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Pediatric Orthopedic Injuries: Evaluation & Treatment Considerations

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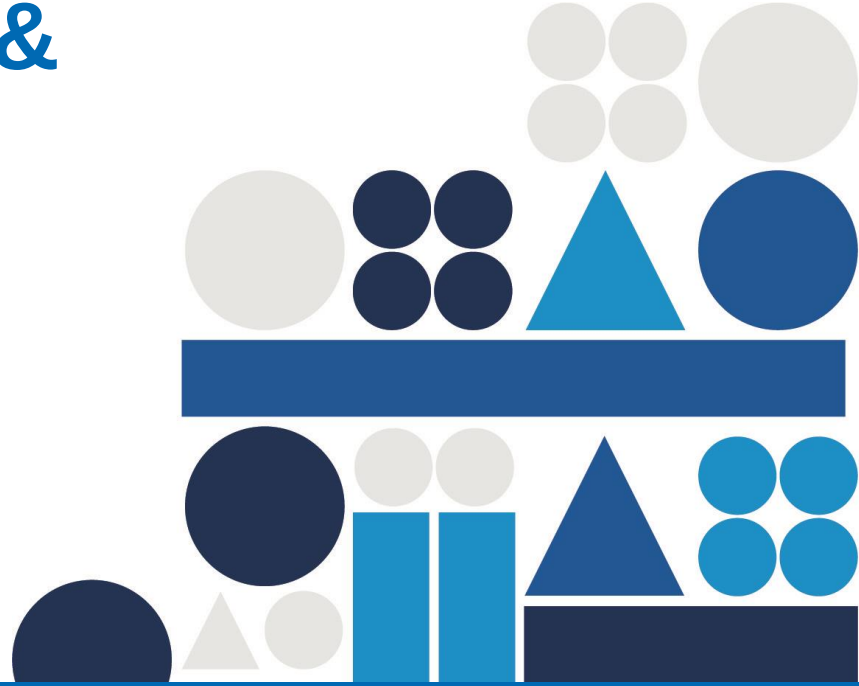


I have no conflicts of interest to report.

Outline

- Basic principles of evaluation
- List some of the more common pediatric injuries and how to stabilize them
- Questions

About Me and What I Do

- Residency at CU (Denver Health, VA, CHCO, UCH)
- Fellowship in peds ortho at University of Michigan -level one
- 4 years of general orthopedics in Cortez CO (mostly trauma, sports injuries) – critical access hospital
- 6 years of peds ortho at Norton Children's Hospital -level one
- 1 year of peds ortho at CHCO in CO Springs -level two

Differential diagnosis of the swollen, painful, limb

- Even if there is a history of trauma (particularly “remote” trauma), please consider in your differential:
  - INFECTION
  - TRAUMA
    - Fracture
    - Sprain
    - Strain
    - Dislocation
  - TUMOR

- **You cannot completely rule out** fracture or recent dislocation with normal x-rays
- **You can see many bony tumors** on plain films but they might be subtle
- You **cannot rule out infection** with normal x-rays

If the history is not completely consistent with recent trauma please consider INFECTION in your differential

Exam

Initial Evaluation – Is the limb . . .

- Deformed or not (and where is the deformity)?
- Swollen – joint effusion vs soft tissue edema?
  - Are compartments compressible
- Ecchymotic?
- Sensate?
- Moving normally?
- Perfused?
  - Pulses vs capillary refill
  - ABIs to evaluate perfusion of lower extremities
- Intact with regards to the skin?
  - Abrasions vs lacerations vs puncture wounds
    - Is the puncture “outside in” or “inside out”

WHERE is the pain?

- It is not uncommon for more than one injury to occur at the same time
- It is not uncommon for pain to be referred

Studies

X-Rays are the First Choice

XR should span the joints above and below the injury

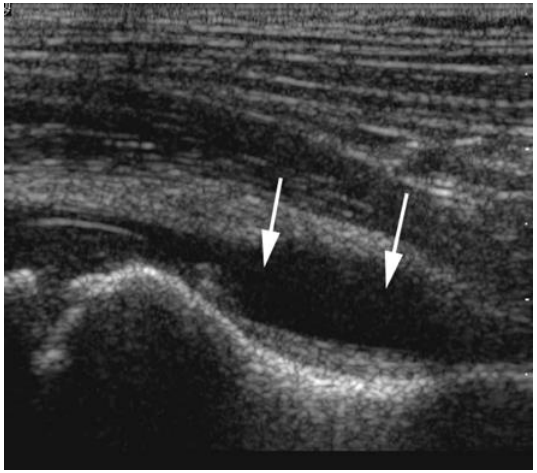
- Ex: for a presumed distal radius fracture, forearm images should span the carpus to the elbow
- Ex: For a presumed tibial injury, the knee and ankle should be included

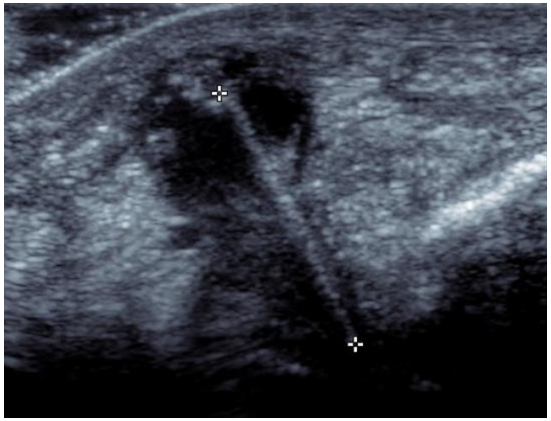
Case Example:

- nonverbal autistic child who did not have a known trauma history but was refusing to bear weight
- X-ray was not obtained initially
- US was obtained – effusion
- ESR/CRP normal
- Ortho consulted for “septic joint”

Ultrasound

- Doesn’t usually require sedation but quality can be operator dependent
- Hip U/S for evaluating effusion
  - Can’t accurately predict type of effusion (sterile, purulent, hemorrhagic)
- Foot and hand U/S for evaluating foreign bodies that are radiolucent





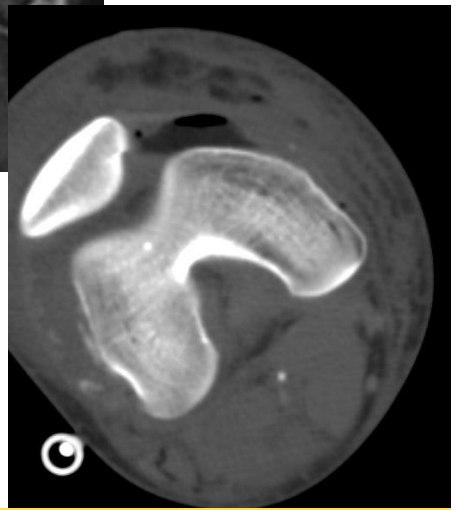
More Advanced Imaging

CT:

- Pros: doesn't usually require sedation, good quality images
- Cons: large amount of radiation
- When I use it: complex intra-articular fractures, **traumatic arthrotomies**

MRI:

- Pros: good at evaluating soft tissue and bone quality, no radiation
- Cons: requires sedation, lengthy and often delayed, not all facilities have access 24/7
- When I use it: dislocations, stress fractures with normal XR, infection, tumor



https://prod-images-static.radiopaedia.org/images/26438942/9e9f5f4c27d81a634bf2ee737606d3_big_gallery.jpeg

Labs

- Infection, inflammatory disease, malignancy
- Appropriate test depending on scenario:
  - CBC (WBC not sens/spec for osteo)
  - ESR (24-48 hrs → 3 wks)
  - CRP (6 hrs → 6-10 days)
  - Blood and fluid cultures
  - Rheumatology labs (RF, ANA, anti-CCP, HLA B27)
  - Lyme titer **

Open Fracture Management

Cochrane Database of Systematic Reviews | Review - Intervention

Timing of antibiotic administration, wound debridement, and the stages of reconstructive surgery for open long bone fractures of the upper and lower limbs

James K-K Chan, Alexander L Aquilina, Sharon R Lewis, Jeremy N Rodrigues, Xavier L Griffin, Jagdeep Nanchahal
Authors' declarations of interest

Version published: 01 April 2022 Version history
https://doi.org/10.1002/14651858.CD013555.pub2

- Most open fractures in kids involve the forearm
- Pokeholes are either “outside-in” or ”inside-out” - need to know which
- Most “inside-out” pokehole forearm fractures can be treated in the ER
- Most important treatment that reduces infection risk – IV Antibiotics and tetanus prophylaxis upon arrival in ED
- Cover wounds with sterile gauze and saline for transport

Pediatric Compartment Syndrome

Instead of the 5 P's (pain, pallor, pulselessness, paresthesia, paralysis), we think of the 3A's:

