

Pediatric Orthopedic Injuries

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Disclosures

- No relevant financial disclosures

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Outline

- Overview of Pediatric Bones
- Classic Injuries
- "Don't Miss" Fractures

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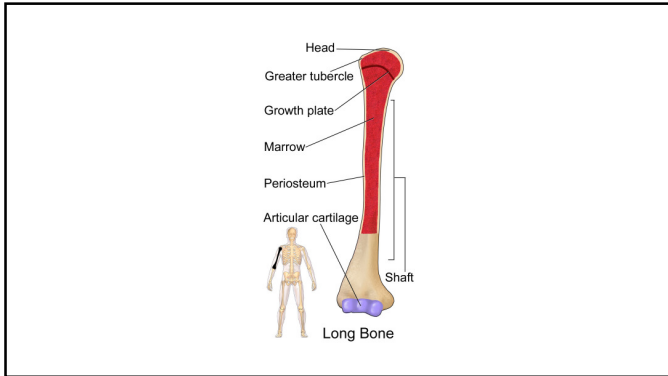
Overview of Pediatric Bones

- Anatomy
- Characteristics that promote healing
- Characteristics that complicate healing

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Anatomy Review

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Pediatric Bone Properties

- Periosteum
 - Thicker
 - More osteogenic
- Bones
 - More porous
 - Highly viscoelastic

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The Good

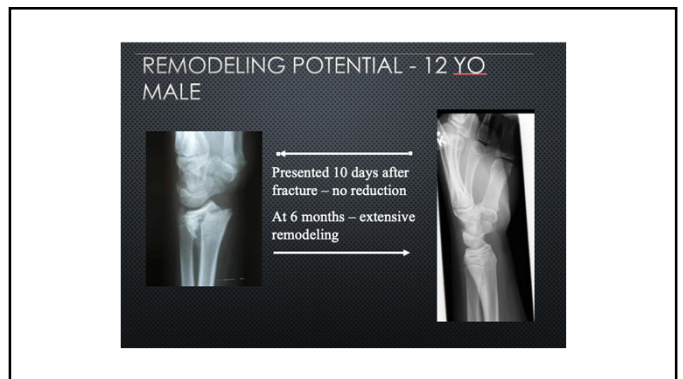
- Healing
- Remodeling

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The Good

- Healing
 - Fractures rarely require surgery
 - Heal remarkably fast: sometimes only need 3-4 weeks immobilization
 - Failure of union is rare
- Remodeling
 - Tolerate significant mal-alignment
 - Deformities can resolve (particularly distal fracture and in plane of motion)

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The Bad

- Plasticity
- Growth Plates

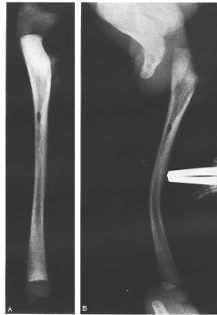
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The Bad

- Plasticity
 - Bend like plastic
 - Can result in permanent deformity
 - Common in forearm, fibula

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Plasticity Example



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The Bad

- Growth Plates
 - Fracture can cause growth to speed up or slow down

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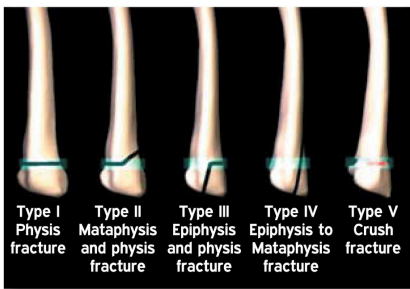


Figure 1: The Salter-Harris epiphyseal fracture classification showing growth plates (green shading) and fracture lines (black)

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Classic Injuries

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Classic Injuries

- Distal Radius Fractures
- Supracondylar Fractures

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Distal Radius Fractures

- Most common fracture in children (28-30%)
- Metaphyseal most common (62%)

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Distal Radius Fractures

- Type I and II Injuries
 - Typically easy to reduce
 - <10yo, can tolerate angulation up to 30 degrees
 - >10yo, can tolerate angulation up to 15 degrees
 - Be patient with angulation (around .8-1 degree/month¹)

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Distal Radius Fractures

- Technique
 - Traction with a gentle push
 - Mold!

