Michelle Omura

Acute Pediatric Elbow Injuries

1

FINDINGS?

RECOMMENDATIONS?

2

IS THERE A DIFFERENCE BETWEEN THESE TWO FRACTURES?

MANAGEMENT?

Patient A

Patient B

3

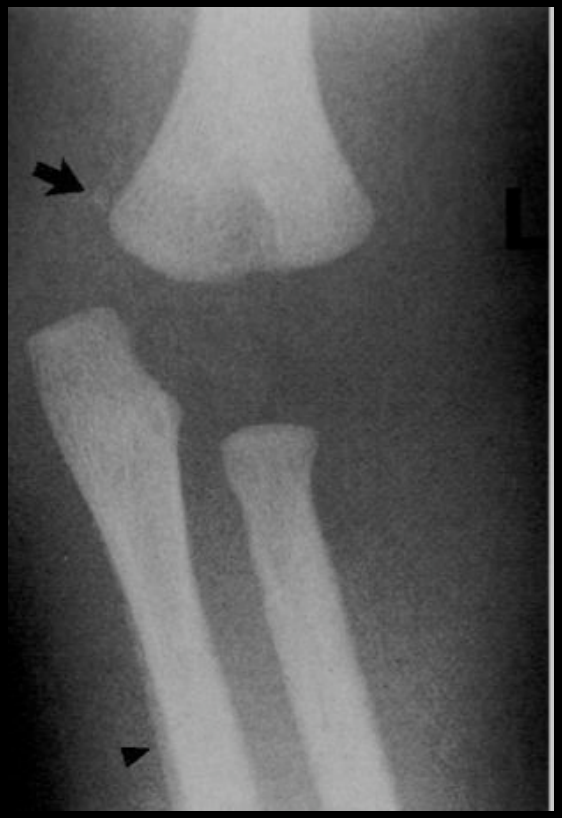
Is my patient's fracture healing properly?

6 year old
acute injury

4 months
later

7 months
later

4



3 mo old boy with arm swelling,
no known trauma

DIFFERENTIAL DIAGNOSIS?

RECOMMENDATIONS?

5

DIAGNOSIS?

RECOMMENDATIONS?

Acute Pediatric Elbow Injury

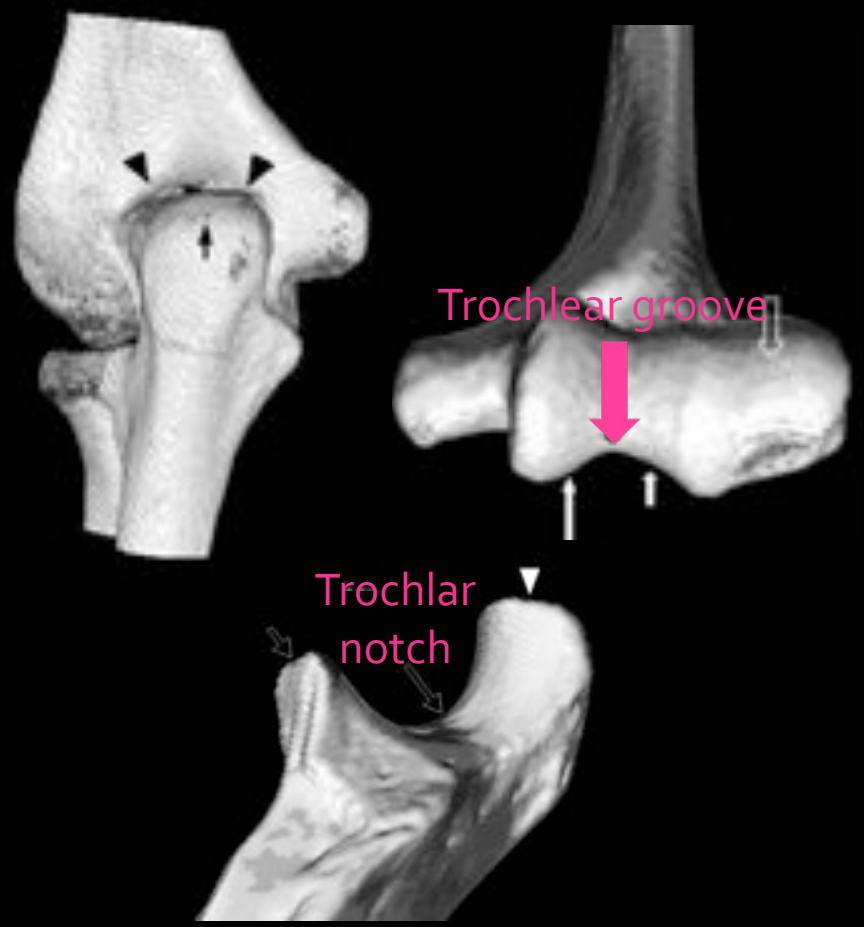
- Clinically challenging
- Physical examination of uncooperative child with grossly swollen elbow is difficult
- Large portion of elbow is radiolucent in young children

