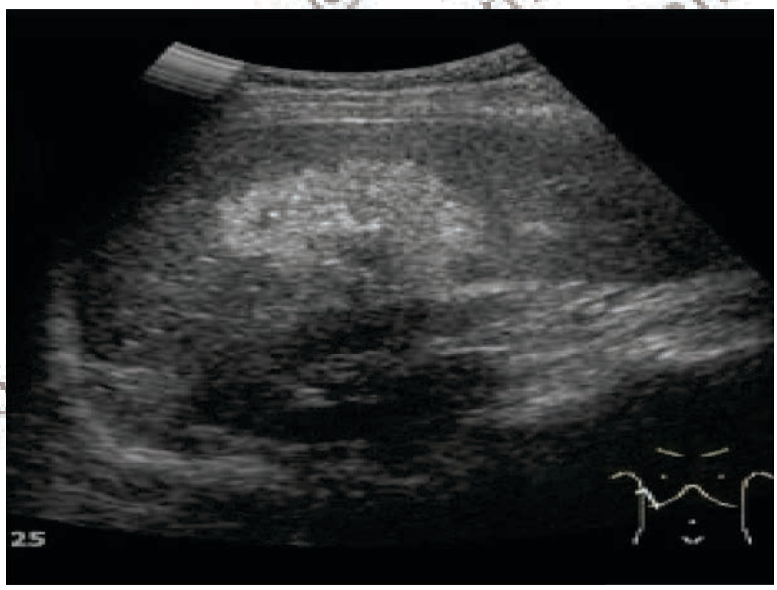
The double line sign is seen in an unruptured unilocular cyst with a double-layered wall representing the pericyst and endocyst.

Serpent sign is seen as wavy membranes within the cyst, on CT imaging.

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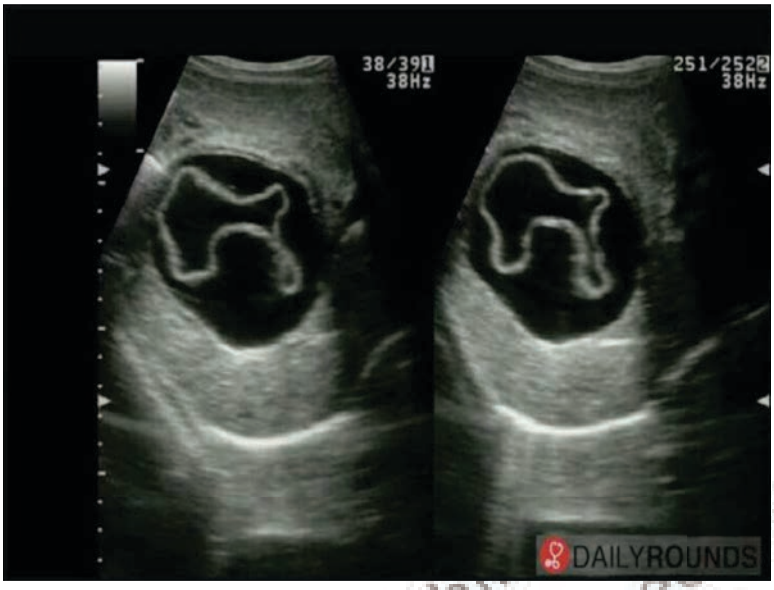


Ball of wool sign is seen on ultrasound when the contents settle in the dependent portion of the cyst, as seen below.



The water-lily sign is seen in hydatid infections when there is detachment of the endocyst membrane which results in floating membranes within the pericyst that mimic the appearance of a water lily, on USG.

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Solution to Question 26:

The ultrasound image is of active hydatid cyst with multiple septations and rosette or honeycomb appearance. As per the WHO classification of cystic echinococcosis (CE), it belongs to type 2 (CE2).

Classification of CE based on ultrasound imaging

Type	Ultrasound features
Active cyst	
CE1	Univesicular fluid collection
CE2	Honeycomb appearance:Multivesicular fluid collection with daughter cysts separated by septae
Transitional cyst	
CE3A	Water lily sign:Fluid collection with detached membrane
CE3B	Daughter cysts present in a solid matrix
Inactive/dead cyst	
CE4	Cysts in a heterogeneous matrix with no daughter cysts
CE5	Solid cystic wall

CE: cystic echinococcosis

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PAIR: puncture, aspiration, injection, and reaspiration

Class	Management
CE1	<5 cm albendazole 400 mg PO BD>5 cm albendazole 400 mg PO BD+PAIR
CE3a	<5 cm albendazole 400 mg PO BD>5 cm albendazole 400 mg PO BD+PAIR
CE2,CE3b	PAIR contraindicatedLarge bore percutaneous treatmentSurgery+albendazole 400 mg PO BID.
CE4,CE5	PAIR contraindicatedObservation (ultrasonography preferred every 6 months)

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Solution to Question 27:

The given imaging finding on CECT is suggestive of class CE3A hydatid cyst disease of the liver.

The ideal management for type CE3A hydatid cyst of dimension >5cm is Albendazole therapy 400 mg twice daily and PAIR (puncture, aspiration, injection, and reaspiration) therapy.

Classification of CE based on ultrasound imaging

Type	Ultrasound features
Active cyst	
CE1	Univesicular fluid collection
CE2	Honeycomb appearance:Multivesicular fluid collection with daughter cysts separated by septae
Transitional cyst	
CE3A	Water lily sign:Fluid collection with detached membrane
CE3B	Daughter cysts present in a solid matrix
Inactive/dead cyst	
CE4	Cysts in a heterogeneous matrix with no daughter cysts
CE5	Solid cystic wall

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CE: cystic echinococcosis; PAIR: puncture, aspiration, injection, and reaspiration

When PAIR is contraindicated (CE2, CE3B), surgical resection involving laparoscopic or open complete cystectomy with instillation of a scolicidal agent is preferred and is usually curative. If complete cystectomy is not possible, then anatomic liver resection can be undertaken.

Careful observation and ultrasound evaluation every 6 months are recommended CE4 and CE5 categories.

Class	Management
CE1	<5 cm albendazole 400 mg PO BD>5 cm albendazole 400 mg PO BD+PAIR
CE3a	<5 cm albendazole 400 mg PO BD>5 cm albendazole 400 mg PO BD+PAIR
CE2,CE3b	PAIR contraindicatedLarge bore percutaneous treatmentSurgery+albendazole 400 mg PO BID.
CE4,CE5	PAIR contraindicatedObservation (ultrasonography preferred every 6 months)

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Solution to Question 28:

A hydatid cyst with honeycomb appearance (CE2) is a contraindication for PAIR (Puncture-Aspiration-Injection-Reaspiration).

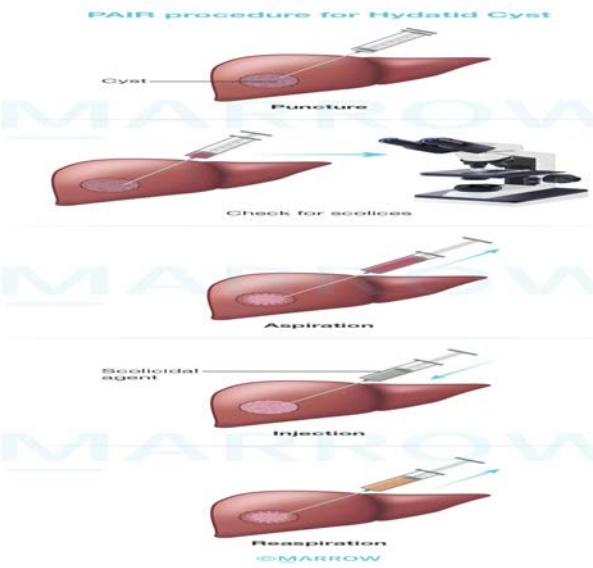
PAIR is unlikely to be successful in CE2 due to the presence of multiple internal septa.

The PAIR technique is performed using either ultrasound or computed tomography (CT) guidance.

It involves aspiration of the cyst contents via a special cannula, followed by injection of a scolicidal agent for at least 15 minutes, and then reaspiration of the cystic contents. This is repeated until the return is clear. An initial course of albendazole is administered before the procedure.

When PAIR is contraindicated, surgical resection involving laparoscopic or open complete cystectomy with instillation of a scolicidal agent is preferred and is usually curative. If complete cystectomy is not possible, then anatomic liver resection can be undertaken.

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Solution to Question 29:

Formalin is not used as a scolicidal agent since it causes sclerosing cholangitis.

Scolicidal agents (used to avoid dissemination of parasite during surgery):

- Hypertonic saline
- Cetrimide
- Alcohol
- Sodium hypochlorite
- Povidone-iodine

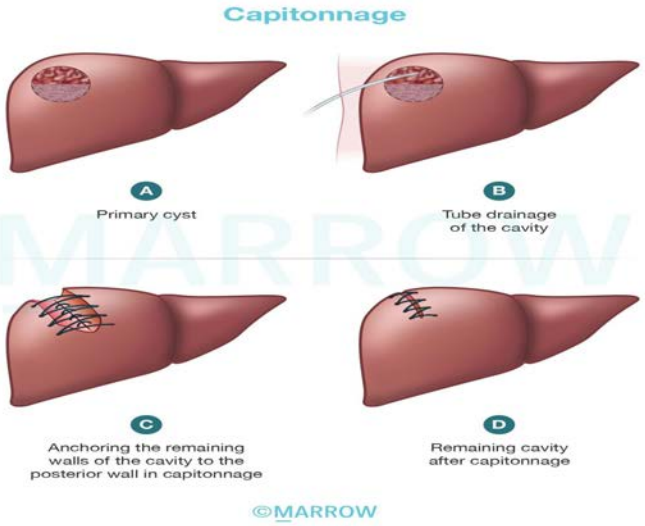
Solution to Question 30:

Capitonnage is used in the treatment of hydatid cyst disease. It is the spiral suturing of the cavity upward from the base of the cavity to the edge of the cyst wall.

Pyogenic liver abscess is treated with antibiotics and percutaneous drainage.

Hepatic tuberculosis is treated with quadruple therapy (isoniazid, rifampin, pyrazinamide, and ethambutol)

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MARROW

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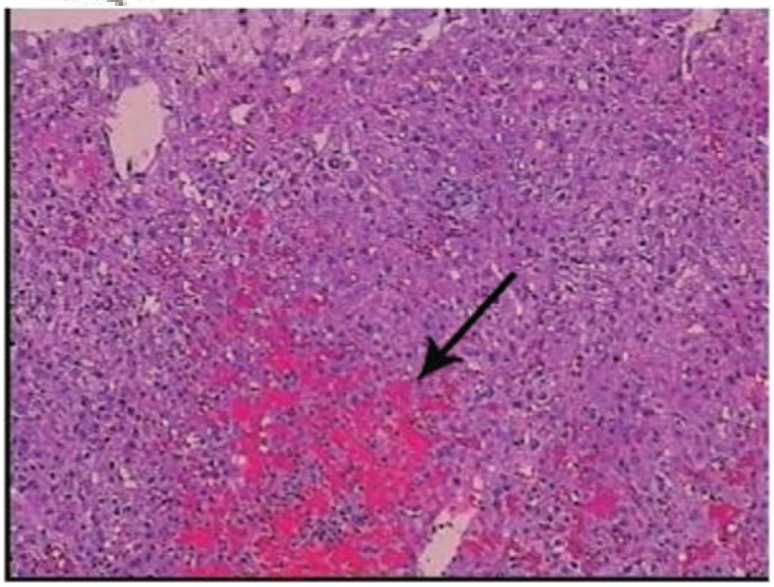
Solution to Question 31:

Analgesics will not cause peliosis hepatis.

Peliosis hepatis is an uncommon vascular condition characterized by hemorrhagic dilatation of the hepatic sinusoids. Conditions causing peliosis hepatis are:

- Bartonella henselae infection, tuberculosis, and human immunodeficiency virus
- Use of anabolic steroids
- Immunosuppressants such as 6-mercaptopurine, azathioprine, methotrexate, and tamoxifen
- X-linked myotubular myopathy

Biopsy showing hemorrhagic dilatation:



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Often an incidental finding, many patients present without symptoms. Less frequently, patients may present with signs more consistent with hepatobiliary pathology such as right upper quadrant pain, jaundice, and signs of portal hypertension.

Laboratory studies, such as LFT may or may not demonstrate changes. CT or MRI angiography often demonstrates contrast accumulating within the parenchyma itself or the sinusoids. A biopsy is the best modality to confirm the diagnosis.

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Benign Tumors of Liver

Question 1:

What is the most common benign lesion of liver?

a) Hemangioma

b) Hepatic adenoma

c) Hepatoma

d) Focal nodular hyperplasia

Question 2:

Which of the following statements is not true about epithelioid hemangioma?

a) Exposure to vinyl chloride is a risk factor

b) Treatment of choice is liver transplantation

c) Factor VIII staining is used for diagnosis

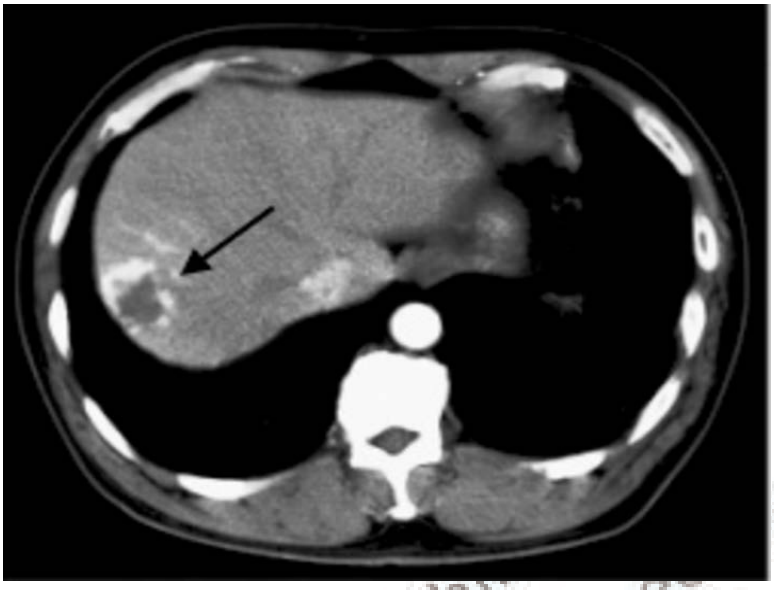
d) More common in males

Question 3:

A 45-year-old woman was incidentally found to have a lesion in the right lobe of the liver during an abdominal ultrasound. CECT showed the following finding. What is the most likely diagnosis?

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a) Hepatic adenoma

b) Focal nodular hyperplasia

c) Hamartoma

d) Hemangioma

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Question 4:

Which of the following hepatic lesions can be accurately diagnosed with 99mTc-labelled red blood cells when CT and MRI are unavailable?

a) Mesenchymal hamartoma

b) Hemangioma

c) Focal nodular hyperplasia

d) Hepatic adenoma

Question 5:

A 2-year-old boy is brought to the ER with complaints of petechiae, bruising, and abdominal distension as shown in the image. Investigations reveal thrombocytopenia and elevated D-dimer. CECT shows solitary growth in the liver with peripheral nodular enhancement. Which of the following statements is false regarding this condition?

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a) Kasai procedure is done for symptomatic cases

b) Small lesions regress spontaneously

c) LFT and tumour markers are normal

d) Congestive heart failure can occur

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Question 6:

A 32-year-old woman presented with abdominal pain and discomfort for the past 2 months. She has been using oral contraceptive pills for more than 5 years. Imaging studies revealed a mass as shown in the image. Which of the following is false regarding this condition?



a) Rupture and intraperitoneal hemorrhage is unlikely

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b) Malignant transformation is seen in 10% of cases

c) Histology shows cords of hepatocytes with absence of bile ductules

d) More common in women

Question 7:

Which of the following types of hepatic adenomas is associated with an increased risk of malignant transformation?

a) Sonic hedgehog activated adenoma

b) Inflammatory type hepatic adenoma

c) HNF1A mutated adenoma

d) Beta-catenin mutated adenoma

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Question 8:

During USG in a 30-year-old bodybuilder on anabolic steroids, a liver mass was noted. The surgeon suspects hepatic adenoma. Which of the following is false regarding investigations performed for this condition?

a) AFP levels are always elevated

b) Imaging shows a well circumscribed vascular tumor

c) Resection and biopsy are done when other investigations are equivocal

d) MRI with gadobenate dimeglumine as contrast helps to distinguish from other tumors

Question 9:

Spontaneous rupture of the liver occurs in _____.

a) Hepatic adenoma

b) Hemangioma

c) Portal hypertension

d) Focal nodular hyperplasia

Question 10:

Which statement regarding the management of hepatic adenoma is false?

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a) MRI surveillance is done for 5 years

b) Hepatic artery embolization is done in cases of hemorrhage

c) In women, the risk of malignant transformation is low if tumour <10 cm

d) In men, resection is done independent of the tumour size

Question 11:

Which of the following statements are false regarding focal nodular hyperplasia?

a) Resection is done for persistent symptomatic cases

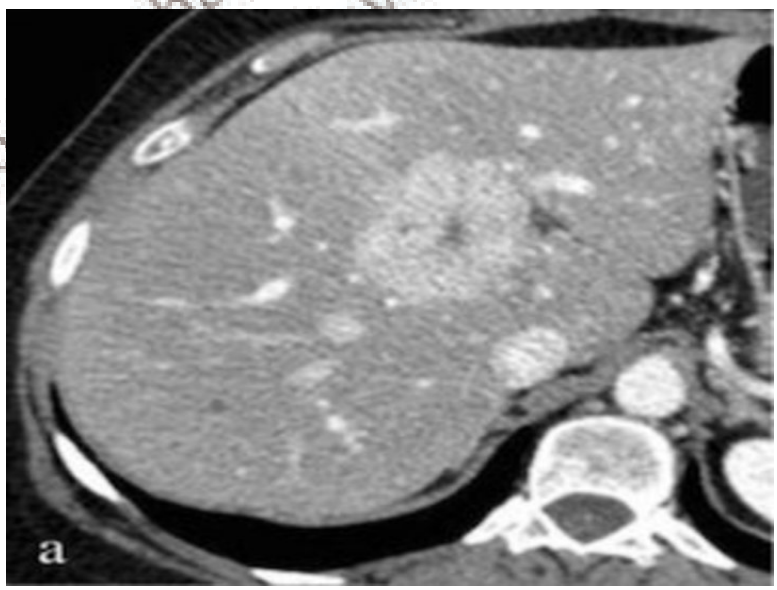
b) AFP levels are normal

c) Appears as hotspots in Tc 99m sulphur colloid scan

d) Increased risk of malignant transformation

Question 12:

A 27-year-old woman was incidentally found to have a liver mass while undergoing ultrasound for renal calculi. CECT showed the following image. What is the most probable diagnosis?



a) Hemangioma

b) Focal nodular hyperplasia

c) Hepatoma

d) Hepatic adenoma

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Question 13:

Which of the following is correctly matched regarding solid liver lesions and their characteristic CECT imaging findings?

a) 1 - D, 2 - C, 3 - A, 4 - B

b) 1 - B, 2 - A, 3 - D, 4 -C

c) 1 - C, 2 - D, 3 - B, 4 - A

d) 1 - D, 2 - A, 3 - B , 4 - C

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Answer Key

Question No.	Correct Option
1	a
2	d
3	d
4	b
5	a
6	a
7	d
8	a
9	a
10	c
11	d
12	b
13	b

Detailed Explanations

Solution to Question 1:

Hemangiomas are the most common benign tumor of the liver.

Focal nodular hyperplasia (FNH) is the second most common benign tumor of the liver.

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Solution to Question 2:

Epithelioid hemangioendothelioma is more common in females.

Epithelioid hemangioendothelioma is a rare vascular tumour. The infantile variety is benign, while the adult variety is malignant. It may undergo malignant degeneration into angiosarcoma.

It is related to exposure to vinyl chloride and oral contraceptive pills (OCPs).

It can affect the lungs, liver, and bones. In the liver, it manifests as multiple bilateral hepatic masses. Extrahepatic metastases occur in approximately 25% of patients. Liver failure is a fatal complication.

Hypervascular enhancement is observed on CECT. A percutaneous biopsy can help differentiate from other tumours. Factor VIII staining differentiates it from other nonvascular tumours.

Treatment is total hepatectomy with liver transplantation.

Solution to Question 3:

The given CECT abdomen shows a well-defined hypodense lesion in the liver with asymmetrical nodular peripheral enhancement which is characteristic of hemangioma.

Hemangioma is a benign tumor composed of increased proliferation of blood vessels. It is the most common benign tumour of the liver and is mainly seen in women at a mean age of 45 years.

Small capillary hemangiomas are of no clinical significance. They are usually solitary, <5 cm in diameter, with equal occurrence in the right and left halves of the liver. However, giant hemangiomas of diameter >5 cm require attention.

They are most commonly asymptomatic and incidentally found during imaging studies. Large compressive masses may cause vague upper abdominal symptoms. The appearance of hepatic hemangioma in a contrast-enhanced CT scan is as follows:

• Non-contrast phase: Well-defined hypodense lesion

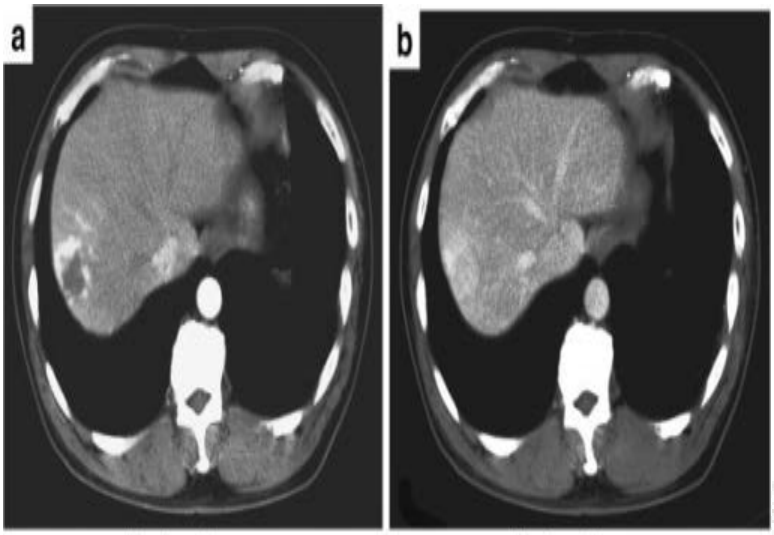
• Arterial phase: Peripheral nodular enhancement

• Washout phase: Homogenous enhancement

The image given below shows early phase with peripheral high attenuation (a) and late phase with homogenous high attenuation (b).

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Solution to Question 4:

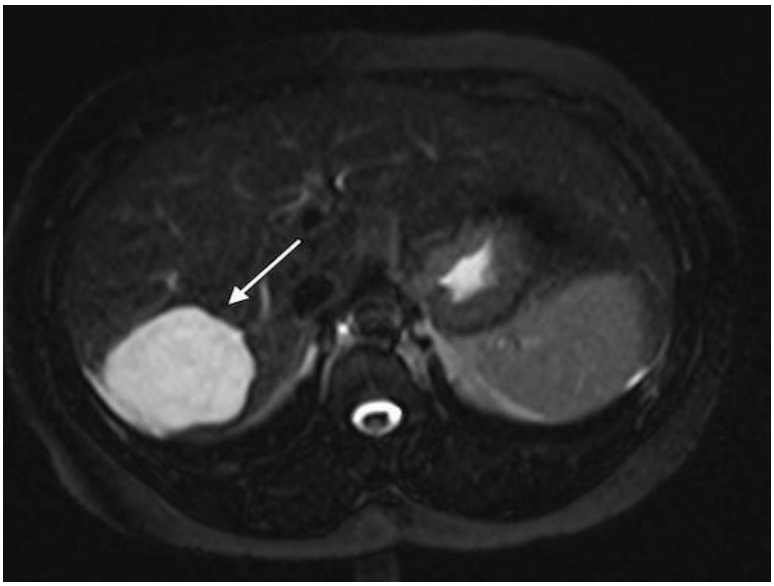
Hemangiomas can be accurately diagnosed with 99mTc-labelled red cells when CT and MRI are unavailable.

In hemangioma, an increase in uptake is observed in blood pool studies such as 99mTc-labelled red cells and appear as photopenic regions. The nuclear imaging techniques for the diagnosis of hemangiomas are used only when high-quality CT and MRI are unavailable.

CECT is the investigation of choice wherein a typical peripheral nodular enhancement pattern is seen.

On magnetic resonance imaging (MRI), hemangiomas are hypointense on T1-weighted images and hyperintense on T2-weighted images.

The below MRI image shows the light bulb sign seen in hemangioma of the liver.



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Percutaneous biopsy is potentially dangerous and inaccurate and, therefore, not recommended.

Isotope scans used for the investigation of hepatobiliary disease are:

• Technetium-99m colloid scan - parenchymal diseases of the liver, such as cirrhosis and alcoholic hepatitis

• Technetium-99m hepatobiliary iminodiacetic acid (HIDA) scan - acute cholecystitis and congenital biliary atresia

• Technetium-99m sulphur colloid scan - focal nodular hyperplasia

Solution to Question 5:

The given clinical scenario is suggestive of Kasabach-Merritt syndrome because of hemangioma of the liver. Kasai procedure or hepatoportoenterostomy is done for biliary atresia, and not in Kasabach-Merritt syndrome.

Rarely a rapidly enlarging hemangioma can cause thrombocytopenia and disseminated intravascular coagulation (indicated by the elevated D-dimer) because platelets and other clotting factors are being used up within the tumour. This is called Kasabach-Merritt syndrome.

LFT and tumour markers are normal in a hemangioma. Large hemangiomas in children can result in congestive heart failure secondary to arteriovenous shunting and they require medical management.

Management:

Observation is the mode of management in asymptomatic liver hemangiomas that are <5cm because they may show spontaneous regression.

Therapeutic embolisation and enucleation with arterial inflow control is the treatment of choice for patients with symptomatic liver hemangiomas.

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Solution to Question 6:

The given clinical scenario and MRI showing homogeneous mass with well-defined margins is suggestive of hepatic adenoma. Rupture leading to life-threatening intraperitoneal hemorrhage is a major complication associated with hepatic adenomas.

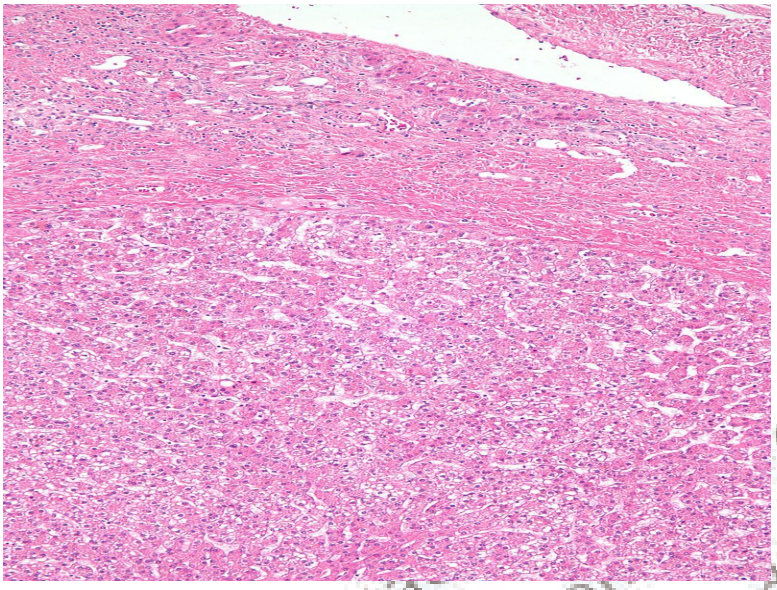
Hepatic adenomas are benign solid neoplasms of the liver. They are usually seen in young women between 20-40 years of age and are typically solitary. Prolonged oral contraceptive use is a clear risk factor. Clinical presentation may be abdominal pain.

Histological studies show cords of benign hepatocytes containing excessive glycogen and fat, giving a congested or vacuolated appearance. There is an absence of bile duct glands and Kupffer cells.

In some patients, hepatic adenomas present with spontaneous intraperitoneal hemorrhage. There is a risk of malignant transformation in 10% of cases.

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The histopathological image given below shows hepatic adenoma.



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Solution to Question 7:

β-catenin mutated subtype of hepatic adenoma is associated with an increased risk of malignant transformation.

The 2017 Bordeaux molecular-pathologic classification of hepatocellular adenomas (HCA) includes six subtypes:

- HNF1A-inactivated HCA
- Inflammatory HCA
- β-catenin exon 3 mutated HCA
- β-catenin exon 7/8 mutated HCA
- Sonic hedgehog activated HCA
- Unclassified HCA

Solution to Question 8:

AFP levels are usually within the normal range in hepatic adenoma.

In this patient, the use of anabolic steroids is a risk factor for developing hepatic adenoma.

Computed tomography (CT) or magnetic resonance imaging (MRI) demonstrates a well-circumscribed and vascular solid tumor. Arterial phase CT demonstrates a well-developed peripheral arterialization of a tumor.

Dynamic magnetic resonance imaging with liver-specific MRI contrast agents such as gadobenate dimeglumine helps to better distinguish hepatic adenomas from follicular nodular hyperplasia by

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their enhancement characteristics during the hepatobiliary phase of imaging.

A biopsy may be necessary for the confirmation and characterization of the nature of these lesions when imaging studies are equivocal.

Solution to Question 9:

Hepatic adenoma can manifest as a case of spontaneous rupture, with the sudden onset of abdominal pain followed by hypovolemic shock secondary to intraperitoneal bleeding.

The clinical presentation may be abdominal pain. In some cases, it can hepatic adenomas present with spontaneous intraperitoneal hemorrhage.

Solution to Question 10:

In women, the risk of malignant transformation is low if tumour <5 cm.

Due to the high risk of malignancy in males, hepatic adenomas should be resected independent of the tumour size or subtype of the lesion.

In female patients, conservative management with discontinuation of oral contraceptive pills and MRI surveillance is recommended if the tumour is <5 cm in diameter. Either annual (non-inflammatory adenoma) or biannual (inflammatory hepatocellular adenoma) MRI surveillance is done for at least 5 years, depending on the tumour subtype.

If the tumour is >5 cm, resection is done. In patients presenting with acute hemorrhage, hepatic artery embolization is done to prevent further hemorrhage till the patient can be taken up for resection of the tumour.

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Solution to Question 11:

Malignant transformation is unlikely in focal nodular hyperplasia.

Contrast-enhanced CT is diagnostic for FNH. It is seen as a well-circumscribed lesion with a typical central scar. They show intense homogeneous enhancement on the arterial phase and isodense as compared to the background liver on the venous phase.

Due to the presence of Kupffer cells, FNH appears as hotspots on Tc 99m sulphur colloid scans.

Asymptomatic patients with typical radiologic features do not require treatment. Careful observation of symptomatic FNH with serial imaging is reasonable, as symptoms may resolve in a significant number of cases.

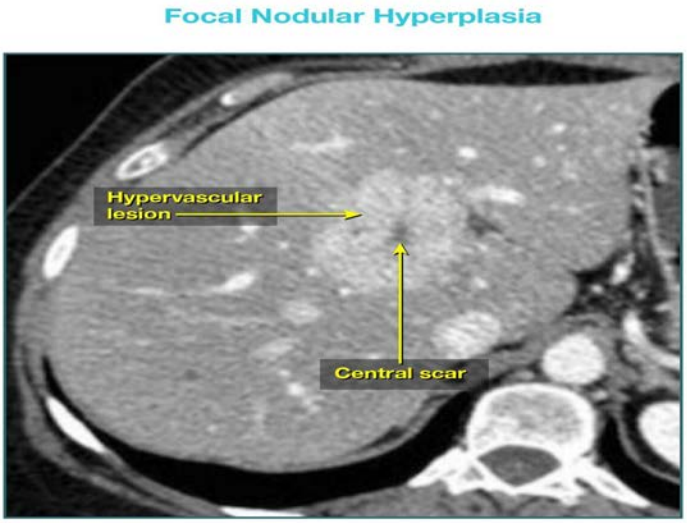
Patients with persistent symptomatic FNH or an enlarging mass should be considered for resection.

If diagnostic uncertainty exists, resection may be necessary for histologic confirmation.

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Solution to Question 12:

The above clinical scenario with contrast-enhanced CT showing hypervascular lesion with a central non-enhancing scar points towards focal nodular hyperplasia (FNH).



Focal nodular hyperplasia is the second most common benign tumour in the liver and is mostly seen in women. This condition is characterised by focal overgrowth of functional liver tissue and the supporting fibrous stroma.

Patients are mostly asymptomatic and FNH is often an incidental finding. If patients are symptomatic, they usually complain of abdominal pain.

On histological examination, cords of hepatocytes are seen with atypical biliary epithelium scattered throughout. A central stellate scar containing a large artery branching out in a spoke-wheel pattern is also seen.

Solution to Question 13:

The correctly matched option is 1 - B, 2 - A, 3 - D, 4 -C.

Differential diagnosis of solid liver lesions and their characteristic imaging findings:

	Noncontrast ultrasound finding	Contrast-enhanced CT finding
Benign lesions		
Hepatic hemangioma	Well demarcated homogenous hyperechoic massHypoechoic in presence of fatty infiltration of the liver	Non-contrast phase: Well-defined hypodense lesion.Arterial phase:Peripheral nodular enhancement in the early phase and filling in during the late phase.Washout phase: Homogenous enhancement.

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	Noncontrast ultrasound finding	Contrast-enhanced CT finding
Focal Nodular hyperplasia	Variable echogenicityCentral hyperechoic region (central scar)	Non-contrast phase: Hypo- or isodense with acentral scar Arterial phase:HyperdensePortal venous phase: Typically isodense
Hepatocellular adenoma	Heterogenous, hyperechoic lesion	A well-demarcated lesion with peripheral enhancement in the early phaseCentripetal flow during the portal venous phase
Malignant lesions		
Hepatocellular carcinoma	Poorly defined margin with coarse and irregular internal echoes	Hypervascularin the arterial phaseEnhancement in the late arterial phase withrapid washoutof contrast in portal venous phase.
Intrahepatic cholangio carcinoma	Homogenous hypoechoic mass	A hypodense lesion with peripheral(rim) enhancement
Liver metastasis	Usuallymultiple lesionsMetastasis from adenocarcinoma is hypoechoic	Metastasis from the colon, stomach, and pancreas usually showslower attenuationHypervascular metastasis (e.g Neuroendocrine tumor, RCC) appears as rapidly enhancing lesions in the arterial phase

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Malignant Tumors of Liver

Question 1:

Patients with hepatocellular carcinoma are least likely to present with _____.

a) Abdominal pain

b) Jaundice

c) Weight loss

d) Palpable mass

Question 2:

Which of the following is not a risk factor for hepatocellular carcinoma?

a) Oral contraceptive pills use

b) Non-alcoholic steatohepatitis

c) Hepatitis B

d) Primary biliary cirrhosis

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Question 3:

Which of the following can be seen with HCC?

a) Hypercalcemia

b) Hyperglycemia

c) Hyponatremia

d) Hyperkalemia

Question 4:

A 57-year-old man presented with persistent upper abdominal pain and weight loss. Ultrasound revealed a lesion in the right lobe of the liver and contrast-enhanced CT was suggestive of hepatocellular carcinoma. Which of the following tumor markers can be elevated in this patient?

a) 1 and 5

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b) 1, 2, 4 and 5

c) 3 and 5

d) 2, 3 and 4

Question 5:

A 43-year-old man presented to the hospital with complaints of abdominal pain, ascites, and weight loss for 6 months. Investigations revealed a thrombus in the portal vein along with invasion from nearby tumor growth. Which of the following conditions can cause this?

a) Hepatic adenoma

b) Hepatocellular carcinoma

c) Focal nodular hyperplasia

d) Cavernous hemangioma

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Question 6:

Which of the following is not true regarding the fibrolamellar variant of HCC?

a) Commonly associated with cirrhosis

b) Recurrences are seen despite better prognosis

c) Occur under the age of 35 years

d) Not commonly associated with chronic hepatitis B infection

Question 7:

A 25-year-old male patient is found to have a well-circumscribed mass in his liver and is suspected to have fibrolamellar HCC. Which of the following tumor markers will be elevated in his condition?

a) AFP

b) Neurotensin

c) ALP

d) Glypican-3

Question 8:

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Which of the following statements is not true about alpha-fetoprotein?

a) AFP level does not return back to normal after hepatic resection

b) Levels of >400 ng/mL with typical radiological findings is suggestive of HCC

c) AFP level can be raised in benign conditions

d) Fibrolamellar HCC has normal levels

Question 9:

AFP is used as a tumor marker in which of the following cancers?

a) 2 and 3

b) 3, 4 and 5

c) 1 and 3

d) 1, 2 and 5

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Question 10:

Which of the following are modalities of treatment in patients with hepatocellular carcinoma?

a) 1, 2, 4

b) 1 and 5

c) 1, 3, 5

d) 1, 2, 3, 4 and 5

Question 11:

A 50-year-old man has been diagnosed with localized hepatocellular carcinoma. He falls into child-pugh class A and his future liver remnant is 22% of the total liver volume. Which of the following will decrease the tumor burden and improve his hepatic functional reserve?

a) Resection followed by chemotherapy

b) Preoperative portal vein embolization followed by resection

c) Radiotherapy, followed by chemotherapy

d) Intralesional ethanol

Question 12:

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Which of the following parameters is not considered in OKUDA staging?

a) Bilirubin

b) Tumor size

c) Ascites

d) AFP

Question 13:

Which of the following scoring systems will you not use to assess oncological outcomes of patients with hepatocellular carcinoma?

a) MELD

b) BCLC

c) CLIP

d) OKUDA

Question 14:

Which of the following is true regarding LI-RADS scoring?

a) LI-RADS 2 has an intermediate probability of malignancy

b) Treatment for hepatocellular carcinoma can be initiated in LI-RADS 5 without biopsy

c) LI-RADS 3 is an indication for immediate liver biopsy

d) LI-RADS 4 is definitive of hepatocellular carcinoma

Question 15:

A 70-year-old retiree was employed for two decades in a plastic industry, where he was exposed to vinyl chloride. He is at an increased risk of developing which of the following tumors?

a) Hepatocellular carcinoma

b) Angiosarcoma of liver

c) Clear cell HCC

d) Intrahepatic cholangiocarcinoma

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Question 16:

An infant is brought to the hospital by his parents with complaints of poor feeding and abdominal distension. On evaluation, a mass is detected in the liver which is later diagnosed to be a hepatoblastoma. Which of the following is false regarding this condition?

a) It is associated with familial adenomatous polyposis

b) Most cases occur before the age of 3 years

c) Treatment is surgical resection followed by chemotherapy

d) Prognosis is extremely poor for pulmonary metastasis

Question 17:

A woman was diagnosed to have metastatic liver adenocarcinoma with CK-7 (-), CK20 (+), and CDX-1 (+) IHC markers. Which of the following is the most likely primary site of origin for this metastasis?

a) Colon carcinoma

b) Breast Carcinoma

c) Pancreatic carcinoma

d) Ovarian carcinoma

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Question 18:

In patients with colorectal carcinoma, which of the following is not a bad prognostic factor?

a) Synchronous lesions

b) Multiple tumors

c) CEA level of >200 ng/mL

d) Metachronous lesions

Question 19:

Patients with which of the following conditions are not suitable for liver transplantation?

a) Cirrhosis

b) Primary biliary cirrhosis

c) Cholangiocarcinoma

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d) Fulminant hepatitis

Question 20:

What is the most common indication for liver transplant in children?

a) Biliary atresia

b) Indian childhood cirrhosis

c) Primary sclerosing cholangitis

d) Inborn errors of metabolism

Question 21:

A 5-year-old child with Wilson's disease is being considered for liver transplantation. Which of the following is not a parameter in the selection criteria for transplantation?

a) Age <10years

b) PT >100 s

c) Bilirubin >300 µmol/L

d) Jaundice less than 7 days before development of encephalopathy

Question 22:

Auxiliary orthotopic liver transplantation is indicated in which of the following conditions?

a) Drug induced hepatic failure

b) As standby procedure till a suitable donor is found

c) Acute fulminant liver failure that is irreversible

d) Metabolic liver disease

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Answer Key

Question No.	Correct Option
1	b
2	a

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3	a
4	b
5	b
6	a
7	b
8	a
9	d
10	d
11	b
12	d
13	a
14	b
15	b
16	d
17	a
18	d
19	c
20	a
21	d
22	d

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Detailed Explanations

Solution to Question 1:

Jaundice is an uncommon sign of hepatocellular carcinoma (HCC).

Hepatocellular carcinoma is the most common primary malignancy of the liver. It is commonly seen in men aged 50-60 years who present with right upper quadrant abdominal pain, weight loss, and a palpable mass.

Non-specific symptoms of the advanced malignant disease are anorexia, nausea, lethargy. The gross appearance shows unifocal or multifocal or diffusely infiltrative lesions that are paler than the surrounding tissue.

Solution to Question 2:

Oral contraceptive use is not an independent risk factor for hepatocellular carcinoma. It is a risk factor for developing hepatic adenoma.

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Although hepatocellular adenoma can undergo malignant transformation, the true risk is low (10%).

Major risk factors for hepatocellular carcinoma:

• Infection:

• Hepatitis B

• Hepatitis C

• Toxins/drugs:

• Alcoholic cirrhosis

• Aflatoxins

• Anabolic steroids

• Genetic:

• Hemochromatosis

• α1-Antitrypsin deficiency

• Immunological:

• Autoimmune chronic active hepatitis

• Primary biliary cirrhosis

• Others:

• Obesity

• Nonalcoholic steatohepatitis

• Cirrhosis (other causes and idiopathic).

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Solution to Question 3:

Paraneoplastic syndrome due to hepatocellular carcinoma can manifest as:

• Hypercalcemia

• Hypoglycemia

• Erythrocytosis

Hypercalcemia in patients with HCC is associated with increased renal reabsorption of calcium and increased bone resorption by parathyroid hormone-related protein (PTHrP) generated by HCC.

Less than 1% of cases of HCC manifest with a paraneoplastic syndrome.

Solution to Question 4:

Alpha-2-macroglobulin is not a tumor marker of HCC.

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Tumor markers of HCC are:

• Alpha-fetoprotein (AFP)

• Normal (<20 ng/mL),

• Elevated (21–400 ng/mL), and

• Diagnostic for HCC (>400 ng/mL).

• Protein Induced by Vitamin K Absence or Antagonist - II (PIVKA-II) also called des-gamma-carboxy prothrombin (DCP)

• Glypican 3.

• Neurotensin (in fibrolamellar type)

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Solution to Question 5:

In the above clinical scenario, the patient has a secondary Budd-Chiari syndrome due to portal vein obstruction by a neighboring invasive lesion. Hepatocellular carcinoma (HCC) has the highest tendency to invade the portal vein.

Budd–Chiari syndrome (BCS) is an uncommon congestive hepatopathy characterized by the obstruction of hepatic venous outflow.

Solution to Question 6:

Fibrolamellar variant of HCC is not commonly associated with liver cirrhosis.

Fibrolamellar carcinoma is a distinctive variant (<5%) of HCC. They occur under the age of 35 years, without any gender predilection or identifiable predisposing conditions.

It usually presents as a single large, hard 'scirrhous' tumor. The tumor is well-demarcated, encapsulated, and may have a central fibrotic area. Histology shows large polygonal cells embedded in a fibrous stroma forming lamellar structures.

Solution to Question 7:

Neurotensin is the tumor marker of fibrolamellar hepatocellular carcinoma (HCC).

Neurotensin is a mitogen which induces cell proliferation in fibrolamellar hepatocellular carcinoma. There is increased serum unsaturated vitamin B12 binding capacity seen in fibrolamellar HCC which can also aid in diagnosis.

Solution to Question 8:

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Alpha-fetoprotein (AFP) level returns to normal after resection.

Alpha-fetoprotein is a glycoprotein that is produced in early fetal life by the liver. It is also produced by a variety of tumors, such as:

• Hepatocellular carcinoma

• Hepatoblastoma

• Non-seminomatous germ cell tumors of the ovary and testis (e.g., yolk sac and embryonal carcinoma).

AFP is also elevated during the following conditions:

• Pregnancy and in benign liver disease (e.g., viral hepatitis, cirrhosis)

• Gastrointestinal tract tumors

• Along with carcinoembryonic antigen in ataxia-telangiectasia

Limitations of AFP include low sensitivity and specificity. It is not specific to HCC and can occur with intrahepatic cholangiocarcinoma and colorectal metastases.

Levels >400 ng/mL with typical radiological findings are suggestive of HCC. Alpha-fetoprotein (AFP) is not elevated in fibrolamellar HCC.

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Solution to Question 9:

Alpha-fetoprotein (AFP) is not a tumor marker used to detect cholangiocarcinoma or fibrolamellar HCC.

It is produced by a variety of tumors such as:

• Hepatocellular carcinoma (HCC)

• Hepatoblastoma

• Non-seminomatous germ cell tumors of the ovary and testis (e.g., yolk sac and embryonal carcinoma).

Solution to Question 10:

All of the given modalities can be used for the treatment of HCC.

Treatment options for hepatocellular carcinoma (HCC):

• Surgical

• Resection (the mainstay of treatment)

• Orthotopic liver transplantation

• Ablative

• Percutaneous ethanol injection (PEI) (less frequently used nowadays)

• Thermal ablation (cryotherapy, radiofrequency ablation, microwave, Nd-YAG laser)

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• Transarterial

• Embolization

• Chemoembolization

• Radiotherapy

• Combination of transarterial and ablative: external beam radiation

• Systemic

• Chemotherapy

• Hormonal

• Immunotherapy

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Solution to Question 11:

The patient should ideally be treated by preoperative portal vein embolization to improve hepatic functional reserve, followed by resection which will decrease the tumor burden.

Portal venous embolization on the side of the tumor will lead to compensatory hypertrophy of the unaffected liver lobe. This improves the volume and function of the future liver remnant (FLR).

Localized hepatocellular carcinoma

• Child-Pugh class A: Patients with child-pugh class A should undergo resection of the tumor.

• Those with low FLR (<30%) should ideally be treated by preoperative portal vein embolization followed by resection. Preoperative embolization helps in improving the FLR volume function prior to resection.

• Those with adequate FLR (>30-40%) can usually tolerate resection alone.

• Child-Pugh class B/C or portal hypertension: Patients with early-stage HCC and child-Pugh class B/C or portal hypertension should be considered for transplantation.

Advanced hepatocellular carcinoma

Patients with advanced hepatocellular carcinoma are treated with palliative intent. Following are the management options:

• Drug therapy - Sorafenib/ Sunitinib/ Regorafenib

• Transarterial chemoembolisation (TACE) and transarterial radioembolisation (TARE) offer the best results in multifocal disease

• Radiofrequency ablation, microwave ablation, high-frequency ultrasound therapy are alternative options

• Patients with extreme deterioration of performance status and liver function should be offered supportive treatment only.

Solution to Question 12:

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OKUDA staging includes assessment of all the above factors except alpha-fetoprotein (AFP).

The OKUDA staging system distinguishes patients with poor prognosis from those with more potential for long-term survival. The OKUDA staging system is an older system.

OKUDA staging system for hepatocellular carcinoma (HCC):

Stage I: 0 points

Stage II: 1-2 points

Stage III: 3-4 points

Clinical parameter	Cut-off value	Points
Serum bilirubin	<3>3	01
Serum albumin	>3<3	01
Tumor size	<50%>50%	01
Ascites	AbsentPresent	01

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Solution to Question 13:

MELD (model for end-stage liver disease) score is not used to assess the oncological outcome of patients with hepatocellular carcinoma. MELD is used to predict the severity of end-stage chronic liver disease.

Barcelona Clinic Liver Cancer staging system (BCLC) is the most commonly used scoring system for staging and management of HCC.

The staging or management of HCC is done by the following:

1. Barcelona Clinic Liver Cancer staging system (BCLC)

• Tumor score (TNM)

• Child-Pugh score

• Performance score(Barcelona clinic score)

2. Cancer of the Liver Italian Program (CLIP)

• Tumor size

• Child-Pugh score

• AFP

• Portal vein thrombosis

3. OKUDA staging

• Bilirubin

• Ascites

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• Tumor size

• Albumin

4. Chinese University Prognostic Index (CUPI)

Note: MELD can be used in prioritizing HCC patients in need of liver transplants.

Solution to Question 14:

LI-RADS 5 indicates a definitive probability(~100%) of hepatocellular carcinoma. Therefore treatment can be initiated as early as possible without waiting for a biopsy.

• Routine surveillance should be continued for LI-RADS 1, 2. Additional imaging may be required for LI-RADS 2 based on individual risk.

• LI-RADS 3 should be evaluated by serial imaging every 3-6 months.

• Evaluation with a biopsy should be done in LI-RADS 4.

• Since LI-RADS 5 indicates a definitive probability of hepatocellular carcinoma, treatment can be initiated as early as possible without waiting for a biopsy.

Liver Imaging Reporting and Data Systems (LI-RADS) categories	
Category	Assessment
LI-RADS 1	Definitely benign
LI-RADS 2	Probably benign
LI-RADS 3	Intermediate probability of malignancy
LI-RADS 4	Probably HCC
LI-RADS 5	Definitely HCC

Solution to Question 15:

Angiosarcoma of the liver is seen in workers who have been exposed to vinyl chloride for prolonged periods.

Angiosarcoma is the most common malignant mesenchymal tumor of the liver. It is a rare and fatal tumor.

They are associated with the following conditions:

• Hemochromatosis

• Neurofibromatosis type I

• Exposure to vinyl chloride, thorium dioxide, and arsenic.

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Patients usually present with vague symptoms of abdominal pain, weakness, fatigue, and weight loss. A hepatic bruit is occasionally heard, reflecting the vascular nature of the tumor.

Central hypovascularity, vascular lakes, and peripheral contrast staining on arteriography are suggestive of an angiosarcoma. Biopsy shows the presence of dilated sinusoids lined by atypical endothelial cells.

Solution to Question 16:

In hepatoblastoma, 85% of patients with pulmonary metastases can be successfully treated with resection of the hepatic tumor and chemotherapy or resection of the pulmonary metastases.

Hepatoblastoma is the most common primary hepatic tumor of childhood. The median age at presentation is 18 months, and almost all cases occur before 3 years of age. It has been associated with familial adenomatous polyposis (FAP) syndrome.

This tumor generally manifests as an asymptomatic mass. Mild anemia and thrombocytosis are commonly found at presentation.

Serum alpha-fetoprotein (AFP) levels are elevated in the majority of patients and can serve as a useful marker for therapeutic response.

Treatment includes chemotherapy that can help downstage tumors such that they are amenable to resection. In patients without metastatic disease or the anaplastic variant, long-term survival rates of 60% to 70% can be expected with complete resection.

Staging of pediatric liver tumors:

Stage	Feature
Stage I	No metastasesTumor completely resected
Stage II	No metastasesTumor grossly resected with microscopic residual disease, or tumor rupture/spill at the time of surgery
Stage III	No distant metastasesTumor unresectable or resected with gross residual tumor, or positive lymph nodes
Stage IV	Distant metastases regardless of the extent of liver involvement

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Solution to Question 17:

Colorectal carcinoma is the most likely primary tumor for the given metastases. Among the given options, cytokeratin 7 is negative only in colon carcinoma.

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The most common site of distant metastasis of colorectal cancer is the liver. These metastases arise from hematogenous spread via the portal venous system. The lung is the next most common site for metastasis.

Cytokeratin profiles of various primary tumors:

CK 7 positiveCK20 positive	CholangiocarcinomaOvarian mucinous carcinoma
CK 7positiveCK 20 negative	Breast carcinomaOvarian serous adenocarcinomaThyroid carcinomaPancreatic adenocarcinomaLung carcinoma
CK 7negativeCK 20positive	Colorectal adenocarcinomaMerkel cell carcinoma
CK 7 negativeCK 20 negative	Hepatocellular carcinomaRenal cell carcinomaProstatic adenocarcinomaSquamous cell carcinoma

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Solution to Question 18:

Metachronous lesions are not associated with a bad prognosis in case of liver metastasis from colon carcinoma.

A metachronous cancer is defined as secondary cancer occurring more than 6 months after the index cancer.

Synchronous cancer is defined as two or more neoplasms identified simultaneously in the same patient, or a second tumor identified within six months after the initial diagnosis.

Predictors of poor outcome in colorectal carcinoma with liver metastasis:

• Lymph-node-positive primary

• Disease-free interval <12 months

• More than one tumor

• Tumor size >5 cm

• Serum carcinoembryonic antigen (CEA) level >200 ng/mL

Solution to Question 19:

Cholangiocarcinoma is not an indication for a liver transplant.

Orthotopic liver transplantation (OLT) for patients with cholangiocarcinoma had very poor results and this treatment strategy has largely been abandoned.

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Solution to Question 20:

The most common indication for liver transplant in children is biliary atresia.

In biliary atresia, the extrahepatic bile ducts are occluded, causing obstructive jaundice (conjugated hyper-bilirubinemia) and progressive liver fibrosis in early infancy. Liver transplantation is required if not diagnosed and managed early.

(option B) Indian childhood cirrhosis (ICC) is a progressive liver failure in young children, associated with marked hepatic copper overload (in excess of 800 µg/g dry weight). Unlike Wilson disease, ICC is associated with normal or elevated ceruloplasmin levels, indicating a defect late in the copper excretory pathway.

Solution to Question 21:

A 5-year-old child with Wilson's disease is a case of non-paracetamol-induced acute liver failure and jaundice for more than 7 days before the development of encephalopathy is one of the parameters in the King's College criteria for liver transplantation.

It includes the following parameters:

Non-paracetamol-induced acute liver failure:

• PT >100 s (INR >6.5)

or/and

• Any three of the following:

• Age <10 years or >40 years

• Etiology non-A, non-B hepatitis, or idiosyncratic drug reaction

• Jaundice more than 7 days before the development of encephalopathy i.e., not hyperacute

• PT >50 s (INR > 3.5)

• Bilirubin > 18 mg/dl (300 µmol/L)

Paracetamol-induced acute liver failure:

• pH <7.30 (irrespective of the grade of encephalopathy)

or/and

• All three of the following:

• Prothrombin time >100 s (INR >6.5)

• Serum creatinine >3.4 mg/dl (300 µmol/L)

• Grade 3 or 4 hepatic encephalopathy

Solution to Question 22:

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Auxiliary orthotopic liver transplantation (A-OLTX) is indicated in non-cirrhotic metabolic liver disease.

Auxiliary partial orthotopic liver transplantation is a technique where part of the diseased native liver is removed and replaced with a part of the healthy donor liver. This is done so the retained native liver can regenerate.

In selective cases of acute liver failure, auxiliary partial orthotopic liver transplantation could provide a chance for native liver regeneration and immunosuppression-free life.

Auxillary orthotopic liver transplant is indicated for the following:

• Patients aged <40 years

• Reversible fulminant hepatic failure (auxiliary liver transplantation cannot be done in cases of irreversible liver failure)

• Non-cirrhotic metabolic liver disease

• No hemodynamic instability

• Hyperacute (not in other cases) Liver failure with Acetaminophen overdose.

Total orthotopic liver transplantation (OLTX)	Auxiliary orthotopic liver transplantation (A-OLTX)
The entire liver is transplanted	Only a portion of the liver is transplanted
Indications:Fulminant hepatic failure (FHF)Liver cirrhosis Primary biliary cirrhosis	Indications:Crigler–Najjar syndrome type IHomozygous familial hypercholesterolemiaGalactosemiaHereditary tyrosinemiaNeimann-Pick's disease
Life-long immunosuppression is required.	Immunosuppression is required until the native liver regenerates

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Gall Bladder

Question 1:

Which of the following statements about the anatomy of the gallbladder is false?

a) Valves of Heister are present around the neck of the gallbladder

b) Gall bladder has a very thick submucosal layer

c) Hartmann's pouch may hinder safe dissection of the cystic pedicle

d) Phrygian cap anomaly is not an indication for cholecystectomy

Question 2:

While assisting a laparoscopic cholecystectomy for gallstones, the surgeon asks you to identify the Calot's triangle. Which of the following structures does not form the boundaries of this triangle?

a) Cystic duct

b) Common hepatic duct

c) Cystic artery

d) The inferior surface of the liver

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Question 3:

Which type of gallstones is most likely to be seen in the Asian population?

a) Cholesterol stone

b) Pigment stone

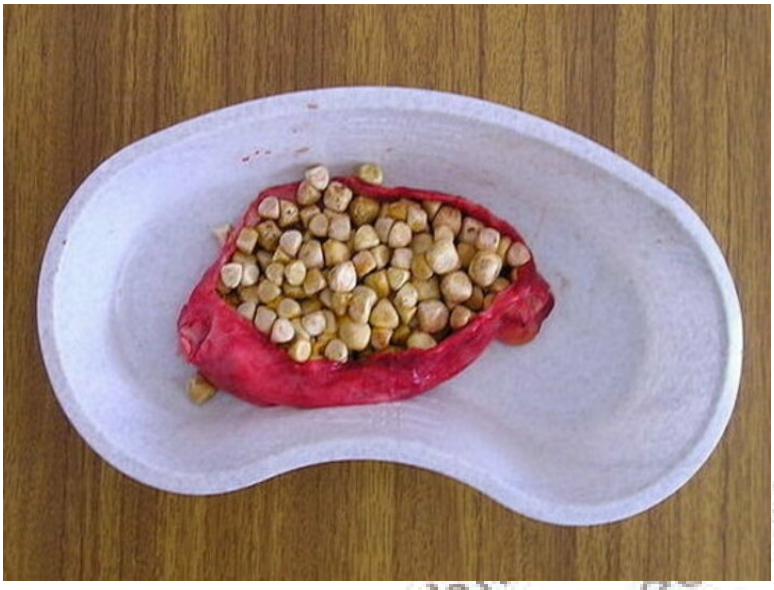
c) Mixed stone

d) Struvite stone

Question 4:

A 28-year-old obese woman underwent laparoscopic cholecystectomy and the specimen of gallstones removed is given below. Which of the following is least likely to be a risk factor for the formation of this type of gallstone in her?

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a) Prolonged fasting

b) High-caloric diets

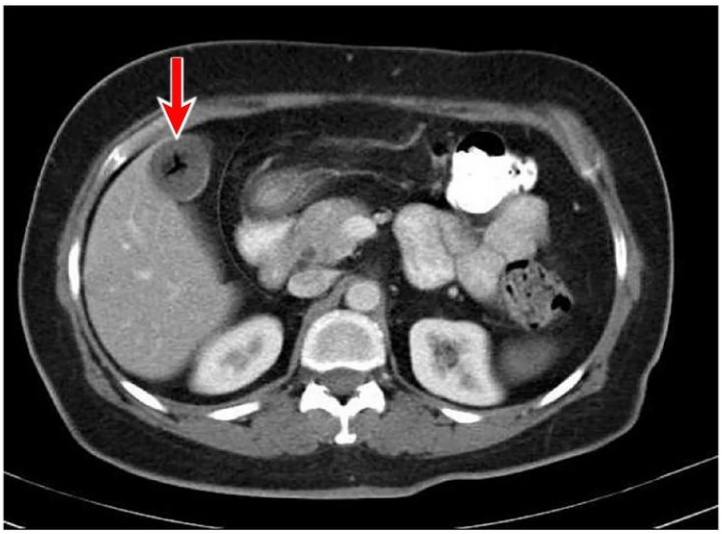
c) Oral contraceptive pills

d) Hereditary spherocytosis

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Question 5:

A 45-year-old woman was brought to the casualty with complaints of abdominal pain and vomiting. CT scan of the abdomen revealed the following finding. What is the most probable diagnosis?



a) Gallstones

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b) Empyema gallbladder

c) Common bile duct stones

d) Carcinoma gallbladder

Question 6:

What percentage of gallstones are radio-opaque?

a) 10%

b) 20%

c) 30%

d) 90%

Question 7:

While performing the HIDA scan in a patient with gallstones, the gallbladder was not visualized. What could be the possible diagnosis?

a) Acute cholecystitis

b) Carcinoma gallbladder

c) Empyema gallbladder

d) Bile duct obstruction

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Question 8:

A 25-year-old patient was admitted with right hypochondriac pain and vomiting. USG demonstrates a stone within the bile duct. All of the following clinical features can be seen in this patient except:

a) Jaundice

b) Dyspepsia

c) Flatulence

d) Murphy's sign

Question 9:

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According to the Tokyo Consensus Guidelines for grading the severity of acute cholecystitis, which of the following conditions is classified under moderate (Grade II) acute cholecystitis?

a) Presence of cardiovascular dysfunction

b) WBC count > 12000/mm3

c) Right upper quadrant pain

d) Duration of complaints >72 hours

Question 10:

A 45-year-old man with a past medical history of diabetes mellitus, hypertension and ischemic heart disease presented with fever, nausea and right upper abdominal pain for the past 2 days. On evaluation, he is hypotensive and has a right upper quadrant palpable mass. Laboratory findings are mentioned below. Which of the following is the most appropriate management for this patient?

a) Percutaneous cholecystostomy, followed by interval cholecystectomy

b) Laparoscopic cholecystectomy

c) Conservative management, followed by delayed cholecystectomy after 6 weeks

d) Open cholecystectomy

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Question 11:

A diabetic patient presents with complaints of right upper quadrant pain, fever and nausea. On examination, there is tenderness over the right upper quadrant. CT scan revealed the following finding. What is the most common organism implicated in this condition?

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a) Clostridium perfringens

b) Proteus

c) Staphylococcus aureus

d) E. coli

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Question 12:

A patient in the burns ward complains of right hypochondriac pain and fever. USG reveals a thickened, hyperemic gallbladder with sludge formation surrounded by pericholecystic fluid but no gallstones. Which of the following statements is false regarding this condition?

a) CT-guided cholecystostomy is the treatment of choice

b) It has a high mortality rate

c) Murphy's sign will be positive

d) E. coli is the causative agent

Question 13:

A 25-year-old lady was incidentally found to have gallstones during the abdominal ultrasound. She is otherwise healthy and does not complain of any symptoms. In which of the following clinical scenarios you will not advise her for prophylactic cholecystectomy?

a) Choledocholithiasis

b) Gallbladder polyp > 1cm

c) Sickle cell disease

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d) Presence of a 1.5 cm gallstone

Question 14:

Medical therapy for gallstones using ursodeoxycholic acid will be considered in all of the following conditions, except:

a) If the size of the cholesterol stone is < 10mm

b) If the patient has biliary pain without any complications

c) In recurrent choledocholithiasis after cholecystectomy

d) In the presence of radio-opaque cholesterol gallstones

Question 15:

A patient with symptomatic gallstones but refusing surgery is at risk of developing all of the following complications except:

a) Intestinal obstruction

b) Diverticulosis

c) Acute cholangitis

d) Acute pancreatitis

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Question 16:

Which of the following statement is false regarding the mucocele of the gallbladder?

a) Caused due to prolonged obstruction of cystic duct

b) Early cholecystectomy needs to be done

c) Obstruction can be seen in the neck of the gallbladder

d) A tender, non palpable gallbladder is characteristic of this condition

Question 17:

A middle-aged woman with a history of cholelithiasis was rushed to the casualty with complaints of vomiting, abdominal distension, and obstipation. On examination, high-pitched bowel sounds were heard. Her X-ray erect abdomen is given below. Which statement is false regarding this condition?

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a) It is associated with Rigler's triad

b) Jejunum is the most common site of obstruction

c) CT scan is the investigation of choice

d) Enterotomy is done in the absence of strangulation

Question 18:

In what condition would you see the gallbladder as shown below?



a) Cholesterolosis

b) Cholesterol polyposis

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c) Cholecystitis glandularis proliferans

d) Adenomyomatosis

Question 19:

A 40-year-old lady presented with colicky abdominal pain, jaundice and generalized pruritus. She has a palpable gallbladder. Which of the following is the least likely cause?

a) Stone impacted in the cystic duct

b) Stone impacted in the fundus of gallbladder

c) Stone impacted within the gallbladder and common bile duct

d) Carcinoma of the head of the pancreas

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Question 20:

A 40-year-old lady presented with abdominal pain, vomiting and jaundice. Her ALP and direct bilirubin levels were raised. She had undergone laparoscopic cholecystectomy 1 year back. On USG there is dilatation of biliary radicles. Which of the following is the ideal management for this patient?

a) Laparoscopic exploration of common bile duct

b) Open surgical exploration of common bile duct

c) ERCP+Sphincterotomy

d) Addition of ursodeoxycholic acid, followed by repeat USG after 10 days

Question 21:

An 80-year-old woman presented with complaints of fatigue. On imaging, she was found to have a scleroatrophic gall bladder with impacted stones in it. A large stone was also present in the common bile duct and the biliary tree is dilated. What is the next step in management?

a) Immediately take up patient for cholecystectomy

b) Endoscopic retrograde cholangiopancreatography

c) Wait and watch

d) CT scan

Question 22:

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What is the best investigation in a patient suspected to have an impacted gallstone at the ampulla of Vater?

a) Computed tomography scan

b) Endoscopic retrograde cholangiopancreatography

c) Endoscopic ultrasound

d) Magnetic resonance cholangiopancreatography

Question 23:

Which of the following features are part of Reynold's pentad?

a) 1, 2, 3

b) 1, 3, 5

c) 2, 3, 4

d) 1, 3, 4

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Question 24:

A jaundiced patient presented with complaints of colicky abdominal pain and itching all over the body. USG abdomen showed thickening of the gallbladder wall and pericholecystic fluid. MRCP showed extrinsic compression of the common bile duct, suggestive of Mirizzi syndrome. Identify the incorrect statement about this condition.

a) Surgery consists of removing the cystic duct, gallbladder, and the stone

b) Cystic duct obstruction will be present

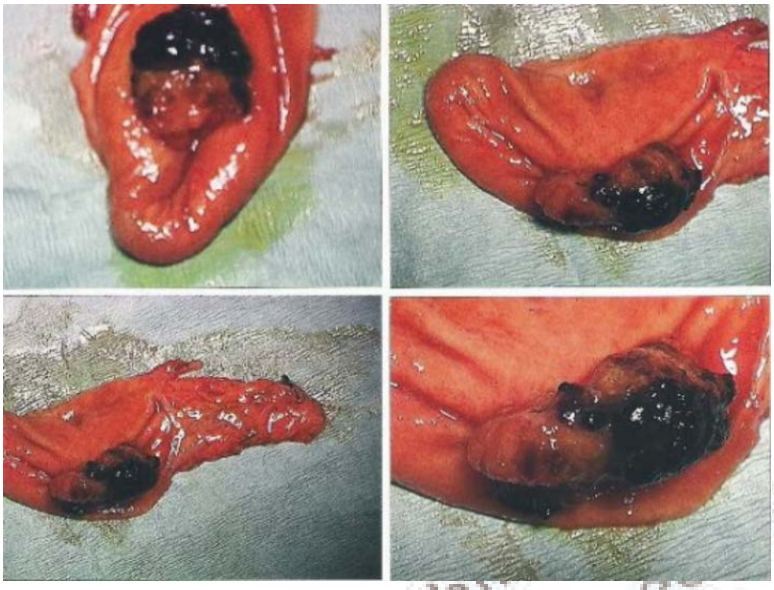
c) Fistula forms between the gallbladder and common bile duct

d) Palpable gallbladder rules out gallstones

Question 25:

Identify the condition.

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a) Cholesterolosis

b) Strawberry gallbladder

c) Gallbladder polyps

d) Gallbladder carcinoma

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Question 26:

A 45-year old lady is found to have a gall bladder polyp of size 1.2cm on abdominal USG. She appears to be healthy and is asymptomatic. How will you manage this patient?

a) Regular follow up every 2 months

b) Polypectomy

c) Exploratory laparotomy

d) Cholecystectomy

Question 27:

What is the treatment of choice for the condition shown below?

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a) Cholecystectomy

b) Ursodeoxycholic acid

c) Observation

d) Extended cholecystectomy

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Question 28:

All of the following are risk factors for gallbladder carcinoma, except:

a) Salmonella typhi carrier state

b) Cholelithiasis

c) Sclerosing cholangitis

d) Adenomyomatosis

Question 29:

Which of the following is false regarding gallbladder carcinoma?

a) Squamous cell carcinoma is the most common type

b) Jaundice is a late feature

c) Depth of invasion is the most important prognostic factor

d) CA 19-9 is used for monitoring

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Question 30:

A patient underwent laparoscopic cholecystectomy for cholelithiasis. Histopathology of the resected gall bladder is reported as Stage T1a of gallbladder cancer. What is the next step in management?

a) No further treatment

b) Perform extended cholecystectomy

c) Adjuvant chemotherapy

d) Palliative nonsurgical therapy

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Answer Key

Question No.	Correct Option
1	b
2	d
3	b
4	d
5	a
6	a
7	a
8	d
9	d
10	a
11	a
12	d
13	d
14	d
15	b
16	d
17	b
18	a
19	b
20	c
21	b
22	b

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23	d
24	d
25	c
26	d
27	a
28	d
29	a
30	a

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Detailed Explanations

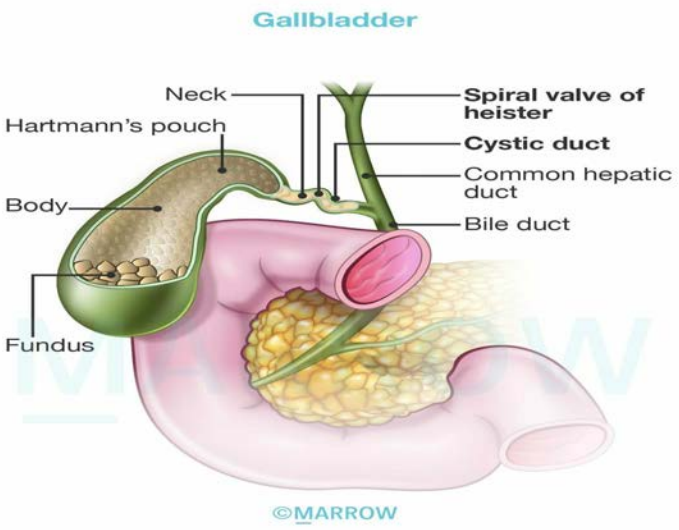
Solution to Question 1:

The gallbladder does not have muscularis mucosa and submucosa. Those layers are absent in the gallbladder.

The mucosa of the cystic duct is arranged in spiral folds known as the valves of the Heister. The valves act to keep gallstones from entering the common bile duct in spite of distention and intraluminal pressure.

Hartmann's pouch is a diverticulum that can occur at the neck of the gallbladder. It may obscure the cystic duct and Calot's triangle during laparascopic surgical dissection.

The Phrygian cap is present in 2–6 percent of cholecystograms and may be mistaken for a pathological deformity of the organ. It is not an indication for cholecystectomy.



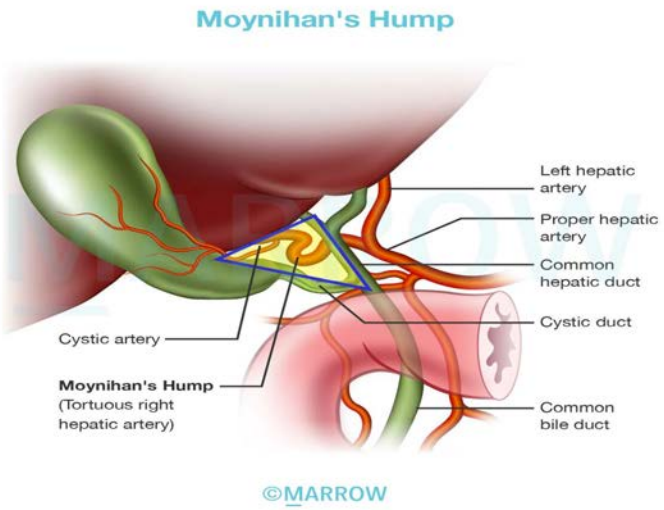
Solution to Question 2:

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The inferior surface of the liver forms the boundary of the hepatobiliary triangle, not Calot's triangle.

Calot's triangle is an important surgical landmark as the cystic artery usually can be found within its boundaries. The cystic artery should be identified while performing a cholecystectomy to avoid damage to the extrahepatic biliary system.

Occasionally, there can be a tortuous course of the right hepatic artery in some patients. This is called Moynihan's hump or caterpillar hump. It is an important anomaly that should be recognized in order to prevent intraoperative vascular and biliary injuries.



Note: The cystic artery is one of the contents as well as forms the superior boundary of the Calot's triangle (originally described in 1891 by Jean-François Calot)

Solution to Question 3:

The most common type of gallstone to be seen in the asian population is pigment stone (80%). The most common type of gallstone worldwide is mixed stone.

Three main types of gallstones include:

• Cholesterol stones - They consist of cholesterol monohydrate crystals. Pure cholesterol stones are uncommon and account for <10% of all cases.

• Pigment stones (brown or black) contain <30% cholesterol:

• Black stones - Made up of insoluble bilirubin pigment polymer mixed with calcium phosphate and calcium bicarbonate. They are associated with hemolysis, usually seen in hereditary spherocytosis or sickle cell disease.

• Brown stones - Contain calcium bilirubinate, calcium palmitate, and calcium stearate, as well as cholesterol. They are also associated with the presence of foreign bodies within the bile ducts, such as endoprostheses (stents), or parasites, such as Clonorchis sinensis and Ascaris lumbricoides.

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• Mixed stones.

The image below shows a resected specimen of the gallbladder with pigment stones.



Struvite stone (triple phosphate stone) is a type of renal calculi. It is made of magnesium, ammonium, and phosphate.

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Solution to Question 4:

The above image shows cholesterol gallstones. Hereditary spherocytosis is not a risk factor for the formation of cholesterol gallstones. Hereditary spherocytosis leads to the production of black pigment stones.

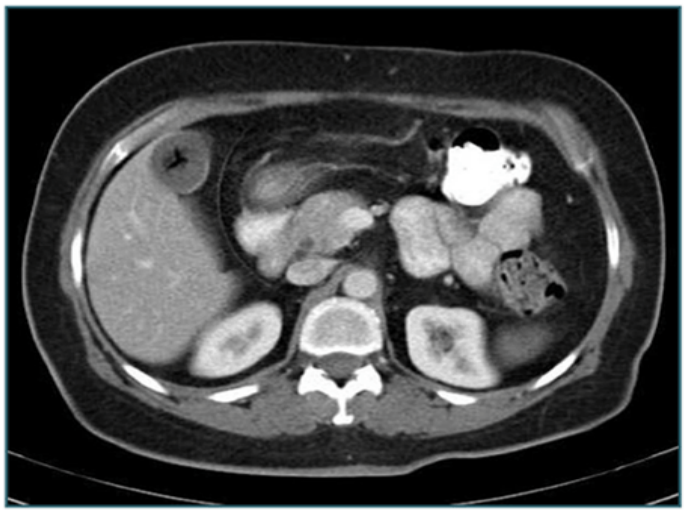
Obesity, high-caloric diets, prolonged fasting, certain medications (e.g., oral contraceptives), and resection of the terminal ileum result in increased secretion of cholesterol and supersaturation of bile. This enhances the lithogenicity of bile.

Solution to Question 5:

The CT image shows the Mercedes-Benz sign. It is a characteristic sign seen in gallstones.

In gallstone, rarely, the center of the stone may contain radiolucent gas in a triradiate or biradiate fissure. This gives rise to characteristic dark shapes on a radiograph called the Mercedes–Benz sign (triradiate sign) or seagull sign (biradiate sign).

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Solution to Question 6:

Only 10% of gallstones are radiopaque.

Approximately 90% of renal stones, 10% of gall stones, and 5% of appendicoliths contain enough calcium to appear radiopaque on plain films.

Gallbladder diseases are regularly diagnosed by ultrasound because of the superficial location of the gallbladder and the absence of overlying bowel gas. Ultrasound has a high specificity and sensitivity for cholelithiasis. It is considered as the first test of choice for delineation of any biliary pathology. Stones appear acoustically dense and also produce an acoustic shadow. They also move with a change in posture. However, CT provides superior anatomic information and therefore is indicated when more anatomic delineation is required.



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Solution to Question 7:

Non-visualization of the gallbladder in HIDA (hepatobiliary iminodiacetic acid) scan is suggestive of acute cholecystitis.

Acute cholecystitis is the inflammation of the gallbladder that develops over hours, usually because a gallstone obstructs the cystic duct. In the majority of cases, the process is limited by the stone slipping back into the body of the gallbladder. Clinical features include:

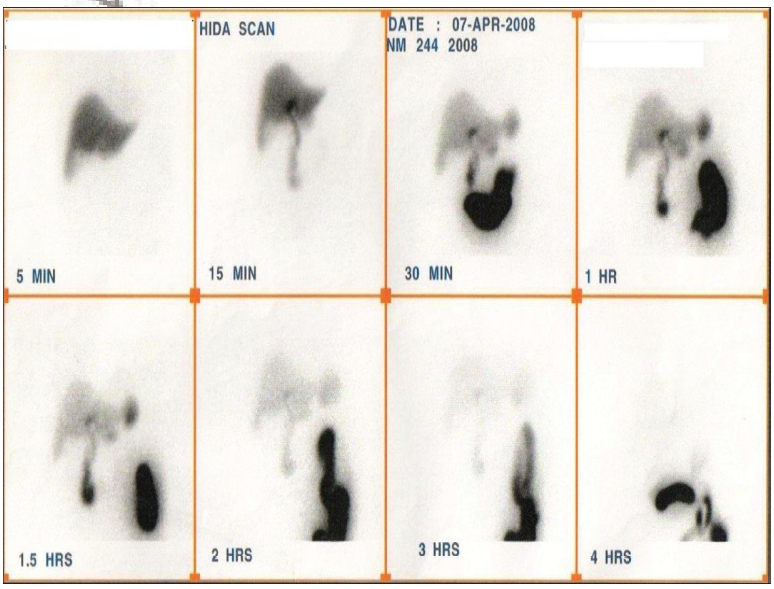
- Pain in the right hypochondrium with referred pain to the back
- Fever
- Nausea, vomiting, dyspepsia
- Jaundice
- Positive Murphy's sign
- Positive Boas' sign

Murphy's sign: After asking the patient to exhale, the examiner places his hand below the costal margin on the right side at the mid-clavicular line of the patient. The patient is then instructed to take a deep inspiration. If the patient stops breathing and winces with a 'catch' of breath, Murphy's sign is said to be positive.

Boas' sign: It is the presence of an area of hyperaesthesia at the site of radiation of the pain to the back, typically, below the scapula.

USG and CT scans are helpful in establishing a diagnosis. The gold standard investigation of acute cholecystitis is the HIDA scan. The radioisotope used is Technetium-99m (99mTc)-labeled derivative of iminodiacetic acid.

The following image depicts the radioisotope scan in which the gallbladder is not visualized even after 4 hours.



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Unlike bilirubin, iminodiacetic acid (IDA) compounds do not undergo conjugation in the hepatocytes. They are rapidly excreted into the bile. This enables excellent visualization of the bile ducts and gallbladder within 30–60 minutes of injection.

Since cystic duct obstruction initiates acute cholecystitis, there is non-visualization of the gallbladder 3 - 4 hours after the intravenous injection of 99m Tc-IDA. This is characteristic of acute cholecystitis. Thus visualization of the GB establishes cystic duct patency and rules out acute cholecystitis.

Solution to Question 8:

The presence of a stone within the bile duct is called choledocholithiasis. Murphy's sign is not seen in choledocholithiasis. It is seen in acute cholecystitis.

Clinical features of choledocholithiasis:

• Right upper quadrant or epigastric pain, which may radiate to the back

• Biliary colic

• Vomiting

• Dyspepsia

• Flatulence

• Food intolerance particularly to fatty foods

• Altered bowel habits

• Jaundice.

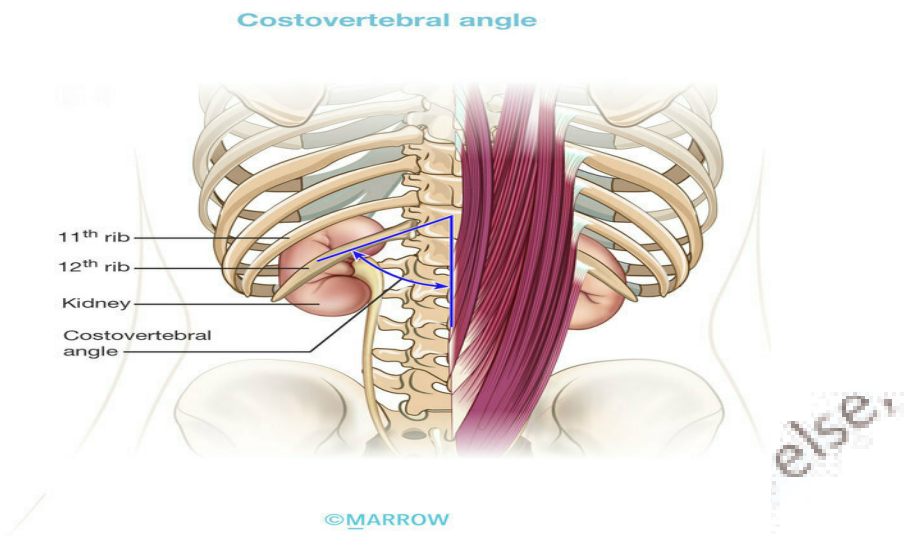
Other Murphy's in surgery:

Murphy's punch sign: This test is performed by the examiner using the fist to make jabbing thrusts over the costovertebral angle. The test is positive in infection, inflammation, or obstruction of the kidney.

The angle shown in the image is the costovertebral angle formed between the lower border of the 12th rib and the vertebral column.

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Murphy's triad is associated with acute appendicitis.

• Pain in the right illiac fossa

• Vomiting

• Fever

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Solution to Question 9:

If the duration of complaints is >72 hours, the patient is classified as having moderate (Grade II) acute cholecystitis.

Acute cholecystitis is treated by keeping the patient nil per oral (NPO), administering intravenous fluids, analgesics, and IV antibiotics.

The timing of surgery in acute cholecystitis remains controversial:

• If the patient presents within 3 days, emergency cholecystectomy is done.

• If the patient presents after 3 days, conservative management is done initially. Once the inflammation subsides, cholecystectomy is performed after 6 weeks (interval cholecystectomy).

Tokyo Consensus Guidelines forgrading the severity of acu te cholecystitis	
Grade III (severe) acute chole cystitis	
Associated with organ dysfun ction	

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Tokyo Consensus Guidelines forgrading the severity of acu te cholecystitis	
1. Cardiovascular dysfunction	Hypotension*requiring treat ment with dopamine>5 mcg/ kg/min, or any dose of norad renaline
2. Neurological dysfunction	Decreased level of conscious ness
3. Respiratory dysfunction	PaO2/FiO2ratio <300
4. Renal dysfunction	Oliguria; serum creatinine >2 mg/dL
5. Hepatic dysfunction	Prothrombin time (PT-INR)> 1.5
6. Hematological dysfunction	Platelet count, <100,000/mm 3
Grade II (moderate) acute ch olecystitis	
Associated with dysfunction of any one of the following:El evated white blood cell count (>18,000/mm3)Palpable ten der mass in the right upper a bdominal quadrantDuration of complaints >72 hoursMark ed local inflammation (gangr enous cholecystitis, perichole cystic abscess, hepatic absces s, biliary peritonitis, emphyse matous cholecystitis)	
Grade I (mild) acute cholecys titis	
Does not meet the criteria of grade II or III acute cholecyst itis.Acute cholecystitis in a he althy person with no organ d ysfunction and mild inflamm atory changes in the gall blad der, making cholecystectomy a safe and low-risk operative procedure.	

Solution to Question 10:

The given clinical vignette is suggestive of severe acute cholecystitis (grade III) based on Tokyo Consensus Guideline. Patients who have multiple comorbidities and present with severely acute cholecystitis should ideally undergo USG guided percutaneous cholecystostomy, followed by

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interval cholecystectomy once the condition has been stabilized..

Management of cholecystitis

• Nil per oral (NPO)

• IV fluids

• Analgesics

• IV antibiotics

• Surgery

• Grade III

• with comorbidities - a percutaneous cholecystostomy can be performed by a radiologist under ultrasound guidance. An interval cholecystectomy once the condition has been stabilized.

• without comorbidities - unless the patient is extremely hemodynamically unstable, operative intervention (cholecystectomy) should be performed.

• Grade I-II

• presenting within 3 days - emergency cholecystectomy is done.

• presenting after 3 days - conservative management is done initially. Once the inflammation subsides, cholecystectomy is performed after 6 weeks (interval cholecystectomy).

Tokyo Consensus Guidelines forgrading the severity of acu te cholecystitis	
Grade III (severe) acute chole cystitis	
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Grade II (moderate) acute ch olecystitis	

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Tokyo Consensus Guidelines forgrading the severity of acu te cholecystitis	
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Solution to Question 11:

The given clinical scenario and the CT scan showing gas within the wall of the gallbladder are diagnostic of acute emphysematous cholecystitis. Clostridia species are the most commonly implicated organisms in acute emphysematous cholecystitis. Other causative organisms include E. coli and anaerobic streptococci.

Emphysematous cholecystitis is a rare form of acute cholecystitis where gallbladder wall necrosis causes gas formation in the lumen or wall.

Clinical features include:

• Right upper quadrant pain

• Nausea

• Vomiting

• Fever

• Presence of crepitus during physical examination

On imaging, the condition is diagnosed when there is a radiographic demonstration of air in the gallbladder wall +/- biliary ducts.

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Emphysematous cholecystitis has a high mortality rate due to the development of gangrene, perforation, and other complications. Hence, emergency cholecystectomy is indicated for the management of these patients. Tube cholecystostomy is done for patients who are not suitable for surgery.

The given image shows a postoperative specimen of an emphysematous gallbladder along with an X-ray showing air in the gallbladder wall.



Note: E. coli is the most commonly implicated organism in acute emphysematous pyelonephritis.

Solution to Question 12:

The given clinical scenario along with the USG findings point to a diagnosis of acalculous cholecystitis. E. coli is not a causative agent of acalculous cholecystitis.

Acute and chronic inflammation of the gallbladder can occur in the absence of stones and are referred to as acalculous cholecystitis.

It is mainly seen in critically ill patients and those recovering from major surgery, trauma, and burns. It has a high mortality rate.

The bacterial infections of the gallbladder causing acalculous cholecystitis include:

• Leptospira

• Streptococcus

• Salmonella

• Vibrio cholerae

Clinical features are similar to that of acute calculous cholecystitis, such as:

• Right upper quadrant pain

• Fever

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• Positive Murphy's sign

• Leukocytosis

• Sepsis

A USG demonstrates a distended gallbladder with thickened wall, biliary sludge, pericholecystic fluid, and the presence or absence of abscess formation. HIDA scan shows a non-visualization of the gallbladder.

Acalculous cholecystitis requires urgent intervention. Percutaneous ultrasound or CT-guided cholecystostomy is the treatment of choice for these patients, as they are usually unfit for surgery.

Cholecystectomy is performed after the patient has recovered from the underlying illness.

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Solution to Question 13:

Prophylactic cholecystectomy in asymptomatic cholelithiasis is indicated only when gallstones >3 cm.

Indications for consideration of prophylactic cholecystectomy in asymptomatic patients:

• Risk factors for carcinoma

• Choledochal cysts

• Gallbladder adenomas

• Porcelain (calcified) gallbladder

• Solitary gallbladder polyp larger than 1 cm

• Choledocholithiasis

• Gallstones >3 cm

• The patient lives in a remote location from a healthcare facility

• Sickle cell disease/spherocytosis

• Transplant or immunosuppressant therapy.

Note: Some books also mention "Prophylactic cholecystectomy is indicated in asymptomatic cholelithiasis when gallstones >2 cm."

Solution to Question 14:

Medical therapy using ursodeoxycholic acid (UDCA) for gall stones is indicated for radiolucent cholesterol stones.

Selection criteria for oral bile acid dissolution therapy:

• Symptomatic patients without complications

• Patients with normal gallbladder functioning and a patent cystic duct

• Patients with radiolucent stones and diameter < 10 mm

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Stones >10 mm in size rarely dissolve. Patients with cholesterol gallstone disease who develop recurrent choledocholithiasis after cholecystectomy should be on long-term treatment with UDCA. The dose of UDCA should be 10–15 mg/kg per day.

Pigment stones are non-responsive to UDCA therapy.

Solution to Question 15:

Diverticulosis is not a complication due to gallstones.

Clinical complications due to gallstones include the following:

- Biliary colic
- Acute cholecystitis
- Chronic cholecystitis
- Empyema of the gallbladder
- Mucocele
- Perforation
- Biliary obstruction
- Acute cholangitis
- Acute pancreatitis
- Intestinal obstruction (gallstone ileus).

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Solution to Question 16:

The gallbladder is palpable but non-tender in the mucocele of the gallbladder.

Mucocele of the gallbladder results from prolonged obstruction of the cystic duct, usually by a large solitary calculus. The obstructed gall bladder lumen is progressively distended by mucus (mucocele) or by a clear transudate (hydrops) produced by mucosal epithelial cells.

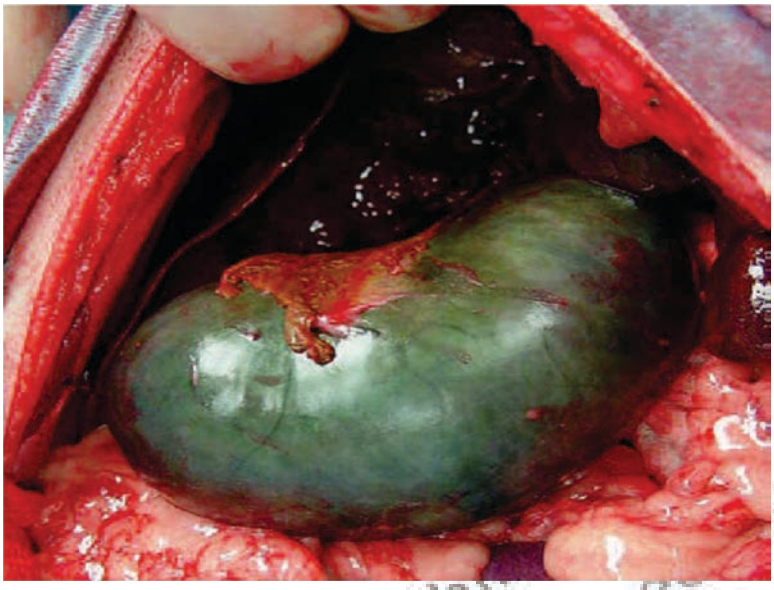
It is usually asymptomatic, although chronic right upper quadrant pain may also occur. On examination, a visible, easily palpable, non-tender gallbladder, sometimes extending from the right upper quadrant into the right iliac fossa may be seen.

Ultrasonography is helpful for the diagnosis.

Early cholecystectomy needs to be done, because empyema, perforation, or gangrene may complicate the condition.

The image below shows mucocele of the gallbladder.

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The image below shows empyema of the gallbladder.



Solution to Question 17:

The given clinical scenario with an X-ray showing gas in the biliary tract (pneumobilia) and multiple air-fluid levels indicating small bowel obstruction is suggestive of gallstone ileus. The distal ileum is the most common site to be obstructed in gallstone ileus because it tapers before entering the cecum.

Gallstone ileus is caused by the obstruction of the intestinal lumen by a gallstone, leading to a mechanical blockage. Big gallstones will not be able to pass through the normal cystic duct. This causes inflammation of the gallbladder and results in pressure necrosis. This in turn leads to biliary-enteric fistula formation.

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Plain radiographs demonstrate air-fluid levels consistent with a small bowel obstruction. Rigler's triad is seen in gallstone ileus. It includes:

• Intestinal obstruction

• Gas in the biliary tract (pneumobilia)

• Ectopic gallstone (Radio-opaque shadow in the right iliac fossa)

The investigation of choice is the CT scan. Pneumobilia is a ubiquitous finding because the fistula that permitted a stone to pass into the duodenum allows air into the gallbladder and the biliary tree.

Initial management involves keeping the patient nil per-oral, IV fluids, IV antibiotics, and analgesics.

If there is no strangulation or peritonitis, it can be managed by:

• Milking the stone beyond ileocaecal junction

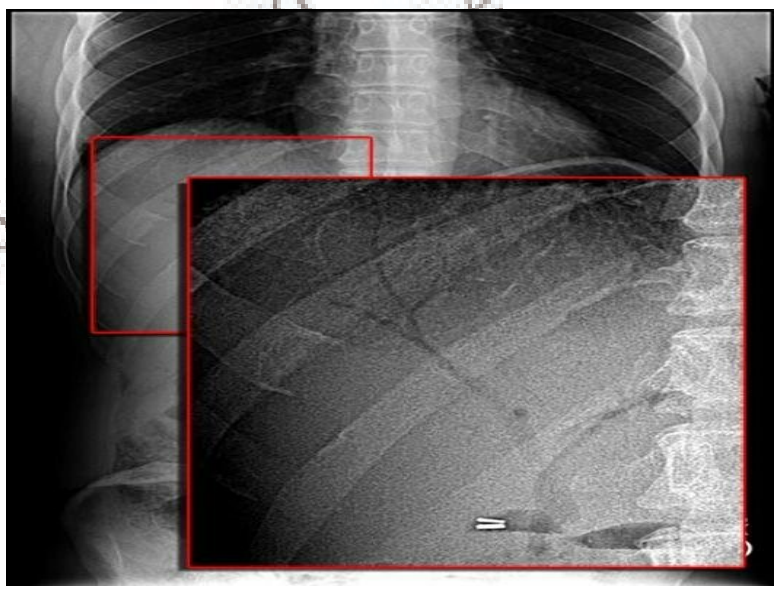
• Crushing the stone

• Enterotomy to remove the stone

If there is perforation or strangulation, resection and anastomosis are done.

Cholecystectomy should be performed to avoid future complications. Fistula closure can be performed along with cholecystectomy or it can be performed later (two-stage procedure).

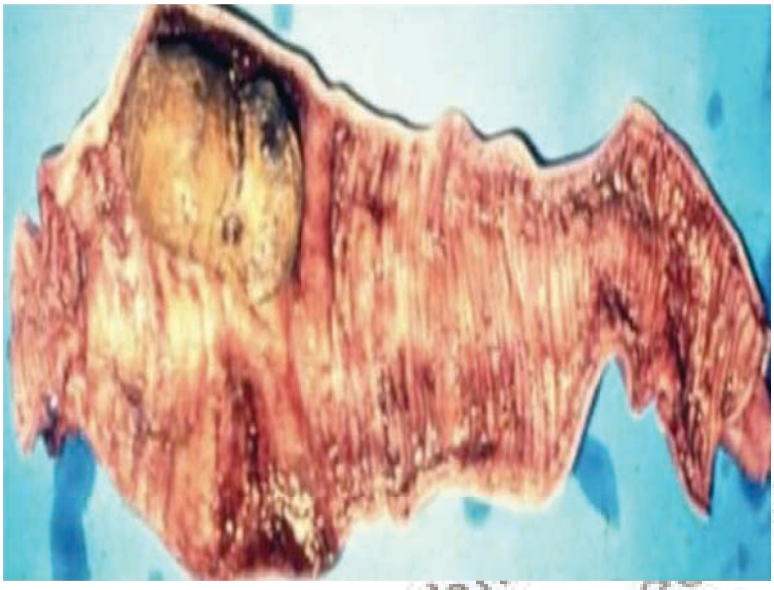
Given below is a plain X-ray of the erect abdomen showing air in the biliary tract (pneumobilia).



A large gallstone causing gallstone ileus is shown below.

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Solution to Question 18:

The given image shows a strawberry gallbladder. Strawberry gallbladder is seen in cholesterolosis and is associated with cholesterol stones.

Cholesterolosis is characterized by mucosal villous hyperplasia. The interior of the gallbladder resembles a strawberry. The yellow specks are aggregations of cholesterol crystals and cholesterol esters in the lamina propria. This corresponds to the seeds of a strawberry.

Option A: Cholesterol polyposis - Cholecystography or ultrasonography shows negative shadows in a functioning gallbladder, indicating the presence of a well-defined polyp.

Options B and C: Cholecystitis glandularis proliferans/adenomyomatosis - All layers of the gallbladder wall may be thickened, but sometimes, an incomplete septum forms that separate the hyperplastic from the normal layer. Intraparietal "mixed" calculi may be present.

Solution to Question 19:

A stone impacted within the fundus of the gallbladder is least likely to cause jaundice with a palpable gallbladder.

According to Courvoisier's law, the presence of a painless, palpable, enlarged gallbladder and mild jaundice, is unlikely due to gallstones. It usually indicates a possibility of carcinoma in the head of the pancreas. However, apart from a cancer in the pancreatic head, certain other conditions may also cause a palpable gallbladder in presence of jaundice. For example,

• Double impacted stones (stones in both the cystic duct and the distal common bile duct)

• Primary CBD stone

• Oriental cholangiohepatitis

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• Mirizzi's syndrome (an impacted gallstone in the cystic duct or neck of the gallbladder due to inflammation, causing common bile duct (CBD) obstruction, jaundice and a palpable gallbladder)

These are considered exceptions to Courvoisier's law.

Solution to Question 20:

The given scenario is suggestive of choledocholithiasis. When diagnosed postoperatively (after cholecystectomy), it should be managed with ERCP + sphincterotomy.

Stone detected within 2 years after cholecystectomy is called retained stone. Stone detected more than 2 years after cholecystectomy is considered recurrent stone.

CBD stone and GB stone detected before cholecystectomy:

• ERCP+Sphincterotomy, followed by laparoscopic cholecystectomy after a few days should be done.

CBD stone detected during surgery (intraoperatively):

• Laparoscopic cholecystectomy + laparoscopic CBD exploration should ideally be done in the same sitting to avoid the need for additional operative sitting and anaesthesia.

• A transcystic approach is preferred usually.

• If there is a small, friable cystic duct; numerous (more than eight) stones in the common bile duct; and large stones (>1 cm), laparoscopic choledocholithotomy is performed.

• If laparoscopic choledocholithotomy exploration is not feasible, it would necessitate the need for an open CBD exploration.

• A T-tube is placed in the CBD after laparoscopic choledocholithotomy or open CBD exploration. It is followed by a cholangiography to exclude retained stone.

CBD stone detected after surgery:

• Endoscopic removal (ERCP) with sphincterotomy is usually the management of choice.

Solution to Question 21:

An 80-year-old woman with imaging showing a scleroatrophic gall bladder with impacted stones and a stone in the bile duct is suggestive of chronic cholelithiasis with choledocholithiasis. ERCP is the next line of management for this patient.

Choledocholithiasis is the presence of stone in the common bile duct (CBD) or biliary tree. It can be primary or secondary:

• Primary stones are formed in the CBD or biliary tree itself and are rare.

• Secondary stones are passed from the gallbladder to the CBD. They are easier to manage than primary stones.

It can be an asymptomatic and incidental finding or present with features such as jaundice (most common), abdominal pain, and fatigue. When there is inflammation of the biliary tree

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(cholangitis), the patient will have intermittent pain, fever, and jaundice (Charcot's triad).

Investigations:

• Liver function tests will show elevated direct bilirubin and alkaline phosphatase levels.

• Abdominal ultrasound is the first imaging modality done and may show gallstones and dilated bile duct (>8 mm).

• CT is sensitive for CBD stones. It shows stones, location, ductal stricture or block, ductal dilatation, and intrahepatic biliary changes.

• MRCP is highly sensitive and specific for CBD stones, but it is only diagnostic and intervention cannot be performed.

Management:

• ERCP with sphincterotomy is the procedure of choice, followed by the removal of stones using a dormia basket or placement of a stent.

• Despite ERCP being an invasive procedure, it has the advantage of being both a diagnostic and therapeutic procedure and is more suited for elderly patients who cannot tolerate anesthesia and surgery.

Other options:

Option A: Cholecystectomy is not recommended for elderly patients, owing to the risk of old age and associated anesthetic and surgical complications.

Option C: Wait and watch approach can be done for asymptomatic patients, and patients with smaller stones.

Option D: CT is sensitive for CBD stones, but it is only diagnostic and intervention cannot be performed.

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Solution to Question 22:

Endoscopic retrograde cholangiopancreatography (ERCP) will be the best investigation in the management of impacted stone at the ampulla of Vater. It allows the surgeon to visualize the presence of gallstone at the ampulla of Vater along with the therapeutic extraction of the stone.

The following image shows an ERCP procedure (endoscope visible).

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Solution to Question 23:

Vomiting and diaphoresis are not part of Reynold's pentad. Reynold's pentad is seen in acute suppurative cholangitis.

Solution to Question 24:

A palpable gallbladder will not rule out gallstones in Mirizzi syndrome. It is an exception to Courvoisier's law.

Courvoisier's law states that in the presence of a painless, palpable, enlarged gallbladder and mild jaundice, the cause is unlikely to be gallstones. Its exceptions include:

- Double impacted stones (stones in both the cystic duct and the distal common bile duct)
- Primary CBD stone
- Oriental cholangiohepatitis
- Mirizzi's syndrome

In Mirizzi's syndrome, gallstones become impacted in the cystic duct or neck of the gallbladder due to inflammation. This causes common bile duct (CBD) obstruction and jaundice. The gallbladder is distended and may be palpable.

ERCP, PTC (Percutaneous transhepatic cholangiography), or MRCP will usually demonstrate the characteristic extrinsic compression of the CBD.

Surgery consists of removing the cystic duct, diseased gallbladder, and the impacted stone. In patients whose gallbladder is densely adherent to the common bile duct, partial cholecystectomy should be done.

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If left untreated, a fistula forms between the gallbladder and common bile duct (cholecysto-choledochal fistula).

Solution to Question 25:

The given image shows a resected specimen of a gallbladder with a polyp on the inner surface.

Specimen of gallbladder carcinoma would include an en-bloc dissection of the gall bladder, surrounding liver tissue and regional lymph nodes (option D). In specimens of cholesterolosis, also known as strawberry gallbladder, the gall bladder would appear yellow and coarsely granular due to the presence lipid nodules (options A and B).

Gall bladder polyps are usually incidental findings during abdominal imaging. Most of them are benign and comprise cholesterol polyps, adenomyomas or inflammatory polyps. Adenomatous polyps are the most common neoplastic polyps. The majority of patients with polyps are stable and smaller polyps are kept under observation. Cholecystectomy is done for symptomatic patients (biliary colic, pancreatitis), patients >50 years, sessile polyps with thickening >4 mm and polyps >10 mm.

The risk factors for malignancy in an adenomatous polyp include age >50 years, size >10 mm, sessile polyp, documented increase in size, and coexistence with gallstones.

Other options:

Option D: The gallbladder in a patient with carcinoma is removed via an en-bloc dissection with surrounding liver tissue along with regional lymph nodes. The given image below shows a cut surface of the resected gallbladder with a tumor at the neck along with liver bed involvement (marked by the red arrow).



Options A and B: Cholesterolosis (strawberry gallbladder) is characterized by the accumulation of lipids (triglycerides, cholesterol precursors and cholesterol esters) in the lamina propria of the gallbladder wall. The nodules are less than 1 mm in diameter and there is mucous villous hyperplasia, which gives it a coarse, yellow and granular appearance, giving it a strawberry-like

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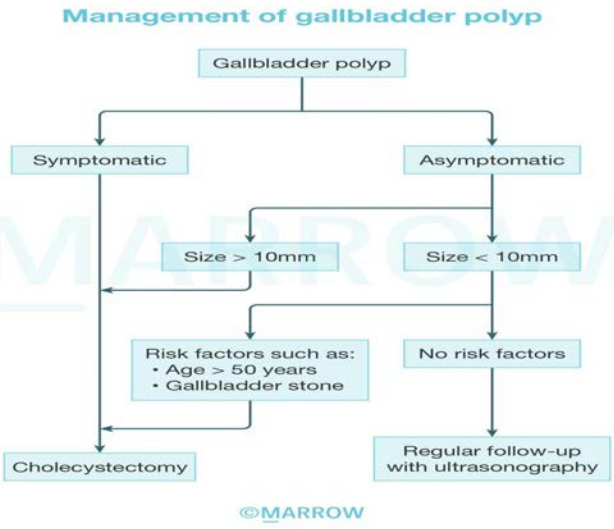
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appearance. The given images below show cholesterolosis.



Solution to Question 26:

Gallbladder polyps larger than 1 cm have an increased risk of malignancy and should be treated by performing a cholecystectomy.



Solution to Question 27:

The X-ray image shows calcification of the gallbladder, also known as porcelain gallbladder. This condition is associated with the risk of gall bladder carcinoma. Cholecystectomy is the treatment of choice.

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Extended cholecystectomy includes removal of the gall bladder with a 2 cm non-anatomical wedge of the liver and lymphadenectomy. It is performed for stage Ib with perineural, lymphatic, vascular invasion, and stage II of gallbladder carcinoma.

Solution to Question 28:

Adenomyomatosis is not a risk factor for carcinoma gallbladder.

Adenomyomatosis is a benign condition of the gallbladder characterized by hypertrophy of the mucosal epithelium. It invaginates into the thickened muscularis forming Rokitansky-Aschoff sinuses.

Risk factors for carcinoma gallbladder:

- Gallstones of size >3 cm (most important risk factor)
- Porcelain gallbladder
- Anomalous pancreato-biliary junction
- Choledochal cyst
- Adenomatous polyps
- Primary sclerosing cholangitis
- Obesity
- Salmonella typhii infection.

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Solution to Question 29:

The most common type of gallbladder carcinoma is adenocarcinoma (80–90%). Squamous carcinomas also occur and are believed to arise from areas of mucosal squamous metaplasia.

Gallbladder carcinoma is a rare malignancy that is seen in the elderly. It is associated with a poor prognosis and is indistinguishable from cholecystitis or cholelithiasis. It is usually diagnosed when patients undergo cholecystectomy for gallstones.