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Distal Radius Fractures

- Indications for Surgery
 - Open
 - Irreducible
 - Displaced intraarticular fractures
 - Nerve damage
 - Compartment Syndrome
 - Soft tissue interposition or associated injuries

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Supracondylar Fractures

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Supracondylar Fractures

- Pathologic Findings
 - Sail sign
 - Posterior fat pad

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Normal anterior fat pad



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Normal anterior fat pad



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Sail sign: billowing hypodensity, indicating blood; sometimes the only (indirect) sign of an elbow fracture



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Sail sign: billowing hypodensity, indicating blood; sometimes the only (indirect) sign of an elbow fracture



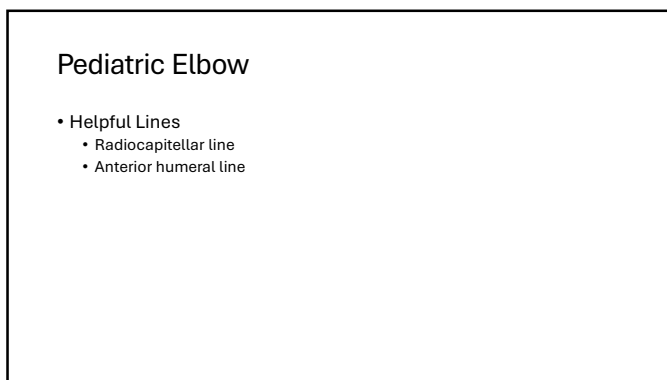
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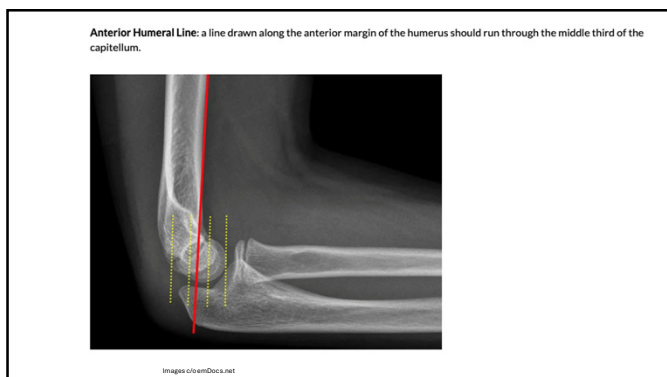
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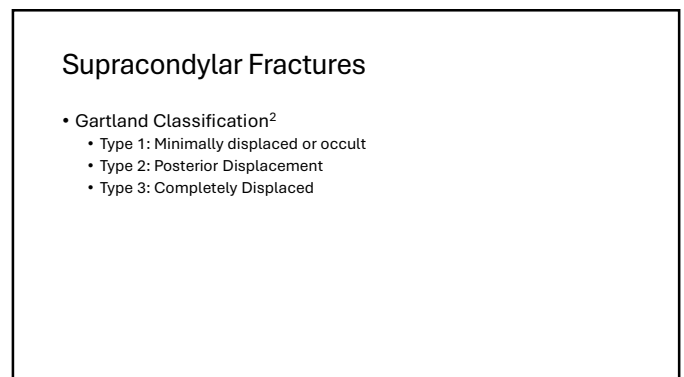
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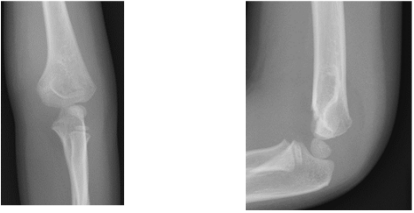
Supracondylar Fractures

- Gartland Classification²
 - Type 1: Cast
 - Type 2: Closed reduction with pinning (non-emergent)
 - Type 3: Closed vs. open reduction (urgent emergent)

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Supracondylar Fractures


- 5-year-old boy who falls off trampoline



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Supracondylar Fractures

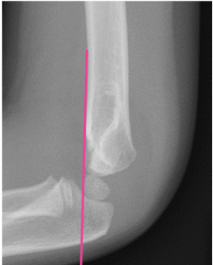
- What type?



