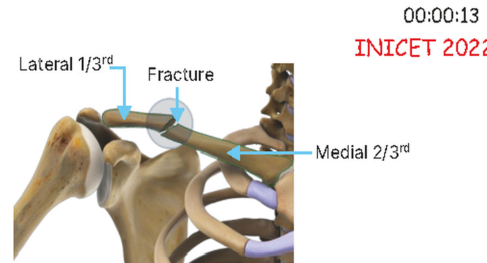
1. UPPER LIMB TRAUMA

FRACTURE CLAVICLE

00:00:13

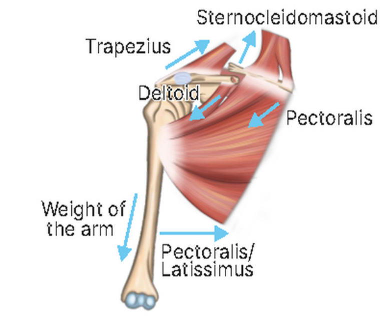
INICET 2022

- M/c fracture in newborn
- M/c site: Junction of Medial 2/3rd and lateral 1/3rd
- **Deforming Forces:**
  - Medial 2/3: Pulled up by Sternocleidomastoid (SCM).
  - Lateral 1/3: Pulled down by Weight of Upper Limb.



Mechanism Of Injury

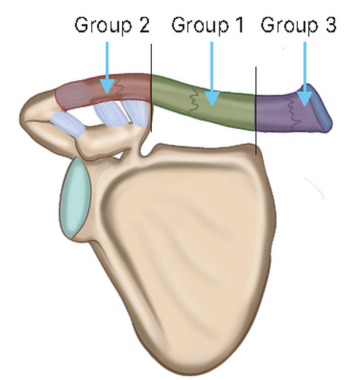
- M/c: Fall onto the same side shoulder
  - Accounts for 87%
- Least Common: Fall on outstretched hand (< 2%)



Classification

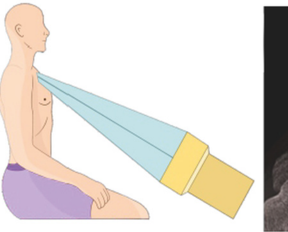
Allman & Craig

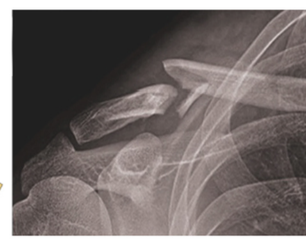
- Group I → middle 1/3rd
  - M/c
  - Accounts for 85%
- Group II → lateral 1/3rd
  - 2nd M/c
  - Accounts for 10%
- Group III → medial 1/3rd
  - Least common
  - Accounts for 5%



Diagnosis

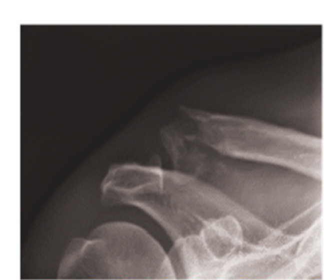
- X ray
  - Beam directed 20° cephalad called serendipity view
    - → It is view of choice in fracture clavicle because it eliminate overlap of ribs on clavicle
  - Beam directed 15° cephalad and centered over acromioclavicular joint called Zanca's view
    - → To see lateral clavicle fracture
- CT scan
  - Medial end of clavicle fracture because through x ray it is not seen
  - Lateral end of clavicle fracture, to rule out intrarticular extension





Treatment

- Conservative:
  - Treatment of Choice in 99% cases: Cuff and Collar sling + Figure of 8 Bandage.



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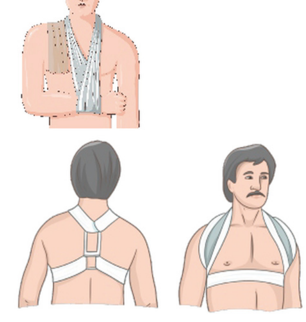
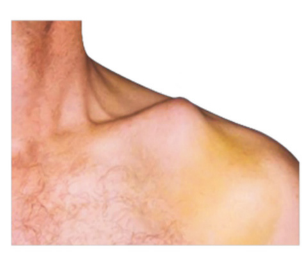
- Excellent healing (Membranous bone)
- Surgical management → Indications
  - Displacement >2cm
  - Open fracture or impending open
  - Injury to the neurovascular bundle
  - Associated rib and scapula fracture
  - Non union
  - Fracture near the acromioclavicular joint
  - Bilateral clavicle fracture
  - Floating shoulder
    → Fracture clavicle + Scapular neck fracture





AIIMS 2019

Complications

- Malunion → Most common → thoracic outlet syndrome
- M/c vessel injured → Subclavian vessel
- M/c nerve injured → medial cord of brachial plexus (ulnar nerve)
- M/c associated fracture → Rib and scapular fracture
- Thoracic outlet syndrome

SHOULDER DISLOCATION

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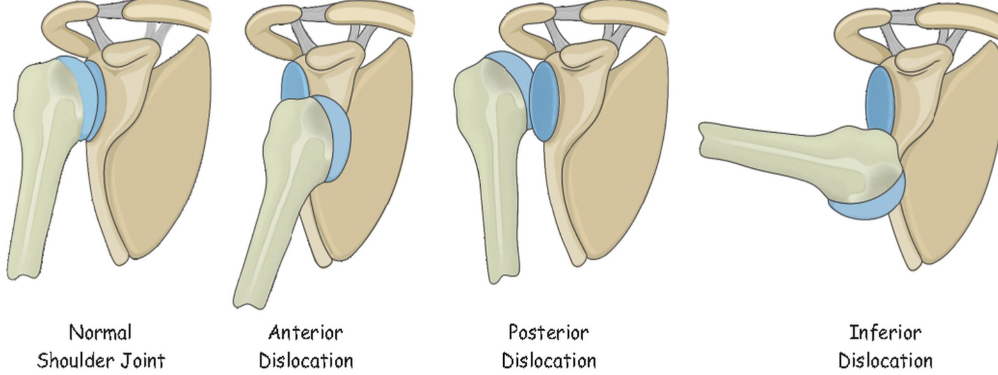
- M/c dislocation in adults
- Accounts for 45% of all dislocations
- 3 types

FMGE 2025



  - Anterior dislocation
    → When the head of the shoulder is lying anterior to the glenoid
  - Posterior dislocation
    → When the head of the shoulder is lying posterior to the glenoid
    → Accounts for 10%
  - Inferior dislocation
    → A/k/a Luxatio erecta
    → When the head of the shoulder is lying inferior to the glenoid

- Shoulder joint stability
  - It is potentially an unstable joint
  - Stability depends upon

Yourwish

Yourwish

- → Static stabiliser
  - – Anatomy of the glenoid and the head of the humerus
  - – Glenoid labrum
  - – Glenohumeral ligaments
- → Dynamic stabiliser
  - – Rotator cuff muscle

Anterior Shoulder Dislocation

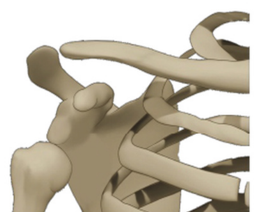
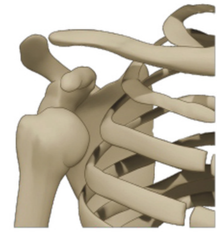
00:10:56

Mechanism Of Injury

- Indirect
  - Fall on outstretched hand with shoulder in abduction , extension and external rotation
  - M/c mechanism
- Direct injury
  - Direct blow to posterior part of shoulder may dislocate humeral head anteriorly

Pathoanatomy Of Anterior Shoulder Dislocation

- It varies grossly in young and old
- In young individuals
  - Anterior capsule and glenoid labrum is stripped completely from the anterior margin of glenoid.
  - So head of humerus slips forward under subscapularis muscle
- In elderly, dislocation occurs through a tear in the capsule
- This will heal easily with immobilization
- So recurrence is relatively less in old people

TYPES OF ANTERIOR DISLOCATION		
• Subcoracoid ○ Head lies under coracoid ○ M/c	• Subglenoid ○ Head lies under glenoid 	• Subclavicular ○ Head lies under Clavicle 

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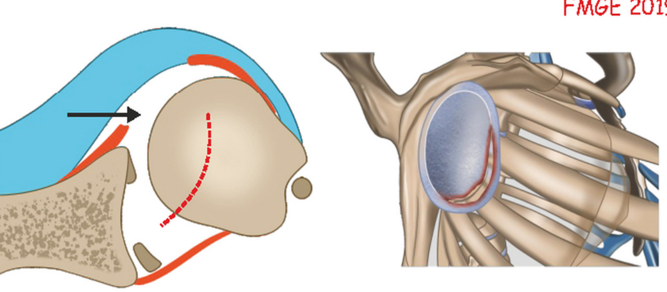
Bankart's Lesion

- Soft tissue lesion
- Tear in the antero inferior aspect of glenoid labrum
- Occurs in 85% of individuals
- It is often referred to as essential lesion

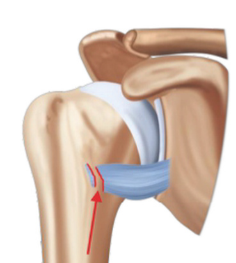


Hill-Sach's Lesion

- Also called Hatchet deformity
- Bony lesion

- Osteochondral depression on postero lateral aspect of head of humerus
- Occurs in 25% of individuals
  - Larger the defect, the greater the chance of recurrence.

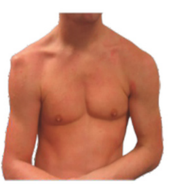
Hagl Lesion



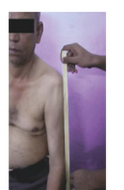
- Humeral avulsion of glenohumeral ligaments
- Involves mainly inferior glenohumeral ligament
- Unhappy triad
  - Bankart's lesion
  - Hill-Sach's lesion
  - HAGL lesion

  } • All three lesions occurs in same shoulder
  • Chance of recurrent shoulder dislocation

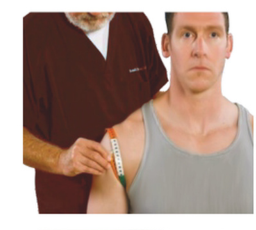
Clinical Features



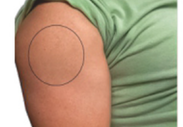
- Attitude
  - Arm is extended ,abducted and externally rotated
  - Loss of deltoid contour
- Sulcus sign
  - Hollowing below the acromion



- Hamilton ruler test
- Callway's test
  - In dislocated shoulder girth of axilla is increased



- Bryant's sign
  - In dislocated shoulder the anterior axillary fold lies at the lower level
- Duga's test
  - Also called Yocum test
  - Inability to touch the opposite shoulder.



- Regimental badge sign
  - Loss of sensation over deltoid
  - Due to compression of the axillary nerve.

Investigations

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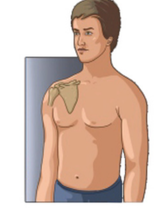
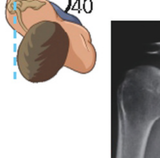
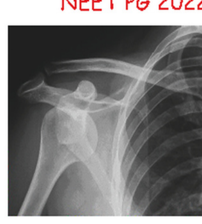
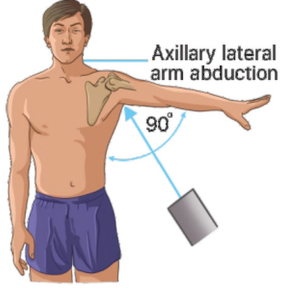
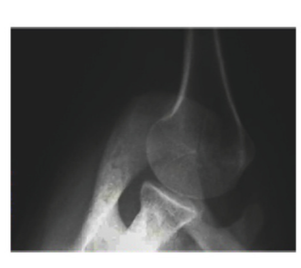






- X ray
  - True AP view - Grashey view
    → Patient in supine position . plate is placed parallel to scapula by raising the opposite shoulder 35° to 45°
    → Joint space is visible clearly
  - Axillary view

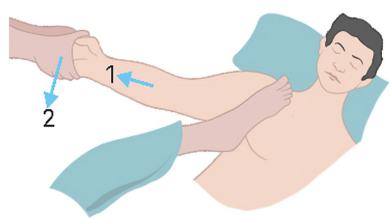




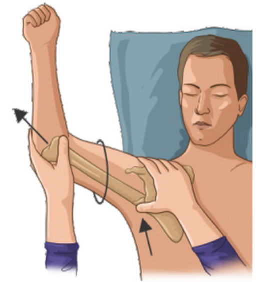
→ Arm is abducted to 90 and beam is passed
→ Glenoid fracture are seen better in this view

Treatment

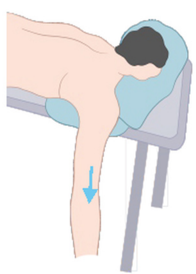
- Hippocrates method



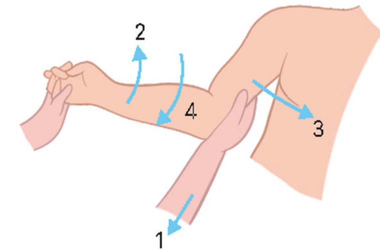
- Milch method



- Stimson's gravity method



- Kocher's method: TOC
  - Aka TEAM technique
    → T → Traction
    → E → External rotation
    → A → Adduction
    → M → Medial rotation



Complications

- Nerve injury
  - Axillary nerve - M/c
  - Musculocutaneous nerve - rare
- M/c artery injured: Axillary artery
- Rotator cuff tear
- Recurrent shoulder dislocation
  - M/c joint to undergo dislocation
  - M/c type
  - More common in young > old (15-20 years)

Posterior Shoulder Dislocation

00:20:00

- Accounts for only 10% of shoulder dislocation

Yourwish

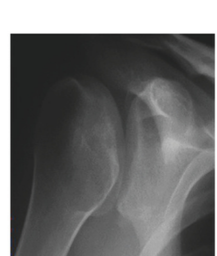
Mechanism Of Injury

- Indirect injury
  - Following electric shock and convulsion
- Direct injury
  - Direct blow on anterior part of shoulder

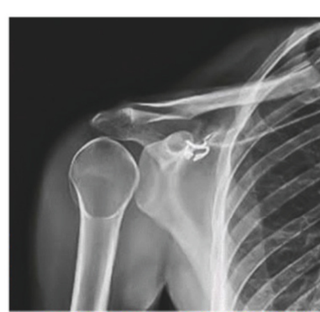
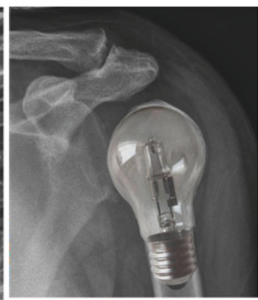
Clinical Features

- Most of the time Clinically Posterior Shoulder Dislocation is missed because it wont show any characteristic deformity
- Humeral Head may be Palpable Posteriorly
- Coracoid may appear prominent
- Sling position → Arm is adducted and internally rotated

Investigations



- X ray
  - Empty glenoid sign / Vacant glenoid sign
    → Space between glenoid rim and humeral head is >6mm
  - Light bulb sign

→ Internal rotation of humeral head gives Rounded appearance

Treatment

- Gentle traction to the adducted arm along the line of deformity
- External rotation is not attempted → it can cause humeral head fracture

Inferior Shoulder Dislocation

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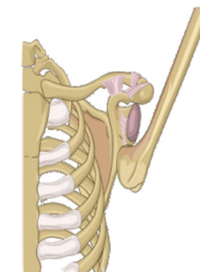
- It is also called Luxatio erecta
- Rarest type → 0.5%



Mechanism Of Injury

- Occurs due to hyperabduction injury

Clinical Features

- Salute position
- Humerus is locked in 110° to 160° abduction

Investigations

- X ray → AP view is diagnostic

Yourwish

Yourwish

Recurrent Shoulder Dislocation

00:24:37

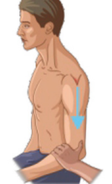
- ≥2 dislocation within a period of 12months
- M/c type is Anterior
- Predisposing factors
  - Age below 20 years
  - Inadequate immobilization
  - Collagen disorders
    - → Ehler-Danlos syndrome
    - → Marfan syndrome
  - Initial shoulder dislocation occurs after trivial trauma
- Pathoanatomy
  - Recuurent shoulder dislocation is associated with
    - → Bankart's lesion
    - → Hill-sachs lesion
    - → Erosion of the glenoid labrum
    - → HAGL lesion
  - Usually more than one lesion occurs in the same patient

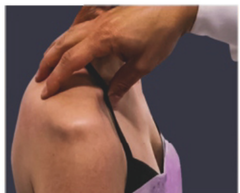
Classification

MASTEN CLASSIFICATION	
T → Trauma U → Unidirectional B → Bankart's lesion S → Surgery	A → Atraumatic M → Multidirectional B → Bilateral R → Rehabilitation I

Clinical Features

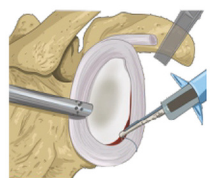
- Apprehension test positive
- Neer & Foster sulcus sign





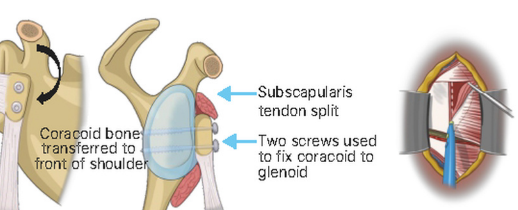
Investigation

- MRI
  - Investigation of choice
  - To visualize soft tissue injury



Treatment

- Bankart's procedure
  - Suturing the tear in the anteroinferior part of glenoid labrum
- Laterjet procedure
  - Coracoid bone is transferred in front of the shoulder
- Putti- platt's procedure
  - Double breasting of subscapularis



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SHAFT OF HUMERUS FRACTURE

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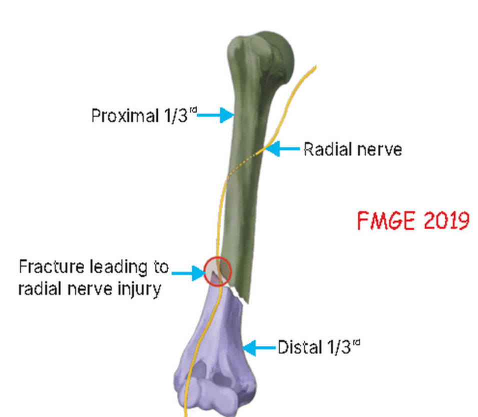
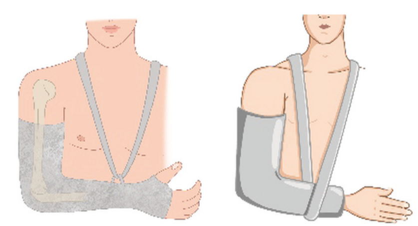
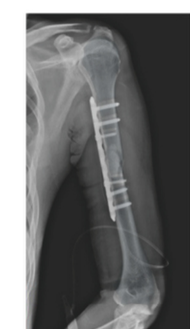
- M/c site is middle third of diaphysis
- Radial nerve is more if it happens in lower third
- Radial nerve injury in shaft of humerus fracture is 10%
  - It is a Neuropraxia
  - It recovery by 6-8weeks
- Mechanism of injury
  - Direct injury
    - → Direct injury to the arm following RTA
    - → M/c
  - Indirect injury
    - → Fall on outstretched hand
    - → Less common
- Holstein Lewis fracture
  - Fracture occurs at junction of proximal 2/3rd and distal 1/3rd
  - Oblique fracture
  - Entrapment of radial nerve
  - It is an emergency because it can lead to Neuropraxia and progress to permanent nerve damage.



- Management
  - Conservative
    - → Most of the time it is managed conservatively because it is surrounded by muscle which has good vascular supply
    - → Hanging arm cast
  - Surgery
    - → Indication
      - – Associated radial nerve injury
      - – If conservative management fails
      - – Floating elbow
      - – Segmental fracture → avascular necrosis
      - – Pathological fracture
      - – Bilateral humerus fracture
    - → Surgical techniques
      - – Plate osteosynthesis



Hanging arm cast

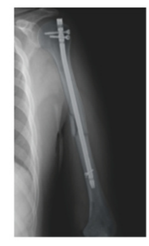


- Gold standard
- Open reduction and internal fixation with Dynamic compression plate
- Chance of radial nerve injury is high

Important Information

DCP

- 2 types
  - Narrow DCP
  - Broad DCP



- Intramedullary interlocking nail
- Used in pathological fracture
- Chance of radial nerve injury is low
- It can cause Bursitis

SUPRACONDYLAR FRACTURE

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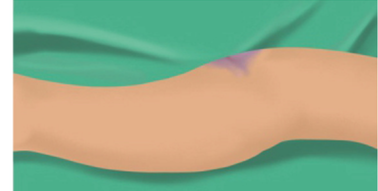
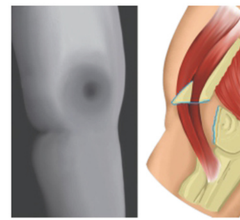


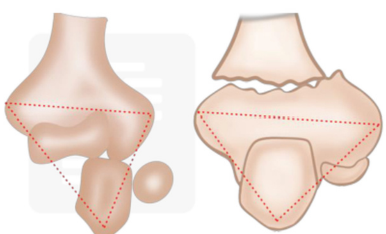
- M/c fracture seen in children below 10 years
- More common in boys
- More common on left side
- Mechanism of injury
  - Fall on outstretched hand on extended hand

Clinical Features



- S shaped deformity of arm and elbow
  - Proximal fragment → tilted anteriorly
  - Distal fragment → tilted posteriorly
- Dimple sign

Supracondylar fracture
↓
Proximal fragment displaced anteriorly
↓
Pierces the bicep brachii
↓
Skin puckering



3 Bony Points are Well Maintained

- Three bony prominences are well maintained
  - Medial epicondyle
  - Lateral epicondyle
  - Tip of olecranon

Types

- Extension Type (98%): Most common
  - Posteromedial (80%): Nerve involved → Radial nerve.
  - Posterolateral (20%): Nerve involved → Anterior Interosseous Nerve (AIN)
- Flexion Type (2%):
  - Most Common Nerve Injury: Ulnar nerve

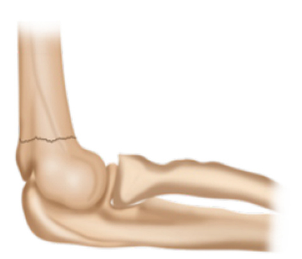
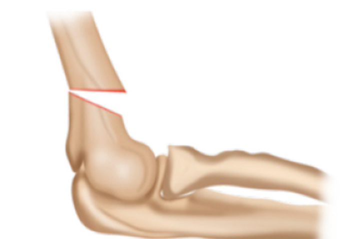
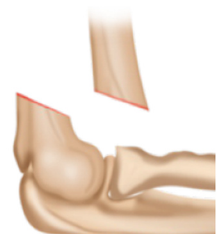
Important Information

- Nerve injury is more common in Posterolateral type than Posteromedial.
- Posterolateral type is more prone for nerve injuries than posteromedial type so Anterior Interosseous Nerve (AIN) is the commonest nerve injured in supracondylar fracture

Yourwish

Classification

INICET 2020

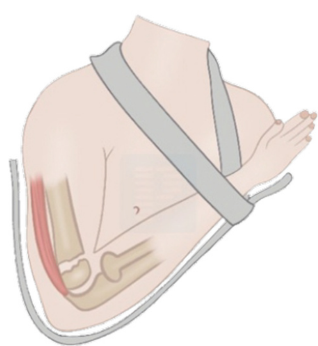
Gartland classification → Based on degree of displacement		
 Type 1 • Complete fracture and undisplaced	 Type 2 • Complete fracture and partially displaced	 Type 3 • Complete fracture and completely displaced

Investigations

Radiological signs			
Lateral view			AP view
Fat pad sign	Tear drop sign disturbed	Crescent sign	Fish tail sign

Treatment

- Type 1



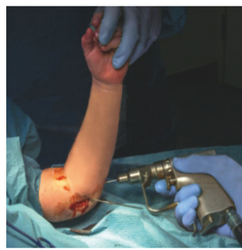
Long arm cast

  - Immobilization in long arm cast at 60 to 110 of flexion for 2-3 weeks
  - Triceps acts as an internal splint so that fracture fragment is not displaced

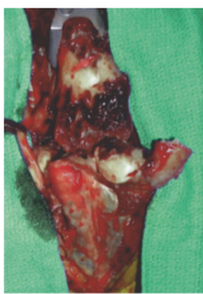
- Type 2

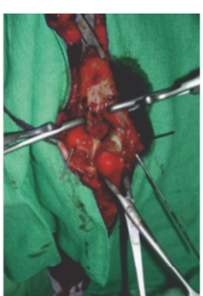
Yourwish

Yourwish



- Closed reduction and internal fixation with K wires
- Type 3





- Open reduction and internal fixation with K wires

Complications

- Nerve injury
  - M/C nerve injured in extension type → AIN
  - M/C nerve injured in flexion type → Ulnar nerve
- M/C vessel injured → Brachial artery
- Malunion
  - M/C late complication
  - Gunstock deformity / Cubitus Varus
- Volkmann's ischemia / compartment syndrome
- Myositis ossificans

ELBOW DISLOCATION

00:45:07

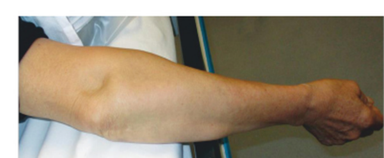
- M/C joint to be dislocated in children
- Mechanism of injury
  - Fall on outstretched hand
- Classification:
  - Simple Elbow Dislocation: Isolated dislocation without associated fractures.
  - Complex Elbow Dislocation: Associated with fractures.
- Most Common Type: Posterolateral

Complex Elbow Dislocation: Terrible Triad Of Elbow

- Also known as: Hotchkiss Triad.
- Components:
  1. Elbow Dislocation.
  2. Radial Head Fracture.
  3. Coronoid Process Fracture.

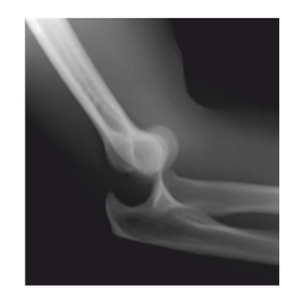
Yourwish

Clinical Features



- Attitude
  - Forearm flexed and partially pronated
  - Forearm appears shorter
- Bow string sign
  - Triceps tendons becomes flabby
- Classical sign
  - 3 Bony prominent is disturbed

Investigations



- X ray
  - Humerus is out of olecranon

Treatment

- Reduction under GA with Aabove elbow POP for minimum 3week
  - Ideally - 6week

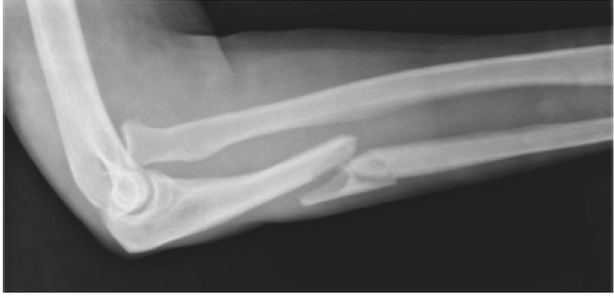
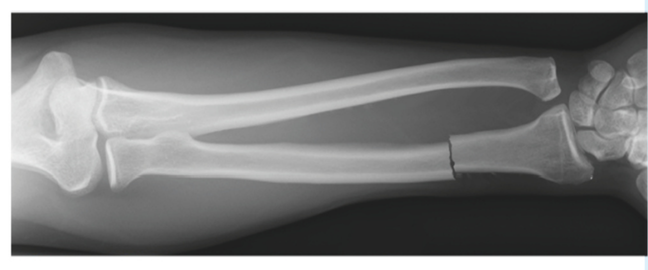
Complication

- M/C nerve injury Median nerve > ulnar nerve
- M/C vessel injured is Brachial artery
- Joint stiffness
  - M/C complication of elbow dislocation
- Myositis officians
- Compartment syndrome

FOREARM FRACTURE

00:49:11

FMGE 2020

Monteggia fracture	Galeazzi fracture
• Fracture proximal 1/3rd ulna with dislocation of radial head • Common in child • Fall on outstretched hand with pronation • X ray : Mac Laughlin's line / Radio capitillar line • Can be managed conservatively • PIN palsy 	• Fracture distal third radius with distal radioulnar joint subluxation • Common in adult • Fall on outstretched hand with hyperpronation • Piano key sign • Treated by surgery • Extensor carpi ulnaris Tendon injury 

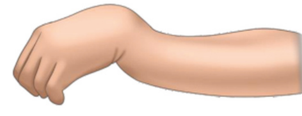
COLLE'S FRACTURE

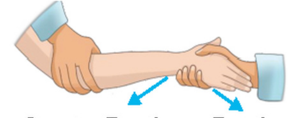
00:53:27
FMGE 2020
AIIMS 2019

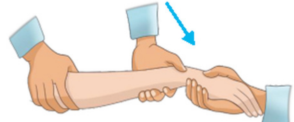
- Fracture at distal end of radius with dislocation at radioulnar joint
- Fracture occurs about 2.5cm above the carpal extremity of radius at cortico cancellous junction
- Purely extra-articular fracture
- Mechanism of injury
  - Fall on outstretched hand with pronated forearm and wrist in dorsiflexion
- Component of colle's fracture (MNEMONIC: DILS)
  - Occur in relation to distal fragment
  - Dorsal tilt
  - Dorsal displacement
  - Impaction
  - Lateral tilt
  - Lateral displacement
  - Supination

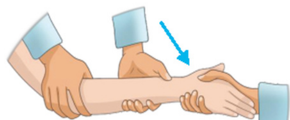
FMGE 2019, 2023

- Clinical features
  - Pain and swelling in the wrist
  - Styloid process test
    - → Styloid process of radius lies 1.3cm distal to ulnar styloid process - NORMAL
    - → Styloid process of radius and ulna lies at same level - Colle's fracture
    - → Most reliable sign
  - Deformity
    - → Dinner fork deformity
- Treatment
  - TOC: Conservative management
  - Fracture is reduced by 2 technique
    - → John Charnley's method
    - → Apley's thenar grip method






Correction of dorsal tilt


Correction of radial tilt

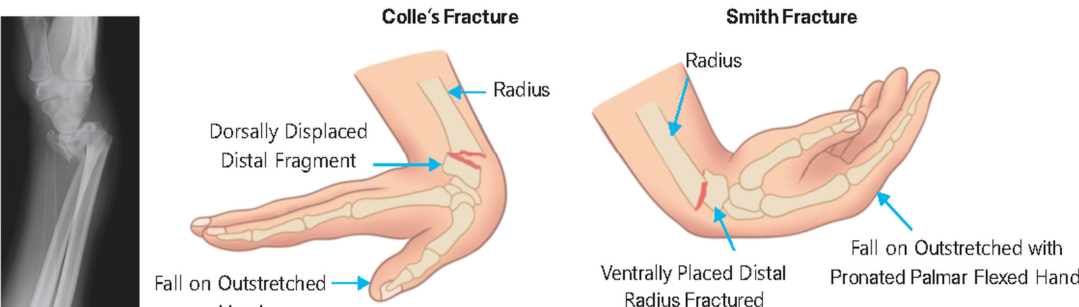
- Steps
  - Disimpaction
  - Reduction
  - Confirmation
  - Cast application
    - → Closed reduction & BE POP in full pronation with palmar flexion and ulnar deviation at wrist for 6weeks - Colle's Cast
    - → Cotton loader's position
    - → Position of immobilization with colle's cast

