

Upper Extremity Trauma: Elbow & Forearm

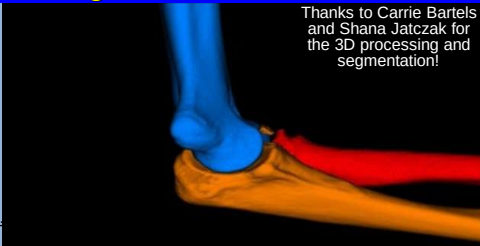
page 1 of 15

Upper Extremity Trauma

Elbow & Forearm

Topics Giving Credit to Famous Authors

- Anatomy
- Radiographs
- FOPH
- BBFF
- Monteggia
- Galeazzi
- Essex-Lop.
- Fat Pads
- Peds Elbow
- Supracond.
- Lat. condyle
- Med. epicon.
- 48



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Slide 1 of 90

Upper Extremity Trauma

Elbow & Forearm

Charles Monroe "Sparky" Schultz (1922-2000)

- Anatomy
- Radiographs
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Creator of...
Charlie Brown
 >1947: *Li'l Folks*
 >1950: *Peanuts*
 ✓ 2600 newspapers
 ✓ 21 languages
 ✓ 355 million readers in 75 countries
 ✓ Published a total of 17,897 strips
 "arguably the longest story ever told by one human being"
 >March 1964...



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wikipedia.org
"Professor Robert Thompson, Syracuse University"

Slide 2 of 90

Upper Extremity Trauma

Elbow & Forearm

What's wrong with Charlie Brown's arm?

- Anatomy
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www.gocomics.com/3/6/1964

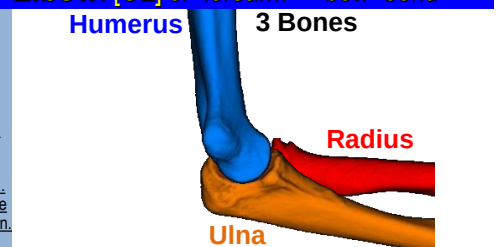
Slide 3 of 90

Upper Extremity Trauma

Elbow & Forearm

Elbow: [OE] el "forearm" + bow "bend"

- Anatomy
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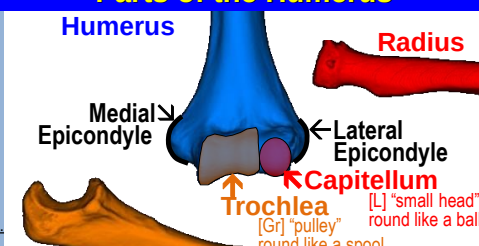
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Upper Extremity Trauma

Elbow & Forearm

Parts of the Humerus

- Anatomy
- Radiographs
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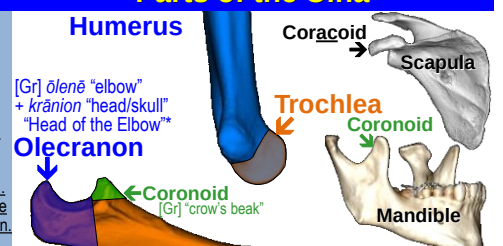
Slide 5 of 90

Upper Extremity Trauma

Elbow & Forearm

Parts of the Ulna

- Anatomy
- Radiographs
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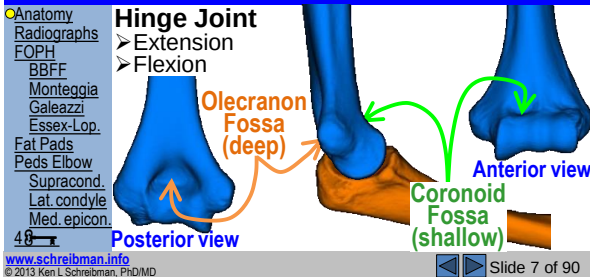
Slide 6 of 90

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page 2 of 15

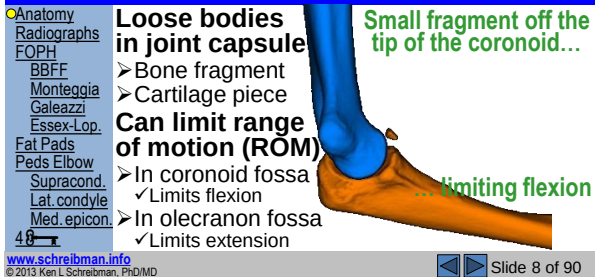
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Olecranon-Trochlea Joint