Anxiety

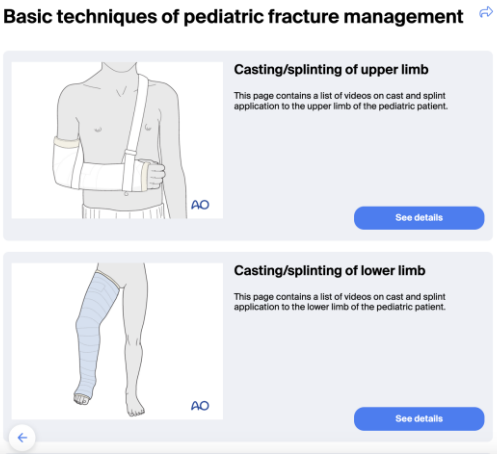
Agitation

Analgesia needs increasing

*** also having Anesthesia (eg: nerve injury) increases risk

Pearls for Immobilization

- Don’t bend fiberglass slabs at edges
- Pad the edges
- make sure fiberglass not in direct contact with skin
- Pad the heck out of the heel in leg splints especially for toddlers and other non-verbal kids
- After a dislocation and before splinting, document the positions of stability and instability of the joint
- Need to immobilize the joint above and below the long bone injury



https://surgeryreference.aofoundation.org/orthopedic-trauma/pediatric-trauma

Slings/Shoulder Immobilizers

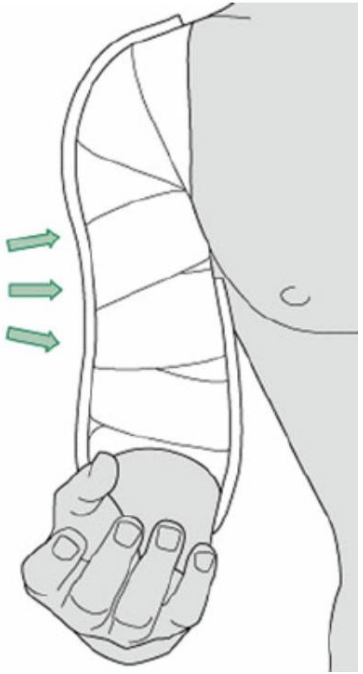
1. Any clavicle fracture
2. AC and SC joint injuries
3. Proximal humerus fractures
4. Post shoulder dislocation

- Wee babes can have their onesie pinned to their chest or gently wrapped in a swathe
- No slings at bedtime, pillows or reclining chair can be used for support

Coaptation Splint or Sarmiento Brace

1. Humerus shaft fractures

***The coaptation works best if the fiberglass slab is secured to the collarbone area with tape or a wrap



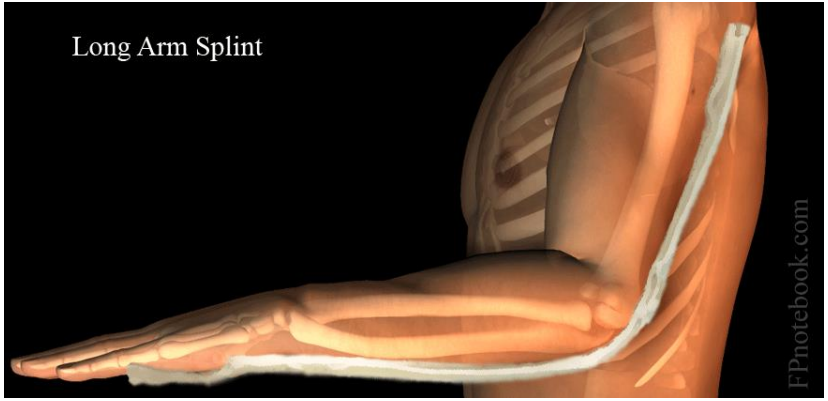
Mader, Konrad. (2015). diaphysis: conservative treatment.

Long Arm Splint

Any elbow injury

1. Distal humerus
2. Elbow dislocation
3. Proximal ulna
4. Proximal radius

- fiberglass slab should extend from axilla to MCP joints
- Pad the top with cast padding

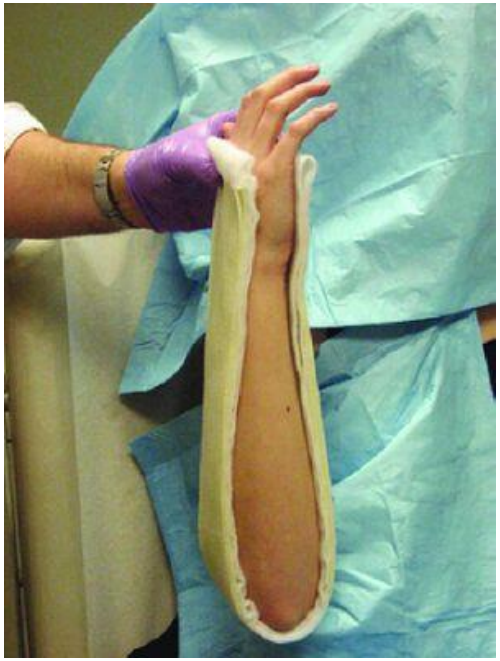


https://fpnotebook.com/Ortho/Procedure/LngArmSplnt.htm

Sugartong Splint

1. Any forearm injury that will be stable with elbow flexion and extension
2. NO olecranons or radial head/neck injuries

- Fingers can be left free for any injury proximal to the carpus
- This is not an appropriate elbow immobilizer



Boyd, Anne S., Holly J. Benjamin, and Chad A. Asplund. "Splints and casts: indications and methods." American family physician 80.5 (2009): 491-499.

Arm Braces

- Wrist brace for stable wrist injuries
- Spica wrist brace for scaphoid and thumb injuries
- Ulnar gutter brace for 4th and 5th ray injuries

Knee Immobilizer

1. Hip dislocation post reduction
2. Most stable knee injuries in <u>compliant</u> children
    1. Nondisplaced distal femur and proximal tibia
    2. Most ligament injuries in the knee
    3. Patellar dislocations

Knee immobilizers should go from just below the groin to the ankle to actually immobilize the knee

Long leg splint

1. Injuries around the knee in very young or non-compliant
    1. distal femur and proximal tibia
    2. Unstable knee ligament injuries
2. Tibial shaft fractures – need to add a stirrup for side-to-side support

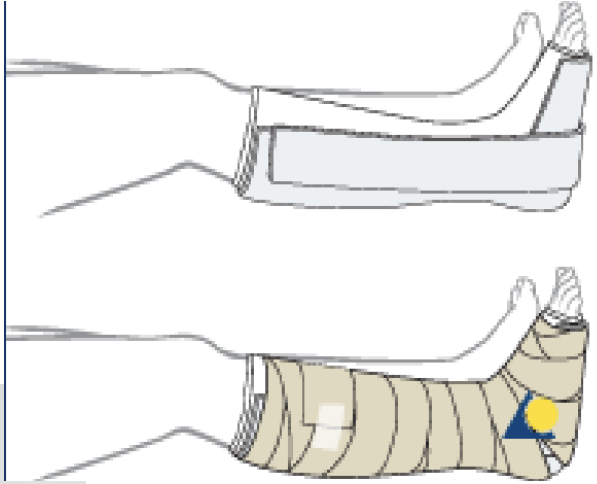
Tall Walking Boot

- Any stable ankle or foot injury
- I prefer this to a shoe for 5th metatarsal injuries to immobilize peroneal tendons
- Make sure the boot fits around the ankle and doesn't wobble
- Sometimes it is more important to fit the ankle than the length of the foot

Short leg 3-way Splint

1. Any distal tibia/fibula fracture (metaphyseal and below)
2. Any ankle or foot injury

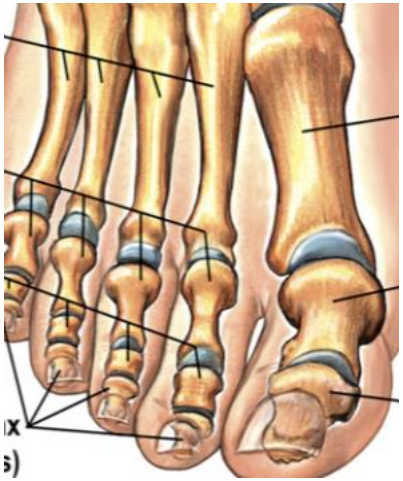
- For large patients who are stable, can splint in the prone position
- Must immobilize from fibular head down to MTP joints



https://www.youtube.com/watch?app=desktop&v=Eju_F_h0zGs

Hard Soled Shoe

- Any midfoot or forefoot injury distal to tarsometatarsal joint (metatarsal and phalanges)
- Add buddy tape to limit side to side motion of the toe if needed



Fingers

- Buddy tape for stable injuries
- Post reduction dislocations or non-displaced finger fractures
- Clamshells for any fracture distal to the shaft of the proximal phalanx
- Need to immobilize the MCP for any proximal phalanx base fracture
- Stack splints are good for DIP and distal phalanx injuries that aren't too swollen

Common Pediatric Orthopedic Injuries

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Shoulder Dislocations

- 20% of all shoulder dislocations occur in people under 20 y/o
- Uncommon in kids under 10 yo → proximal humerus fractures instead
- Anterior dislocation most common
- Repeat dislocations common (anywhere between 0-100%)
- After plain films confirm reduction, MRI indicated in primary shoulder dislocations in teenagers
- PT and sling are almost always a reasonable first line treatment
- Occasionally surgery is warranted -> referral to specialist is warranted early
- Confirm reduction with 3 views (AP, Y and axillary) OR CT if concerns