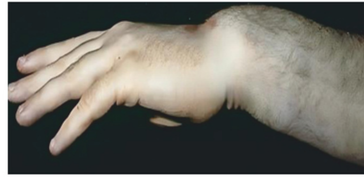
- Complication
  - Stiffness of finger - M/C complication
  - Malunion - 2nd M/C complication
  - DRUJ subluxation
  - Carpal tunnel syndrome
  - Sudeck dystrophy / chronic regional pain syndrome
  - EPL tendon rupture

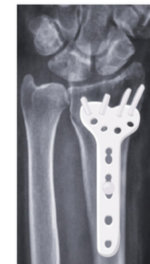
Yourwish

SMITH'S FRACTURE

01:00:35





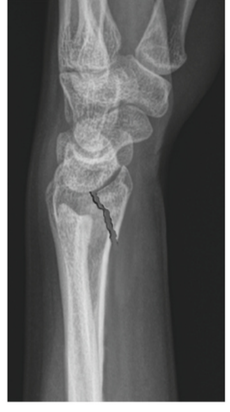
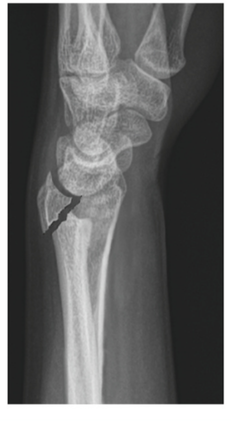


- **Mechanism of injury**
  - Fall on outstretched hand with pronated forearm and wrist in palmarflexion
- Clinical features
  - Severe pain
  - Deformity: Garden spade deformity
- Treatment
  - Closed reduction & AE POP in extension for 6weeks
  - Open reduction and internal fixation with Ellis plate

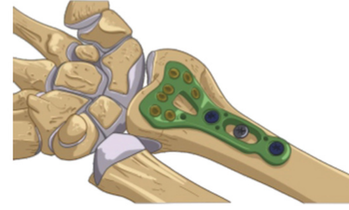
BARTON FRACTURE

01:02:50

- Vertical , marginal ,intraarticular fracture of distal radius
- Mechanism of injury
  - Fall on outstretched hand with pronated forearm and wrist in dorsiflexion
- Types

Types of Barton	
Volar • M/C type • Classical Barton • Distal fragment is placed volarly 	Dorsal • Distal fragment is placed dorsally 

- Treatment
  - TOC: Open reduction and internal fixation with anterior buttress plating



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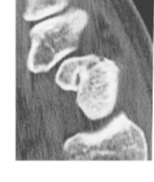
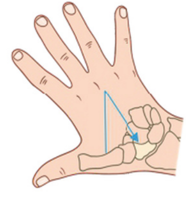
SCAPHOID FRACTURE

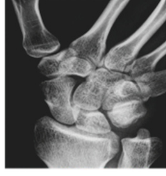
01:03:58

- M/C carpal bone to get fracture is Scaphoid
- M/C age group for scaphoid fracture is Young adult
  - Rare in children and old age
  - Due to relative weakness of distal radius when compared to scaphoid in this age group
- Blood supply
  - Radial artery mainly through the distal pole
- Mechanism of injury
  - Fall on outstretched hand with wrist in forced dorsiflexion
- M/C site - waist of scaphoid
- Clinical features
  - Fullness and tenderness in anatomical snuff box
  - Hump back deformity
  - Clinical test
    - → Scaphoid lift test
    - → Watson test



- Investigation
  - Xray - scaphoid view
    - → Wrist in ulnar deviation to free the scaphoid from bony superimposition
    - → If clinically scaphoid fracture is suspected and there is no fracture line visible in X ray → BE POP cast applied and X ray repeated after 2-3 weeks
  - MRI
    - → Detects scaphoid fracture much earlier than the X ray

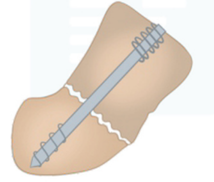




- Treatment
  - Undisplaced fracture
    - → Scaphoid cast / Bohler Gauntlet cast
    - → Below elbow cast in glass holding position
    - → Unite my 6-10weeks
  - Displaced fracture
    - → Open reduction and internal fixation with Herbert's screw (headless screw)

Bohler-Gauntlet scaphoid cast

- Complications
  - Non union
  - Avascular necrosis
  - Malunion

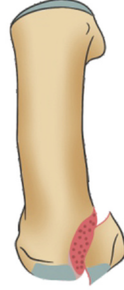


Herbert's screw

BENNET FRACTURE

01:11:12

- Oblique intraarticular fracture dislocation of base of the thumb
- Fragment is pulled by APL tendon



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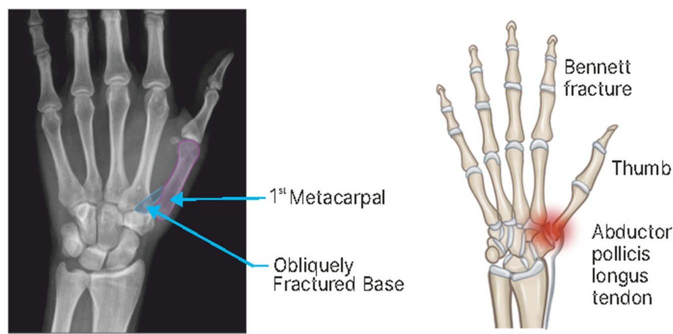
- Mechanism of injury

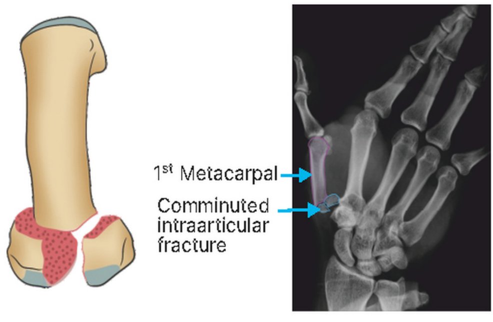


  - Axial blow directed against partially flexed metacarpals
  - Common in fist fight and contact sports
- Treatment
  - K wire fixation
- Complication
  - Recurrent subluxation of joint
  - Osteoarthrosis of the 1st carpometacarpal joint

ROLANDO FRACTURE

01:12:32
INICET 2021, 2020

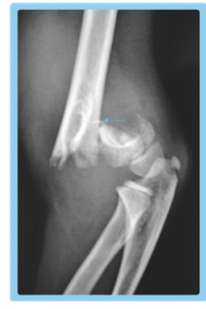
- Comminuted intraarticular fracture of the base of the first metacarpal
- Comminution may be T or Y configuration
- Worse prognosis in comparison to Bennet fracture
- Treatment
  - Open reduction and internal fixation with plate and miniscrew



PYQ

01:13:14
NEET PG 2022

Q. What is the M/c late complication of this condition , if left untreated?



a. Pulled elbow

b. Dinner fork deformity

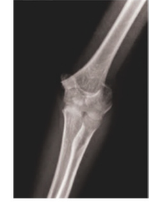
c. Cubitus varus

d. Osteoarthritis

Ans: c

Q. Which classification is used for the following fracture , and what is its stage ?

NEET PG Aug 2024



a. Gartland 3

b. Gartland 2

c. Salter Haris 3

d. Salter Haris 2

Ans: a

Q. Which of the following fractures can cause a deformity as shown in the image below ? NEET PG Aug 2024

a. Lateral Condyle of humerus fracture

b. Monteggia fracture

c. Supracondylar fracture of humerus

d. Shaft of humerus fracture

Ans: c

Q. Which nerve is most likely to be damaged in cases of anterior shoulder dislocation? INI CET May 2023

a. Axillary nerve

b. Median nerve

c. Radial nerve

d. Suprascapular nerve

Ans: a

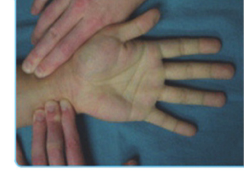
Q. What is the name of the test performed in the image given below? INI CET May 2023

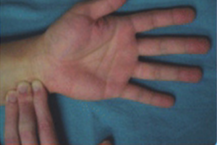
a. Allen's test

B. Adson test

c. Barbeau test

d. Homans test





Ans: a

Q. In the emergency room, a 40 year old male patient arrived with a complaint of pain and swelling in the right shoulder region following a fall. The patient's X ray indicates a tear in which of the following ligaments?

INI CET May 2023

a. Coracoclavicular ligament

b. Acromioclavicular ligament

c. Both the above

d. Glenohumeral ligament

Ans: b

Q. A patient presents with a tear in the anteroinferior aspect of the glenoid capsule and the labrum. What is the likely diagnosis for this type of lesion? INI CET Nov 2023

a. Hill-sachs lesion

b. Bankart lesion

c. Both A and B

d. Osteolytic lesion

Ans: b

Q. A patient presents after a fall on an outstretched hand. The X ray is normal, but there is fullness in the

Yourwish

anatomical snuff box.what is the next best step in management? INI CET May 2023

a. MRI to evaluate soft tissue and ligaments

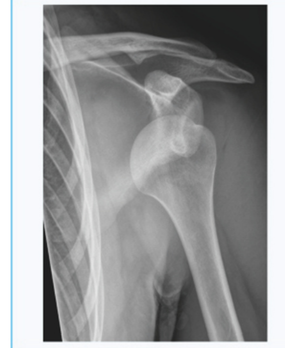
b. Immediate CT Scan

c. Cast immobilization and follow up with repeat imaging after 2weeks

d. Bone scan for early fracture detection

Ans: c

Q.A 30 year old man presents with a history of fall .He complains of severe shoulder pain and inability to his arm. On examination the arm is slightly abducted and externally rotated.The X ray is given.what is the likely diagnosis? INICET May 2025 INI CET May 2025



a. Anterior dislocation

b. Posterior dislocation

c. Fracture clavicle

d. Proximal humerus fracture

Ans: a

Yourwish

Yourwish

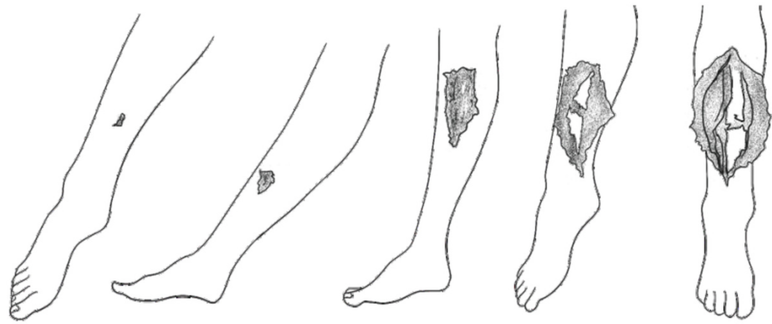
2. COMPLICATIONS OF FRACTURE

OPEN FRACTURES

00:00:14

Gustilo & anderson's classification

Type	Wound Size	Soft Tissue Condition	Sub-type Characteristics
Type - I	< 1 cm	No devitalization of soft tissue	Simple, clean wound.
Type - II	> 1 cm & <10 cm	No devitalization of soft tissue	—
Type - III	> 10 cm	Soft tissues are devitalized	**A.** Adequate soft tissue coverage **B.** Extensive soft tissue loss with bone exposure **C.** Associated with arterial injuries



- Other classification: Tscherne classification

VOLKMANN'S ISCHEMIA

00:02:47

- Elevation of interstitial pressure in a closed osseofascial compartment that results in microvascular compromise and eventual contracture of muscles

INICET 2021, FMGE 2020, 2024, 2025, NEET PG 2024

- Sites:
  - Volar compartment of the forearm - M/c
  - Anterior and deep posterior compartments of the leg
  - Buttocks, Shoulder, Hand, Foot, and Lumbar regions are relatively rare sites.

Etiology

- Supracondylar Fracture: M/c cause in children
- Crush Injuries of the Forearm: M/c cause in adults
- Tight Bandage: Another very common cause.

Muscles affected

- M/c muscle affected: FDP (Flexor Digitorum Profundus)

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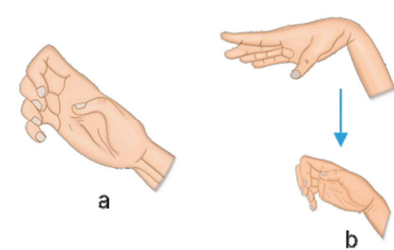
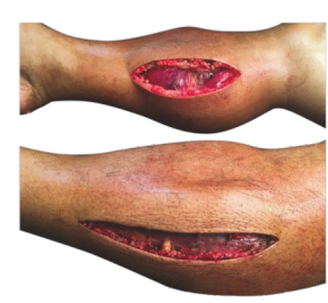
- Affected earliest
- Other muscles involved: FPL (Flexor Pollicis Longus), FDS (Flexor Digitorum Superficialis), Wrist Flexors, and Thumb Flexors
- Tsuge's Classification for VIC:
  - Mild: FDP involved
  - Moderate: FDP + FDS + FPL involved
  - Severe: All wrist and thumb flexors involved
- Volkmann's Sign
  - When wrist is flexed passively, the fingers get extended spontaneously



Treatment

- Positive Clinical Findings: Requires a Fasciotomy
  - Pain, Pallor, Paresthesia, Paralysis, Pulselessness
- Doubtful case with ICP >30mmHg: Requires a Fasciotomy
- Doubtful case with ICP <30mmHg: Managed Conservatively
- Established VIC:
  - Mild: Turn Buckle's Splint (Volkmann's splint)
  - Moderate: Max Page's Operation (Soft Tissue Sliding Operation)
  - Severe: Seddon's Carpectomy

    → Remove proximal row of carpel bones



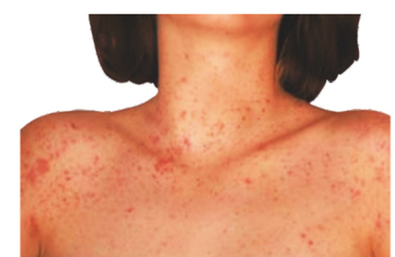
ARDS/ FAT EMBOLISM

00:08:17

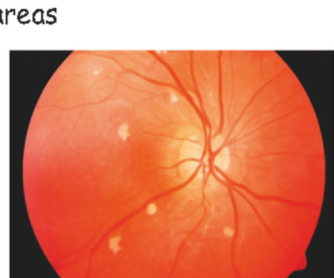
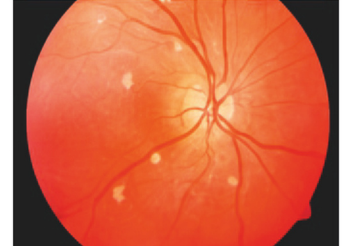
- It usually manifests within 48 Hrs
- Common etiology:
  - Young adult: Long Bone Fracture (Femoral Shaft)
  - Elderly: Pelvic fracture
- Source of Fat:
  - From bone marrow
  - From plasma by agglutination of chylomicrons
  - FFA (Free Fatty Acids): Destroys the pneumocytes

Clinical features

- Non-Specific Clinical Signs: Unexplained Tachypnoea, Tachycardia.
- The Classical Gurd's Triad:
  - Hypoxia
  - Mental confusion unrelated to head injury
  - Petechiae
- Pulmonary Signs:
  - Earliest sign to develop.
  - Tachypnoea > 30 breaths/min.
  - PaO_2 < 60 mmHg.
- Cerebral Signs:
  - Restlessness, confusion, Disorientation progressing to stupor, and coma.
  - Long tract signs, extensor posturing, seizures
  - Urinary incontinence.

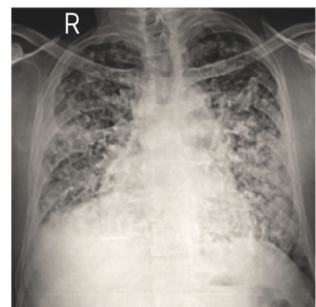


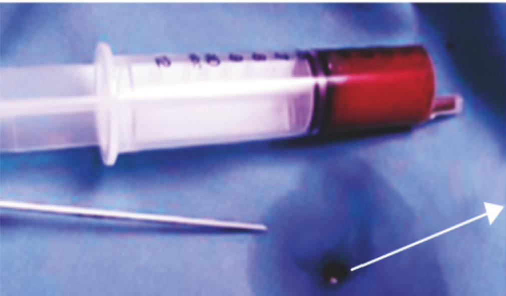
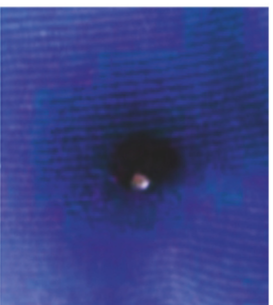
- Neurological signs are typically transient and reversible
- Petechial Rash
  - Considered a pathognomonic sign of Fat Embolism.
  - Fleeting types occur periodically, often during attacks of coma
  - Location: Appears on the chest, upper arm, axilla and root of neck
  - Very Characteristic Sites: Lower Conjunctiva and Retina.
- Distribution is related to fat floating in the aortic arch like "oil in water".
- Fat globules in the blood are embolised in non-dependent skin areas
- Fat globules cause capillary occlusion leading to extravasation of erythrocytes, which causes petechiae
- Other signs:
  - Pyrexia.
  - Fundoscopy: Cotton Wool Spots
  - Renal Changes: Lipiduria, Hematuria, and Proteinuria

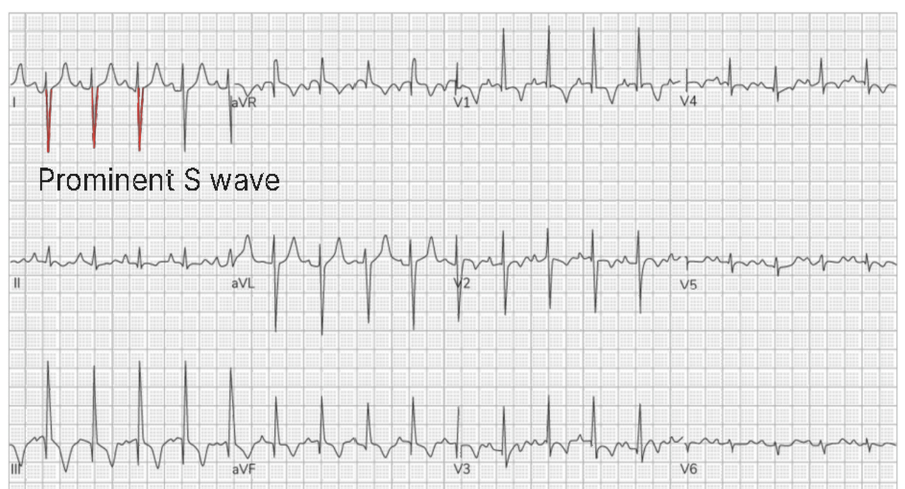



Investigations

- Hallmark: Arterial Hypoxemia ($PaO_2 < 60$ mmHg).
- Chest X-ray: Snow storm appearance.
- Laboratory:
  - Thrombocytopenia
  - Elevated Serum Lipase & FFA.Staining
- Urine, Blood, or Sputum stained with Sudan III or Oil Red O show Fat Globules
- ECG → Prominent S wave
- Gurd test: Best bedside investigation
- Petechial Skin Biopsy: Used for fat detection





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Gurd's criteria

Major Criteria (At least One)	Minor Criteria (At least Four)	Lab Changes (At least One)
• Respiratory Insufficiency • Cerebral Dysfunction • Petechial Rash	• Pyrexia • Tachycardia • Retinal Changes • Jaundice • Renal Changes	• Anemia • Thrombocytopenia • High ESR • Fat Macroglobulinemia

Treatment

- Fracture Stabilization
  - Main treatment which prevents further Embolization.
- Maintenance of Airway, Fluid & Electrolytes
- Respiratory Support: 100% oxygen
  - The aim is to maintain PaO2 > 60mmHg
  - If Hypoxemia is severe, Mechanical Ventilation with an ET tube needed.
- Drug Therapy
  - Corticosteroids - Methyl Prednisolone 10mg/kg
  - Ethanol/ Alcohol - Bolus may prevent FES by acting as Lipase inhibitor
  - Heparin - It is Lipolytic & Antiplatelet.
  - Low molecular weight Dextran - Improves Microcirculation

Prophylaxis

- Gentle Handling
- Proper Splinting
- Early Stabilization
- Careful Reaming

Prognosis

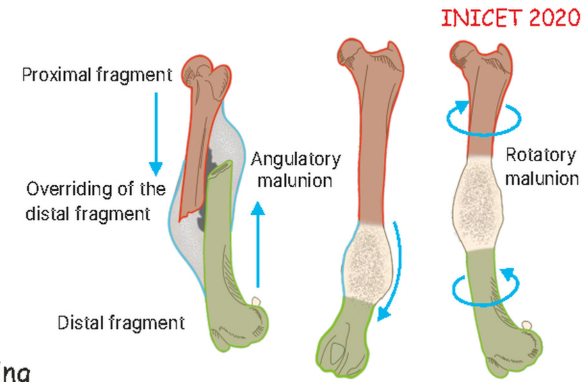
- Subclinical Form → Good Recovery
- Non Fulminant & Fulminant Form → Mortality 5 - 15%
  - Morbidity is secondary to Cerebral Deficit

MALUNION

00:16:00

INICET 2020

- Definition: When fracture fragment unite in an abnormal position, it is called malunion
- It may cause shortening, alteration in posture and balance
- Improper treatment is the M/c cause
- 3 Types of Malunion:
  - Length malunion
  - Angulatory malunion
  - Rotatory malunion
- Among the above, rotatory malunion is not corrected by remodeling
- Malunion of 5-10° will get corrected by remodeling → don't treat actively



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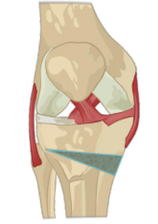
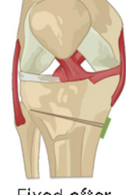
- 3 methods of treatment:
  1. Osteoclasis
  2. ORIF (Open Reduction Internal Fixation)
  3. Osteotomy (e.g., Remove a Wedge-shaped Bone)


Remove a wedge-shaped bone


Fixed after correction

00:18:46

NON-UNION

Definition - fda panel

- Non union is said to be established when a "minimum of 9 months has elapsed since the injury, or fracture shows no radiological signs of healing for three consecutive months"
- In non union, the biological activity of healing reaches a standstill

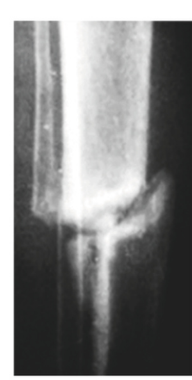
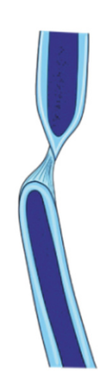
Etiology

- Distraction
- Inadequate Immobilization (M/c cause)
- Improper Reduction
- Ischemia
- Infection
- Interposition of Soft Tissue
- Intact Fellow Bone
- Segmental Fracture
- Comminuted Fracture
- Open Fracture
- General factors:
  - Malnutrition
  - Steroids
  - Smoking

Cech, weber & muller's classification

Hypervascular Non-union	Avascular Non-union
Hypertrophic Non-Union • Elephant Foot • Horse Hoof	Torsion Wedge
	Comminuted

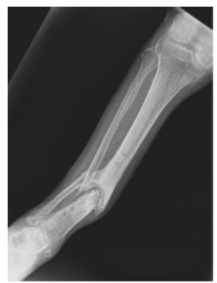
Yourwish

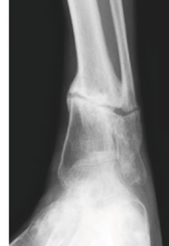
<table>
<tr><td rowspan="2">Oligotrophic Non-Union</td><td>Defect of gap
</td></tr>
<tr><td>Atrophic
</td></tr>
</table>

Clinical features

- The classical clinical sign is painless abnormal mobility in more than one plane
- Deformities can be seen
- No tenderness in fracture site

X-ray





- Gap seen between fracture fragments
- No bridging callus
- Fracture ends are rounded with closed medullary canal
- Fracture ends are sclerotic

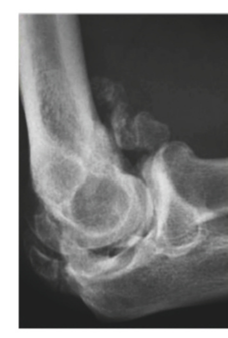
Management

- No role of conservative management
- Managed best by ORIF & Bone grafting

MYOSITIS OSSIFICANS

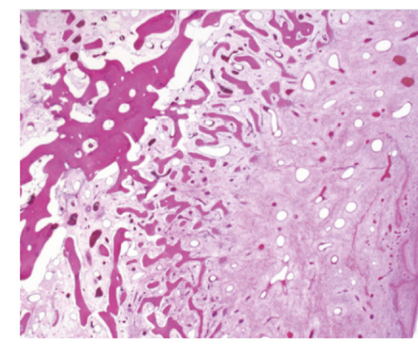
00:22:56

Myositis ossificans traumatica



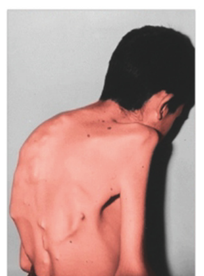
- AKA: Heterotopic ossification
- Ossification in unwanted/ ectopic sites
  - Long bones typically ossify endochondrally, whereas flat bones ossify membranously
- M/c cause: Ill advised massage
- 4 structures involved:
  - Muscle
  - Tendon

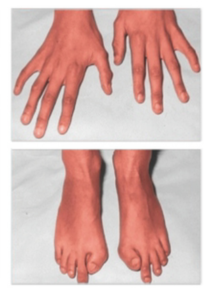
- Fascia
- Periosteum



- M/c site: Elbow → Brachialis
- Clinical features:
  - Pain, swelling, redness (blistering skin), range of movement ↓
- Differential diagnosis: Osteogenic sarcoma
- X-ray:
  - Fluffy mass
  - Periosteal elevation
- Confirmation is by biopsy: Ackermann's zone phenomenon
  - Inner cellular
  - Middle: Fibroelastic tissue
  - Outer: Mature lamellar bone
- Treatment:
  - Immobilize
  - Indomethacin for 6 weeks
  - Myositis mass excision

MYOSITIS OSSIFICANS PROGRESSIVA





- AKA: Fibrodysplasia Ossificans Progressiva
- Characteristics & Presentation
- It is a congenital condition
- Common age of presentation 5-15 yr
- It usually starts in the region of trapezius and latissimus dorsi
- Finally it involves all the joints.
- Common association:
  - Microdactyly
  - Klippel-Feil Syndrome
- Cause of death: Due to inter current infection → Respiratory failure
- Treatment
  - No curative treatment.
  - Bisphosphonates after excision of bony bars may reduce regeneration

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3. LOWER LIMB TRAUMA

HIP DISLOCATIONS

00:00:07

- Types:
  - Posterior dislocation - M/c
  - Anterior dislocation
  - Central dislocation - Least common

Feature	Anterior Dislocation (ADH)	Posterior Dislocation (PDH)
Mechanism of Injury	Air crash injury	Dashboard injury
Classical Attitude	Flexion, Abduction & External Rotation	Flexion, Adduction & Internal Rotation
Limb Length	Clinical lengthening	Marked shortening of the affected limb
M/c Nerve Injured	Femoral Nerve	
Vascular Sign of Narath	Negative	Positive

NEET PG 2019, 2021, 2024, 2025
FMGE 2020, 2021, 2024, 2025
AIIMS 2020, 2021, 2024, 2025

- In central dislocation of hip → Head is palpable in per rectal examination
- Differential Diagnosis of Positive Vascular Sign of Narath → Broken Shenton's Line
  - Posterior Hip Dislocation Hip
  - Congenital Dislocation Hip
  - Fracture Neck of the Femur
  - AVN Head of Femur
  - Tom Smith Arthritis
  - Girdlestone's Excision Arthroplasty → TB Hip

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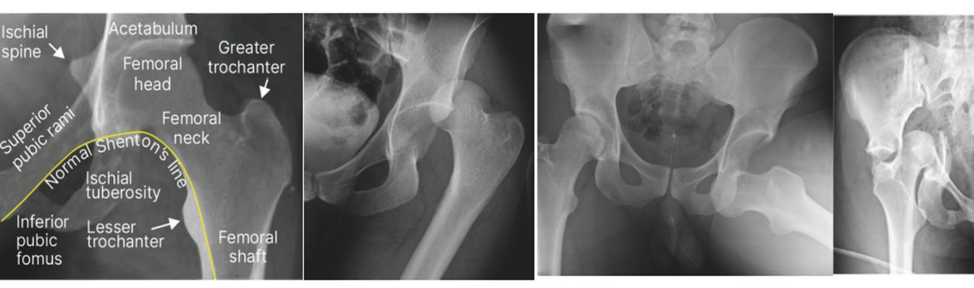


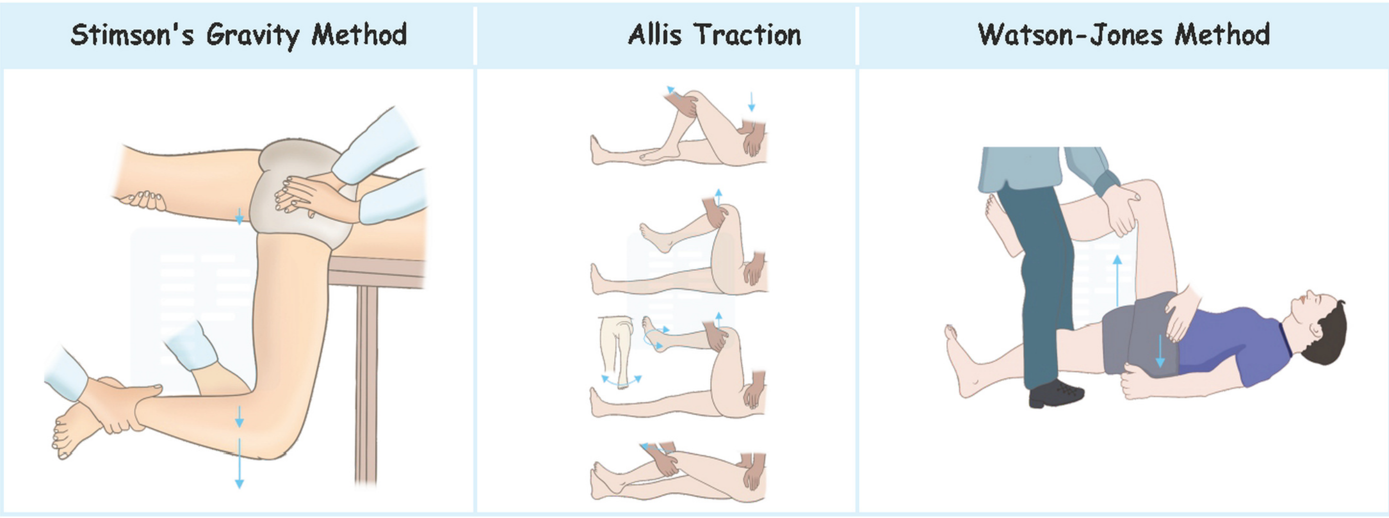
NEET PG 2019, 2021, 2024, 2025
FMGE 2020, 2021, 2024, 2025
INICET 2020, 2021, 2024, 2025

Treatment

- Dislocation hip is an orthopaedic emergency
- Usually, closed reduction is tried under anaesthesia
- Ideally, it should be reduced within 6-12 hrs
- After reduction, the hip is immobilized in thomas splint for 3 weeks
- Full weight bearing is allowed after 6 weeks
- Associated fracture is an indication for open reduction

Reduction Techniques

- Stimson's Gravity Method
- Allis Traction
- Bigelow's Method
- Classical Watson-Jones Method
- East Baltimore Technique



Complications

- M/c nerve affected is the sciatic nerve, specifically the peroneal division
- M/c vessel affected is the superior gluteal artery
- Myositis ossificans
- AVN femoral head
- Secondary osteoarthritis
- Recurrent dislocation
- Thromboembolism