Outline

I. Elbow anatomy
II. Imaging approach
III. Specific injury patterns
    I. Distal humerus
    II. Proximal radius
    III. Proximal ulna
    IV. Dislocations

Osseous Anatomy

- Ulnohumeral joint
  - Trochlea of the humerus & trochlear notch of the ulna
  - Hinge joint, flexion-extension
- Radiocapitellar joint
- Proximal radioulnar joint



Kijowsky et al, Skeletal Radiol 2004;33:685-697

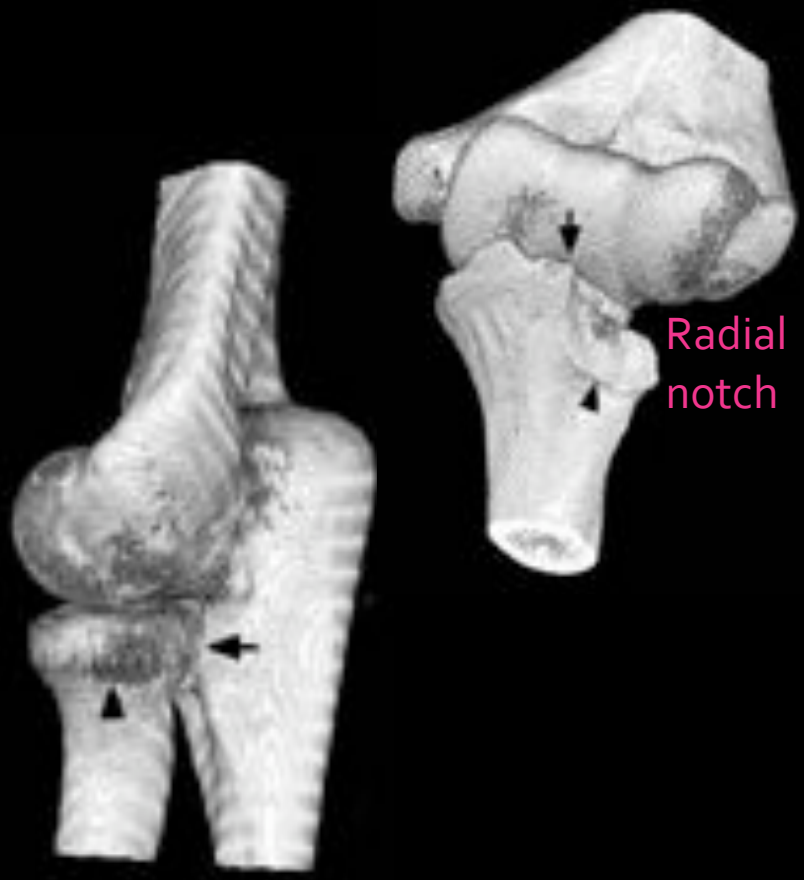
Osseous Anatomy

- Humeroulnar joint
- Radiocapitellar joint
  - Pronation-supination
- Proximal radioulnar joint

Kijowsky et al, Skeletal Radiol 2004;33:685-697

Osseous Anatomy

- Humeroulnar joint
- Radiocapitellar joint
- Proximal radioulnar joint
  - Radial head & radial notch of the ulna
  - Pronation-supination



Kijowsky et al, Skeletal Radiol 2004;33:685-697

Synovial Recesses and Fat Pads

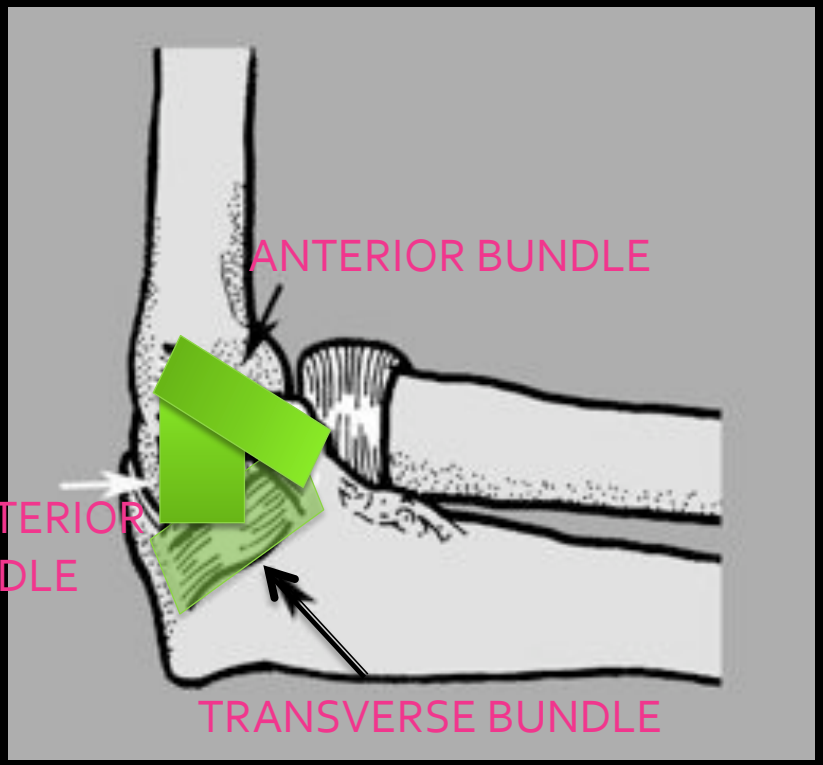
- Anterior humeral recesses and fat pads
  - Coronoid fossa
  - Radial fossa
- Olecranon recess and posterior fat pad
- Supinator fat pad
  - Overlies the supinator muscle

