Sideline Management of Elbow & Wrist Injuries

Michael O'Malley, MD[1,2]

Brian Hansen[2]

[1]Carilion Clinic Department of Orthopaedics, Section of Sports Medicine

[2]Virginia Tech Carilion School of Medicine

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Objectives

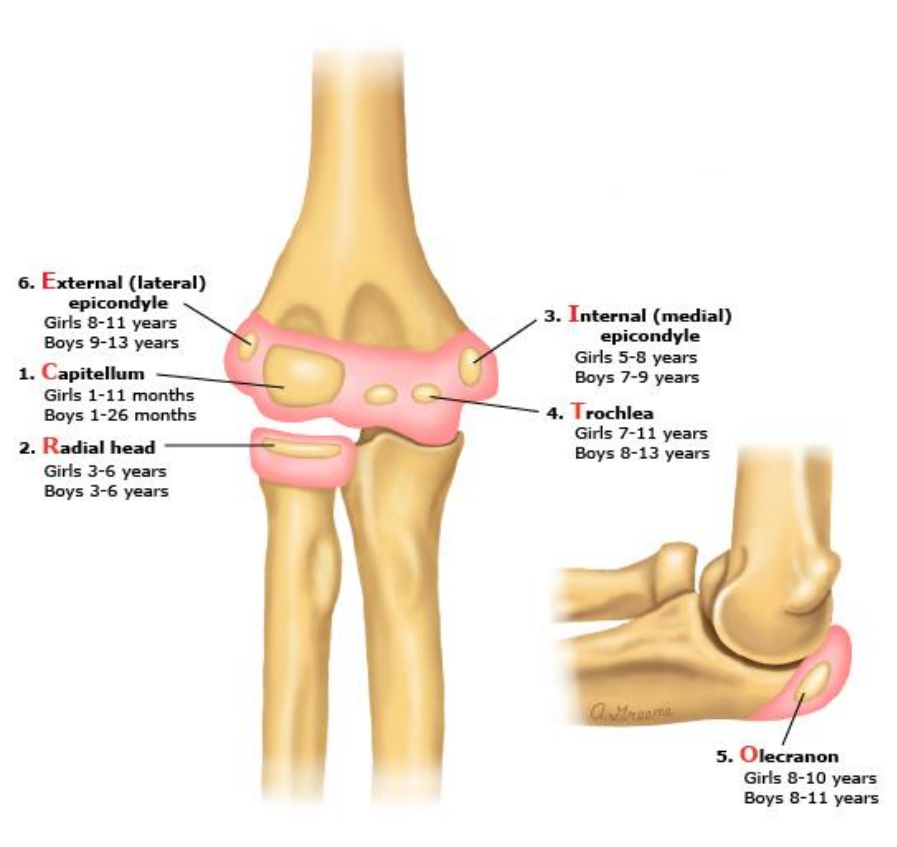
- Understand mechanism of injury and presentation of common in-game elbow and wrist injuries
- Understand acute management of common in-game elbow and wrist injuries

Ossification Centers

- "CRITOE"
  - Capitellum; 1m – 2y
  - Radial head; 3 – 6y
  - Medial epicondyle; 5 – 9y
  - Trochlea; 7-13y
  - Olecranon; 8 – 11y
  - Lateral epicondyle; 9 – 13y

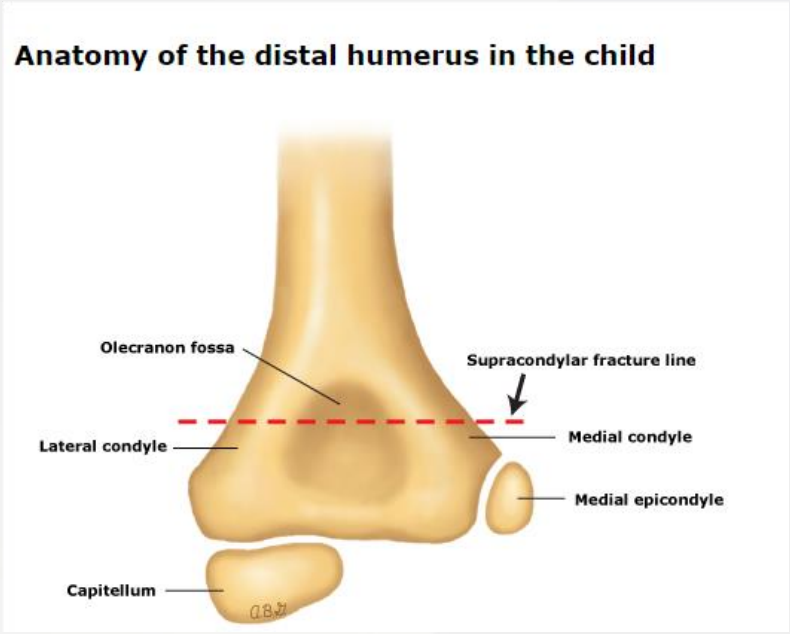
- Elbow accounts for 20% of longitudinal growth of the upper extremity

