Upper Extremity Trauma: Elbow & Forearm

Topics
- Anatomy
- Radiographs
- FOPH
- BBFF
- Monteggia
- Galeazzi
- Essex-Lop.
- Fat Pads
- Peds Elbow
- Supracond.
- Lat. condyle
- Med. epicon.

Upper Extremity Trauma

Slide 2 of 90

Charles Monroe “Sparky” Schultz (1922-2000)
Creator of...
- Charlie Brown
  - 1947: Li’l Folks
  - 1950: Peanuts
  - 3600 newspapers
  - 21 languages
  - 355 million readers in 76 countries
  - Published a total of 17,897 strips
- March 1964...

Slide 1 of 90

What’s wrong with Charlie Brown’s arm?

Slide 3 of 90


Slide 4 of 90

Parts of the Humerus

Slide 5 of 90

Parts of the Ulna

Slide 6 of 90

©Ken L Schreibman, PhD/MD 6/4/15 www.schreibman.info
Upper Extremity Trauma: Elbow & Forearm

**Olecranon-Trochlea Joint**
- Hinge Joint
  - Extension
  - Flexion

**“Joint Mice”**
- Loose bodies in joint capsule
  - Bone fragment
  - Cartilage piece
- Can limit range of motion (ROM)
  - In coronoid fossa
  - Limits flexion
  - In olecranon fossa
  - Limits extension

**Parts of the Radius**
- Radial Head
  - Round & flat
  - Like a disk
  - Inside the joint capsule
- Radial Neck
  - Outside the joint capsule

**Radiocapitellar Joint**
- Ball & Socket Joint
  - Flex & Extend
  - Rotate
    - Pronation & Supination
  - #1:
    - Radial head ALWAY points to the Capitellum
    - Regardless of how the elbow is bent
    - Regardless of how the x-ray beam is oriented

**Elbow Radiographs**
- AP View
  - X-ray beam
    - Vertical
  - Capitellum aligned with Radial head
  - Elbow raised to shoulder height

©Ken L Schreibman, PhD/MD  6/4/15  www.schreibman.info
Upper Extremity Trauma: Elbow & Forearm

Lateral View

- Anatomy
- Radiographs
- FOFP
- Monteggia
- Galeazzi
- Essex-Lop.
- Fat Pads
- Peds Elbow
- Supracond.
- Lat condyle
- Med epicon

Capitellum aligned with Radial head

Elbow flexed 90°

Coronoid overlaps Radial Head

Radial Head View

- Anatomy
- Radiographs
- FOFP
- BBFF
- Monteggia
- Galeazzi
- Essex-Lop.
- Fat Pads
- Peds Elbow
- Supracond.
- Lat condyle
- Med epicon

Capitalum signed with Radial head

Elbow flexed 90°

X-ray beam angled 45°

Eliminates Radial Head Overlap

Fall On Out-Stretched Hand (FOOSH)

- FOOSH
- Hyperextend Wrist

Fall On Palm Heel (FOPH)

- FOOSH
- Hyperextend Wrist

Fall On Palm Heel

- FOOSH
- Hyperextend Wrist

Forearm is a Ring

"You can’t break a ring in 1 place"

- FOOSH
- "Both Bone Forearm Fracture"
- Fracture/Dislocations
  - Monteggia
  - Galeazzi
  - Essex-Lopresti

You CAN break a ring in 1 place

- FOOSH
- "Nightstick fracture"
  - Ulna
  - Mid-shaft
  - Uncommon fracture
  - Uncommon mechanism

©Ken L Schreibman, PhD/MD  6/4/15   www.schreibman.info
Upper Extremity Trauma: Elbow & Forearm

About to get a nightstick fracture...

Nightstick (isolated ulna) fracture

©Ken L Schreibman, PhD/MD 6/4/15 www.schreibman.info
Upper Extremity Trauma:  Elbow & Forearm

Upper Extremity Trauma

Sir Asley Paston Cooper (1788-1841)

Cooper’s suspensory ligaments of the breast

© Ken L Schreibman, PhD/MD

www.schreibman.info

Upper Extremity Trauma

Anatomy

Monteggia vs Galeazzi

Fracture:
- Proximal
- Ulna
- Radial Neck
- DRUJ

Dislocation:
- Proximal
- Rad-Cap

Common: Whenever you see an ulna fx, ask yourself, “Am I missing a radial head dislocation?”