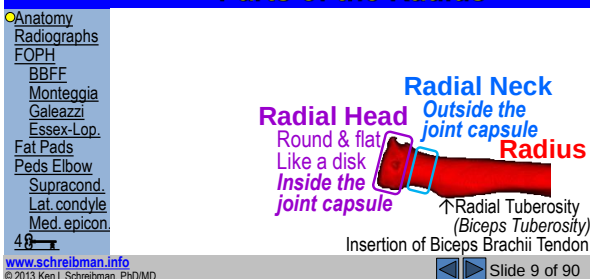
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"Joint Mice"



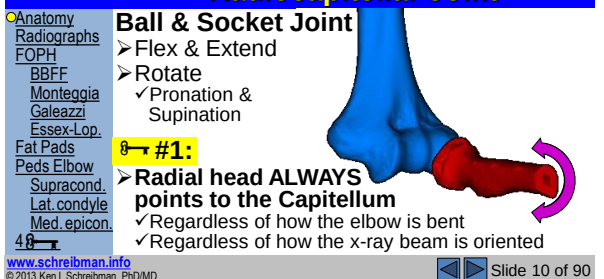
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Parts of the Radius



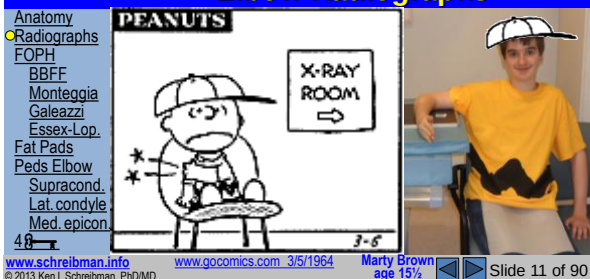
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Radiocapitellar Joint



Upper Extremity Trauma Elbow & Forearm

Elbow Radiographs



Upper Extremity Trauma Elbow & Forearm

AP View



Upper Extremity Trauma: Elbow & Forearm

page 3 of 15

Upper Extremity Trauma

Elbow & Forearm

Lateral View

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
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Elbow flexed 90°

X-ray beam Vertical

Capitellum aligned with Radial head

Coronoid overlaps Radial Head

K,C 33yoF

Slide 13 of 90

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Upper Extremity Trauma

Elbow & Forearm

Radial Head View

Anatomy
Radiographs
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Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
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Elbow flexed 90°

X-ray beam angled 45°

Capitellum aligned with Radial head

Eliminates Radial Head Overlap

Greenspan. AJR 1982; 138: 1186

H,E 22yoF

Slide 14 of 90

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Upper Extremity Trauma

Part 2: Wrist

Fall On Out-Stretched Hand (FOOSH)

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

Hyperextend Wrist

Hyperextend Wrist

RADIUS
ULNA
HAND

FOOSH

Marty age 8%

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Upper Extremity Trauma

Elbow & Forearm

Fall On Palm Heel (FOPH)

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
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Which load dominates ulna or radius determines the pattern of injury

ULNA
RADIUS
CARPUS

Fall On Palm Heel

Fall On Palm Heel

Marty age 8%

Slide 16 of 90

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Upper Extremity Trauma

Elbow & Forearm

Forearm is a Ring

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

"You can't break a ring in 1 place"
This is not entirely true...

➢ Yes, with a fall on the palm heel, causing an axial load, the forearm ring breaks in 2 places

✓ "Both Bone Forearm Fracture"

✓ Fracture/Dislocations

- Monteggia
- Galeazzi
- Essex-Lopresti

Fall On Palm Heel

Slide 17 of 90

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Upper Extremity Trauma

Elbow & Forearm

Forearm is a Ring

Anatomy
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Lat. condyle
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You CAN break a ring in 1 place

➢ With a direct blow, like from a stick, the forearm ring breaks in 1 place

"Nightstick fracture"

- ✓ Ulna
- ✓ Mid-shaft
- ✓ Uncommon fracture
- ✓ Uncommon mechanism

Stick

Slide 18 of 90

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page 4 of 15

Upper Extremity Trauma Elbow & Forearm

About to get a nightstick fracture...