FEMUR NECK OF FEMUR

00:06:50

FMGE 2023

- This occurs most commonly in Postmenopausal women

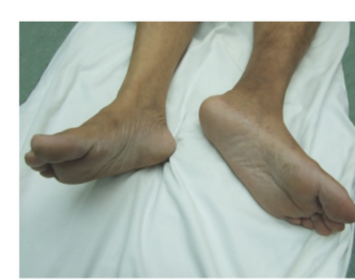
- Most of them break their neck & fall, rather than fall & break their neck
- Risk Factors for Fracture Neck of Femur in the elderly are:
    - Osteoporosis - M/c
    - Decreased physical activity
    - Impaired vision
    - Altered reflexes
    - Muscle atrophy

Mechanism Of Injury

AIIMS 2019

- In the elderly: Trivial falls or twisting injuries (lateral rotations).
- In young adults: High-energy trauma.
- Recent studies says the mechanism is cyclical loading

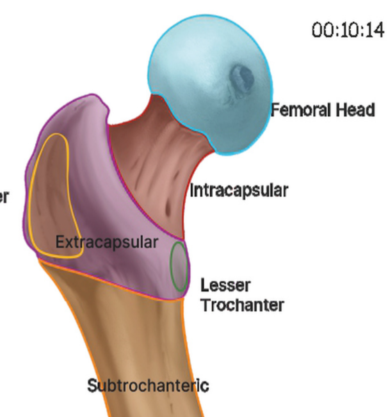
Clinical Features



- In Impacted NOF:
    - No gross limb deformities
    - Patients are able to stand or even walk
    - The only positive finding is anterior joint line tenderness
      → Anterior joint line: 2.5 cm below and lateral to the mid-inguinal point
- In Displaced NOF:
    - The patient cannot stand or walk
    - The affected limb is shortened and externally rotated
    - The vascular sign of Narath is positive

Classification

00:10:14

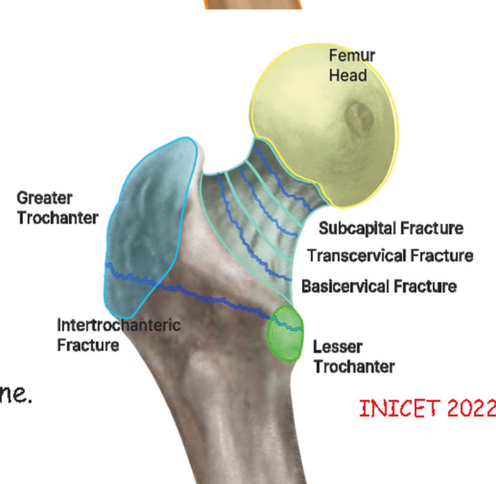


- 4 Important Classification Systems are available for NOF in Adults
    1. Broad Classification
    2. Anatomical Classification
    3. Pauwel's Classification
    4. Garden's Classification
- The Classification System for NOF in Children is the Delbet Classification

Broad Classification

- Intracapsular - Inside the Joint, 90%
- Extracapsular - Outside the Joint, 10%

Anatomical Classification



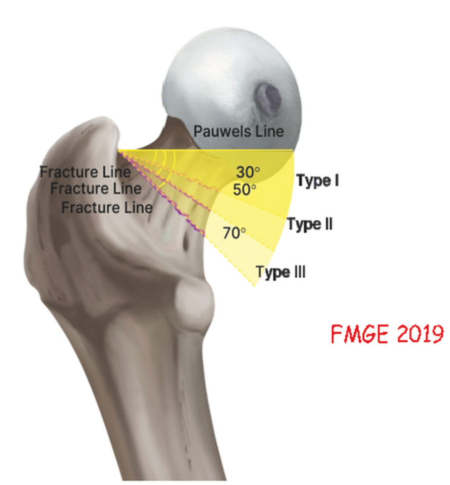
- Sub Capital - MC Type; Worst Prognosis → Avascular necrosis
- Transcervical - Middle Part of the Neck
- Basicervical - Below this, it becomes Extracapsular

Pauwel's Classification

INICET 2022

- Pauwel's Angle is the angle formed between horizontal line & fracture line.
    - Type I — <30°
    - Type II — 30 - 50°

- Type III – >70°
- As the angle increases, the prognosis becomes worse

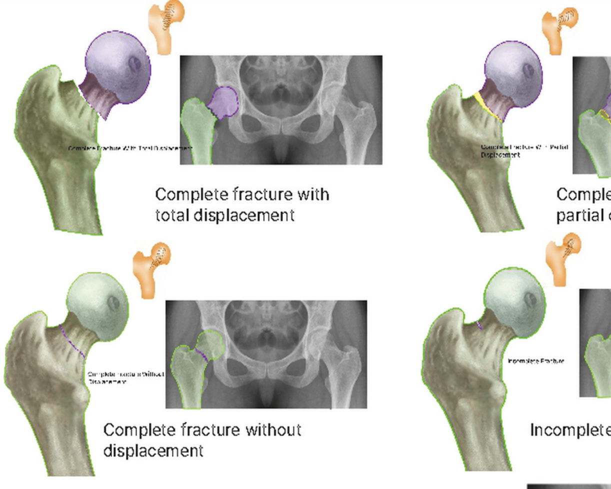


FMGE 2019

Garden Classification

- Based on:
  - Whether the fracture line is complete or incomplete
  - Displacement of fracture
  - Trabecular pattern in X-ray of the head of the femur, neck of the femur & the acetabulum

Type	Fracture Description	Displacement Status	Trabecular Alignment
Type I	Incomplete Fracture (Valgus Impacted)	Undisplaced / Impacted	Normally aligned between the acetabulum, head, and neck.
Type II	Complete Fracture	Undisplaced	Alignment is maintained across all three structures.
Type III	Complete Fracture	Partial Displacement	Trabecular pattern of femoral head is not aligned with acetabulum and neck.
Type IV	Complete Fracture	Total Displacement	Distal fragment is externally rotated & head comes in normal position. Trabecular pattern of head assumes parallel orientation with acetabulum (Worst Prognosis).

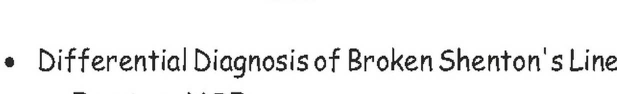


Complete fracture with total displacement

Complete fracture with partial displacement

Complete fracture without displacement

Incomplete fracture



- Differential Diagnosis of Broken Shenton's Line
  - Fracture NOF
  - PDH in Adults
  - DDH in Child

00:15:30

Treatment

- Fracture NOF in adults cannot be treated non-operatively
  - Orthopedic emergency

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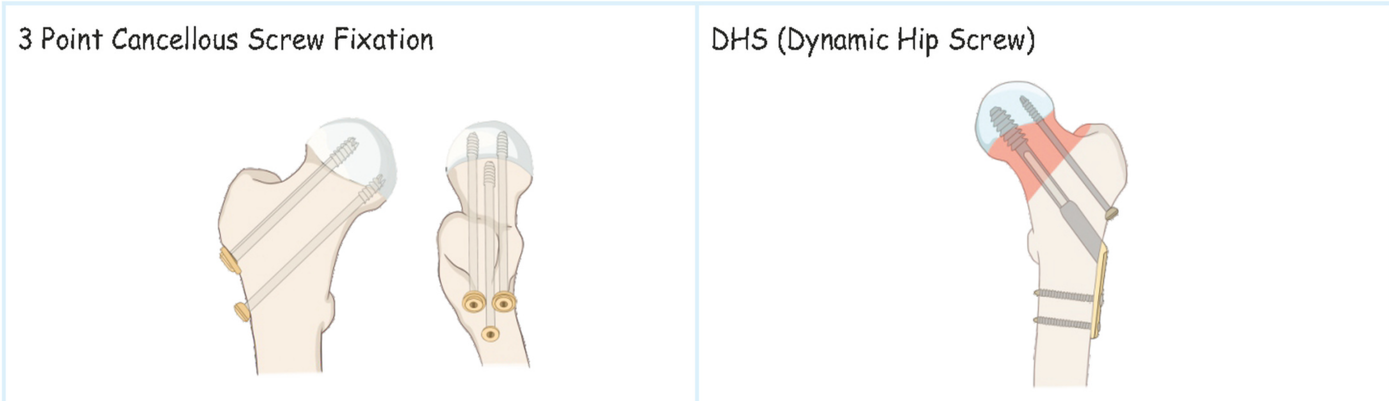
- Reduction and fixation required within 24 hours
  → Key management decision:
  → Conserve the femoral head OR Replace the femoral head
- Conserve the femoral head in:
  - Impacted fracture neck of femur in elderly
  - Fracture neck of femur in young adults
- Treatment of Choice:
  - Very active elderly → Total Hip Replacement (THR)
  - Home-bound / low-demand elderly → Hemiarthroplast

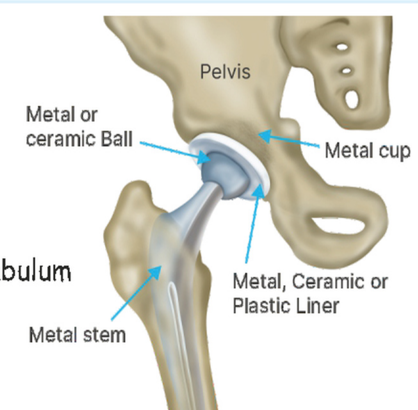
Toc According To Garden's Classification

Classification	Treatment of Choice (TOC)
Garden's Type I	Hip Spica, Moore's Pin, Knowles Pin
Garden's Type II	Three Point Fixation, DHS (Dynamic Hip Screw)
Garden's Type III/IV	Prosthetic Replacement

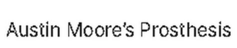
Conservative Surgeries For Nof



Prosthetic Replacement



- Hemiarthroplasty: Replacement of only the femoral head and neck.
  - Patient is over 60 years of age
  - If the calcar is sufficient - Austin Moore's Prosthesis
  - If the calcar is inadequate - Thompson's Prosthesis
- Total Hip Replacement (THR): Replacement of the femoral head and the acetabulum



Austin Moore's Prosthesis

Thompson's prosthesis

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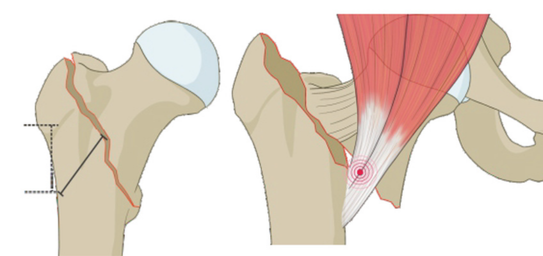
Complications

- The three main complications are:
  - AVN → 15 to 40%
  - Non-Union → 15 to 36%
  - Thromboembolism → 20%

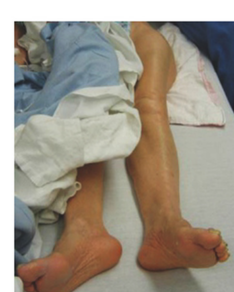
Intertrochanteric Fracture

00:20:00



- This is a fracture that occurs between Greater Trochanter & the Lesser Trochanter
  - The Gluteus Medius & Minimus (Abductors) are attached to GT
  - Iliopsoas (Flexors) is attached to the LT
- Leads to displaced fracture due to the pull of these attached muscles

Mechanism Of Injury



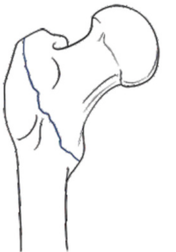
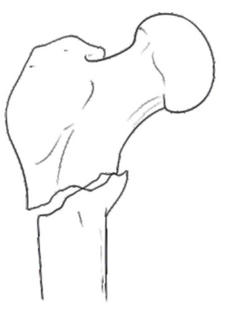
- In Elderly (M/c) - Trivial Fall due to Osteoporosis
- In Young Individuals (Rare) - High Energy Trauma

Clinical Features

- The Extremity Appears Shortened & Significantly Externally Rotated

Classification

Evans-Jensen Classification

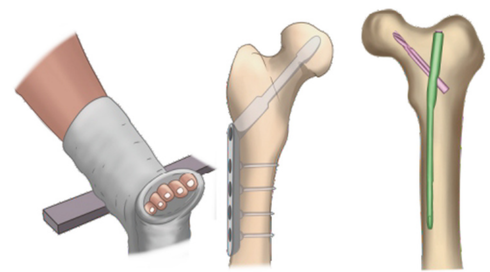
Type I: 	• Stable; characterized as undisplaced or displaced with intact medial support
Type II: 	• Unstable; characterized as a reverse oblique fracture

Boyd & Griffin Classification

Type	Key Features
Type I	• Fracture along the intertrochanteric line. • Extends from the Greater Trochanter (GT) to the Lesser Trochanter (LT). • Stable
Type II	• Same as Type I but with comminution (multiple bone fragments). • Unstable
Type III	• Fracture begins at or below the LT and extends into the subtrochanteric zone. • Unstable
Type IV	• Fracture begins at the LT and extends into the proximal shaft • Reverse oblique type • Unstable • Same as type 2 Evans-Jensen

Treatment

- Type-I fractures
  - Non-Surgical (Conservative):
    → Derotation Boot : for 45 days.
  - Surgical:
    → DHS (Dynamic Hip Screw)
- Other types: Proximal Femoral Nail



Complications

- Malunion is the M/c complication → Coxa Vara
- Secondary OA
- Nonunion → rare

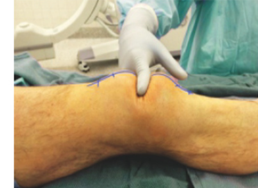
PATELLAR FRACTURE

00:27:12

Mechanism Of Injury

- Indirect Injury:
  - M/c injury type
  - Occurs when a person tries to prevent a fall
  - The forceful contraction of quadriceps leads to a Transverse Fracture
- Direct Injury:
  - Occurs when a person falls and there is a direct hit of the patella onto the ground.
  - This mechanism typically causes a Comminuted Fracture

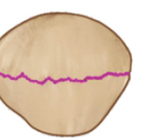
Clinical Features

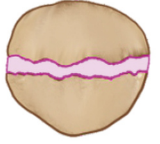


- Pain and Swelling: Located over the knee, often associated with Hemarthrosis
- Palpable Gap over the patella
- Loss of Extension: If the retinacular expansion is damaged, the patient cannot perform active knee extension

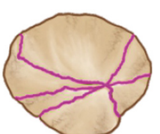
Classification

- Displaced Fractures: Gap is > 1-2mm
  - Transverse: Accounts for 85% (M/c)
  - Comminuted Fracture.
  - Oblique Fracture.
  - Vertical Fracture.
- Undisplaced Fractures: Gap is < 1mm

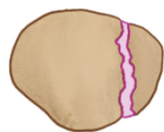

Undisplaced Transverse Fracture


Displaced Transverse Fracture

Displaced Lower Pole Fracture


Undisplaced Comminuted Fracture

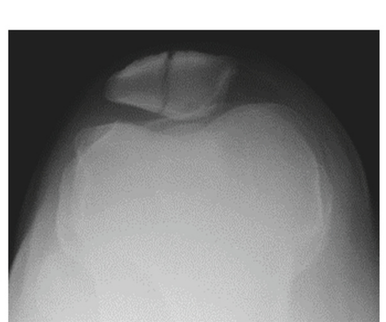
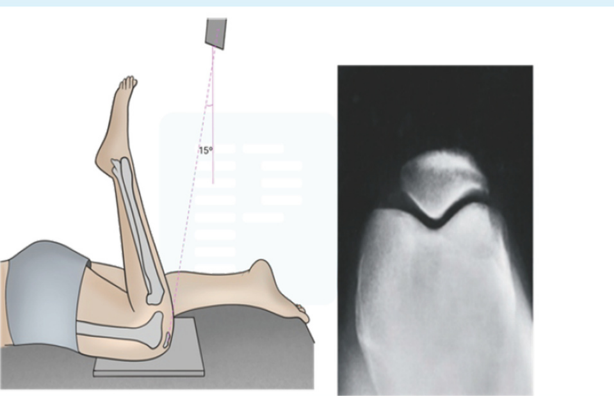
Displaced Comminuted Fracture


Displaced Vertical Fracture

Displaced Osteochondral Fracture

INICET 2021

X-Ray

Skyline View (Axial or Merchant view): 45°	Sunrise view: 110°
	

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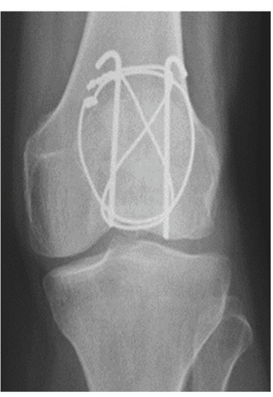
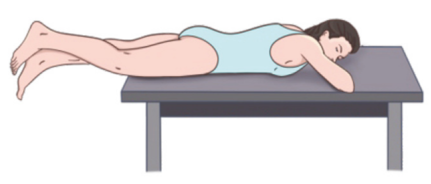
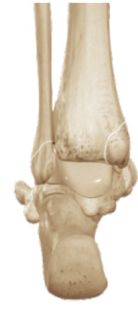
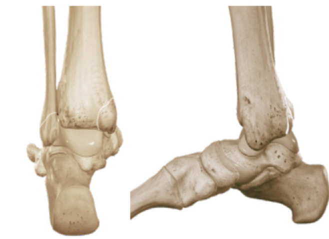
Treatment

Undisplaced 	Cylindrical Cast For displacement < 1-2 mm.
Displaced 	Surgery Should be performed within 7 days.
	Transverse fracture: Martin's Circumferential Wiring / TBW (Tension Band Wiring)
	Comminuted fracture: Patellectomy Complication of patellectomy: Extensor lag • The inability of the patient to perform the last 10° of extension. • Approximately 80% of Quadriceps strength is required to achieve the last 20° of extension. • Following a patellectomy, patients are often unable to achieve terminal extension of the knee joint 

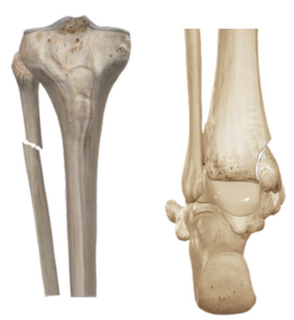
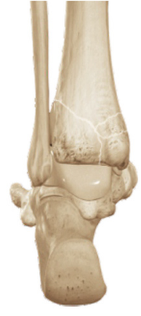
ANKLE FRACTURES

00:32:57
FMGE 2024

Pott's Fracture: 	A bimalleolar fracture caused by supination-adduction or pronation-abduction injuries. TOC: Surgery • Medial malleoli - Screw fixation • Lateral malleoli - Plate fixation
Cotton Fracture: 	• A trimalleolar fracture of the ankle due to supination and external rotation injury. • TOC: Surgery

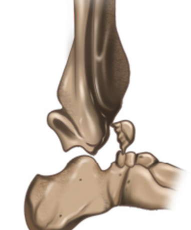
Yourwish

Yourwish

Maisonneuve's Fracture: 	• A fracture of the proximal 1/3rd of the fibula associated with injury to the distal tibiofibular syndesmosis and deltoid ligament with or without Medial Malleolar fracture • TOC: Surgery
Tibial Pilon Fracture: 	• Aka Tibial Plafond fracture, involving the distal tibia at its articulation with the talus, caused by high-energy axial loads. • TOC: Surgery

AVIATOR'S FRACTURE

00:35:14

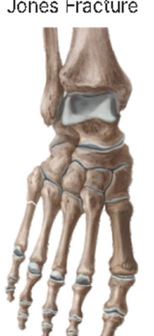


- This is Neck of Talus Fracture occurring in Pilots during crash landing due to impaction of Rudder Bar on the plantar aspect of the foot
- M/c cause for Talar Fractures - RTA, Fall from Height
- Mechanism of Fracture is HyperDorsiflexion of the Ankle
- Risk of Avascular Necrosis
- TOC: Surgery

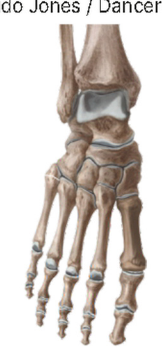
METATARSAL FRACTURES

00:36:09

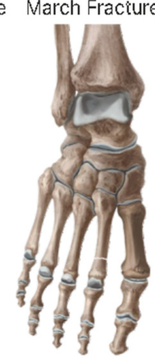
Jones Fracture

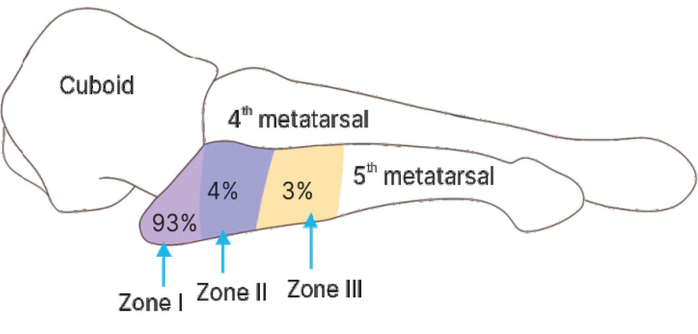


Pseudo Jones / Dancer Fracture



March Fracture





Jones Fracture	Typically located > 1.5 cm from the Tip
Pseudo Jones / Dancer Fracture	Typically located < 1.5 cm from the Tip
March Fracture	Typically refers to a stress/fatigue fracture of the metatarsal shaft (often the 2nd metatarsal)

Yourwish

4. PERIPHERAL NERVE INJURY

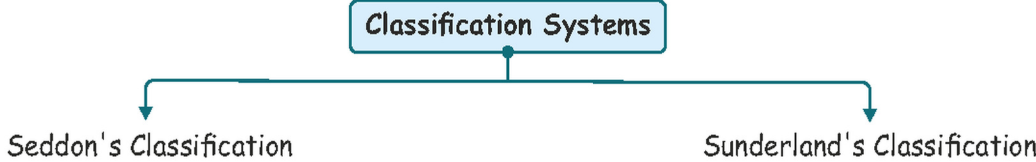
CAUSES OF PERIPHERAL NERVE INJURY

00:00:05

1. Trauma
   - M/c Cause
   - Stretching → Birth brachial plexus injury
   - Compression → in dislocations, Saturday night palsy, Crutch palsy
   - Laceration → : As in fracture and gunshot wounds
2. Uncontrolled diabetes mellitus
   - Second M/c cause:
3. Leprosy & Polio are rare causes

CLASSIFICATION OF PERIPHERAL NERVE INJURY

INI CET July 2021
FMGE June 2021



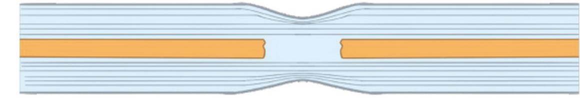
Seddon Classification

- Formulated in 1943
- Three types:
  1. Neuropraxia
  2. Axonotmesis
  3. Neurotmesis

Neuropraxia

- This is a transient episode of complete motor with a little sensory paralysis
- Temporary physiological disruption of nerve impulse
- Complete recovery is the rule
- It is thought to be a local reaction to ischemia that results in ion - induced conduction blockage
- No Wallerian Degeneration
- Tinel's Sign Negative
- Recovery begins within 2 to 3 weeks
  - Completes within 8 weeks
- Eg; Crutch Palsy, Saturday Night Palsy

Axonotmesis



- This is a more severe injury involving loss of continuity of the axon with maintenance of continuity of the outer sheath
- The Motor, Sensory & Autonomic Paralysis is complete and denervated muscle atrophy can be progressive

- Wallerian degeneration is seen
- Tinel's positive & progressive
- Motor march seen
- Recovery is never complete
- Eg; Closed Fractures & Dislocations

Neurotmesis

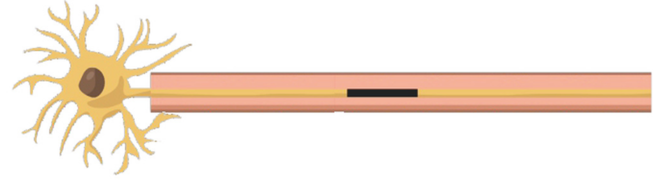
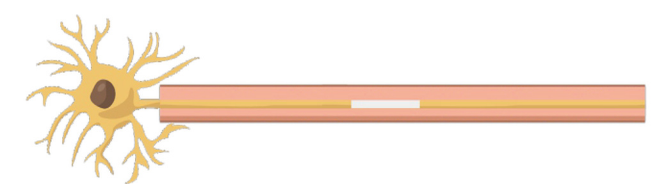
- This is complete transection of the nerve
- It is common in severe lacerated injuries
- Tinel's positive & non progressive
- Spontaneous recovery is not possible
- Requires nerve repair
- If widely separated ends - It forms proximally neuroma & distally glioma

Sunderland's Classification (1951)

00:04:17

- In this classification, injury to the peripheral nerve is arranged in ascending order of severity from 1st to 5th degree

1. First Degree Injury
2. Second Degree Injury
3. Third Degree Injury
4. Fourth Degree Injury
5. Fifth Degree Injury

FIRST DEGREE INJURY	• Conduction along the axon is physiologically interrupted at the site of the injury, but the axon is intact • No Wallerian degeneration • Spontaneous & complete recovery is the rule within few weeks (~8 weeks) • This corresponds to Seddon's Neuropraxia  Sunderland I Neuropraxia
SECOND DEGREE INJURY	• The axons are damaged with intact endoneurium • Neurological deficit is complete with loss of motor, sensory & sympathetic functions • Wallerian degeneration happens • Tinel's positive & progressive • Regeneration takes place & good functional return is achieved • This corresponds to seddon's axonotmesis  Sunderland II Axonotmesis

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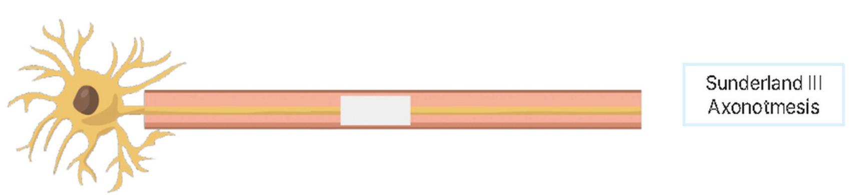
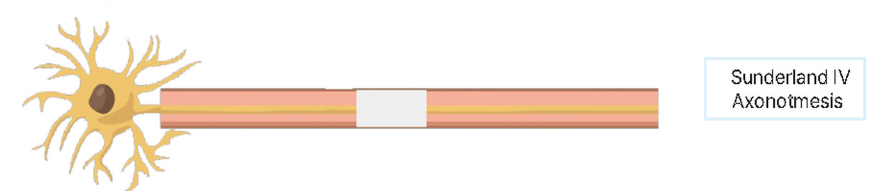
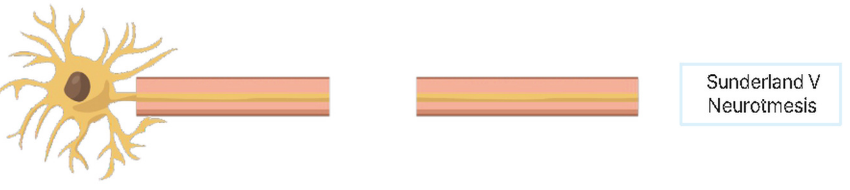
THIRD DEGREE INJURY	• In this axons & endoneurium are disrupted, but the perineurium is intact • The scar tissue within the endoneurium can hamper the recovery • Varying degree of permanent, motor or sensory deficit may persist • This corresponds to seddon's axonotmesis 
FOURTH DEGREE INJURY	• The axon & endoneurium are disrupted, but some of the epineurium & possibly some of the perineurium are preserved • The nerve continuity is maintained only by the scar tissue • So surgical intervention is compulsory to achieve the return of the function • This corresponds to seddon's axonotmesis 
FIFTH DEGREE INJURY	• The nerve is completely transected resulting in variable distance between the cut neural stumps • The injury occurs in open wound • Needs compulsory surgical intervention for recovery • This corresponds to seddon's neurotmesis 

Summary Table

Type 1	• Focal Conduction Block • No Wallerian degeneration	Equivalent to: Neuropraxia
Type 2	• Axonal Disruption	Equivalent to: Axonotmesis
Type 3	• Axon +Endoneurium Disruption	Equivalent to: Axonotmesis
Type 4	• Axon + Endoneurium + Perineurium Disruption	Equivalent to: Axonotmesis
Type 5	• Axon + Endoneurium + Perineurium + Epinerium disruption	Equivalent to: Neurotmesis

INVESTIGATIONS FOR PERIPHERAL NERVE INJURY

00:07:24

X-RAY	• This is needed to diagnose associated fractures and dislocations
MRI	• Very useful in brachial plexus injury to evaluate the avulsion nerve roots from the spinal cord

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NERVE CONDUCTION STUDIES	• Important means of evaluating the functional integrity of peripheral nerves • NCS combined with needle EMG can determine whether the nerve injury is complete or incomplete • Best guide to assess prognosis
EMG	• It is performed only after 4 weeks of nerve injury • If you do this before 4 weeks it will yield only false negative findings • Evidence denervation is indicated by presence of muscle fibrillation • Reinnervation is signalled by presence of motor unit potential (MUP)
HIGH RESONANCE USG	• Shows individual nerve fasciculi • Entire anatomical course of peripheral nerve can be depicted • Reveals the discontinuity of the nerve • Clearly shows scar tissue & presence of neuroma

GENERAL MANAGEMENT OF PERIPHERAL NERVE INJURY

00:09:13

- Closed nerve injury with neuropraxia can be managed conservatively using specific splints

Surgical Intervention

- Surgical intervention is needed if nerve injury doesn't show signs of recovery by 6 months

ENDONEUROLYSIS	• When the nerves are stretched or chronically compressed, internal scarring may occur. • So the epineurium is opened under microscope & scar within the nerve is removed • This is called endoneurolysis • This will restore the nerve continuity
NEURORRHAPHY	• This is a direct approximation of the cut ends • This should be done without nerve tension • Various methods to prevent nerve tension are: 1. Nerve Mobilisation 2. Nerve Transposition 3. Joint Flexion 4. Nerve Graft 5. Bone Shortening
NERVE GRAFT	• A segment of unrelated nerve is used to replace or bridge an injured portion of nerve, is called nerve grafting ○ The grafted nerve serves as a track along which sprouting axon can grow down to the target area ○ When large nerve gap is present, sural nerve is the preferred donor ○ When short nerve gap is present, the anterior branch of medial cutaneous nerve of forearm is a good donor
TENDON TRANSFER	• The main indication for tendon transfer is peripheral nerve injury that has no potential to recover • The critical period of nerve recovery is ○ 6 to 9 months in upper limb

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- 9 To 12 months in lower limb
- Tendon transfer is the only alternative to regain some or all functions after the critical period

BASIC CRITERIA THAT SHOULD BE FULFILLED BEFORE TENDON TRANSFER

1. The joints should be supple
2. It should pass through a healthy bed of tissue free from inflammation, edema, scar
3. Donor tendon should have adequate strength (Grade IV Power)
4. Donor muscle must be expandable
5. It should be synergistic muscles
6. Transfer should be in a straight line of pull
7. One donor muscle is for one single function