Rare: You may never see one

Impaction radial head into capitellum
- Comminuted radial head fracture
- Proximal migration radial shaft
- Disruption DRUJ

This is a rare injury

I’ve seen... one

Peter Gordon Lawrence Essex-Lopresti (1916-1951) reported on his series of... two

Upper Extremity Trauma

Forearm Ring: Essex-Lopresti Fracture

Radial head fractures are common
R.C. Murray 1927-37 looked at all 1640 elbow fractures
- 44% of all elbow fractures
- 5% of all fx at Liverpool Royal Infirmary
- 10%: Comminuted
- Comminuted/impacted head fractures are uncommon
- 14%: Radial Neck (mostly in children)
- 15%: Displaced Radial Head fractures
- 61%: Non-displaced Radial Head fractures

© Ken L Schreibman, PhD/MD

www.schreibman.info
Radial Head Fractures

Most Radial Head fractures are non-displaced or minimally displaced.
- Treated with sling/splint for a few days
- Important to begin early range of motion
- To avoid post-traumatic stiffness

How do we detect a Radial Head fx if it is non-displaced?

→ #2: Fat pads are your friends

Fat Pads Live in Fossae

Fat Pads on CT
- Can’t see inside fossae on lat
- Can’t see inside fossae on sagittal 2D CT
- CAN see inside fossae on sagittal 2D CT
- Posterior Fat Pad
- Anterior Fat Pad

Fat Pads on MR
- Normal Fat Pads in Fossae
- Fat Pads Elevated out of Fossae
- Joint effusion in Fossae

Elevated Fat Pads
- Fluid within the elbow joint elevates the fat pads
  - Pus (septic arthritis)
  - Pannus (rheumatoid arthritis)
  - Synovial fluid (synovitis)
  - BLOOD (acute trauma)
  - Adults: Radial Head Fracture
  - ℹ️ intra-articular fracture ➔
  - Hemarthrosis ➔
  - Fat Pad Elevation.

Fat Pads Not Easy To See
- Look for them on lateral view
- Needs to be a good lateral view
- Condyles overlap
- Easier to see on PACS
- You should magnify the image
- You should adjust window/level

©Ken L Schreibman, PhD/MD 6/4/15 www.schreibman.info
Upper Extremity Trauma: Elbow & Forearm

### Elevated Posterior Fat Pad

If you can see a posterior fat pad, it’s elevated!
- Normally you can’t see the posterior fat pad because it’s tucked inside the deep olecranon fossa

### Normal Anterior Fat Pad

- Normally you can see a small anterior fat pad inside the shallow coronoid fossa
- But it should be thin, flat, flush against the bone

### Elevated Anterior Fat Pad

Sticks out like a spinnaker sail
- “Sail Sign”
- Not thin, flat, flush to the bone

### Elevated elbow fat pads are your friends

Fat pads are your friends
#### #2: Elevated Anterior Fat Pad

Elevated fat pads are telling you there is something filling the joint
- In the setting of acute trauma, that something is blood (hemarthrosis)
- In the setting of acute trauma, the blood came from an intra-articular fracture
- If the patient is an adult (skeletally mature), it’s telling you there’s a radial head fracture… even if you can’t see the fracture
- 61%: Radial Head fractures non-displaced

### Occult Radial Head Fracture

Occult radial head fracture

### Occult Radial Head Fracture

Treated with sling
Followup 11 days later...
Upper Extremity Trauma: Elbow & Forearm

Elbow Joint Capsule

- Fluoroscopic Guided Arthrograph
- Contrast filling the Coracoid Fossa
- Neck fx distal to capsule
- Barely extends to Radial Neck

Radial Neck Fractures

- When Radial Neck is outside capsule
- Radial Neck fx don’t yield hemarthrosis
- Radial Neck fx don’t yield fat pad elevation

