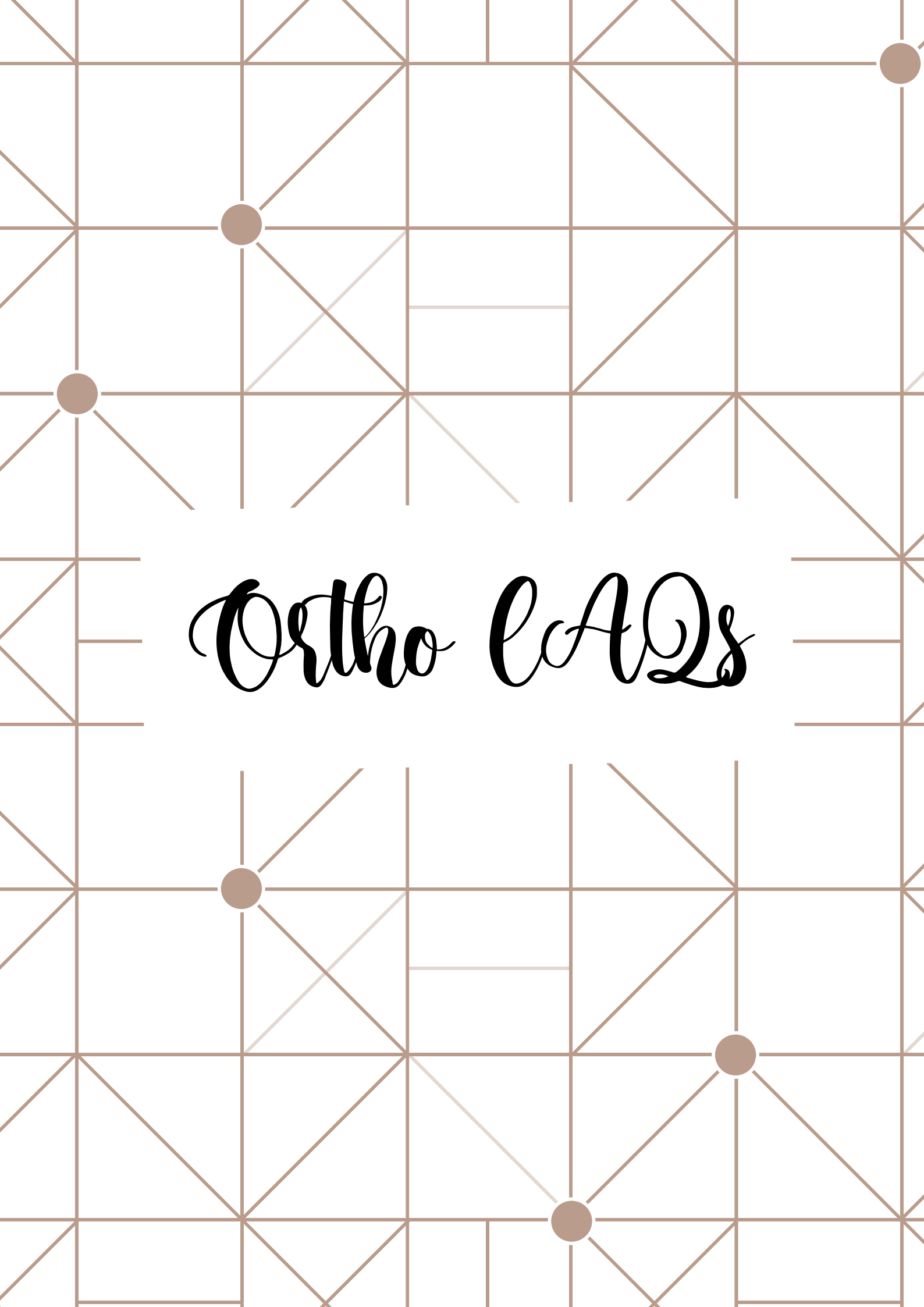




Ortho L&A Qs

Fractures

• Definition: Break in continuity of surface / cortex of Bone.

• Classification : ① Aetiology

- Traumatic
 - Direct - Tap / Crush / Penetration
 - Indirect - Traction / Angulation / Rotation
- Pathological
- Stress - due to chronic repetitive injury

② On basis of complexity:

- Simple - fracture in 2 pieces
- Complex - fracture in multiple pieces.

③ On basis of displacement:

- Undisplaced
- Displaced

- Most consistent symptom: Pain
- Most consistent sign: Tenderness

④ On basis of Relationship with external environment:

- Close
- Open
 - Internally open [from within] - due to sharp fracture
 - Externally open - Object causing fracture lacerates skin and soft tissue

⑤ On basis of pattern:

- Transverse
- Oblique
- Spiral
- Comminuted - Multiple fragments
- Segmental - 2 fractures in one bone at different levels

⑥ On basis of force causing fracture:

- High velocity
- Low velocity

• Causes of Pathological Fractures:

• Local

- Infection [Pyogenic, Tubercular]
- Bone Cyst [Simple; Aneurysmal]
- Ischemia
- Radiation
- Eosinophilic granuloma
- Tumors [Benign; malignant]

• Generalised diseases:

- Hereditary
 - Osteogenesis imperfecta
 - Ollier's disease
- Acquired
 - Osteoporosis (most common)
 - Osteomalacia
 - Rickets
 - Scurvy
 - Paget's disease
 - Multiple myeloma
 - Metastatic Carcinoma

Fracture healing

• Stages

① Stage of Haematoma

- Upto 7 days
- Blood leaks from torn vessels and forms haematoma.
- Ischemic Necrosis of fracture ends.
- Sensitisation of precursor cells which later contribute to healing process.

② Stage of Granulation tissue

- Upto 2-3 weeks
- Sensitised precursor cells produce cells which differentiate to form Blood vessels, Fibroblasts, Osteoblasts etc and these collectively form a soft granulation tissue.
- Fracture is still mobile.

③ Stage of Callus

- 4th to 12th week
- Callus is radiologically visible. [Earliest sign on X-ray (at 3 weeks)]
- Callus formation is slower in adults than children.
- Fracture is clinically united; No more mobile.

④ Stage of Remodelling

- Formerly called stage of Consolidation
- Over 1-2 years
- Woven bone is replaced by mature bone with typical lamellar structure.

⑤ Stage of Modelling

- Formerly called stage of Remodelling.
- Bone is gradually strengthened over period of many years.

• Factors

- Patient Factors:
 - Age (faster in children)
 - Nutritional status
 - Systemic diseases
- Related to fracture:
 - Pattern (comminuted fractures heal slower)
 - Soft tissue interposition
 - Ischaemic fracture ends
 - Open fractures

} → delay
- Related to treatment:
 - Compression - Enhances healing
 - Immobilisation [Improper may delay healing]
 - Reduction
 - └ Good apposition → Faster healing
 - └ Inadequate reduction - delayed healing

**Lower end of Radius Fractures:

Galeazzi fracture dislocation

- Colle's fr.
- Smith's fr.
- Barton's fr.