Its clinical features include right upper quadrant pain, nausea, vomiting, and anorexia. Jaundice is a late feature. CA 19-9 is elevated in the carcinoma gallbladder and is used for monitoring.

The preoperative diagnosis is often made on ultrasonography and followed up by a CT scan or MRI/Magnetic resonance cholangiopancreatography.

A percutaneous biopsy under radiological guidance is done for pathological examination. PET scanning helps in detecting metastatic disease.

In select cases, a laparoscopic examination is useful in staging the disease. Laparoscopy can also detect peritoneal or liver metastases. The most important prognostic factor is the depth of invasion (T-stage).

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Solution to Question 30:

Cholecystectomy is sufficient for gallbladder carcinoma with T1a lesions, wherein the tumor penetrates the lamina propria but does not invade the muscle layer.

Treatment of gallbladder carcinoma (in general):

If the carcinoma gall bladder was found incidentally after cholecystectomy:

• Up to stage Ia and stage Ib with negative margins, standard cholecystectomy would suffice

• Stage Ib with perineural, lymphatic, vascular invasion and stage II, extended cholecystectomy should be performed

If the initial procedure was performed laparoscopically, the surgeon should examine the laparoscopic port sites. The finding of disease at the port sites is a sign of generalized peritoneal disease and carries a very poor prognosis. However, resection of port sites is no longer recommended.

Chemotherapy is not required in early gall bladder cancer. Radiation has no role.

TNM staging	Treatment
T1a	Simple cholecystectomy
T1b, T2, T3	Radical cholecystectomy
T4	Unresectable, chemotherapy and palliative nonsurgical therapy are provided
N1	Regional lymphadenectomy
N2	Radical cholecystectomy plus hepatopancreatic duodenectomy

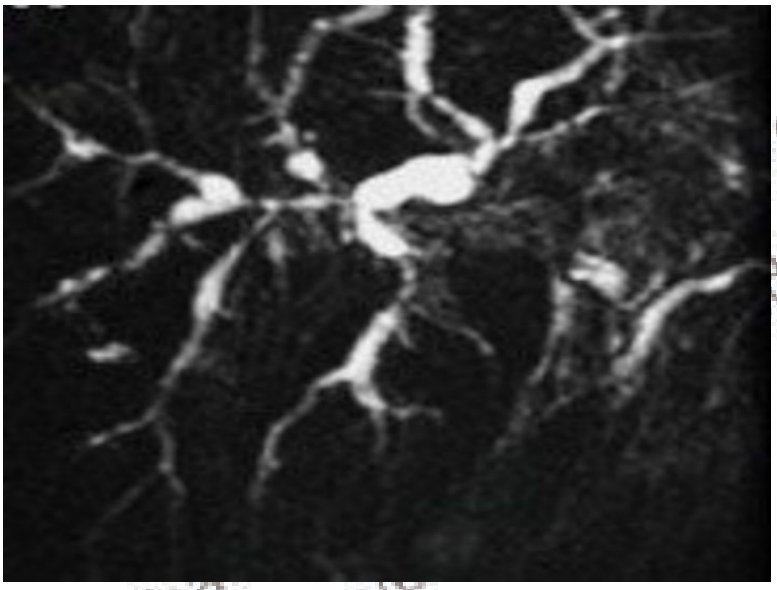
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Bile Duct

Question 1:

A 35-year-old man presented with recurrent episodes of fever with chills. MRCP image is shown below. What is the most likely diagnosis?



a) Primary sclerosing cholangitis

b) Caroli disease

c) Oriental cholangitis

d) Primary biliary carcinoma

Question 2:

According to Strasberg's classification of bile duct injuries, injury to the right aberrant posterior sectoral duct with bile leak is:

a) Type A

b) Type B

c) Type C

d) Type D

Question 3:

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A patient presents with pain in the right upper quadrant on the second postoperative day following a cholecystectomy. Evaluation reveals a collection in the subhepatic space. A bile leak was suspected. Which of the following is the best investigation for this patient?

a) MRCP

b) ERCP

c) HIDA

d) CECT

Question 4:

A patient underwent laparoscopic cholecystectomy and was discharged after removing the drain tube on the first postoperative day. On day three, the patient came back to the hospital and was febrile. On ultrasound examination, there was a 5 x 5 cm collection in the subhepatic space. What is the next best step?

a) To give oral antibiotics since the given accumulation is normal

b) To re-explore the wound and insert a T-tube

c) Insert pigtail catheter for drainage

d) ERCP and stenting

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Question 5:

Five days following a common bile duct injury resulting in a leak, a patient presents with fever and abdominal pain. What would be the next step in management?

a) Ultrasound-guided aspiration

b) Endoscopic retrograde cholangiopancreatography (ERCP) and stenting

c) Re-exploration and hepatojejunostomy

d) Re-exploration and primary repair

Question 6:

Where does biliary stricture most commonly occur after laparoscopic cholecystectomy?

a) Common hepatic duct

b) Common bile duct

c) Right hepatic duct

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d) Left hepatic duct

Question 7:

Which of the following statements is false about hemobilia?

a) It is associated with Quincke's triad

b) Tumors are the most common cause of bleeding

c) Treatment involves trans-arterial embolization

d) Arterial angiography is the diagnostic procedure of choice

Question 8:

How will you confirm the diagnosis in a patient suspected to have bilhemia?

a) CT angiography

b) Endoscopic retrograde cholangiopancreatography

c) Endoscopic ultrasonography

d) Magnetic resonance cholangiopancreatography

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Question 9:

Cholangiohepatitis is associated with which of the following parasites?

a) 1, 3, and 5

b) 1, 2, and 3

c) 2 , 3, and 4

d) 1, 2, and 4

Question 10:

A 60-year-old man presented with complaints of weight loss, clay coloured stools, and abdominal pain. CT scan and MRCP was suggestive of cholangiocarcinoma. What is the most common site at which this occurs?

a) Distal third of the common bile duct

b) Middle third of the common bile duct

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c) Confluence of the right and left hepatic ducts

d) Right hepatic duct

Question 11:

Match the following triads:

a) 1-a, 2-c, 3-b, 4-d

b) 1-b, 2-a, 3-d, 4-c

c) 1-c, 2-a, 3-d, 4-b

d) 1-c, 2-d, 3-a, 4-b

Question 12:

A 19-year-old patient presented with right upper quadrant pain. USG and CT scans showed no evidence of gallstones. MRCP shows fusiform dilatation of the common bile duct. Identify the false statement regarding this condition.

a) It predisposes to malignancy

b) Roux-en-Y hepaticojejunostomy will be done

c) Seen more commonly in males

d) Jaundice will be the most consistent finding

Question 13:

What is the most common type of choledochal cyst?

a) Type I

b) Type II

c) Type III

d) Type IV

Question 14:

In which of the following conditions will you perform the Kasai procedure?

a) Extrahepatic biliary atresia

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b) Type 1 choledochal cyst

c) Caroli disease

d) Cholangiocarcinoma

Answer Key

Question No.	Correct Option
1	a
2	c
3	b
4	c
5	a
6	a
7	b
8	b
9	d
10	c
11	c
12	c
13	a
14	a

Detailed Explanations

Solution to Question 1:

The presence of fever and chills, along with the MRCP showing multiple areas of intrahepatic beading is typical of primary sclerosing cholangitis.

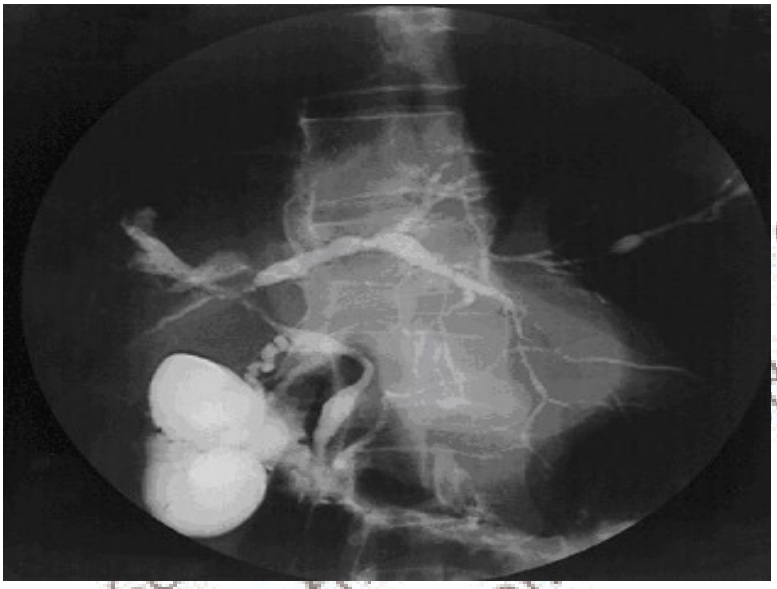
Option B: Caroli's disease is a rare congenital condition characterized by irregular dilatation of the intrahepatic bile ducts with a normal extrahepatic duct system. It is common in both sexes and mostly presents before the age of 30 years with abdominal pain, cholangitis, or end-stage liver disease. MRCP shows irregular, cystic dilation of the large proximal intrahepatic bile ducts with a normal common bile duct.

Primary sclerosing cholangitis (PSC) is an autoimmune condition characterized by inflammatory strictures involving the intra and extra-hepatic biliary tree. It is a progressive condition that leads to secondary biliary cirrhosis.

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MRCP or ERCP will show demonstrate multifocal, diffuse dilatation and strictures of the intrahepatic and extrahepatic biliary trees, this pattern is a beading or chain of lakes appearance. Pseudodiverticula of extrahepatic bile ducts are pathognomic of PSC. MRCP is useful in diagnosis and surveillance, while ERCP is reserved for the treatment of dominant strictures and to exclude malignancy.

The below image shows a cholangiogram of primary sclerosing cholangitis:



The common age group of primary sclerosing cholangitis is 30-45 years. Men are affected twice as commonly as women. Two-thirds of these cases are associated with ulcerative colitis. It is also associated with Riedel's thyroiditis and retroperitoneal fibrosis. 10–20% of patients develop cholangiocarcinoma.

Clinical features of a patient with PSC include pruritis, fever, chills, right upper quadrant discomfort, jaundice, and weight loss.

Liver function tests show a cholestatic pattern with an elevation of ALP and GGT and smaller rises in the aminotransferases. Bilirubin values may be variable.

Liver biopsy excludes other causes of cholestatic liver disease and defines the stage of PSC. It shows onion skin concentric periductal fibrosis. With disease progression, periportal fibrosis occurs, progressing to bridging necrosis, and eventually biliary cirrhosis.

Currently, there is no known effective medical therapy. Surgical management involving resection of extrahepatic biliary tree and hepaticojejunostomy has shown reasonable effects. For patients with advanced liver disease, liver transplantation is the only available option.

Other options:

Option C: Oriental cholangitis, also known as recurrent pyogenic cholangitis is characterized by recurrent attacks of cholangitis due to bile stasis and stone formation. Patients between 30-40 years and both sexes are equally affected. It is caused due to infections (liver flukes, E.coli, Klebsiella, Pseudomonas, and Proteus). Patients present with Charcot's triad (intermittent fever, pain, and jaundice). MRCP shows intra or extrahepatic calculi, dilatation of ducts, and strictures.

Option D: Biliary carcinoma (cholangiocarcinoma) most commonly affects patients >60 years and presents with fever, abdominal pain, weight loss, and features of obstructive jaundice. MRCP

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shows irregular narrowing of the bile duct involved by the tumor, with asymmetric upstream dilatation of the intrahepatic ducts.

Solution to Question 2:

Injury to the right aberrant posterior sectoral duct associated with bile leak is classified as Strasberg's type C injury.

Biliary injury may occur post-laparoscopic cholecystectomy. The most common site of bile leak following cholecystectomy is the cystic duct.

MRCP is the gold standard for complete morphological evaluation of the biliary tree. MRCP with magnetic resonance angiography is more useful in cases of associated vascular injury. A HIDA scan can confirm the presence of a bile leak or biliary obstruction.

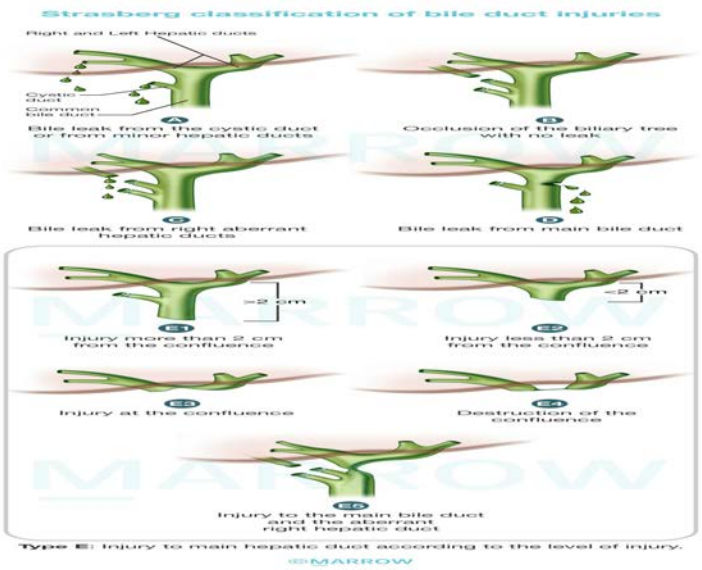
The Strasberg classification of bile duct injury is widely used to anatomically define bile duct injuries.

Classification

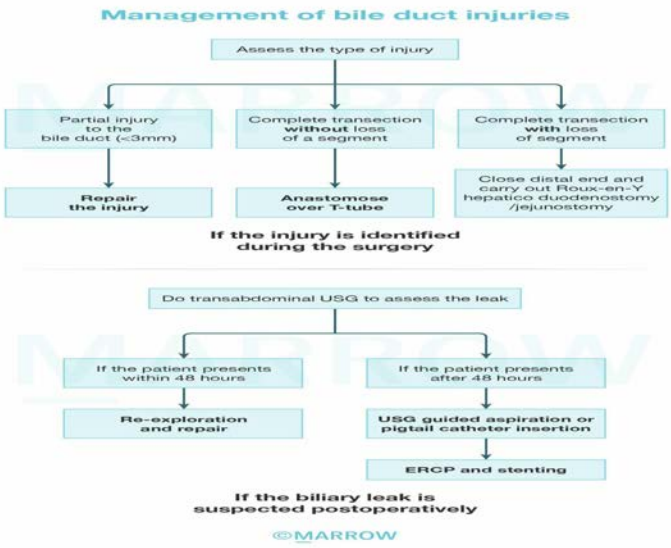
- Type A: Bile leak from cystic duct stump or a minor biliary radical in the gallbladder fossa
- Type B: Occluded right posterior sectoral duct.
- Type C: Bile leak from the divided right posterior sectoral duct.
- Type D: Bile leak from the main bile duct without major tissue loss.
- Type E: Injury to the main hepatic duct; classified according to the level of injury
- E1: Transected main bile duct with a stricture more than 2cm from the hilus.
- E2: Transected main bile duct with a stricture less than 2cm from the hilus
- E3: Stricture of the hilus with right and left ducts in communication.
- E4: Stricture of the hilus with separation of right and left hepatic ducts.
- E5: Stricture of the right aberrant sectoral and main bile ducts.

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Management of bile duct injuries is shown below:



Solution to Question 3:

Endoscopic retrograde cholangiopancreatography (ERCP) is the best investigation in a patient suspected of post-cholecystectomy biliary leaks.

Patients with post-cholecystectomy biliary leak usually present with fever, jaundice and abdominal pain. USG is used for an initial evaluation in such cases and can show a collection in the sub-hepatic space.

The most common bile leak following cholecystectomy is from the cystic duct. This can be treated by placing a biliary endoprosthesis (stent) in the common bile duct across the origin of the cystic duct.

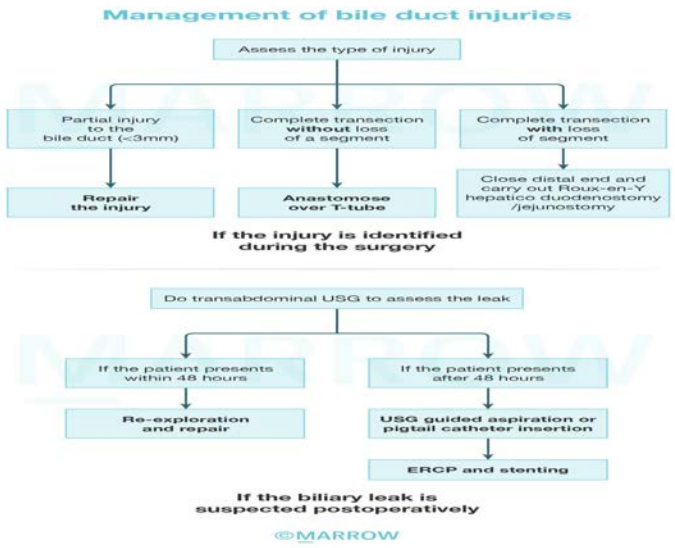
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MRCP shows fluid collections arising from bile leaks but cannot differentiate these from other causes of fluid collections.

ERCP is the best investigation as it has the advantage of being both diagnostic and therapeutic. ERCP is useful post-cholecystectomy as there is a high likelihood of a retained stone and stone extraction and/or temporary stenting may be required.

HIDA scan is the most sensitive investigation for biliary leakage.

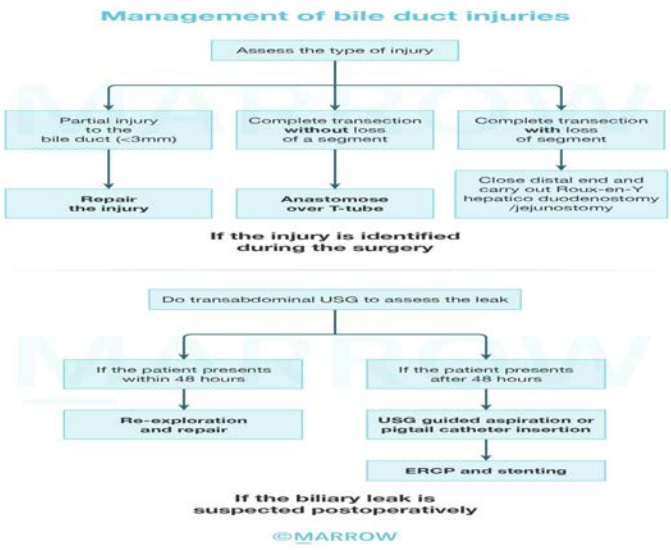
CT scan can show focal fluid collections, ascites, biliary obstruction, hepatic atrophy, signs of secondary biliary cirrhosis and any vascular injury.



Solution to Question 4:

The given clinical situation suggests a bile duct injury following laparoscopic cholecystectomy. The next best step after imaging would be to control inflammation by drainage of fluid collections by pigtail insertion and administration of broad-spectrum IV antibiotics.

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Solution to Question 5:

In the case of a common bile duct injury with a leak and a patient presenting with signs of localized peritonitis, the next step of management is an ultrasound-guided aspiration. This will be followed by ERCP and stenting.

Laparoscopic cholecystectomy is the most common cause of bile duct injury. Major biliary leakage is usually seen 2 to 10 days after cholecystectomy. Affected patients typically present with:

• Fever

• Abdominal pain

• Bilious ascites

• Mild jaundice

• Leukocytosis

• Elevations in the serum levels of ALP and GGT.

Management of bile duct injury:

If the injury is identified during surgery:

• Partial injury to the bile duct (<3mm) - repair the injury

• Complete transection without loss of segment - anastomose over T-tube

• Complete transection with loss of segment - close distal end and carry out Roux-en-Y hepaticoduodenostomy/jejunostomy

If the leak is suspected postoperatively:

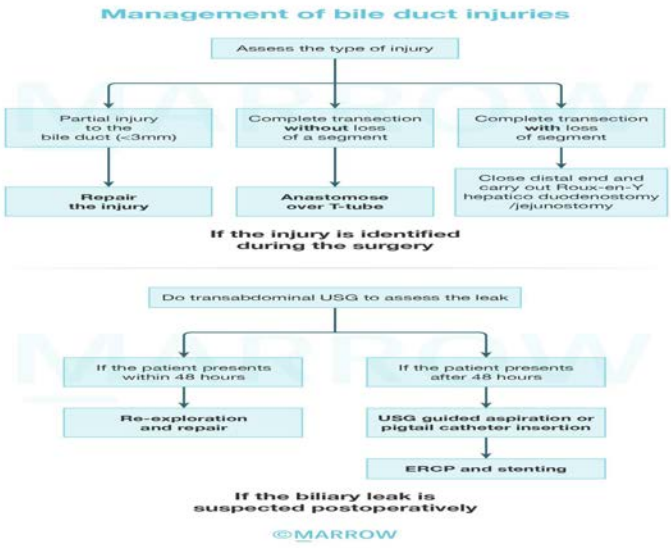
Transabdominal ultrasonography is initially performed to assess the leak.

• If the patient presents within 48 hours - Re-explore and repair

• If the patient presents after 48 hours - USG-guided aspiration or pigtail catheter insertion.

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This is followed by ERCP and stenting.



Solution to Question 6:

Biliary stricture after laparoscopic cholecystectomy usually occurs in the common hepatic duct, distal to the confluence of the right and left hepatic ducts.

After open cholecystectomy, biliary strictures are more common in the common bile duct.

Solution to Question 7:

The most common cause of hemobilia is iatrogenic trauma.

Hemobilia is defined as bleeding into the biliary tree from abnormal communication between a blood vessel and bile duct.

Causes of hemobilia include:

• Traumatic or operative injury to the liver or bile ducts

• Intraductal rupture of a hepatic abscess or aneurysm of the hepatic artery

• Biliary or hepatic tumor hemorrhage

• Mechanical complications of choledocholithiasis or hepatobiliary parasitism

• Diagnostic procedures, such as liver biopsy, percutaneous transhepatic cholangiography (PTC), and transhepatic biliary drainage catheter placement

• Vascular disorders

Patients often present with a classic triad (Quincke's triad/Sandblom triad) of:

• Biliary pain

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• Obstructive jaundice

• Melena or occult blood in the stools

Investigation of choice: Arterial angiography (CT angiography) is the diagnostic procedure of choice.

Management:

Minor hemobilia can be managed conservatively.

Major hemobilia: Transarterial embolization is indicated for major hemobilia requiring blood transfusion. Ligation of the bleeding vessel may also be required.

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Solution to Question 8:

Endoscopic retrograde cholangiopancreatography (ERCP) is the best investigation for the diagnosis of bilhemia.

Bilhemia is a condition in which bile flows into the bloodstream through the hepatic veins or portal vein branches. This flow occurs due to a high intrabiliary pressure, exceeding that of the venous system.

The cause can be the erosion of gallstones into the portal vein, or accidental/iatrogenic trauma. This condition can be fatal secondary to the embolization of large amounts of bile into the lungs. Usually, bile flow is low, and the fistulas close spontaneously.

Its clinical features include:

• Rapidly progressive jaundice

• Marked direct hyperbilirubinemia, without elevation of the hepatocellular enzyme levels.

• Septicemia.

Diagnosis of bilhemia is best made by ERCP.

Treatment is directed at reducing the intrabiliary pressure through stent placement or sphincterotomy. Endovascular embolization can also be done.

Solution to Question 9:

Cholangiohepatitis or recurrent pyogenic cholangitis is associated with biliary parasites such as:

• Clonorchis sinensis

• Opisthorchis viverrini

• Ascaris lumbricoides.

It is caused by bacterial contamination of the biliary tree. Some commonly implicated organisms are Escherichia coli, Klebsiella species, Bacteroides species, or Enterococcus faecalis.

Cholangiohepatitis is a pre-malignant condition and can result in cholangiocarcinoma.

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Schistosoma haematobium primarily causes genito-urinary schistosomiasis.

Paragonimus westermani (oriental lung fluke) causes a pulmonary syndrome characterized by cough, chest pain, and hemoptysis.

Solution to Question 10:

Cholangiocarcinomas are most common at the location where the right and left hepatic ducts meet i.e., the confluence of the hepatic ducts.

Cholangiocellular carcinomas (CCCs) or cholangiocarcinomas are mucin-producing adenocarcinomas of the biliary duct system that may originate in the liver and extrahepatic bile ducts. Cholangiocarcinomas are encountered in three anatomic regions:

• Intrahepatic

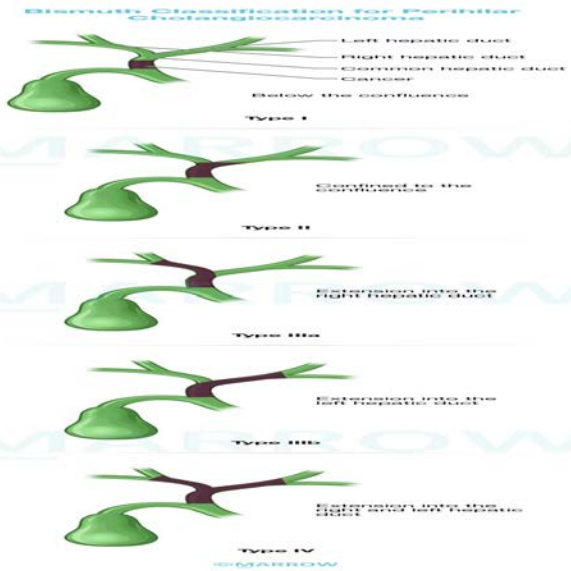
• Hilar (65%) - also known as Klatskin tumours

• Peripheral (30%)

The sclerosing variant of cholangiocarcinoma is the most common and most difficult to treat. The nodular variant is usually intrahepatic and presents as a mass lesion. The papillary variant is rare and is associated with favourable outcomes.

Portoenterostomy is done for hilar cholangiocarcioma and for peripheral cholangiocarcionoma, Whipple's surgery is done.

In Bismuth-Corlette classification they are classified according to their location:



The FDA approved Pemigatinib, FGFR2 inhibitor for patients with cholangiocarcinoma that is locally advanced or metastatic, and tumors with fusion or rearrangement of fibroblast growth factor receptor 2 (FGFR2) gene.

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Solution to Question 11:

The correct option is 1-c, 2-a, 3-d, 4-b.

Triad	Condition	Components
Saint's triad		Hiatus herniaGallstonesColonic diverticulosis
Sandblom triad	Hemobilia	MalenaBiliary colicObstructive jaundice
Charcot triad	Acute cholangitis	JaundiceFeverRight upper quadrant pain
Rigler's triad	Gallstone ileus	Small bowel obstructionPneumobiliaEctopic gallstone

Solution to Question 12:

The given clinical scenario and MRCP showing fusiform dilation of extrahepatic biliary tree point towards the diagnosis of a choledochal cyst (Type I). Choledochal cysts are more commonly seen in females.

A choledochal cyst is a premalignant condition leading to the development of cholangiocarcinoma.

The classic clinical triad of symptoms includes abdominal pain, jaundice (most consistent finding), and a mass in the abdomen.

Diagnosis of choledochal cyst can be made by:

• USG (Initial investigation)

• MRCP (Investigation of choice)

• ERCP (Gold standard investigation)

• Endoscopic ultrasound (Most sensitive)

Management includes effective drainage and removal of abnormal mucosa to reduce the risk of malignancy.

Type of choledochal cyst	Surgical management
Type I	Roux-en-Y hepaticojejunostomy
Type II	Diverticulectomy + common bile duct repair
Type III	ERCP + sphincterotomy (Only cyst in which reconstruction is not required)

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Type of choledochal cyst	Surgical management
Type IVa and Type V	Liver transplant
Type IVb	Kasai procedure (portoenterostomy)

Solution to Question 13:

Type I is the most common type of choledochal cyst (75%).

Choledochal cysts are congenital dilations of the intra- and/or extra-hepatic biliary system.

Solution to Question 14:

Kasai procedure (Roux-en-Y hepatoportoenterostomy) is done for extrahepatic biliary atresia. In the Kasai procedure, the occluded extrahepatic bile ducts are excised and a jejunal Roux loop is anastomosed to the hepatic hilum.

Extrahepatic biliary atresia (EHBA) is defined as a partial or total absence of permeable bile duct between porta hepatis and the duodenum. It is due to inflammatory fibrosis of the biliary tree. It leads to obstruction to bile flow thereby causing leaking of conjugated bilirubin into the circulation.

Associated anomalies include cardiac lesions, polysplenia, situs inversus, absent vena cava, and a preduodenal portal vein.

HIDA scan is the investigation of choice for EHBA. Intraoperative cholangiogram is the gold standard for diagnosis.

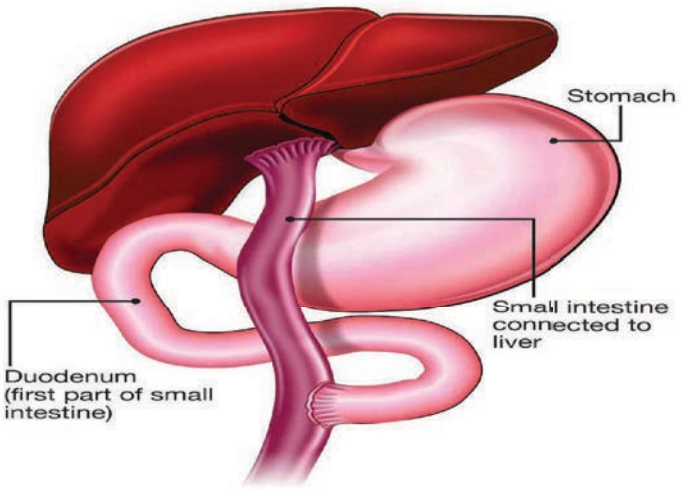
Infants with biliary atresia, who do not achieve successful drainage after Kasai's procedure, require liver transplantation within the first year of life. It is the most common reason for liver transplantation in children.

Kasai procedure:

Management of extrahepatic biliary atresia		
Type I	Atresia restricted to the common bile duct	Roux-en-Y hepaticojejunostomy
Type II	Atresia of the common hepatic duct	Kasai procedure(Roux-en-Y hepatoportoenterostomy)
Type III	Atresia of the right and left hepatic duct	

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Spleen

Question 1:

Which among the following statements is true regarding the anatomy of the spleen?

a) The spleen develops from the ventral mesogastrium

b) The axis of the spleen lies along the 9th rib

c) The superior border is notched

d) The spleen is partly covered by the peritoneum

Question 2:

The downward displacement of the spleen is prevented by which of the following ligaments?

a) Phrenocolic ligament

b) Lienorenal ligament

c) Gastrosplenic ligament

d) Lienophrenic ligament

Question 3:

Which of the following is the most common site for an accessory spleen?

a) Gastrocolic ligament

b) Splenocolic ligament

c) Splenic hilum

d) Greater curvature of the stomach

Question 4:

A 55-year-old lady presents with complaints of epigastric and lower back pain. Past history is significant for post-traumatic splenectomy at the age of 12 years. CT scan showed multiple nodules scattered across the intestinal loops and under the diaphragm. The tumours were excised following laparotomy and histology was typical for splenic tissue. What is the likely diagnosis?

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a) Splenunculi

b) Splenosis

c) Disseminated metastatic deposits

d) Multiple splenic abscesses

Question 5:

Two weeks following an upper respiratory tract infection, a 5-year-old child presents with a skin rash as shown in the image. She also complains of bleeding gums and her platelet count is 18,000/µL. Which among the following is false about her condition?



a) Chronic form of this condition is more common in females

b) Splenomegaly is characteristically present

c) Bone marrow examination shows increased megathrombocytes

d) Splenectomy is the best alternative treatment for this condition

Question 6:

A young man with idiopathic thrombocytopenic purpura is posted for splenectomy. His platelet count is 32000 per cubic millimeter. What is the best time to transfuse platelets in this patient?

a) Immediately after skin incision

b) Immediately after the ligation of splenic artery

c) Immediately after the ligation of splenic vein

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d) Next day of surgery

Question 7:

In a patient with hypersplenism, which of the following features can not be seen?

a) Anemia

b) Leucopenia

c) Thrombocytopenia

d) Bone marrow failure

Question 8:

Which of the following statements is false?

a) Schistosomiasis can lead to tropical splenomegaly

b) Thrombocytopenia can occur following splenectomy

c) Autosplenectomy is seen in sickle cell anemia

d) Howell-Jolly bodies are seen in asplenia

Question 9:

A young male patient who is on treatment for osteomyelitis was found to have multiple splenic abscesses. This patient is least likely to have which of the following?

a) Abdominal discomfort

b) Pleuritic chest pain

c) Peritonitis

d) Splenomegaly

Question 10:

Which of the following is the most common indication for splenectomy?

a) Trauma

b) Hemolytic anemia

c) Portal hypertension

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d) Immune thrombocytopenic purpura

Question 11:

What is the most common complication that is expected to occur in patients following splenectomy?

a) Overwhelming post-splenectomy infection

b) Avascular necrosis of greater curvature of stomach

c) Pancreatitic fistula

d) Left lower lobe atelectasis

Question 12:

Vaccine for post-splenectomy infection is given against all except _____.

a) Streptococcus pneumoniae

b) Haemophilus influenzae

c) Neisseria meningitidis

d) E. coli

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Question 13:

Which of the statements regarding opportunistic post-splenectomy infection are correct?

a) 1, 2 and 3

b) 2, 3 and 5

c) 1, 3 and 4

d) 1, 2 and 4

Question 14:

A 24-year-old professional football player was tackled hard during a match. He complains of severe pain in the left upper abdomen. On examination, his BP is 100/74 mm Hg and there is tenderness and crepitus over the left 10th and 11th ribs. He also complains of pain over the left shoulder when pressure is applied over the left upper abdominal quadrant. This sign is called:

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a) Ballance sign

b) Cullen sign

c) Kehr sign

d) Grey Turner sign

Question 15:

Which of the following statements regarding splenic artery aneurysms is true?

a) It is the most common visceral artery aneurysm

b) The most common presentation is severe epigastric pain

c) Rupture is more common during the second trimester of pregnancy

d) All diagnosed cases require surgical intervention

Question 16:

Which of the following is the most common cyst of the spleen?

a) Hydatid cyst

b) Pseudocyst

c) Epidermoid cyst

d) Cystic splenic metastasis

Question 17:

Which of the following statements regarding tumors of the spleen is true?

a) The most common primary malignant tumor of the spleen is hemangiosarcoma

b) The most common primary benign tumor of the spleen is hemangioma

c) The most common cause of isolated splenic metastasis is gastric carcinoma

d) The most common cause of neoplastic splenic enlargement is metastasis

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Answer Key

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Question No.	Correct Option
1	c
2	a
3	c
4	b
5	b
6	b
7	d
8	b
9	d
10	a
11	d
12	d
13	c
14	c
15	a
16	b
17	b

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Detailed Explanations

Solution to Question 1:

The superior border of the spleen is notched.

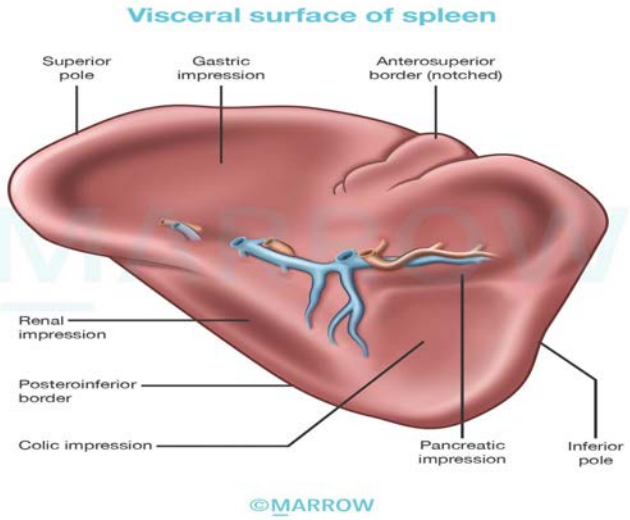
The superior border of the spleen separates the diaphragmatic surface from the gastric impression of the visceral surface. It often contains one or two notches. Additionally, there can be a notch on the inferolateral border, and this may be palpated only when the spleen is enlarged.

Option A: The spleen arises from the primitive mesoderm as an outgrowth of the left side of the dorsal mesogastrium.

Option B: The spleen is related to the 9th, 10th, and 11th ribs, with its long axis along the 10th rib.

Option D: The spleen is completely intraperitoneal.

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Solution to Question 2:

The phrenocolic ligament prevents the downward displacement of the spleen.

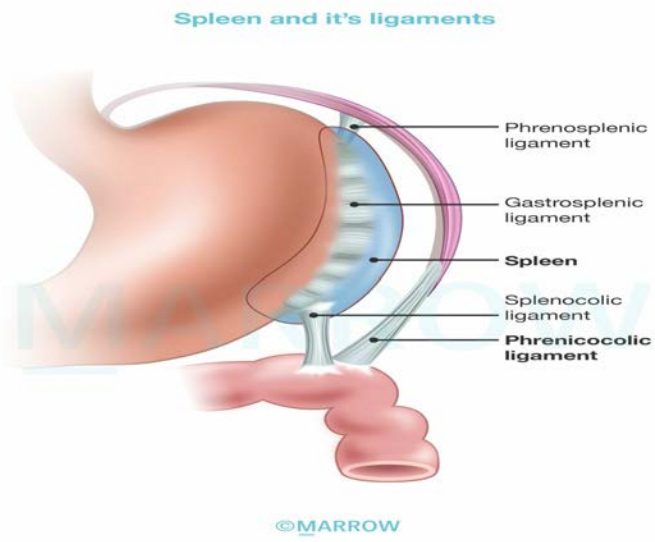
The phrenicocolic ligament is not attached to the spleen. It attaches the splenic flexure of the colon to the diaphragm. When the spleen gets enlarged, the phrenicocolic ligament along with the splenic flexure of the colon restricts its downward displacement.The enlargement of the spleen occurs towards the right iliac fossa and is directed obliquely.

Splenic ligaments and their attachments:

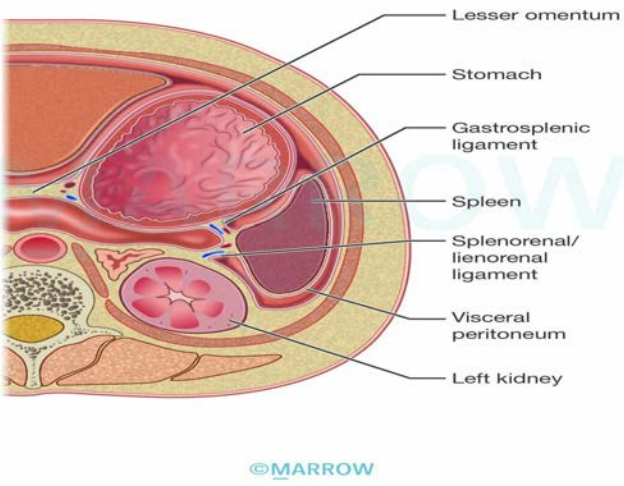
Splenic ligament	Attachments	Contents
Phrenicocolic ligament	Diaphragmto the splenic flex ure of thecolon	-
Phrenicosplenic ligament	Posterior abdominal wall to t he upper pole of the spleen	-
Splenorenal (lienorenal) liga ment	Hilum of the spleen to the an terior surface of the left kidn ey	Tail of pancreasSplenic arter y and vein
Gastrosplenicligament	Greater curvature of the stom ach to the upper pole of the s pleen	Short gastric vesselsLeft gast roepiploic artery

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The below image shows the cross-sectional view of the spleen and its ligaments:



Solution to Question 3:

The most common site for accessory spleen or splenunculi is the splenic hilum. It is the most common anomaly of splenic embryology.

Other locations for accessory spleen in descending order of frequency are:

- Gastrocolic ligament
- Pancreatic tail
- Greater omentum
- Greater curvature of the stomach

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• Splenocolic ligament

• Small and large bowel mesentery

• Left broad ligament in women

• Left spermatic cord in men

Solution to Question 4:

The given clinical scenario is suggestive of splenosis.

Splenosis refers to the rupture of the spleen and distribution of splenic tissue on the peritoneum. This should be considered as a differential diagnosis when a patient with a splenic injury in the past presents with tumour-like lesions on abdominal imaging.

Solution to Question 5:

The image showing petechiae and the given history of a child presenting with mucocutaneous bleed following an upper respiratory tract infection are highly suggestive of immune thrombocytopenic purpura.

In idiopathic/immune thrombocytopenic purpura (ITP), the spleen is palpable in fewer than 10% of the patients, and the presence of gross splenic enlargement should raise the suspicion of an alternative diagnosis.

Management of ITP:

• In patients with platelet counts <30,000/µL, treatment may be instituted if there are symptoms of life-threatening bleeding.

• Prednisone at 1 mg/kg is the initial treatment of choice.

• Rh(D) immune globulin is used only in Rh-positive patients.

• Intravenous immunoglobulin (IVIG).

• Splenectomy is indicated in patients who have relapsed on glucocorticoid therapy. Relapse patients with intermittent or high platelet count can be managed with anti-Rho(D) immunoglobulin, IVIG, or with a thrombopoietin receptor agonist.

• Subcutaneous romiplostim and oral eltrombopag are thrombopoietin receptor agonists used in adults who are at risk of bleeding even after splenectomy.

Option A: The acute form is more commonly seen in children following a viral infection, while the chronic form is more often seen in adult women of childbearing years.

Option C: The bone marrow examination can be normal or show an increased number of megathrombocytes.

Option D: 80% of cases undergo spontaneous remission in children. Patients who do not respond to first-line therapy like steroids and IVIG are best treated by splenectomy.

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Solution to Question 6:

The best time to transfuse platelets in this patient is immediately after ligation of the splenic artery.

The platelets are destroyed by the spleen within one hour of transfusion, and the splenic artery is the major vessel that brings blood to the spleen. Therefore, the best time to transfuse the platelets is immediately after the ligation of the splenic artery.

Solution to Question 7:

Bone marrow failure is not seen in a patient with hypersplenism.

Hypersplenism is an indefinite clinical syndrome that is characterised by:

- Splenic enlargement
- Combination of anemia, leucopenia or thrombocytopenia
- Compensatory bone marrow hyperplasia
- Improvement after splenectomy.

Solution to Question 8:

Thrombocytosis occurs following splenectomy.

This occurs particularly in patients with myeloproliferative disorders (e.g., chronic myeloid leukemia, polycythemia vera, essential thrombocytosis). It may result in thrombosis of the mesenteric, portal, and renal veins which can be life-threatening as it can lead to haemorrhage and thromboembolism.

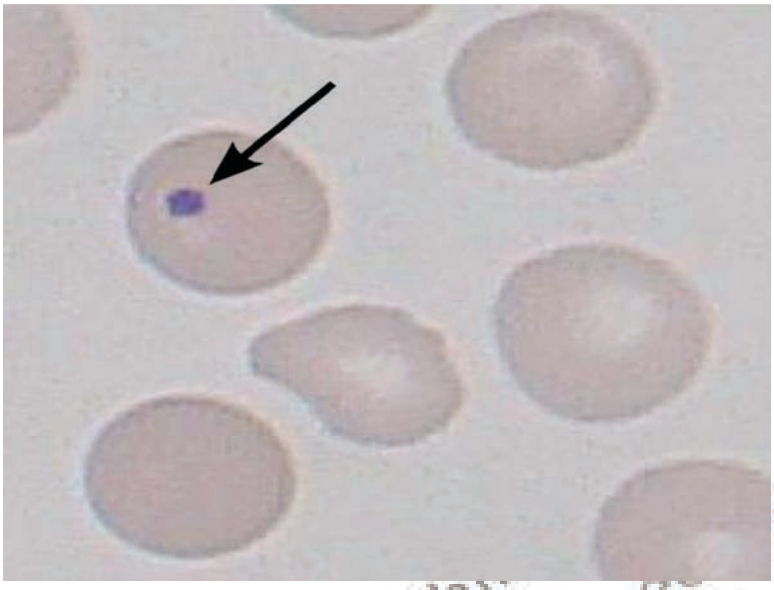
Option A: Tropical splenomegaly is massive splenic enlargement, which frequently occurs in the tropics due to malaria, kala-azar, and schistosomiasis.

Option C: Autosplenectomy is seen in sickle cell anemia. Splenomegaly is seen in thalassemia and hereditary spherocytosis.

Option D: Howell-Jolly bodies are the nuclear remnants present in the RBCs. They appear as dense blue colored circular inclusions as shown in the image below. They are usually seen in patients lacking normal spleen function (asplenia).

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Solution to Question 9:

Splenomegaly is not a typical feature of splenic abscess.

Splenic abscesses manifest with vague abdominal pain, fever, peritonitis, and pleuritic chest pain.

A splenic abscess may arise from an infected splenic embolus, or in association with:

- Typhoid or paratyphoid fever
- Osteomyelitis
- Otitis media
- Puerperal sepsis.

Solution to Question 10:

Overall, the most common indication for splenectomy is trauma to the spleen, whether external (blunt or penetrating) or iatrogenic (e.g., during operative procedures for other reasons).

The most common indication for:

- Elective splenectomy - Haematological disorders such as ITP, TTP, etc.
- Emergency splenectomy - Trauma
- Splenectomy (overall) - Trauma.

Solution to Question 11:

Left lower lobe atelectasis is the most common complication after splenectomy.

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Other complications of splenectomy include:

• OPSI (Overwhelming post-splenectomy infection)is the most common fatal late complication of splenectomy.

• Avascular necrosis of the greater curvature of the stomach is a rare complication that can occur after ligation of short gastric vessels.

• Damage to the tail of the pancreas during surgery can lead to pancreatitis, a localized abscess, or pancreatic fistula.

• Hemorrhage during the perioperative period etc.

Solution to Question 12:

Escherichia coli vaccination is not recommended in post-splenectomy patients.

Currently, the standard of care for post-splenectomy patients includes immunization with the following if the patient did not receive these before surgery:

• Polyvalent pneumococcal vaccine (PPV23)

• Haemophilus influenzae type B conjugate vaccine

• Meningococcal polysaccharide vaccine.

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Solution to Question 13:

The risk of developing opportunistic post-splenectomy infection is greatest when splenectomy is done for haematological conditions than for post-trauma.

Opportunistic post-splenectomy infection is a major complication following splenectomy due to septicemia, which may result from an infection of:

• Streptococcus pneumoniae (most common)

• Neisseria meningitides

• Haemophilus influenzae

• Escherichia coli.

The risk of overwhelming sepsis is greatest within the first 2–3 years following splenectomy.

Hence, if an elective splenectomy is planned, consideration should be given to vaccinating against pneumococcus, meningococcus C (both repeated every 5 years), and H. influenzae type B (Hib) (repeated every 10 years) at least 2 weeks before elective surgery.

In case of emergency splenectomy, patients should be vaccinated as soon as possible after recovery from surgery but before discharge from the hospital.

Solution to Question 14:

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Kehr sign refers to referred pain in the tip of the left shoulder when firm pressure is applied over the left upper quadrant. It is also elicited by raising the left leg.

It is seen in the case of hemoperitoneum, especially due to splenic injury. It occurs due to the collection of blood below the diaphragm and irritation of the phrenic nerve.

Option A: Ballance sign is also seen in splenic injury. It is an area of percussive dullness in the left upper quadrant due to the coagulation of blood from the injured spleen.

Option B: Cullen sign refers to periumbilical bruising in cases of hemoperitoneum, especially those of pancreatic origin.



Option D: Grey Turner sign refers to bluish discolouration around flanks in case of hemoperitoneum especially acute hemorrhagic pancreatitis.



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Solution to Question 15:

Splenic artery aneurysm is the commonest visceral artery aneurysm.

Splenic artery aneurysm occurs more commonly in females. It is usually situated in the main arterial trunk. It is usually asymptomatic unless it ruptures. During pregnancy, rupture is more common in the third trimester and in labour.

CT angiography is the investigation of choice. Not all diagnosed cases of splenic artery aneurysms need intervention.

Treatment should be considered in aneurysms larger than 2 cm in diameter.

In an elderly patient with a calcified aneurysm, there is less risk of rupture and observation may be preferred. In a younger patient with an asymptomatic aneurysm, surgery or interventional radiology is indicated.

In patients with pancreatic necrosis, the treatment should include drainage of the septic focus.

The treatment comprises of:

• Ligation of the proximal and distal ends of the sac

• Embolization or endovascular stenting

• Splenectomy with the removal of the artery

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Solution to Question 16:

The most common splenic cyst is pseudocyst, secondary to trauma. These are termed pseudocysts due to their lack of cellular lining.

Splenic cysts are classified as either parasitic or non-parasitic:

• Parasitic/hydatid cysts are the most common true/primary splenic cysts

• Splenic pseudocysts are the most common non-parasitic splenic cysts and occur following trauma

• Epidermoid cysts are the most common non-traumatic, non-parasitic splenic cysts.

Note: These epithelial cells are often positive for CA 19-9 and carcinoembryonic antigen by immunohistochemistry. Patients with splenic epidermoid cysts may have elevated serum levels of one or both of these tumor markers.

Solution to Question 17:

The most common primary tumor of the spleen is hemangioma.

Option A: Lymphoma (not Hemangiosarcoma) is the most common malignant primary tumour of the spleen.

Option C: Ovarian carcinoma is the most common cause of isolated splenic metastasis

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Option D: Lymphoma is the most common cause of neoplastic splenic enlargement and the most common malignant tumour associated with splenic involvement.

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Endocrine Pancreas

Question 1:

What is the most common endocrine tumor of the pancreas?

a) Insulinoma

b) Glucaganoma

c) Somatostatinoma

d) VIPoma

Question 2:

Which of the following statements about insulinoma is false?

a) Majority of insulinomas are benign and solitary

b) Insulinomas occur more commonly in females

c) Insulinomas occur more commonly in the tail, than in the head and body of pancreas

d) Mean age at diagnosis is 45 years

Question 3:

Which of the following is not a component of Whipple's triad?

a) Symptoms of hypoglycaemia after fasting or exercise

b) Plasma glucose levels <2.8 mmol/L

c) Elevated plasma insulin levels

d) Relief of symptoms on intravenous administration of glucose

Question 4:

The gold standard test for the diagnosis of insulinoma is _____.

a) Measurement of plasma insulin levels

b) Measurement of C-peptide levels

c) 72-hour fasting test

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d) CECT abdomen

Question 5:

A 50-year-old previously healthy man presents to the clinic with complaints of episodic palpitations, sweating, and giddiness which are relieved with food or fruit juices. Laboratory investigations are suggestive of insulinoma. Which of the following will be the best imaging modality to localize the site of the tumor in this patient?

a) Intra operative ultrasound

b) Dynamic contrast enhanced MRI

c) Somatostatin receptor study

d) Contrast enhanced CT scan

Question 6:

A 54-year-old woman presents with recurrent attacks of dizziness and abdominal pain for 3 months. Fasting blood glucose level was 40 mg%, and insulin levels were elevated. CT abdomen showed a well-defined 1 cm lesion in the head of the pancreas. The treatment plan should be _____.

a) Whipple's operation

b) Enucleation only

c) Enucleation with radiotherapy

d) Enucleation with distal pancreatectomy

Question 7:

A young man with parathyroid hyperplasia and pituitary adenoma is diagnosed with multiple tumors in Passaro's triangle. Which of the following structures are constituents of the triangle?

a) Superior and descending duodenum, head of the pancreas, lymph nodes

b) Superior duodenum, head of the pancreas, greater curvature of stomach

c) Third part of the duodenum, body of the pancreas, greater curvature of stomach

d) Body of the pancreas, greater curvature of stomach, lesser curvature of stomach

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Question 8:

What is the most common site of gastrinoma in MEN 1 syndrome?

a) Jejunum

b) Ileum

c) Duodenum

d) Stomach

Question 9:

A patient who had been suffering from chronic esophageal reflux and diarrhea is diagnosed with multiple gastrinomas. All of the following statements are true regarding his condition except _____.

a) This occurs more commonly in males

b) More than 60% of tumors are malignant

c) It is a beta-islet-cell tumor

d) Surgical exploration is indicated in all patients without metastasis

Question 10:

A 25-year-old man with chronic abdominal pain was brought to the casualty in a dehydrated state due to multiple diarrheal episodes. He was started on IV fluids and analgesics. On further investigation, multiple ulcers were seen in the second and third part of the duodenum and his serum gastrin concentration was 2000 pg/ml. Which of the following is least likely to be associated with this condition?

a) Improvement of diarrhoea following nasogastric aspiration

b) Gastric pH < 2

c) Positive secretin stimulation test

d) Reduced basal to maximal acid output ratio

Question 11:

A patient who is recently diagnosed with Zollinger-Elison syndrome is started on proton pump inhibitors. There is no previous history of acid-reduction procedure done. The target basal acid output should be less than _____.

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a) 5mEq/hr

b) 8mEq/hr

c) 10mEq/hr

d) 12mEq/hr

Question 12:

Which of the following would be the preoperative imaging study of choice in patients with gastrinoma?

a) Endoscopic ultrasound

b) MRI

c) CT Scan

d) Somatostatin receptor study

Question 13:

Which among the following statements is false about non-functioning pancreatic endocrine tumors?

a) Most of the tumors are malignant

b) They account for 60-90% of all pancreatic neuroendocrine tumors

c) They are clinically asymptomatic

d) They have a much better prognosis than functioning tumors

Question 14:

A 50-year-old woman presents to the OPD with a skin lesion as shown in the image below. The lesions were initially small but have now spread to the entire limb and the abdomen. She has a history of long-standing diabetes and recurrent episodes of deep vein thrombosis despite anticoagulation therapy. What is the most likely diagnosis?

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a) Insulinoma

b) Gastrinoma

c) Glucagonoma

d) VIPoma

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Question 15:

A 49-year-old female patient presents with complaints of abdominal pain and foul-smelling, greasy stools for one year. She is known to be diabetic and underwent cholecystectomy one year back. CT scan shows the presence of a tumor in the pancreas. What is the most probable diagnosis?

a) Glucagonoma

b) Insulinoma

c) Somatostatinoma

d) VIPoma

Question 16:

A patient with MEN 1 syndrome is diagnosed with VIPoma. Which of the following is not seen in this condition?

a) Watery diarrhea

b) Hypokalemia

c) Metabolic acidosis

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d) Increased acid secretion

Answer Key

Question No.	Correct Option
1	a
2	c
3	c
4	c
5	a
6	b
7	a
8	c
9	c
10	d
11	c
12	d
13	d
14	c
15	c
16	d

Detailed Explanations

Solution to Question 1:

The most common functioning endocrine tumor of the pancreas is insulinoma. It is a tumor arising from the beta cells of the pancreas.

The most common malignant functional neuroendocrine tumor of the pancreas is gastrinoma.

Solution to Question 2:

Insulinomas are distributed equally throughout the pancreas, despite the predominance of beta-cells in the body and tail.

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The majority (90%) of insulinomas are benign and solitary, and only 10% are malignant and multifocal. Malignant insulinomas are usually found in association with multiple endocrine neoplasia (MEN) syndrome. Insulinomas are typically small, with an average size of 1.0 to 1.5 cm.

Insulinomas occur more commonly in females, between 40–60 years of age with the mean age of diagnosis at 45 years.

Solution to Question 3:

Elevated plasma levels of insulin is not a component of the triad. Whipple's triad is a clinical condition characterised by an insulin-producing tumour of the pancreas called insulinoma.

The components of the triad are:

• Symptoms of hypoglycaemia after fasting or exercise.

• Plasma glucose levels <2.8 mmol/L.

• Relief of symptoms on intravenous administration of glucose.

Patients with insulinoma eat frequently to avoid hypoglycemic symptoms. Hence, weight loss is not a feature of insulinoma.

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Solution to Question 4:

The gold standard for the diagnosis of insulinoma is the 72-hour monitored fasting test.

In this test, the levels of blood glucose, insulin, proinsulin, C peptide are measured in 1 to 2-hour intervals. When done so, a patient with insulinoma will have higher values of insulin, proinsulin, and C peptide which are expected to decrease in a normal person in response to the hypoglycemia due to fasting.

All patients should be advised to undergo surgical excision of insulinoma following the exclusion of diffuse abdominal metastases by ultrasound or CT scan.

Solution to Question 5:

Intra-operative ultrasound is the best method in localizing the site of the insulinoma.

This is a dynamic imaging modality that provides interactive and timely information during surgical procedures. This is essential for the identification of small tumors, especially within the pancreatic head or uncinate process.

Preoperatively, the site of the tumor can be assessed by endoscopic ultrasound or CT scan.

Solution to Question 6:

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Recurrent hypoglycemic symptoms (dizziness) and low blood glucose with elevated insulin is suggestive of insulinoma. Tumour enucleation is the technique of choice for benign insulinomas.

Insulinomas of <2 cm in diameter without signs of vascular invasion or metastases are considered benign.

Distal pancreatectomy is advised for the following:

• Tumors deep in the pancreatic body or tail

• Tumors of size >2 cm

• Tumors within 2 mm of the main pancreatic duct

Medical management to treat hyperinsulinism includes frequent intake of carbohydrate-rich meals, octreotide or diazoxide.

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Solution to Question 7:

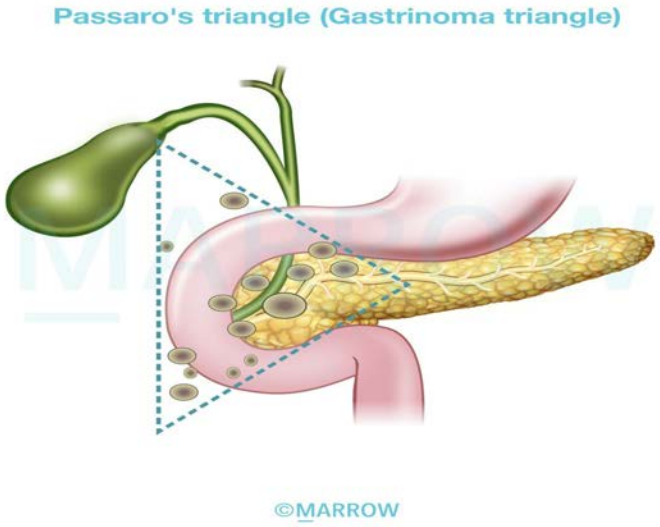
The patient is most likely suffering from MEN 1 syndrome. Gastrinoma is the most common functional entero-pancreatic tumor in MEN1. Superior and descending duodenum, head of the pancreas, and lymph nodes constitute the anatomical area called gastrinoma triangle, also known as the Passaro's triangle.

The triangle is bounded by the lines connecting:

• The cystic duct

• The junction between the second and third portions of the duodenum

• The junction between the neck and body of the pancreas.



Solution to Question 8:

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The most common site of gastrinoma in MEN 1 syndrome is the duodenum.

Gastrinoma is the most common pancreatic islet tumor in MEN 1 syndrome, arising from the G cells of the pancreas. Gastrinoma, associated with marked gastric acid production and recurrent peptic ulcers, is called Zollinger-Ellison syndrome. The majority of gastrinomas occur in the gastrinoma (Passaro's) triangle.

In MEN 1, they often occur in patients <30 years. Patients present with abdominal pain (the most common symptom), diarrhea and steatorrhea.

Management:

• Medical management for tumors <2 cm with proton-pump inhibitors.

• Surgery for tumors >2 cm.

• Proton-pump inhibitors with somatostatin analogues for advanced locoregional disease or metastasis.

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Solution to Question 9:

Gastrinoma/Zollinger–Ellison syndrome (ZES) is a non–beta islet cell tumor of the pancreas.

Option A: ZES is more common in males than in females.

Option B: At the time of diagnosis, >60% of tumors are malignant.

Option D: Surgical exploration should be performed in all patients without diffuse metastases, to remove known malignant and benign tumors.

Solution to Question 10:

The given clinical scenario is suggestive of Zollinger-Ellison syndrome/gastrinoma. Here, the basal acid output (BAO) is increased. Hence, the BAO:MAO ratio is increased.

In these patients, there is gastrin hypersecretion that stimulates gastric acid secretion. This leads to peptic ulcers that occur at atypical sites like the duodenum and jejunum and are refractory and multiple.

Abdominal pain is the most common complaint in these patients. However, diarrhea can occur due to:

• Acid-induced injury to the small intestine mucosa

• Inability of the intestinal tract to absorb large volumes of fluids secreted by the stomach

• Inactivation of pancreatic lipase by low pH

• Precipitation of bile salts.

The unique characteristic of acid-induced diarrhea is that it is controlled by nasogastric aspiration of gastric secretions.

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Gastric pH <2.5 and a serum gastrin concentration >1000 pg/mL confirm the diagnosis of Zollinger Ellison syndrome.

If the diagnosis remains in doubt, a secretin stimulation test is done. In this test, the fasting gastrin level is measured before secretin (2 IU/kg) is administered intravenously, and subsequent samples are obtained 2, 5, 10, and 20 minutes. Gastrin levels >200 pg/mL after administration of secretin are suggestive of gastrinoma.

Solution to Question 11:

The proton-pump inhibitor (PPI) dosage should be titrated to keep basal acid output <10 mEq/hr in this patient.

The target BAO is <5 mEq/hr if the patient has had a prior acid-reducing procedure.

Ideally, the dose of proton pump inhibitors is titrated using acid output in order to improve the healing rate of peptic ulcer disease, and to avert its complications.

Solution to Question 12:

Currently, the preoperative imaging study of choice for gastrinoma is somatostatin receptor scintigraphy (octreotide scan).

The majority of the gastrinomas are found within the Passaro's triangle and can be detected by endoscopic ultrasound (EUS). However, it still misses many of the smaller lesions, and may confuse normal lymph nodes for gastrinomas.

If there is no tumor visible on EUS, a somatostatin receptor study is useful in identifying the location. When the pretest probability of gastrinoma is high, the sensitivity and specificity of this modality are almost 100%.

Solution to Question 13:

Non-functioning pancreatic endocrine tumors (NF-PETs) have a worse prognosis compared to functioning tumors.

They account for 60-90% of all neuroendocrine tumors. They are usually larger (>5cm), solitary, mostly in the head of the pancreas, malignant and metastatic. These do not cause any clinical symptoms.

They stain positive for immunohistochemical markers such as synaptophysin, chromogranin A (CgA), and neuron-specific enolase. Chromogranin A is used as a serum marker to monitor response to treatment and to detect recurrence.

Treatment is mainly surgical. It includes partial pancreaticoduodenectomy as well as the synchronous or metachronous resection of liver metastases.

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Solution to Question 14:

The image depicts necrolytic migratory erythema. This skin lesion along with a history of long-standing diabetes and recurrent deep vein thrombosis is suggestive of glucagonoma.

Solution to Question 15:

The most probable diagnosis is somatostatinoma.

Somatostatin inhibits pancreatic and biliary secretions. Patients with somatostatinoma usually present with vague abdominal pain along with the triad of:

- Gallstones - due to bile stasis
- Diabetes - due to inhibition of insulin secretion
- Steatorrhea - due to inhibition of pancreatic exocrine secretion and bile secretion.

Solution to Question 16:

VIPoma is associated with achlorhydria.

Vasoactive intestinal peptide-secreting tumor (VIPoma) is also known as Verner–Morrison syndrome/WDHA syndrome. WDHA stands for:

- WD - Watery Diarrhea
- H – Hypokalemia
- A – Achlorhydria

Metabolic acidosis from fluid and bicarbonate loss is common in VIPoma.

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Congenital Anomalies and Acute Pancreatitis

Question 1:

What is the most common congenital anomaly of the pancreas?

a) Annular pancreas

b) Pancreas divisum

c) Sphincter of Oddi dysfunction

d) Agenesis of pancreas

Question 2:

Which of the following statements is false regarding the management of pancreatic divisum?

a) Sphincteroplasty is done

b) Pancreatojejunostomy is also known as Puestow's procedure

c) Endoscopic sphincterotomy relieves the symptoms

d) ERCP is more advantageous than MRCP for the diagnosis

Question 3:

A 9-year-old girl was referred to the OPD with a chronic history of early satiety and recurrent non-bilious vomiting after heavy meals. Barium meal revealed a diffusely narrowed second portion of the duodenum, suggesting extrinsic compression. Which of the following statements is false regarding the most likely diagnosis?

a) It is associated with failure of complete rotation of the ventral bud

b) Can be associated with classic double bubble sign on radiograph

c) Duodenoduodenostomy is the treatment of choice

d) MRCP is the gold standard investigation

Question 4:

A 40-year-old chronic alcoholic presents with sudden onset abdominal pain in the epigastric region radiating to the back. The pain relieves on leaning forwards. X-ray abdomen shows no

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gas under the diaphragm. Elevated amylase levels and total WBC count are seen. Which of the following signs are likely to be present in this condition?

a) 1, 2 and 3

b) 1, 3 and 5

c) 2, 4 and 5

d) 2, 3 and 4

Question 5:

What is the most common cause of acute pancreatitis?

a) Alcohol

b) Gallstones

c) Autoimmune

d) Iatrogenic

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Question 6:

A patient presenting with acute abdomen was found to have elevated serum amylase levels. Which of the following should be part of your differential diagnosis?

a) 1, 3, 4

b) 1 and 5

c) 2, 3, 4

d) 1, 2, 3, 4, 5

Question 7:

All of the following derangements can be expected in a patient with acute pancreatitis except:

a) Hypoalbuminemia

b) Hyperglycemia

c) Hypercalcemia

d) Azotemia

Question 8:

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Which of the following is not used to assess the severity of acute pancreatitis?

a) HAPS score

b) Ranson's criteria

c) Modified Glasgow criteria

d) Alvarado scoring

Question 9:

All of the following parameters will be included in the assessment of acute pancreatitis using Ranson's criteria, except:

a) Age > 55 years

b) Serum LDH level > 250 IU/L

c) Blood glucose level > 200 mg/dL

d) WBC > 16000 cells/mm3

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Question 10:

Revised atlanta classification is used for assessing severity of:

a) Pancreatic fistula

b) Acute pancreatitis

c) Chronic pancreatitis

d) Calcification of pancreatic duct

Question 11:

A gasless abdomen is seen in:

a) Ulcerative colitis

b) Intussusception

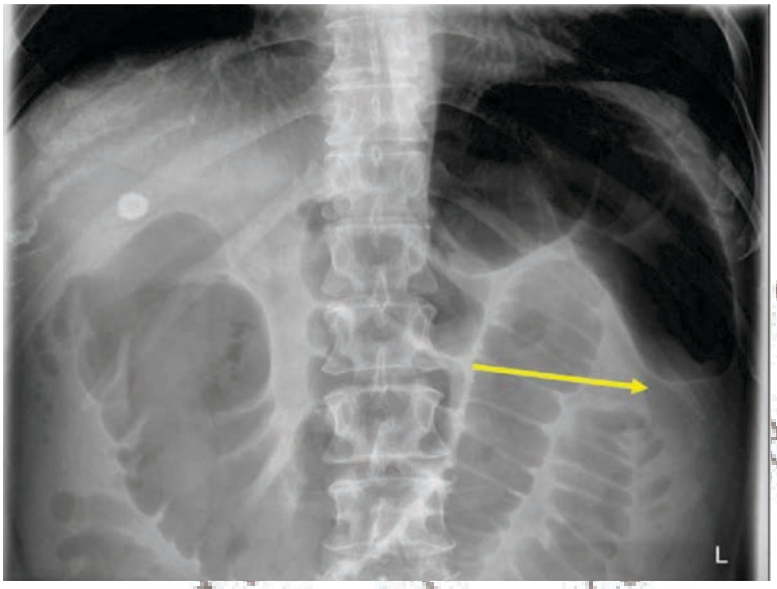
c) Acute pancreatitis

d) Crohn's disease

Question 12:

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A young man presents to the emergency department with complaints of severe abdominal pain and 3 episodes of vomiting in the past 9 hours. He says that the pain radiates to the back and is partially relieved by bending forwards. The abdominal radiograph of the patient is given below. What is the sign that is seen in the radiograph?



a) Sentinel loop sign

b) Colon cut-off sign

c) Renal halo sign

d) Obliteration of psoas shadow

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Question 13:

Which of the following statements is false regarding usage of the contrast-enhanced CT scan in cases of acute pancreatitis?

a) It is the investigation of choice

b) It should be done within 72 hours from the onset of symptoms

c) Balthazar criteria is used to stage the severity of pancreatitis detected on CT scan

d) Signs of sepsis is an indication for CT scan

Question 14:

A patient with acute pancreatitis underwent a contrast-enhanced CT scan of the abdomen. CT scan shows diffuse enlargement of the pancreas without necrosis. What will be the CT severity index of the patient?

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a) 3

b) 1

c) 4

d) 2

Question 15:

When will you use the SOFA score in a patient with acute pancreatitis?

a) To assess organ failure

b) To assess the need for surgery

c) In cases of pancreatic abscess formation

d) To assess the length of hospital stay

Question 16:

A 35-year-old man presented with a 1-day history of sudden onset of severe abdominal pain with radiation to the back. He gives a history of binge drinking on the night prior to his symptom onset. He is hemodynamically stable and there is no sign of organ impairment. His serum amylase level is 500 U/L (normal: 23–85 U/L) and lipase level is 1100 U/L (normal: 10-140 U/L). Which of the following is false regarding the most likely diagnosis?

a) CECT abdomen is almost always necessary to establish the diagnosis

b) CT should be performed 72 hours after the onset of symptoms to assess complications

c) Modified marshall scoring system can be used to assess the severity of organ failure

d) Early initiation of enteral nutrition is beneficial for overall improvement of prognosis

Question 17:

A patient with pancreatitis is likely to develop all of the following vascular complications, except:

a) Splenic vein thrombosis

b) Splenic artery aneurysm

c) Gastroduodenal artery aneurysm

d) Mesenteric artery thrombosis

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Question 18:

A chronic alcoholic presented with complaints of progressive abdominal distension. His past history is significant for acute pancreatitis which was managed by supportive care. USG abdomen showed peri-pancreatic ascitic fluid collection. A large volume paracentesis (LVP) was performed. Which of the following statements is false about this condition?

a) The ascitic fluid will be low in protein.

b) Amylase levels in the fluid are raised.

c) Somatostatin will help in decreasing secretion.

d) Paracentesis shows turbid fluid.

Question 19:

A young lady presents with acute epigastric pain and vomiting. She also gives a history of pain and swelling over the right parotid gland for 3 days. USG abdomen reveals peripancreatic ascitic fluid collection. Which of the following is not true about the fluid collection?

a) It is not associated with fibrous wall

b) The most common vessel involved is the splenic artery

c) Most resolve spontaneously.

d) Associated with hemosuccus pancreaticus.

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Question 20:

A patient with acute pancreatitis was admitted following binge drinking. 7-days post-admission, he complains of fever with chills and rigor. Blood investigation shows a WBC count of 21,450. CT scan reveals the presence of extraluminal gas in the pancreatic tissue. How will you manage this patient?

a) Cystogastrostomy

b) Cystojejunostomy

c) Percutaneous catheter drainage

d) IV antibiotics alone

Question 21:

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Which of the following will not be part of the management plan of patients with infected pancreatic necrosis?

a) Conservative management with IV antibiotics

b) Percutaneous drainage

c) Pancreatic necrosectomy

d) CT guided aspiration

Question 22:

Regarding the revised Atlanta classification for morphologic stages of acute pancreatitis, which of the following is not true?

a) Acute necrotic collection is non-encapsulated necrosis within 4 weeks of onset

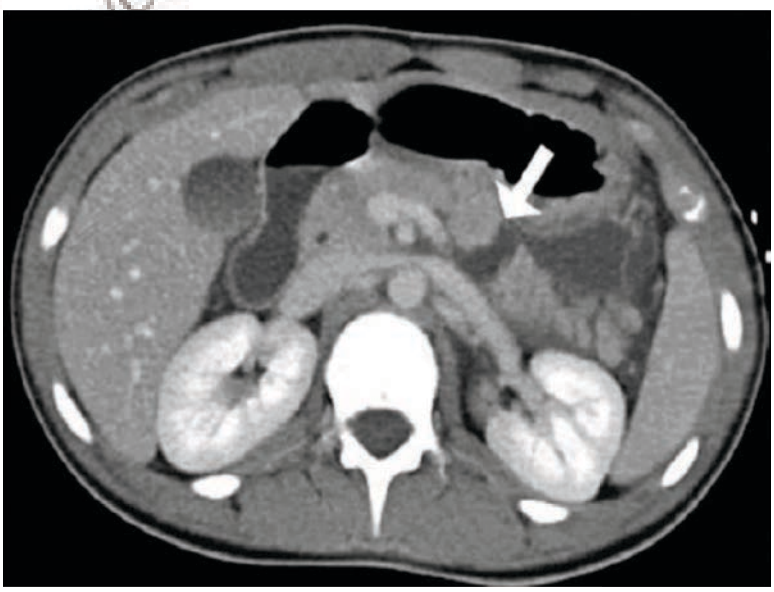
b) Acute peripancreatic fluid collection can be seen in interstitial edematous pancreatitis

c) Pancreatic pseudocyst can be seen in necrotizing pancreatitis

d) Collection that contains non-liquefied material is more likely to become infected

Question 23:

A 12-year-old girl was rushed to the casualty after she was injured by a bicycle's handlebar in the abdomen. She complains of severe epigastric pain. On examination, bruises are seen in the epigastrium. Her CT scan is given below. Which of the following statements is false about her condition?



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a) Damage control surgery is done.

b) Distal pancreatectomy will be the definitive management.

c) Surgery is indicated if the main pancreatic duct is disrupted.

d) Amylase levels are highly sensitive

Answer Key

Question No.	Correct Option
1	b
2	d
3	d
4	b
5	b
6	d
7	c
8	d
9	b
10	b
11	c
12	b
13	b
14	b
15	a
16	a
17	d
18	a
19	d
20	c
21	a
22	c
23	d

Detailed Explanations

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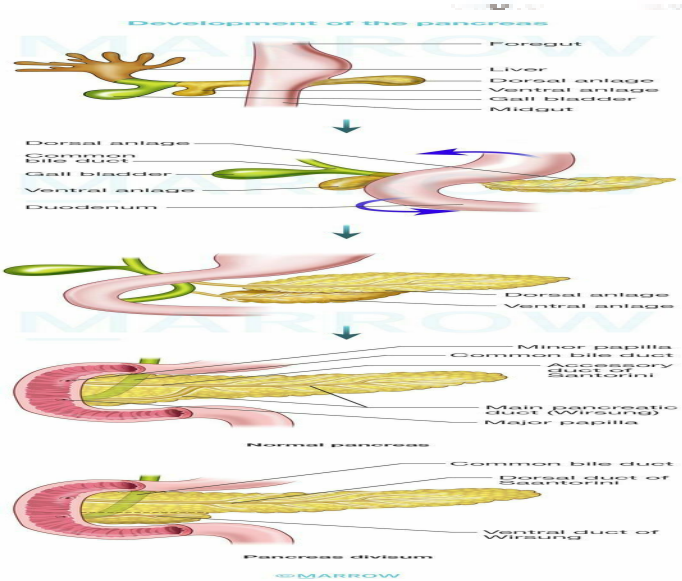
Solution to Question 1:

Pancreas divisum is the most common congenital anomaly of the pancreas.

During embryogenesis, the developing pancreatic ducts usually fuse in such a way that most of the dorsal duct drains into the proximal part of the ventral duct. The proximal portion of the dorsal duct usually persists as an accessory duct.

In about 10% of the population, there is a failure of fusion of the dorsal and ventral pancreatic buds leading to a condition called pancreatic divisum (pancreas divisum). Pancreatic drainage is accomplished mainly through the accessory papilla.

Since most of the pancreatic exocrine secretions exit through the dorsal duct, the pancreas divisum can lead to a partial obstruction due to the small minor papilla, leading to the development of relapsing acute or chronic pancreatitis



Solution to Question 2:

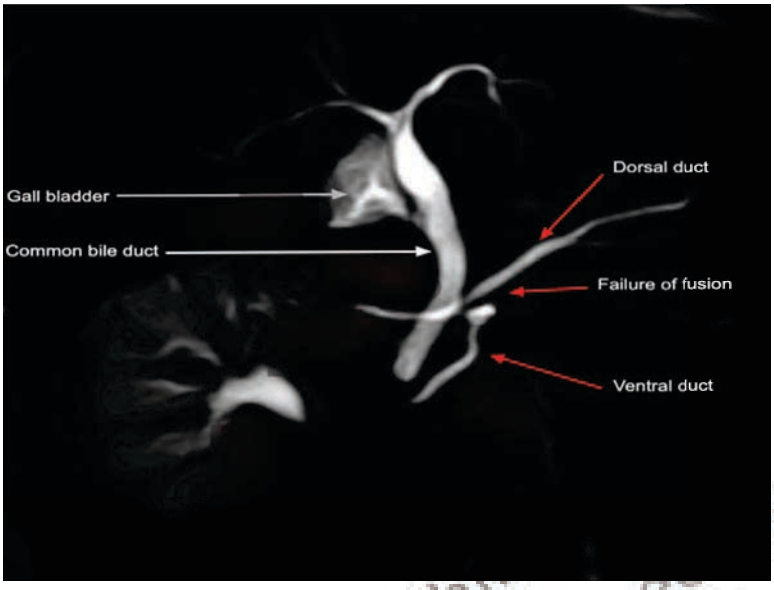
MRCP is more advantageous than ERCP in diagnosing pancreatic divisum. This is because, MRCP can delineate the entire dorsal pancreatic duct, whereas ERCP can assess only the ventral duct on cannulation of the major duodenal papilla.

The diagnosis of pancreatic divisum can also be made by EUS, or ERCP, augmented by injection of secretin if necessary.

Endoscopic sphincterotomy and stenting of the minor papilla relieve the symptoms. Surgical intervention may involve sphincteroplasty, pancreatojejunostomy (Puestow procedure), or even resection of the pancreatic head.

The image given below shows an MRCP done for a case of pancreatic divisum.

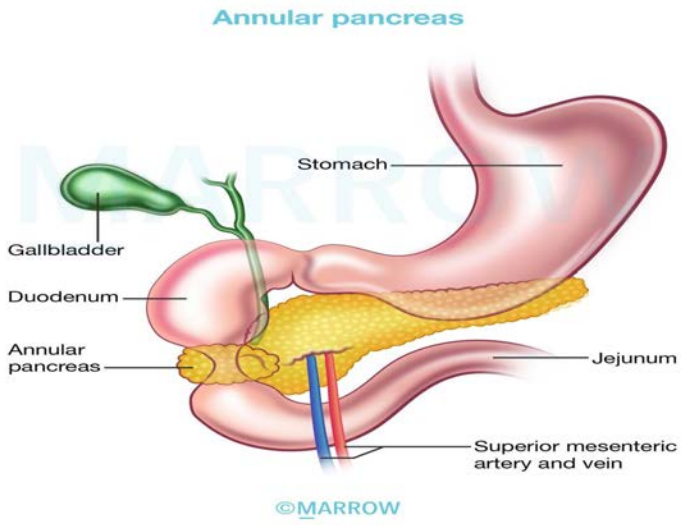
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Solution to Question 3:

The given clinical vignette is suggestive of annular pancreas, which is a type of developmental anomaly leading to duodenal compression. Laparotomy with a thorough gross examination of the duodenum and the head of the pancreas is the gold standard test for an annular pancreas, not an MRCP.

The annular pancreas is due to result of the failure of the complete rotation of the ventral pancreatic bud. During development, a ring of pancreatic tissue surrounds the second or third part of the duodenum.



It is most often seen in association with congenital duodenal atresia and is, therefore, more prevalent in children with Down's syndrome.

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Duodenal obstruction typically causes non-projectile, non-bilious vomiting in neonates.

Plain abdominal radiographs may demonstrate the classic double bubble sign. But it is non-specific for the annular pancreas. Despite many advances in diagnostic techniques such as CT scan, endoscopic ultrasound (EUS), MRCP, and ERCP, the gold standard test for diagnosing AP remains to be laparotomy. It involves a thorough gross examination of the duodenum and the head of the pancreas.

The treatment for an annular pancreas is a duodenal bypass procedure (duodenoduodenostomy).

Solution to Question 4:

The clinical scenario is suggestive of acute pancreatitis. Rovsing sign and Aaron sign are seen in acute appendicitis.

Rovsing sign: Pain in the right lower quadrant during palpation of the left lower quadrant.

Aaron sign: Pain or pressure in the epigastrium or anterior chest with firm pressure applied to McBurney's point.

In severe acute pancreatitis, the injured pancreas releases pancreatic enzymes that cause fat necrosis and inflammation, occasionally resulting in peri-pancreatic bleeding. The resulting fluid collection can travel via an anatomical defect of the transversalis fascia. This accumulates at various sites and shows discoloration of the skin.

Cullen's sign: If the blood diffuses from the retroperitoneum along with the gastrohepatic and falciform ligaments to the umbilicus, it results in bluish discoloration around the umbilicus

Grey Turner sign: If the blood diffuses from the posterior pararenal space to the lateral edge of the quadratus lumborum muscle, it results in bluish discoloration of the flanks

Fox sign: Pooling of retroperitoneal hemorrhage at the inguinal ligament shows discoloration below the inguinal ligament

Bryant sign: Pooling of blood at the scrotum

Solution to Question 5:

The most common cause of acute pancreatitis is the presence of gallstones (50-70%). The second most common cause is alcohol abuse (25%).

Causes of acute pancreatitis: (Mnemonic: I GET SMASHED)

- I – Idiopathic
- G – Gallstones
- E – Ethanol
- T – Trauma
- S – Steroids
- M – Mumps, malignancy (pancreatic cancer)

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- A – Autoimmune
- S – Scorpion sting
- H – Hypercalcemia, hypertriglyceridemia (Usually more than 1000 mg/dL)
- E – Endoscopic retrograde cholangiopancreatography (ERCP)
- D – Drugs

Solution to Question 6:

All the above conditions should be part of the differential diagnosis in patients with acute abdominal pain and elevated serum amylase levels.

Conditions associated with elevated serum amylase levels:

- Burns
- Pregnancy
- Pancreatitis
- Cholecystitis
- Diabetic ketoacidosis
- Ruptured ectopic pregnancy
- Aortic aneurysm
- Renal failure
- Renal transplantation
- Chronic liver disease
- Intestinal obstruction
- Drugs like morphine
- Salivary gland involvement: mumps, calculus, maxillofacial surgery
- Tumors of the lungs, esophagus, breast, or ovary (LEBO)

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Solution to Question 7:

Acute pancreatitis causes hypocalcemia, not hypercalcemia.

The pancreatic enzymes cause autodigestion of the mesenteric fat leading to the release of free fatty acids. These free fatty acids combine with calcium to form calcium salts, causing low levels of circulating calcium.

Hypercalcemia may cause acute pancreatitis. Hypocalcemia is a complication of acute pancreatitis.

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Solution to Question 8:

Alvarado scoring is used in acute appendicitis, not acute pancreatitis.

Solution to Question 9:

Serum lactate dehydrogenase (LDH) > 350 IU/L is included in Ranson's criteria, not 250 IU/L.

Solution to Question 10:

Revised atlanta classification is used for assessing the severity of acute pancreatitis.

Revised atlanta classification:

Mild Acute Pancreatitis

• No organ failure

• No local or systemic complications

Moderately Severe Acute Pancreatitis

• Transient organ failure (<48 hours) and/or

• Local or systemic complications without persistent organ failure

Severe Acute Pancreatitis

• Persistent organ failure (>48 hours) – Single organ or multiorgan

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Solution to Question 11:

A gasless abdomen is an X-ray feature that can be seen in acute pancreatitis. Patients with acute pancreatitis can have significant vomiting and diarrhea that may produce a gasless abdomen.

Common causes of gasless abdomen include:

• High obstruction: gastric outlet obstruction, congenital atresia

• Small bowel obstruction

• Bowel ischemia

• Ascites

• Acute pancreatitis

• Gastroenteritis

• Large abdominal mass - due to displacement

• Post-surgery following total colectomy, esophagogastrectomy, gastrectomy, and low anterior resection

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• A paucity of small bowel gas may be a normal finding in some adults

Note: In intussusception, an X-ray shows small bowel obstruction, a mass, and a paucity of gas in the right iliac fossa.

Solution to Question 12:

The image shows the colon cut-off sign, which is seen in acute pancreatitis.

The colon cut-off sign refers to the abrupt termination of the gas filling of the colon on the left side. The inflammation of acute pancreatitis may extend to the phrenicocolic ligament via the transverse mesocolon. This causes functional spasm of the splenic flexure resulting in the colon cut-off sign.

All the other options mentioned above are also seen in acute pancreatitis.

Solution to Question 13:

The optimal time for performance of contrast-enhanced CT imaging in cases of acute pancreatitis is more than 72 hours from the onset of symptoms. In the first 72 hours, CT may underestimate the extent of necrosis.

A contrast-enhanced CT scan is the investigation of choice in acute pancreatitis. However, it is not performed in all cases of pancreatitis. Indications of CT scan in pancreatitis:

• Diagnostic uncertainty

• In patients with severe acute pancreatitis, to distinguish interstitial from necrotizing pancreatitis

• In patients with organ failure, signs of sepsis or progressive clinical deterioration

• When a localized complication is suspected, such as fluid collection, pseudocyst, or a pseudoaneurysm

The image below is a CT scan from a patient with acute exudative pancreatitis.

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The severity of pancreatitis detected on CT scan is staged according to the Balthazar criteria.

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Solution to Question 14:

The CT severity index (CTSI) of this patient will be 1.

The CT severity index for grading of acute pancreatitis is determined as the sum of two scores:

• Balthazar score: grading of pancreatitis

• Necrosis score: grading of the extent of pancreatic necrosis

The Balthazar score for diffuse enlargement of the pancreas is 1. Since there is no necrosis, the necrosis score of the patient is zero. Hence the CTSI of this patient is 1.

Solution to Question 15:

The Sequential Organ Failure Assessment (SOFA) score is used to assess organ failure in acute pancreatitis. The three organ systems most frequently involved are the cardiovascular, respiratory, and renal systems. Multiple organ failures are said to exist when 2 or more organs register 2 or more points on these scoring systems.

qSOFA score (quickSOFA) is a bedside prompt that may identify patients with suspected infection who are at greater risk for a poor outcome outside the intensive care unit (ICU). It uses three criteria, assigning one point each for

• Low blood pressure (SBP≤100 mmHg)

• High respiratory rate (° 22 breaths per min)

• Altered mentation (Glasgow coma scale, <15)

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The score ranges from 0 to 3 points. The presence of 2 or more qSOFA points is a simple prompt to identify infected patients outside the ICU who are likely to develop sepsis.

Solution to Question 16:

The given clinical scenario with characteristic lab findings is suggestive of acute pancreatitis. CECT abdomen is not always necessary to diagnose acute pancreatitis.

According to the revised Atlanta classification, acute pancreatitis is clinically defined by at least the first two of three features:

• abdominal pain suggestive of pancreatitis (epigastric pain often radiating to the back),

• serum amylase and lipase levels ° 3 times normal (imaging is to be used if the elevated values are less than 3 times normal); and

• characteristic imaging findings on CT, magnetic resonance (MR) imaging, or transabdominal ultrasonographic (US) studies.

If acute pancreatitis is diagnosed on the basis of the first two criteria with no systemic sign of severe systemic inflammatory response syndrome or persistent organ failure, contrast material–enhanced CT may not be necessary for determining patient care.

Option B: The optimal time for performance of contrast-enhanced CT imaging in cases of acute pancreatitis is more than 72 hours from the onset of symptoms. In the first 72 hours, CT may underestimate the extent of necrosis. Indications of CT scan in pancreatitis are

• Diagnostic uncertainty

• In patients with severe acute pancreatitis, to distinguish interstitial from necrotizing pancreatitis

• In patients with organ failure, signs of sepsis or progressive clinical deterioration

• When a localized complication is suspected, such as fluid collection, pseudocyst, or a pseudoaneurysm

Option C: For severe acute pancreatitis with systemic inflammatory response syndrome and possible organ impairment, the modified marshall scoring can be used to assess the severity of organ failure. It includes respiratory, cardiovascular, and renal systems scores. A score of more than 2 for any organs indicates organ failure. Revised Atlanta classification recommends the modified Marshall scoring system as the main tool in determining organ failure.

Option D: Current evidence confirms that the administration of enteral nutrition is beneficial for the treatment of severe acute pancreatitis. Enteral feeding reduces mortality, infectious complications, and multiorgan failure. In terms of the timing of enteral nutritional support, relatively early administration within 48 or 72 h of hospital admission is suggested.

Solution to Question 17:

Mesenteric artery thrombosis is unlikely in patients with acute pancreatitis.

The most common vascular complication following acute pancreatitis is arterial pseudoaneurysm.

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Solution to Question 18:

The given scenario is suggestive of pancreatic ascites. The pancreatic ascitic fluid is rich in enzymes, and not low in protein.

Pancreatic ascites occurs due to the disruption of the pancreatic duct. It presents with significant abdominal distention, with free intra-abdominal fluid.

Diagnostic paracentesis typically demonstrates turbid fluid with elevated amylase and lipase levels.

Treatment involves suppression of pancreatic secretion by parenteral or nasojejunal feeding and administration of octreotide/somatostatin. Abdominal drainage combined with the endoscopic placement of a pancreatic stent across the disruption is done.

If the above steps fail, surgical treatment consisting of distal pancreatic resection and closure of the proximal stump is done.

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Solution to Question 19:

The given clinical scenario is suggestive of acute pancreatitis caused due to mumps. Hemosuccus pancreaticus in acute pancreatitis is not associated with ascites.

Hemosuccus pancreaticus is due to the erosion of the wall of the pancreatic pseudocyst into the splenic artery forming a direct communication. It presents with abdominal pain and upper gastrointestinal (GI) bleeding, without ascites.

In contrast to pseudocysts and cystic neoplasias of the pancreas, fluid collections are not surrounded or encased by epithelium or fibrotic capsules.

Diagnostic paracentesis typically demonstrates turbid fluid with elevated amylase and lipase levels.

Most fluid collections will be spontaneously reabsorbed by the peritoneum. Treatment involves suppression of pancreatic secretion by parenteral or nasojejunal feeding and administration of octreotide/somatostatin. Abdominal drainage combined with the endoscopic placement of a pancreatic stent across the disruption is done.

If the above steps fail, surgical treatment consisting of distal pancreatic resection and closure of the proximal stump is done.

Solution to Question 20:

The given clinical scenario with a history of pancreatitis, elevated WBC, and CT scan findings are suggestive of pancreatic abscess. It is treated by percutaneous drainage.

A pancreatic abscess is a circumscribed intra-abdominal collection of pus, usually in proximity to the pancreas. It may be an acute fluid collection or walled-off necrosis that has become infected.

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Clinical features include:

• Fever with chills

• Elevated white blood cell count

• Abdominal pain

Contrast-enhanced CT scan and MRI are both options for the assessment of pancreatic necrosis and abscesses. On imaging, the presence of extraluminal gas in the pancreatic and/or peripancreatic tissues is consistent with an underlying infection.

Treatment is by percutaneous drainage with the widest possible drains placed under imaging guidance, along with appropriate antibiotics and supportive care.

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Solution to Question 21:

Infected pancreatic necrosis should not be managed conservatively with antibiotics alone because of the high risk of multiorgan failure and death.

CT scan has to be performed in patients with severe acute pancreatitis, organ failure, sepsis, and in patients with clinical deterioration despite the treatment:

• If the CT scan shows the presence of sterile pancreatic necrosis medical management is recommended.

• If the CT scan shows the presence of necrosis with evidence of infection, then ultrasound or CT-guided aspiration of the fluid has to be done and the fluid is sent for staining and culture.

Infected pancreatic necrosis is treated by the administration of intravenous antibiotics (preferably carbapenems) and percutaneous drainage of the infected fluid. Pancreatic necrosectomy is be considered in the patients if the clinical condition worsens despite percutaneous drainage.

Solution to Question 22:

Pancreatic pseudocyst is seen as a sequela of interstitial edematous pancreatitis, which is a non-necrotic collection. Necrotizing pancreatitis usually leads to acute necrotic collection (ANC) and walled-off necrosis (on encapsulation of ANC).

Based on the revised Atlanta classification, peripancreatic fluid and their collections can be classified into 4 different types based on their morphology and time of presentation.

• IEP - Interstitial Edematous Pancreatitis

• APFC - Acute Peripancreatic Fluid Collection:

Non-necrotic fluid collection presenting within 4 weeks

• Pancreatic pseudocyst:

Non-necrotic fluid collection when it undergoes encapsulation (after 4 weeks)

• Necrotising Pancreatitis

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• ANC - Acute Necrotic Collection:

Necrotic fluid collection presenting within 4 weeks

• WON - Walled-Off Necrosis:

Necrotic fluid collection when it undergoes encapsulation (after 4 weeks)

ANC, APFC, WON, and pancreatic pseudocysts can be infected or non-infected. Collections that contain non-liquefied material or show the presence of gas, are more likely to be infected.

Duration since onset	IEP	Necrotizing pancreatitis
<4 weeks after onset(not encapsulated)	APFC	ANC
⇓Undergoes encapsulation⇓		
°4 weeks after onset(encapsulated)	Pancreatic pseudocyst	WON

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Solution to Question 23:

The given clinical scenario with a handlebar injury and the CT scan showing transection of the body of the pancreas are suggestive pancreatic injury. Plasma amylase levels are not sensitive in pancreatic injuries.

The most common mechanism of pancreatic injury in children is blunt trauma (because of the decreased amount of fat and incomplete protection of the rib cage). In adults, penetrating injuries are the most common cause. Involvement of other organs is also likely to be seen.

Direct compression of the epigastrium against the vertebral column and a blunt object (handlebar) is typically seen after bicycle injuries. The most common segment of the pancreas affected is the body.

Patients usually present with epigastric pain. In some cases, a delayed presentation may be due to leakage of pancreatic fluids.

The modality of choice is the CT scan of the abdomen. If there is doubt about duct disruption, an urgent ERCP or MRCP should be done.

Surgery is indicated if the main pancreatic duct is disrupted. A damage control procedure with packing and drainage should be performed initially and the patient referred for definitive surgery after stabilization.

Definitive management includes:

• Distal pancreatectomy - If the body or tail is involved

• External drainage - If the head of the pancreas is involved

• Pancreatoduodenectomy - If the pancreatic head and duodenum is involved

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Chronic Pancreatitis

Question 1:

A 55-year-old chronic alcoholic presents with complaints of recurrent epigastric pain, progressive weight loss, and foul-smelling diarrhoea for the past 6 months. CT scan reveals pancreatic calcification and dilatation of the main pancreatic duct. Which of the following statements is false about his condition?

a) It is more common in males

b) It can result in diabetes

c) Abdominal pain is the most common symptom

d) Pain increases as destruction of the pancreas progresses

Question 2:

What is the most common cause of chronic pancreatitis?

a) Gallstones

b) Alcohol

c) Autoimmune

d) Drugs

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Question 3:

Which of the following is not a part of the TIGAR-O classification?

a) Recurrent pancreatitis

b) Trauma

c) Obstruction

d) Autoimmune

Question 4:

A young patient with recurrent abdominal pain and pancreatic calcification was found to have a mutation in SPINK1. Which of the following statements is false about this condition?

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a) Associated with high incidence of diabetes mellitus.

b) It can be distinguished from chronic alcoholic pancreatitis histologically.

c) Cassava ingestion is an etiological factor.

d) Seen in malnourished individuals.

Question 5:

Hereditary chronic pancreatitis is caused by the mutation of:

a) PRSS1

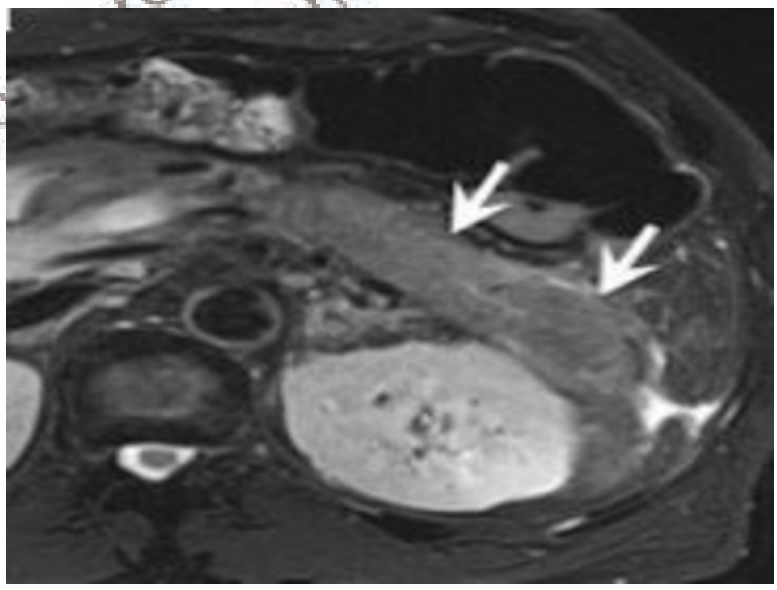
b) CFTR

c) PSTI

d) SPINK1

Question 6:

A 35-year-old diabetic patient presented with complaints of recurrent abdominal pain and weight loss. Investigations showed features suggestive of obstructive jaundice and MRI revealed the following abnormality. All of the statements are true regarding the given condition except:



a) It is likely to resolve spontaneously

b) NSAIDs should not be used

c) Serum IgG4 is elevated in type 2

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d) Corticosteroids are the treatment of choice

Question 7:

The Rosemont criteria for the diagnosis of chronic pancreatitis is based on:

a) CT scan findings

b) ERCP findings

c) MRCP findings

d) EUS findings

Question 8:

Which of the following diagnostic tests have the highest sensitivity and specificity to diagnose chronic pancreatitis?

a) Magnetic resonance imaging (MRI)

b) Computed tomography (CT) scan

c) Secretin test

d) Endoscopic ultrasound (EUS)

Question 9:

All of the following are tests used to diagnose exocrine deficiency of the pancreas except:

a) Lundh test

b) Fecal elastase estimation

c) NBT-PABA test

d) sFLT-1 test

Question 10:

A 65-year-old man who had multiple episodes of pancreatitis presented with a history of mild epigastric pain and the presence of foul-smelling greasy stools for the past 5 months. MRCP showed the presence of a chain of lake appearance in the pancreas. What is the most likely diagnosis?

a) Acute pancreatitis

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b) Chronic pancreatitis

c) Carcinoma pancreas

d) Pseudocyst of the pancreas

Question 11:

A patient with chronic pancreatitis can develop all of the following complications, except:

a) 2 and 5

b) 1 and 3

c) 4 and 5

d) 1 and 2

Question 12:

Which of the following statements is false about the complications of chronic pancreatitis?

a) All the complications of acute pancreatitis can occur in patients with chronic pancreatitis.

b) Exocrine insufficiency precedes endocrine insufficiency.

c) Calcium oxalate is the most common type of stone in chronic pancreatitis.

d) At least 90% of acinar cells should be lost before malabsorption symptoms manifest.

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Question 13:

A young male patient presents with steatorrhea associated with chronic pancreatitis. A stool examination of the patient shows increased fecal fat and decreased fecal elastase. What is the mode of administration of the pancreatic enzymes in this patient?

a) Oral

b) Intravenous

c) Subcutaneous

d) Transdermal patch

Question 14:

Pain relief in chronic pancreatitis can be obtained by the destruction of:

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a) Celiac ganglia

b) Vagus nerve

c) Anterolateral column of spinal cord

d) Splenic plexus

Question 15:

A patient with chronic pancreatitis complains of intractable abdominal pain despite the administration of analgesics. CT scan shows pancreatic head enlargement. A EUS guided fine-needle biopsy ruled out pancreatic malignancy. What will be the preferred management in this patient?

a) ERCP with sphincterotomy

b) Whipple procedure

c) Beger procedure

d) Puestow procedure

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Question 16:

A 34-year-old patient presents with intractable pain associated with chronic pancreatitis. MRCP shows the chain of lakes appearance. What will be the preferred management in this patient?

a) Total pancreatectomy

b) Side-to-side pancreaticojejunostomy

c) Sphincteroplasty

d) Resection of pancreatic tail and pancreatojejunostomy

Question 17:

A 36-year-old man presents with dull aching epigastric pain. He gives a history of acute abdominal pain following a binge of alcohol 5 weeks back which was managed conservatively. On examination, he appears icteric and a firm mass was palpable in the epigastrium. His CT scan is given below. Which of the following statements is false about his condition?

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a) Cyst wall is lined by squamous epithelium.

b) It can cause bowel obstruction.

c) Increased amylase levels are seen.

d) Splenic artery is the most common artery involved.

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Question 18:

A young man is incidentally found to have a pseudocyst of the pancreas on abdominal ultrasound during a master health check-up. The size of the pseudocyst is 5 cm and is located in the tail of the pancreas. Past history is notable for two episodes of acute pancreatitis. How will you manage this patient?

a) Cystogastrostomy

b) Cystojejunostomy

c) Observation

d) External drainage

Question 19:

A 45-year-old patient presents to the emergency room with abdominal pain and severe non-bilious vomiting. He was treated for upper abdominal pain 5 weeks ago. CT scan reveals a pancreatic pseudocyst of size 8 cm in close proximity to the stomach with secondary pressure effects. What is the best treatment option for this patient?

a) Cystogastrostomy

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b) Roux-en-Y cystojejunostomy

c) Percutaneous drainage

d) Observation and symptomatic management

Question 20:

A 55-year-old chronic alcoholic presents with recurrent abdominal pain radiating to the back and passage of dark-colored stools. He has pallor and mild epigastric tenderness on palpation. Blood investigations show severe anemia and high serum lipase. CT scan reveals a pancreatic pseudoaneurysm and subsequent endoscopy shows blood near the ampulla of Vater. Identify the false statement about his condition:

a) Splenic artery is involved.

b) ERCP is the gold standard investigation.

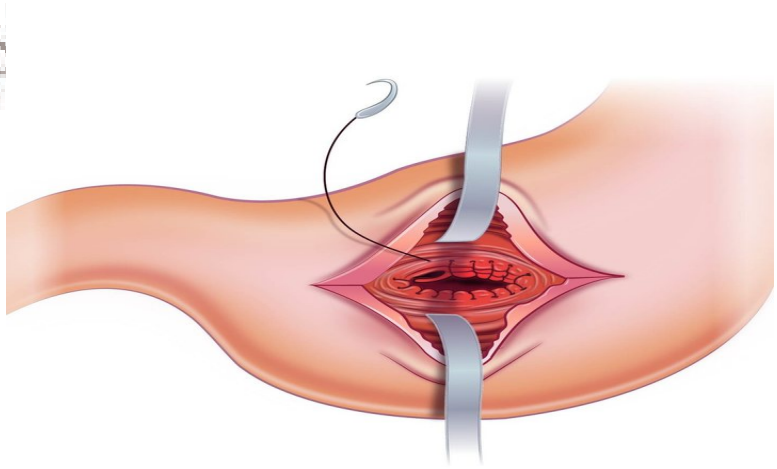
c) Coil embolization is done only in stable patients.

d) Surgical interventions include distal pancreatectomy.

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Question 21:

Which of the following statements is false about this procedure done for pancreatic pseudocyst?



a) Failure to respond to an endoscopic treatment is an indication.

b) Defect in the anterior wall of the stomach is closed in two layers.

c) The pseudocyst is drained through the anterior wall of the stomach.

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d) Hemorrhage is the major complication expected.

Question 22:

Milwaukee classification is used for the assessment of:

a) Duodenal atresia

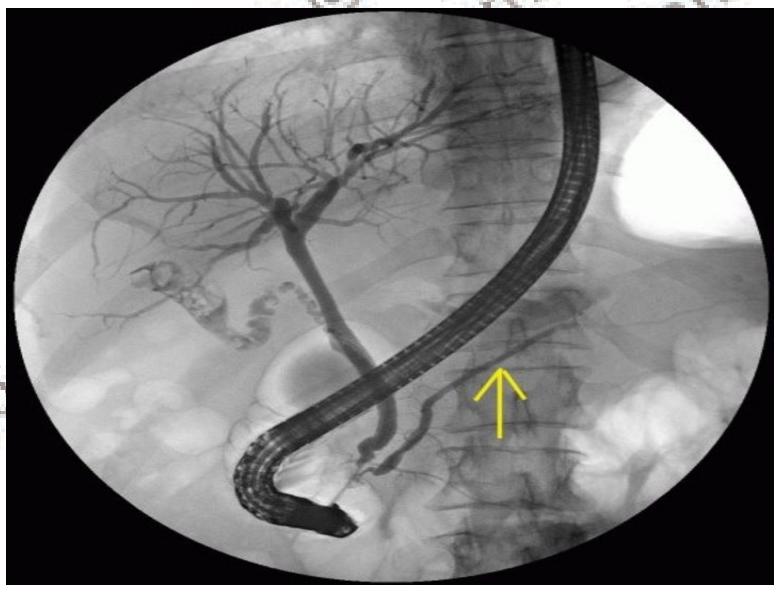
b) Choledocal cyst

c) Sphincter of Oddi dysfunction

d) Cystic tumours of pancreas

Question 23:

Identify the marked structure:



a) Bile duct

b) Cystic duct

c) Main pancreatic duct

d) Accessory pancreatic duct

Answer Key

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Question No.	Correct Option
1	d
2	b
3	b
4	b
5	a
6	c
7	d
8	c
9	d
10	b
11	a
12	c
13	a
14	a
15	c
16	b
17	a
18	c
19	a
20	b
21	c
22	c
23	c

Detailed Explanations

Solution to Question 1:

The given clinical scenario is suggestive of chronic pancreatitis. Pain decreases or disappears as the destruction of the pancreas progress. This is called a burned-out pancreas. This correlates with the progression of disease from a mild or moderate stage to severe destruction of the pancreas.

Chronic pancreatitis is a progressive inflammatory disease in which there is an irreversible destruction of pancreatic tissue. It is more common in males, with a male: female ratio of 4:1.