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Supracondylar Fractures


- What type?
- Type 2



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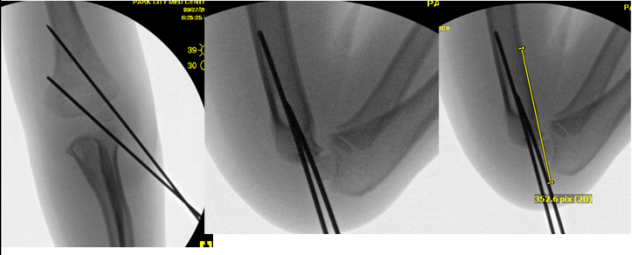
Supracondylar Fractures

- What type?
- Type 2
- Management



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Supracondylar Fractures



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Supracondylar Fractures

- Splinted for 1 week after surgery
- Cast x 3 weeks
- Pins pulled at 4 weeks

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Clavicle Fractures

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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 F. Heyworth, MD, Andrew T. Pennock, MD, FRCR, and Donald S. Bee, MD, PhD. [View all authors and affiliations](#)

Volume 50, Issue 11 | <https://doi.org/10.1177/03635465221114420>

Background: The objective of this study was to evaluate the functional outcomes of operative and nonoperative treatment of completely displaced midshaft clavicle fractures in adolescents. The study population included 100 adolescents with completely displaced midshaft clavicle fractures.

Purpose/Hypothesis: The purpose was to identify a predictor for outcome of operative versus nonoperative treatment in adolescents with completely displaced midshaft clavicle fractures. The hypothesis was that age, hand dominance, and skin tenting were predictors for patient age and fracture severity, which influenced the choice of treatment and patient outcome.

Study Design: Cohort study, level of evidence 2.

Methods: Twenty-eight (28) of 100 adolescents with completely displaced midshaft clavicle fractures were treated operatively and 72 (72) were treated nonoperatively. Demographic information, including age, hand dominance, and skin tenting, was recorded. Functional outcomes were measured using the American Shoulder and Elbow Surgeons (ASES) score at 2 and 24 months postinjury.

Results: Of 100 adolescents with completely displaced midshaft clavicle fractures, 28 (28%) were treated operatively and 72 (72%) were treated nonoperatively. There was no significant difference in ASES scores at 2 and 24 months postinjury between the operative and nonoperative groups. Age, hand dominance, and skin tenting were not significant predictors of outcome. The only significant predictor of outcome was fracture severity, with higher severity fractures resulting in lower ASES scores at 2 and 24 months postinjury.

Conclusion: Despite patient desire for benefit, patient-reported quality of life, satisfaction, and patient function at 2 and 24 months postinjury were similar between operative and nonoperative treatment of completely displaced midshaft clavicle fractures in adolescents.

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Clavicle Fractures

- Surgery without benefit 2 years after injury (patient-reported quality of life, satisfaction, shoulder function, or prevention after completely displaced clavicle fractures in adolescents⁴)

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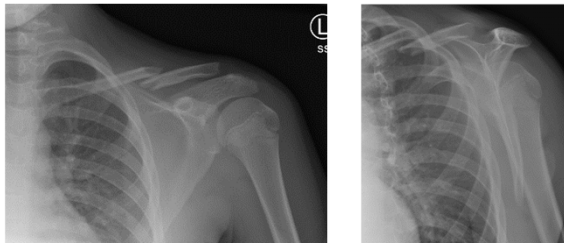
Clavicle Fractures

- Considerations
 - Age
 - Hand Dominance
 - Skin Tenting
 - UE athlete?