Colle's fracture

• <u>Definition</u>	Fracture at distal end of Radius, at its cortico-cancellous junction [about 2cm from distal articular surface] in adults with typical displacements.
• <u>Incidence</u>	• Commonest fracture above 40 years of age • More common in women because of post menopausal osteoporosis.
• <u>Mechanism</u>	• Direct - High velocity impact. • Indirect - Fall on outstretched hand.
• <u>Displacements</u>	• Impaction of fragments. • Proximal shift • Dorsal displacement & Dorsal tilt • Lateral displacement & Lateral tilt • Supination
• <u>C/F</u>	Pain • Swelling • Tenderness • Dinner fork deformity may be present.
• <u>Radiology</u>	• Most displacements can be identified on X-ray. • Dorsal displacement is most characteristic (seen in lateral view) • Lateral displacement is seen in AP view.
• <u>Complications</u>	• Stiffness of joints - Fingers stiffness is most common. • Malunion • Subluxation of inferior radio-ulnar joint • Carpal tunnel syndrome - due to injury to median nerve. • Sudeck's osteodystrophy • Rupture of extensor pollicis longus tendon.
• <u>Mx</u>	• Undisplaced - Immobilisation in Colle's cast x 6 weeks • Displaced - Manipulative reduction followed by immobilisation in Colle's cast x 6 weeks.
	• <u>Technique</u> - ① Muscles of forearm relaxed ② Surgeon grasps injured hand as if he is shaking hands. ③ Disimpact fragments by longitudinal traction. ④ After correction of displacements, distal fragment is pressed into Palmar Flexion and Ulnar deviation ⑤ Plaster cast applied from below elbow to metacarpal heads, maintaining wrist in Palmar Flexion & Ulnar deviation → Colle's cast ** Patient is encouraged to move fingers as soon as Plaster dries ** X-ray is taken to check closed reduction X-ray is taken every week for 1st 3 weeks to detect redisplacement ** Percutaneous K-wires may be needed for transfixated comminuted fractures.

Supracondylar Fracture of Humerus

* One of most serious fractures of childhood.

- Mechanism
 - Fall on outstretched hand.
 - Elbow is forced into hyperextension.

- Pathoanatomy Transverse fracture line through distal metaphysis of humerus above condyles

- Types
 - ① Extension: Distal fragment is extended in relation to proximal fragment. (more common)
 - ② Flexion: Distal fragment is flexed in relation to proximal fragment.

- Displacements
 - ① Posterior / Backward shift
 - ② Posterior / Backward tilt
 - ③ Medial / Lateral shift
 - ④ Medial tilt
 - ⑤ Internal Rotation

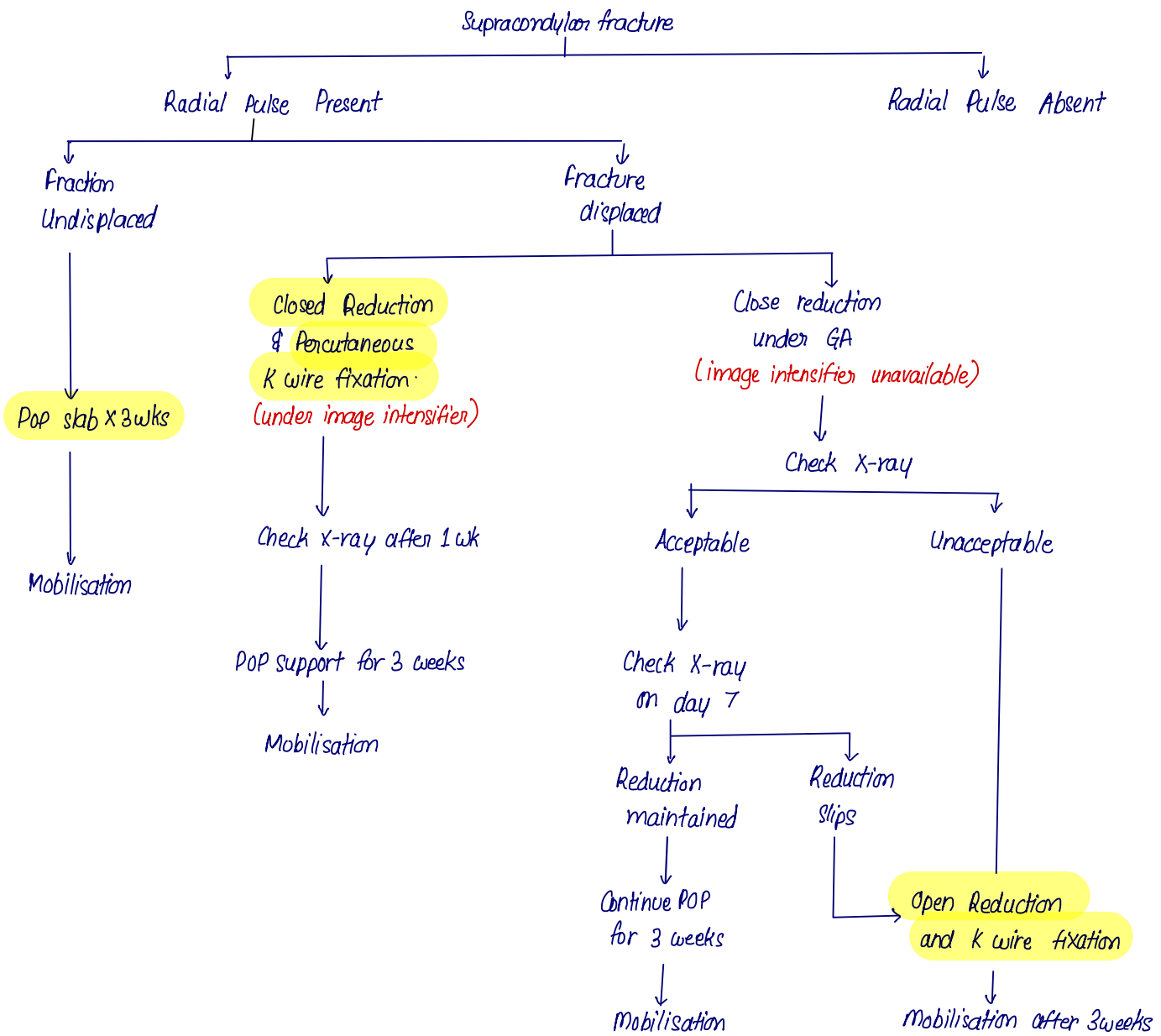
- Symptoms
 - Pain
 - Swelling
 - Inability to move affected elbow.

- Signs
 - Tenderness
 - Unusual prominence of tip of olecranon due to backward tilt.
 - Since fracture is above condyles; 3 bony points relationship of normal elbow is maintained.