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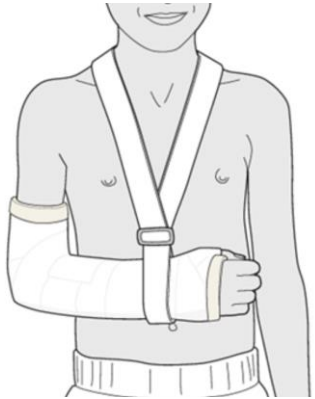
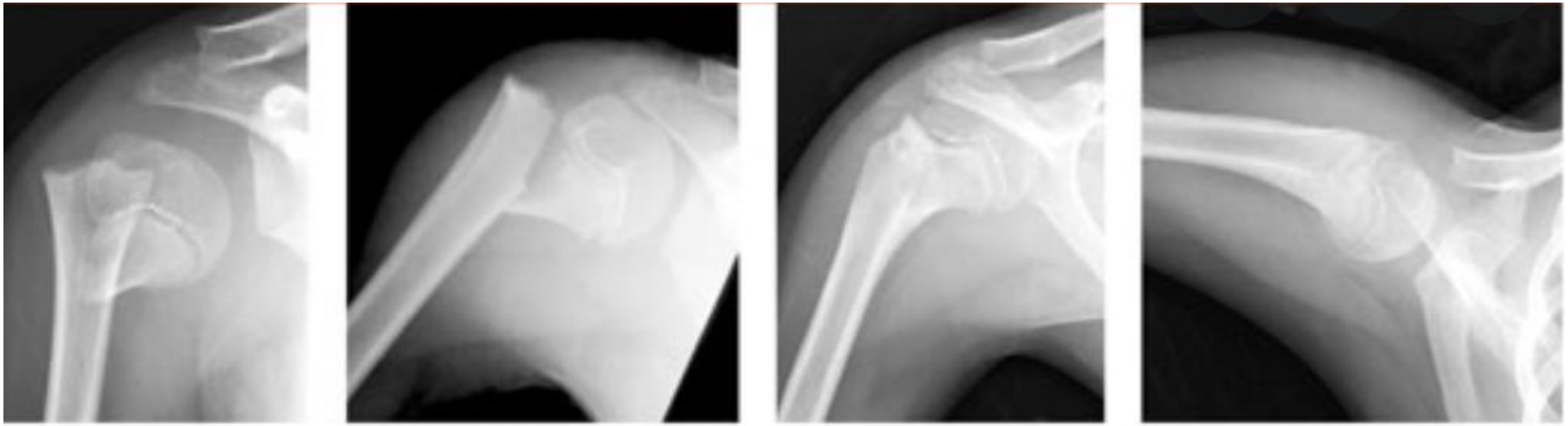
https://www.ortho-teaching.feinberg.northwestern.edu/XRreading/shoulder/axillaryview.html and Radiopaedia.org

Proximal Humerus Fractures

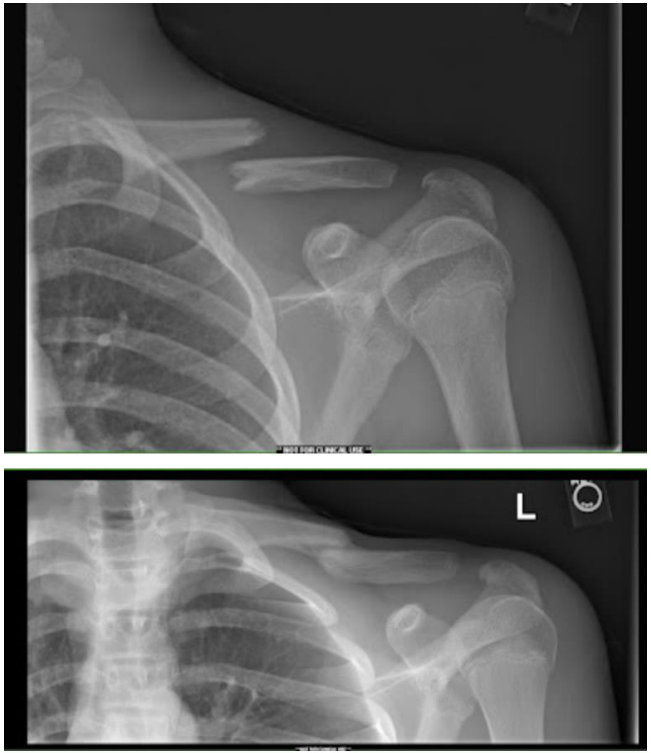
- Almost never need surgery
- Extremely powerful physis → extensive remodeling potential
- Residual deformity is well tolerated
- Sling or shoulder immobilizer or hanging arm cast for 3-4 wks





Clavicle Shaft Fractures

- Recent publications and expert opinion = **the only clavicle fractures that "need" surgery are open fractures**
  - severe deformity, skin tenting, etc only very soft indications
- Sling/immobilizer 3-6 wks
  - No evidence that "figure of 8" braces are better
- Kids under 5 will always heal and don't need follow-up radiographs
- Refracture a risk for perhaps many months



Two-Year Functional Outcomes of Operative vs Nonoperative Treatment of Completely Displaced Midshaft Clavicle Fractures in Adolescents

Results From the Prospective Multicenter FACTS Study Group

Benton E. Heyworth,* MD, Andrew T. Pennock, MD, Ying Li, MD, Elizabeth S. Liotta, MBBS, Brittany Dragonetti, MA, David Williams, PhD, Henry B. Ellis, MD, Jeffrey J. Nepple, MD, David Spence, MD, Crystal A. Perkins, MD, Nirav K. Pandya, MD, and Donald S. Bae, MD
Investigation performed at Boston Children's Hospital, Boston, Massachusetts, USA

"Conclusion: **Surgery demonstrated no benefit** in patient-reported quality of life, satisfaction, shoulder-specific function, or pre- vention of complications after completely displaced clavicle shaft fractures in adolescents at 2 years after injury." (AJSM, 2022:11)

“Torso Belt Shoulder Immobilizer”

Benefits

- Can be worn to bed without anything around the neck
- easier to keep on
- Doesn’t hurt neck
- Can be purchased online by parents
- Can allow the kid to write but keep arm by side

Problems

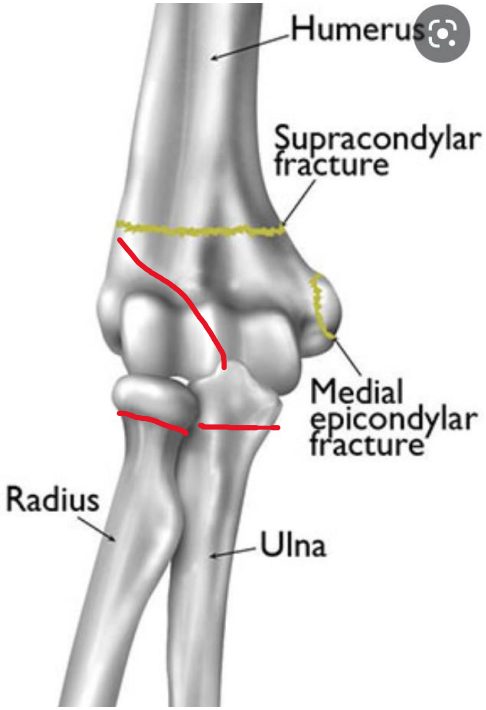
- Another thing to stock
- Not always available for very small kids

Pediatric Acromioclavicular (AC) Injuries

- **The distal clavicle physis typically does not close until late teens**
- Most injuries of the AC joint are NOT dislocations or “separations” but are **fractures of the distal clavicle growth plate**
- If XR are normal and mechanism of injury and exam are concerning for AC joint, likely is non-displaced physeal injury
- Unless there is significant displacement of the AC joint itself, most will heal fine with shoulder immobilization

Elbow Fractures

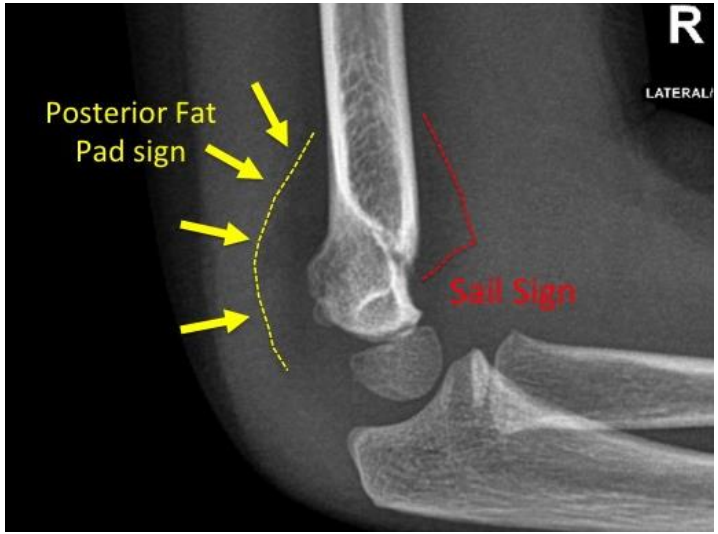
- NONDISPLACED elbow fractures can be treated with immobilization only
  - Radial head/neck *
  - Type 1 supracondylar fractures
  - Medial epicondyles not associated with elbow dislocation
  - Lateral condyles
  - Olecranons
- Medial epicondyle fracture with elbow dislocation needs surgical evaluation but most can be treated non-operatively initially
- Elbows have poor remodeling potential



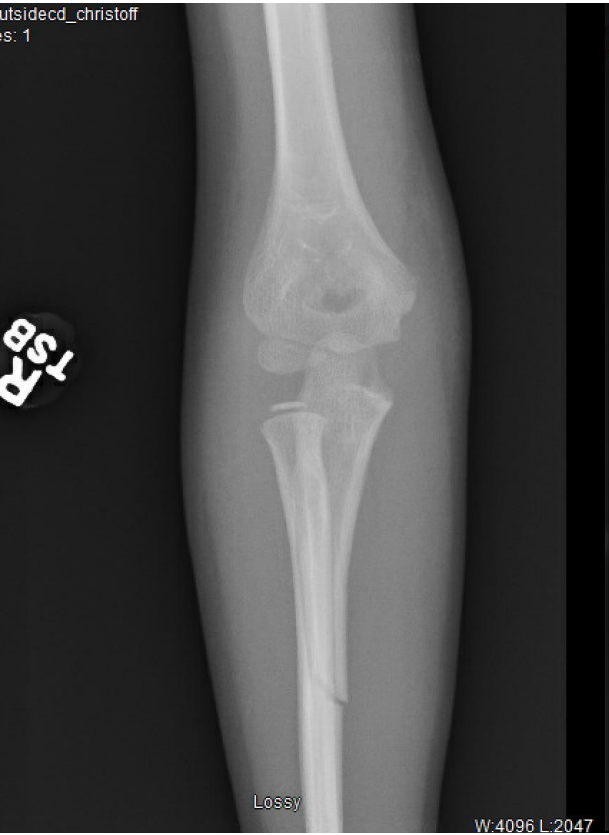
The Occult Elbow

- FOOSH + radiographic evidence of effusion + elbow pain = FRACTURE even if X-rays are NEGATIVE
- Younger kids (<8yo) – more likely supracondylar humerus fracture
- Older kids/adults – more likely radial head/neck
- Long arm splint is appropriate

Radiographic Measures



Case courtesy of Dr Afra Alfalahi, Radiopaedia.org, rID: 54689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Lossy
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What is the TRASH elbow?