Solution to Question 2:

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Alcohol consumption is the most common cause of chronic pancreatitis, accounting for 60–70% of the cases. Smoking increases the risk of alcohol-induced chronic pancreatitis.

Cystic fibrosis is the most common cause of chronic pancreatitis in the pediatric age group.

Other causes of chronic pancreatitis include:

• Pancreatic divisum

• Annular pancreas

• Hyperlipidemia

• Hypercalcemia

• Hyperparathyroidism

• Chronic duct obstruction

• Autoimmune pancreatitis

• Cystic fibrosis

• Tropical pancreatitis

• Hereditary pancreatitis

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Solution to Question 3:

The T in the TIGAR-O classification stands for toxic-metabolic, not trauma.

The TIGAR-O classification system is an etiological approach to classify chronic pancreatitis and pancreatic exocrine insufficiency.

Solution to Question 4:

The given clinical scenario of chronic pancreatitis with SPINK1 mutation is suggestive of tropical pancreatitis (nutritional pancreatitis). Tropical pancreatitis is histologically indistinguishable from chronic alcoholic pancreatitis.

Normally, if trypsinogen does become prematurely activated within the pancreas, it is inhibited by SPINK1 and then gets destroyed. A loss-of-function mutation in SPINK1 affects this process and predisposes to tropical pancreatitis.

Tropical pancreatitis is a form of idiopathic pancreatitis that begins at a young age and is usually seen in Indonesia, southern India (Kerala), and tropical Africa. It is associated with a high incidence of diabetes mellitus (a brittle form of pancreatogenic diabetes) and stone formation. Causes of chronic tropical pancreatitis include:

• Malnutrition

• Ingestion of cyanogenic glycosides in cassava

• Exposure to hydrocarbons released from kerosene or paraffin lamps

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Tropical pancreatitis is histologically indistinguishable from chronic alcoholic pancreatitis.

Solution to Question 5:

Hereditary chronic pancreatitis is caused by the mutation of PRSS1 (protease serine 1).

Hereditary pancreatitis is an autosomal dominant disorder, associated with a gain-of-function mutation in the cationic trypsinogen gene (PRSS1) on chromosome 7q. This leads to intrapancreatic activation of trypsinogen and the production of the degradation-resistant form of trypsin.

PRSS1 mutation accounts for about two-thirds of cases of hereditary pancreatitis. There is an increased risk of developing pancreatic cancer, particularly if the patient smokes tobacco.

Option B: Cystic fibrosis transmembrane conductance regulator (CFTR) gene is located on the long arm of chromosome 7, and it regulates bicarbonate and chloride concentrations in respiratory and pancreatic secretions.

• Homozygous CFTR mutations result in cystic fibrosis

• Heterozygous mild CFTR mutations predispose to pancreatic exocrine insufficiency and chronic pancreatitis

Options C and D: Serine peptidase inhibitor Kazal type 1 (SPINK1) or pancreatic secretory trypsin inhibitor (PSTI) is associated with tropical calcific pancreatitis as well idiopathic chronic pancreatitis.

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Solution to Question 6:

The clinical features and characteristic sausage-shaped appearance of the pancreas on the T2 weighted image are diagnostic of autoimmune pancreatitis (AIP). Serum IgG4 is normal in type 2 AIP. It is elevated in type 1 AIP.

Autoimmune pancreatitis (AIP) is a chronic inflammatory disorder of the pancreas. Patients present with features of obstructive jaundice, weight loss, and mild abdominal pain.

CT scan or MRI showing a diffuse enlarged, sausage-shaped pancreas is characteristic of autoimmune pancreatitis.

Serum IgG4 level is considered the best serological marker for AIP.

Most of the cases resolve spontaneously. However, corticosteroid therapy is the treatment of choice as it causes increased remission of AIP. Also, AIP is associated with gastric ulcer formation as there are abundant IgG4 levels. Hence NSAIDs are not part of the management.

They are of two types:

Features	Type 1 AIP	Type 2 AIP
Age	Elderly	Young
Gender	Males	Equal

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Features	Type 1 AIP	Type 2 AIP
Serum IgG4	Elevated	Normal
Histopathology	Lymphoplasmacytic sclerosing pancreatitis	Idiopathic duct centric pancreatitis
Infiltrating cells	IgG4 + plasma cells	Granulocytes
Relapse rate	High	Low
Other organ involved	Biliary striturePseudotumorsKidneyLungOthersRetroperitoneal fibrosisSialoadenitis	No
Extra pancreatic lesion	IgG4 related disease	Inflammatory bowel disease(15-30%)

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Solution to Question 7:

Rosemont's criteria for the diagnosis of chronic pancreatitis is based on endoscopic ultrasonographic (EUS) findings.

Solution to Question 8:

The diagnostic test with the best sensitivity and specificity for chronic pancreatitis is the secretin test.

Secretin is a hormone secreted by the small intestines. It normally stimulates the pancreas to secrete a fluid with a high concentration of bicarbonate. Secretin stimulation test is a test that measures the ability of the pancreas to respond to secretin.

In order to perform the test, a tube is passed into the duodenum. Secretin is administered intravenously and the contents of the duodenal secretions are aspirated and analyzed over a period of about 2 hours. The test becomes abnormal when ° 60% of the pancreatic exocrine function has been lost. This usually correlates well with the onset of chronic abdominal pain.

Other investigations to diagnose chronic pancreatitis:

Pancreatic calcifications can be seen on abdominal X-rays.

Endoscopic ultrasound showing the presence of four or more of these following features is highly suggestive of chronic pancreatitis:

• Presence of stones

• Visible side branches

• Cysts

• Lobularity

• An irregular main pancreatic duct

• Hyperechoic foci and strands

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• Dilatation of the main pancreatic duct

• Hyperechoic margins of the main pancreatic duct

An abdominal CT scan is the initial modality of choice for diagnosing chronic pancreatitis. CT or MRI scan will show the outline of the gland, the main area of damage, and the possibilities for surgical correction.

The investigation of choice for chronic pancreatitis is MRCP with secretin stimulation. ERCP is the gold-standard investigation. They help in identifying the presence of biliary obstruction and the state of the pancreatic duct.

Solution to Question 9:

sFLT-1 (soluble FMS like tyrosine kinase-1) is not used to test pancreatic exocrine deficiency. sFLT-1 is a marker used for pre-eclampsia.

Tests for pancreatic exocrine deficiency	
Direct tests:	
Lundh test	The pancreatic secretion is directly measured following a test meal
Secretin or CCK stimulation test	Following intravenous injection of secretin or CCK, the pancreatic secretion is measured
Indirect tests:	
Nitroblue tetrazolium–para-aminobenzoic acid (NBT–PABA) test	The NBT-PABA is administered orally and degraded in the gut by a pancreatic enzyme. The breakdown product (PABA) is absorbed by the intestine and excreted in the urine. Its urinary value is measured.
Pancreolauryl test	Works on the similar principle of NBT-PABA
Measurement of thefecal elastase	A value below 100 µg/g establishes the diagnosis of severe pancreatic exocrine insufficiency
Fecal fat and weight estimation test	

Solution to Question 10:

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The chain of lakes appearance on pancreatography (ERCP or MRCP) is diagnostic of chronic pancreatitis.

In chronic pancreatitis, there are multiple strictures and stones in the pancreatic duct. This leads to the alternate stenosis and dilatation of the pancreatic duct leading to the chain of lakes appearance.

Solution to Question 11:

Renal artery stenosis and insulinoma are not complications of chronic pancreatitis.

Complications of chronic pancreatitis:

Intrapancreatic complications:

• Pseudocysts

• Duodenal or gastric obstruction

• Thrombosis of splenic vein

• Abscess

• Perforation

• Erosion into the visceral artery

• Inflammatory mass in the head of the pancreas

• Bile duct stenosis

• Portal vein thrombosis

• Duodenal obstruction

• Duct strictures and/or stones

• Ductal hypertension and dilatation

• Pancreatic carcinoma

Extrapancreatic complications:

• Pancreatic duct leak with ascites or fistula

• Pseudocyst extension beyond lesser sac into mediastinum, retroperitoneum, lateral pericolic spaces, pelvis, or adjacent viscera

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Solution to Question 12:

Calcium carbonate stone is the most common type of stone formed in chronic pancreatitis.

Calcium and bicarbonate ions are normally present in pancreatic juice in high concentrations. Lithostathine is a potent inhibitor of calcium carbonate crystal formation. In alcoholics and in patients with alcoholic chronic pancreatitis, lithostathine expression and secretion are dramatically inhibited leading to calcification.

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Other complications of chronic pancreatitis:

• Exocrine insufficiency - At least 90% of the gland needs to be dysfunctional before malabsorption symptoms manifest like:

• Fat-soluble vitamin deficiency

• Bleeding

• Osteopenia

• Osteoporosis

• Endocrine insufficiency - Diabetes mellitus. Exocrine insufficiency usually precedes endocrine insufficiency.

• All the complications of acute pancreatitis can occur in patients with chronic pancreatitis.

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Solution to Question 13:

The mode of administration of pancreatic enzymes in exocrine pancreatic insufficiency is through an oral route.

Effects of pancreatic enzyme replacement in chronic pancreatitis:

• Reverses exocrine insufficiency

• Prevents secondary complications such as metabolic bone disease due to inadequate absorption of the fat-soluble vitamins A, D, E, and K

• Reduces pain due to chronic pancreatitis

Pancreatic enzyme supplementation is done with meals. Non-enteric-coated tablets are degraded by gastric juice and the released enzymes inhibit cholecystokinin (CCK) secretion. This, in turn, decreases the pancreatic secretion and thereby reduces the pain caused due to the increased accumulation of the secretions within the pancreatic duct.

Enteric-coated tablets are not degraded in the proximal small intestine and, hence, might not be effective in reducing CCK secretion and relieving pain.

Solution to Question 14:

Celiac plexus block is used for pain relief in chronic pancreatitis as well as pancreatic carcinoma. It can be done using alcohol or other analgesics. It is a safe procedure, but the effect is short-lived.

Solution to Question 15:

Beger's procedure is the procedure of choice for patients with chronic pancreatitis, having an associated mass in the head of the pancreas.

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Beger's procedure is a duodenum-preserving pancreatic head resection. It preserves the function of the foregut. Once the pancreatic head is removed, a Roux-en-Y is created and anastomosed to the rim of the pancreas or duodenum, pancreatic duct, and body and also the bile duct, if involved.

Solution to Question 16:

The pancreatic duct dilation observed on pancreatography for chronic pancreatitis is classically described as a chain of lakes, which reflects the presence of multiple dilations and stenoses.

When it is accompanied by intractable pain, this condition is best treated with side-to-side Roux-en-Y pancreaticojejunostomy, also known as the modified Puestow procedure or lateral pancreaticojejunostomy.

Solution to Question 17:

The given clinical scenario with a history of acute pancreatitis, epigastric mass, and the CT image showing a cyst is suggestive of pancreatic pseudocyst. The capsule of the cyst is composed of collagen and granulation tissue, and it is not lined by epithelium. Hence, it is called a pseudocyst.

Pseudocysts are post-inflammatory cysts that arise following an attack of mild acute pancreatitis. Formation of a pseudocyst requires 4 weeks or more from the onset of acute pancreatitis. They are also the most common complication of chronic pancreatitis.

Pseudocysts are usually solitary and most commonly seen in the lesser omental sac. The most common artery involved is the splenic artery.

Complications of pancreatic pseudocyst include:

- Abscess
- Systemic sepsis
- GI bleeding
- Fistula formation
- Peritonitis
- Obstructive jaundice
- Bowel obstruction
- Hemorrhage into the cyst
- Hemoperitoneum

Pancreatic pseudocysts can be distinguished from cystic neoplasms by having high amylase levels and absence of mucin and low serum carcinoembryonic antigen (CEA) levels.

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Solution to Question 18:

Observation is the preferred treatment in this case since the size of the pseudocyst is <6 cm and is arising from the tail of the pancreas.

Indications for conservative management in pancreatic pseudocyst:

• Asymptomatic patients

• Pseudocysts smaller than 6 cm (according to Bailey)

• Located on the tail

• No evidence of pancreatic duct obstruction or communication with the main pancreatic duct

Solution to Question 19:

The best treatment option for this patient would be to perform a cystogastrostomy since the size of the tumor is greater than 6 cm and in close proximity to the stomach.

Interventions in pseudocyst are required when:

• Complicated by infection

• Presence of a mass effect

• Diameter increasing in size or greater than 6 cm

• Recurrence following the previous resection

Endoscopic drainage is usually curative.

Surgical drainage is done if endoscopy is contraindicated or has failed.

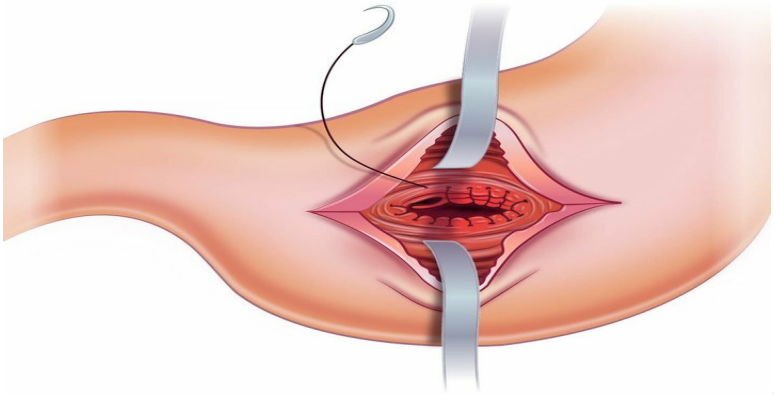
In this cystogastrostomy, an anterior gastrostomy is performed. Once the pseudocyst is located, it is drained through the posterior wall of the stomach using a linear stapler. The defect in the anterior wall of the stomach is closed in two layers.

The image shows the procedure involved in cystogastrostomy.

Feature	Treatment approach
Close contact (<1 cm) with the stomach	Transgastric drainage
Close contact (<1 cm) with the duodenum	Transduodenal drainage
Communicating with the main pancreatic duct	Transpapillary drainage
Pancreatic duct stricture associated with a pancreatic pseudocyst	Endoscopic dilation and stent placement

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Cystoduodenostomy is done when pseudocyst is adjacent to the duodenum, or concern about disrupting pancreatic ductal entry into the duodenum.

Roux-en-Y Cystojejunostomy is generally done for cysts that are neither in close proximity to the stomach and nor to the duodenum. This is generally preferred as the last resort as it is associated with a lot of complications.

Percutaneous drainage to the exterior under radiological guidance is associated with a high recurrence rate and high incidence of pancreatic-cutaneous fistula. Hence, it is not usually done.

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Solution to Question 20:

The given clinical scenario is suggestive of hemosuccus pancreaticus. CT angiography is the gold standard in diagnosing hemosuccus pancreaticus.

Haemosuccus pancreaticus, also known as pseudohaemobilia, is a rare cause of GI bleeding, due to blood originating from the pancreatic duct into the duodenum via the ampulla of Vater. It is usually caused by the erosion of a pancreatic pseudocyst into the splenic artery.

In hemosuccus pancreatitis, abdominal pain radiating to the back accompanied by melena is the most typical presentation. The pain usually has an up and down pattern, which means it changes in intensity over time. This is due to the transient closure of pancreatic ducts. Other features include:

- Hematochezia
- Hematemesis
- Anemia
- Jaundice
- A palpable pulsatile mass with a thrill murmur
- Retroperitoneal bleeding

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Laboratory values show elevated lipase and low hemoglobin levels. The diagnosis is mainly through imaging modalities like upper GI endoscopy, ERCP, endoscopic ultrasound (EUS), and contrast-enhanced CT scan.

CT angiography is the gold standard diagnostic tool. It helps to localize the site of bleed and plan the management accordingly.

Once the bleeding source is identified, hemodynamically stable patients are managed by coil embolization, balloon tamponade, or stent placement.

Hemodynamically unstable patients are managed by distal pancreatectomy.

Solution to Question 21:

The image shows cystogastrostomy, which is done for the pancreatic pseudocyst. The pseudocyst is drained through the posterior wall of the stomach.

Surgery in pseudocyst is indicated for patients who fail to respond to endoscopic treatment.

Pancreatic pseudocysts closely attached to the stomach should be treated with a cystogastrostomy. In this procedure, an anterior gastrostomy is performed. Once the pseudocyst is located, it is drained through the posterior wall of the stomach using a linear stapler. The defect in the anterior wall of the stomach is closed in two layers.

Hemorrhage is the major complication expected post-surgery.

Solution to Question 22:

Milwaukee classification is used for the assessment of sphincter of Oddi dysfunction.

Sphincter of Oddi dysfunction or dyskinesia (SOD) is a clinical syndrome in which pain, biochemical abnormalities, and dilatation of the bile duct and/or pancreatic duct are attributed to abnormal functions of the sphincter of Oddi.

SOD may result from stenosis of the sphincter or from dysmotility. Scarring or stenosis of the sphincter can result from the passage of stones, pancreatitis, or prior endoscopic sphincterotomies.

Milwaukee classification of the sphincter of Oddi dysfunction (SOD) :

• Type I SOD is usually managed by Sphincterotomy. Whether such patients should undergo dual sphincterotomies (biliary and pancreatic) is debatable.

• Type II SOD is usually assessed by a manometry first, followed by surgical or medical management based on manometry findings.

• Type III SOD is difficult to manage. Surgical management, such as sphincterotomy has variable outcomes with response rates ranging from 8% to 65%. Medical management in the form of nifedipine, proton-pump inhibitor, botulinum toxin injection, etc. does not have long-term benefits as well.

Note:

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Cystic tumors of the pancreas are classified according to Klo■ppel's classification system.

Choledochal cysts are classified according to the Todani classification system.

Biliary type SOD				
	Biliary-type pain	Abnormal LFT (a)	Dilated CBD (b)	Delayed drainage(c)
Type I	+	+	+	+
Type II	+	One or two of (a), (b) and (c)		
Type III	+	None of (a), (b) and (c)		
	ALT and AST levels are > 2 times normal on ° 2 occasionsCBD diameter > 12 mm on USG or > 10mm on cholangiographyDelayed drainage (> 45 min) of contrast on ERCP while supine			

Pancreatic type SOD				
	Pancreatic-type pain	Abnormal LFT (a)	Dilated pancreatic duct (b)	Delayed drainage(c)
Type I	+	+	+	+
Type II	+	One or two of (a), (b) and (c)		
Type III	+	None of (a), (b) and (c)		
	Amylase and/ or Lipase levels are > 2 times normal on ° 2 occasionsDilated pancreatic duct diameter: head > 6 mm and body > 5 mmDelayed drainage (> 9 min) of contrast while in prone position			

Solution to Question 23:

The structure marked is the main pancreatic duct.

Endoscopic retrograde cholangiopancreatography (ERCP) is performed using a side-viewing fibreoptic duodenoscope. The ampulla of Vater is intubated, and contrast injected into the biliary and pancreatic ducts to display the anatomy radiologically.

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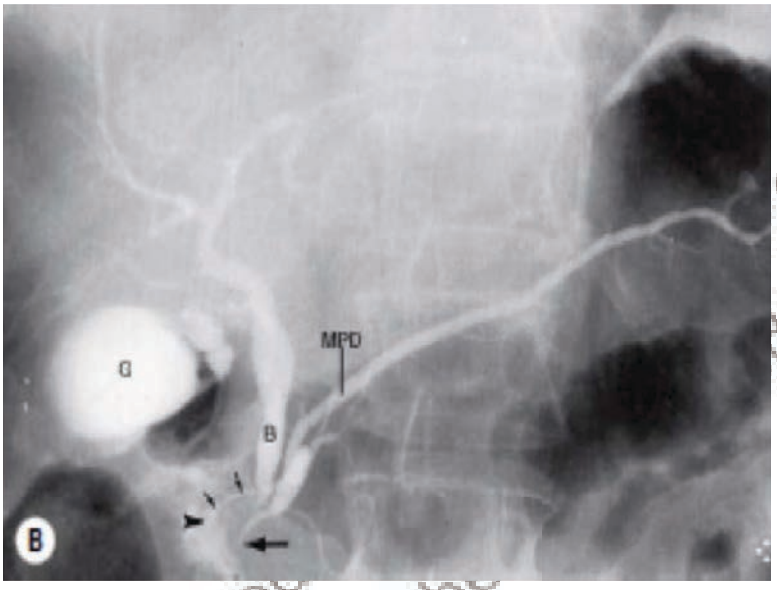
ERCP is helpful for:

• Direct opacification of bile ducts and pancreatic ducts

• Dynamic information during the introduction and drainage of the contrast medium

• Visual assessment of the duodenum and ampulla of Vater, thereby facilitating biopsy

• Interventional procedures such as sphincterotomy, stone extraction, biliary stenting, and biliary stricture dilatation



ERCP shows filling of the main pancreatic duct (MPD), common bile duct (B), and gallbladder (G). The MPD and CBD drain into the major papillary (large arrow). The small accessory pancreatic duct (small arrows) drains separately into the minor papilla (arrowhead).

The most common complication of ERCP is acute pancreatitis. The main diagnostic disadvantage with ERCP is the underfilling of ducts above a stricture.

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Carcinoma Pancreas

Question 1:

Which of the following statements is false about mucinous cystadenoma of the pancreas?

a) It is lined by columnar epithelium

b) Commonly seen in peri-menopausal women

c) Identified histologically by the presence of ovarian-like stroma

d) It is not premalignant

Question 2:

A patient with a pancreatic neoplasm undergoes cyst fluid aspiration. The aspirated fluid stains positive for mucin and shows elevated levels of amylase and CEA. What is the most probable diagnosis?

a) Serous cystadenoma of pancreas

b) Mucinous cystadenoma of pancreas

c) Intraductal papillary mucinous neoplasm

d) Mature cystic teratoma

Question 3:

A 58-year-old man is being evaluated for recurrent attacks of pancreatitis. An ERCP is done and it shows the presence of a fish-mouth sign at the ampulla of Vater. Which of the following statements is true about his condition?

a) It is more common in males

b) It only involves the main pancreatic duct

c) Head of pancreas is most common site of the neoplasm

d) They have no malignant potential

Question 4:

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A 60-year-old man was incidentally found to have a pancreatic lesion on a USG. On further evaluation, a CT scan revealed the presence of a multicystic, lobulated mass in the pancreatic head, suggestive of serous cystadenoma. He is currently asymptomatic. What will be the next step in the management of this patient?

a) Repeat CT scan after 6 months

b) Resection of the tumor

c) Endoscopic ultrasound guided FNA

d) Diagnostic laparoscopy

Question 5:

What is the initiating event in the oncogenesis of pancreatic cancers?

a) Activation of K-ras 2

b) Loss of p16 function

c) p53 mutation

d) Loss of DPC4 function

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Question 6:

Which of the following are not risk factors for the development of pancreatic cancer?

a) 1 and 4

b) 1 and 5

c) 2 and 3

d) 3 and 4

Question 7:

What is the most common type of pancreatic malignancy?

a) Squamous cell carcinoma

b) Adenocarcinoma

c) Insulinoma

d) Acinar cell carcinoma

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Question 8:

What is the most common site for pancreatic carcinoma?

a) Head

b) Neck

c) Body

d) Tail

Question 9:

Which of the following statements is false regarding the presentation of patients with pancreatic carcinoma?

a) Release of platelet aggregating factors cause migratory thrombophlebitis

b) Abdominal pain is the most common presentation

c) Courvoisier's law implicates possible cancer of the head of the pancreas

d) Tumors of the body present at an advanced unresectable stage

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Question 10:

Which of the following statements is not true about pancreatic ductal adenocarcinoma?

a) It is associated with desmoplastic changes, with scattering of neoplastic glands

b) Perineural invasion is characteristic

c) Body tumors are smaller

d) Carcinoma of the head of the pancreas causes obstruction of both the pancreatic and biliary ducts

Question 11:

A 60-year-old man with a history of chronic pancreatitis presents with jaundice, severe itching, and weight loss. A smooth, globular mass is palpable in the right upper quadrant of the abdomen. You suspect pancreatic cancer. What will be the imaging modality of choice for the evaluation of the tumor?

a) Endoscopic retrograde cholangiopancreatography

b) Magnetic resonance cholangiopancreatography

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c) Multidetector CT scan

d) PET scan

Question 12:

Which of the following is a radiological sign that is not seen in patients with adenocarcinoma of the pancreas?

a) Scrambled egg appearance

b) Inverse 3 sign

c) Double duct appearance

d) Narrowing of C-loop of the duodenum

Question 13:

The best method to obtain tissue for the diagnosis of pancreatic carcinoma is:

a) Transgastric FNAC guided by endoscopic ultrasound

b) MRI-guided biopsy

c) Laparoscopic-guided biopsy

d) Percutaneous transperitoneal biopsy

Question 14:

Which is the most reliable tumor marker for the pre-treatment evaluation of a patient with pancreatic adenocarcinoma?

a) Carcinoembryonic antigen

b) CA 19-9

c) Alpha-fetoprotein

d) CA 15-3

Question 15:

A 50-year-old man has been diagnosed with pancreatic cancer. In order to diagnose a resectability status, a CECT abdomen is performed. Which of the following features will indicate an unresectable tumor?

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a) Abutment of superior mesenteric artery

b) Stage II cancer on AJCC staging criteria

c) Short segment occlusion of superior mesenteric vein

d) Encasement of celiac artery

Question 16:

A patient presents to the OPD with complaints of jaundice, clay-colored stools, and pruritis. After detailed radiological and pathological investigations, a 2 cm adenocarcinoma is found at the head of the pancreas. There is no spread to the adjacent structures. What is the preferred surgical management in this patient?

a) Whipple's procedure

b) Pylorus preserving pancreaticoduodenectomy

c) Duodenum-preserving pancreatic head resection

d) Puestow's procedure

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Question 17:

You assist in performing a Whipple procedure in a patient with carcinoma of the pancreas. All of the following structures will be resected in this surgery, except:

a) 1 and 3

b) 2 and 4

c) 3 and 5

d) 4 and 5

Question 18:

During the reconstruction of the Whipple procedure, all of the following anastomoses will be done by a surgeon except:

a) Pancreaticojejunostomy

b) Ileojejunostomy

c) Choledochojejunostomy

d) Gastrojejunostomy

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Question 19:

During the Whipple procedure, a surgeon performs the Kocher maneuver to access the retroperitoneum. This maneuver involves:

a) Mobilization of gall bladder

b) Mobilization of second part of duodenum

c) Mobilization of the pancreas

d) Mobilization of ascending colon

Question 20:

Which of the following statements is false regarding complications of the Whipple procedure?

a) Delayed gastric emptying is characterized by the need for prolonged nasogastric decompression

b) Endocrine insufficiency is a complication

c) Any drainage output on or after postoperative day 3, with amylase >3 times normal value indicates pancreatic fistula

d) Biliary leakage is the most common complication

Question 21:

What is the most common cause of death in patients following pancreaticoduodenectomy?

a) Cardiopulmonary complications

b) Gastric outlet obstruction

c) Anastomotic leakage

d) Haemorrhage

Question 22:

A patient was found to have a 3 cm adenocarcinoma of the body of the pancreas invading into the superior mesenteric artery. All of the following chemotherapeutic agents can be utilized for the management of this patient except:

a) FOLFIRINOX regimen

b) Albumin-bound paclitaxel

c) MVAC regimen

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d) Gemcitabine

Answer Key

Question No.	Correct Option
1	d
2	c
3	c
4	c
5	a
6	a
7	b
8	a
9	b
10	c
11	c
12	d
13	a
14	b
15	d
16	b
17	c
18	b
19	b
20	d
21	c
22	c

Detailed Explanations

Solution to Question 1:

Mucinous cystadenoma of the pancreas is a premalignant condition.

Mucinous cystadenoma or mucinous cystic neoplasm (MCN) is a benign tumor of the pancreas with high risk of malignancy. They are commonly seen in perimenopausal women, and about

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two-thirds are located in the body or tail of the pancreas.

MCNs are mostly incidental findings. When symptoms are present, they are usually nonspecific and include upper abdominal discomfort, early satiety, or weight loss.

The cysts are lined by tall columnar epithelium. MCN's contain mucin-producing epithelium and are identified histologically by the presence of mucin-rich cells and ovarian-like stroma. Staining for estrogen and progesterone is positive in most cases.

Malignant transformation of MCN is common with large tumors and old patients. This is due to a stepwise accumulation of mutations (K-ras, p53).

WHO classification of primary tumors of the pancreas	
Benign	Mucinous cystadenomaSerous cystadenomaIntraductal papillary mucinous adenomaMature teratoma
Borderline	Mucinous cystic tumor with moderate dysplasiaIntraductal papillary mucinous tumor with moderate dysplasiaSolid pseudopapillary tumor
Malignant	Ductal adenocarcinomaSerous/mucinous cystadenocarcinomaIntraductal mucinous papillary tumor

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Solution to Question 2:

Positive mucin staining, elevated carcinoembryonic antigen (CEA), and elevated amylase levels are seen in cases of intraductal papillary mucinous neoplasm (IPMN).

Cyst fluid analysis of various pancreatic cystic neoplasms:

Characteristics	Serous cystic neoplasm (SCN)	Mucinous cystic neoplasm (MCN)	Intraductal papillary mucinous neoplasm (IPMN)
Cytology	Scant glycogen-rich cells, with positive periodic acid–Schiff stain	Sheets and clusters of columnar, mucin-containing cells	Tall, columnar, mucin-containing cells
Mucin stain	Negative	Positive	Positive
Amylase	Low	Low	High
CEA	Low	High	High

Solution to Question 3:

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A fish mouth sign at the ampulla of Vater during ERCP is indicative of intraductal papillary mucinous neoplasm (IPMN). It is most commonly seen in the head of the pancreas.

The intraductal papillary mucinous neoplasm can be diagnosed with the following findings (Ohashi triad) during endoscopy:

• Bulging ampulla of Vater (fish-mouth sign)

• Dilated pancreatic duct

• Mucin secretion from the opening

Equal distribution is seen between males and females in IPMN. Patients are usually in their seventh or eighth decade of life and present with abdominal pain or recurrent pancreatitis. This is caused by the obstruction of the pancreatic duct by thick mucin. Some patients have symptoms secondary to pancreatic insufficiencies like steatorrhea, diabetes, and weight loss.

IMPNs are of three types:

• Branch-duct IPMN (BD-IPMN) - affects only the small side branches. It is less frequently associated with malignancy.

• Main duct IPMN (MD-IPMN) - Affects the main pancreatic duct. Malignant transformation is commonly seen.

• Mixed-type IPMN - side-branch IPMNs that extend into the main duct

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Solution to Question 4:

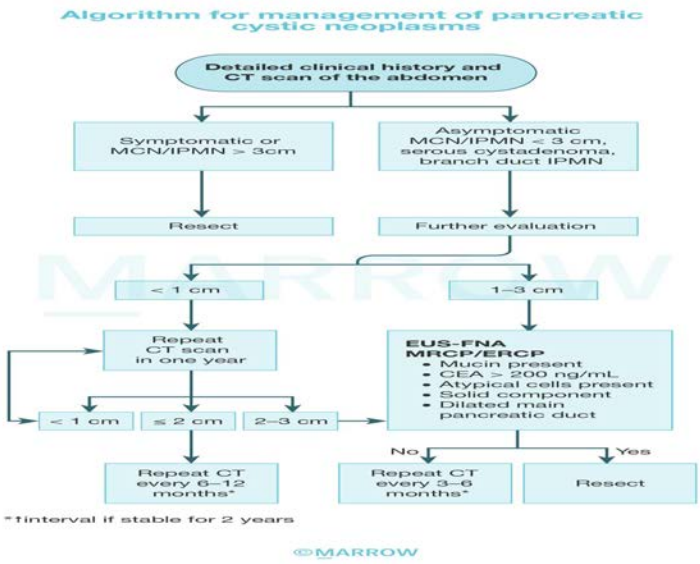
Endoscopic ultrasound-guided FNA (EUS-FNA) will be the next step in the management of this patient.

Serous cystadenomas are essentially benign tumors without malignant potential. Serous cystadenocarcinoma has been reported very rarely (<1%). Therefore, malignant potential should not be a consideration for surgical resection. Surgical resection is done only for symptomatic patients.

In asymptomatic patients, conservative management is adopted. However, it is important to confirm the diagnosis using EUS-FNA. It yields a non-viscous fluid with low CEA and amylase levels.

Algorithm for management of pancreatic cystic neoplasms:

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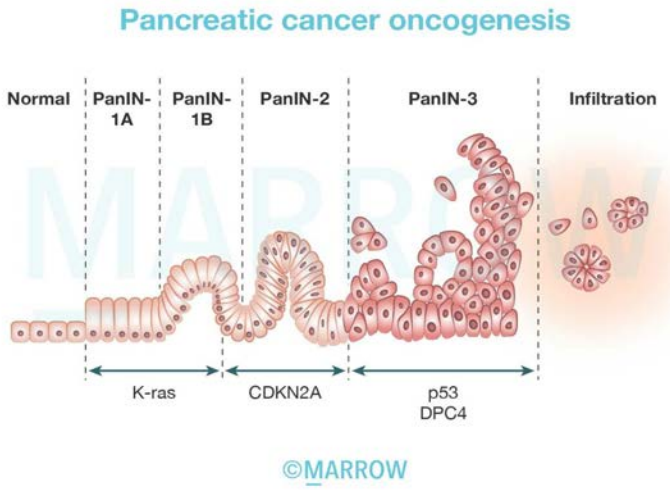
Solution to Question 5:

The activation of the K-ras 2 oncogene is the initiating event in the oncogenesis of pancreatic cancers. It is activated in more than 95% of pancreatic cancers.

Pancreatic intraepithelial neoplasia (PanIN) develops into pancreatic ductal adenocarcinoma (PDAC) in a sequential pathway. A number of tumor suppressor genes and oncogenes play a significant role in the pathogenesis of PDAC. They include:

- K-ras 2
- PDX1
- CDKN2A/p16
- p53
- DPC4 (SMAD4)

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Solution to Question 6:

An history of acute pancreatitis and female gender are not risk factors for the development of pancreatic cancer.

Risk factors for pancreatic cancer:

- Demographic factors:
- Age (peak incidence, 65–75 years)
- Male gender
- Black ethnicity
- Cigarette smoking
- Genetic factors and medical conditions
- Family history:
- Two first-degree relatives with pancreas cancer
- Germline BRCA2 mutations in some rare high-risk families
- Hereditary pancreatitis
- Chronic pancreatitis
- Lynch syndrome
- Ataxia telangiectasia
- Peutz–Jeghers syndrome
- Familial breast-ovarian cancer syndrome
- Familial adenomatous polyposis
- Diabetes mellitus

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• Obesity

Solution to Question 7:

Ductal adenocarcinoma is the most common type of pancreatic cancer.

Types of exocrine pancreatic cancer:

• Ductal adenocarcinoma (85%)

• Adenosquamous carcinoma

• Acinar cell carcinoma

Endocrine cancer of the pancreas is rare. They account for only 5% of clinically detected pancreatic tumours.

Solution to Question 8:

Pancreatic carcinomas arise most commonly from the head of the gland.

Solution to Question 9:

Jaundice is the most common presentation of carcinoma of the head of the pancreas. It is secondary to obstruction of the distal bile duct.

Clinical features of pancreatic cancers:

• Jaundice (most common)

• Nausea

• Epigastric discomfort

• Pruritus, dark urine, pale stools

• Steatorrhea

• Anorexia

• Weight loss

• Back pain - indicates retroperitoneal infiltration

On examination, the patient can have:

• Palpable abdominal mass

• Ascites

• Supraclavicular lymphnodes

• Migratory superficial thrombophlebitis (Trousseau's sign of malignancy) - due to release of platelet aggregating factors from the tumor

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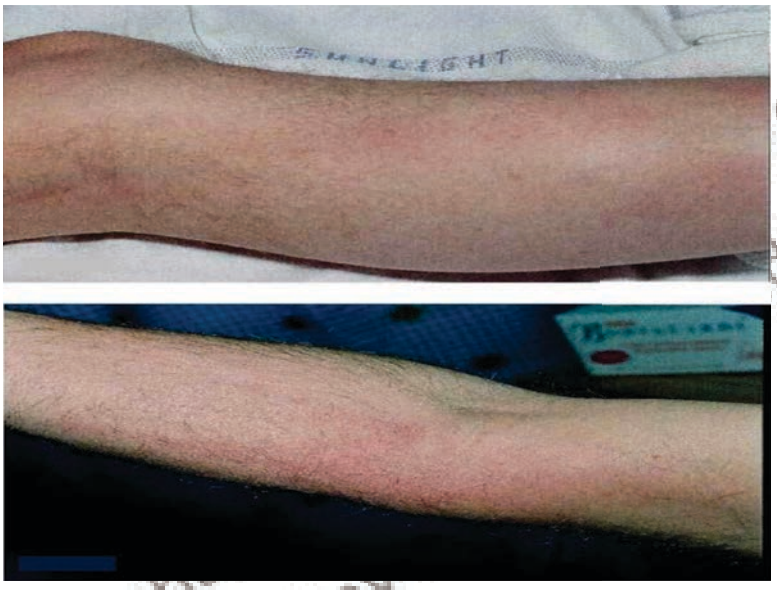
• Secondaries in the rectovesical pouch (Blumer's shelf)

• A palpable, non-tender gall bladder

Courvoisier's law states that in the presence of a painless, palpable, enlarged gallbladder and mild jaundice, the cause is unlikely to be gallstones. This sign implicates possible cancer of the head of the pancreas.

Tumors of the body and tail of the gland often grow silently and present at an advanced unresectable stage.

Image showing migratory superficial thrombophlebitis (Trousseau's sign of malignancy):



Note: Trousseau's sign is also seen in hypocalcemia. It indicates carpopedal spasm (finger and wrist spasm) after inflation of a blood pressure cuff for several minutes when the brachial artery is occluded.

Solution to Question 10:

Pancreatic ductal adenocarcinomas situated in the body of the pancreas are usually larger.

Pancreatic adenocarcinomas are solid, slow-growing tumors, characterized by neoplastic tubular glands within a markedly desmoplastic fibrous stroma. They infiltrate locally, typically along nerve sheaths, along lymphatics, and into blood vessels.

Carcinoma of the head of the pancreas causes obstruction of both the pancreatic and biliary ducts.

Solution to Question 11:

Multidetector computed tomography (CT) is the imaging modality of choice for the evaluation of pancreatic tumors. It allows an accurate determination of the level of biliary obstruction, the relationship of the tumor to the blood vessels, and the presence of regional or metastatic disease.

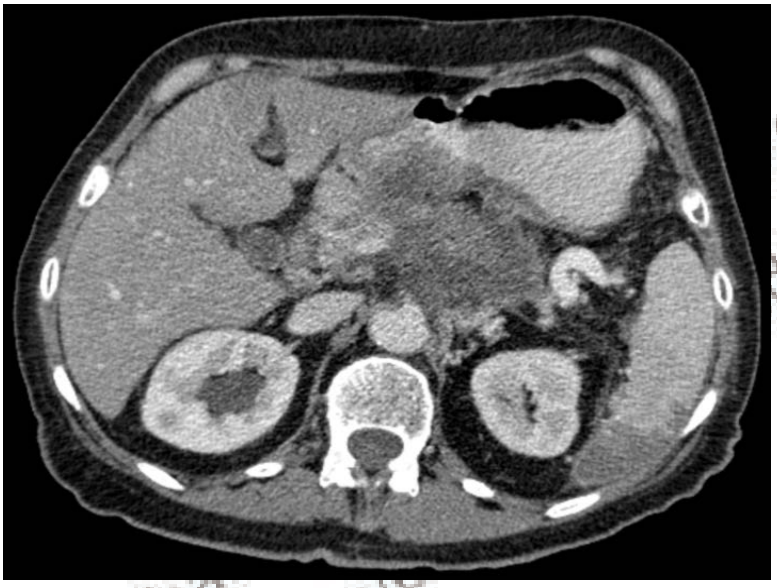
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For a detailed assessment of the luminal pancreato-biliary anatomy, MRCP should be considered.

ERCP is reserved for cases requiring therapeutic or palliative intervention. It helps to perform a biopsy and to relieve obstruction by biliary stenting. The invasiveness of ERCP increases the rate of wound infection. Hence, it is not suitable for patients who will be undergoing surgery.

F-fluorodeoxyglucose positron emission tomography (FDG-PET) has the ability to differentiate between benign and malignant pancreas tumors. However, false-positive results are seen in FDG-PET. The benefits of FDG-PET over CT scans are yet to be determined.

A CT-scan of pancreatic cancer:



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Solution to Question 12:

Widening of the C-loop of the duodenum is a barium meal finding seen in the adenocarcinoma of the pancreas.

Radiological features of adenocarcinoma pancreas:

Endoscopic retrograde cholangiopancreatography (ERCP) findings:

- Scrambled egg appearance
- Double duct appearance

Barium meal findings:

- Inverse 3 sign
- Rose thorning of 2nd part of the duodenum
- Widened duodenal C-loop

Solution to Question 13:

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Transgastric or transduodenal FNAC or trucut biopsy performed under endoscopic ultrasound (EUS) guidance is the best method to obtain tissue for the diagnosis of pancreatic carcinoma. This is because it avoids the spillage of tumor cells into the peritoneal cavity.

Endoscopic ultrasonography with a fine needle aspiration (EUS-FNA) is done if CT has failed to demonstrate a tumor. When a tissue diagnosis is required prior to surgery to distinguish between inflammation and neoplasia, EUS-FNA is helpful.

Diagnostic laparoscopy prior to resection can spare an unnecessary laparotomy by identifying small peritoneal and liver metastases.

Percutaneous transperitoneal biopsy of potentially resectable pancreatic tumors is avoided.

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Solution to Question 14:

Carbohydrate antigen (CA) 19-9 is the most reliable tumor marker for pretreatment evaluation and post-treatment surveillance of pancreatic adenocarcinoma.

Other tumor markers for pancreatic carcinoma are carcinoembryonic antigen (CEA) and α-fetoprotein.

Solution to Question 15:

Encasement of the celiac artery (i.e >180° or >50% of the vessel circumference involvement) indicates surgical inoperability and is therefore considered to be non-resectable.

Varadhachary- Katz criteria for resectability of pancreatic cancer:

SMA: superior mesenteric artery, CHA: common hepatic artery, SMV-PV: superior mesenteric vein-portal vein confluence

Definitions:

• Abutment means ≤180° or ≤50% of the vessel circumference involvement;

• Encasement means >180° or >50% of the vessel circumference involvement

Criteria	Resectable(if all are satisfied)	Borderline resectable(if any one is satisfied)	Unresectable(if any one is satisfied)
AJCC stage	I/II	III	III
SMA	Not affected	Abutment	Encasement
Celiac axis	Not affected	Abutment	Encasement
CHA	Not affected	Abutment	Encasement
SMV-PV	Patent	Short segment occlusion	Long segment occlusion

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Criteria	Resectable(if all are satisfied)	Borderline resectable(if any one is satisfied)	Unresectable(if any one is satisfied)
Note: Any evidence of peritoneal seeding, malignant ascites, or distant metastasis also indicates an unresectable tumor.			

Solution to Question 16:

Since there is no involvement of adjacent structures, the preferred surgical management in this patient is pylorus-preserving pancreatoduodenectomy (PPPD), also known as Longmire–Traverso procedure.

Pylorus-preserving pancreatoduodenectomy (PPPD) involves the removal of:

• Duodenum

• Pancreatic head

• The distal part of the bile duct

The original pancreatoduodenectomy, as proposed by Whipple, included resection of the gastric antrum.

Preserving the antrum and the pylorus results in a better physiological outcome, with no difference in survival or recurrence rates. Hence PPPD is preferred.

For tumors of the body and tail, distal pancreatectomy is the preferred surgical management.

Duodenum-preserving pancreatic head resection (Beger's procedure) and Puestow's procedure (resection of tail followed by longitudinal pancreaticojejunostomy) are management options for chronic pancreatitis.

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Solution to Question 17:

Whipple procedure does not involve the removal of the spleen and tail of the pancreas.

The Whipple procedure is a complex surgery done for carcinomas involving the head of the pancreas. It is done only in cases when:

• The entire duodenum has to be removed e.g. in familial adenomatous polyposis (FAP)

• Tumor encroaches in the first part of the duodenum, or stomach

• A clear resection margin is not achieved by pylorus preserving pancreatoduodectomy

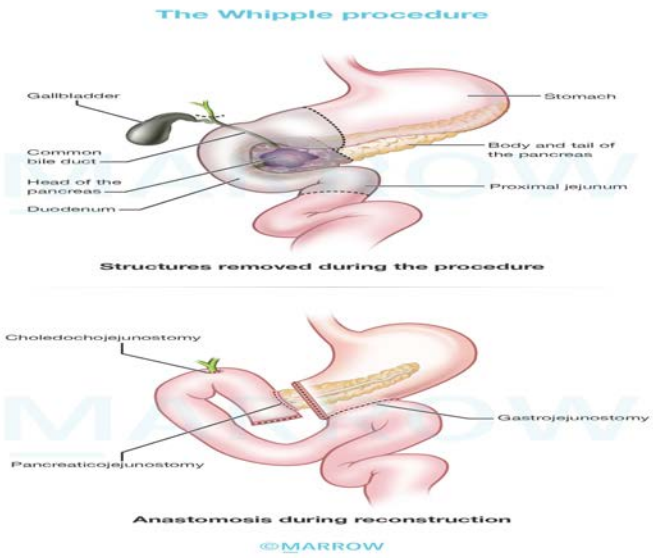
The following structures are removed during Whipple's procedure:

• Distal stomach

• Duodenum

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- Proximal jejunum
- Head of the pancreas
- Gallbladder
- Common bile duct (CBD)
- Regional lymphatics



Solution to Question 18:

Ileojejunostomy will not be done during the reconstruction of the Whipple procedure.

The reconstruction following Whipple's procedure or pylorus-preserving pancreaticoduodenectomy involves anastomosis in the following order:

Pancreaticojejunostomy

↓

Choledochojejunostomy

↓

Gastrojejunostomy

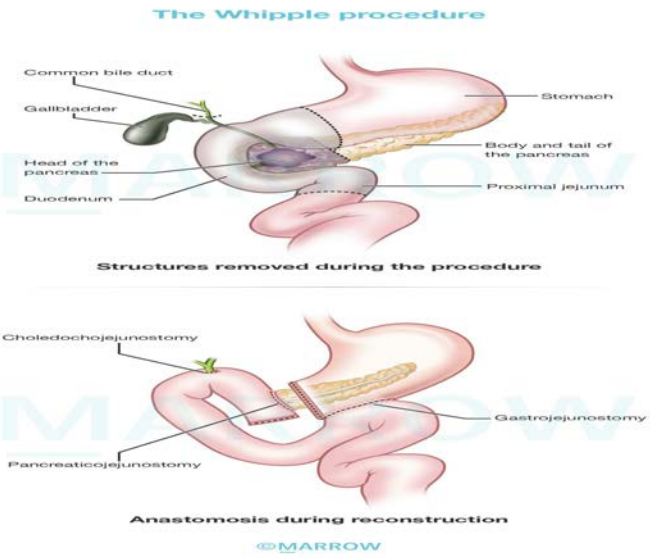
This is controversial since there is a difference in the reconstruction procedures mentioned in standard textbooks:

Bailey and Love, 27th edition (Pg no: 1236) - Pancreaticojejunostomy + choledechojejunostomy + duodenojejunostomy

Schwatrz, 11th edition (Pg no: 1493) - Pancreaticojejunostomy + choledechojejunostomy + gastrojejunostomy/duodenojejunostomy

Sabiston, 20th edition (Pg no: 1546) - Pancreaticojejunostomy + hepaticojejunostomy + duodenojejunostomy

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Solution to Question 19:

The Kocher maneuver involves the mobilization of the second part of the duodenum. It allows exposure of the retroperitoneal fat and the inferior vena cava (IVC).

Another maneuver that is used to access the retroperitoneum is the Cattel Braasch maneuver. It involves the mobilization of the ascending colon.

Other Kocher's in medicine:

• Kocher's technique is used for the reduction of anterior shoulder dislocation. It involves four steps:

Traction → External Rotation → Adduction → Medial Rotation (TEAM)

• During thyroid palpation, Kocher's method is done to demonstrate the pressure effect of the thyroid gland on the trachea or larynx. Lateral compression will result in stridor.

Solution to Question 20:

Delayed gastric emptying is the most common complication following the Whipple procedure, not biliary leakage.

Delayed gastric emptying is characterized by the need for prolonged nasogastric decompression or the inability to tolerate oral intake.

Most pancreatic fistulas are controlled by drainage catheters placed at the time of surgery. A pancreatic leak or pancreatic fistula is defined as the output via an intraoperatively placed drain (or percutaneous drain) of any measurable volume on or after postoperative day 3, with amylase >3 times the normal value.

Other complications of the Whipple procedure include:

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- Wound infection
- Intra-abdominal abscess
- Cardiac events
- Bile leak
- Overall reoperation
- Exocrine insufficiency
- Endocrine insufficiency

Solution to Question 21:

The most common cause of death following pancreaticoduodenectomy is sepsis due to anastomotic leakage.

Anastomotic leakage is responsible for 33–88 % of postoperative deaths after pancreaticoduodenectomy. Only about 5–16 % of patients develop post-surgical bleeding complications.

Solution to Question 22:

MVAC regimen (methotrexate, vinblastine, adriamycin, and cisplatin) is not used in the management of this patient. MVAC regimen is used in advanced bladder carcinoma.

Chemotherapy in pancreatic cancer is indicated in patients with unresectable tumours and lymph node metastasis. Agents used in chemotherapy are:

- Gemcitabine
- Gemcitabine with capecitabine
- Albumin bound paclitaxel (nab-paclitaxel)
- FOLFIRINOX - a combination of fluorouracil, irinotecan, oxaliplatin, and leucovorin

However, there is only a 2–5 months increase in median survival with these regimens. No long-term cure is seen with chemotherapy or radiotherapy for pancreatic carcinomas.

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Congenital Diseases of Kidney and Urinary Calculi

Question 1:

Which of the following statements is false regarding the surgical anatomy of the kidney?

a) The right renal artery is longer than the left renal artery

b) The line of Brodel is an important access route for renal surgeries

c) The renal arteries are end arteries without collateral circulation

d) The kidney has a very poor lymphatic network

Question 2:

Which of the following statements is true concerning a live-donor kidney transplant?

a) The iliac fossa on the posterior abdominal wall is the usual site

b) The renal artery is anastomosed end-to-end to the external iliac artery

c) The renal vein is anastomosed end-to-side to the internal iliac vein

d) Right kidney is preferred over the left for transplantation

Question 3:

An intravenous pyelogram done for evaluation of recurrent UTI in a child is shown below. Which of the following is false regarding this condition?



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a) Associated with an increased incidence of renal cell carcinoma

b) Commonly associated with obstructive uropathy

c) Lies just below the origin of inferior mesenteric artery

d) Division at the level of the isthmus improves function

Question 4:

A child was brought to the clinic for evaluation of recurrent UTI. Ultrasound revealed a dilated renal pelvis. Intravenous urogram done is shown below. What is the most likely diagnosis?



a) Duplex kidney

b) Retrocaval ureter

c) Childhood polycystic kidney disease

d) Horseshoe kidney

Question 5:

A known hypertensive presented with intermittent left-sided flank pain. His brother passed away two years ago due to a ruptured berry aneurysm. CT abdomen done is shown below. Which of the following is false regarding his condition?

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a) Decompression of cyst improves renal function

b) Caused by mutation in chromosome 16

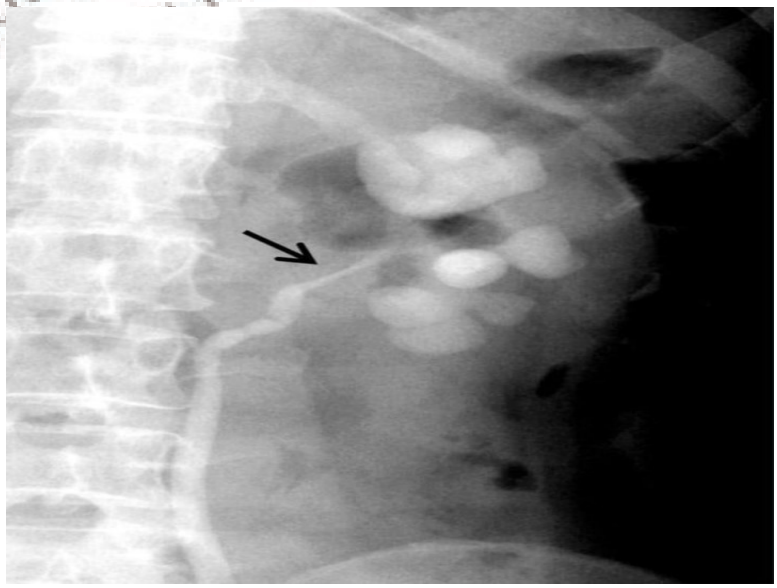
c) Associated with mitral valve prolapse

d) Leads to chronic renal failure

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Question 6:

The following image shows the retrograde ureteropyelogram of a patient with loin pain. What is the most probable clinical diagnosis?



a) Hydronephrosis

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b) Duplex kidney

c) Renal carcinoma

d) Renal stone

Question 7:

An ultrasound scan done at 32 weeks for a woman with oligohydramnios revealed fetal hydronephrosis. What is the most likely cause for this condition?

a) Ureteropelvic junction obstruction

b) Vesicoureteral reflux

c) Ureteroceles

d) Posterior urethral valve

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Question 8:

A mother brings her 3-month-old infant to the OPD with complaints of him crying while urinating. On palpation, a left-sided flank mass is felt. A USG KUB revealed dilation of the pelvicalyceal system with a normal-looking distal urinary tract. What is the investigation of choice to confirm his diagnosis?

a) Intravenous pyelogram

b) 99mTc-MercaptoAcetyl-triGlycine scan

c) Micturating cystourethrogram

d) Retrograde urethrogram

Question 9:

A child was brought to you with recurrent episodes of colicky abdominal pain. USG revealed left-sided hydronephrosis. On the third follow-up day, a decrease in abdominal pain was noted after he passed a large amount of urine. Repeat USG showed a significant decrease in the size of the left kidney. What is the most likely diagnosis?

a) Dietl's crisis

b) Multicystic dysplastic kidney

c) Ureterocele

d) Childhood polycystic kidney disease

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Question 10:

Which of the following are risk factors for calcium stone formation?

a) 2 & 3

b) 1, 3 & 4

c) Only 1

d) 1, 2, 4 & 5

Question 11:

Which among the following is the investigation of choice in a patient suspected to have ureteric stones?

a) Non-contrast CT abdomen and pelvis

b) Ultrasound abdomen and pelvis

c) Plain X-Ray abdomen and pelvis

d) Intravenous urogram

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Question 12:

A man presents to the casualty with fever and hematuria for 3 days. He also gives a history of recurrent left-sided loin pain radiating to the groin. X-ray KUB done is shown below. Which of the following is false regarding stones seen in his condition?



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a) Composed of calcium, ammonium, and magnesium phosphate

b) It is formed in acidic urine

c) Increased risk with infections by urease producing organisms

d) Rectangular or coffin lid appearance on microscopy

Question 13:

Acetohydroxamic acid will be prescribed for patients with which of the following types of renal stones?

a) Cystine stone

b) Oxalate stone

c) Xanthine stone

d) Struvite stone

Question 14:

A patient is referred for the evaluation of severe right-sided abdominal pain. Abdominal X-ray appears normal, and a USG revealed the presence of a 6mm renal stone. Which of the following stones is most likely to be seen in this patient?

a) Cystine stone

b) Oxalate stone

c) Uric acid stone

d) Struvite stone

Question 15:

The urine microscopy of a young man admitted for the evaluation of renal stones shows the following finding. What type of stone is this?

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a) Uric acid

b) Oxalate

c) Cystine

d) Xanthine

Question 16:

Which of the following statements is false regarding renal stones?

a) A low calcium diet can prevent the recurrence of calcium stone

b) Potassium citrate reduces the risk of uric acid stone

c) d-Penicillamine can be used to prevent cystine stone formation

d) Pyridoxine can reduce the risk of oxalate stone formation

Question 17:

An HIV-positive man on HAART presents to the casualty with intermittent right-sided flank pain. He is suspected to have renal stones. Which of the following drugs is most likely to be responsible for this condition?

a) Lamivudine

b) Indinavir

c) Efavirenz

d) Emtricitabine

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Question 18:

Which of the following types of renal stones are produced by laxative abuse?

a) Uric acid

b) Ammonium urate

c) Struvite

d) Calcium oxalate

Question 19:

A woman with severe right-sided colicky loin pain is suspected to have renal calculi. What is the maximum size of the calculi up to which this patient can be managed expectantly?

a) 0.5 cm

b) 1 cm

c) 1.5 cm

d) 2 cm

Question 20:

In patients with which of the following renal stones, will extracorporeal shockwave lithotripsy not be considered?

a) Oxalate stone

b) Phosphate stone

c) Uric acid stone

d) Cystine stone

Question 21:

Extracorporeal shockwave lithotripsy is contraindicated in all of the following patients except?

a) A young woman with untreated bleeding diathesis

b) A 28-week pregnant woman

c) A man with a ureteric stricture

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d) A middle aged man with a saccular aneurysm

Question 22:

An elderly woman was brought to the hospital with a history of severe loin pain for the past 7 hours. Ultrasound of the kidney reveals a 2.5 cm renal stone. What is the treatment of choice for this patient?

a) Extracorporeal shock-wave lithotripsy

b) Percutaneous nephrolithotomy

c) Ureteroscopic removal

d) Open surgery

Question 23:

A man came to the casualty with right-sided colicky loin pain radiating to the inner thigh. NCCT abdomen revealed a non-impacted 1cm calculi in the right ureter. How will you manage this patient?

a) ESWL

b) PCNL

c) Ureteroscopic removal

d) Analgesics and medical expulsion therapy

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Question 24:

A man was brought to the casualty with severe left-sided colicky flank pain. On examination, he was febrile, with a BP of 90/60 mmHg and a feeble rapid pulse. Investigations revealed WBC= 16,800 with a 2.5 cm calculi in the left ureter. What is the preferred management in this patient?

a) Nephrostomy

b) Extracorporeal shock wave lithotripsy

c) Percutaneous nephrolithotomy

d) Ureteroscopic removal

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Answer Key

Question No.	Correct Option
1	d
2	a
3	d
4	a
5	a
6	a
7	a
8	b
9	a
10	b
11	a
12	b
13	d
14	c
15	c
16	a
17	b
18	b
19	a
20	d
21	d
22	b
23	c
24	a

Detailed Explanations

Solution to Question 1:

The kidney has an extensive lymphatic network.

It begins in three plexuses which drain into the lateral aortic nodes. These are located around the renal tubules, under the renal capsule, and in the perirenal fat.

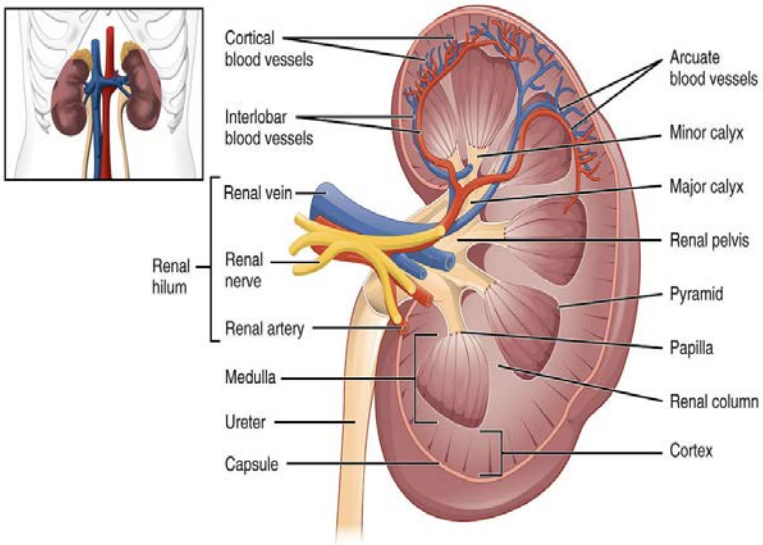
The renal arteries are end arteries without collateral circulation. The right renal artery is longer than the left renal artery. This is due to the position of the abdominal aorta which is slightly to the

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left of the midline.

The left renal vein is much longer than the right renal vein. This is due to the position of the IVC which is slightly to the right of the midline.

The line of Brodel is the avascular plane of the kidney. It lies between anterior and posterior segmental branches. It is an important access route for both open and endoscopic surgical procedures, as it minimizes the risk of damage to major arterial branches.



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Solution to Question 2:

The iliac fossa on the posterior abdominal wall is the usual site chosen for transplantation of the kidney.

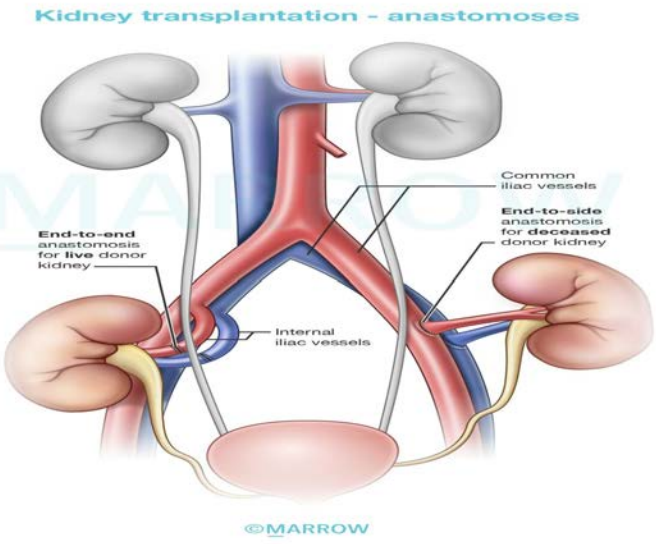
The left kidney is preferred for transplantation because the left renal vein is longer.

In the case of a deceased donor, the arterial graft is traced until the aorta which makes it longer, and hence end-to-side anastomosis is possible. Whereas, in the case of a live donor, the arterial graft cannot be extended until the aorta.

The below image shows the different types of anastomosis in kidney transplantation from live and deceased donors.

	Live donor	Deceased donor
Anastomosis	End-to-end	End-to-side
Recipient vessels	Internal iliac	External or common iliac

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Solution to Question 3:

The given scenario with intravenous pyelogram showing flower vase sign points to a diagnosis of horseshoe kidney. Division of the relatively avascular isthmus between the kidneys is usually not indicated. This is because it can lead to an increased risk of urinary fistula.

Horseshoe kidneys are the most common fusion defects of the kidney, characterized by abnormalities in the position, rotation, and vascular supply of the kidney.

The fused portion lies adjacent to the L3 or L4 vertebra just below the origin of the inferior mesenteric artery. Ascent of the fused kidneys is prevented by the inferior mesenteric artery. Adrenal glands remain in the normal position.

There is a 2:1 male predominance. It is also commonly associated with renal cell carcinoma, Wilms tumor, multicystic dysplastic kidney, and Turner's syndrome.

Patients may be asymptomatic or may present with:

• Dull renal pain

• Abdominal lump

• Urinary tract infections

• Increased angulation of ureters resulting in -

• Nephrolithiasis

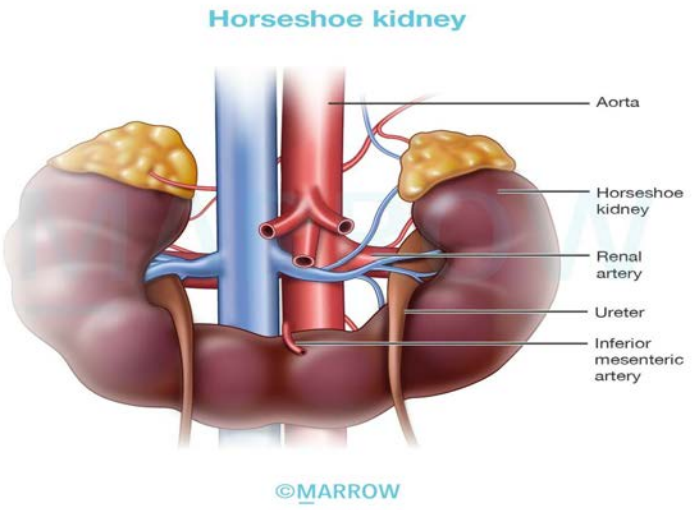
• Hydronephrosis

Radiological diagnosis is by intravenous pyelogram which shows flower vase sign or handshake sign.

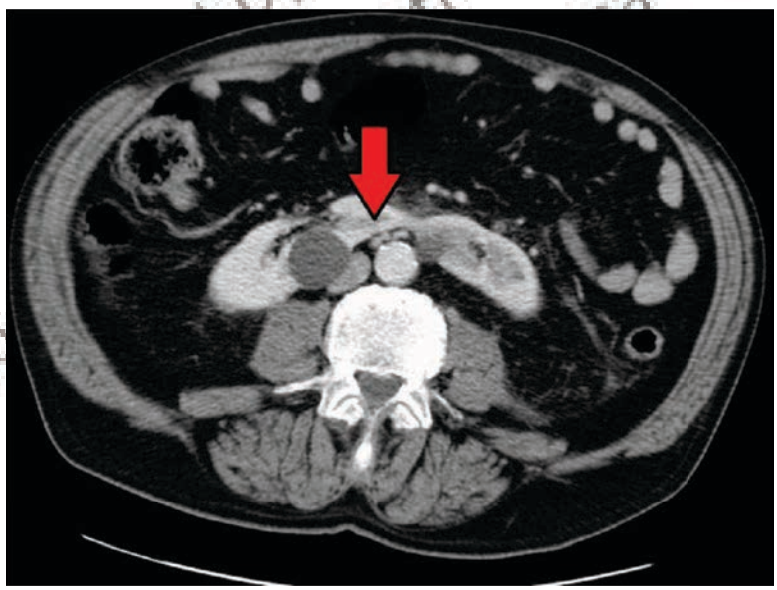
Symptomatic management is preferred. Heminephrectomy is usually not indicated for horseshoe kidneys with unilateral RCC/ Wilms tumor. This is because it can result in devascularisation due to the unpredictable blood supply of the horseshoe kidney from nearby major vessels.

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Note: Division of the relatively avascular isthmus between the kidneys is only indicated in the course of surgery for abdominal aortic aneurysm.



The below CECT shows a fusion defect of the kidneys.



Solution to Question 4:

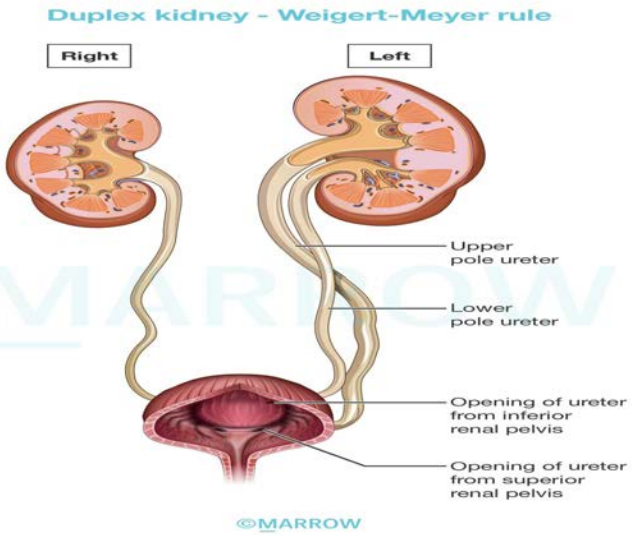
The given scenario and intravenous urogram showing a "drooping lily" sign point to a diagnosis of a duplex kidney.

It refers to the presence of duplicated ureters or collecting systems. This is due to the incomplete fusion of the upper and lower pole of the kidney. Duplex kidneys have two separate pelvicalyceal systems draining single renal parenchyma.

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The lower pole ureter is normally inserted into the bladder. However, the upper pole ureter has an ectopic insertion. It crosses the lower pole ureter to open inferior and medial to the normal site of insertion (Weigert–Meyer rule). This results in reflux and incontinence.

Option B: In retrocaval ureter, the IVC presses on the right ureter as it lies behind the IVC. Intravenous urogram shows reversed 'J'/ fish hook ureter.



Solution to Question 5:

The given scenario with CT showing multiple cysts in the kidneys and liver points to a diagnosis of adult polycystic kidney disease (ADPKD). In such patients, decompression or deroofing of the cysts (Rovsing's procedure) cannot restore normal renal function.

ADPKD is inherited as an autosomal dominant trait with mutations in the PKD1(chromosome 16) and PKD2 genes (chromosome 4).

The disease does not usually manifest before 30 years of age, and in some patients, it is never diagnosed. The progression of the disease is faster in males.

Hypertension is the most common presentation. Renal manifestations of ADPKD include:

• Flank/loin pain - either due to hemorrhage inside cysts or due to renal stones (most commonly uric acid stones)

• Irregular upper quadrant renal mass

• Hematuria

• Uremia

• Renal failure (seen in 10-15% of the patients who receive hemodialysis)

Intravenous pyelography shows characteristic spider leg sign, as a result of stretched calyces due to multiple cysts. Nephrogram shows a swiss cheese appearance. On prenatal USG, the presence of either > 3 cysts in unilateral kidneys or > 2 cysts in each kidney is suggestive of PKD.

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Treatment includes:

• Long-term dialysis

• Renal transplantation

• Vasopressin V2 receptor antagonists

Autosomal recessive polycystic kidney disease (ARPKD) occurs secondary to a mutation of the PKHD1 gene. The severe form manifests in-utero or during infancy; milder cases can manifest later in childhood. 50% of affected newborns die in the first few days of life.

Solution to Question 6:

The given image showing dilated clubbed calyces with stricture of the left ureteropelvic junction points to a diagnosis of hydronephrosis.

Hydronephrosis refers to the dilatation of the pelvicalyceal system caused by a partial or complete blockage of urinary flow.

Investigations:

• Ultrasound is the least invasive technique for diagnosing hydronephrosis.

• Retrograde pyelography is rarely indicated but will confirm the site of obstruction before corrective surgery.

• Intravenous urogram (IVU) is helpful only if the obstructed kidney is functional. In IVU, the extrarenal pelvis is dilated and the minor calyces lose their normal cupping. In early stages, there is blunting of calyces followed by its clubbing in the late stages.

• A renal isotope scan (DTPA or MAG-3) is the best modality to confirm the obstructive dilatation of the collecting system.

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Solution to Question 7:

Ureteropelvic junction obstruction is the most common cause of hydronephrosis found on prenatal ultrasound.

The causes of UPJ obstruction can be:

• Intrinsic - due to an adynamic or stenotic segment of the proximal ureter

• Extrinsic - due to accessory renal arteries

Treatment includes Anderson Hynes dismembered pyeloplasty.

Option B: Vesicoureteral reflux (VUR) is the second most common cause of hydronephrosis. In VUR, the valve that prevents the backflow of urine from the bladder into the ureter is defective.

Option C: Ureterocele is a cystic dilation of the terminal ureter, thought to result from the persistence of the membrane between the ureteral bud and urogenital sinus. IVU shows cobra head/ adder head appearance.

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Option D: Posterior urethral valve is an obstructing membrane in the posterior male urethra as a result of abnormal in-utero development. It is the most common cause of bladder outlet obstruction in male newborns.

Note: Renal stones are the most common cause of acquired unilateral hydronephrosis.

Solution to Question 8:

The given scenario is suggestive of a ureteropelvic junction (UPJ) obstruction. The investigation of choice for UPJ obstruction is 99mTc-MercaptoAcetyl-triGlycine (MAG3) scan. Delayed clearance of contrast or the radiotracer implies obstruction.

Renal isotope scans have replaced intravenous pyelogram as the diagnostic modality of choice in UPJ obstruction.

• 99mTc-MAG3 is the most commonly used isotope in dynamic renography. Its uptake reflects the tubular function.

• 99mTc-DTPA may also be used. Its uptake reflects the glomerular function. Hence, it is commonly used to assess GFR.

In obstructive uropathy, 99mTc-DTPA is the preferred isotope as glomerular function declines earlier and more rapidly than tubular function.

Micturating cystourethrogram is the investigation of choice in vesicoureteric reflux.

Tc-99m dimercaptosuccinic acid (DMSA) scan is used for assessing renal scarring.

Note: In children, crying before and after micturition is usually considered normal. While crying during micturition is usually suggestive of pathology.

Solution to Question 9:

The given scenario of hydronephrosis with renal pain relieved after the passage of a large amount of urine is suggestive of Dietl's crisis.

It is defined as intermittent ureteropelvic junction (UPJ) obstruction causing episodic abdominal pain and nausea, most often due to an aberrant accessory renal artery or vein.

In an acute phase of ureteropelvic junction (UPJ) obstruction, loin swelling occurs along with renal pain due to the retention of urine in the kidney. When the obstruction is relieved, the patient passes a large amount of urine, the swelling is reduced and the pain disappears. This is termed Dietl's crisis.

In the majority of cases, pyeloplasty results in the complete resolution of symptoms.

Solution to Question 10:

Hypercalciuria, hyperoxaluria, and hyperuricosuria are risk factors for calcium stone formation.

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Risk factors for calcium stone formation include:

• High urine concentration of calcium, oxalate, or uric acid

• Low urine concentration of renal stone inhibiting factors such as citrate and magnesium

• Abnormal urine pH

Renal stone formation is governed by factors promoting and inhibiting stone formation. Stone formation occurs when the concentration product is more than the formation product i.e., CP > FP, where:

• Concentration product (CP) - the amount of solute in solution

• Formation product (FP) - maximum concentration of solute in solution after taking into account stone inhibiting factors.

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Solution to Question 11:

Non-contrast CT abdomen (NCCT) is the investigation of choice for the clinical evaluation of ureteric stones.

NCCT is the preferred investigation for evaluation of:

• Renal stones except for indinavir stones

• Ureteric stones

• Head injury

• Salivary gland stones

Solution to Question 12:

The given scenario and X-Ray KUB showing staghorn appearance points to a diagnosis of struvite stones. Struvite stone is produced in alkaline urine.

It is commonly associated with infections with urea-splitting organisms like Proteus and Klebsiella species. Increased metabolism of urea results in alkalinity of the urine.

Struvite is a triple-phosphate calculus (calcium, ammonium, and magnesium phosphate). The calculus may enlarge to fill most of the collecting system, forming a staghorn calculus.

These stones are dirty-white in color, and grossly smooth in texture. Rectangular or coffin lid appearance is seen on microscopic examination.

Solution to Question 13:

Acetohydroxamic acid is used for the treatment of struvite stone.

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It is a urease inhibitor. The urease enzyme generates ammonia from urea, elevating the pH of the urine. This favors the production of struvite stones. Thus, the use of AHA(Acetohydroxamic acid) causes complete, noncompetitive inhibition of urease production, thereby slowing struvite stone growth. Owing to its side-effects, the use of this drug has been restricted in cases of recurrent UTIs, and those intolerant or who refuse surgical management.

It can also be used for oral chemolysis and can potentiate the action of antibiotics.

Solution to Question 14:

In the given scenario since the stone is radiolucent, it is most likely to be uric acid stone.

Uric acid stones are preferentially formed in acidic urine. It is commonly associated with disorders of purine metabolism such as gout, and tumor lysis syndrome. On microscopic examination, the crystals appear as glass shards.

Patients with recurrent uric acid stones are treated with Allopurinol.

Note: 90% of the renal stones are radio-opaque, while 80% of gall bladder stones are radiolucent.

Solution to Question 15:

The urine microscopy shows the presence of hexagonal-shaped stones which are likely to be cystine stones.

These stones are commonly found in acidic urine. Recurrent stones are treated using D-penicillamine.

Solution to Question 16:

A low calcium diet has not shown any significant benefit in the prevention of calcium stone formation, compared to a normocalcemic diet.

However, a diet rich in calcium rather binds with dietary oxalate and reduces dietary absorption of oxalate. This effect leads to a lower risk of calcium oxalate stone formation in the kidneys.

Option B: Uric acid crystallization and stone formation take place in acidic pH. Therefore, urinary alkalinization by potassium citrate reduces the risk of urate stone formation.

Option C: Cystine stones are usually formed in presence of cystinuria. Initial treatment options to prevent recurrent cystine stone formation includes increased fluid intake and urinary alkalinization (e.g citrate). If this therapy fails, d-penicillamine can be used.

Option D: Pyridoxine acts as a cofactor in the oxalic acid metabolism process and helps in the reduction of endogenous oxalate levels. Several studies have mentioned the role of pyridoxine in the reduction of oxalate stone formation.

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Solution to Question 17:

Indinavir (a protease-inhibitor) is most likely to be responsible for renal stones in a patient on HAART. It has the highest incidence of nephrolithiasis among anti-retroviral drugs.

Indinavir is released in high concentration in the urine due to poor solubility in the physiologic pH. Consequently, patients develop stones that are principally composed of indinavir or of a mixture of indinavir and other substances, such as calcium oxalate.

Other urolithogenic drugs are:

• Antihypertensives - furosemide, bumetanide (loop diuretics), triamterene (potassium-sparing diuretic)

• Decongestant - ephedrine

• Expectorant - guaifenesin

• Carbonic anhydrase inhibitors - acetazolamide, topiramate, and zonisamide

• Newer antiretroviral agents - lopinavir-ritonavir, ritonavir-boosted atazanavir, nelfinavir, and amprenavir

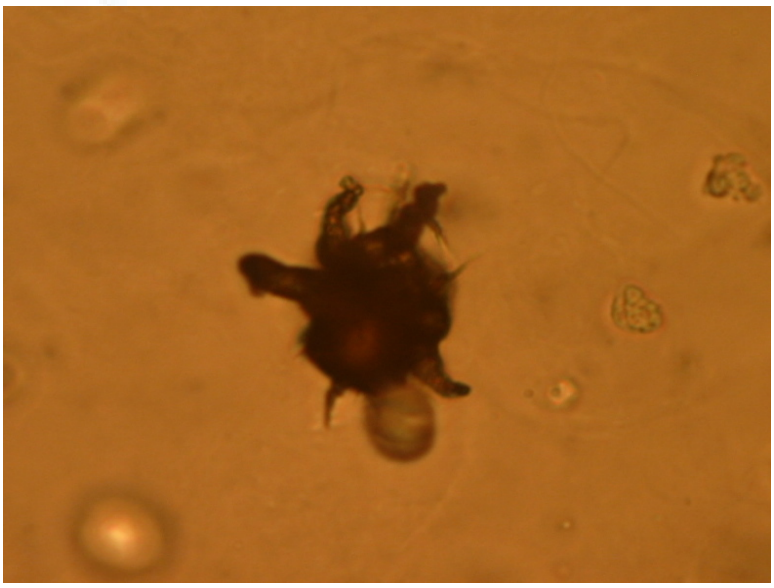
Solution to Question 18:

Ammonium urate stones are most likely to be seen in patients with laxative abuse.

Loss of potassium and sodium in laxative abuse causes intracellular acidosis, which increases the production of ammonia in urine. Dehydration and sodium loss further exacerbate hypokalemia and reduces the urinary volume, resulting in hyperuricemia. Highly concentrated uric acid and ammonia promote the formation of ammonium urate stones.

These are also associated with inflammatory bowel disease, chronic diarrhea, ileostomy, recurrent urinary tract infection and recurrent uric acid stone formation.

The below image shows an ammonium urate stone.



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Solution to Question 19:

Patients with renal calculi ≤ 0.5 cm in size can be treated expectantly, as they are likely to pass spontaneously.

Medical management of renal stones involves:

• Pain control with NSAIDs or opioid analgesics

• Medical expulsive therapy with tamsulosin (α blocker) and Nifedipine (calcium channel blockers)

• Monitoring for the symptoms of urinary tract infection and decreased renal function

Solution to Question 20:

Cystine stones are very hard stones, hence it is difficult to disintegrate it with extracorporeal shockwave lithotripsy (ESWL).

ESWL is a non-invasive method that generates shockwaves outside the body, which are focused on the stones. Stones up to approximately 1.5 cm in size are suitable for this form of treatment.

Stones that are difficult to disintegrate by ESWL:

• Cystine

• Brushite

• Calcium oxalate monohydrate

Stones that are relatively easy to disintegrate by ESWL:

• Calcium oxalate dihydrate

• Phosphate

Solution to Question 21:

Saccular aneurysm or berry aneurysm is not a contraindication for extracorporeal shockwave lithotripsy (ESWL).

Contraindications to ESWL:

• Pregnancy

• Uncorrected coagulopathy or bleeding diathesis

• Untreated urinary tract infection

• Arterial aneurysm near stones (renal or abdominal aortic aneurysms)

• Obstruction of urinary tract distal to the stones

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• Skeletal malformations resulting in an inability to target stones

Complications of ESWL include:

• Pain

• Hematuria

• Steinstrasse - means a street of stones. It occurs due to the collection of stone fragments in the ureter

• Urinary tract infections

Solution to Question 22:

The treatment of choice for renal calculi of size >2cm is percutaneous nephrolithotomy (PCNL).

In PCNL, endoscopic instruments are passed into the kidney using a percutaneous technique, and stones are removed. PCNL is also indicated in:

• Staghorn calculi

• Multiple stones

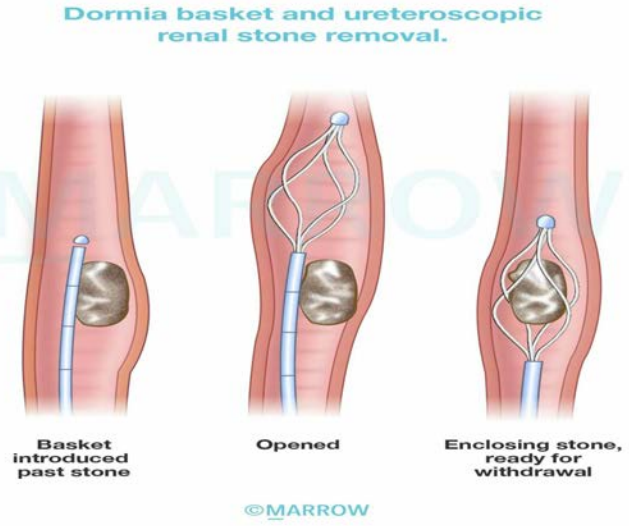
• Proximal ureteral stones >1 cm

Complications of percutaneous nephrolithotomy include hemorrhage, perforation of the collecting system, and of the colon or pleural cavity.

Another approach for the management of renal stones is ureteroscopic removal(URS) or retrograde intra-renal surgery (RIRS). In URS, stones are removed via a retrograde approach using a dormia basket, or a Holmium YAG laser is used to break the stones.

If PCNL or URS fails, open or laparoscopic pyelolithotomy or nephrolithotomy is done.

The image below summarizes how the Dormia basket works with ureteroscopy.



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Solution to Question 23:

Ureteroscopic removal is the preferred treatment in non-impacted ureteric stones >5-6mm in size.

Solution to Question 24:

The given scenario is suggestive of a patient in sepsis secondary to an obstructed renal calculi. Nephrostomy is the preferred management in these patients.

Treatment in patients with sepsis secondary to an obstructing urinary tract calculi includes:

• Insertion of a percutaneous nephrostomy

• Insertion of a ureteric stent via cystoscopy

Nephrostomy is preferred in extremely unwell patients as it is less manipulative and has a lower risk of septicemia.

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Infections and Tumors of Kidney

Question 1:

Which of the following statements is false regarding acute pyelonephritis?

a) CECT abdomen is the investigation of choice

b) Commonly associated with uric acid stones

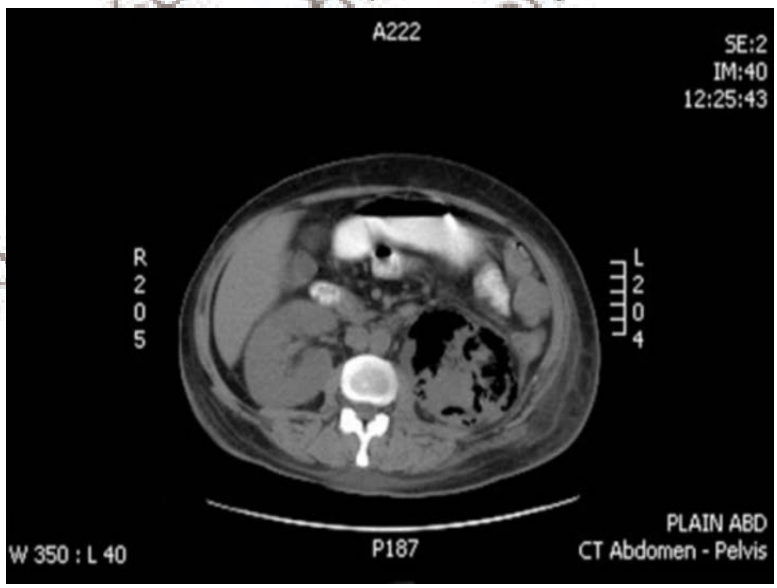
c) Renal scarring is common in untreated cases

d) The mainstay of treatment is broad-spectrum antibiotics

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Question 2:

A diabetic patient presents with pyrexia and left flank pain. On examination, Murphy's punch sign is positive. CECT abdomen done is shown below. What is the most likely causative organism for this condition?



a) E.coli

b) Proteus

c) Clostridium

d) Staphylococcus aureus

Question 3:

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A woman is referred to you for evaluation of recurrent episodes of right flank pain and high-grade fever. She also had a history of recurrent urinary calculi in the past. CECT abdomen done is shown below. What is the preferred treatment for this patient?



a) DJ stenting

b) Subcapsular nephrectomy

c) Drainage

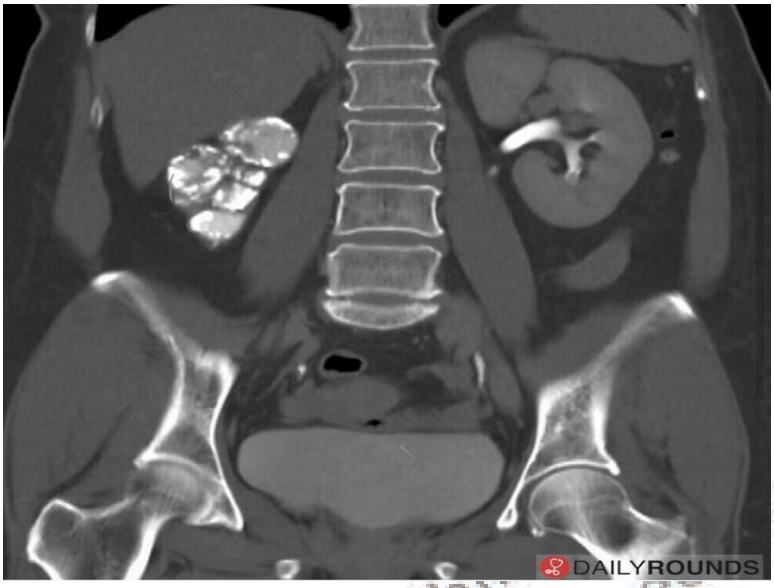
d) Broad spectrum antibiotics

Question 4:

CT done for a patient with abdominal pain and sterile pyuria is shown below. What is the most likely diagnosis?

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a) Renal stones

b) Renal cell carcinoma

c) Renal tuberculosis

d) Nephrocalcinosis

Question 5:

A man presented to the OPD with hematuria and intermittent right flank pain. He received ATT for pulmonary TB two years ago. Urine analysis revealed pus cells, and no growth was seen on culture. Which of the following lesions are associated with this condition?

a) Only 1

b) 1 & 4

c) 2, 3 & 4

d) 1, 2, 3, 4 &5

Question 6:

The Bosniak classification system is used in assessing patients with which of the following conditions?

a) Renal cysts

b) Ureteropelvic junction obstruction

c) Renal carcinoma

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d) Renal stones

Question 7:

An ultrasound abdomen done for evaluation of flank pain in a man revealed a large mass arising from the right kidney. CECT abdomen done showed the presence of a central stellate scar. What is the most likely diagnosis in this patient?

a) Wilms tumor

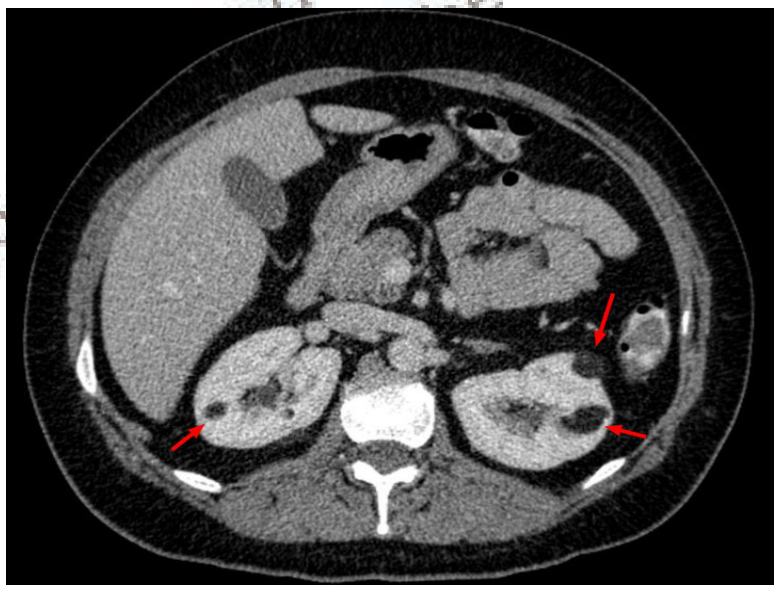
b) Oncocytoma

c) Angiomyolipoma

d) Renal sarcoma

Question 8:

A patient presented to the casualty with severe back pain and vomiting. He was diagnosed to have tuberous sclerosis during childhood. CT scan revealed the presence of renal tumors with high-fat content as shown in the image below. What is the most probable diagnosis?



a) Adrenal myolipoma

b) Renal cell carcinoma

c) Angiomyolipoma

d) Retroperitoneal liposarcoma

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Question 9:

Which of the following is false regarding Grawitz tumor?

a) Most common renal neoplasm

b) Derived from the proximal tubular epithelium

c) Clear cell is the most common histological type

d) Radiosensitive tumor

Question 10:

Which of the following is not true regarding the presentation of renal cell carcinoma?

a) Flank pain is the most common presentation

b) It is more commonly associated with left sided varicoceles

c) It may be associated with pulsatile bony metastasis

d) Palpable abdominal mass is part of the classic triad seen in RCC

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Question 11:

A man presents with intermittent hematuria and flank pain for 2 months. He is a known smoker and is found to be anemic. Further investigations reveal an enhancing lesion arising from the right kidney. Which of the following paraneoplastic syndromes is not likely to be seen in his condition?

a) Cushing's syndrome

b) Polycythemia

c) Cerebellar degeneration

d) Hypercalcemia

Question 12:

Lab values from a routine workup done for a hypertensive man are given below. Further investigations revealed hepatosplenomegaly with a 5.5 cm tumor arising from the right kidney. No signs of metastasis were noted. What is the most likely diagnosis in this patient?

a) Hepato renal syndrome

b) Stauffer syndrome

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c) Budd chiari syndrome

d) Metastatic liver dysfunction syndrome

Question 13:

Which of the following types of renal cell carcinoma is characterized by multiple losses of entire chromosomes?

a) Papillary

b) Clear cell

c) Chromophobe

d) Collecting duct

Question 14:

A man was referred for the evaluation of an unsteady gait with weakness of his legs for the past 1 month. He gave a history of similar problems in his brother. Imaging revealed cerebellar hemangioblastomas and bilateral renal masses suggestive of RCC. Which histological type of this renal malignancy is he most likely to have?

a) Papillary

b) Clear cell

c) Chromophobe

d) Collecting duct

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Question 15:

Which of the following is the most common method of diagnostic investigation in patients suspected to have hypernephroma?

a) CT scan abdomen and pelvis

b) USG abdomen and pelvis

c) MRI abdomen and pelvis

d) Intravenous pyelogram

Question 16:

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A CECT abdomen done to evaluate an elderly man with intermittent flank pain is shown below. Which of the following will be the most common site for secondary metastasis in patients with this tumor?



a) Adrenal glands

b) Lungs

c) Liver

d) Brain

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else,
d.

Question 17:

In patients with which of the following findings on CECT abdomen, would you stage the tumor as T3 stage of RCC?

a) 8.5 cm tumor limited to the kidney

b) 5 cm tumor limited to the kidney

c) 12 cm tumor involving the supra-diaphragmatic IVC

d) 11.5 cm tumor extending into the ipsilateral adrenal gland

Question 18:

Which of the following should be the treatment of choice for renal cell carcinoma with tumor less than 4 cm in size?

a) Partial nephrectomy

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b) Partial nephrectomy + neoadjuvant chemotherapy

c) Radical nephrectomy

d) Radical nephrectomy + postoperative radiotherapy

Question 19:

You are assisting in a radical nephrectomy in a patient with renal cell carcinoma. Which of the following statements is false regarding this procedure?

a) Early ligation of vessels is performed to reduce tumor spread

b) It includes removal of the kidney with Gerota's fascia

c) Excision of ipsilateral adrenal gland is done in all the cases

d) Regional lymphadenectomy is done for tumors more than 10 cm in size

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Question 20:

Which is the most common abdominal tumor seen in children?

a) Wilm's tumor

b) Neuroblastoma

c) Lymphoma

d) Hepatoblastoma

Question 21:

A boy was brought by his parents, with complaints of blood in his urine. A left-sided reniform mass was palpated. Further investigations were suggestive of Wilms tumor. Which of the following is false regarding this condition?

a) Most cases occur in children between 2-5 years of age

b) It is the most common primary malignant renal tumor of childhood

c) Early metastasis occurs to the liver

d) Nephrogenic rest cells are precursor lesions

Question 22:

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A mother notices a swelling in the abdomen of her 3-year-old child while bathing him. He had a history of hematuria two weeks back which resolved spontaneously. On examination, a right-sided reniform ballotable mass was found. What all investigations will you do?

a) 1 and 2

b) 2 and 4

c) 1, 2 and 3

d) 1, 2, 3 and 4

Question 23:

Which of the following is the most important factor in determining the prognosis of a child with Wilms tumor?

a) Size of the abdominal mass

b) Loss of heterozygosity of chromosome 1p

c) Histology of the tumour

d) Age less than 1 year at presentation

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Question 24:

Which of the following staging systems is used for staging of Wilms tumor in a child posted for partial nephrectomy post neoadjuvant chemotherapy?

a) Children's oncology group staging

b) International society of paediatric oncology staging

c) American joint committee on cancer staging

d) Shimada staging

Question 25:

A child with a left-sided renal mass is suspected to have Wilms tumor. CECT also revealed a small mass on the right kidney. A frozen section done intraoperatively confirmed the presence of bilateral Wilms tumor. What is the stage of the tumor in this child?

a) Stage II

b) Stage III

c) Stage IV

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d) Stage V

Answer Key

Question No.	Correct Option
1	b
2	a
3	b
4	c
5	d
6	a
7	b
8	c
9	d
10	a
11	c
12	b
13	c
14	b
15	a
16	b
17	c
18	a
19	c
20	b
21	c
22	c
23	c
24	b
25	d

Detailed Explanations

Solution to Question 1:

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The given clinical scenario is suggestive of acute pyelonephritis. Patients with acute pyelonephritis are more likely to have struvite stones, not uric acid stones. This is because of infection with urea-splitting organisms such as proteus that release ammonia. This makes the urine alkaline and promotes the formation of struvite stones.

Acute pyelonephritis is a bacterial infection causing inflammation of the kidneys. Ascending infection in the urinary tract is the most common route. It is more common in young, sexually active women. Up to 50% of children with urinary infections have an underlying anatomical abnormality (e.g., reflux or obstruction).

Clinical features include:

• Prodromal symptoms such as headache, lassitude, vomiting

• Flank pain, fever, rigor

• Pyuria and occasionally hematuria

CECT abdomen is the investigation of choice to rule out pyonephrosis.

The mainstay of treatment is broad-spectrum antibiotics to prevent renal scarring. Surgery is indicated only if antibiotic therapy fails.

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Solution to Question 2:

The given history with Murphy's punch sign positive, and streaks of gas on CECT abdomen point to a diagnosis of emphysematous pyelonephritis. Escherichia coli is the most common causative organism.

Emphysematous pyelonephritis is associated with an acute necrotizing infection of the kidney by gas-producing organisms that occurs predominantly in diabetic patients. E. coli produces carbon dioxide by the fermentation of sugar.

Patients frequently present with sepsis and ketoacidosis. It can be associated with tenderness at the costovertebral angle known as Murphy's punch sign.

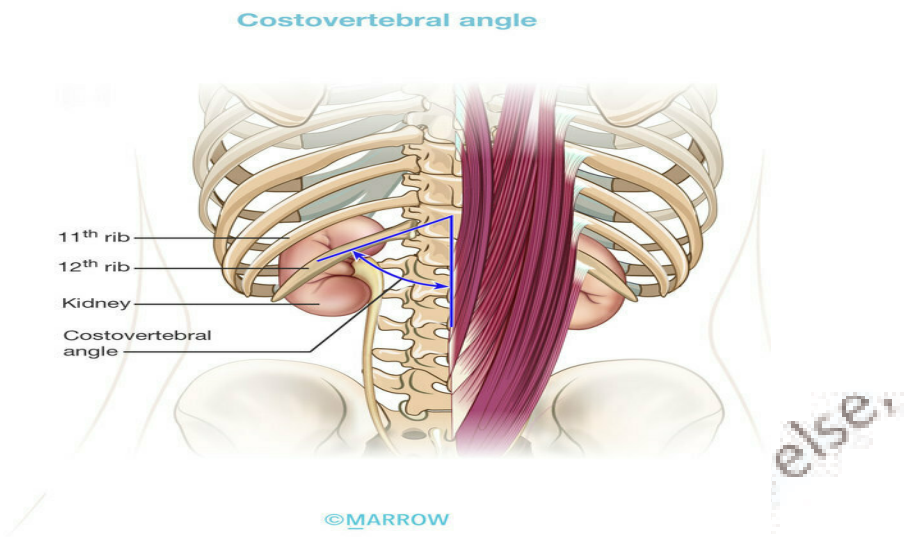
CECT abdomen shows an enlarged destructed renal parenchyma with small linear streaks of gas.

Treatment includes broad-spectrum antibiotics with drainage. In patients who fail to respond to treatment, nephrectomy is considered.

Note: Clostridium species are the most common causative organisms in emphysematous cholecystitis.

Murphy's punch sign is also seen in infection, inflammation, or obstruction of the kidney. The below image shows the costovertebral angle formed between the lower border of the 12th rib and the vertebral column.

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Solution to Question 3:

The given scenario with CECT abdomen showing bear paw sign is suggestive of xanthogranulomatous pyelonephritis (XGP). Subcapsular nephrectomy is the preferred treatment in patients with XGP.

It is a form of chronic pyelonephritis seen most frequently in middle-aged diabetic women and, rarely, in children. XGP is most commonly caused by proteus followed by E. coli. The disease is usually unilateral and is associated with prolonged obstructing nephrolithiasis.

CECT abdomen shows dilated and enlarged renal pelvis and calyxes showing a multiloculated appearance. This is referred to as the bear paw sign. Histology shows foamy, lipid-laden macrophages.

Solution to Question 4:

The given scenario of sterile pyuria with CT showing right-sided putty kidney points to renal tuberculosis.

Putty kidney refers to the amorphous dystrophic calcification seen over the entire kidney during the end stage of genitourinary TB.

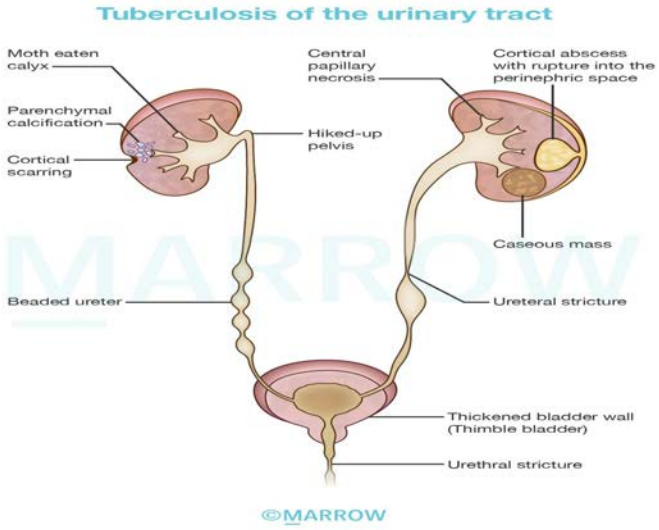
Genitourinary tuberculosis is caused by the dissemination of the organism through the bloodstream. It occurs either due to reinfection or reactivation of old TB.

CT is the most sensitive modality and is the preferred means of visualizing renal calcifications. CT urography is done to assess the various stages of renal TB.

ATT is given to all patients with genitourinary TB. Nephrectomy is the preferred treatment in patients with putty/ cement kidneys.

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Option D: Nephrocalcinosis refers to the deposition of calcium salts in the kidney parenchyma and tubules.



Solution to Question 5:

The given history of pulmonary TB and presence of sterile pyuria on urine culture is suggestive of a diagnosis of renal tuberculosis. All of the above lesions can be seen in renal TB.

Lesions in the kidney include:

• Papillary ulcer - earliest lesion

• Pyonephrosis/ Putty kidney - caused by multiple scattered papillary ulcers undergoing caseous necrosis, which later become filled with pus

• Cement kidney - caused by calcifications in putty kidney

• Perinephric abscess - by extension of pyonephrosis or tuberculous renal abscess

• Pseudocalculi - occurs when calcium gets deposited in a papillary ulcer healed with fibrosis

• Ghost calyces - caused by the destruction of the calyces

• Thimble bladder - caused by fibrosis. The earliest sign is the paleness of bladder mucosa. managed by ileocystoplasty

• Golf hole ureteric orifice - Dilated ureteric orifice. Managed by ureter reimplantation.

Solution to Question 6:

The Bosniak classification system is used for assessing patients with renal cysts.

It divides renal cystic masses into five classes based on imaging characteristics seen on CECT. It is helpful in predicting the risks of malignancy and identifying the appropriate choice of clinical

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follow-up or treatment.

Renal cyst class	Risk of malignancy	Workup
1	0%	Nil
2	0%	Nil
2F	5%	USG/ CT follow up
3	50%	Partial nephrectomyRadiofrequency ablation - in elderly or poor surgical candidates
4	100%	Partial or total nephrectomy



Solution to Question 7:

In the given scenario, the presence of a central stellate scar on CECT is suggestive of a diagnosis of oncocytoma.

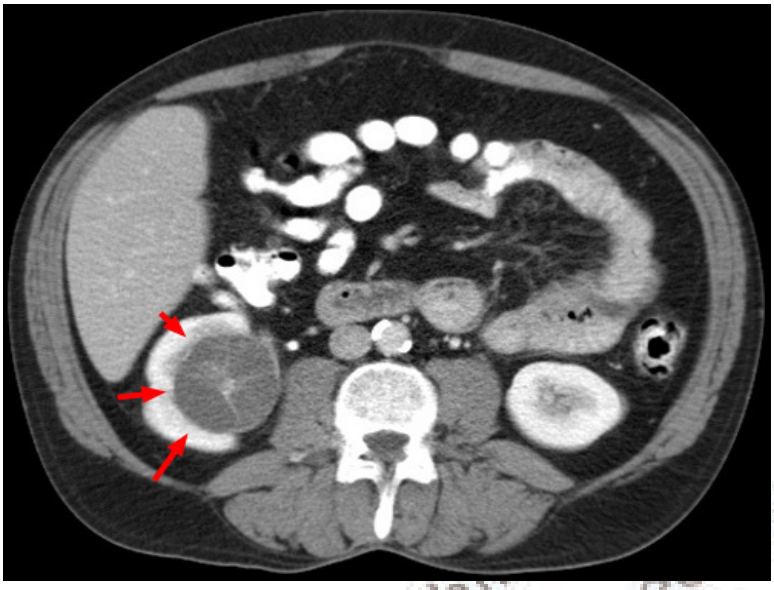
Oncocytoma is the most common benign renal tumor. It arises from cells rich in mitochondria. Familial type is associated with Birt Hogg Dube syndrome. Most patients remain asymptomatic even with large oncocytomas. In some cases, it may present as an abdominal lump.

The cystic variant of the tumor is classified as Bosniak class III on CECT. On histological examination, large eosinophilic cells owing to an abundance of mitochondria are seen arranged in distinct nests. Partial nephrectomy is the preferred treatment.

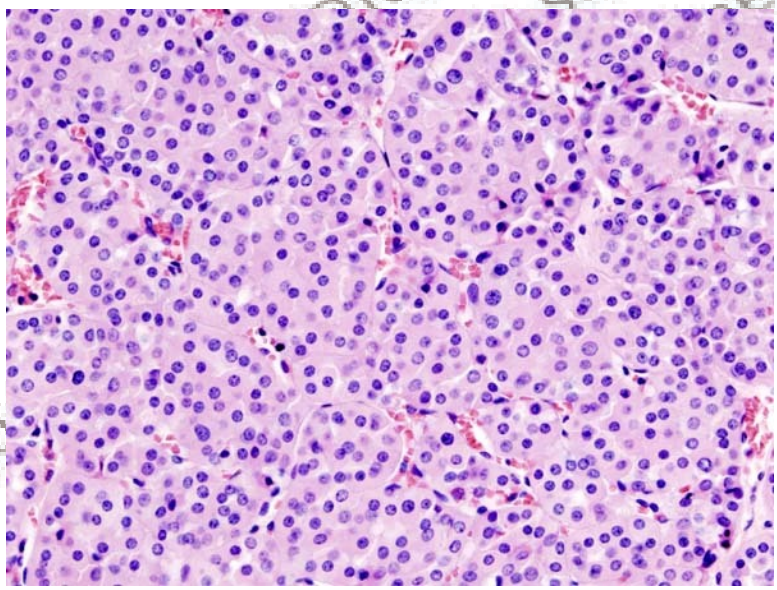
Note: Central stellate scar on CECT is also seen in chromophobe RCC and focal nodular hyperplasia of the liver.

