Common Paediatric Fractures

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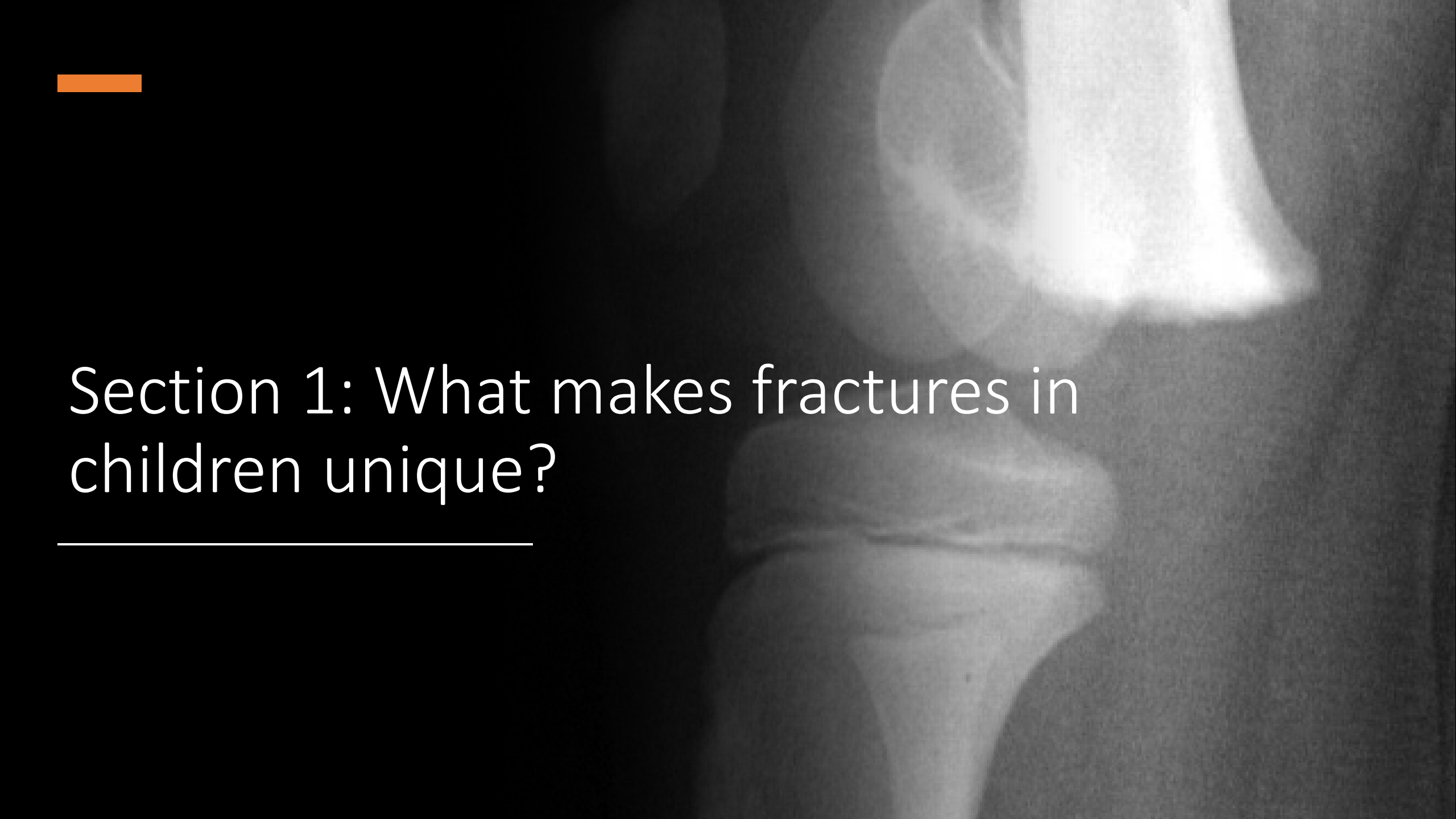
Introduction

- Children are not just small adults:
  - Larger head: torso ratio means they have higher rates of head injuries compared to adults
  - They have better blood supplies means the potential for healing is greater
  - Different physicochemical properties of bones and ligaments means their fracture patterns are different
  - Because of their light weight, they project when struck, resulting in different injury patterns than adults.

Section 1: What makes fractures in children unique?



What makes fractures in children Unique?

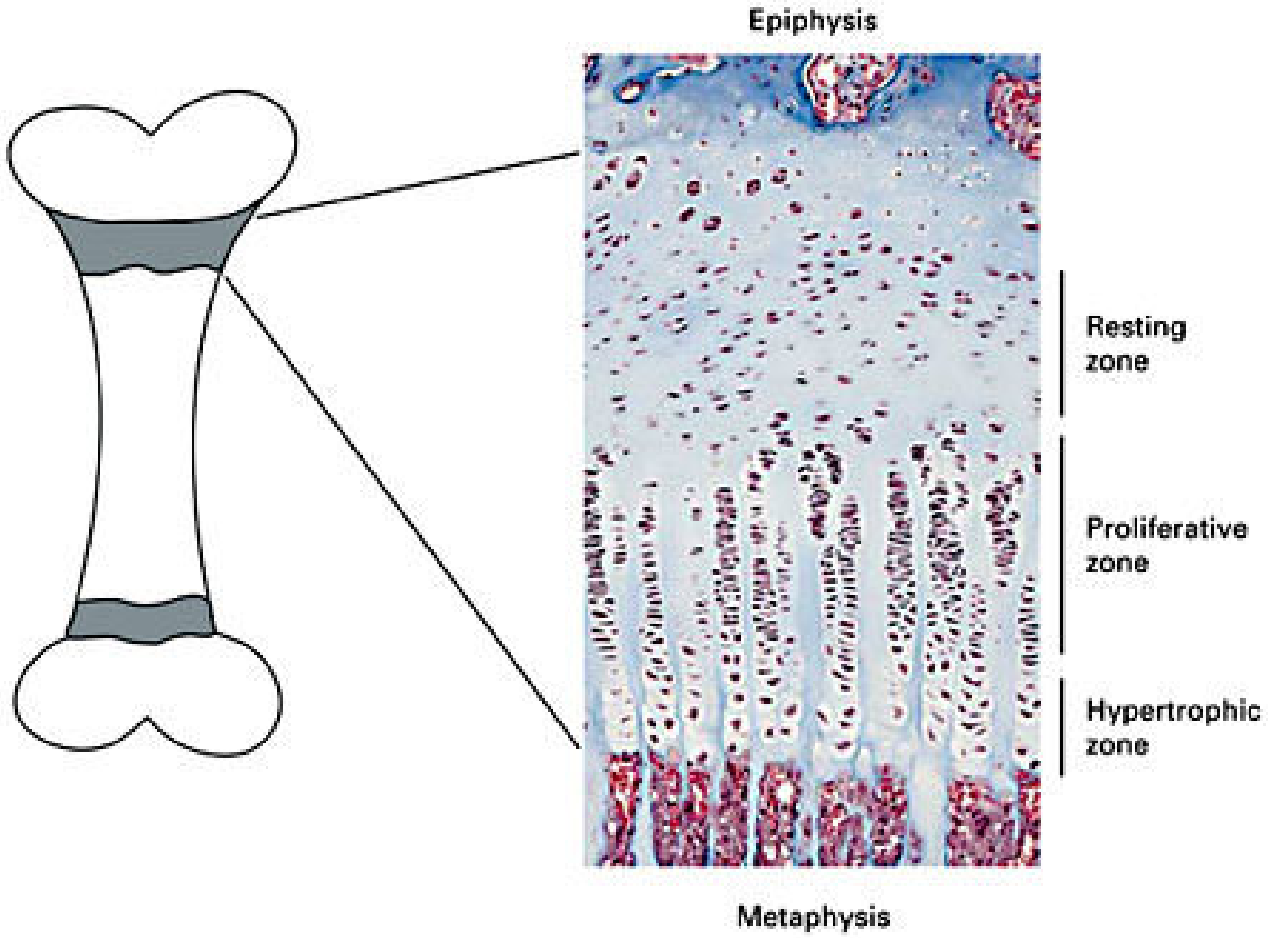
- The nature of children’s bones
- Presence of the growth plate
- The nature of children’s cartilage
- The nature of children’s periosteum
- The nature of their ligaments
- The nature of their ligaments
- The blood supply of their bones
- Their nature of their activities

What makes Fractures in Children Unique?

The nature of children's bones

- Compared to adults, their bones:
  - Contain more collage
  - Therefore, they are more flexible
  - They can sustain more deformation before braking

What makes Fractures in Children Unique?



The presence of the growth plate

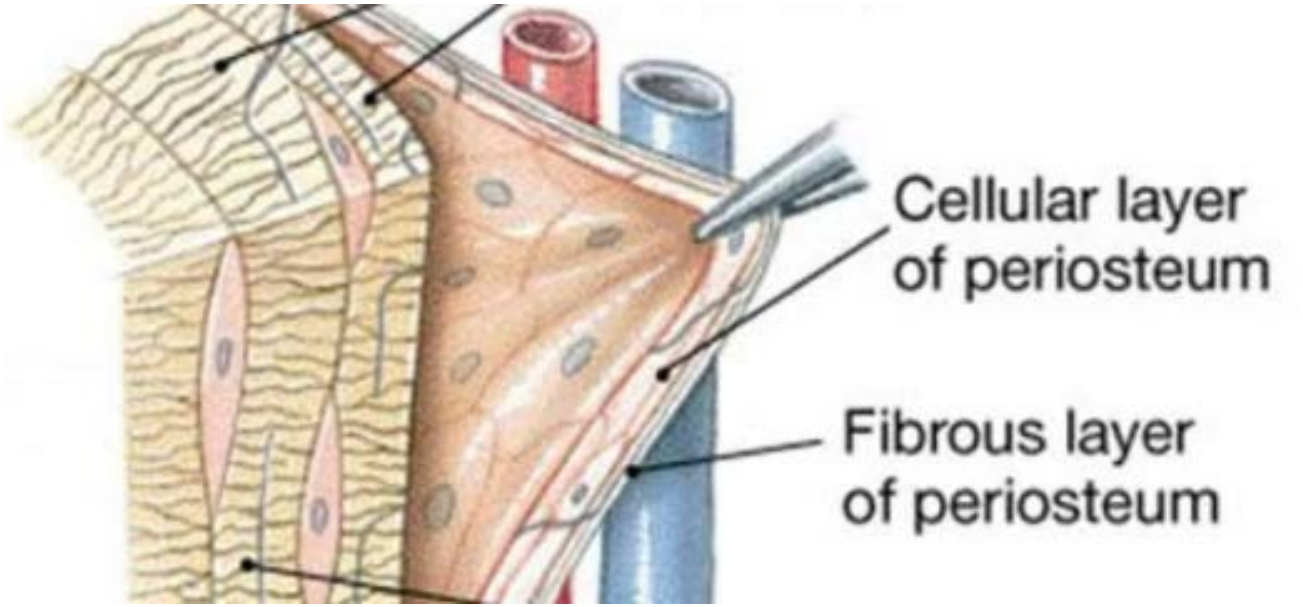
- The growth plate presents a source of weakness in children's bones
  - Therefore, stresses around the growth plate may cause growth plate fractures rather than bone fractures.
- Growth Plate regenerates faster than other part of the bone, therefore:
  - Growth plates fractures heal fast
  - Deformities following growth plate fractures correct well
  - But fractures through the growth plate can also lead to overgrowth

What makes Fractures in Children Unique?