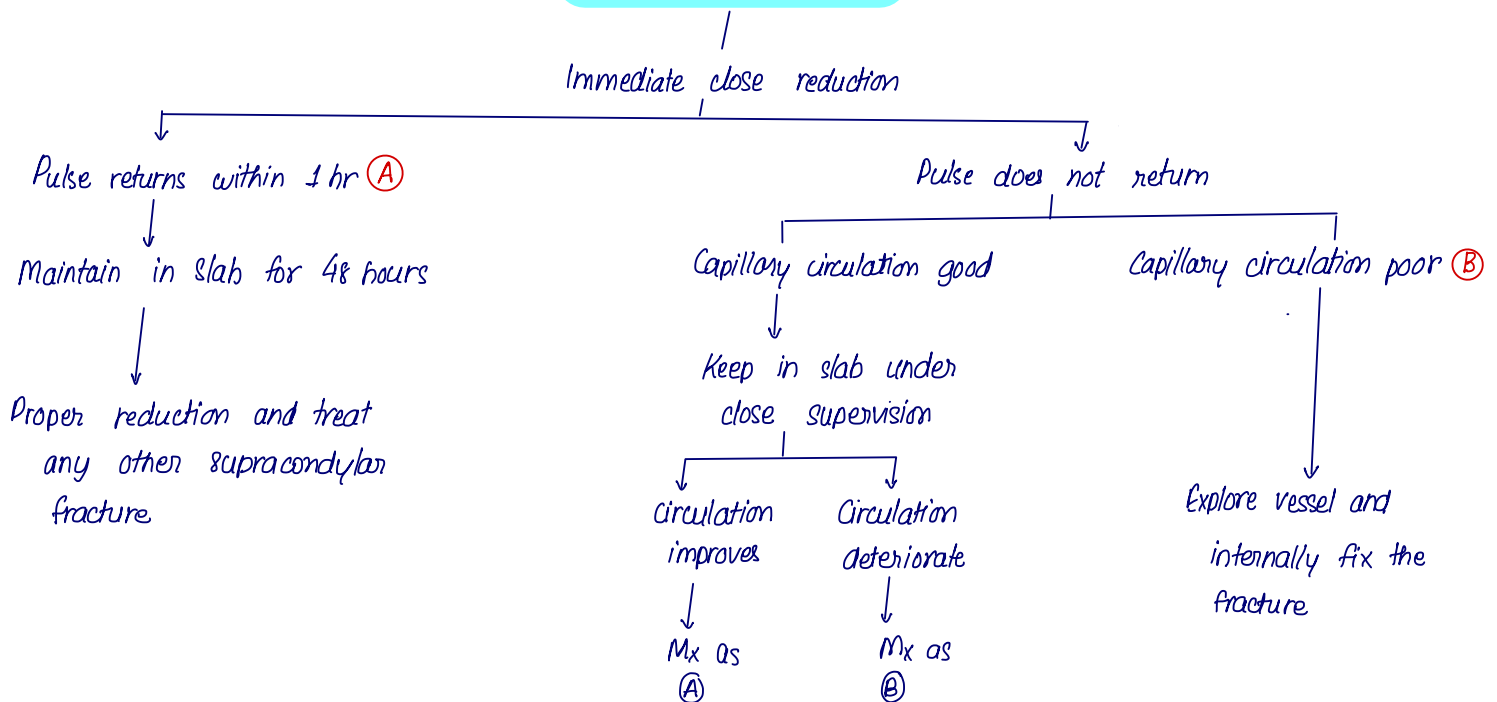
* If presented late, swelling makes it difficult to appreciate latter 2 signs.

- Radiology
 - Presence of ossification centres around elbow may make diagnosis difficult in minimally displaced fractures.
 - Following may be seen on X-rays:
 - AP view: Proximal shift, medial / lateral shift, medial tilt, Rotation of distal fragment
 - Lateral view: Proximal shift, posterior shift, posterior tilt, rotation of distal fragment

• Management:



* Radial Pulse Absent



• Complications

• Immediate

- Injury to brachial artery
- Injury to nerves
 - └ Median nerve (most common)
 - └ Radial nerve

• Early

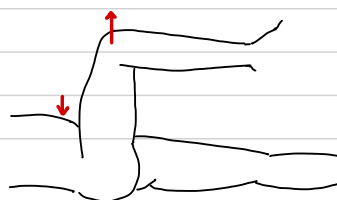
- Volkmann's ischemia - Ischemic injury to muscles and nerves of flexor compartment of forearm.

• Late

- Malunion - Gun stock deformity
- Myositis ossificans
- Volkmann's ischemic contracture

Posterior Dislocation of Hip

	- There are 3 main types of dislocations in hip: • Posterior (commonest) • Anterior • Central fracture-dislocation
• <u>Intro</u>	• Head of femur is pushed out of acetabulum posteriorly. • It is associated with chip fracture of posterior lip of acetabulum in about 50% of cases (called fracture-dislocation).
• <u>Mechanism</u>	Force directed along shaft of femur with hip flexed. - Occurs often in motor accidents; occupant of car is thrown forwards and his knee strikes against the dashboard [Hence called Dashboard Injury].
• <u>C/F</u>	• H/o severe trauma • Pain • Swelling • Deformity [Flexion, adduction, internal rotation] • Associated with shortening of leg. • Head of femur may be felt in gluteal region. ✱ This injury is often missed when a/w other severe injuries.
• <u>Radiology</u>	• Femoral head is out of acetabulum. • Thigh is internally rotated; Lesser trochanter is not seen. • Shenton's line is broken. • Bony chip from acetabulum should be looked for. ✱ CT may be necessary where associated fracture is suspected.
• <u>Mx</u>	Reduction of dislocated hip is an emergency as longer head remains out, more are chances of it becoming avascular. • <u>Closed Reduction</u> - In most cases, it is possible to reduce hip by manipulation under general anaesthesia. - The chip fracture of acetabulum (if present), falls in place as head is reduced. - <u>Technique</u>: ① Patient is anaesthetized and placed supine. ② Assistant grasps the pelvis firmly. ③ Surgeon flexes hip and knee at right angles and exerts an axial pull. ④ Usually a sound of reduction is heard and hip moves freely in all directions.



• Open Reduction: May be required in cases where:

(i) Close reduction fails

(ii) There is an intra articular loose fragment not allowing accurate reduction.

(iii) Acetabular fragment is large & is from weight bearing part of acetabulum.

• Complications

① Injury to sciatic nerve

② Myositis ossificans:

- Occurs a few weeks to months after injury.

- X-ray shows mass of fluffy new bone around hip.

- Rx: Rest & analgesics.

③ Avascular Necrosis of femoral head:

- In 15-20% cases of dislocation

- Changes appear in X-ray generally 1-2 years after injury

- Clf: Pain in hip after a seemingly painless period following Rx of dislocated hip.

- Eventually requires hip replacement.