The given CECT shows an enhancing right renal mass with a central stellate scar

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The given slide shows large eosinophilic cells arranged in nests



Solution to Question 8:

The given scenario and CT findings are suggestive of a diagnosis of angiomyolipoma.

Angiomyolipoma (AML) is a benign neoplasm of the kidney. It contains blood vessels, smooth muscles, and fat, and arises from perivascular epithelioid cells. It can occur in isolated forms or may be associated with tuberous sclerosis.

Patients can either be asymptomatic or may present with abdominal pain or a lump. Some patients may also present with massive hemorrhage referred to as Wunderlich's syndrome. Lenk's triad seen in patients with Wunderlich's syndrome includes:

• Abdominal mass

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• Abdominal pain

• Shock

Due to the presence of abundant fat tissue, they can be easily identified on CT scans. Immunohistochemistry is positive for HMB 45. Treatment includes:

• Asymptomatic tumors and tumors less than 4 cm in size - Observation with serial CECT

• Symptomatic tumors and tumors more than 4 cm in size - Partial nephrectomy/ nephron-sparing surgery

• Bleeding tumors - Angioembolization followed by partial nephrectomy

Everolimus is FDA approved for the treatment of AMLs.

Note: HMB45 is positive on IHC for malignant melanoma and angiomyolipomas.

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Solution to Question 9:

Renal cell carcinoma (RCC) also known as Grawitz tumor or hypernephroma, is a radio-resistant tumor.

RCC accounts for 85% of renal neoplasms in adults. It is more common in males between the sixth to seventh decades. Clear-cell RCC is the most common type of renal cell cancer.

The proximal convoluted tubule (PCT) of the nephron is usually the site of origin of RCC.

Risk factors for RCC:

• Smoking

• Obesity

• Family history of RCC

• Drugs like phenacetin and diuretics

• Thorotrast exposure

• Increased protein intake

Solution to Question 10:

The most common presentation in patients with renal cell carcinoma (RCC) is gross hematuria.

The classic triad (seen in <10% of cases) includes :

• Gross hematuria

• Flank pain

• Palpable abdominal mass

Rapidly developing varicoceles can be seen in patients with RCC. Varicocele is usually seen on the left side, as the left gonadal vein drains into the left renal vein at a sharp angle. On the right side, the gonadal vein opens into the much larger IVC.

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Patients may also present with paraneoplastic syndromes. RCC can give rise to pulsatile bony metastases.

Solution to Question 11:

Hematuria and flank pain in a known smoker with the given investigation findings is suggestive of renal cell carcinoma. Cerebellar degeneration is not a paraneoplastic syndrome associated with RCC.

Paraneoplastic syndromes associated with RCC include:

Endocrine paraneoplastic syndromes -

• Stauffer syndrome - non-metastatic liver dysfunction, characterized by elevated serum bilirubin, ALP, and prolonged prothrombin time

• Hypercalcemia - due to increased vitamin D, PTH-related protein

• Hypertension

• Polycythemia

• Galactorrhea

• Cushing's syndrome

• Alterations in glucose metabolism

Non-endocrine paraneoplastic syndromes include Lambert Eaton syndrome (neuromyopathy), amyloidosis, anemia, vasculopathy, nephropathy, coagulopathy, elevated ESR, prostaglandin elevation.

Elevated ESR is the most common paraneoplastic syndrome associated with RCC.

Note: Cerebellar degeneration is a paraneoplastic syndrome in Hodgkin's lymphoma.

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Solution to Question 12:

The given scenario points to a diagnosis of Stauffer syndrome in a patient with renal cell carcinoma.

Stauffer syndrome is a rare paraneoplastic syndrome seen in RCC. It is a non-metastatic liver dysfunction mediated via interleukin 6. It is characterized by the presence of hepatosplenomegaly with no features of metastasis and the following lab findings:

• Hyperbilirubinemia

• Raised ALP

• Hypoalbuminemia

• Hypergammaglobulinemia

• Prolonged prothrombin time

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Option A: Hepatorenal syndrome refers to the development of renal failure in patients with advanced chronic liver disease.

Option C: Budd Chiari syndrome is characterized by hepatic venous outflow tract obstruction (HVOTO).

Solution to Question 13:

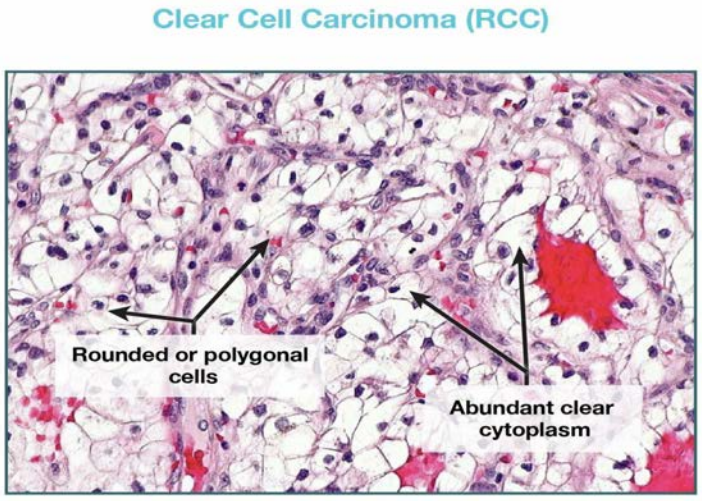
Chromophobe type renal cell carcinomas (RCC) are uniquely associated with multiple losses of entire chromosomes, including chromosomes 1, 2, 6, 10, 13, 17, and 21. Thus, they show extreme hypodiploidy.

Solution to Question 14:

The clinical features mentioned are consistent with renal cell carcinoma and cerebellar hemangioblastoma which along with the family history points to a diagnosis of von Hippel Lindau's disease (VHL). Clear cell RCC is the most common type associated with VHL disease.

VHL disease is inherited as an autosomal dominant trait and is caused by a germline mutation of the VHL gene on chromosome 3p. A second hit can increase the predisposition to a variety of neoplasms, particularly hemangioblastomas of the cerebellum and retina, and clear cell renal carcinoma(in 40-60%).

The given slide shows clear cell RCC.



Solution to Question 15:

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The most common method of diagnostic investigation in hypernephroma or renal cell carcinoma is a CT scan of the abdomen and pelvis. Characteristic features of RCC on CT scan include:

• Enhancement of the lesion after injection of IV contrast

• Thickened irregular walls

• Thickened or enhanced septa within the mass or multilocular mass

CT scan has replaced IVP and ultrasound as the radiological modality of choice to evaluate renal masses.

MRI can be performed for diagnosing poorly characterized renal masses on CT or if a CT scan is contraindicated (in case of allergy to IV contrast). It also helps in defining tumor extension into the renal vein or IVC.

The below image shows a cystic tumor involving the left kidney suggestive of renal cell carcinoma.



Solution to Question 16:

The history and CECT mentioned in the above scenario are consistent with a diagnosis of renal cell carcinoma. The most common site for secondary metastasis in RCC is the lungs, where they form secondaries commonly known as cannonball secondaries.

The tumor is prone to extend into the renal vein and reach the lungs via circulation. RCC also metastasizes to the bone, lymph nodes, liver, adrenal glands, and brain.

Para-aortic nodes are the first draining lymph nodes.

The image below shows multiple round opacities in bilateral lungs suggestive of cannonball metastasis in the lungs.

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Solution to Question 17:

In the T3c stage of hypernephroma or renal cell carcinoma, the tumor spreads to the supra-diaphragmatic IVC or invades the wall of the IVC.

TNM staging for renal cell carcinoma

Note: Robson staging is a less commonly used staging system for RCC. Fuhrmann grading is used for grading RCC.

T: Primary tumor
T1: Limited to the kidney,<7 cm
T2: Limited to the kidney,>7 cm
T3: Tumorextension into maj or veins or perinephric tissue s, but not into ipsilateral adr enal gland or beyond Gerota' s fasciaT3a: Tumor grossly ex tends into the renal vein or it s segmental (muscle-containi ng) branches, or tumor invad es perirenal and/or renal sinu s fat but not beyond the Gero ta's fasciaT3b: Spread to infr a-diaphragmatic IVCT3c: Spr ead to supra-diaphragmatic I VC or invades the wall of the IVC

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T: Primary tumor
T4: Involvesipsilateral adren al glandor invadesbeyond Ge rota's fascia

N: Regional lymph nodes
N0: No nodal involvement
N1: Metastatic involvement o f regional lymph node(s)

M: Metastasis
M0: No distant metastas es
M1: Distant metastases

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Solution to Question 18:

Partial nephrectomy (also known as nephron-sparing surgery) is the treatment of choice for tumors <4 cm.

Indications for partial nephrectomy:

• Tumors < 4cm

• Well-selected tumors between 4-7 cm

• Bilateral tumors

• Tumor in solitary kidneys

• Patients with pre-existing renal dysfunction.

Recently, partial nephrectomy is also increasingly being performed for stage T1b tumors.

Treatment of renal cell carcinoma:

RCC is a radio and chemoresistant tumor.

Radical nephrectomy consists of the removal of the kidney, perirenal fat, adrenal gland, and regional lymph nodes. The adrenal gland is no longer removed except in cases of obvious tumor involvement. Lymphadenectomy is indicated only in high-risk patients with large primary tumors and enlarged lymph nodes.

Cryoablation is indicated in the T1a stage of RCC if surgery cannot be performed. It is also indicated in advanced/metastatic tumors.

Note: Sunitinib and sorafenib are also used in GIST and hepatocellular carcinoma.

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Staging	Description	Management
Stage 1	Tumor <7 cm, confined to the kidney	Partial nephrectomy
Stage 2	Tumor >7 cm, confined to the kidney	Radical nephrectomy
Stage 3	Tumor extends into the major veins or adrenal gland with intact Gerota's fascia or regional lymph nodes involved.	Radical nephrectomy
Stage 4	Tumor invades beyond Gerota fascia (including contiguous extension into the ipsilateral adrenal gland)	Debulking surgerymTOR inhibitors such as everolimus, sirolimusTyrosine kinase inhibitors: sunitinib, sorafenib

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Solution to Question 19:

Excision of the ipsilateral adrenal gland in radical nephrectomy is done only if the tumor is adherent to it.

Classical radical nephrectomy includes:

• Early ligation of the renal artery and vein to prevent tumor spread

• Removal of the kidney with primary dissection external to the Gerota's fascia

• A complete regional lymphadenectomy from the crus of the diaphragm to the aortic bifurcation

Regional lymphadenectomy is not required in every radical nephrectomy. It is indicated in the following conditions:

• Enlarged lymph nodes on imaging

• Cytoreductive surgery for metastatic disease

• Tumor size > 10 cm

• Nuclear grade ° 3

• Sarcomatoid histology in renal tumor

• Presence of tumor necrosis on imaging

• Extrarenal tumor extension

• Tumor thrombus

• Direct tumoral invasion of adjacent organs

Solution to Question 20:

Neuroblastoma is the most common abdominal tumor of childhood.

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Wilms tumor, or nephroblastoma, is the most common primary malignant renal tumor of childhood.

The renal origin of the mass is usually apparent on CT, but it can be mistaken for neuroblastoma. Wilm's tumor shows peripheral calcification in contrast-enhanced CT, unlike intratumoral calcifications and vascular encasement, which are observed in neuroblastoma.

Features	Wilms tumor (Nephroblastoma)	Neuroblastoma
Age group	Peaks at 3-4 years of age	Age <2 years of age
Presentation	Painless abdominal mass	Painful abdominal mass
Associated syndromes	WAGR syndromeBeckwith Weidman syndromeDenys Drash syndrome	Opsoclonus-myoclonus syndrome
Calcifications	Uncommon (10-15%)	Very common (90%)
Margins	Well circumscribed	Poorly marginated
Vascular invasion	Extends into the IVC and renal vein	Encases vascular structures but does not invade them
Metastasis	Lung (most common)	Bone (most common)
Findings on CECT	Peripheral calcifications	Intratumoral calcifications with vascular encasement

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Solution to Question 21:

Metastasis to the lungs occurs early in Wilms tumor. Liver, bone, and brain metastasis is rare.

Wilms tumor or nephroblastoma is the most common primary malignant renal tumor of childhood. It is commonly seen in children between 2-5 years of age. More than one-third of the cases contain precursor lesions known as nephrogenic rests.

Asymptomatic abdominal mass discovered incidentally is the most common presentation. Patients may also present with:

• Abdominal pain

• Gross painless hematuria

• Fever

• Hypertension

Most unilateral tumors are treated by chemotherapy (cyclophosphamide, vincristine, and dactinomycin) followed by nephrectomy.

Radical nephrectomy is the standard surgical procedure done. Partial nephrectomy is considered if all the following conditions are met:

• The tumor involves only one pole of the kidney

• No evidence of collecting system or vascular involvement

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• The involved kidney has an appreciable function

• There are clear margins between tumor and surrounding structures

It is done for children with bilateral disease or with a solitary kidney. Preoperative chemotherapy can be used in these cases to induce tumor shrinkage.

Solution to Question 22:

The clinical features of a ballotable renal mass with hematuria in a 3-year-old child are suggestive of Wilms tumor and FNAC is not done in this condition.

Investigations in suspected cases of Wilms tumor:

• Laboratory study - shows hematuria, polycythemia, thrombocytosis, and elevated APTT

• USG with doppler study of renal veins - for evaluation of the collecting system and to look for tumor thrombi in renal veins and inferior vena cava

• CECT abdomen - to identify the extent of the disease, to access the contralateral kidney, and for metastasis

• MRI - not used routinely as it requires sedation

• Positron emission tomography(PET) scan - to identify regional spread and metastatic lesions

Diagnosis should be made by imaging studies and it is confirmed after nephrectomy. A biopsy is discouraged in this condition as it results in disease upstaging. Only in cases with atypical presentation such as older age, signs of infection, etc, or with unusual imaging findings a core needle biopsy via the posterior approach can be performed.

Note: Neuroblastoma also presents similar to Wilms tumor. It is commonly seen in children of preschool age. Affected children commonly present with a palpable abdominal mass and the most common site of the tumor is the retroperitoneum. Therefore, this disease becomes an important differential diagnosis. So we should also test for the presence of vanillyl mandelic acid (VMA) in this patient to exclude this tumor.

Solution to Question 23:

The most important prognostic factor in Wilms tumor is the histology of the tumor.

Wilms tumor (WT) is characterized by abnormal proliferation of the metanephric blastema, with no differentiation into tubules or glomeruli. It usually arises from three tissue elements (triphasic tumor):

• Blastema (poor prognosis if the blastemal component is more)

• Epithelium

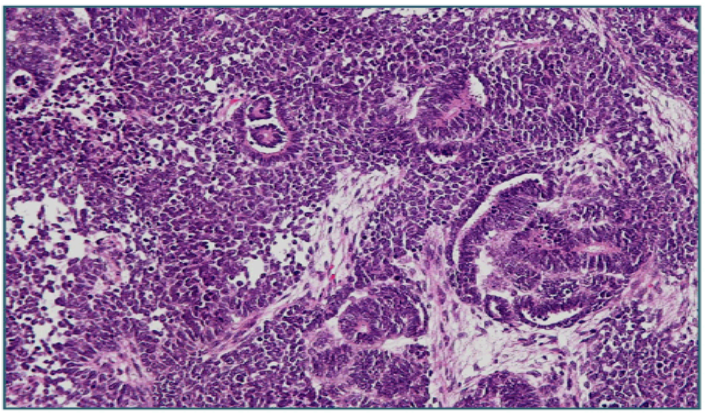
• Stroma

Wilms tumors lacking anaplasia (presence of atypical, polyploid mitotic figures, large nuclear size, and hyperchromasia) are designated as having “favorable histology".

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Wilms Tumor/Triphasic Nephroblastoma



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Solution to Question 24:

International society of pediatric oncology (SIOP) is the post-chemotherapy staging system used for Wilms tumor. The SIOP approach involves the shrinkage of the tumor using preoperative chemotherapy.

Option A: Children's oncology group (COG) staging is used for post-operative staging followed by chemotherapy. It was previously known as national Wilms tumor staging (NWTSG).

Option C: TNM staging (AJCC) is used for staging internal malignancies such as gastric, renal, breast, etc.

Option D: Shimada staging is used for neuroblastoma.

Solution to Question 25:

Wilms tumor with bilateral involvement of kidneys is stage V.

Children's oncology group (COG) staging system

Stage I	Tumor confined to the kidney and completely resected with negative lymph nodes.
Stage II	Tumor extends beyond the kidney but is completely resected with negative margins and lymph nodes.

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Stage I	Tumor confined to the kidney and completely resected with negative lymph nodes.
Stage III	Residual tumor present following surgery confined to the abdomen, including gross or microscopic tumor.
Stage IV	Hematogenous metastases (lung, liver, bone, brain, etc.) or lymph node metastases outside the abdominopelvic region.
Stage V	Metastasis to opposite kidney (bilateralrenal involvement).

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Urinary Bladder and Ureters

Question 1:

The uterine artery crosses the ureter _____

a) Laterally

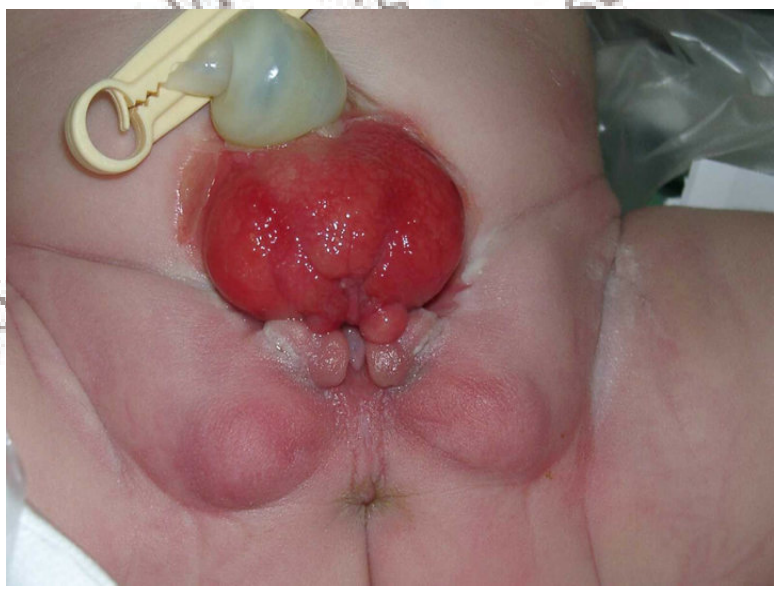
b) Medially

c) Anteriorly

d) Posteriorly

Question 2:

A newborn child was noted to have a congenital anomaly as shown in the image below. All of the following statements are true about this condition except:



a) Closure of abdominal wall should be done within the first year

b) Bilateral inguinal hernia is seen in males

c) It is associated with hypospadias

d) It predisposes to bladder cancer

Question 3:

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A young girl presents with continuous dribbling of urine but she voids normally. Her parents tell you that she had never been totally dry since her birth. What is the most likely diagnosis?

a) Ectopic ureter

b) Ureterocele

c) Congenital megaureter

d) Vesicoureteric reflux

Question 4:

During a cricket match, a batsman controls his urge to urinate as he is unable to take a break in-between. While batting, he suffers a sudden blow as the ball hits him in the suprapubic region. He presents to the emergency department with severe hypogastric pain and the inability to pass urine. He collapses suddenly during the examination. What is the most likely diagnosis?

a) Intraperitoneal rupture of the bladder

b) Extraperitoneal rupture of the bladder

c) Membranous urethra rupture

d) Pubic diastasis with bulbar urethra rupture

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Question 5:

A patient was rushed to the casualty after sustaining a suprapubic injury. On examination, no blood is seen at the meatus. On inserting Foley's catheter, gross hematuria is noted. His vitals are stable and his pelvic X-ray is given below. What will be the next step in the management of this patient?

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a) Suprapubic catheterization

b) Urinary diversion

c) Exploratory laparotomy

d) CT cystogram

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Question 6:

An elderly man was rushed to the casualty at midnight with complaints of severe suprapubic pain and inability to pass urine for the past 24 hours. The abdominal examination finding of the patient is given below. A smooth and enlarged prostate was felt in the per-rectal examination. While attempting to insert a 16-F Foley catheter in this patient, you feel resistance and fail to catheterize. What will be the next step in the management?



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a) Insert an 18-Fr Coudé catheter

b) Insert a smaller sized Foley catheter

c) Perform cystoscopy

d) Suprapubic catheterization

Question 7:

You are asked to remove a Foley's catheter after a procedure but you are unable to deflate the balloon. The surgeon himself tries to remove it after cutting the sidearm but is unsuccessful as well. What should be the next step of management?

a) CT-guided rupture of bulb of Foley's

b) Inject ether to dissolve the balloon and pull it out

c) Inject water to over distend the balloon until it bursts and remove the catheter

d) Inflate with 20ml of water and under USG guidance, locate and prick the balloon

Question 8:

In the given picture of a Foley's catheter, what is the function of the tube marked 'A'?



a) Suction

b) Irrigation

c) BCG Instillation

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d) Cystoscope

Question 9:

What is the earliest sign seen on cystoscopy in a patient suspected to have bladder tuberculosis?

a) Tubercles at the ureteric orifice

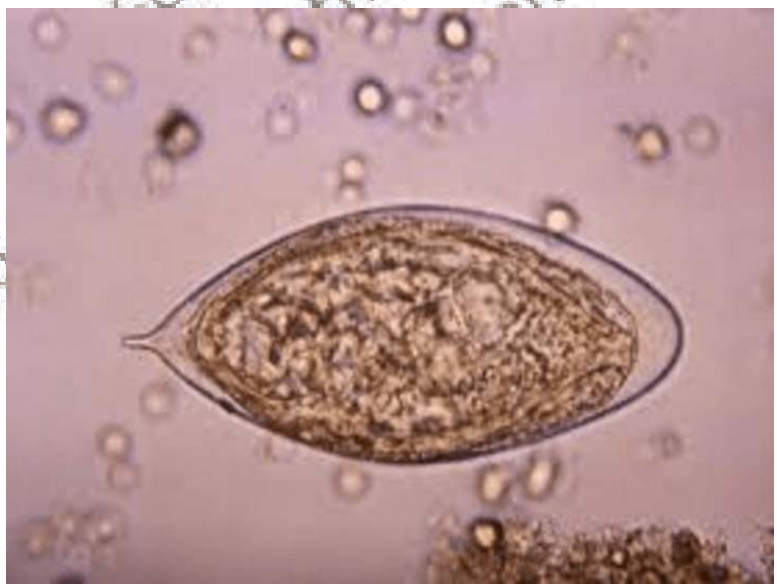
b) Pallor around the ureteric orifices

c) Focal areas of hyperaemia

d) Hunner's patches

Question 10:

A 50-year-old man comes with complaints of hematuria and difficulty in urination for the past few weeks. Microscopic examination of urine samples shows parasitic eggs as shown in the image. Which type of bladder carcinoma is the patient most likely to develop?



a) Transitional cell carcinoma

b) Squamous cell carcinoma

c) Adenocarcinoma

d) Uroepithelial carcinoma

Question 11:

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Which of the following drugs causes carcinoma bladder?

a) Cyclophosphamide

b) Cisplatin

c) Taxane

d) Tamoxifen

Question 12:

Identify the incorrect statement regarding bladder carcinoma.

a) Painless hematuria is the most common symptom

b) Inactivation of the Rb gene is implicated in the cancer formation

c) Urine cytology has low sensitivity

d) The most important prognostic factor is the size of the tumor

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Question 13:

What is the treatment of choice for a patient with non-invasive bladder carcinoma of stage pT1?

a) Intravesical BCG

b) Radical cystectomy

c) Transurethral resection of the bladder tumor

d) Chemotherapy

Question 14:

A patient with carcinoma in situ of the urinary bladder is posted for intravesical therapy. What is the strain of mycobacteria that will be used in this therapy?

a) Mycobacterium bovis

b) Mycobacterium tuberculosis

c) Mycobacterium canettii

d) Mycobacterium indicus pranni

Question 15:

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Which laser is preferred for performing transurethral resection of the bladder tumor?

a) Carbon dioxide laser

b) Nd-YAG laser

c) Ho-YAG laser

d) Argon laser

Question 16:

An elderly man on follow-up for treatment of bladder cancer presents with painless hematuria. Which of the following assays should be done on this patient?

a) CA 19-9

b) Carcinoembryonic antigen

c) Thymidine kinase

d) NMP 22

Question 17:

Urinary diversion is indicated in all the following clinical conditions, except:

a) Ectopia vesicae

b) Carcinoma bladder

c) Neurogenic bladder

d) Bladder hematoma

Question 18:

A patient presents to the emergency department with confusion and drowsiness. He underwent cystectomy with urinary diversion for bladder carcinoma 8 weeks back. ABG analysis and electrolyte values are given below. Which of the following urinary diversion conduits was most likely done in this patient?

a) Stomach

b) Jejunum

c) Ileum

d) Sigmoid colon

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Question 19:

A 35-year-old lady experiences increased frequency of urination and lower abdominal pain which is relieved by micturition. Urinalysis is normal. Cystoscopy reveals fissures and punctate hemorrhages in the bladder mucosa. What is the most likely diagnosis?

a) Interstitial cystitis

b) Malakoplakia

c) Tuberculosis bladder

d) Cystitis cystica

Question 20:

A child with recurrent urinary tract infection undergoes voiding cystourethrogram. It shows reflux of urine into the pelvis and calyces, without dilation of the ureter. What is the grade of vesicoureteric reflux?

a) Grade II

b) Grade I

c) Grade III

d) Grade IV

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Question 21:

Which of the following will be seen in a patient with Marion's disease?

a) Hypertrophy of the internal sphincter of the bladder

b) Hypertrophy of the external sphincter of the bladder

c) Congenital obstruction of the prostatic urethra

d) Posterior urethral valve

Question 22:

Which of the following is true regarding the condition shown below?

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a) Bilateral in more than 50% of the cases

b) Associated with dysplastic renal tissue

c) Children usually present with stones

d) Affects males more often than females

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Question 23:

Which of the following statements regarding bladder stone is false?

a) Primary bladder stone develops in sterile urine

b) Cystine calculus is radiolucent

c) Uric acid stones occur in patients with ileostomies

d) Triple phosphate calculus occurs in urine infected with urea-splitting organisms

Answer Key

Question No.	Correct Option
1	c
2	c
3	a
4	a
5	d

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6	a
7	d
8	b
9	b
10	b
11	a
12	d
13	a
14	a
15	b
16	d
17	d
18	d
19	a
20	a
21	a
22	b
23	b

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Detailed Explanations

Solution to Question 1:

The uterine artery crosses the ureter anteriorly (Water under the bridge). Damage to the ureter is more likely at this site (most dangerous site) during hysterectomy.

Solution to Question 2:

The congenital anomaly seen in the above image is exstrophy of the bladder (ectopia vesicae). It is associated with epispadias, not hypospadias.

Bladder exstrophy refers to herniation of the urinary bladder through an anterior abdominal wall defect. The bladder is open and exposed on the outside of the abdomen. The male to female ratio is 4:1. Chronic exposure of the bladder to the external environment can lead to adenocarcinoma of the bladder.

The clinical features of bladder exstrophy include:

• Separation of the pubic bones with non-united symphysis pubis

• Epispadias

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• In males: Broad and short penis and bilateral inguinal hernia

• In females: Bifid clitoris

Management involves a staged surgical reconstruction of the bladder and genitalia. Closure of the abdominal and bladder wall is done in the first year of life. This often requires an iliac osteotomy to relax the tension on the bladder and repair the abdominal wall during wound-healing.

Later, reconstruction of the bladder neck, sphincters, epispadias, and other genital defects is done.

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Solution to Question 3:

The given clinical scenario with continuous dribbling of urine, in spite of regular voiding, is suggestive of an ectopic ureter.

Ectopic ureter is a congenital anomaly that occurs as a result of abnormal caudal migration of the ureteral bud during its insertion into the urinary bladder. They are usually associated with duplex ureters and drain from the upper pole of the kidney.

It is more common in females. The ectopic ureter usually opens into the urethra, vagina, and perineum. Hence, female patients present with constant urinary dripping all day, even though the child voids regularly (Paradoxical incontinence). It can cause hydroureteronephrosis and recurrent UTI.

In males, the ectopic ureter opens always above the external urethral sphincter. Hence they are usually continent. However, it can cause other complications such as orchitis and epididymitis.

Management involves re-implantation of the ureter into the bladder to treat incontinence and preserve renal functions. If the kidney is severely affected, partial nephrectomy is helpful.

Solution to Question 4:

The given clinical scenario with a history of injury to a full bladder, inability to pass urine, and syncope are suggestive of intraperitoneal rupture of the bladder.

Bladder rupture can be of two types:

Pubic diastasis refers to the separation of the pubic symphysis without concomitant fracture. Pubic diastasis with bulbar urethra rupture usually occurs due to straddle injury and presents with blood at the tip of the meatus.

	Extraperitoneal rupture	Intraperitoneal rupture
	More common(80%)	Less common (20%)
Cause	Penetrating traumaPelvic fracture Surgical damageAssociated withproximal urethral injury	Direct blow or fall on adistended bladder

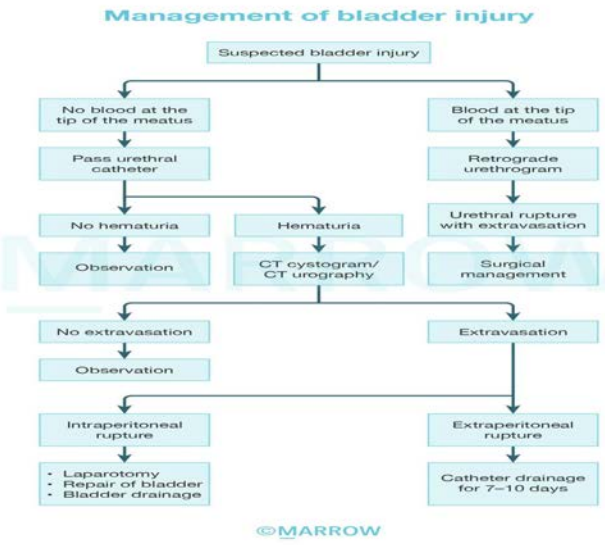
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	Extraperitoneal rupture	Intraperitoneal rupture
Clinical features	Pelvic urinoma(encapsulated collection of extravasated urine) is seenBlood at the tip of the meatus	Sudden severe pain in the hypogastriumSyncopePeritonitis
Treatment	Catheter drainage for 7–10 days	LaparotomyRepair of bladder Bladder drainage

Solution to Question 5:

The given clinical scenario is suggestive of a bladder injury. Open book fracture is most likely suggestive of an intraperitoneal bladder injury. CT cystogram will be the next step in the management to confirm the type of bladder injury. In unstable patients, a cystogram will be the investigation of choice.

If an associated urethral injury is suspected, retrograde urethrogram (RGU) is done.



Note: Closed book pelvic fractures are more commonly associated with urethral injuries than bladder injuries.

Solution to Question 6:

The given clinical scenario is suggestive of acute retention of urine, possibly because of benign prostatic hyperplasia (BPH). The next step would be to insert an 18-Fr Coudé catheter.

In men, the BPH especially the middle lobe enlargement obstructs the insertion of Foley's catherter. Hence, a Coude catheter is advised over suprapubic catetherization as the immediate next step as larger Fr Coude catheter is helpful in negotiating past the angulation in the prostatic urethra.

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(Note: In acute urine retention, urethral strictures should be suspected when there is resistance at the urethral meatus as the strictures are more common in distal urethra than proximal urethra)

Bladder outlet obstruction is usually the most common cause of acute retention of urine. Its clinical features include:

• Inability to pass urine

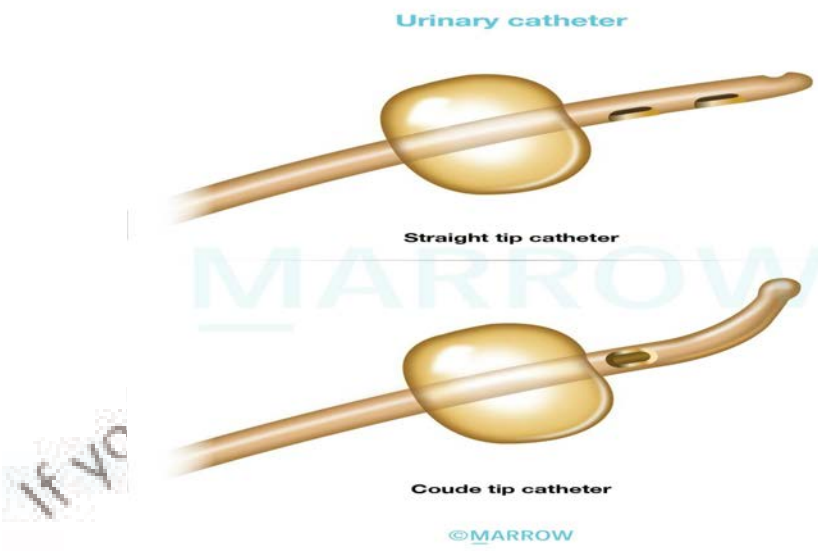
• Severe suprapubic pain

• A distended, palpable, and tender bladder

Acute urinary retention is managed by placing a urethral catheter as early as possible. Usually in BPH, smaller catheters will not pass through the angulation of the prostatic urethra as they are flexible and kink. Hence in BPH, the Coudé-tip catheter, which has a rigid and angulated tip, can be used to overcome the urethral obstruction.

If urethral catheter placement is not successful, suprapubic catheterization should be done.

If there is a urethral stricture, a council tip catheter is used to dilate it using a cystoscope, guide wires, and urethral dilators.



Solution to Question 7:

USG-guided rupture of the balloon percutaneously after inflating it with 20ml water should be the next step of management.

The failure of the balloon to deflate may be caused by:

• Faulty valve mechanism

• Blockage of the inflation channel by debris

• Crystallization of the fluid within the balloon (when saline is used)

The next best step in the management of a retained Foley's catheter is to further inflate the balloon with 20mL of water, following which the inflated balloon is ruptured percutaneously with

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a needle under USG guidance.

A suprapubic approach is used in males, while in females, either a transurethral or transvaginal route can be used. A cystoscopy should be done to ensure that all fragments are removed.

Other methods of approach include cutting the sidearm of the catheter, thereby disabling the valve mechanism, or advancing a ureteric stylet or fine-gauge wire through the inflation port to dislodge debris or puncture the balloon. But these are often unsuccessful.

Option A: CT is not routinely used in most settings with retained Foley's.

Option B: Injection of ether through the balloon port causes the rupture of the balloon within seconds. But this technique causes significant bladder irritation.

Option C: Balloons should not be overinflated until they rupture. This may cause severe pain and could cause bladder rupture.

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Solution to Question 8:

The given image shows a three-way Foley's catheter. The tube marked 'A' is used for continuous irrigation of the bladder to remove debris & blood clots. This is most commonly used after any prostate surgery or conditions with bleeding in the bladder.

The central tube is used for the drainage of urine and the tube on the right is used for inflating the balloon.

Solution to Question 9:

The earliest sign of tuberculosis of the bladder observed by cystoscopy is the pallor of the mucosa around the ureteric orifice due to submucous edema. Subsequently, tubercles may be seen.

In long-standing cases, there is marked fibrosis and the capacity of the bladder is greatly reduced (thimble bladder). This is managed by augmentation cystoplasty.

The following X-ray KUB shows a thimble bladder:

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Ureteric lesions can also be seen in genitourinary tuberculosis. They include:

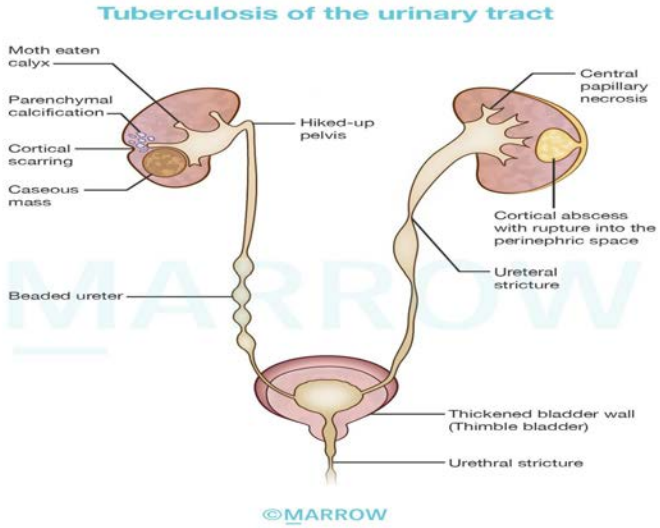
• Kerr's kink - kinking of the ureteropelvic junction (UPJ)

• Ureteral stricture

• Beaded ureter

• Shortening of the ureter

• Golf hole ureter - Longitudinal fibrosis leading to shortening of the ureter and pulling up the orifice as a gaping hole. Reimplantation of ureter is done.



Solution to Question 10:

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The given clinical scenario is suggestive of schistosomiasis. The patient is most likely to develop squamous cell carcinoma as it is associated with schistosomiasis. The image shows oval-shaped eggs with the terminal spine which is characteristic of Schistosoma haematobium.

Schistosomal bladder cancers can also be adenocarcinoma or transitional cell carcinoma (less frequently).

Primary bladder tumors usually originate from the transitional epithelium of the bladder (90%). Sometimes, they arise from connective tissue. Secondary tumors of the bladder arise from the sigmoid and rectum, the prostate, the uterus, or the ovaries.

Carcinoma of the bladder & associated risk factors:

Histological subtype	Risk factors
Transitional cell carcinoma (urothelial)	SmokingExposure to anilined yesCyclophosphamidePelvic i rradiation
Squamous cell carcinoma	SchistosomiasisChronic irrita tion caused by stone disease Bladder diverticulaChronic U TISmoking
Adenocarcinoma	Persistent urachus or trigone of the bladder

Solution to Question 11:

Cyclophosphamide (an alkylating agent) causes bladder cancer

The risk of bladder cancer with cyclophosphamide is directly proportional to the duration and intensity of cyclophosphamide treatment. Phosphoramide mustard is the primary mutagenic metabolite that causes bladder cancer in patients exposed to cyclophosphamide.

Painless, gross hematuria is the most common symptom that is indicative of a bladder carcinoma until proven otherwise.

Depending upon the depth of invasion, bladder carcinoma can be divided into

• Flat, non-invasive carcinoma in situ (CIS)

• Non-muscle invasive bladder cancer (70% of cases) - does not invade detrusor muscle but can invade lamina propria.

• Muscle-invasive bladder cancer - invades the detrusor muscle.

Diagnosis is by cystourethroscopy (directly visualizing the growth) and biopsy. Management is as follows:

• Non-muscle invasive bladder cancer:

• Transurethral resection of bladder tumor (TURBT) followed by intravesical chemotherapy with mitomycin C or epirubicin

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• Immunotherapy with regular intravesical instillations of Bacille Calmette Guerin (BCG) in high-risk tumors.

• Muscle invasive bladder cancer: Radical cystectomy along with urinary diversion procedure and lymph node dissection +/- neoadjuvant chemotherapy

Other options:

Option B: Cisplatin is an anticancer drug used to treat testicular cancer. It is associated with an increased risk for acute myeloid leukemia (AML).

Option C: Taxane is an anticancer drug and is the main component in the treatment regimens of metastatic cancers. Taxane's adverse effects are neutropenia and fluid retention (pulmonary edema).

Option D: Tamoxifen is a selective estrogen receptor modulator (SERM) and is used in the treatment of estrogen-dependent breast cancer. Due to its partial agonistic activity, it is known to increase endometrial cancer in post-menopausal women.

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Solution to Question 12:

The most important prognostic factor in bladder carcinoma is the depth of invasion.

Activation of oncogenes such as ras, c-erbB, E2F3, and inactivation of tumor-suppressor genes such as p53, p21, p16, and Rb gene is implicated in the cancer formation of the bladder.

Clinical features of bladder carcinoma include:

• Painless gross haematuria - Most common symptom and is indicative of a bladder carcinoma until proven otherwise

• Urinary retention

• Constant pelvic pain

• Increased urinary frequency

• Discomfort while urinating

• If there is nerve involvement, pain is referred to the suprapubic region, groins, perineum, and thighs.

Investigations done for bladder cancer are:

• Urine cytology - Low sensitivity

• Intravenous urography - Not frequently used nowadays. Replaced by non-contrast CT and MRI

• Cystourethroscopy and biopsy - The best investigation

Solution to Question 13:

Since the pathological staging of the tumor is given (pT1), it implies that transurethral resection of the bladder tumor (TURBT) has already been done. Therefore, this patient should be managed

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by instillation of intravesical BCG.

TURBT is done for the pathologic staging of the tumor. This staging helps us to decide the further plan of treatment. Intravesical therapy (using chemotherapy or immunotherapy) is done within 24hrs of TURBT in order to kill any residual cancer cells. It only affects the lining of the bladder and is not useful for cancers that have spread into the deeper layers.

pT stage: Pathological stage

Treatment of carcinoma bladder:

M-VAC chemotherapy regime consists of:

• Methotrexate

• Vinblastine

• Adriamycin

• Cisplatin

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pT stage	Extent of the tumor
Tx	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Ta	Noninvasive papillary carcinoma
Tis	Carcinoma in situ
T1	Tumor invades subepithelial connective tissue (lamina propria)
T2	Tumor invades muscularis propria bladder wall
T3	Tumor invades perivesical tissue
T4	Tumor invades any of the following: Prostate, uterus, vagina, pelvic wall and abdominal wall

pT stage	Treatment
Low-grade pTa	Intravesical chemotherapywith mitomycin, thiotepa, and adriamycin may be started after TURBT
High-grade pTapTis pT1	Intravesical BCGis started after TURBT

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pT stage	Treatment
pT2	Radical cystectomyfollowed b yradiotherapy
pT3pT4	Neoadjuvant chemotherapy (M-VAC), radical cystectomy, and radiotherapy

Solution to Question 14:

An attenuated strain of Mycobacterium bovis is used in intravesical BCG therapy.

Intravesical BCG is used for the treatment of non-invasive (no invasion into the muscle layer) urinary bladder tumors. It induces a strong local inflammatory response against the attenuated bacteria, which helps in the destruction of the tumor cells.

Option d: Mw vaccine for multibacillary leprosy patients and their contacts is extracted from Mycobacterium indicus pranii. It is also used as an adjunct to chemotherapy for category II tuberculosis.

Solution to Question 15:

The Nd: YAG laser is preferred for the resection of minimally invasive bladder tumors.

Solution to Question 16:

An NMP 22 assay should be done in this patient to detect the recurrence of bladder carcinoma.

NMP 22 is a nuclear matrix protein that is used to form cell nuclei. It is shed into the urine and has a higher concentration in the urine of bladder cancer patients. NMP-22 cutoff levels for bladder cancer detection is > 10 units/mL.

Solution to Question 17:

Urinary diversion is not done in cases of bladder hematoma.

Urinary diversion procedures are performed to divert urine from the bladder to a new exit site. It is of two types:

• Cutaneous urinary diversion (External diversion): Urine drains through an opening created in the abdominal wall and skin

• Ileal conduit - urine is diverted by implanting ureters into a loop of ileum that is led out through the abdominal wall.

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• Cutaneous ureterostomy - ureters are directed through the abdominal wall and attached to an opening in the skin.

• Continent urinary diversion (Internal urinary diversion): A portion of the intestine is used to create a new reservoir for urine. The internal pouch is placed inside the abdomen. The ureters are attached to the internal pouch, and the internal pouch is attached to the urethra or to a stoma in the abdomen with a valve.

Indications of urinary diversion:

• Post cystectomy

• Carcinoma of the urinary bladder

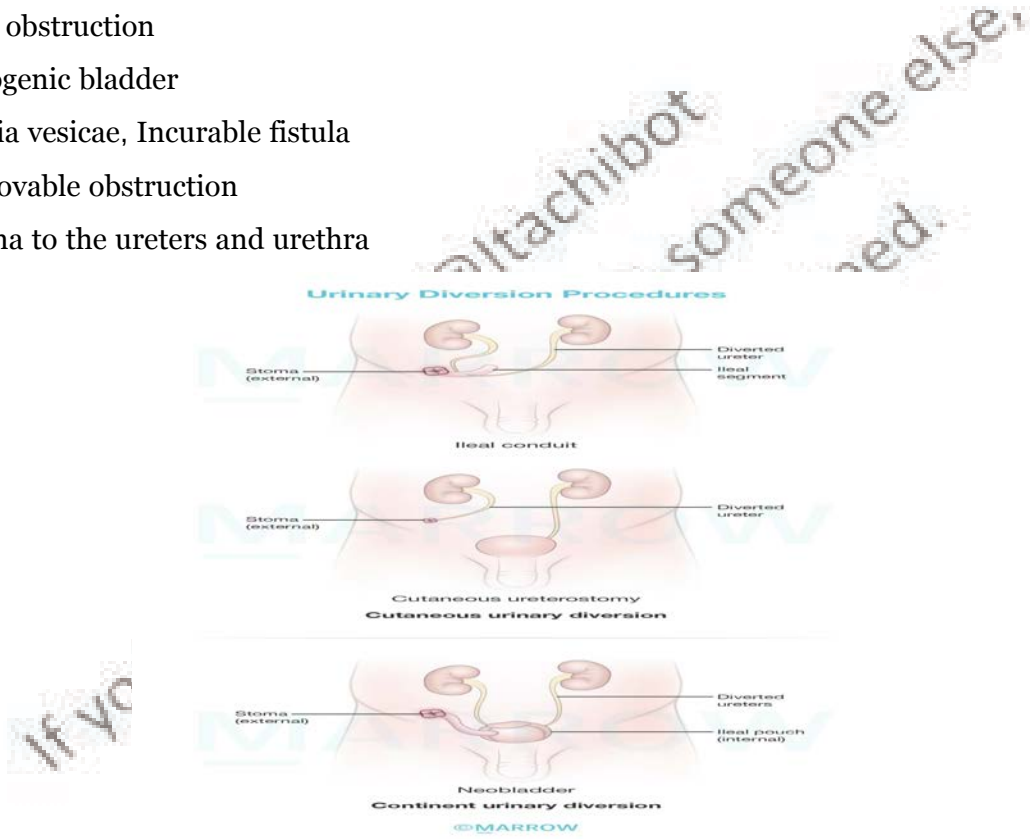
• Distal obstruction

• Neurogenic bladder

• Ectopia vesicae, Incurable fistula

• Irremovable obstruction

• Trauma to the ureters and urethra



Solution to Question 18:

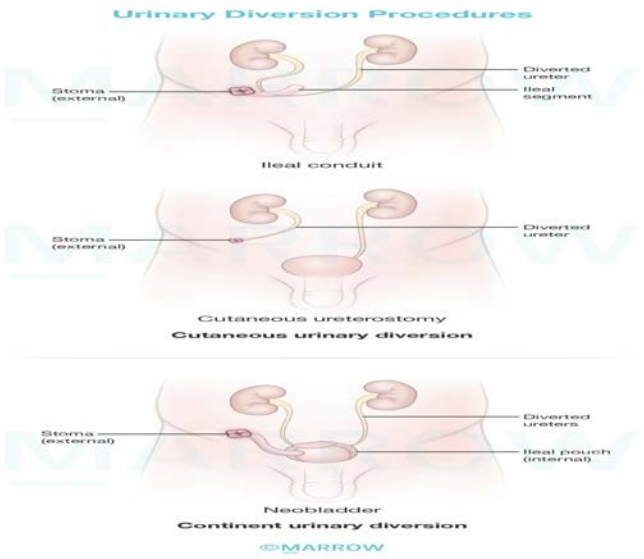
A uretero-sigmoid diversion was most likely done in this patient as it frequently results in hyperchloremic hypokalemic acidosis. Hypokalemia is less common with ileal diversions because the ileum reabsorbs some of the potassium from the urine while the colon does not.

The order in which the hyperchloraemic hypokalemic acidosis occurs is sigmoid colon > colon/ileum.

Electrolyte abnormalities based on the part of intestine involved:

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Stomach	Jejunum	Ileum/colon
Hypokalemia	Hyperkalemia	Hypokalemia
Hypochloremia	Hypochloremia	Hyperchloremia
Metabolic alkalosis	Metabolic acidosis	Metabolic acidosis



Solution to Question 19:

The given clinical scenario with normal urinalysis and cystoscopy findings are suggestive of interstitial cystitis.

Interstitial cystitis is a persistent, painful form of chronic cystitis, occurring most frequently in women. It is also known as chronic pelvic pain syndrome or bladder pain syndrome. Its clinical features include:

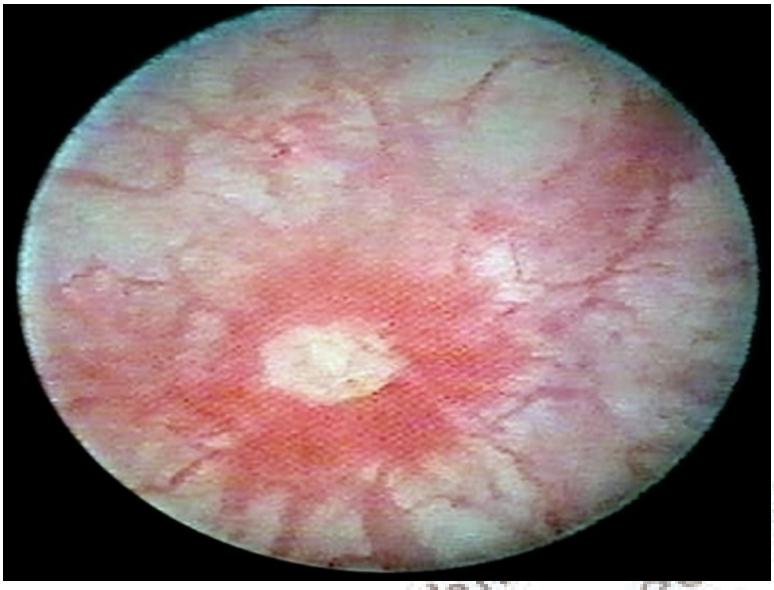
- Severe suprapubic pain
- Urinary frequency
- Urgency
- Hematuria
- Dysuria without evidence of bacterial infection

Cystoscopic findings seen in bladder mucosa are:

- Fissures
- Punctate hemorrhages (glomerulations)
- Ulcerations in the fundus of the bladder (Hunner's ulcer)

The image shows Hunner's ulcer seen in interstitial cystitis:

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Treatment options include :

• Conservative - Patient education about the chronicity of the condition, behavioral modification (timed voiding, bladder training), stress reduction, dietary alteration (avoidance of caffeine and spicy and acidic foods) and physical therapy should be the initial management for all patients.

• Pharmacological - Neuropathic analgesics (e.g. amitriptyline, pregabalin) are used for those with a significant pain component, whereas antimuscarinics and β3-agonists are used for frequency, nocturia and urgency symptoms.

• Surgical - For those with Hunner lesions, fulguration or laser to these lesions can be beneficial. Cystodistension as a treatment has variable evidence for success. If these options fail to improve symptoms major surgical reconstruction can be considered in selected cases.

Option b: Malakoplakia is a distinct form of inflammatory reaction seen in chronic cystitis. It appears as soft, yellow, slightly raised mucosal plaques.

Option d: Cystitis cystica occurs due to chronic irritation of the bladder mucosa. Cystoscopy reveals cystic lesions in the bladder.

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Solution to Question 20:

Reflux of urine into pelvis and calyces without dilatation is Grade II vesicoureteric reflux (VUR).

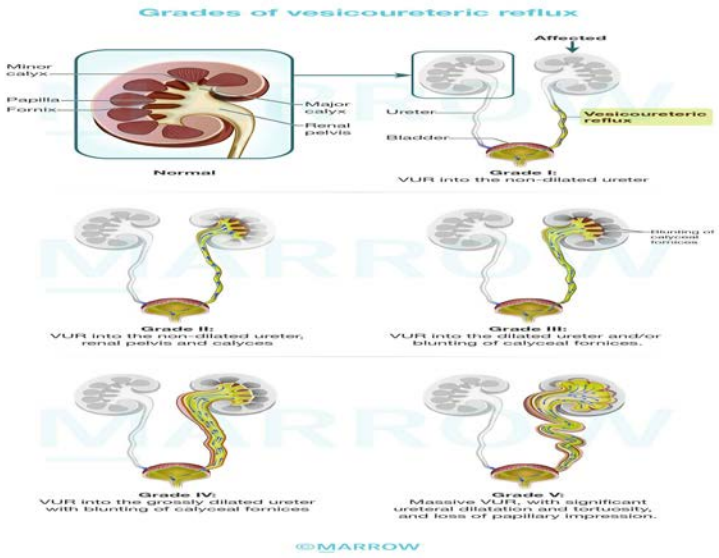
VUR is the retrograde flow of urine from the bladder to the upper urinary tract. VUR is a common clinical entity. The investigation of choice for VUR is micturating cystourethrogram (MCU).

VUR is graded as follows:

GRADE	DESCRIPTION
I	Reflux into a non-dilated ureter

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GRADE	DESCRIPTION
II	Reflux into the pelvis and calyces without dilatation of the ureter
III	Reflux is associated with mild to moderate dilatation of the ureter, renal pelvis, and calyces, with minimal blunting of the fornices
IV	Moderate ureteral tortuosity and dilatation of the pelvis and calyces
V	Gross dilatation of the ureter, pelvis, and calyses; loss of papillary impressions; ureteral tortuosity



Solution to Question 21:

Hypertrophy of the internal sphincter of the bladder is seen in Marion's disease. This leads to bladder outlet obstruction. Its clinical features include voiding and storage symptoms (usually associated with BPH). Therefore it is also called prostatism sans prostate:

- Increased urinary frequency
- Urgency
- Dribbling of urine
- Hesitancy
- Intermittent stream

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• Nocturia

It is commonly seen in young patients.

Bladder outlet obstruction can occur due to 2 causes:

• Muscular causes

• Congenital hypertrophy of internal sphincter, i.e., Marion's disease

• Dyssynergic contraction of the smooth muscle of the bladder neck (bladder neck dyssynergia)

• Fibrosis of bladder neck following transurethral resection of the prostate (TURP)

Solution to Question 22:

The given intravenous urography (IVU) image depicts cobra head/adder head deformity which is a classic sign of ureterocele. It is associated with dysplastic renal tissue.

Ureterocele:

A ureterocele is the cystic enlargement of the intramural ureter. It is thought to be caused due to ureteric orifice atresia. It is observed more in females than males in a 4:1 preponderance and is bilateral in about 10% of the cases. They are similar to ectopic ureters wherein the upper pole of the kidney is drained. This condition is typically associated with dysplastic and non-functional renal tissue.

Clinical presentation:

• Children with ureterocele usually present with infection.

• Adults present with renal stones.

Diagnosis:

• IVU shows a classical cobra head sign but is relatively infrequently performed these days.

• Cystoscopy shows a bulging, translucent swelling involving the ureteric orifice where there is urinary stasis. It is emptied by ureteric peristalsis.

Treatment:

• Surgical excision with re-implantation of the ureter is the treatment of choice for simple ureterocele.

• Renal stones associated with ureterocele are removed using an endoscopic incision

• An advanced disease that causes hydronephrosis or pyonephrosis is an indication for nephrectomy.

Solution to Question 23:

A cystine calculus occurs only in the presence of cystinuria and is radioopaque because of its high sulfur content.

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Primary bladder stone:

• Develops in sterile urine in the absence of any known functional, anatomic, or infectious factors and does not necessarily imply that stones have formed de novo in the bladder.

• Most common in children younger than 10 years of age

• Most vesical calculi are mixed

• Ammonium acid urate, calcium oxalate, uric acid, and calcium phosphate are the most common components of primary bladder calculi

Secondary bladder stone: Forms during infection, due to bladder outflow obstruction, impaired bladder emptying, or the presence of a foreign body.

Types:

• Calcium oxalate stones

• Uric acid stones - occur in patients with gout but are also observed in patients with ileostomies or with bladder outlet obstruction

• Cystine stones - in cystinuria

• Triple phosphate stones - occur in urine infected with urea-splitting organisms

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Prostate

Question 1:

Which of the following are storage symptoms of BPH?

a) 1, 3, 4

b) 2 and 5

c) 1, 2, 4, 5

d) 1, 2, 4

Question 2:

A 60-year-old man presented with fever, chills, and dysuria. On per-rectal examination, his prostate was tender and boggy. His PSA level was 7.4 ng/dl. What is the next best step in the management of this patient?

a) Repeat PSA

b) Catheterization and prostatic massage

c) TURP-guided biopsy

d) Antibiotic therapy

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Question 3:

Which is the most common organism causing acute bacterial prostatitis?

a) Enterococcus

b) Proteus

c) Streptococcus Agalacticia

d) E.coli

Question 4:

Which of following compounds form endogenous prostatic calculi?

a) Calcium oxalate

b) Calcium phosphate

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c) Struvite

d) Uric acid

Question 5:

Which of the following is false regarding the medical management of benign prostatic hyperplasia?

a) 5-alpha-reductase inhibitors take at least 6 months to act.

b) Alpha blockers act quicker.

c) Tamsulosin can cause abnormal ejaculation.

d) 5-alpha-reductase inhibitors act best when the gland is small.

Question 6:

Which of the following findings is not an indication to perform prostatectomy in patients with benign prostatic hyperplasia?

a) Bladder diverticula

b) Recurrent urinary tract infections

c) Residual volume of 200 ml

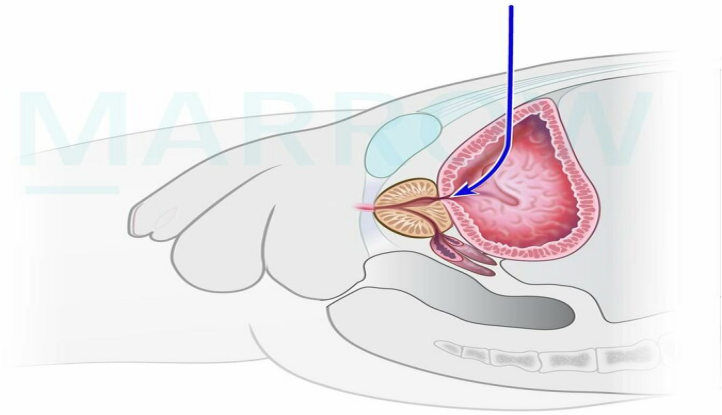
d) Increased frequency of micturition

Question 7:

Identify the approach for surgery of the prostate as shown in the image:

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a) Young approach

b) Freyer approach

c) Millin approach

d) Transurethral approach

Question 8:

As a first-year surgery resident, you have scrubbed in to assist a urologist on a TURP procedure. Up to what distal anatomical landmark do you expect him to resect?

a) External urethral sphincter

b) Prostatic utricle

c) Bladder neck

d) Verumontanum

Question 9:

A patient in your ward is scheduled for monopolar-TURP. Which of the given fluids should be used for irrigation during the procedure?

a) 1.5 % glycine

b) Normal saline

c) N/5 saline

d) Distilled water

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Question 10:

A 70-year-old patient with benign prostatic hypertrophy underwent TURP. An hour later, he was found to have an altered sensorium and had several bouts of vomiting. What is the most probable cause?

a) Overdose of spinal anesthetic agent

b) Hypernatremia

c) Hyperkalemia

d) Water intoxication

Question 11:

A man presents with a history of minimal ejaculation at sexual climax and passing cloudy urine after. He is a known diabetic and underwent TURP 6 months ago. What is the mechanism leading to this complication?

a) Injury to the external urethral sphincter

b) Disruption of the autonomic nerve supply to the corpora of the penis

c) Over use of coagulating diathermy during the procedure

d) Bladder neck disruption

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Question 12:

On per rectal examination, which of the following findings will help you identify a malignant prostate lesion?

a) Smooth surface

b) Firm consistency

c) Rectal mucosa mobile over the prostate

d) Presence of nodules

Question 13:

A 68- year-old patient presents with difficulty in initiating micturition. A DRE reveals an enlarged nodular prostate with adherent rectal mucosa. PSA was found to be 25 ng/ml and a biopsy result was suggestive of adenocarcinoma. Which of the following statements is false

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regarding his condition ?

a) PSA is a not specific marker for the condition.

b) Gleason score correlates with the pathological stage

c) It is associated with decreased % free PSA

d) It arises from the transitional zone of the gland.

Question 14:

A 63-year-old patient comes to the urology OPD with hesitancy, incomplete voiding, and pelvic pain. On a digital rectal examination, an irregularly enlarged prostate with a nodular surface is felt. The rectal mucosa does not move freely over it. A biopsy using an automated gun is planned. How many biopsy cores should be obtained?

a) 5

b) 8

c) 10

d) 12

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Question 15:

A 77-year-old man was evaluated for a nodule found on his prostate. His PSA levels were 15 ng/dl and a transrectal biopsy indicated a malignancy. Which of the following statements is false regarding its spread?

a) Local spread can occur to the seminal vesicles.

b) Direct involvement of rectum is common.

c) Obturator nodes are most commonly involved.

d) Spread by bloodstream usually occurs to the bones.

Question 16:

A 66-year-old man presents with an enlarged, hard, nodular prostate. Further investigations reveal a tumor that has extended through the prostatic capsule to the seminal vesicle. Other adjacent structures are not involved. What is the stage of his disease?

a) T1

b) T2

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c) T3

d) T4

Question 17:

A 75-year-old man provisionally diagnosed with BPH underwent a TURP procedure. Histopathological exam of the resected tissue revealed a tumor involving less than 5% of the specimen. What is the most appropriate management?

a) Conservative

b) Radical prostatectomy

c) Radiotherapy

d) Androgen ablation

Question 18:

Orchidectomy is used as treatment for which of the following stages of prostate cancer?

a) T1c cancer in the young

b) T2b cancer in the young

c) T2b cancer in the elderly

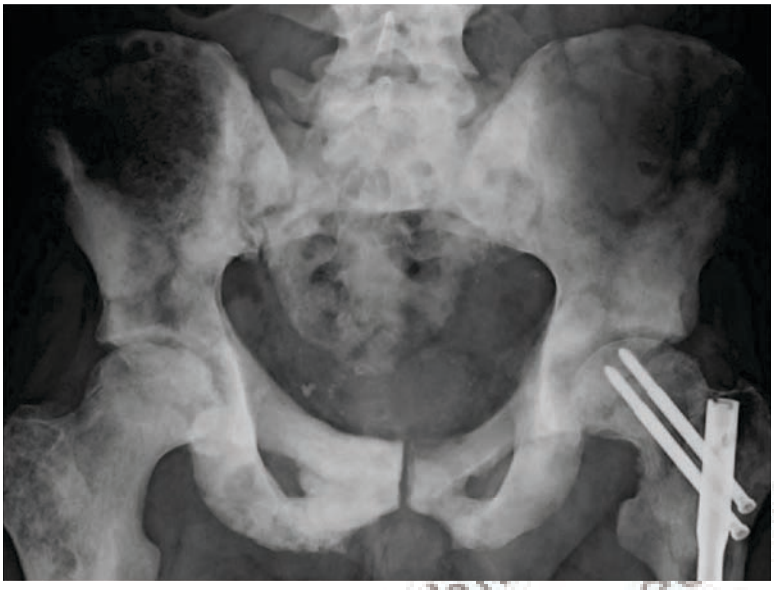
d) T1c disease in the elderly

Question 19:

A 77-year-old man presented with worsening hip and back pain. The X-ray revealed the given lesions The patient had undergone an orchidectomy three years ago to manage his prostatic carcinoma. However, recent serial estimations of PSA have shown an increasing trend. What is the treatment of choice for his condition?

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a) Paclitaxel

b) Goserelin

c) Docetaxel

d) Radium-223

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Question 20:

Which of the following vaccines is used in the treatment of prostate cancer?

a) Talimogene laherparepvec

b) Bacillus Calmette–Guérin

c) Sipuleucel-T

d) Algenpantucel-L

Question 21:

Which of the following is used in laser enucleation of the prostate?

a) Carbon dioxide laser

b) Nd-YAG laser

c) Ho-YAG laser

d) Argon laser

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Answer Key

Question No.	Correct Option
1	d
2	d
3	d
4	b
5	d
6	d
7	b
8	d
9	a
10	d
11	d
12	d
13	d
14	d
15	b
16	c
17	a
18	c
19	d
20	c
21	c

Detailed Explanations

Solution to Question 1:

Urgency, enuresis and frequency are storage symptoms.

Lower urinary tract symptoms (LUTS) can be classified as:

Storage	Voiding
Frequency(earliest symptom in BPH)NocturiaUrgencyUrge incontinenceNocturnal incontinence (enuresis)	HesitancyPoor flowIntermittent streamDribblingSensation of poor bladder emptyingEpisodes of near retention

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Storage symptoms are seen in conditions where the bladder is irritated. Voiding symptoms are common in conditions causing bladder outlet obstruction. In benign prostatic hyperplasia, both storage and voiding symptoms are present.

Solution to Question 2:

The given clinical scenario is suggestive of acute bacterial prostatitis and should be managed by antibiotics.

A rigorous and prolonged treatment for 2-6 weeks with an antibiotic that penetrates the prostate wall is indicated (trimethoprim, ciprofloxacin or aminoglycoside). Incomplete infection eradication lead to recurrent attacks and chronic prostatitis.

Acute bacterial prostatitis is usually caused by an ascending urinary tract infection (UTI) or reflux of infected urine into prostatic ducts. The most common organism is Escherichia coli. An associated increase in levels of PSA(>4ng/ml) may be present due to prostate inflammation.

Catheterization and prostatic massage are contraindicated in patients with suspected acute prostatitis, as they increase the chance for bacteremia and sepsis. Instead, suprapubic tap should be performed to alleviate retention.

Chronic bacterial prostatitis is the sequela of inadequately treated acute prostatitis.

Diagnosis includes:

• Three-glass urine test - If the first glass with the initial urine sample is clear, but the second and third samples contain prostatic threads and leukocytes, it indicates the presence of prostatitis.

• Digital rectal examination - Prostate may be normal, boggy, or tender.

• Prostatic fluid examination - post-prostatic massage fluid shows pus cells and bacteria.

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Solution to Question 3:

The most common organism causing acute bacterial prostatitis (ABP) is Escherichia coli.

It is commonly caused by an ascending urethral infection or reflux of infected urine into prostatic ducts. Sexually transmissible infections and other urinary pathogens, such as Staphylococcus aureus and Streptococcus faecalis may also be responsible.

The patient presents with fever, perineal pain, chills and rigor, and dysuria. Per rectal examination will reveal a tender, boggy prostate. Care should be taken to avoid aggressive palpation or prostatic massage as it can lead to bacterial dissemination and sepsis.

Urine examination and culture should be done. Urine examination reveals threads in urine.

Management:

Patients with systemic signs of infection should be admitted for IV antibiotics, hydration, and monitoring of laboratory parameters.

Patients who have no signs of systemic infection, who can tolerate oral intake, and who have no urinary retention can be treated with oral antibiotics. Antibiotics are given for 2-6 weeks to ensure

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the eradication of the infection as antibiotics don't penetrate the prostate capsule easily.

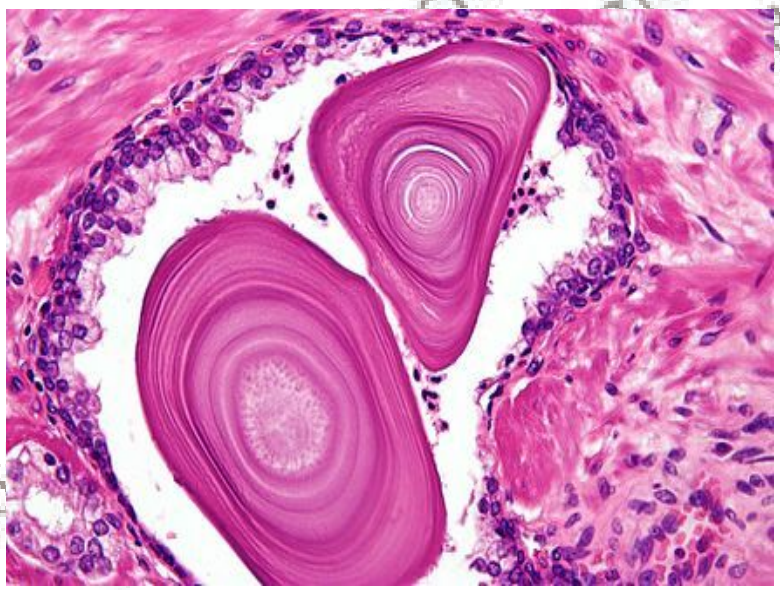
For outpatient therapy: Ciprofloxacin 500 mg oral every 12 hours or levofloxacin 500 mg OD or trimethoprim-sulfamethoxazole double-strength tablet oral every 12 hours can be used.

For hospitalized patients: Intravenous ciprofloxacin or levofloxacin with or without an aminoglycoside (gentamicin or tobramycin) or intravenous beta-lactam with or without an aminoglycoside. Gram-positive infections are treated with cephalosporins (cephalexin, cefazolin) or dicloxacillin and vancomycin.

Solution to Question 4:

Endogenous calculi are most commonly composed of calcium phosphate.

Exogenous calculi are urinary calculi that are arrested in the prostatic urethra. They are relatively rare.



Corpora amylacea are benign histological findings in prostate glands. Prostatic calculi are thought to develop from the calcification of corpora amylacea.

Solution to Question 5:

5-alpha-reductase inhibitors act best when the prostate is large(>50g).

The pathogenesis of BPH has a static and dynamic component responsible for the lower urinary tract symptoms. Conversion of testosterone to DHT is responsible for prostatic stromal hypertrophy which is the static component of BPH. The contraction of smooth muscles in the prostate is considered the dynamic component of BPH.

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	Alpha-blockers	5-alpha-reductase inhibitors
Mechanism of acti on	Inhibit thecontraction of smo oth musclesin the prostate.	Inhibit theconversion of testo sterone to dihydrotestosteron e (DHT)
Onset of action	Workquickly	To be taken for at least6 mon ths
Example	Tamsulosin	Finasteride
Adverse effects	Dizziness (due to postural hy potension)Abnormal ejaculati on	DizzinessImpotence

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Solution to Question 6:

Increased frequency alone is not an indication for prostatectomy.

Increasing difficulty in micturition, with considerable frequency during both day and night, delay in starting, and a poor stream are the usual symptoms for which surgery is advised.

Other indications include the following:

- Acute retention
- Chronic retention and renal impairment
- Residual urine of ° 200 mL
- Raised blood urea
- Hydroureter or hydronephrosis
- Complications of bladder outflow obstruction
- Stone
- Infection
- Diverticuli
- Hemorrhage - Venous bleeding from a ruptured vein overlying the prostate

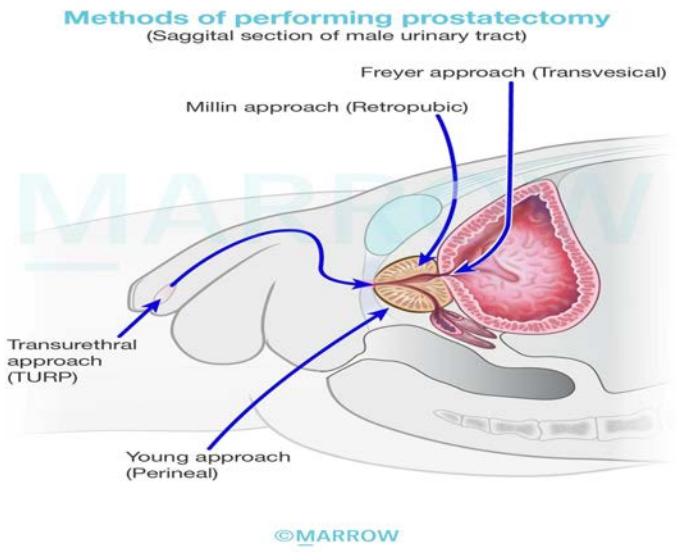
Solution to Question 7:

The image shows the transvesical approach, also known as Freyer approach.

In this approach, the bladder is opened and the prostate is enucleated by putting a finger into the urethra, pushing forward towards the pubes to separate the lateral lobes, and then working the finger between the adenoma and the false capsule.

Among the other approaches, TURP is most commonly performed.

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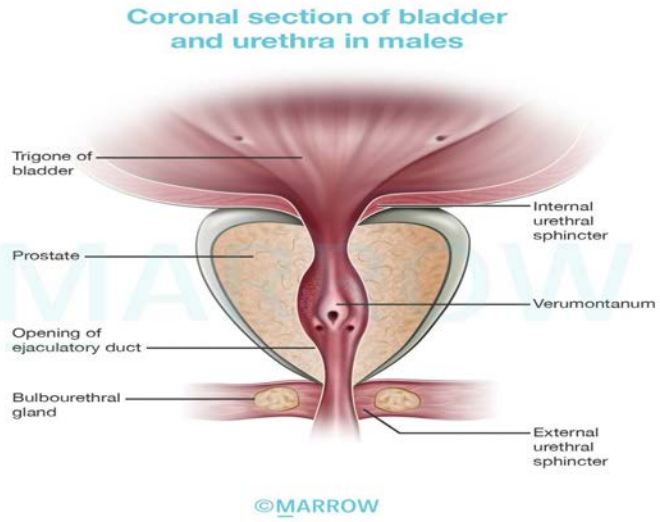


Solution to Question 8:

Verumontanum is used as the distal-most border of the resection in transurethral resection of the prostate (TURP). This prevents damage to the external urethral sphincter which is located just distal to the verumontanum.

Damage to the external urethral sphincter leads to urinary incontinence.

The bladder neck is the proximal limit of resection.



Solution to Question 9:

The best irrigating fluid for M-TURP is 1.5% isotonic glycine.

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M-TURP removes tissue with a wire loop that has an electrical current flowing in one direction (monopolar). The surgical site is irrigated with a non-conducting non-ionic fluid as the use of an ionic solution leads to dissipation of the cutting current and poor cutting efficacy. Thus, normal saline and N/5 saline cannot be used.

The use of distilled water in TURP leads to the water-intoxication syndrome.

Bipolar transurethral resection of the prostate (B-TURP) uses a specialized resecting loop that incorporates both the active and the return portions of the circuit on the same electrode and an ionic irrigating solution such as normal saline can be used safely.

Solution to Question 10:

The most probable cause for the above-mentioned symptoms is water intoxication also known as transurethral resection of the prostate (TURP) syndrome.

Absorption of water into the circulation at the time of transurethral urethral resection can lead to :

• Hyponatremia, which may manifest as confusion, nausea, and vomiting

• Congestive cardiac failure

• Hemolysis

It is managed by fluid restriction.

The use of isotonic glycine for irrigation during resection reduces the incidence of water intoxication.

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Solution to Question 11:

The clinical scenario above suggests the patient has retrograde ejaculation. The most likely mechanism of its development is disruption of the bladder neck.

Retrograde ejaculation is the most common complication of transurethral resection of the prostate (TURP).

Option A: Injury to the external urethral sphincter causes incontinence following TURP.

Option B: Disruption of the autonomic nerve supply to the corpora of the penis causes impotence.

Option C: Overuse of coagulating diathermy following TURP causes bladder neck contracture.

Other complications of TURP include:

• Transurethral resection of prostate (TUR) syndrome

• Primary and secondary hemorrhage

• Perforation of the bladder or the prostatic capsule

• Sepsis

• Urethral stricture

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Note:Transurethral microwave thermotherapy (TUMT), Transurethral needle ablation (TUNA), and laser vaporization are less invasive methods used for the treatment of BPH. They have a decreased incidence of ejaculatory dysfunction and hemorrhage.

Solution to Question 12:

Palpable nodules over the prostate is highly suggestive of carcinoma.

Features of carcinoma of the prostate	Features of benign disease of the prostate
HardconsistencyRectal muco sa immobileover the prostate Obliteration of the median gr ooveNodular surface	FirmconsistencyRectal muco sa mobileover the prostateRe sidual urine may be feltas a fl uctuating swelling above the prostateSmooth surface

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Solution to Question 13:

Prostatic carcinoma, as indicated in the clinical scenario, arises from the peripheral zone of the gland.

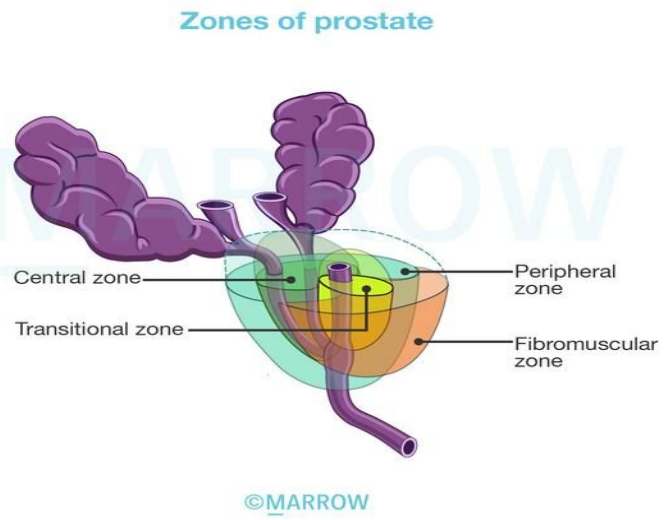
Anatomically, the prostate is divided into three zones.

• The peripheral zone lies posteriorly and has an abundance of prostatic glands.

• The central zone lies posterior to the urethral lumen and above the seminal vesicles as they course through the prostate.

• The transitional zone is periurethral.

Benign prostatic hyperplasia arises from the transitional zone.



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Gleason grading may be used after biopsy to evaluate the stage of histopathological specimen. Gleason scores range from 6 to 10 where 6 is low risk for prostate cancer while 10 is high risk.

PSA (prostatic specific antigen) is a glycoprotein peptidase that facilitates the liquefaction of semen. It is useful for screening and for monitoring response to therapy but is neither specific nor sensitive to the condition as it can be elevated due to old age and benign conditions such as prostatitis and BPH.

Slightly elevated total PSA (between 4.0 and 10.0 ng/mL) and low free PSA (<25%) is suspicious for prostate cancer.

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Solution to Question 14:

Ideally, 12 systematic biopsy cores are obtained in patients with suspected prostatic cancer.

A 12-core systematic biopsy that incorporates apical and far-lateral cores in template distribution allows maximum cancer detection. It also avoids detection of insignificant prostate cancers and the need of a repeat biopsy.

Solution to Question 15:

Palpable nodules over the prostate with raised PSA are highly suggestive of carcinoma. direct involvement of the rectum is rare but it may become stenosed by the tumor infiltrating around it.

Option A: Local invasion occurs upwards, first involving seminal vesicles, bladder neck, and trigone; this is followed by distal invasion to the external sphincter. Obstruction of one or both ureters can occur resulting in anuria.

Option C: Lymph nodes involved are obturator lymph nodes, external iliac nodes, and occasionally retroperitoneal, mediastinal, and supraclavicular lymph nodes.

Option D: Spread by the bloodstream occurs mostly to the bones; the bones involved most frequently in carcinoma of the prostate are the pelvic bones and the lower lumbar vertebrae.

Solution to Question 16:

The stage of the tumor that has extended through the prostatic capsule to the seminal vesicle and not to other adjacent structures is T3b.

Staging of prostate carcinoma:	
Tx	Primary tumor cannot be assessed

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Staging of prostate carcinoma:	
T0	No evidence of primary tumor
T1	Clinically inapparent tumor. Neither palpable nor visible on imaging
T1a	Incidental histologic finding in 5% or less of tissue resected
T1b	Incidental histologic findings in more than 5% of tissue resected
T1c	Tumor identified by needle biopsy (for example, because of elevated PSA level)
T2	Tumorconfined withinthe prostate
T2a	Tumor involves one-half of one lobe or less
T2b	Tumor involves more than one-half of one lobe but not both lobes
T2c	Tumor involves both lobes
T3	Tumorsextend through the prostate capsule
T3a	Extracapsular extension (unilateral or bilateral)
T3b	Tumor invades seminal vesicle(s)
T4	Tumor is fixed orinvades adjacent structures other than seminal vesicles, such as external sphincter, rectum, bladder, levator muscles, and/or pelvic wall

Solution to Question 17:

A tumor discovered incidentally on TURP present in <5% of resected tissue is staged as T1a. For older men, conservative treatment is done for stage T1a prostatic carcinoma.

Radical surgical treatment might be considered in younger (<70 years) men with the same stage of the disease.

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Staging of prostate carcinoma:	
Tx	Primary tumor cannot be assessed
T0	No evidence of primary tumor
T1	Clinically inapparent tumor. Neither palpable nor visibleon imaging
T1a	Incidental histologic finding in 5% or less of tissue resected
T1b	Incidental histologic findings in more than 5% of tissue resected
T1c	Tumor identified by needle biopsy (for example, because of elevated PSA)
T2	Tumorconfined withinthe prostate
T2a	Tumor involves one-half of one lobe or less
T2b	Tumor involves more than one-half of one lobe but not both lobes
T2c	Tumor involves both lobes
T3	Tumorsextend through the prostate capsule
T3a	Extracapsular extension (unilateral or bilateral)
T3b	Tumor invades seminal vesicle(s)
T4	Tumor is fixed orinvades adjacent structures other than seminal vesicles, such as external sphincter, rectum, bladder, levator muscles, and/or pelvic wall

Management of Prostatic Carcinoma		
Stage of cancer	Age > 70 or Gleason score=6	Age < 70 or Gleason score >6
Early prostate cancer: T1B,T2A	Active surveillance	Radical prostatectomy
Locally advanced prostate cancer: T2B, T2C, T3, T4, N1	Brachytherapy + Androgen deprivation therapy	Brachytherapy + Radical prostatectomy

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Management of Prostatic Carcinoma		
Metastatic prostate cancer	Androgen deprivation therapy Chemotherapy and radiotherapy (hormone-resistant tumor)Radiopharmaceutical therapy (hormone resistant bony metastasis)	

Solution to Question 18:

Orchidectomy is performed to carry out androgen ablation in the treatment of locally advanced disease in the elderly. It is also done to manage metastatic disease.

Bilateral orchidectomy, whether total or subcapsular, will eliminate the major source of testosterone production. LHRH analogs such as goserelin and buserelin along with anti-androgens such as flutamide is used to perform medical androgen ablation.

Management of Prostatic Carcinoma		
Stage of cancer	Age > 70 or Gleason score=6	Age < 70 or Gleason score >6
Early prostate cancer: T1,T2A	Active surveillance	Radical prostatectomy
Locally advanced prostate cancer: T2B, T2C, T3, T4, N1	Brachytherapy + Androgen deprivation therapy	Brachytherapy + Radical prostatectomy
Metastatic prostate cancer	Androgen deprivation therapyChemotherapy and radiotherapy (hormone-resistant tumor)Radiopharmaceutical therapy (hormone resistant bony metastasis)	

Solution to Question 19:

Blastic lesions on X-Ray after surgical castration (therapeutic orchidectomy) in patients with prostatic carcinoma is suggestive of hormone-resistant bone metastasis. The treatment of choice for hormone-resistant bone metastasis is radiopharmaceutical therapy with radium-223.

Radium-223 is a radioactive isotope that emits low levels of alpha-particle radiation. The alpha-particle radiation causes double-strand breaks in DNA, which kills cells. Radium-223 is a “calcium mimetic” that accumulates preferentially in areas of bone undergoing increased turnover, such as areas of bone metastases.

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Management of Prostatic Carcinoma		
Stage of cancer	Age>70 or Gleason score=6	Age<70 or Gleason score>6
Early prostate cancer: T1, T2A	Active surveillance	Radical prostatectomy
Locally advanced prostate cancer: T2B, T2C, T3, T4, N1	Brachytherapy + Androgen deprivation therapy	Brachytherapy + Radical prostatectomy
Metastatic prostate cancer	Androgen deprivation therapyChemotherapy and radiotherapy (hormone-resistant tumor)Radiopharmaceutical therapy (hormone-resistant bony metastasis)	

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Solution to Question 20:

Sipuleucel-T (Provenge) is an autologous prostatic acid phosphatase (PAP)-loaded dendritic cell vaccine.

It is approved for patients with hormone-resistant, metastatic prostate cancer with minimal or no cancer-related symptoms.

Other immunotherapies in prostate cancer include:

• GVAX allogeneic recombinant whole-cell vaccine

• Immune checkpoint inhibitors such as PD-1/PD-L1 inhibitor

• CTLA-4 inhibitor

Option A: Talimogene laherparepvec (T-VEC) has demonstrated therapeutic activity in melanoma.

Option B: Bacillus Calmette–Guérin is used for bladder carcinoma.

Option D: Algenpantucel-L is used as immunotherapy in pancreatic adenocarcinoma.

Solution to Question 21:

Ho-YAG laser is the most common laser used in enucleation of the prostate. The procedure is known as Holmium laser enucleation of the prostate (HoLEP).

Laser reduce the duration of the procedure and the risk of harmorrhage.

KTPA green light laser is the best laser that can be used. It causes vaporisation of prostatic tissue. As it is hemostatic in nature, it can be safely used in patients on anticoagulants.

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Urethra and Penis

Question 1:

Where does urethral stricture most commonly occur?

a) Penile urethra

b) Bulbar urethra

c) Prostatic urethra

d) Membranous urethra

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Question 2:

Identify the investigation and the lesion depicted in the image given below.



a) Retrograde cystourethrogram with membranous urethra stricture

b) Retrograde cystourethrogram with penile urethral stricture

c) Micturating cystourethrography with bulbar stricture

d) Micturating cystourethrography with prostratic urethra stricture

Question 3:

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A 40-year-old man presents to the OPD with complaints of difficulty to start urination and that he has to strain to maintain a proper flow. He gives a history of pelvic injury one year back. Investigations reveal a stricture of length 1.5 cm at the bulbar urethra. What will be the best management for this patient?

a) Urethral dilatation

b) Excision with end-to-end urethroplasty

c) Partial graft urethroplasty

d) Urethrotomy

Question 4:

A man was brought to the emergency department after he fell into a manhole and injured his perineum. He gets an urge to micturate but is unable to urinate. On examination, blood was seen at the tip of the urethra, and swelling of the penis and scrotum was seen. What is the site of injury?

a) Membranous urethra rupture

b) Bulbar urethra injury

c) Prostatic urethra injury

d) Urinary bladder rupture

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Question 5:

A 20-year-old was brought to the ER after falling off his bicycle. His vitals were stable, but he had a bruise over the perineum and he has not passed urine yet. Blood was seen at the meatus and the bladder was not palpable. What will be the next step in the management of this patient?

a) Suprapubic catheterization

b) Immediate insertion of foleys catheter

c) Nephrogram

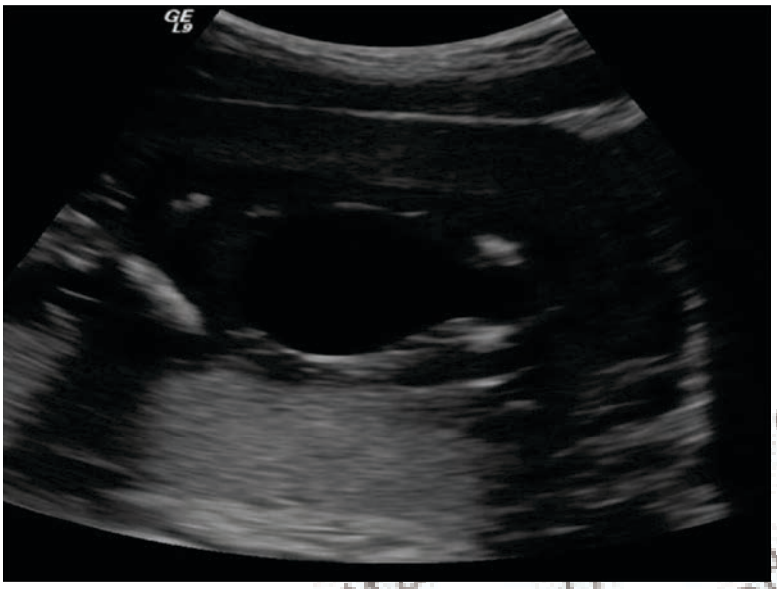
d) Wait for bladder to fill and urge to urinate

Question 6:

A worried mother brings her 18-month-old son to OPD with complaints of repeated urinary tract infections. During diagnostic work-up, pelvic USG shows the following finding. What is

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the most likely diagnosis?



a) Vesicoureteric reflux

b) Posterior urethral valve

c) Ureterocele

d) Pelvi-ureteric junction obstruction

Question 7:

A newborn was found to have a following anomaly of the penile urethra while being examined by a pediatrician. Identify the incorrect statement regarding the condition.



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a) It is the most common congenital abnormality of the urethra

b) Circumcision should be done to remove the excess skin

c) It does not cause urinary obstruction

d) Ventral chordee is a common association

Question 8:

What is the appropriate age at which corrective surgery should be done for the defect shown in the image?



a) 6-18 months

b) 1-6 months

c) Immediately after birth

d) After 2 years of age

Question 9:

A patient with sickle cell anemia presents to the casualty with complaints of painful erection of the penis for the past 5 hours. On examination, his penis is rigid. Penile blood aspiration is performed and it shows dark-colored blood. This patient can be managed by all of the following, except:

a) Aspiration of the sludged blood

b) Intracavernosal phenylephrine injection

c) Selective arterial embolization

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d) Quackel's shunt

Question 10:

What is the most common cause of erectile dysfunction?

a) Drugs

b) Stress

c) Atherosclerosis

d) Diabetes

Question 11:

All of the following are indications to perform circumcision in children, except:

a) 1 and 4

b) 2 and 5

c) 3 and 5

d) 3 and 4

Question 12:

A 7-year-old boy was catheterized for a surgical procedure, and an intern noticed the following finding when he removed the catheter. A manual reduction was attempted and was not successful. What will be the next step in the management of this patient?



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a) Circumcision

b) Nesbit's procedure

c) Urinary diversion

d) Dorsal slit procedure

Question 13:

In patients with which of the following symptoms is Nesbitt's procedure done?

a) Penile deformity, painful erection and palpable penile plaques

b) Downward directed stream of urine with bending of penis

c) Painful erection of penis > 4hrs

d) Popping sound during sexual intercourse, painful and flaccid penis

Question 14:

Heineke-Mikulicz principle is used in which of the following procedures?

a) Preputioplasty & circumcision

b) Preputioplasty & frenuloplasty

c) Circumcision & frenuloplasty

d) Circumcision alone

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Question 15:

Which of the following statements is false regarding carcinoma of the penis?

a) Balanitis xerotica obliterans is a pre-malignant condition

b) It is usually painless

c) Jackson staging is used to stage the disease

d) Superficial inguinal lymphadenopathy indicates metastasis

Question 16:

A 52-year-old man came to the urology OPD with complaints of a slow-growing ulcerative lesion in the penis for the past few months. On examination, a fungating mass in his glans

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penis was seen and lymph nodes were not palpable. He was suspected to have penile carcinoma. Which of the following statements is false regarding the management of the patient?

a) MRI is the investigation of choice for staging

b) 1cm margin of normal tissue must be removed

c) Sentinel lymph node biopsy should be done

d) If stump is < 3cm, total amputation of the penis is done

Question 17:

Which of the following is the most important prognostic factor in patients with penile cancer?

a) Depth of primary lesion

b) Stage of primary lesion

c) Site of primary lesion

d) Lymph node status

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Answer Key

Question No.	Correct Option
1	b
2	b
3	b
4	b
5	d
6	b
7	b
8	a
9	c
10	b
11	d
12	d
13	a
14	b

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15	d
16	d
17	d

Detailed Explanations

Solution to Question 1:

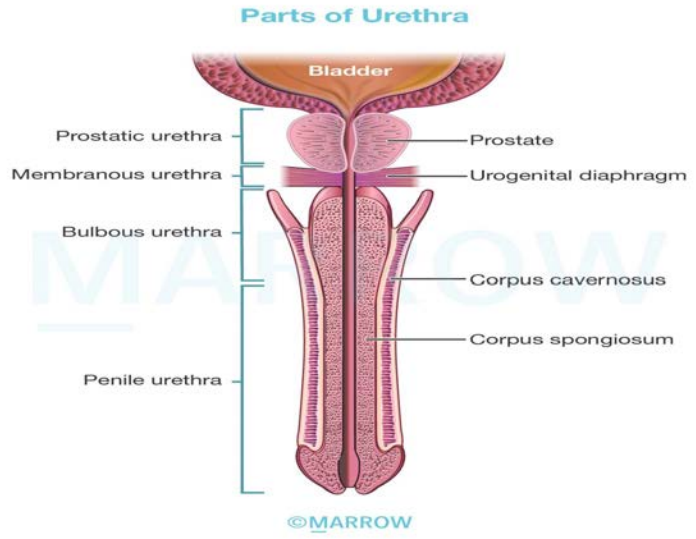
The most common site of urethral stricture is the bulbar urethra.

A urethral stricture is a narrowing of the urethra caused by scarring, which functionally causes obstructive voiding dysfunction of the lower urinary tract.

The most common cause of urethral stricture is trauma. It can also be iatrogenic due urethral catheterization and infections.

These patients present with features of the hesitancy of micturition, straining to void, and poor urinary stream.

The most common complication of urethral stricture is urinary tract infection.



Solution to Question 2:

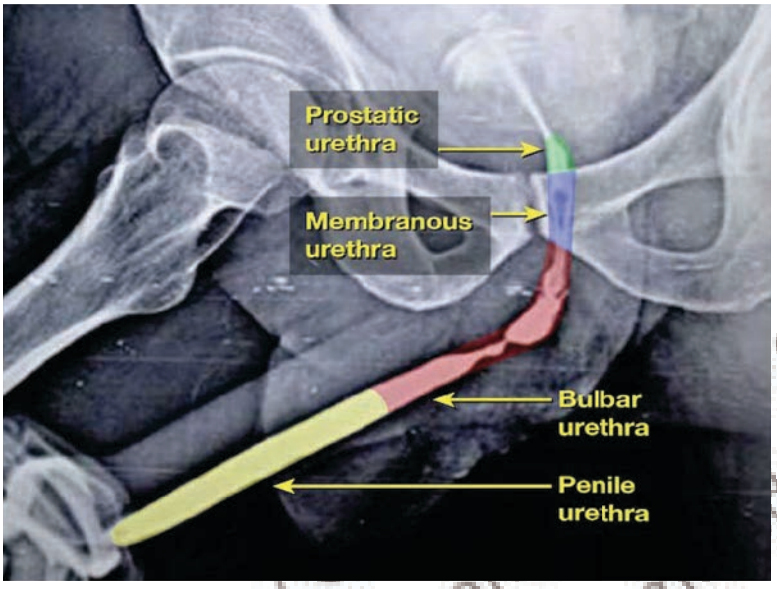
The given image shows retrograde cystourethrogram with findings consistent with penile urethral stricture.

The male urethra can be visualized by retrograde urethrography (RGU) or voiding cystourethrogram (VCU), also known as micturating cystourethrogram (MCU).

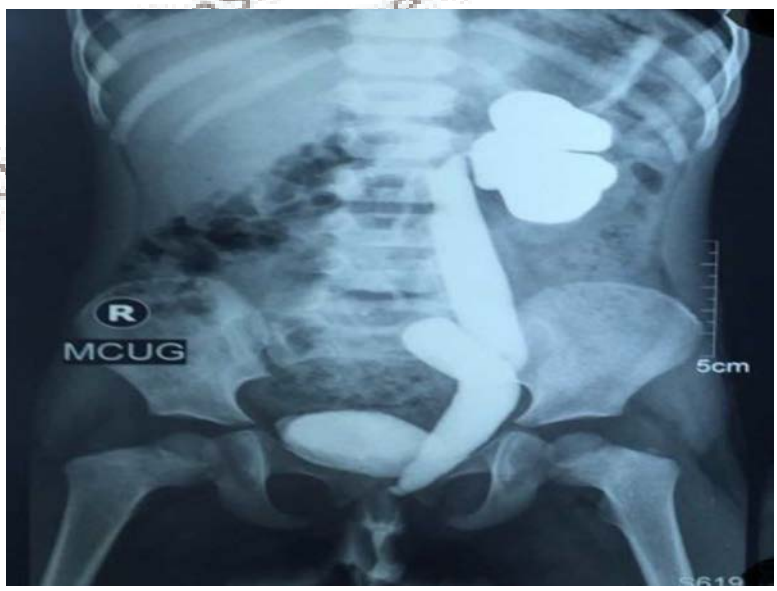
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In RGU, the urethra is visualized with the instillation of contrast into the anterior urethra (penile urethra and bulbar urethra). It is helpful for diagnosing anterior urethral abnormalities.

The following image shows an RGU with bulbar urethral stricture:



In VCU, after injecting contrast into the bladder using a Foleys catheter, the posterior urethra (membranous urethra and prostatic urethra) is visualized during micturition. It is helpful for diagnosing posterior urethral abnormalities and bladder abnormalities. It is the investigation of choice for vesicoureteric reflux (VUR) and posterior urethral valve.



Solution to Question 3:

The given clinical scenario with a short bulbar urethral stricture (<2cm) due to trauma, will be best managed by excision with end-to-end urethroplasty. It is the gold standard for the repair of

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anterior urethral stricture.

The management of a urethral stricture depends on the site, the length, and the cause of the stricture. They include:

• Endoscopic urethrotomy - The stricture is released using a knife passed through a rigid urethroscope.

• Urethroplasty - Excision of the stenosed length of the urethra and re-anastomosis is done. A buccal mucosa graft can be used to bridge the gap. It is considered when a stricture is due to trauma or recurred following endoscopic treatment.

• Urethral dilation - The urethra is stretched using urethral dilators. This is a blind procedure and it can cause injury. Hence, it is not done frequently.

• Intermittent self-dilatation - In patients with recurrent strictures who are unable to undergo urethroplasty, then intermittent self-dilatation with soft hydrophilic catheters is done on a daily basis.

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Solution to Question 4:

The given clinical scenario with a history of a blow to the perineum, blood at the tip of the meatus, swelling of the penis and scrotum is suggestive of an injury to the bulbar urethra.

Urethral injuries can be classified into:

Note: Urinary bladder rupture occurs due to an injury to the suprapubic region. Extraperitoneal bladder rupture is more common and associated with pelvic fracture. Intraperitoneal bladder rupture is caused by a blow or a fall on a distended bladder. It manifests as sudden severe pain in the hypogastrium and syncope.

Type	Proximal urethral injury	Distal urethral injury
Site of injury	Prostatic urethraMembranous urethra	Bulbar urethraPenile urethra
Mechanism	Secondary topelvic fracture	Occurs due to a blow to the perineum by:Straddle injuryLoose manhole coveringGymnasium accidents
Clinical features	Urinary retentionBlood at the urethral meatusHigh-riding prostate on digital rectal examination (Vermooten sign)Deep perineal hematoma	Urinary retentionBlood at the urethral meatusPerineal hematoma (butterfly hematoma)

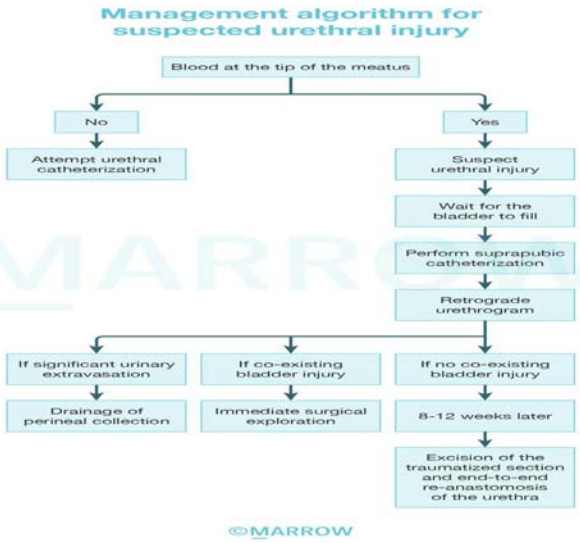
Solution to Question 5:

The clinical features such as perineal bruise and blood at the urethral meatus following a fall from the bicycle are suggestive of a bulbar urethral injury. In this case, as the bladder is not palpable

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the best option would be to wait for the bladder to fill and urge to urinate. Once the bladder is full the urine should be drained by a suprapubic catheter.

Foleys catheter insertion should not be done in cases of suspected urethral injury, as it can convert a partial tear into a complete tear.



Solution to Question 6:

The given clinical scenario with the USG showing the key-hole sign is suggestive of the posterior urethral valve (PUV). It is seen due to dilatation of the bladder and the proximal urethra.

The posterior urethral valves are membranes that have a small posterior slit, which lies just distal to the verumontanum. They function as flap valves and are obstructive to antegrade urinary flow.

The posterior urethral valve is the most common congenital cause of bladder outlet obstruction in males. PUV is classified into three types based on Young's classification.

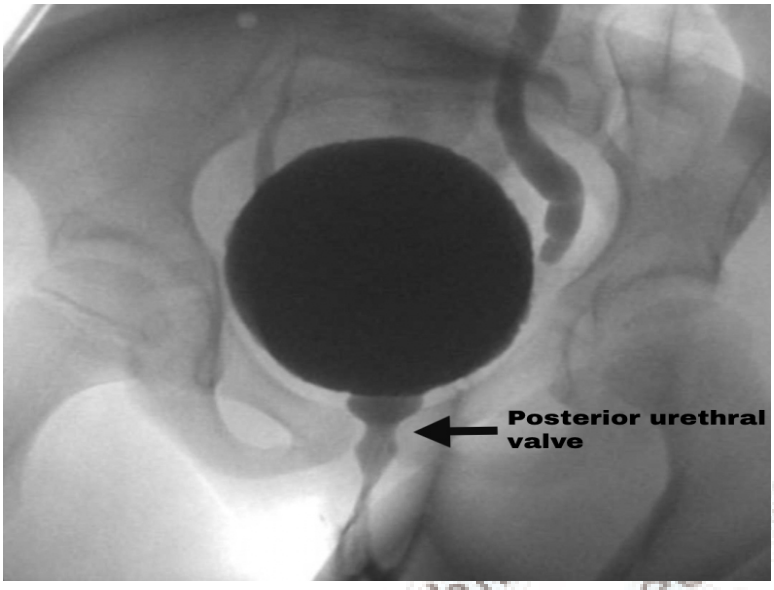
Diagnosis is made antenatally with ultrasound, which demonstrates bilateral hydronephrosis above a distended bladder. If the diagnosis is not made antenatally, then neonates typically present with urinary infection or uremia and renal failure.

The investigation of choice for a posterior urethral valve is micturating cystourethrography (MCUG).

Initially, the obstruction is relieved by catheterization to preserve renal function. Definitive treatment is by urethroscopic destruction of the valves with lifelong supportive treatment.

The following VCUG shows vesicoureteric reflux due to posterior urethral valves:

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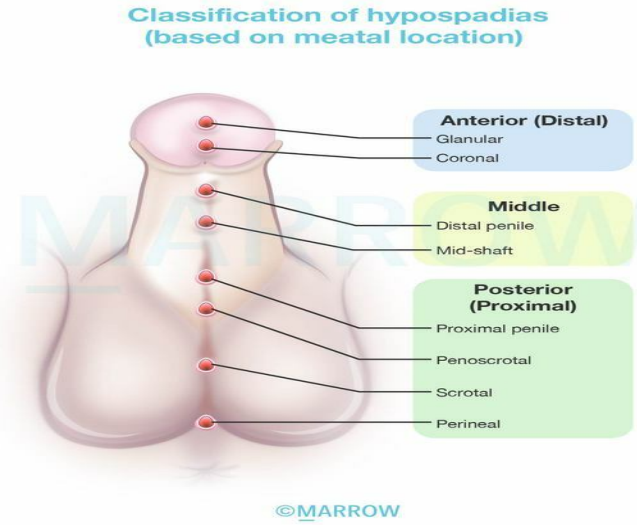
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Solution to Question 7:

The image showing a newborn having a urethral meatus that opens on the underside of the penis is indicative of hypospadias. Circumcision should not be done in hypospadias as the foreskin will be used for surgical reconstruction.

Hypospadias is the most common congenital abnormality of the urethra. It is characterized by the combination of:

- A ventrally placed urethral meatus (underside of penis or perineum)
- Poor development of the ventral aspect of the prepuce (resulting in hooded foreskin)
- Ventral chordee (bending of the penis)



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Hypospadias does not cause either obstruction or urinary tract infection and surgery is recommended for sexual, urinary stream, or cosmetic reasons.

Note: In hypospadias, ventral chordee is seen, whereas, in epispadias, dorsal chordee is seen.

The image below shows a hooded prepuce:



The image below shows epispadias with bladder exstrophy:



Solution to Question 8:

The image shows penoscrotal hypospadias. Operations for hypospadias are routinely performed when the patient is between 6 and 18 months of age. The infant has good tolerance to surgery by the age of 6 months. The child is well aware of his genitalia and will be toilet trained by the age of 18 months.

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Surgery in hypospadias is done to correct problems with the urinary stream and for cosmetic reasons. The main principles of surgery in hypospadias include:

• Orthoplasty - Chordee correction

• Urethroplasty - To reposition the urethral opening

• Glanuloplasty - Reconstruction of glans

• Skin cover and scrotoplasty

Surgery depends on the site of the hypospadias. Tubularized incised plate (TIP) urethroplasty is the most commonly done procedure. It is done for distal hypospadias.