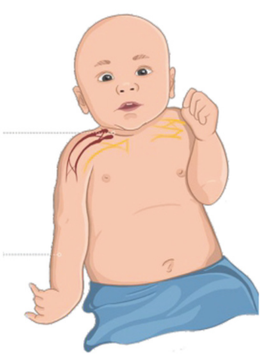
BRACHIAL PLEXUS INJURY

00:15:45

Erb's palsy

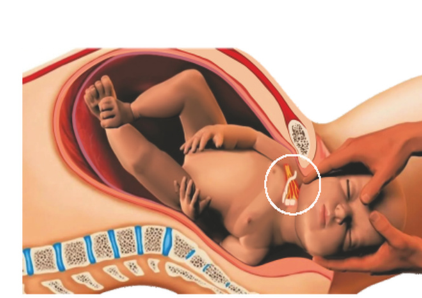
Introduction

- The Birth Brachial Plexus Palsy (Obstetric Plexus Injury) is partial or complete paralysis of upper Brachial Plexus - C5 & C6 roots
- The most commonly involved nerves in Birth Brachial Plexus injury are
  - Suprascapular Nerve
  - Musculocutaneous Nerve
  - Axillary Nerve
- In Erb's palsy, there is paralysis of the Deltoid, Biceps & Brachialis muscles with Loss of Sensation in the Arm
- The upper limb assumes a characteristic position with the arm hanging by the side, rotated internally with the elbow in extension & forearm pronated
- Waiter's Tip Hand / Police Man Tip Hand
  - Arm can't be Abducted
  - Elbow can't be Flexed
  - Forearm can't be Supinated



Mechanism Of Injury

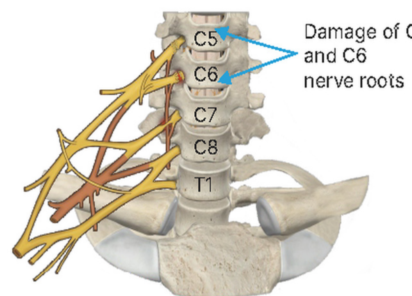
- It was generally accepted that the injury was in cases of shoulder dystocia & the mechanism was the traction to the neck caused by the pull by hand or instruments like forceps or vacuum
- Now it is believed that the trauma during delivery may not be the cause in every case, it could be caused by intrauterine maladaptation
- The classical birth plexus injury is the damage to C5, C6 roots but all roots can be involved

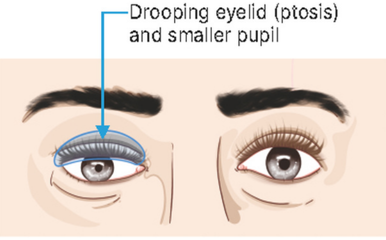


- The level & nature of root involvement vary from a neuropraxia to varying levels of axonotmesis to neurotmesis
- In the worst injuries, even a root avulsion is possible

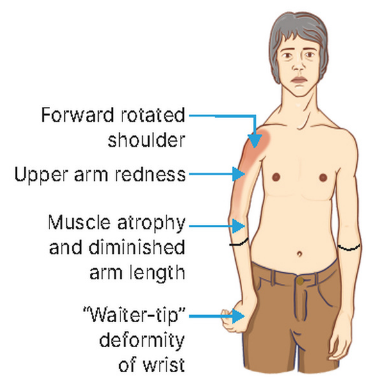
Clinical Features

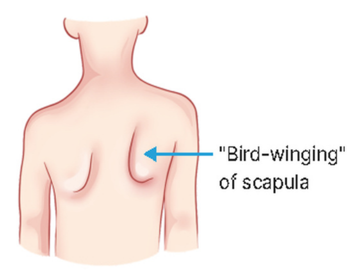
- Drooping eyelid (ptosis) and smaller pupil
- Forward rotated shoulder
- Upper arm redness
- Muscle atrophy and diminished arm length
- "Waiter-tip" deformity
- "Bird-winging" of scapula
- Horner's syndrome
  - Components
    - → Ptosis
    - → Enophthalmos
    - → Miosis
    - → Anhidrosis





Horner's syndrome





Treatment

- Spontaneous recovery is possible in nearly over 90% of cases & others may need surgery
- Electrophysiology study is recommended at 4 weeks initially to confirm the diagnosis & get a baseline reading

Surgical

- If there is no Biceps function at 3 months, surgery is indicated
- Surgery consists of a complete exploration of the supra & infraclavicular plexus & nerve repair using microsurgical techniques
- The source of nerve grafts is both sural nerves & the ipsilateral medial cutaneous nerve of forearm

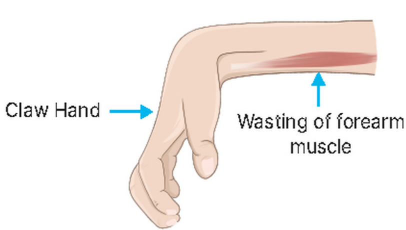
Secondary Surgery

- It is performed to treat either untreated older children or as a follow-up to primary nerve reconstruction
- Secondary surgery involves surgery on shoulder, elbow as well as the hand
  - Shoulder → Release of contracted pectoralis major & subscapularis or in late cases Derotation osteotomy of the humerus
  - Elbow → The surgery is directed towards restoration of either flexion or extension
    - → For elbow flexion, the Triceps is transferred to Biceps. The Latissimus dorsi also can be transferred
    - → For extension, the transfer of choice is Deltoid to Triceps
  - Hand → The Tendon Transfers are done depending on the paralysis

Klumpke's Palsy

00:22:11

- In Klumpke's Palsy, the lowest roots C8 - T1 are paralysed
- Clinically it presents as "Claw Hand"(Intrinsic Minus Hand) deformity, with numbness in the C8 to T1 distribution



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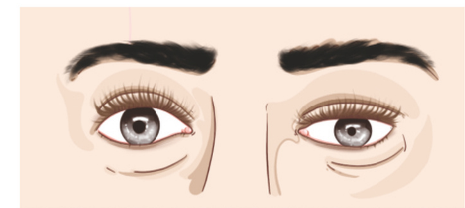
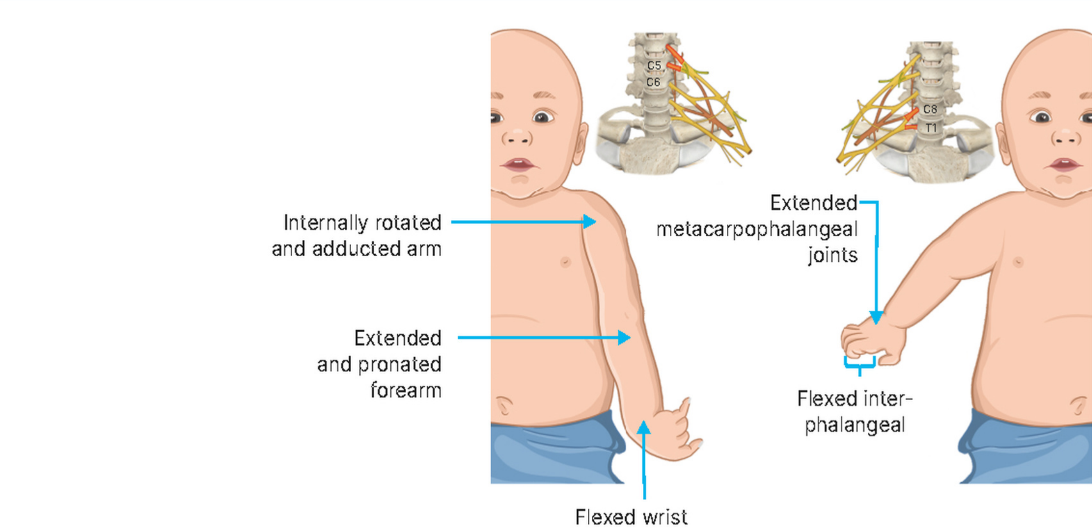
- If Horner syndrome is present, there is miosis (constriction of the Pupils) in the affected eye



ERB'S PALSY	KLUMPKE'S PALSY
• Internally rotated and adducted arm • Extended and pronated forearm • Flexed wrist	• Extended metacarpophalangeal joints • Flexed interphalangeal joints



RADIAL NERVE INJURY

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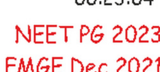

Causes

- In Arm
  - Holstein-Lewis fracture
    - → Fracture of the shaft of the humerus
    - → Junction of proximal 2/3 and distal 1/3
    - → Oblique fracture with radial nerve entrapment
  - Crutch palsy
  - Saturday night palsy
- In Forearm
  - Elbow dislocation
  - Fractures around the elbow
  - Tight pop cast

Radial Tunnel Syndrome

- In the forearm the nerve may be compressed at the tendinous origin of supinator ie, Arcade of Frohse

Wartenberg Syndrome / Watch Palsy

- It is the entrapment of superficial sensory branch of radial nerve in the distal forearm

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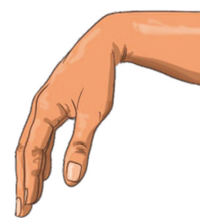
Clinical Presentation



Wrist Drop

- If lesion is at Axilla → Complete wrist drop
  - Elbow Extension → Lost
  - Wrist Extension → Lost
  - Finger Extension → Lost
  - Sensory loss over posterior part of forearm & dorsum of hand is lost
- Radial Groove → Complete wrist drop
  - Triceps Supply Is Preserved, So Elbow Extension Present
  - Extensor muscles of the wrist → Lost
  - Extensor muscles of the finger → Lost
  - Extensor muscles of the thumb → Lost
  - Sensory loss over the radial dorsal part of the hand & posterior part of the forearm
- At or Below Elbow
  - In isolated PIN palsy
    → Sensation is spared
    → Only finger & thumb drop present
  - In distal radial sensory lesion at wrist, no motor weakness, only numbness on dorsum of the hand sparing little finger

Treatment Of Radial Nerve Palsy

1. Cock-up Splint
2. Dynamic Splint
3. Nerve Repair
4. Tendon Transfers
   - If the nerve doesn't recover within 9 months after the repair

Jones Triple Tendon Transfer

- Three donor tendons were used.

Donor Tendon	Transferred to
Pronator teres	Extensor carpi radialis brevis
Flexor carpi ulnaris	Extensor digitorum communis
Palmaris longus	Extensor pollicis longus

- Disadvantages
  - Large incision
  - Multiple scars
  - Pronator bulge deformity

Modified Jones Transfer

- Only two tendons are used
- Pronator teres is not used

Yourwish

Donor Tendon	Transferred To
Palmaris longus	Extensor pollicis longus
Extensor carpi radialis	Extensor digitorum communis

- Advantages
  - Smaller Incision
  - More Cosmetic
  - No Bulging of PT

ULNAR NERVE INJURY

00:29:04

FMGE Jan 2025
INI CET Nov 2021

Cause

1. Dislocation of elbow
2. Supracondylar fracture
3. Ulnar nerve entrapment

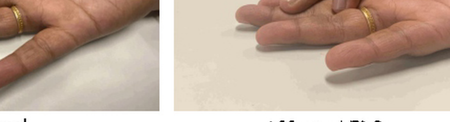
- M/c site of entrapment → Cubital Tunnel (Epicondylar Groove)
- 2nd Common site → Guyon's Canal

Clinical evaluation

1. Flexor digitorum profundus test

- Method:
  - Hold the middle phalanx of the little finger (stabilize PIP joint)
  - Ask patient to flex the terminal phalanx (DIP joint)
  - Positive Test: Inability to flex DIP joint → Ulnar nerve palsy
  - Negative Test: DIP flexion present → Normal FDP / intact ulnar nerve

Normal



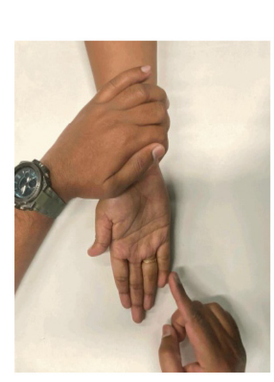
Affected FDP

2. FLEXOR CARPI ULNARIS TEST

- Method:
  - Ask the patient to ulnar deviate the wrist
  - Apply resistance
  - Positive Test
    → Weak or absent ulnar deviation → suggests ulnar nerve palsy
  - Negative Test
    → Normal ulnar deviation against resistance → FCU functioning normally / ulnar nerve intact

3. Abductor Digiti Minimi Test

- Method:
  - Ask the patient to abduct the little finger
  - Apply resistance
  - Positive Test: Weak or absent abduction of little finger → suggests ulnar nerve palsy
  - Negative Test: Normal abduction against resistance → abductor digiti minimi functioning normally / ulnar nerve intact

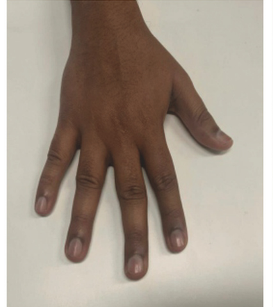


4. Card Test

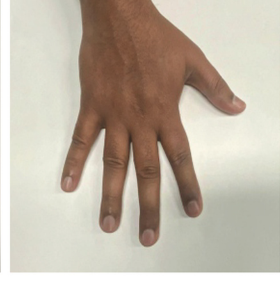
- Palmar Interossei Test
- Function: Finger adduction
- Method
  - Place a card/paper between two fingers
  - Ask the patient to hold it tightly
  - Positive Test: Card slips out / cannot be held → Ulnar nerve palsy
  - Negative Test: Card held firmly → Normal palmar interossei function / intact ulnar nerve

5. Dorsal Interossei Test

- Also called: Egawa test
- Function: Finger abduction
- Method
  - Place the palm flat on the table
  - Ask the patient to move the middle finger side-to-side
  - Positive Test: Inability to move the middle finger sideways → Ulnar nerve palsy
  - Negative Test: Normal side-to-side movement → Intact dorsal interossei / ulnar nerve



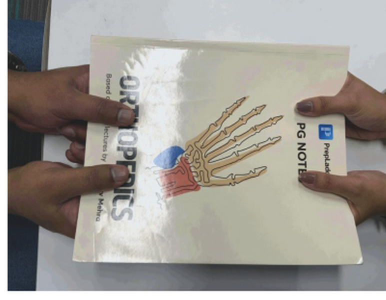
Normal



Affected Dorsal Interossei

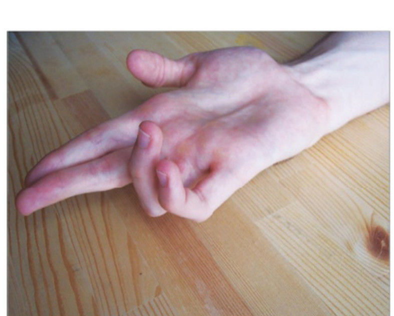
6. Froment Sign

- Also called: Book test
- Method: Ask the patient to hold a book between the thumb and index finger
- If the ulnar nerve is injured, the thumb flexes to compensate



Important Concepts

- Partial Claw Hand
  - Cause: Pure ulnar nerve injury
  - Features:
    - → Clawing of the ring finger
    - → Clawing of the little finger
  - Also called: True claw hand



- Total Claw Hand
  - Cause: Ulnar nerve + Median nerve injury
  - Features: Clawing of all fingers
- Ulnar Paradox
  - Definition: The higher the lesion → lesser the deformity
  - Called: Ulnar paradox
- Tardy Ulnar Palsy
  - Slowly developing ulnar nerve palsy
  - Occurs in: Cubitus valgus (Lateral condyle fracture)

Yourwish

- Mechanism

Progressive cubitus valgus

↓

Stretching of the ulnar nerve behind the medial epicondyle

Late-onset claw hand

Treatment

- The procedure to correct claw hand is of two types
  1. Static Procedures
     → Zancolli Capsulodesis
     → Zancolli Lasso Procedure
  2. Dynamic Procedures
     → Modified Bunnell Technique: The FDS Tendon of the middle finger is divided into number of slips
     → Brand Technique: Here ECRB is used as a power

MEDIAN NERVE INJURY

00:35:45

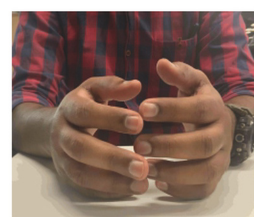
NEET PG 2023
FMGE 2021
INICET Nov 2025

Causes

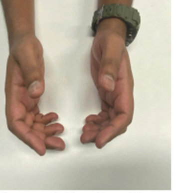
- In the Arm
  - Tight Tourniquet's
  - Humerus Fracture
- In the Elbow
  - Supracondylar Fracture
  - Posterior dislocation elbow
  - Entrapment at distal humerus by ligament of Struthers
- In the Wrist
  - Carpal Tunnel Syndrome

Clinical Evaluation

- Pointing Index (Ochsner's Clasp Test)

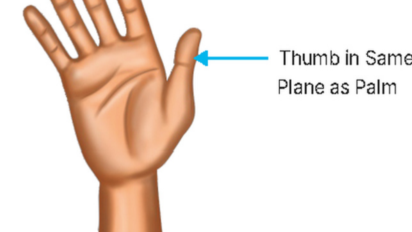


Normal



Affected Median Nerve

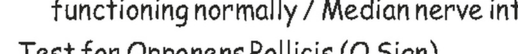
- The Ape Thumb Deformity (APB Paralysis)



- Pen test (Test for APB)
  - Method

Yourwish

- → Place a pen on the palm near the thumb
- → Ask the patient to lift/abduct the thumb perpendicular to the palm to touch the pen
  - Positive Test: Inability to abduct the thumb → Median nerve palsy
  - Negative Test: Normal thumb abduction → APB functioning normally / Median nerve intact



Normal

Affected APB

- Test for Opponens Pollicis (O Sign)
  - Method
  - → Ask the patient to touch the tip of the thumb to the tip of the little finger, forming an "O" shape
  - Positive Test
  - → Inability to oppose the thumb / cannot form "O" → Median nerve palsy
  - Negative Test
  - → Able to form "O" normally → Opponens pollicis functioning / Median nerve intact

Treatment

- If no recovery after nerve repair by 9 months in high lesions & 12 months in low lesions, tendon transfer should be done
- For High Median Nerve Palsy: The Transfer of BR or ECRL → FPL, restores the lost thumb flexion & side to side transfer of FDP of the index finger
- For Low Median Nerve Palsy: To restore the opposition of the thumb, the FDS of middle fingers or ECR is used

COMMON PERONEAL NERVE INJURY

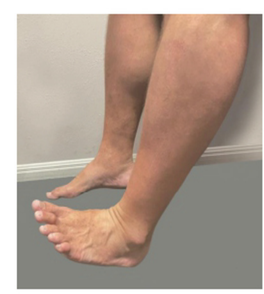
00:38:25

- Also called: Foot drop

Causes

- Neck of fibula fracture
- Posterior hip dislocation
- Knee dislocation
- Proximal tibia fracture
- Tight above → aboveknee POP cast

Clinical Features



- Foot drop
- High-stepping gait
- Inability to evert the ankle
- Decreased sensation over:
  - Dorsum of the foot
  - Outer part of the leg

Treatment

- If no recovery after 12 months: Tendon transfer required
- Tendon of Choice: Tibialis posterior tendon
  - Two common methods:

Yourwish

→ Through interosseous route → Barr technique
→ Circumtibial route → Ober's technique

- Double Tendon Transfer
  - Donor tendons: Tibialis posterior & Flexor digitorum longus

MCQ

00:40:36

Q. When the outer sheath and nerve fiber remain intact while the inner axons are affected, this condition is referred to as? INI CET July 2021

A. Neurapraxia
B. Axonapraxia
C. Axonotmesis
D. Neurotmesis

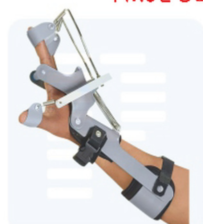
Answer: C

Q. The patient experiences an inability to extend their wrist upon waking up after sleeping with their arm hanging over the back of a chair. This condition is caused by? FMGE June 2021

A. Neurotmesis
B. Neurolysis
C. Axonotmesis
D. Neuropraxia

Answer: D

Q. The type of splint shown in the image is known as? FMGE Dec 2021



A. Wrist splint
B. Cock-up splint
C. Knuckle bender splint
D. Dynamic finger splint

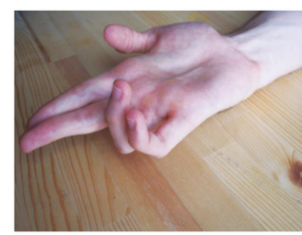
Answer : D

Q. In which of the following nerve injuries is the instrument shown below used? NEET PG 2023

A. Radial nerve
B. Median nerve
C. Ulnar nerve
D. Volkmann's ischemic contracture

Answer : A

Q. Which nerve is responsible for the following finding observed at rest? FMGE Jan 2025



A. Ulnar
B. Median
C. Musculocutaneous
D. None

Answer : A

Q. What condition is caused by nerve injury? INI CET Nov 2021

A. Ulnar nerve

B. Radial nerve

C. Median nerve

D. Posterior interosseous nerve

Answer : A

Q. In the orthopedics outpatient department, a female patient is presenting with difficulty sleeping at night due to experiencing numbness and tingling in the outer three digits of their hand. The symptoms improve when the patient hangs their arms from the bed. Which of the following choices identifies the patient's condition and the test employed to evaluate it? NEET PG 2023

A. Guyon's canal syndrome, Froment's test

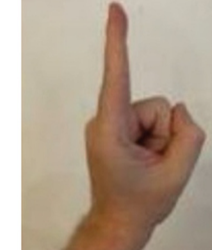
B. Carpal tunnel syndrome, Froment's test

C. Guyon's canal syndrome, Durkan's test

D. Carpal tunnel syndrome, Durkan's test

Answer : D

Q. After a surgical procedure, the patient demonstrates a particular clinical sign. Which specific nerve is likely to be damaged in this case? FMGE June 2021



A. Radial nerve

B. Median nerve

C. Ulnar nerve

D. Radial artery

Answer : B

Q. While examining a patient with a right forearm fracture, you ask him to make a fist. The following finding is noted during this procedure. What is the sign called? FMGE June 2021

A. Froment's sign

B. Pointing index sign

C. Benediction sign

D. Policeman tip deformity

Answer : B

Q. A 7-year-old boy presents to the emergency department after falling on an outstretched hand. X-ray shows an extension-type supracondylar fracture of the humerus. On examination, he is unable to make an "OK" sign with the thumb and index finger. Which structure is most likely injured? INICET Nov 2025

A. Ulnar nerve

B. Median nerve

C. Brachial artery

D. Radial nerve

Answer : B

Yourwish

5. BONE TUMORS PART-1

- MC primary benign tumour- Osteochondroma
- MC malignancy of bone- Metastasis
- MC primary malignant bone tumour- Multiple Myeloma
- MC non-hematological primary malignant bone tumour- Osteogenic Sarcoma

WHO CLASSIFICATION OF BONE TUMORS

00:01:18

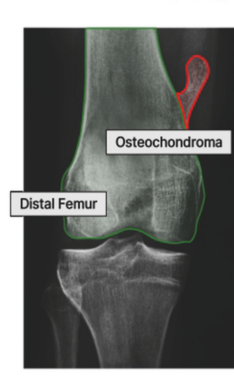
Cell type	Benign	Malignant
Osteogenic	• Osteoid osteoma • Osteoblastoma	• Osteogenic sarcoma
Cartilagenous	• Osteochondroma (AKA Exostosis) • Enchondroma • Chondroblastoma • Chondromyxoid fibroma	• Chondrosarcoma
Fibrogenic	• Non-ossifying fibroma • Fibrous dysplasia • Benign fibrous histiocytoma	• Fibrosarcoma FMGE 2019, 2020
Bone Marrow	• Eosinophilic Granuloma	• Ewing's Sarcoma • Multiple Myeloma • Lymphoma
Giant Cells	• Giant Cell Tumour	• Malignant Giant Cell Tumour
Uncertain Origin	• Unicameral Bone Cyst • Aneurysmal Bone Cyst	• Unicameral Bone Cyst • Aneurysmal Bone Cyst

OSTEOCHONDROMA

00:03:57

FMGE 2021, 2023
INICET 2023

- AKA Exostosis
- MC benign bone tumour
- 20-50% of all benign tumours & 9% of all bone tumours
- It is an offshoot from the spongy bone tissue covered with a cartilaginous cap
- Classically occurs in the metaphysis of a long bone
- MC site: Distal Femur, Proximal Tibia (knee), Proximal Humerus
- MC age: Growth period
- MC sex: Male

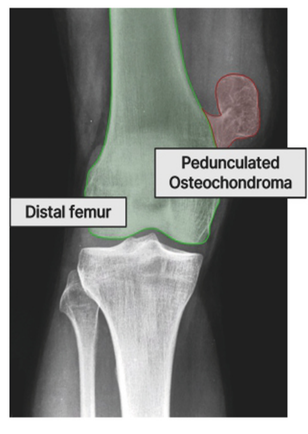
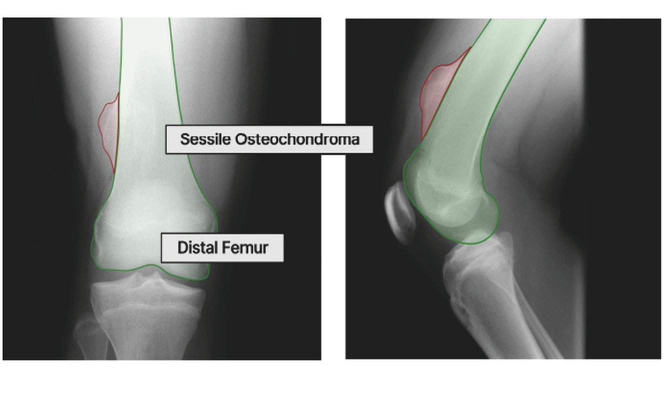


Yourwish

Yourwish

Types

- There are two types Of Osteochondroma

Pedunculated	Sessile
• This is the MC type • This has a stalk directed away from physis • A cartilaginous cap covers the bony mass • 1% chance of malignant transformation	• Very rare • No Stalk • Associated with HME • 3-5% chance of malignant transformation
	

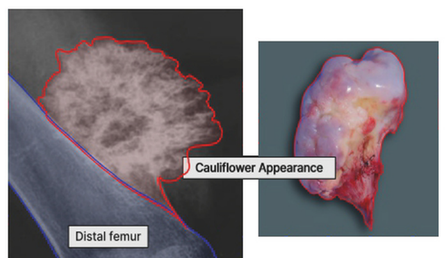
Clinical Features

- Most often, it is asymptomatic
- Can present as a hard mass around the joint
- Pain usually does not occur with osteochondroma. If it occurs, suspect the following;
  - Bursitis (MC)
  - Neurovascular compression
  - Fracture of exostosis
  - Malignant transformation

Imaging

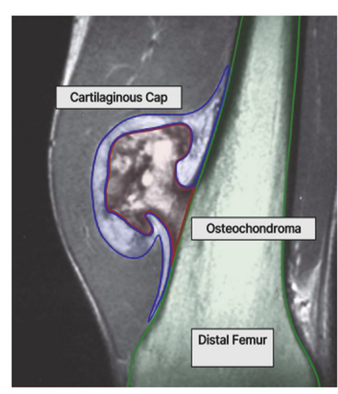
X-Ray

- Shows whether it is pedunculated or sessile
- There will be a broadening of metaphysis from which it arises
- Cartilaginous cap is seen only if it is calcified, with a classical Cauliflower appearance



MRI

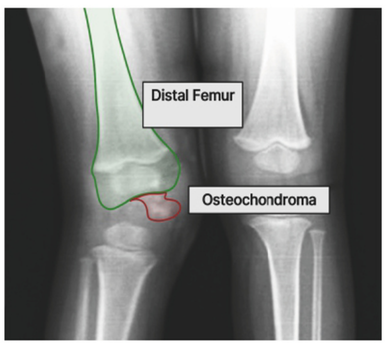
- If we suspect malignancy, MRI is the best investigation, because it gives the exact thickness of the cartilaginous cap

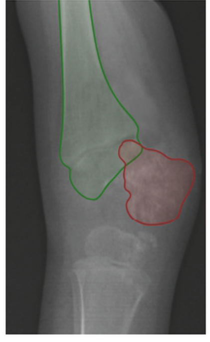


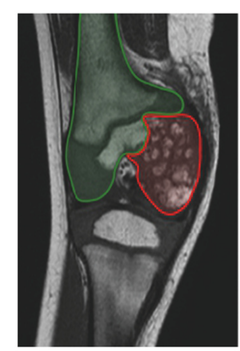
Trevor's Disease

- This is Dysplasia Epiphysealis Hemimelica
- This is an intra-articular epiphyseal osteochondroma
- It involves multiple joints & is always unilateral

Yourwish

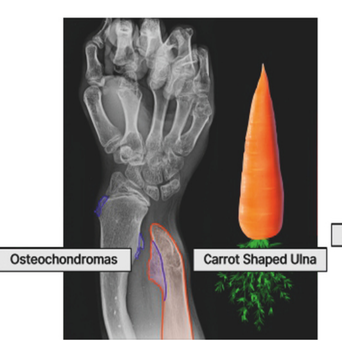


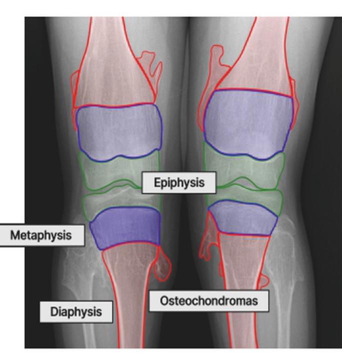




Multiple Hereditary Exostosis

- This is otherwise called Diaphyseal Achalasia
- Autosomal dominant
- More common in men
- It is often multiple & causes growth retardation
- Deformities like knock-knee, bowing of the radius & shortening of the ulna can happen
- X-ray distal Ulna - Carrot-shaped





Risk Factors And Signs Of Malignant Transformation

- 1% chance in solitary osteochondroma & 5% chance in MHE
- Sessile > pedunculated
- Osteochondroma transforms into low-grade chondrosarcoma
- Sudden increase in size
- New onset of pain without h/o of trauma
- Cartilaginous cap thickness >2 cm in MRI
- Confirmed by biopsy

Treatment

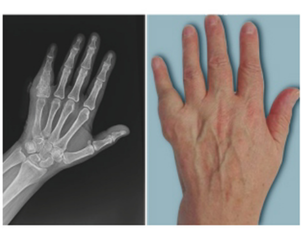
- If asymptomatic, leave it alone
- If there is persistent pain or suspicion of malignancy, surgery is indicated
- Extra periosteal excision with cartilaginous cap is the TOC
- Malignant osteochondroma - Wide surgical resection with limb preservation

ENCHONDROMA

00:13:44

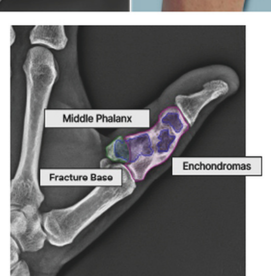
NEET PG 2022
FMGE 2023
INICET 2023

- MC tumour of small bones of the hand & feet
- Benign tumour of hyaline cartilage
- MC age- 10-30 Yrs
- MC site- Medullary canal of phalanges, especially ring & little finger
- It has the potential to undergo malignancy



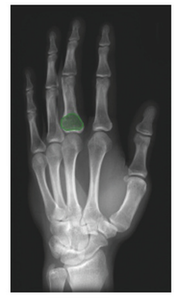
Clinical Features

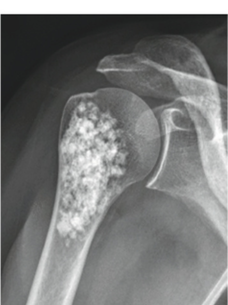
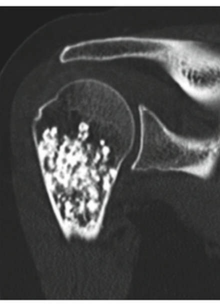
- Mostly asymptomatic or an incidental finding
- The first presentation may be a pathological fracture



X-Ray

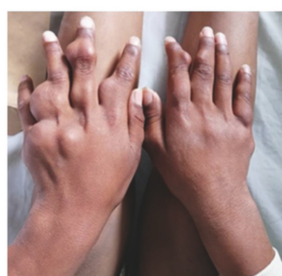
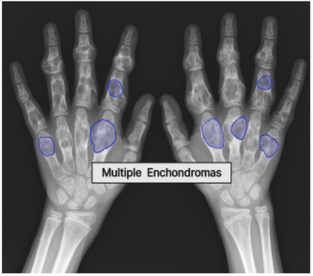
- The cartilaginous lobule undergoes enchondral ossification, resulting in the characteristic 'O' Ring Sign
- Stippled calcification
- Expanded lytic lesions with a wisp of calcification is very pathognomonic
- Popcorn calcification