④ Osteoarthritis:

- Late complication

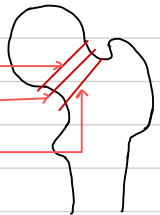
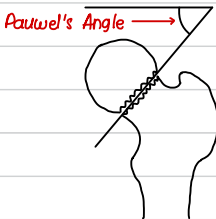
- Causes

└ Avascular femoral head

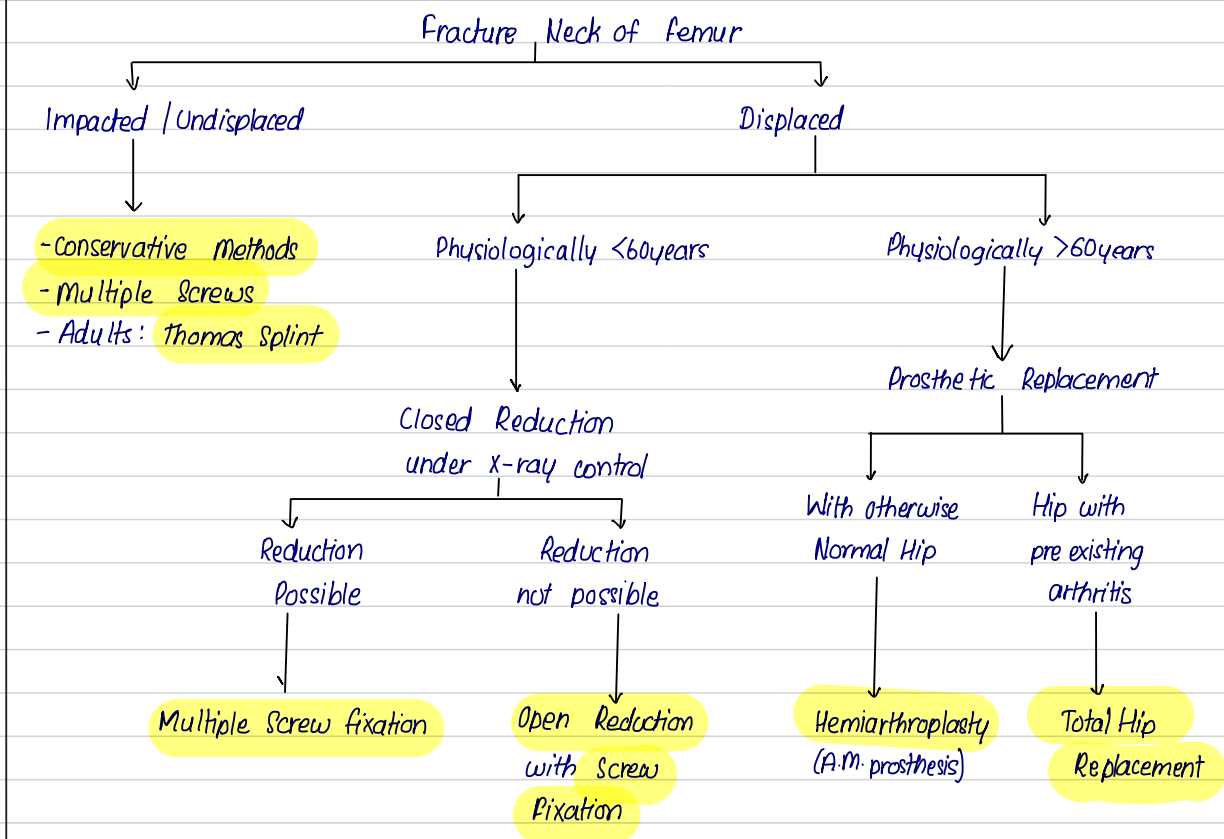
└ Incongruous acetabulum and femoral head.

- Rx: Total hip replacement

Fracture of neck of femur

- The term fracture of neck of femur is used for Intracapsular fractures of femur neck.
 - Extracapsular fractures are generally called Inter-trochanteric fractures.
- Pathoanatomy
- Most fractures are displaced → Distal fragment is proximally migrated & externally rotated
 - Displacements are less marked because capsule of hip joint is attached to distal fragment.
- Classifications
- ① Anatomical :
- (i) Subcapital - fracture just below head
 - (ii) Transcervical - fracture in middle of neck
 - (iii) Basal - At base of neck
- ✦ More proximally fracture is located, worse is the prognosis.
- 
- ② Pauwel's Classification : Based on angle of inclination of fracture in relation to horizontal plane (Pauwel's angle)
- 
- Type I : $\angle = 30^\circ$
 - Type II : $\angle = 50^\circ$
 - Type III : $\angle = 70^\circ$
- ③ Garden's Classification : Based on degree of displacement of fracture.
- Stage 1 : - Fracture incomplete
 - Head tilted in posterolateral direction.
 - Obtuse angle laterally at trabecular stream
 - Called Impacted or Abducted fracture
 - Stage 2 : - Fracture complete but undisplaced
 - Break in trabecular stream with little angulation
 - Stage 3 : - Fracture is complete and partially displaced.
 - Distal fragment rotates externally & causes internal rotation of head.
 - Alignment b/w trabeculae of head and acetabulum is also lost.
 - Stage 4 : Fracture is complete and fully displaced.

• <u>Mechanism</u>	• Elderly - Trivial fall · Osteoporosis is considered important contributory factor. • Young - Severe trauma
• <u>Clf</u>	• Pain in Groin • Inability to move limb or bear weight following trivial injury. • Slight swelling • Patient with impacted fracture may even arrive walking. • <u>On Examination:</u> - External rotation of leg, Patella facing outwards - Shortening of leg - Tenderness in groin - Attempted hip movements are painful - Active straight leg raising is not possible.
• <u>Radiology</u>	• Take X-ray of both hips rather than just affected hip. • Following features should be noted: - Break in medial cortex of neck - External rotation of the femur - Overriding of greater trochanter (lies at level of head of femur) - Break in trabecular stream - Break in Shenton's line.
• <u>Mx</u>	• This fracture is rightly termed an "Unsolvable fracture" because of high incidence of complications. • Factors which make treatment difficult: - Blood supply of proximal fragment (Head) is cut off. - It is difficult to achieve reduction and maintain it because proximal fragment is too small. • Because of above factors, this fracture invariably needs operative treatment. • Modality of treatment is usually Closed/Open Reduction with Internal Fixation. • <u>Internal Fixation:</u> following implants are used: - Multiple Cancellous Screws - Most commonly used. - Dynamic Hip Screw (DHS) - Multiple Knowle's Pin / Moore's Pins - In children



• Mx of Late Presenting Cases:

• Patient Age > 60 years: Replacement Arthroplasty

• Younger Patients

- Head Vascular — McMurray's / Pauwel's osteotomy
Meyer's Procedure
- Head Avascular — Bipolar Prosthesis

• Complications

① Non Union

- In approximately 30-40% cases.
- Due to inadequate immobilisation & poor blood supply.
- Rx: Elderly: Replacement Arthroplasty
Young: - Neck reconstruction (Baksi's procedure)
- Pauwel's osteotomy

② Avascular Necrosis

- Diagnosis on Xray possible after few months to 2 years.
- Rx: • Elderly - Hemiarthroplasty
- Young: Bipolar prosthesis; Meyer's Procedure.
- Total Hip Replacement

③ Osteoarthritis: • Late Complication. Occurs due to Avascular deformation of head or Union in faulty alignment.

- Rx: • Young: Inter-trochanteric osteotomy
- Elderly: Total Hip Replacement

Inter-trochanteric fractures

• Def Fractures of intertrochanteric region of proximal femur, involving either the greater or lesser trochanter or both.