Complications of hypospadias surgery include:

• Urethrocutaneous fistula (most common)

• Recurrence of chordee

• Urethral stricture

• Meatal stenosis

• Infection

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Solution to Question 9:

The given clinical scenario with a sickle cell patient having prolonged erection and dark-colored blood in penile aspiration is suggestive of low-flow priapism. Selective arterial embolization has no role in low-flow priapism.

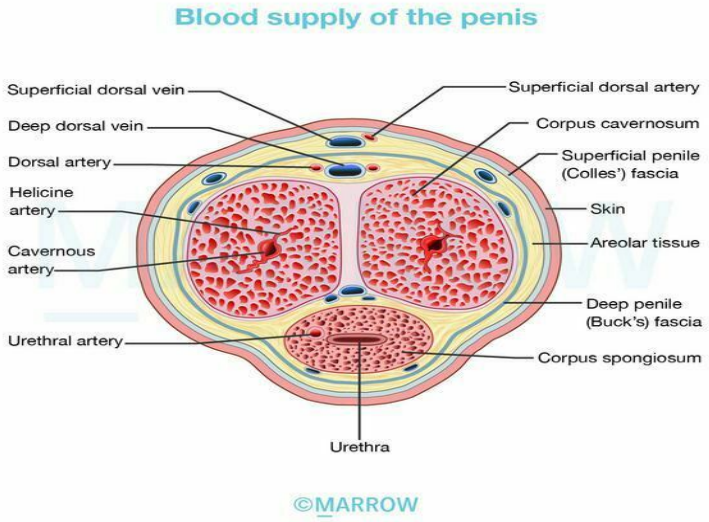
Persistent erection of penis lasting longer than 4 hours is defined as priapism. If the erection lasts for more than 6 hours, ischemia and necrosis can occur. Hence ischemic priapism is a surgical emergency.

Stuttering or intermittent priapism is historically described as recurrent unwanted and painful erections in men with sickle cell disease (SCD). Any patient who has experienced an episode of ischemic priapism is also at risk for stuttering priapism.

Type	Low-flow / Ischemic priapism	High-flow / Non-ischemic priapism
Mechanism	Venousoutflow obstruction	Increasedarterialflow
Incidence	More common	Less common
Cause	Sickle cell anemiaLeukemiaAntipsychotics	TraumaPapaverine injectionSpinal injury
Pain	Painful	Painless
Corpora cavernosa	Rigid	Tumescent
Penile blood gas analysis	Deoxygenated blood	Oxygenated blood
Doppler	Absence of blood flow within the penis	Demonstrate thefistulabetween the artery and the sinusoidal space due to trauma

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Type	Low-flow / Ischemic priapism	High-flow / Non-ischemic priapism
Treatment	Aspirationof the sludged blood in the corpora cavernosaIntracavernosalphenylephrineinjectionDecompressionof the penis by creating a shunt between the corpus cavernosum and either the glans (Winter shunt) or the corpus spongiosum (Quackel's shunt)	Selective arterial embolization



Solution to Question 10:

The most common cause of erectile dysfunction (ED) is stress. It can also be associated with diabetes, hypertension, dyslipidemia, and smoking.

The most common pathological cause of ED is vascular disease affecting the penile arterial blood flow.

Evaluation of ED involves confirmation of the diagnosis by history taking, assessing the patient for underlying risk factors, and physical examination of the genitalia. Measurement of the blood pressure and assessment of the secondary sexual characteristics is also done.

Biochemical assessment of the blood sugar, the serum lipid profile, and the serum testosterone is done in all cases.

Treatment involves the use of phosphodiesterase-V inhibitors (sildenafil) with an intra-cavernosal injection of alprostadil. Vacuum erection devices and penile implants are reserved for resistant cases.

The most common cause of erectile dysfunction in:

• Middle-aged men: Psychological

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• Older men: Organic (atherosclerosis)

• Overall: Psychological

Solution to Question 11:

A tight frenulum and physiological phimosis are not indications of circumcision in children.

Physiological phimosis is seen in children that are less than 6 years of age (2-6 years) due to natural adhesions between the glans and inner preputial skin. It rectifies on its own.

Circumcision is the surgical removal of the foreskin that covers the glans penis.

Indications of circumcision in children:

• True phimosis (associated with a white, scarred preputial orifice, most common just before puberty)

• Paraphimosis

• On request (most common)

• Balanitis xerotica obliterans (BXO)

• Recurrent UTI with abnormal upper urinary tract

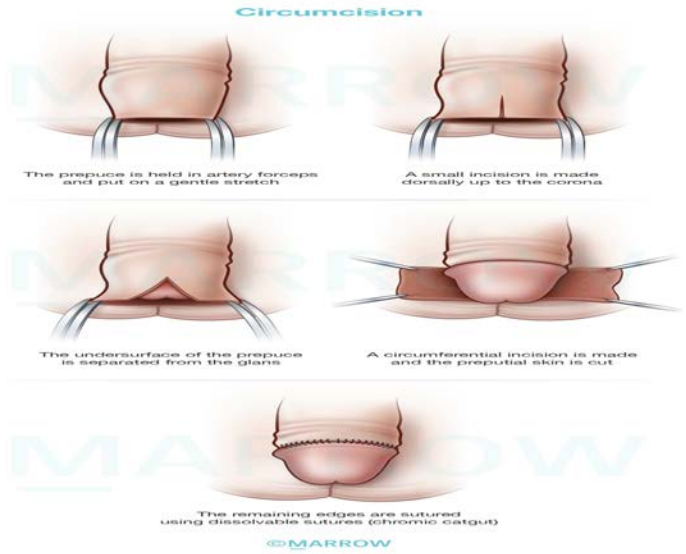
• Recurrent balanoposthitis

Indications of circumcision in adults:

• Recurrent balanitis

• Tight frenulum (Splitting of frenulum can occur during sexual activity)

• Inability to retract the foreskin for intercourse



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Solution to Question 12:

The clinical history and the image showing swollen glans are suggestive of paraphimosis. If manual reduction of the skin is unsuccessful, a dorsal slit procedure should be performed.

Paraphimosis is the inability to place back the retracted preputial skin. This creates a ring-like constriction, and the glans tend to be swollen, and edematous, with severe pain and tenderness. Paraphimosis is precipitated after sexual intercourse or iatrogenically after urethral catheterization.

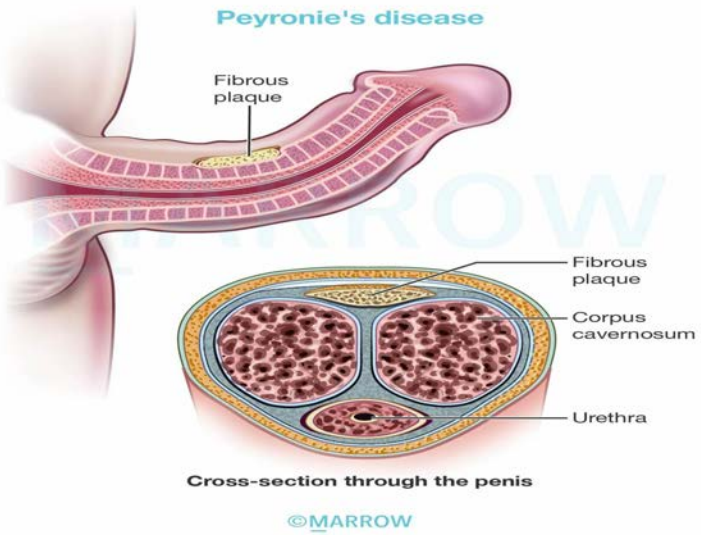
The first line of treatment includes manual reduction of the skin by applying lignocaine jelly. Ice bags and injection of a solution of hyaluronidase in normal saline may help to reduce the swelling.

If this fails, an initial dorsal slit is made to relieve the edema and compression. Antibiotics and analgesics are also given. Circumcision is performed after 3 weeks.

Solution to Question 13:

Penile deformity, painful erection, and palpable penile plaques are features associated with Peyronie's disease. Nesbitt's procedure is the most common procedure done for this condition.

Peyronie's disease is caused due to injury to tunica albuginea resulting in microhemorrhages. This leads to excess collagen deposition, calcification, and penile plaques. Hence, the penis bends towards the side of the plaque. This causes difficulty during sexual intercourse. It is also associated with Dupuytren's contracture.



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Nesbitt's procedure corrects the deformity by plicating the opposite side of the deformity, thereby straightening the penis. This procedure is done once the active phase subsides as the bend increases during the active phase (18-24 months).

Option B: Downward directed stream of urine with bending of the penis are symptoms of hypospadias.

Option C: Persistent erection lasting longer than 4 hours is called priapism.

Option D: Popping sound during sexual intercourse, painful and flaccid penis is suggestive of fracture of the penis. There will be bluish discoloration of the penis and scrotum due to extensive bruising (eggplant deformity). Management is mainly surgery for evacuation of hematoma and repair of corpora.

The image below shows eggplant deformity in fracture of the penis:



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Solution to Question 14:

The Heineke-Mikulicz principle is used in both preputioplasty and frenuloplasty.

The Heineke-Mikulicz principle involves the use of a longitudinal incision followed by a transverse closure, or vice-versa. In preputioplasty, it allows for the retraction of the foreskin, and in frenuloplasty, it allows the lengthening of the frenulum.

Heineke-Mikulicz's pyloroplasty also uses the same principle. Here, a longitudinal incision is done through the pylorus, with extension to the duodenum and gastric antrum. This incision is then closed transversely. It is done for gastric outlet obstruction and along with highly selective vagotomy.

Solution to Question 15:

Superficial inguinal lymphadenopathy in the context of carcinoma of the penis more often reflects infection rather than metastatic disease.

It is usually a painless condition and the patient presents late because of embarrassment or misdiagnosis. They may present with:

• Large fungating lesion

• Foul, bloody discharge (secondary to infection)

• Non-retractile prepuce

• Enlarged inguinal lymph nodes (often due to infection)

• Erosion of inguinal lymph nodes

Jackson staging is used for the staging of penile carcinoma:

• Stage I - Only glans / prepuce involved

• Stage II - Tumour extending into the body of penis

• Stage III - Tumour having mobile inguinal nodes

• Stage IV - Tumour spreading to adjacent structures / fixed nodes

Premalignant lesions of penile squamous cell carcinoma include

• Bowen disease - Reddish papules in the shaft of the penis

• Erythroplasia of Queyrat - Reddish papules involving glans and prepuce

• Condyloma acuminatum - Usually benign, but can undergo a malignant transformation (Buschke–Löwenstein tumor) when associated with HPV 16, 18, 31, 33, 35, and 39

• Balanitis xerotica obliterans (BXO) - White, thickened foreskin which forms a constricting band. This prevents retraction and later develops into carcinoma

• Leukoplakia

The following image shows erythroplasia of Queyrat:

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Solution to Question 16:

In penile carcinoma, total amputation of the penis is done if the stump is < 2cm.

The investigation of choice for penile carcinoma is a biopsy from the primary tumor. For staging, MRI is the investigation of choice.

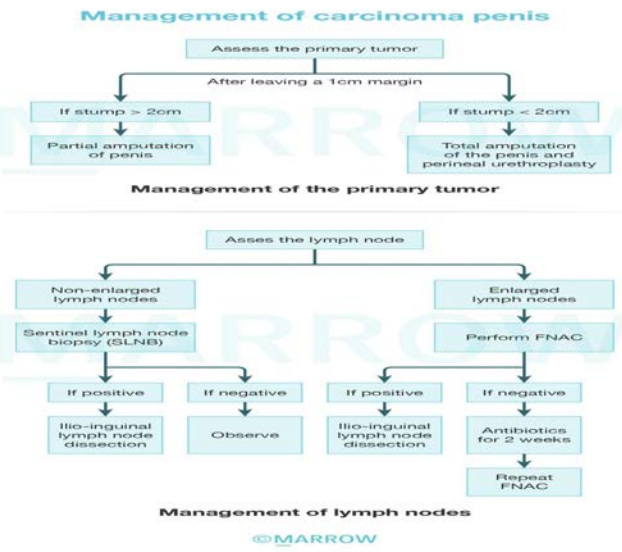
The first lymph node to be involved is the superficial inguinal lymph node and thus, the sentinel lymph node biopsy (SLNB) is helpful for evaluating the spread of penile cancer.

The management is divided into treatment of the primary tumour and the treatment of the lymph nodes.

The main principles of penile cancer surgery are to remove a 1cm margin of normal tissue and have at least a 2cm stump after surgery.

Surgery is the mainstay treatment of penile cancer. Chemotherapy regime includes 5-fluorouracil and cisplatin. Radiotherapy can be done for inguinal lymph nodes if lymph node dissection is not done.

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Solution to Question 17:

Inguinal lymph node status is the most important prognostic indicator in penile carcinoma.

The prognosis for tumors confined to the penis is good with 5-year survival rates in excess of 80%. With nodal involvement, the 5-year survival rate falls to around 40%.

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Testes and Scrotum

Question 1:

What is the most common site of ectopic testis?

a) Superficial inguinal pouch

b) Deep inguinal pouch

c) Perineum

d) Femoral triangle

Question 2:

A 2-month-old infant is brought to the OPD for consultation regarding an empty scrotal sac. On examination B/L inguinal masses are palpable. What is the ideal age for orchidopexy in this child?

a) At 6-10 years

b) At 1-2 years

c) At puberty

d) < 1 year of age

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Question 3:

A 1-year-old child was brought to the OPD as the mother noticed that the scrotum contained only one testicle. On examination, the testis is not palpable in the inguinal region or abdomen. A diagnostic laparoscopy reveals abdominal testes and orchiopexy is done. Which of the following tumors is most likely to develop in this patient?

a) Seminoma

b) Yolk sac tumor

c) Mature teratoma

d) Choriocarcinoma

Question 4:

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A newborn was diagnosed with undescended testes. Due to the intra-abdominal location of the testes, a two-stage Stephen-Fowler's orchiopexy was planned. Which of the following is performed during the first stage of this procedure?

a) Chevassu's manoeuvre

b) Clipping of testicular vessels

c) Clipping of cremasteric vessels

d) Abdominal exploration

Question 5:

What is the most common cause of testicular torsion?

a) Inversion of the testis

b) Presence of remnant of mullerian duct

c) High investment of tunica vaginalis

d) Pedicle between epididymis and body of testis

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Question 6:

A 14-year-old boy presents with acute onset of pain in his scrotum. He previously had similar pain that would subside spontaneously but the pain this time is unbearable. Physical examination shows a swollen erythematous scrotum. Cremasteric reflex is absent. What is the next best step in management?

a) Manual detorsion

b) Doppler ultrasound

c) Surgical exploration

d) Observation

Question 7:

A child presents with pain and swelling in the right side of his scrotum and testicular torsion is suspected. Which is the most appropriate management?

a) Immediate exploration on both symptomatic and asymptomatic side

b) Immediate exploration on symptomatic side only

c) Delayed exploration on both symptomatic and asymptomatic side

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d) Delayed exploration on symptomatic side only

Question 8:

A young man presents to the emergency with a painful scrotum. On examination, the patient is febrile and a Prehn's sign is positive. What is the most likely cause of the patient's condition?

a) Epididymal cyst rupture

b) Testicular appendix torsion

c) Acute epididymitis

d) Testicular inversion

Question 9:

A young male patient presented with painless swelling of the scrotum. Examination revealed a firm, enlarged epididymis along with beading of the vas deferens. Testes were normal. What is the next best step in management?

a) Start anti-tubercular therapy

b) Send urine or semen for PCR

c) Plan for epididymectomy

d) Perform a scrotal USG

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Question 10:

A 57-year-old diabetic patient presented with a painful, malodorous, discolored scrotum as shown in the image. The patient was febrile and in extreme pain. Which of the following statements is true about his condition?

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a) The testes remain unaffected

b) Managed by antibiotics and scrotal support

c) Staphylococcus is the most common causative organism

d) The condition is usually self limiting

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Question 11:

A 24-year-old presents with a scrotal swelling as shown in the image. The swelling is brilliantly transilluminant and the testes cannot be palpated separately. Which additional clinical finding is most likely to be present?



a) Cough impulse

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b) Cannot get above the swelling

c) Fluctuation

d) Reduction on rest

Question 12:

Which of the following is the most common cause of a secondary hydrocele ?

a) Torsion of testes

b) Testicular tumor

c) Epididymo-orchitis

d) Trauma

Question 13:

A patient with hydrocele is scheduled for Lord's plication. Which of the following is false regarding the procedure?

a) The procedure can be performed under local anesthesia

b) Increased risk of hematoma formation as compared to Jaboulay's

c) Preferred for small to medium sized swellings

d) Tunica vaginalis is bunched to obliterate the hydrocoele sac

Question 14:

A 32-year-old male patient presented with a scrotal swelling. On examination, the testis is felt separate from the scrotal swelling and the swelling is brilliantly transilluminant, as shown in the image below. What is the probable diagnosis?

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a) Varicocele

b) Epididymal cyst

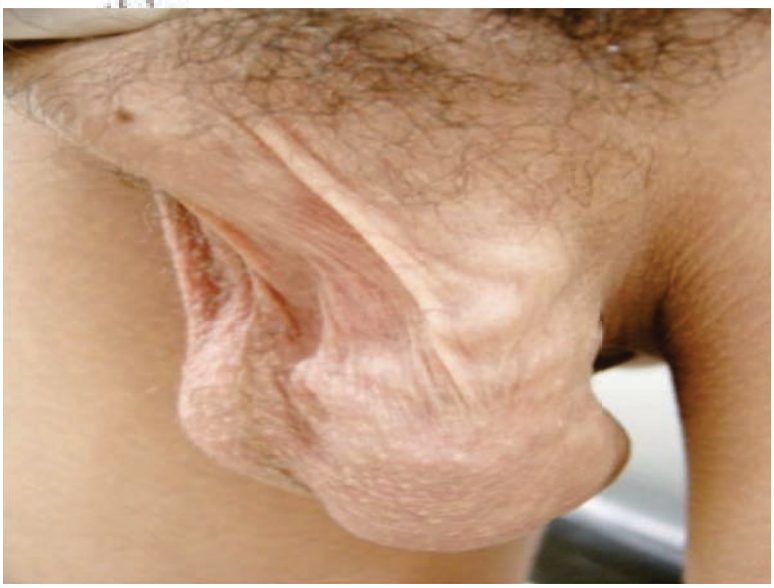
c) Spermatocele

d) Chylocele

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Question 15:

A 33-year-old man was referred to the surgery OPD from the infertility clinic. On inspection, the scrotum appeared as in the image. On palpation, a bag of worms sensation was felt. What is the appropriate management?



a) NSAIDs and scrotal support

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b) Palomo procedure

c) Keetley-Torek procedure

d) Beevan procedure

Question 16:

Which of the following is not a risk factor for developing testicular carcinoma?

a) Undescended testes

b) Klinefleter's syndrome

c) Benzopyrene exposure

d) History of contralateral testicular tumor

Question 17:

Which among the following are germ-cell tumors?

a) 2,3,4,6

b) 1,5,6

c) 1,3,4

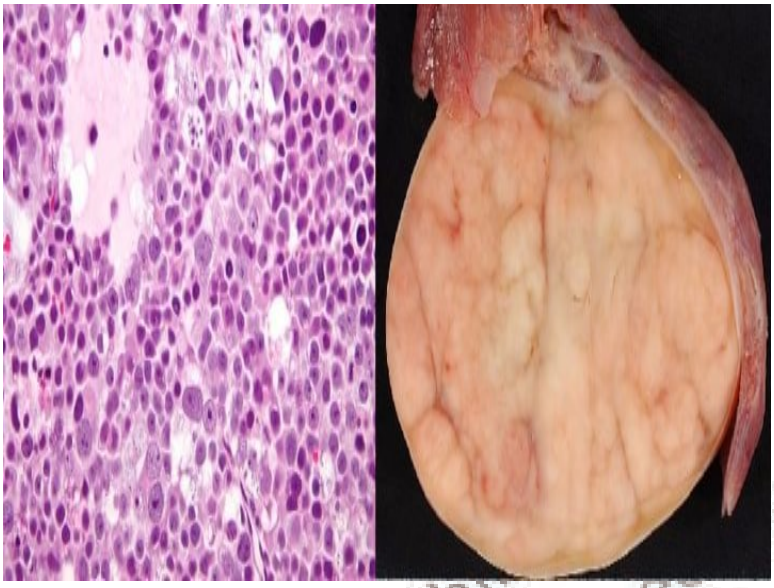
d) 2,3,5,6

Question 18:

A 45-year-old male patient who presented with a scrotal swelling underwent an orchidectomy. The image below shows the histopathology findings. What is your diagnosis?

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a) Seminoma

b) Yolk-sac tumor

c) Embryonal cell carcinoma

d) Teratoma

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Question 19:

Which of the following statements is false regarding testicular tumors?

a) They may present as an abdominal lump.

b) Testicular biopsy is done to diagnose testicular carcinoma.

c) Seminomas metastasize predominantly via the lymphatic system.

d) Elevated tumor markers are found almost exclusively in non-seminomatous germ-cell tumors.

Question 20:

A patient with a left-sided testicular tumor is being evaluated for metastasis. Which group of lymph nodes is most likely to get involved first?

a) Deep inguinal lymph nodes

b) Precaval lymph nodes

c) Preaortic lymph nodes

d) Para-aortic lymph nodes

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Question 21:

A 25-year-old male patient presented with a hard painless testicular lump with a dragging sensation. The blood investigations showed raised AFP levels. Which of the following is least likely to be included, in further management of this case?

a) Orchidectomy via scrotal incision

b) Ultrasonography of the testis

c) CT of the abdomen and pelvis

d) Combination chemotherapy

Question 22:

A patient with Stage I seminoma underwent an orchidectomy 3 months ago. On a follow-up visit, elevated LDH levels were seen. What is the most appropriate line of management?

a) Radiation therapy

b) Platinum-based chemotherapy

c) Bleomycin -Etoposide -cis-Platinum regimen

d) Regular scanning using CT and tumor marker measurement

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Answer Key

Question No.	Correct Option
1	a
2	d
3	a
4	b
5	c
6	c
7	a
8	c
9	b
10	a
11	c
12	c

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13	b
14	b
15	b
16	c
17	d
18	a
19	b
20	d
21	a
22	b

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Detailed Explanations

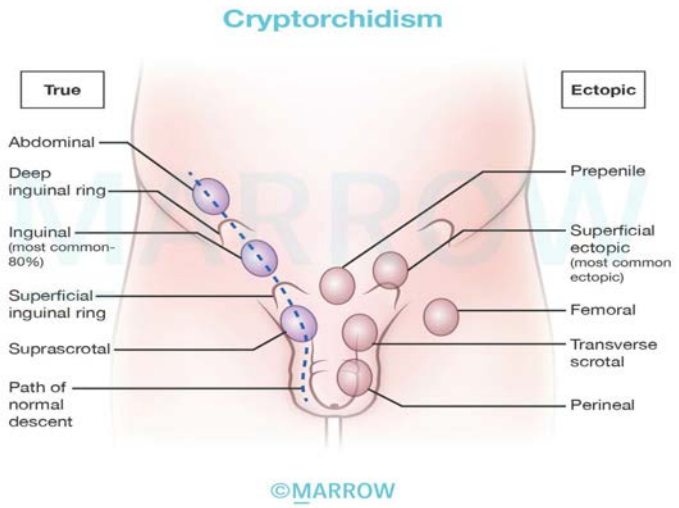
Solution to Question 1:

The most common site of ectopic testes is the superficial inguinal pouch.

Testes develop from the genital ridge in the retroperitoneum at 3 months of intrauterine life. They descend into the scrotum by 9 months of age due to differential abdominal growth, pull of the gubernaculum, and the effect of testosterone.

Cryptorchidism refers to the absence of one or both testes in the scrotal sac. The descent of the testis can be arrested in its usual path of descent (true undescended testis) or can migrate from the usual path of descent (ectopic testis).

The image below shows the possible sites of the testes in cryptorchidism:



A retractile testis can also lie in the inguinal canal and needs to be differentiated between an ectopic testes. It is present in the scrotum and occasionally moves into the inguinal canal.

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An ectopic testis is treated with orchidopexy, while a retractile testis requires no intervention as it resolves spontaneously.

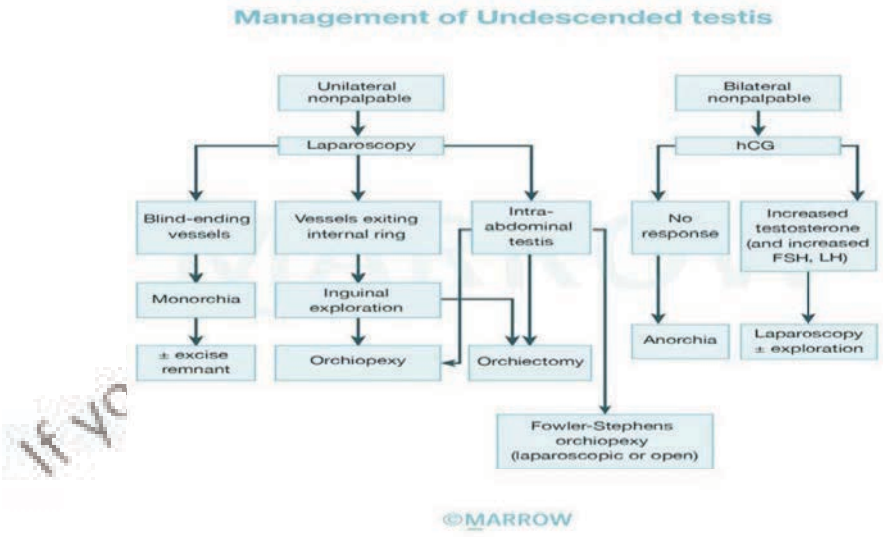
Solution to Question 2:

Orchidopexy is ideally performed before the boy reaches 12 months of age.

Orchidopexy is done before 12 months of age to avoid the following complications:

- Infertility
- Malignancy (Risk may still exist post surgery)
- Hernia
- Testicular torsion
- Infection

The management for undescended testes that are not palpable is:



Solution to Question 3:

The tumor most likely to develop in this patient is seminoma.

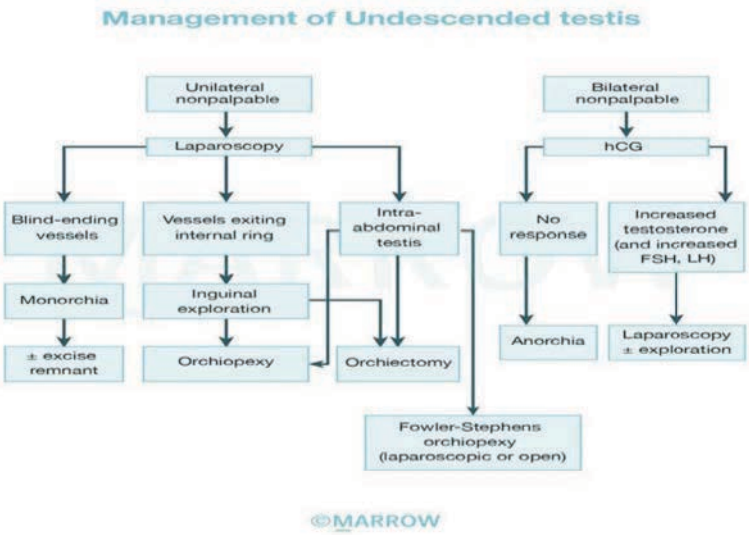
The tumor that develops most commonly in undesceded testes is germ cell tumor in situ or intratubular germ cell tumor. It commonly progresses into seminomas.

In patients with a nonpalpable testicle, diagnostic laparoscopy is performed. If testis is still not visualised, the spermatic cord or testicular artery is traced at the deep inguinal ring to locate it.

If a blind ending spermatic cord is found instead, vanishing testis syndrome (or testicular regression syndrome) is suspected. It is the partial or total absence of testicular tissue often due to an ischemic event in foetal life.

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The testis once found can be delivered into the scrotum, and an orchidopexy is performed.



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Solution to Question 4:

In the first stage of a two-stage Stephens-Fowler approach, the testicular vessels are clipped.

Clipping of the testicular artery promotes neo vasculogenesis along the vas deferens. It does not result in ischemia of the testis due to the presence of collaterals from the cremasteric artery and the artery to the ductus deferens (deferential artery).

Several months later, after collaterals are established, the second stage is performed during which the testis and its new blood supply is mobilized into the scrotum.

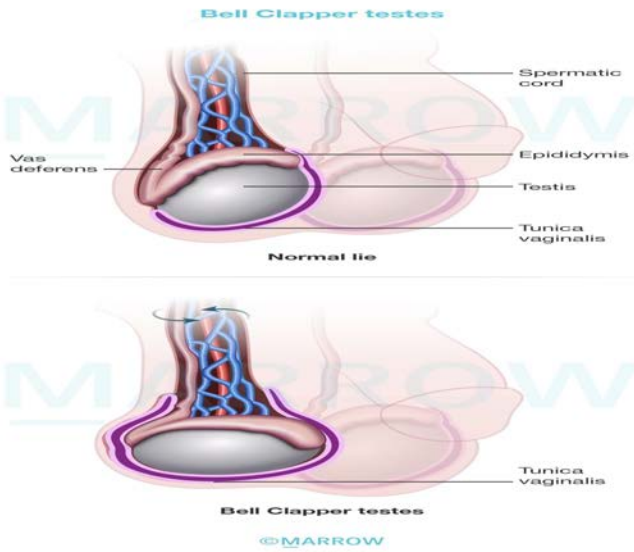
Stephen-Fowler's approach is done when an intra abdominal testes is located too far to reach the scrotum. Alternatively, Silbar's orchiopexy may be done. In this procedure, microvascular anastomosis of the testicular vessels with internal illiac vessels is done after the testis is mobilised to the scrotum.

Solution to Question 5:

High investment of the tunica vaginalis is the most common cause of torsion of testis. It causes the testes to hang within the tunica like a clapper in a bell. This is the most common cause of testicular torsion in adolescents.

Bell clapper testes are typically bilateral. The image below shows the bell-clapper deformity of the testes:

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Other abnormalities that cause torsion of the testes:

• Inversion of the testis: The testis is rotated so that it lies transversely or upside down.

•

Pedicle between epididymis and body of testis: Separation of the epididymis from the body of the testis by a pedicle allows torsion of the testis on the pedicle that connects the testis with the epididymis.

An appendix testis is a small vestigial appendage located on the upper pole of the testis. Twisting of the appendage causes testicular appendix torsion. In it, a classic blue dot sign is seen on the upper pole of the testis. It is seen as a hard tender nodule with a blue discoloration on the superior aspect of the testis. This is a remnant of the Mullerian duct, that regresses on development.

The image below shows the blue dot sign on the testis:



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Solution to Question 6:

The given clinical vignette is suggestive of testicular torsion. In cases of high clinical suspicion, the next best step is to explore surgically.

Clinical features of testicular torsion are painful scrotal swelling, erythema, nausea, and vomiting, testis seems high in the scrotum and the twisted cord can sometimes be palpated.

Signs seen on torsion of the testis are:

• Deming's sign: Spasm of the cremaster muscle due to twisting of the spermatic cord causes the affected testis to be positioned higher than the normal testis.

• Angell's sign: The testis on the normal side lies horizontally because of the mesorchium between the testis and epididymis.

• Cremastic reflex: Absent on the side of the affected testis

Doppler ultrasound scanning can confirm the absence of the blood supply to the affected testis, but the false positives are high and hence it is not routinely recommended.

Manual detorsion of the testes is usually difficult because of acute pain during manipulation. Nonoperative manual detorsion is not a substitute for surgical exploration.

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Solution to Question 7:

In a case of suspected testicular torsion, immediate exploration needs to be done on both the symptomatic as well as the asymptomatic side. After the de-torsion, the adequacy of the blood flow has to be assessed by Doppler.

In testicular torsion, the blood supply to the testicle is compromised due to the twisting of the spermatic cord within the tunica vaginalis, resulting in ischemia of the epididymis and the testis. The patient usually presents with acute onset pain and swelling of the scrotum. On examination, the cremasteric reflex is lost, and the scrotum looks asymmetrical.

Prehn's sign is used to differentiate epididymitis from testicular torsion. Prehn's sign is said to be positive when the pain gets relieved on lifting the testis, and it is seen in epididymo-orchitis.

At the time of surgical exploration, contralateral testes also must be explored and fixed to the dartos fascia in order to prevent possible torsion occurring in this testes.

More than 80% of the testis can be salvaged if surgery is performed within 6 hours. If the testis is found to be necrosed on scrotal exploration, orchidectomy of the necrosed testis and orchidopexy of the contralateral testis is done.

Solution to Question 8:

The clinical scenario is suggestive of acute epididymitis.

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A positive Prehn's sign is used to differentiate epididymis from testicular torsion. A Prehn's sign is said to be positive when the pain gets relieved on lifting the testis. If it persists, it is likely to be testicular torsion.

Chlamydia trachomatis is the most common cause of acute epididymitis in young, sexually active males. In older men(>40yrs) with bladder outflow obstruction, epididymitis results from urinary infection, most commonly due to Escherichia coli.

Acute epididymitis is managed by antibiotics and scrotal support.

Solution to Question 9:

In the given scenario, a firm enlarged epididymis, beading of the vas deferens, and a normal testis on palpation indicate secondary tubercular epididymo-orchitis. The next best step is confirmation with polymerase chain reaction (PCR).

Beading of the vas deferens is due to subepithelial tubercle formation and is specific to genital tuberculosis.

A scrotal USG will reveal an enlarged epididymis but does not have diagnostic value. Chest, kidney, and upper urinary tract imaging may reveal a primary focus.

Tuberculous epididymo-orchitis is usually secondary and resolves once the primary focus is treated. Hence, a course of anti-tubercular therapy must be completed even if there is no evidence of disease elsewhere.

If resolution does not occur within two months, epididymectomy or orchidectomy is advisable.

Solution to Question 10:

The clinical scenario is suggestive of Fournier's gangrene in which the testis is classically spared.

It lies naked following debridement of the gangrenous skin and is tucked subcutaneously into the thigh. It is also called "shameful exposure of the testis."

Fournier's gangrene is a surgical emergency. It is a life-threatening disease, with a mortality of over 40% even with treatment. It is due to a mixed infection of both aerobic and anaerobic bacterial flora.

Concurrent illnesses that diminish the host defense, especially diabetes mellitus and alcoholism, predispose patients to the development of Fournier's gangrene.

It is managed by debridement, wide surgical excision, IV fluids, and antibiotics.

Solution to Question 11:

The scrotal swelling is most likely a hydrocele. Due to the movement of fluid, a fluctuation test is positive.

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Hydrocoele is an accumulation of fluid within the tunica vaginalis. It is brilliantly transilluminating and testes will not be separately palpable. As it arises in the scrotum, it is possible to get above the swelling. It is irreducible and cough impulse is absent.

A USG will show anechoic reflection due to fluid collection.

Solution to Question 12:

A secondary hydrocele is most commonly caused by an acute or chronic epididymo-orchitis. Other causes of secondary hydrocele include torsion of the testis and testicular tumors.

Primary vaginal hydrocele	Secondary vaginal hydrocele
Due to defective absorption o f fluid	Due to increased secretion of fluid
Tense swelling	Lax swelling
Testis not palpable separately	Testis palpable separately
Transillumination positive (cl ear fluid present)	Transillumination negative (t urbid fluid present)

Solution to Question 13:

Lord's plication has a lower risk of hematoma formation as compared to Jaboulay's procedure.

Hydrocele may be managed surgically by various techniques. Lord's plication and Jaboulay's eversion of the sac are most commonly performed.

Jaboulay's eversion of the sac is preferred for large hydroceles. In this method, the tunica vaginalis sac is everted around the testis. Although it has a shorter operative time, the risk of hematoma formation is more.

Congenital hydroceles are managed by a herniotomy.

Solution to Question 14:

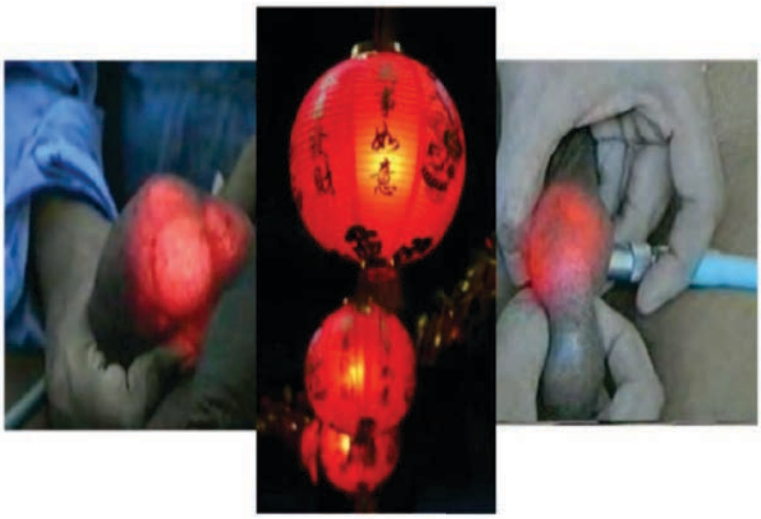
The given clinical scenario of a transilluminant scrotal swelling palpated apart from normal testes is suggestive of an epididymal cyst.

An epididymal cyst is a multilocular cyst formed due to is the cystic degeneration of the epididymis. Multiple cysts formed posterior to the epididymis can feel like a bunch of grapes on palpation. Due to the presence of crystal clear fluid, an epididymal cyst brilliantly transilluminates and has a Chinese lantern appearance.

The image shows the Chinese lantern appearance on transillumination:

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It can be differentiated from a hydrocele, where the testis is not separately palpable.

Option A: Varicoceles present with dragging discomfort in the scrotum on standing and characteristic 'bag of worms' feel on palpation.

Option C: Spermatocele is a unilocular transluminant retention cyst formed at the epididymal head. Due to the presence of spermatozoa, barley-water fluid is seen. Although transilluminant, the cyst does not have a Chinese lantern appearance.

Option D: Chyloceles are formed due to the rupture of lymphatic varix and the discharge of chyle into the hydrocele. Fluid rich in cholesterol is seen and the swelling is not transilluminant.

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Solution to Question 15:

The clinical scenario is suggestive of a varicocele. As this patient is young and infertile, varicocelectomy is indicated and a Palomo procedure may be performed.

Varicocele may present with a dull aching scrotal pain and enlargement. Additionally, patients may have infertility. A bag of worms, which gets prominent on Valsalva's maneuver is palpated due to the engorged pampiniform plexus.

Often, patients may be asymptomatic and do not require treatment.

Left-sided varicocele is more common. Isolated right-sided varicocele should always raise suspicion of renal cell carcinoma.

(Note: Varicoceles occurs on left side more commonly as the left spermatic vein opens at sharp angle to the left renal vein, whereas, on the right side, the right spermatic vein opens into a larger Inferior vena cava and an isolated Right-sided varicocele may indicate a tumour that compresses the venous return in the inferior vena cava)

Treatment of young patients includes surgical ligation of the gonadal vein. It may be achieved through embolectomy or varicocelectomy. Approaches to varicocelectomy are:

• Inguinal (Ivanisevic method)

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• Retroperitoneal (Palomo procedure)

• Natural orifice transluminal endoscopic surgery through the transvesical route

In older patients, NSAIDs and scrotal support are adequate.

Grades of varicocele	
Grade 1	Varicocele only palpable on Valsalva's maneuver
Grade 2	Varicocele palpable without Valsalva's maneuver
Grade 3	Varicocele is seen on inspection of the testis

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Solution to Question 16:

Benzopyrene exposure is not associated with an increased risk of developing testicular cancer but with an increased risk of developing scrotal carcinoma.

Shale oil exposure (a petroleum byproduct) is also associated with an increased incidence of scrotal carcinoma.

Undescended testes, history of contralateral testicular tumor, and Klinefelter's syndrome are known to increase one's risk to develop testicular cancer.

Note: Patients with Klinefelter's syndrome also have an increased risk of developing extragonadal germ cell tumors.

Solution to Question 17:

Germ-cell tumors (90–95%) include seminoma, embryonal cell carcinoma, yolk-sac tumor, teratoma, and choriocarcinoma.

Leydig and Sertoli cell tumors are non-germ-cell tumors.

Solution to Question 18:

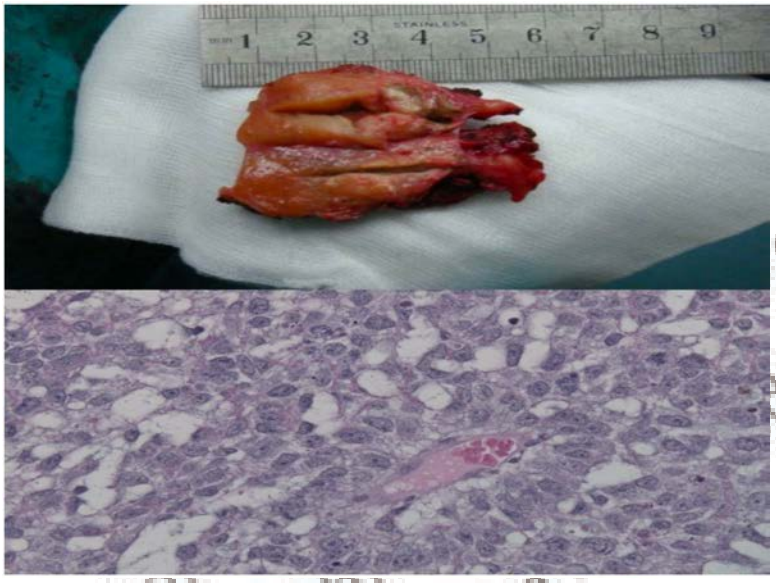
Based on the gross and microscopic appearance of the specimen, the diagnosis is seminoma.

The gross specimen shows a well-circumscribed, pale, gray-white, fleshy, homogenous mass, with a lobulated cut surface, usually devoid of hemorrhage or necrosis. Histopathology shows uniform tumor cells with abundant clear cytoplasm, distinct cell borders, and large central nuclei. There is a sparse lymphocytic infiltrate. Classically, they have a fried egg appearance.

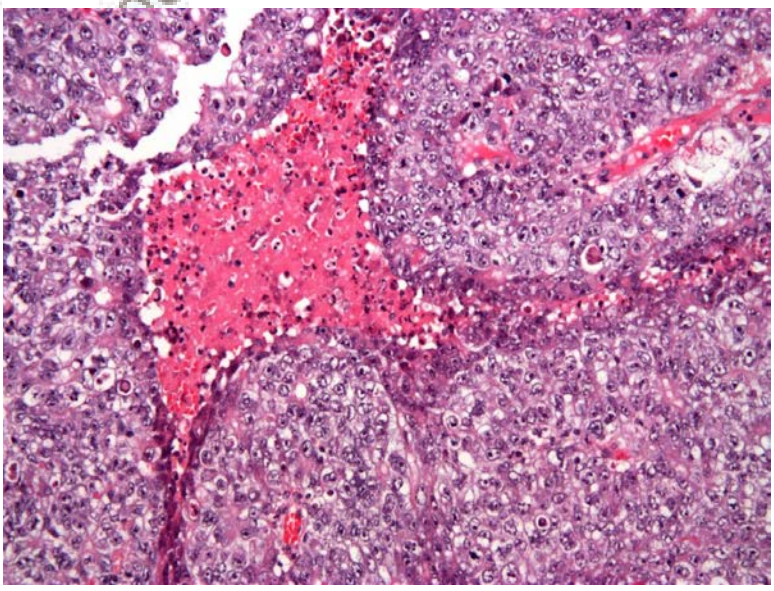
Other options:

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Option B: Yolk-sac tumor has a yellowish-white, mucinous appearance. Histologically, they are typically composed of a lace-like (reticular) network of medium-sized cuboidal, flattened, or spindled cells, which generally show less cytologic atypia than embryonal carcinoma. In approximately 50% of tumors, structures resembling endodermal sinuses (Schiller-Duval bodies) may be seen; these consist of a mesodermal core with a central capillary and a visceral and parietal layer of cells resembling primitive glomeruli.



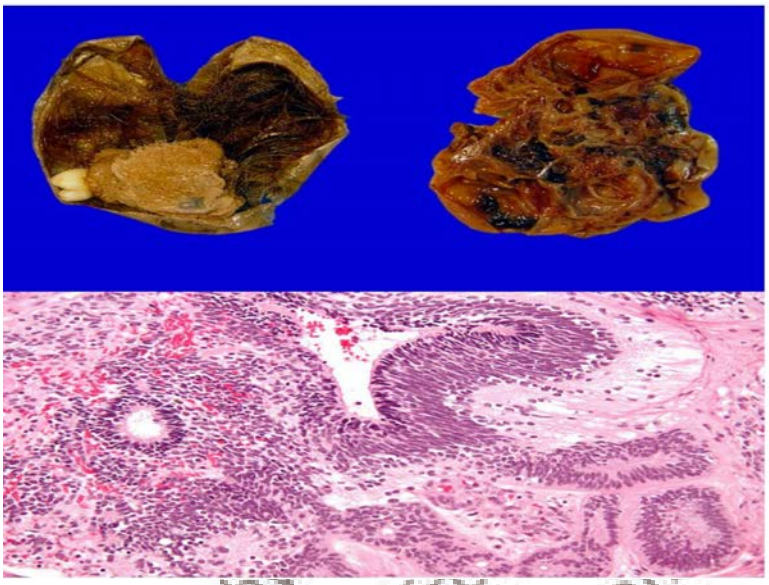
Option C: Embryonal cell carcinoma appears variegated with foci of hemorrhage or necrosis. Histologically, the cells grow in alveolar or tubular patterns, sometimes with papillary folds. More undifferentiated lesions may display sheets of cells with cleft-like spaces. The neoplastic cells have an epithelial appearance, are large and anaplastic, and have hyperchromatic nuclei with prominent nucleoli. The cell borders are usually indistinct, and there is considerable variation in cell and nuclear size and shape (pleomorphism). Mitotic figures and tumor giant cells are frequently seen.



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Option D: Teratomas also have a variegated appearance but have cysts reflecting the multiplicity of tissue types. Histologically, collections of differentiated cells or organoid structures originating in all 3 germ layers can be seen. Elements may be mature (resembling various adult tissues) or immature (sharing histologic features with fetal or embryonic tissue).



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Solution to Question 19:

There is no role of testicular biopsy in the diagnosis of testicular tumors. This is due to the risk of seeding tumor cells onto the scrotal wall.

In testicular tumors, the most common site of lymphatic spread is retroperitoneal lymph nodes which may present as an abdominal lump.

Elevated tumor markers are found almost exclusively in non-seminomatous germ-cell tumors. Few seminomas may have elevated placental alkaline phosphatase (PLAP) or beta-human chorionic gonadotropin (HCG). Lactate dehydrogenase (LDH) can be used as a marker of tumor bulk.

Seminomas are radiosensitive tumors that metastasize via lymphatics. Non-germ-cell tumors arise from Sertoli or Leydig cells and follow a more benign course. Approximately only 10% are malignant.

Solution to Question 20:

The first sites of metastasis in left-sided testicular tumors are the para-aortic lymph nodes.

Testicular tumors metastasize first to the retroperitoneal nodes. Right-sided tumors metastasize primarily to the interaortocaval nodes. Left-sided tumors metastasize primarily to the left para-aortic nodes.

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Deep inguinal lymph nodes receive drainage from the perineum and lower extremity. Inguinal lymph nodes may be involved if the testicular tumor spreads to the skin of the scrotum.

Solution to Question 21:

The clinical scenario is suggestive of a non-seminomatous germ cell tumor (NSGCT) of the testis. Orchidectomy via a scrotal approach is not done due to fear of seeding the tumor in the scrotal skin. Instead, an inguinal approach is used.

Raised AFP levels point towards the diagnosis of non-seminomatous germ cell tumor (NSGCT) of the testis.

Ultrasound of the testis should be done in all suspected cases of testicular tumor. Tumor markers (AFP, hCG, LDH) are measured for the staging of cancer. CT of the chest, abdomen, and pelvis is done to detect metastasis.

Management of testicular tumors		
Stage	Non-seminomatous	Seminomatous
Stage ITumor confined to testis	Orchidectomy and chemotherapy	Orchidectomy and Active SurveillanceIf poor prognostic features* are seen, chemotherapy with a single agent, cisplatin for 1-2 cycles
Stage IINodal disease confined to nodes below the diaphragm	Orchidectomy and chemotherapyRetroperitoneal lymph node dissection for residual disease	Orchidectomy andradiotherapyIf residual lymph node disease is present, chemotherapy
Stage IIINodal disease present above the diaphragm	Orchidectomy,radiotherapy, and chemotherapyIf residual lymph node disease is present, retroperitoneal lymph node dissection is done	
Stage IVMetastasis	Orchidectomy and chemotherapy	
In testicular tumors, the BEP regimen is followed withbleomycin, etoposide, cisplatin.*Poor prognostic factors following orchidectomy are:No decrease or change in tumor marker values or tumor sizePoor follow up		

Solution to Question 22:

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Platinum-based therapy is the primary treatment of stage I seminomas following orchidectomy for patients with poor prognostic factors such as elevated tumor markers. It consists of a cycle of single-agent carboplatin.

Management of testicular tumors		
Stage	Seminomatous	Non-seminomatous
Stage I: Restricted to testis	Orchidectomy and active surveillanceSingle cycle carboplatin*	Orchidectomy and active surveillanceBEP chemotherapy
Stage II: Involving testis and para-aortic lymph node	Orchidectomy and chemotherapy (BEP)If there is a complete response → observe- If residual disease → RPLND or RT**	Orchidectomy and chemotherapy (BEP)If residual lymph node disease is present, RPLND is done
Stage III: Metastasis	Orchidectomy and chemotherapy (BEP)+ RPLND and RT with or without metastatectomy.	Orchidectomy and chemotherapy (BEP) + RPLND with or without metastasectomy
In testicular tumors, the BEP regimen is followed withbleomycin, etoposide, cisplatin.*Poor prognostic factors following orchidectomy are:No decrease or change in tumor marker values or tumor sizePoor follow up**RPLND: Retroperitoneal Lymph node Dissection; RT: Radiotherapy		

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Head Injury

Question 1:

A patient is brought to the casualty following a head injury. He is unconscious and is not able to open his eyes. He also has no verbal or motor responses. What will be his GCS score?

a) 0

b) 1

c) 3

d) 2

Question 2:

A patient is confused, opens his eyes on painful stimuli, flexes one limb on painful stimuli, and can localize the stimulus with the other limb. His Glasgow Coma Score is _____

a) 8

b) 9

c) 10

d) 11

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Question 3:

An 18-month-old child is brought to the ER after sustaining a head injury from a fall. On examination, she moans to pain. What is her verbal response score on the GCS scale?

a) 4

b) 2

c) 3

d) 1

Question 4:

After assessing a patient with a traumatic head injury, a score of 3 was given for motor response. According to the Glasgow Coma Scale, what does the score indicate?

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a) Decorticate posture

b) Decerebrate posture

c) Withdrawal to pain

d) Extension

Question 5:

A 35-year-old woman is brought to the casualty ward with a history of road traffic accident and head trauma. She opens her eyes to pain, moans, can localize her limb towards the pain stimulus on the left hand and away from the pain stimulus on the right hand and both the legs are in extended posture. Calculate her GCS.

a) 11

b) 9

c) 7

d) 3

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Question 6:

Which of the following head injury patients need not undergo head CT at this point in time?

a) An RTA victim with GCS score of 12

b) A patient with an episode of vomiting

c) A child with an episode of seizure post-trauma

d) A biker with suspected skull fracture

Question 7:

A 26-year-old batsman was rushed to the ER when he fell unconscious after a cricket ball hit his head. He regained consciousness later but started to deteriorate rapidly. A plain CT of the patient is shown below. What is the diagnosis?

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a) Extradural hematoma

b) Subdural hematoma

c) Subarachnoid hemorrhage

d) Intraparenchymal bleed

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Question 8:

An alcoholic patient was brought to the casualty after he was found lying near a ditch. He had a laceration over his scalp. His GCS on arrival was 13 and after a few minutes, it dropped to 10. A plain CT scan was done and given below. What will be your diagnosis?



a) Extradural hematoma

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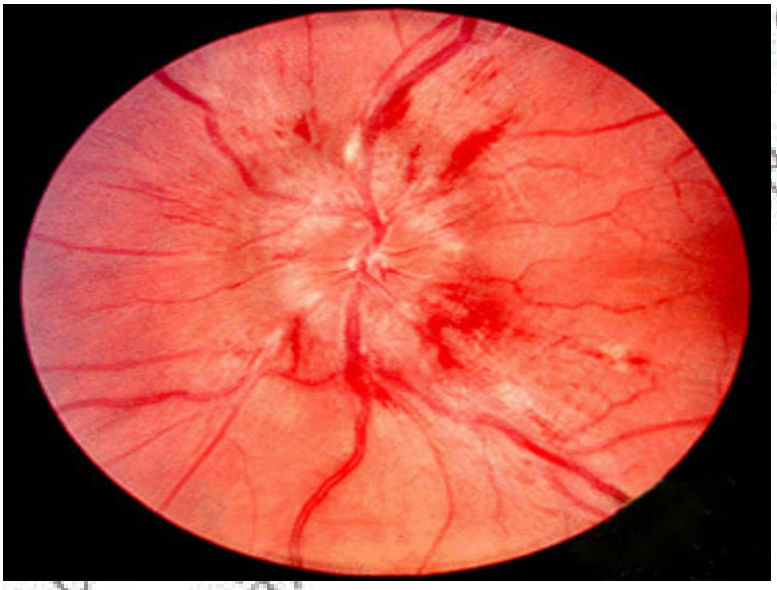
b) Subdural hematoma

c) Acute on chronic subdural hemorrhage

d) Subarachnoid hemorrhage

Question 9:

A 70-year-old man presents with headache, vomiting, and altered sensorium for the past 6 hours. His wife reports him having a fall in the bathroom 4 weeks ago. On evaluation, the following funduscopic findings are noted. What will be your provisional diagnosis?



a) Extradural hematoma

b) Chronic subdural hematoma

c) Subacute subdural hematoma

d) Intraventricular hemorrhage

Question 10:

A 50-year-old man presented with a sudden onset severe headache and vomiting. His medical record revealed he has autosomal dominant polycystic kidney disease. On examination, pulse - 100 bpm, BP - 190/110 mm Hg, marked neck rigidity was present and no neurological deficits were noted. What could be the most likely cause of the symptoms?

a) Acute subdural hematoma

b) Chronic subdural hematoma

c) Intraparenchymal bleed

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d) Subarachnoid hemorrhage

Question 11:

Which of the following statements is false regarding delayed ischemic neurological deficit?

a) It is seen in subarachnoid haemorrhage

b) It usually occurs after 14 days

c) It is attributed to cerebral vasospasm

d) Nimodipine is used for prophylaxis

Question 12:

A 26-year-old formula one driver was rushed to the casualty, unconscious, following a heavy crash from a side-impact collision during a racing event. The CT scan was normal. However, MRI showed multiple small hemorrhages, especially in the corpus callosum and the dorsolateral midbrain, with no midline shift. What is the most likely diagnosis?

a) Diffuse ischemic injury

b) Subdural hematoma

c) Diffuse axonal injury

d) Subarachnoid Hemorrhage

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Question 13:

According to the Glasgow Outcome Score, what score will you give to a patient who is in a persistent vegetative state following a head injury?

a) 5

b) 3

c) 2

d) 1

Question 14:

A patient is recovering from a spinal shock after a fall from height. Which of the following is the first reflex that you will expect to reappear in him?

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a) Cremasteric reflex

b) Bulbocavernosus reflex

c) Knee jerk

d) Ankle reflex

Question 15:

Which of the following is not used for managing a patient with raised intracranial pressure following a head injury?

a) Reverse trendelenburg position

b) IV Dexamethasone

c) Sedation

d) Mannitol infusion

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Question 16:

In patients with head trauma, which of the following is least likely to cause secondary brain injuries?

a) Hypoxia

b) Hypotension

c) Hypocapnea

d) Hyperglycemia

Question 17:

A patient with a head injury presents to the casualty with rapidly deteriorating sensorium and progressive dilatation and fixation of the pupil. Neurosurgeon and CT scan are not available. The duty surgeon decides to make a burr hole. What will be the management plan?

a) Make a hole in the temporal region, contralateral to the side of pupillary dilatation.

b) Make a hole in the midline, if both pupils are equal or it is not known which side dilated first.

c) If no localizing sign is found, make a hole in the left temporal region.

d) Refer to higher center if both pupils are equal or it is not known which side dilated first

Question 18:

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Which of the following is true regarding post-traumatic seizures in patients with head injury?

a) Use of antiepileptics in late post-traumatic seizure patients is recommended

b) Prolonged seizures cause primary brain injury post head trauma

c) Occurrence of seizures after 2 weeks of head injury is called late post-traumatic seizures

d) Initiation of antiepileptics in early post traumatic seizure patients reduces the likelihood of developing post-traumatic epilepsy

Question 19:

Which of the following is true regarding basilar skull fractures?

a) Racoon eyes is one of the earliest signs to develop

b) Battle sign is associated with posterior cranial fossa fractures

c) CSF leaks should be promptly managed by surgical intervention

d) Noninvasive positive pressure ventilation should be avoided

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Question 20:

A man is brought to the ER with a depressed skull fracture and a clean overlying scalp laceration. There are no focal neurological deficits. CT scan revealed that the degree of depression was less than the thickness of the adjacent skull bone. What is the next step in the management of the patient?

a) Surgically elevate the depressed segment and close the laceration with sutures

b) Provide prophylactic antibiotics and discharge the patient

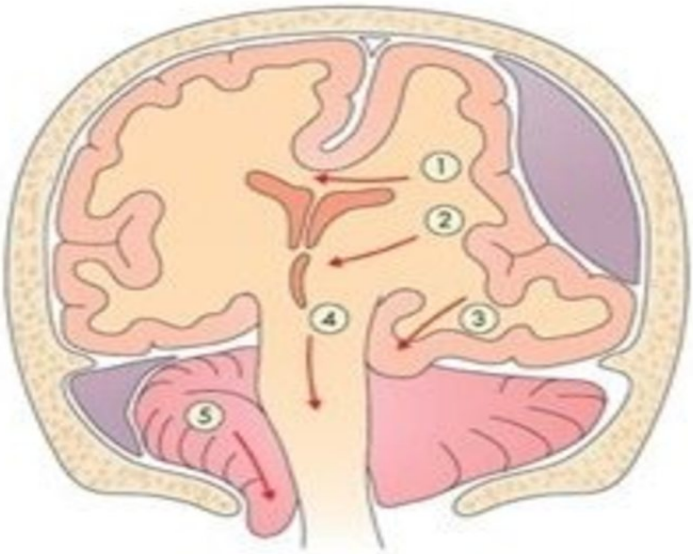
c) Close the laceration with suture

d) Apply dressing and discharge the patient

Question 21:

Identify the type of herniation labelled as '1' in the given image.

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a) Midline shift herniation

b) Central herniation

c) Subfalcine herniation

d) Uncal herniation

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Question 22:

A 25-year-old football player had a fall followed by one episode of vomiting, a day before his final match. When brought to the casualty, he was awake and conscious but could not recall events after the fall. Which of the following is the most appropriate next step in the management of this patient?

a) Obtain NCCT of Brain

b) Discharge home and advice adequate rest before playing the final match

c) Observe for 6 hours in the ED and refrain from playing for one week

d) Admit to intensive care for intracranial pressure monitoring

Answer Key

Question No.	Correct Option
1	c
2	d

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3	b
4	a
5	b
6	b
7	a
8	b
9	b
10	d
11	b
12	c
13	c
14	b
15	b
16	c
17	c
18	a
19	d
20	c
21	c
22	c

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Detailed Explanations

Solution to Question 1:

The GCS score in this patient will be 3. The lowest possible Glasgow Coma Scale (GCS) score is 3 and never zero.

Solution to Question 2:

The GCS in this patient is 11.

• The score for verbal response: 4, because he is confused.

• The score for eye-opening: 2, because his eyes are opening to only painful stimuli.

• The score for best motor response: 5, because he can localize pain.

Therefore, the GCS score is (4+2+5) = 11.

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Solution to Question 3:

The verbal response of "moans to pain" in a child <2 years of age is 2.

Verbal response:

Motor response:

Eye-opening: Same in infants and children as in adults

Adult	Pediatric	Score
Oriented	Age-appropriate vocalization, smile	5
Confused, Disoriented	Cries, irritable	4
Inappropriate words	Cries to pain	3
Incomprehensible sounds	Moans to pain	2
None	1	

Adult	Pediatric	Score
Obeys commands	Moves spontaneously and purposefully	6
Localizes painful stimulus	Withdraws to touch	5
Withdraws in response to pain	4	
Decorticate posturing (abnormal flexion) in response to pain	3	
Decerebrate posturing (abnormal extension) in response to pain	2	
No response	1	

Eyes Opening	Score
Spontaneously	4
To verbal command	3
To painful stimulus	2
Do not open	1
Non-testable	NT

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Solution to Question 4:

Motor response of 3 indicates decorticate posture or abnormal flexion to pain stimulus.

Solution to Question 5:

The GCS (Glasgow Coma Scale) of this patient is E2V2M5, which comes to a total score of 9.

• E2 - Eye opens to pain

• V2 - Moans

• M5 - Localizes to pain on the left hand (the score represents the best performance elicited, which would be localized towards the pain stimulus)

Solution to Question 6:

A single episode of vomiting after a head injury is not an indication for immediate CT brain. However, more than one episode mandates a scan.

Solution to Question 7:

The presence of lucid interval in this patient and the CT image are suggestive of extradural hematoma. The above CT scan shows a large extradural hematoma (hyperdense biconvex/lentiform shape) with a mass effect.

Extradural hemorrhage (EDH) is the accumulation of blood between the skull and the dura. It usually results from arterial disruption, especially of the middle meningeal artery. It lies behind the pterion, which is the thinnest part of the skull.

In EDH, the patient is initially unconscious from the concussive aspect of the head trauma. The patient then awakens and has a “lucid interval,” while the hematoma sub-clinically expands. As the volume of the hematoma grows, intracranial pressure (ICP) increases, and the patient rapidly becomes lethargic and herniates.

Uncal herniation from an EDH classically causes ipsilateral third nerve palsy and contralateral hemiparesis.

Solution to Question 8:

The given clinical scenario and the plain CT scan showing a concavo-convex shaped hematoma on the left side with a midline shift to the right is suggestive of subdural hematoma (SDH).

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An acute SDH is the result of the accumulation of blood between the arachnoid membrane and the dura. It is usually due to the rupture of bridging veins running from the cerebral cortex to the dural sinuses.

The level of consciousness is usually impaired at presentation and may deteriorate further as the hematoma expands.

Elderly and alcoholic patients are at a higher risk of acute SDH formation after head trauma due to brain atrophy.

Open craniotomy for the evacuation of acute SDH is indicated for the following:

• Thickness >1 cm

• Midline shift >5 mm

• Glasgow Coma Scale (GCS) drops by two or more points from the time of injury to hospitalization.

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Solution to Question 9:

The given clinical scenario and fundus examination are most probably suggestive of chronic subdural hematoma. The fundoscopic image shows dilated veins with a blurred disc margin which is suggestive of papilledema.

Chronic SDH is a collection of blood breakdown products that are at least 2 to 3 weeks old. It occurs in patients without a clear history of head trauma, as they may arise from a minor head injury. Alcoholics, the elderly, and patients on anticoagulation are at higher risk for developing chronic SDH than others.

Patients may present with headaches, seizures, confusion, contralateral hemiparesis, or coma.

A chronic SDH >1 cm or any symptomatic SDH should be surgically drained.

Nomenclature	Time
Acute SDH	<3 days
Subacute SDH	4–21 days
Chronic SDH	> 21 days

Solution to Question 10:

The given clinical scenario is suggestive of subarachnoid hemorrhage (SAH) due to the rupture of a berry aneurysm. It is an extrarenal manifestation of autosomal dominant polycystic kidney disease.

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Clinical features of SAH:

• Sudden-onset severe headache (thunderclap headache)

• Rapid onset vomiting

• Confusion or a lowered level of consciousness

• Seizures

• Meningitic features of neck stiffness and photophobia often develop over hours.

The most common cause is trauma and is managed conservatively. The second most common cause is a rupture of a berry aneurysm.

CT scan is the investigation of choice. A hyperattenuating material is seen filling the subarachnoid space. Most commonly this is apparent around the circle of Willis, on account of the majority of berry aneurysms occurring in this region.



A lumbar puncture should be performed if the CT scan fails to establish the diagnosis of SAH. It will show xanthochromic CSF.

Delayed ischemic neurological deficit (DIND) is attributed to vasospasm of the cerebral vasculature typically developing 3–10 days following ictus. It is the main cause of a poor outcome.

Management:

• Endovascular treatment ("coiling") is generally preferred over craniotomy and clipping for aneurysms amenable to this approach.

• The combination of induced hypertension, hypervolemia, and hemodilution (Triple-H therapy) is often utilized to prevent and treat cerebral vasospasm after aneurysmal subarachnoid hemorrhage (SAH).

Note: The combination of subarachnoid hemorrhage and vitreous hemorrhage (subhyaloid) is known as Terson syndrome.

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Solution to Question 11:

Delayed ischemic neurological deficit (DIND) usually occurs between 3 and 10 days after the SAH.

It is a delayed complication of subarachnoid hemorrhage characterized by the fluctuating decline in consciousness and appearance of neurological deficits. It is attributed to ischemia resulting from reactive cerebral vasospasm. Patients with a larger blood load (in the subarachnoid space) are at higher risk of vasospasm.

Medical management strategies aim to minimize secondary brain injury, through avoidance of hypoxia and hypotension and control of ICP.

The incidence of DIND can be lowered by prophylaxis with nimodipine (60 mg, 4 hourly) and hypervolemia (8 hourly normal saline).

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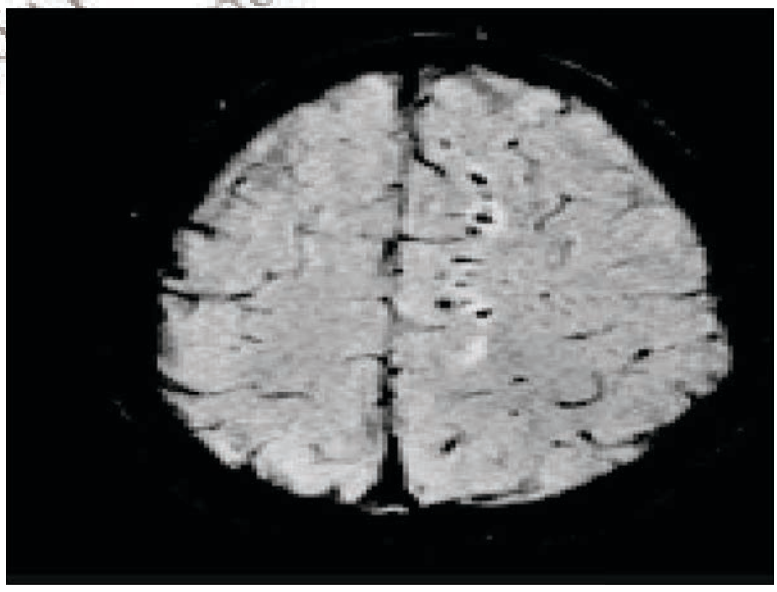
Solution to Question 12:

The given clinical scenario with a normal CT and MRI showing evidence of hemorrhages in the corpus callosum and midbrain is probably due to a diffuse axonal injury.

A diffuse axonal injury is a form of primary brain injury seen in high-energy accidents. It is caused by damage to axons throughout the brain due to rotational acceleration and then deceleration. Axons may be completely disrupted and then retract, forming axon balls.

Small hemorrhages can be seen in more severe cases, especially on MRI (investigation of choice). Hemorrhage is classically seen in the corpus callosum and the dorsolateral midbrain. The prognosis is very poor.

MRI showing multiple hypointense punctate foci within the subcortical and deep white matter within the corpus callosum is characteristic of diffuse axonal injury.



Solution to Question 13:

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A persistent vegetative state is given a score of 2, according to the Glasgow Outcome Score.

The Glasgow Outcome Scale (GOS) is different from the Glasgow Coma Scale (GCS), and it is used to quantify the degree of recovery achieved after a head injury, especially for research purposes.

The scoring system is as follows:

Patient condition	Score
Good recovery	5
Moderate disability	4
Severe disability	3
Persistent vegetative state	2
Dead	1

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Solution to Question 14:

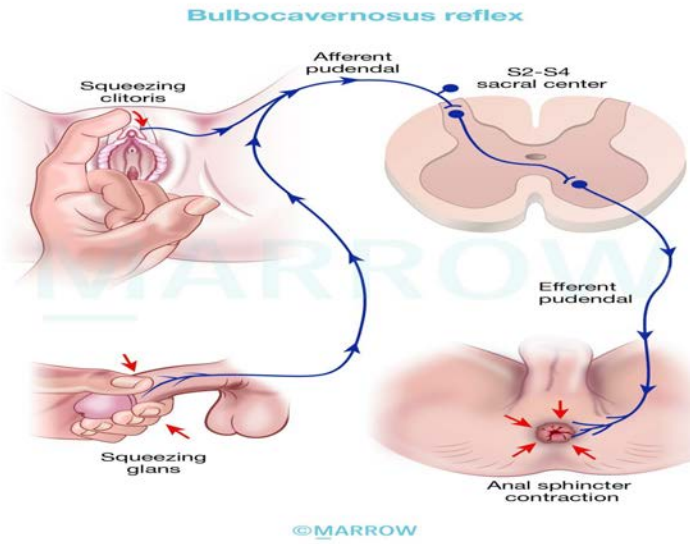
Bulbocavernosus reflex is the first reflex to return after the spinal shock has resolved.

It is elicited by squeezing the glans penis in males and applying pressure to the clitoris or pulling the Foleys catheter in females. Any of these will lead to anal sphincter contraction.

Spinal shock is a condition of transient physiologic reflex depression of spinal cord function (motor, sensory, tone, reflexes) below the level of injury. It usually results from a high-impact, direct trauma to the spinal cord. When the level of injury is above T6, it can result in hemodynamic changes such as hypotension and bradycardia (due to loss of sympathetic tone and unopposed parasympathetic function).

The resolution of spinal shock occurs over a period of days to months, when the areflexia slowly transitions to hyperreflexia and spasticity. Reflexes return sequentially rather than simultaneously. The resolution of the somatic component of spinal shock is classically signaled by the return of the bulbocavernosus reflex, a polysynaptic cutaneous spinal reflex (mediated by the conus medullaris) which is then followed by monosynaptic deep tendon reflexes (e.g. ankle jerk).

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Solution to Question 15:

Steroids are not used in severe head injury, since they are associated with increased mortality.

Initial management of raised intracranial pressure (ICP):

- Airway protection
- Positioning the head up 20–30° (reverse Trendelenburg positioning)
- A bolus of mannitol up to 1 g/kg for free water diuresis (the effect is delayed by 20 min)
- Hypertonic saline (3% or 5%)
- Maintaining fluid and electrolyte balance
- Seizure control
- Sedation using a combination of opiates and barbiturates
- Ventriculostomy and/or craniectomy may be needed for definitive decompression.

ICP normally varies between 4 and 14 mmHg. Sustained ICP levels above 25 mmHg can injure the brain. The goal of therapy in raised ICP is to maintain the ICP 20 - 25 mmHg.

Note: Cerebellar tonsillar herniation through the foramen magnum compresses medullary vasomotor and respiratory centers, classically producing Cushing's triad. It is comprised of:

- Bradycardia
- Raised blood pressure
- Irregular respirations.

Solution to Question 16:

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Hypercapnea (and not hypocapnea) is a cause of secondary brain injury.

It is essential to avoid hypercapnia in patients with head injury since it will raise intracranial pressure (ICP). While hyperventilation is an effective way of managing acute intracranial hypertension, it should be remembered that it can produce a dangerous decrease in cerebral blood flow, especially if cerebral perfusion pressure is low.

Primary brain injury (focal and diffuse) results from mechanical injury at the time of the trauma. Secondary brain injury is caused by the physiologic responses to the initial injury. This is thought to involve a cascade of events, with edema and hematomas leading to increased intracranial pressure, which leads to compression and deformation of surrounding brain tissue and further damage.

Causes of secondary brain injury:

- Hypoxia
- Hypotension
- Raised ICP >20 mmHg
- Low cerebral perfusion pressure
- Hypercapnea
- Hyperthermia
- Seizures
- Metabolic disturbance (hyperglycemia)

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Solution to Question 17:

In the given situation, no localizing sign is found and it is not known which side dilated first. So, the best choice would be to do a burr hole in the dominant hemisphere (most commonly, the left temporal region).



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Solution to Question 18:

The use of antiepileptics in late post-traumatic seizure (PTS) patients is recommended.

Post-traumatic seizures (PTS) are seizures that result from traumatic brain injury (TBI). They are classified into early and late. Early PTS occurs within 1 week and late PTS occurs after 1 week of trauma (Option C).

Early PTS are acute symptomatic events, attributed to a direct reaction to injury and hemorrhage. Risk factors for early PTS are:

• Younger age (especially <5 years)

• Moderate to severe head injury (measured by GCS)

• Acute intracerebral hematoma

• Subdural / Subarachnoid hemorrhage

• Depressed skull fractures

• Diffuse cerebral edema

• History of alcohol abuse

• Penetrating head injury

Late PTS usually occurs due to underlying permanent structural and physiologic changes within the brain. Patients with late PTS may develop post-traumatic epilepsy (PTE). It refers to recurrent and unprovoked PTS that occur at least 1 week after TBI. Risk factors for PTE are:

• Early PTS

• Severe head injury

• Older age (especially >65 years)

• Focal neurological deficit

• Intracranial hemorrhage

• Intracranial infection

• Abnormalities on EEG

• Alcohol-related head injury

Prolonged seizures (30 to 60 minutes) can cause secondary brain injury, not primary (Option B). Hence, it is imperative to control acute seizures as soon as possible.

The initiation of antiepileptics in early PTS patients is to prevent damage due to seizures themselves. It does not reduce the likelihood of developing PTE (Option D). For patients who develop late PTS, because of the high risk of seizure recurrence after the first episode of late PTS, the use of antiepileptic medication is recommended even after a single late seizure episode. The long-term sequelae of head injury are headache, raised ICP, impaired short-term memory, lack of concentration, emotional disinhibition, and depression.

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Prophylaxis for PTS is indicated in patients at risk of early PTS, for 7 days and is stopped without tapering the dose if no seizures have occurred during this duration. Prophylaxis is not recommended for late PTS.

Solution to Question 19:

Noninvasive positive pressure ventilation should be avoided in patients with basilar skull fractures due to the risk of pneumocephalus.

Signs in basilar skull fractures:

• Hemotympanum: Pooling of blood behind the tympanic membrane, associated with fracture of the temporal bone. It is one of the earliest signs of basilar fracture.

• Periorbital ecchymosis (raccoon eyes): Pooling of blood surrounding the eyes, associated with fractures of the anterior cranial fossa.

• Retroauricular or mastoid ecchymosis (Battle sign): Pooled blood behind the ears in the mastoid region is associated with fractures to the middle cranial fossa.

• CSF rhinorrhea or otorrhea: “Halo” sign, a double-ring pattern described with CSF-containing bloody fluid from the ear or nose, when dripped onto paper or linen.

Battle sign and raccoon eyes are both typically not present during the initial evaluation and are delayed by 6 hrs up to 3 days after head injury.

CSF leaks may be delayed hours to days after the initial trauma. Fluid suspicious for CSF is confirmed by testing for β2 transferrin. Most CSF leaks are conservatively managed. Persistent leaks >7 days have a heightened risk of meningitis and are often surgically repaired.

Nasopharyngeal airways and nasogastric tube insertion are relatively contraindicated in basilar skull fractures due to the risk for intracranial placement. NIPPV is avoided due to the risk for pneumocephalus.

The image below shows the 'battle' sign.



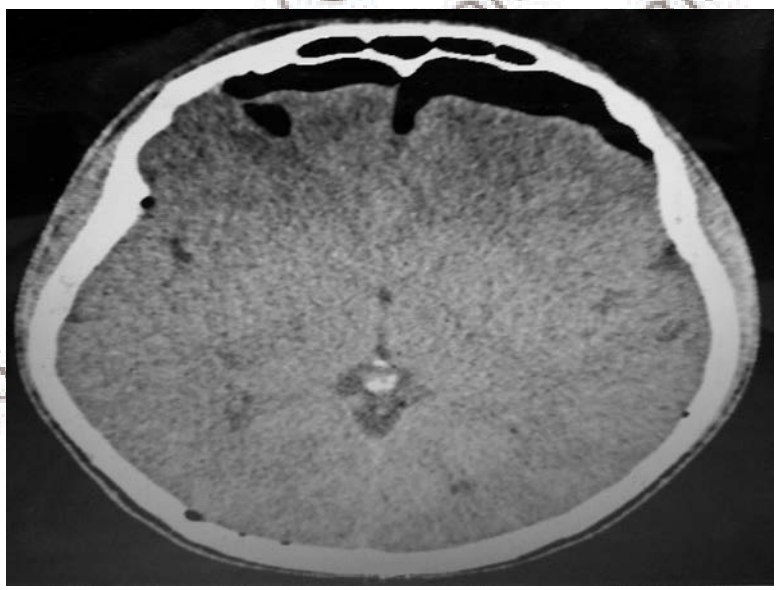
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The image below shows 'racoon' eyes.



The image below shows pneumocephalus.



Solution to Question 20:

In the given scenario, the next step is to close the laceration with suture.

The management of the depressed skull fractures:

• The first step is to order a CT scan to know the degree of depression and to exclude the presence of an intracranial hematoma or contusion.

• The depressed fracture is elevated and managed as an open fracture (surgery) if:

• The degree of depression is greater than the thickness of the adjacent skull

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• The wound is are open and grossly contaminated

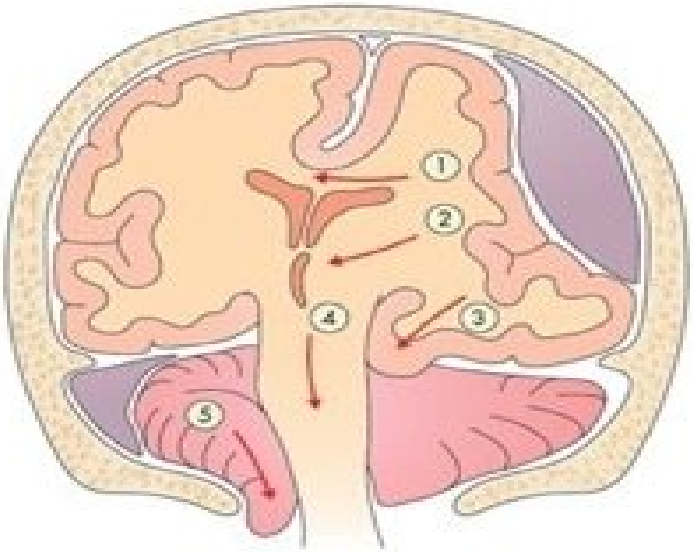
• There are focal neurological deficits

• Less severe depressed fractures are managed by the closure of the overlying scalp laceration, if present.

Solution to Question 21:

The type herniation labelled as '1' in the given image shows herniation of the cingulate gyrus under the falx cerebri, which is known as subfalcine herniation.

Image: Sites of brain herniation



• Subfalcine herniation: herniation of the cingulate gyrus under the falx cerebri

• Herniation with midline shift

• Uncal herniation (uncus is part of temporal lobe)-can compress the ipsilateral third nerve

• Central herniation

• Tonsillar herniation (part of the cerebellum)

Site of herniation	Structures involved	Presenting symptoms
Subfalcine	Cingulate gyrusPericallosal arteries	Leg weakness
Uncal (lateral)	Oculomotor nerveCerebral pedunclePosterior cerebral artery	PtosisIpsilateral mydriasisContralateral hemiparesisDecreased consciousness
Tectal (posterior)	Superior colliculi	Bilateral ptosisUpward gaze paralysis

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Site of herniation	Structures involved	Presenting symptoms
Axial (central)	Perforating branches from basilar arteryMidbrain, pons, medullaReticular formation	Decreased consciousnessImpaired eye movementCushing's triad (hypertension, bradycardia, respiratory irregularity/apnea)
Tonsillar	Medulla	Cushing's triad

Solution to Question 22:

The given history of fall and anterograde amnesia with no focal neurologic deficits points towards the diagnosis of concussion. Observation followed by a gradual return to play is the current recommendation for a concussion.

It is defined as an alteration of consciousness as a result of closed head injury. It is the most common type of traumatic brain injury, which can result from vehicle accidents, falls, sports injuries, etc.

Clinical features of concussion include:

• Anterograde amnesia/post-traumatic amnesia - a hallmark of a concussion. In this type of amnesia, the events following the injury cannot be recalled.

• Confusion

• Headache

• Dizziness

• Nausea

• Vomiting

Observation in the emergency department is essential following the clinical exam to look for alterations in mental status or focal neurological signs. The presence of either of which may signal more serious underlying pathology (e.g., intracranial bleeding).

Following discharge, the patients are advised to not return to contact sports e.g., football, boxing, etc. which carries the risk of further injury, for at least a week. Then, there should be a gradual, stepwise increase in physical activity.

Option A: There are no focal neurological deficits to warrant an NCCT of the brain.

Option B: Immediate discharge and return to intense physical activity following mild TBI are inappropriate. Because those who are symptomatic after a head injury, are vulnerable to a repeat impact. Due to disturbed cerebral autoregulation, even a minor second injury may trigger a form of malignant cerebral edema refractory to treatment.

Option D: Admission to the intensive care unit for intracranial pressure monitoring would be appropriate in patients with severe TBI, for which elevated intracranial pressure is a serious concern due to brain edema and/or bleeding. Severe TBI is characterized by a GCS ≤ 8. Here the patient has a GCS of >14.

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Oral Cavity & Salivary glands

Question 1:

In patients with confirmed sialolithiasis, what is the most common location of stone formation?

a) Parotid gland

b) Minor salivary glands

c) Submandibular gland

d) Sublingual gland

Question 2:

Which of the following is true regarding management considerations in a patient with submandibular gland stones?

a) Surgical gland excision is the treatment of choice if patient is unresponsive to conservative management

b) Associated chronic sialadenitis is a contraindication for sialendoscopy

c) Conventional radiography is mostly useless as more than 80% of submandibular stones are radiolucent

d) Stones proximal to the lingual nerve can be removed via an intra-oral approach

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Question 3:

A 56-year-old man presented with complaints of recurrent bilateral painless swelling over the parotid glands. FNAC done showed acinar cell hypertrophy without any inflammatory signs. All of the following are associated with this condition except?

a) Diabetes mellitus

b) Alcoholism

c) Bulimia nervosa

d) Hyperthyroidism

Question 4:

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A 40-year-old man on routine dental checkup was found to have the following finding on orthopantomogram. What is the reason for the finding marked with the arrow?



a) Benign tumor of alveolus

b) Submandibular gland cyst

c) Ectopic salivary tissue

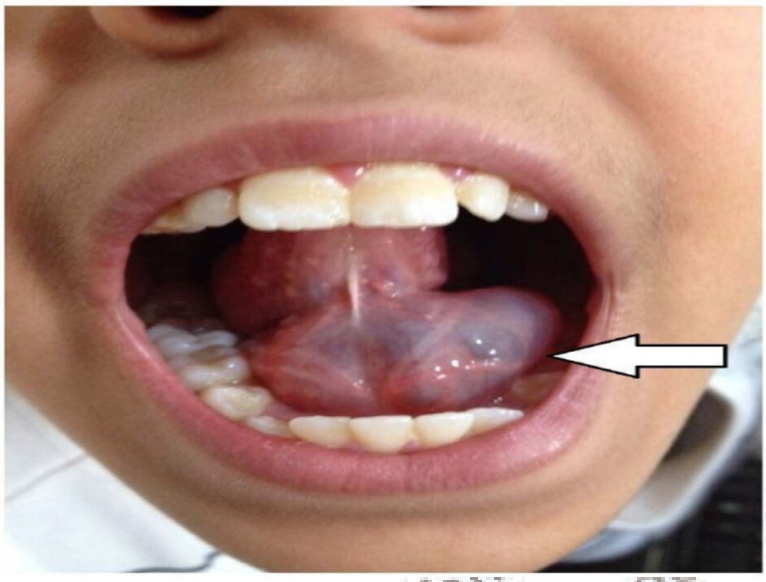
d) Dentigerous cysts

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Question 5:

A 5 year-old-boy was brought to the OPD by his parents with a painless, soft, translucent swelling under the tongue. On examination, the swelling is as seen below. Which of the following statements best describe his condition?

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a) Mucous retention cyst from a minor salivary gland

b) Mucous extravasation cyst from sublingual gland

c) Mucous extravasation cyst from a minor salivary gland

d) Mucous retention cyst from sublingual gland

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Question 6:

Which of the following is true regarding salivary gland tumors?

a) 90% of the minor salivary gland tumors are malignant

b) The submandibular gland is the most common site for salivary tumors

c) Adenoid cystic carcinoma is the most common malignant tumor of the salivary gland

d) A salivary gland tumor with perineural invasion is mucoepidermoid carcinoma

Question 7:

A man presents with a slowly progressive swelling over the past 1 and 1/2 years. On examination, it has a variable consistency and appears as shown in the image. What is the probable cause?

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a) Adamantinoma

b) Dermoid cyst

c) Pleomorphic adenoma

d) Sebaceous cyst

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Question 8:

A 45-year-old woman presented with painless swelling in front of the left ear for the past 2 years. On examination, her left earlobe was lifted and the curtain sign was positive. Which of the following is false about the condition?

a) Treatment of choice is total radical parotidectomy

b) Investigation of choice is FNAC

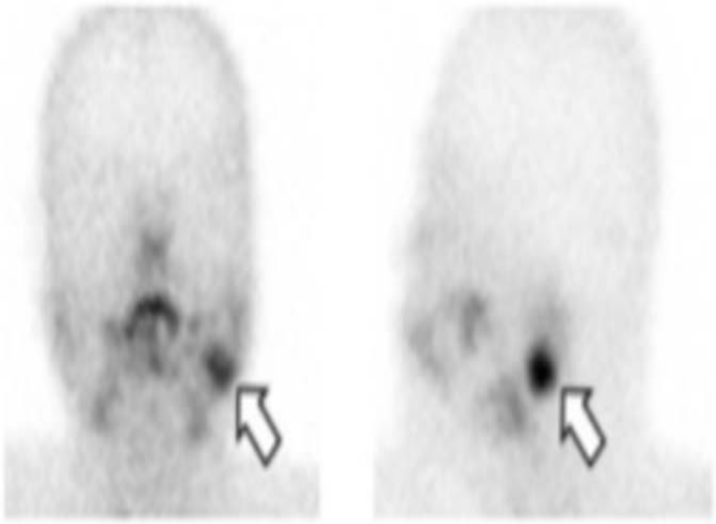
c) Open biopsy is contraindicated

d) Malignant form shows LMN facial palsy

Question 9:

Technetium-99m pertechnetate scintigraphy done for a patient with a chronic painless facial swelling is shown below. Which of the following statements is false regarding this tumor?

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a) This tumor has no malignant potential

b) Superficial parotidectomy is the treatment of choice

c) Histology shows a double layer of epithelial cells with dense lymphoid stroma

d) It is the most common unilateral benign tumor of the parotid gland

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Question 10:

Match the following

a) 1-b, 2-d, 3-a, 4-c

b) 1-b, 2-a, 3-d, 4-c

c) 1-a, 2-b, 3-c, 4-d

d) 1-c, 2-a, 3-d, 4-b

Question 11:

An elderly woman presents with recent onset facial asymmetry and a lump over the roof of the mouth for the past 1 year. On examination, a solitary erythematous swelling with diffuse borders is seen over the left hard palate. Biopsy of the lesion reveals a swiss cheese pattern. Which of the following conditions is she likely to have?

a) Malignant mixed tumor

b) Mucoepidermoid carcinoma

c) Adenoid cystic carcinoma

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d) Adenocarcinoma

Question 12:

Which of the following is the most common malignant tumor involving the parotid gland?

a) Pleomorphic adenoma

b) Mucoepidermoid carcinoma

c) Adenoid cystic carcinoma

d) Adenocarcinoma

Question 13:

As a 1st year resident assisting in a superficial parotidectomy, you have been asked to identify the facial nerve trunk. All of the following structures can be used for its localization except:

a) Posterior belly of digastric

b) Conley's pointer

c) Inferior belly of omohyoid muscle

d) Mastoid process

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Question 14:

A patient is scheduled to undergo a total parotidectomy with selective node dissection of levels Ib, IIa, IIb, and III. Which of the following groups of lymph nodes will be removed during the procedure?

a) 1, 2, 3 and 4

b) 2 and 3

c) 3, 4 and 5

d) 2, 3, 4 and 5

Question 15:

A patient with pleomorphic adenoma is posted for submandibular gland excision. Which of the following nerves is least likely to be injured during this procedure?

a) Marginal mandibular branch of the facial nerve

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b) Lingual nerve

c) Hypoglossal nerve

d) Inferior alveolar nerve

Question 16:

Which nerve is involved in Frey's syndrome?

a) Facial Nerve

b) Oculomotor nerve

c) Auriculotemporal nerve

d) Glossopharyngeal nerve

Question 17:

After parotidectomy patients complains of loss of sensation while shaving. Which nerve is most likely affected?

a) Auriculotemporal nerve

b) Great auricular nerve

c) Facial nerve

d) Mandibular nerve

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Question 18:

At what age should the congenital defect (shown in the image below) be ideally repaired?

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a) 3-6 months

b) 6-8 months

c) 8-10 months

d) 10-12 months

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Question 19:

A child with a cleft lip is posted for surgery. Which of the following methods is not used to repair this condition?

a) Le Muserier's method

b) Tennison's method

c) Millard's method

d) Wardill's method

Question 20:

Which among the following is an oral cavity lesion with a high-risk of malignant transformation?

a) Oral lichen planus

b) Discoid lupus erythematosus

c) Discoid keratosis congenita

d) Speckled erythroplakia

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Question 21:

A 35-year-old man presented with complaints of difficulty in opening his mouth, restricted tongue movements, and a burning sensation in the mouth while eating food. He is a smoker and chews pan masala. On examination, scarring is present in the oral cavity. What is the most likely diagnosis?

a) Plummer-Vinson syndrome

b) Proliferative verrucous leucoplakia

c) Oral submucous fibrosis

d) Erythroplakia

Question 22:

A 57-year-old male patient presents to the surgery OPD, with a 7cm lesion over the left buccal mucosa and difficulty opening the mouth. On examination, the right cervical lymph node is 4cm in size with overlying skin involvement. What is the TNM staging of this lesion?

a) T4aN2bMx

b) T4bN3aMx

c) T4bN3bMx

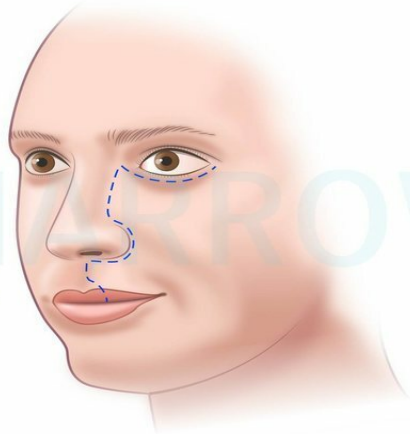
d) T4aN2cMx

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Question 23:

Identify the given incision used for maxillectomy.

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a) Crile's incision

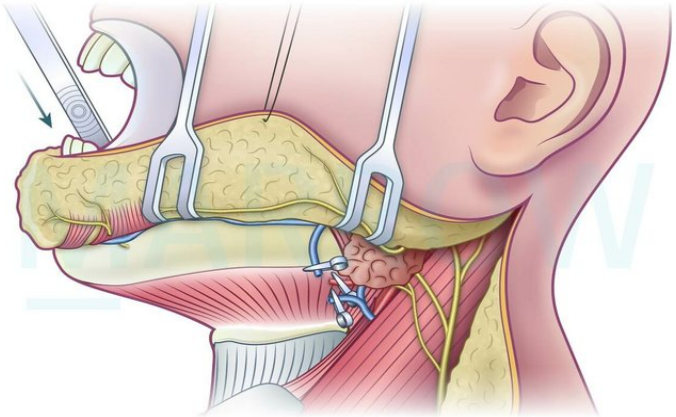
b) Martin's incision

c) MacFee incision

d) Weber–Ferguson incision

Question 24:

What is this approach used in the treatment of oral cancer?



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a) Lip-split approach

b) Visor approach

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c) Wedge resection

d) Commando operation

Question 25:

You will use an Abbe-Estlander flap for the reconstruction of which of the following structures?

a) Lip

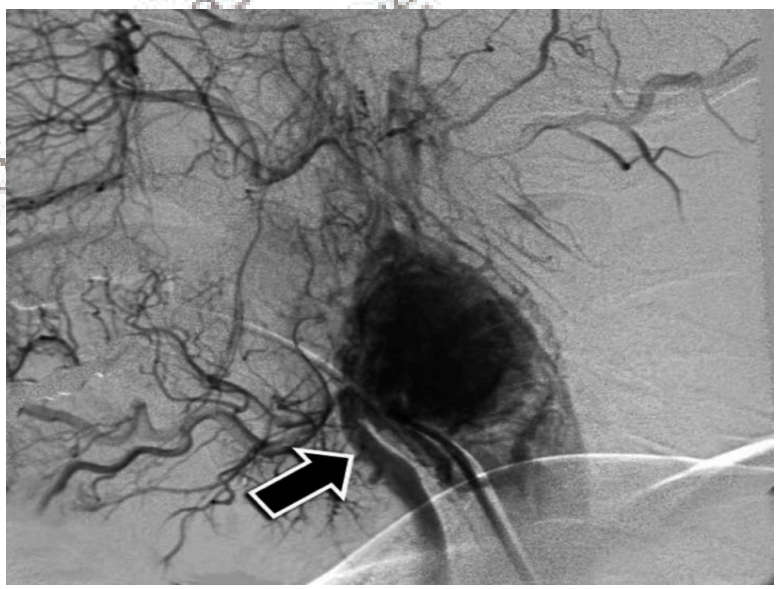
b) Palate

c) Floor of the mouth

d) Tongue

Question 26:

A woman from Himachal Pradesh, presented with complaints of neck swelling for the past 1 year. On examination, a firm, non-tender, pulsatile mass was palpated on the left side of the neck. The mass is mobile from side to side, but not up and down. A carotid angiogram of the patient is shown below. Which of the following is false regarding this condition?



a) It is usually benign

b) Shamblin classification is used for staging

c) It arises from neuroendocrine tissue

d) FNAC is the initial investigation of choice

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Question 27:

The most common site of branchial cyst is _____.

a) Junction of upper and middle third of the sternomastoid muscle

b) Junction of middle and lower third of the sternomastoid muscle

c) Middle of the sternomastoid muscle

d) Between the two heads of the sternomastoid muscle

Question 28:

To which group of lymph nodes does a tumor limited to the glottis of the larynx spread commonly?

a) Pre-tracheal

b) Pre-laryngeal

c) Upper jugular

d) None

Question 29:

Radical neck dissection spares which of the following structures?

a) Digastric muscle

b) Sternocleidomastoid muscle

c) Spinal accessory nerve

d) Ipsilateral cervical lymph nodes

Question 30:

A patient is posted under your unit for type 2 modified radical neck dissection. Which of the following structures will you preserve during this procedure?

a) Only 5

b) 2 & 3

c) 1 & 5

d) 2,3 & 4

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Answer Key

Question No.	Correct Option
1	c
2	d
3	d
4	c
5	b
6	a
7	c
8	a
9	d
10	b
11	c
12	b
13	c
14	b
15	d
16	c
17	b
18	a
19	d
20	d
21	c
22	c
23	d
24	b
25	a
26	d
27	a
28	d
29	a
30	c

If yo
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d.

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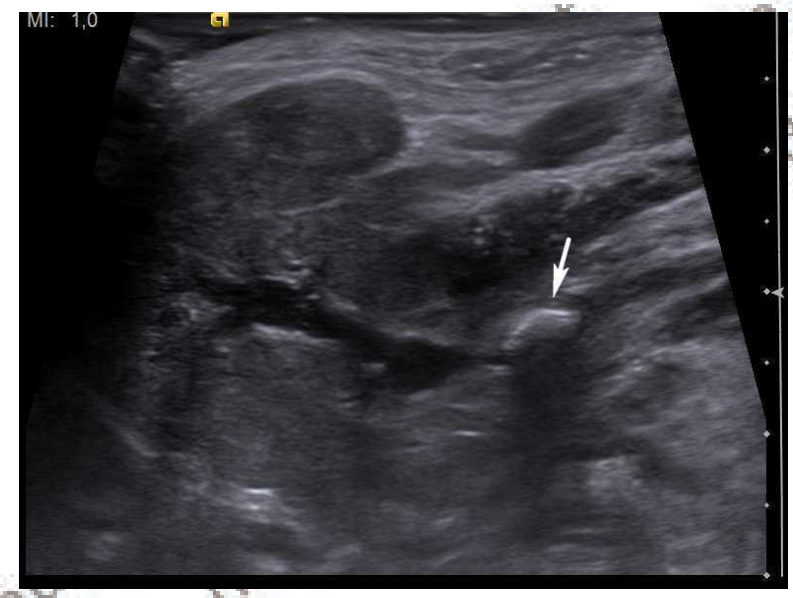
Detailed Explanations

Solution to Question 1:

The most common site for salivary gland stone formation is the submandibular gland due to highly viscous secretions.

80% of submandibular stones are radio-opaque, while parotid duct stones are usually radiolucent and rarely visible on plain radiography. Parotid gland sialography is usually required to identify the stone. A stone located in the collecting duct or within the gland may be managed by either endoscopic retrieval or lithotripsy; in rare cases, surgical removal via a parotidectomy approach may be required.

The below USG image shows a stone in the Wharton duct of the submandibular gland.



Solution to Question 2:

If the stone is proximal to the lingual nerve, stone retrieval can be done via an intraoral surgical approach under general anesthesia.

80% of submandibular stones are radio-opaque. Conventional radiography is useful in the initial workup of salivary stones, but ultrasound, CT, MRI, and sialendoscopy are required for accurate diagnosis and localization (especially for smaller and parenchymal stones).

The only contraindication for sialendoscopy is acute sialadenitis. This is because sialendoscopy and ductal dilation is more difficult in the setting of inflammation and there will be a greater likelihood of ductal trauma and potential spread of infection.

Management of sialolithiasis should begin with conservative measures, oral hydration, analgesia, massaging of gland, sialogogues, and antibiotics (if there are signs of infection). If unsuccessful, the next step is based on the sialolith's size, number, and location:

• Small stones (<4mm) - endoscopic removal using Dormia basket.

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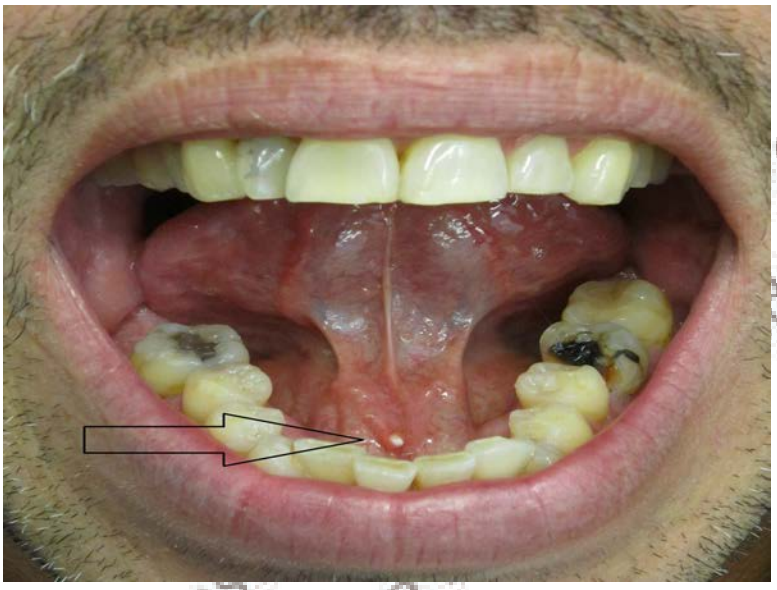
• larger stones - external shockwave lithotripsy (ESWL) + fragment removal or Open surgery and stone removal

• Surgical excision of the gland should always be a last resort

If distal to lingual nerve: Make a longitudinal incision over the duct. Remove the stone. Suture the duct using absorbable suture.

If proximal to lingual nerve: intraoral approach

The image below shows a stone in the submandibular salivary duct.



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Solution to Question 3:

The given clinical scenario and FNAC report of acinar hypertrophy are suggestive of sialadenosis. Hyperthyroidism is not associated with sialadenosis.

Sialosis (sialadenosis) is defined as an asymptomatic, non-inflammatory, non-neoplastic parenchymal salivary gland disease. It is accompanied by a persistent painless bilateral swelling of the salivary glands, most commonly involving the parotid glands. Most cases of sialadenosis are observed in patients between 40 to 70 years of age, and the salivary gland swellings are often soft and symmetrical. On FNAC, acinar cell hypertrophy is seen without any inflammatory signs.

Sialadenosis is associated with the following conditions:

• Nutritional disorders

• Bulimia nervosa

• Vitamin deficiency

• Endocrine disorders

• Diabetes mellitus

• Hypothyroidism

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• Metabolic disorders

• Obesity

• Cirrhosis

• Malabsorption

• Autoimmune disorders

• Sjögren disease

• Drug-induced

• Valproic acid

• Thiourea

• Pregnancy

• Alcoholism

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Solution to Question 4:

The given orthopantomogram shows a right-sided clearly demarcated radiolucent lesion suggestive of a stafne bone cyst. It is the most common type of ectopic salivary tissue.

It presents as an asymptomatic, clearly demarcated radiolucent lesion at the angle of the mandible, characteristically below the inferior dental neurovascular bundle. It is more common in males. Usually, no treatment is required.

A dentigerous cyst is a cyst in relation to an unerupted tooth. Most commonly involves the 3rd molar. It is managed by enucleation and removal of the tooth.

Solution to Question 5:

The given scenario and image points to a diagnosis of an oral ranula. It is a mucous extravasation cyst arising from the sublingual gland.

Ranula is a transilluminant mucocele. It is also known as "frog's belly", as it resembles the vocal sacs of a frog. It is of two types:

• Oral ranula - It is a benign cystic lesion formed by extravasation of mucus, involving the sublingual gland. Clinically present as cystic swelling in the floor of the mouth. On examination fluctuation test and transillumination test is positive. It is conservatively managed by marsupialisation. Definitive management is excision of the cyst. Some may resolve spontaneously.

• Cervical or plunging ranula- is a rare type of retention cyst arising from the sublingual gland. The mucous passes through the mylohyoid muscle diaphragm to enter the neck. Clinically present as intraoral and cervical swelling. Diagnosis is made by USG or MRI. Management includes excision of sublingual gland + aspiration of saliva out of the sac.

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Note: Oral ranulas located in the floor of the mouth can often be confused with an epidermoid cyst.

Solution to Question 6:

90% of the minor salivary gland tumors are malignant, and the common sites are the upper lip, palate, and retromolar regions.

Option B: The most common site for salivary tumors is the parotid gland, mostly involving the superficial lobe.

Option C: Mucoepidermoid carcinoma is the most common malignant tumor of the salivary gland.

Option D: Adenoid cystic carcinoma is known to be associated with perineural invasion.

Solution to Question 7:

A slowly progressive swelling, with a variable consistency, lifting the ear lobe, is suggestive of pleomorphic adenoma of the parotid gland.

Pleomorphic adenoma, the most common benign salivary gland tumor, primarily affects the parotid gland, particularly its superficial lobe. It is also referred to as a mixed tumor due to its combination of epithelial and mesenchymal components. This tumor most commonly occurs in females around the age of 40.

Clinical features:

• Painless, slow-growing swelling

• Lobulated, firm, variable in consistency

• Lifts the earlobe

• No facial nerve involvement

• Curtain sign positive - cannot be moved above the zygomatic bone.

• In case of deep lobe involvement, tonsils, and faucial pillars will be pushed medially.

• Features of malignancy - a sudden increase in size, ulceration of the overlying skin, facial nerve palsy (involvement of facial nerve), painful swelling, and restriction of jaw movements.

Fine needle aspiration cytology (FNAC) is the investigation of choice in diagnosing pleomorphic adenoma. Open biopsy is contraindicated due to the chances of injury to the facial nerve.

All tumors of the superficial lobe of the parotid gland should be managed by superficial parotidectomy. Radical parotidectomy is performed for malignant pleomorphic adenoma.

Other options:

Option A: Adamantinoma is a low-grade malignant tumor that usually presents with pre-tibial pain and swelling since it most commonly affects the tibial diaphysis.

Option B: Dermoid cysts present as firm painless subcutaneous nodules and are of 4 types:

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• Sequestration dermoid - sequestration of epithelium during embryological development.

• Tubulodermoid - accumulation of secretions from ectodermal tube/duct

• Implantation dermoid - implantation of the epidermis due to trauma

• Teratomatous dermoid - having all 3 germ layers (ecto, meso, and endoderm)

Option D: Sebaceous cysts are retention cysts of the sebaceous glands that present as smooth, non-tender, non-transillumination swelling with a punctum (in 70% of the patients).

Solution to Question 8:

The given clinical scenario is suggestive of pleomorphic adenoma. The treatment of choice is superficial parotidectomy.