The nature of children's cartilage

- The cartilage in the metaphysis of children's bones are more abundant, therefore:
  - It is difficult to evaluate metaphyseal x-rays.
  - The size of the fractured fragments are frequently underestimated

What makes Fractures in Children Unique?

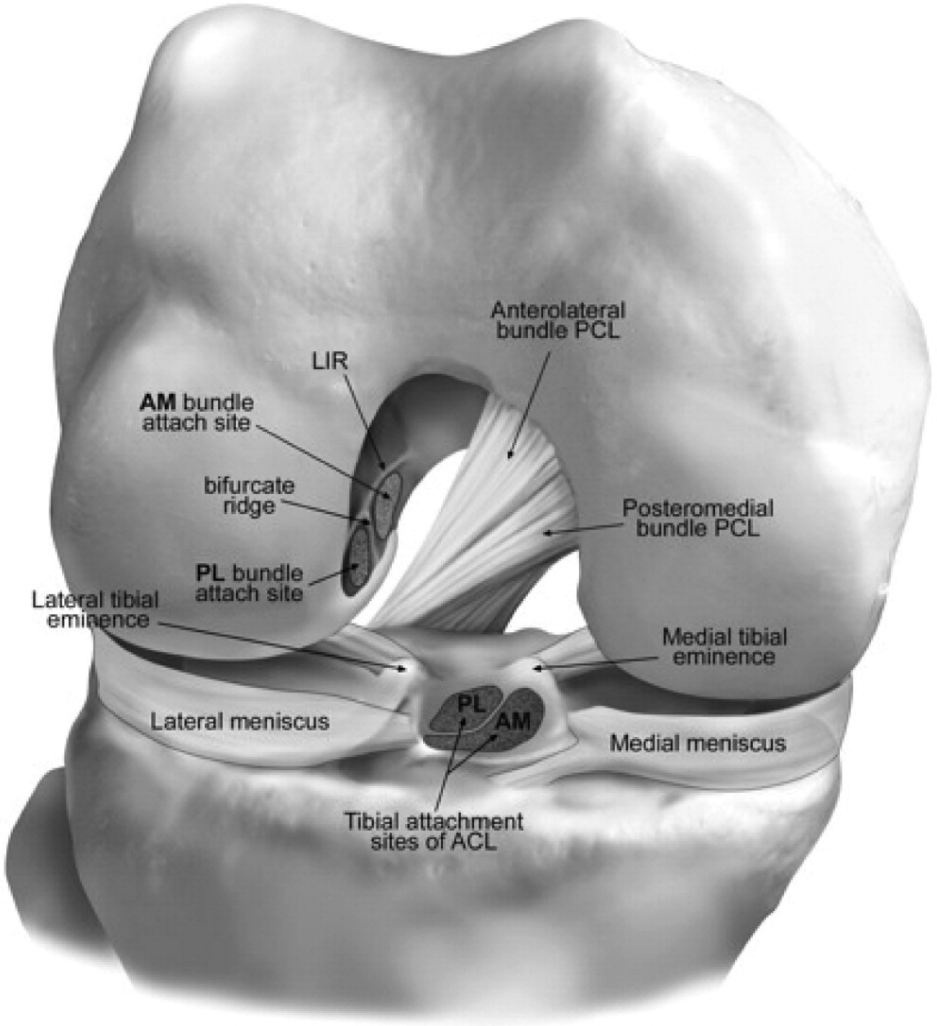


The nature of children's periosteum

Compared to adult's periosteum, they are:

- Metabolically more active
  - More callus formation
  - Rapid union
  - Increased remodeling
- More Thickness and strength
  - Intact periosteal helps to keep fracture fragments in place
  - Intact periosteum may aid reduction

What makes Fractures in Children Unique?

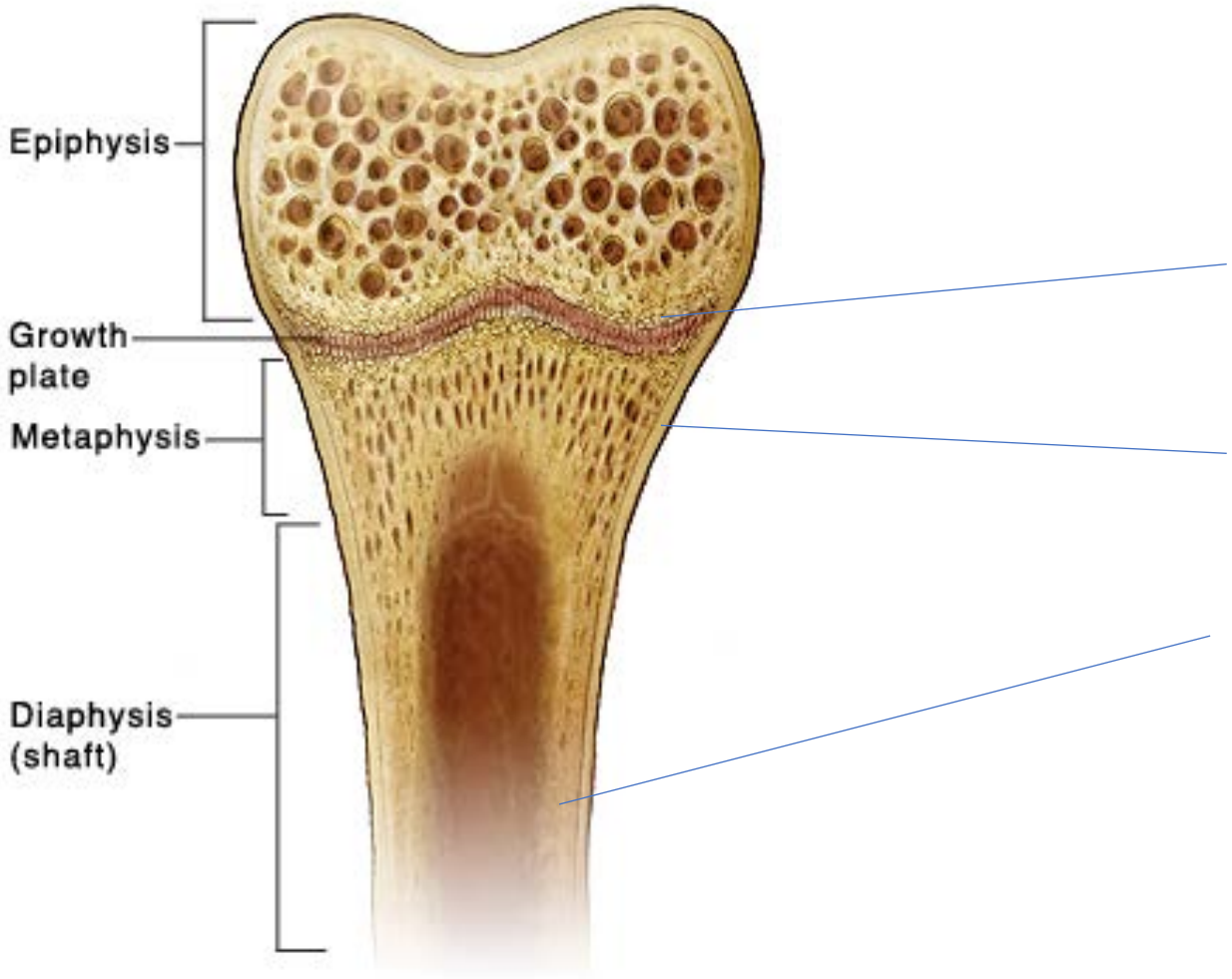


The nature of children's Ligaments

Compared to adult's ligaments, children's ligaments are stronger

- Bones will fracture before ligaments break
- Injuries that leads to ligamental injuries in adults may cause fractures in children

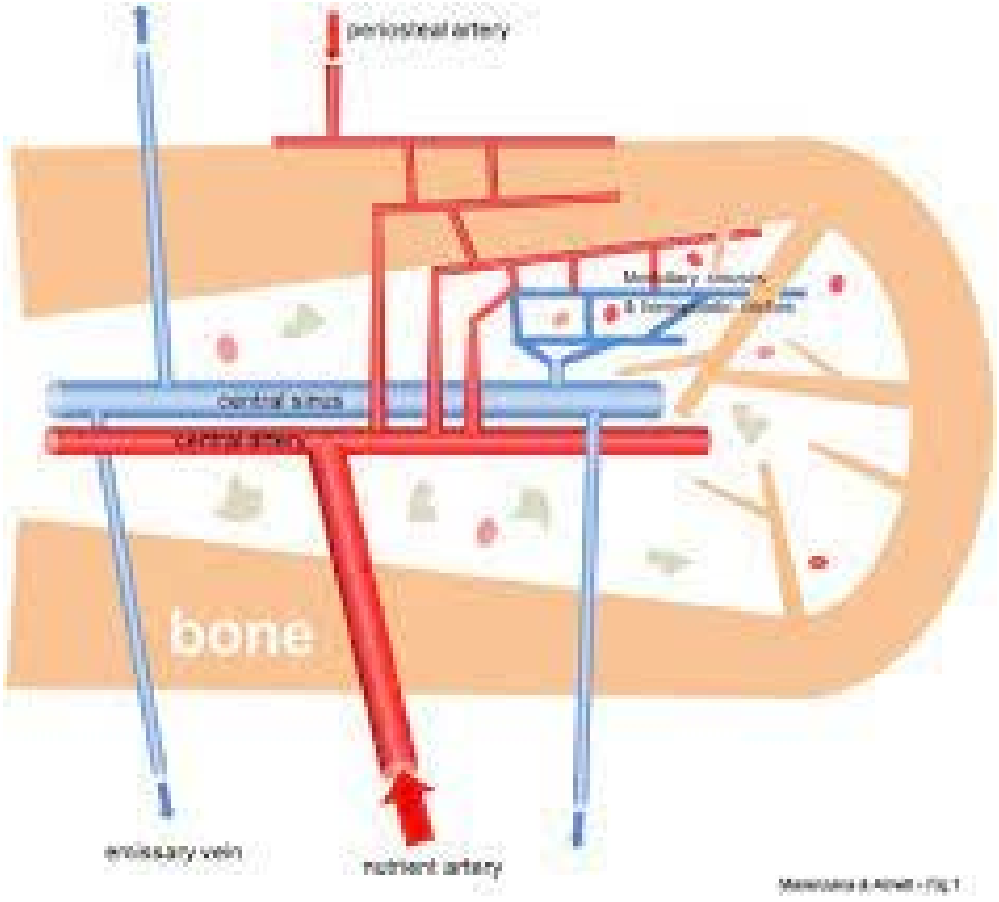
What makes Fractures in Children Unique?