Anatomy
Radiographs
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Monteggia
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Essex-Lop.
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Chicago, 1968

Slide 19 of 90

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Nightstick (isolated ulna) fracture

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Essex-Lop.
Fat Pads
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S, E 9yoM, friend fell on the patient's arm

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Forearm Ring: Both Bone Forearm Fracture

Anatomy
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Common pattern

- Children
 - ✓ 75% distal 1/3*
 - ✓ Heal, remodel
 - <10yo, <25° angulation OK**
 - >10yo, >10° unlikely to correct
- Adult
 - ✓ Most require ORIF

7 months later

P, Z 12yoM

Slide 21 of 90

Upper Extremity Trauma Elbow & Forearm

Adult BBFF

Anatomy
Radiographs
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Galeazzi
Essex-Lop.
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K, N 54yoF

Slide 22 of 90

Upper Extremity Trauma Elbow & Forearm

Forearm Ring: Monteggia Fracture

Anatomy
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Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.

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Fracture proximal 1/3 ulna + dislocation radial head relative to capitulum

- Not uncommon
 - ✓ I see several of these a year
- Important not to miss the radial head dislocation!
 - ✓ Example of why understanding injury mechanisms helps to detect fracture patterns

If you see isolated ulna fx... you need to look for the radial head dislocation!

B, J 43yoM

Slide 23 of 90

Upper Extremity Trauma Elbow & Forearm

#1: Radial Head Points to Capitulum

Anatomy
Radiographs
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S, A 6yoF

Slide 24 of 90

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page 5 of 15

Upper Extremity Trauma

Elbow & Forearm

Giovanni Battista Monteggia (1762-1815)

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48		1814 (same year Colles wrote his article) 768 pages in Italian Volume Primo 1 illustration...	
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www.schreibman.info books.google.com
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Upper Extremity Trauma

Elbow & Forearm

José Luis Bado (1903-1977)

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48		Montevideo, Uruguay Instituto Rizzoli, Bologna, Italy Created Instituto de Ortopedia y Traumatología, Montevideo 1959, 1967: "The Monteggia Lesion" "Pulled Elbow Syndrome"	
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www.schreibman.info www.bjs.org
© 2013 Ken L. Schreibman, PhD/MD Clin Orthop 1967
Jan Feb 50 71-86

Slide 26 of 90

Upper Extremity Trauma

Elbow & Forearm

Bado's classification of Monteggia fractures

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48	Type 1 	Type 2 	Type 3 	Type 4 
--	---	---	---	---

- Radial Head: Anterior Disloc
- Ulna Fracture: Anterior Angle
- 60%

- Radial Head: Post. Disloc.
- Ulna Fracture: Post. Angle
- 15%

- Rad Head: Lat. Disloc.
- Ulna Fx Metaph.
- 20%

- Rad Head: Anterior Disloc
- Ulna & Rad Fx Proximal 1/3
- 5%

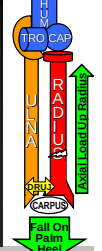
www.schreibman.info RadioGraphics 2000;20:819-836
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Slide 27 of 90

Upper Extremity Trauma

Elbow & Forearm

Forearm Ring: Galeazzi Fracture

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48	Fracture distal 1/3 radius + dislocation ulna at Distal Radio-Ulna Joint (DRUJ)		
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- Very uncommon
- ✓ I see these twice a decade
- Ulna dislocation may be best seen on wrist views
- ✓ Sometimes DRUJ dislocation is subtle
- ✓ Helps to compare to contralateral wrist

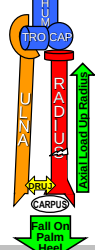
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Slide 28 of 90

Upper Extremity Trauma

Elbow & Forearm

Forearm Ring: Galeazzi Fracture

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48	Contralateral Normal Wrist 		
--	--	---	---

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Slide 29 of 90

Upper Extremity Trauma

Elbow & Forearm

Riccardo Galeazzi (1866-1952)

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop. Fat Pads Peds Elbow Supracond. Lat. condyle Med. epicon. 48	Galeazzi, R.: Ueber die Lagebestimmung von Fremdkörpern mittelst Röntgenstrahlen. Zentralblatt für Chirurgie, Leipzig, 1899, xxvi, No. 18, 529.	
--	--	---

- Reported his experience with 18 cases (I've seen 4 cases)
- He was not the first to describe this pattern...

www.schreibman.info www.bjs.boneandjoint.org.uk
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Slide 30 of 90

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page 6 of 15

Upper Extremity Trauma

Elbow & Forearm

Sir Astley Paston Cooper (1768-1841)