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Clavicle Fractures

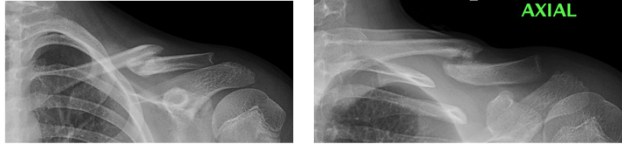
- 14yo mountain bike injury



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Clavicle Fractures

- 10 weeks out



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“Don’t Miss” Fractures

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Tillaux Fracture




Image c/o Kennedy MA, Sama AE, Padavan S. The Tillaux fracture: a case report. J Emerg Med. 1998 Jul-Aug;16(4):603-6

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Tillaux Fracture




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Tillaux Fracture



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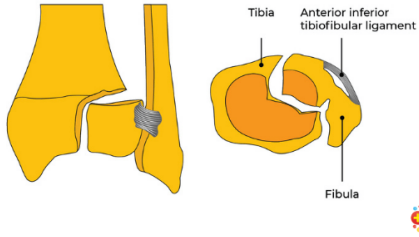
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Tillaux Fracture

- An avulsion fracture in kids 12- 15 years old
- The anterior talofibular ligament pulls the growth plate off
 - Ligaments are generally stronger than bones in kids

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Tillaux Fracture



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Tillaux Fracture

- Easily missed on plain films
 - Particularly the degree of displacement
- Can have minimal swelling

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Tillaux Fracture

- Orthopedic consultation needed
- A "perfect reduction" and casting is necessary
- Post reduction CT with 3D recon is often requested
- Generally, these are treated conservatively, with reduction only if 2mm or more
 - But fraught with complications
 - Osteonecrosis of distal tibial epiphysis, premature growth arrest, compartment syndrome, early-onset arthritis

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Growth Plate Injuries

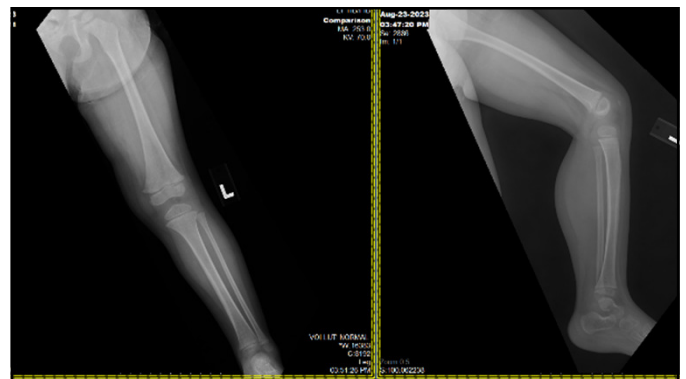
- If there is tenderness near a growth plate, split it!

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Sneaky Fractures

- 2-year-old female with leg pain

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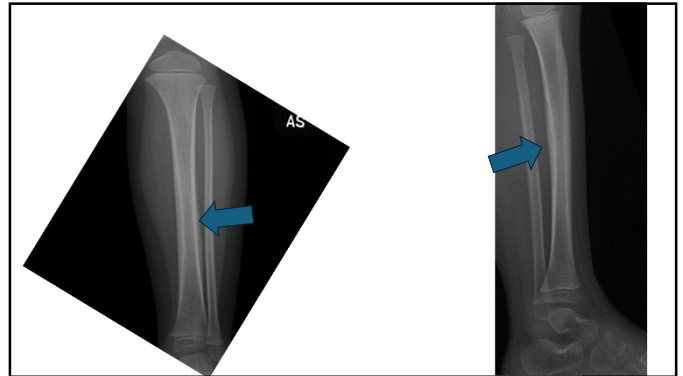


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Sneaky Fractures

- Splinted due to pain
- One week later

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Nonaccidental Trauma

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NAT Statistics

- >45% of deaths from child abuse occur among children <1 year of age⁵
- Up to 30% of children with abusive head trauma are missed on initial evaluation⁶
 - Often no external signs of trauma are present
- Most common reasons for medical attention
 - Seizures, breathing difficulty, apnea, lifelessness, local injury swelling

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NAT Screening

- Inadequate history
- Apnea or seizures on evaluation
- Rib fractures
- Oropharyngeal injuries, ear bruising, neck bruising
- Torso bruising
- Long bone fractures
- Injury pattern not consistent with injury

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NAT

- A very challenging, but critical diagnosis
- Your job is to consider NAT, *not* prove NAT

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What to do?

- Transport
- Call DCFS
- Safe havens

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Peds Ortho: Park City Hospital



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References

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Images

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