- Knowing timing/pattern of appearance of oss. Centers important for assessing fractures



Supracondylar Humerus Fractures

- Most Common Fracture about the elbow (60% of ped elbow fractures)
- 70% occur due to FOOSH
- Peak age: 2 – 7 years of age; why?
  - Decreased Anterior-Posterior diameter in supracondylar region
  - Laxity of ligaments
  - Anterior joint Capsule is thicker than posterior – acts as a fulcrum to firmly engage olecranon in olecranon fossa
- Mechanism:
  - Hyperextension during FOOSH
  - Direct Trauma or Fall onto flexed elbow



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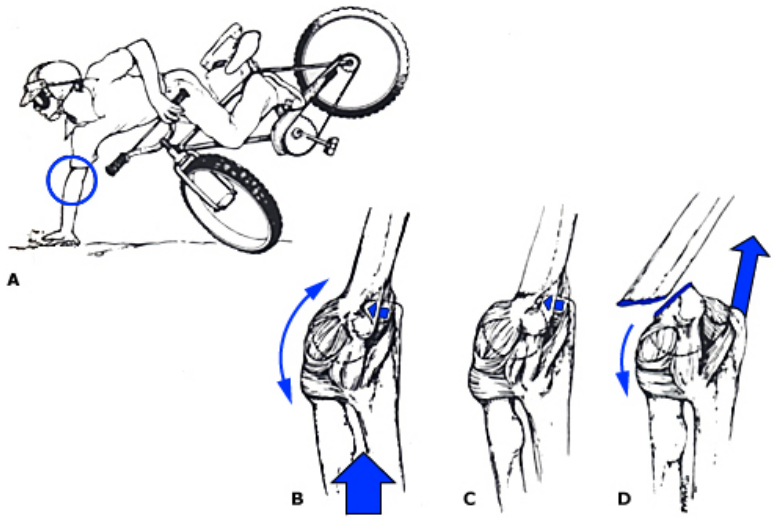
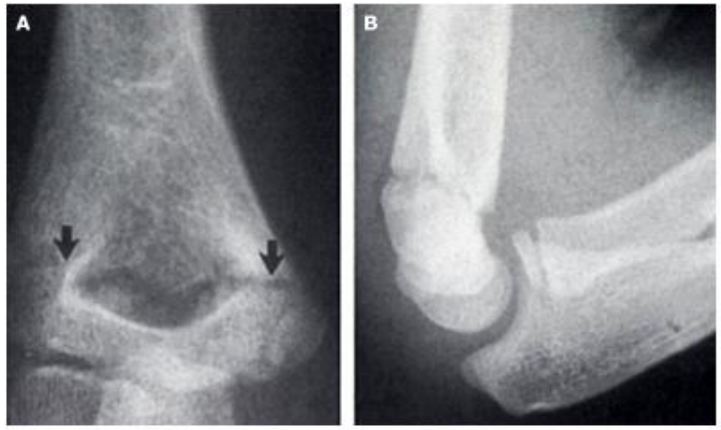
Extension supracondylar fractures



Hyperextension forces. A) Most young children attempt to break their falls with the upper extremity extended. Because of the laxity of the ligaments, the elbow becomes locked into hyperextension. B) This converts the linear applied force (large arrow) to an anterior tension force. Posteriorly, the olecranon is forced into the depths of the olecranon fossa (small arrow). C) As the bending force continues, the distal humerus fails anteriorly in the supracondylar area. D) When the fracture is complete, the distal fragment becomes posteriorly displaced. The strong action of the triceps (large arrow) produces proximal displacement of the distal fragment.