Fracture patterns are different for different age-groups

- Adolescents: Epiphyseal Fractures
- Older Children: Metaphyseal fractures
- Infants: Diaphyseal fractures

What makes Fractures in Children Unique?



Blood supply is better

- Lower incidence of:
  - delayed union
  - Non-union

What makes Fractures in Children Unique?

Their activities are different too

- Play related fractures (Fall is more common among children)

The power of fracture remodeling in children

- Tremendous power of remodeling
- **Therefore**, greater angulation and displacement is acceptable vs in adults
- **However**, rotational mal-alignment does not remodel

The power of fracture remodeling in children

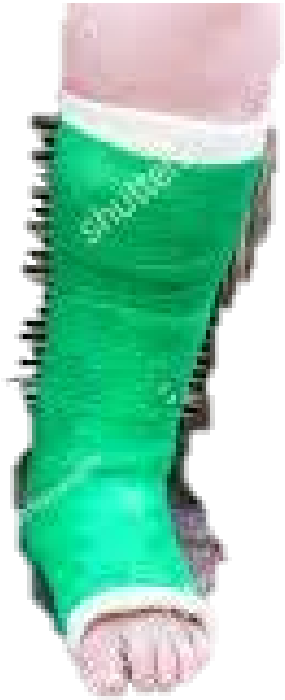
Extent of remodeling depends on factors affecting remodeling potential:

- **Years of remaining growth** – most important factor
- **Position in the bone** – the nearer to physis the better
- **Physeal status** – if damaged, less potential for correction
- **Growth potential of adjacent physis** e.g., upper humerus better than lower humerus

Section 2: Methods of treatment of paediatric fractures

1. Casting

Still the Commonest method for pediatric fracture fixation



2. Tractions

- Pulling force is applied to the skeleton
- Counterbalanced by a counter-traction
- Used in open fractures

Download my lecture on Principles of fracture management from www.oluwadiya.com for more on tractions

3. Kirchner-wires

- Most commonly used internal fixation method for paediatric fractures
- Mostly used in metaphyseal fractures

4. Screws

- Used to hold small fragment fractures
- Must not cross the growth plate

5. Intramedullary wires

- Useful for shaft (diaphyseal) fractures
- Multiple wires are usually used
- Should avoid crossing the growth plates
- Supplemented by cast or cast bracing

6. Plates

- Useful for shaft (diaphyseal) fractures
- Useful especially in multiple fractured
- The screws must not cross the growth plate

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6. Intramedullary nails

- Useful for shaft (diaphyseal) fractures
- Intermedullary nails are not commonly used in children but are more commonly used in adults
- Must not cross the growth plate
- Supplementary casting is not required

Download my lecture on Principles of fracture management from www.oluwadiya.com for more on IM nails

7. External Fixation

- For open fractures

Download my lecture on Principles of fracture management from www.oluwadiya.com for more on external fixation

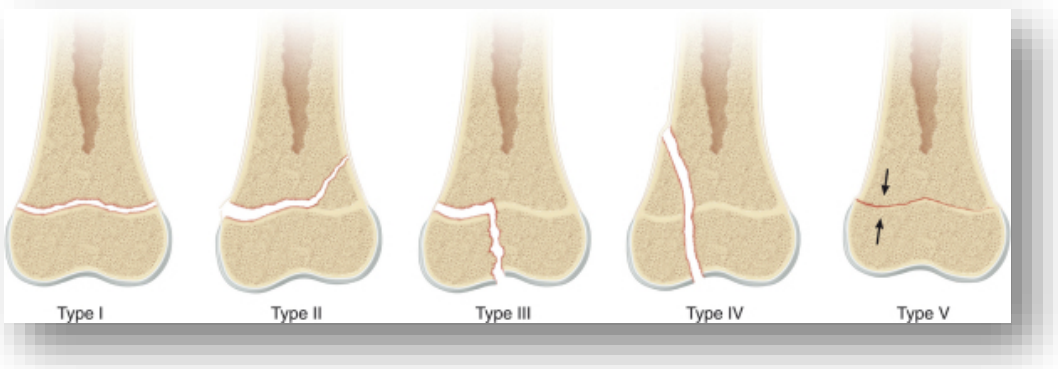
Section 3:
Non-Specific Paediatic Fractures

Physeal Injuries

Physeal fractures are childhood fractures that goes through the growth plate

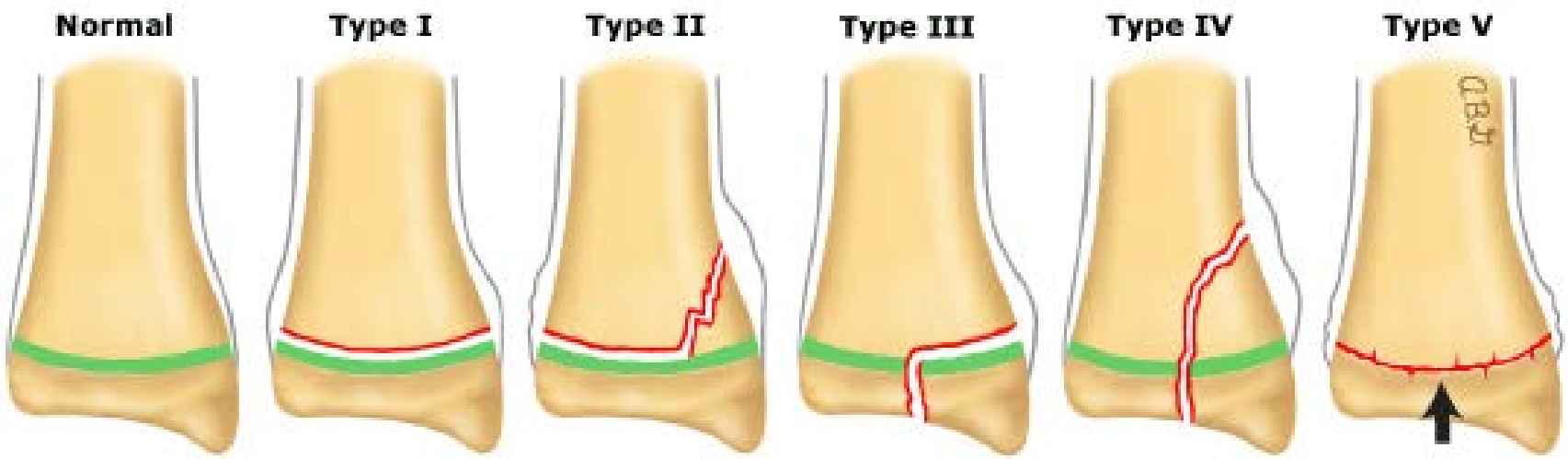
- Account for about 25% of all children's fractures
- More in boys
- More in the upper limb
- Most heal rapidly
- Most remodel excellently
- Growth may be affected

Physis Injuries- Classifications



- **Salter I (Slipped):** This is when the fracture line extends through the physis or within the growth plate.
- **Salter II (Above):** These are when the fracture extends through both the physis and metaphysis
- **Salter III (Lower):** This is an intra-articular fracture extending from the physis into the epiphysis
- **Salter IV (Through/Transverse):** This is also an intra-articular fracture, in which the fracture passes through the epiphysis, physis, and metaphysis.
- **Salter V (Rammed/Ruined):** This fracture type is due to a crush or compression injury of the growth plate