Kijowsky et al, Skeletal Radiol 2004;33:685-697

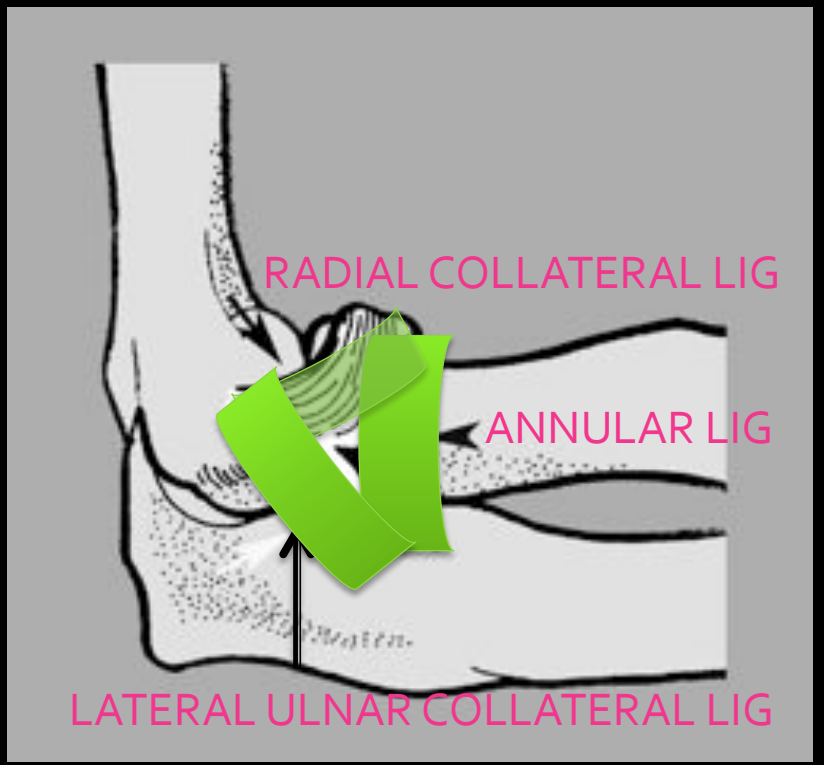
John et al, Radiographics 1996; 16: 1443-1460

