HIP Fractures

- Result from High energy (young) / low energy trauma (Adults) -> pathological/fragile Fx
- If displaced: pt cannot stand/ambulate + shortened & externally rotated extremity + tenderness to palpation + ecchymosis
- Not displaced -> may ambulate with minimal pain
- Displacement of proximal femur Fx: Proximal: abducted (gluteus medius/minimus) + flexed (iliopsoas) / Distal: adducted
- If suspected -> do X-ray
- Complications: General (DVT/PE/Pneumonia/Bed sores) + Local (AVN/Non or Mal-union/ Failure of fixation/post-traumatic arthritis)

<table>
<tr><th colspan="3">Intracapsular</th><th colspan="2">Extracapsular</th></tr>
<tr><td colspan="3">- Within lining of joint capsule -> Femur head + proximal 1/2 of neck
- Assoc. with injury to blood supply to head of femur (risk of AVN)
- Worse than IT (poor blood supply) -> more non-union
- Divided into: Femoral head Fx & Femoral neck Fx</td><td colspan="2">- Outside capsule
- less vascular damage & complications
- Divided into: Inter-trochanteric (IT) & Sub-trochanteric</td></tr>
<tr><td colspan="3">Femoral neck Fx
classified according to Fx location into:</td><td>Intertrochanteric
(from GT -> LT)</td><td>Subtrochanteric
(from LT -> highest 5cm of femur shaft)</td></tr>
<tr><td>Sub-capital</td><td>Transcervical</td><td>Basi-cervical</td><td>Evans classification (Reverse oblique is the most unstable)</td><td></td></tr>
<tr><td>- Just below head
- More complications (AVN & non-union)
- Mx: replacement</td><td>- through mid neck</td><td>- Through base of neck
- Lesser complications
- Mx: Fixation</td><td># better blood supply -> tends to mal-union</td><td># Poor blood supply (watershed area) + Bone type (cortical = less osteogenic) -> Poorer healing & higher non-union</td></tr>
<tr><td colspan="3">Are also classified according to severity (Garden's classification)

Intracapsular Fx -> filled with Hyaluronic acid -> prevents clotting & hematoma formation which is the 1st step of healing -> higher risk of non-union & post trauma arthritis</td><td colspan="2">- Mx depends on Age: Young: Fix / Old: Replace
- Functional reduction (dynamic hip screw/IMN)
IMN perfect for: Unstable IT/ Sub-trochanteric/All shaft Fx</td></tr>
</table>

Lower Limb

Fracture	Injury	Complications	Management
Femur Shaft	- High energy trauma - Low energy in elderly (pathological) # Displacement: Proximal: abducted (Gluteus medius/minimus) + flexed (iliopsoas) / Distal: adducted	- Blood loss & shock - Compartment syndrome - Fat embolism, ARD, TE, infxn, mal-union, non-union	- Save Life! Emergency (significant blood loss 1.5L each leg) - Mostly surgery (ORIF/OREF) Intramedullary Nails are MC used - Heals in 4-6m's
Distal Femur	- Direct trauma - 4 types: Supracondylar/ intercondylar/ single condyle/ comminuted # Displacement: Distal is pulled backwards by GN	- Popliteal a. injury (Bleeding, check pulse, ABI, angiography if ABI <0.9)	- Save Limb = artery - Non displaced -> cast/hinged knee brace - Displaced -> surgery (ORIF/OREF/IMN)
Tibial Plateau	- Bending force with axial load (car striking a pedestrian on side of knee "bumper fracture"or fall from height on varus/valgus knee) - Schatzer classification	- High energy assoc. with soft tissue injuries (meniscal/ACL/vascular injuries + compartment) - Popliteal a. injury	- Knee brace/cast - ORIF/external fixation
Tibial shaft	- MC long bone Fx (subcutaneous position) - low energy (torsion/spiral) => Tscherne grade 0/1 + Fibula Fx at different lvl - High energy : wedge, short oblique, comminuted => severe soft tissue injury (Tscherne 2/3 + open Fx) + Fibula Fx at same lvl - Butterfly fragment	- Soft tissue injury (Wound > Fx) - Assoc. with compartment syndrome (Tibial Fx + IMN are the MCC of compartment syndrome in leg) Also, bone loss, plateau/plafond injury	- Open: 5A's (ATLS, Anti-tetanus, Antibiotic, Adequate irrigation, Analgesia) + # # - closed: closed reduction/cast or ORIF/OREF/IMN
Tibial Plafond	- Pilon Fx - High energy axial loading	- Associated with fibula Fx	Non op: immobilization Op: ORIF/ temporizing spanning external fixation across ankle joint

<table>
<tr><td>Ankle</td><td colspan="3">- Danis weber classification + relation of Fx to syndesmosis)
<table>
<tr><td>Type A</td><td>Below ankle joint</td><td>Intact syndesmosis</td><td>Stable</td><td>Intact deltoid ligament</td></tr>
<tr><td>Type B</td><td>At joint</td><td>Intact or partially torn</td><td>Variable</td><td>Maybe torn</td></tr>
<tr><td>Type C</td><td>Above joint</td><td>Torn</td><td>Unstable (ORIF)</td><td>Torn</td></tr>
</table></td></tr>
<tr><td>Talar neck</td><td>- MC Fx of talus
- high energy with dorsiflexion + axial loading</td><td>- Associated with LL Fx
- Poor vascularity -> Osteonecrosis
- Intra-articular -> post trauma arthritis
- Varus</td><td>Non-op/op (ORIF)</td></tr>
<tr><td>Calcaneus</td><td>- MC fractured tarsal bone
- Extra vs Intra articular</td><td></td><td>Non-op/ Op (ORIF/Open reduction with percut. pinning)</td></tr>
</table>

