FRACTURES IN PEDIATRIC SKELETON

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Fractures in Pediatric skeleton

- Define the features of the growing skeleton
- Understand the anatomy of the physis in the immatare skeleton
- List different types of growth plate fractures
- Recognize the difference of treating injuries in the growing skeleton, when not to operate ?
- List the indications for operative treatment in the growing skeleton
- Understand the different fixation techniques available to treat these injuries

Fractures in Pediatric skeleton

Anatomical Peculiarities

- It's presence is a major difference
- GP is stronger than bone
- Provide perfect remodelling power
- Injury may cause deformity

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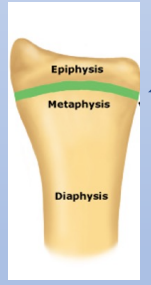

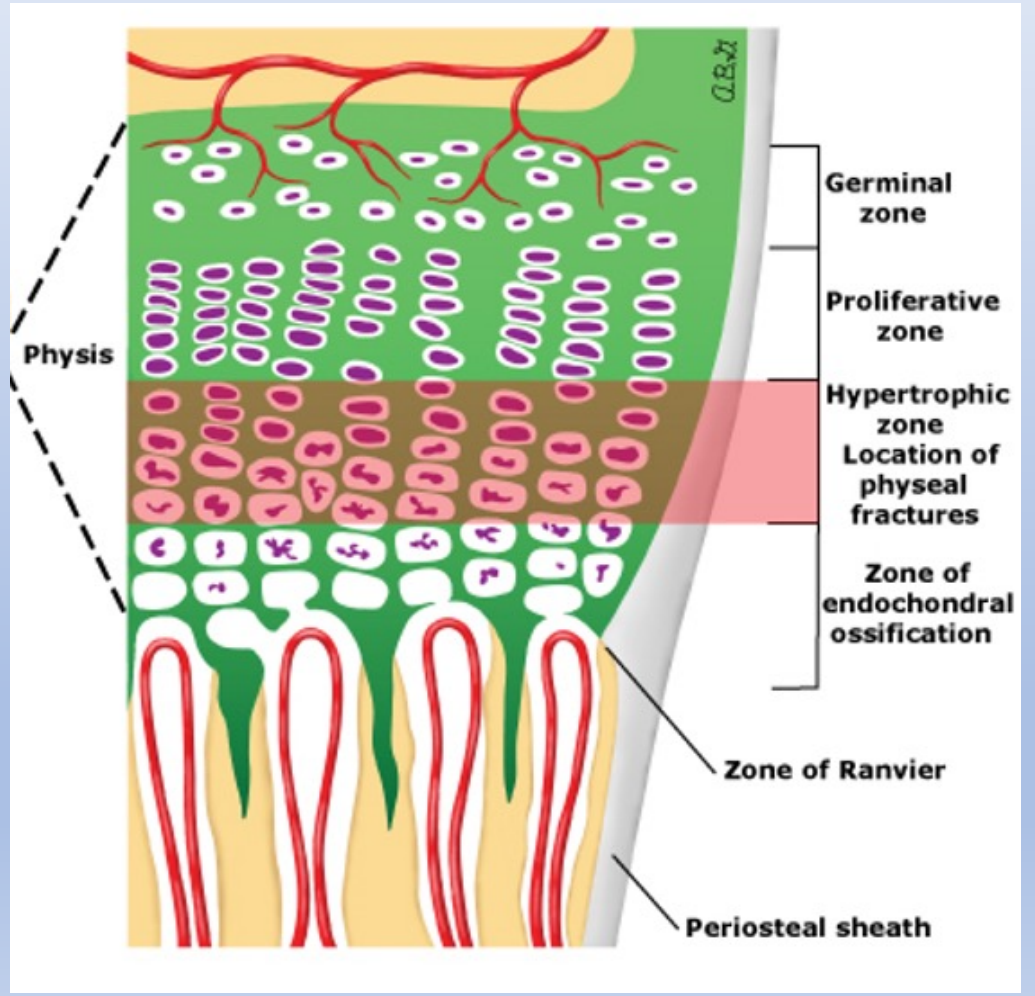