Ligaments

MEDIAL COLLATERAL LIGAMENT COMPLEX

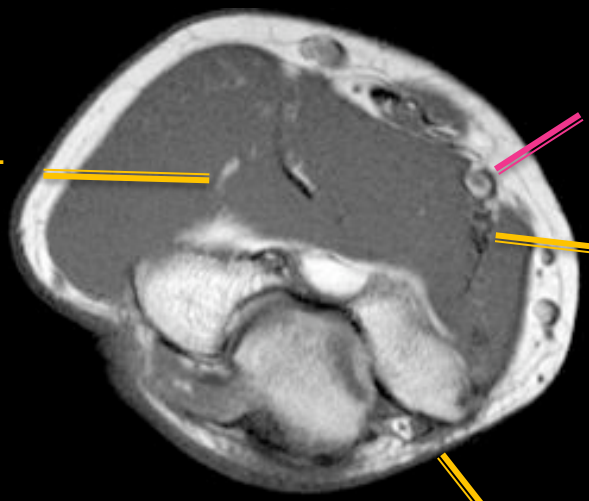


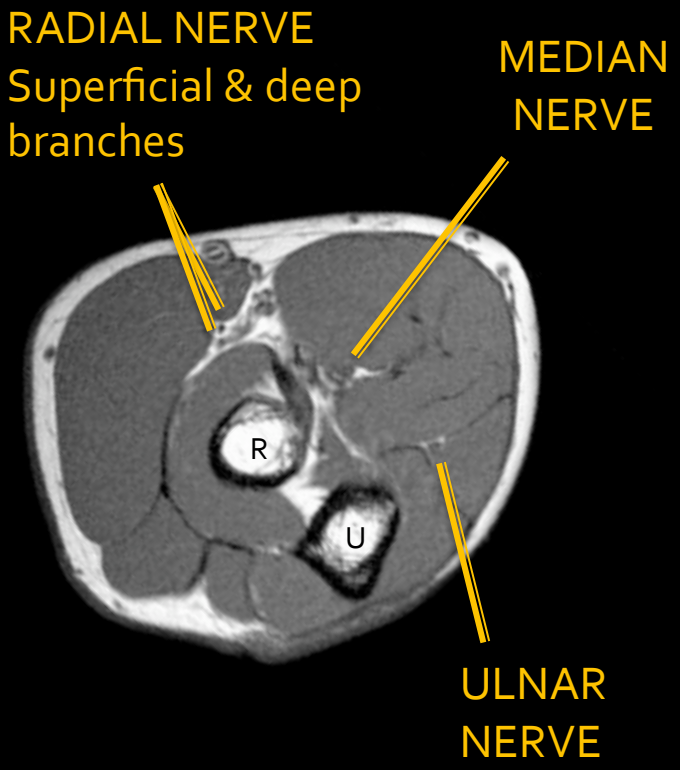
LATERAL LIGAMENTS



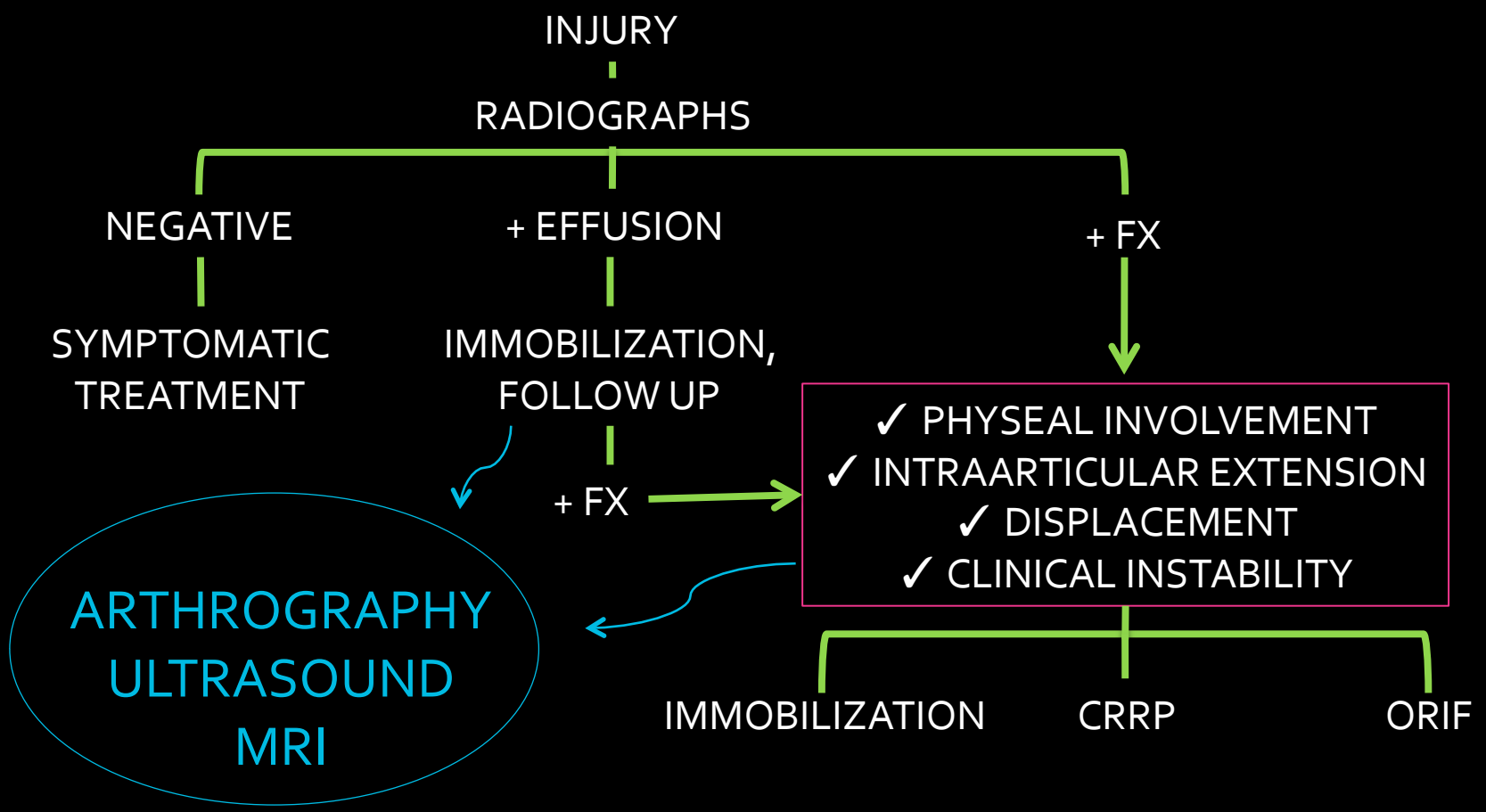
Kijowsky et al, Skeletal Radiol 2004;33:685-697