Cooper's suspensory ligaments of the breast
jdc.jefferson.edu

**TREATISE
ON
DISLOCATIONS AND FRACTURES
OF THE JOINTS.**
BY SIR ASTLEY PASTON COOPER, BARR. AT LAW.
FIRST PUBLISHED 1822
A NEW EDITION, WITH ADDITIONS.
BY JOHN COOPER, ESQ., F.R.S.
1842 edition: 576 pages
LONDON: ADAM AND AMES, 15, N. B. STREET.
www.schreibman.info www.ariandarchitecture.org.uk
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Case CCCLIII.—A man was admitted into St. Thomas's Hospital, under the care of Mr. Chandler. I now forget in what manner the accident had happened, but the ulna projected through the integuments at the back of the carpus; and a compound fracture of the radius, with great comminution of the bone, was produced. The ulna was at first replaced, but immediately resumed its dislocated position on the back of the wrist, although it did not again protrude through the skin. The hand and fore-arm were placed in a poultice, and were ordered to be fomented twice a day. A copious suppuration ensued, attended with violent constitutional irritation; and Mr. Chandler, in order to save the patient's life, after a lapse of five weeks, amputated the limb.

Slide 31 of 90

Upper Extremity Trauma

Elbow & Forearm

Monteggia vs Galeazzi

Anatomy Radiographs FOPH BBFF Monteggia Galeazzi Essex-Lop.

Fracture:
➤ Proximal
✓ Ulna
Dislocation:
➤ Proximal
✓ Rad-Cap

Fracture:
➤ Distal
✓ Radius
Dislocation:
➤ Distal
✓ DRUJ

"MU/GR"
"I was attacked by a MUGGER"
Monteggia = Ulna fx
MU Proximal 1/2 = Fx & Disloc are Proximal
Galeazzi = Radius fx
GR Distal 1/2 = Fx & Disloc are Distal

Slide 32 of 90

Upper Extremity Trauma

Elbow & Forearm

Monteggia vs Galeazzi

COMMON
Whenever you see an ulna fx, ask yourself, "Am I missing a radial head dislocation?"

RARE
You may never see one

Slide 33 of 90

Upper Extremity Trauma

Elbow & Forearm

Forearm Ring: Essex-Lopresti Fracture

Impactation 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

Slide 34 of 90

Upper Extremity Trauma

Elbow & Forearm

Forearm Ring: Essex-Lopresti Fracture

5 days later...
Radial head prosthesis restores radial length

DRUJ restored

Slide 35 of 90

Upper Extremity Trauma

Elbow & Forearm

Radial Head Fractures

Radial head fractures are common
R.C. Murray 1927-37 looked at all 1640 elbow fractures

➤ Radial Head/Neck fractures:
= 44% of all elbow fractures
= 5% of **all** fxs 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**

Slide 36 of 90

Upper Extremity Trauma: Elbow & Forearm

page 7 of 15

Upper Extremity Trauma

Elbow & Forearm

Radial Head Fractures

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

✓61%: Non-displaced 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

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www.wheelessonline.com

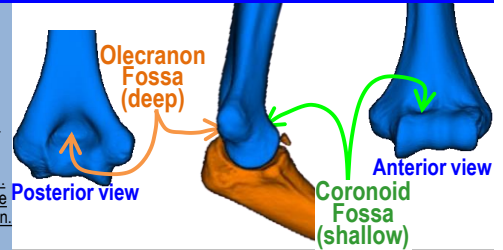
Slide 37 of 90

Upper Extremity Trauma

Elbow & Forearm

Fat Pads Live in Fossae

Anatomy
Radiographs
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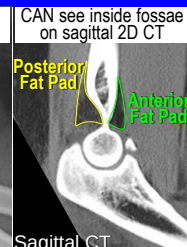
Slide 38 of 90

Upper Extremity Trauma

Elbow & Forearm

Fat Pads on CT

Anatomy
Radiographs
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Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
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R,A 27yoF

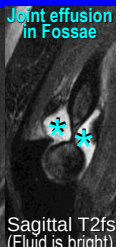
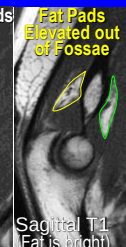
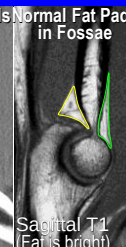
Slide 39 of 90

Upper Extremity Trauma

Elbow & Forearm

Fat Pads on MR

Anatomy
Radiographs
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R,A 27yoF