- Mechanism
- Elderly: Sideway fall or blow to greater trochanter.
 - Young: following a violent trauma (like in road traffic accident)

- Pathoanatomy
- Generally displaced and comminuted
 - Distal fragment rides up so that femoral neck shaft angle is reduced [coxa vara].

- C/F
- Pain in groin region.
 - Swelling in region of hip
 - Inability to move the leg.
 - Tenderness over greater trochanter.

- Radiology
- Easy diagnosis on X-ray.
 - Findings indicating unstable fracture and poor prognosis:
 - Comminution of medial cortex.
 - Avulsion of lesser trochanter
 - Extension of fracture to subtrochanteric region.

• Rx Inter-trochanteric fractures unite readily.

• Objective: Maintain a normal femoral neck shaft angle during process of union.

• Conservative Methods:

- (i) Russell's traction
- (ii) Skeletal traction in Thomas splint.

- Prolonged bed rest required [3-4 month].
- May cause complications related to recumbency [Bed sores, pneumonia etc].
- Conservative methods are used less because of success of operative methods

	• <u>Operative Methods</u>: Fracture is reduced under x-ray control and fixed with internal fixation devices. • Most commonly used internal fixation devices: (i) Dynamic Hip Screw (DHS) (ii) Ender's Nails (iii) Gamma nails (iv) Proximal femoral Nail [PFN] • External fixation: Useful for patients with bedsores and those who are unfit for major operation
• <u>Complications</u>	• Malunion - Gives rise to Coxa vara (↓ Neck shaft angle) ↳ Rx - Inter-trochanteric osteotomy (Generally avoided for elderly patients) • Osteoarthritis → Rx { Early stage - Physiotherapy Late stage { Young - Trochanteric osteotomy Old - Total Hip Replacement

Table-18.1: Differences between fracture neck of the femur and inter-trochanteric fracture

Point	Fracture neck femur	Inter-trochanteric fracture
Age	After 50 yrs	After 60 yrs
Sex	F > M	M > F
Injury	Trivial	Significant
Ability to walk	May walk in impacted fracture	Not possible
Pain	Mild	Severe
Swelling	Nil	Severe
Ecchymosis	Nil	Present
Tenderness	In Scarpa's triangle	On the greater trochanter
Ext. rotation deformity	Less than 45°	More than 45°
Shortening	Less than 1 inch	More than 1 inch
Treatment	Int. fixation always	Can be managed in traction
Complications	Non-union	Malunion

* The lesser trochanter is situated postero-medially on the shaft. So if the leg is externally rotated, the lesser trochanter appears more prominent on the X-ray.

Fracture of patella

• Mechanisms

- Direct : - Blow to anterior aspect of a flexed knee.
 - Usually results in comminuted fractures.
 - Stellate fracture: Comminution of whole of patella.
- Indirect : - Due to violent contraction of quadriceps
 - fracture line runs transversely across the patella dividing it into two (Two part fracture).

• Pathoanatomy

- Usually undisplaced due to Pre-patellar expansion of quadriceps tendon in front and Patellar retinaculæ on sides.
- Strong quadricep contraction may result in rupture of Patellar Retinaculæ.

• C/E

- Pain and Swelling over knee
- Patient is not able to lift leg with knee in full extension [Extensor lag seen]
- Tenderness over patella
- Comminuted fracture: Crepitus is felt
- Displaced fractures: A gap is felt b/w fracture fragments.

• Radiology

- AP view and lateral view sufficient in most cases.
- A fracture with wide separation of fragments is easy to diagnose in lateral view.
- Skyline view: May be required in some undisplaced fractures.

• Mx

- Undisplaced : - Analgesics
 - Plaster Cast extending from the groin to just above malleoli, with knee in full extension [Cylinder cast] x 3 weeks.
 - Physiotherapy.
- Two Part fracture: Operation is always necessary.
 - Reduction of fragments
 - Tension band wiring
 - Repair Extensor Retinaculæ
- If reduction not possible: Patellectomy + Repair extensor retinaculæ
 - IF 1 fragment is one of poles: Excision (Partial Patellectomy) + Repair Extensor Retinaculæ
- All operations are followed by support in Cylinder Cast for 4-6 weeks.
- Comminuted fracture: Patellectomy

• Complications:

- ① Knee Stiffness: Treated by Physiotherapy
- ② Extensor weakness: Due to inadequate repair of extensor apparatus.
- ③ Patello femoral Osteoarthritis.

Osteoarthritis

- Osteoarthritis (OA) is a degenerative joint disease.

• Types

① Primary:

- Occurs in a joint de novo.
- Generally seen in old age in weight bearing joints.
- Joints involved: - **knee** [most common for Asian habits (Squatting, Sitting cross legged)]
 - Hip [most common in population with western living habits]
 - Trapezio-metacarpal joint
 - Interphalangeal joints

② Secondary: • There is an underlying primary disease of joint which leads to degeneration.

- May occur at any age after adolescence.

• Causes:

Hip joint

- Avascular Necrosis
- Coxa vara
- Congenital dislocation of Hip
- Malunited fractures
- Acetabular fractures

Knee Joint

- Condylar fractures of femur
- Patellar fractures
- Ligament injuries of knee joint

• Pathology

↑ in water content & depletion of proteoglycans from cartilage matrix



Repeated weight bearing on such cartilage



Fibrillation of cartilage



Further Rubbing



Subchondral bone becomes hard and glossy (**Eburnated**)



Bone margins of joint hypertrophies and forms a rim of projecting spurs (**osteophytes**)



Formation of Subchondral cysts and Sclerosis



Loose flakes of cartilage incite synovial inflammation and thickening of capsule



Deformity and Stiffness

• CIF

- Occurs more commonly in elderly.
- Frequently bilateral
- Shows geographical variation:
 - Knee joint (Population with Asian living habits)
 - Hip joint (Population with western living habits)
- Pain (**Earliest symptom**)
 - Intermittent in beginning, constant later
 - Initially dull on starting activity after rest; cramping later
- Stiffness
 - Initially - due to pain and muscle spasm
 - Later - Contracture and incongruity of joint surface
- Swelling is a late feature.

• Examination

- Tenderness
- Coarse crepitus on moving the joint
- Irregular and enlarged looking joint (due to peripheral osteophytes)
- Deformity
 - Knee - Varus
 - Hip - Flexion-adduction- External Rotation
- Effusion - Rare and transient
- Terminal limitation of joint movement.
- Subluxation detected on ligament testing

• Investigations

- Radiology
 - Narrowing of joint space [may be limited to medial compartment of Tibio-femoral joint of the knee]
 - Subchondral Sclerosis (dense bone under articular surface)
 - Subchondral Cysts
 - Osteophyte formation
 - Loose bodies
 - Joint deformity
- Others:
 - Serology and ESR : Rule out rheumatoid arthritis
 - Serum Uric Acid: Rule out gout.
 - Arthroscopy

- Mx

- Principles:

- ① Delay occurrence if hasn't begun yet.
- ② Stall progress of disease and Relieve symptoms.
- ③ Rehabilitate patient with or without surgery.