Neurovascular Anatomy





Clinical Approach



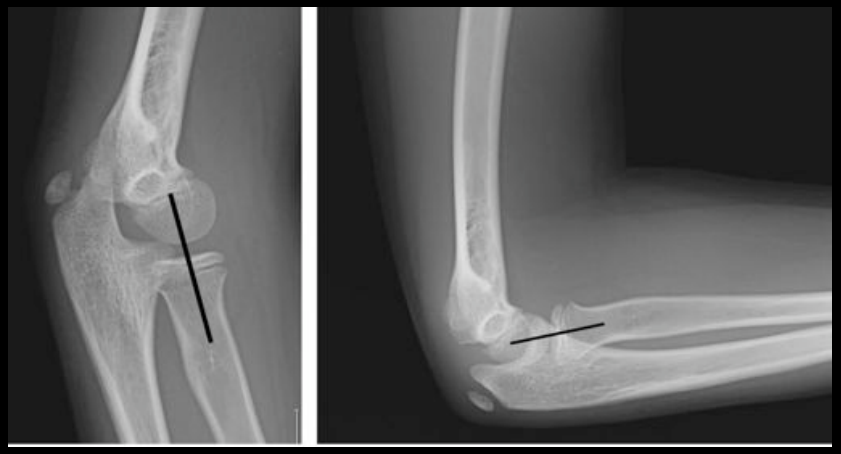
Imaging Approach

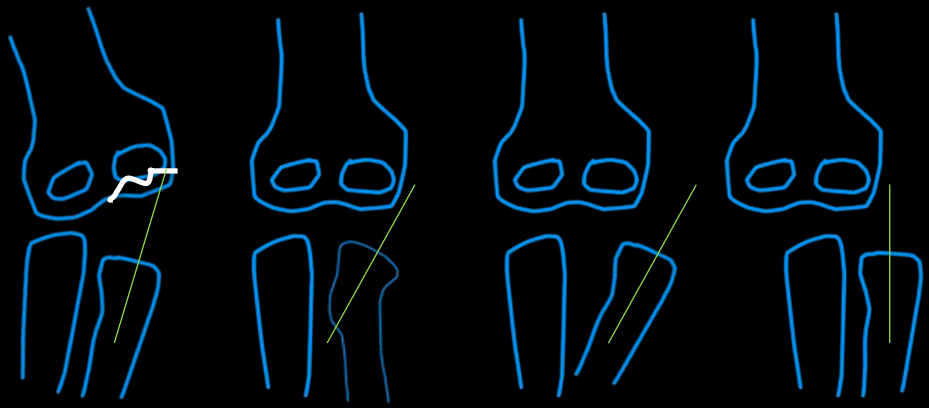
RADIOGRAPHS

1. LINES
   - ✓ RADIOCAPITELLAR
   - ✓ ANTERIOR HUMERAL
2. FAT PADS
3. OSSIFICATION CENTERS
   - ✓ LOCATION
   - ✓ MORPHOLOGY

Radiography

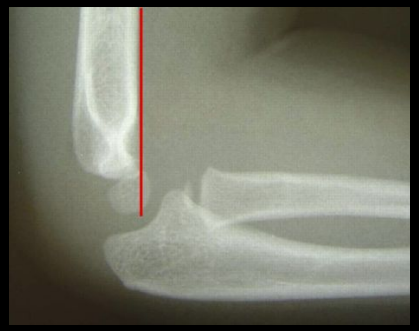
- Radiocapitellar line
  - Should bisect capitellum in all views
  - If abnormal, consider
    - Lateral condyle fx
    - Radial head/neck fx
    - Radial head subluxation/ dislocation
    - Elbow dislocation





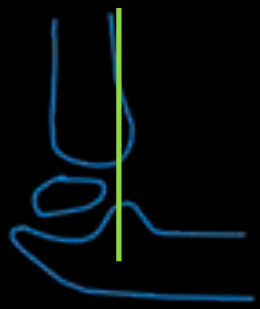
Radiography

- Anterior humeral line
  - Should pass through middle third of capitellum
    - Must be true lateral view
    - Variable <4 yrs, may pass through anterior third*
  - Abnormal in
    - Supracondylar fx
    - Distal humeral epiphyseal separation



< 4 yrs old

Supracondylar fx

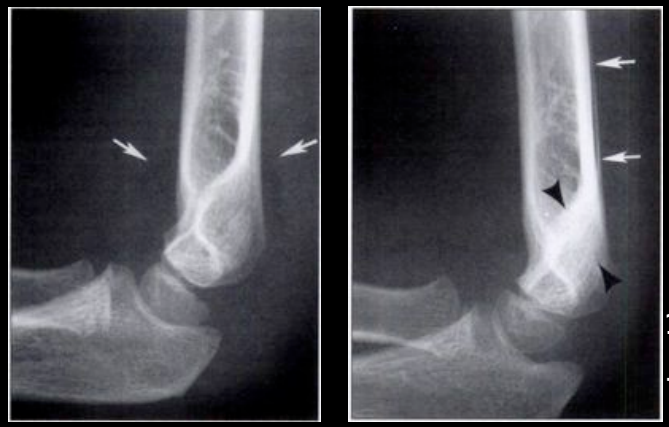


Distal humeral epiphyseal separation

*Herman et al, JBJS 2009; 91:2188-2193

Radiography

- Fat pad elevation
  - Traditionally synonymous with intra-articular fracture
  - May not be a reliable indicator of fracture*
    - Only 9/ 54 (17%) children with trauma and joint effusion had evidence of fx on follow up radiographs
    - However, patients were not evaluated with MRI or CT