B,A 35yoM

T,L 39yoF

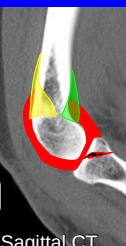
Slide 40 of 90

Upper Extremity Trauma

Elbow & Forearm

Elevated Fat Pads

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
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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
 - ❖ Intra-articular fracture →
 - ❖ Hemarthrosis →
 - ❖ Fat Pad Elevation

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Upper Extremity Trauma

Elbow & Forearm

Fat Pads Not Easy To See

Anatomy
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Monteggia
Galeazzi
Essex-Lop.
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Supracond.
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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



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S,W 32yoM

Slide 42 of 90

Upper Extremity Trauma: Elbow & Forearm

page 8 of 15

Upper Extremity Trauma

Elbow & Forearm

Elevated Posterior Fat Pad

Anatomy
Radiographs
FOPH
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Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
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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



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Slide 43 of 90

Upper Extremity Trauma

Elbow & Forearm

Normal Anterior Fat Pad

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Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.

➤ Normally you *can* see a *small* anterior fat pad inside the shallow coronoid fossa

➤ But it should be thin, flat, flush against the bone



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Slide 44 of 90

Upper Extremity Trauma

Elbow & Forearm

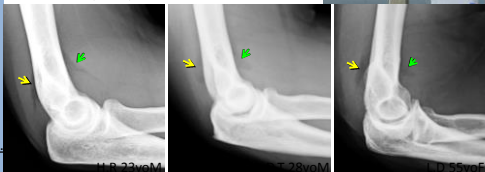
Elevated Anterior Fat Pad

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

Sticks out like a spinnaker sail

➤ "Sail Sign"

➤ Not thin, flat, flush to the bone



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Slide 45 of 90

Upper Extremity Trauma

Elbow & Forearm

8→ #2: Fat Pads are your Friends

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

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), it's telling you there's a radial head fracture...
...even if you can't see the fracture

✓61%: Radial Head fractures non-displaced

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Slide 46 of 90

Upper Extremity Trauma

Elbow & Forearm

Occult Radial Head Fracture

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

Lateral View
Fat Pad Elevation

AP View

Radial Head View



Can't see the radial head fx

Can't see the radial head fx

Can't see the radial head fx

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Slide 47 of 90

Upper Extremity Trauma

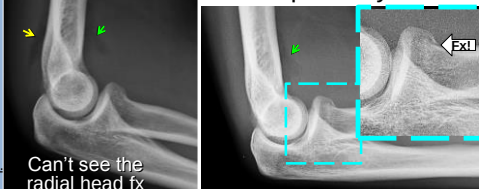
Elbow & Forearm

Occult Radial Head Fracture

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

Lateral View
Fat Pad Elevation

Treated with sling
Followup 11 days later...



Can't see the radial head fx

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Slide 48 of 90

Upper Extremity Trauma: Elbow & Forearm

page 9 of 15

Upper Extremity Trauma Elbow & Forearm

Elbow Joint Capsule

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

Fluoroscopic Guided Arthrogram
Needle in Radio-Capitellar joint

Contrast filling the Coronoid Fossa
Distal Capsule
Barely extends to Radial Neck

Contrast filling the Olecranon Fossa
Neck fx distal to capsule
Capsule doesn't extend to Radial Neck

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E,S 23yoF
WD 56yoM
Slide 49 of 90

Upper Extremity Trauma Elbow & Forearm

Radial Neck Fractures

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

When Radial Neck is *outside* capsule
➤ Radial Neck fxs don't yield hemarthrosis
➤ Radial Neck fxs don't yield fat pad elevation

“Fell from bike, landing on bilateral outstretched arms”

Normal Flat Ant Fat Pad
Neck Ex
Elevated Flat Ant Fat Pad
Radial Neck fx extends to Head

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G,P 41yoM
Slide 50 of 90

Upper Extremity Trauma Elbow & Forearm

#2: Fat Pads are your Friends

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

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%)***

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*RadioGraphics 1996; 16: 1446
Slide 51 of 90

Upper Extremity Trauma Elbow & Forearm

Pediatric Elbow

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

I HAVE TO GO SEE A PEDIATRICIAN!

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imgur.com
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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers:

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

At birth, none of the elbow epiphyses are ossified.
As the child matures, they ossify in a specific order...