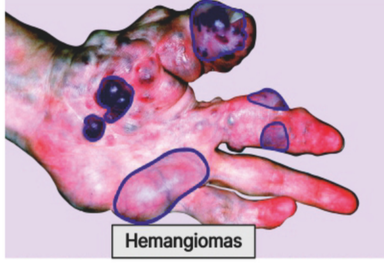



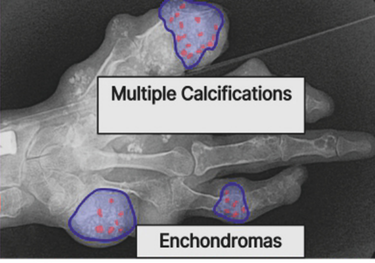
Ollier's Disease & Maffucci's Syndrome

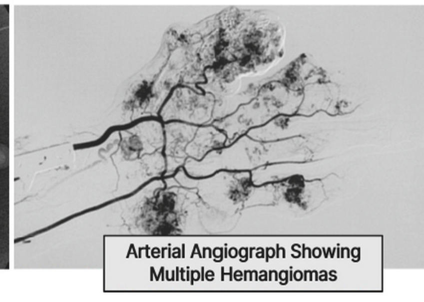
- Multiple enchondromatosis is called Ollier's disease

- When Ollier's disease had superadded hemangiomas of the overlying soft tissue, it is called Maffucci's Syndrome







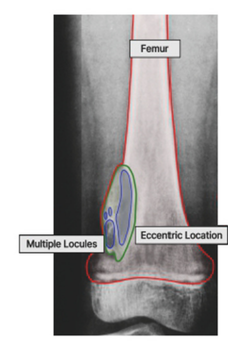
Treatment

- Extended curettage with wall cauterization is the TOC
- Recurrence is very common
- Chondroma of the pelvis has the worst prognosis

ANEURYSMAL BONE CYST

00:17:33

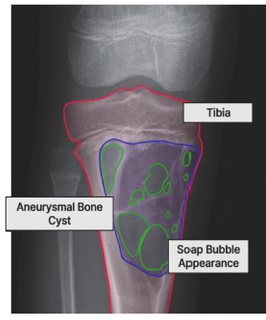
- Benign, solitary, expansile & erosive lesion of the bone
- 1% of all benign bone tumours
- MC age- <20 Yrs
- MC sex- Females
- MC site- Lower end of femur, Upper end of tibia, Upper end of humerus
- Classically occurs in the metaphysis of long bones



Yourwish

Clinical Features
- Pain & swelling
- Can present with a pathological fracture

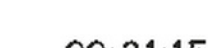
Differential Diagnosis
- UBC (Unicameral Bone Cyst): Osteolytic lesion present centrally
- GCT (Giant Cell Tumor):
  - This also presents eccentricity and has a soap bubble appearance
  - Only be differentiated on biopsy
    → Only giant cell: GCT
    → Hemosiderin with giant cell: Aneurysmal bone cyst
- Osteoblastoma
- Telangiectatic Osteosarcoma



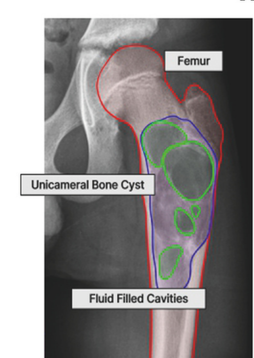
X-Ray
- An osteolytic lesion is present eccentrically in the metaphysis
- Periosteum is elevated & the cortex is eroded to a thin margin
- It gives a blow-out or soap bubble appearance

Treatment
- TOC for ABC is curettage with or without bone grafting, depending upon the size of the void

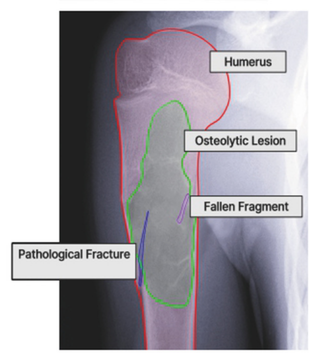
UNICAMERAL BONE CYST



- This is otherwise known as a simple bone cyst
- It's a benign fluid-filled cavity that enlarges over a long time
- MC age- <20 yrs
- MC site- Proximal humerus
- Classically occurs in the metaphysis of long bones

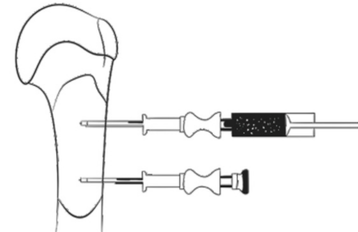


Clinical Features
- Usually asymptomatic
- Incidentally found on X-rays
- If the patient presents with pain & swelling, suspect a pathological fracture



X-Ray
- Osteolytic lesion present centrally in the metaphysis with a well-demarcated outline
- Fallen fragment sign: Very characteristic (as it is gravity dependent)

Treatment
- If asymptomatic, leave it alone
- Pathological fracture is immobilized with POP
- Symptomatic UBC- TOC is curettage with or without bone grafting, depending upon the size of the void
- Aspiration & intralesional injection of corticosteroids, bone marrow aspirate, or demineralized bone matrix can be tried



Yourwish

PYQS

Q. A woman, during her routine examination, presents with the following X-ray finding. What is her most likely diagnosis?

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a. A multiple brown tumour
b. Fibrous dysplasia
c. Multiple Enchondromas
d. Multiple exostoses

Ans: c

Q. A patient has a painless, palpable bony mass near the metaphysis of a long bone. The X-ray done shows the following findings. What is the most probable diagnosis?

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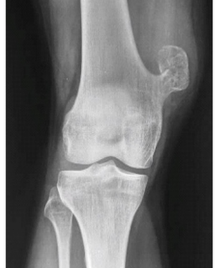
a. Osteosarcoma
b. Multiple myeloma
c. Osteochondroma
d. Osteoid osteoma



Ans: c

Q. A 22-year-old male presents with pain and swelling over the distal radius. X-ray shows an expansile lytic lesion in the metaphysis. Fine needle aspiration (FNA) reveals a bloody aspirate with hemosiderin-laden macrophages. What is the most likely diagnosis?

FMGE Jan 2025

a. Giant cell tumor
b. Aneurysmal bone cyst
c. Osteosarcoma
d. Chondroblastoma

Ans: b

Yourwish

6. BONE TUMOR PART-2

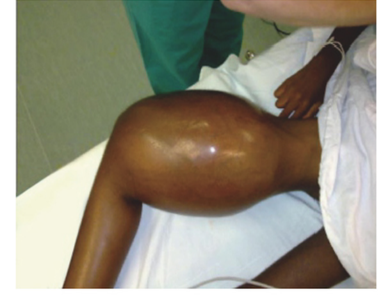
OSTEOGENIC SARCOMA

00:00.06

AIIMS 2020

- MC non-hematological primary malignant bone tumour
- 2nd MC primary malignant bone tumour
- It arises from multifactorial mesenchymal tissue
- MC age- 15-25 yrs
- MC site- Distal end of femur, upper end of tibia
- MC sex- Male
- Classically occurs in the metaphysis of a long bone
- Predisposing factors
  - DNA virus- Polyoma & SV-40 virus
  - RNA virus- Harvey & Moloney mouse sarcoma virus
  - Radiation- >2000 rads
  - Chemicals- Beryllium & Methylcholanthrene

CLINICAL FEATURES



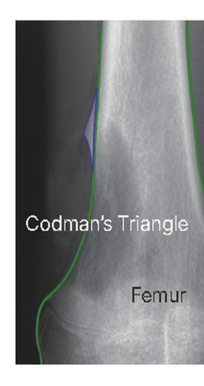
- Pain is the first symptom (because the periosteum is sensitive to pain)
- Swelling appears a few weeks later
- Skin over the swelling is stretched, shiny, and with prominent veins
- Swelling is firm to hard in consistency
- Osteosarcoma is very dangerous because it spreads to the lung very fast (Hematogenous spread)

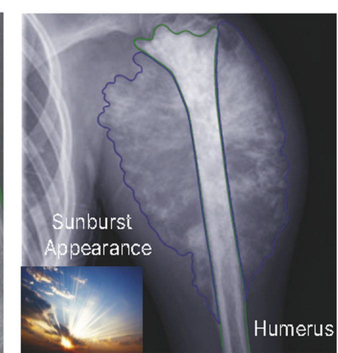
Secondary Osteosarcoma

- Paget's disease
- Irradiation
- Hereditary multiple exostosis
- Chronic osteomyelitis
- Bone infarction

X-Ray

- Location: It appears in the metaphyseal area either centrally or from the cortex
- Hazy Osteolytic area alternating with dense Osteoblastic area
- It can present with two forms of periosteal reaction:
  - Codman's triangle due to periosteal elevation
  - Sunburst or Sunray appearance: D/t microcalcification along the vessels

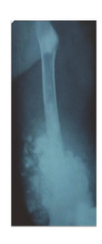




Important Information

- Periosteal elevation is seen in
  - Acute osteomyelitis
  - Osteogenic sarcoma
  - Syphilis
  - Scurvy

Bone Scan



- Tc99 Methylene diphosphonate (Tc99 MDP)
- This helps to identify Skeletal metastasis & skip lesions.

Treatment

- Surgery
  - Early & Radical ablation is the surgery of choice
- Amputation remains a mainstay
  - Preferred levels:
    - → Upper end of humerus - Forequarter amputation
    - → Upper end of tibia - Mid thigh amputation
    - → Upper end of femur: Hindquarter amputation with hip disarticulation
    - → Lower end of femur: Mid thigh amputation with hip disarticulation
- Radiotherapy
- Radiation is given preoperatively to decrease the viable cells & get disseminated into the bloodstream
- Total dose: 6000 to 8000 Rads or 230 Rads/day or 1000 Rads/week
- Chemotherapy
  - It is given pre & postoperatively to control micro metastasis
  - The drugs used are:
    - → Methotrexate
    - → Citrovorum factor
    - → Adriamycin
    - → Endoxan
    - → Cisplatin
- Sandwich therapy/Combined approach: Radiotherapy → Neoadjuvant chemotherapy → Surgery → Post OP chemotherapy
- Newer Techniques
  - Limb salvage with tumour endoprosthesis
  - Immunotherapy
    - → The sensitized lymphocytes from the survivors are infused into the patient
    - → The immunological status is increased by giving:
- BCG vaccine
- Allogeneic sarcoma tumour cell vaccine

Prognosis

- Without treatment, death occurs in 6 months to 2 Yrs
- With a combined approach, a 5-year disease-free life is seen in 70% of patients

Yourwish

GIANT CELL TUMOUR

00:12.04

AIIMS 2019
INICET 2021, 2022, 2024
FMGE 2020, 2021, 2022, 2024, 2025
NEET PG 2019, 2020, 2021, 2023

- AKA Osteoclastoma
- MC age- 15-35 yrs
- MC sex- Male
- MC site- Lower end of femur, Upper end of tibia
- Though it is benign, it behaves locally as malignant
- Classically occurs in the epiphysis of a long bone after epiphyseal closure

Clinical Features

- Swelling is the main complaint
- Pain is a late feature
- If sudden pain happens, suspect a pathological fracture
- Skin over the swelling looks shiny, but no dilated veins
- On palpation, it gives an eggshell crackling sensation
- Although GCT is benign, pulmonary metastasis occurs in 3% of cases

X-Ray

- Shows an eccentric lytic lesion in the epiphysis with a tendency to extend into the subchondral bone
- There is no visible mineralization within the tumour matrix
- There is no periosteal new bone formation
- Multiloculated, expansile lytic lesion with internal trabeculations & an intact cortex — Soap Bubble Appearance

Important Information

- Giant Cell Variants
  - Chondroblastoma
  - Aneurysmal bone cyst
  - Brown tumour
  - Fibrous dysplasia
  - Non-ossifying fibroma
  - Adamantinoma

Treatment

- Simple curettage:
  - This is the standard method of treatment
  - Here, the recurrence rate is high
- Extended curettage (TOC)
  - A power burr is used to enlarge the cavity 1-2 cm in all directions
  - This is done to prevent recurrence
- Curettage with bone grafting
- Curettage with bone cementing
- Additional Management
  - Embolization: For inoperable lesions in the spine or pelvis
  - Local Irradiation: Only for inoperable lesions

Yourwish

Yourwish

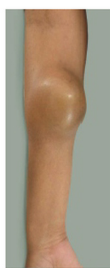
- Bisphosphonates: As a surgical adjuvant or in inoperable cases
- Denosumab: DOC (increases maturation of osteoclasts)

EWING'S SARCOMA

00:17.14

- AKA Small blue cell tumour
- It arises from the endothelial cells of the bone marrow
- MC age- 5-25 yrs
- MC sex- Male
- MC site- Lower end of femur, Upper end of tibia
- Classically occurs in the diaphysis of a long bone
- Highly sensitive to radiotherapy, but radiotherapy is not the TOC

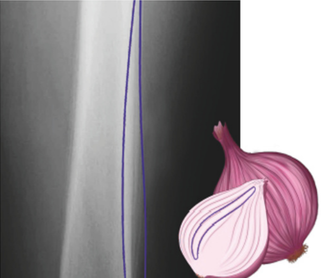
Clinical Features

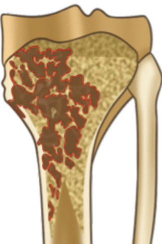
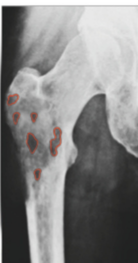


- Clinical presentation resembles osteomyelitis closely
- Local swelling, erythema
- Metastasis to bone, bone marrow & lungs

X-Ray

- Onion Peel Appearance (multiple layers of stripped periosteum)
- Moth-eaten appearance
- Cracked ice appearance



Differential Diagnostics

- Chronic osteomyelitis
- Reticulum cell sarcoma
- Eosinophilic granuloma
- Neuroblastoma
- Fibrous dysplasia
- Metastasis

Treatment

- Chemotherapy (VIDE Regimen)
  - Vincristine
  - Ifosfamide
  - Doxorubicin
  - Etoposide
- Surgery: After chemotherapy, the remaining tumour is surgically resected
- Radiotherapy: Not routinely used as it causes growth disturbances in growing children; reserved only for localized lesions

Yourwish

MULTIPLE MYELOMA

00:22.29

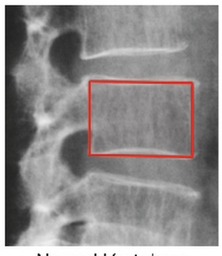
- Malignant tumour arising from a plasma cell of the bone marrow
- MC primary malignant bone tumour in adults
- MC age- 50-80 yrs
- MC sex- Males
- MC site- Vertebra, Skull, Pelvis, Rib
- Types:
  - Solitary plasmacytoma- Rare
  - Multiple myeloma

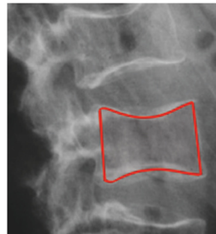
CLINICAL FEATURES

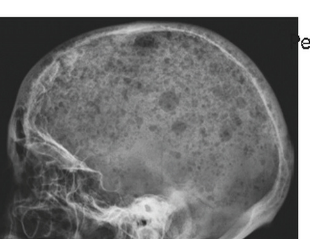
- Bone pain is the main symptom; initially intermittent, it later becomes intense & constant.
- Systemic symptoms like anemia, loss of weight, and renal failure
- Hypercalcemia is a late feature
- The patient may present with pathological fractures
- Intercurrent infection due to leukopenia

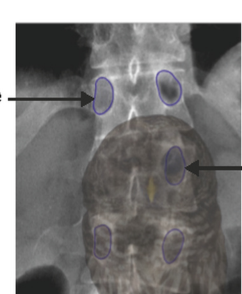
X-Ray

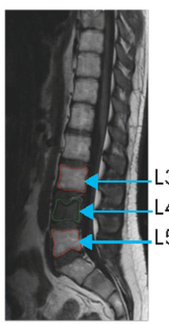
- Biconcave vertebrae
  - AKA Cod fish vertebrae
    - → First DD is osteoporosis
    - → Next is Multiple Myeloma
- Punched out lesions in the skull(Raindrop skull)
- Pedicle sign(Winking Owl Sign)
- Wanishing/collapsing/disappearing vertebrae


Normal Vertebrae


Biconcave Vertebrae







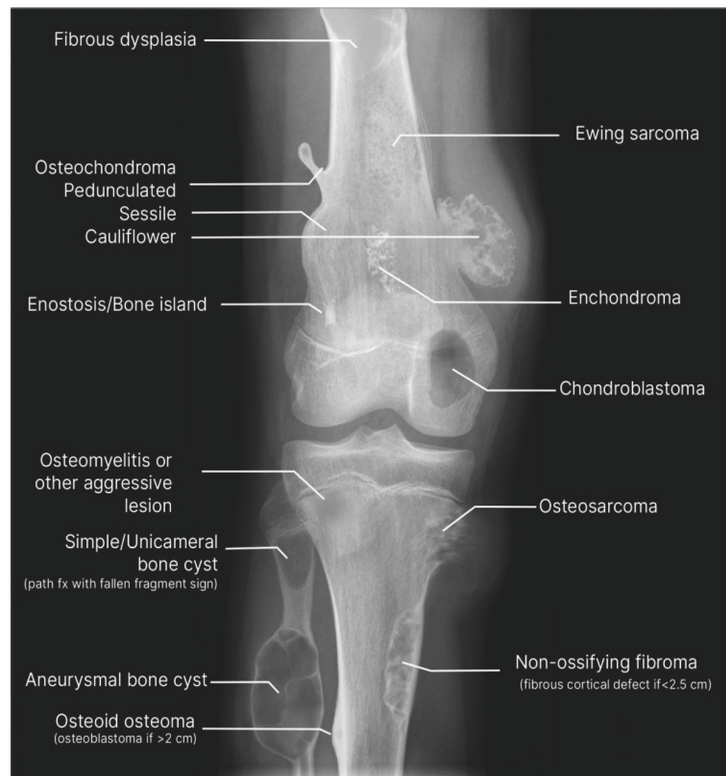
Laboratory Investigations

- Peripheral smear- Normocytic normochromic anemia
- ESR- Raised >100
- Hypercalcemia with normal alkaline phosphatase (increased in Paget's disease)
- Bence Jones Protein- Raised in urine, but only in 30% of cases
- Serum Electrophoresis- This is the confirmatory test
  - It shows M spiking
- Bone Marrow Aspiration- Increased amount of plasma cells with classical histopathological findings

Treatment

- Chemotherapeutic Agents (SCUM Regime)

- Steroids (Dexamethasone)
- Cyclophosphamide
- Urethane
- Mephalan
- Other Agents
  - Lenalidomide
  - Bortezomib
- Autologous stem cell transplantation
  - It improves the complete response rate & prolongs the median overall survival by approximately 12 Months
- Maintenance therapy
  - Lenalidomide & Bortezomib are used
- Hypercalcemia
  - It is treated mainly by correcting Hydration, Corticosteroids & Bisphosphonates
- Vertebral Collapse
  - Managed by Vertebroplasty & Kyphoplasty



PYQs

00:28:10

Q. A 20-year-old male patient presented with localized pain, which is gradual in onset and worsens over time. The X-ray showed the following findings. What is the diagnosis? FMGE Jan 2025

A. Osteosarcoma
B. Ewing sarcoma
C. Chondrosarcoma
D. Gout

Answer: A

Q. A 30-year-old female patient presented with complaints of a gradually progressive swelling around her wrist joint for 3 months. Below is an image of the X-ray film. What is the most likely diagnosis? FMGE Dec 2021

A. Osteosarcoma
B. Ewing's Sarcoma
C. Osteoclastoma
D. Osteochondroma

Answer: C

Yourwish

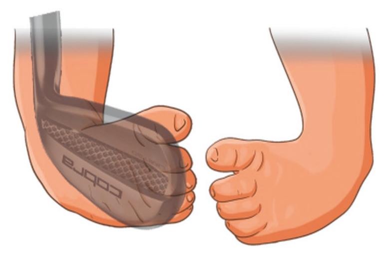
7. PEDIATRICS ORTHOPEDICS

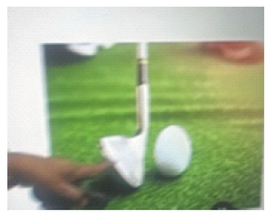
CONGENITAL TALIPES EQUINO VARUS (CTEV)

00:00:06

AIIMS 2019, FMGE 2022, INICET 2022

- A/K/A club foot
- Tali means Ankle
- Pes means Foot
- Equinus means like a Horse Foot
- Varus means Deviated towards Midline
- incidence - 1 per 1000 Live Births
- Male: Female Ratio -2:1
- 30-50% Cases are Bilateral
- Incidence in 1st Degree Relatives - 2%
- Monozygotic Twins - 32%
- Polygenic Inheritance





DEFORMITIES IN CTEV

INI CET May 2022

- It Is Better Remembered with the Pneumonic CAVE
  - Cavus of mid foot
  - Adduction of forefoot
  - Varus of hund foot
  - Equinus at ankle

CAVUS	ADDUCTION	VARUS	EQUINUS
Exaggerated arch	Forefoot inverted and turned upwards	Inversion of hell and hindfoot	Horse foot deformity Plantar flexion

THEORIES OF CTEV

- **Turco's Theory**
  - Medial Displacement of Navicular & Calcaneum Aro
- **Brockman's Theory**
  - Congenital Atresia of Talo Navicular Joint
- **Mckay's Theory**
  - Three Dimensional Bony Deformity of Subtalar Co
- **Intrauterine Theory**
- **Muscle Imbalance Theory**
  - Week Pronators, Overacting Extensors & Inverters

Yourwish

Yourwish

- **Germ Plasm Theory**
  - Germ Plasma Defect In Talus
- **Sherman theory: most accepted theory**

ASSOCIATIONS

- Meningomyelocele/spina bifida
- Arthrogryposis Multiplex Congenita
- Tibial Hemimelia
- Lateral Popliteal Nerve Palsy
- Poliomyelitis
- Cerebral Palsy

Clinical Tests

Dorsiflexion Test

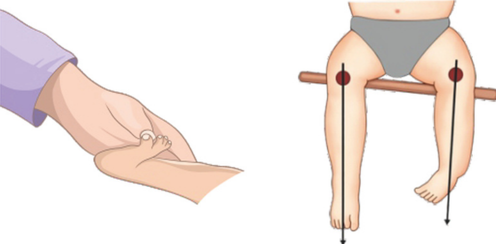
- Dorsiflex the foot the dorsal aspect should touch the shin

Scratch Test

- Scratch plantar aspect of foot there is dorsiflexion of foot

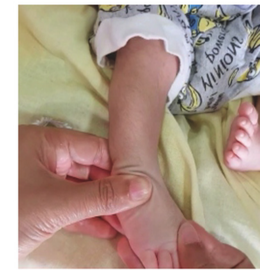
Plumbline Test

- Stool or stand erect when u draw the plumbline from tibial tuberosity come and cuts second toe



Treatment

- Should Begin As Soon As Birth
- **Birth -- 30 days -**
  - Manipulation by Mother- gold standard
  - Dorsiflex the foot and every the foot then after five minutes leave and repeat again every 5 minutes
  - Most CTEV gets corrected by this
  - She Dorsiflexes & Evert the Foot
  - Maintain it for 5 Sec & Repeat it after every
- **3 Months - 1 yr**
  - Serial Correction & Casting by
    → Kite's Method
    → Ponseti's Method



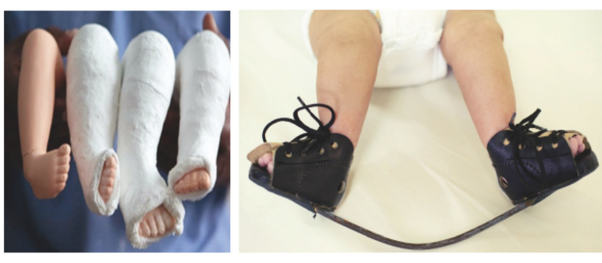
Treatment Phases In Following Order

FMGE June 2021

- Cavus First
- Forefoot Adduction Next
- Inversion Third
- Equinus Last By Tendoachillis Tenotomy

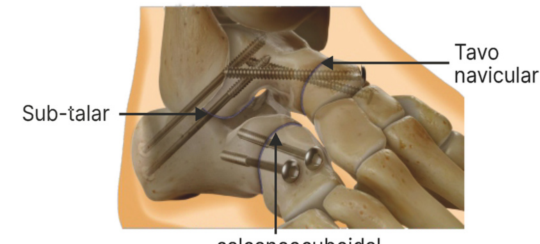
- Wrongly corrected CTEV - rocker bottom foot

Maintenance Phase



- Maintained by Foot Abduction Orthrosis to Prevent Relapse
- Success Rate of Ponseti's Method - Around 90%

- **1 Yr-5 Yrs**
  - **Turco's Procedure**
  - It is Posteromedial Soft Tissue Release (PMSTR)
  - Ponsetti method didn't work
- **5 Yrs-10 Yrs** -
  - Bony Reshaping
  - Dwyer's Osteotomy
  - Dilwyn-Evans Procedure
- **10 Yrs & Above**
  - This is Called Neglected CTEV
  - The Only Option is triple arthrosesis



DDH

FMGE 2020

- Uncommon in India
- Very Common in Europe
- Girl: Boy Ratio = 7:1
- Mostly Unilateral,(Left Hip More Than right)
- This Abnormality Ranges From Mild Acetabular dysplasia to frank dislocation of femoral head
- Incidence 1.5/1000 Live births

Risk Factors

Famous 7 F's

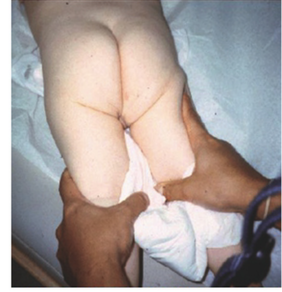
- Fetal Malposition
  - Breech Presentation -30-50%
- First Born-60% of DDH are 1st Born (relaxin hormone theory)
- Female Child-80% of DDH occurs in Girls
- Family History Positive
- Full Term
- Fetal Packaging Anomaly - Oligohydramnios
- Foot Anomaly - Metatarsus Adductus

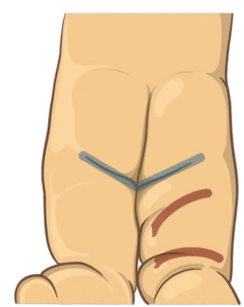
Pathology

- Delay in Ossification Of Capital Femoral Epiphysis - Main Pathology
- Dysplasia of the Acetabulum
  - Increased Anteversion of the Femoral Neck
  - Femoral Head is Flattened
- Limbus
  - Repetitive Subluxation of the Femoral Head Form a ridge of thickened Articular Cartilage called Limbus Limbus is the Hypertrophied labrum

- Potential Block to Concentric Reduction of Dysplastic hip

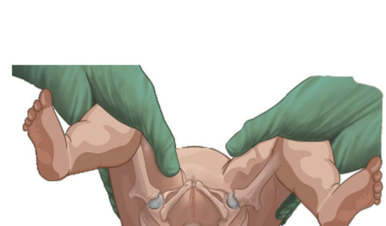
Clinical Features



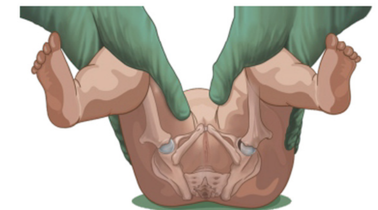


- Limitation of Abduction - Very Important Feature of DDH
- This is due to Contracture of Adductors
- Asymmetry of the Gluteal, Thigh, Buttocks or Labial Folds
- There Will Be Shortening Leg Or Additional Crease in Posterior And Medial Aspect Of Upper Thigh

Clinical Tests



- **Ortolani Test**
  - This is Effective only for 1st 2 months
  - Slow abduction and internal rotation causes relocation of hip



- **Barlow's Test**
  - Theoretically test
  - Suspected DDH
  - Test identified dislocatable hip
  - Provocative test

TELESCOPING OR PISTON SIGN

- dislocated hip
  - if pushed down goes down
  - If pushed up comes up

Allis or Galeazzi Sign -

- This is done only in a Child Older than 2 Months
- Baby lies in supine position flex the both hip joint Flex both knee joint
- Knee joint is on lower level instead of same level in DDH

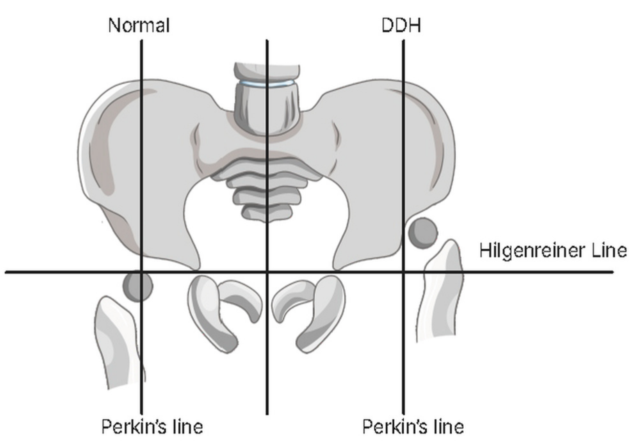
Gait In DDH:

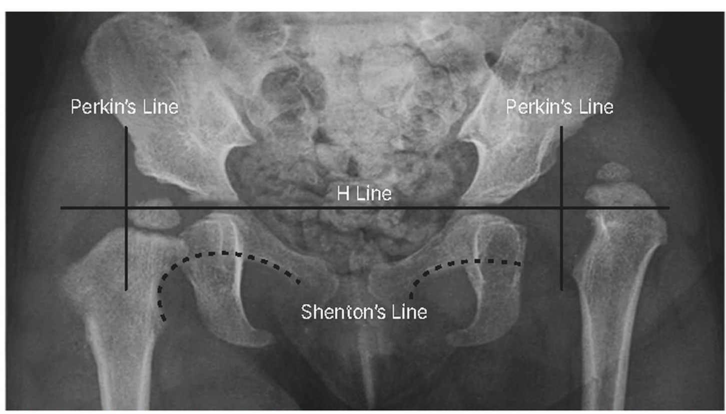
- In Unilateral -- Trendelenburg Gait
- In Bilateral -- Sailor's Gait or Duck Waddling Gait

X Ray

- 2 lines are very important
  - Hilgenreiner line
  - Perkins line

Yourwish

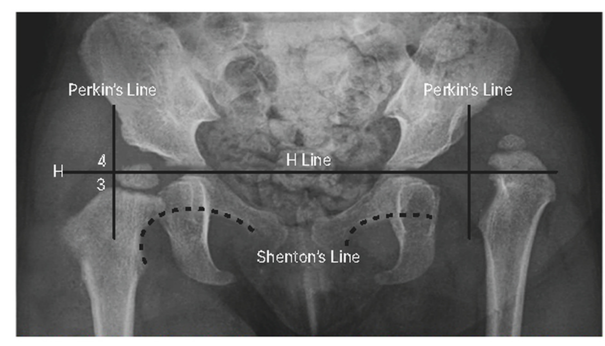




HILGENREINER LINE

- Draw a horizontal line along the triradiate cartilage

Perkin's Line



- Outer aspect of acetabulum vertical line
- The hip divides into 4 quadrants
  - Upper inner
  - Lower inner
  - Upper outer
  - Lower outer

Treatment

- The Treatment of DDH Mainly Depends on Age of the Child
  - 0-6 Months - Pavlik Harness
  - Hip in flexion and abduction

Pavlik Harness

Shoulder Strap
Chest Strap
Abduction Strap
Leg strap

- **6 Months - 18 Months**
  - Closed Reduction & Immobilized in Hip Spica in Human Position
  - Broomstick plaster
  - Hip
    - → Flexed at 45 degree
    - → Abducted to 30 degree

Complications

- Avascular Necrosis Is A Complication Of Forceful Reduction And Excessive Abduction.
- 2-3 Yrs Open Reduction & Immobilized in Hip Spica in Human Position
- 3-4 Yrs - Open Reduction + Femoral Shortening + Varus Osteotomy
- 4-6 Yrs - Acetabular Reconstruction Procedures
- >6 years - neglected DDH

Yourwish

Yourwish

- Schantz Osteotomy
- Apley says CHIARI's Osteotomy

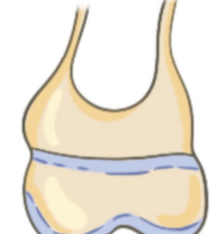
Epiphyseal Injuries

- Most likely to be injured at the age of 10 years
- The weakest point of the long bone in children is the junction between metaphysis and Epiphysis. So more vulnerable to shearing forces
- If it involves hypertrophic or calcific layer of growth plate and usually will not disturb longitudinal growth of long bone.
- If it involves reproductive layer it may result in premature ossification and disturb longitudinal growth of long bones

Salter And Harris, Rang Classification

NEET PG August 2024, FMGE June 2024, INICET May 2024

- **Type-1**
  - Complete separation of epiphysis from metaphysis without fracture. Apart from Trauma it is common in rickets, scurvy, osteomyelitis. Hypertrophic or calcific layer is involved.
  - No growth arrest



Type - II

- The epiphysis is separated carrying a small triangular fragment of metaphysis (Thurston Holland sign). This is the MC type
- No growth arrest
- Complete separation of epiphysis and metaphysis

B

Type III

- Fracture is intraarticular and extends along the epiphysis and the growth plate Reproductive layer is very rare.