- ***"The Radiographic Appearance Seemed Harmless"***
- Rather benign looking injuries that have disastrous complications if not recognized in a timely fashion for their long-term implications
- <10 yrs old, high energy mechanisms
- Often unstable requiring anatomic reduction, internal fixation with or without soft tissue repair
- Late or missed diagnoses or improper treatment can result in long-term complications that are difficult to manage
- Surgical reconstruction of the late presenting malunion is difficult

- high index of suspicion, early additional imaging [ultrasound, arthro-gram, magnetic resonance imaging (MRI) scan] and surgical treatment

Occult Elbow Fracture vs TRASH Elbow?

Supracondylar Humerus Fractures

- Most common elbow fracture
- 16% of ALL pediatric fractures
- 60% of ALL pediatric ELBOW fractures
  - peak age: 4-8 yrs
  - most common fracture in the 0-7 age group

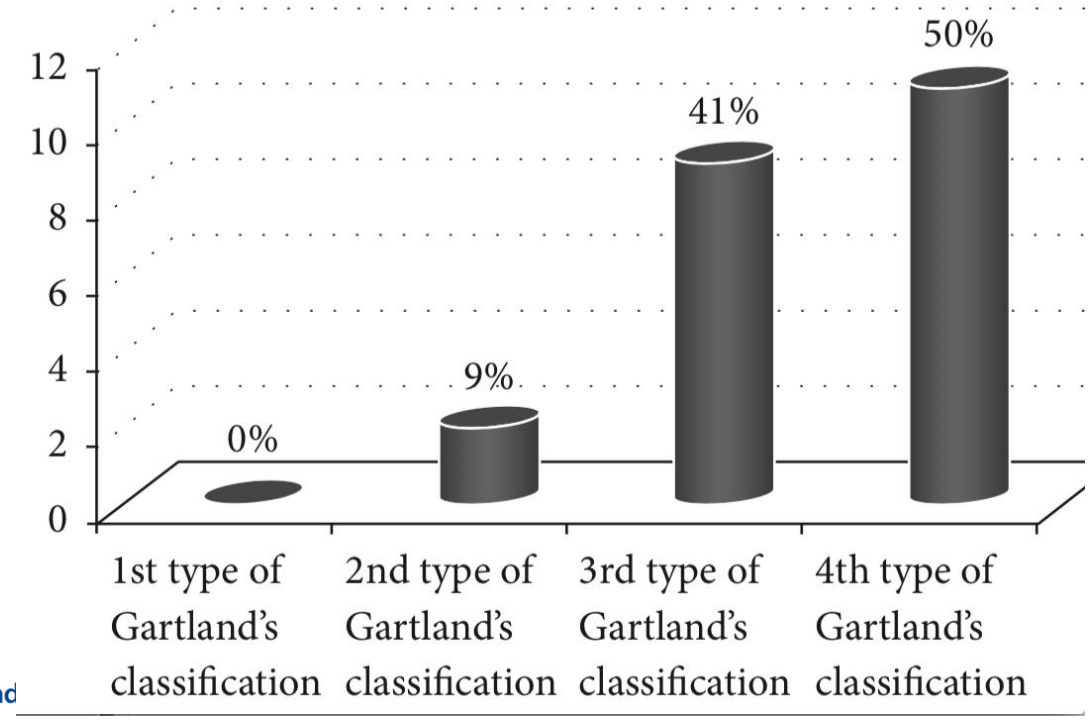
Classification SCHF

- Gartland (I-III)
- modified Gartland (I-IV)
  - IV -complete lack of periosteal continuity
- Wilkins' modification of the Gartland
  - IIA vs IIB determined by rotation and translation

Flexion Types

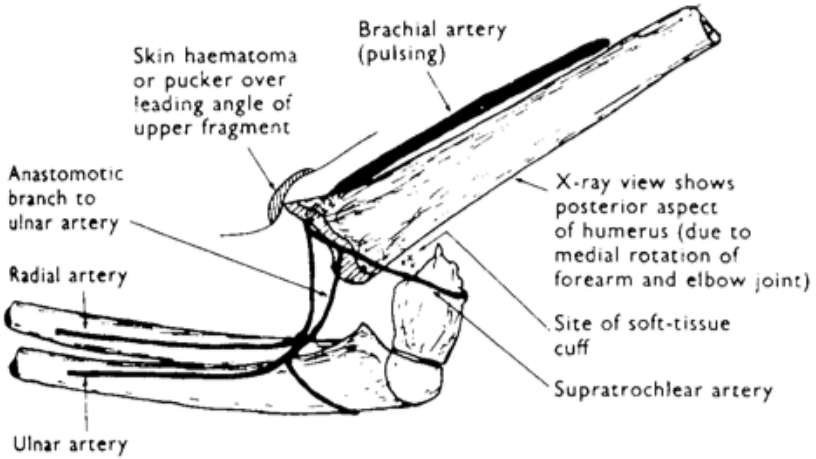
- 2% of SCHF
- Reduce in extension
- Ulnar nerve injury (10.5%)
- More likely to require open reduction

Nerve Injury in SCHF



Initial Treatment of SCHF

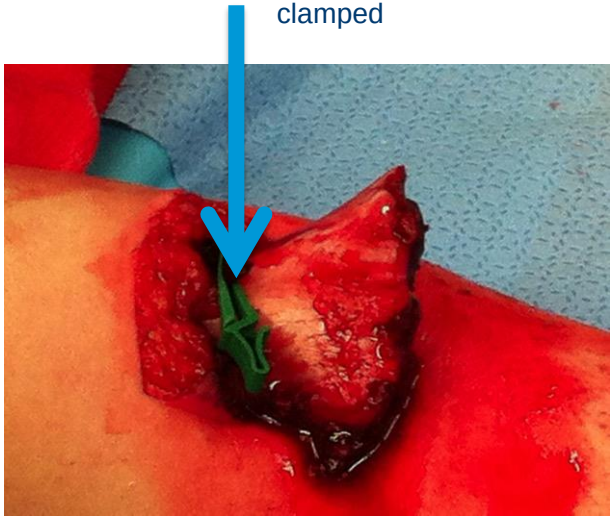
- Neurovascularly intact - no clear difference has been found in complication rates, operative duration, and radiographic or functional outcomes after early versus delayed intervention
  - Increased rate of malunion with “late night surgery?”
- Indications of severe injury:
  - Brachialis entrapment - puckering of anterior humeral skin, bruising and a prominent spike on lateral XR
  - Neurologic injury (AIN palsy predictive of brachial artery injury, increased risk of compartment syndrome)
- Multiple studies show that in the very displaced NVI patients, a preliminary reduction can be helpful
- Pale/cold pulseless SHCF need emergent reduction, ideally in the operating room


Brachial artery
(pulsing)
Skin haematoma
or pucker over
leading angle of
upper fragment
Anastomotic
branch to
ulnar artery
Radial artery
Ulnar artery
X-ray view shows
posterior aspect
of humerus (due to
medial rotation of
forearm and elbow joint)
Site of soft-tissue
cuff
Supratrochlear artery

Management of the Pink, Pulseless Hand

- transient brachial arterial spasm and/or to a brachial artery injury with distal perfusion maintained by collateral circulation at the elbow
- Closed vs open reduction with stable fixation
  - Controversial as to timing (emergent vs urgent)
- Arteriography pre-op not indicated
- Concern for development of LLD, claudication, cold intolerance as late complications → rare in documentation

Open fracture with brachial artery clamped



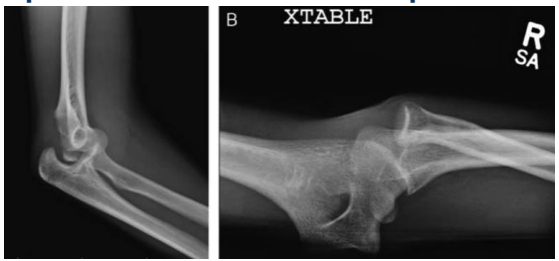
This hand was pulseless and definitely not pink

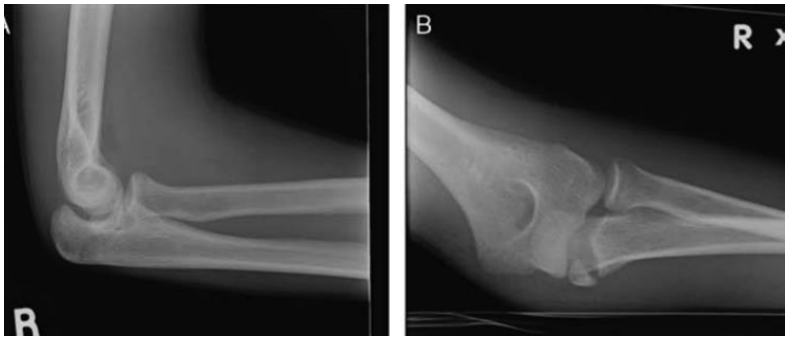
Medial Epicondyle Humerus Fractures (MEHF)