Clinical features:

• Painless, slow-growing swelling

• Lobulated, firm, elastic-to-hard in consistency

• Lift the ear lobe

• Free from deeper structures

• With no facial nerve involvement

• Curtain sign positive - cannot be moved above the zygomatic bone

Pleomorphic adenoma involves the superficial lobe of parotid gland and should be managed by superficial parotidectomy.

Types of Parotidectomy

• If only the superficial lobe is involved:

• Superficial parotidectomy - only superficial lobe removed. Usually done in benign conditions.

• If both lobes are involved:

• Total conservative parotidectomy - both lobes are removed but the facial nerve is preserved.

• Total radical parotidectomy - both lobes and facial nerve removed.

Sometimes it may undergo malignant transformation. The malignant form is mixed malignant tumor or carcinoma ex pleomorphic adenoma (most aggressive salivary malignancy).

Signs of malignant transformation

• A rapid increase in size

• Pain and ulceration

• Facial nerve involvement (LMN)

• Lymph node involvement

• Restricted jaw movements

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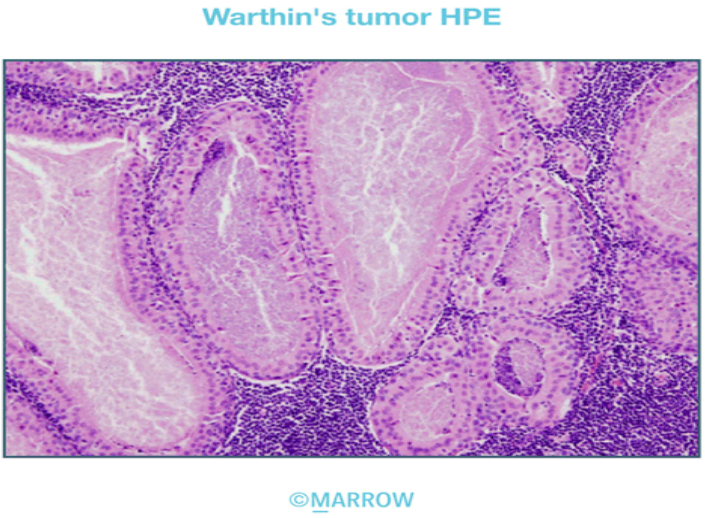
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Solution to Question 9:

The given clinical scenario and image are suggestive of Warthin's tumor. These tumors appear as hot spots on radionuclide scans because of the high mitochondrial content in oncocytes that incorporate technetium-99m. The most common benign tumor of the parotid gland is pleomorphic adenoma.

Warthin's tumor or papillary cystadenoma lymphomatosum usually presents as a unilateral tumor. It is usually seen in the lower poles of the parotid and is commonly associated with smoking. It occurs most often in elderly males. It has no malignant potential.

Histology shows tumor cells lined by a double layer of neoplastic epithelial cells resting on the dense lymphoid stroma. FNAC is the preferred investigation. Superficial parotidectomy is the treatment of choice.



Note: Both pleomorphic adenoma and Warthin's tumors commonly present as unilateral tumors. A bilateral presentation is usually rare. However in rare cases, if there is a bilateral benign salivary tumor, the tumor is most likely to be a Warthin's tumor.

Solution to Question 10:

Godwin's tumor

- Benign lymphoepithelial tumor of the salivary gland.
- It is associated with CMV.
- < 5% shows malignancy - known as Eskimoma.

Kuttner's tumor is chronic sclerosing sialadenitis of the submandibular gland.

Oncocytoma (oxyphil adenoma) -

- Usually benign, originating from oncocytes.

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• Grossly - tan-colored small, well-circumscribed, and encapsulated.

• Microscopically - large oncocytes with swollen granular cytoplasm.

• Appear as a hotspot on Technetium-99m pertechnetate scintigraphy due to an abundance of mitochondria.

Tumor	Description
Godwin's tumor	Benign lymphoepithelial tumor
Eskimoma	Malignant salivary gland tumor
Kuttner's tumor	Chronic sclerosing sialadenitis
oncocytoma	Hotspot on 99Tc scintigraphy

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Solution to Question 11:

The given scenario and biopsy finding is suggestive of adenoid cystic carcinoma. Facial asymmetry points to the perineural invasion of the tumor into the facial nerve, which is characteristic of adenoid cystic carcinoma.

It is the second most common malignant tumor of the parotid gland. It is a slow-growing tumor most commonly involving the parotid and submandibular glands. Histology shows a swiss cheese pattern. The tubular type has the best prognosis, while the solid type has the worst.

It has a deceptively benign histologic appearance characterized by indolent, locally invasive growth with a high propensity for local recurrence and distant metastasis. The most common site of distant metastasis is the lung. Treatment involves removal of the gross tumor, with radiation therapy for the microscopic disease.

Solution to Question 12:

Mucoepidermoid carcinoma is the most common malignant tumor, while pleomorphic adenoma is the most common benign tumor of the parotid gland.

Histological classification and incidence of tumors of salivary glands:

NOS: Not otherwise specified.

Benign Tumors	Incidence	Malignant tumors	Incidence
Pleomorphic adenoma	50%	Mucoepidermoid carcinoma	15%
Warthin's tumor	5–10%	Adenocarcinoma (NOS)	10%

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Benign Tumors	Incidence	Malignant tumors	Incidence
Oncocytoma	1%	Acinic cell carcinoma	5%
Other adenomas	5–10%	Adenoid cystic carcinoma	5%
Basal cell adenoma	1-2%	Malignant mixed tumor	3–5%
Canalicular adenoma	1%	Squamous cell carcinoma	1%
Ductal papillomas	-	Other carcinomas	2%

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Solution to Question 13:

The inferior belly of the omohyoid muscle is not used as an anatomical landmark for the identification of the facial nerve trunk.

There are two methods for localization of the facial nerve trunk:

1. Anterograde method: In this method, the facial nerve trunk is identified based on the anatomical landmarks after it exits from the stylomastoid foramen. The anatomical landmarks include:

• Conley's pointer is the inferior portion of the cartilaginous canal. The facial nerve trunk lies 1 cm deep and inferior to its tip.

• Posterior belly of digastric- The facial nerve lies superior to the upper border of the muscle.

• Mastoid process- Upon drilling it, the nerve is identified proximally.

• Squamotympanic fissure is a fissure in the temporal bone, which runs from TMJ to the tympanic cavity. The facial nerve runs through this fissure.

• Styloid process- The facial nerve lies superficial to it.

2. Retrograde method: In this method, the main branches of the facial nerve trunk are identified and are then traced proximally until the main tunk is identified. Some of the main branches that are commonly used for tracing the facial nerve trunk include:

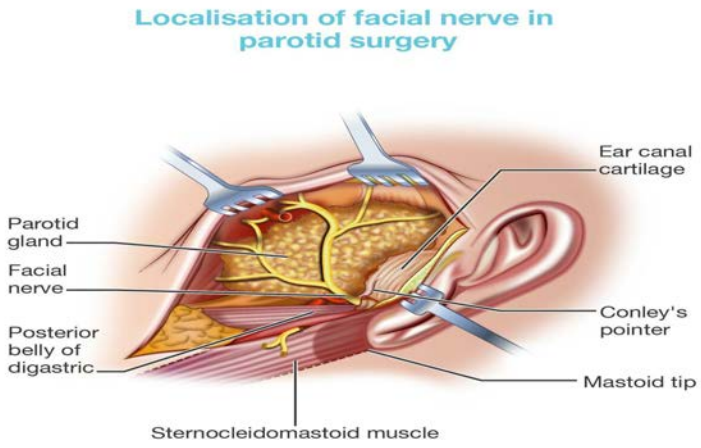
• Buccal branch lies in relation to the parotid gland

• Marginal mandibular branch lies in relation to the facial vessels

• Temporal branch

The given image points to the facial nerve (marked by arrow).

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Solution to Question 14:

Among the given options, only submandibular (Level Ib) and middle jugular nodes (Level III) nodes will be removed. The other nodes that will be removed in the procedure will be upper jugular nodes (Level IIa and IIb).

Selective neck dissection has been used in the treatment of patients with cancer of the upper aerodigestive tract (oral cavity, pharynx, larynx), cancer of the thyroid gland, cutaneous malignancies, and cancer of the salivary gland. The type of selective neck dissection used varies depending on the lymphatic drainage and metastatic pattern associated with the primary cancer site.

Solution to Question 15:

The inferior alveolar nerve is the nerve least likely to be affected by submandibular surgery.

Nerves at risk for injury during removal of the submandibular gland include:

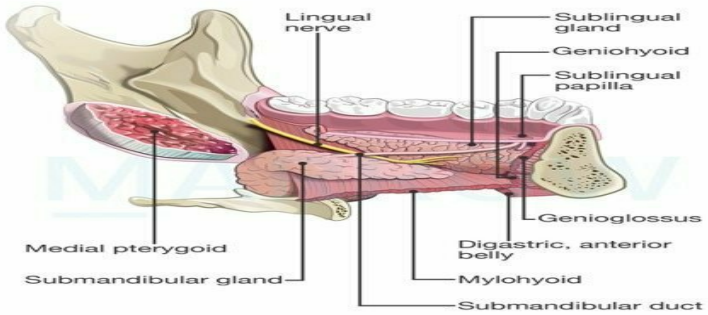
• Marginal mandibular branch of the facial nerve

• Lingual nerve

• Hypoglossal nerve

An important landmark in submandibular gland dissection is the posterior border of the mylohyoid muscle. Once identified, it can be retracted to reveal the deep lobe of the gland. The hypoglossal nerves lie deep to the submandibular capsule and should not be damaged during intracapsular dissection. The facial artery is ligated twice during the surgery.

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Relations of submandibular gland

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Solution to Question 16:

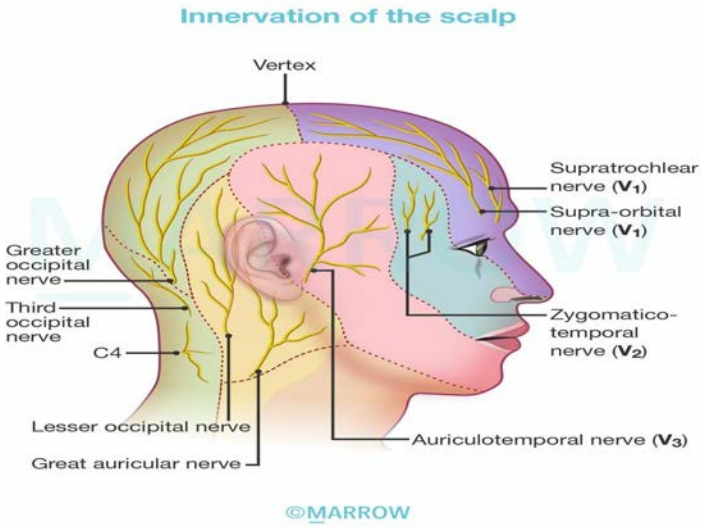
The auriculotemporal nerve (V3 nerve) is involved in Frey's syndrome (gustatory sweating).

Frey's syndrome is also known as Dupuy syndrome or auriculotemporal syndrome. It commonly develops after parotid surgery. It is caused by an aberrant regeneration of post-ganglionic parasympathetic nerve fibers crossed along the sympathetic pathways to the sweat glands near the parotid region.

Clinical features are due to the result of salivary stimulation (by the smell or taste of food) leading to the sweating and flushing of the periauricular region on the involved side of the face. A starch iodine test is used for diagnosis.

Treatment ranges from antiperspirants (in mild cases) to tympanic neurectomy or botulinum toxin injection (in severe cases). It can be prevented by incorporating careful extracapsular dissection and closure of the superficial musculoaponeurotic layer during parotidectomy.

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Other options:

Option A: Facial nerve is the 7th cranial nerve that supplies the muscles of the face, and results in facial paralysis if injured during parotidectomy

Option B: Oculomotor is the 3rd cranial nerve which supplies the extraocular muscles. If injured during ophthalmic surgeries, it results in ocular paralysis and the eye pointing down and out.

Option D: Glossopharyngeal nerve is the 9th cranial nerve and its injury causes loss of taste sensation from the posterior 1/3rd of the tongue.

Solution to Question 17:

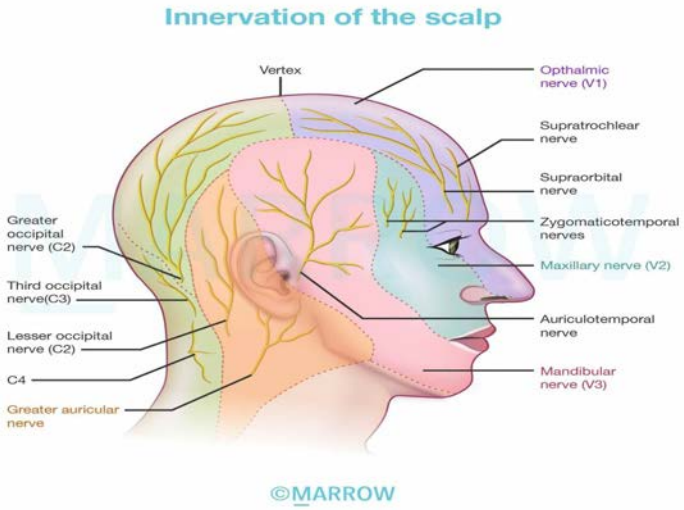
After parotid surgery, the nerve involved in the loss of sensation while shaving is the great auricular nerve.

The great auricular nerve (GAN) originates from the second and third nerve roots of the cervical plexus (C2-C3). It supplies the skin over the lower pinna, pre-auricular region, and angle of the mandible (image below). The main trunk passes over the sternocleidomastoid and into the anterosuperior portion of the parotid glands and branches into the anterior and posterior GAN. The anterior branch of GAN is often injured during parotid surgery during the initial elevation of the skin flap.

When GAN is injured, it can cause reduced sensations in the earlobe, pre-auricular skin, and the angle of the mandible that can interfere with habits such as shaving, wearing earrings, etc.

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Other options:

Option A: The auriculotemporal nerve, a branch of the mandibular nerve (V3 of trigeminal) supplies the posterior part of the temple, tragus, and adjoining auricle. It does not supply the area where a person is likely to shave. However, the injury to the auriculotemporal nerve resulting in aberrant regeneration would result in Frey's Syndrome (gustatory sweating).

Option C: Though the facial nerve is the most common nerve affected during parotidectomy, any damage would result in facial paralysis and not loss of sensation of the face.

Option D: The mandibular nerve is a branch of the trigeminal nerve (cranial nerve V) that supplies the skin over the mandible, lower lip, and cheek. However, they are not injured during parotidectomy.

Solution to Question 18:

The given image shows a unilateral cleft lip. Repair of cleft lip (primary palate) along with associated nasal deformities is done at 3–6 months of age.

Solution to Question 19:

Wardill's method is not a method of cleft lip repair. It is a technique for hard palate closure.

Cleft-lip repair techniques:

• Millard's rotation advancement technique (most common)

• Thompson

• Le Mesurier

• Tennison–Randall

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Techniques of hard palate closure include the use of the following:

• Unipedicled hard palate mucoperiosteal flaps as in the Wardill-Veau-Kilner repair

• Bipedicled hard palate mucoperiosteal flaps as in the von Langenbeck repair

Solution to Question 20:

Speckled erythroplakia has a high risk of malignant transformation.

Malignancy risk:

High-risk lesions

Erythroplakia (homogenous/speckled)

• Seen as red velvety lesions

• Speckled type is the most aggressive

• The treatment of choice is surgical ablation

Proliferative verrucous leucoplakia

• A white patchy lesion that cannot be rubbed off.

• Speckled leucoplakia has an erythematous base

• The treatment of choice is excision

Chronic hyperplastic candidiasis

• White patches that can be rubbed off with a hyperaemic border.

• Management includes prolonged treatment with topical antifungals or systemic antifungal therapy. If no improvement or if there are any signs of dysplasia, surgical excision is done.

Medium risk lesions

Oral submucous fibrosis

• Hypersensitive reaction to betel nut product.

• Other risk factors are - tobacco, chili, vitamin deficiency

• Clinical features - trismus, ankyloglossia, soreness, and burning sensation in the mouth.

• Management includes antioxidants, intralesional triamcinolone, and surgical excision.

Syphilitic glossitis

• Associated with tertiary syphilis

Low-risk lesions

Oral lichen planus

• Reticulate fine lace-like pattern.

• Management is topical corticosteroids.

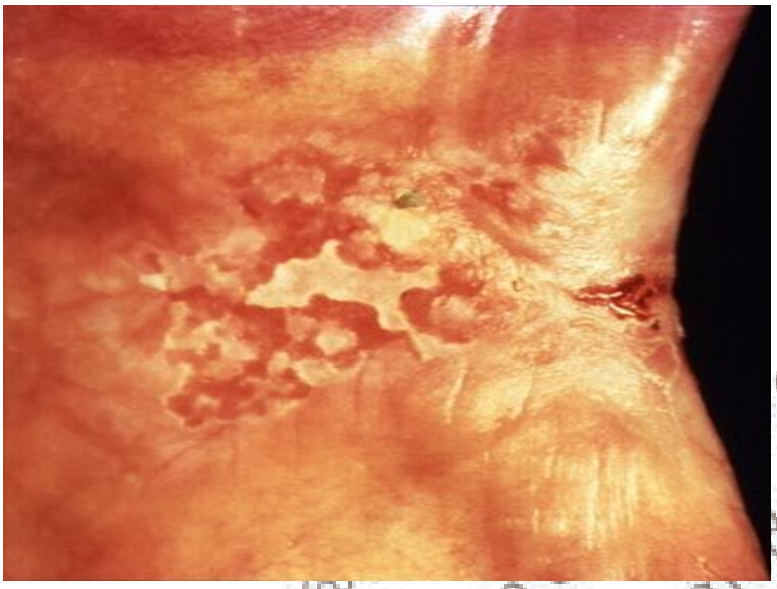
Discoid lupus erythematosus

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Discoid keratosis congenita

Speckled erythroplakia:



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Solution to Question 21:

The most likely diagnosis is oral submucous fibrosis. It is a premalignant lesion of the oral cavity, in which fibrous bands are formed beneath the oral mucosa.

Risk factors are

- Betel nut
- Chilli
- Tobacco
- Vitamin deficiency

Clinical features include ankyloglossia, trismus, soreness, and a burning sensation in the mouth while eating.

Management includes intralesional steroids, vitamin supplements, and surgical excision.

Option A: Plummer-Vinson syndrome is characterized by post cricoid web that is associated with iron deficiency anemia, glossitis, and koilonychia. It usually presents as dysphagia.

Option B: Proliferative verrucous leucoplakia appears as a white patchy lesion, that cannot be rubbed off.

Option D: Erythroplakia is seen as bright red velvety plaque in the oral cavity.

Solution to Question 22:

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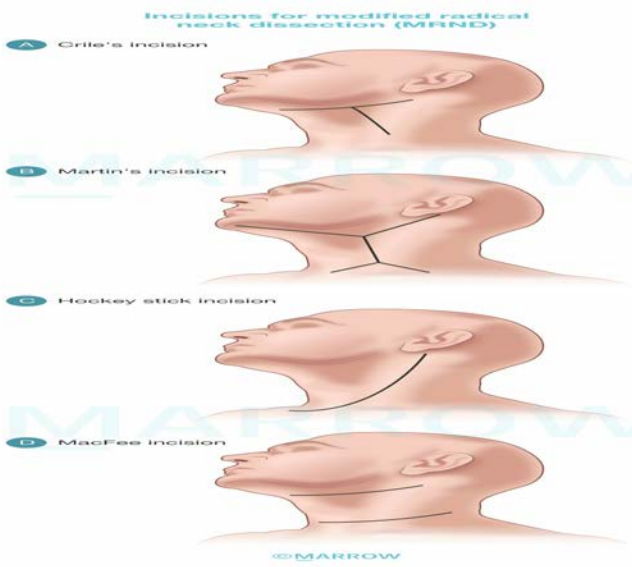
The TNM staging in this patient is T4bN3bMX. A 7-cm primary tumor in the oral cavity with difficulty in opening mouth denotes a locally advanced tumor: T4b. Contralateral cervical lymph node involvement with skin involvement (extranodal extension-positive): N3b

Note: Here the skin invasion corresponds to ENE positive, and hence, the N staging is N3b instead of N2c (contralateral lymph nodes, <6 cm and ENE■negative).

Solution to Question 23:

The image shows Weber–Ferguson incision which is used to access the floor of the maxillary sinus in the case of maxillary carcinoma.

The rest of the options are incisions used for modified radical neck dissection (MRND).



Solution to Question 24:

The given image shows the visor approach.

In the visor approach, an incision is made extending from one end of the mandible to the opposite side and subplatysmal flaps are elevated superiorly over the mandible (like a visor of a helmet). This approach provides a wide exposure to remove larger lesions involving the anterior oral cavity that is not amenable to a peroral approach. This avoids a lip-splitting incision but has the disadvantage of anesthesia of chin/lower lip (due to the sacrifice of submental nerves).

The surgical approach selected for excision of oral cavity tumors depends on the size of the tumor, location (anterior vs posterior), proximity to bone (mandible or maxilla), and the need to perform neck dissection. The most commonly employed approaches are as follows:

• Peroral - accessible early-stage tumors

• Lower cheek flap - tumors requiring partial mandibulectomy or large posterolateral tumors that cannot be accessed via a peroral approach

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• Upper cheek flap - tumors requiring partial maxillectomy or those involving the hard palate, upper gum, upper gingivobuccal sulcus and anterior soft palate

• Mandibulotomy -
larger tumors of the posterior oral cavity, tumors that involve the base of the tongue or pharyngeal wall.

• Visor flap - larger lesions of the anterior oral cavity involving the anterior floor of the mouth and lower gum that are not amenable to a peroral approach

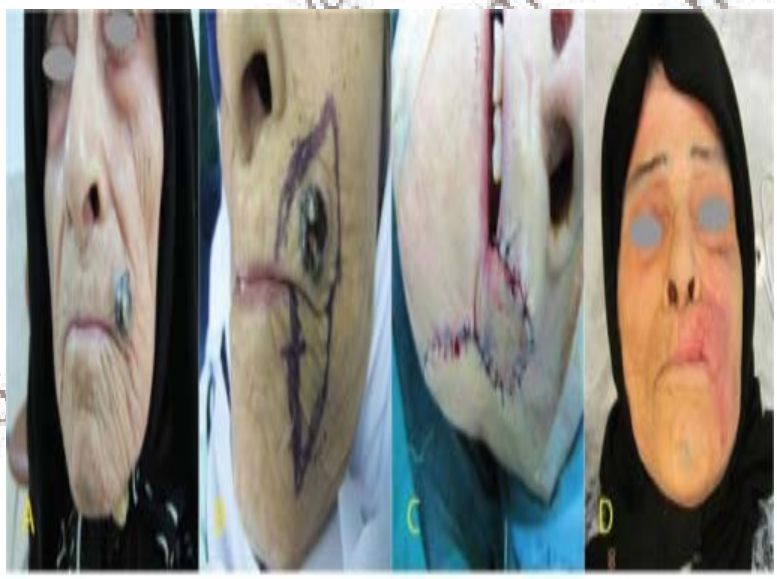
Commando operation is the combined mandibular resection and neck node dissection. It is used mainly for carcinoma of the tongue.

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Solution to Question 25:

Abbé- Estlander flaps are used for the reconstruction of the lip.

They are lip switch flaps based on the sublabial or superior labial artery. When the defect involves the commissure, the Estlander flap is used, and the Abbé flap is used for more midline defects.



Solution to Question 26:

The given scenario and carotid angiogram showing splaying of the bifurcation of the carotids, also known as lyre sign points to a diagnosis of chemodectoma. Fine-needle aspiration cytology (FNAC) is contraindicated when a chemodectoma is suspected.

Chemodectoma is also known as carotid body tumor (aka potato tumor). It is a benign tumor of the neuroendocrine tissue of the carotid body. It has a higher incidence at high altitudes because of chronic hypoxia, which leads to carotid body hyperplasia.

The tumor presents as a slowly enlarging mass that is firm, rubbery, pulsatile, mobile from side to side but not up and down. A bruit may be heard. Family history can be present in 10% of the

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cases.

Shamblin classification is used for staging carotid body tumors.



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Solution to Question 27:

The most common site of a branchial cyst is at the junction of the upper and middle third of the sternomastoid muscle at its anterior border.

The below image shows a large right-sided branchial cyst.



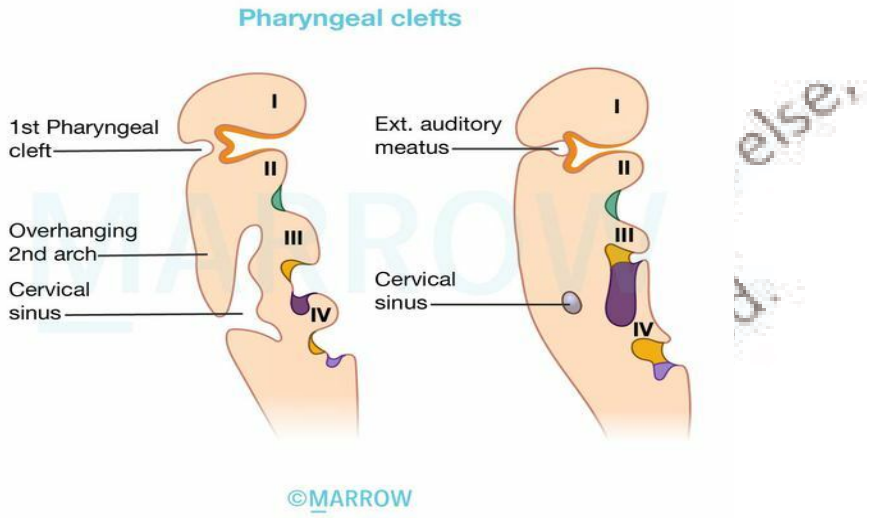
Branchial cyst develops due to the persistence of the cervical sinus. The cervical sinus is formed when the 2nd arch mesoderm overgrows the succeeding arches and overhangs them as shown in the image. The space between the overhanging 2nd pharyngeal arch and the 3rd, 4th, and 6th arches is called the cervical sinus. The cavity of the cervical sinus is lined by ectoderm and

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normally gets obliterated.

Branchial cysts are usually lined by squamous epithelium and contain thick, turbid fluid full of cholesterol crystals. It is fluctuant and may transilluminate when it contains clear fluid.

A branchial fistula may be acquired or congenital. The congenital fistula is seen at the junction of the middle and lower third of the sternomastoid (option B). An acquired fistula is usually seen in cases of incomplete surgery for the branchial cyst or spontaneous rupture, and it is seen at the same site as the cyst.



Solution to Question 28:

Tumors limited to the glottis usually do not spread to any lymph nodes, as there are no lymphatics in the vocal cords. However, if the tumor invades the supra- or the infra-glottic spaces, lymph node spread can occur.

The most common malignant tumor of the larynx is squamous cell carcinoma. Glottis is the most common site of laryngeal cancer.

Solution to Question 29:

Digastric muscle is spared in radical neck dissection (RND). RND is used in the treatment of malignant lesions of the neck with local spread or metastasis.

In 1905, Crile described RND where Level I-V LN, sternocleidomastoid (SCM), internal jugular vein (IJV), and XI cranial nerve (spinal accessory nerve) are removed.

In 1962, Suarez described modified RND (MRND) where Level I-V LNs are removed and the following are preserved:

• MRND I - XI cranial nerve

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• MRND II - XI cranial nerve and IJV

• MRND III - XI cranial nerve, IJV, and SCM

Note: RND with an additional LN/muscle/nerve is called extended RND.

Solution to Question 30:

In type 2 modified radical neck dissection (MRND), internal jugular vein and spinal accessory nerve will be preserved.

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Burns

Question 1:

Which among the following are indications to shift a patient to the burn center?

a) 2,5

b) 3,4

c) 1,2,5

d) 1,3,4,5

Question 2:

Which of the following are false regarding first-degree burns?

a) Pain is the chief symptom

b) Has minimal blister formation

c) Protective functions of the skin are intact

d) No residual scar after injury heals

Question 3:

A man accidentally took a bath with overheated water. A few hours later, he developed the given lesion on his shoulders and chest. Following spontaneous rupture 3 days later, the base of the lesion was erythematous and blanches on touch. What is the time taken by these wounds to heal?

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a) 1 week

b) 2 weeks

c) 3 weeks

d) 4 weeks

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Question 4:

Which layer is involved in blister formation in a superficial partial thickness burn?

a) Epidermis

b) Subcutaneous tissue

c) Papillary dermis

d) Reticular dermis

Question 5:

A patient has presented to you with a burn wound as seen in the image below. With regards to Jackson's zones of tissue injury, which of the following statements is false?

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a) Area 2 is the most severely burned portion

b) The outer area of a burn is called the zone of hyperemia

c) Vasodilation is seen in the area 3

d) Area 1 heals with minimal or no scarring

Question 6:

While examining the burns on this patient, you find a lack of sensation and capillary refill at the burnt site. What is the degree of burn?



a) Fourth degree burns

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b) Superficial Second degree burns

c) Deep Second degree burns

d) Third degree burns

Question 7:

A chemical engineer burnt his fingers as shown in the image while working with hydrofluoric acid. What is the most appropriate way to manage this patient?



a) Topical application of calcium gluconate gel along with ECG monitoring

b) Irrigation with Dakin's solution followed by surgical excision of the burn site

c) Immediate intrarterial injection of calcium gluconate

d) Copious irrigation with normal saline and application of mafenide acetate

Question 8:

20% of a patient's total body surface area was burnt from an overhead electric supply line. What is leading cause of death in such burns?

a) Acute kidney injury

b) Cardiac arrest

c) Internal haemorrhage

d) Internal burns

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Question 9:

ABG of a patient with extensive burns shows pH: 7.29, pCO_2: 38mmHg, HCO_3: 16.5, and elevated lactate of 5mmol/L. As part of initial fluid resuscitation, which fluid would be the best to initiate in this patient?

a) Normal saline

b) Ringer lactate

c) Hypertonic saline

d) Human albumin solution

Question 10:

An adult whose both lower limbs are charred along with genitalia has ____ burns.

a) 10%

b) 19%

c) 36%

d) 37%

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Question 11:

A 3-year-old is brought with superficial and deep second degree burns on his chest. What is the most accurate method to assess the total body surface area involved ?



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a) Parkland's formula

b) Lund and Browder chart

c) Using the child's palm as reference

d) Wallace's rule

Question 12:

A patient comes to your clinic with a superficial partial-thickness burn. Which of the following statements regarding the management is false?



a) Superficial burns generally do not require the use of topical antibiotics

b) Blisters on second degree burns should not be burst

c) All topical antibiotics retard wound healing

d) Facial burns of the same degree will require a hydrocolloid dressing

Question 13:

While starting fluid resuscitation on a patient with burns, it is important to keep in mind that all of the following parameters will be decreased, except:

a) 1 and 4

b) 4 and 5

c) 3 and 5

d) 2 and 4

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Question 14:

A patient has rushed to your clinic after she spilled hot tea on her hand. What should be the ideal temperature of the water used to cool her injuries?



a) 0-4 degrees

b) 15 degrees

c) 20 degrees

d) 25 degrees

Question 15:

While fixing faulty wiring, an electrician sustains the given burn. Which of the following is false?

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a) Electric burns are usually third degree burns

b) Urine output should be monitored for volume and deposits

c) ECG should be monitored even in low voltage burns

d) Fluid requirement is less as compared to other burns

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Question 16:

A man with severe burn injuries is admitted to the ward. Proton-pump inhibitors are started. Which ulcer is being prevented?

a) Curling's ulcer

b) Cushing's ulcer

c) Marjolin's ulcer

d) Buruli's ulcer

Question 17:

A 34-year-old electrician sustains electrical burns while at work. On arrival he is hemodynamically stable, and he is placed on ECG monitoring and initial fluid resuscitation is initiated. His urine is collected for routine labs and appears as below. Which of the following lab abnormalities may be seen in this patient?

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a) Elevated unconjugated bilirubin

b) Elevated RBC count in urine

c) Elevated creatinine kinase

d) Low platelet count

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Question 18:

A woman, weighing 58 kg, has second-degree burns covering 20% of the total body surface area. Which of the following formulae would you use to calculate the amount of fluid to be given?

a) Percentage of burns × weight (kg) × 2 = volume in mL

b) Percentage of burns × weight (kg)/2 = volume in mL

c) Percentage of burns × weight (kg) × 4 = volume in mL

d) Weight + 1500 ml/m2×BSA burnt = volume in mL

Question 19:

Which of the following formulas will you use to calculate the amount of albumin to be administered to a patient with burns?

a) Parkland formula

b) Muir and barclay formula

c) Evan's formula

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d) Wallace formula

Question 20:

A patient was brought to the hospital after being rescued from a burning house where he was trapped for 4 hours. The patient has a few minor burns but is coughing extensively. His voice is hoarse and he is able to drink water with some difficulty. What is the safest strategy of management?

a) Start him on CPAP

b) O2 therapy with well-fitting face mask

c) Elective cricothyroidotomy

d) Elective endotracheal intubation

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Question 21:

A 12-year-old boy presented to the OPD with a scald injury of his arm. The lesion was pink, oozing, and painful to moving air and touch. Which of the following is the most appropriate management?

a) Silver sulphadiazine cream dressing

b) Excision and grafting

c) Paraffin gauze dressing

d) Collagen dressing

Question 22:

Which of the following antibiotics will be most appropriate for managing the burn wound in this patient?

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a) Mafenide acetate

b) Neomycin

c) Silver nitrate

d) Silver sulfadiazine

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Question 23:

A 58-year-old homeless man was brought to a PHC in Himachal Pradesh during late winter. He was found unresponsive. His rectal temperature was 23 degrees C, pulse was not measurable, heart rate was 30 per minute and respiratory rate was 6. Rewarming with an electric blanket was started. Which organ is most susceptible to dysfunction in this patient?

a) Brain

b) Heart

c) Liver

d) Kidney

Question 24:

Sweating is usually absent in _____

a) Heat cramp

b) Heat exhaustion

c) Classic heat stroke

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d) Heat syncope

Question 25:

A marathon runner was training on a hot afternoon when he experienced leg cramps and dizziness. He fainted and was taken indoors by his coach. His temperature was 104.8 F, pulse 126 per minute and BP 90/60 mm of Hg. Despite an hour of rest and cold sponging, he did not improve. Which of the following is false regarding his condition?

a) Is a result of imbalance between heat production and heat dissipation

b) The patient should be cooled rapidly

c) Only occurs during exertion

d) Body temperature is measured rectally

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Answer Key

Question No.	Correct Option
1	d
2	b
3	b
4	c
5	c
6	d
7	a
8	b
9	b
10	d
11	b
12	d
13	c
14	b
15	d
16	a
17	c
18	a

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19	b
20	d
21	d
22	a
23	b
24	c
25	c

Detailed Explanations

Solution to Question 1:

> 5% BSA burnt is not an indication to send a patient to the burns center.

Guidelines for referral to a burn center:

• Partial-thickness burns greater than 10% body surface area (BSA).

• Burns involving the face, hands, feet, genitalia, perineum, or major joints.

• Third-degree burns in any age group.

• Electrical burns, including lightning injury.

• Chemical burns.

• Inhalation injury.

• Burn injury in patients with complicated pre-existing medical disorders.

• Patients with burns and concomitant trauma in which the burn is the greatest risk. If the trauma is the greater immediate risk, the patient may be stabilized in a trauma center before transfer to a burn center.

• Burned children in hospitals without qualified personnel for the care of children.

• Burn injury in patients who will require special social, emotional, or rehabilitative intervention.

Solution to Question 2:

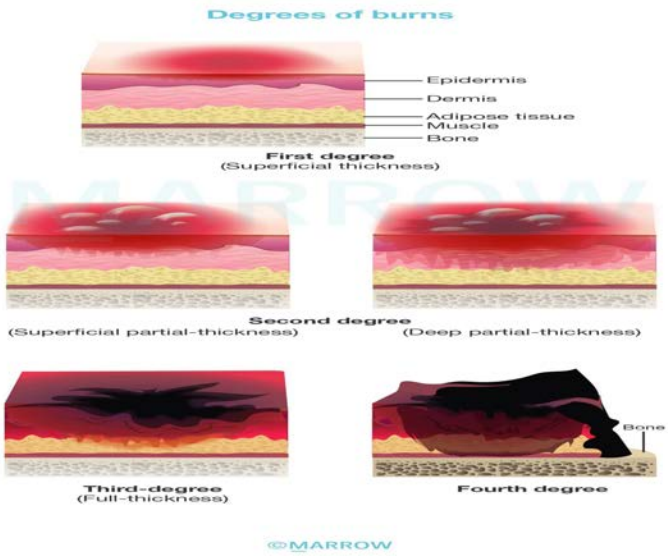
First-degree burns involve only the epidermis, are painful, but do not blister, protective functions of the skin are intact and heals without a scar.

Second-degree burns have dermal involvement and are extremely painful and blister.

Third-degree burns are leathery, painless, and non-blanching.

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Solution to Question 3:

The clinical scenario is suggestive of second-degree superficial burns. They usually heal with minimal scarring in 10–14 days unless they become infected.

Second-degree burns are divided into two types:

• Superficial Dermal burns are erythematous and painful, blanch to touch, and often blister. They heal in 10–14 days.

• Deep dermal burns involve the reticular dermis, appear more pale with erythmatous regions, do not blanch to touch, but remain painful to pinprick. They heal in 4–8 weeks.

Solution to Question 4:

The papillary dermis is involved in blister formation in a superficial partial-thickness burn.

First-degree burns involve only the epidermis, with pain, redness, and mild swelling.

Second-degree (partial thickness) burns involve the epidermis and some parts of the dermis (also known as partial-thickness burns). Further divided into:

• Superficial second-degree burns - involves the upper part of the dermis (papillary) and shows pain, blisters, and severe swelling.

• Deep second-degree burns - extends up to the reticular layer of the dermis and appears more pale and mottled, does not blanch to touch, but remains painful to pinprick.

Third-degree or full-thickness burns involve the full thickness of the dermis and subcutaneous tissue.

Fourth-degree burns involve deep structures such as muscle and bone.

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Solution to Question 5:

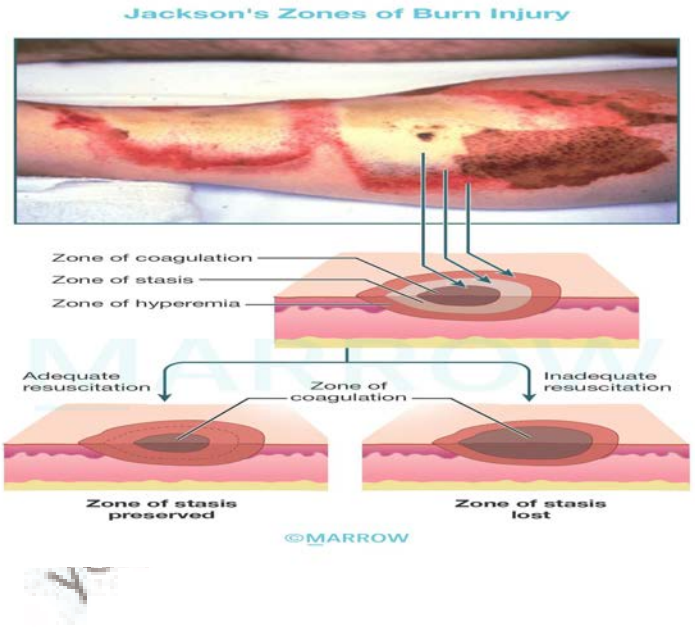
Vasoconstriction (not vasodilation) is seen in red region or zone of stasis (marked zone 3).

Jackson zones of tissue injury following burns has three zones:

• The zone of coagulation is the most severely burned portion and is typically in the center of the wound.

• Peripheral to that is a zone of stasis, with variable degrees of vasoconstriction and resultant ischemia.

• The last, outermost area of a burn is called the zone of hyperemia, which will heal with minimal or no scarring and is most like a superficial or first-degree burn. It is characterized by vasodilation from inflammation surrounding the burn wound.



Solution to Question 6:

The characteristic features of full-thickness burns (third-degree burns) are lack of sensation in the burned skin, lack of capillary refill, and a leathery texture that is unlike normal skin.

Deep dermal and full-thickness burns require excision with skin grafting for the patient to heal the wounds properly.

Solution to Question 7:

Following irrigation of the burn site, topical application of calcium gluconate gel along with ECG monitoring is the most appropriate management.

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Hydrofluoric acid is the strongest inorganic acid and it can cause liquefaction necrosis of deeper tissues (since the acid is highly lipophilic). Pain out of proportion to physical examination is a hallmark finding in HF burns. Systemic absorption of fluoride ions can result in intravascular chelation of calcium causing hypocalcemia.

Depletion of calcium causes inhibition of the sodium-potassium ATPase pump, leading to hyperkalemia and subsequent life-threatening arrhythmias. Therefore ECG monitoring is imperative. ECG abnormalities that can occur include prolonged QTc (from hypocalcemia) and QRS widening (from hyperkalemia).

Following copious irrigation of the burn site with water, the mainstay of treatment is with topical application of calcium gluconate gel. If the pain does not subside, or if systemic signs ensue, an intraarterial injection of calcium gluconate can be given in the affected extremity.

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Solution to Question 8:

The leading cause of death in electrical injuries is cardiac arrest. This is because alternating current injuries interfere with normal cardiac pacing.

The electricity itself does not usually cause significant underlying myocardial damage. So resuscitation, if successful, should be lasting.

The domestic electricity supply comprises a low voltage alternating current.

Solution to Question 9:

The best fluid used for burns is Ringer's lactate or Hartmann's solution.

Ringer lactate (crystalloid) is a mixture of sodium chloride, sodium lactate, potassium chloride, and calcium chloride in water. It prevents metabolic acidosis that may occur in burns.

Crystalloids are said to be as effective as colloids for maintaining intravascular volume and are given during the initial 24 hours.

Option A: Normal saline may be used, but large quantities of saline can cause hyperchloremic metabolic acidosis, worsening this patient's existing acidosis.

Option D: Human albumin solution is a colloid. Colloids should be ideally be given after the first 12 hours of burn because before this period, the massive fluid shifts cause proteins to leak out of the cells.

Solution to Question 10:

Using Wallace's Rule of 9, the % total burn surface area:

• One lower limb = Thigh (9%) + leg (9%) = 18%

• Genitals = 1%

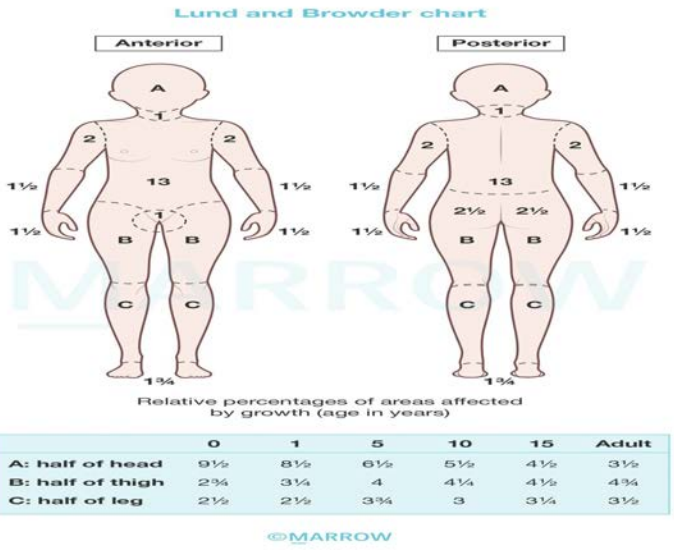
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Hence, in this patient, one lower limb+ other lower limb + genital = 18% + 18% + 1% = 37%.

Solution to Question 11:

Lund and Browder chart gives a more accurate accounting of the true burn size in children.

Unlike the Wallace rule of nines, the Lund and Browder chart takes into consideration the age of the person, by decreasing percentage BSA (Body Surface Area) for the head and increasing percentage BSA for the legs as the child ages, making it more useful in pediatric burns.



Relative percentages of areas affected by growth (age in years)

	0	1	5	10	15	Adult
A: half of head	9½	8½	6½	5½	4½	3½
B: half of thigh	2¾	3¼	4	4¼	4½	4¾
C: half of leg	2½	2½	3¾	3	3¼	3½

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Solution to Question 12:

Facial burns do not require a hydrocolloid dressing. Exposure therapy (no dressings are applied over the wound) is typically used on the face and head.

All topical antibiotics retard wound healing to some extent so they are used only in second or third-degree burns or wounds, which have a high risk of infection.

Blisters on second-degree burns should not be burst as they may cause an infection.

Topical treatment of deep burns:

- 1% silver sulphadiazine cream
- 0.5% silver nitrate solution
- Mafenide acetate cream
- Silver nitrate, silver sulphadiazine and cerium nitrate

Solution to Question 13:

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Capillary permeability and afterload is increased after severe burns.

Significant burns is associated with massive release of inflammatory mediators, both in the wound and in other tissues. These mediators produce vasoconstriction and vasodilation, increased capillary permeability, and edema locally and in distant organs.

Cellular and humoral immunity are decreased in burns (increased risk of infection).

Changes in various systems in burns:

CVS

• Massive edema

• Increased afterload

• Decreased venous return

• Decreased cardiac output

Renal

• Low volume concentrated urine

• Decreased urinary sodium

• Myoglobinuria

• Renal ischemia

• Acute tubular necrosis

• Acute renal failure

GI

• Reflex Ileus

• GI Ulcers (Curling's Ulcer)

Endocrine and Metabolism

• Increased glucagon, cortisol

• Protein catabolism

• Ureagenesis

• Lipolysis

• Increased gluconeogenesis

• Lactic acidosis

Hematological

• Anaemia

• Initial thrombocytopenia then thrombocytosis

• Decreased capacity of neutrophil phagocytosis

• Overall lymphopenia

• Relative increase in T-Suppressor Cells

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Solution to Question 14:

In temperate climates, cooling should be at about 15 °C, and hypothermia must be avoided. Moreover, studies show that ice cold water increases tissue damage.

Water at 15 °C provides analgesia and delays the microvascular damage in burns.

It should occur for a minimum of 20 minutes and is effective up to 1 hour after the burn injury.

Particularly important in scalds.

Solution to Question 15:

Fluid requirement is more as compared to other burns. All electric burns are managed by resuscitation at 4mL/Kg/%TBSA (which means 4mL for every Kg for every %TBSA). This is double what the ATLS guidelines advise for other burns as electrical burns may cause myoglobinuria and acute kidney injury.

Most of the electrical burns are of severe degree and cause third-degree burns.

The fluid resuscitation is done to ensure urine output of 100 mL/hr in adults and 1–1.5 mL/kg/hr in children < 30 kg, until the urine clears from pigmentation. The IV fluid is then titrated down to ensure the urine output of 0.5 mL/Kg/hr.

Electrical injuries are usually divided into low and high-voltage injuries.

• Low voltage injuries cause small, localized, deep burns.

• High voltage injuries damage by flash (External burn) and conduction (Internal burn)

The myocardium may be directly damaged without pacing interruption. Thus, ECG must be monitored for arrhythmias.

Solution to Question 16:

Proton pump inhibitors are used in burns patients to prevent Curling's ulcer. It is an acute gastric erosion that is a complication from severe burns when reduced plasma volume leads to ischemia and cell necrosis of the gastric mucosa.

Marjolin's Ulcer is squamous cell carcinoma occurring in a long-standing burn scar or any chronic ulcer.

Cushing's ulcer is a gastric ulcer occurring in elevated intracranial pressure.

Buruli's Ulcer is an infectious disease caused by Mycobacterium ulcerans.

Solution to Question 17:

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The tea-colored urine in the clinical vignette in the setting of an electrical injury is suggestive of rhabdomyolysis following electrical burns. Elevated creatine kinase is seen in rhabdomyolysis.

AC injuries are more commonly seen and this current creates tetany within the muscles. This sustained contraction can lead to muscle injury and resulting in rhabdomyolysis and myoglobinuria, presenting as tea-colored urine.

Damage to the underlying muscles in the affected limb can also cause the rapid onset of compartment syndrome. The release of the myoglobins will cause myoglobinuria and subsequent renal dysfunction. Therefore, during the resuscitation of these patients, efforts must be made to maintain a high urine output of up to 2 mL/kg body weight per hour.

Biochemical features of rhabdomyolysis are:

• Elevated CPK, BUN, Cr

• Hyperkalemia, hyperphosphatemia, hypocalcemia.

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Solution to Question 18:

According to the latest ATLS (Advanced Trauma Life Support) 10th edition 2018, resuscitation formula for second and third-degree thermal burns in the first 24 hours is given by the following equation:

Total percentage body surface area burned × weight (kg) × 2 = volume (mL).

Half this volume is given in the first 8 hours and the second half is given in the subsequent 16 hours. This has been recommended to reflect concerns about over-resuscitation when using the traditional Parkland formula.

Adequacy of fluid resuscitation is assessed by monitoring for a urine output of 0.5-1.0 mL/kg/hr.

However, in cases of electrical burns, the formula is:

Total percentage body surface area burned× weight (kg) × 4 = volume (mL).

Parkland and Modified Parkland formula:

• Parkland's formula for resuscitation in the initial 24 hours is given by = Total percentage body surface area × weight (kg) × 4 = volume (mL).

• Modified Parkland's formula provides more specific recommendations for the second 24 hours, advising colloid infusion of 5% albumin at the amount of 0.3-1.0/mL/kg/%BSA/hr. The management of the first 24 hours remains the same.

Solution to Question 19:

The most commonly used colloid-based formula is the Muir and Barclay formula:

• 0.5 × percentage body surface area burnt × weight = one portion

• A total of six portions are given in 36 hours

• Three portions: One portion for every 4 hours in 12 hours.

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• Two portions: One portion for every 6 hours in the next 12 hours.

• One portion: Remaining one portion in the last 12 hours.

Colloid-based resuscitation using the Muir-Barclay formula results in the administration of lower volumes of fluid than Parklands formula and carries a lower risk of complications from over-resuscitation. However, colloids (4.5% Albumin) are deferred for the first 8 hours when capillary permeability is highest and the benefit is questionable. So, the 36-hours schedule of the Muir and Barclay formula would begin after the first 8 hours of burn.

Options A and C: Parkland formula and Evan's formula are used to calculate the crystalloid volume to be given in the first 24 hours.

Option D: Wallace's rule of nine is used to calculate the percentage of the burnt body surface area (%TBSA).

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Solution to Question 20:

For a patient who presents with a history or suspicion of inhalational burn injury, elective endotracheal intubation is the safest strategy.

Delay can make intubation very difficult because of airway edema and can lead to airway obstruction. One should be ready to perform an emergency cricothyroidotomy if intubation is delayed.

Recognition of the potentially burned airway:

• A history of being trapped in the presence of smoke or hot gases

• Burns on the palate or nasal mucosa, or loss of all the hairs in the nose

• Deep burns around the mouth and neck

American Burn Life Support (ABLS) indications for early intubation include:

• Signs of airway obstruction (hoarseness, stridor, accessory respiratory muscle use, sternal retraction)

• The extent of the burn (TBSA > 40%–50%)

• Extensive and deep facial burns

• Burns inside the mouth or difficulty swallowing

• Significant edema or risk for edema

• Signs of respiratory compromise: Inability to clear secretions, respiratory fatigue, poor oxygenation or ventilation

• Decreased level of consciousness where airway protective reflexes are impaired

• Anticipated patient transfer of large burn with airway issue without qualified personnel to intubate en route

Solution to Question 21:

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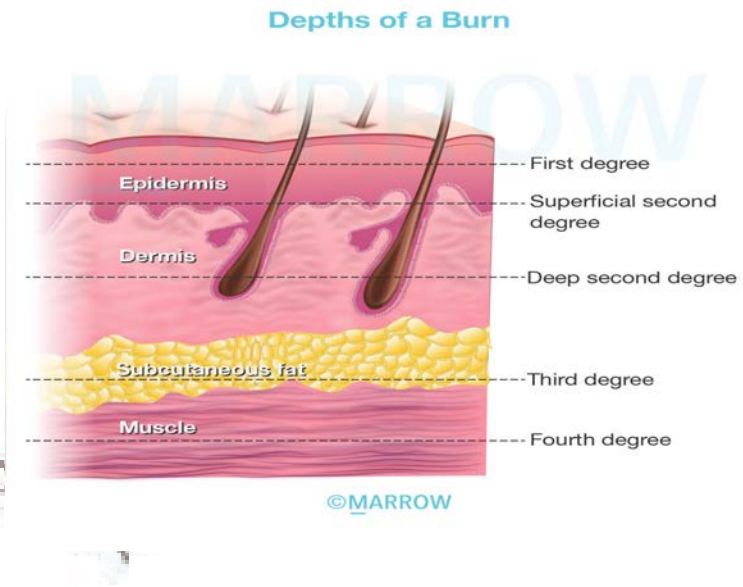
Scald injury (damage from contact with hot liquids) that appears pink in colour, has oozing, and pain is suggestive of a 2nd-degree burn (i.e. partial-thickness burn). Collagen dressing is the most appropriate management for this injury.

The best dressing for burn wounds is skin; collagen is a good substitute for skin, especially in partial-thickness burns. For full-thickness burns, sequential excision and grafting should be considered.

Initial treatment for burns includes cleaning burnt areas and removing loose dead skin. Blisters are de-roofed and an appropriate dressing is applied.

Biological dressing (collagen dressings, amniotic membrane, etc.) is the preferred dressing material, especially in partial thickness burns.

If this is not available then a non-adhesive dressing like paraffin gauze impregnated with silver sulfadiazine (SSD) cream, colloidal silver, ionic silver cream, or silver nitrate cream can be applied. Since increased resistance to SSD has recently emerged, it should be judiciously used and reserved for deep dermal, full thickness, infected, and old neglected burns.



Solution to Question 22:

The image shows a burn eschar. Among the given topical antibiotics, only mafenide acetate penetrates burn eschar to reach the interface with the patient's viable tissue.

This agent has the disadvantage that it is quite painful on any partial thickness areas, and it is a carbonic anhydrase inhibitor and can potentially cause metabolic acidosis.

Solution to Question 23:

The given clinical scenario is suggestive of hypothermia. The heart is the organ most sensitive to cold and is subject to ventricular fibrillation or asystole when the temperature drops to 21–24 °C.

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Hypothermia affects the dissociation of oxygen from hemoglobin, so less oxygen is released to the tissues. Other complications are coagulopathies and disseminated intravascular coagulation (DIC), pancreatitis, and acute renal failure.

Classification of hypothermia:

	Trauma	Accidental
Mild	36-34oC	35-32oC
Moderate	34-32oC	32-28oC
Severe	<32oC	<28oC

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Solution to Question 24:

Sweating is usually absent in classic (epidemic) heatstroke (CHS).

Heatstroke occurs as a result of an imbalance between heat production and heat dissipation (sweating). The skin is pink or ashen and sometimes, paradoxically, dry and hot. Dry skin in the presence of hyperpyrexia is virtually pathognomonic. It is of 2 types:

• Exertion-induced heat stroke is seen in people with prolonged exposure to or physical exertion in high temperatures, usually without adequate training.

• Sedentary heatstroke (CHS) is a disease of elderly or infirm people whose cardiovascular systems are unable to adapt to the stress of a hot environment and release sufficient heat such that body temperature rises.

Heat Cramps:

• These are painful spasms of voluntary muscles which follow strenuous work in a hot atmosphere.

• Caused by loss of water and salt in profuse sweating.

Heat exhaustion/heat prostration:

• Collapse without any elevation of body temperature

• Occurs due to exposure to high temperature in closed environment

• Precipitated by muscular exercise and unsuitable clothing

• Extreme exhaustion with peripheral vascular collapse with scanty sweating.

Solution to Question 25:

The heat stroke may be either exertion induced or sedentary heatstroke.

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Heat stroke occurs as a result of an imbalance between heat production and heat dissipation.

• Exertion-induced heat stroke is seen in people with prolonged exposure to or physical exertion in high temperatures, usually without adequate training.

• Sedentary heat stroke is a disease of elderly or infirm people whose cardiovascular systems are unable to adapt to the stress of a hot environment and release sufficient heat such that body temperature rises.

The body temperature must be measured rectally.

Treatment is rapid cooling by spraying the patient with water at 15 °C.

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Wound Healing, Tissue Repair & Scar

Question 1:

If histopathological examination of a 2-day-old forearm laceration is done, which of the following would be seen?

a) Early collagen deposition

b) Neutrophilic infiltration

c) Angiogenesis

d) Increased fibroblast activity

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Question 2:

A patient's wound has the given appearance 1 week after the injury. Which cells are predominantly found in this stage of wound healing?



a) Neutrophils

b) Lymphocytes

c) Macrophages

d) Fibroblasts

Question 3:

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Which of the following is an anti-inflammatory cytokine involved in wound healing?

a) IL-1

b) IL-6

c) IL-8

d) IL-10

Question 4:

Which of the following events of wound healing will be altered in a patient with scurvy?

a) Platelet aggregation

b) Phagocytosis

c) Early matrix scaffolding

d) Deposition of inorganic matrix

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Question 5:

In patients presenting with non-healing surgical incisions, what is the most common underlying cause?

a) Malnutrition

b) Infection

c) Smoking

d) Diabetes mellitus

Question 6:

A child with a grazed knee comes to your clinic for first aid. He has a history of nephrotic syndrome and is on oral prednisolone therapy. Which stage of wound healing would be most affected by his medication?

a) Epithelialisation of the wound

b) Collagen synthesis and remodelling

c) Initial inflammatory phase and angiogenesis

d) Contraction of the wound

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Question 7:

Which of the following findings in a long-standing ulcer would indicate malignant transformation?

a) Persistent granulation tissue with bleeding

b) Oedema beyond area of erythema

c) Everted wound edges

d) Non-healing after 2 weeks of therapy

Question 8:

A 21-year-old man came to the casualty 12 hours after sustaining a laceration on his leg from a trekking accident. On closer examination, other than dirt, you do not notice any pus or signs of infection. What is the most appropriate management?



a) Closure after granulation tissue has formed

b) Delayed closure 2 days after removal of devitalised tissue

c) Primary closure after adequate wound toileting and debridement

d) Wound debridement, topical antibiotics and dressing

Question 9:

Stage the bedsore in the following image:

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a) 4

b) 3

c) 2

d) 1

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Question 10:

Which of the following is the most common site of pressure sores ?

a) Heel

b) Occiput

c) Greater tochanter

d) Ischium

Question 11:

An elderly paraplegic patient admitted to a nursing home, developed an ulcer on her gluteal region. All of the following are true regarding the management of this patient except:

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a) Diet and nutritional support should aim to establish a positive nitrogen balance

b) Following debridement, exposure of the wound is recommended

c) Tensor fascia lata flap with an intact nerve supply may be used for covering the defect

d) Frequent change in position and air mattresses can help in preventing further sores

Question 12:

A meshed skin graft was used to cover a defect and vacuum-assisted closure of the transplant was done. What is the pressure generated within the dressing?



a) -50 mmHg

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b) -100 mmHg

c) -125 mmHg

d) -150 mmHg

Question 13:

A man who had undergone an exploratory laparotomy 6 months ago came for a follow-up visit. Which of the following statements about healed incision is false?



a) Disorganized collagen fibers become aligned along stress lines

b) Strength of the scar is in their weave rather than in their amount

c) By the first week it is held by sutures and a weak type 3 collagen matrix

d) Tensile strength is about 60-80% of normal skin by 3 months

Question 14:

The forearm of a patient admitted to the psychiatric ward is shown in the image. Which of the following is true about the healed injury?

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a) Extends beyond the original incision

b) Has racial and genetic predilection

c) Parallel orientation of collagen fibers

d) Does not heal spontaneously

Question 15:

Which of the following statements are true with regards to a keloid scar?

a) The extent does not cross the wound margins

b) Wide excision of the keloid scar prevents recurrence

c) Histopathology of a keloid scar shows reduced collagen and increased vascularity

d) A keloid scar forms due to increase in the level of growth factors

Question 16:

A patient has been treated for the lesion shown in the picture below for the past 12 months but there has been no response to treatment. What is the next line of treatment for this patient?

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a) Intralesional injection of steroids

b) Pressure treatment

c) Excision with adjuvant therapy

d) Excision alone

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Question 17:

Which of the following techniques will you use to reduce suture marks and scars?

a) 2,5

b) 1,2,4

c) 3,4,5

d) 2,4

Question 18:

Which of the following is not a skin substitute?

a) Integra

b) Alloderm

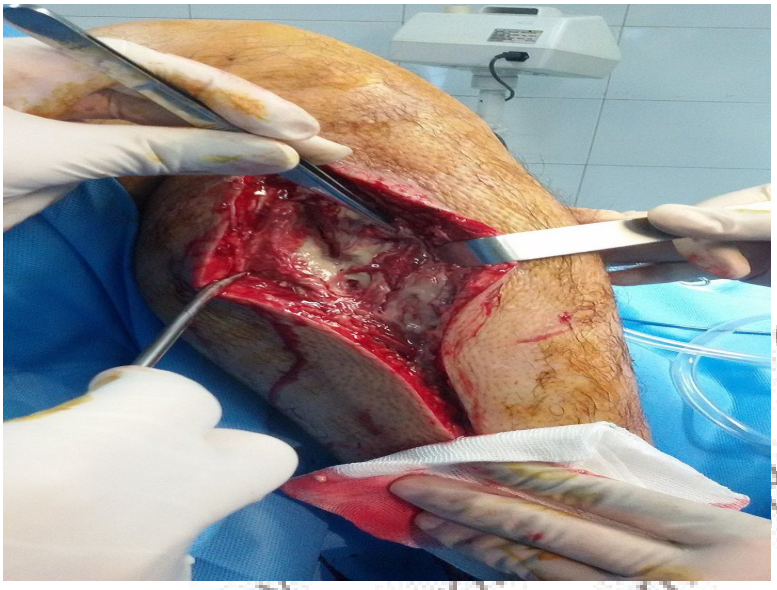
c) Trancyte

d) Duoderm

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Question 19:

Identify the procedure shown in the image.



a) Venesection

b) Fasciotomy of lower limb

c) GSV stripping

d) Linton's operation

Question 20:

A catheter is inserted into the limb of a patient suspected to have compartment syndrome. What minimum reading on the pressure monitor will prompt an immediate fasciotomy?

a) 20 mmHg

b) 30 mmHg

c) 40 mmHg

d) 50 mmHg

Question 21:

While performing a fasciotomy for compartment syndrome, the following layers are incised:

a) Skin and Subcutaneous tissue

b) Skin, Subcutaneous tissue, Superficial fascia

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c) Skin, Subcutaneous tissue, Superficial fascia and Deep fascia

d) Skin, Subcutaneous tissue, Superficial fascia, Deep fascia and a few muscular fibres

Question 22:

The lower limb of this patient was run over by a car. Identify the type of injury.



a) Degloving injury

b) Crush injury

c) Lacerated injury

d) Tidy wound

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d.

Question 23:

What is the most likely diagnosis of the lesion shown in the image below?

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a) Arterial insufficiency

b) Neuropathic ulcer

c) Venous ulcer

d) Tuberculous ulcer

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Question 24:

A 68-year-old diabetic presented with a foot ulcer that he first noticed 1 month ago. The edges are irregular with sloped margins. The ulcer does not bleed to touch. Peripheral pulses are felt and an arterial doppler does not indicate a compromised blood flow. Which growth factor has been formulated and approved for treatment?

a) IGF-1

b) PDGF

c) EDGF

d) TGF-B

Question 25:

Which of the following procedures leaves a clean-contaminated wound?

a) Thyroidectomy

b) Repair of an old duodenal perforation

c) Elective cholecystectomy

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d) Emergency appendectomy

Question 26:

ASEPSIS wound scoring takes all of the following into consideration except:

a) Wound swab from the site

b) Serous discharge

c) Erythema

d) Induration

Question 27:

Which of the following is used for wound infection grading?

a) ASA classification

b) SIRS criteria

c) Southampton grading

d) APACHE II score

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Answer Key

Question No.	Correct Option
1	b
2	d
3	d
4	c
5	b
6	c
7	c
8	b
9	a
10	d
11	b
12	c

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13	c
14	c
15	d
16	c
17	c
18	d
19	b
20	b
21	c
22	a
23	b
24	b
25	c
26	d
27	c

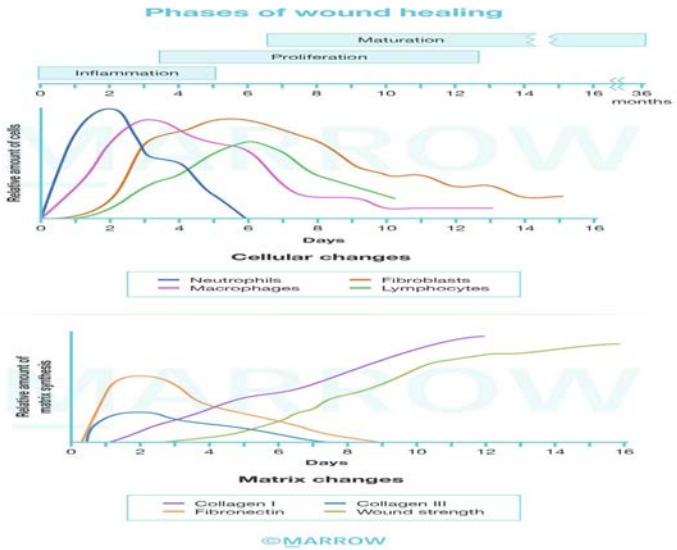
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Detailed Explanations

Solution to Question 1:

Neutrophil peak is seen on day 2 of the inflammatory phase of wound healing.

Wound healing has three phases: The inflammatory phase, proliferative phase, and maturation phase. The inflammatory phase lasts 2-3 days.



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Solution to Question 2:

The given image shows granulation tissue formed during the proliferative stage of wound healing. Fibroblasts are the predominant cell during the proliferative stage.

Fibroblasts are specialized cells that differentiate from resting mesenchymal cells into connective tissue. The primary function of fibroblasts is to synthesize collagen.

The proliferative stage of wound healing is characterized by the formation of granulation tissue, which consists of a capillary bed, fibroblasts, macrophages, and a loose arrangement of collagen, fibronectin, and hyaluronic acid.

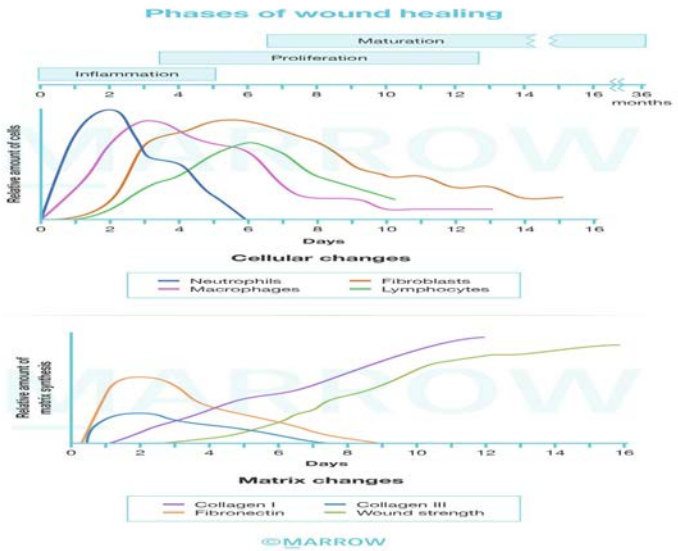
Solution to Question 3:

Interleukins 1, 6 and 8 are pro-inflammatory cytokines, whereas IL-10 is an anti-inflammatory cytokine.

Solution to Question 4:

Dietary deficiency of vitamin C (scurvy) results in poorly formed collagen and affects the early matrix scaffolding.

Type I and Type III collagens are both present in the extracellular matrix of normal skin (in an 8:1 ratio). However, during the proliferative phase of wound healing, the dominant collagen that is laid is Type III. This stage is also known as early matrix scaffolding. Type III collagen is gradually replaced by type I collagen (during the final remodeling phase) until a ratio (type I: type III) of 4:1 is achieved.



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Solution to Question 5:

All the factors listed impair wound healing, but local infection is the most common underlying cause of non-healing surgical incisions.

To reduce the chances of infection ,the surgeon should make every effort to remove all devitalized tissue and leave a clean wound for closure.

Factors affecting wound healing:

• Site of the wound

• Structures involved

• Mechanism of wounding (crushing, incision, avulsion)

• Contamination

• Loss of tissue

• Local factors (vascularity, previous irradiation, pressure)

• Systemic factors (malnutrition, anemia, steroids, AIDS, smoking)

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Solution to Question 6:

While all of the given options are inhibited by steroids, the major effect of steroids is to inhibit the initial inflammatory phase of wound healing (angiogenesis, neutrophil and macrophage migration, and fibroblast proliferation) and the release of lysosomal enzymes.

The stronger the anti-inflammatory effect of the steroid compound used, the greater the inhibitory effect on wound healing. Steroids used after the first 3 to 4 days post-injury do not affect wound healing as severely as when they are used in the immediate postoperative period.

In addition to inhibiting collagen synthesis, steroids also inhibit epithelialization and contraction and contribute to increased rates of wound infection, regardless of the time of administration.

Steroid delayed healing of cutaneous wounds can be stimulated to epithelialize by topical application of vitamin A.

Solution to Question 7:

Everted edge around a chronic wound is a sign of malignant transformation.

The majority of wounds that have not healed in 3 months are considered chronic and are prone to malignant changes. Malignant wounds are differentiated clinically from non-malignant wounds by the presence of overturned edges. Biopsy of the wound edges should be performed to rule out malignancy.

Malignant transformation can occur in any long-standing wound. The image shows a Marjolin's ulcer with everted edges. It is squamous cell carcinoma that develops on a long-standing burn.

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Solution to Question 8:

Contaminated wounds older than 6 hours should be managed with delayed primary closure.

The wound is cleaned, debrided, and left open for a few days. This allows soft tissues to drain and also ensures no infection is present before surgical closure can be done.

Wound closure is categorized into primary, secondary, or tertiary:

Primary closure is done for clean wounds with minimal tissue loss that are amenable to approximation of wound edges. Healing occurs by primary intention. Primary closure is ideally performed within 6 to 8 hrs of trauma, but wounds in vascular areas (e.g. face) may be delayed to up to 24 hours after trauma.

Secondary closure allows healing by secondary intention. The wound is left open to heal largely by the formation of granulation tissue and contraction. These wounds often have significant tissue loss precluding tension-free approximation of edges, with devitalized edges. Wound dressings are changed daily to aid in the formation of granulation tissue and subsequent contraction.

Tertiary closure, also known as delayed primary closure, results in a combination of healing by primary and secondary intention. The wound is thoroughly irrigated, debrided, and left open for 2 to 5 days before surgical closure. It is used for wounds that are grossly contaminated without significant tissue loss.

Solution to Question 9:

The given image shows complete skin loss that involves muscles and shows exposed bone indicating a stage 4 pressure sore.

Pressure sores are skin or soft tissue injuries that occur due to prolonged pressure over specific areas of the body. An external pressure of >30 mmHg leads to the formation of pressure sores.

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The common sites of pressure sores in decreasing frequency are the ischium, greater trochanter, sacrum, heel, malleolus (lateral followed by medial), and occiput.

Pressure sores can be prevented with good skincare, the use of air-fluidized beds, special pressure-dispersion cushions, or foams. Repositioning the patient every two hours can lessen the pressure on the area.

Ulcers of stages 1 and 2 often do not require operative measures. They are managed with regular wound cleaning and dressing with a good antibiotic cover.

Stage 3 and 4 ulcers are adequately debrided, and vacuum-assisted closure (VAC) is used to promote the growth of granulation tissue required for surgical closure. Large skin flaps that have muscle with sensory innervation are best for reconstruction.

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Solution to Question 10:

Pressure sore frequency in descending order:

- Ischium
- Greater Trochanter
- Sacrum
- Heel
- Malleolus
- Occiput

Solution to Question 11:

The given image is that of a grade 3 bedsore. A grade 3 pressure sore requires dressing following debridement.

Preoperative management involves adequate debridement, and the use of vacuum-assisted closure (VAC) to provide a suitable wound for surgical closure. Alginates, foams, hydrocolloids, hydrogels are other options that are available.

The aim of surgery is to fill the dead space and to provide durable sensate skin. Large skin flaps that include muscle are best and, occasionally, an intact sensory innervated area can be included (e.g. extensor fascia lata flap with the lateral cutaneous nerve of the thigh).

Nutritional optimization with high caloric and protein diet should be done to establish a positive nitrogen balance. Frequent changes in position and air mattresses can also help in preventing further sores.

Solution to Question 12:

The pressure used in vacuum-assisted closure for wound healing is –125 mmHg.

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Applying negative pressure appears to hasten debridement and the formation of granulation tissue in chronic wounds and ulcers.

It acts by decreasing edema, by removing interstitial fluid, and as a result, helps in decreasing bacterial counts and cell proliferation increases.

Solution to Question 13:

During the first week, a surgical wound has minimal inherent strength because the dermal edges are held together solely by a hemostatic plug and sutures.

During the second postoperative week, fibroblasts proliferate rapidly and begin to produce type I collagen in addition to type III. The strength of the wound is still limited to less than 10% of its final strength. By week 6, the concentration of strong collagen fibers begins to resemble that of intact skin.

As the collagen matures and becomes denser, the scar becomes almost acellular as the fibroblasts and blood vessels reduce.The disorganized collagen fibers become aligned along stress lines with their strength being in their weave rather than in their amount.

Most of these changes occur over the first three months but a scar will continue to mature for 1 to 2 years. Tensile strength will continue to increase but would not be expected to exceed 60–80% of that of normal skin.

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Solution to Question 14:

The given image shows hypertrophic scars which have developed on possible sites of self-inflicted cuts. Type 3 collagen fibers are arranged parallelly in hypertrophic scars. This is in contrast to a keloid where the collagen fibers are more and randomly arranged.

Hypertrophic scars rise above the skin level but stay within the confines of the original wound and often regress over time. They have no racial or genetic predilection.

Difference between keloid and hypertrophic scar:

Features	Hypertrophic scar	Keloid
Genetic predisposition	Not familial	Maybe familial - Autosomal dominant with incomplete penetration
Age	Children	Adolescents. Middle age
Race	No predilection	African American, Asian, Hispanic
Site	Anywhere (more common on extensor surface)	Neck, chest, ear lobes, shoulders, upper back
Timings	4–6 weeks postinjury	Symptom-free interval; may appear years after injury

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Features	Hypertrophic scar	Keloid
Symptoms	Raised, some pruritus, respects wound confines	Pain, pruritus, hyperesthesia, growth beyond wound margins
Regression	Frequent spontaneous	No
Contracture	Frequent	Rare
Histology	Parallel orientation of collagen fibers	Hypocellular, thick, wavy collagen fibers in random orientation

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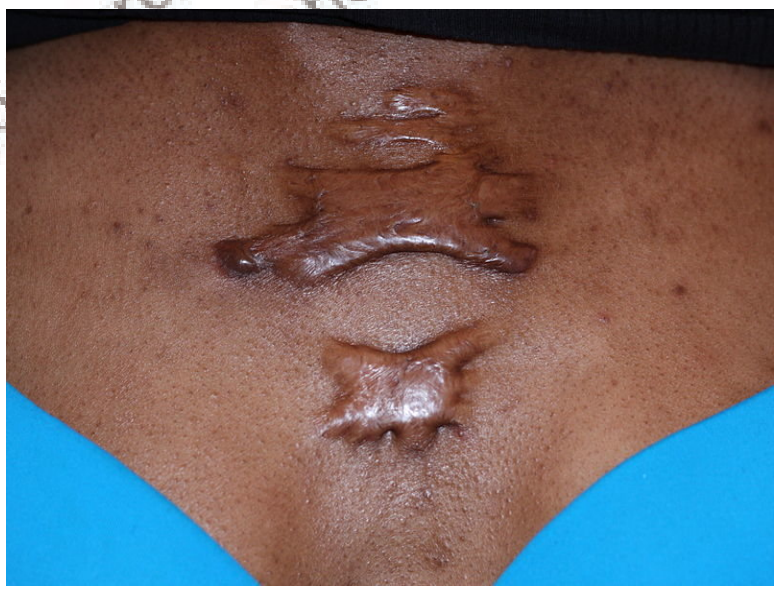
Solution to Question 15:

Keloid scars are associated with elevated levels of growth factor leading to increased proliferation of fibrous tissue.

A keloid scar is defined as excessive scar tissue that extends beyond the boundaries of the original incision or wound (option A) and rarely regresses on its own. It is more common in darker-pigmented ethnicities.

It can arise from surgery, burns, skin inflammation, infections, ear piercing, and even spontaneously. It occurs 3 months to years after the initial insult with even minor injuries causing keloid formation.

It most commonly occurs on the skin of the earlobe, deltoid, presternal, upper back, and rarely extends into the subcutaneous tissue.



The histology of keloid scars shows excess collagen and hypervascularity with collagen fibres arranged haphazardly in loose sheets (option C).

Treatment: Keloid scars do not improve spontaneously with time and excision alone has a high rate of recurrence (option B). The following can be done:

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• Pressure - local moulds or elastic garments.

• Silicone gel sheeting.

• Intralesional triamcinolone injection.

• Excision and steroid injections.

• Excision and postoperative radiation (external beam or brachytherapy).

• Intralesional excision.

• Laser to reduce redness.

• Vitamin E and palm oil massage.

Differences between Keloids and Hypertrophic scars:

	Keloid	Hypertrophic scar
Incidence	Rare	Frequent
Ethnic groups	African, American, Asian, Hispanic	No predilection
Prior injury	Yes	Yes
Site predilection	Neck, chest, earlobes, shoulders, upper back	Anywhere
Genetics	Autosomal dominantwith incomplete penetration	No
Timing	Symptom-free interval; may appear years after injury	4-6 weeks post-injury
Symptoms	Pain, pruritus, hyperesthesia, growth beyond wound margins	Raised, some pruritus, respects wound confines
Regression and contracture	No, and rare	Frequent
Histology	Hypocellular, thick, wavy collagen fibres inrandom orientation	Parallel orientationof collagen fibres

Solution to Question 16:

Surgical excision in combination with adjuvant therapy is advised to patients with refractory keloids.

The adjuvant therapy usually includes radiation.The risk of malignancy attributable to keloid radiation therapy is minimal

Treatment of keloids :

• First-line treatments include silicones in combination with pressure therapy and intralesional corticosteroid injections.

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• Intralesional 5-fluorouracil, bleomycin, and verapamil should be used in accordance with established treatment protocols.

• Refractory cases after 12 months of therapy should be considered for surgical excision in combination with adjuvant therapy.

• Excision alone results in a high recurrence rate of 50% to 100% and enlargement of the keloid.

• Immediate postoperative electron beam irradiation or brachytherapy with iridium-192 reduces recurrence rates. The risk of malignancy attributable to keloid radiation therapy is minimal.

• An additional new invasive treatment modality is internal cryotherapy, in which a metal rod is introduced into the keloid and the subsequent extreme cooling leads to tissue necrosis.

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Solution to Question 17:

Fine sutures (6/0 or smaller) placed close to the wound margins tend to cause less scarring. Subcuticular suturing avoids suture marks on either side of the wound or incision.

Suture marks can be minimized using monofilament sutures that are removed early (3–5 days). Wounds can be strengthened post-suture removal by the use of sticky strips.

Solution to Question 18:

Duoderm is a hydrocolloid and not a skin substitute.

Skin substitutes are skin products made of cells, extracellular matrix components, or a combination of the two.

Integra is a bilayered membrane skin substitute.

Alloderm is a acellular cadaveric dermis.

Apligraf is a living bilayered biologic dressing composed of neonatal dermal fibroblasts on a collagen matrix.

Trancyte is a tissue-engineered skin substitute is made from a nylon mesh and a silastic semi-permissible and biocompatible layer.

Solution to Question 19:

The image depicts a fasciotomy of the lower limb.

Fasciotomy involves incising the deep muscle fascia and is best carried out via longitudinal incisions of skin, fat, and fascia. The muscle is seen bulging out through the fasciotomy opening.

The lower limb can be decompressed via two incisions, each being lateral to the subcutaneous border of the tibia. This gives access to the two posterior compartments and to the peroneal and anterior compartments of the leg.

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Solution to Question 20:

The pressure threshold for doing a fasciotomy in a case of suspected compartment syndrome is 30 mmHg

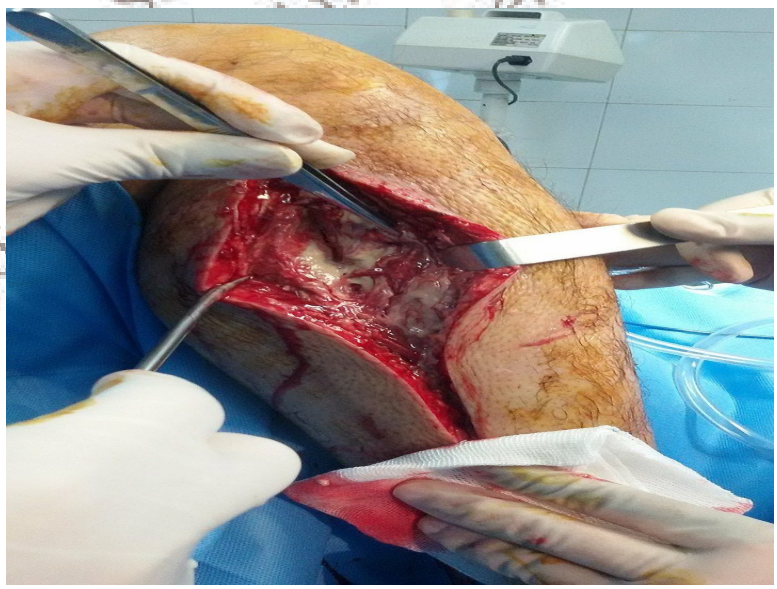
Fasciotomy involves incising the deep muscle fascia and is best carried out via longitudinal incisions of skin, fat, and fascia.

Solution to Question 21:

The incision for a fasciotomy involves the skin, subcutaneous tissue, superficial fascia, and deep fascia.

Fasciotomy involves incising the deep muscle fascia and is best carried out via longitudinal incisions of skin, subcutaneous fat, and superficial and deep fascia. The muscle will be seen bulging out through the fasciotomy opening.

The lower limb can be decompressed via two incisions, each being lateral to the subcutaneous border of the tibia. This gives access to the two posterior compartments and the leg's peroneal and anterior compartments.



Solution to Question 22:

Degloving injury occurs when the skin and subcutaneous fat are stripped by avulsion from its underlying fascia, leaving neurovascular structures, tendons, or bones exposed.

It may be open or closed.

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A tidy wound is a clean incised wound with seldom tissue loss whereas an untidy wound is one that is crushed, avulsed, contaminated often with tissue loss.

Solution to Question 23:

The given image which shows a punched-out ulcer with regular margins on the plantar surface of the dry, crackled foot is suggestive of a neuropathic ulcer.

Neuropathic ulcers occur as a result of repeated trauma to the insensitive part due to peripheral neuropathy. There is a lack of sensation over the pressure points, leading to unnoticed microtrauma, wounds or cuts which develop into an ulcer. Causes of neuropathic ulcers include diabetic neuropathy, B12 deficiency, alcoholism, hypothyroidism, leprosy, peripheral nerve injury, transverse myelitis and myelomeningocele.

Other options:

Option D: Tuberculous ulcers occur when a cold abscess from bone and joint tuberculosis breaks out on the surface. The most characteristic feature of this ulcer is its edge which is thin and undermined. The following is a picture of a tuberculous ulcer:

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Type of Ulcer	Arterial(option A)	Venous(option C)	Neuropathic	Pressure
Underlying co ndition	Peripheral vascular d isease, hypertension	Varicose veins, DVT, obesity, previous thr ombophlebitis	Diabetes, peripheral neuropathy	Limited mobility
Location	Lateral malleolus, to es, and dorsum of th e foot	Lower leg, above the medial malleolus	The plantar surface o f the foot, toes	Bony prominences (e. g.heel)
Characteristic s	Deep, punched-out, i rregular margins. Th e wound bed has un healthy necrotic tiss ue	Shallow, flat with ex udate	Punched-out with re gular calloused marg ins.	Deep, macerated
Condition of l eg/foot	Cool thin shiny skin, pallor on leg elevatio n, absent peripheral pulses, and delayed c apillary refill	Excematous and pig mented. Limb edema may be present	Dry, cracked, insens ate	Atrophic skin, loss of muscle

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The following is a picture of an arterial ulcer.



The following is a picture of a venous ulcer.

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The following is a picture of a pressure ulcer.



Solution to Question 24:

The clinical scenario is suggestive of a diabetic foot ulcer. At present, PDGF (platelet-derived growth factor)-BB is currently approved by the FDA for the treatment of diabetic foot ulcers.

Application of recombinant human PDGF-BB in a gel suspension to these wounds increases the incidence of total healing and decreases healing time.

Solution to Question 25:

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Elective procedures in uninfected respiratory, genital, urinary, and gastrointestinal tracts such as elective cholecystectomy produce clean-contaminated wounds.

Option A: Thyroidectomy leaves a clean wound.

Option B: Repair of an old duodenal perforation is a contaminated wound.

Option D: Emergency appendectomy is usually performed in the setting of an inflamed appendix and results in a dirty surgical wound.

Solution to Question 26:

ASEPSIS wound score does not take induration into consideration. Instead, the I in ASEPSIS stands for the isolation of bacteria from the wound.

ASEPSIS wound score and Southampton wound score are used to determine the severity of the surgical site wound infection (SSI).

ASEPSIS score includes:

• Additional treatment

• Antibiotics for wound infection

• Drainage of pus under local anesthesia

• Debridement of the wound under general anesthesia

• Serous discharge

• Erythema

• Purulent exudate

• Separation of deep tissue

• Isolation of bacteria from the wound

• Stay as inpatient prolonged over 14 days as a result of wound infection

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Solution to Question 27:

Southampton wound grading system is used to score the severity of wound site infection.

Southampton wound grading system:

• Grade 0 - Normal healing

• Grade I - Normal healing with different grades of erythema

• Grade II - Erythema with other signs of inflammation at different parts of the wound.

• Grade III - Clear or serosanguinous discharge at different sites

• Grade IV - Pus discharge

Other options:

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Option A: American Society of Anesthesiologists (ASA) grading is used in pre-anesthetic checkups to assess a patient's physical health and fitness for anesthesia and surgery.

Option B: Systemic Inflammatory Response Syndrome (SIRS) is a set of clinical criteria used to identify and monitor critically ill patients with high-grade burns, severe trauma, and other major surgeries.

Option D: Acute Physiology and Chronic Health Evaluation II (APACHE II) is a scoring system used to assess the severity and predict the outcome of pancreatitis.

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Reconstructive Surgery

Question 1:

A scar excision followed by reconstruction with a split skin graft was performed on the forearm of a 28-year-old man. The survival of the graft during the first 48 hours will be mainly dependent on _____.

a) Inosculation

b) Imbibition

c) Early revascularization

d) Stored glycogen

Question 2:

A patient with a leg injury was treated with a skin graft as shown below. Which of the following statements is false regarding this type of skin graft?



a) Degree of contraction is dependant on amount of dermis in graft

b) Healing with abnormal pigmentation are more common.

c) High reliability of take

d) Meshing grafts improve their ultimate cosmetic appearance

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Question 3:

A 34-year-old man sustains facial burns and is being planned for reconstruction with a skin graft. Which type of graft should he receive to achieve a better cosmetic appearance and minimal contraction?

a) Wolfe graft

b) Thiersch graft

c) Composite graft

d) Blair-Brown graft

Question 4:

The most common cause of skin graft failure is ____

a) Hematoma

b) Infection

c) Graft movement

d) Poor quality of the recipient bed

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Question 5:

A 20-year-old lady sustained extensive burns over her left forearm for which a split-thickness skin graft was planned. During surgery, after obtaining a skin graft from the anterior thigh, the patient became hemodynamically unstable and a transplant to the forearm could not be completed. What would you do with the harvested graft?

a) It must be discarded and fresh graft harvested before repeat surgery

b) It can be stored for up to 2-3 days at +4°C in saline

c) It can be stored for up to 2-3 weeks at +4°C in saline

d) It can be stored for 2-3 months at +4°C in saline

Question 6:

Which of the following is true with respect to a skin graft harvested from the post-auricular area?

a) Harvested using Humby knife

b) Donor site must be sutured

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c) Lower rates of graft failure

d) Secondary contracture is more common

Question 7:

A child is being prepared for a Millard's repair as seen in the image. The factors influencing the development of his condition are all except _____.



a) Smoking during pregnancy

b) Infections during pregnancy

c) Vitamin A deficiency during pregnancy

d) Increased parental age

Question 8:

The given image shows a forearm flap harvested for the reconstruction of the oral cavity of a 45-year-old patient with squamous cell carcinoma. Identify the type of flap.

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a) Axial flap

b) Islanded flap

c) Free flap

d) Random flap

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Question 9:

The flap shown in the picture is which of the following?



a) Serratus anterior flap

b) Pectoral myocutaneous flap

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c) TRAM flap

d) VRAM flap

Question 10:

The image shows a surgical technique used to release Dupuytren's contracture. Which of the following statements is true regarding this?



a) It can also be used in the surgical management of keloid scars and contractures

b) It reorients the direction of the central wound by 90 degrees

c) Triangular flaps created using 60 degrees can lengthen the scar by 50%

d) It is a type of local advancement flap

Question 11:

A truck driver undergoes a Limberg flap operation using a random flap for recurrent pilonidal sinus infections. What is the generally accepted safe and reliable length: width ratio for this type of flap?

a) 1.5:1

b) 2:1

c) 3:1

d) 2.5:1

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Question 12:

A free flap is used to resurface a tendoachilles defect in a 58-year-old chronic smoker. As a first-year surgical resident, you are asked to monitor the flap for venous occlusion. Which of the following should you be looking out for?

a) Increasing warmth

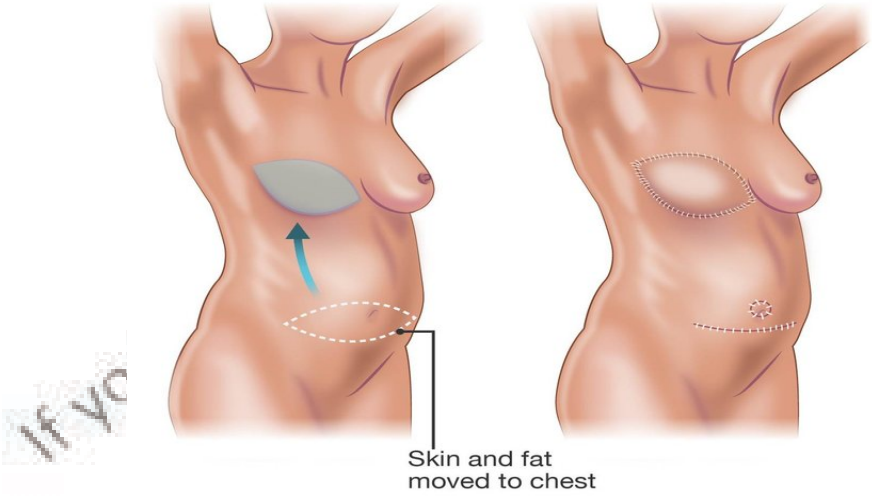
b) Increasing paleness

c) Increasing coolness

d) Increasing sluggishness of pinprick bleeding

Question 13:

Which of the following is true about the flap given in the image.



a) Pedicled TRAM based on superior epigastric artery

b) Free TRAM based on superior and inferior epigastric artery

c) DIEP based on deep inferior epigastric artery

d) Lower Abdominal Fat based inferior epigastric vessels

Question 14:

A 30-year-old woman who underwent a skin-sparing mastectomy a year ago has returned to your clinic to discuss her options for breast reconstruction. All of the following are options to consider except:

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a) A TRAM flap provides the best cosmetic result than LD flap

b) An LD flap provides adequate bulk of breast tissue

c) Reconstruction may be delayed or immediate

d) Capsular contraction is a dreaded complication of silicone implants

Question 15:

A 35-year-old man with osteosarcoma of the mandibular ramus is planned for resection and reconstruction with a flap. The flap used most commonly in mandibular reconstruction is based on which of the following vascular structures?

a) Anterior tibial artery

b) Peroneal artery

c) Posterior tibial artery

d) Dorsalis pedis artery

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Question 16:

A 56-year-old patient suffering from alcoholic cirrhosis receives a healthy liver from his biological son. What is this type of transplant known as?

a) Autograft

b) Allograft

c) Xenograft

d) Isograft

Question 17:

What incision would you make to excise a lesion on the bridge of the nose, in order to cause minimal scarring?

a) Vertical

b) Horizontal

c) Oblique

d) Circular

Question 18:

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A plastic surgeon performs an upper eyelid reconstruction using a tarsoconjunctival flap for a patient who underwent a sebaceous gland carcinoma excision. What is the maximum tissue loss for which a primary repair would have sufficed?

a) <5%

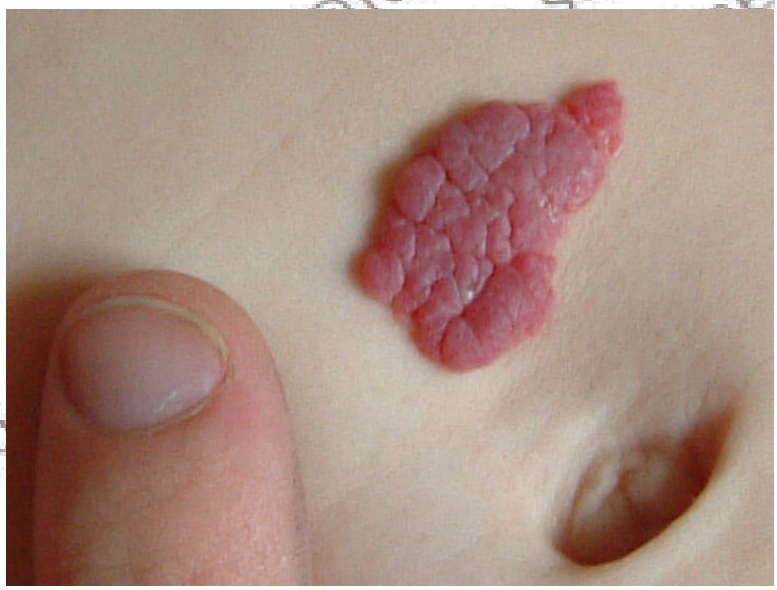
b) <10%

c) <25%

d) <40%

Question 19:

A mother brings her 3-week-old baby to the pediatrics OPD, with a lesion on his abdomen which has been growing in size since birth. On examination, the lesion is red, nodular, and blanches on pressure. What is the next step in management?



a) Local resection with carbon dioxide laser

b) En bloc excision with skin grafting

c) Emollient application and intralesional triamcinalone

d) Monitoring of the lesion

Answer Key

Question No.	Correct Option

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1	b
2	d
3	a
4	a
5	c
6	b
7	c
8	c
9	a
10	b
11	c
12	a
13	c
14	b
15	b
16	b
17	b
18	c
19	d

If you purchase... you may have... else, ...d.

Detailed Explanations

Solution to Question 1:

Skin grafts survive by imbibition during the first 48 hours.

The stage of imbibition is the first stage of graft uptake during which the graft draws nourishment from the plasma exudate at the host site (by simple diffusion). After this inosculation and revascularization take over.

Solution to Question 2:

The given image shows a meshed, split-thickness skin graft. Split grafts are meshed to expand the surface area that can be covered but it does not improve the cosmetic appearance.

Less dermis in the split-thickness skin graft translates into less primary contraction (the degree to which a graft shrinks in surface area after harvesting and before grafting) and more secondary contraction (the degree to which a graft shrinks during healing).

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Less dermis also translates into a better chance of graft survival. Thin split grafts have a low primary contraction, high secondary contraction, and high reliability of graft take. However, they tend to heal with abnormal pigmentation and poor durability.

The image given below shows the procedure of obtaining a split-thickness skin graft using a handheld Humby knife.

Type of graft	Split-thickness graft	Full-thickness graft
Composition	Epidermis + part of the derm is	Epidermis + full dermis
Cosmetic appearance	Relatively poor	Good (texture and pigmentation are better matched)
Graft take/survival	High chance of survival	Poor (long healing time and vascularization)
Contraction	Lesser primary contraction and more secondary contraction	More primary contraction and lesser secondary contraction
Use	Can cover large areas of defects	For areas where least contraction (finger) or best cosmesis (face) is desired



Solution to Question 3:

The patient should receive a Wolfe graft to achieve a better cosmetic appearance and minimal contraction. Wolfe grafts are full-thickness skin grafts that are used for small areas of skin replacement where good elastic skin that will not contract is required (such as fingers, eyelids, and facial parts).

Option B: Partial-thickness skin grafts or split-thickness grafts are called Thiersch grafts. They consist of the epidermis and a portion of the dermis. They tend to heal with abnormal

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pigmentation and result in suboptimal cosmetic appearance.

Option C: Composite grafts are grafts that contain skin and fat or skin and cartilage. They are often taken from the ear margin and useful for rebuilding missing elements of the nose, eyelids, and fingertips.

Option D: Blair-Brown grafts are a type of intermediate thickness split skin graft.

	Full-thickness skin graft (Wolfe)	Split thickness skin graft (Thiersche)
Structure	Epidermis +complete dermis ± fat	Epidermis +part of dermis
Donor site location	Post auricular, supra/infra-clavicular.Never axillary	Thigh > buttocks
Donor site wound	Must be sutured	Requires only dressing and can be reused
Recipient site	Must be well vascularised. Small area	May be inadequately vascularized. Larger area (achieved by meshing)
Graft features		
Durability	High	Low
Contracture	Primary > secondary	High secondary contracture
Uptake	Require more care to ensure uptake	High-reliability
Cosmetic result	Good	Poor (abnormal pigmentation)

Solution to Question 4:

The most common cause of skin graft failure is hematoma under the graft, where the blood clot is a barrier to contact of the graft and bed for revascularization.

Other causes are shearing or movement of the graft on the bed, infection, poor quality of the recipient bed, and characteristics of the graft itself, such as thickness or vascularity of the donor site.

Solution to Question 5:

The harvested graft can be stored at +4°C in refrigeration after wrapping it in a sterile gauze pad moistened with saline. The process of harvesting and storing skin grafts is called skin banking. Skin banks store grafts using various methods. Most commonly preferred is to store the graft for up to 2-3 weeks at +4°C.

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Solution to Question 6:

Graft harvested from the postauricular area is a full-thickness skin graft. As it involves harvesting the complete dermis donor site needs to be sutured following harvest.

Option A: Humby knife is used to harvest split-thickness skin grafts (Thiersche grafts).

	Full-thickness skin graft (Wolfe)	Split thickness skin graft (Thiersche)
Structure	Epidermis +complete dermis ± fat	Epidermis +part of dermis
Donor site location	Post auricular, supra/infra-clavicular.Never axillary	Thigh > buttocks
Donor site wound	Must be sutured	Requires only dressing and can be reused
Recipient site	Must be well vascularised. Small area	May be inadequately vascularized. Larger area (achieved by meshing)
Graft features		
Durability	High	Low
Contracture	Primary > secondary	High secondary contracture
Uptake	Require more care to ensure uptake	High-reliability
Cosmetic result	Good	Poor (abnormal pigmentation)



Solution to Question 7:

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Vitamin A deficiency during pregnancy is not a factor influencing the development of cleft lip/palate. Millard's repair is the most common surgical repair of cleft lip and is usually performed between 3 to 6 months of age.

The cause of orofacial clefting is felt to be multifactorial. Factors that likely increase the incidence of clefting include increased parental age, drug use and infections during pregnancy, and smoking during pregnancy.

Solution to Question 8:

The picture shows a radial forearm free flap. Fasciocutaneous radial forearm free flap is the most common free flap used in head and neck reconstruction.

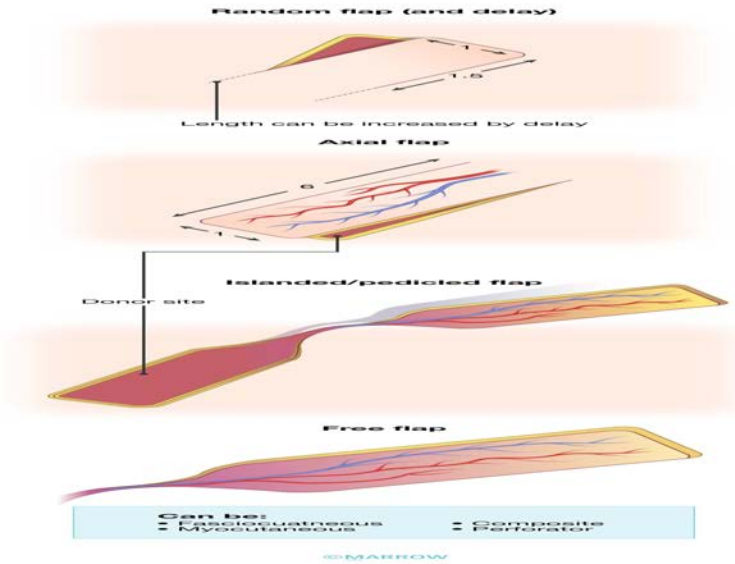
A flap defines the tongue of tissue whereas a pedicle is used to describe the base or stem with the vascular supply.

In a free flap, the blood supply is isolated, disconnected, and then reconnected using microsurgery at the new site. Other Eg for free flaps: free fibular flap, DIEP flap (Deep inferior epigastric perforators)

Option A: Axial flaps are much longer and are based on known blood vessels. Eg: Latissmus Dorsi flap, TRAM (Transverse rectus abdominis myocutaneous) flap.

Option B: An islanded flap is that in which the axial blood supply is swung round on a stalk.

Option D: A random flap includes three sides of a rectangle, bearing no specific relationship to where the blood supply enters. Eg: V-Y plasty, Z plasty, Limberg, or rhomboid flap.



Solution to Question 9:

The given image shows a serratus anterior flap. The serratus anterior flap is a highly reliable flap with a consistently long pedicle. Its anatomy permits coverage of complex wounds. The

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underlying rib can be included as a myoosseous flap to expand the versatility of this flap.

Classification of muscle flaps		
Based on blood supply	Random flapUnnamed vessel supplying flap	Axial flapNamed vessel supplying flap.
Method of movement	Local transferRotation flapTransposition flapAdvancement flap	Distant transferPedicle flapFree flap
Based on composition	Simple FlapCutaneous flapMusculocutaneousFasciocutaneous	Composite flapOsseocutaneous flapSensory flap

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Solution to Question 10:

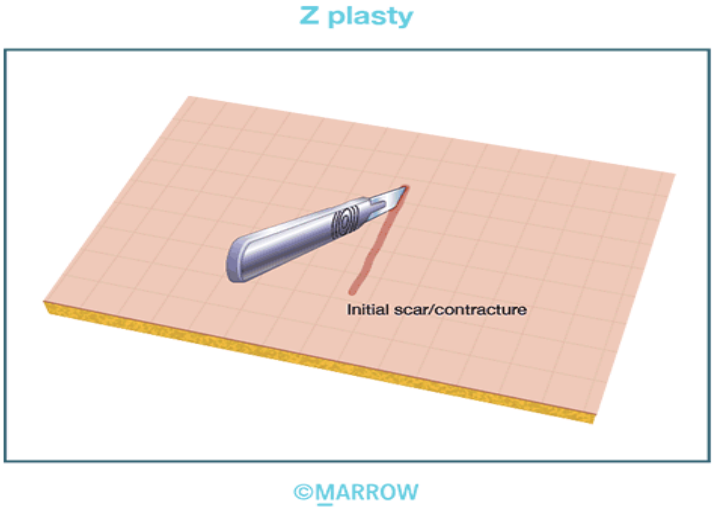
The image shows a typical example of a Z Plasty.

It is a type of transposition flap that incorporates qualities of both advancement and rotation flaps. Z plasty is used for the lengthening of linear scars. It is best used in releasing simple contractures.

Usually, all the limbs are of equal length and ideally, the angle between them is 60°. Two triangular flaps are raised. Theoretically, a 60-degree angle flap will result in a 75% increase in the length of the scar and a 90-degree reorientation of central wound.

Angles smaller than 60 degrees are easier to transpose but result in less lengthening and realignment of the scar to less than 90 degrees. Angles larger than 60 degrees should be avoided because the force required to transpose the flaps increases markedly, making the closure of the wound difficult.

Relative contraindications to Z-plasty include patients with keloids and hypertrophic scarring tendencies.



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Solution to Question 11:

The Limberg flap is a type of random flap and the safe and reliable length:width ratio for the random flap 3:1.

Random pattern flaps have a blood supply based on small, unnamed blood vessels in the dermal-subdermal plexus, as opposed to the discrete, well described, directional vessels of axial pattern flaps. As random flaps have a variable blood supply, they need an adequate base (width) to survive.

The rhomboid (Limberg) flap involves creating a skin flap with two opposing angles of 60° and 120° at the corners, forming a rhomboid shape positioned directly next to the defect. The design allows the flap to be rotated into the defect, with the donor site closed primarily, ensuring minimal distortion to the surrounding tissues. This method is especially useful in areas like the gluteal region, where complex closure techniques help achieve optimal results.

Solution to Question 12:

The first sign of venous occlusion in a free flap is increasing warmth.

Clinical signs of arterial and venous compromise in a free flap:

Note: Venous and arterial compromise may coexist, and one may lead to the other.

Clinical Sign	Arterial Compromise	Venous Compromise
Color	Becoming paler	Increasingly reddish or purplish
Temperature	Becoming cooler	Becoming warmer
Tissue turgor	Reducing	Increasing
Capillary refill time	Becoming slower	Becoming faster
Pinprick bleeding	Increasingly sluggish	Quickening (and darkening)

Solution to Question 13:

The given image showing only skin and fat moved to the chest is suggestive of a deep inferior epigastric artery perforator flap (DIEP), based on the deep inferior epigastric artery.