https://ukemigquickhit.wordpress.com/2012/10/01/salter-harris-fractures/

Fractures in Pediatric skeleton

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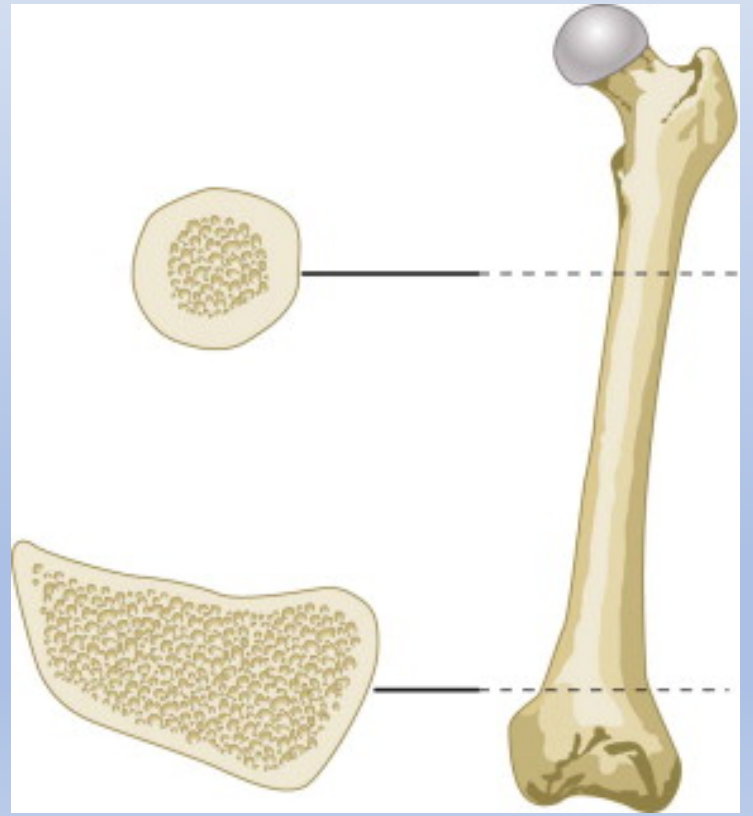
Fractures in Pediatric skeleton

- Increased cancellous bone

  reduces tensile strength

  reduces tendency of fracture to propagate

  Less comminuted fractures



Fractures in Pediatric skeleton

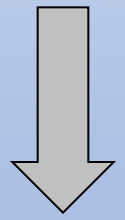
➢ **Periosteum:**

- Metabolically active

- Thickness and strength
  intact periosteal hinge affects
  fracture pattern
  may aid reduction

Fractures in Pediatric skeleton

- **Bone:**
- lower modulus of elasticity



more susceptible to bending forces

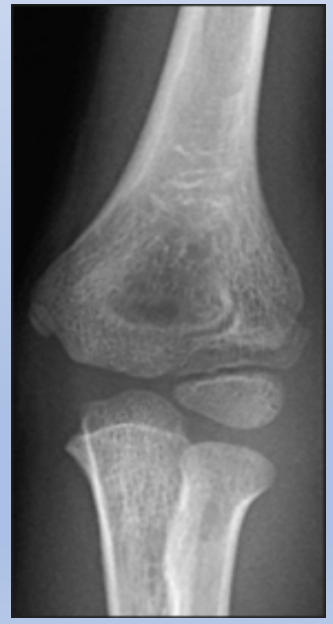
Fractures in Pediatric skeleton

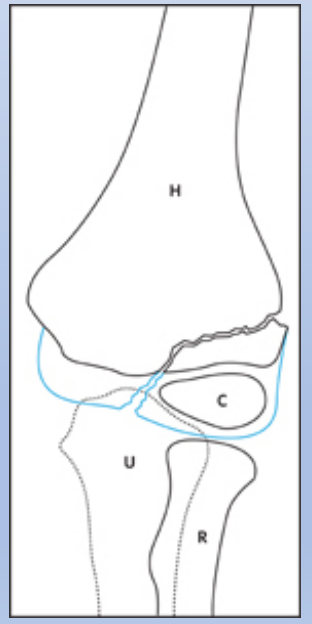
- **Cartilage:**
- Increased cartilage : bone ratio