Salter-Harris Classification : Memory Aide



S — **S**traight across

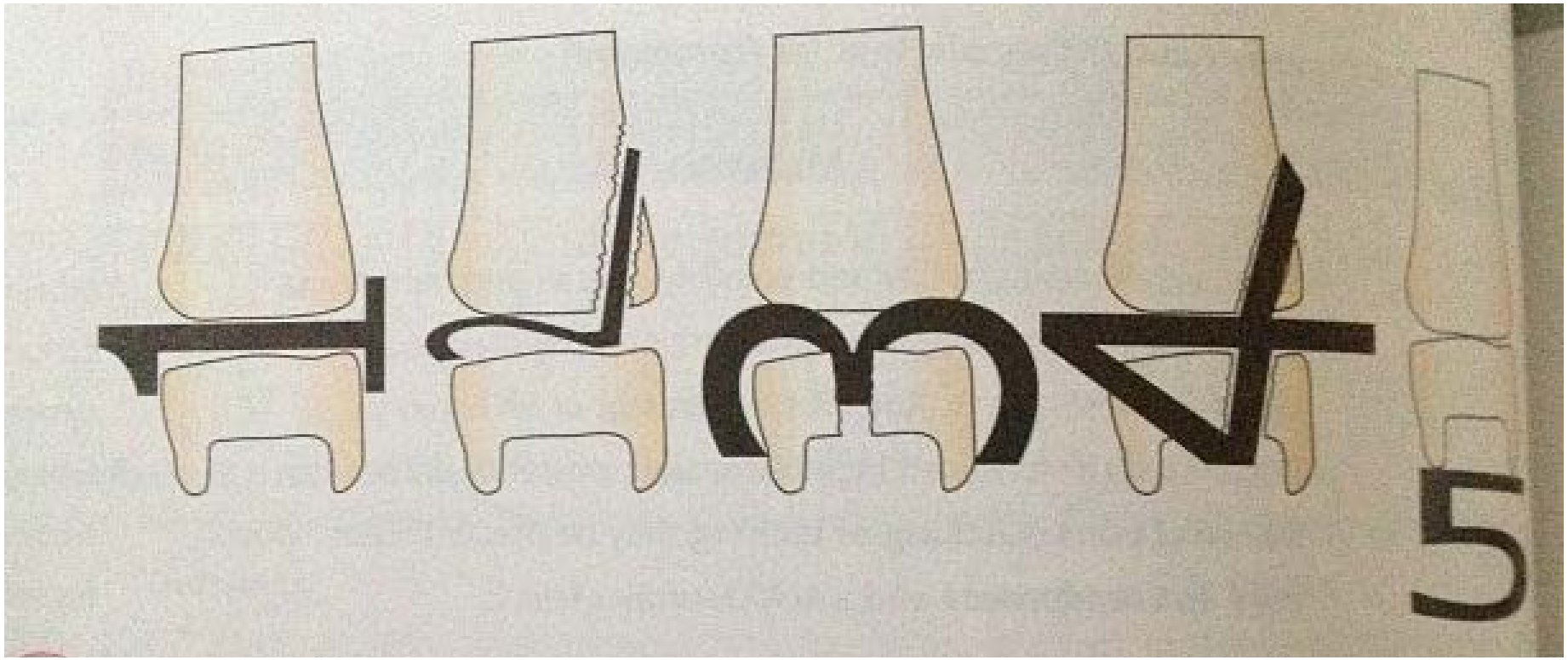
A — **A**bove

L — **L**ower or Be**L**ow

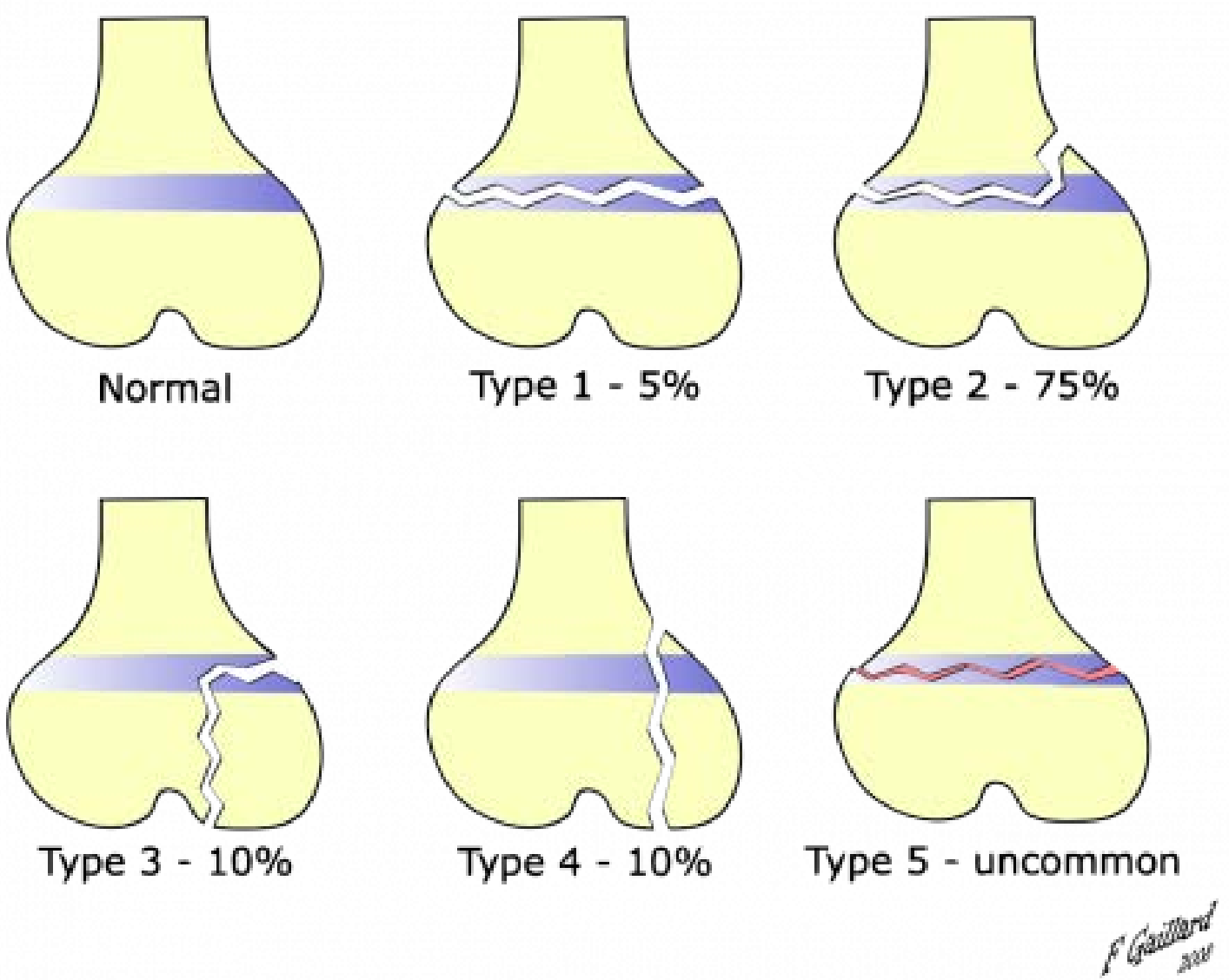
T — **T**wo or **T**hrough

ER — **ER**asure of growth plate or C**R**ush

Salter-Harris Classification: Another memory Aide



Salter-Harris Classification : How common?



Physeal Injuries: Treatment

- **Salter Harris I & II**
  - Close Reduction and Casting
- **Salter Harris III & IV**
  - Open Reduction & Internal Fixation
  - Those with little or minimal displacement can be treated with close reduction and casting too
- **Salter Harris V**
  - Usually missed physician has high index of suspicion
  - Requires surgery
  - Treatment may involve treating complications

Physeal Injuries: Complications

- Most important complication is growth disturbance which is most usually due bridging of the physis by callus or bony spur
  - Peripheral bridging will lead to angulation (Varus or Valgus
  - Central bridging may lead to shortening
  - Complete bridging may lead to shortening
- Increased blood supply may lead to increased growth
  - Limb elongation
  - Angular deformity if growth is not uniform

Greenstick Fractures

- A fracture where only one cortex is interrupted on one side of the bone, while it remains uninterrupted on the other side
- Most often occurs in long bones, but can occur in other bones as well
- Occurs only in children because the bones are elastic

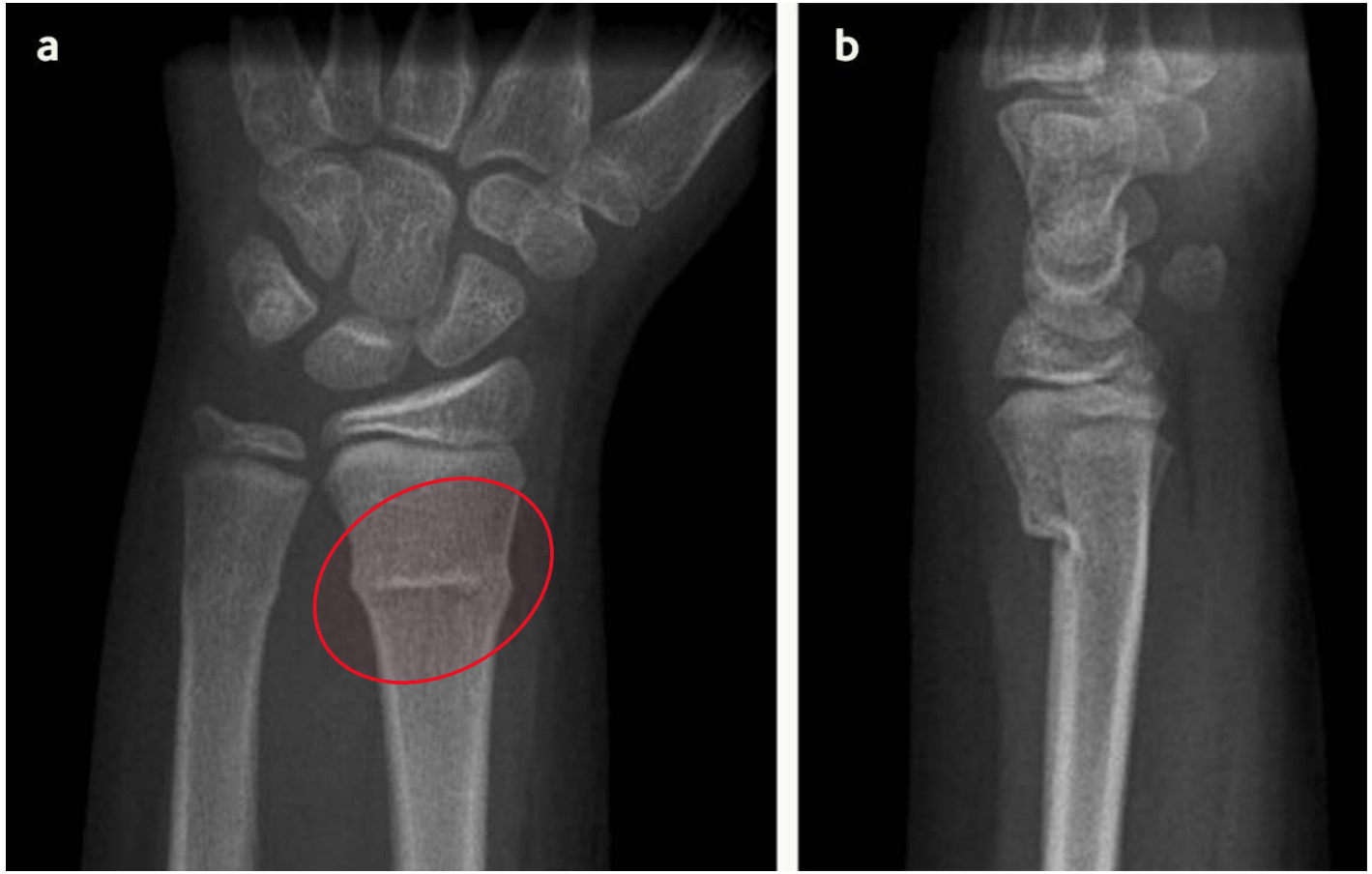
Greenstick Fractures: Presentation

- Clinical presentation similar to other close fractures
- Mechanism: usually indirect forces
- Type: Usually close
- Symptoms & signs: Usually not different from symptoms of uncomplicated fractures
- X-rays: Angulation can be marked

Greenstick Fractures: Treatment

- Casting
- Close reduction when there is marked angulation
- Splints can be used when there is little angulation especially in the upper limb.
- Differentials: Salter-Harris fracture, torus fracture, toddler fracture (non-displaced spiral fracture of the distal tibia).