AP view
Lateral view
L,C 5moF

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Slide 53 of 90

Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C

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

Capitulum
➤ 1st to ossify
✓ appears at ~ 1 year old

AP view
Lateral view
T,V 15moF

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Slide 54 of 90

Upper Extremity Trauma: Elbow & Forearm

page 10 of 15

Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C

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

Capitulum
➤ 1st to ossify
✓ ~ 1 year old
✓ well ossified by 2 years old

AP view Lateral view

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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C R

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

Radial Head
➤ 2nd to ossify
✓ appears at 3-4 years old

AP view Lateral view

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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C R I

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

Internal (medial) epicondyle
➤ 3rd to ossify
✓ appears at ~5 years old

AP view Lateral view

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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C R I T

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

Trochlea
➤ 4th to ossify
✓ appears at ~7 years old

AP view Lateral view

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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C R I T O

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

Olecranon
➤ 5th to ossify
✓ appears at ~9 years old

AP view Lateral view

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Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: C R I T O E

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

External (lateral) epicondyle
➤ last to ossify
✓ appears at ~11 years old

AP view Lateral view

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Upper Extremity Trauma: Elbow & Forearm

page 11 of 15

Upper Extremity Trauma Elbow & Forearm

Elbow Ossification Centers: CRITOE

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

Approximate age
 Capitellum.....1
 Radial Head....3
 Int. epicond....5
 Trochlea.....7
 Olecranon.....9
 Ext. epicond....11
 ... then go on to fuse

AP view Radial Head view

HJ 14yoM

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Slide 61 of 90

Upper Extremity Trauma Elbow & Forearm

Causes of Pediatric Elbow Pain

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

PEANUTS
 HE CAN'T KEEP PITCHING HIS ARM HURTS!
 FORGET ABOUT THE PAIN CHARLIE BROWN KEEP THROWING THOSE CURVES!
 MAYBE HE HAS BURSITIS
 HOW ABOUT A SHOT OF CORTISONE?
 FORGET ABOUT THE PAIN! PITCH THROUGH YOUR TEARS!

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Slide 62 of 90

Upper Extremity Trauma Elbow & Forearm

Supracondylar Fracture

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

Fracturing ABOVE Condyles

Axial Load Up Forearm

Fall On Palm Heel

Marty age 8½

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Slide 63 of 90

Upper Extremity Trauma Elbow & Forearm

Supracondylar Fracture

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

Negative, No Fracture Fracture, Above Condyles

Axial Load Up Forearm

5y 8m F SJ 7yoF

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Slide 64 of 90

Upper Extremity Trauma Elbow & Forearm

Supracondylar Fracture

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

Pushed Condyles Behind Humerus

Axial Load Up Forearm

AP view: ER AP view: OR

Closed reduction & fixation with K-wires

SJ 7yoF

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Slide 65 of 90

Upper Extremity Trauma Elbow & Forearm

Supracondylar Fracture

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

THE most common pediatric elbow fx

FRACTURES OF THE ELBOW IN CHILDREN
 REVIEW OF THREE HUNDRED CONSECUTIVE CASES
 Donald J. Mayhew, M.D.
 and
 John J. Fahey, M.D., Chicago
 J.A.M.A. Jan. 18, 1958, Vol. 166, No. 3, p 220-228

> 60%: Supracondylar
 ✓ 24%: Marked displaced
 ✓ 32%: Non/Min displaced
 > 7%: Radial Head/Neck (Most common adult elbow fx)

Type of Fracture	Cases	% of Total
Supracondylar fractures	177	60
Unilateral	177	60
Minimally displaced	29	16
Marked displacement	148	84
Marked displacement	148	84
Fracture of lateral condyle	34	19
Non-displaced	15	8
Displaced	19	11
Fracture of medial epicondyle (54% with dislocation of the elbow)	27	9
Fracture of upper end of radius	10	6
Fracture of olecranon	19	11
Without displacement	10	6
With displacement	9	5
"T" fracture	6	3
Minimally displaced	6	3
Fracture of trochlea	1	0
Fracture of coronoid	1	0
Fracture of lateral epicondyle	1	0
Fracture of radial condyle	1	0
Fracture of capitulum/epiphysis	1	0
Monteggia's fracture	1	0

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Slide 66 of 90

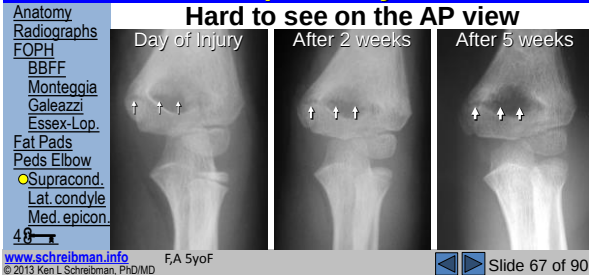
Upper Extremity Trauma: Elbow & Forearm

page 12 of 15

Upper Extremity Trauma Elbow & Forearm

Subtle Supracondylar Fractures

Hard to see on the AP view



Upper Extremity Trauma Elbow & Forearm

Subtle Supracondylar Fractures

Hard to see on the Lateral view...