  difficult x-ray evaluation

  size of articular fragment

  often under-estimated





Fractures in Pediatric skeleton

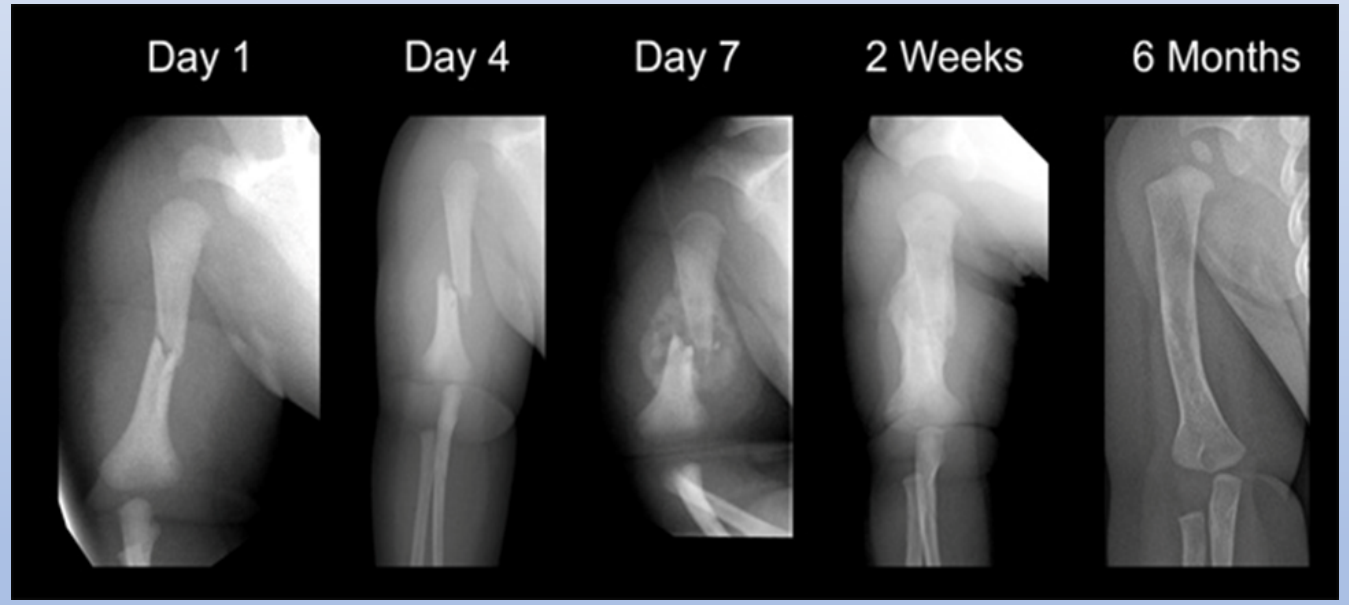
- **Age related fracture pattern**
- Infants: diaphyseal fractures
- Children: metaphyseal fractures
- Adolescent: epiphyseal injuries

Fractures in Pediatric skeleton

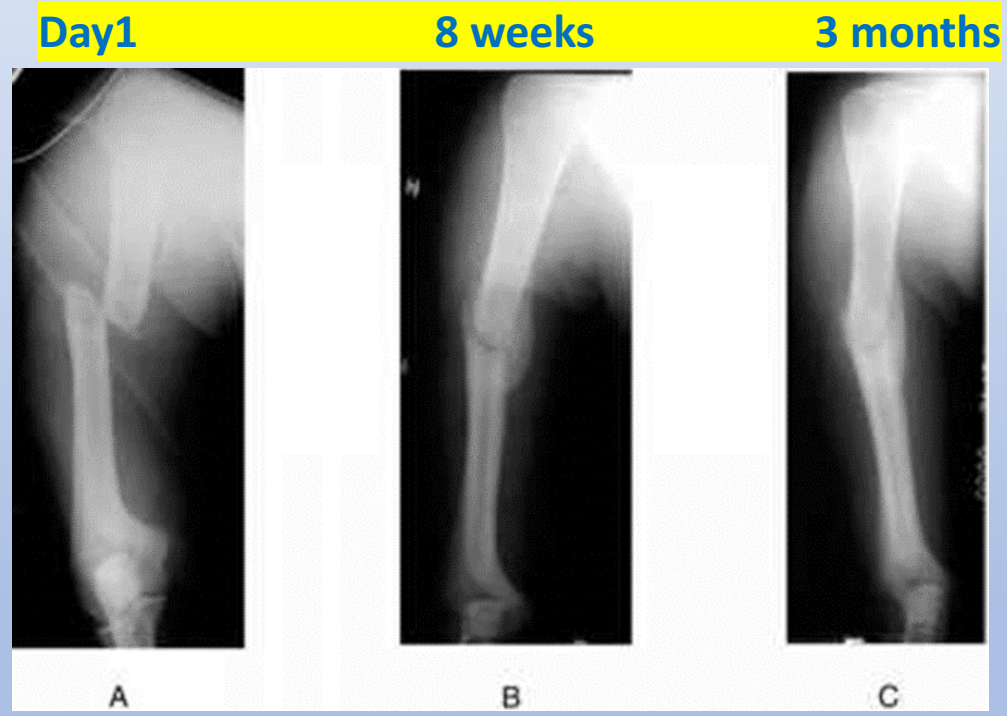
- **Physiology:**
- Better blood supply

  rare incidence of delayed and non-union

Fractures in Pediatric skeleton



Infant pt



Adult pt

https://www.rch.org.au/fracture-education/fracture_healing/
https://www.barnardhealth.us/humeral-shaft/v-nonoperative-management.html