DIEP is a variant of TRAM flap and free flap where only the skin and fat are moved to the chest. A microvascular technique is used in which no muscle is taken and the perforating vessels are dissected out.

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As the muscle is spared in DIEP, there is a reduced risk of abdominal wall weakness and its associated complications.

Other options:

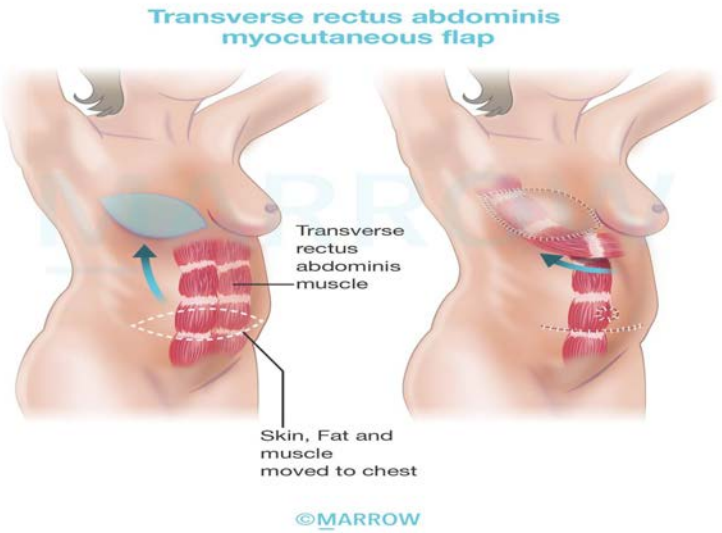
Options A and B: The pedicled TRAM flap is based on the superior epigastric artery and the free TRAM flap is based on superior and inferior epigastric arteries (supercharged TRAM flap); however, the given image depicts a deep inferior epigastric artery flap. In TRAM flaps:

• The skin, fat, and muscle are moved to the chest.

• It provides good cosmesis and bulk since it has a soft tissue consistency similar to the breast.

• Disadvantages include epigastric bulge, partial flap loss, fat necrosis, abdominal wall weakness, and hernias.

The given image below shows a TRAM flap:

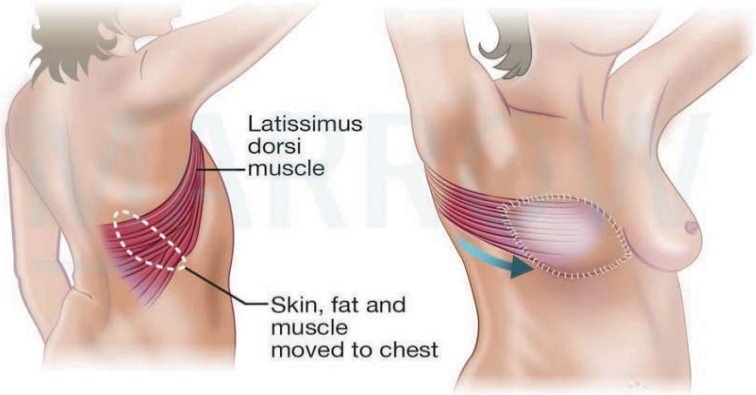


Solution to Question 14:

An LD flap does not provide the bulk required and is usually used along with an implant. It is based on the thoracodorsal pedicle. It is an axial flap.

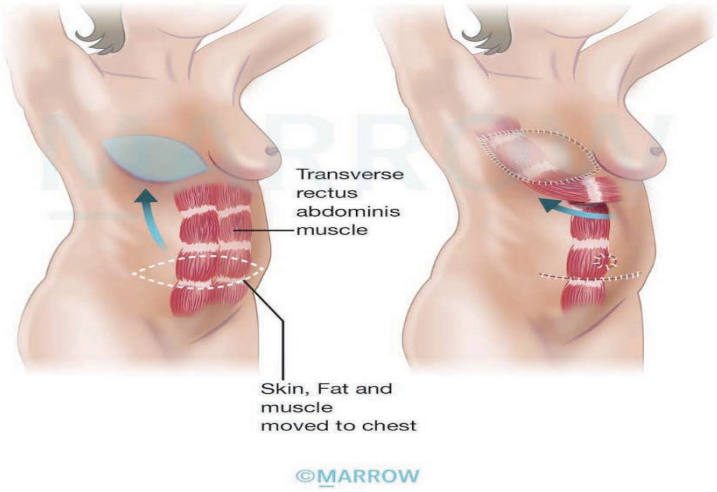
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Latissimus dorsi flap



Transverse rectus abdominus myocutaneous (TRAM) flap is either based on superior epigastric or inferior epigastric or both (supercharged TRAM). Skin, fat, and muscle are moved to the chest. It provides good cosmesis and bulk. An implant is usually not required.Since the rectus abdominis muscle is excised in the procedure, it can lead to abdominal wall weakness and hernias.

Transverse rectus abdominis myocutaneous flap



The timing of reconstruction may be immediate or delayed. Impediments to immediate reconstruction include insufficient theatre time and a lack of experienced reconstructive surgeons. In addition, the patient is likely to need post-op radiotherapy, then a delayed reconstruction using a flap often gives better results.

The easiest type of reconstruction is using a silicone gel implant under the pectoralis major muscle. Capsular contraction is a dreaded complication of silicone implants.

Solution to Question 15:

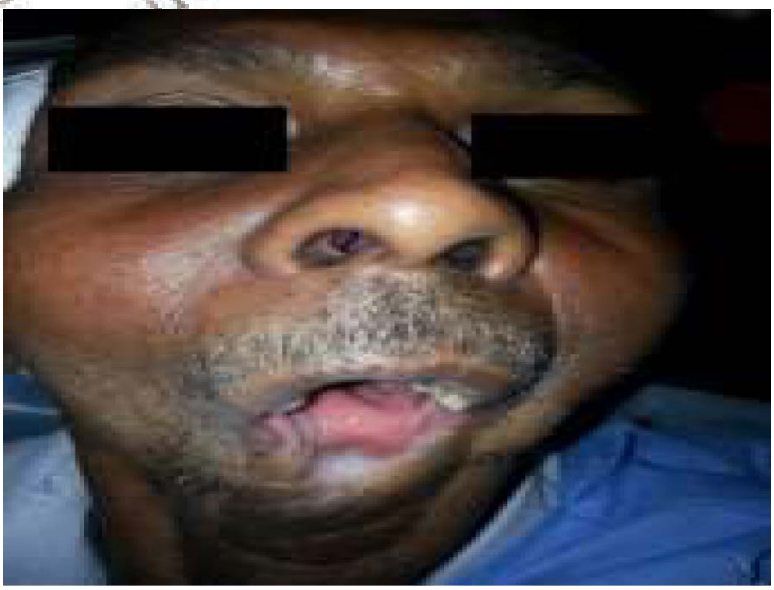
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The most commonly used osseous flap for mandibular reconstruction is the fibular free flap. The fibular free flap is based on the peroneal artery and vein, and the blood supply to the foot should be investigated before harvesting this flap.

Common flaps and their uses

The free fibular flap may also be used to correct the Andy Gump deformity. It is an anterior mandibular defect that creates the appearance of an absent chin and lower lip and severely retrognathic lower jaw, which is named after a character in an early 20th-century comic strip.

Name of flap	Use	Based on
Pectoralis major myocutaneous	Head and neck reconstruction	Pectoral branch of thoracoacromial artery
Deltopectoral	Head and neck reconstruction	Internal mammary vessels
Radial forearm	Head and neck reconstruction	Radial vessels
Abbe Estlander	Midline lip and angle of mouth reconstruction	Labial vessels
Karapandzic	Lip reconstruction	Labial vessels
Transverse rectus abdominis myocutaneous (TRAM)	Breast reconstruction (most commonly used flap)	Superior epigastric vessels
Free TRAM	Breast reconstruction	Inferior epigastric vessels
Lattisimus dorsi	Breast reconstruction	Thoracodorsal vessels
Deep inferior epigastric artery	Breast reconstruction	Deep inferior epigastric artery perforators
Free fibular	Mandibular reconstruction Andy Gump deformity	Peroneal vessels



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Solution to Question 16:

Transplant of an organ/tissue from a son to a parent is an example of an allograft.

An allograft is transplant of cells/tissues/organs from a genetically non-identical donor of the same species.

Isografts are allografts in which cells/tissues/organs are transplanted from a donor to a genetically identical recipient. (monozygotic twins)

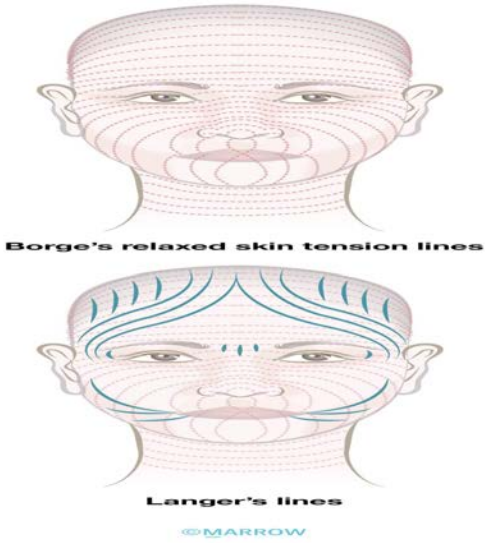
Solution to Question 17:

A horizontal incision should be taken as the relaxed skin tension lines (Borge's lines) at the bridge of the nose are horizontal.

Aligning a surgical incision or excision with skin tension lines results in minimal tension across the closure of the defect. This leads to optimal scar formation and minimizes wound contraction.

Skin tension lines reflect internal tension within the skin and are produced by the parallel alignment of connective tissue of the dermis. Several different skin tension lines have been described. Borge's lines which are also called relaxed skin tension lines are most useful to guide surgical incision. These are often confused with Langer's lines.

Langer's lines, also called cleavage lines are topological lines drawn based on the shape of wounds on cadavers. These were not intended as a guide for surgical incisions and they do not always correspond to the best orientation of skin tension and often run perpendicular to skin folds. On the face, these two sets of lines often run at right angles to one another.



Solution to Question 18:

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Defects comprising <25% of the upper eyelid can generally be closed primarily in pentagonal approximating fashion.

For defects involving 25–50% of the upper eyelid, lateral canthotomy and cantholysis can be performed.

Defects more than 50% need proper flap cover.

Solution to Question 19:

The given clinical picture is suggestive of infantile hemangioma. Only monitoring of the lesion is required as in 50% of cases, complete involution is seen by 5 years of age.

Hemangioma growth frequently peaks before the first year, and then the lesions enter the involuting phase. The involution phase begins in 50% of children by 5 years of age and in 70% by 7 years of age. It continues until 10 years of age.

Indications for immediate treatment are complications such as ulceration or those pertaining to the location of the mass (e.g. visual issues due to large hemangioma over eyelid).

Treatment options include:

• Beta blockers - oral propranolol

• Steroids - intralesional triamcinolone, topical clobetasol, systemic steroids

• Interferon alfa-2a and vincristine - for steroid-resistant lesions

• Local resection with cutting cautery or carbon dioxide laser

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Thorax & Lungs

Question 1:

Which of the following statements is false about the surgical anatomy of the lungs?

a) There are 10 bronchopulmonary segments on the right lung.

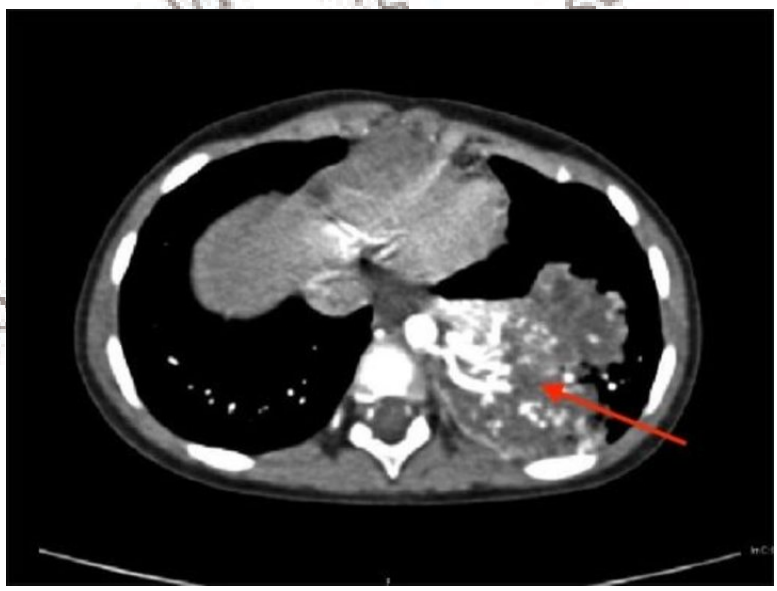
b) Each bronchopulmonary segment has a separate lymphatic drainage.

c) The tracheobronchial tree is normally lined by pseudostratified ciliated columnar cells.

d) Segmentectomy is done after locating the segmental branch of bronchial artery.

Question 2:

An infant has a congenital bronchopulmonary malformation as shown in the CT scan given below. Which of the following is most likely to supply the marked structure?



a) Internal mammary artery

b) Bronchial artery

c) Pulmonary artery

d) Thoracic aorta

Question 3:

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A 50-year-old patient on DOTS therapy was rushed to the casualty after having massive hemoptysis. Which of the following is false regarding this condition?

a) Intubation is done into the non-bleeding lung.

b) Massive hemoptysis is defined as expectoration of over 750 mL of blood within 24-hours.

c) Presence of significant cavitary disease is an indication for urgent surgery.

d) Bleeding is most likely due to pulmonary artery erosion.

Question 4:

Where is Rasmussen's aneurysm seen?

a) Internal thoracic artery

b) Pulmonary artery

c) Bronchial artery

d) Subclavian artery

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Question 5:

A 50-year-old chronic smoker with left-sided lung cancer is rushed to the emergency department with massive hemoptysis. On examination, pulse - 102 bpm, BP - 80/50 mmHg, RR - 30/min. Which of the following will be part of your management plan for this patient?

a) 1, 2, 3

b) 1, 4, 5

c) 2, 4, 5

d) 2, 3, 5

Question 6:

A 54-year-old comes to the casualty with a history of massive hemoptysis. His routine investigation and chest X-ray were normal. Which of the following you will not do to prevent hemoptysis?

a) Bronchial artery embolization

b) Pulmonary artery embolization

c) Procoagulant drugs

d) Surgical removal of lobe

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Question 7:

A 20-year-old man presents with h/o sudden breathlessness while watching television. Upon examination, he is noticed to be 6 ft tall and very lean. He is not breathless at the moment. Chest X-ray reveals a right-sided pneumothorax of 1.5 cm. He does not smoke or drink. Which of the following is the next step in the management of this patient?

a) Outpatient follow-up in 2-4 weeks

b) Place a Chest drain

c) Do a chest CT

d) Aspirate with an 18G needle

Question 8:

The ultrasound diagnosis of pneumothorax depends on :

a) 1,2, and 3

b) 2, 4, and 5

c) 1 and 5

d) 3 and 4

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Question 9:

A patient presents with breathlessness to the casualty after a motorcycle accident. On examination, the left chest is hyper-resonant on percussion and shows reduced air entry over the same side. His pulse is 110 bpm, RR - 25/min, BP - 80/45mmHg, and JVP was elevated. What will be your immediate management?

a) Insert a wide bore needle in 5th intercostal space anterior to the mid axillary line

b) Chest X-ray

c) Insert a chest tube in the 5th intercostal space in the anterior axillary line

d) Intubation

Question 10:

A 34-year-old man is brought to the emergency department with a stab wound to his right chest following a fight at the local bar. His vitals are normal. On examination, the trachea is

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central and a penetrating wound is noted on the right chest. A sucking sound is heard during inspiration. Which of the following is the initial management in this case?

a) Occlusive dressing tapped on the 3 sides

b) Placing chest drain at the site of the wound

c) Surgical exploration of the wound

d) Needle decompression

Question 11:

A patient presents with a productive cough, fever, and breathlessness. On examination, decreased breath sounds and dull note on percussion is noted on the left side. A chest X-ray is given below. USG-guided aspiration revealed frank pus. Chest tube was inserted but there was no improvement in symptoms. How will you manage this patient?



a) VATS debridement

b) Antibiotics

c) Pleurodesis

d) Decortication procedure

Question 12:

Which of the following is not an indication for performing thoracotomy in patients with blunt chest injury?

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a) >1500 ml drainage after placing an intercostal tube

b) Continuous bleeding through intercostal tube of more than 200 ml/hour for three or more hours

c) Cardiac tamponade

d) Rib fracture

Question 13:

All of the following will be your differential diagnosis in a patient with anterior mediastinal mass except:

a) Germ cell tumor

b) Lymphoma

c) Thyroid mass

d) Neurogenic tumors

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Question 14:

A 35-year-old patient complains of double vision that gets worse after he watches television. He also has drooping of the eyelids that gets better after a nap. Serology is positive for anti-acetylcholine receptor antibodies. A CT scan of his chest is given below. Which of the following is false regarding his condition?



a) It is the most common tumor of the anterior mediastinum.

b) Masoaka classification system is used for staging.

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c) Tumor size is a reliable indicator of malignancy.

d) Surgery can be performed through a median sternotomy approach.

Question 15:

Which stage of Masaoka staging does a patient with thymoma invading the great vessels come under?

a) Stage II

b) Stage IV A

c) Stage III

d) Stage IV B

Question 16:

A toddler with cough and progressive breathing difficulty was found to have a poorly defined solid mass in the mediastinum. What is the most common mediastinal mass in this age group?

a) Thymoma

b) Mesenchymal tumor

c) Neurogenic tumor

d) Bronchogenic Cyst

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Question 17:

Lymphomas most commonly a■ect which compartment of the mediastinum?

a) Anterior

b) Middle

c) Posterior

d) Inferior

Question 18:

What is the most common benign tumor of the lung?

a) Hamartoma

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b) Alveolar adenoma

c) Chondroma

d) Fibroma

Question 19:

Which of the following is true about bronchial carcinoid?

a) Smoking is a risk factor

b) Metastasis is common

c) It is usually asymptomatic

d) It is associated with MEN 2

Question 20:

In patients with lung cancer, presence of which of the following indicates an immune-mediated paraneoplastic syndrome?

a) Hypercalcemia

b) Cushing's Syndrome

c) Hyponatremia

d) Peripheral Neuropathy

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Question 21:

Identify the incorrectly matched pair based on the type of lung cancer and their paraneoplastic effects.

a) Adenocarcinoma lung - Hypertrophic primary osteoarthropathy

b) Small cell lung cancer - SIADH

c) Squamous cell carcinoma - Cushing's syndrome

d) Non-small cell lung cancer - Clubbing

Question 22:

According to the TNM staging, a patient with lung cancer of size 2.5 cm is staged as _____

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a) T1b

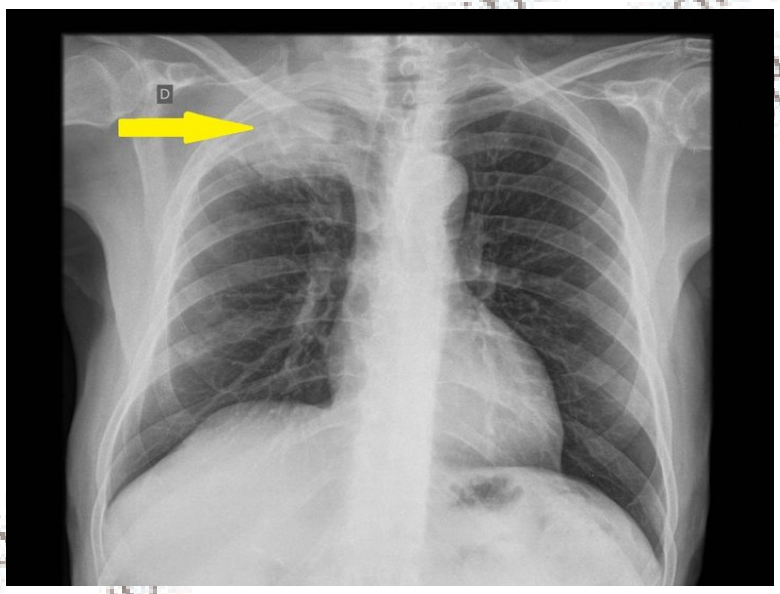
b) T1c

c) T2a

d) T1a

Question 23:

A 52-year-old smoker presents with cough and pain along the right arm for the past few weeks. He appears cachexic. On examination, clubbing and right-sided ptosis were noted. Chest X-ray of the patient is given below. Which of the following statements is false about this condition?



a) CT scan is preferred over MRI.

b) Arises from the superior sulcus.

c) Can cause phrenic nerve palsy.

d) N2 nodal stage requires definitive chemoradiotherapy.

Question 24:

During a health checkup in a factory, a 52-year-old worker complained of progressive cough and weight loss for the past 6 months. Chest X-ray showed a mass in the right apical region of the lung with pleural effusion. The biopsy sample obtained stained positive for calretinin. Which of the following is false about this condition?

a) Immunohistochemical analysis will be positive for TTF-1.

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b) Carries a poor prognosis.

c) Asbestos exposure is the major risk factor.

d) Surgery includes extrapleural pneumonectomy.

Question 25:

A 48-year-old man with a chronic history of smoking is diagnosed with small cell lung carcinoma. Which of the following statement is false regarding the management of the patient?

a) Chemotherapy has a good response.

b) In wedge resection, anatomical bronchopulmonary segment is removed.

c) Posterolateral thoracotomy approach is used for surgical resection.

d) Lobectomy is the treatment of choice for early-stage lung cancer.

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Question 26:

Which of the following is not a component of Thoracoscore?

a) Performance status

b) Complication of surgery

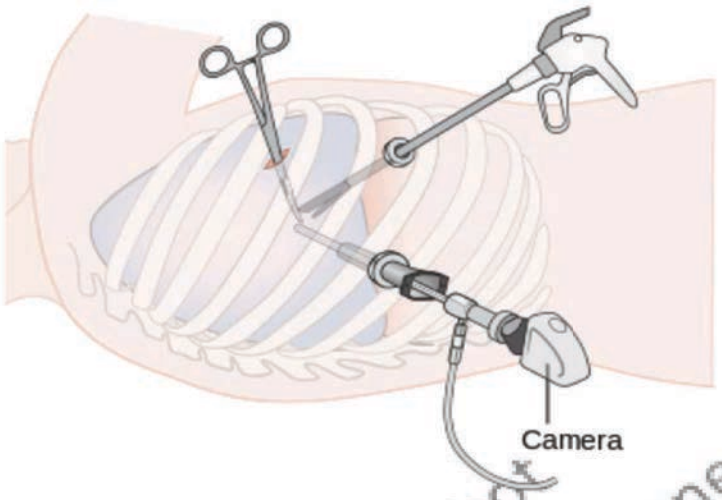
c) ASA grading

d) Priority of surgery

Question 27:

A patient with a mediastinal mass undergoes the following procedure. Which of the following statements is false?

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a) The patient is positioned in a lateral decubitus with the diseased side up.

b) It is contraindicated if the patient is having empyema.

c) Lobectomy can be done via this procedure.

d) It allows direct visualization of the pleural cavity.

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Question 28:

What is the conduit of choice for the left anterior descending artery while performing CABG?

a) Femoral vein

b) Left internal mammary artery

c) Saphenous vein

d) Radial artery

Question 29:

A 55-year-old man has been in the ICU for the past 1 month due to end-stage liver failure. He is not eligible for a transplant and his doctors have said there is nothing they can do at this stage. His family has consented to organ donation once his heart stops. Which of the categories of non-beating heart donors would this patient fall into as per the modified Maastricht classification?

a) Category IV

b) Category II

c) Category I

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d) Category III

Answer Key

Question No.	Correct Option
1	d
2	d
3	b
4	b
5	c
6	c
7	a
8	b
9	a
10	a
11	a
12	d
13	d
14	c
15	c
16	c
17	a
18	a
19	c
20	d
21	c
22	b
23	a
24	a
25	b
26	b
27	b
28	b
29	d

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Detailed Explanations

Solution to Question 1:

In segmentectomy, the segment is removed from the lobe after locating the intersegmental vein.

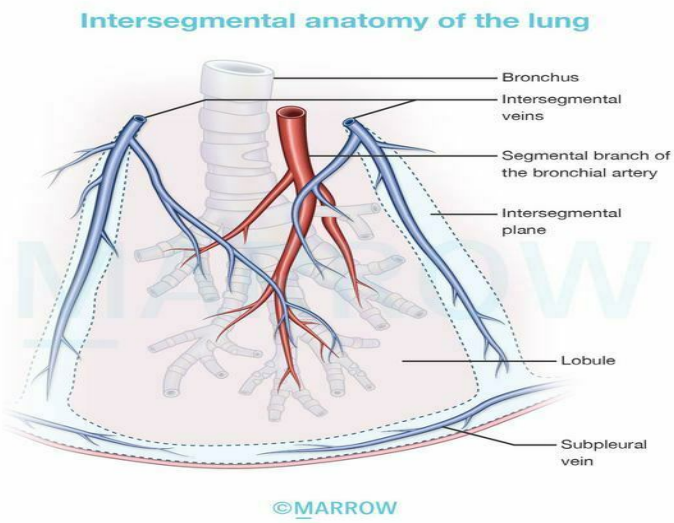
Bronchopulmonary segments are well-defined, anatomic, functional, and surgical areas of the lung. There are 10 bronchopulmonary segments each on the right and the left lung. The segments help in segmental resection and bronchoscopy as each segment has a separate:

• Tertiary bronchus

• Segmental artery

• Autonomic nerve supply

• Lymphatic drainage



The tracheobronchial tree is normally lined by pseudostratified ciliated columnar cells and mucous cells.

Solution to Question 2:

The given CT shows an intralobar pulmonary sequestration of the left lung. The thoracic aorta commonly supplies the sequestered lobe of the lung.

Pulmonary sequestration is an area of embryonic lung tissue, separate from the lung. It receives blood supply from an anomalous systemic artery from the aorta. It is of two types:

• Extralobar sequestration occurs primarily on the left side and blood supply is usually from the thoracic or upper abdominal aorta

• Intralobar sequestration occurs in the lower lobes predominantly (>95%). It is equally distributed between the right and left lower lobe and blood supply is from the descending thoracic

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aorta, venous drainage via pulmonary veins

Treatment involves resection of the pulmonary sequestration.

Solution to Question 3:

Massive hemoptysis is defined as the expectoration of over 600 mL of blood within a 24-hour period. Common causes include tuberculosis, bronchiectasis, and cancer. It is a medical emergency.

Any hemoptysis that can cause airway compromise or lead to hemodynamic collapse is called massive hemoptysis. This includes blood loss of >600mL/24h or >150ml/h which can flood the anatomical dead space of the lung.

Bleeding can either be from the bronchial artery circulation (most common) or from the pulmonary artery circulation. Bleeding from cavitary lesions is due to pulmonary artery erosion.

The chest X-ray is the first investigation followed by rigid or flexible bronchoscopy.

The cause of death in massive hemoptysis is usually due to asphyxiation (rather than blood loss itself). This is why airway stabilization by intubating into the non-bleeding lung is the priority. After ventilation is achieved, the bleeding site should be identified using bronchoscopy. Bleeding is controlled by laser, bronchial occlusion, or arterial embolization. Surgical resection of the involved area is also done in some cases.

Indications for urgent surgical intervention for massive hemoptysis:

• Presence of a fungus ball

• Presence of a lung abscess

• Presence of significant cavitary disease

• Failure to control the bleeding.

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Solution to Question 4:

The aneurysm of the pulmonary artery within the tuberculous cavity is called Rasmussen's aneurysm.

Rasmussen's aneurysm is an inflammatory pseudo-aneurysmal dilatation. This occurs during the healing of the tuberculous cavity. There is a progressive weakening of the arterial wall, in which both the tunica adventitia and media are replaced by granulation tissue. This is gradually replaced by fibrin resulting in thinning of the arterial wall leading to pseudoaneurysm formation.

Rupture of Rasmussen's aneurysm can cause massive hemoptysis. CT angiography plays an important role in locating the aneurysm.

Most cases of massive hemoptysis arise from the bronchial arterial tree because of high pressure within bronchial arteries. Even when a pulmonary aneurysm is present, the actual bleeding may be from the bronchial artery, rather than from the pulmonary artery itself.

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Solution to Question 5:

The left side is most likely to be the bleeding side in this patient. Hence, the patient should be placed in the left lateral decubitus position to prevent aspiration into the unaffected lung. Also, a CT scan is not indicated as he is hemodynamically unstable.

Treatment priorities in the management of massive hemoptysis:

• First priorities are to maintain the airway, optimize oxygenation and stabilize the hemodynamic status by administering IV fluids.

• Chest X-ray is the first investigation of choice. CT scan is done only in hemodynamically stable patients.

• If the bleeding side is known, the patient should be placed in a lateral decubitus position, with the bleeding side down to prevent aspiration into the unaffected lung and given supplemental oxygen.

• If large-volume bleeding continues or the airway is compromised, the patient should be intubated and undergo emergency bronchoscopy.

• The bleeding site is localized using flexible/rigid bronchoscopy.

• Control the hemorrhage:

• Endobronchially with Nd: YAG laser or bronchial occlusion

• Endovascularly with bronchial and/or pulmonary artery embolization

• Electrocauterization

• Surgically with resection of the involved lobe

The cause of the hemoptysis must be determined to definitively prevent a recurrence.

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Solution to Question 6:

Procoagulant drugs are not used to prevent hemoptysis. Procoagulant drugs like vasopressin are indicated only if there is an abnormal coagulation profile.

Massive hemoptysis is generally defined as the expectoration of over 600 mL of blood within a 24-h period.

Treatment priorities in the management of massive hemoptysis:

• First priorities are to secure the airway, optimize oxygenation and stabilize the hemodynamic status by administering IV fluids.

• Chest X-ray is the first investigation of choice. CT scan is done only in hemodynamically stable patients.

• If the bleeding site is known, the patient should be placed in a lateral decubitus position with the bleeding side down to prevent aspiration into the unaffected lung. Supplemental oxygen should be given.

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• If large-volume bleeding continues or the airway is compromised, the patient should be intubated and undergo an emergency bronchoscopy.

• The bleeding site is localized using flexible/rigid bronchoscopy.

• Control the hemorrhage:

• Endobronchially with Nd: YAG laser or bronchial occlusion

• Endovascularly with bronchial and/or pulmonary artery embolization

• Electrocauterization

• Surgically with resection of the involved lobe

The cause of the hemoptysis must be determined to definitively prevent a recurrence.

Solution to Question 7:

The given clinical scenario is suggestive of primary pneumothorax. The next step would be to discharge and follow up in 2-4 weeks as the size is <2cm.

Pneumothorax is the abnormal accumulation of air in the pleural space. It can be primary or secondary.

Primary pneumothorax can occur spontaneously due to rupture of the apical blebs. Risk factors include:

• Males > Females

• Young, tall, and thin individuals

• Family history

• Smoking

It resolves spontaneously hence just follow-up is usually needed in most cases.

Secondary pneumothorax occurs due to some underlying pathology. Risk factors include:

• Age> 50 years

• Smoking

• COPD

• Asthma

• Cystic fibrosis

• Infection (pneumonia, abscess, and tuberculosis)

• Interstitial lung disease

• Connective tissue disease

• Procedures (subclavian lines, thoracentesis, bronchoscopy, and mechanical ventilation)

• Blunt trauma

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Patients with pneumothorax present with acute dyspnea and pleuritic chest pain. A physical examination will reveal:

• An enlarged hemithorax

• Decreased chest movements

• Hyper-resonance on percussion

• Absent vocal fremitus

• Diminished breath sounds

Diagnosis is made by chest X-ray (best initial test), CT scan, or USG.

Management of pneumothorax:

• Primary pneumothorax

• <2 cm size: Discharge and follow-up in 2-4 weeks

• >2 cm size and/or breathless: Aspirate with 16 G cannula → If fails, place a chest drain of size 8-14 Fr

• Secondary pneumothorax

• <1 cm size: High-flow oxygen with observation for 24 hours

• 1-2 cm size: Aspirate with 16 G cannula → If fails, place a chest drain of size 8-14 Fr

• >2 cm size: Place chest drain of size 8-14 Fr

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Solution to Question 8:

The ultrasound diagnosis of pneumothorax depends on the presence of barcode sign, absence of the sliding lung and absence of comet-tail artifacts that are seen in relation to a normal lung–pleural interface.

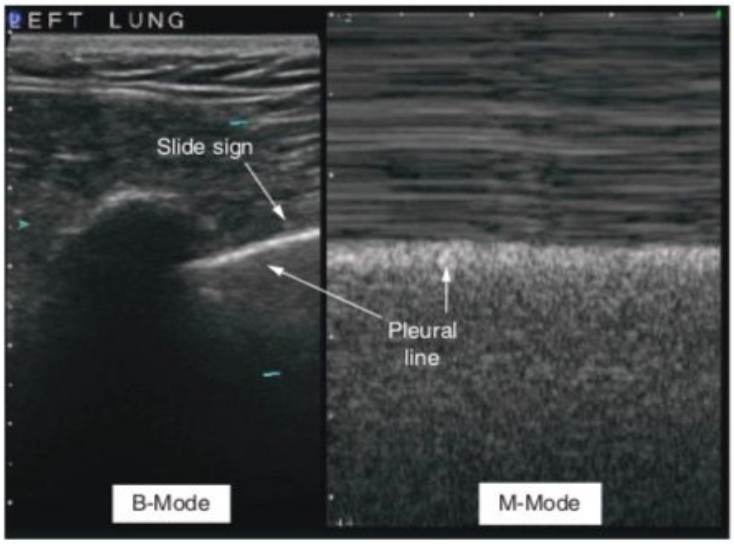
Normally, lung sliding corresponds to the to-and-fro movement of the visceral pleura on the parietal pleura that occurs with respiration. It is a dynamic sign and can be identified on ultrasound as horizontal movement along the pleural line.

In pneumothorax, the air separates visceral and parietal pleura and prevents visualization of visceral pleura. Hence lung sliding is absent and typical to and fro movement and shimmering of the pleural lines will not be present.

Comet tail artifacts are seen in the normal lungs due to the acoustic impedance differences between water and air, whereas it is absent in pneumothorax.

The image given below shows a sliding sign seen in a normal lung.

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A

Option A: The quad sign is seen in pleural effusion. It consists of four lines representing the pleura, rib, fluid, and lung.

Option C: The motionless portion of the chest above the pleural line creates horizontal 'waves,' and the sliding below the pleural line creates a granular pattern, the 'sand'. The resultant picture is one that resembles waves crashing onto the sand and is therefore called the 'seashore sign' and is present in normal lungs.

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Solution to Question 9:

The given clinical scenario is suggestive of tension pneumothorax. The first line of management in tension pneumothorax is to insert a wide-bore needle in the 5th intercostal space just anterior to the midaxillary line.

Pneumothorax is the abnormal accumulation of air in the pleural space. Tension pneumothorax develops when air enters the pleural space through a point that acts as a one-way valve. More and more air enters with every breath without any way for the air to escape. This is a medical emergency where the patient can quickly deteriorate.

A patient with pneumothorax presents with acute dyspnea and pleuritic chest pain. A physical examination will reveal:

- An enlarged hemithorax
- Decreased chest movements
- Hyper-resonance on percussion
- Absent vocal fremitus
- Diminished breath sounds

In addition to the above findings, a tension pneumothorax would also have the following:

- Deviation of trachea to the opposite side

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• Distended neck vein

• Cyanosis

• Sudden onset hemodynamic compromise:

• Hypotension

• Tachycardia

• Low O2 saturation

• Loss of consciousness

A diagnosis of tension pneumothorax is usually made based on the clinical findings. If the tension in the pleural cavity is not relieved, the patient can die due to hemodynamic collapse. Hence, treatment should never be delayed waiting for radiological confirmation.

The management of tension pneumothorax is to convert a tension pneumothorax into a simple pneumothorax. This can be done by rapid decompression using a wide-bore cannula on the affected side, followed by the insertion of a chest tube for definitive management.

The safest site for insertion of a drain is in the triangle (Triangle of safety) that lies:

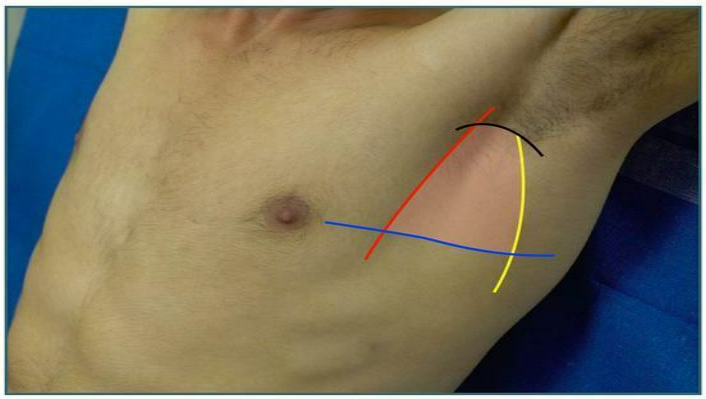
• Anterior to the mid-axillary line

• Above the level of the nipple

• Below and lateral to the pectoralis major muscle

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Triangle of safety



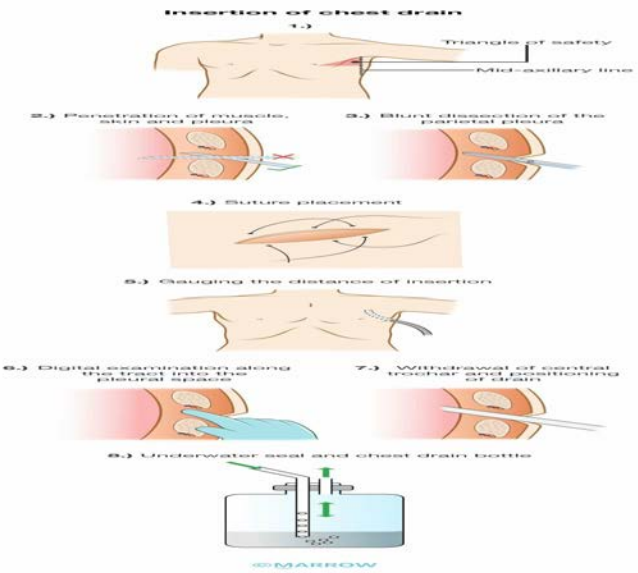
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Note:

If immediate management is asked, the answer will be to insert a wide-bore needle in the 5th intercostal space in the midaxillary line.

If definitive management is asked, the answer will be to insert an intercostal tube in the triangle of safety.

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Solution to Question 10:

The given clinical scenario is suggestive of open pneumothorax. Initial management, in this case, is to apply occlusive dressing taped on the 3 sides.

Open pneumothorax is due to a large open defect in the chest, making intrathoracic pressure equal to atmospheric pressure. In this defect, the air is preferentially drawn through the defect, rather than through the trachea. Air gets accumulated causing pneumothorax leading to hypoventilation and hypoxia. It acts as a sucking chest wound. Sucking sound during inspiration is characteristic.

It is managed initially with the application of a sterile occlusive dressing tapped on the 3 sides. Then a chest tube is inserted at a different site, away from the wound.

Solution to Question 11:

The given clinical scenario is suggestive of empyema thoracis. Symptoms failed to resolve on treatment with chest tube insertion, hence it is managed by VATS debridement.

Empyema thoracis is an infection of the pleural space. It commonly progresses from an acute phase with thin fluid that can be drained completely with a chest tube or small-bore catheter to a more turbid and thick fluid that might loculate. It is an exudative effusion. It can be caused due to:

• Underlying infection of the lung (pneumonia or abscess)

• Complication after chest surgery

• Infected hemothorax

• Complication of Pleural effusion

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• Trauma (esophageal perforation)

• Osteomyelitis of ribs

An empyema thoracis on chest x-ray can mimic a pleural effusion or a lung abscess.

The procedure VATS (Video-Assisted Thoracoscopic Surgery) is used in the debridement of empyema. At the end of the procedure, chest drains are placed for dependent drainage.

If VATS fails to re-expand the lung after drainage, a more radical procedure (decortication) may be done.

Solution to Question 12:

A rib fracture is not an indication for thoracotomy.

Indications for thoracotomy:

• Initial tube thoracostomy drainage of >1000 ml (penetrating injury) or >1500 ml (blunt injury) of frank blood

• Ongoing tube thoracostomy drainage of >200 ml/ hr for 3 consecutive hours in non-coagulopathic patients with hemothorax

• Caked hemothorax despite the placement of two chest tubes

• Massive air leak from chest tube with inadequate ventilation

• Open pneumothorax

• Great vessel injury

• Pericardial tamponade

• Cardiac herniation

• Tracheobronchial injury

• Esophageal perforation

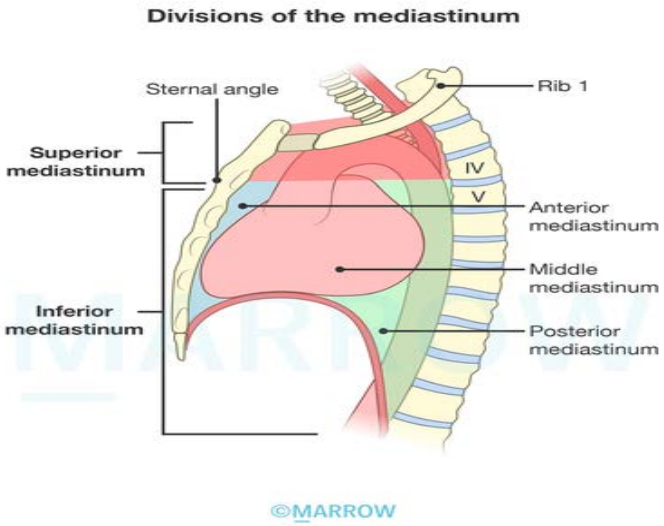
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Solution to Question 13:

Neurogenic tumors are found in the posterior mediastinum and not in the anterior mediastinum.

They are the most common primary tumors of the posterior mediastinum. Schwannomas and Neurilemomas are the most common neurogenic tumors.

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Solution to Question 14:

The given clinical features of myasthenia gravis along with the CT scan image showing an anterior mediastinal mass are suggestive of thymoma. The only reliable indicator of malignancy in thymoma is the capsular invasion, not tumor size.

Thymoma is the most common mediastinal tumor and is derived from the thymus gland. Thymomas vary in behavior from benign to aggressively invasive. Masoaka classification system is used to stage thymomas.

Myasthenia gravis is often related to thymomas. Symptoms of myasthenia gravis improve after excision of the thymus gland even in the absence of a thymoma.

Complete thymectomy is the treatment for thymoma. It can be performed by two approaches:

• A median sternotomy approach

• A transcervical approach with or without an additional VATS procedure (Video-Assisted Thoracoscopic Surgery) for smaller thymomas

Solution to Question 15:

Thymoma invading great vessels come under stage III of the Masaoka staging system.

Masaoka staging system is the most commonly accepted staging system for thymoma. It is based on the presence or absence of gross or microscopic invasion of the capsule and of surrounding structures, and metastasis.

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Stage	Features
Stage I	Encapsulated tumor with no gross or microscopic evidence of capsular invasion
Stage II	Grosscapsular invasionor invasion into the mediastinal fat or pleura or microscopic capsular invasion
Stage III	Gross invasion into the pericardium, great vessels, or lung
Stage IVA	Pleural or pericardialdissemination
Stage IVB	Lymphogenous or hematogenousmetastasis

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Solution to Question 16:

The most common mediastinal mass in young children is neurogenic tumors (50%-60%). In most cases (< 4 years of age), they are invariably malignant.

The most common mediastinal masses in adults are thymomas and thymic cysts.

Solution to Question 17:

Lymphoma most commonly occurs in the anterior mediastinum. Occasional involvement of the middle compartment and rare involvement of posterior mediastinum is seen.

Chemotherapy and/or radiotherapy results in a cure rate of up to 90% for early-stage Hodgkin's disease and up to 60% for more advanced stages.

Note:

• Most common tumor of the middle mediastinum: Lymphoma.

• Most common mass of the middle mediastinum: Pericardial Cyst.

Solution to Question 18:

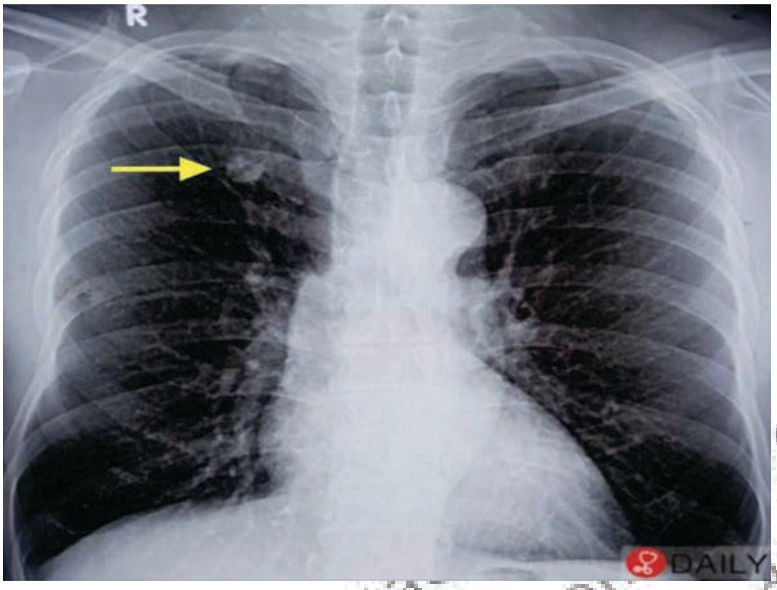
The most common benign tumor of the lung is hamartoma.

Hamartoma is a developmental abnormality containing mesothelial and endothelial elements. They are manifested by the overgrowth of cartilage. It is typically seen in 40-60 years of age, more common in males.

It is usually seen in the periphery of the lung and grows slowly. Popcorn calcification in chest X-ray is suggestive of a hamartoma.

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Chest X-ray showing a popcorn calcification in the apex of the right lung.



Diagnosis and definitive treatment are achieved by excision of the lesion.

Gross specimen showing hamartoma of the lung.



Note: Popcorn calcification is also seen in:

- Chondroid lesions like chondrosarcoma
- Fibrous dysplasia
- Fibroadenoma breast
- Calcified uterine fibroid
- Metaphyses and epiphyses of long bones of children with osteogenesis imperfecta

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Solution to Question 19:

Bronchial carcinoid is usually asymptomatic.

Bronchial carcinoids are the most indolent of the spectrum of pulmonary neuroendocrine tumors. They arise from the Kulchitsky cells in the bronchial epithelium. Most tumors are confined to the main stem bronchus and commonly project into the lumen. It is associated with MEN 1.

Most patients affected are <40 years and it is not related to smoking. It is usually asymptomatic and only 10% of bronchial carcinoids give rise to carcinoid syndrome which is characterized by intermittent attacks of:

• Diarrhea

• Flushing

• Bronchospasm

• Cyanosis

Bronchial carcinoids follow a relatively benign course and do not metastasize to distant sites. They have a good prognosis and can be easily resected.

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Solution to Question 20:

Peripheral neuropathy is an immune-mediated paraneoplastic syndrome. It is due to the secretion of antigens normally expressed only by the nervous system which leads to antibodies production against CNS.

Lung cancers are capable of producing a variety of paraneoplastic syndromes. They may produce symptoms even before any local symptoms are produced by the primary tumor, thereby aiding in early diagnosis.

Paraneoplastic syndromes in lung cancer:

System	Paraneoplastic syndromes
Endocrine	Hypercalcemia (ectopic parathyroid hormone)Cushing's syndromeSIADHCarcinoid syndromeHyperthyroidism
Neurologic	Subacute cerebellar degenerationPeripheral neuropathyAutonomic neuropathyOptic neuritis
Skeletal	ClubbingPulmonary hypertrophic osteoarthropathy
Hematologic	AnemiaThrombocytopeniaEosinophiliaDisseminated intravascular coagulation
Cutaneous	Acanthosis nigricansHyperpigmentation

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System	Paraneoplastic syndromes
Other	Nephrotic syndromeHypouricemiaSecretion of a vasoactive intestinal peptide with diarrhea

Solution to Question 21:

Squamous cell carcinoma (SCC) causes hypercalcemia. Cushing's syndrome is caused by small cell lung cancer.

Paraneoplastic syndrome is usually associated with small cell carcinoma, even though all varieties of lung cancer are capable of causing it.

Lung cancer	Paraneoplastic syndromes
Squamous cell carcinoma (SCC)	Hypercalcemia
Small cell lung cancer (SCLC)	Syndrome of inappropriate secretion of antidiuretic hormone (SIADH)Cushing's syndromeEaton- Lambert syndromeRetinal blindness
Adenocarcinoma	Hypertrophic primary osteoarthropathy
Non-small cell lung cancer (NSCLC)	Clubbing

Solution to Question 22:

According to TNM staging, a patient with lung carcinoma of size 2.5cm is staged as T1c.

Stage T1-3/N0-1/M0 are amenable to resection.

TNM staging system of Lung carcinoma	
T: Primary tumor	
Tx	Primary tumor cannot be assessed or tumor proven by the presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy
T0	No evidence of primary tumor

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TNM staging system of Lung carcinoma	
Tis	Carcinoma in situ
T1	Tumour ≤3 cm in the greates t dimension surrounded by l ung or visceral pleura withou t bronchoscopic evidence of i nvasion more proximal than the lobar bronchus (i.e. not i n the main bronchus)
T1a(mi)	Minimally invasive adenocar cinoma
T1a	Tumour≤1 cmin greatest dim ension
T1b	Tumor>1 cm but ≤2 cmin gre atest dimension
T1c	Tumor >2 cm but≤3 cmin the greatest dimension
T2	Tumor >3 cm but≤5 cmor tu mor with any of the following features:– involves themain bronchus regardless of distan cefrom thecarinabutwithoutt he involvement of the carina – invades visceral pleura– ass ociated withatelectasisorobst ructive pneumonitisthat exte nds to thehilar region, involvi ng part or all of the lung
T2a	Tumor>3 cm but ≤4 cmin gre atest dimension
T2b	Tumor>4 cm but ≤5 cmin gre atest dimension
T3	Tumor>5 cm but ≤7 cmin gre atest dimension or associated with separate tumor nodule(s) in the same lobe as the pri mary tumorordirectly invade s any of the following structu res:chest wall (including the parietal pleura and superior s ulcus tumors), phrenic nerve, the parietal pericardium

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TNM staging system of Lung carcinoma	
T4	Tumor>7 cmin greatest dimension or associated with separate tumor nodule(s) in a different ipsilateral lobe than that of the primary tumor or invades any of the following structures:diaphragm, mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, and carina
N: Lymph node involvement	
Nx	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in ipsilateral peribronchial and/or ipsilateral hilar lymph nodes and intrapulmonary nodes, including involvement by direct extension
N2	Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s)
N3	Metastasis in contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s)
M: Distant metastasis	
M0	No distant metastasis
M1	Distant metastasis present
M1a	Separate tumor nodule(s) in a contralateral lobe; tumor with pleural or pericardial nodule(s) or malignant pleural or pericardial effusion
M1b	Single extrathoracic metastasis
M1c	Multiple extrathoracic metastases in one or more organs

Solution to Question 23:

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The given clinical scenario along with the X-ray showing opacity of the apex of the right lung is suggestive of Pancoast syndrome. MRI is preferred over CT because of the associated soft tissue infiltration, the extent of which can be best visualized using an MRI.

Pancoast syndrome/superior sulcus tumor results from a local extension of a tumor growing in the apex of the lung, with the involvement of C8, T1, and T2 nerve roots.

Regional spread can cause:

• Pain that radiates to the ulnar distribution of the arm, often with the destruction of the 1st and 2nd ribs

• Recurrent laryngeal nerve paralysis with hoarseness of voice

• Endobronchial growth of the primary tumor may present with a cough, hemoptysis, wheeze, stridor, dyspnea, or post-obstructive pneumonitis

• Phrenic nerve palsy with the elevation of the hemidiaphragm.

• Sympathetic nerve paralysis with Horner's syndrome (enophthalmos, ptosis, miosis, and anhydrosis). It occurs due to invasion of the sympathetic chain and of the inferior cervical (stellate) ganglion

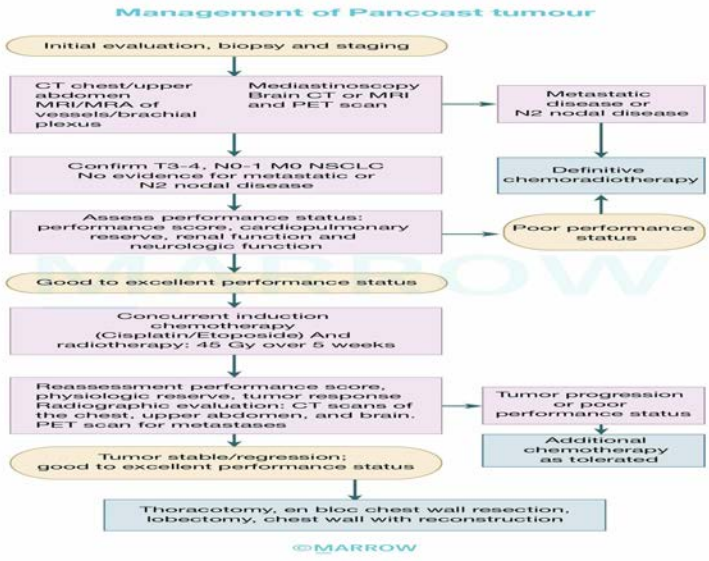
• Tracheal obstruction

• Esophageal compression with dysphagia

Bronchoscopy can be done to obtain a tissue diagnosis.

Surgery with curative intent is offered to patients with early-stage cancer (T1–3, N0–1).

Management is summarized in the flowchart as shown below:



Solution to Question 24:

The given clinical scenario with biopsy showing positive calretinin is suggestive of mesothelioma. The immunohistochemical analysis will be negative for TTF-1 in mesothelioma. TTF-1 is positive

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in adenocarcinoma of the lung.

Malignant mesothelioma is the most common tumor of the pleura. Exposure to asbestos is the major known risk factor. The latency period between asbestos exposure and the development of mesothelioma is at least 20 years. It is more common in males, usually seen after 40 years of age. It has a very poor prognosis.

Histological subtypes include:

• Epithelial

• Sarcomatous

• Biphasic

The physical characteristics of specific fibers are important for causation. They are:

• Serpentine fibers: Large and curly, not able to travel beyond larger airways.

• Amphibole fibers: The narrow, straight amphibole fibers, in particular, the crocidolite fibers navigate distally into the pulmonary parenchyma and are most clearly associated with mesotheliomas.

It is not bilaterally symmetrical. Its clinical features include:

• Dyspnoea

• Chest pain

• Pleural effusion – in 90% cases

Diagnostic imaging includes chest X-ray, CT scan, and FDG-PET scan to determine the extent of tumor invasion and to evaluate occult metastases. Thoracoscopy or open pleural biopsy with special staining of tumor samples is required to differentiate mesotheliomas from adenocarcinomas.

Treatment includes a combination of surgery, chemotherapy, and radiation therapy. Extrapleural pneumonectomy and total pleurectomy are two commonly used surgical procedures.



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Solution to Question 25:

Wedge resection involves the non-anatomical excision of the tumor. Excision of the anatomical bronchopulmonary segment is called segmentectomy.

Small cell lung cancer (SCLC) is a type of tumor that originates from neuroendocrine progenitor cells (Kulchitsky cells) in the lining bronchial epithelium. They tend to metastasize early to lymph nodes and by the blood-borne spread.

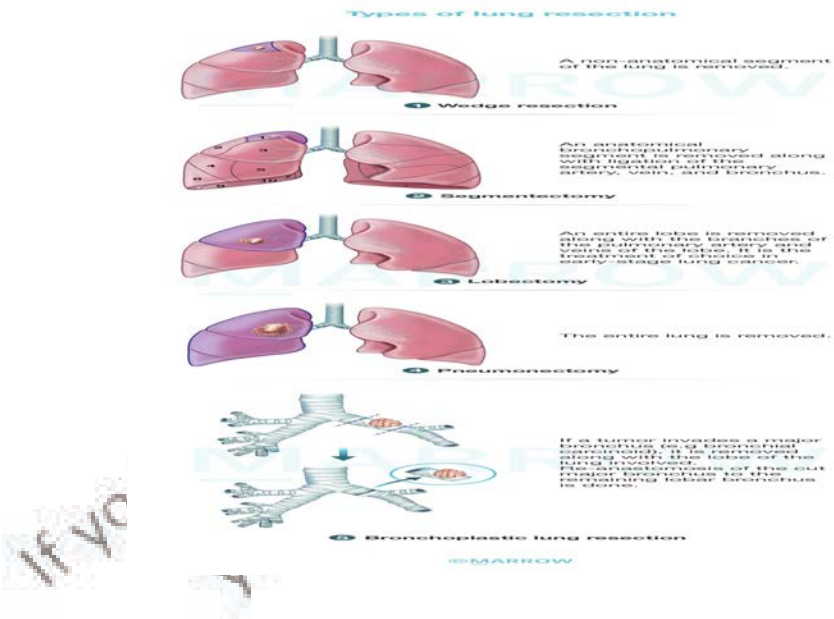
SCLC is very responsive to chemotherapy such that median survival may be doubled.

Surgery for lung cancers:

Surgery with curative intent is offered to patients with early-stage lung cancer (T1–3, N0–1). Lung cancer resection can be approached through:

• Posterolateral thoracotomy

• Video-assisted thoracoscopic surgery (VATS)



Complications of surgery include:

• Bleeding

• Respiratory infection

• Persistent air-leak

• Bronchopleural fistula

Solution to Question 26:

The complication of surgery is not a component of thoracoscore.

Thoracoscore is used to assess the risk of operative mortality in a patient undergoing thoracic surgery. It includes 9 variables:

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• Age

• Sex

• American Society of Anesthesiologists score (ASA)

• Performance status

• Dyspnoea score

• Priority of surgery

• Extent of surgery

• Malignant diagnosis

• Composite comorbidity score

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Solution to Question 27:

The procedure that is shown is Video-Assisted Thoracoscopic Surgery (VATS) and empyema is not a contraindication for the procedure.

VATS is a minimally invasive surgical technique used to diagnose and treat disorders of the thoracic cavity. It also allows direct visualization of the pleural cavity.

Lung biopsy and recurrent pneumothorax are the most frequent indications for VATS. Other conditions where VATS is used include:

• Malignancies

• Empyema

• Oesophageal surgeries

• Patent ductus arteriosus

• Undiagnosed pleural effusion

• Pneumonectomy

• Lobectomy

• Pleural biopsy

• Pleurodesis

The patient is usually positioned with the diseased side up in a lateral decubitus position. A double lumen endotracheal-bronchial tube is placed by the anesthetist for single-lung ventilation. At the end of the procedure, chest drains are placed to allow dependent drainage.

The following precautions must be noted before placing the drains:

• The drain should exit the skin anterior to the midaxillary line. If this is not done then the patient will have to lie on the tube which will cause pain and obstruction of the tube.

• The course of the drain should be oblique to the skin, chest wall, and pleura, or else it will lead to kinking of the tube.

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The main advantage of VATS is that a large incision is avoided. This causes less postoperative pain and a rapid recovery. However, VATS procedure limits the ability of the surgeon to palpate the lung to identify occult metastases.

Solution to Question 28:

The left internal mammary artery (LIMA) or internal thoracic artery is the conduit of choice for the left anterior descending (LAD) coronary artery. The most important criterion in conduit selection is graft patency. The conduit with the highest patency rate is the left internal mammary artery or internal thoracic artery.

Left internal mammary artery > Radial artery > long saphenous vein represents the correct order of graft patency in a patient undergoing CABG procedure.

Venous grafts:

• The long saphenous vein is the most common vein used as a conduit as it is straightforward to harvest, provides good length, and is easy to handle.

• The ten-year patency rate for long saphenous vein grafts is reported to be 50–60 percent.

Arterial grafts:

• The left internal mammary artery (LIMA) or internal thoracic artery has become the conduit of choice for the left anterior descending (LAD) coronary artery. The radial artery can be used as a second or alternative arterial bypass graft. Other arterial bypass grafts include the gastroepiploic artery and the inferior epigastric artery.

• Long patency rates of >98 percent have been reported.

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Solution to Question 29:

The patient would fall under category III.

Modified Maastricht classification- Categories of non-heart-beating donors:

• Uncontrolled - transplant team not present or prepared

• Category I - includes victims of accident and suicide who are found dead at the scene and resuscitation is deemed pointless (e.g. fatal cervical spine fracture).

• Category II - donors are mostly victims of sudden cardiac or cerebral catastrophes who are brought to emergency departments while being resuscitated by ambulance personnel or who die in the department. Other sources include patients suffering an isolated brain injury, anoxia, and stroke, and victims of major trauma who died soon after hospital admission.

• Category V - Unexpected cardiac arrest during intensive care.

• Controlled - transplant team present and prepared

• Category III - encompasses patients who are dying, often in an intensive care unit. These are the patients awaiting cardiac arrest where the treating clinicians have decided to withdraw treatment and not commence resuscitation for various reasons.

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• Category IV - comprises patients who suffer unexpected cardiac arrest during or after the determination of brain death.

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Ischemic Arterial Diseases

Question 1:

The most common cause of peripheral vascular disease is?

a) Atherosclerosis

b) Emboli

c) Trauma

d) Hypertension

Question 2:

What is the most common symptom of peripheral occlusive vascular disease?

a) Rest pain

b) Intermittent claudication

c) Ulceration

d) Swollen and erythematous limb

Question 3:

A 60-year-old man presented to the OPD with complaints of pain in the lower limbs, on walking a certain distance. He noticed that the pain subsides on resting. Which of the following is false regarding this condition?

a) Pain is usually felt in the calf muscles

b) Muscle group affected is below the level of arterial disease

c) Distance at which pain occurs varies greatly from day to day

d) Worsened by anemia or heart failure

Question 4:

A 50-year-old male who is a chronic smoker presented to the hospital with intermittent claudication pain of both thigh and buttock region on walking about 500 m. Which of the following is a likely diagnosis?

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a) Arterial disease involving the superficial femoral artery

b) Arterial disease with aortoiliac involvement

c) Femoral venous insufficiency

d) Arterial disease involving the profunda femoris artery

Question 5:

Critical limb ischemia is characterized by all except_____

a) Ulceration

b) Rest pain

c) Intermittent claudication

d) Gangrene

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Question 6:

In a patient with critical limb ischemia, what is the ankle-brachial pressure index (ABPI) likely to be?

a) < 0.1

b) < 0.4

c) < 0.5

d) < 0.9

Question 7:

A 35-year-old chronic smoker presents with bluish discoloration of the toe along with intermittent claudication. Which of the following will be the next appropriate investigation in this patient?

a) CT angiography

b) MR angiography

c) Digital subtraction angiography

d) Duplex scan

Question 8:

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Which of the following is false regarding the investigation of peripheral arterial disease?

a) Duplex scanning is a non invasive technique

b) On doppler ultrasound a normal artery has a biphasic signal

c) DSA is now the standard technique used

d) Computed tomographic angiography is not used routinely to diagnose PAD

Question 9:

A patient with right leg arterial stenosis is being taken up for angioplasty. Which one of the following is incorrect about this procedure?

a) It is done for patients with rest pain or tissue necrosis

b) It gives best results for management of stenosis below the knee

c) Satisfactory dilatation is confirmed by performing angiogram

d) Usually approached through femoral artery

Question 10:

Which is the best graft for a femoropopliteal bypass?

a) Dacron

b) Great saphenous vein

c) Polytetrafluoroethylene

d) Short saphenous vein

Question 11:

A 52-year-old man presented with complaints of pain in the right leg right for a day. He has a history of recurrent episodes of atrial fibrillation. Which of the following statements are false regarding his condition?

a) Ischemia beyond 6 hrs is usually irreversible

b) Pain, pallor, pulselessness, and parasthesia/anesthesia are characteristic

c) Movement of the digits is not affected

d) Embolectomy and thrombolysis are treatment options

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Question 12:

An elderly man is brought to the emergency department with sudden onset severe pain and numbness of the left lower limb. He has no previous history of any limb claudication. The limb appears to be cold and peripheral pulses are not palpable. What is the most appropriate next step?

a) Embolectomy using Fogarty balloon catheter

b) Intravenous Heparin 5000U

c) CT Angiogram to check for embolus

d) Thrombolysis with intra-arterial tissue plasminogen activator (tPA) infusion

Question 13:

A 71-year-old man had an acute STEMI for which coronary stenting was performed. On the follow-up visit, he reported pain over his toes and discoloration of both feet as shown in the image. His creatinine was also elevated. What is the most probable diagnosis?



a) Sharp syndrome

b) Antiphospholipid antibody syndrome

c) Aortic dissection

d) Atheroembolism

Question 14:

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A patient with untreated severe peripheral arterial disease comes to the surgery OPD with a right leg as shown in the image. Which of the following is false regarding this condition?



a) Usually affects most distal part of a limb

b) It is a surgical emergency if crepitus is felt on palpation

c) Occurs when tissues are desiccated by gradual slowing of blood stream

d) Amputation is not done if severe sepsis is present

Question 15:

A 51-year-old, diabetic patient presents with the following features during a village health camp. Which of the following statements is false regarding this condition?



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a) Due to immunosuppression caused by elevated glucose levels

b) Repeated injury leads to Charcot's foot

c) Glycemic control and antibiotic therapy is first line managment

d) Sensory nerves are affected in the late stage of disease

Question 16:

A 40-year-old man presents to the casualty with complaints of recurrent episodes of syncope and cramping of his left arm. Symptoms mostly occur during his evening badminton practice sessions. Which of the following is incorrect about this condition?

a) Due to occlusion in the 3rd part of subclavian artery

b) Distal pulse of the affected side is feeble

c) CT angiography is used to visualize retrograde blood flow

d) Management includes angioplasty and stenting

Question 17:

In Paget-Schroetter syndrome which of the following structure is affected?

a) Subclavian artery

b) Subclavian vein

c) Axillary artery

d) Brachiocephalic vein

Question 18:

A 26-year-old male patient who came to the OPD with complaints of pain and numbness of the arm is diagnosed with thoracic outlet syndrome. Which nerve is involved in this condition?

a) Median Nerve

b) Ulnar Nerve

c) Axillary Nerve

d) Radial Nerve

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Question 19:

A resident is trying to elicit symptoms of thoracic outlet syndrome in a patient. He asks the patient to keep both arms in the 90° abduction-external rotation position and to open and close the hands slowly over a 3-minute period. What is this test called?

a) Adson test

b) Halsted test

c) Wright test

d) Roos test

Question 20:

A young woman presents to the hospital with sudden discoloration of the hands. Which of the following would suggest a diagnosis of acrocyanosis over Raynaud's phenomenon?

a) Episodic

b) Absent peripheral pulses

c) Absence of pain and numbness

d) Presence of trophic skin changes

Question 21:

A 24-year-old female nurse was on her way to the hospital for her early morning shift. Suddenly she started to notice pain in her fingers which were turning pale and numb after which they turned blue. Which of the following statements are false regarding this condition?

a) Triggered by cold as well as stress

b) Calcium channel blockers are used for treatment

c) Mainstay of treatment includes avoidance of triggers

d) Is not associated with autoimmune diseases

Question 22:

Which of the following is an incorrect statement about Buerger's disease?

a) 2,3,4

b) 1,5

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c) 1,3

d) 2,4

Question 23:

A 34-year-old male construction worker presents with exertional pain and darkening of the skin in both forearms and hands as shown in the image. He smokes 1 pack of cigarettes per day and has no comorbidities On examination, brachial pulses are palpable but radial and ulnar pulses are feeble. Angiography of his upper extremity shows smooth tapering segmental lesions in the distal arterial vessels. Which of the following treatments has the greatest chance of success?



a) Cilostazol

b) Heparin and surgical revascularization

c) High dose steroids

d) Smoking cessation

Question 24:

A 50-year-old chronic smoker presented with cramping pain in the buttocks and erectile dysfunction for the past 6 months. He has no history of bladder dysfunction or fecal incontinence. Examination revealed absent femoral pulses and normal sensory and motor system. How will you surgically manage this patient?

a) Aortobifemoral grafting

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b) Aortofemoral grafting

c) Illiopopliteal grafting

d) Iliofemoral grafting

Question 25:

Which of the following is not an indication for a carotid endarterectomy?

a) Dysphonia

b) Amaurosis fugax

c) Facial palsy

d) Hemianopia

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Answer Key

Question No.	Correct Option
1	a
2	b
3	c
4	b
5	c
6	b
7	d
8	b
9	b
10	b
11	c
12	b
13	d
14	d
15	d
16	a
17	b
18	b
19	d

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20	c
21	d
22	c
23	d
24	a
25	a

Detailed Explanations

Solution to Question 1:

Atherosclerosis is the most common cause of peripheral occlusive vascular disease (POVD). Other causes are trauma and emboli.

Peripheral arterial insufficiency is predominantly a disease of the lower extremities with the superficial femoral and iliac arteries commonly affected.

Solution to Question 2:

The most common symptom of peripheral obstructive vascular disease is intermittent claudication.

Intermittent claudication is the debilitating cramp-like pain felt in the leg muscles due to reduced blood flow brought on by peripheral arterial disease. It usually signifies mild to moderate chronic vascular occlusive disease.

Rest pain is when the disease progresses to a degree that perfusion is severely reduced and cramp-like pain in the calf is felt even at rest.

A swollen and erythematous limb is seen in critical limb ischemia. When the limb is in the dependent position, there is pooling of blood which causes the limb to appear red and swollen(sunset foot sign).

Buerger's test is done to assess the severity of peripheral vascular disease. In normal individuals, the elevation of the lower limb to a 90-degree angle does not produce any pallor but in affected individuals, even at an elevation of 20-degrees, pallor and venous guttering of the limb can be seen.

Solution to Question 3:

The patient is likely experiencing intermittent claudication due to peripheral occlusive vascular disease.

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Intermittent claudication is the debilitating cramp-like pain felt in the leg muscles due to reduced blood flow brought on by peripheral arterial disease. It usually signifies mild to moderate chronic vascular occlusive disease.

The pain classically occurs during activity and is relieved with rest. The distance that a patient can walk without stopping till the pain is experienced in the muscles is known as claudication distance. This distance varies only slightly from day-to-day. The muscle group affected is one anatomical level below the arterial disease.

Boyd's classification

Class l - Pain on walking but pain decreases on continuation of walking.

Class ll - Pain on walking, but continues to walk despite the pain.

Class lll - Pain forces the patient to stop walking.

Class lV - Pain at rest.

It is worsened by health conditions such as anemia and heart failure.

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Solution to Question 4:

The given clinical scenario is suggestive of arterial disease with aortoiliac involvement. Classically, the muscle group affected by claudication is one anatomical level below the level of arterial disease.

Intermittent claudication is a feature of chronic arterial disease or occlusion of the artery. Aortoiliac disease affects the infrarenal aorta and iliac arteries.

Management involves smoking cessation, lifestyle modifications, and treatment of underlying diabetes or hyperlipidemia if present.

For claudication, cilostazol or pentoxyfilline is used. Cilostazol is superior to pentoxyfilline.

Surgical options include aortoiliac bypass, aortobifemoral bypass, percutaneous transluminal angioplasty (PTA), which can be with or without stent placement, and thromboendarterectomy.

Correlation of clinical findings to the Site of Disease	
Aortoiliac obstruction	Claudication inbuttocks, thighs, and calvesBruit over the aortoiliac regionImpotence(Leriche's syndrome)
Iliac obstruction	Claudication ofthigh and calf, unilaterallyAbsence of femoral and distal pulsesBruit over iliac region
Femoropopliteal obstruction	Claudication incalfFemoral pulse felt but distal pulses absent

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Correlation of clinical findings to the Site of Disease	
Distal obstruction	Ankle pulses absentClaudication incalf and footFemoral and popliteal pulses palpable

Solution to Question 5:

Critical limb ischemia is characterized by rest pain and/or ulceration and gangrene. Intermittent claudication progresses to rest pain in critical limb ischemia.

Rest pain occurs with the limb at rest and is felt in the foot; it is exacerbated by lying down or elevation of the foot. Characteristically, the pain is worse at night and it may be lessened by hanging the foot out of bed or by sleeping in a chair. The pressure of clothes on the foot usually makes the pain worse.

Ulceration occurs with severe arterial insufficiency and may present as painful erosion between toes or as shallow, non-healing ulcers on the dorsum of the feet, on the shins, and especially around the malleoli. The blackened mummified tissues of frank gangrene are unmistakable and superadded infection often makes the gangrene wet.

Solution to Question 6:

In a patient with critical limb ischemia, the ABPI is < 0.4.

Solution to Question 7:

Chronic smoker presenting with bluish discoloration of the toe along with intermittent claudication is suggestive of peripheral arterial disease and duplex scanning will be the next appropriate investigation.

Duplex Scanning is a major non-invasive technique that uses B-mode ultrasound to provide an image of the vessel. Most scanners now have color coding, which allows detailed visualization of blood flow in a vessel. Different colors indicate changes in the direction and velocity of flow, with areas of high flow usually indicating stenotic lesions.

Other options:

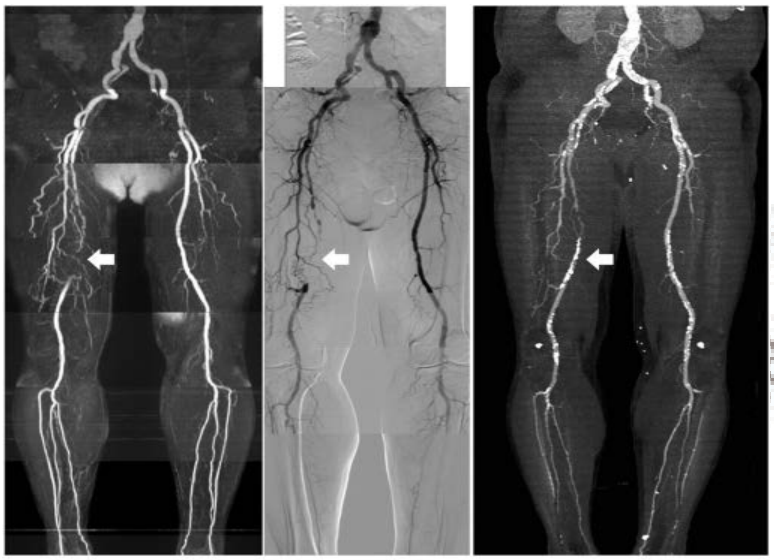
Option A: CT Angiography (CTA) is more useful in the evaluation of visceral arterial disease (eg. mesenteric ischemia). It can be beneficial in peripheral artery diseases where a duplex scan shows poor images (aortoiliac segment involvement). CTA is not routinely recommended in peripheral artery disease because of concomitant renal dysfunction in these patients which can lead to contrast-induced nephropathy.

Option B: MR Angiography is time-consuming and expensive, hence not done as the next investigation. It is contraindicated in patients with claustrophobia and metallic implants.

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Option C: Digital subtraction angiography (DSA) is an invasive and expensive procedure compared to other investigations. The benefits of DSA are that it provides dynamic arterial flow information and can be combined with a definitive endovascular intervention when indicated. DSA is indicated only when there is a discrepancy in diagnosis or intervention is planned. Complications associated with DSA include bleeding, hematoma, false aneurysm formation, thrombosis, arterial dissection, distal embolisation, renal dysfunction, and allergic reaction.



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Solution to Question 8:

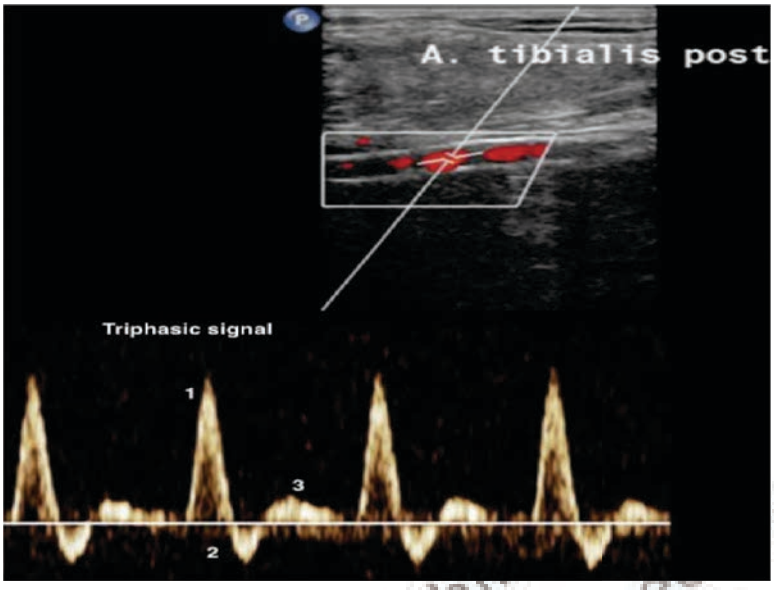
A normal artery has a triphasic signal. The waveform becomes biphasic in mild-moderate stenosis and monophasic in severe stenosis.

Option A: Duplex scanning is a major non-invasive technique that uses B-mode ultrasound to provide an image of the vessel.

Option C: Digital subtraction angiography (DSA) is now the standard technique whereby the images obtained are digitized by computer and the extraneous background (bone, soft tissues, etc.) is removed to provide clearer images.

Option D: Computed tomographic angiography (CTA), and conventional catheter-based angiography should not be used for routine diagnostic testing but are performed before potential revascularization. These tests define the anatomy that assists in planning for revascularization procedures.

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Solution to Question 9:

Angioplasty gives the best results for medium-sized vessels hence it is preferred for treating the vessels above the knee in peripheral arterial disease.

Angioplasty is indicated in patients with rest pain or tissue necrosis.

Steps of angioplasty:

• Patients posted for angioplasty are given aspirin (325 mg) and clopidogrel (loading dose of 300–600 mg).

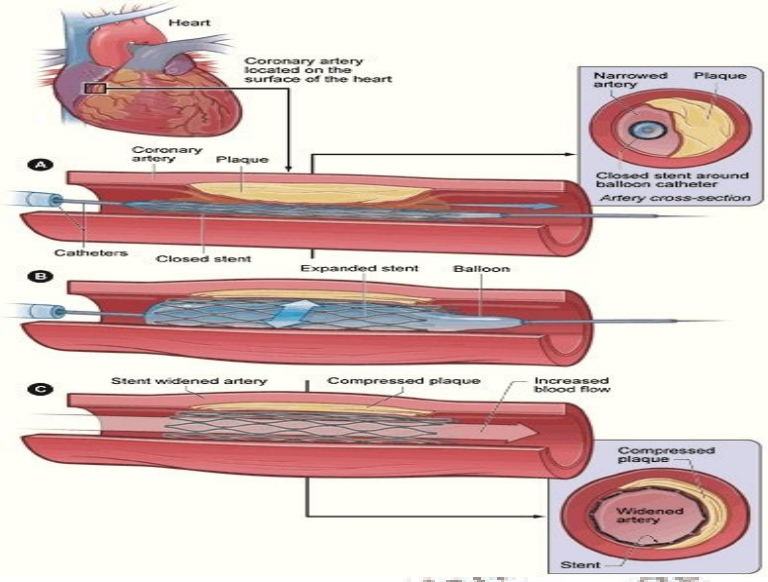
• During the procedure, anticoagulation is achieved by administration of unfractionated heparin, enoxaparin, or bivalirudin (a direct thrombin inhibitor).

• The femoral artery is punctured under local anesthetic, followed by insertion of a guidewire. The guidewire is negotiated through the stenosis or occlusion under fluoroscopic control.

• A balloon catheter is then inserted over the guidewire and positioned within the lesion. The balloon is then inflated at high pressure for approximately 1 minute and deflated.

• Once the angioplasty is done, dilatation is confirmed by performing angiogram.

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Solution to Question 10:

The great saphenous vein (GSV) is the best as it lasts longer than polytetrafluoroethylene (PTFE), dacron, and human umbilical vein as a graft in a femoropopliteal bypass.

The GSV is the conduit of choice for arterial bypass grafts below the inguinal ligament.

For bypass above the inguinal ligament, while both GSV and PTFE grafts have similar patency rates in the first 2 years, the GSV is superior thereafter and hence preferred over PTFE or any other grafts.

The ipsilateral GSV is the conduit of choice for femoropopliteal bypass. When it is not available, contralateral GSV should be used. Other veins are preferred when both ipsilateral and contralateral GSV is not available and they include a small saphenous vein, cephalic vein, and basilic vein.

Non-autogenous grafts are used for patients who lack a suitable venous conduit. The most commonly used prosthetic conduit is PTFE. Recent studies have shown that heparin-bonded PTFE is superior to compared to PTFE without heparin.

Solution to Question 11:

The patient most likely has acute arterial occlusion and atrial fibrillation can predispose to emboli formation. In acute arterial occlusion, the movement of the digits will be affected and the limb will be cold. Whereas, in venous occlusion, muscle function is not affected.

The leg is often affected with:

• Pain

• Pallor

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• Paralysis

• Loss of pulsation

• Paraesthesia (or anesthesia).

Embolic arterial occlusion is an emergency that requires immediate treatment. Ischaemia beyond 6 hours is usually irreversible and results in limb loss.

The diagnosis can be made clinically in a patient who has no history of claudication and has a source of emboli, who suddenly develops severe pain or numbness of the limb, which becomes cold and mottled.

Solution to Question 12:

The above clinical scenario is suggestive of sudden arterial occlusion. The immediate next step is to administer 5000 IU of heparin to prevent extension of clot.

Management of sudden arterial occlusion:

• Embolectomy with Fogarty's balloon catheter is the definitive treatment of choice.

• Thrombolysis with tissue plasminogen activator (tPA) can be done in cases where there are no acute signs of limb ischemia as complete lysis of thrombus in tPA infusion is achieved within 24 hours, however, it is cautiously used in the elderly due to risk of bleeding diathesis.

• A CT angiogram is performed after the procedure to ensure that the flow to the distal leg has been restored.

Ischaemia beyond 6 hours is usually irreversible and may result in limb loss.

Complications of arterial revascularization

• Compartment syndrome

• Reperfusion syndrome

• Ischaemic neuropathy

• Myoglobinuria

• Renal failure

Usually, a prophylactic fasciotomy is done in patients undergoing revascularization surgery to prevent compartment syndrome.

Solution to Question 13:

The given clinical scenario is suggestive of atheroembolism. It is also called cholesterol embolism or blue toe syndrome.

Atheroembolism is a condition in which multiple small deposits of fibrin, platelets, and cholesterol debris embolize from proximal atherosclerotic lesions or aneurysmal sites.

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The typical presentation is a patient with ST-elevation myocardial infarction presenting with features of limb ischemia (cyanotic discoloration of the toes with pain and tenderness) following an intraarterial procedure (angioplasty).

Digital vascular occlusion may result in ischemia and the "blue toe" syndrome; digital necrosis and gangrene may develop. Localized areas of tenderness, pallor, and livedo reticularis occur at sites of emboli. Since the atheroemboli tend to lodge in the small vessels of the limbs and may not occlude the large vessels, distal pulses are usually palpable.

Large protruding aortic atheromas are a source of emboli that may lead to limb ischemia, as well as stroke and renal insufficiency. Skin or muscle biopsy may demonstrate cholesterol crystals.

Sharp syndrome, also known as mixed connective tissue disease, is an autoimmune condition with features of SLE, systemic sclerosis, and polymyositis. Clinical features include Raynaud's syndrome, polyarthritis, myositis, swollen hands, and fingers.

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Solution to Question 14:

The patient is suffering from gangrene of the foot. If there is severe sepsis and if re-establishing blood supply is difficult(revascularization) then amputation is the preferred choice of treatment.

Gangrene refers to death of macroscopic portions of tissue which turn black because of the breakdown of haemoglobin and the formation of iron sulphide.

It usually affects the most distal part of a limb because of arterial obstruction (from thrombosis, embolus or arteritis).

Dry gangrene occurs when the tissues are desiccated by gradual slowing of the bloodstream. Wet Gangrene occurs when superadded infection and putrefaction are present. Crepitus may be palpated as a result of infection by gas-forming organisms commonly in diabetic foot problems.

Solution to Question 15:

The image and clinical scenario are suggestive of diabetic gangrene of the foot. It is accompanied by sensory loss in the early stage of the disease and motor involvement in the late stage.

Diabetic gangrene is caused by a combination of three factors:

• Ischemia secondary to macrovascular disease and microvascular dysfunction,

• Peripheral sensorimotor neuropathy, which leads to trophic skin changes

• Immunosuppression is caused by excess sugar in the tissues, which predisposes to infection

Diabetic gangrene is accompanied by loss of sensation and reflexes which lead to repeated injury. There occurs an imbalance between the flexors and extensors of the foot which causes deformities known as Charcot's foot (neuropathic joints).

Initial treatment comprises strict glycemic control and antibiotic therapy. The gangrene is treated by drainage of pus, debridement of dead tissue with local amputation of necrotic digits.

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Solution to Question 16:

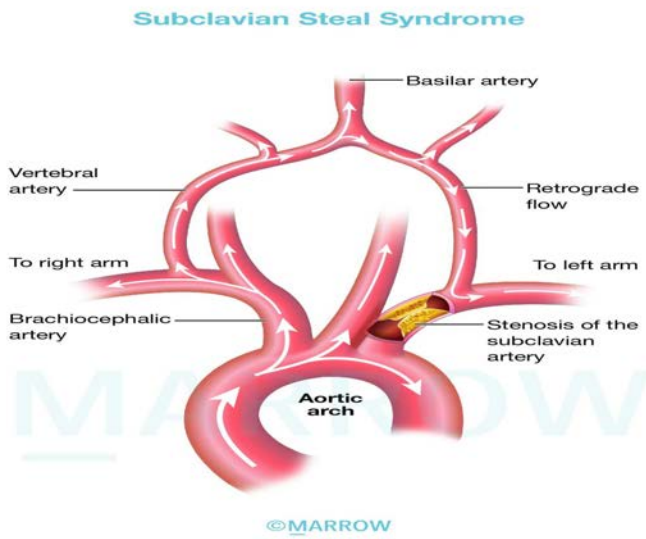
The given clinical scenario points to a diagnosis of subclavian steal syndrome. In subclavian steal syndrome, the first part of the subclavian artery is occluded.

Subclavian steal syndrome is characterized by the presence of stenosis in the first part of the subclavian artery either due to atherosclerotic changes or emboli. It leads to reversed flow in the vertebral artery causing cerebral ischemia.

Symptoms include dizziness, syncope on arm exercise. Occasionally, distal pulses in the arm of the affected side are found to be feeble.

Investigations include duplex ultrasonography, CT, and MR angiography.

It can be treated by angioplasty, stenting or by extra-thoracic subclavian bypass.



Solution to Question 17:

In Paget-Schroetter syndrome, the subclavian vein is affected.

Compression of subclavian vein between anterior scalene, clavicle, and the first rib can produce axillary-subclavian vein thrombosis. It results in severe upper extremity pain and swelling, that is exaggerated by exercise.

Activities such as throwing, swimming, and weightlifting can cause microtrauma of the venous intima that initiates thrombus formation.

Solution to Question 18:

In thoracic outlet syndrome (TOS) the lower two nerve roots of the brachial plexus, C8 and T1 are most commonly involved and produce pain and paresthesia along the ulnar nerve distribution.

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Solution to Question 19:

The test described in the question is a provocative test for thoracic outlet syndrome called Roos test (extended arm stress test).

Solution to Question 20:

In acrocyanosis, there is no pain or numbness. In Raynaud's phenomenon, there is pain and tingling sensation.

Acrocyanosis is a chronic, benign vasoconstrictive disorder. It is due to arterial vasoconstriction and secondary dilation of the capillaries and venules that results in persistent cyanosis of the hands and feet. It can be primary or secondary.

Primary acrocyanosis is more common in females with an onset <30 years. Trophic skin changes and ulcerations do not occur and examination reveals normal pulses.

The disorder can be distinguished from Raynaud's phenomenon:

• Because it is persistent and not episodic

• There is no pain in acrocyanosis whereas in Raynaud's phenomenon there is pain and numbness

• The discoloration extends proximally from the digits

• Blanching does not occur

Solution to Question 21:

The given clinical scenario is suggestive of Raynaud's phenomenon. Secondary causes of Raynaud's phenomenon are seen in association with autoimmune diseases such as scleroderma, systemic lupus erythematosus etc.

Raynaud's phenomenon is characterized by triphasic color response of the fingers or toes:

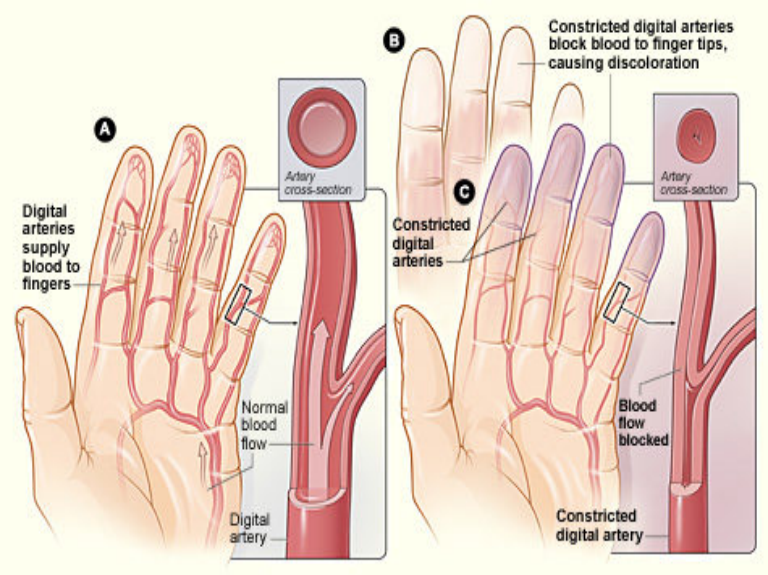
• Digital blanching or pallor

• Cyanosis

• Rubor

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Primary Raynaud's phenomenon (Raynaud's disease)	Secondary Raynaud's phenomenon
Idiopathic and more common	Secondary to other conditions (autoimmune diseases, vibration injury)
Women are more commonly affected	No gender predisposition
Age of presentation is between 20 to 40 years	Present later in life
Episodic	-
Affects both hands and feet	Affects either both hands or both feet

Solution to Question 22:

Statements 1 and 3 are false. In thromboangitis obliterans, there is normal brachial and popliteal pulses but reduced or absent radial, ulnar, and/or tibial pulses. It is most common in male smokers, usually under the age of 30 years.

Thromboangiitis obliterans (Buerger's disease) is an inflammatory occlusive vascular disorder involving small and medium-sized arteries and veins in the distal upper and lower extremities.

The clinical features include a triad of:

• Claudication of the affected extremity

• Raynaud's phenomenon

• Migratory superficial vein thrombophlebitis

Patients frequently have rest pain, ulceration, and digital gangrene.

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Solution to Question 23:

The clinical scenario points to a diagnosis of thromboangiitis obliterans. There is no specific treatment except abstinence from tobacco. Key findings in this patient is age < 40 years, smoker, and involvement of upper extremity.

Although the cause of thromboangiitis obliterans is not known, there is a definite relationship to cigarette smoking in patients with this disorder. There is no specific treatment except abstention from tobacco.

MRA, CTA, and conventional arteriography show smooth, tapering segmental lesions in the distal vessels with collateral vessels at sites of vascular occlusion.

The prognosis is poor in individuals who continue to smoke.

Surgical revascularization is not possible due to extensive vascular inflammation and damage. Anticoagulants and glucocorticoids are not helpful. If the condition worsens, amputation may be required.

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Solution to Question 24:

The above clinical scenario is suggestive of Leriche syndrome. The treatment of choice here is aortobifemoral grafting.

Leriche syndrome is due to occlusion at the aortic bifurcation and is characterized by

- Buttock claudication
- Impotence
- Absence of femoral pulse.
- No sensory or motor deficit
- Normal reflexes

Atherosclerosis is the most common cause of Leriche syndrome.

Differential diagnosis includes

- Abdominal dissection
- Spinal canal stenosis
- Spinal disc herniation

Aortofemoral grafting is done in unilateral iliac vessel occlusion.

Iliofemoral grafting is done for unilateral occlusion of distal common iliac or external iliac artery.

Illiopopliteal grafting is done for femoral artery occlusion.

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Intermittent claudication	Neurogenic claudication	osteoarthritis
Pain after walking a certain d istance	Pain after walking or standin g for some time	Maximum pain on the first st ep.
Pain quickly relieved on resti ng.	Pain relieved on flexion	Pain relieved on resting.

Solution to Question 25:

Dysphonia is not an indication for carotid endarterectomy. Carotid endarterectomy is done in carotid artery stenosis.

Indications of carotid endarterectomy in symptomatic patients.

CT angiography showing 70% or more stenosis and

- Ipsilateral amaurosis fugax or monocular blindness
- Contralateral facial paralysis or paresthesia
- Arm/leg paralysis or paresthesia
- Hemianopia
- Dysphasia

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Arterial Aneurysms, Dissections and Malformations

Question 1:

What is the most common location of aortic aneurysm?

a) Infrarenal aorta

b) Suprarenal aorta

c) Descending aorta

d) Arch of aorta

Question 2:

A patient is found to have an abdominal aortic aneurysm when an ultrasound abdomen was done to look for gallstones. He is otherwise healthy. What is the diameter of the aneurysm above which elective repair is indicated?

a) ° 5 cm

b) ° 5.5 cm

c) 4-5 cm

d) ° 4 cm

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Question 3:

Which of the following statements regarding abdominal aortic aneurysm is false?

a) Abdominal aneurysms are more suitable for endovascular repair than open repair

b) Most abdominal aortic aneurysms rupture into the retroperitoneal space

c) Systolic pressure is maintained at <100 mm of Hg in aortic aneurysm rupture

d) USG is used to diagnose abdominal aortic aneurysm rupture

Question 4:

Most common site of traumatic aneurysm of aorta?

a) Ascending aorta

b) Aortic arch

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c) Descending thoracic aorta

d) Abdominal aorta

Question 5:

A 41-year-old female patient presented with a tortuous swelling over the left side of the scalp and face as shown in the image given below. On local examination, the swelling was pulsatile. On auscultation, a bruit was heard. Which of the following is the most likely diagnosis?



a) Neurofibromatosis

b) Liposarcoma

c) Cirsoid Aneurysm

d) Varicocele

Question 6:

A 50-year-old male patient, during his routine annual checkup, is found to have an abdominal aortic aneurysm measuring 40 mm in diameter on USG. Which of the following is true about the management of this patient?

a) Urgent endovascular aneurysm repair

b) Surgery is indicated if aneurysmal diameter is >55mm

c) Urgently wheel the patient to OT for surgery

d) Surgery is indicated only if aneurysm is >77mm

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Question 7:

Which is the most common site for peripheral aneurysms?

a) Popliteal artery

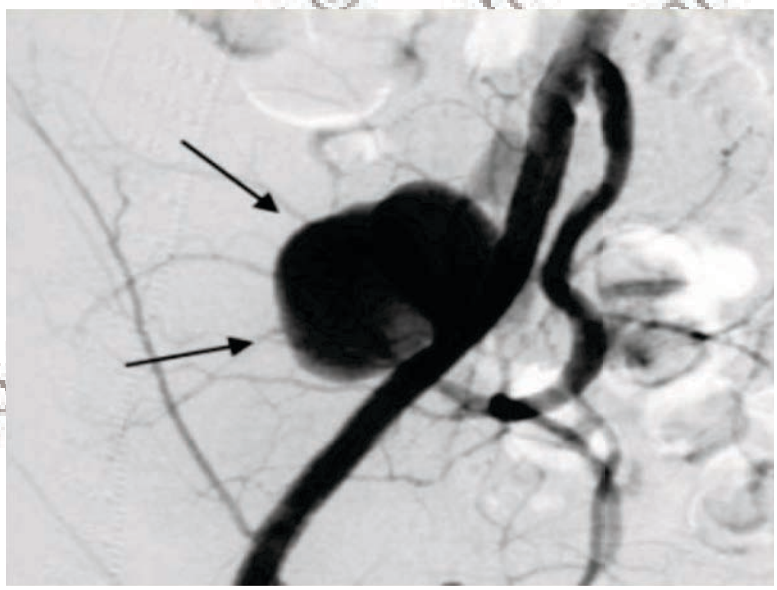
b) Femoral artery

c) Brachial artery

d) Axillary artery

Question 8:

A 30-year-old man presented to the emergency department with complaints of fever and severe back pain. He is an IV drug abuser. CT scan of the abdomen revealed a saccular, lobulated dilatation of the aorta as shown in the image. What organism is his blood culture most likely to grow?



a) Mucor

b) Salmonella

c) Staphylococcus

d) Aspergillus

Question 9:

A patient presents with complaints of swelling behind the knee for the last 3 years. On evaluation, he is diagnosed to have a popliteal artery aneurysm. Beyond what diameter is

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repair indicated?

a) 2-3 cm

b) 4-5 cm

c) 6 cm

d) 5.5 cm

Question 10:

Which of the following is an indication for operative repair of thoracic aortic aneurysm?

a) Asymptomatic ascending thoracic aortic diameter of 3 cm with bicuspid aortic valve

b) Asymptomatic ascending thoracic aortic diameter > 5 cm

c) Asymptomatic descending thoracic aortic diameter > 5 cm

d) When diameter of an ascending aortic aneurysm has increased more than 0.5 cm per year

Question 11:

An elderly man presented with a new-onset pulsatile swelling over his wrist as shown in the image. He was recently discharged after a one-month-long ICU admission for urosepsis. On examination, systolic bruit was audible and a doppler revealed bidirectional flow of blood. Which of the following is false regarding the given condition?



a) Due to focal dilation in a vessel in which only the intimal layer is disrupted

b) Treatment includes endovascular stent insertion and thrombin therapy

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c) Most common cause is iatrogenic

d) Yin-yang sign is seen on doppler ultrasound of the swelling

Question 12:

A 70-year-old man presents with acute pain in the chest which radiates to the interscapular region of the back. He is a known hypertensive for the past 7 years. His CT is shown below. Which of the following statements regarding the condition is false?



a) Men are affected more than women

b) In Stanford type B ascending aorta is affected

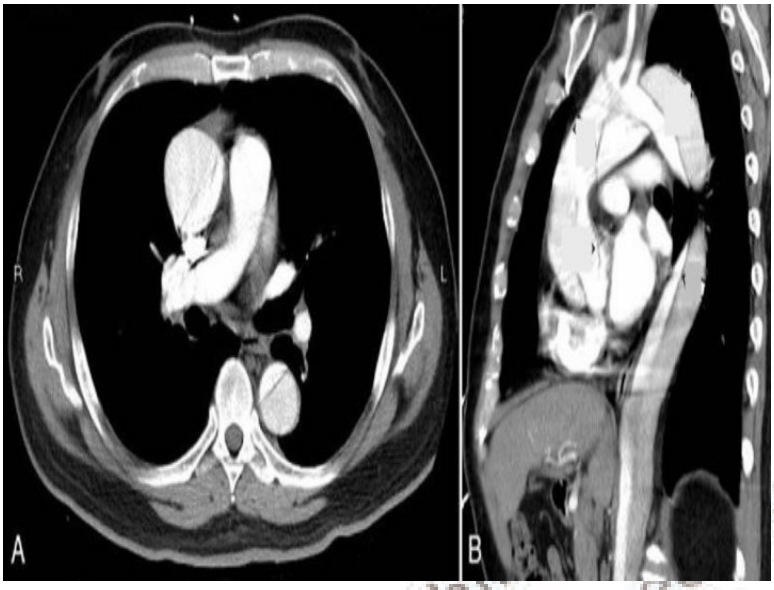
c) Pleural effusion associated with aortic dissection is usually left sided

d) Sensitivity of transthoracic echocardiography in diagnosing proximal ascending aortic dissections is higher

Question 13:

A 57-year-old male patient presented with a sudden tearing type of chest pain. He has had hypertension for the past 15 years and has not been on regular treatment. The patient was hemodynamically stable. A CECT chest was done and is given below. What is the preferred treatment option for this patient?

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a) Emergency surgical intervention

b) Medical management with blood pressure control

c) Magnetic resonance angiography

d) Further diagnostic workup with transesophageal echocardiography

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Question 14:

In which of the following conditions is a double-barrelled aorta seen?

a) Syphilitic aneurysm

b) Atherosclerotic aneurysm

c) Giant cell arteritis

d) Aortic dissection

Question 15:

An AV fistula in the forearm is created in a patient with end-stage renal disease so that he can undergo dialysis. Which of the following responses will you not see when you apply pressure proximal to the AV fistula?

a) Decrease in heart rate

b) Increase in pulse pressure

c) Decrease bruit

d) Decrease in size of swelling

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Question 16:

What is the investigation of choice for evaluation of peripheral AV malformation?

a) CT

b) MRI

c) Duplex USG

d) Digital subtraction angiography

Question 17:

A 50-year-old man with a history of coronary artery disease (CAD) presents with complaints of recurrent postprandial abdominal pain associated with vomiting and diarrhea. Abdominal examination shows no tenderness or rigidity. What could be the most likely diagnosis?

a) Ischemic colitis

b) Wilkie's syndrome

c) Nutcracker's syndrome

d) Chronic mesenteric ischemia

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Question 18:

All of the following are true about superior mesenteric artery syndrome except?

a) Third part of duodenum is compressed

b) Angle between SMA and aorta is more than 70 degrees

c) Surgical management is by dudenojejunostomy

d) Also known as Wilkie's Syndrome

Answer Key

Question No.	Correct Option
1	a
2	b

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3	d
4	c
5	c
6	b
7	a
8	c
9	a
10	d
11	a
12	b
13	a
14	d
15	b
16	b
17	d
18	b

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Detailed Explanations

Solution to Question 1:

The most common location of aortic aneurysms is the infrarenal aorta.

Solution to Question 2:

Asymptomatic abdominal aortic aneurysm ° 5.5 cm should undergo operative repair.

Indications for operative repair in abdominal aortic aneurysm:

• Symptomatic abdominal aortic aneurysm of any size or one that is expanding rapidly

• Asymptomatic abdominal aortic aneurysm >5.5 cm

Indications for operative repair in aortic aneurysm:

Clinical scenario	Indication for operative repai r
Symptomatic aneurysm	Any size
Asymptomaticabdominal aor ticaneursym	°5.5cm

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Clinical scenario	Indication for operative repair
Asymptomaticascending thoracicaortic diameter	> 5.5 cm
When the diameter of an ascending aortic aneurysm has increased	> 0.5 cm per year
Asymptomaticdescendingthoracicaortic diameter or	> 6 cm
When the diameter ofdescendingaorticaneurysm has increased	> 1 cm per year
Asymptomatic ascending thoracic aortic diameter in patients with Marfan's syndrome or bicuspid aortic valve	4-5cm

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Solution to Question 3:

CT scan is used to diagnose an abdominal aortic aneurysm rupture and to determine suitability for endovascular repair. If there is a doubt about the presence of an abdominal aortic aneurysm, USG may help in visualizing aneurysm but it cannot be used to diagnose rupture.

80% of abdominal aortic aneurysms rupture into the retroperitoneal space and 20% rupture into the peritoneal cavity.

During the initial resuscitation of a patient with abdominal aortic aneurysm rupture, the systolic pressure is maintained at less than 100mm of Hg (permissive hypotension) to avoid provoking further uncontrolled hemorrhage. It is maintained at adequate levels to preserve cerebral perfusion till the patient can be taken up for surgery.

Solution to Question 4:

Most common site of a traumatic aneurysm is descending thoracic aorta just beyond the site of insertion of the ligamentum arteriosum.

Traumatic aneurysms may occur after penetrating or nonpenetrating chest trauma.

Solution to Question 5:

The presence of a tortuous, pulsatile swelling over the scalp and face is suggestive of a cirsoid aneurysm.

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Cirsoid aneurysm is a slow-growing, tortuous swelling that develops due to abnormal arteriovenous connections among the subcutaneous blood vessels. They are usually congenital. However, in some cases, they may be traumatic. The superficial temporal artery is most commonly involved.



Patients present with a tortuous, pulsatile swelling over the scalp or face. They are usually asymptomatic and present to the clinic due to cosmetic deformity. However, some patients may have headache, tinnitus, and/or bleeding. A loud bruit is heard on auscultation.

Angiography is the investigation of choice.

Treatment includes surgical resection, endovascular occlusion or injection of percutaneous sclerosing agents.

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Solution to Question 6:

Surgery is indicated in an asymptomatic abdominal aortic aneurysm (AAA) only if its diameter is more than 55 mm in a male patient.

If the diameter is less than 55 mm, regular ultrasound monitoring is required. This is because elective open surgery has a higher rate of mortality when compared to conservative management for aneurysms of size < 55 mm.

Indications for surgery in abdominal aortic aneurysm:

• Size >5.5 cm in males

• Size >5 cm in females

• Expansion of >1 cm in one year

• Painful tender aneurysm

• Thrombosed aneurysm; aneurysm with distal emboli

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Management of aortic aneurysm: AAA is surgically managed by dacron graft repair. It can be either open or EVAR (endovascular aneurysm repair)

• Open surgical repair is done by exposing the aorta through a mid-sternal incision and graft replacement. To expose the aorta the descending colon should be mobilized medially and this is known as left visceral rotation or Mattox procedure.

• EVAR is a minimally invasive procedure in which an aortic stent graft is placed on the nonaneurysmal aortoiliac segment.

Complications following an AAA repair are:

• Cardiovascular (ischemia and infarction)

• Respiratory (atelectasis or consolidation).