Fat Pads are your Friends

- Elevated elbow fat pads are telling you there is something filling the joint
- In the setting of acute trauma, that something is blood (hemarthrosis)
- In the setting of acute trauma, the blood came from an intra-articular fracture
- If the patient is an adult (skeletally mature)
  - RADIAL HEAD FRACTURE!
- If the patient is a child (skeletally immature)
  - DISTAL HUMERUS FRACTURE (81%)

Elbow Ossification Centers:

- At birth, none of the elbow epiphyses are ossified.
- As the child matures, they ossify in a specific order...
Upper Extremity Trauma: Elbow & Forearm

Subtle Supracondylar Fractures

Hard to see on the AP view

Day of Injury

After 2 weeks

After 6 weeks

Fat Pads

Peds Elbow

Supracond.

Lat condyle

Med epicon.

Subtle Supracondylar Fractures

Hard to see on the Lateral view

Need to use the  θ's

Fat pads are your friends

Trauma + Elevated Fat Pads = Hemarthrosis

Adults: Radial Head Fracture

Peds: Supracondylar Fracture (60%)

#2:

#3:

Anterior Humeral Line

Passes through middle ⅓ of Capitellum

Subtle Supracondylar Fractures

Can't see fracture on this AP view.

Clues are on Lateral view...

Fx line

Elevated Posterior Fat Pad

Anterior Humeral Line (AHL)

Normally passes through MIDDLE ⅓ of Capitellum

Supracondylar fractures Capitellum behind AHL

#4:

Compare with normal side

Pediatric Elbow Fractures

Supracondylar Fracture

Most common (60%)

Grossly displaced

Quite subtle

Elevated Fat Pads

Anterior Humeral Line

Compare with normal side

Lateral Condylar Fracture

Second most common

12% - 19%*

Fracturing just above Capitellum

*JAMA Jan 18, 1958, Vol. 166, No. 3, p 220


Axial Load Up Radius

PALM

CARPUS

R A D U S

U L N A

H U M

CAP

Fracturing just above Capitellum

Pediatric Elbow Fractures

Supracondylar Fracture

Most common (60%)

Grossly displaced

Quite subtle

Elevated Fat Pads

Anterior Humeral Line

Compare with normal side

Lateral Condylar Fracture

Second most common

12% - 19%**

Fracturing just above Capitellum

*JAMA Jan 18, 1958, Vol. 166, No. 3, p 220


Axial Load Up Radius

PALM

CARPUS

R A D U S

U L N A

H U M

CAP

Subtle Lateral Condylar Fractures

Presented at RSNA Course

For practicing Radiologists

Used an Audience Response System

50% of the audience missed this case...

Anterior Humeral Line

DOESN'T pass through middle ⅓ of Capitellum

©Ken L Schreibman, PhD/MD  6/4/15  www.schreibman.info
Upper Extremity Trauma: Elbow & Forearm

Pediatric Elbow Fractures

- Supracondylar Fracture (55%** - 60%*)
- Lateral Condylar Fracture (12%* - 19%**)  
  - Grossly displaced → Quite subtle
  - Most 2 – 8 years old
  - Mechanism: FOPH
- Medial Epicondylar Fracture (7%** - 9%*)
  - Majority 8 – 15 years old
  - Mechanism: 1) Elbow Dislocation (54%*)
  - 2) Avulsion, Valgus Stress

FOPH = Fossa Olecrani Plica Hypoplasia
BBFF = Biceps Brachii Femoral Fracture
Monteggia = Fracture of Humerus with Dislocation of Radius
Galeazzi = Fracture of Radius with Dislocation of Ulna
Essex-Lop. = Fracture of Radius and Ulna

Fat Pads
Peds Elbow
Supracond. Lat.-condyle Med. epicon.

References:
- *JAMA Jan 18, 1958, Vol. 166, No. 3, p 220-228

Medial Epicondylar Fractures

- Secondary to Elbow Dislocation
- Abnormally widened growth plate
- Normal width of growth plate
- Common Flexor Tendon
- Valgus Stress

Normal Side

What’s wrong with Charlie Brown’s arm?