Fractures in Pediatric skeleton

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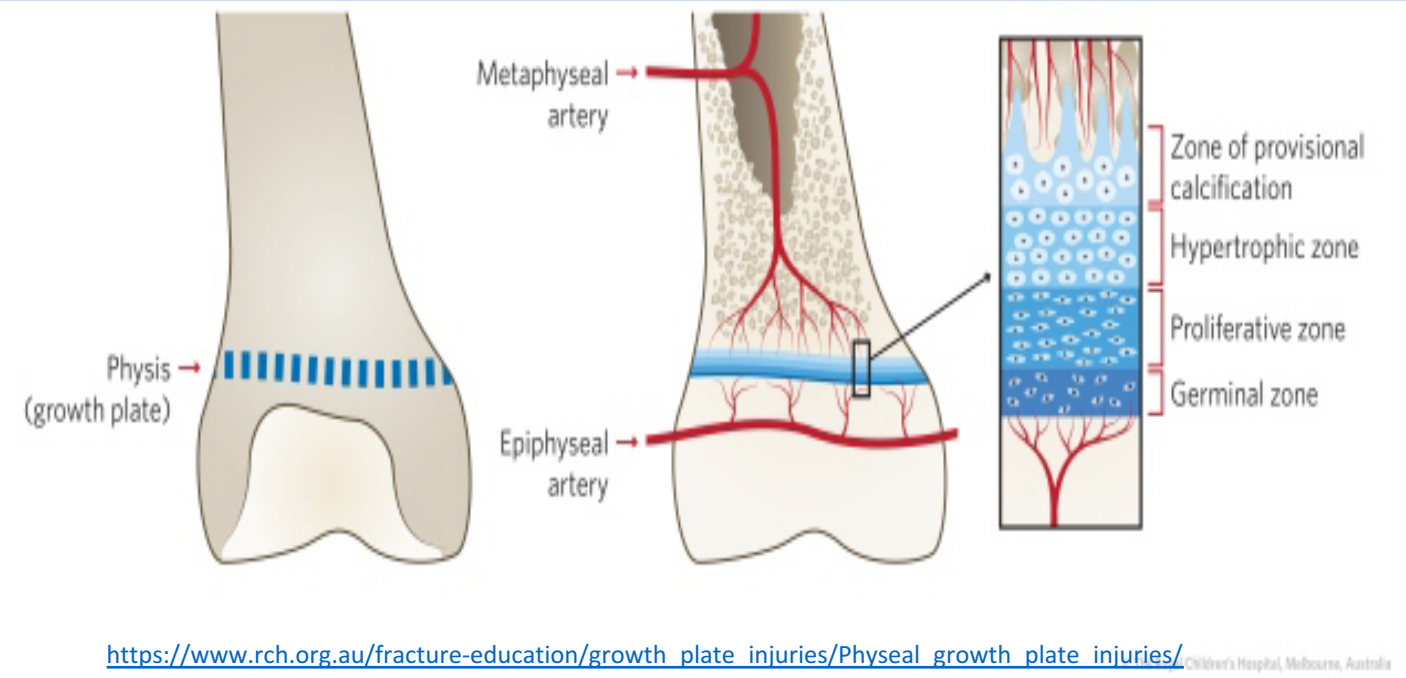
http://www.pmmonline.org/page.aspx?id=848

file:///C:/Users/Flinaro/Downloads/Outcomes_of_Severe_Comminuted_Distal_Radius_Fractu.pdf

Fractures in Pediatric skeleton

Anatomy of the growth plate



https://www.rch.org.au/fracture-education/growth_plate_injuries/Physeal_growth_plate_injuries/

Fractures in Pediatric skeleton

Physeal injuries

- Account for ~25% of all children's fractures.
- More in boys.
- More in upper limb.
- Most heal well rapidly with good remodeling.
- Growth may be affected

Fractures in Pediatric skeleton

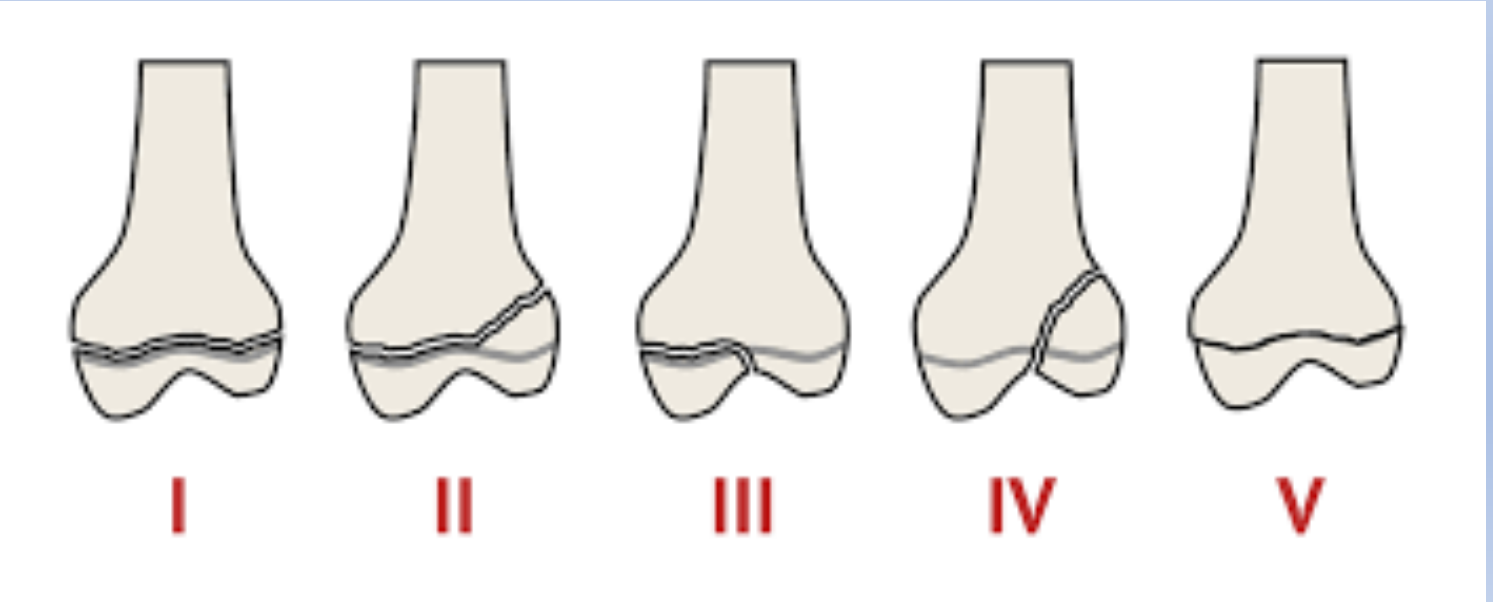
- Less than 1% cause physeal bridging affecting growth.
  - Small bridges (<10%) may lyse spontaneously.
  - Central bridges more likely to lyse.
  - Peripheral bridges more likely to cause deformity