- Methods:

- ① Analgesics (long acting formulations preferred)
- ② Chondroprotective agents: Glucosamine and Chondroitin sulphate
- ③ Viscosupplementation: Sodium Hyaluronan (injected in joints 3-5 times at weekly intervals)
- ④ Supportive therapy:
 - Weight Reduction
 - Avoidance of stress
 - Local heat
 - Exercises to build muscles to improve stability
 - Local application of counter-irritants and liniments
- ⑤ Surgery:
 - Osteotomy: High Tibial Osteotomy - for knee with genu varum
Inter trochanteric Osteotomy - for Hip joint
 - Joint Replacement
 - Joint debridement
 - Arthroscopic removal of loose bodies, degenerated meniscal tears etc.

Fracture of shaft of Tibia

• Mechanism

- Direct :
 - Road traffic accidents are commonest cause.
 - Generally object causing fracture lacerates skin over it causing an Open fracture.
 - Fracture occurs in tibia and Fibula at same level.
- Indirect :
 - Bending force - Oblique fracture
 - Torsional force - Spiral fracture
 - Sharp edge of fracture may pierce skin from within causing an open fracture.

• Displacements

Sideways ; Angular ; Rotational.

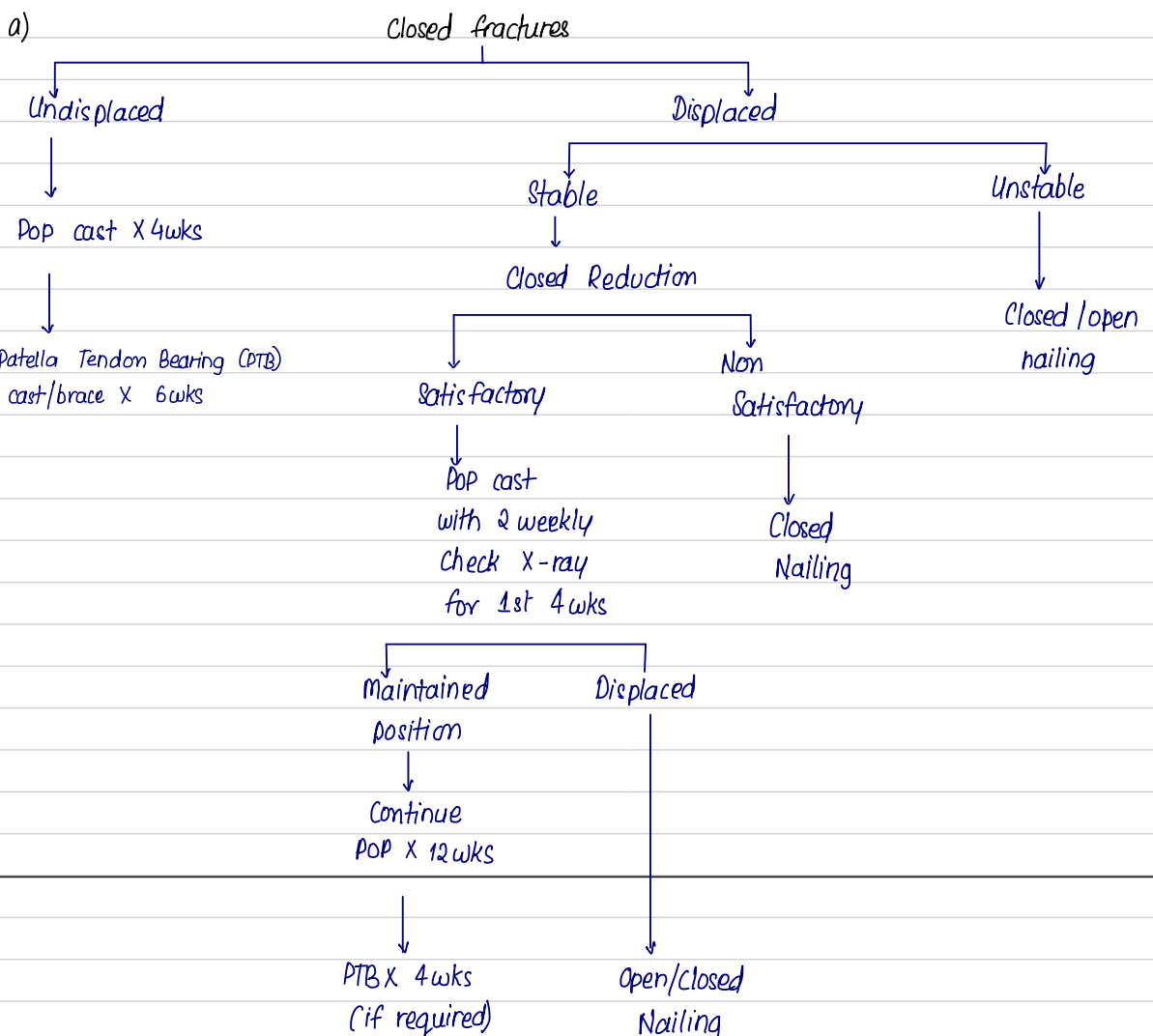
C/F

- History of injury
- Pain
- Swelling
- Deformity
- Wound communicating with underlying bone

• Dx

X ray in AP view and lateral view.

• Mx



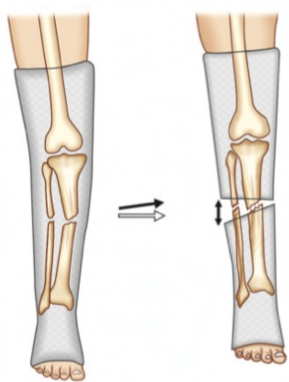


Fig-21.2: Wedging of a cast

b) Open fracture :

- Grade 1 : Wound debridement
 - POP cast with dressing through a window in cast.
 - Antibiotics
- Grade 2 : Wound debridement + primary closure + External fixator
 - Above knee plaster cast.
 - Change to POP after wound heals.
- Grade 3 : • Wound debridement + dressing
External fixation
 - Early bone grafting

Now a days, operative techniques are preferred over conservative methods.
 → Hence most open fractures are treated using Open Reduction Internal Fixation (ORIF).

• Technique of Closed Reduction -

- Under anaesthesia, patient lies supine with knees flexed over end of table.
- The leg is kept in traction using halter (made of bandage)
- Fracture ends are manipulated till good alignment is achieved.

• Wedging

- Done for fractures which show little angulation on X-ray after POP is applied.
- Plaster is cut circumferentially at level of fracture on concave side of angulation.

• Complications

1. Delayed Union or Non Union
 - Rx- a) Nailing with Bone grafting
 - b) Phemister grafting
 - c) Ilizarov's method
2. Malunion
3. Infection
4. Compartment Syndrome
5. Injury to popliteal artery
6. Injury to common peroneal and tibial nerves.

Pott's fracture

• Definition

Fracture (Fracture-dislocation) of bones forming the ankle joint.