Photo courtesy of Gil Brogdon, MD

Little Leaguer’s Elbow

By MAJOR BYRON G. BROGDON, USAF (MC), and MAJOR NEIL E. CROW, USAF (MC)  
(residents at) LACKLAND AIR FORCE BASE, TEXAS

Referencing W.E. Dotters’ 1953 article, “Little Leaguer’s shoulder; fracture of the proximal epiphyseal cartilage of the humerus due to baseball pitching.”


Go on to write,
During the past baseball season we have seen in pubescent pitchers an injury which we choose to call “little leaguer’s elbow.” The similarity of these cases is striking.

Photo courtesy of Byron Brogdon, MD

©Ken L Schreibman, PhD/MD  6/4/15  www.schreibman.info
Upper Extremity Trauma

**Little Leaguer’s Elbow**

Case 1. C.S., a well-developed eleven year old fast-baller, pitched the opening game of the Little League Season. Despite an inadequate warm-up he pitched a no-hitter and allowed only one walk. However, by the middle of the game he was experiencing pain over the medial epicondyde of the pitching arm with every throw and could not really “bear down.” For several days afterward there was local tenderness and swelling over the right medial epicondyde and pain on extreme flexion or pronation of the forearm.

He vacated for one month and did not pitch or otherwise violently exercise the elbow. The patient was brought to the hospital by his father when attempted resumption of his pitching career reproduced the initial symptoms.

Roentgenographic study of the elbow revealed separation and fragmentation of the epiphysis of the right medial epicondyde and loss of fascial markings about the elbow suggesting edema or hematoma.

The patient was forbidden to pitch or otherwise strenuously exercise the elbow. One month later all symptoms had disappeared, but a clandestine experiment on the part of the patient proved that pitching still elicited pain.

**Charlie Brown’s Elbow**

The X-rays revealed separation and fragmentation of the epiphysis of the right medial epicondyde and loss of fascial markings about the elbow suggesting hematoma.

**Little Leaguer’s Elbow in the Media**

**Peanuts Comic Strip**

- 1964: Charlie Brown has it.
- 1963: Snoopy was worried about it.

**1962: Magazine Articles**

- Time: “Medicine: The Dangerous Arm”
- Life: “Little League’s Elbow”

**Little League Baseball® Response**

It is estimated that 20 million people were exposed to the story and the role of radiologists, radiology, and the diagnosis of Little League elbow. Little League Baseball® threatened a lawsuit against Brogdon and Crow for copyright infringement for using the term Little League™ without permission.

The suit was eventually dropped.

**Gil Brogdon on NBC’s Today 1962**

**Upper Extremity Trauma: Elbow & Forearm**

4/6/15
Upper Extremity Trauma: Elbow & Forearm

**Little League Baseball® Response**

- Protecting Young Pitching Arms
- The Pitch Count Regulation
- League Age: 11-12, 105 pitches per day
- 9-10, 75 pitches per day

**Elbow Radiographs**

1) Radial Head Point to Capitellum
   - On all views
2) Fat Pads are your Friends
   - In acute trauma, elevated fat pads = Fracture
   - Adults: Radial Head Fracture
   - Children: Supracondylar (or Lateral Condyle) Fracture
3) Anterior Humeral Line
   - Should pass through middle ⅓ Capitellum
4) When in doubt, get the other side

**Giving Credit to Famous Authors**

- Schultz
- Monteggia
- Bado
- Galeazzi
- Cooper
- Essex-Lopresti
- **Brogdon**
  - Only one I’ve personally worked with

**Questions: Forearm/Elbow**

- Anatomy
- Radiographs
- FOPH
- BBFF
- Galeazzi
- Essex-Lop
- Fat Pads
- Peds Elbow
- Supracond.
- Lat condyle
- Med epicon

**Bill Receipt Cheque Spike**

- Anatomy
- Radiographs
- FOPH
- BBFF
- Galeazzi
- Essex-Lop
- Fat Pads
- Peds Elbow
- Supracond.
- Lat condyle
- Med epicon

**Gil Brogdon (1929-2014)**

- Emeritus Professor, U South Alabama
- ARRAS Gold Medal Recipient
- medschoolwatercooler
- amazon.com

---

©Ken L Schreibman, PhD/MD 6/4/15  www.schreibman.info