...Need to use the 8→s

8→ #2: Fat pads are your friends

➤ Trauma + Elevated Fat Pads = Hemarthrosis

✓ Adults: Radial Head Fracture

✓ Peds: Supracondylar Fracture (60%)

8→ #3: Anterior Humeral Line

➤ Passes through middle 1/3 of Capitulum

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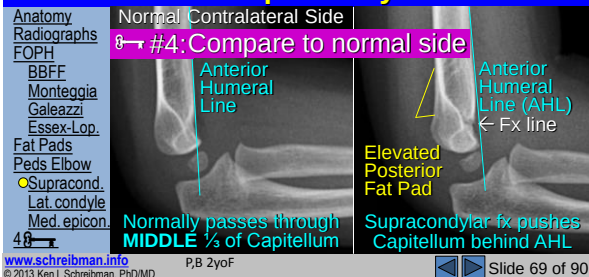
Slide 68 of 90

Upper Extremity Trauma Elbow & Forearm

Subtle Supracondylar Fractures

Normal Contralateral Side

8→ #4: Compare to normal side



Upper Extremity Trauma Elbow & Forearm

Pediatric Elbow Fractures

Supracondylar Fracture

➤ Most common (60%*)

➤ Grossly displaced

➤ Quite subtle

8→ Elevated Fat Pads

8→ Anterior Humeral Line

8→ Compare with normal side

Lateral Condylar Fracture

➤ Second most common

✓ 12%* - 19%**

www.schreibman.info *JAMA Jan. 18, 1958, Vol. 166, No. 3, p 220-228 RadioGraphics 1996; 16: 1446 © 2013 Ken L. Schreibman, PhD/MD

Slide 70 of 90

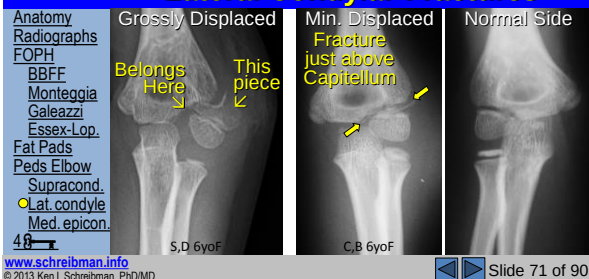
Upper Extremity Trauma Elbow & Forearm

Lateral Condylar Fractures

Grossly Displaced

Min. Displaced

Normal Side



Upper Extremity Trauma Elbow & Forearm

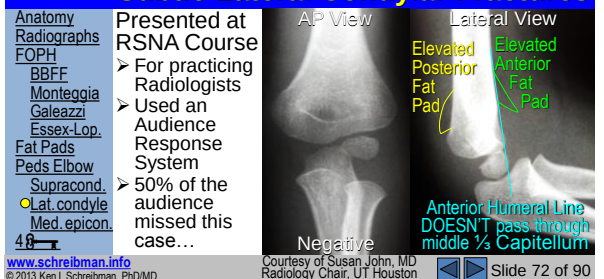
Subtle Lateral Condylar Fractures

Presented at RSNA Course

➤ For practicing Radiologists

➤ Used an Audience Response System

➤ 50% of the audience missed this case...



Upper Extremity Trauma: Elbow & Forearm

page 13 of 15

Upper Extremity Trauma Elbow & Forearm

Pediatric Elbow Fractures

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

www.schreibman.info JAMA Jan. 18, 1958, Vol. 166, No. 3, p 220-228
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Upper Extremity Trauma Elbow & Forearm

Medial Epicondylar Fractures

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

Secondary to Elbow Dislocation

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Upper Extremity Trauma Elbow & Forearm

Medial Epicondylar Fractures

Secondary to Elbow Dislocation

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

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Upper Extremity Trauma Elbow & Forearm

Subtle Medial Epicondylar Fractures

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

Avulsions from Valgus Stress

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Upper Extremity Trauma Elbow & Forearm

What's wrong with Charlie Brown's arm?