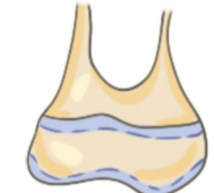
Type-IV

- Fracture is intra articular and extends through epiphysis, physis and metaphysis perfect reduction is necessary and open reduction is more often necessary to prevent growth arrest

- **Type-V**
  - Crushing of epiphysis, growth arrest usually follows.

D

- **Type VI**
  - There is a peripheral physis lesion.
  - Precondrial ring



Treatment

- While Reducing One Should Bare In One Important Point That An Overlap Of 1cm Should Be Allowed Because Overgrowth After Long Bone Fracture Is Very Common
- **Type I & II**
  - Close Reduction Is The T.O.C
- **Type-III & IV**
  - Open Reduction Is The T.O.C

Complications

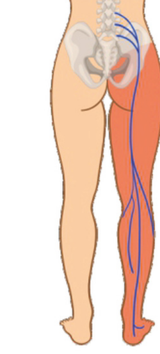
- Overgrowth
- Deformity
- Growth Arrest

SPINE

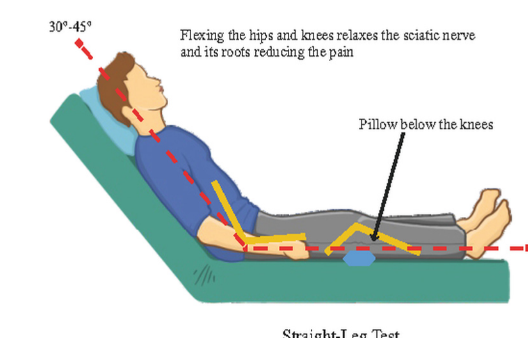
00:26:58

Disc Prolapse

- Disc Herniation can be Posterolateral Disc Herniation - MC central disc Herniation
- Posterolateral Disc Herniation can cause more Nerve Compression
- MC symptom is Sciatica - Pain that radiate along the Sciatic ne the back of the thigh & calf into the foot. It is often caused by compression of lower spinal nerve root L5 & S1

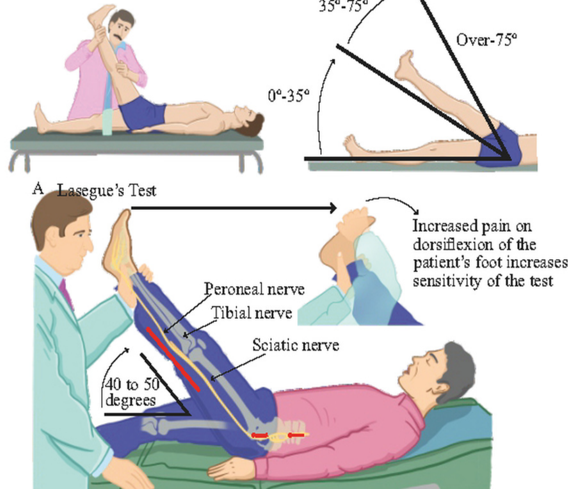


- Pain From The Herniation Increases With Activity & Decreased With Rest Especially In Semi Fowler's Position
- Other Symptoms Of Disc Herniation Are
  - Weakness
  - Paraesthesia
- Patient With Lumbar Disc Prolapse Often
- Presents With Sciatic List:
  - Trunk of patient tilted towards one side
  - Axillary Type- same side tilt
  - Shoulder Type- opposite side tilt



Slrt

- Straight leg raising test
  - 0-35 degree → no pain
  - 35-75 degree pain present as sciatic nerve stretches Sign
- Lasegue test (Charles lasegue 1864)
  - Improved form of SLRT test
  - Extend the leg + dorsiflexing the foot also



Femoral Stretch Test

- patient in prone position
  - Extend the hip
  - Extends the femoral component →causes pain

Localization Of The Level

L4 ROOT

- Paresthesia On Medial Side Of Leg Below The Knee
- Motor Weakness Of Knee Extensors
- Sensory Deficit Over Medial Side Of Leg And Great Toe
- Knee Jerk: Absent

L5 ROOT LEVEL

- Paresthesia on lateral side of leg below the knee and dorsum of the foot
- Weakness of EHL, gluteus medius, EDL and EDB
- Sensory deficit over lateral aspect of leg and dorsum of the foot
- Reflexes: Not affected

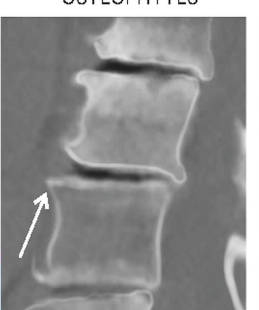
S1 ROOT LEVEL

- Paresthesia On Lateral Side Of Foot And Little Toe, Upto Back Of Calf
- Weakness Of FHL, Peroneus Longus And Brevis, soleus, Gastrocsoleus, Gluteus Maximus
- Sensory Loss Over Lateral Aspect Of Foot And Little Toe
- Ankle Jerk Absent

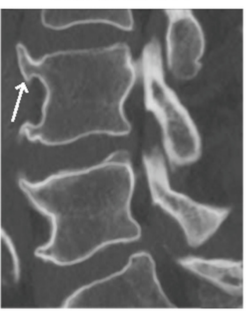
X Ray

- This Is Mainly Used To Diagnose Other Abnormalities in The Vertebra Than To Diagnose Intervertebral Disc Prolapse
- Features Suggestive Of Intervertebral Disc Prolapse Are
  - Reduced Intervertebral Disc Space
  - Traction Osteophytes
  - Claw Osteophytes
  - Wraparound Bumper

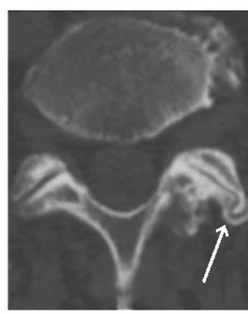
TRACTION OSTEOPHYTES



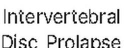
CLAW OSTEOPHYTES

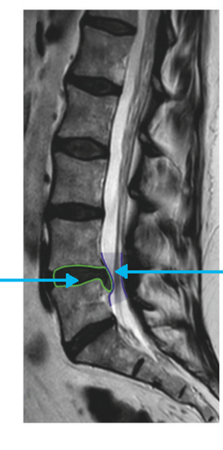


WRAP AROUND BUMPER OSTEOPHYTES



- This is the Gold Standard IOC for Disc Prolapse





Yourwish

Treatment

Non Surgical

- Bed rest
- Traction
- NSAIDS/ Steroids
- Epidural Steroids
- Physiotherapy

Surgical

- Open Discectomy
- Laminectomy & Discectomy
- Micro Discectomy
- Micro - Endoscopic Discectomy

HANGMAN FRACTURE

00:35:30

- This is Traumatic Spondylolisthesis of C2

Causes

- Hanging
- RTA

Mechanism

- This is a Hyperextension Injury with Bilateral avulsion of neural arches from the Vertebral Body

Treatment

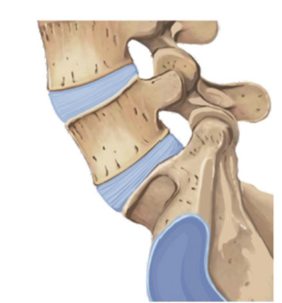
- Type I - Rigid Collar for 8 to 12 weeks
- Type II - Traction followed by Halo Vest for 12 weeks
- Type III - Immediate Reduction with Surgical fixation

SPONDYLOLISTHESIS.

00:37:02

FMGE Dec 2021, NEET PG August 2024

- It Refers To Forward Slip Of One Vertebral Body With Respect To The One Which Is Below It
- MC Site - Lumbosacral Junction
- L5 Over S1
- It Can Happen At Any Level



Classification

- Based on Etiology, Spondylolisthesis is Classified into Five Type
- **Type I**
    - Congenital or Dysplastic
- **Type II**
    - ischemic
    - Overall mc type

Yourwish

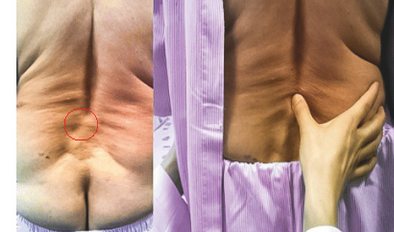
Yourwish

- **Type III**
  - Degenerative
  - mc in elderly
- **Type IV**
  - Traumatic
- **Type V**
  - Pathologic

Clinical Features

NEET PG 2025

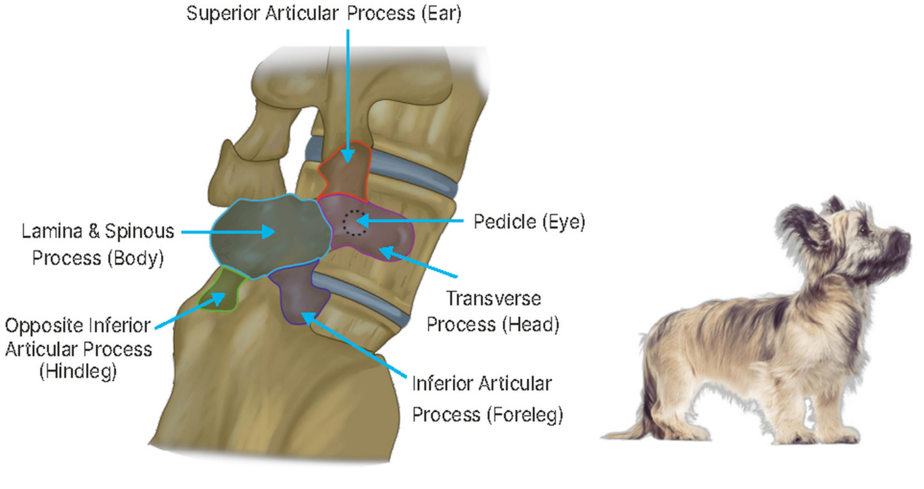
- It May Be Asymptomatic
- The Clinical Presentation Varies According To Type Of Slip & age of patient
- Initial Presentation May Be Low Back Ache Which Gets radiated to buttocks and posterior Thigh
- Degenerative Spondylolisthesis Presents With
  - Back Pain
  - Radiculopathy
  - neurogenic Claudication
- There Will Be Hyperlordosis in Thoracolumbar Junction
- Hamstring Tightness
- If L5 Is Involved, There Will Be EHL Weakness
- Palpable STEP OFF
  - Make patient to sit down
  - Roll your thumb on L5-S1 junction step is felt

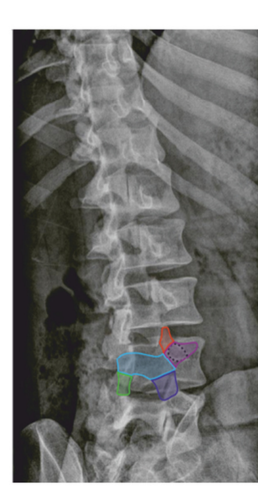


Imaging

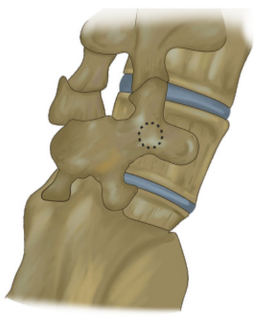
Xray

- AP View
- Lateral View
- Oblique View- view of choice
  - Isthmic Defects Are Best visualised in Oblique View
  - The Classical Scottish Terrier Refers to The Normal Appearance of The Lumbar Vertebra in The Oblique View
- Segmental instability is Best Seen In Lateral Flexion Extension View

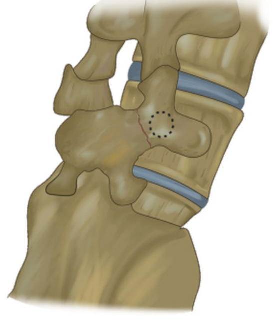




- In Spondylolisthesis, the Pars Interarticularis, or the Neck of the Dog will have a Defect Resembling the Classic Beheaded scottish terrier sign
- It looks as if the Dog has a Collar around the Neck or Decapitated



Scottish Terrier



Scottish Terrier with Collar

Ct Scan

- It is useful in Demonstrating the Defects in
  - Pars Interarticularis
  - Facet Arthropathy
  - Foraminal Stenosis

MRI

- It is the Most Sensitive Investigation In Demonstrating The Root compression

Treatment

Non Surgical

- Indications:
  - Young Patient
  - Low Grade Slip
  - Lack Of Slip Progression
  - In Elderly With Degenerative Spondylolisthesis Having Minimal symptoms
  - Mechanical Back Pain Alone
- The Modalities Available are
  - Activity Restriction
  - NSAIDS
  - Physical Therapy

Surgical

- Radiculopathy Not Responding To Conservative Management
- High Grade Slip > 50%
- Spondylolisthesis With Gross Instability.
- Traumatic Spondylolisthesis
- Procedures Available are
  - Decompression
  - Done In degenerative Or traumatic spindylolisthesis
  - Decompression Of Neural Elements both centrally and laterally over the nerve Root is Done
  - Reduction -- An Attempt To Reduce The Spondylolisthesis Is Done To Improve The Sagittal Alignment & Spinal Biomechanics

- Reduction
  - An Attempt To Reduce The Spondylolisthesis Is Done To Improve The Sagittal Alignment & Spinal Biomechanics
  - Fusion With Instrumentation - Intertiansverse Interbody Are Transverse process/
  - Sacral Ala Arthrodesis With The Use Of iliac Crest Autograft is A Common procedure
  - The Fusion is Secured Using Segmental Spinal Instrumentation

REGIONAL CONDITIONS

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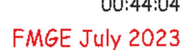
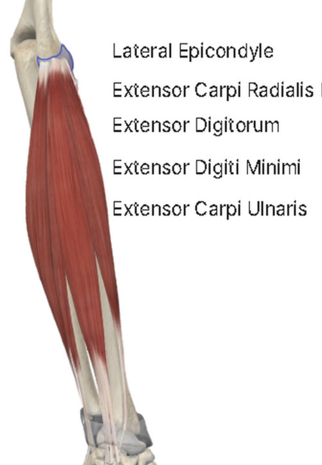


Lateral Epicondylitis
(Tennis Elbow)



- The Term Tennis Elbow Is A Misnomer
- It Is Not Chronic Inflammatory, Is A Tendinosis- That Is A Chronic Symptomatic Degeneration Of Tendon
- Equal in men & Women, More On Dominant Upper Limb
- It Is Idiopathic, Benign & Self Limiting
- 1% Of Population
- It Affects The Attachment Of Four Tendons
  - Extensor Carpi Radialis Brevis (MC)
  - Extensor Digitorum
  - Extensor Digiti Minimi
  - Extensor Carpi Ulnaris

Etiology

- exact Etiology Not Known
- Overuse Of Wrist Extensors & Supinator

- Why Tennis Causes Lateral Epicondylitis??
  - Incorrect Technique
  - Backhand Play & Hitting The Ball Late
  - Overtraining
  - Increased Size & Increased Weight Of The Bat

Clinical Features

- Usual Age Of Presentation Is Between 35 To 55 Yrs
- Pain & Tenderness Localized Over Lateral Epicondyle In Stage I
- Diffuse in Other Stages
- Gripping, Lifting A Jar, Handshaking Movements Are painful

Clinical Tests

Cozen's Test/Thompson Test

- Resist Wrist Extension In Full Pronation Causes Pain Over Lateral Epicondyle

Mill's Test

- Pronated Forearm & Fully Flexing the wrist and then elbow is extended
- This causes pain over lateral epicondyle

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Maudsley's Test

- Resisted 3rd Digit Extension causes pain over lateral epicondyle
- This Is Called Middle Finger Test

Chair Test

- In extended elbow ask patient to lift the chair severe pain is produced on the lateral epicondyle

Differential Diagnosis

- Cervical Nerve Root Compression C6, C7
- Pin Syndrome - Entrapment At Arcade Of Fronsc
- Bursitis

Investigations

- Plain X-ray - Shows Calcification
- Doppler Ultrasound - Detect Neovascularization & Gray-scale Changes
- Thermography - Correlate Clinical Severity Of Disease
- MRI - Confirms Degenerate Changes & Tears In Tendon(Investigation of choice)

Treatment

- Aims Of The Treatment
- Pain Control
- Restoration Of The Movement
- Regaining Grip Strength
- Preventing Recurrence

Management

Non Operative

- Rest for Minimum of 6 wks
- NSAIDS
- Stretching Exercise Extended
- Physical Therapy
- Counter-force Brace
- Steroid Injection
- Extracorporeal Shock Wave Therapy
- Autologous Blood Injection
- Platelet Rich Plasma

Operative

- Open Procedure - Modified Nirschl Technique.
- Erase the fibres of extensor tendon using extensor slide technique
- Arthroscopy
- Percutaneous Release
  - Percutaneous Epicondylar Stripping & This is called Hohmann's Procedure
  - High failure rate

Yourwish

De Quervain's Tenosynovitis

- Otherwise Called Washerwoman's Sprain

Tenovaginitis

- This is Chronic Inflammation of Tendons of
  - Abductor Pollicis Longus (APL) &
  - Extensor Pollicis Brevis (EPB)
  - Common Age Group - 40 to 60 Yrs
  - More Common in Females

Etiology

- Idiopathic
- Rheumatoid Arthritis
- Pregnancy
- Recurrent Trauma
- Malunited Colle's Fracture
- Exostosis

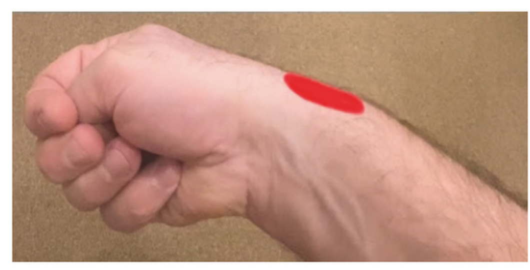
Clinical Features

- Classic Triad Is
  - Tenderness Over Radial Styloin
  - Swelling Over First Extensor Radial Compartment
  - Positive Finkelstein's Test
  - Crepitus or Squeaking with Movements Of Involved Tendon—wet Leather Sign
  - Locking Phenomena is Rare, But When Present is a Sure Indication for surgery

Clinical Tests

- There Are Two Physical Test
  - FinkelStein's Test
    - → Patient Elbow Flexed, Forearm In Neutral, Ask The Patient to flex the thumb against the palm & Ask The Patient To Ulnar Deviate The Wrist Causes Severe Pain
    - → The Specificity Of Finkelstein's Test Is questionable as this may provoke pain even in normal individuals or those with underlying arthritis

- Eichhoffs test
  - This Is Totally A Different Test
  - Previously This Was Confused With Finkelstein's Test
  - Ask The Patient To Flex The Thumb Against Palm, Curl The Fingers Now Passively Ulnar Deviate The Wrist, Which Provokes Severe Pain along
  - Abductor pollicis longus and extensor pollicis brevis
  - This Is More Specific Test



Investigations

- X Ray Is Taken To Rule Out Bony Lesions
- USG Is Very Reliable As It Shows Increase In APL & EPB Tendon sheaths thickness

Management

Non Surgical

- NSAID'S
- Plaster Splints
- Physiotherapy
- Local Steroid Injection Side Effects are
  - Depigmentation
  - Subcutaneous Atrop
  - Adipose Necrosis

Surgical

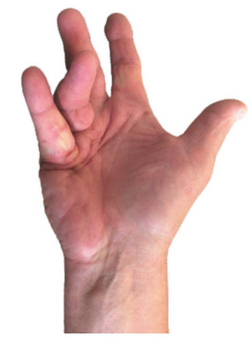
- Transverse Or Longitudinal Incision Is Made Over Skin Crease
- All The Slips Of APL Are Divided
- Slitting Of Tendon Sheath Should Be Done On Ulnar Side Of The sheath to prevent volar subluxation of tendons
- One Should Take Atmost Care To Prevent Damage of superficial nerve.
- This Will Cause Very Severe Painful neuroma

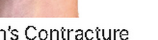
Dupuytren's Contracture

- Contracture Of Superficial Palmar fascia
- Autosomal Dominant

Causes

- Phenytoin
- AIDS
- Alcohol
- Diabetes
- Tuberculosis
- Palmar Aponeurosis Opposite To Ring And Little Fingers Are Commonly Affected
- Garrod's Pods
  - Hypertrophy and hyperkeratosis of knuckles
  - Associated
    - → peyronie's Disease
    - → Ormond syndrome disease





Dupuytren's Contracture

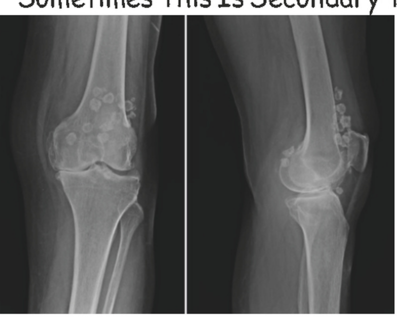
Garrod's Pads

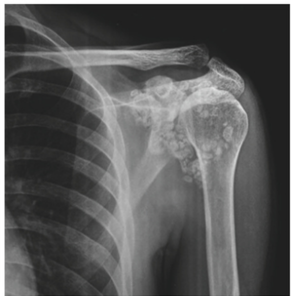
Synovial Chondromatosis

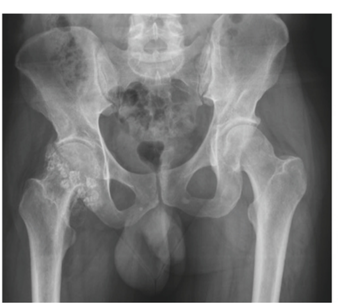
- This Is Otherwise Called "Reichel Syndrome"
- This Is Metaplastic Proliferation Of Cartilaginous Nodules In The Synovial membrane Joints, Bursae & Tendon Sheath
- These Nodules Detaches And Becomes Loose Bodies Within The Joint. They undergo Secondary Calcification & Ossification

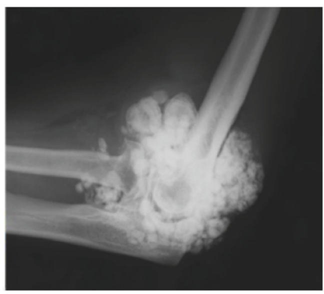
Causes

- Mostly, This Is A Primary Condition
- Sometimes This Is Secondary To Osteoarthritis


Knee Joint (MC)

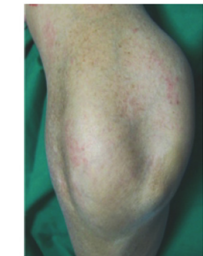

Shoulder Joint


Hip Joint


Elbow Joint

Clinical Features

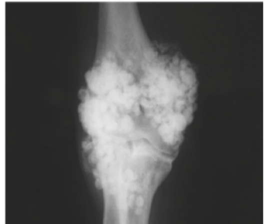
- Patients Presents With
  - Effusion Of The Joint
  - Diffused Tenderness
  - Decreased. Range of motion
  - Crepitus

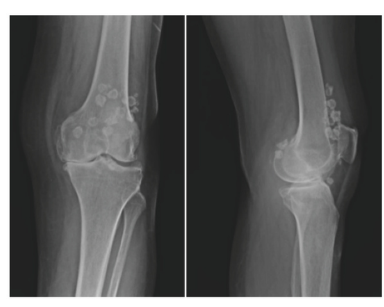

Elbow Joint

Investigations

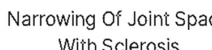
Xray

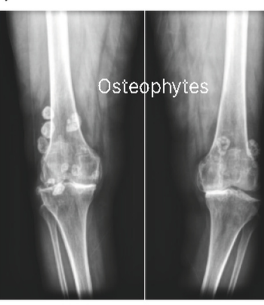
- Fine Stippled Calcification
- Intra-articular Loose Bodies
  - In PSC-Loose Bodies Are Numerous, Small, Round & Uniform In Size
  - In SSC- Loose Bodies Are Small & Variable In Size


Stippled Calcification



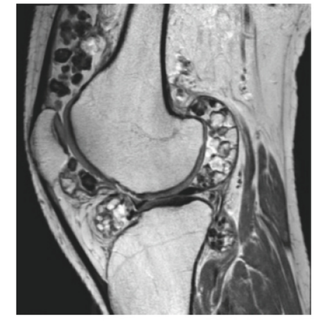
- In Late Stages, Joint Space Narrowing, Osteophytes & Periarticular Erosion With Sclerosis





Ct Scan And Mri

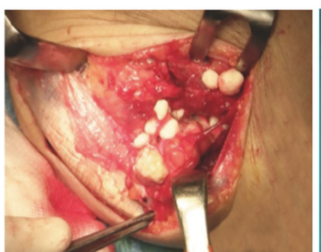
- They Detect Radiolucent Loose Bodies That Are Not Visible On X Ray

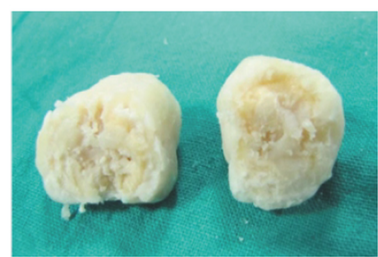


Yourwish

Treatment

- Removal of Loose Bodies with Synovectomy is the TOC
- For Knee
  - Arthroscopic Removal is Preferable
- For Hip
  - Open Approach is Preferable, Surgical Dislocation of the Hip
  - (GANZ) will Allow Access to the Entire Joint
  - Manual scooping out of loose bodies





Carpal Tunnel Syndrome

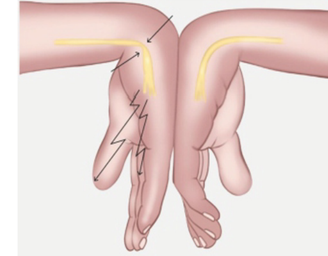
NEET PG 2023

- Compression of Median Nerve
- Median nerve is superficial most structure

Median nerve
Carpal Tunnel
Numbness In The Area Supplied By The Median Nerve

Causes

- Rheumatoid Arthritis
- Compound Palmar Ganglion
- Dislocation Of Lunate
- Malunited Colles Fracture
- Myxedema
- Pregnancy, Menopause-most common cause



Clinical Tests

Phalen's Test

- Stay in this position 1 min
- Pain in median nerve course

Durkens Test

- pressure over median nerve excruciating pain along course of median nerve

PYQ

01:00:57

Q. Amongst the following, which is the most suitable combination of foot deformit typical to CTEV?

INI CET May 2022

A. Equinus, eversion, forefoot adduction, cavus.
B. Equinus, eversion, forefoot abduction, cavus.
C. Equinus, inversion, forefoot adduction, cavus.
D. Equinus, inversion, forefoot adduction, planus

Answer: **C**

Yourwish

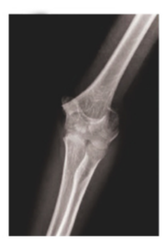
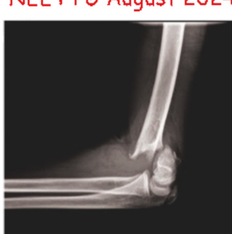
Q. The splint depicted below is

A. Foot abduction orthosis
B. DiMeglio splint
C. Ponseti cast
D. Pirani cast

Answer: **A**

Q. Which classification is used for the following fracture, and what is its stage

NEET PG August 2024

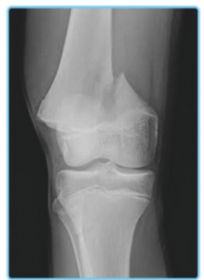



A. Gartland 3
B. Gartland 2
C. Salter Harris 3
D. Salter Harris 2

Answer: **A**

Q. Utilizing the provided x ray, identify the type of fracture using the Salter Harris classification?

FMGE June 2024



A. Type 1
B. Type 2
C. Type 3
D. Type 4

Answer: **B**

Q. Which of the following layer is affected in a Salter-Harris type 1 fracture

INICET May 2024

A. Calcific zone of the growth plate
B. Hypertrophic zone of the growth plate
C. The resting zone of the growth plate
D. Through the whole of the epiphysis

Answer: **B**

Q. A 74-year-old man, who was previously a weighthtter, presented with lower back pain that was radiating to his legs. On esamination a palpable step was felt in the lumbosacral region of the spine. The x-ray of the spine is given below What is diagnosis?

FMGE Dec 2021

A. Spondylolysis
B. Spondylolisthesis
C. Disc prolapse
D. Spondylosis

Answer: **B**

Q. A 55-year-old female presented with back pain for six months. Her CT scan ima given below. What is the most likely diagnosis?