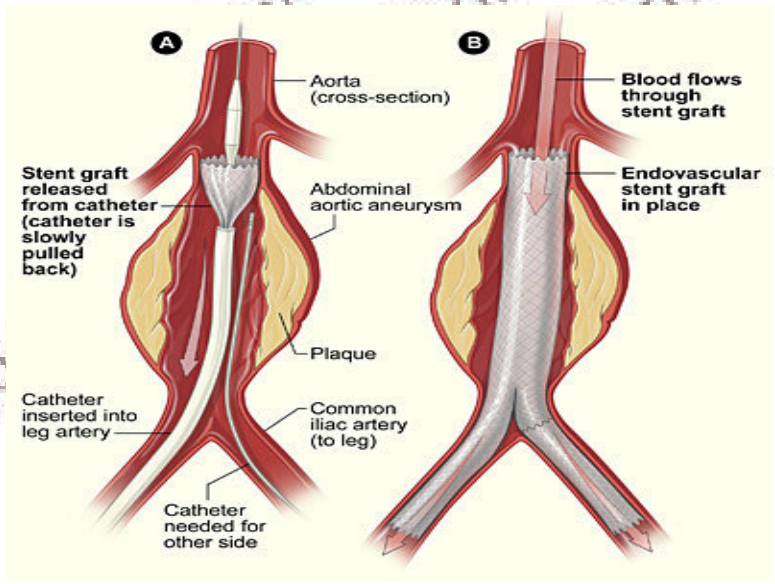
• Colonic ischemia.

• Renal failure.

• Aortoduodenal fistula

• spinal cord ischemia

The given image below shows the technique of EVAR:



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Solution to Question 7:

Femoral and popliteal artery aneurysms account for more than 90% of peripheral aneurysms, with popliteal artery aneurysms being the most common (70%).

Two-thirds of popliteal artery aneurysms are bilateral.

Solution to Question 8:

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The above clinical scenario points to a diagnosis of mycotic aneurysm and it is secondary to microbial aortitis. The most common organism causing mycotic aneurysm is staphylococcus and is mostly due to IV drug abuse.

Symptoms may include hypotension, abdominal pain, pulsatile abdominal mass with concomitant fever. Laboratory findings reveal elevated inflammatory parameters such as CRP, ESR, and increased white cell count. A contrast-enhanced CT scan is the initial imaging modality of choice.

Patients require prolonged antibiotic therapy tailored to the culture and sensitivity findings. Surgical management includes debridement, revascularization, or bypass techniques.

The term 'mycotic aneurysm' is a misnomer as the aneurysm commonly occurs secondary to bacterial infection, and is rarely caused by a fungal infection.

Any major artery may be infected, however, the aorta is most commonly affected. The organisms infect the aorta and destroy the wall of the aorta, which may lead to an aneurysm.

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Solution to Question 9:

Popliteal artery aneurysm repair is indicated when the diameter exceeds 2–3 cm, owing to the risk of thrombosis, embolism, or rupture and when they are symptomatic.

Solution to Question 10:

Among the given options, the patient in whom the diameter of ascending aortic aneurysm has increased more than 0.5 cm per year, is considered for operative repair.

Option A: Asymptomatic ascending thoracic aortic diameter of 4-5 cm with Marfan's syndrome or bicuspid aortic valve is an indication.

Option B: Asymptomatic ascending thoracic aortic diameter > 5.5 cm, not 5 cm.

Option C: Asymptomatic descending thoracic aortic diameter > 6cm, not 5cm.

The indications for operative repair of the thoracic aortic aneurysm are given in the table below.

Clinical scenario	Indication for operative repai r
Symptomatic aneurysm	Any size
Asymptomaticabdominal aor ticaneursym	°5.5cm
Asymptomaticascending thor acicaortic diameter	> 5.5 cm
When the diameter of an asc ending aortic aneurysm hasin creased	> 0.5 cm per year
Asymptomaticdescendingtho racicaortic diameter or	> 6 cm

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Clinical scenario	Indication for operative repair
When the diameter ofdescendingaorticaneurysm has increased	> 1 cm per year
Asymptomatic ascending thoracic aortic diameter in patients withMarfan's syndromeor bicuspid aortic valve	4-5cm

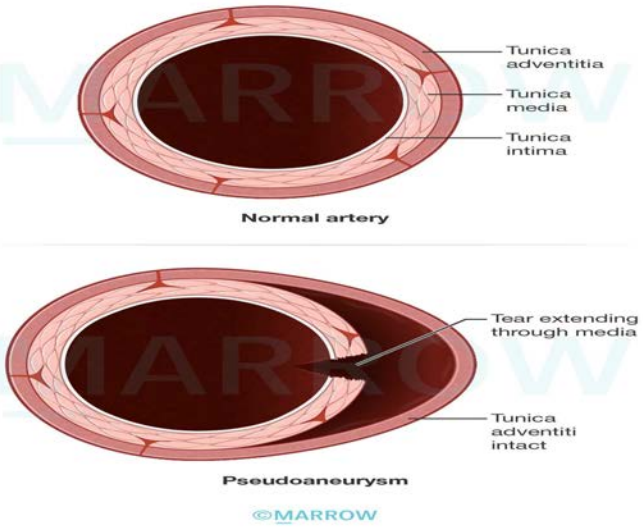
Solution to Question 11:

The patient most likely has a pseudoaneurysm of the radial artery due to repeated arterial blood gas sampling done in the ICU. Dilatation of vessel due to tear involving only the intima is a dissection, not a pseudoaneurysm.

In pseudoaneurysm, the intimal and medial layers are disrupted and the dilated segment of the aorta is lined by adventitia only and at times by perivascular clot. Pseudoaneurysm is most commonly seen due to repeated arterial puncture for blood sampling or catheterization procedures where there is an increased chance of arterial wall injury. It is usually pulsatile and systolic bruit can be heard on auscultation.

Doppler ultrasound reveals bidirectional, 'to-and-fro' flow of blood which is known as the yin-yang sign. Treatment options include endovascular stent insertion, ultrasound-guided thrombin injection, and surgical repair.

Note: A true aneurysm involves all three layers of the vessel wall.



Solution to Question 12:

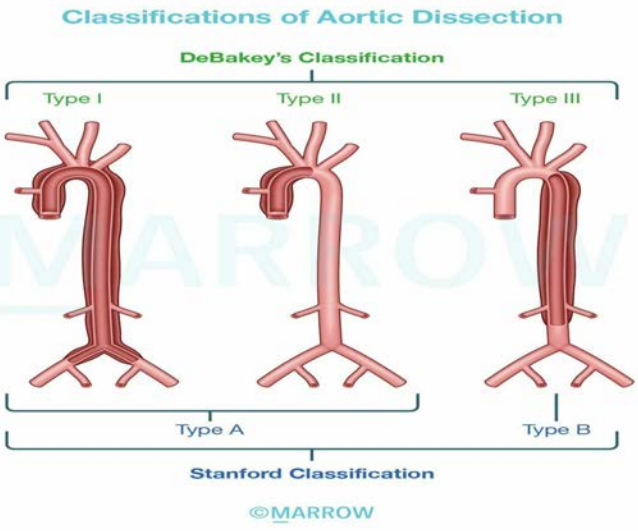
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The given clinical scenario and the CT image showing the double-lumen of the aorta are suggestive of aortic dissection. Stanford type A is when ascending aorta and arch are affected while Stanford Type B involves descending aorta only, commencing after the origin of the left subclavian artery.

Aortic dissection occurs when a defect or flap occurs in the intima of the aorta. Predisposing factors include increasing age, hypertension, Marfan syndrome.

The most typical presentation of aortic dissection is a tearing interscapular pain. Aortic dissection affects men more than women by a ratio of 2:1. Pleural effusion associated with aortic dissection is usually left-sided.

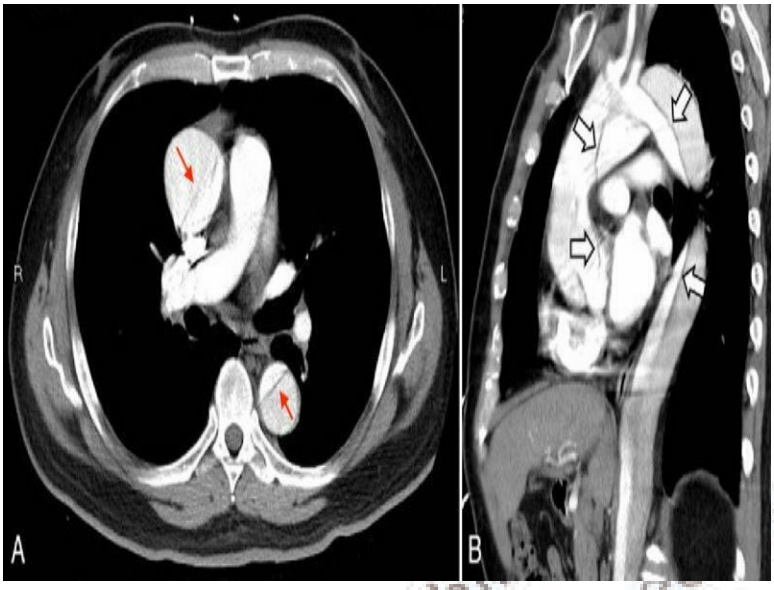
Transthoracic echocardiography has an overall sensitivity of 60–85% for aortic dissection. For diagnosing proximal ascending aortic dissections, its sensitivity exceeds 80%. It is less useful for detecting dissection of the arch and descending thoracic aorta.



Solution to Question 13:

The patient seems to be having an aortic dissection and CT chest indicates a Stanford Type A aortic dissection from the aortic root. He requires urgent surgical management.

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The Stanford classification is used to separate aortic dissections into those that need surgical repair, and those that usually require only medical management. The Stanford classification divides dissections by the most proximal involvement.

Type A is when ascending aorta and arch are affected. It requires urgent surgical management and may result in:

• Coronary artery occlusion

• Aortic incompetence

• Rupture into the pericardial sac with resulting cardiac tamponade

Type B begins beyond brachiocephalic vessels and dissection commences distal to the left subclavian artery affecting only the descending aorta. Medical management with blood pressure control is the preferred choice of treatment.

The DeBakey classification divides dissections into:

• Type I: involves ascending and descending aorta (= Stanford A)

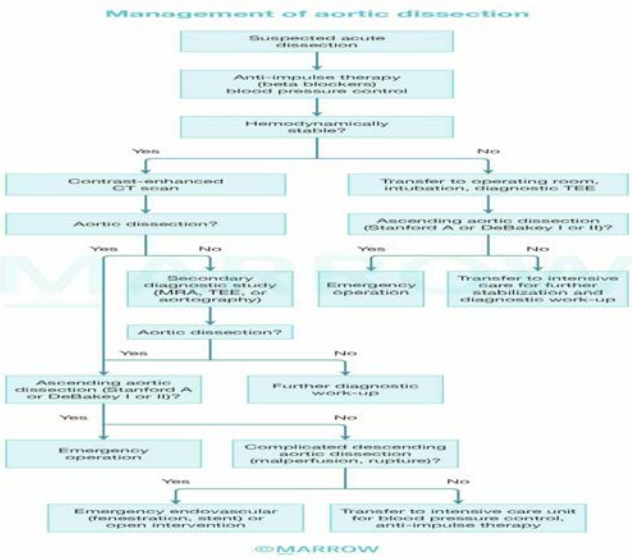
• Type II: involves ascending aorta only (= Stanford A)

• Type III: involves descending aorta only, commencing after the origin of the left subclavian artery (= Stanford B)

Further diagnostic workup with TEE(transesophageal echocardiography) or MRA (magnetic resonance angiography) is not required as CT is showing ascending aorta dissection clearly.

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Solution to Question 14:

A double-barrelled aorta is seen in an aortic dissection.

An aortic dissection usually initiates with an intimal tear. In some instances, the dissecting hematoma reenters the lumen of the aorta through a second distal intimal tear, creating a new vascular channel and forming a double-barreled aorta with a false channel.

Acute aortic dissection can be classified by the original DeBakey system, based on location of proximal tear and distal extent of the dissection flap, or the Stanford system that uses location of proximal tear alone.

DeBakey system:

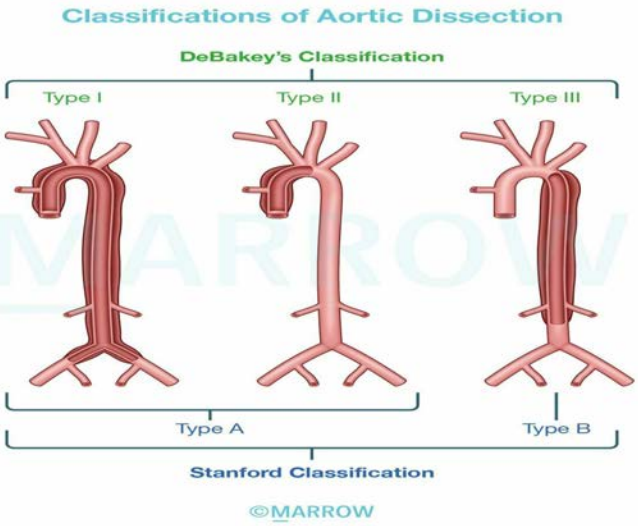
• Type I: involves the ascending aorta and extends through the aortic arch and into the descending aorta/abdominal aorta

• Type II: confined to the ascending aorta

• Type IIIa: limited to the descending aorta

• Type IIIb: descending aorta and abdominal aorta

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Solution to Question 15:

Pulse pressure returns to normal when pressure is applied to an artery proximal to an AV fistula.

In an AV fistula, peripheral resistance is decreased because of which diastolic pressure is less leading to higher pulse pressure. Compression of the artery proximal to the AV fistula increases peripheral resistance leading to increased diastolic pressure and the pulse pressure returns to normal.

Compression of the artery proximal to an arteriovenous fistula results in:

- Reflex bradycardia
- Pulse pressure returns to normal
- Decrease in size of swelling
- Bruit will decrease or disappear

The reflex bradycardia and increase in blood pressure that immediately follows the sudden occlusion of an arteriovenous (A-V) fistula is known as the Nicoladoni-Branham sign.

Solution to Question 16:

MRI has become the imaging study of choice for the evaluation and follow-up of peripheral arteriovenous malformations.

Magnetic resonance imaging (MRI) offers numerous advantages over both CT and radiographs and has become the most important modality to diagnose AVM's. MRI techniques including time-of-flight and phase contrast can be used to isolate inflow blood supply to better predict the risk of ischemia following embolization.

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MRI also provides well-defined images defining boundaries between the AVM, surrounding fat, and neurovascular bundles, which is necessary for the planning of surgical or embolic interventions.

Solution to Question 17:

Postprandial abdominal pain in the background of CAD is suggestive of chronic mesenteric ischemia(CMI). The most common cause of chronic mesenteric ischemia is atherosclerotic disease.

The three classic symptoms pathognomonic of CMI are:

• Postprandial pain (crampy periumbilical abdominal pain within 30 minutes of meals)

• Food fear (foods that precipitate symptoms are avoided by the patient and unintentional weight loss can result)

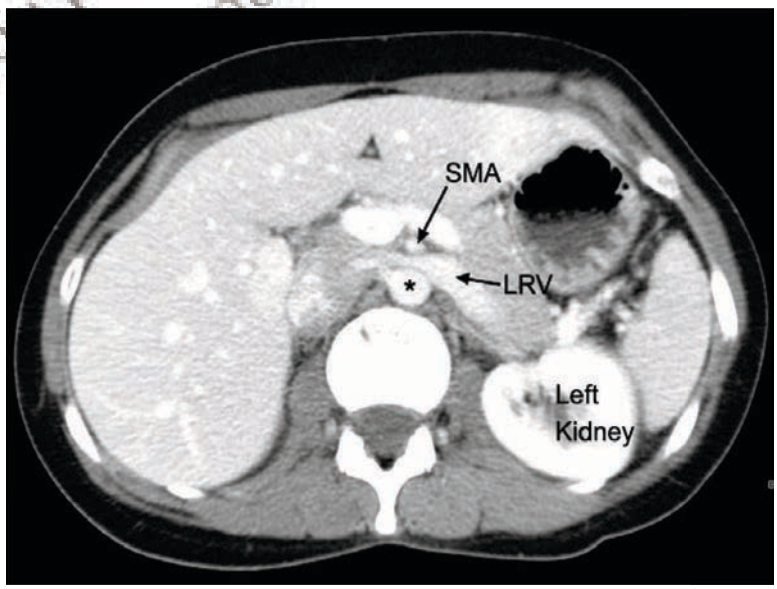
• Significant weight loss

CT angiogram demonstrates both the arterial lesion and the patterns of collateral blood flow.

Percutaneous transluminal angioplasty (PTA) and stenting have gained acceptance as the first line of therapy for mesenteric ischemia.

Nutcracker syndrome refers to compression of the left renal vein, most commonly between the aorta and the superior mesenteric artery, with impaired blood outflow often accompanied by distention of the distal portion of the vein. Most commonly presents with hematuria, flank pain, and varicoceles.

CT image of nutcracker syndrome showing compression of the LRV between the aorta and the SMA:



Solution to Question 18:

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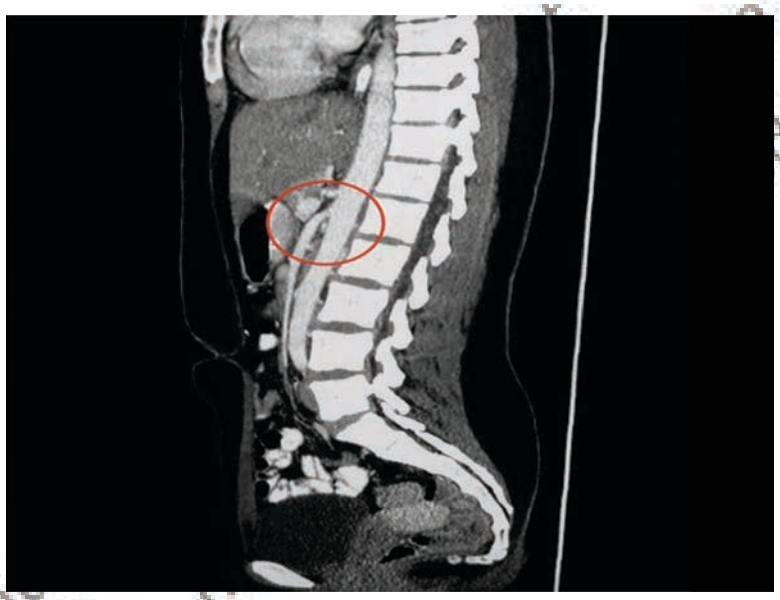
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Option B is the false statement. In superior mesenteric artery (SMA) syndrome, the aortomesenteric angle is reduced to less than 25 degrees. The normal aortomesenteric angle is approximately between 38-65 degrees.

SMA syndrome, also called Wilkie's syndrome (option D), is characterized by an obstruction of the third part of the duodenum by the SMA (option A) due to compression against fixed retroperitoneal structures.

Symptoms include episodic epigastric pain associated with vomiting. Risk factors include rapid childhood growth without compensatory weight gain, profound weight loss, abdominal surgery, inflammatory diseases of the abdomen, and immobilization in a cast that increases lordosis and accentuates the angle of the SMA with the aorta.

Abdominal CT angiography is the investigation of choice. The CT image below shows narrowed aortomesenteric angle in SMA syndrome:

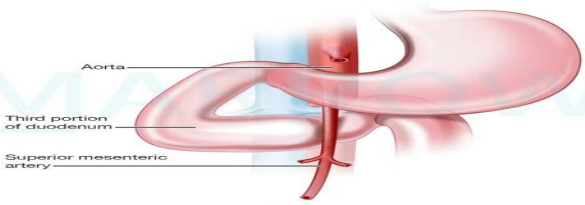


Lifestyle therapy includes frequent small feedings and patients may benefit from lying prone or on their left side postprandially.

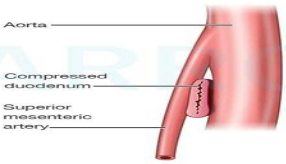
In some cases, weight gain or removal of a body cast improves symptoms. Laparoscopic lysis of the ligament of Treitz is beneficial in few cases. The preferred surgical treatment is Strong's procedure involving duodenojejunostomy (option C).

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Wilkie syndrome



Anterior view



Lateral view

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Venous Diseases

Question 1:

Which of the following is not part of Virchow's triad?

a) Venous stasis

b) Injury to veins

c) Blood hypercoagulability

d) Thrombus formation

Question 2:

Which of the following patients are not at an increased risk for developing deep vein thrombosis?

a) Woman on high dose oestrogen therapy for menopausal symptoms

b) Child with nephritic syndrome

c) Middle aged man with polycythemia vera

d) Teenager who has sustained major trauma in an accident

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Question 3:

Which of the following statements is false regarding deep vein thrombosis (DVT)?

a) Clinical assessment is unreliable

b) Mostly bilateral

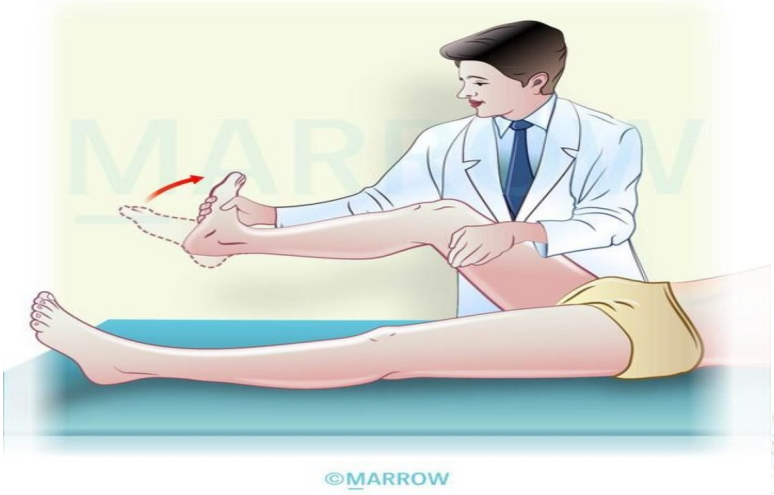
c) Most common clinical presentation is pain and tenderness in calf

d) Some cases may directly present as pulmonary thromboembolism

Question 4:

When performing the test on a patient as shown in the image, you noticed that there was tenderness and resistance on flexion. What is this finding known as?

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a) Pratt's sign

b) Moses sign

c) Homan's sign

d) Lowenberg's sign

Question 5:

A 30-year-old woman who is in the third trimester of pregnancy started to experience pain in her left leg. She also noticed that her left leg was turning pale and edematous as given in the image below. What is the cause of this condition?



a) Femoral vein thrombosis and lymphatic obstruction

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b) Deep femoral vein thrombosis

c) Lymphatic obstruction only

d) Due to pressure exerted by uterus on the iliac veins

Question 6:

You are tasked with giving post-operative care to a patient who just underwent open abdominal surgery. Which of the following is the most effective treatment to prevent the patient from developing deep vein thrombosis?

a) Early ambulation

b) Physiotherapy

c) Prophylactic heparin

d) Low dose aspirin

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Question 7:

All of the following are risk factors for developing varicose veins, except?

a) Multiple pregnancies

b) Superficial venous thrombosis

c) AV fistula in lower limb

d) BMI > 40 kg/m2

Question 8:

A truck driver presents with dilated, tortuous veins of 4 mm in the foot. What is the stage of clinical classification according to CEAP(Clinical-etiology-anatomy-pathophysiology for chronic venous disorders)?

a) C0

b) C1

c) C2

d) C3

Question 9:

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A 42-year-old daily wage laborer comes to you with discoloration of her legs. She was diagnosed with varicose veins 5 years ago which was left untreated. Identify the feature given in the picture.



a) Atrophie blanche

b) Corona phlebectatica

c) Lipodermatosclerosis

d) Phlegmasia alba dolens

Question 10:

A bus conductor was diagnosed with varicose veins. On examination, skin eczema and lipodermatosclerosis were noted. According to the CEAP classification system, He would be classified as

a) C1

b) C2

c) C3

d) C4

Question 11:

Which of the following is false regarding Klippel-Trenaunay syndrome?

a) Limb hypertrophy

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b) Not familial

c) Surgery is indicated in all cases

d) Increased risk of deep vein thrombosis

Question 12:

A patient presents to you with dilated, tortuous veins of the legs. Which is the best investigation to perform that will confirm the diagnosis?

a) Doppler study

b) Duplex ultrasound imaging

c) CT venography

d) MR venography

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Question 13:

Which vessel is not involved in the formation of mickey mouse sign that is seen while performing a duplex ultrasound?

a) Common femoral artery

b) Common femoral Vein

c) Great saphenous Vein

d) Accessory saphenous vein

Question 14:

A duplex ultrasound was done on a patient with varicose veins. It revealed incompetence of the perforator connecting the great saphenous vein to the superficial femoral vein. What is this perforator known as?

a) Boyd perforator

b) Dodd perforator

c) Kustner perforator

d) Cockett perforator

Question 15:

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Presence of which of the following would make a patient with varicose veins unsuitable for sclerotherapy?

a) Deep vein thrombosis

b) Multiple incompetent perforators

c) Varicose vein with leg ulcer

d) Recurrence of varicose veins after ligation and stripping surgery

Question 16:

Which sclerosant is most commonly used when performing sclerotherapy for varicose veins?

a) Sodium tetradecyl sulphate

b) Polidocanol

c) Hypertonic saline

d) Sodium morrhuate

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Question 17:

Which of the following is done in Trendelenburg operation?

a) Stripping of the superficial varicose vein

b) Ligation of the perforators

c) Saphenofemoral flush ligation

d) Ligation of small tributaries at the distal end of superficial varicose vein

Question 18:

Which of the following statements regarding complications of varicose vein surgery is false?

a) Injury to the lymphatic system can cause secondary lymphoedema

b) Saphenous nerve injury causes loss of sensation in the medial aspect of the leg

c) The sural nerve is in danger during stripping of the great saphenous vein

d) Deep vein thrombosis can occur

Question 19:

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In patients with chronic venous insufficiency, where are venous ulcers most likely to develop?

a) Medial aspect of the foot

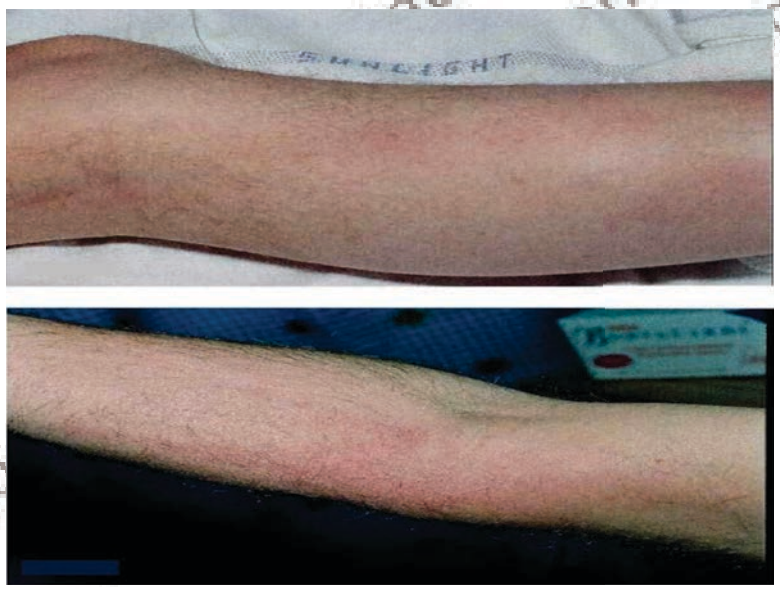
b) Lower 1/3rd of leg

c) Lower 2/3rd of leg

d) Middle 1/3rd of leg

Question 20:

A 61-year-old man presented with a recurrent, tender, erythematous rash on the medial aspect of the right forearm and lower limb as shown in the image. He was diagnosed with pancreatic adenocarcinoma 1 year ago. Blood investigations showed normal eosinophil counts and no signs of infections. What is the most likely diagnosis?



a) Migratory thrombophlebitis

b) Urticaria

c) Secondary to repeated cannulation of vein

d) Cellulitis

Question 21:

A 60-year-old male patient with sudden onset pain, cyanosis, and edema of the left upper limb. Doppler ultrasound revealed thrombosis of the left subclavian vein. Which of the following is false regarding this condition?

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a) Can be caused by indwelling venous catheters

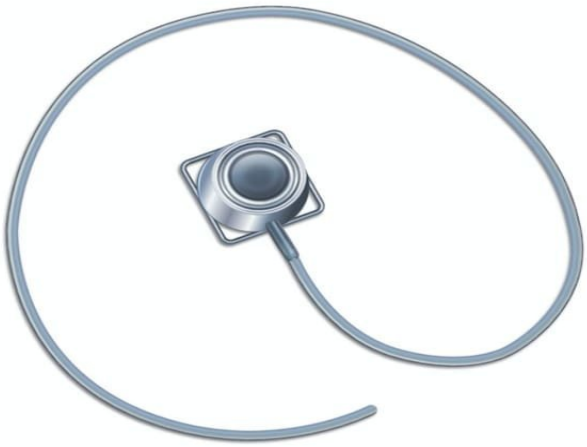
b) Treated with IV anticoagulants

c) Primary axillary vein thrombosis is seen in hypercoagulable states

d) May occur following excessive arm exercise

Question 22:

Identify the device given below.



a) Dialysis port

b) Chemoport

c) Electro-convulsive therapy lead

d) Gamma camera

Question 23:

Which of the following vessel is affected in May-Thurner syndrome?

a) left iliac vein

b) Right iliac artery

c) Left iliac artery

d) Right iliac vein

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Question 24:

A 65-year-old woman with a history of varicose vein, presented with a painless lesion on her left leg for the past 1 month. On examination, an ulcer of size 5 × 5 cm with an irregular margin and sloping edge was found on the medial malleolus of the left leg. All the following can be used to manage this patient except?

[Image unavailable]

a) Oral pentoxifylline

b) Surgical excision and pinch mesh grafting

c) 4 layer bandaging system

d) Revascularization

Question 25:

A 40-year-old hairdresser presented with complaints of swelling, throbbing pain, and heaviness in her left leg for the past 1 year. A duplex scan done showed great saphenous vein incompetence. Which of the following is the treatment of choice?

a) Trendelenburg's procedure

b) Dodd and Crockett surgery

c) SEPS

d) Endothermal ablation

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Question 26:

A 55-year-old locomotive operator presents with complaints of worm-like swelling over his right leg. During clinical examination, a Brodie Trendelenburg test is performed. Which of the following statements is false regarding the test?

a) A tourniquet can be used for occluding the saphenofemoral junction

b) Rapid filling from above indicates saphenofemoral incompetence

c) Gradual filling from below upwards indicates saphenopopliteal incompetence

d) Positive Brodie Trendelenburg test indicates a need for surgery

Answer Key

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Question No.	Correct Option
1	d
2	b
3	b
4	c
5	b
6	c
7	b
8	c
9	a
10	d
11	c
12	b
13	d
14	b
15	a
16	a
17	c
18	c
19	b
20	a
21	c
22	b
23	a
24	d
25	d
26	c

Detailed Explanations

Solution to Question 1:

Thrombus formation is not included in Virchow's triad.

Virchow's triad refers to three primary influences that predispose to thrombus formation:

• Endothelial injury

• Stasis or low turbulence of blood flow

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• Blood hypercoagulability

Solution to Question 2:

Nephritic syndrome is not associated with an increased risk of DVT. Nephrotic syndrome is associated with an increased risk of developing deep vein thrombosis.

Deep vein thrombosis is the presence or formation of a thrombus is present in the deep venous system, usually in the deep veins lower limbs.

Solution to Question 3:

Most cases of deep vein thrombosis (DVT) are unilateral. It is bilateral in only 30% of the individuals.

DVT refers to thrombosis of the deep venous system.

Caused by:

• Postoperative thrombosis (most common cause)

• Oral contraceptive pills (OCPs)

• After childbirth

• Immobility

Sites:

• Pelvic veins—common

• Leg veins—common in femoral and popliteal veins (common on the left side).

Fever is the earliest symptom, which is also most commonly accompanied by pain and tenderness in the calf and thigh (option C).

The following signs could be elicited:

• Positive Homan's sign: Resistance of calf muscles on passive foreceful dorsiflexion of the foot.

• Mose's sign: Gentle squeezing of the lower part of the calf from side to side is painful.

• Neuhof's sign: Thickening and deep tenderness seen on deep palpation of the calf muscles.

Sometimes, the thrombus may get dislodged and present as pulmonary thromboembolism (option D) with features of dyspnoea, tachypnoea, and chest pain.

Clinical features are unreliable for making a definitive diagnosis (option A), and a venous Doppler is the best modality for confirming DVT. It reveals a non-compressible dilated vein. The likelihood of pulmonary embolism can be predicted using modified Wells criteria.

Patients with DVT should be immediately started with subcutaneous low molecular weight heparin (LMWH). If contraindicated due to renal insufficiency or thrombocytopenia-related conditions, they should be started on fondaparinux (indirect factor Xa inhibitor) or bivalirudin (direct thrombin inhibitor). Anticoagulants should be administered for a minimum period of 3

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months. Vena cava filters are used in patients with bleeding risks (like hemophilia).

Solution to Question 4:

The given findings can be seen in a patient with DVT and this is known as Homan's sign i.e. calf tenderness and resistance on forced ankle dorsiflexion.

Moses Sign - calf tenderness on squeezing the calf from sides.

Lowenberg's sign- pain when blood pressure cuff placed on the calf is inflated to 80 mm of Hg

Solution to Question 5:

The patient is having phlegmasia alba dolens also known milk leg or white leg. It is due to ileofemoral deep vein thrombosis.

It is usually seen in pregnant women and in individuals at risk of developing deep vein thrombosis. They typically present with painful, oedematous, and pale lower limb that blanches to touch. The lack of cyanosis differentiates this entity from phlegmasia cerulea dolens.

In phlegmasia alba dolens, the thrombosis involves only major deep venous channels of the extremity, thus sparing collateral veins. The venous drainage is decreased but still present.



In phlegmasia cerulea dolens, the thrombosis extends to collateral veins, resulting in severe venous congestion with massive fluid sequestration and more significant edema.

Both phlegmasia cerulea dolens and phlegmasia alba dolens results from acute massive deep vein thrombosis and can be complicated by venous gangrene.

Edema of pregnancy does not present with pain in the lower limbs but edema due to pressure exerted by the gravid uterus on the iliac veins.

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Solution to Question 6:

Heparin, especially low molecular weight heparin (LMWH) is more effective for prophylaxis of DVT in patients who have undergone major surgeries where early ambulation is not possible.

The choice of prophylaxis depends on the type of surgery, trauma, and duration of postoperative immobilisation. Major trauma, abdominal and orthopaedic surgeries warrant a longer duration of postoperative immobilisation. So, the pharmacological method is preferred in these situations.

Mechanical methods are advised in patients who are expected to be up and walking within 24 to 48 hours such as after minor trauma. The simplest method is for the patient to ambulate. The activation of the calf pump mechanism is an effective means of prophylaxis.

Additionally, compression stockings are advised. It can reduce the risk of DVT by exerting graduated pressure on the leg, with the pressure being greatest at the ankle.

Advantages of LMWH over unfractionated heparin:

• LMWH has a longer plasma half-life and significantly higher bioavailability.

• The consistent bioavailability and clearance of LMWH do not require monitoring of aPTT or anti-factor Xa activity.

• Dosing is merely based on the patient's weight.

• There is a more predictable anticoagulant response than with unfractionated heparin.

LMWH inhibits factor Xa and not IIa activity, with the ratio of anti-factor Xa to anti-factor IIa activity ranging from 1:1 to 4:1.

Solution to Question 7:

Superficial venous thrombosis is not a risk factor for developing varicose veins because the deep venous system is not affected and there is no increased stasis of blood.

Varicose veins are defined as dilated, usually tortuous, subcutaneous veins >3 mm in diameter measured in the upright position with demonstrable reflux.

Important risk factors for varicose veins are:

• Sex – Females > Males

• Age – increases with age

• Pregnancy (especially multiparity)

• Family history

• Body mass and height: Increasing BMI (obesity) and height are associated with a high prevalence of varicose veins.

There is inconclusive evidence regarding the increased prevalence of varicose veins in smokers, patients who suffer constipation, and occupations that involve prolonged standing.

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Primary varicose veins are due to genetic or developmental defects in the vein wall that causes diminished elasticity and valvular incompetence.

Secondary varicose veins arise from destruction or dysfunction of valves caused by trauma, DVT, AV fistula, non-traumatic proximal venous obstruction (pregnancy, pelvic tumor).

Solution to Question 8:

Dilated tortuous veins of 4 mm indicate varicose veins, so the stage is C2.

Solution to Question 9:

Atrophia blanche is localised white atrophic skin frequently surrounded by dilated capillaries and hyperpigmentation, usually seen around the ankles. This is a sign of chronic venous disease.

Lipodermatosclerosis is changes in the skin of the lower legs due to chronic venous insufficiency. It is a form of panniculitis (inflammation of the layer of fat under the skin). There is swelling and a tapering of the legs above the ankles, leading to 'inverted champagne bottle' appearance.



Inverted champagne bottle legs

Corona phlebectatica are fan-shaped patterns of small intradermal veins on the medial or lateral aspects of the ankle or foot. It is also called ankle flare or malleolar flare. It is an early sign of advanced venous disease.

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Solution to Question 10:

According to CEAP classification, varicose veins with skin eczema and lipodermatosclerosis come under the clinical class of C4.

The clinical class of C4 under CEAP includes changes in skin and subcutaneous tissue secondary to chronic venous disease. It is further classified as,

- C4a- pigmentation or eczema
- C4b- lipodermatosclerosis or atrophie blanche
- C4c- corona phlebectatica

Recent 2020 update on the CEAP system:

- C2r for recurrent varicose veins
- C4c for Corona phlebectatica
- C6r for recurrent active venous ulcer.

Solution to Question 11:

All patients with Klippel–Trenaunay syndrome should be treated conservatively with elastic compression. A surgical intervention is only indicated for affected large superficial veins provided the underlying deep system is normal and demonstrates only mild-to-moderate reflux.

Klippel-Trenaunay syndrome is a sporadic nonhereditary mesodermal abnormality that usually affects a single lower limb with deep veins which have hypoplastic or aplastic segments. It is characterized by a triad of:

- Haemangioma presenting as nevus flammeus (port-wine stain)

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• Varicose veins

• Soft tissue and bone hypertrophy

Venous stripping, ligation, excision, or sclerotherapy are done in suitable cases. Low molecular weight heparin should be given to all patients undergoing surgical procedures as this syndrome is associated with an increased risk of venous thromboembolism.

Solution to Question 12:

Duplex ultrasound is the best investigation to confirm varicose veins.

Duplex ultrasound gives information about the presence of blood flow in the studied vessels such as its speed, direction and turbulence alongwith image of surrounding tissues.

The aim of the duplex scan in patients with varicose veins is to establish:

• If saphenous junctions are incompetent and the extent of reflux in the saphenous veins and their diameters.

• Number, location, and diameter of incompetent perforating veins

• Source of all superficial varices

• Competence and evidence of previous venous thrombosis in the deep venous system.

Doppler study only gives information about the presence of blood flow in the studied vessels such as its speed, direction, and turbulence, not the surrounding tissue.

Very rarely if pelvic and iliac veins are involved then CT or MR venography might be opted for, when duplex ultrasound fails to visualise properly.

Solution to Question 13:

Mickey mouse sign is seen in transverse B mode image of duplex ultrasound formed by:

• Common Femoral Vein (CFV)

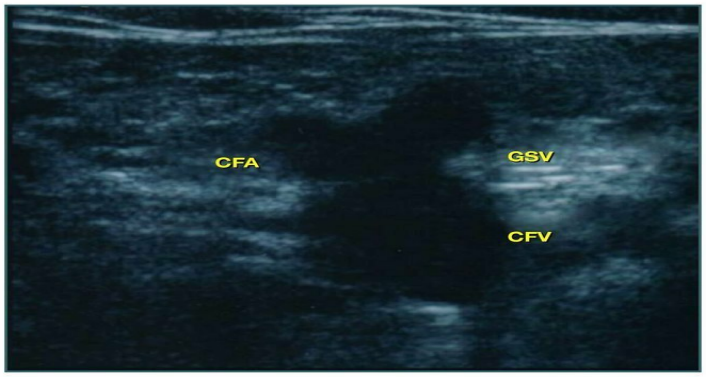
• Common Femoral Artery (CFA)

• Greater Saphenous Vein (GSV) at the Saphenofemoral junction (SFJ).

It represents the normal anatomy of the femoral vessels as seen in a duplex ultrasound.

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CFA - Common femoral artery
GSV - Great saphenous vein
CFV - Common femoral vein

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Solution to Question 14:

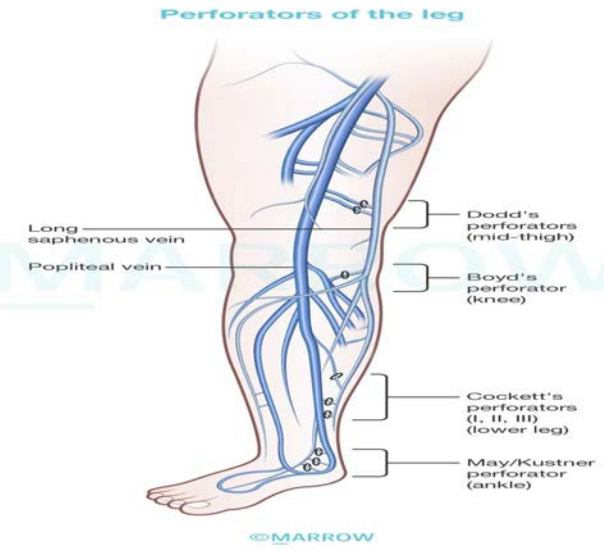
Dodd's perforator connects the great saphenous vein to the superficial femoral veins. It is also known as 'above knee' perforator and is seen at the inferior ■ of the thigh.

Perforating veins connect the superficial venous system to the deep venous system by penetrating the fascial layers of the lower extremity. Although the total number of perforator veins is variable, up to 100 have been documented.

Named perforators:

- Adductor Canal (thigh) – Hunter's perforator
- Above Knee – Dodd's perforator
- Below Knee – Boyd's perforator
- Medial Calf – Cockett I, II, and III perforator
- Ankle - May or Kustner perforator

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Solution to Question 15:

Deep vein thrombosis is a contraindication for sclerotherapy in varicose veins.

This is because, in patients with DVT, the superficial veins are the only valved venous pathway carrying blood back to the heart, and excising them in the presence of deep venous thrombosis will only aggravate the condition.

Solution to Question 16:

The most commonly used sclerosant is sodium tetradecyl sulfate.

In injection sclerotherapy a detergent is injected directly into the superficial veins. The detergent destroys the lipid membranes of endothelial cells causing them to shed, leading to thrombosis, fibrosis and obliteration (sclerosis).

Injection sclerotherapy alone can be successful in varicose veins <3 mm in diameter and in telangiectatic vessels.

Complications of sclerotherapy:

• Allergic reaction,

• Local hyperpigmentation

• Thrombophlebitis

• DVT

• Skin necrosis

Patients with symptomatic GSV or SSV reflux may be treated with endovenous ablation techniques or surgical removal of the affected vein.

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Saphenous vein ligation and stripping is preferred therapy for patients with GSVs of very large diameter (>2 cm).

Types of sclerosants:

Detergents

• Sodium tetradecyl sulfate

• Polidocanol

• Sodium morrhuate

• Ethanolamine oleate

Osmotic agents

• Hypertonic saline

Chemical irritants

• Chromated glycerin

• Polyiodinated iodine

• Alcoholic solution of zein

• Bleomycin

Tessari method

• Widely used method to prepare foam for sclerotherapy

• Sclerosant : Air ratio taken is 1:3 or 1:4.

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Solution to Question 17:

Saphenofemoral flush ligation is done in Trendelenburg's procedure.

The great saphenous vein is stripped and tied close to the common femoral vein at the saphenofemoral junction so that there aren't any branches left that lead to recurrences.

Procedure:

An oblique groin incision is made at the level of and lateral to the pubic tubercle. The great saphenous vein is identified and dissected to the saphenofemoral junction.

Six great saphenous vein tributaries are normally encountered close to the saphenofemoral junction:

• The superficial inferior epigastric vein and superficial circumflex iliac vein laterally

• The deep and superficial external pudendal veins medially

• More distally the anterolateral and posteromedial thigh veins

A flush saphenofemoral junction ligation is then performed and the great saphenous vein retrogradely stripped to the knee. Flush ligation is when the great saphenous vein is stripped and tied close to the common femoral vein at the saphenofemoral junction so that there aren't any tributaries that lead to recurrences.

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Solution to Question 18:

The sural nerve accompanies the short saphenous vein laterally along its course and supplies cutaneous sensation to the lateral malleolar region. Thus it is more prone to injury during stripping of the short saphenous vein, not the great saphenous vein.

The saphenous nerve accompanies the great saphenous vein medially from the ankle to the level of the knee and supplies cutaneous sensation to the medial leg and ankle. Thus it is more prone to injury during stripping of the great saphenous vein.

Surgery for the varicose veins extraction may trigger injury of the lymph vessels and may lead to secondary lymphedema.

Injury and inflammation to the venous system during varicose vein surgery can cause slowing and stasis of blood flow in the lower limb, making them prone to develop deep vein thrombosis postoperatively.

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Solution to Question 19:

Venous ulcers due to chronic venous insufficiency are most commonly seen in the lower ■ of the leg and foot. They usually lie just proximal to the medial or lateral malleolus.

Venous ulcers are accompanied by lipodermatosclerosis and hemosiderosis.

Feature	Venous ulcer	Arterial ulcer
Predisposing factors	Varicose veinsPrevious DVT Recurrent superficial thrombophlebitis	Peripheral arterial diseaseDiabetesSmokingHypertension
Location	Lower 1/3 of leg'gaiters area'	Lateral malleolus and tibial aspect of legToes and feet
Ulcer characteristics	Shallowandflat marginsExudate with slough and granulation tissue at base of wound	Punched out,deep,and irregular in shapeNecrotic and unhealthy tissue at base of wound
Appearance of the lower limb	LipodermatosclerosisAtrophie blancheLimb oedemaNormalcapillary refill time	Pale, shiny skinAbsent or weak peripheral pulsesDelayedcapillary refill time

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Solution to Question 20:

The most likely diagnosis is migratory thrombophlebitis.

It is a paraneoplastic syndrome that is also known as Trousseau's syndrome or Trousseau's sign of malignancy. It is characterised by recurrent episodes of localised thrombosis of the superficial veins of limbs. It can lead to tender and erythematous rashes.

Migratory thrombophlebitis is seen in:

- Pancreatic cancer (most common)
- Lung cancer
- Gastrointestinal cancer
- Ovarian cancer
- Prostate cancer
- Lymphoma

Note: Trousseau's sign is seen in hypocalcemia where there is an involuntary contraction of the muscles of the hand and wrist when a blood pressure cuff is placed on the arm and inflated to 20mm of Hg above systolic blood pressure.

Solution to Question 21:

The patient has axillary-subclavian vein thrombosis. Hypercoagulable states lead to secondary axillary vein thrombosis.

Axillary-subclavian vein thrombosis (ASVT) is of 2 types.

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Primary ASVT occurs as a result of compression of the subclavian vein in the costoclavicular space by repeated contraction of muscles that surround the thoracic outlet. There is repeated compression and traumatization to the vein. This leads to the formation of clots. It is also known as:

• Paget-Schrotter Syndrome

• Venous thoracic outlet syndrome

• Effort thrombosis

Secondary ASVT occurs due to venous injury by indwelling central venous catheters, external trauma or pacemaker wires. It is also seen in hypercoagulable states.

Symptoms and signs include pain, edema, and cyanosis of the upper extremity. Significant superficial venous distension can be seen in arm, forearm, shoulder and anterior chest wall.

Doppler study is the investigation of choice. Anticoagulation is initiated once ASVT is diagnosed to prevent pulmonary embolism.In severe cases, thrombolytic therapy is done using tissue plasminogen activator (rtPA) or streptokinase.

Adjuvant procedures following thrombolytic therapy may include balloon angioplasty for residual venous narrowing and cervical or first rib resection for thoracic outlet abnormalities.

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Solution to Question 22:

The given image shows a chemoport.

Chemoports are implantable venous access devices used to facilitate chemotherapy administration.

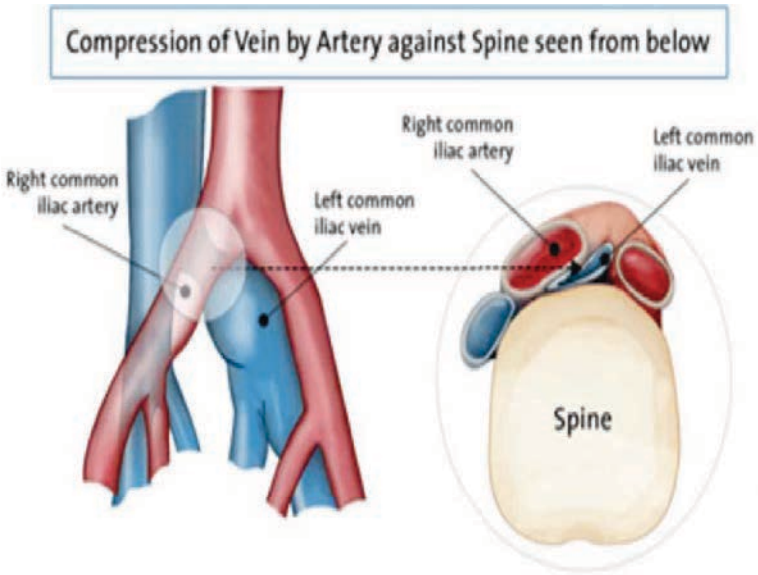
Internal jugular veins and subclavian veins are the commonly used access veins for port placement. These devices are usually retained for a period of 1 to 2 years or more after which the device is explanted.

Solution to Question 23:

May-Thurner syndrome refers to iliofemoral venous thrombosis.

At the site where the right iliac artery crosses over the left iliac vein, the left iliac vein may become chronically narrowed predisposing to iliofemoral venous thrombosis.

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Solution to Question 24:

The likely diagnosis, in this case, is a venous ulcer secondary to the varicose vein. Revascularization is not a part of the management of venous ulcers.

Venous ulcers are due to chronic venous insufficiency and are particularly seen in the area between the muscles of the calf and ankle. It has a sloping edge and the floor contains granulation tissue covered by slough and exudate. Marjolin's ulcer is a type of squamous cell carcinoma seen in chronic long-standing venous ulcers.

Management of venous ulcers:

• Bisgaard's regimen

• Education

• Elevation of the affected limb to reduce the edema

• Elastic compression stockings - The ideal interface pressure in venous ulceration is 35-40 mmHg.

• Evaluation

• 4 layer bandaging system comprising of:

• Orthopedic wool

• Cotton crepe

• Elastic bandage - first compressive layer

• Cohesive bandage - second compressive layer

• Antibiotics are given only if the wound is infected.

• Regular dressing.

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• Medical management by oral pentoxifylline is considered which helps in reducing the viscosity and improving circulation.

• Surgery - Ulcer excision with pinch mesh grafting has a good outcome and helps in preventing recurrence.

Solution to Question 25:

The above clinical scenario is suggestive of varicose veins and the treatment of choice in this patient is endothermal ablation.

Management of varicose veins

1. Great saphenous vein (GSV) and saphenofemoral incompetence (SFJ)

• Endothermal ablation - It is the gold standard method. It includes:

• Endovenous laser ablation (EVLA)

• Radiofrequency ablation (RFA.

• Trendelenburg procedure ± stripping - Flush ligation of SFJ and ligation of 6 tributaries.

2. Short saphenous vein (SSJ) and saphenopopliteal incompetence (SPJ).

• Flush ligation of SPJ. No stripping is done to prevent nerve injury

• EVLA or RFA.

3. Perforator incompetence

• Dodd and Crockett surgery - Multiple subfacial ligations.

• Subfascial endoscopic perforator surgery (SEPS)

• EVLA or RFA

New treatment modalities

• Foam sclerotherapy

• Endovenous glue therapy

• TriVex - Transilluminated powered phlebectomy

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Solution to Question 26:

The gradual filling of veins from below upwards indicates the perforator incompetence. Brodie Trendelenberg test is performed to test for the incompetence of the saphenofemoral valve and the communicating system.

1. Trendelenburg's test - Lay the patient down and elevate the leg. Empty the vessels and tie a tourniquet below the SFJ. Ask the patient to stand up:

• Trendelenburg's test part ll - Here the tourniquet is not released. A gradual filling from below to upwards indicates perforator incompetence.

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• Trendelenburg's test part l - Here the tourniquet is released. A rapid filling from above shows the saphenofemoral incompetence.

2. Morrisey's cough impulse: the patient is asked to cough. A cough impulse at the saphenofemoral junction indicates SFJ incompetence.

3. Schwartz test: If a thrill is felt at SFJ on tapping over the incompetent vein, indicates SFJ incompetence.

4. Modified Perthes test: A tourniquet is tied below SFJ and the patient is asked to walk. An increase in pain and prominence of dilated veins indicate DVT.

5. Fegan's method - Mark the places of excessive bulges within the varicosities. Ask the patient to lie down and empty the varicose vessels. Palpate along the marked area to look for gaps and pits in the deep fascia, which indicates perforator incompetence.

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Lymphatic Diseases

Question 1:

A patient comes with long-standing non-pitting edema in the legs. What is the most probable cause?

a) Lymphedema

b) Arterial Disorders

c) Venous Disorders

d) Coronary heart disease

Question 2:

A patient comes to you with complaints of long-standing swelling of the left leg, as shown in the image. The swelling disappears in the morning and on examination, pitting is seen. What grade of lymphedema is this?



a) Grade II

b) Subclinical grade

c) Grade III

d) Grade I

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Question 3:

While examining a patient with lymphoedema, you are unable to pinch the skin of the patient on the base of the toes. What is this sign called?

a) Stemmer's sign

b) Frank's sign

c) Levine's sign

d) Winterbottom's sign

Question 4:

An 8-month-old girl child was brought to the hospital with complaints of swelling of both feet as shown in the image. On examination pitting is seen. Her ECG, RFT, and urine analysis were normal. What is the true statement regarding this condition?



a) Inherited as a recessive trait

b) Known as Meige's disease

c) Only conservative management is done

d) Onset before 2nd year of life

Question 5:

Which of the following will you perform when asked to do a lymphangiography of the leg?

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a) Inject sodium diatrizoate subcutaneously on the dorsum of the foot

b) Inject sodium diatrizoate retrogradely under pressure into a small vein on the dorsum of foot

c) Dissect the lymphatics through an incision on the dorsum of foot and injecting contrast

d) Insertion of guidewire into the lymphatic system of the leg and inject contrast

Question 6:

Which of the following complications are least likely to develop, in patients with chronic lymphoedema?

a) Thickening of the skin

b) Recurrent soft tissue infections

c) Marjolin's ulcer

d) Sarcoma

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Question 7:

Which of the following statements regarding mediastinal lymphoma is false?

a) Middle mediastinum is the most common site of mediastinal lymphoma

b) Can cause SVC syndrome

c) Chemotherapy is the treatment of choice

d) Video assisted thoracoscopy is used to diagnose the condition

Question 8:

A 5-month-old boy is brought to the hospital with complaints of swelling in the neck as given in the image. Which of the following is true regarding this condition?

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a) It is a malignant tumor

b) It is a congenital sequestration of lymphatic channel

c) Laser excision is done

d) Sclerotherapy is not used in treatment

Question 9:

Where is lymphangiosarcoma most commonly seen?

a) Cystic hygroma

b) Milroy disease

c) Post mastectomy edema of arm

d) Filarial lymphedema

Question 10:

A patient underwent surgery for breast carcinoma. She now presents with painless swelling involving the arm as shown in the image below. What is the most likely diagnosis?

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a) Lymphedema

b) Lymphangiosarcoma

c) Venous thrombosis

d) Cellulitis

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Question 11:

Which of the following is not a part of decongestive lymphoedema therapy (DLT)?

a) ii, iv

b) iii, v

c) i, ii

d) iii, iv

Question 12:

Which among the following is not a limb reduction surgery for lymphoedema?

a) Sistrunk procedure

b) Homan procedure

c) Charles procedure

d) Kinmonth procedure

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Answer Key

Question No.	Correct Option
1	a
2	d
3	a
4	d
5	c
6	c
7	a
8	b
9	c
10	a
11	d
12	d

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Detailed Explanations

Solution to Question 1:

Lymphedema is the most probable cause of long-standing non-pitting edema in the limbs.

Lymphedema is the abnormal accumulation of protein-rich fluid in the interstitial spaces of the tissues.

Lymphedema can be primary or secondary.

Primary lymphedema includes:

• Lymphedema congenita (0-2 years): more common in males, involves multiple limbs, face, and genitalia. It can be familial or sporadic. The familial type is called Nonne Milroy syndrome.

• Lymphedema praecox (2-35 years): more common in females, the most common type of primary lymphedema with a peak incidence in puberty. It can be familial or sporadic. The familial type is called Meig's disease.

• Lymphedema tarda (>35 years): Rare and uncommon.

Secondary lymphedema is more common than primary and is the most common cause of lymphedema overall. Causes include lymph node dissection (axillary or inguinal), post-mastectomy, postoperative radiotherapy, obesity, varicose vein surgery, and trauma.

Complications of lymphedema include infections, skin changes, recurent cellulitis, non-healing ulcers, and lymphangiosarcoma.

Treatment mostly includes patient education and nonsurgical interventions, which include limb elevation, and external compressive garments. When the above methods fail, surgery can be

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considered.

Solution to Question 2:

In the given clinical scenario, pitting edema which disappears completely on elevation and bed rest indicates grade I lymphedema, according to Brunner's classification.

Skin changes seen in lymphedema include peau d'orange, erythema, hyperkeratosis, ulceration, stemmer sign, and buffalo hump.

Stemmer sign is the inability to pinch a fold of skin on the dorsum of the toes due to lymphedema.

Clinical classification of lymphedema:

Grade (Brunner)	Clinical features
Subclinical	There is excessive interstitial fluid and histological abnormalities in lymphatics and lymph nodes, but no clinically apparent lymphedema.
Grade I	Edema pits on pressure and the swelling completely disappears on elevation and bed rest.
Grade II	Edema does not pit and does not significantly reduce on elevation
Grade III	Edema is associated with irreversible skin changes, i.e. fibrosis and papillae.

Solution to Question 3:

In lymphedema, skin on the base of the toes cannot be pinched due to subcutaneous fibrosis. This sign is called Stemmer's sign.

Sign	Description
Stemmer's sign	Seen in lymphoedemaSkin on the dorsum of the toes cannot be pinched due to Subcutaneous Fibrosis.

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Sign	Description
Frank's sign	A diagonal crease in the earlobe that runs backward from the tragus at a 45-degree angle across the lobule to the rear edge of the auricle.May be a predictor of coronary artery disease.
Levine's sign	Clenched fist held over the chest to describe ischemic chest pain.
Winterbottom's sign	Posterior cervical lymphadenopathy in african trypanosomiasis.

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Solution to Question 4:

The patient most likely has Milroy disease which is the familial version of congenital lymphedema. It is inherited as a dominant trait.

Primary lymphedema is classified on the basis of age of onset and the presence of familial clustering.

• Congenital lymphoedema - onset before 2 years of age

• Lymphedema precox - most common type. onset between 2 to 35 years of age

• Lymphedema tarda - rare. onset after 35 years of age

Treatment includes conservative management such as massage, compression stockings, or bandaging.

Surgical management includes vascularized lymph node transfer (VLNT). It involves the transfer of functional lymph nodes from a healthy donor site to an area of the body with damaged or diseased lymphatic drainage.

Features	Congenital lymphoedma	Lymphedema precox
Onset	Before2nd yearof life	Between2-35 yearsof life
Extent	Extends to multiple limbs, genitalia, and/or the face	Mostly unilateraland extends only to the knees
Eponyms	Known asMilroy disease	Known asMeige's disease
Sexual predilection	None	More common in females

Solution to Question 5:

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Direct contrast lymphangiography is done by dissecting the lymphatic vasculature through an incision on the dorsum of the foot and injecting contrast.

Direct contrast lymphangiography is an invasive study done to visualise the lymphatic system. It involves exposure and cannulation of lymphatics and slow injection of contrast medium such as ethiodized oil.

Complications:

• Damage to the visualized lymphatics

• Allergic reactions

• Pulmonary embolism if the oil-based contrast agent enters the venous system through lymphovenous anastomosis.

Contrast magnetic resonance lymphangiography is a newer testing method. It is performed after intracutaneous injection of gadobenate dimeglumine into the interdigital webs of the dorsal foot.

It is capable of visualizing the anatomy and functional status of lymph flow transport of lymphatic vessels and lymph nodes of lymphedematous limbs.



Image A shows a lymphangiography with normal uptake.

Image B shows a lymphangiography scan with no uptake in Milroy's disease.

Image C depicts a lymphangiography scan in a patient with lymphoedema and reflux.

Solution to Question 6:

Marjolin's ulcers are unlikely to develop in patients with chronic lymphedema.

Marjolin's ulcers are malignant ulcers that develop over chronic scars, most commonly from burns. Marjolin's ulcer may also develop in chronic long standing venous ulcers but are not seen in chronic lymphedema.

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Initially, the lymphedema is soft and pits on the pressure but with time the skin becomes thickened and non-pitting due to fibrosis, dermal thickening, and hyperkeratosis.

Frequent episodes of lymphangitis and cellulitis may occur. This is due to loss of local immune defense mechanisms. Chronic eczema, the fungal infection of skin and nails, fissuring, verrucae, and papillae (warts) are frequently seen in advanced disease.

Rarely malignancy (lymphangiosarcoma or angiosarcoma) may occur in chronic lymphedema. This neoplastic transformation of blood vessels and lymphatics is called Stewart-Treves syndrome.

Solution to Question 7:

Anterior compartment is the most common site of lymphoma in the mediastinum. Other sites include the middle compartment and hilar nodes.

Primary mediastinal lymphoma is an uncommon type of lymphoma. Hodgkin's lymphoma (HL), primary mediastinal B-cell lymphoma (PMBCL), and T-lymphoblastic lymphoma are the most common primary mediastinal lymphomas. In about 50% of patients who have both Hodgkin's and Non-Hodgkin's Lymphoma, the mediastinum may be the primary site.

Superior vena cava (SVC) syndrome refers to symptoms produced by the obstruction of blood flow through the SVC by the enlarging mediastinal mass, resulting in symptoms of dyspnea, facial and upper-extremity edema, cough, chest pain, and dysphagia.

Video-assisted thoracoscopy (VATS) is used to obtain a biopsy of the mediastinal mass for confirmation and diagnosis.

Chemotherapy with six cycles of R-CHOP regimen is preferred. Rituximab is a chimeric monoclonal anti-CD20 antibody and has become a standard component of treating all B-cell lymphoma histologies that express CD20.

Note: Thymoma is the most common mediastinal tumor in adults (overall).

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Solution to Question 8:

The given image depicts a lymphangioma, also known as cystic hygroma. They are brilliantly transilluminant.

Lymphangiomas are congenital benign tumors of the lymphatic system. They are the isolated cystic mass of lymphatic tissue that has the ability to produce lymph. Over time the tumor enlarges due to the accumulation of lymph within the cyst.

Types of lymphangiomas:

• Simple or capillary lymphangioma: They occur subcutaneously in the head, neck, and axilla. They may also occur within the internal organs and connective tissues in the thoracic and abdominal cavities.

• Cavernous lymphangioma or cystic hygroma: They also occur in the neck or axilla. Rarely they may occur in retroperitoneum.

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Treatment includes surgical excision of the tumor and image-guided sclerotherapy.

If there is any residual lymphatic malformation after the treatment, then a conservative excision or unroofing of the cyst is done. It may be combined with sclerosing therapy or repeated partial excisions.

Note: The terms lymphangioma and cystic hygromas are older terms. They are now called lymphatic malformations.

Solution to Question 9:

Lymphangiosarcoma is most commonly seen in post-mastectomy edema of the arm.

Lymphangiosarcoma is a rare tumor that develops as a complication of long-standing lymph-edema.



Clinically, the patients present with acute worsening of the edema and appearance of subcutaneous nodules that have a propensity toward hemorrhage and ulceration.

The tumor can be treated, like other sarcomas, with preoperative chemotherapy and radiation followed by surgical excision, which usually may take the form of radical amputation. Overall, the prognosis is very poor.

Solution to Question 10:

The given clinical vignette and the image are suggestive of post-mastectomy lymphedema involving the upper limb.

Lymphoedema occurs when interstitial fluid accumulates due to defective lymphatic drainage. It is a common complication of breast cancer treatment involving axillary lymph node dissection and radiotherapy. Sentinel lymph node dissection (SLND) reduces the risk of

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lymphedema significantly.

Clinical signs and symptoms are observed in the ipsilateral arm. A significant increase in the limb size due to swelling is seen. Other symptoms are heaviness, tightness, numbness, tingling, limb fatigue, and reduced limb mobility.

Diagnosis is predominantly based on the clinical swelling of the arm. The girth of the affected arm >2 centimeters than the normal limb, a 200-mL or more increase in limb volume, or a 5% or greater limb volume change are other diagnostic criteria.

Management:

Limb elevation, elastic arm stockings, and pneumatic compression devices can help reduce swelling.

Dry skin can be seen due to fluid accumulation, which can lead to cellulitis/skin infections. Using a low pH water-based moisturizer is helpful.

Manual lymphatic drainage (MLD) by a therapist followed by simple lymphatic drainage (SLD) by the patient daily aids interstitial fluid evacuation.

Benzpyrones and flavonoids are some naturally occurring substances that may be of use to treat lymphedema.

Surgical options are lymphaticovenular anastomosis, liposuction, and debulking.

Other options:

Option B: Stewart-Treves syndrome refers to lymphangiosarcoma seen in chronic long-standing lymphedema following mastectomy (more than 10 years). They present as single/multiple bluish-red skin and subcutaneous nodules. They can ulcerate and hemorrhage.

Option C: Axillary venous thrombosis or Paget-Schrotter disease is seen in patients doing rigorous exercise and in weightlifters. The subclavian vein is compressed at the thoracic outlet. Painful swelling of the arm is observed.

Option D: Cellulitis usually presents with an ulcer and the skin is erythematous, swollen, and painful. Fever, chills, and rigor follow.

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Solution to Question 11:

Diuretics and Homan's procedure are not a part of DLT, and are a part of drug therapy and surgical management.

Decongestive lymphoedema therapy (DLT) is the currently used method for controlling swelling in lymphoedema. It consists of 2 phases: intensive and maintenance.

Intensive phase includes:

• Skin care: Prevent drying of skin and exposure to the sun, avoid venipuncture from the affected limb.

• Limb elevation

• Manual lymphatic drainage (MLD) - Proximal massage along lymphatic channels.

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• Compression therapy: Multilayer lymphoedema bandaging (MLLB), Pneumatic lymphoedema stockings, Graded compression stockings (100% in the ankle/foot, 70% in the knee, 50% in mid-thigh, and 40% in the groin).

• Exercise: Slow rhythmic isotonic movements are beneficial, while vigorous, anaerobic isometric exercises are to be avoided.

Standard MLLB is only done if ABPI is ° 0.8. It is contraindicated if ABPI is < 0.5.

Maintenance phase includes:

• Simple lymphatic drainage (SLD) - It is a simple massage technique done by the patient.

• Pain relief

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Solution to Question 12:

Kinmonth procedure is a bypass surgery done for lymphoedema not a limb reduction surgery.

Surgical management of lymphoedema is divided into bypass procedures, liposuction, and limb reduction procedures.

• Bypass procedures include:

• Neilubowicz procedure - anastomosing lymph nodes to the veins.

• Kinmonth procedure - using ileal mucosal patch.

• Limb reduction procedures include:

• Sistrunk procedure - A wedge of skin and subcutaneous tissue is excised and the wound closed primarily. This is the most commonly carried out procedure to reduce the girth of the thigh.

• Homan's procedure - Skin flaps are raised, and then subcutaneous tissue is excised from beneath the flaps.

• Thompson's procedure - Modification of Homan's procedure.

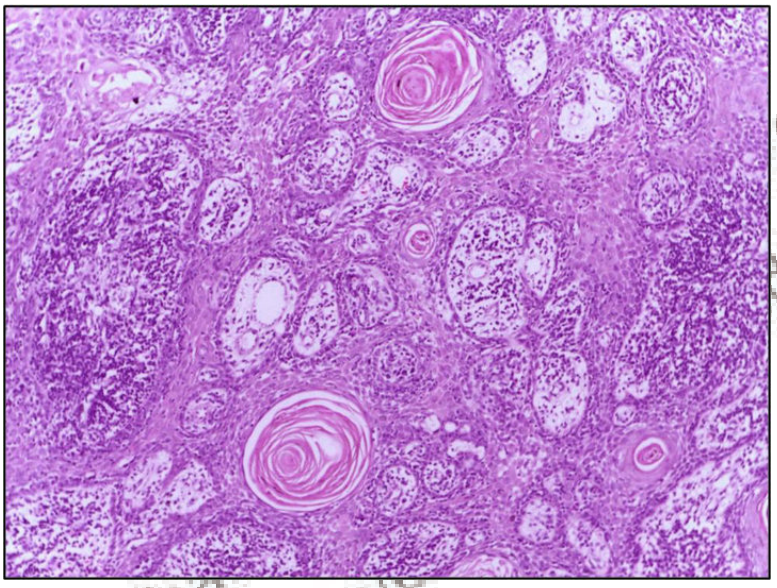
• Charles procedure - Excision of all of the skin and subcutaneous tissues down to the deep fascia, with coverage using split-skin grafts.

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Skin Malignancies

Question 1:

A biopsy done for a chronic verrucous lesion over the right cheek in an elderly man revealed the given histopathological finding. What is the most likely diagnosis?



a) Basal cell carcinoma

b) Squamous cell carcinoma

c) Molluscum contagiosum

d) Malignant melanoma

Question 2:

During rounds, you have been asked to examine a patient with an ulcer over the face. Which of the following features will raise the suspicion of it being squamous cell carcinoma?

a) Inverted margins

b) Rolled out margins

c) Everted margins

d) Undermined margins

Question 3:

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Which of the following can increase the risk of developing squamous cell carcinoma?

a) Only 1

b) 2, 4 & 5

c) 1, 2 & 3

d) 1, 3, 4 & 5

Question 4:

Which of the following is not true regarding squamous cell carcinoma?

a) Skin biopsy is mandatory in all cases

b) Mohs micrographic surgery is indicated for recurrent tumors

c) Broder's staging is based on the depth of the lesion

d) Lesion on the ear is a high-risk feature

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Question 5:

A 55-year-old farmer presented with a slow-growing lesion over his left hand for the past 5 months. The lesion was initially nodular, which then ulcerated. On examination, a 2 x 1 cm ulcer with everted margins was noted. Biopsy revealed keratin pearls. Which of the following stains will be positive for this condition?

a) Only 3

b) 3 & 5

c) 2 & 5

d) 1, 3 & 4

Question 6:

A 75-year old man came with complaints of a painless nodule on the left palm for the past 4 weeks. He gave a history of sustaining a thorn prick injury to the palm 5 weeks ago. On examination, the lesion appears as shown below. What is the most likely diagnosis?

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a) Actinic keratoses

b) Bowen's disease

c) Keratoacanthoma

d) Mycosis fungoides

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Question 7:

A firefighter presented with a chronic non-healing painless ulcer over his left leg. He gave a history of sustaining 2nd-degree burns injury to the leg 10 years back during a rescue mission. The examination finding is as shown below. All of the following are true about this condition, except _____.



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a) Painless

b) Highly vascular

c) No lymphatic spread

d) Low-grade squamous cell carcinoma

Question 8:

A 65-year-old man has the following lesion over the face. He complains of bleeding while itching. The most likely diagnosis is



a) Dermatofibrosarcoma

b) Marjolin's ulcer

c) BCC

d) Naevus

Question 9:

Which of the following is true regarding basal cell carcinoma?

a) Nodular is the most common type

b) Prognosis is very poor

c) Most commonly seen over the neck

d) Only punch biopsy is used for diagnosis

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Question 10:

Lymph node involvement may be seen in patients with all of the following cutaneous malignancies except?

a) Squamous cell carcinoma

b) Merkel cell carcinoma

c) Malignant melanoma

d) Basal cell carcinoma

Question 11:

A construction worker presented to the clinic with a slowly enlarging lesion near the left inner canthus for the past 2 years. He noticed bleeding from the lesion for the past 2 months. On examination, a 3 x 1 cm ulcer with pearly rolled-out margins was noted. A biopsy was done. Which of the following is the characteristic finding that will be seen in this condition?

a) Keratin pearls

b) Psammoma bodies

c) Nuclear palisading

d) Foam cells

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Question 12:

In patients with BCC, Mohs microscopic surgery will be indicated for which of the following features of the tumor?

a) Only 2

b) 1, 4 & 5

c) 2, 3, & 5

d) 1, 2 & 3

Question 13:

Which of the following is unlikely to be seen in a patient with Gorlin syndrome?

a) Bifid ribs

b) Medulloblastoma

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c) Osteoma

d) Basal cell carcinoma

Question 14:

ABCDE rule applies for:

a) Malignant melanoma

b) BCC

c) SCC

d) Actinic keratosis

Question 15:

An anxious patient with a black mole over his back presents to the clinic for evaluation. All of the following features according to the ABCDE rule will point towards a diagnosis of melanoma in this patient except?

a) Asymmetric outline

b) Evolution

c) Variation in color

d) Depth > 6 mm

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Question 16:

Which of the following is not true regarding malignant melanoma?

a) Lentigo maligna type has the worst prognosis

b) Commonly arises from junctional melanocytes

c) Most commonly metastasizes to lungs

d) Acral melanoma is the most common type in dark-skinned individuals

Question 17:

Which of the following is the most common type of malignant melanoma?

a) Nodular

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b) Superficial spreading

c) Lentigo maligna melanoma

d) Acral lentiginous

Question 18:

What does the finding depicted in the image signify?



a) Subungual hematoma

b) Nodular melanoma

c) Subungual melanoma

d) Lentigo maligna melanoma

Question 19:

Most common site of lentigo maligna melanoma is _____

a) Face

b) Legs

c) Trunks

d) Soles

Question 20:

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Which of the following can be used for staging patients with melanoma?

a) Only 1

b) 2 & 4

c) 1 & 3

d) 3 & 5

Question 21:

A farmer presented with a brownish lesion over the plantar aspect of the left foot for 2 years. Over the last few months, he noticed that the lesion was increasing in size. On examination, a 2 x 1.5cm asymmetric lesion with notched edges was noted. Excision biopsy revealed cells containing large, pleomorphic nuclei and numerous mitotic figures. Which of the following will be used as a marker for this condition?

a) S-100

b) CK-20

c) CK-10

d) Vimentin

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Question 22:

Which of the following will be the most important prognostic indicator in patients with stage 1 melanoma?

a) Site

b) Stage

c) Lymph node involvement

d) Depth of melanoma

Question 23:

Arrange the types of melanoma from best to worst according to their prognosis?

a) 1 & 4 > 3 > 2

b) 2>3>1>4

c) 4>3>2>1

d) 3>4>1 & 2

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Question 24:

A patient presented from the dermatology out-patient with a biopsy-proven melanoma on her right arm with a Breslow depth of 2.1 mm. Nodes were clinically negative. What is the surgical management for this patient?

a) Excision with 1-cm margin

b) Excision with 2-cm margin and SLNB

c) Excision with 3-cm margin

d) Excision with 2-mm margin and SLNB

Question 25:

Which of the following FDA-approved adjuvant therapy will be recommended for patients with malignant melanoma?

a) Doxorubicin

b) Infliximab

c) Imatinib

d) Interferon alpha 2b

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Question 26:

Which of the following is false regarding Merkel cell carcinoma?

a) Regional lymph nodes will be involved in 30% of the cases

b) It is characterized by a rapidly growing, flesh-colored papule

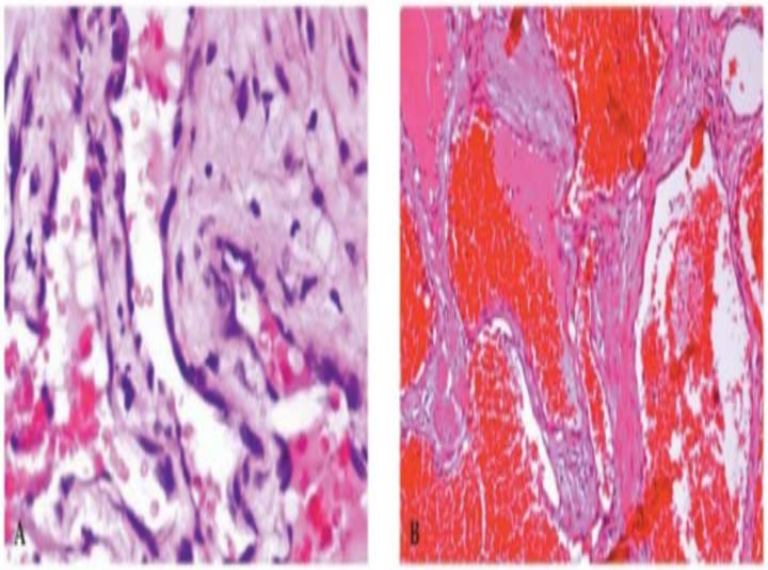
c) Recurrence is rare

d) Wide local excision is usually done

Question 27:

A lady comes with a reddish firm nodule on her chest which hasn't grown in size. Its histolopathological image is shown below. What is the diagnosis?

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a) Lipoma

b) Fibroadenoma

c) Nevus

d) Hemangioma

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Question 28:

Extra mammary Paget's disease is commonly seen in the:

a) Vulva

b) Vagina

c) Uterus

d) Cervix

Question 29:

A postmenopausal lady presented with an itchy plaque over the vulva for the past 2 years, which persisted despite multiple topical treatments. Biopsy of the lesion revealed large vacuolated cells with mucin. What is the most likely diagnosis?

a) Squamous cell carcinoma

b) Adenocarcinoma

c) Basal cell carcinoma

d) Melanoma

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Question 30:

In which of the following subtypes of soft tissue sarcoma is lymph node dissection mandatory?

a) 1,2,4 and 5

b) 2,3,4 and 5

c) 1,2,3 and 5

d) 1,2,3,4 and 5

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Answer Key

Question No.	Correct Option
1	b
2	c
3	d
4	c
5	c
6	c
7	b
8	c
9	a
10	d
11	c
12	b
13	c
14	a
15	d
16	a
17	b
18	c
19	a
20	c
21	a

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22	d
23	a
24	b
25	d
26	c
27	d
28	a
29	b
30	d

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Detailed Explanations

Solution to Question 1:

The given image shows keratin pearls which are characteristic of squamous cell carcinoma. Squamous cell carcinoma is characterized by the proliferation of atypical squamous cells with horn pearls/keratin pearls.

Solution to Question 2:

On examination of an ulcer, everted margins will be suggestive of squamous cell carcinoma (SCC).

SCC is the second most common skin cancer, while BCC is the most common skin cancer. Variants of SCC in-situ include:

• Bowen's disease

• Erythroplasia of Queyrat

SCC initially presents as smooth nodular, verrucous, papillomatous lesions. These lesions then ulcerate and form a characteristic, everted edge, surrounded by inflamed, indurated skin.

Surgical excision is the treatment of choice. Other modalities of treatment include:

• Cautery ablation

• Cryotherapy

• Drug therapy including imiquimod

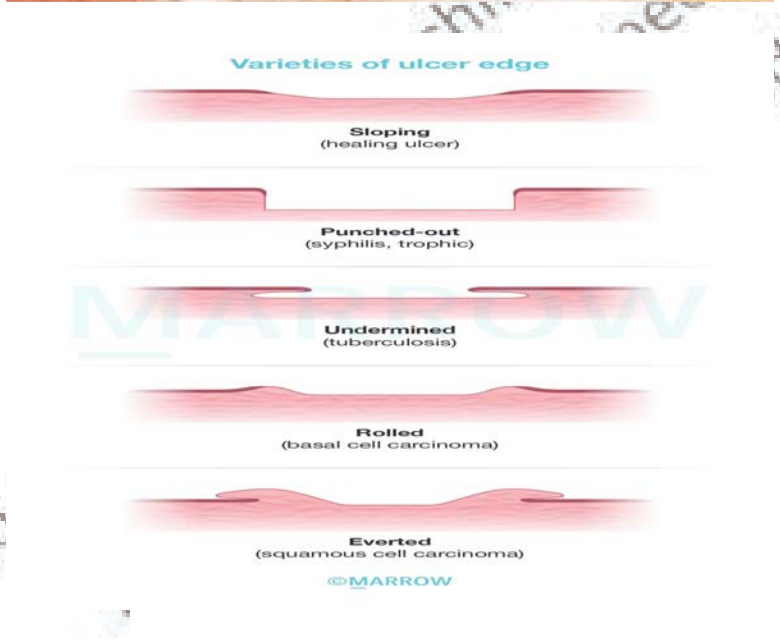
• Moh's microsurgery

• Radiation therapy

The below image shows SCC with everted margins:

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Solution to Question 3:

HPV 6 & 11 are not risk factors for squamous cell carcinoma, HPV 16 & 18 are risk factors for squamous cell carcinoma.

Note: Skin cancer is the most frequent malignant neoplasm in organ transplant recipients, with SCC and BCC representing 95% of cancer.

Solution to Question 4:

Broder's staging for SCC is based on histological grading. Depth or size of the tumor and lymph node involvement are not included in Broder's staging.

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A skin biopsy is mandatory in all patients with suspected squamous cell carcinoma. Mohs micrographic surgery is indicated in patients with aggressive and high-risk SCC.

High-risk features of SCC include:

- Perineural invasion
- Depth of lesion greater than 2 mm
- Lesions on the ear
- Poorly differentiated lesions

Note: Mohs micrographic surgery is the treatment of choice in BCC.

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Solution to Question 5:

SCC is a malignant tumor of keratinizing cells of the epidermis arising from the stratum germinatum (basalis) and expresses cytokeratins 1 and 10.

CK-20 is specific for Merkel cell carcinoma. BCL2 is used to distinguish between basal cell carcinomas and trichoepitheliomas. HMB-45 is used to detect melanocytes.

Solution to Question 6:

The given scenario and image showing an exophytic nodule with central keratinous debris is suggestive of keratoacanthoma.

Keratoacanthoma is a low-grade squamous cell carcinoma. It presents clinically as a proliferating dome-shaped keratin-filled crater. Patients usually give a prior history of minor trauma. Treatment of choice is an excisional procedure with 4 mm margins.

Option A: Actinic keratoses consist of hyperkeratotic erythematous papules and patches on the sun-exposed skin. They arise in middle-aged to older adults and have some potential for malignant transformation.

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Option B: Bowen's disease appears histologically as SCC in situ. It initially presents with a reddened□ area that progresses to thickened plaques and may vary from small lesions (<1 cm) to large areas. When it is confined to the glans penis or vulva, Bowen disease is sometimes referred to as Erythroplasia of Queyrat.



Option D: Mycosis fungoides is a cutaneous T cell lymphoma, and plaque-stage lesions are seen.

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Solution to Question 7:

The given scenario and image showing an irregular ulcer with cauliflower shaped granulation tissue points to a diagnosis of Marjolin's ulcer. It is avascular.

Solution to Question 8:

The given history with the image showing an ulcer over the face with pearly, rolled-out borders points to a diagnosis of basal cell carcinoma.

Basal cell carcinoma (BCC) is an epithelial tumor arising from basal cells. It is the most common type of skin cancer most commonly seen over the face, above the line joining corner of the mouth, and lobule of the ear. Risk factors for BCC include ultraviolet radiation (strongest risk factor), age 40-80 years with excessive sun exposure, light-skinned people, and exposure to arsenic compounds, coal tar, aromatic hydrocarbons, and infrared light. It is more common in males than females. It is also associated with syndromes such as xeroderma pigmentosum and Gorlin's syndrome.

Features of BCC include:

• Pearly nodule with rolled border

• Tortuous telangiectatic vessels

• Surface which can get ulcerated with raised and beaded edge, often with a central depression or umbilication

• Bleeding on minor trauma

BCC has various subtypes such as nodular (most common type), pigmented, nodulocystic, morphoeic, infiltrative, and fibroepithelioma of Pinkus.

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It is locally aggressive and can erode the bone or facial sinuses. It rarely metastasizes via lymph nodes.

The occasional presence of melanin in the nodular variant of BCC (pigmented BCC) may lead to confusion with melanoma.

Depending upon the type of the lesion, a shave, punch or excisional biopsy may be employed for diagnosis. X-ray or CT may be needed if there is a local invasion. Histology shows peripheral palisading of cells.

Treatment:

• Surgical: Wide excision (4-6 mm clearance) with a skin graft or flap or primary suturing

• Mohs' surgery for BCC close to the eyes, nose, or ear to preserve more tissue.

• Non-surgical: Radiotherapy, vismodegib and sonedegib.

Other options:

Option A: Dermatofibrosarcoma, also known as dermatofibrosarcoma protuberans (DFSP) is a rare, slow-growing, well-differentiated primary fibrosarcoma of the skin, associated with increased production of platelet-derived growth factor-beta. It presents as a protuberant nodule within a firm, indurated plaque that can ulcerate. They are locally aggressive tumors with high recurrence rates. Treatment is wide excision and Mohs microscopic surgery. Imatinib is used for unresectable, metastatic, and recurrent tumors. The given image below shows a DFSP near the umbilicus.



Option B: Marjolin's ulcer is a painless, slow-growing, locally malignant, well-differentiated squamous cell carcinoma that occurs in a chronic scar (burns scar, scar of venous ulcer). It presents as an indurated, non-tender ulcer with raised and everted edges with scarring in the surrounding area with marked fibrosis. The ulcer can spread to the lymph nodes when it reaches the normal skin. A wedge biopsy and MRI of the region involved confirm the diagnosis. Management is by wide excision, for larger ulcers, amputation is done. The given image below shows a marjolin's ulcer of the leg.

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Option D: Naevus is a common benign neoplasm caused due to mutations in the components of the RAS signaling pathway. It has various types, such as congenital naevus, blue naevus, Spitz naevus, halo naevus, and dysplastic naevus. The given image below shows a patient with multiple dysplastic nevi.



Solution to Question 9:

The most common form of BCC (60%) is the nodular variant.

Other types of BCC are:

• Superficial BCC- typically appears on the trunk as a pink or erythematous plaque with a thin pearly border

• Infiltrative BCC

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• Pigmented variant of nodular BCC

• Morpheaform variant - is an uncommon variant and is the most aggressive form

• Fibroepithelioma of Pinkus

Option B: Patients with BCC show excellent prognosis with 100% survival rates for cases that have not spread to other sites.

Option C: Most of the basal cell carcinoma occurs on the face above the line joining the corner of the mouth and lobule of the ear.

Option D: Depending upon the type of lesion, a shave, punch, or exicision biopsy can be used to confirm the diagnosis.

The below image shows a nodular BCC



Solution to Question 10:

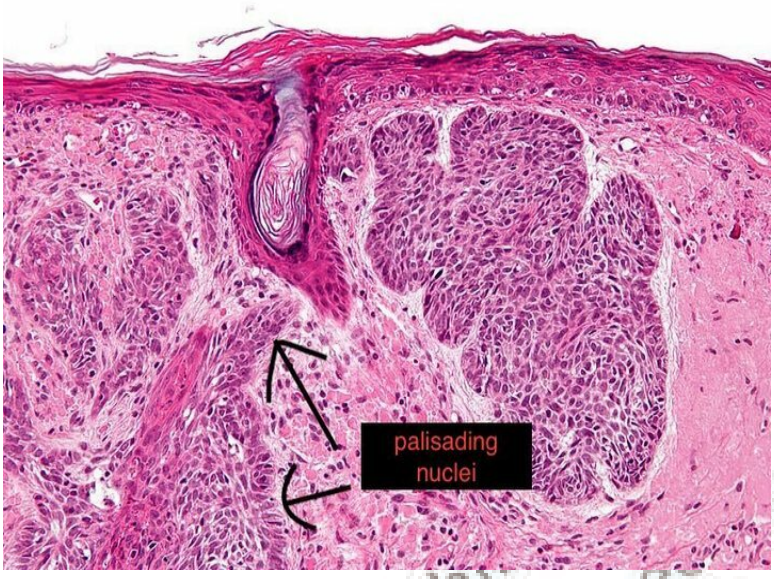
Basal cell carcinoma does not show lymphatic or hematogenous metastasis. It is locally invasive.

Solution to Question 11:

The characteristic finding of basal cell carcinoma is of ovoid cells in nests with a single 'palisading' layer.

The cells of a BCC resemble those of the basal layer of the epidermis. They are basophilic, have a large nucleus, and appear to form a basal layer by forming an orderly line around the periphery of tumor nests in the dermis, a feature referred to as palisading.

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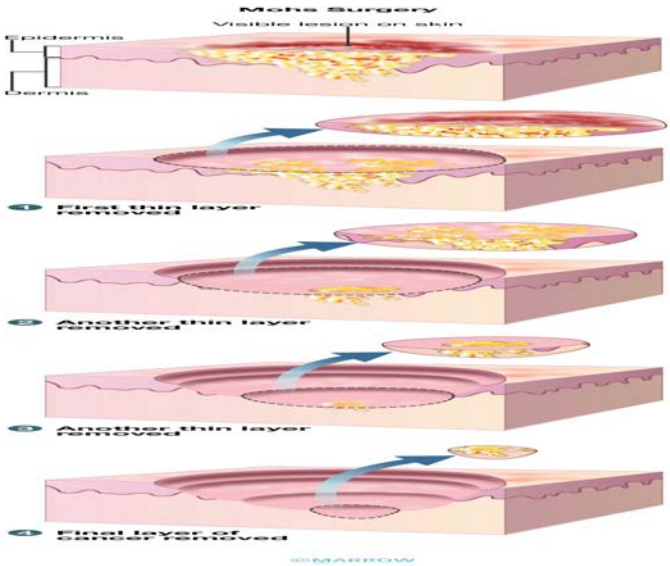
Solution to Question 12:

Moh's microscopic surgery is indicated in patients with the following features of BCC:

- Primary lesions of the ear or lip
- Recurrent lesions
- With perineural invasion
- Poorly differentiated lesions
- Tumors more than 2 cm in size

Moh's microscopic surgery involves initial surgical excision of the tumor, followed by repeated tissue sampling along lateral and deep margins. These tissue samples are examined immediately under a frozen section for evidence of tumor. This process is repeated until the clearance is finally obtained.

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Solution to Question 13:

Osteoma is not a part of Gorlin syndrome.

Gorlin syndrome/basal cell naevus syndrome is an autosomal dominant condition caused by a mutation in the PTCH gene.

Components of Gorlin syndrome include:

- Basal cell carcinomas
- Medulloblastoma
- Bifid ribs
- Odontogenic keratocysts

Solution to Question 14:

ABCDE algorithm is used to diagnose melanoma.

It comprises of:

- Asymmetry
- Border irregularity
- Color variegation
- Diameter of more than 6 mm
- Evolution or change

Melanoma is a malignant tumor arising from melanocytes at the epidermal-dermal junction. Though it represents only 4% of skin cancers, it accounts for 80% of deaths (high mortality rate).

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It presents as a pigmented lesion that has enlarged, ulcerated, or bled.

Histopathological confirmation is the gold standard in the diagnosis of melanoma. It is divided into four main types: nodular melanoma (NM), superficial spreading melanoma (SSM), lentigo maligna melanoma (LMM), and acral lentiginous melanoma (ALM).

The treatment consists of wide local excision of the tumor and follow-up to detect any local recurrence around the scar and excluding nodal spread.

Solution to Question 15:

D stands for diameter >6 mm and not depth > 6mm.

Solution to Question 16:

Lentigo maligna melanoma has the best prognosis. Nodular melanoma has the worst prognosis.

Option B: Malignant melanoma arises from melanocytes at the dermo-epidermal junction (junctional melanocytes). They may also arise from mucosal surfaces of the eyes, pharynx, esophagus, anorectal and genital areas.

Option C: Malignant melanoma most commonly metastasizes to the lungs.

Option D: Acral melanoma is the most common type in dark-skinned individuals.

Solution to Question 17:

Superficial spreading melanoma is the most common type of malignant melanoma. It usually arises in a pre-existent naevus.

Other types of malignant melanoma include:

• Nodular melanoma - presents as a nodule, and has the worst prognosis.

• Acral lentiginous melanoma - commonly seen over palms and soles. Most common melanoma in dark-skinned individuals.

• Lentigo maligna melanoma - also known as Hutchinson's melanotic freckle. More commonly seen on sun-exposed areas like the face, neck, or hands of the elderly. It is the least common and has the best prognosis.

Solution to Question 18:

The image shows Hutchinsons's nail sign in subungual melanoma. It arises from the nail matrix, most commonly in the great toe or thumb.

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Hutchinson's nail sign is an important clinical clue to subungual melanoma. It is characterized by the extension of brown or black pigment from the nail bed, matrix, and nail plate to the adjacent cuticle and proximal or lateral nail folds. It is also associated with nail dystrophy.

Note: Pseudo-Hutchison's sign is a reflection of the pigmentation of the nail bed and nail matrix through the transparent nail folds.

Option A: Subungal hematoma is a close differential of subungual melanoma. It is seen secondary to trauma which causes bleeding and resultant hematoma formation and pigmentation. It is important to note that the features of Hutchinson's nail sign are not seen with subungual hematoma.

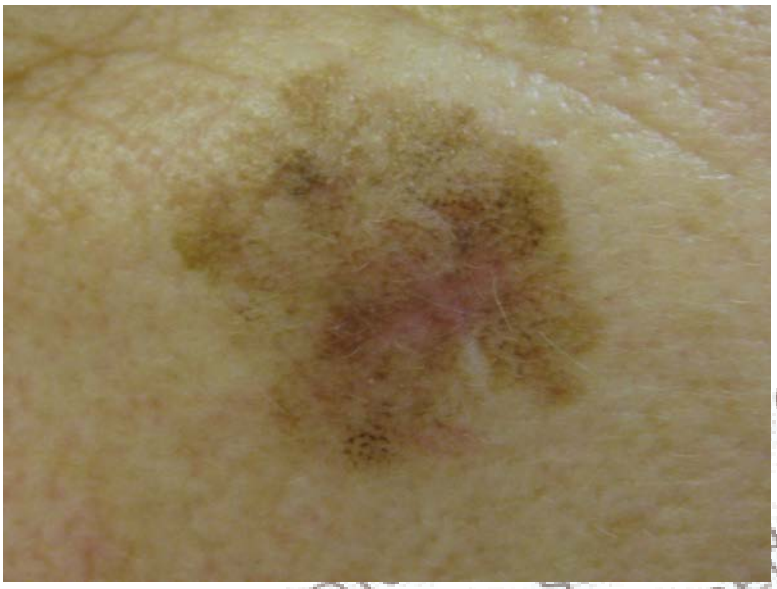


Option B: Nodular melanoma is a condition where malignant melanoma cells proliferate downwards through the skin – this is known as vertical growth. The lesion presents as a nodule that has been rapidly enlarging.



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Option D: Lentigo maligna is an early form of melanoma, in which the malignant cells are confined to the tissue of origin, the epidermis, hence it is often reported as in-situ melanoma.



Note: Subungual melanoma can be either superficial spreading melanoma or acral lentiginous melanoma. A difference of opinion has been noted in Bailey and Love, 27th ed. where it has been mentioned that melanoma under the fingernail is usually superficial spreading melanoma. However, most dermatology textbooks including the Rooks 9th ed. and Fitzpatrick's 9th ed and several research articles mentioned subungual melanoma as a variant of acral lentiginous melanoma.

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Solution to Question 19:

Lentigo maligna melanoma also known as Hutchison's melanotic freckle is more commonly seen on sun-exposed areas like face, neck or hands of the elderly. It is the least common and least malignant type.

Solution to Question 20:

Both Breslow and Clark's system is used for melanoma staging.

Breslow thickness is the depth of invasion measured from the granular layer of the epidermis to the base of the lesion. As the thickness of the melanoma increases, the prognosis worsens. Clark's is based on the layer of skin to which melanoma has invaded.

Breslow thickness has largely supplanted Clark's as it is a more accurate method of predicting prognosis.

Van-nyus prognostic index is used for DCIS.

Atlanta's is used for acute pancreatitis.

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Onodera's prognostic index is used for hepatocellular carcinoma after initial hepatectomy

Solution to Question 21:

The given history and biopsy finding is suggestive of melanoma. S-100 is a marker for melanoma.

Other markers for melanoma are:

• MELAN-A

• HMB (Human Melanoma Black)-45

• LDH

Solution to Question 22:

The best prognostic factor in primary stage 1 melanoma (T1N0) is the tumor thickness or depth of the melanoma.

The presence of lymph node metastases is the single most important prognostic index for melanoma in general. But in Stage 1 melanoma, as there is no lymph node involvement, the depth of the melanoma is the best prognostic factor.

Other major prognostic factors, in order of impact on survival, include:

• Presence of lymph node metastases

• Ulceration

• Age

• Anatomic location of the primary tumor

• Gender

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Solution to Question 23:

The order of prognosis for types of melanoma from better to worse is:

Lentigo maligna melanoma (LMM) and acral lentiginous melanoma (ALM) > superficial spreading melanoma (SSM) > nodular melanoma (NM)

The LMM and ALM both have long horizontal phases. As a result of this, there will be more time to detect them before they enter the vertical phase of growth. Thus LMM and ALM have a better prognosis than other subtypes.

The SSM has an intermediate prognosis, as the horizontal phase is rapidly followed by the vertical phase.

The NM has the worst prognosis, as there is no horizontal phase and it starts with a vertical growth phase. This leads to a greater average tumor thickness.

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Solution to Question 24:

Wide local excision with a resection margin of 2 cm along with sentinel lymph node biopsy (SLNB) will be recommended for melanomas invading to a depth > 2mm.

Recommended margins of wide local excision:

Wide local excision with SLNB is preferred for early-stage tumours. SLNB should be performed for lesions >1mm in depth. If SLNB is positive or if nodes are clinically positive, lymph node dissection should be performed.

SLN biopsy is more challenging in the head and neck than in other regions because of the rich lymphatic drainage network, and the false-negative rate for SLN biopsy is generally higher for melanomas in these locations. Cross-sectional imaging, such as with a single-photon emission CT, helps to identify the exact anatomic location of the SLNs more accurately.

Depth	Margin
In situ	0.5 cm
<1 mm	1 cm
1-2 mm	1-2 cm
>2-4 mm	2 cm
>4 mm	2 cm

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Solution to Question 25:

The only systemic adjuvant therapy approved by the US FDA for malignant melanoma is high-dose interferon alpha 2b.

It is administered at nearly the maximum tolerated dose, with 1 month of intravenous injections followed by 11 months of subcutaneous injections three times weekly.

Note: Dabrafenib is a BRAF inhibitor used in advanced stages of melanoma.

Solution to Question 26:

Recurrence is common in Merkel cell carcinoma.

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Merkel cell carcinoma is a rare and aggressive neuroendocrine tumor of the skin, most commonly found in white men and diagnosed at a mean age of 70 years. A rapidly growing, flesh-colored papule or plaque characterizes the disease.

Regional lymph nodes are involved in 30% of the patients and 50% will develop systemic disease. CK-20 is a specific marker for Merkel cell carcinoma. Wide local excision is usually necessary.

Solution to Question 27:

The given clinical scenario of a woman with reddish firm nodule on her chest and histology showing multiple dilated vascular structures with a single layer of epithelial cells is suggestive of a hemangioma.

Hemangioma is a benign tumor caused by the abnormal growth of blood vessels. Types of hemangioma are capillary hemangioma (most common), juvenile/ strawberry hemangioma, cavernous hemangioma and pyogenic hemangioma.

Indications for immediate treatment are complications such as ulceration or those pertaining to the location of the mass (e.g. visual issues due to a large hemangioma over the eyelid).

Treatment options include:

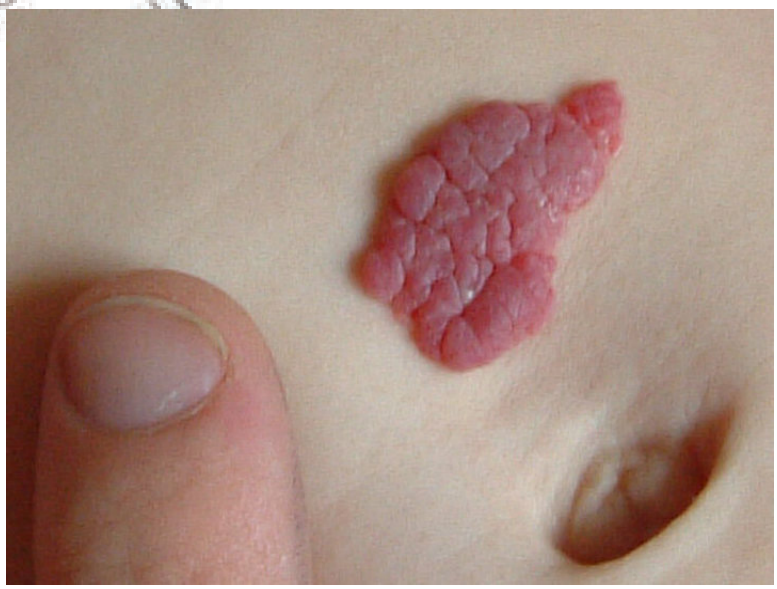
• Beta-blockers - oral propranolol

• Steroids - intralesional triamcinolone, topical clobetasol, systemic steroids

• Interferon alfa-2a and vincristine - for steroid-resistant lesions

• Local resection with cutting cautery or carbon dioxide laser

The given image shows a flat to elevated, irregular, pinkish-red mass over the skin of the abdomen suggestive of a strawberry hemangioma.



The given image shows a capillary hemangioma in a child

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Solution to Question 28:

Extramammary Paget's disease arises most frequently on the vulva. Other sites include the perineum, scrotum, perianal skin, and penis.

Extramammary Paget's disease (EMPD) can be primary or secondary.

• Primary EMPD is more common and occurs in the absence of an underlying malignancy, thought to arise from intraepidermal parts of apocrine glands or from pluripotent cells from the epidermis.

• Secondary EMPD arises from an underlying adnexal carcinoma or internal malignancy due to the epidermotropic spread of malignant cells from the underlying tumor.

Visceral malignancies associated with EMPD are carcinomas of the colon, rectum, bladder, urethra, cervix, and prostate. The patient presents with well-defined, moist, erythematous scaly plaques and severe pruritis. Lichenification and excoriations may also be seen.

Diagnosis is confirmed by punch, wedge, or excisional skin biopsy. A systemic workup should also be done to identify any underlying malignancy and they include colonoscopy, cystoscopy, colposcopy, and pelvic examination with pap smear in females.

Treatment:

• Mohs microscopic surgery with 5 cm margin clearance

• Radiotherapy

• Topical 5-fluorouracil and imiquimod

• Chemotherapy

• Photodynamic therapy

The given image below shows extramammary Paget's disease of the vulva.

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Solution to Question 29:

The given scenario and presence of large vacuolated cells with mucin (Paget's cells) points to a diagnosis of extramammary Paget's disease. It is a form of intraepidermal adenocarcinoma.

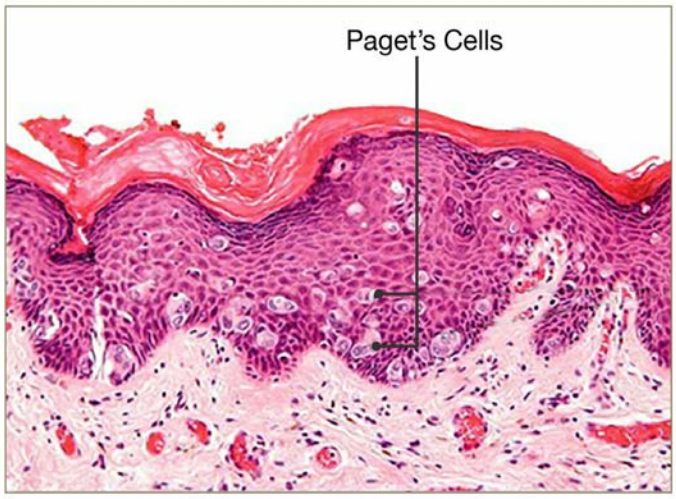
Extramammary Paget's disease usually presents in the sixth to eighth decades of life. It may occur in the genital or perianal regions, or in cutaneous sites rich in apocrine glands such as the axilla. Approximately 25% of the cases are associated with an underlying in situ or invasive neoplasm.

It most commonly presents with pruritus. The clinical appearance is similar to mammary Paget's Disease. Scattered areas of erosion and white scale can give rise to a “strawberries and cream” appearance. The invasion of the lymphatic system by the tumor gives rise to underpants-pattern erythema.

Surgical excision forms the basis of treatment.

The given image shows large vacuolated cells with mucin (Paget's cells)

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Solution to Question 30:

Most of the soft tissue sarcomas undergo hematogenous dissemination to metastasize to lungs, liver, bones, and subcutaneous tissue. Regional lymph node involvement is relatively uncommon. However, the most common subtypes with nodal metastasis are:

- Clear cell sarcoma
- Liposarcoma
- Rhabdomyosarcoma
- Angiosarcoma
- Epitheloid sarcoma
- Malignant fibrous histiocytoma

Lymph node involvement is an important prognostic indicator for survival. Hence, lymph node dissection is mandatory in these cases.

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