- 12% of all elbow fractures in skeletally immature
- More common in adolescents
- Mechanisms:
  - fall onto an outstretched upper extremity with the elbow in extension and the wrist and fingers in hyperextension
  - avulsion type injury through pull of the forearm flexors or the medial ulnar collateral ligament (UCL) – overhead athletes
- incidence of medial epicondyle fractures with elbow dislocations is 15% to 25% - many will be incarcerated
- Incarcerated fractures almost always occur with dislocation – with spontaneous reductions common
  - Vacuum effect if no dislocation?
  - high rate of ulnar nerve injuries - incarcerated fragment trapping the ulnar nerve vs higher energy mechanism stretching the nerve

Treatment of MEHF

- **Absolute indications** for ORIF: Incarcerated fragments and open fractures
- **Relative indications** for ORIF displaced fragments: dislocation (instability), ulnar nerve symptoms
  - acceptable displacement – no consensus (from >2 to 15 mm)
- 9.33 times greater odds of radiographic union with operative treatment vs non-op BUT no significant difference between operative and nonoperative treatment long-term





Pediatric Wrist Fractures

- Many distal forearm fractures can be treated non-operatively in young patients
- Excellent remodeling potential in **metaphyseal** bone
- Some angulation and translation is often acceptable in the **skeletally immature**
- **Visible external deformity often not tolerated**
- Isolated ”buckle” or torus fractures of distal radius can be treated in a brace
  - Clinically clear at 4-6 weeks
- Repeated reduction attempts for displaced physeal fractures are NOT recommended (”1 and done”)

30 Months

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Akar D, Köroğlu C, Erkus S, et al. (September 05, 2018) Conservative Follow-up of Severely Displaced Distal Radial Metaphyseal Fractures in Children. Cureus 10(9): e3259

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https://posna.org/Physician-Education/Study-Guide/Pediatric-Distal-Radius-and-Galeazzi-Fractures

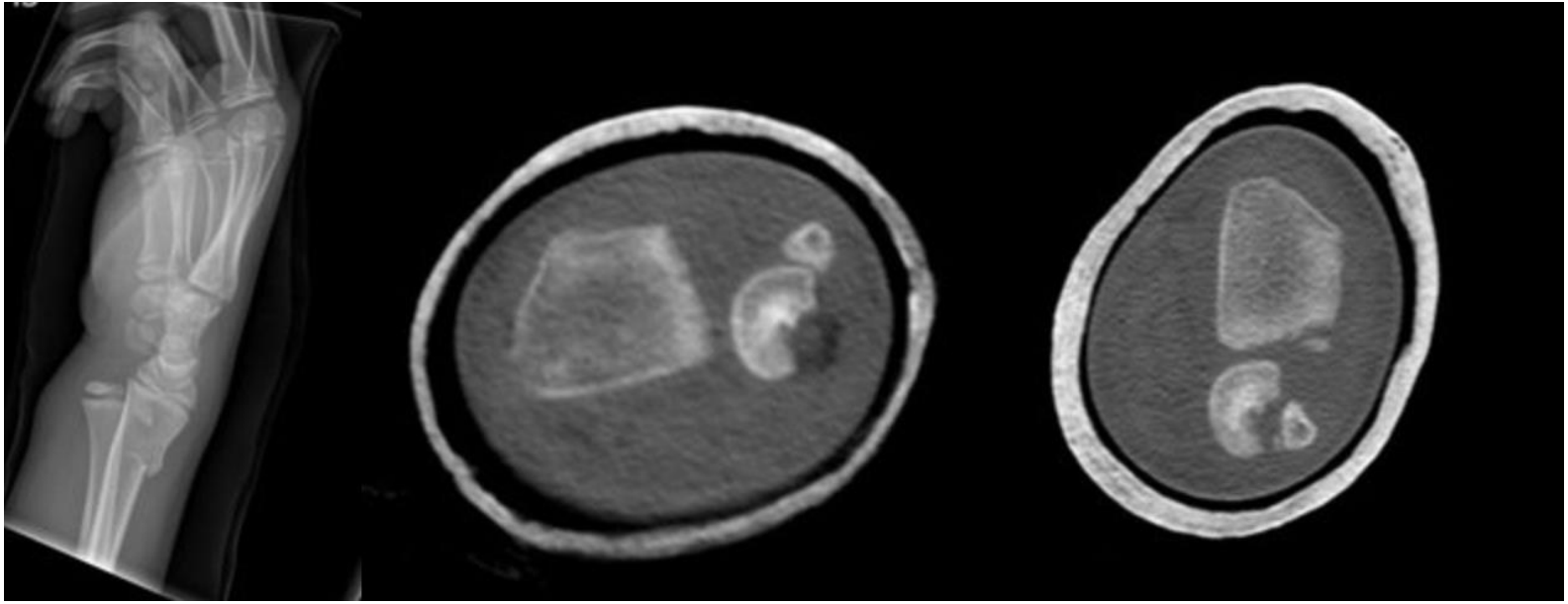
Torus Fractures of the Wrist

Immobilisation of torus fractures of the wrist in children (FORCE): a randomised controlled equivalence trial in the UK

Daniel C Perry [1], Juul Achten [2], Ruth Knight [3], Duncan Appelbe [2], Susan J Dutton [3], Melina Dritsaki [4], James M Mason [5], Damian T Roland [6], Shrouk Messahel [7], James Widnall [7], Matthew L Costa [2]; FORCE Collaborators in collaboration with PERUKI

"This trial found equivalence in pain at 3 days in children with a torus fracture of the distal radius assigned to the offer of a bandage group or the rigid immobilisation group, with no between-group differences in pain or function during the 6 weeks of follow-up." (Lancet, 2022)

Beware of the Galeazzi Equivalent



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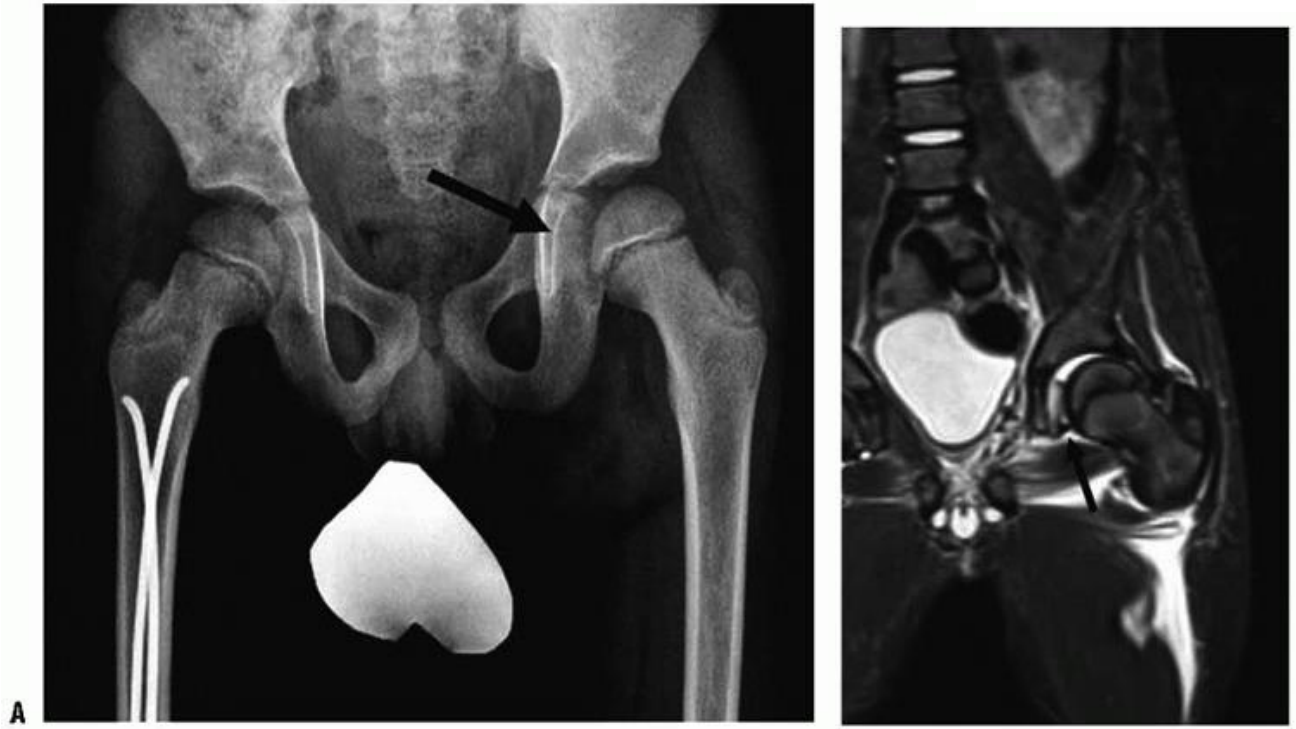
https://posna.org/Physician-Education/Study-Guide/Pediatric-Distal-Radius-and-Galeazzi-Fractures

Hip Dislocations

- < 8 y/o dislocations can be low energy due to ligamentous laxity
- Usual direction is posterior
- **Be aware there can be a spontaneous reduction**

Spontaneous Reduction



Treatment and Complications

Adequate reduction is key	Need fluoro in the ER/OR
Avoid aggressive reduction to avoid iatrogenic physeal injury	Reduce <6 hours
Post reduction immobilization in knee immobilizer	CT or MRI post-reduction in kids older than 10 year old