Torus Fractures

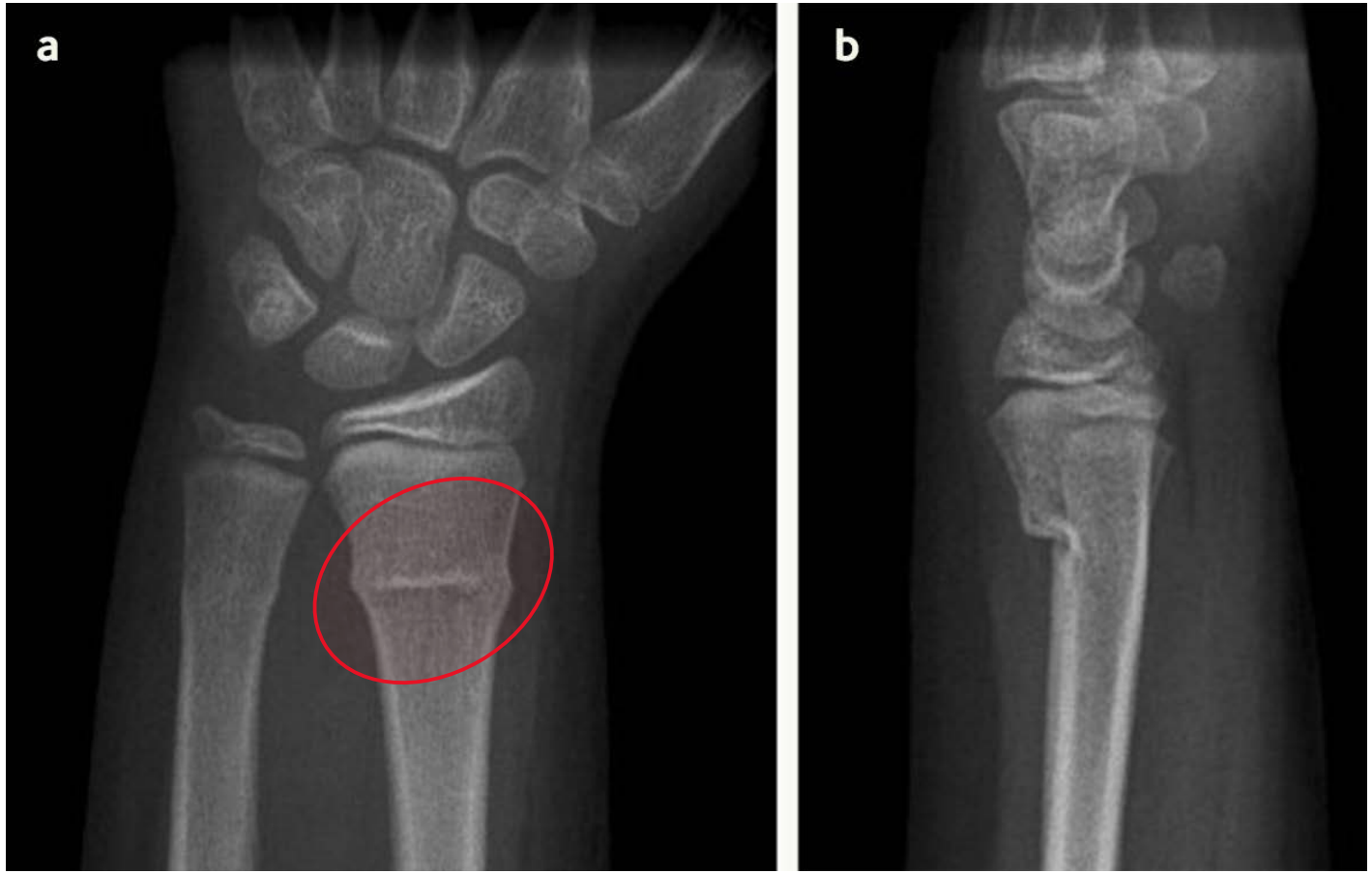


- Also known as buckle fractures
- Incomplete fractures of the shaft of a long bone that is characterized by bulging of the cortex
- Most commonly occurred in the distal radius and then tibia
- Like greenstick fractures, it occurs only in children because the bones are elastic

Torus fractures: Presentation

- Clinical presentation similar to greenstick fractures
- Mechanism: Indirect forces: axial loading of long bone leads crumpling.
- Type: Usually close
- Symptoms & signs: Similar to greenstick fractures
- X-rays:
  - distinct fracture lines are not seen
  - subtle deformity or buckle of the cortex may be evident
  - in some cases, a dent or angulation is the only diagnostic clue (see illustration)

Torus Fractures: Treatment



- Splinting is sufficient for most torus fractures
- In some cases, casting too can be used
- Differentials: Greenstick fractures, Salter-Harris fracture, toddler fracture (non-displaced spiral fracture of the distal tibia).

Pathophysiology of greenstick and torus fractures

- **In Immature bones**
- Compressive forces usually cause torus fracture
- Bending forces cause bones to bow instead of breaking
- When bending is pronounced, greenstick fracture occurs
- Bowing is also more common in long thin bones (hence, radius and less commonly distal tibia)

Section 4:
Common Paediatic Fractures

Common Pediatric Fractures

- **Upper Limb:**
  - Clavicle: 5.2% of all pediatric fractures
  - Humeral supracondylar: 13.9% of all pediatric fractures
  - Distal Radius: 27.2% of all pediatric fractures
  - Hand: 20.3%
    - Finger phalangeal fractures: 8.3%
    - Metacarpals: 6%
    - Scaphoid: 4%
- **Lower Limb:**
  - Ankle fractures: 9.2% of all pediatric fractures

Clavicle fractures: Incidents

- 8-15% of all pediatric fractures
- 80% of clavicle fractures occur in the shaft
- Remodeling is very good, therefore close-fitting reduction is not a must in children

Clavicle Fracture: Mechanism Injury

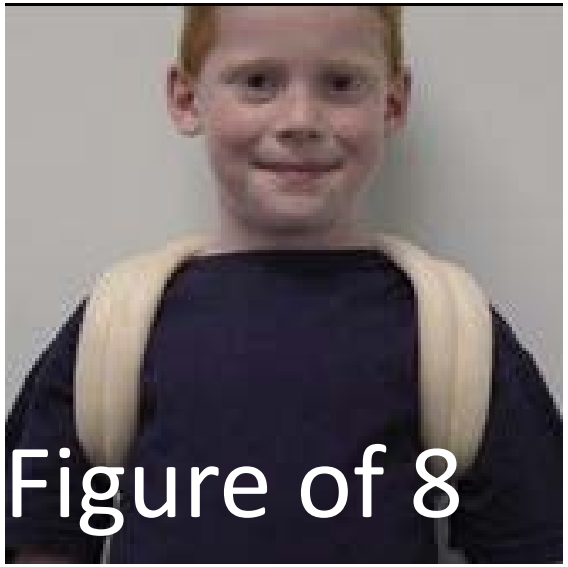
- Indirect
  - fall onto an outstretched hand
  - Most common mechanism
- Direct:
  - Has highest incidence of injury to the underlying structures:
    - Neurovascular structures
    - Apex of the lung
- Birth injury
  - More common in breach deliveries than SVD

Clavicle Fractures: Examination

- Look:
  - Swelling
  - Deformity
  - Ecchymosis
- Feel:
  - Tender at fracture site
  - Displacement felt as a palpable mass along the clavicle
- Assess for injury to nearby structures
  - Neurovascular
  - Pulmonary

Clavicle Fracture: X-ray

- Anteroposterior view is usually sufficient)



Clavicle Fracture:
Treatment

Neonate (< 28 days):

- No splint
- Unite in 1w

1month – 2years:

- Figure-of-eight
- For 2weeks

2 – 12years:

- Figure-of-eight or sling
- For 2-4 weeks

Clavicle Fractures: Treatment

Indications of operative treatment:

- Open fractures
- Neurovascular compromise

Clavicle Fractures: Complications

Complications are rare

- From the fracture:
  - Malunion
  - Nonunion
  - Secondary:
    - Neurovascular compromise
    - Pulmonary injury
- From the wound:
  - Keloid
  - Infection

Supracondylar fracture: Epidemiology

- 55-75% of all elbow fractures
- M:F 3:2
- Peak age of incidence: 5 - 8 years
- Left (non-dominant) side: most frequently fractured

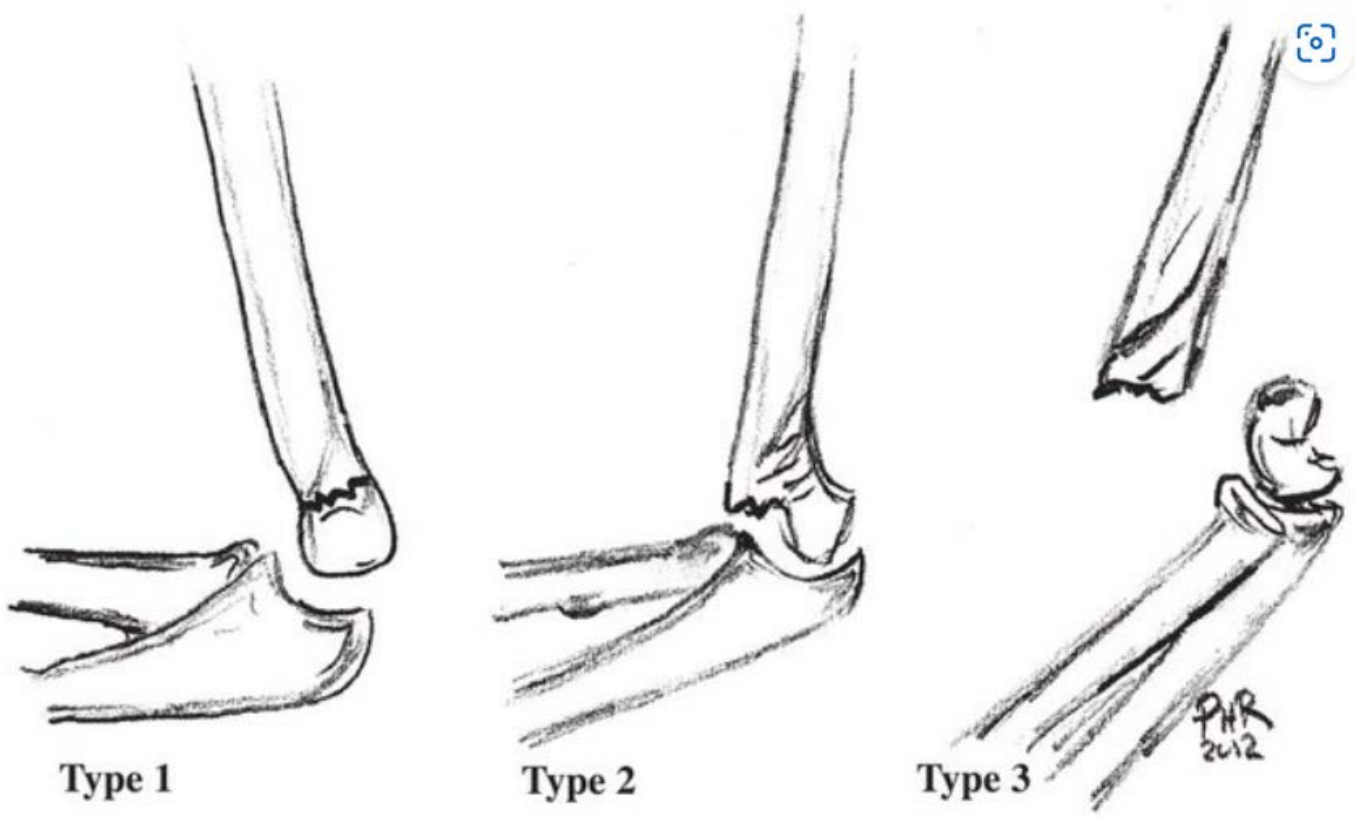
Supracondylar fracture: Classification

Extension Type (95-97%)

Flexion Type Fractures (3-5%)

Supracondylar Fracture: Gartland Classification

- **Type 1**: Undisplaced.
- **Type 2**: Displaced, with intact posterior cortex.
- **Type 3**: Displaced with no bony contact between fragments.