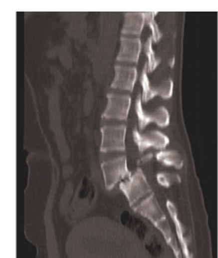
NEET PG August 2024

A. Paget's disease

B. Osteoporosis

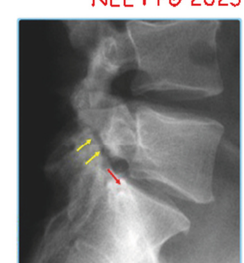
C. Spondylolisthesis

D. Renal osteodystrophy



Answer: **C**

Q. A 70-year-old female presents with chronic lower back pain. A lateral lumbar spin ray is provided. Based on the radiological findings, which of the following is the likely diagnosis? NEET PG 2025



A. Spondylitis

B. Spondylolisthesis

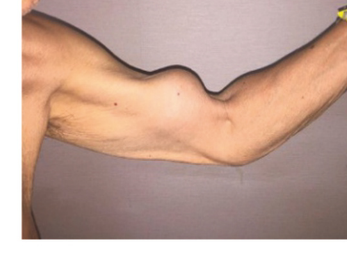
C. Osteosarcoma

D. Vertebral fracture

Answer: **B**

FMGE July 2023

Q. What condition is shown in the image?



A. Biceps tendon rupture

B. Triceps muscle rupture

C. Humerus fracture

D. Tennis elbow

Answer: **A**

Q. In the orthopedics outpatient department, a female patient is presenting with difficulty sleeping at night due to experiencing numbness and tingling in the outer three digits of their hand. The symptoms improve when the patient hangs their arms from bed. Which of the following choices accurately identifies the patient's condition test employed to evaluate it? NEET PG 2023

A. Guyon's canal syndrome, Froment's test

B. Carpal tunnel syndrome, Froment's test

C. Guyon's canal syndrome, Durkan's test

D. Carpal tunnel syndrome, Durkan's test

Answer: **D**

8. BONE INFECTIONS

OSTEOMYELITIS

00.00.06

- It is infection and inflammation involving bone & bone marrow (or) infection & inflammation of all layers of bone

NEET PG Aug 2024

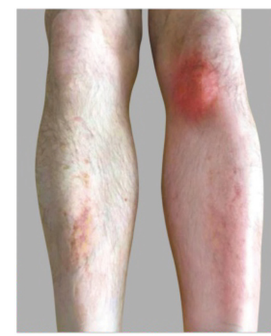
CLASSIFICATION

- Waldvogel classification is based on
  - Duration
  - Mode of spread

Duration	Mode of spread	
Acute	< 2 wks	Hematogenous
Sub-acute	2 to 6 wks	Direct Inoculation
Chronic	> 6 wks	Contiguous spread

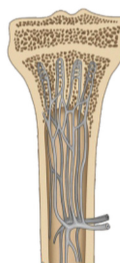
ACUTE OSTEOMYELITIS

00.01.07



- Commonest mode of spread → Hematogenous
- Most commonly seen in children (younger than 5 yrs)
- Mc site overall → Knee joint
  - Proximal tibia
  - Distal femur
  - Proximal femur
- MC site in adult → Thoraco-lumbar vertebra > Long bones
- MC organism
  - Overall → Staph. Aureus
  - MC organism below 4 yrs → Haemophilus influenza
- Pus is formed around → 2nd or 3rd day
- Evidence of bone death → 1 week
- New bone formation from deep layer of stripped periosteum is a typical of acute pyogenic osteomyelitis seen at end of 2nd week
- MC part of bone involved → Metaphysis
- In infants or child below 1 yr → Involvement of epiphysis is also seen
  - Tom smith arthritis → Infection of epiphysis

Hypothesis

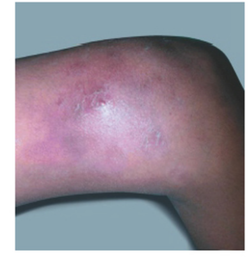


Yourwish

Hypothesis	Description
Lexer hypothesis	• Hair pin bend arrangement of blood vessels
Hobo hypothesis	• Phagocytosis is less at the metaphysis
Burrows hypothesis	Micro fracture ↓ Micro hematoma ↓ Organisms grows
Trueta hypothesis	• Sluggish blood flow due to hair pin bend arrangement of blood vessels

Clinical Features

- Local Pain, swelling, erythema
- Toxic Symptoms like fever and dehydration
- Classic symptoms → Pseudoparalysis



Important Information

- MC cause of Pseudoparalysis → Osteomyelitis > Scurvy > Congenital syphilis

Investigations

X-RAY

- Loss of normal soft tissue planes may be the first evidence of osteomyelitis
- During 1st week (first 10 days)
  - X-ray is normal and no bony changes is seen
- During end of 2nd week
  - Periosteal new bone formation → classical x-ray sign of pyogenic osteomyelitis
- Late x-ray sign
  - Regional osteoporosis → Indicates Metabolically active living bone
  - Dead Bone → A segment of increased density

Periosteal New Bone Formation
Soft Tissue Swelling
Regional Osteoporosis

MRI

- Sensitive even in the early phase

Other Investigation

- Radioscintigraphy with gallium citrate → Highly sensitive but less specific
- Aspiration of pus → Most certain way to confirm the diagnosis but is invasive

Treatment

Nade's principle

- Appropriate antibiotic is effective before pus formation
- Once a pus is formed, or when a bone is dead, an antibiotic will not reach the site

Yourwish

Yourwish

- Antibiotic after surgical drainage prevents reformation
- Surgical drainage restores periosteal blood supply
- Antibiotics should be continued after surgery

Order Of Treatment

- Supportive therapy for dehydration & pain
- Splintage of the affected parts
- Antibiotic therapy
  - Flucloxacillin & Fusidic acid, If resistant → Vancomycin, if resistant → Linezolid → Meropenam
- Surgical drainage
  - If constitutional symptoms and local pain fail to improve within 36 hrs after appropriate antibiotic then surgical drainage is done

Complications

- Septicaemia and Septic shock
- Septic arthritis
  - Involvement of metaphysis and epiphysis and spread to involve joint
- Growth Disturbances
  - Due to involvement of epiphysis
- Chronic Osteomyelitis

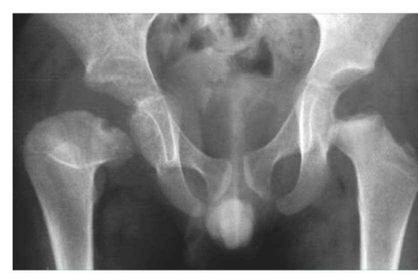
Tom Smith Arthritis

- Acute osteomyelitis in Infant below 1 year, involving epiphysis

Etiology

- Transphyseal vessels are present in early infancy before the formation of the growth plate, so the organism enters the joint through these vessels
- Focus commonly from septic umbilicus
- MC joint involved → Hip joint
- MC organism → Staphylococcus aureus

Differential Diagnosis



- Developmental dysplasia of hip
  - X-ray → complete absence of head and neck of femur
  - Hypermobile joint instead of bony ankylosis → very characteristic
- If presence of gas is seen in the joint → E.coli is suspected

Treatment

- IV antibiotics + arthrotomy and debridement

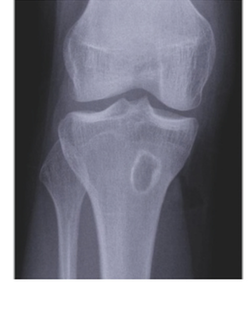
SUBACUTE OSTEOMYELITIS

00.12.45

- Types
  - Brodie's abscess
  - Typhoid osteomyelitis
  - Garre's osteomyelitis

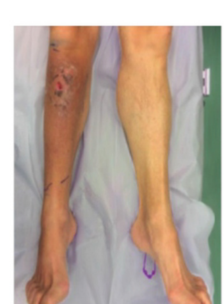
Yourwish

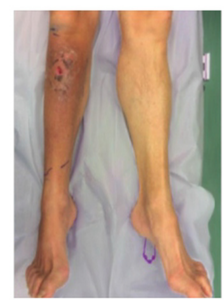
Brodie's Abscess



- It is a localised form of osteomyelitis in the medullary cavity surrounded by a sclerotic wall
- MC in 2nd Decade
- MC organism → Staphylococcus aureus
- MC site → knee joint
  - Proximal tibia & distal femur

Clinical Features



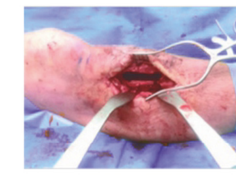


- MC symptom → chronic intermittent pain
- Patient may present with night cries
  - Similar to osteoid osteoma

Differential Diagnosis

- Osteoid osteoma
- Langerhans histiocytosis
- Eosinophilic granuloma
- TB osteomyelitis

Treatment

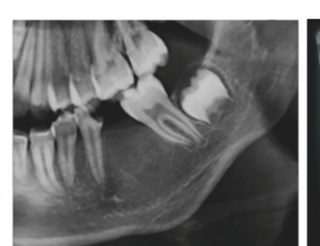


- Surgery: Treatment of choice
  - Deroofing & curettage

Garre's Osteomyelitis

- A/k/a Periostitis ossificans / Diffuse sclerosing osteomyelitis
- Dry osteomyelitis → no signs of inflammation or abscess formation

> **Important Information**
> - Caries sicca → Dry tuberculosis



- MC site → Mandible
- Causative organism → Anaerobic organisms
- X-ray → Diffuse sclerosis of bone
- Treatment
  - NSAIDs
  - Intermittent antibiotics
  - Bisphosphonates
  - Surgical fenestration & curettage

CHRONIC OSTEOMYELITIS

00.16.04

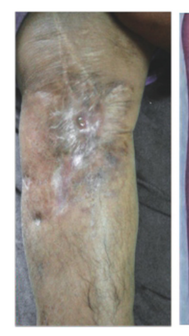
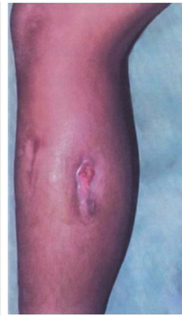
INICET May 2024

- Osteomyelitis persisting for >6 weeks
- Hallmark feature → Sequestrum

Etiology

- MC cause of chronic osteomyelitis
  - In child → sequelae of acute osteomyelitis
  - In adults → open fractures
- MC organism → Staphylococcus aureus
- It is formed as a sequelae of Tuberculosis
- In foreign body implant → Staphylococcus epidermidis

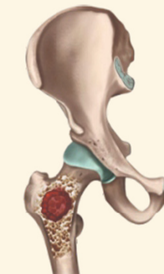
Clinical Features

- Walenkamp phenomenon
  - Skin bulges → pus points → Toxic symptoms occurs
  - Skin breaks → pus released → sinus heal → Toxic symptoms decrease
- Discharging sinus with classical waxing waning pattern
- Discharge of bone chips → pathognomic
- Multiple healed scars
- Deformity

Important Information

- Sinus → Blind tract which connects bone to exterior lined by epithelial tissue
- Fistula → Tract which connects two hollow viscus

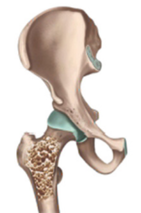


Tubercular Sinus Vs Pyogenic Sinus

	Tubercular sinus	Pyogenic sinus
Causative agent	Tuberculosis	Staphylococcus aureus
Edge	Undermined	Normal
Color of the edge	Bluish	Black
Sensation	Hypoaesthesia / Hypoanaesthesia	Sensation is intact

Sequestrum

- Sequestra in Latin means → Stand apart
- Dead bone surrounded by living bone
- 2 surface of sequestrum
  - Inner surface → Irregular and rough and in contact with granulation tissue
  - Outer surface → Smooth and in contact with Pus



Types of Sequestrum

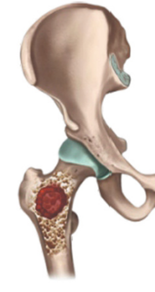
According to shape	
Type	**Seen in**
Pencil Like	Infants

Yourwish

Ring	Pin Tract Infection
Conical	Amputation Stump
Coralliform	Perthes Disease
Button Hole Sequestrum	Radiation
According to consistency	
Coke like	TB
Feathery or Flake	TB
Fine Sandy	Viral Osteomyelitis
Coarse Sandy	TB
Ivory	Syphilis
According to colour	
Black or Bombay	Fungal, Amputation stump
Green	Pseudomonas
Special form	
Kissing Sequestrum	Peridiscal TB

Involucrum

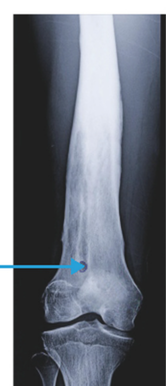
- Living bone
- Involucrum refers to new bone formation that develops around a sequestrum

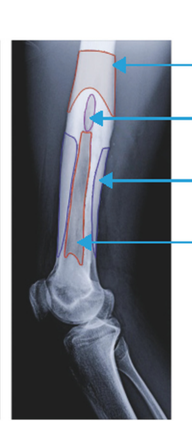


Imaging

X RAY

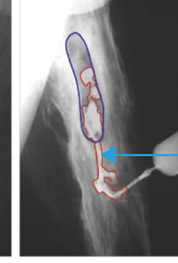
- The cortex of the infected bone becomes thickened & irregular due to repeated periosteal reaction
- Patchy loss of bone density
  - Metabolically bone is alive and getting revascularization
- Sequestrum
  - Seen only after 6 weeks
  - Appears denser
- Cloaca seen in Involurum
- Loss of corticomedullary differentiation





Sinogram

- When there are multiple sinuses, a sinogram is done
- Radio-opaque dye is injected & read with x ray or CT
- Detects the sinus tract and helps for complete excision



Yourwish

Yourwish

CT Scan

- Major role is → Detects sequestra

MRI

- Provides an accurate determination of the extent of pathology in bone & soft tissue.
- It detects sinus tract also

TREATMENT

- Treatment is Essentially Surgical
- The 4 Important Steps are:
  - Radical debridement
  - Dead space management
  - Soft tissue coverage
  - Antibiotic therapy

Radical Debridement

- This is achieved by sequestrectomy & saucerization
- Sequestrectomy
  - Removal of infected non-viable bone
- Saucerization
  - Conversion of hollow cavity into a shallow cavity
- Implant like plates & screws should be removed because they are source of biofilm

Dead Space Management

- After radical debridement, defects in bone & soft tissues are formed. This is called dead space
- If the dead space is not treated properly it will lead to early recurrence of infection
- Various methods of dead space management
  - Papineau-Rheidlander's technique
  - VAC therapy
  - Antibiotic PMMA (Poly methyl methacrylate) beads
  - Masquelet technique
  - Ilizarov technique

Soft Tissue Coverage

- Soft tissue coverage done by muscle flaps & skin grafting in chronic osteomyelitis for extensive scarring of muscles, fascia and skin

Antibiotic Therapy

- IV Nafcillin or Cefazolin → Staphylococcus aureus
- Vancomycin → MRSA
- Revascularization of the bone occurs by 4 weeks hence antibiotic are given for 4 to 6 weeks and as a result they are able infiltrate the site of infection

Complications

- Acute exacerbation

Yourwish

- Growth disturbances
- Pathological fracture
- Epithelioma
- Secondary amyloidosis → leads to nephrotic syndrome

SKELETAL TUBERCULOSIS

00:30:20

FMGE June 2021, 2024
INICET May 2025

- MC site of skeletal TB → spine > hip > knee
- Least common sites are mandible & TM joint
- Highest incidence seen in young adults
- Uncommon in old age
- Causative agent in india
  - Human type of Tubercle bacilli
  - Bovine type is rare due to Pasteurization of milk
- MC route of spread → Hematogenous
- Infection first affects → epiphyseal cartilage
  - Epiphyseal Cartilage does not act as barrier for invasion
- Types
  - Caseating type → Children
  - Proliferating type (Caries Sicca) → Adults
- Confirmatory test → Synovial biopsy
- Only in vertebra and in greater trochanter of femur, the infection persist as chronic osteomyelitis
- Healing is by fibrosis and incomplete ankylosis
- Night cries → very characteristic
  - Synovitis → Synovial effusion
  - Day time → no symptoms are seen because muscles act as splint
  - Night time → symptoms are precipitated due to stretching of synovium because of relaxation of muscle

Important Information

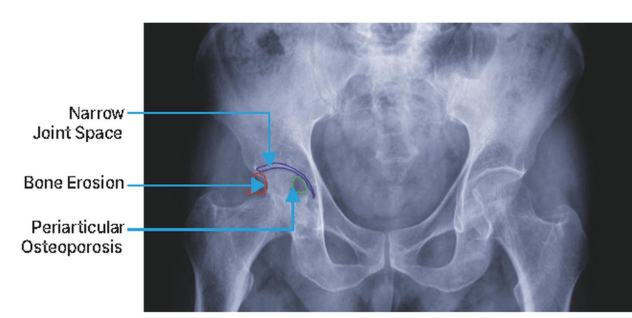
Ankylosis → Fusion of joint

- Incomplete ankylosis → Fibrous ankylosis
  - Seen in Skeletal TB and RA
- Complete ankylosis → Bony ankylosis
  - Seen in Ankylosing spondylitis and pyogenic septic arthritis

Investigations

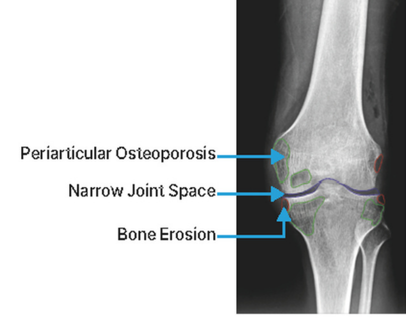
X RAY

- Soft tissue swelling is the earliest radiological sign
- Periarticular osteoporosis & localised osteoporosis are very characteristic called Washed out appearance
  - Periarticular osteoporosis is also seen in Rheumatoid arthritis



- Joint space narrowing
- Enlarged epiphysis
- Erosion of subarticular bone → characteristically on both sides of the joint

- Phemister's Triad
  - Periarticular osteoporosis
  - Peripherally located bone erosions
  - Joint space narrowing



Treatment

- For skeletal TB WHO recommends category I treatment → 2 HRZE + 4 HR
- First line drugs

Isonoazid (H)	• Bacteriostatic, 5 mg/kg/day • It inhibits cell wall synthesis
Rifampicin (R)	• Bactericidal, 10 mg/kg/day
Ethambutol (E)	• Bacteriostatic, 15 mg/kg/day
Streptomycin (S)	• Bactericidal, 15 mg/kg/day
Pyrazinamide (Z)	• Bactericidal, 25 mg/kg/day

- Second line drugs

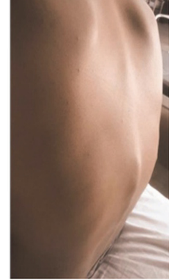
Thioacetazone	• Bacteriostatic 2.5mg/kg/day
PAS	• Bacteriostatic 10 gm/day
Ethionamide	• Bacteriostatic 15 mg/kg/day
Cycloserine	• Bacteriostatic 1 gm/day

POTT'S SPINE

00.41.10

- Clinical symptom is painful stiffness of the back
- Classical Night Cries is very Characteristic
- Deformity
  - First deformity → Loss of normal cervical & lumbar lordosis due to spasm of paraspinal muscle
  - Second deformity → gibbus due to fusion of 2-3 spinous process → Gibbus characteristic in thoracic spine
- Paraplegia caused by pott's spine is usually spastic type
- Highest incidence of paraplegia is seen in lesions of thoracic spine

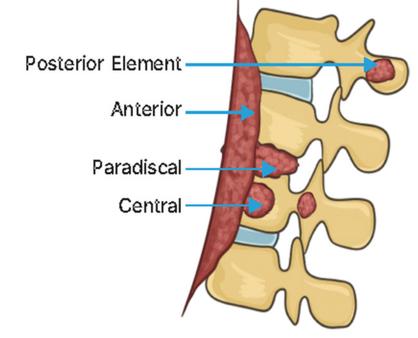
Wall Test


GIBBUS

Investigations

X Ray

- Earliest sign → Radiolucencies & loss of definition of plate margins
- Common sites of lesions in vertebral column are
  1. Paradiscal
  2. Central
  3. Anterior



Yourwish

4. Posterior

- Cold abscess in the thoracic region shows typical fusiform shape → Bird nest appearance

CT Scan

- Preferred imaging modality for the assessment of destruction of vertebral body & sequestrum formation

MRI

- Detects the disease earlier and is accurate
- Assess spinal nerve root compression, discitis, paraspinal soft tissue lesions
- It is the IOC in pott's spine among non-invasive investigations

Biposy

- Best investigation → Percutaneous CT guided biopsy is preferred

Treatment

- Chemotherapy for pott's spine should be continued for at least 9 months
- SM Tuli's Middle Path regime
  - Rest is provided in hard bed or pop bed
  - ATT
  - Follow up every 3 months. X ray & ESR are used to assess the prognosis
- Gradual mobilization is done in patients with no neurological deficit with help of spinal braces
- Surgery is done only when there is no recovery after fair trial or worsening neurological status

Indications For Surgery

WITH NEUROLOGICAL DEFICIT	WITHOUT NEUROLOGICAL DEFICIT
• No recovery after 3 - 4 weeks of drugs • Paraplegia getting worsen in spite of conservative treatment • Spastic paraplegia with severe and uncontrollable spasm of legs	• Extensive paravertebral abscess not responding to ATT • Mechanical instability → Disease affecting facet joints bilaterally

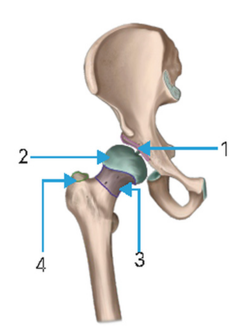
Surgical Options Available

- Costo - transversectomy
- Anterolateral decompression → now widely used
- Anterior decompression and spinal fusion → Hong Kong operation
- The posterolateral transpedicular approach is used extensively for management of spinal TB

TUBERCULOSIS OF HIP

00.49.36

- Hip is the most common site next to spine
- MC site affected by TB in children → hip joint
- The initial focus of TB lesion in hip
  1. Acetabular roof
  2. Epiphysis of femoral head
  3. Metaphysis of femoral neck (babcock's triangle)



Yourwish

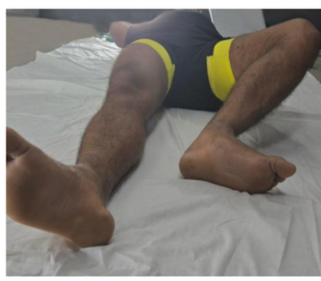
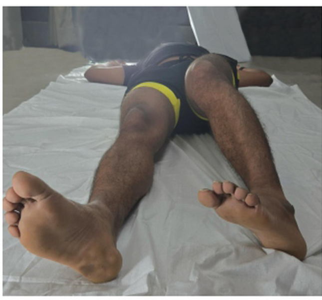
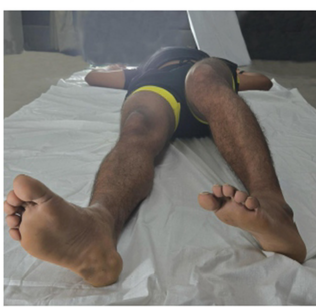
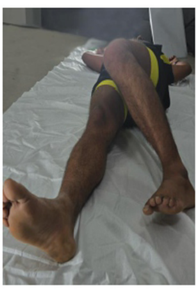
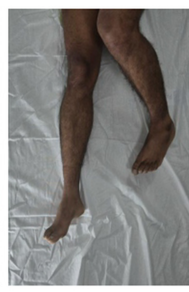
4. Greater trochanter
5. Synovial membrane

Clinical Features

- Very common in 30 yrs of age
- Night cries
- Antalgic gait (stance phase is decreased)
- Restriction of movements

Classification

- Babulkar & Pandey clinico-radiological classification

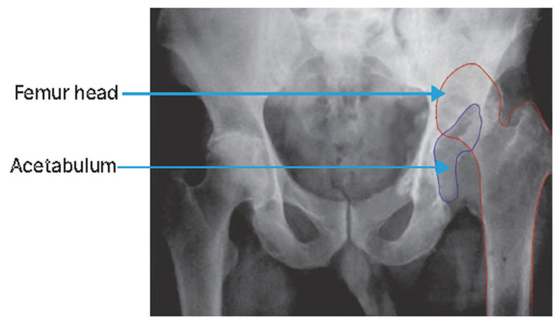
Stage	Features
Stage I - Stage of Synovitis 	• Irritable hip • FABER → Flexion , Abduction and external rotation • Apparent lengthening • Terminal range of movements restricted by 25%
Stage II - Stage of early Arthritis 	• Articular cartilage damage • FADIR → Flexion , Adduction and internal rotation • Apparent shortening • Gluteal, quadriceps muscle wasting • All ROM restricted By 50% • X Ray shows osteopenia, narrowing of joint space
Stage III - Stage of late Arthritis 	• Significant destruction of articular surface • Marked FADIR → Flexion , Adduction and internal rotation • True shortening • Gross restriction of movement • X Ray shows significant subchondral erosion & destruction
Stage IV - Stage of Pathological Dislocation  	• Gross destruction of the femoral head or the superior acetabular margin causes pathological dislocation • All ROM grossly restricted, marked shortening • Attitude of the limb mimics PDH

Yourwish

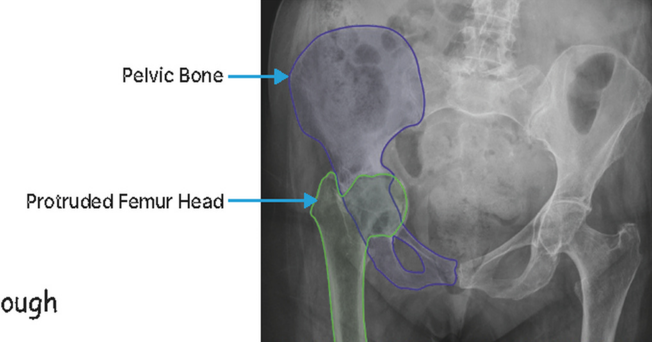
Investigations

X Ray

- Travelling acetabulum



  - The upper end of femur may displace upwards & dorsally in the outer aspect of ilium.
- Protrusio acetabuli



  - Sometimes head of femur protrude medially through destroyed acetabulum

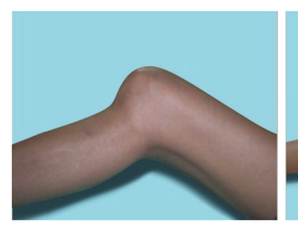
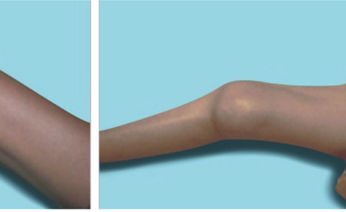
Treatment

- Stage of Synovitis
  - ATT for 9 months
  - Traction
  - Rest & mobilisation exercises
- Stage of Arthritis
  - ATT
  - Non weight bearing ROM exercises
  - Unresponsive cases - Synovectomy & Joint Debridement
- Stage of Pathological Dislocation
  - Girdlestone's Excision Arthroplasty
  - Total Hip replacement (Definitive management)

TUBERCULOSIS OF KNEE JOINT

00.55.40

- 3rd common site affected is knee
- Initial focus may be in synovium
- Triple deformity → Subluxation of tibia posteriorly, shifted laterally, rotated externally
  - It is due to spasm of biceps, hamstrings and Iliotibial band
  - Triple deformity is also seen in Poliomyelitis

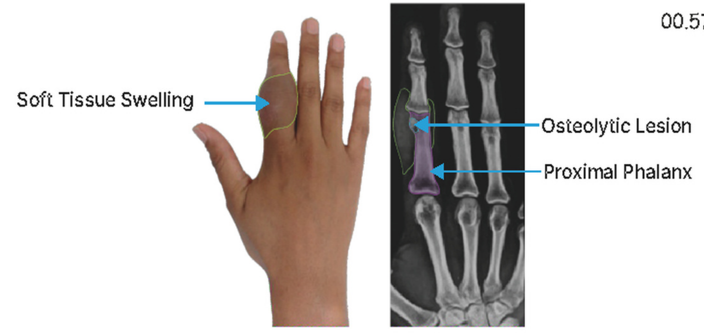



- Treatment
  - ATT
  - Traction
  - Synovectomy & joint debridement
  - Total knee replacement

TB DACTYLITIS

00.57.23

- Spina Ventosa
- Painful spindle shaped finger



BCG OSTEOMYELITIS

00.57.48

- Poncet's Arthritis → Tuberculous polyarthritis resembling Rheumatoid arthritis

PYQ

00.58.27

Q. An 8-year-old male child presents with fever and tenderness in the left lower limb. The limb is warm to the touch, and ESR is raised. An X-ray reveals periosteal elevation. What is the most likely diagnosis?

NEET PG Aug 2024

A. Ewing sarcoma
B. Osteosarcoma
C. Osteomyelitis
D. Giant Cell Tumor (GCT)

Answer: C

Q. What is the current stage of the disease in a patient who presents with hip pain and true shortening of the limb, and is diagnosed with tuberculosis of the hip?

FMGE June 2021

A. Stage of early arthritis
B. Stage of synovitis
C. Stage of advanced arthritis
D. Stage of arthritis without subluxation

Answer: C

Q. What is the most likely stage of TB hip in a female with left leg shortening?

FMGE June 2024

A. Stage 1
B. Stage 2
C. Stage 3
D. Stage 4

Answer: C

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9. METABOLIC BONE DISEASES

RICKETS

00.00.00

- Rickets & Osteomalacia are due to imperfect mineralization of bone.
- Rickets is characterized by insufficient mineralization of the growth plate osteoid.
    - Rickets is Vitamin D deficiency happening before Epiphyseal closure
- Osteomalacia is characterized by insufficient mineralization of the bone matrix osteoid.
    - Osteomalacia is Vitamin D deficiency happening after Epiphyseal closure.

Classification of Rickets

- Broadly classified into:
    - Calcipenic: Nutritional
    - Phosphopenic: Renal

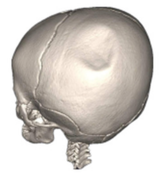
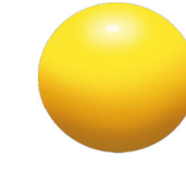
Causes For Nutritional Rickets

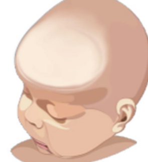
- ↓ Nutritional intake of Vit D
- Excessive breastfeeding → exclusive breastfeeding beyond 6 months
- Disorders associated with Vit D synthesis:
    - Increased skin pigmentation
    - Clothing & Sunscreen preventing exposure to sunlight
    - Low sunlight area residence
- Malabsorption: Celiac disease, Pancreatic insufficiency (Cystic Fibrosis)
- ↓ Synthesis (or) ↑ Degradation of 25-hydroxy Vit D:
    - Chronic liver disease
    - Drugs (Rifampicin, Anticonvulsants)

Clinical features of rickets

Head

- Craniotabes: Softening of cranial bones; a sensation similar to pressing a ping pong ball.
    - Pliable skull bone → McEwan's sign
    - Craniotabes is also seen in:
        - → Osteogenesis Imperfecta
        - → Hydrocephalus
        - → Syphilis
- Frontal Bossing
- Hot cross bun skull: Frontal bossing with prominent depressed sutures
- Delayed closure of fontanel
- Delayed dentition



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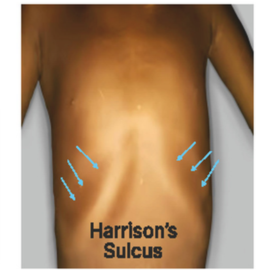
Chest

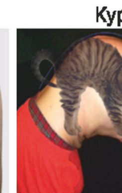
- Rachitic Rosary:
  - Widening of the osteochondral junction.
  - Feels like beads of a rosary on moving fingers along the osteochondral junction from rib to rib.
  - Harrison's Sulcus: Occurs due to pulling of softened ribs in inspiration by the diaphragm.
  - Two problems predisposed by softened ribs:
    - → Atelectasis
    - → Pneumonia
- Pectus Carinatum (Pigeon chest or keel chest): Sternum Projects Forward

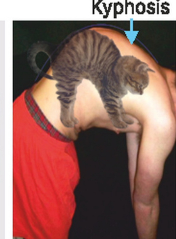
Sternum projects forward



Spine

- Rachitic cat back (Kyphosis): Common
- Scoliosis: Uncommon

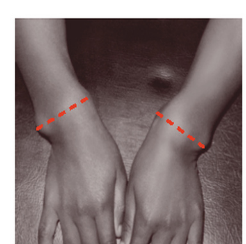


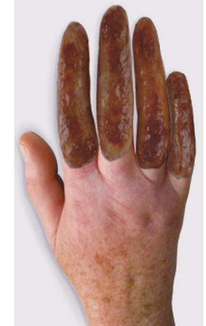


Limbs

- Genu Valgum, Genu Varum, or Wind Swept deformity

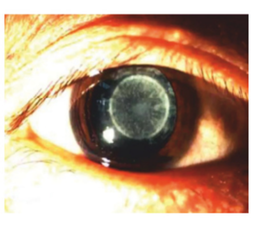
- Wrist
  - Widening of the Wrist
- Fingers
  - Sausage-Shaped Fingers:
    - → Regular constriction corresponding to the joints- String of pearl appearance.
  - 7 Differential diagnosis for sausage digit:
    - → Rickets
    - → Tuberculosis
    - → Sickle cell disease
    - → Syphilis
    - → Sarcoidosis
    - → Spondyloarthropathy
    - → Infection
- Double malleoli sign → Marfan's sign





General Features

- Failure to thrive
- Pot belly
- Symptoms of hypocalcemia
- Bilateral lamellar cataract



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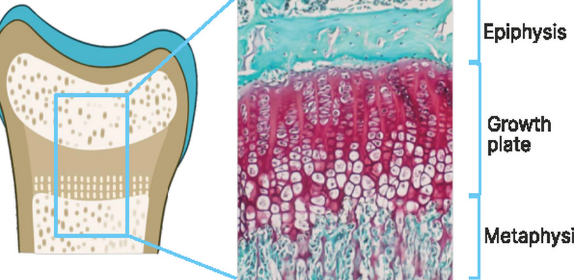
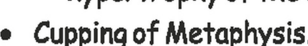
Lab Investigations
- Serum Calcium:
  - Early stage serum calcium low.
  - This stimulates PTH; after some time, it comes back to normal.
- Serum Phosphorus: Low in Phosphopenic rickets
- Alkaline phosphatase: Constantly high.
  - Most reliable lab findings

X-Ray Signs



- Generalized Osteopenia.
- Widening of the growth plate:
  - Secondary to deficient mineralization in the provisional zone of calcification.
  - A widened growth plate is due to continued hypertrophy of the cartilage cells.