• Mechanism

Bending or twisting injury to ankle joint.

• Classification

Lauge-Hansen Classification:

Injury	Medial side	Lateral Side	Tibio-fibular syndesmosis	Others
1) Adduction injury	Medial malleolus fracture with oblique fracture line	Avulsion fracture of lateral malleolus	Normal	
2) Abduction injury	Avulsion fracture of medial malleolus	Fracture of lateral malleolus at the level of ankle mortise	Normal	
3) Pronation - external rotation	Transverse fracture of medial malleolus at level of ankle mortise	Spiral fracture of fibula above level of ankle mortise	Damaged	
4) Supination - external rotation	Transverse fracture of medial malleolus at level of ankle mortise	Spiral fracture of lateral malleolus at level of ankle mortise	Normal	Fracture of posterior malleolus
5) Vertical compression	Comminuted fractures of medial malleolus, distal end of tibia & lateral malleolus.			

• C/F

- Pain
- Swelling over ankle joint
- H/o twisting injury to ankle.
- On examination -
- Tenderness
- Crepitus (if fracture is present)
- Ankle may be lying deformed (Abducted or adducted).

• Radiology

- X-ray ankle joint AP and lateral view.
- Note following features:
 - (i) Fracture line of medial & lateral malleoli.
 - (ii) Tibio fibular syndesmosis
 - (iii) Posterior subluxation of talus.

- Rx • Fracture without displacement: Immobilisation by below knee plaster cast X 3-6 weeks.

- Fracture - dislocation:

- A) Conservative:
- i) Closed reduction by manipulation under general anaesthesia.
 - ii) Below knee plaster cast.
 - iii) Check with x-ray.
 - iv) Continue plaster cast for 8-10 weeks if xray is satisfactory.
 - v) If x-ray unsatisfactory → operative methods.

- B) operative methods: Open reduction + internal fixation.

Techniques of internal fixation

- Medial malleolus:
 - Transverse fracture: Compression screw, Tension band wiring
 - Oblique fracture: Compression screws
 - Avulsion fr.: Tension band wiring.
- Lateral malleolus:
 - Transverse fr.: Tension band wiring
 - Spiral fracture: Compression screws
 - Comminuted fracture: Buttress plating
 - Lower 1/3 of fibula fr.: 4-hole plate
- Posterior malleolus:
 - < 1/3 articular surface of tibia: No additional Rx
 - > 1/3 articular surface of tibia: Compression screws
- Tibio-fibular syndesmosis damage: Long screw from fibula into tibia.

- C) External fixation. Required in cases where closed method can't be used.
eg- Open fractures with crushing of muscles and tendons

- Complications

1. Stiffness of ankle joint.
- 2 Osteoarthritis

Acute Osteomyelitis

- Commonest site: Lower end of femur

• <u>Types</u>	• Primary - Haematogenous [More common → Often seen in children] • Secondary - Following an open fracture or bone operation.
• <u>Aethiopathogenesis</u>	• Organisms: • Staphylococcus aureus (Commonest) • Streptococcus • Pneumococcus • Organisms reach the bone via blood circulation ↓ Bacteria get lodged in metaphysis ↓ Bone initiates an inflammatory reaction in response to bacteria ↓ Bone destruction and production of inflammatory exudate ↓ Spread of pus: a) Along medullary cavity - Thrombosis of medullary vessels. b) out of cortex → damage to periosteal blood supply ↳ Segment of bone becomes avascular (Sequestrum) → Pus under periosteum → Generation of subperiosteal new bone (Periosteal Reaction) → Perforation of periosteum → Pus moves out into subcutaneous plane (Abscess) • Epiphyseal plate resistant to spread of pus.
• <u>CLF</u>	• Acute onset of pain & swelling at the end of bone. Fever • On examination; Patient (mostly child) is febrile & dehydrated. Inflammation localised to metaphyseal area of the bone.
• <u>Investigations</u>	• Blood - PMN Leukocytosis ; Elevated ESR • X-rays: Earliest sign - Periosteal new bone deposition at metaphysis (takes 7-10 days to appear) • Bone Scan: Tc99 may show increased uptake by bone in metaphysis. • Indium - 111 labelled leukocyte scan is most specific for diagnosis of bone infections.
• <u>D/Ds</u>	- Acute septic arthritis - Acute rheumatic arthritis - Scurvy - Acute poliomyelitis

• Rx

A) Child is brought within 48 hours of onset of symptoms:

- No pus is formed yet
- Limb is put to **rest** in a splint or by traction
- Antibiotics: Children <4 years: **Ceftriaxone & Vancomycin**
Older children: **Ceftriaxone & cloxacillin**
 - Antibiotics changed to specific ones after culture & sensitivity.
- Child is adequately hydrated with IV fluids.
- A four hourly temperature chart.
- Limb can be mobilised when child improves.
- Weight bearing is restricted for 6-8 weeks.
- Surgical intervention is required if patient does not respond favourably to antibiotics within 48 hours.

B) If child is brought after 48 hours of onset of symptoms:

- USG examination of the affected part for early detection of deep collection of pus
- **Surgical exploration and drainage**
- A drill hole is made in the bone in region of metaphysis.
- Hole is enlarged untill free drainage is obtained.
- Swab is taken for culture & sensitivity.
- Wound is closed over sterile suction drain.
- Rest, antibiotics and hydration are continued post operatively.
- Antibiotics are continued for 6 weeks

• Complications

• General:

- Septicaemia
- Pyaemia

• Local:

1. Chronic osteomyelitis
2. Acute pyogenic arthritis
3. Pathological fracture
4. Growth plate disturbances: Damage may lead to complete or partial cessation of growth.
This may give rise to shortening, lengthening, deformity of limb.

Chronic Osteomyelitis

	→ used synonymously with Chronic Osteomyelitis.
• <u>Types</u>	• Chronic pyogenic osteomyelitis (secondary to acute osteomyelitis). • Chronic osteomyelitis due to TB, fungal infections. - Garre's osteomyelitis - sclerosing, non suppurative chronic osteomyelitis • Brodie's abscess
• <u>Etiology</u>	- Delayed and inadequate treatment of acute osteomyelitis. - Highly virulent organism - Reduced host resistance: Malnutrition, Immunocompromised states.
• <u>Pathology</u>	• Persistent infections → more subperiosteal new bone (Periosteal reaction) ↓ Thickening of bone [Osteomyelitic bone has an irregular surface]. • Continuous discharge of pus → Sinus formation • Sequestrum (piece of dead bone) surrounded by infected granulation tissue trying to eat sequestrum away. - It has smooth inner surface and rough outer surface [outer surface is constantly eroded by surrounding granulation]. • Involucrum - dense sclerotic bone overlying a sequestrum.
• <u>Complaints</u>	• Chronic discharging sinus (commonest complaint) • Sinuses often heal and reappear with acute exacerbations. • Pain - minimal but may become aggravated during acute exacerbations. • Fever
• <u>Examination</u>	• Chronic discharging sinus - Sequestrum may be visible at the mouth of the sinus itself. - Thickened irregular bone • Tenderness on deep palpation • Adjacent joint may be stiff due to excessive scarring in soft tissues.
• <u>Investigations</u>	1) X-ray - Thickening and irregularity of cortices - Patchy sclerosis - Sequestrum → denser than the surrounding normal bone - Involucrum and cloacae may be visible.