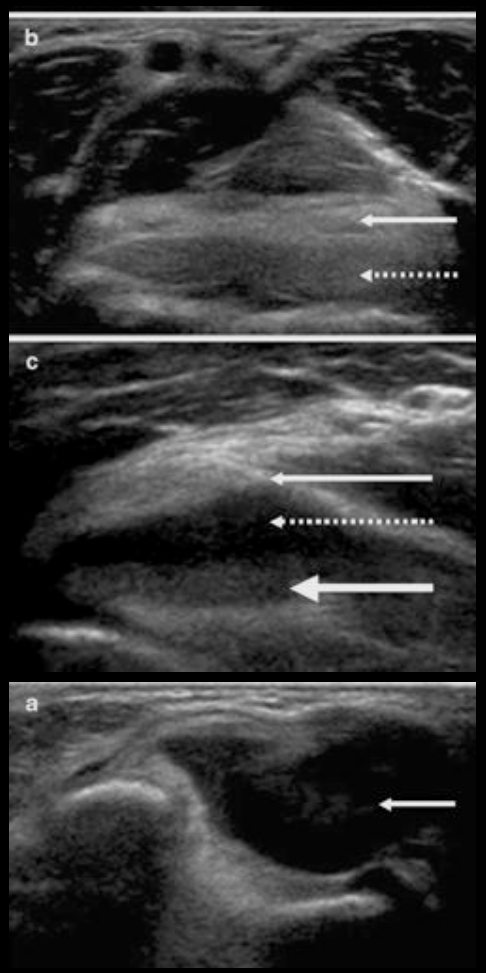
16 days later
+ Fracture

18 days later
No fracture

*Donnelly et al, AJR 1998;171:243-245

Role of Ultrasound

- Detection of lipohemarthrosis
  - Fluid-fluid level
  - Double fluid-fluid level
- 14 children with elbow trauma, xray = effusion, no fx
  - 7 lipohemarthrosis on US
    - 7/7 had cortical fracture on MRI (PPV=100%)
  - 7 simple hemarthrosis on US
    - 6/7 had no fracture (NPV= 86%)
    - 1/7 had cortical fracture (false negative)



Lipohemarthrosis:

Fat

Blood

Lipohemarthrosis:

Fat (hyperechoic)

Serum (anechoic)

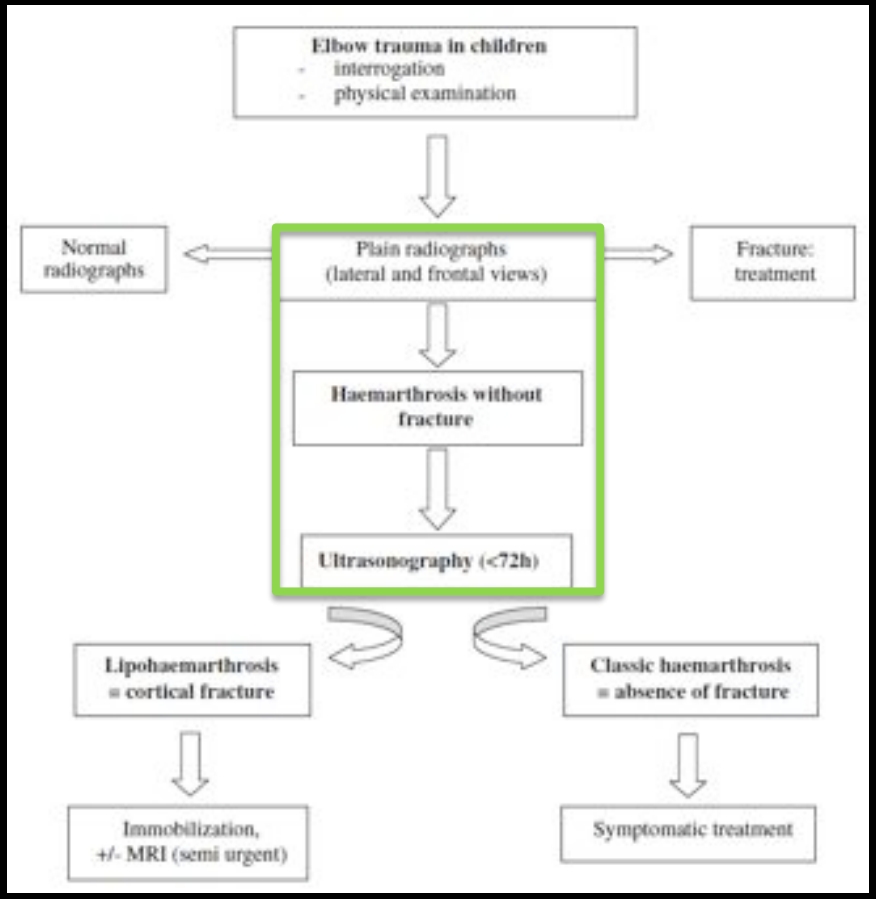
RBCs (hypoechoic)