- AVN: 3-10 % vs 25% in adults
- Nerve injury = 5%
  - Rate of spontaneous recovery: 60-70 %
- Salvage option in delayed reduction is open reduction

Proximal Femur Fractures

Different than adults

- Different energy mechanism
- Different blood supply
- Different classification system

Complications

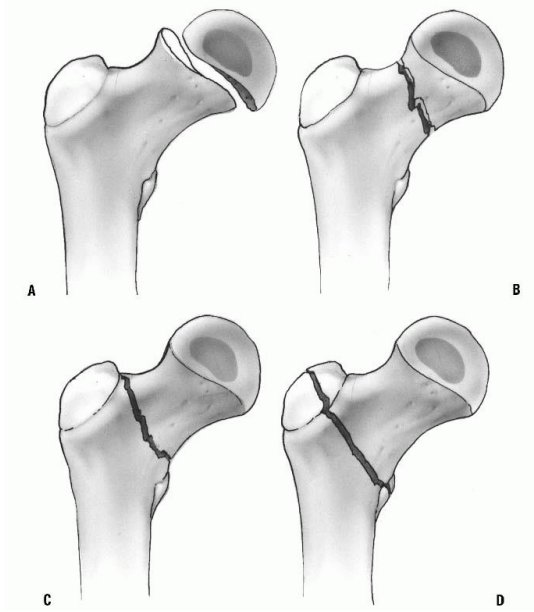
- Reported rate 15-60% due to AVN, nonunion, growth arrest
  - Growth arrest at greater trochanter ▫ coxa valga
  - Greater troch overgrowth ▫ coxa vara

Treatment Principles

- **Anatomic reduction = most important**
- Prompt treatment
- Stable fixation
- Decompression of hematoma
- Everything is meant to reduce risk of AVN
- No good evidence for traction

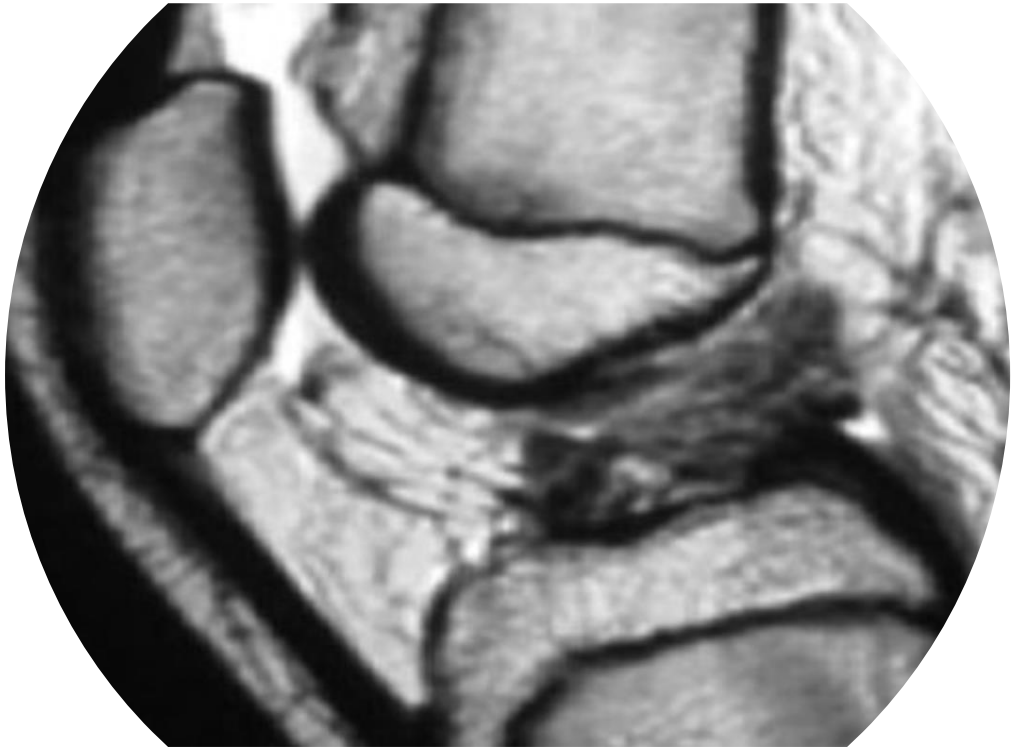
Delbet Classification

- Type I -III highest risk of AVN
  - Need to get anatomic reduction
- Type IV can be fixed less emergently



Tibial Spine Fractures

- Mechanism of injury similar to ACL injury
- Degree of displacement determines treatment
- Knee immobilizer and non weightbearing are acceptable treatment with referral to specialist
- MRI used for pre-op planning – meniscus often stuck under fragment

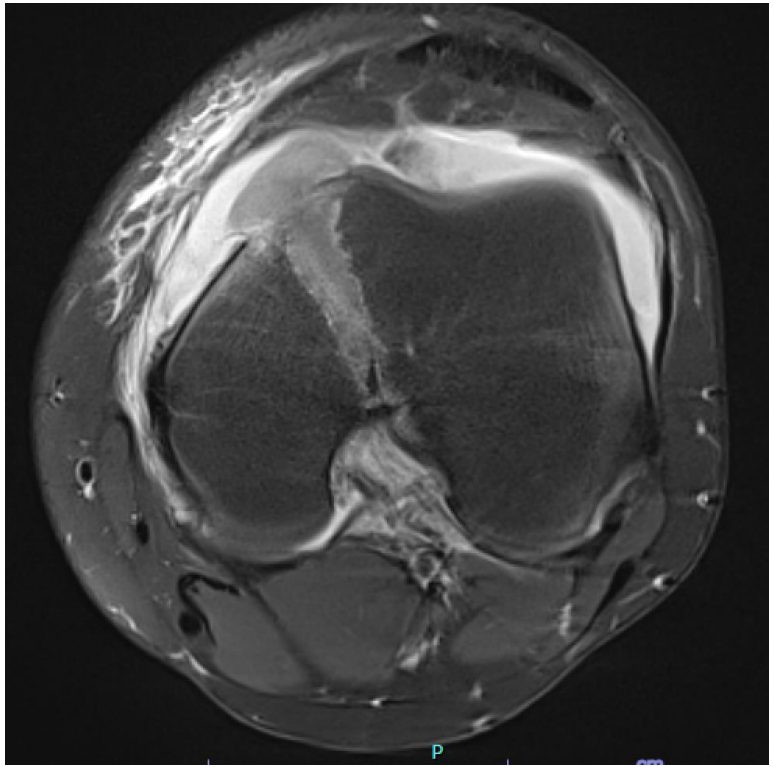


ACL Injuries

- Definitive treatment for ACL tears is **always surgery** in pediatric/adolescent population
- MRI is indicated in any effusion/hemarthrosis in child with concerning history
- Surgery isn't necessarily urgent – depends on comorbidities
  - "Prehab" is often necessary
  - A stiff knee pre-op is a stiff knee post-op!
- Open physes require special surgical techniques -> refer to peds ortho
- A knee brace and crutches are useful until patient can be seen by ortho

A Word About ”Knee Sprains”

A pediatric patient with open growth plates around the knee has a growth plate fracture NOT a knee sprain until proven otherwise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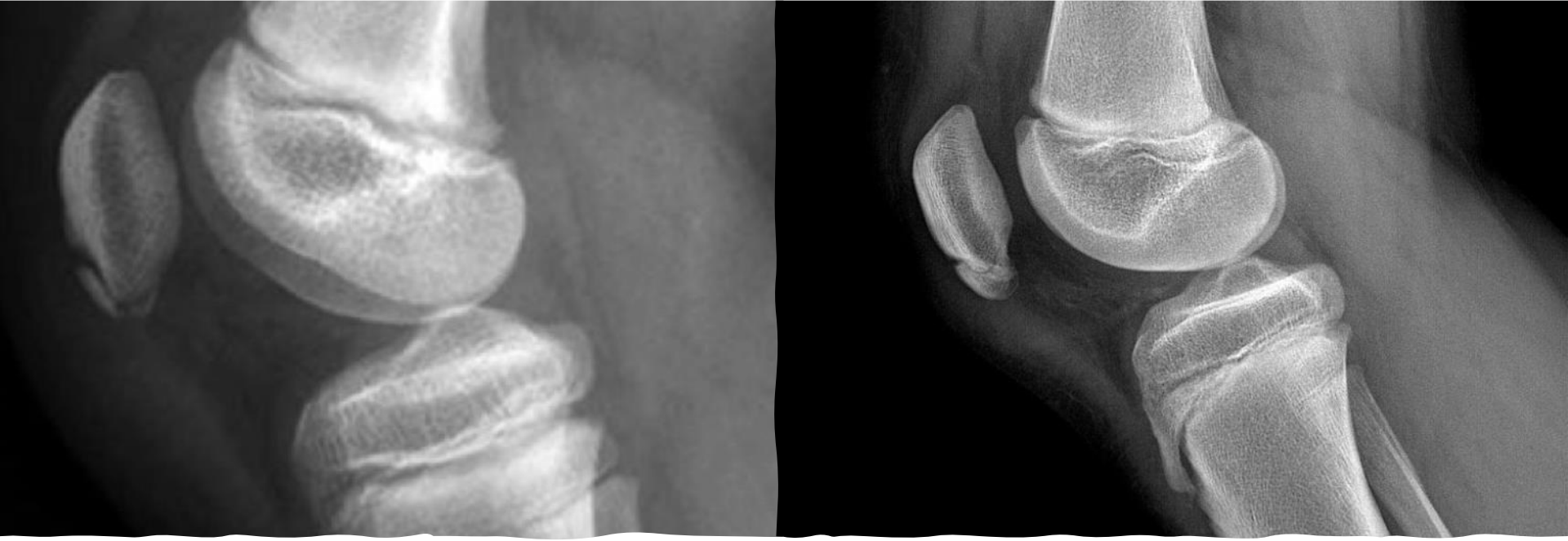
Apophyseal Injuries

Tibial Tubercle Fracture or Osgood-Schlatter?