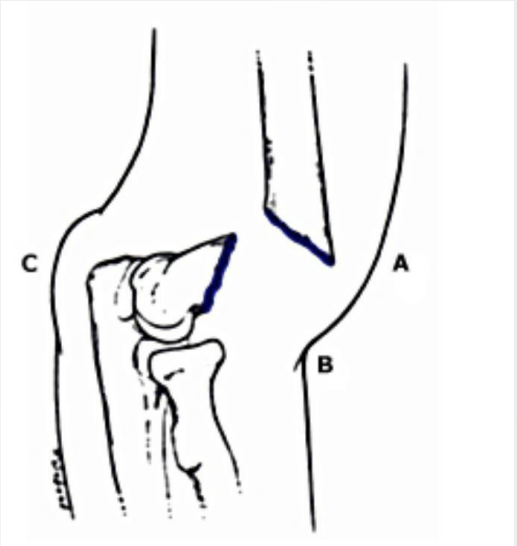
Supracondylar fracture line



Orientation of fracture lines. A) The typical transverse fracture line originates just above the epicondyles and courses through the supracondylar area (arrows). B) In the lateral projection, the fracture line is usually also transverse.

Supracondylar Humerus Fractures

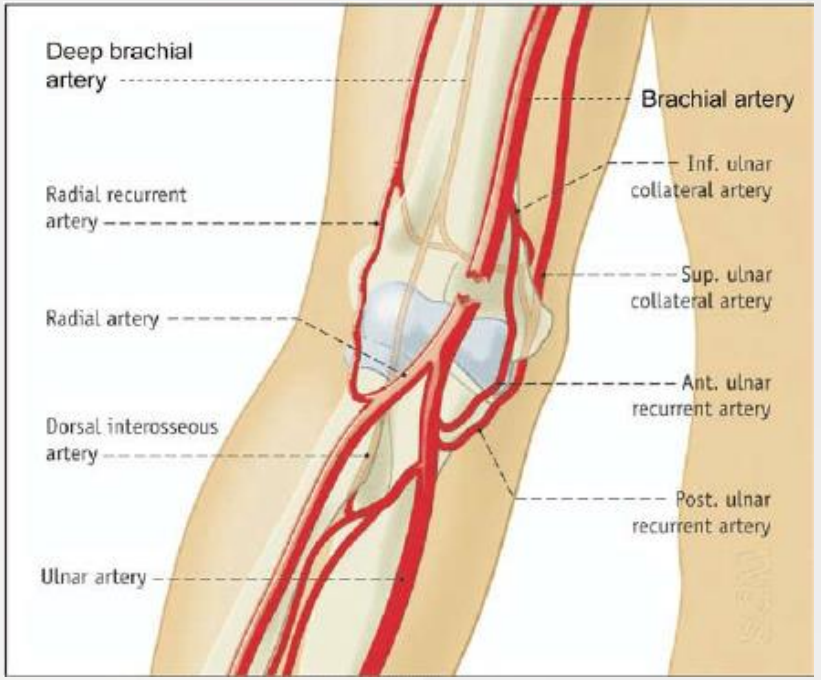
- Physical Exam:
  - **S-shaped elbow**
  - **Pucker Sign**
  - Ecchymosis
- Neuro Exam
  - Insufficiency in 7-18% of patients
- Vascular Status
  - Insufficiency in 5-20%
  - Brachial Artery spasm, Disruption, thrombosis



Abzug JM, Herman MJ. Management of Supracondylar Humerus Fractures in Children: Current Concepts. *JAAOS*.2012;2:69-77.