Simple hemarthrosis:

Homogeneous anechoic/ hypoechoic

Zuazo et al, Pediatr Radiol 2008;38:982-988

Role of Ultrasound



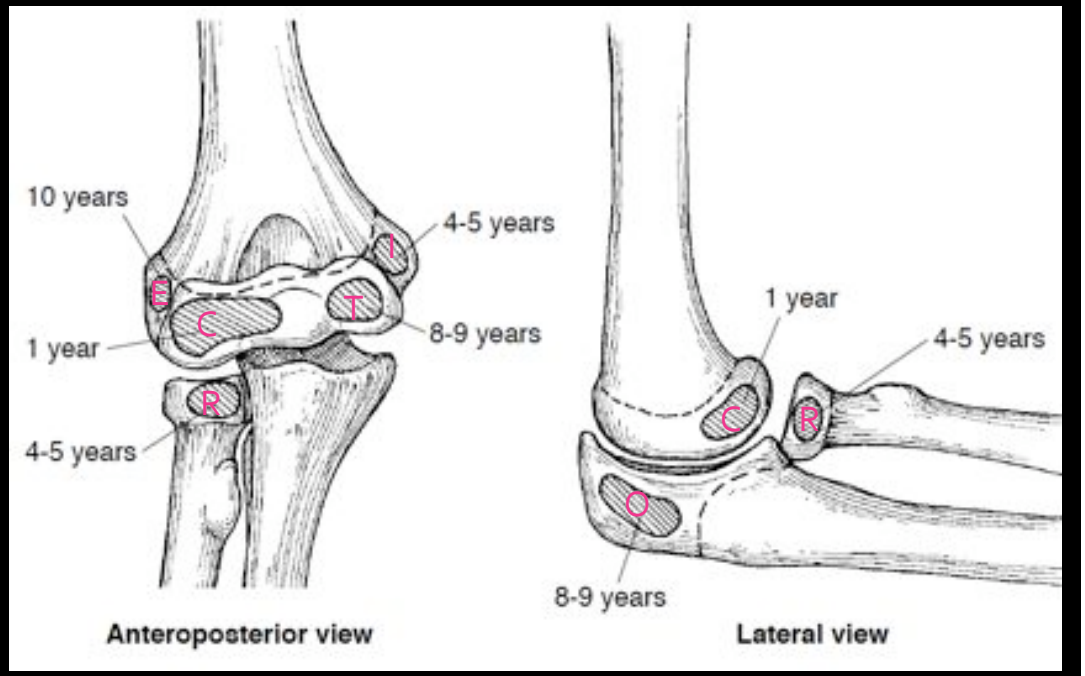
Zuazo et al, Pediatr Radiol 2008;38:982-988

Radiography

- Secondary ossification centers
- Order of appearance

  "CRITOE"

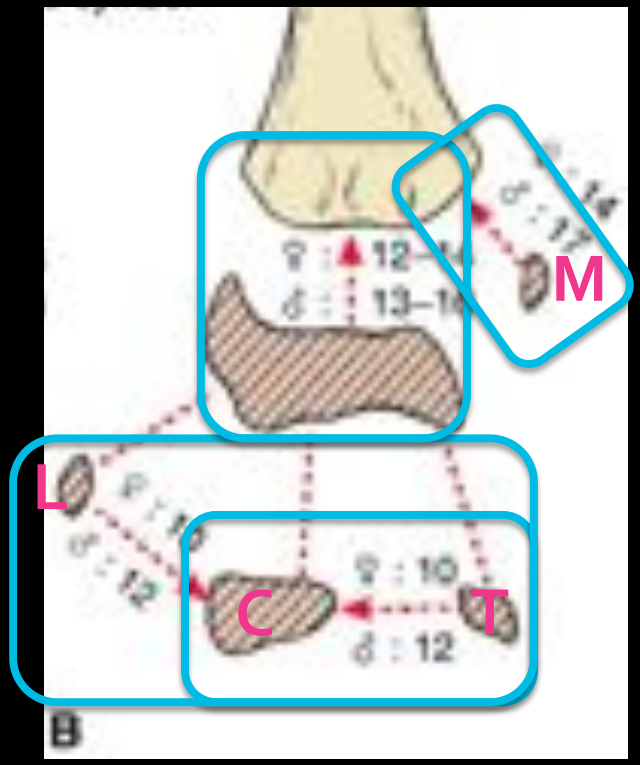
  - Capitellum
  - Radial head
  - "Internal" (medial) epicondyle
  - Trochlea
  - Olecranon
  - "External" (lateral) epicondyle