Patella sleeve fracture or Sinding-Larsen-Johansson syndrome?

Iselin Disease or 5th metatarsal apophysitis?

Determining the Correct Treatment

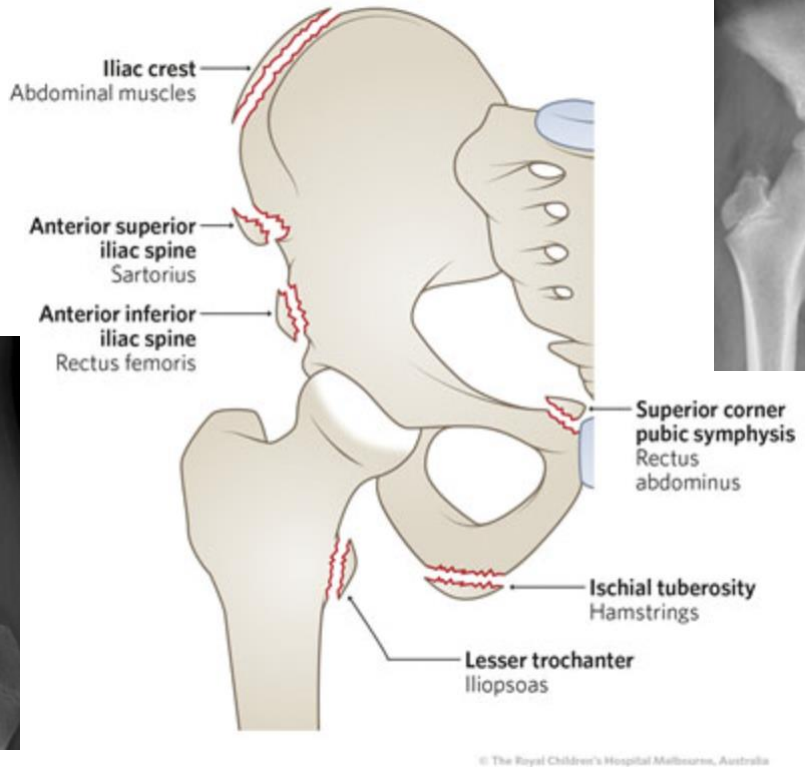
Apophyseal Fracture

- Always occurs suddenly
  - Acute or acute-on-chronic
- Patient's usually have felt a "pop"
- A day or two of rest does nothing for pain
- Walking, stairs, are still painful even after cessation of sports
- Refer to orthopedics!
- Displaced tibial tubercle fractures at risk for anterior compartment syndrome
- Improve with treatment for fracture

Apophysitis

- Repetitive stress injury to proximal tibial tubercle apophysis
- Symptoms evolve gradually
- Worsen with activity
  - Running and jumping
- Improve with rest
- Can do stairs relatively easily after a day or two of rest
- Risk factor for apophyseal fractures

Pelvic Apophyseal Fractures



- Rest
- Crutches for comfort
- Advance weightbearing as tolerated
- Avoid running and jumping for 4-6 weeks
- PT to maintain motion and strength

https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Fractures/Pelvic_Avulsion_Injuries_%E2%80%93_Emergency_Depart ment/

Toddler Injuries

Toddler Lower Extremity Injuries

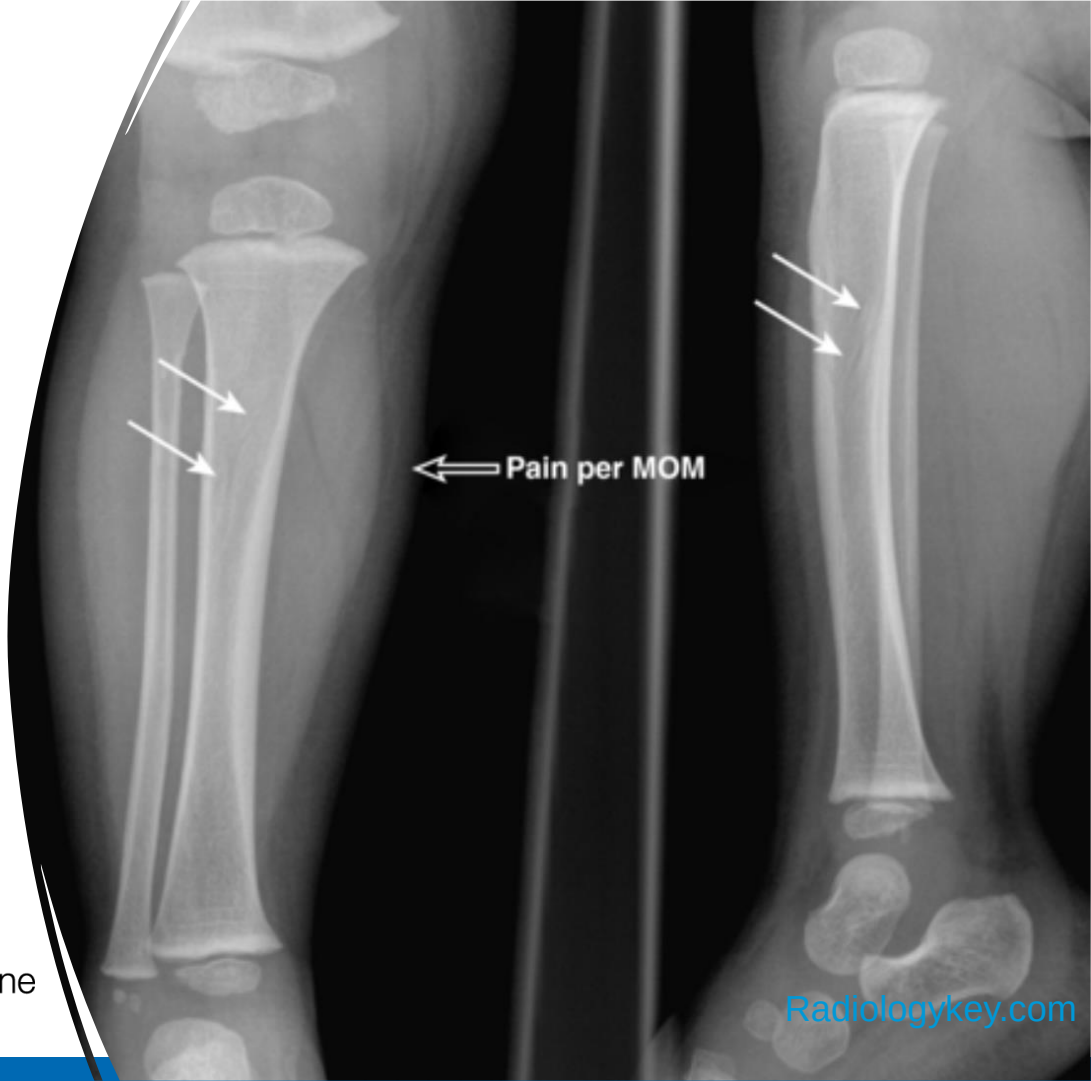
- Several common mechanisms – predicts fracture location and pattern
- Fall out of crib with leg caught in slats→ femur shaft spiral
- Sliding with parent and leg catches on slide → tibial shaft spiral
- Trampoline → proximal tibia torus
- Fall onto the foot → 1st metatarsal torus
- NAT → fracture in non-ambulator, weird history
  - Ex: a transverse femur fracture (bending/direct blow mechanism) with twisting history

Image the hips to toes in the limping kid

Exam of the "good leg" first is helpful to decrease fear, judge patient baseline

Proximal tibia torus fracture

Tibial Spiral Fractures



1st Metatarsal Torus Fractures

Toddler Fracture Treatment

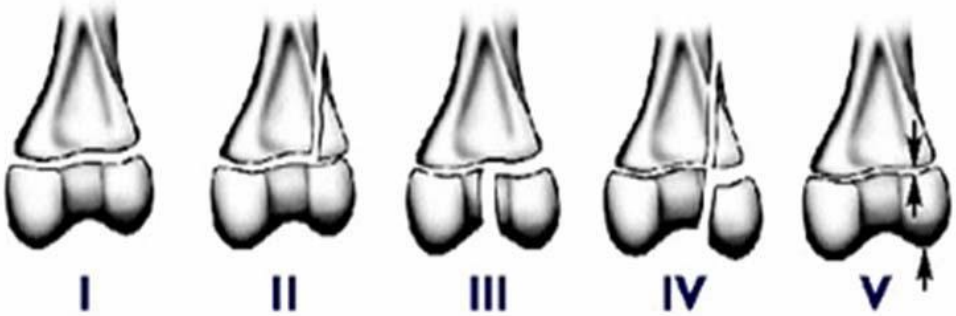
- Weightbearing immobilization for 3-4 weeks
- Boot or short leg walking cast for injuries below the knee
- Long leg walking cast for proximal tibia injuries
  - I like to use “soft cast” (fiberglass parents can unwrap at home)
- Treatment modality based on:
  - Guardian preference
  - availability of DME
  - patient compliance

Pediatric Ankle Injuries

- 5% of all pediatric fractures but 17% of physeal fractures
- The younger child might have a toddler fracture from the same mechanism that will give an adolescent an ankle fracture
- Transitional ankle fractures are those given to ankle growth plate injuries in the nearly skeletally mature ankle
  - Ex:Tillaux and Triplane fracture
- Treatment of displaced fractures
  - Reduction in ER! Then get CT if articular surface involved!
  - If >2mm gap at the joint remains, there is likely periosteum and/or neurovascular structures interposed and you need to open reduce
- Younger patients can tolerate some displacement and can remodel but older patients should have good reduction