Gatland Classification X-ray Examples

Type I

Type II

Type II

Supracondylar Fracture: Mechanism of Injury

- **Indirect**:
  - Fall on the outstretched hand
  - Leads to extension type
- **Direct**:
  - Fall on the olecranon
  - Leads to flexion type

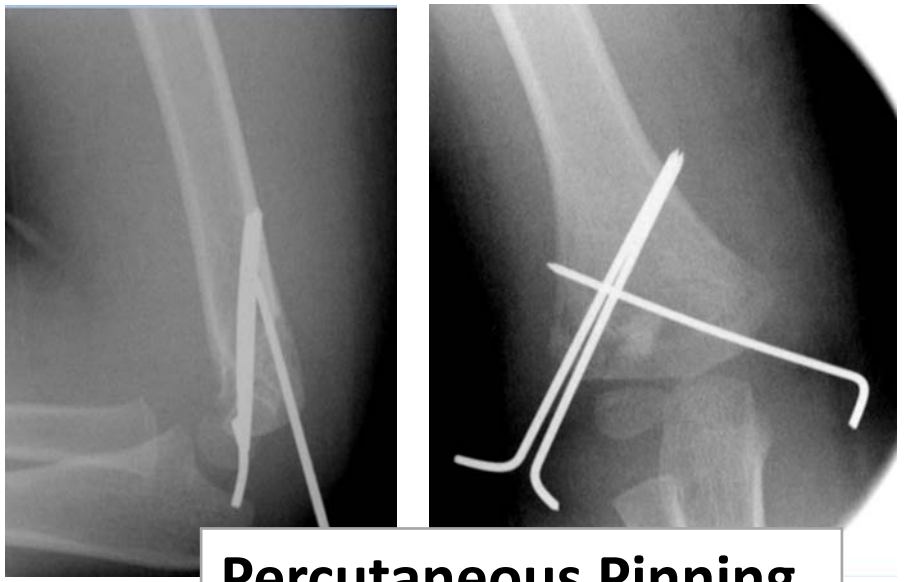
Supracondylar fracture: Clinical Evaluation

- Look:
  - Swollen
  - Angulation which may be S-shaped
  - Pucker sign (dimpling of the skin anteriorly)
- Feel:
  - Tender elbow
- Move:
  - Movement is painful
  - Would not move the limb
- Neurovascular examination

Supracondylar fracture: Treatment

- **Type I and II:**
  - Closed reduction and splinting with POP/Fibrecast long arm back slab
  - Type II fractures may sometimes need close reduction and percutaneous pinning
- **Type III:**
  - Attempt closed reduction (usually difficult)and pinning
  - If it fails, then open reduction and internal fixation (ORIF) by pinning
  - ORIF with pinning in unstable fractures , open fractures or fractures with neurovascular injuries

POP Back slab



Percutaneous Pinning

Supracondylar fracture: Complications

- Neurologic injury (7% to 10%):
  - Median and anterior interosseous nerves (most common)
  - Ulna nerve
  - Most are neurapraxias
  - Most are self-limiting
- Vascular injury (0.5%):
  - Direct injury to the brachial artery, or
  - May be due to compartment syndrome

- Bone Complications
  - Malunion
    - Cubitus varus
  - Myositis ossifican
  - Joint stiffness
- Others
  - Compartment syndrome
  - Volkmann ischaemic contracture

Distal Radial Fractures

- Distal radial fractures are the first to second commonest childhood fractures in most series (Around 27.2%)
- Two types are most common in children:
    i. Physeal fractures
    ii. Metaphyseal fractures

Distal Radial Physeal Fractures: X-ray appearances

Type I

Type II

Type II

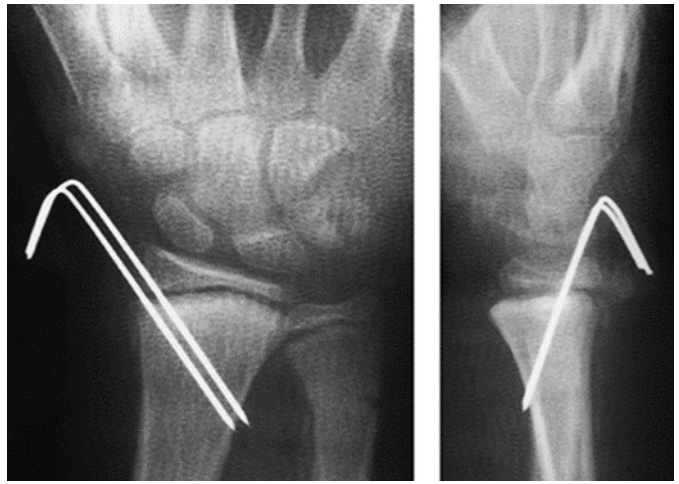
Note: Types IV and V (Salter Harris) are not common

Distal Radial Physeal Fractures: Treatment of Types I & II

- Closed reduction
- Followed by long arm cast, with the forearm pronated
- Some deformities are acceptable
  - Up to 50% apposition
  - Will remodel
  - But angulations and rotations will not correct
- Open reduction is indicated
  - Irreducible fractures
  - Open fractures

Distal Radial Physeal Fractures: Treatment of Types III

- Anatomic reduction is necessary
- ORIF with smooth pins or screws



Distal Radial Physeal Fractures: Treatment of Types IV & V

- Rare
- Anatomic reduction is necessary
- ORIF with smooth pins or screws

Distal Radial Physeal Fractures: Complications

- Physeal arrest
  - Shortening
  - Angular deformity
- Nonunion
- Carpal tunnel syndrome

Distal Radial Metaphyseal Fractures: Classification

- Depending on the biomechanical pattern:
  - Torus (only one cortex is involved)
  - Incomplete (greenstick)
  - Complete
- Other important considerations
  - Direction of displacement
  - Involvement of the ulna

Distal Radius Metaphyseal Injuries

Incomplete: Torus fracture

- Stable
- No need for reduction in most cases
- Splint with a full-arm cast for immobilization

Distal Radius Metaphyseal Injuries

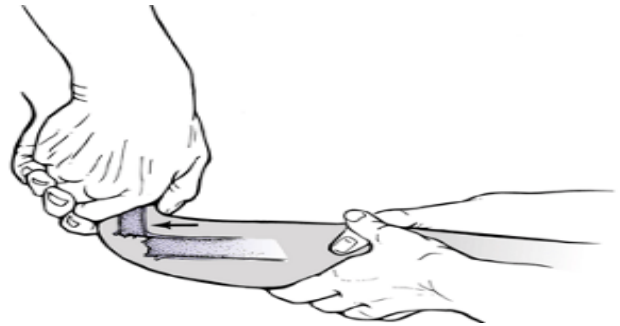
Incomplete: Greenstick Fracture

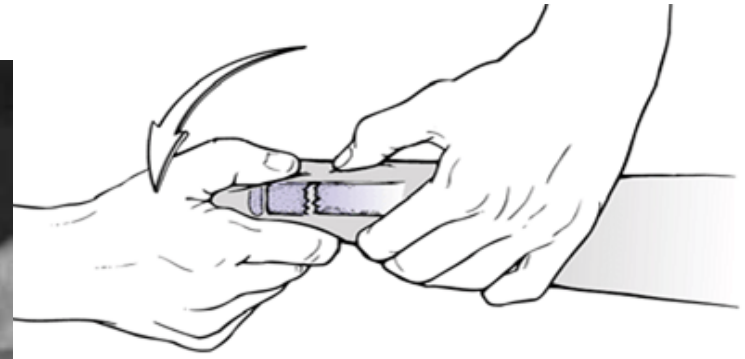
- Greater ability to remodel in the sagittal plane
- Closed reduction and full-arm cast
- As with other distal fractures, the forearm should be fully supinated forearm to relax the pronatus quadratus muscle

Distal Forearm Metaphyseal Injuries

Complete fracture

- Closed reduction is sufficient for most cases
- Full-arm cast for 3-4 weeks in full pronation
- Some levels of displacement acceptable after reduction
- Will remodel after



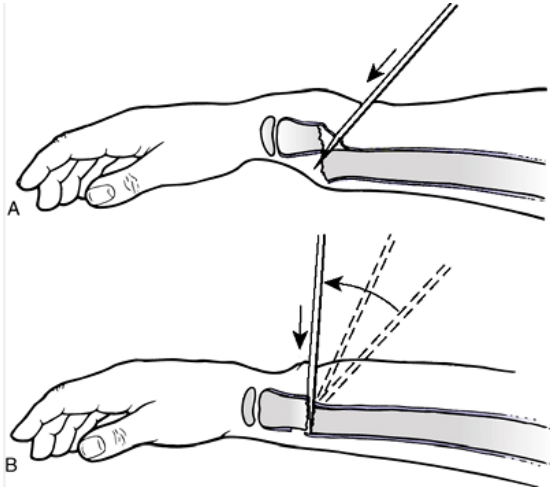


Distal Radius Metaphyseal Injuries

Complete fracture

Indications for percutaneous pinning without open reduction

- Failure or loss of close reduction
- Excessive swelling
- Multiple failed manipulations
- Associated with floating elbow i.e., coexisting ipsilateral humeral fracture

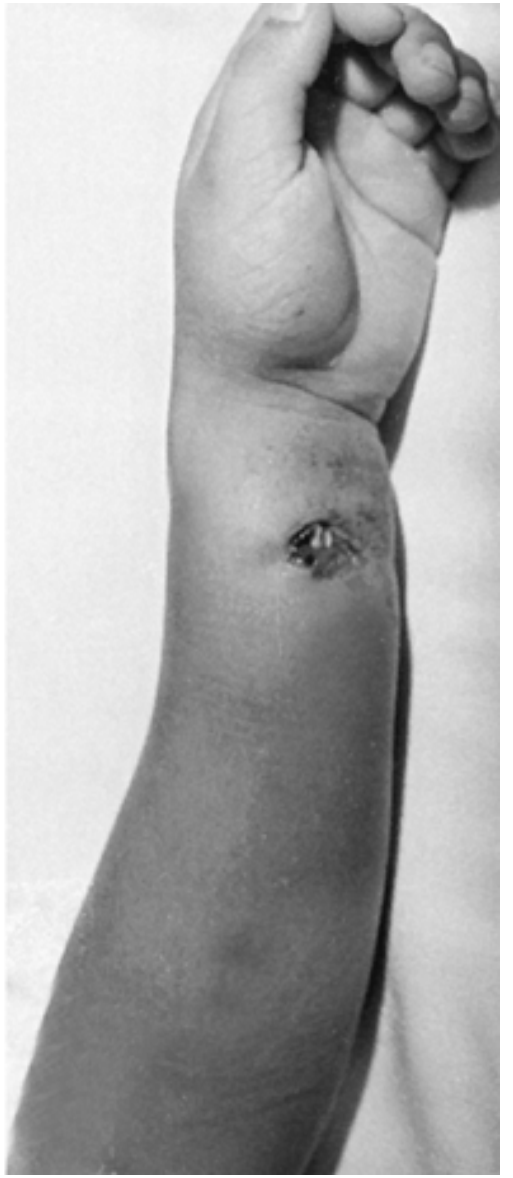


Distal Forearm Metaphyseal Injuries

Complete fracture

Indications for ORIF:

- Irreducible fracture
- Open fracture
- Compartment syndrome



Distal Radius Metaphyseal Injuries: Complications

- Malunion
  - Residual angulation may result in loss of forearm rotation
- Nonunion
  - Rare
- Refracture
  - Occurs with early return to activity (before 6 weeks)
- Growth disturbance
  - Overgrowth or undergrowth especially with physeal injuries
- Neurovascular injuries
  - Rare
  - Occurs with extreme positions of immobilization

Phalangeal Injuries of the Hand

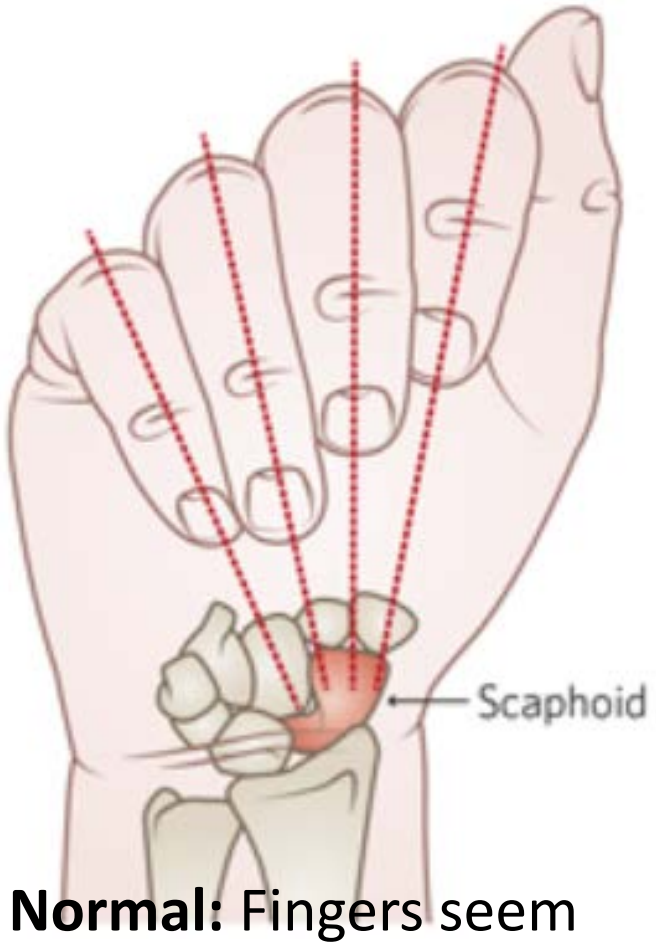
- Accounts for 8.3% of all pediatric fractures
- Incidence increases with age (Up to 20-fold increase in the first decade.
- Most are due to sports injuries and falls in the older children
- Due to crush injuries among toddlers (Use their hands to explore)
- More common in males (about 65%)

Phalangeal Injuries of the Hand: Classification

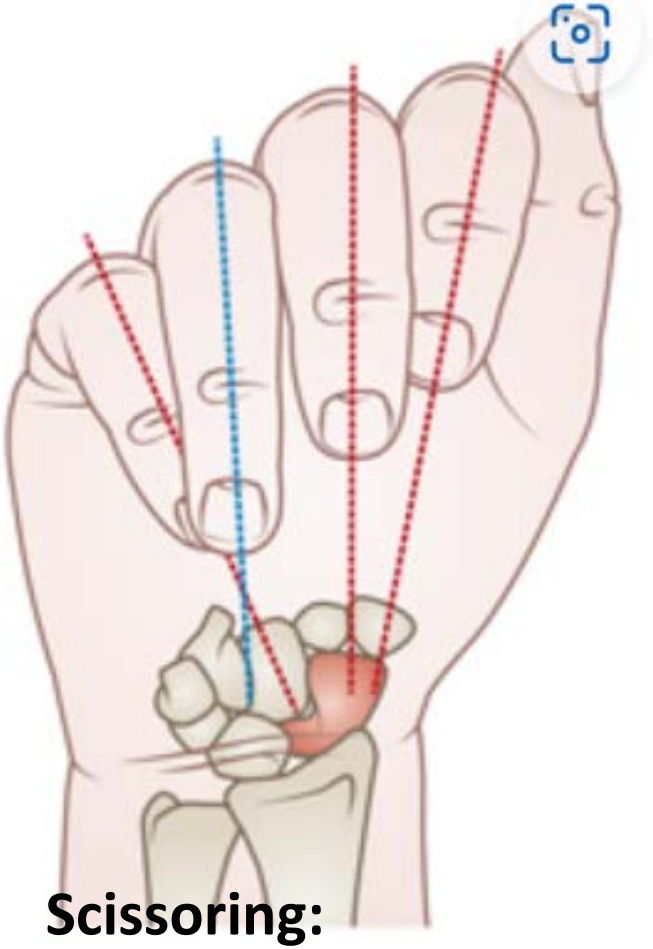
- Can be classified as
  - Open/Closed,
  - Displaced/Nondisplaced
  - By presence and type of growth plate involvement (Salter-Harris classification)
  - By anatomical location of which phalanx is affected
  - By co-existing tendon or nailbed injuries

Phalangeal Injuries of the Hand: Clinical Picture

- Usually presents with:
  - Pain/tenderness
  - localised swelling,
  - bruising,
- with or without deformity.
- Look for Scissoring: Evidence of rotational deformity

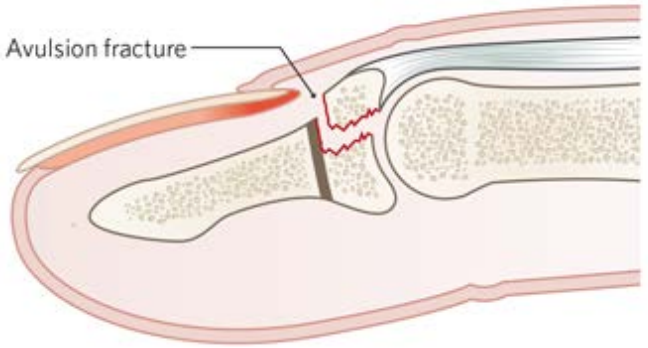


Normal: Fingers seem to be pointing towards a common point



Scissoring: Fractured finger (5^{th}) misaligned

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Distal Phalangeal Fractures



Mallet Finger

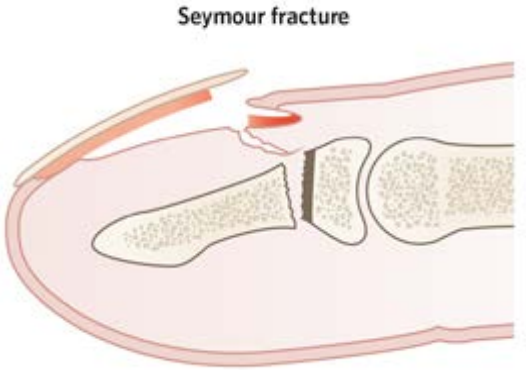
- Due to forced flexion of extended finger, with extensor tendon avulsion fracture at insertion site
- **Examination**
  - distal phalanx is in joint flexed position with no active extension of DIP (“extensor lag”).
  - Tenderness over dorsal aspect of DIP joint.
- **X-ray**
  - shows avulsion of the insertion of the long exyensor tendon in the distal phalange
- **Treatment:**
  - splinting the joint in neutral/ slight hyperextension for 4-6 weeks

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Distal Phalangeal Fractures

Tuft Fracture (crush injury)

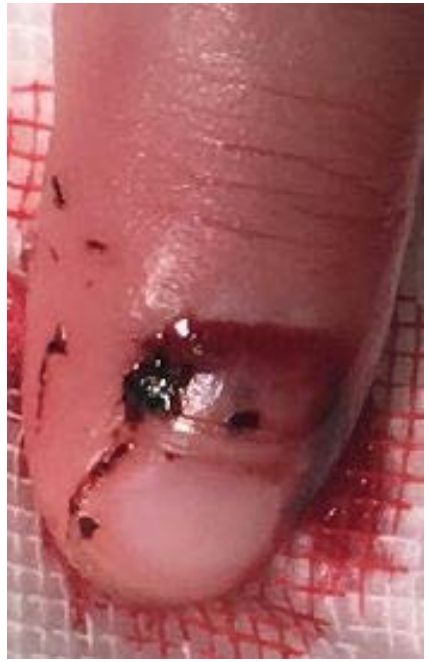
- Soft tissue injury is often more obvious
- Xray required to detect underlying fracture
- Management
  - Treat associated soft tissue or nailbed injury or tip avulsion.
  - Place in a neutral hand splint
  - Antibiotics
  - Nailbed repair may be required.

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Distal Phalangeal Fractures



Seymour Fracture

- Hyperflexion injury distal phalanx with associated nailbed injury and injury to growth plate.
- Examination
  - May look deceptively mild
  - It's an open fracture!
  - avulsion of the nail bed
  - Deformity and other signs of fracture
- X-ray shows fracture of the proximal physis of the distal phalanx
- Treatment
  - Explore and debride
  - Pin fixation
  - Cast
  - antibiotics



Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures

Shaft fracture

- Usually Oblique
- Treatment
  - Buddy strapping (to adjacent finger) if undisplaced
  - Hand splint in neutral position
  - Pinning rarely required

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures

Condyle fracture (Head fracture)

- One or both condyles may be affected
- a unicondylar fracture is shown in the illustration
- Usually, close
- Management:
- these require early exact anatomical reduction and pin fixation to prevent malunion
- Open Reduction with Internal fixation may sometimes be required

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures

Phalangeal Neck Fracture

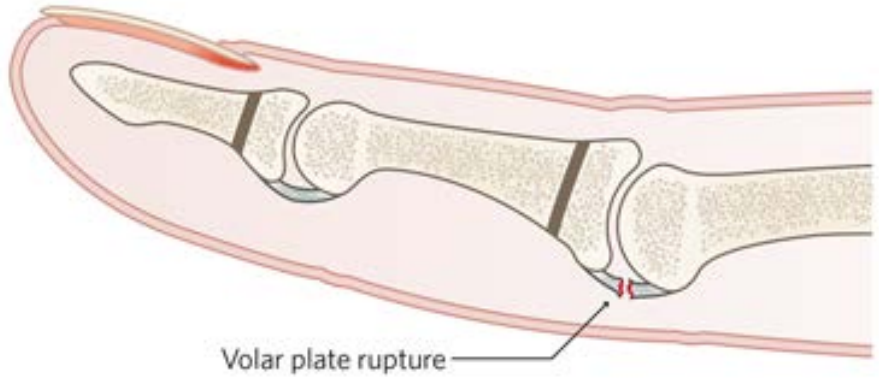
- Fracture through the distal neck (metaphysis) of the middle or proximal phalange
- Examination
  - Dorsal displacement along with
  - Bruising
  - Swelling
  - Tenderness
- Management
  - Must be accurately reduced to prevent extension deformity.
  - Place in neutral hand splint until surgical repair.