Supracondylar Humerus Fractures

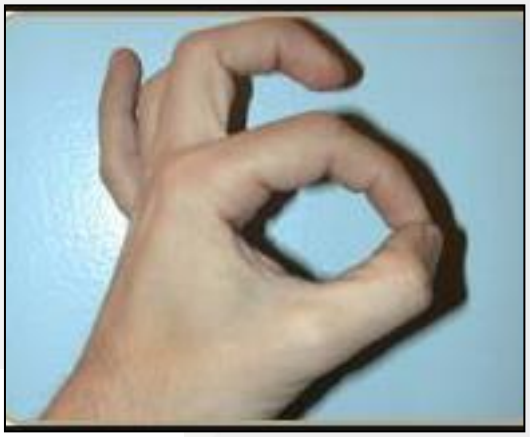
- Vascular Injuries (up to 20%)
  - Distal Radial Pulse may be absent
  - Collateral flow can maintain circulation
    - Diminished radial pulse, **but:**
    - Maintained capillary refill, skin temperature, and color
  - Brachial Artery tented over metaphyseal spike. If insufficient perfusion:
    - Muscle Ischemia → necrosis → compartment syndrome → **Volkmann's Contracture**
  - Distal Radius Fracture or olecranon avulsion fractures

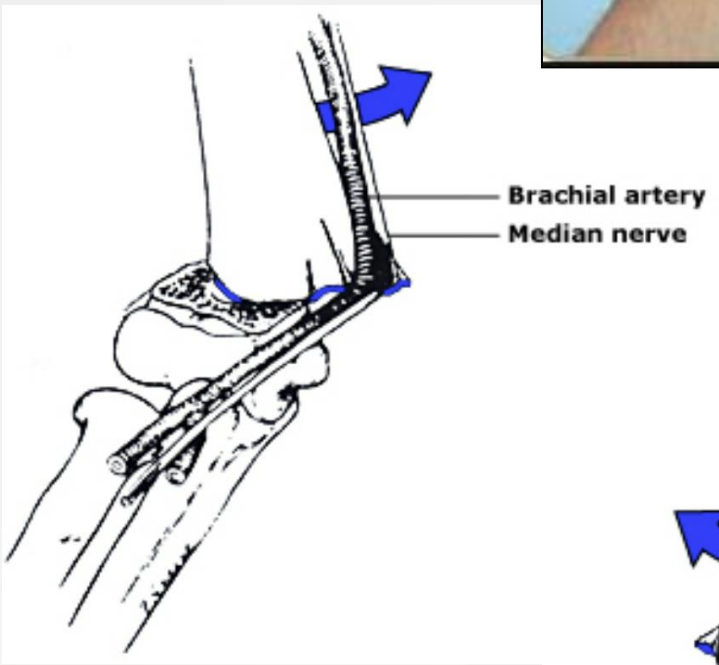


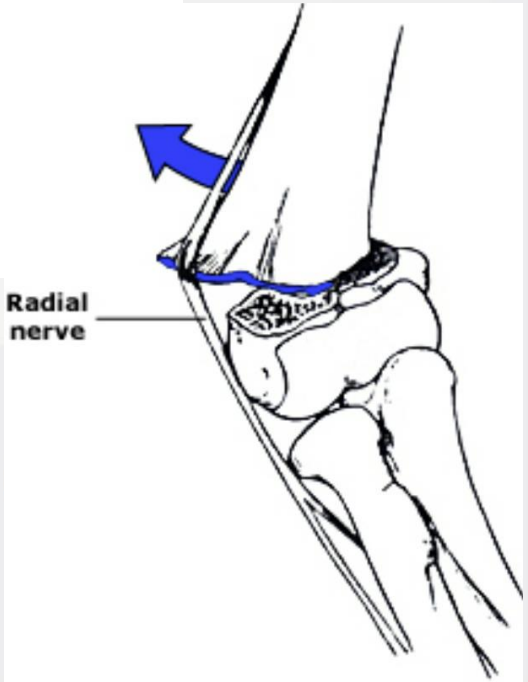
Badkoobehi H, et al. Management of the Pulseless Pediatric Supracondylar Humeral Fracture. *JBJS.* 2015;97: 937 – 943.

Supracondylar Humerus Fractures

- Neurologic Injuries (up to 18%)
  - Assessment may be difficult due to pain, anxiety, or poor co-operation.
  - Most neuro deficits identified at time of injury resolve in 6-12 weeks
    - Further dx studies not indicated in acute setting
  - **Anterior Interosseous Nerve** (AIN)
    - Most common (up to 50% in type III SHFs)
    - Posterolateral displacement
    - **Can't Make "OK" Sign**
  - **Radial Nerve** (25% in type III)
    - Posteromedial displacement
    - Inability to extend wrist/digits
  - **Ulnar Nerve**
    - Flexion-type fractures
  - Compartment Syndrome may be missed w/ median nerve injury







Cramer. Incidence of anterior interosseous nerve palsy in supracondylar humerus fractures in children. J Pediatr Orthop. 1993;13:502.