Upper Limb

Fracture	Injury	Complications	Management
Clavicle	- MC in mid 1/3 - Lateral 1/3 Fx -> Unstable (involve ligaments) & need Op ## Displacement: Medial: upward (by SCM) Lateral: downward (arm wt.)	MC complication: Mal-union	- Conservative for mid 1/3 - Operative for lateral 1/3
Proximal Humerus	At different locations: - MC: Surgical neck => fragility Fx, good healing - Anatomical neck => Risk of AVN & non-union -> always surgical - Greater tuberosity => avulsion Fx (supra/infra) associ. With shoulder dislocation	- AVN (anatomical neck) - Axillary n. injury (Surgical neck)	Conservative (sling) to Operation (replacement/fixation) depending on comminution & bone quality
Humeral Shaft	- After trauma - if spiral/ oblique -> Child abuse # Displacement: Proximal: lateral (by deltoid) Distal: Medial	- Radial n. injury -> Wrist drop + lost sensation over 1st dorsal web space	ORIF
Olecranon	- Avulsion Fx of triceps tendon after FOOSH - Intra-articular Fx		Anatomical reduction + absolute fixation
Forearm (R+U)	1) Monteggia - Fx in Ulna, dislocation in Radius (both proximal) 2) Galeazzi - Fx in Radius, dislocation in Ulna (both Distal)	1) causes Radial n. injury -> finger drop at MCP 2) causes Ulnar n. injury -> Weak abd/add of fingers + Froment's sign +ve	Anatomical reduction + absolute fixation in ADULTS (as R + U act as a joint so the Fx is considered intra-articular)

Isolated Ulna Fx	- Also called nightstick injury - very rare, by direct trauma	High risk of non-union	Conservative -> failed? -> surgical fixation (functional reduction)
	Distal radius		
Colles' - extra-articular - Dorsally displaced - Falling on extended wrist - Wrist swelling (hematoma + deformity) - Dinner fork deformity - Fragility Fx - Functional reduction (volar) + cast for 6w's	**Smith's** - extra-articular - Volary displaced (reversed colles') - Falling on flexed wrist - Functional reduction (dorsal) + cast for 6w's	**Barton's** - Intra-articular - Lip of radius (volar or dorsal) - Best seen on lateral x-ray - resembles a triangle - Anatomical reduction & absolute fixation	**Chauffer** - Intra-articular - Radial styloid - Sudden radial deviation of wrist - Anatomical reduction & absolute fixation

Pediatric Fx :

* Pediatrics differ in the following :

- Presence of Growth plate (↑ in length)
  + Perichondral plate (↑ thickness)
- Periosteum : thicker (Better healing & less Fx spread)
- Bone type : ↑ Cancellous (less propagation of Fx)
  ↓ Stiff (Bends not Fx)
- Soft tissue is stronger than bone
  [same injury damages bone not ligaments ⇒ Avulsion Fx]
- More radiolucent bone → Fx underestimation
- Better blood supply → ↓ non/mal-union
- Presence of Transitional Fx (14 Y ± 2)
  ↳ as growth plate closes gradually over 2Y's
  ↳ ossification starts Central > medial > lateral

* Distal tibia *

Tillaux Fx	Triplane Fx
Salter harris 3	Salter harris 4 (2 Fx in 2 views)
Older age	Younger **(both in children)
2 planes	3 planes

• Growth plate layers

Epi
↳ Germinal [most imp./source of all cells / affected in SH5 Fx]
↳ Proliferative
↓
↳ Hypertophic [the weakest → Fx happen here]
meta
↳ Zone of provisional calcification

* Fixation methods *

- MC ⇒ Casting
- k-wires ⇒ Commonly used for Metaphyseal Fx
- IM wire / elastic nail ⇒ Diaphyseal Fx
- Screws ⇒ never enter the physis

* indications for operative Mx *

- Open Fx
- Displaced intra-artic. SH3-4
- Fx + vascular injury
- Failed closed reduction
- Unstable diaphyseal Fx

• Physeal Fx :

- 25% of all children Fx
- MC : in boys + Upper limb
- Most heal well rapidly with good remodelling

• Classification → Salter-Harris

Salt Harris Classification (important; because it has prognostic value)

- **Type 1** : A fracture that passes **only** through **hypertrophic** layer and happens by shearing force and could be displaced or not.
- **Type 2** : primary through hypertrophic zone and secondary fracture through **metaphysis**
- **Type 3** : primary through hypertrophic zone and secondary fracture through **epiphysis**
- **Type 4** : fracture through all epiphysis, physis and metaphysis
- **Type 5** : compressed fracture due to axial loading force leads to 2ndry closure after long time due to the crush of the germinal layer (diagnosed after long time like for example one year with retrospective history of falling down because nothing seen on x-ray acutely, after one year you see shortening of limb disproportionately. You can not prevent it!)

• Prognostic Factors :

1) Severity of injury [SH 1-5]
2) Age (Younger = worse)
3) Physis & growth potential
   → LL : around knee heals better [Distal Femur / Prox. tibia]
   → UL : away from elbow
4) Anatomic type of Fx
5) The treatment