- Cupping of Metaphysis.
  - Excessive concavity
- Fraying of Metaphysis:
  - Irregularity
  - Trees on the plains top appearance.
- Splaying of Metaphysis.
  - Widening
- Looser's Zone: This is otherwise called the Umbau zones
  - Stamp of osteomalacia
  - AKA: Milkman's Fracture/Pseudo Fracture/Fracture Insufficiency.

Treatment
- Stoss Therapy:
  - 3,00,000 - 6,00,000 IU Vitamin D is administered orally or IM in 2 to 4 doses over one day.
- Alternate Therapy: Given for 2-3 months
  - 1000 IU - For neonates
  - 1000 - 5000 IU - For 1 to 12 months.
  - 5000 IU - For > 12 months
- Maintenance dose: 400 IU.
- Radiological evidence of healing occurs within 2 to 4 weeks of treatment
  - Harris growth arrest line

SCURVY

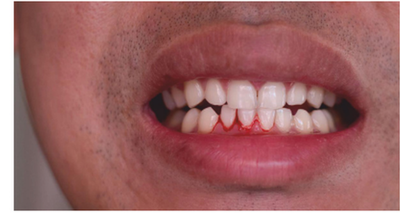
00.12.55

NEET PG 2021

- Scurvy results from Vitamin C deficiency.
- Normal collagen synthesis depends upon hydroxylation of proline and lysine, which requires Vitamin C as a cofactor.
  - Vitamin C deficiency → Hydroxyproline & Hydroxylysine depletion → Collagen contains only Non-Hydroxylated Proline & Lysine → Defective Collagen.
- Osteoblasts fail to lay down osteoid.
- Scurvy is a disorder of defective collagen synthesis and osteoid formation.

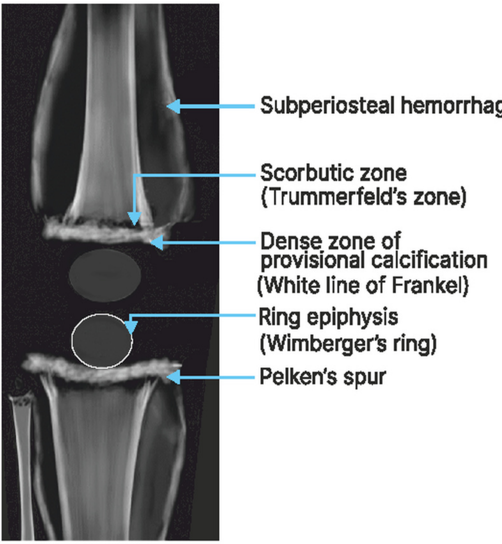
Clinical Features

- Age of onset is 6 months to 2 Years.
- Infants are irritable & anemic.
- Gums may bleed spontaneously.
- Haemorrhage near large joints may cause excruciating pain & tenderness.
- Skin petechiae



X Ray

- Generalized bone rarefaction with pencil-thin cortex.
- Metaphyseal lucency (trummerfeld zone).
- Metaphyseal corner fractures through the weakened lucent pane (pelkan spurs).
- Cupping of the metaphysis.
- Normal calcification in growing cartilage produces dense transverse bands:
  - At juxta-epiphyseal zones (Frankel's white line).
  - Around ossific centers of the epiphyses (Wimberger's ring sign)
- Subperiosteal hemorrhage → Periosteal elevation.



Treatment

- Large doses of vitamin C is the only treatment.
- Bleeding stops within 24 hrs.
- Skin petechiae resolve in 2 weeks.

OSTEOPOROSIS

00.17.18
INI CET July 2021
INICET Nov 2025

- Defined as a reduction in bone mass & structural deterioration of the bone tissue.
- Silent disease that causes no symptoms until a fracture occurs.
- MC in women, postmenopausal age.

Classification

- Primary osteoporosis
  - Type I: Postmenopausal
  - Type II: Senile
- Secondary osteoporosis
  - Drug-induced and many others

Primary Osteoporosis

TYPE I → Postmenopausal osteoporosis

- Associated with loss of estrogen, which causes increased bone turnover with bone resorption exceeding bone formation.
- Estrogen ↑ osteoprotegerin level & ↓ RANK → Inhibits osteoclastic activity.
  - ↓ Estrogen after menopause → ↓ osteoprotegerin level → ↑ osteoclastic activity → Osteoporosis
  - Estrogen deficiency causes high bone resorption by fast osteoclast activity.
- Predominant loss of trabecular bone compared with cortical bone loss.

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TYPE II → Senile osteoporosis

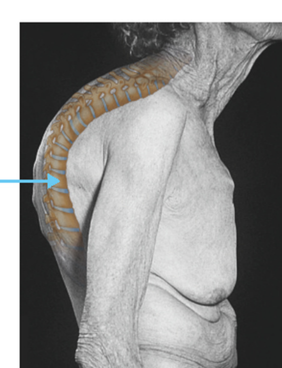
- Gradual age-related bone loss is found in both men & women.
- Usually over 70 yrs.
- Bone resorption is normal, but bone formation is defective.
- Because of increasing age, there is a reduction in the number of osteoprogenitor (pre-osteoblastic) cells.
- There is a predominant loss of cortical bone.

Secondary Osteoporosis

- Endocrine disorders:
  - Glucocorticoid-induced osteoporosis
  - Hypogonadism
  - Hyperparathyroidism.
- GIT disorders
  - Celiac disease
  - Inflammatory bowel disease
  - Gastric bypass surgery.
- Blood dyscrasias
  - Monoclonal gammopathy of uncertain significance
  - Multiple myeloma.
- Autoimmune disorders:
  - Rheumatoid arthritis
  - Systemic lupus erythematosus
  - Ankylosing spondylitis.
- Drugs
  - Glucocorticoids
  - Antidepressants
  - Anticonvulsants
  - Loop diuretics
  - Proton-pump inhibitors.
- Others
  - Carbonated soft drinks
  - Alcohol
  - Tobacco

Clinical Features

- Osteoporosis is a silent disease & is asymptomatic until a bone fracture occurs.
- Suspect osteoporosis in any individual > 50 yrs who presents with:
  - Hip fracture
  - Distal radius
  - Vertebral compression fracture
- In a vertebral compression fracture → Progressive kyphosis in the thoracic spine: Dowager's hump.
- Typical skin folds appear that run down the back laterally to the flanks: Fir tree phenomenon or Tannenbaum phenomenon



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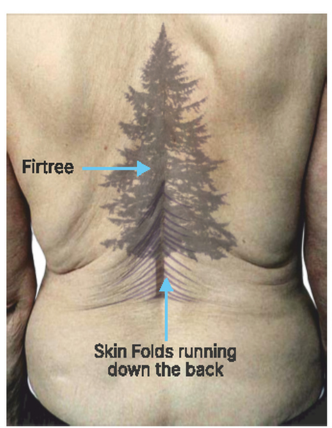
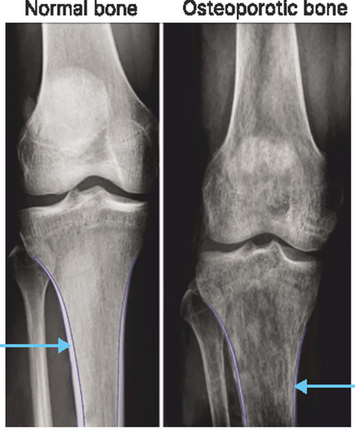


X Ray

- Most characteristic feature of osteoporosis is decreased bone density.
- The reduction in bone calcium content must exceed 30% to find features of osteoporosis in a conventional X-ray.
    - Conventional X-ray is not very helpful in the early stages.
- Pencil-thin cortex



Dexa Scan

- Diagnosis of osteoporosis is based on measurement of bone mineral density (BMD).
- BMD is measured using dual-energy X-ray absorptiometry (DEXA).
- Dexa is the gold standard investigation to diagnose osteoporosis.

T- score	Condition
• +1 to -1	• Healthy bone density
• -1 to -2.5	• Osteopenia
• -2.5 to -3.0	• Osteoporosis
• -3.0 and lower	• Severe osteoporosis

Treatment

Non pharmacological

- This is the key to the treatment of osteoporosis.
- Can be divided into:
    - Nutrition: Daily intake of at least 1200 mg of elemental calcium + 400-800 IU Vitamin D/day is recommended.
    - Lifestyle: Regular weight-bearing exercise, avoidance of tobacco & alcohol.
    - Fall prevention: Includes night lights, correction of impaired eyesight, etc.

Pharmacological

- Indications
    - Women with postmenopausal osteoporosis with BMD T scores of -2.5 & below.

- Women with borderline low BMD T scores of -1.5 & below.
- Women for whom non-pharmacological preventive measures are ineffective.

- Antiresorptive agents: Bisphosphonates, Denosumab.
- Anabolic agents: Teriparatide.

Bisphosphonates

- Main agents for the management of osteoclast-mediated bone loss leading to osteoporosis, i.e., postmenopausal osteoporosis.
- Indications for bisphosphonates:
  - Postmenopausal osteoporosis
  - Paget's disease
  - Metastasis of bone
  - Multiple myeloma
  - Hypercalcemia
- Drugs available:
  - Alendronate - Purely oral, once a week
  - Risedronate - Purely oral, once a week
  - Ibandronate - Both oral & IV
  - Zoledronic acid - only IV
- Side effects of bisphosphonates:
  - Oesophageal erosion
  - Osteonecrosis of the jaw
  - Atrial fibrillation
  - Myalgia
  - Atypical femoral fracture

Denosumab

- Fully human monoclonal antibody of the immunoglobulin isotype IgG2.
- Specifically inhibits the activity of Rankl on the surface of osteoclasts.
- Increases the maturity time of osteoclasts → Decreases the osteoclastic activity.
- Can be used in renal failure.

Teriparatide

- Shortened, recombinant form of human parathyroid hormone
- Helps in the augmentation of bone substance by stimulation of proliferation & differentiation of osteoblasts
- Contraindications:
  - Hypercalcemia
  - Renal insufficiency
  - Paget's disease

ARTHRITIS

00.27.07

Gout

FMGE June 2021

- Metabolic disorder that produces inflammation of the joints due to precipitation of Monosodium Urate Crystals within the joints.
- MC affected joint is the great toe.

- Acute attack may be followed by remission.
  - When more than two attacks happen within 12 months → Chronic gout.

Etiology

- Classified into primary & secondary.
- Primary is due to underexcretion of urate in the kidney without any obvious cause.
- Secondary may be due to:
  - Myeloproliferative disorders
  - Diuretics
  - Renal failure

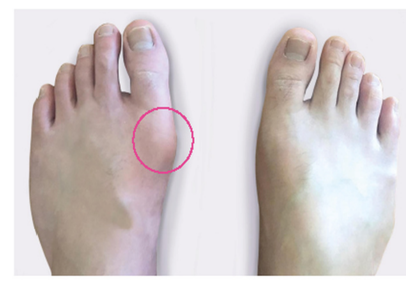
Precipitating Factors

- Men - 10 times more common than women
- Menopause is a risk factor for women
- Increasing age
- Overweight
- Alcohol consumption
- Sugary food
- Heavy meat

Clinical features

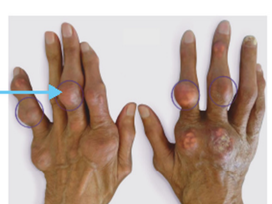
Acute gout

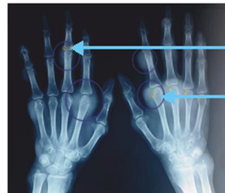
- Asymptomatic hyperuricemia is 10 times more common than gout.
- Acute gout affects the following joints:
  - First MTP joints (podagra) - 70%
  - Knee
  - Ankle
  - Midfoot
  - Elbow
  - Wrist
- Symptoms
  - The acute attacks often begin at night & within a few hours the affected joint becomes red, hot, swollen & extremely painful.
  - The patient may be unable to walk or bear the touch of a bedsheet.
  - The symptoms normally settle after 5-7 days.



Chronic Gout

- A patient with chronic gout has more than two acute gout attacks within 12 months.
- Multiple joints are involved
- Urate Deposits (Tophi) → Chalky deposits of uric acid.
  - They collect in subcutaneous planes as masses under the skin of the affected joint.
  - They usually develop after several years of gout.
  - Tophi results in erosive disease → Chronic gouty arthropathy





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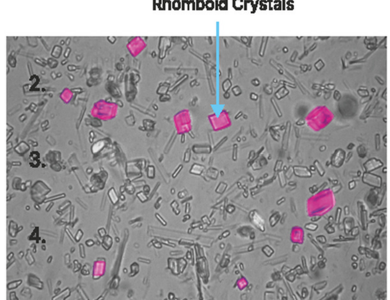
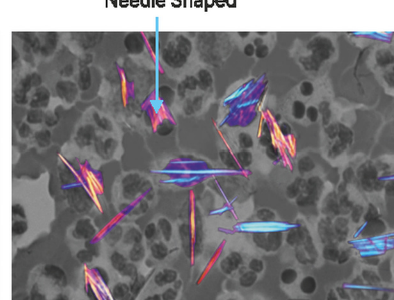
Diagnosis

- Uric Acid Levels
  - Normal uric acid level → 6.8 mg/dl
  - Hyperuricemia → > 7 mg/dl
  - Hyperuricemia remains an important feature of gout, but levels may be normal in between acute attacks.
  - If gout is suspected, repeated estimations of serum uric acid over a period of a few weeks can be of great value.
- Acute gout can be diagnosed by identifying urate crystals in synovial fluid, bursa, or aspirate of tophus.
  - Crystals are needle-shaped and strongly negative birefringent under polarized light.
- Crystal Differentiation:
  - Pseudo Gout: Calcium Pyrophosphate Dihydrate Crystals.
    - → Appear as rhomboid crystals.
    - → Positive birefringent
    - → MC joint: Knee joint
  - Gout: Monosodium Urate Crystals.
    - → Appear as needle-shaped crystals.
    - → Negative birefringent
    - → MC joint: Great toe.
- The absence of crystals doesn't rule out gout.



Pseudo Gout



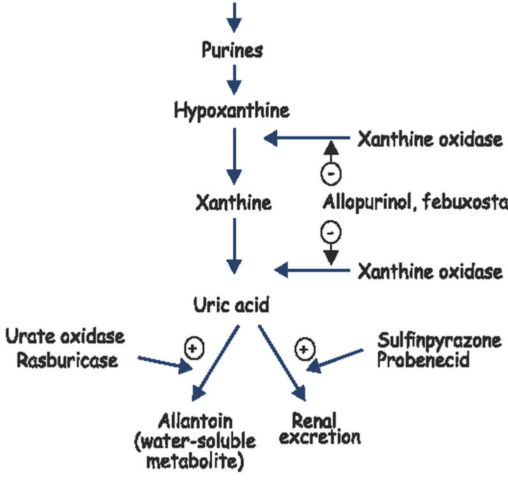
Gout

Management

- Acute Attack
  - Topical: Ice and rest of the inflamed joint.
  - NSAIDs (Drug of Choice): Indomethacin 75mg BD or Naproxen 500mg BD.
  - Oral & IV: colchicine.
  - Injections: Intra-articular and systemic steroids.
- Chronic Gout
  - Appropriate Lifestyle Modification
  - Weight Loss
  - Reduction of Alcohol & Fructose consumption.

Urate-Lowering Drugs

- Uricostatic Drugs - Xanthine Oxidase Inhibitors
  - Allopurinol
  - Oxypurinol
  - Febuxostat
- Uricosuric Drugs
  - Probenecid, Benzbromarone, Losartan
  - Indicated in allopurinol allergic patients & under excretors.
  - Used only in patients with normal renal function and no lithiasis.



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Rhuematoid Arthritis

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- Chronic inflammatory disease characterized by hyperplasia of synovial lining cells, angiogenesis, and infiltration of mononuclear cells, resulting in pannus formation, cartilage erosion, and ultimately ending in joint destruction.
- Statistics

INICET Nov 2023,2025
FMGE Jan 2023

  - 1% of the adult population suffers from RA.
  - 75% are women.
  - The peak age of incidence is 40 to 50 years.

Etiology

- 15 to 20% of Monozygotic twins exhibit concordance.
- HLA DR4 found to be a major risk factor.
- HLA DW16 major risk factor in Asian Indians.
- HLA DRB1 individual who smokes is at high risk.
- Infectious Causes:
  - Mycoplasma
  - Mycobacteria
  - E.Coli
  - EBV, CMV, Parvovirus, Rubell

  a

Clinical Features

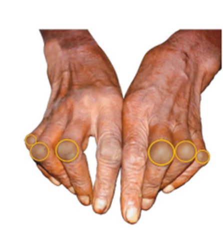
- Symmetrical involvement of the small joints of the hands and feet.
- Joints involved in decreasing frequency:
  - MCP > Wrist > PIP > Knee > MTP
  - Other joints involved: Shoulder, Ankle, Cervical Spine, Hip, Elbow, TMJ
  - Only the cervical spine is involved.
  - Backache is not a feature of RA (Rheumatoid Arthritis)
- Joints that are NOT Involved:
  - Distal Interphalangeal joint
  - Sacroiliac joint
- Rheumatoid Nodules:
  - Present Only In 25% Cases.
  - Commonly seen on the olecranon aspect of the elbow, achilles tendon, and the extensor aspect of the hand & foot.
  - Methotrexate may cause an increase in nodulosis.
- Caplan's Syndrome: RA + Coal workers' Pneumoconiosis
- Felty's Syndrome: RA + Splenomegaly + Neutropenia
- Still's disease: Juvenile RA
- Symptoms of RA will improve with pregnancy

Rheumatoid Nodules

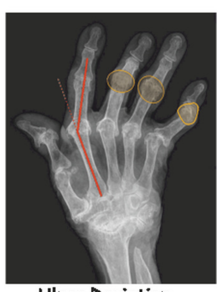
Typical Deformities Of Ra

- Swan Neck Deformity
- Boutonniere Deformity
- Hitch-Hikers Deformity
- Z-Deformity
- Main-En-lorgnette Deformity (Telescoping Fingers)

Swan Neck Deformity



Boutonniere Deformity



Ulnar Deviation - Z Deformity

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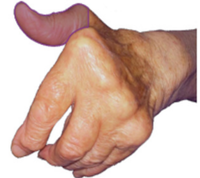
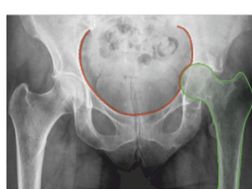
- Wind-Swept Deformity
- Torch-Light Deformity
- Sudden Onset Flat Foot - Due to Tibialis Posterior Insufficiency
- Protrusio Acetabuli
- Bakers Cyst



Hitch Hikers Deformity

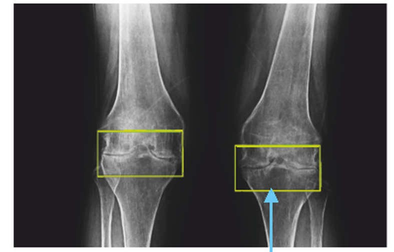
Wind Swept Deformity



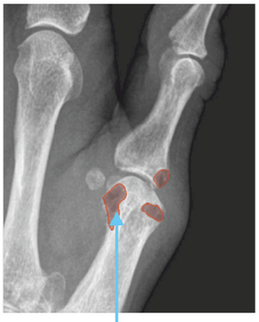
Protrusio Acetabuli

Diagnostic Criteria

- 1987 American College of Rheumatology Revised Criteria
  - Morning stiffness for more than one hour
  - Arthritis of three or more areas
  - Arthritis of hand joints
  - Symmetrical Arthritis
  - Rheumatoid Nodule
  - Positive Rheumatoid Factor
  - Positive Radiological Feature
- 4 out of 7 for six weeks is considered positive.



Symmetrical Joint Space Narrowing



Marginal Erosion

Classical Radiological Features

- Symmetrical joint space narrowing
- Marginal & central articular erosion - Earliest articular change
- Periarticular osteoporosis (Also in Skeletal TB)
- Soft tissue swelling - Earliest sign

Lab Investigations

- Anti-CCP
  - Can Be Positive in Early Stages
  - Has prognostic importance
- Rheumatoid factor
  - Positive only in 60% cases.
  - False positive RA factor:
    - → Cryoglobulinemia
    - → Parvo 19 Infection
    - → Hepatitis C
    - → Sjogren's Syndrome
    - → SLE
    - → 5% Of Normal Individuals
- Positive ANA Occurs In 40%
- Elevated ESR & CRP

Treatment

- In the Acute Stage, corticosteroids are used temporarily for 1 to 2 weeks
- DMARDs
  - HCQ
  - Sulfasalazine

- MTX
- Leflunomide
- Biological DMARDs (Subclinical TB should be ruled out before starting)
  - Infliximab
  - Etanercept
  - Adalimumab
  - Golimumab
  - Anakinra
  - Tocilizumab
- Surgical Correction → Total knee replacement

Ankylosing Spondylitis

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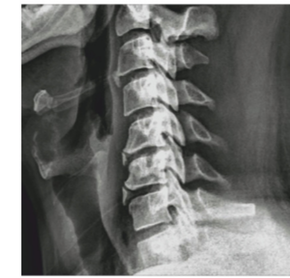
NEET PG 2021
FMGE June 2022

- Aka: Marie-Strumpell Disease.
- Inflammatory arthritis belonging to the group of "seronegative Spondyloarthropathy."
- Seronegative Spondyloarthritis are:
  - Ankylosing Spondylitis
  - Psoriatic Arthritis
  - Reactive Arthritis → Reiter's Disease
    → Non-gonococcal urethritis, arthritis, and conjunctivitis
- Autoimmune Disease that mainly involves the sacroiliac joints, joints of the vertebral column, and their adjacent soft tissues, such as tendons and ligaments.

Etiology

- The prevalence of Ankylosing Spondylitis has a clear correlation with the Human Leukocyte Antigen (HLA)-B27.
- 80 to 95% of patients with Ankylosing Spondylitis have HLA-B27.
- Other environmental triggers may be bacterial infection, specifically Intestinal Klebsiella.

Pathology



- The inflammation mainly affects the entheses
  - Where ligaments, tendons, and capsules are attached to the bone.
- Three processes are observed at the entheses:
  - Inflammation
  - Bone Erosion
  - Syndesmophyte (Spur) Formation

Clinical Features

- Men are affected three times more than women.
- Age of Onset: Typically 20 to 30 years.
- Early Presentation: Pain and stiffness in the thoracolumbar region
  - Low back pain and buttock pain with pronounced morning stiffness.
- Symptoms:
  - Severe night pain is disturbing sleep.
  - Lumbar spine movements in all directions are restricted and painful.
  - Gradual loss of normal lumbar lordosis with the development of thoracic kyphosis and forward bending of the cervical spine.

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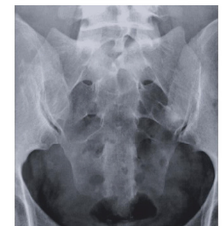
- The patient may develop plantar fasciitis and Achilles tendinitis.
- Costochondral and costovertebral joints become painful; chest expansion is markedly reduced.
- In 25% to 30% of patients, hip joints are involved
  → Painful
  → Movements are gradually reduced

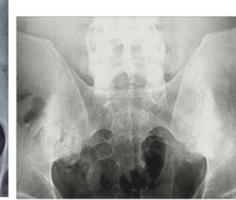
Advanced Manifestations

- Extra-articular Manifestations: Uveitis and cardiac involvement
  - Aortic incompetence and conduction defects are seen rarely.
- In fully developed Ankylosing Spondylitis, the patient develops Question Mark Body Posture, with difficulty in walking and inability to look forward.

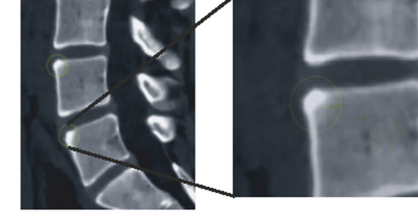
Imaging

- Sacro-iliac joint
  - Radiological changes in the sacro-iliac joint are one of the important criteria to diagnose ankylosing spondylitis.
  - Initially, Subchondral erosions develop at the iliac side of the sacro-iliac joints, followed by sclerosis & proliferation.
  - At the end-stage, the Sacro-iliac joint may be completely obliterated & seen as a thin line or not visible at all.

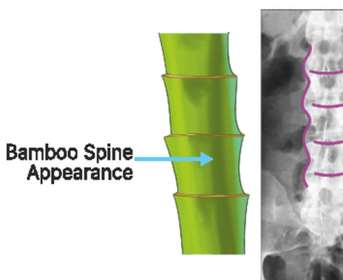

Normal Sacro - Iliac Joint


Sacro - Iliac Joint In Ankylosing Spondylitis

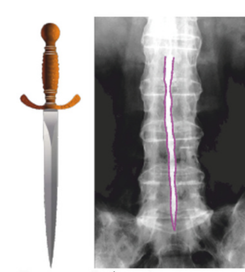
- Spine
  - In the early stages of Ankylosing spondylitis, small erosions are seen at the corners of the vertebral bodies with reactive sclerosis: Shiny corner sign - Romanus sign.
  - The Vertebral bodies are squared.



  - Paravertebral ossification, known as syndesmophytes, is seen later
    → Finally, fuse with each other, giving a "classical bamboo spine appearance"



  - Linear ossification of the interspinous ligament gives a "dagger spine appearance" in the AP view.


Dagger Spine Appearance

Diagnosis

- Modified New York criteria
  - 3 months or more of inflammatory arthritis that improves with exercise & worsens with rest
  - Limitations of lumbar movement in the coronal and sagittal planes
  - Limitation of chest expansion

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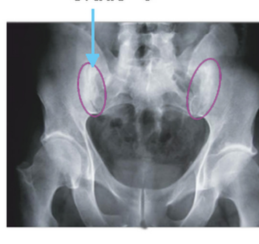
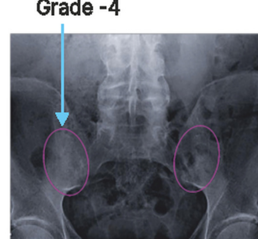
- Radiographic parameters include:
  → >= Grade 2 Sacroiliitis bilaterally (or)
  → Grade 3 or 4 Sacroiliitis unilaterally
- Requires at least 1 clinical manifestation & at least 1 Radiographic parameter.





Treatment

- Medical
  - Physical therapy to improve the spine mobility & physical functioning
  - NSAIDs - Indomethacin is the DOC
  - TNF inhibitors, including Infliximab, Adalimumab
  - For peripheral arthritis, the disease-modifying antirheumatic drugs, including Sulfasalazine(DOC) & Methotrexate, are used.
- Surgical
  - Spinal Osteotomy
  - Osteotomy & Spinal Fusion

PYQ

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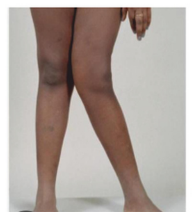
Q. A child presents with growth failure. Biochemical analysis shows normal Ca^{2+}, normal PTH, reduced phosphate, and increased ALP. What is the diagnosis?

A. Nutritional rickets
B. Hypophosphatemic rickets
C. Type 1 vddr
D. Type 2 vddr



Answer: B

Q. Which of the following vitamin deficiencies is seen in rickets?

A. Vitamin A
B. Vitamin B
C. Vitamin C
D. Vitamin D

Answer: D

Q. A 7-year-old child was brought in with bow legs, and on x-ray of the wrist, the following were the findings. What is the diagnosis?

A. Rickets
B. Scurvy
C. Hypophosphatemia
D. None

Answer : A

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Q. What is a characteristic feature observed in osteoporosis?
A. Normal calcium and increased ALP
B. Normal calcium and normal ALP
C. Decreased calcium and normal ALP
D. Increased calcium and increased ALP

Answer : C

Q. A 60-year-old woman presents with generalized bone pain and easy fatigability. X-ray shows diffuse osteoporosis. There is hypercalcemia. Which of the following investigations is most appropriate to confirm the diagnosis?
A. Sestamibi Scan
B. Ct Scan
C. Triple Phase Bone Scan
D. Mri

Answer : A

Q. Diagnosis of Gout is confirmed by which test?
A. Serum Uric Acid Level
B. Synovial Fluid Analysis
C. Urine Uric Acid Levels
D. X-ray changes

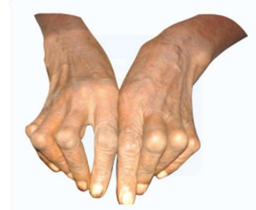
Answer: A

Q. In the outpatient department, a female patient presents with arthritis that symmetrically affects multiple joints, including the wrists, hands, and feet. The patient reports morning stiffness lasting for more than 1 hour, and examination reveals swollen and tender joints. What is the likely diagnosis?
A. Rheumatoid Arthritis
B. Psoriatic Arthritis
C. Osteoarthritis
D. Gout

Answer: A

Q. An elderly patient with the presented deformity was brought to the outpatient department. What is the likely diagnosis?
A. Rickets
B. Osteomalacia
C. Osteoarthritis
D. Rheumatoid arthritis

Answer: D

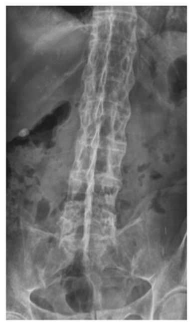


Q. Which deformity of rheumatoid arthritis is shown below?
A. Swan Neck Deformity
B. Boutonniere Deformity
C. Z Line Deformity
D. Piano Key Deformity

Answer: B

Q. What is the most probable diagnosis for a 20-year-old male patient who has been experiencing lower backache and morning stiffness for two years, along with bilateral heel pain for the past six months?
A. Tuberculosis Of The Spine
B. Ankylosing Spondylitis
C. Disc Prolapse
D. Mechanical pain

Answer : B



Q. A 34-year-old male has been suffering from a progressive lower backache and early morning stiffness for the past six months. His symptoms are more severe in the morning and improve with exercise. He is a known case of ulcerative colitis. An X-ray of his lumbar spine is given below. What is the most likely diagnosis?
A. Pott's Spine
B. Psoriatic Arthritis
C. Ankylosing Spondylitis
D. Rheumatoid arthritis

Answer : C

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