Ankle Growth Plate Injuries

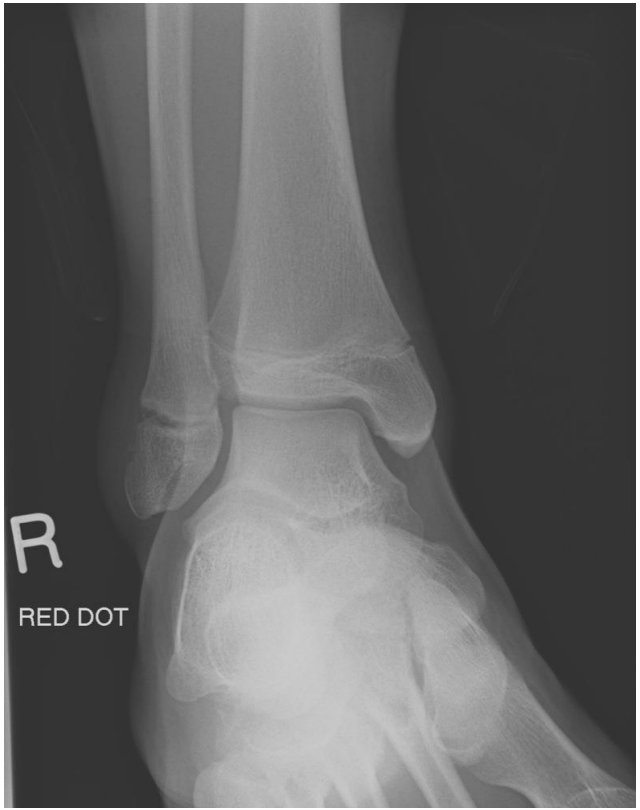
- Treatment is dependent on fracture morphology
- Risk of growth disruption increases with SH class
- Vahvanen and Aalto classification:
  - Group I. Low risk, including avulsion fractures and epiphyseal separations (Salter-Harris types I and II)
  - Group II. High risk, including fractures through the epiphysis (Salter-Harris types III, IV) and displaced transitional fractures



Salter-Harris Classification (orthobullets.com)

Distal Fibula Physeal Injuries

- Sometimes difficult to “See” on X-ray
- Clinical diagnosis is common, based on history and physical exam findings
- Treatment is immobilization for 4 wks in walking boot or walking cast



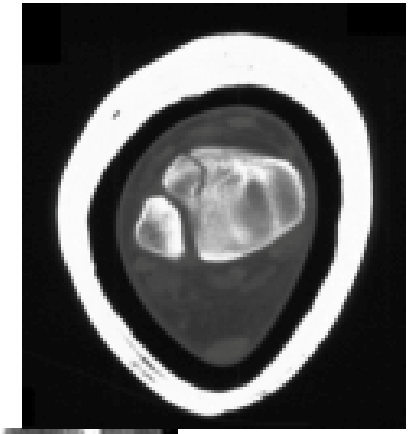
High Risk Ankle Fracture Treatment

- Usually intra-articular, often unstable
- Obtain CT pre-operatively after provisionally reducing the joint for evaluation
- If < 2 mm displacement then you can treat with closed methods (long leg cast and close follow up)
- Goal of treatment is perfect restoration of the joint surface
- Intra-epiphyseal wires or cannulated screws with anterior arthrotomy
- If > 12 yrs old, hardware can be placed across the physis

SH III

“Transitional” Ankle Fractures

- Tillaux and triplane injuries
- occur as the growth plate is in the process of closing
- growth disturbance is guaranteed but doesn’t cause long-term problems
- Restoration of the joint surface is the objective of treatment and reduction in the ER is key

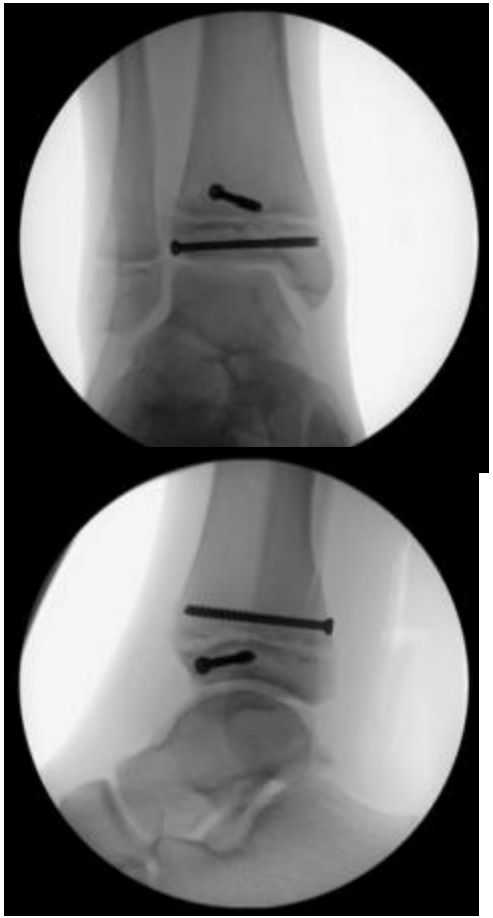


Tillaux

Triplane

SH3 on the AP

SH2 on the lateral



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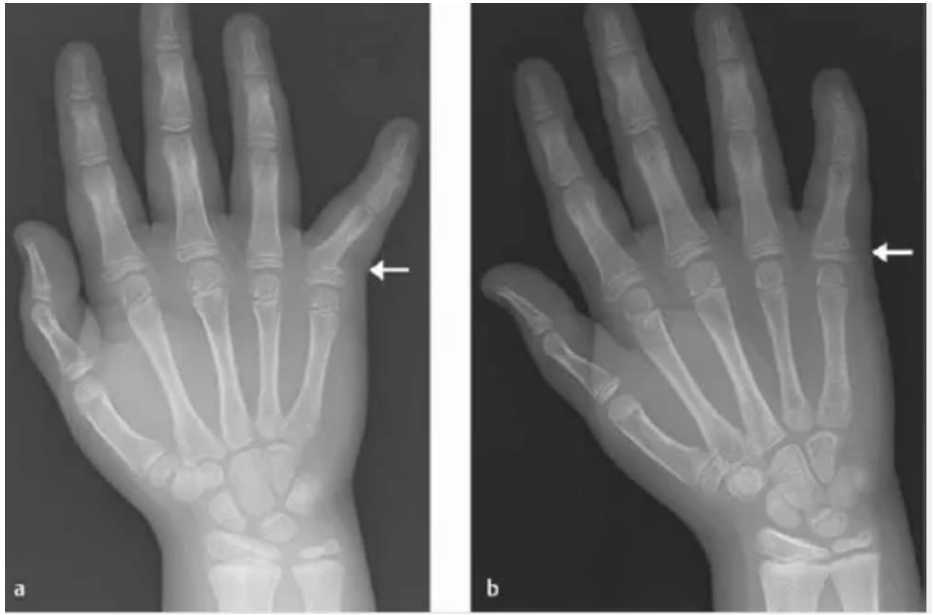
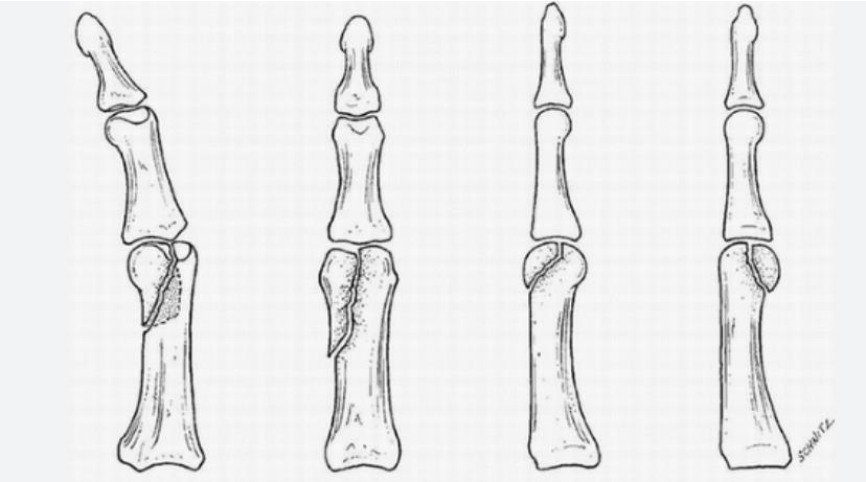
Pediatric Finger Fractures

- The key is to make the finger straight!
- Open phalanx injuries can easily be treated at the bedside
  - If no nail left, use non-stick type dressing under the cuticle (NOT Xeroform)
  - IV Antibiotics in ER and PO at discharge
- Unstable fracture patterns are large volar lip injuries, oblique fractures and intra-articular injuries



https://plasticsurgerykey.com/25-fractures-of-the-pediatric-hand/

Unstable Finger Fractures



Orthobullets.com and musculoskeletalkey.com

Rotational Deformity

Seymour Fractures

- The nail bed is attached to the pediatric distal phalanx physis
- Injuries to the toe or finger distal phalanx can injure and entrap the nail bed IN the physis
- Subungual hematoma or bleeding around the nail edge/cuticle are clues
- These are technically OPEN fractures
- Risk of infection
- Open reduction may be needed to remove nail bed from physis if large gap

https://www.hand.theclinics.com/article/S0749-0712%2813%2900064-4/pdf