Sideline Management: Suspected Elbow Fractures

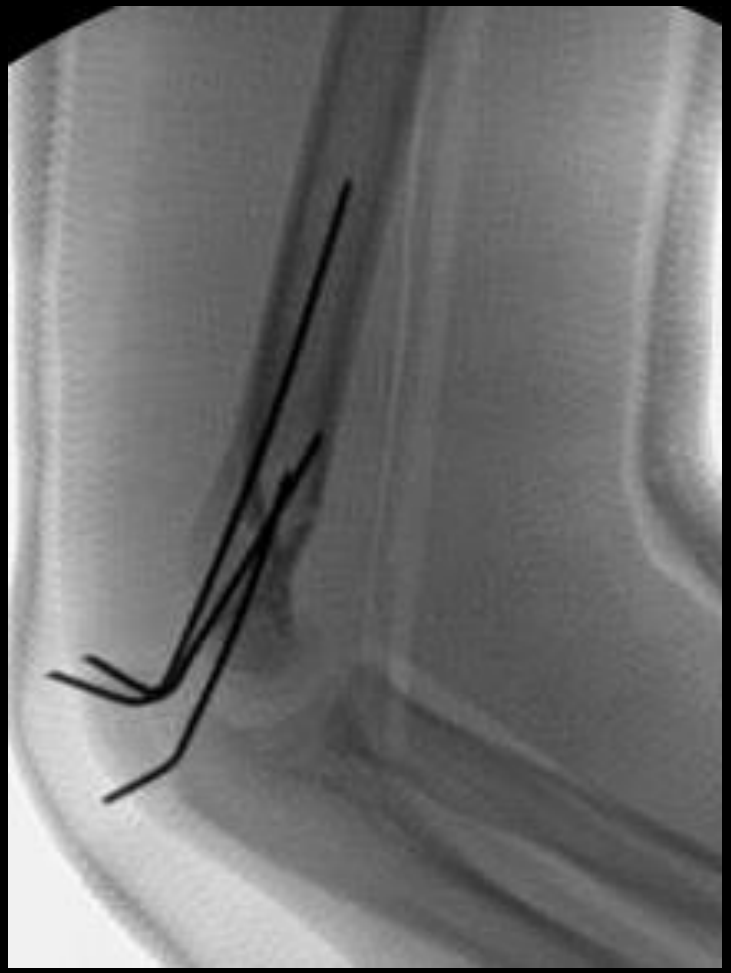
- Splint **Immobilization**
  - Immobilization avoids additional soft tissue injury from inadvertent arm movement
  - Splint it “as it lies”
    - Typically, this is elbow flex at 20-30 degrees
- Send to the ER



EK: 7 yo female

Fell playing soccer. Neuro intact, warm, pink well-perfused hand, no palpable pulse

EK: 7 yo female

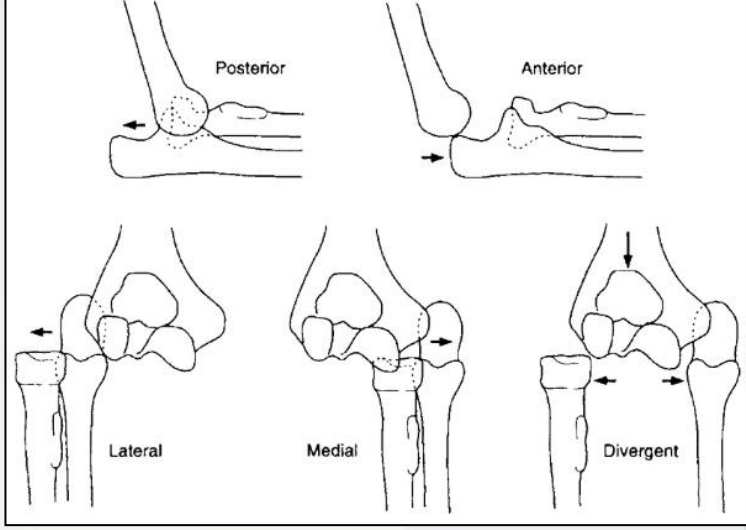


EK: 7 yo female

2 months post-op

Elbow Dislocations:

- 3 – 6% of all pediatric elbow injuries
  - Males > Females (3:1)
- **2nd most dislocated joint**
  - 90% of elbow dislocation are **posterior-lateral** direction
- Elbow dislocates after ring of soft tissue surrounding joint are compromised.
  - LCL, anterior capsule, MCL
  - Usual disrupted in that order with progression from stable → perched → complete dislocation
- High incidence of associated fractures
  - **Pure dislocation is uncommon**
  - Medial epicondyle (most common)
  - May become incarcerated w/i joint
  - Coronoid process, Radial neck (less common)



Rasool MN. Dislocations of the elbow in children. *J Bone Joint Surg Br*. 2004;86(7):1050-1058. doi:10.1302/0301-620x.86b7.14505

Elbow Dislocations:

Mechanism of Injury:

- Fall onto outstretched hand (FOOSH) or twisting injury to elbow
  - Posterior dislocation:
    - Combination of elbow hyperextension, valgus stress and forearm supination with soft tissue injury to capsule, collateral ligaments (especially medial), and musculature
  - Anterior dislocation:
    - Direct force striking the posterior aspect of flexed elbow

Physical Exam:

- Guarding, gross instability, swelling, deformity
- Neurovascular exam crucial prior to radiographs and manipulation

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Sideline Management: Elbow Dislocations

Reduction:

- Posterolateral dislocation
  - **Gentle supination, valgus stress**
  - This maneuver re-creates the injury mechanism and replicates the deformity
  - Longitudinal traction is applied with **varus stress** and **simultaneous pronation**
  - Wrap fingers around olecranon to bring distal, anterior
  - Once elbow reduces – the forearm is held in **pronation** to stabilize joint
  - Elbow typically immobilized @ 90^{o} of flexion, w/ forearm pronated

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Do what you are comfortable with!!!

https://www.youtube.com/watch?v=A91TWNbSEOQ

Elbow Dislocations:

Post-Reduction:

- Prompt Radiographic Evaluation is critical. Check for:
  - Congruent reduction
  - Coronoid or radial head fractures

- Once reduced, the elbow should be ranged through arc of motion in pronation and supination to test stability

- Elbow should be placed in posterior splint

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EC: 9 yo female

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Wrist Pain:

- Fractures of wrist and hand are **most common** injuries in skeletally immature athletes

- **Distal radius fractures** (with and w/o epiphyseal involvement)
  - Most common fracture (35-47% of wrist fractures)
  - Associated injuries: DRUJ injury, TFCC tears
  - Important Sideline Evaluations:
    - *Point tenderness, swelling, ecchymosis, grip strength, function*
- **Scaphoid Fractures:**
  - Most common carpal fracture
  - Most missed fracture in all clinical settings
  - Have high suspicion of scaphoid fracture in wrist injured athletes
  - Important sideline evaluation:
    - *Pain along radial aspect of wrist*
    - *Tenderness of anatomic snuff box*
    - *+ scaphoid compression test*

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Noonan KJ, Price CT. Forearm and distal radius fractures in children. *J Am Acad Orthop Surg*. 1998;6(3):146-156. doi:10.5435/00124635-199805000-00002

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Wrist Pain:

Less common etiologies:

- Radiocarpal dislocation
  - Dorsal >> Volar
- Lunate/perilunate dislocations
- Careful NV exam to assess impingement or injury
- For reduction:
  - Distal traction for reduction
  - Splint post-reduction
  - Imaging

Gholson JJ, Bae DS, Zurakowski D, Waters PM. Scaphoid fractures in children and adolescents: contemporary injury patterns and factors influencing time to union. *J Bone Joint Surg Am*. 2011;93(13):1210-1219. doi:10.2106/JBJS.J.01729

Sideline Management: Wrist Pain

- Any skeletally immature athlete with a suspected wrist fracture should be **splinted** and **removed from the game** until further imaging is performed

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