  - Avoid injury to physis during fixation.
  - Monitor growth over a long period.
  - Image suspected physeal bar (CT, MRI)

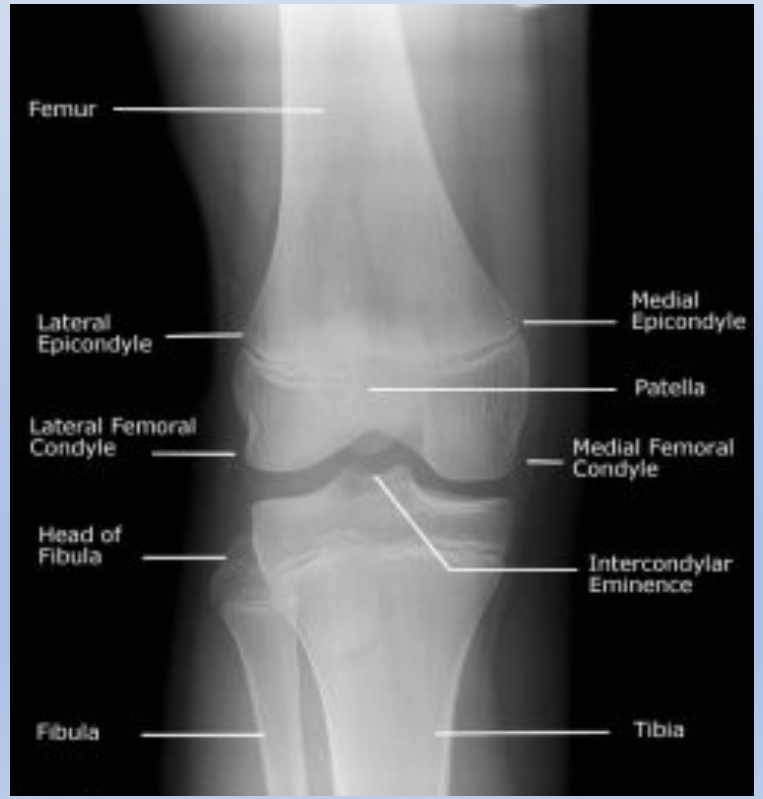
Fractures in Pediatric skeleton

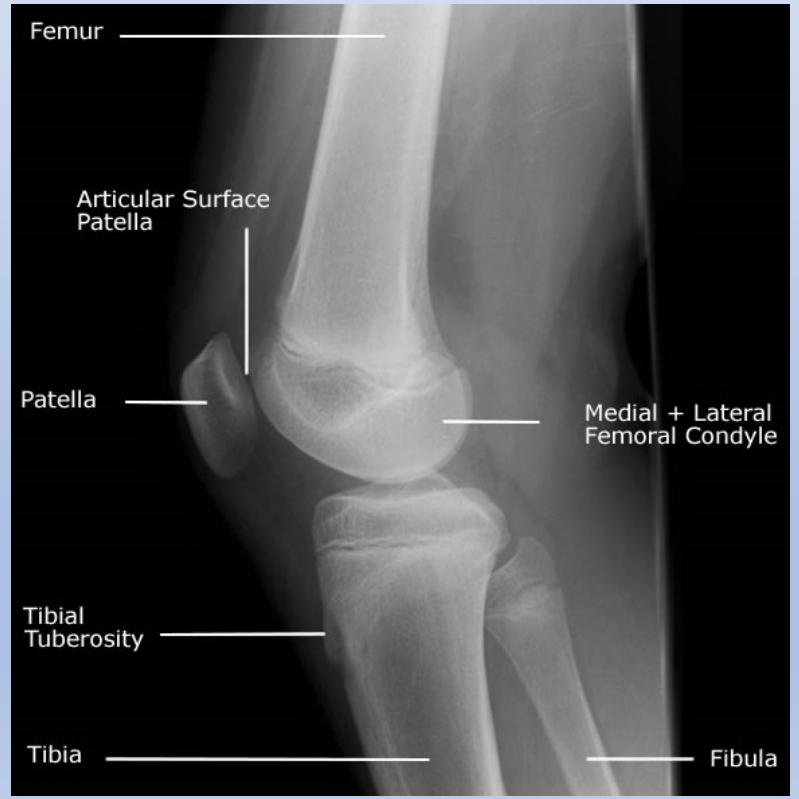
Classification:

Salter harris



Fractures in Pediatric skeleton





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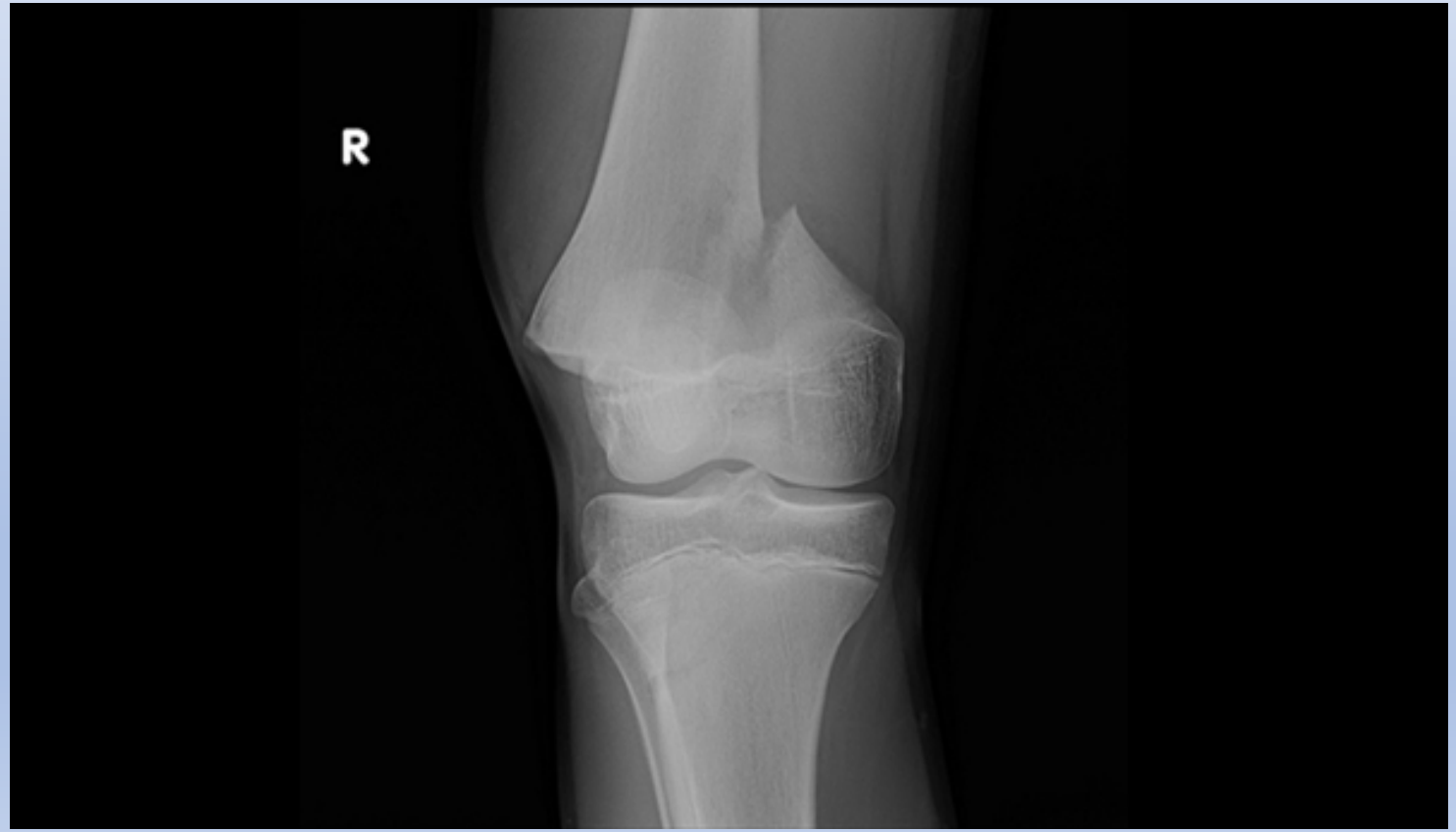

