Evaluation and Management of the Pediatric Upper Extremity Injury: Review of X-Ray Findings

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History

- Fall directly onto shoulder, arm or elbow
- Fall on outstretched arm
- Pull on the arm
Initial Approach

• Evaluate involved area for complications
  – Neurovascular compromise
  – Open fractures / compartment syndrome

• PAIN MANAGEMENT and SPLINTING
Initial Approach

Quick Sensory Exam

• Tip of index finger (median)
• Tip of small finger (ulnar),
• Dorsal thumb web space (radial)
Initial Approach

Quick Motor Exam

• Thumbs up (radial)
• Flex thumb or index finger (median)
• Flex tip of 5th finger (ulnar)
Fracture Unique to Children

- Greenstick
- Torus (buckle)
- Bowing
- Avulsion
- Physeal

Consider fracture before consider sprain!
Salter-Harris

- I, II, III, IV, V most clinically important
- Type II most common
- Types III and IV involve articular surface of joint and higher morbidity
- Types I and V require high clinical suspicion, difficult to diagnose on plain film
X-rays

Should be ordered if:

• Point tenderness
• Pain with axial / transverse loading – large amount of swelling
• None or very limited ROM
• Persistent symptoms
• High risk mechanism
• Include joint above and joint below: AP, lateral at least
Case 1

- Toddler, playing Spiderman on couch, attempts to leap onto wall from couch. Mother hears a thud, cry, finds her child in mild distress, not wanting to use his left arm. Holds the arm flexed at the elbow, does not want anyone to touch him.

- Exam and approach to care?
Clavicle Fracture

- Most frequently fractured bone in childhood
- More than 50% occur in children < 10 yo
- Majority are midshaft, often greenstick
- Mechanism: direct trauma; falls against humerus or onto an outstretched hand
- Exam: shoulder pain, carrying the arm, focal tenderness, painful ROM, scarf sign
- Treatment: immobilize, RICE, early ROM,
- ? ortho referral
Case 2

- 10 year old girl falls from her horse onto left arm. She denies neck, chest or abdominal pain. Complains of pain in the left upper arm. She presents holding the arm tight against her side, slightly bent at the elbow. Tearful.

- Exam and approach to care?
Proximal Humerus Fracture

- **Location**: Proximal metaphysis: most frequent in ages 5-11 years
  - Shaft uncommon
- **Fall onto extended, adducted arm**
- **Exam**: point tenderness, painful ROM
- **Can tolerate < 1 cm separation, < 40 degree angulation, no malrotation**
- **Sling and swath, shoulder immobilizer, reverse sugartong (co-arctation splint)**
Case 3

• 4 year old boy, running in house, trips, falls on out-stretched right arm. Complains for a bit, then resumes play. Dad does not note any obvious injury when he examines the boy between commercials during the game. Mother gets home from work, notes child favoring right arm while still playing. Yells at dad, then brings him to see you.

• Exam and approach to care?
Torus or “buckle” fracture

- Periosteum “buckles” circumferentially
- Compression type, stable fracture
- Heals quickly, 2-3 weeks
- Removable wrist splint appears to be safe to use with potentially better outcome.
Case 4

- 8 year old fall from the jungle gym at school. Fall on outstretched hand. Pain at left elbow.

- Exam and approach to care?
Elbow Fracture

- 16% supracondylar
- 12 to 15% lateral condyle
- 12% medial epicondyle
- 8% radial neck
- 8% miscellaneous
Elbow Fracture – X-ray Review

- Fat pads
- Anterior humeral line
- Radio-capitellar line
- Ossification centers
- Hourglass sign
- Fractures
- Clinical correlation
Lines of Alignment

- **Anterior humeral line** - lateral view, bisect the middle 1/3rd of capitellum

- **Radio-capitellar line** - “radius points to capitellum” in all views
Ossification Centers

- Lateral epicondyle
- Medial epicondyle
- Capitellum
- Trochlea
- Radial head
- Olecranon
- Capitellum
- Radial head
Ossification Centers

- C - capitellum 1 yr
- R - radial head 3 yr
- I - internal (medial) epicondyle 5 yr
- T - trochlea 7 yr
- O - olecranon 9 yr
- E - external (lateral) epicondyle 11 yr
Hourglass Sign
Supracondylar Fractures

- Most common elbow fracture in children
- Fall on outstretched hand - extension type
- Fall onto flexed elbow - flexion type
- Extension > flexion, ~ 95 %
- Average age, 5 to 8 years
- Boys > girls
Supracondylar Fractures

- Type I – nondisplaced
- Type II - displaced with intact posterior cortex
- Type III - displaced with no cortical contact
Type 2
Type 3
Case 5


- Exam and approach to care?
Monteggia Fracture/Dislocation

- Fracture of proximal 1/3 of ulna and dislocation of radial head
- Radial head dislocation frequently missed
- Ulna fractures may be subtle - greenstick & bowing fractures
- High morbidity if missed
Case 6

• 14 year old boy crashes on his skateboard, falling onto outstretched right arm. Complains of pain at forearm.

• Exam and approach to care?
Galeazzi’s Fracture

- Fracture of radial shaft, usually at the junction of the middle or distal thirds with disruption of radioulnar joint
- More common in teenagers & adults
- Suspect in angulated fracture of the distal radius
- Orthopedic consult
Case 7

- 2 year old boy, throwing a fit in the grocery store, attempts to run away from dad who grabs the boys arm. Boy cries, does not want to use the arm. Father worried he is going to jail.

- Approach and care?
Radial Head Subluxation

- Most common upper extremity injury in pediatric patients < 6yrs presenting to ED
- Axial traction - “pulled on the arm”
- Radial head becomes trapped distal to annular ligament
- Pain, sudden loss of arm function
- X-rays?
- Best treatment?
Hyperpronation
Supination/flexion
Hyperpronation vs supination/flexion

- Prospective randomized study
- 90 patients enrolled
- Hyperpronation vs supination/flexion
- 40 of 41 (97.5%) in hyperpronation group vs 38 of 44 (86%) in supination/flexion group
- 2 pts in hyperpronation vs 10 pts in supination group required 2 attempts
- Concluded hyperpronation more successful
Conclusion

- Careful history and physical examination
- Pain management
- Radiographic evaluation - remember pediatric differences,
- Think “fracture” before “sprain”
- When in doubt - SPLINT!!
- If in doubt, talk with your friendly neighborhood pediatric orthopedist