2) Sinogram: Radio-opaque dye is injected and X-ray is taken.

3) CT Scan and MRI

4) Pus culture

5) Blood investigations

- Rx

- Principles: Treatment is surgical.

Aims: (i) Removal of dead bone

(ii) Elimination of dead space and cavities

(iii) Removal of infected granulation tissue and sinuses

- Operative Procedures :

a) Sequestrectomy: Removal of sequestrum. If it lies within medullary cavity, a window is made in overlying involucrum and the sequestrum removed.

b) Saucerisation: Bone cavity is non collapsing and thus there is always pent up pus and it is responsible for persistence of infection.

- In saucerisation, cavity wall is removed and cavity is converted into a saucer

- This allows free drainage of infected material.

c) Curettage: The wall of cavity, lined by infected granulation tissue, is curetted until the underlying normal looking bone is seen.

d) Excision of infected bone (if it can be excised without compromising the functions of the limb).

e) Amputation: Rarely in cases of long standing discharging sinus, especially when sinus undergoes a malignant change.

- After surgery, the wound is closed over a **Continuous irrigation system**.

- Inlet tube goes into medullary cavity, and an outlet tube brings the irrigation fluid out

- A slow suction is applied to outlet tube.

- Irrigation fluid consists of suitable antibiotics and a detergent. Medullary canal is irrigated in this way for 4 to 7 days.

• Complications

i) Acute exacerbation or flare up of infection.

ii) Growth abnormalities

- Shortening
- Lengthening
- Deformities

iii) Pathological fracture

iv) Joint stiffness

v) Sinus tract malignancy

vi) Amyloidosis

Tuberculosis of the Spine

- Spine is commonest site of bone and joint TB.

• Agent Mycobacterium tuberculosis

• Pathology

- TB spine is always secondary.
- Bacteria reach spine via haematogenous route ; from lungs or lymph nodes
 - Spreads via paravertebral plexus of veins (Batson's plexus), which has free communication with visceral plexus of abdomen, a common site for TB infection

↓

Bacteria lodge in contiguous areas of 2 adjacent vertebra

↓

Granulomatous inflammation

↓

Erosion of vertebral margins

↓

Disc degeneration and eventually destruction

↓

Collapse of vertebra (wedging- more severe in lesions of dorsal spine)

↓

Cold abscess

• Types

- Paradiscal (commonest)
- Central
- Anterior
- Posterior

• CIF

- Back pain (commonest presenting symptom)
- Stiffness
- Cold abscess - presents as a swelling
- Paraplegia
- Deformity
- Constitutional symptoms - fever, weightloss

• Examination

- Gait : Short steps to avoid jerking the spine
- Attitude & deformity: Stiff straight neck.
Kyphus / gibbus in dorsal spine TB.
- Paravertebral swelling - Fluctuant (cold abscess)
- Tenderness
- Spinal movements are limited

• Investigations

1) X-ray:

- Reduction of disc space (earliest sign)
- Destruction of vertebral body
- Evidence of cold abscess: i) Paravertebral abscess
 - └ Fusiform (Bird nest abscess)
 - └ Globular/tense abscess
- (ii) Widened mediastinum on AP view
- (iii) Retropharyngeal abscess
- (iv) Psoas abscess
- Diffuse rarefaction of vertebrae above and below the lesion.
- Signs of healing - Sclerosis of areas surrounding lytic lesions

2) CT scan: - May detect small para vertebral abscess

- Precise extent of destruction of vertebral body and posterior elements

3) MRI - Investigation of choice to evaluate the type and extent of compression of cord.

4) Myelography - Indicated for patients presenting with spinal tumor syndrome

5) Biopsy - To confirm diagnosis in doubtful cases

6) Others: CBC, ESR, ELISA, Chest x-ray.

• R

Principles:

- Achieve healing of the disease
- Prevent, detect and treat promptly complications like paraplegia.

• Antitubercular therapy:

- Rifampicine [R] (10 mg/kg)
- Isoniazide [H] (5 mg/kg)
- Pyrazinamide [Z] (25 mg/kg)
- Ethambutol [E] (15-25 mg/kg)

→ Intensive phase (2 months) - HRZE

→ Continuation phase (9-18 months) - HRE

• Care of spine: Rest to spine during acute phase followed by guarded mobilisation.

• Rest - Period of bed rest is required during early stages of treatment.

- Minnerva jacket or a collar may be used for immobilisation of cervical spine
- Body cast may be used in children.

- Mobilisation: Patient is allowed to sit and walk as he improves while spine supported in collar for cervical spine or ASH brace for dorso-lumbar spine.
- Patient is advised to avoid sports for 2 years.

Treatment of Cold abscess:

- Aspiration: Should be by antigravity insertion with needle entering through a zig zag tract.
- Evacuation: Cold abscess is drained, its wall curetted and the wound is closed without a drain.

• Complications

1. Cold abscess
2. Neurological compression

Pott's Paraplegia

• Pathology

- TB spine with neurological involvement.
- Inflammatory oedema - Neural tissues become oedematous because of vascular stasis.
- Extradural pus and granulation tissue - Most common cause of compression
- Sequestra displaced into canal.
- Internal gibbus

Types

Early onset

- during active phase

Causes:

- i) Abscess
- ii) Granulation tissue
- iii) Posterior spinal disease
- iv) Infective thrombosis of spinal blood supply

Late onset

- several years after disease has become quiescent.

- (i) Recurrence of disease
- (ii) Fibrous septae following healing
- (iii) Severe kyphosis (Internal gibbus)

• Grading

- Grade 1: Patient unaware of deficit.
Babinski +ve; Ankle/ Patellar clonus present.
- Grade 2: Complaints of incoordination or spasticity while walking.
- Can walk with support.
- Grade 3: Severe weakness
- Paraplegia in extension
- Partial loss of sensation
- Grade 4: - Paraplegia in flexion with severe muscle spasm
- Near complete loss of sensation.

• CIF

- Muscle weakness
- Loss of sensations
- Paraplegia in extension
- Paraplegia in flexion
- Complete flaccid paraplegia

• Investigations

- X-ray
- MRI
 - type of vertebral destruction.
 - presence of paravertebral abscess
 - Cause of paraplegia (pus; sequestrum)

• Rx

- Principles:
 - Promote recovery of affected neural tissues.
 - Achieve healing of vertebral lesion
 - Undertake rehabilitative measures to prevent contractures.
- Conservative Mx:
 - ATT
 - Rest
 - Bracing for 6-12 months
- Operative Rx: For paraplegia not improving with conservative Rx or severe paraplegia in flexion with sensory loss >6 months.
 - i) Costo-transversectomy
 - ii) Antero lateral decompression
 - iii) Hongkong operation (Radical debridement and arthodesis)
 - iv) Laminectomy