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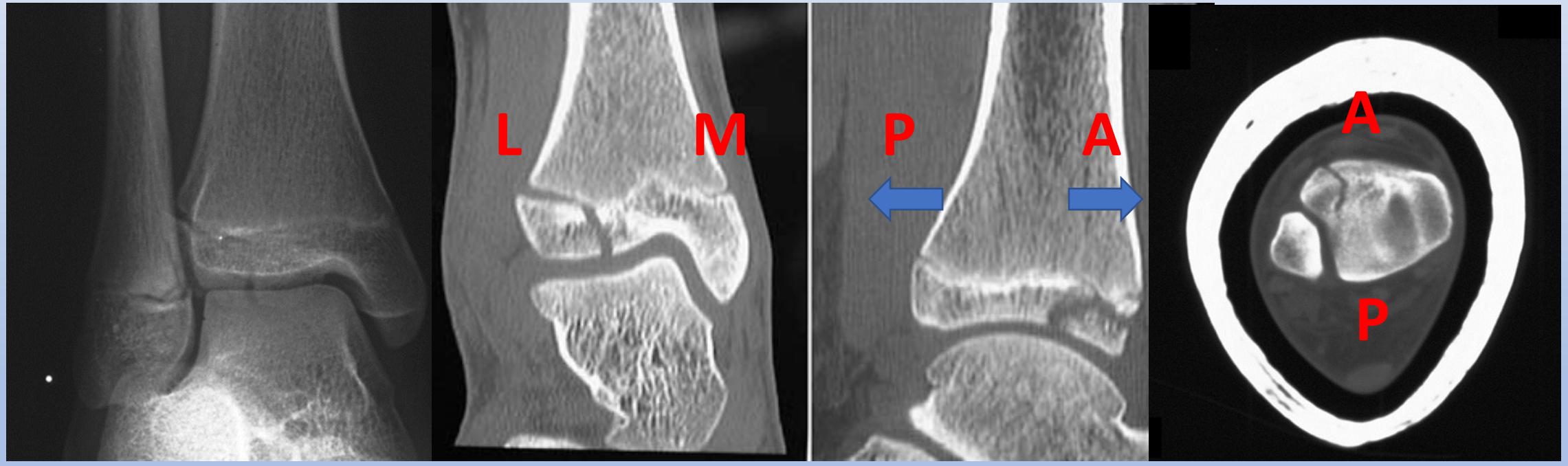

Fractures in Pediatric skeleton

https://radiopaedia.org/articles/triplane-fracture?lang=us

Fractures in Pediatric skeleton

Fractures in Pediatric skeleton

Prognostic factors

- The patient's age
- The severity of injury
- The physis injured
- The treatment.

Fractures in Pediatric skeleton

The power of remodeling

Factors affecting remodeling potential of ALL Pediatric #

- **Years of remaining growth** – **most important factor**
- **Position in the bone** – the nearer to physis the better the remodelling
- **Plane of motion** –
  greatest in sagittal, the frontal, and least for transverse plane
- **Physeal status** – if damaged, less potential for correction
- **Growth potential of adjacent physis**
  e.g. proximal humerus better than distal humerus
  & distal radius better than proximal radius

Fractures in Pediatric skeleton

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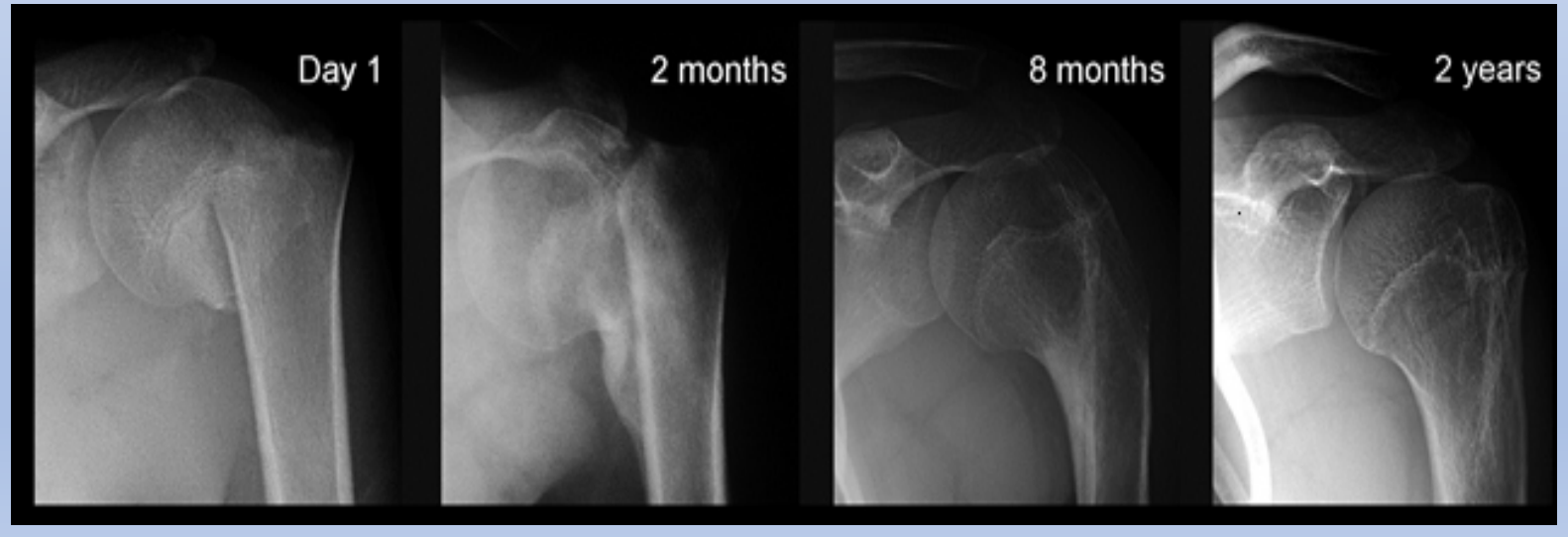