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

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Upper Extremity Trauma Elbow & Forearm

Little Leaguer's Elbow

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

By MAJOR BYRON G. BROGDON, USAF (MC),
and MAJOR NEIL E. CROW, USAF (MC)
(residents at) LACKLAND AIR FORCE BASE, TEXAS
American Journal of Radiology, April 1960, Vol. 83, No. 4, p 671-5

Referencing W.E. Dotters' 1953 article,
"Little Leaguer's shoulder; fracture of the
proximal epiphysal cartilage of the
humerus due to baseball pitching,"
Guthrie Clin. Bull., 1953, 23, 68-72

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 Gil Brogdon, MD
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Upper Extremity Trauma: Elbow & Forearm

page 14 of 15

Upper Extremity Trauma

Elbow & Forearm

Little Leaguer's Elbow

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48

Case I. 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 epicondyle 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 epicondyle and pain on extreme flexion or pronation of the forearm. He vacationed 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 epicondyle and loss of fascial marking 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.

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AJR April 1960, Vol. 83, No. 4, p 671

Slide 79 of 90

Upper Extremity Trauma

Elbow & Forearm

Charlie Brown's Elbow

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
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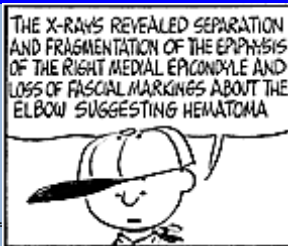
Slide 80 of 90

Upper Extremity Trauma

Elbow & Forearm

Charlie Brown's Elbow

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48



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

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AJR April 1960, Vol. 83, No. 4, p 671

Slide 81 of 90

Upper Extremity Trauma

Elbow & Forearm

Little Leaguer's Elbow in the Media

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48



1962: Magazine Articles

- > Time: "Medicine: The Dangerous Arm"
- > Life

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time.com

Slide 82 of 90

Upper Extremity Trauma

Elbow & Forearm

Gil Brogdon on NBC's Today 1962

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48



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ajronline.org

Slide 83 of 90

Upper Extremity Trauma

Elbow & Forearm

Little League Baseball® Response

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48

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.

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AJR. 192, May 2009

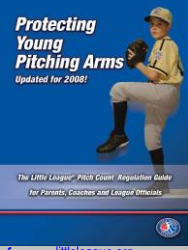
Slide 84 of 90

Upper Extremity Trauma: Elbow & Forearm page 15 of 15

Upper Extremity Trauma Elbow & Forearm Little League Baseball® Response

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48

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Protecting Young Pitching Arms
Updated for 2008!

THE PITCH COUNT REGULATION

League Age	17-18	105 pitches per day
13-16	95 pitches per day	
11-12	85 pitches per day	
9-10	75 pitches per day	
7-8	50 pitches per day	

The Little League® Pitch Count Regulation Guide for Parents, Coaches and League Officials

littleleague.org

Slide 85 of 90

Upper Extremity Trauma Elbow & Forearm 4 8→ Elbow Radiographs

Anatomy
Radiographs
FOPH
BBFF
Monteggia
Galeazzi
Essex-Lop.
Fat Pads
Peds Elbow
Supracond.
Lat. condyle
Med. epicon.
48

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- 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) Fr
- 3) Anterior Humeral Line**
➤ Should pass through middle 1/3 Capitellum
- 4) When in doubt, get the other side**

Slide 86 of 90

Upper Extremity Trauma Elbow & Forearm Giving Credit to Famous Authors

Anatomy
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- Schultz
- Monteggia
- Bado
- Galeazzi
- Cooper
- Essex-Lopresti
- **Brogdon**

✓ Only one I've personally worked with



Slide 87 of 90

Upper Extremity Trauma Elbow & Forearm Gil Brogdon (1929-2014)

Anatomy
Radiographs
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Galeazzi
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Emeritus Professor,
U South Alabama
ARRS Gold Medal
Recipient



medschoolwatercooler.com
amazon.com

Slide 88 of 90

Upper Extremity Trauma Elbow & Forearm Questions: Forearm/Elbow

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Fat Pads
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Slide 89 of 90

Upper Extremity Trauma Elbow & Forearm Bill Receipt Cheque Spike

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Slide 90 of 90