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures

Salter Harris Fracture at base of phalanx

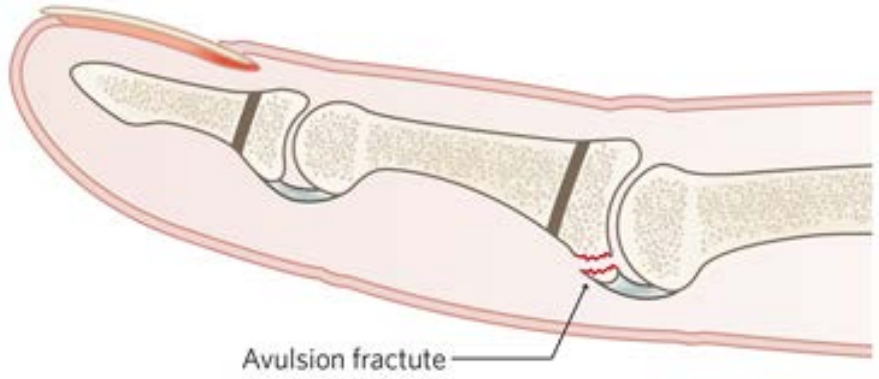
- Examination
  - Localized swelling and bruising
  - Tenderness.
  - Deformity
- X-ray
  - Salter-Harris II is the most common fracture seen
- Management
  - Close reduction in ED if angulated;
  - Neutral hand splint

Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures



Volar Plate injury

- Hyperextension injury, often from ball sports or following a dislocated finger.
- Examination
  - Localised bruising or tenderness on volar aspect of joint (usually PIP).
  - Findings can be subtle.
- X-Ray
  - there may or may not be an avulsion fragment
  - If tendon ruptures instead of avulsion, there won't be any avulsion fragment
- Management:
  - Apply a dorsal splint to prevent hyperextension (See next slide)



Phalangeal Injuries of the Hand:
Types of Phalangeal injuries
Proximal or Middle Phalangeal Fractures

Volar Plate injury :Dorsal Splint to prevent hyperextension

- Application
- First buddy-strap to the adjacent finger
- Apply an aluminum or fiberglass splint as shown

Different Hand Splints

- Note that in the treatment of these fractures, the hand must be elevated and placed in a collar and cuff.

Buddy strapping
Finger taped to the adjacent finger (cotton placed between the fingers to prevent skin maceration)

Ne**utral hand splint**:
Held in place with crepe bandage (cotton placed between the fingers to prevent skin maceration)

Section 5:
Some specific children’s fracture

Toddler’s fracture

- A spiral or oblique undisplaced fracture of the distal shaft of the tibia with an intact fibula
- Also called childhood accidental spiral tibial fracture (CAST fracture)
- Presentation:
  - Seen in toddlers
  - Limping or child refuses to walk
- X-ray
  - Initial X-ray may not reveal fractures
  - Radiographic evidence may only become apparent 7-10 days after the initial injury when new periosteal bone formation occurs
- Treatment
  - Above-knee walking cast for 4-6 weeks

Apophysitis and Avulsion of the Apophysis

- The apophysis is a secondary ossification center that serves as the attachment of muscle tendons to the bone
- The apophysis is the weakest point of the tendon-bone attachment in a growing child. It can be damaged by repeated stress or a sudden avulsion injury.
- Avulsion fractures are due to forceful muscle contractions displacing the apophysis from its attachment.
- Apophysitis refers to the irritation, inflammation, and microtrauma resulting from overuse injury to the apophysis
- It is unique to the skeletally immature child or adolescent

Apophysitis and Avulsion of the Apophysis: Common Locations

- Occurs in upper and lower extremities
- More common in the lower extremities
- Common locations include:
- Lower Limb
  - Patellar tendon attachment at the patella or tibia (i.e., Larsen-Johansson and Osgood-Schlatter diseases),
  - The calcaneus (i.e., Sever disease),
  - Around the hip, including the anterior inferior iliac spine.
- Upper Limb
  - medial epicondyle of the Humerus
  - Fifth metatarsal (i.e., Iselin disease) - rare.

Apophysitis and Avulsion of the Apophysis: Presentation

- History
  - Involvement in sports: often there is a preceding spike in these activities
  - Pain over the apophysis, which is worse during activities
  - Rest usually relieves the pain, only to flare up again with a return to sport.
  - Avulsion is accompanied by limping
- Examination
  - Tenderness over the apophysis
  - Pain in the apophysis when the muscle is contracted

Apophysitis and Avulsion of the Apophysis: Investigations

- X-Ray
  - Not usually necessary in apophysitis
  - But might be needed to exclude avulsions or other more serious causes
  - USS can also show changes in the apophysis
- CT Scan and MRI sometimes needed to rule out more serious causes

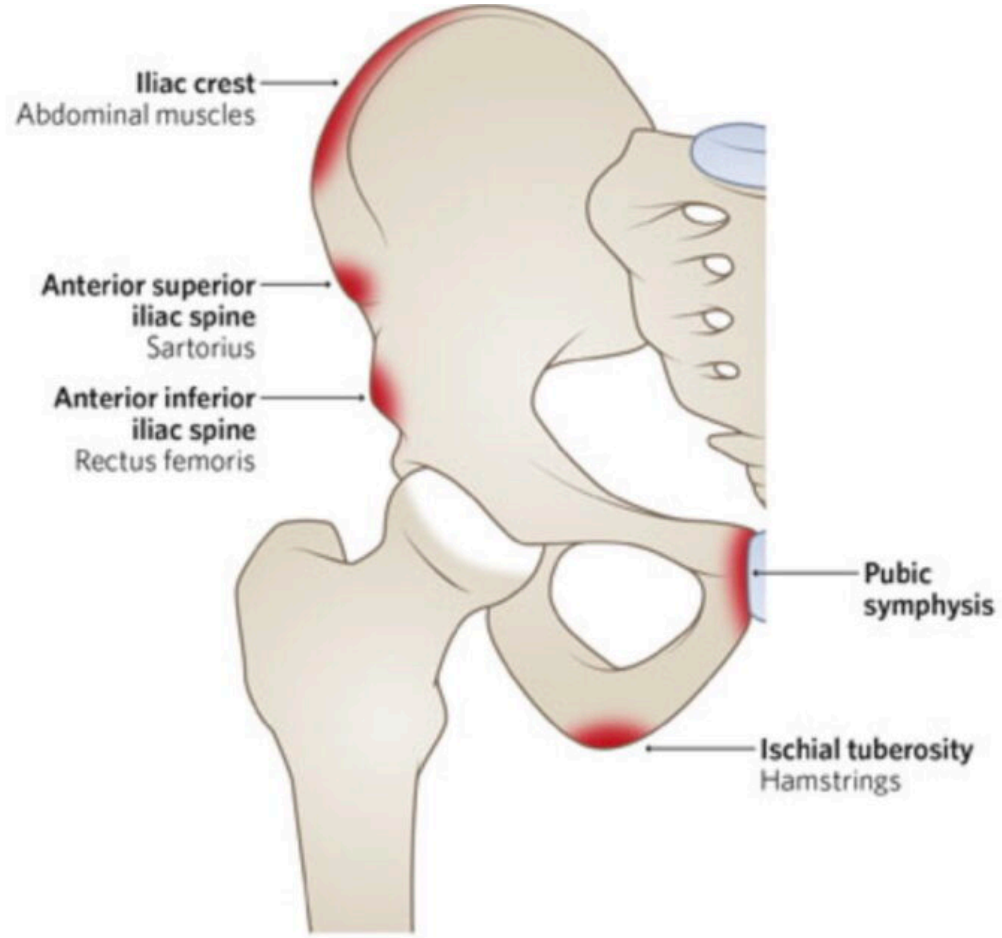
Apophysitis and Avulsion of the Apophysis: Treatment

- Rest
- Analgesics
- Splinting is rarely necessary
- Stretching exercises helps to recondition the muscles

Apophysitis and Avulsion of the Apophysis: Types

Disorder	Clinical presentation	Radiographic findings	Initial treatment	Orthopedic referral
Apophysitis				
Hip apophysitis	Pain over affected apophysis (seven sites in pelvis)	Normal or widened apophysis compared with contralateral side	Rest from painful sport or activities	Patients with persistent pain despite conservative management
Iselin disease	Insidious onset of pain over base of fifth metatarsal head	Normal or widened apophysis of the proximal metatarsal	Rest, stiff-soled shoe for protected weight-bearing	Patients with acute avulsions or continued symptoms despite rest
Larsen-Johansson disease	Pain at inferior patellar pole with activity and kneeling	Soft tissue swelling and calcification of inferior pole of patella	Activity modification; short course of acetaminophen or NSAIDs	Patients with a mature skeleton who have persistent symptoms
Medial epicondyle apophysitis (i.e., thrower's elbow)	Localized pain over medial epicondyle with throwing	May show fragmentation or widening of medial epicondyle	Throwing cessation; acetaminophen or NSAIDs as needed	Patients with acute avulsions or continued symptoms despite rest
Osgood-Schlatter disease	Pain at anterior tibial tubercle with activity and kneeling	Soft tissue swelling and fragmentation of tibial tubercle	Activity modification; acetaminophen or NSAIDs	Patients with a mature skeleton who have persistent symptoms
Sever disease	Posterior heel pain with activity and shoe wear	Plain radiography results are usually normal	Activity and shoe modifications; heel cups; calf stretches; acetaminophen or NSAIDs	Patients with a mature skeleton who have persistent symptoms

Apophysitis and Avulsion of the Apophysis: Common sites around the hip



A major Differential of Childhood fractures

Non-accidental injuries (Child Abuse)

Red Flags include:

- Multiple injuries
- Unusual locations of injuries
- Injuries at various levels of healing
- Unclear history – mismatching with examination findings
- Circumstantial evidence
  - Soft tissue injuries - bruising, burns
  - Intraabdominal injuries
  - Intracranial injuries
  - Delay in seeking treatment

Thank You