Fractures in Pediatric skeleton

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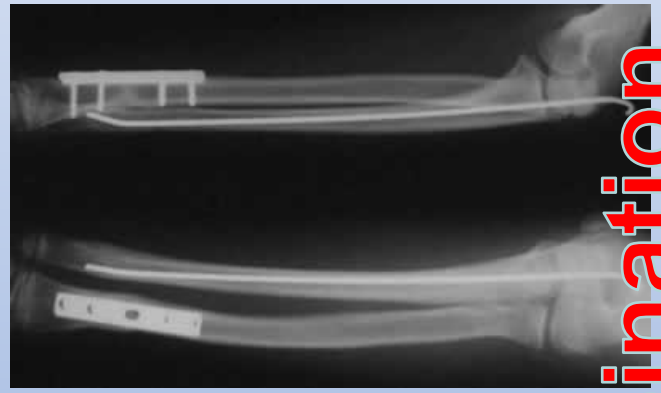
Indications for operative fixation

- Open fractures
- Displaced intra articular fractures
  (Salter-Harris III-IV)
- fractures with vascular injury
- ? Compartment syndrome
- Fractures not reduced by closed reduction
  (soft tissue interposition)
  or reduction lost with follow up
- Unstable diaphyseal fractures

Fractures in Pediatric skeleton

Methods of fixation



Combination from all

- Casting - still the commonest
- K-wires
  - most commonly used
  - Metaphyseal fractures
- Intramedullary wires, elastic nails
  - Very useful
  - Diaphyseal fractures
- Screws
- Plates – multiple trauma
- IMN - adolescents
- Ex-fix

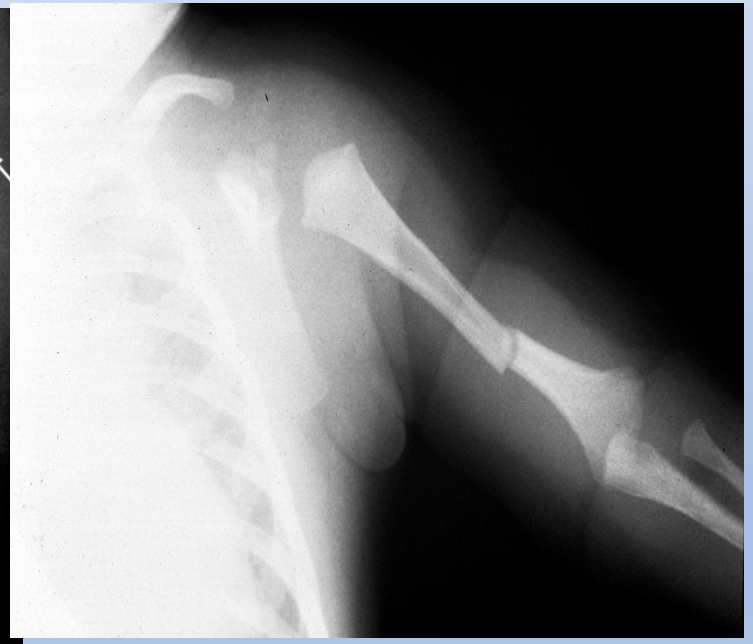
Fractures in Pediatric skeleton

Complications

- Ma-lunion is not usually a problem
  (except cubitus varus)
- Non-union is hardly seen
  (except in the lateral condyle)
- Growth disturbance – SH III. IV, V & too many times of manipulation
- Vascular – volkmann's ischemia
- Infection - rare

Fractures in Pediatric skeleton

Child abuse



Fractures in Pediatric skeleton

Take-home messages

- The child is not a small adult
- High capability of rapid healing
- Remodeling for deformities is high if :

  - In the plane of motion
  - long growth remaining

Fractures in Pediatric skeleton

Take-home messages

- Respect physeal injuries
  - Avoid multiple reduction attempts
  - Follow closely if nonoperative
  - Anatomic reduction for articular fracture
  - Smooth K-wires when crossing the physis
  - Screws parallel to physis
  - **Be aware of possible child abuse**