Skaggs, J Am Acad Orthop Surg 1997;5:303-312

Radiography

- Ossification center fusion
  1. Capitellum & trochlea fuse
  2. Combined center fuses with lateral epicondyle to form main body of distal humeral epiphysis
  3. Distal humeral epiphysis fuses to metaphysis
  4. Radial head fusion and olecranon fusion
  5. Medial epicondyle fuses to distal humerus (14-17 yrs)



Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Role of MRI

Skeletal Radiol (1994) 23:277–281

Skeletal Radiology

Pediatric elbow fractures: MRI evaluation

Javier Beltran, M.D.[1], Zehava S. Rosenberg, M.D.[1], Moises Kawelblum, M.D.[2], Lourdes Montes, M.D.[3], A. Gabrielle Bergman, M.D.[4], Alan Strongwater, M.D.[2]

Acute Elbow Trauma in Children:
Spectrum of Injury Revealed by MR Imaging Not Apparent on Radiographs

James F. Griffith[1]
Derek J. Roebuck[1,2]
Jack C. Y. Cheng[3]
Yu Leung Chan[1]
Timothy H. Rainer[4]
Bobby K. W. Ng[3]
Constantine Metreweli[1]

OBJECTIVE. The objective of this study is to evaluate the frequency and significance of unrecognized bone or soft-tissue injury in pediatric patients with elbow trauma assessed with radiographs alone.

SUBJECTS AND METHODS. Fifty children (32 boys and 18 girls; mean age, 7.3 years; age range, 2–12 years) with acute elbow trauma were examined with radiography and MR imaging. Radiographs were categorized into those showing normal findings, an effusion, an equivocal fracture, or an unequivocal fracture. MR examinations were assessed for an effusion, fracture, transphyseal fracture extension, physeal injury, bone bruising, and ligament or muscle injury. Average clinical follow-up was 1.6 years (range, 6–28 months) after injury.

Skeletal Radiol (1998) 27:250–255

ARTICLE

John Carey
Liam Spence
Hans Blickman
Stephen Eustace

MRI of pediatric growth plate injury: correlation with plain film radiographs and clinical outcome

ORIGINAL ARTICLE

ACTA RADIOLOGICA

Magnetic Resonance Imaging in Pediatric Elbow Fractures

T. Pudas, T. Hurme, K. Mattila & E. Svedström
Departments of Radiology and Pediatric Surgery, University of Turku, Turku, Finland

Assessment of Stability in Children's Minimally Displaced Lateral Humeral Condyle Fracture by Magnetic Resonance Imaging

Kamegaya, Makoto M.D.; Shinohara, Yuhji M.D.; Kurokawa, Masahiro M.D.; Ogata, Satoshi M.D.*

Skeletal Radiol (1998) 27:250–255
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n= 14

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n= 8

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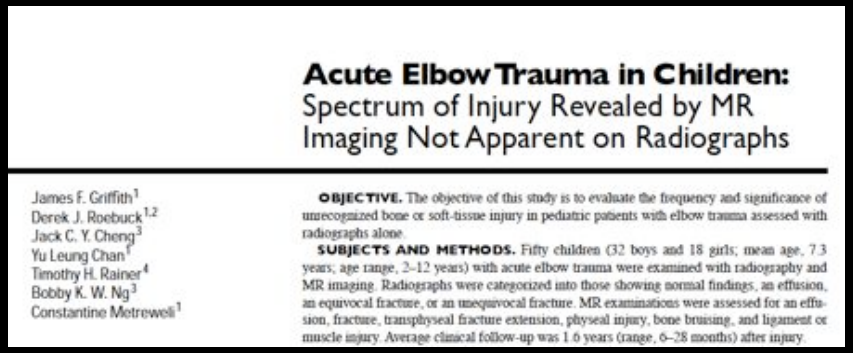
n= 12

"MRI allows detection of occult fractures, may alter Salter Harris staging, and in the reported study it frequently resulted in a change in patient management."

"...MRI might play a role in the preoperative evaluation of pediatric patients presenting with elbow trauma when extension of the fracture cannot be determined with routine radiographic studies."

"...MRI distinguished the potentially unstable fracture (type II) from the minimally displaced fracture and [we] recommend the use of a percutaneous pin fixation for the expected unstable fracture."



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n= 50 children with elbow injury

- X-RAY:
  - Normal (7)
  - Effusion (17)
  - Non-displaced fracture (26)
- MRI:
  - 11 occult fractures
  - 7 fractures with transphyseal extension (Salter IV)
  - 3 physeal injuries (Salter I or II)

All children treated with immobilization in 90° cast / splint

ORIF reserved for displaced fractures

MRI did not lead to any treatment modifications

All children made complete functional recovery

"… the additional information afforded by MR imaging has little bearing on treatment or clinical outcome"

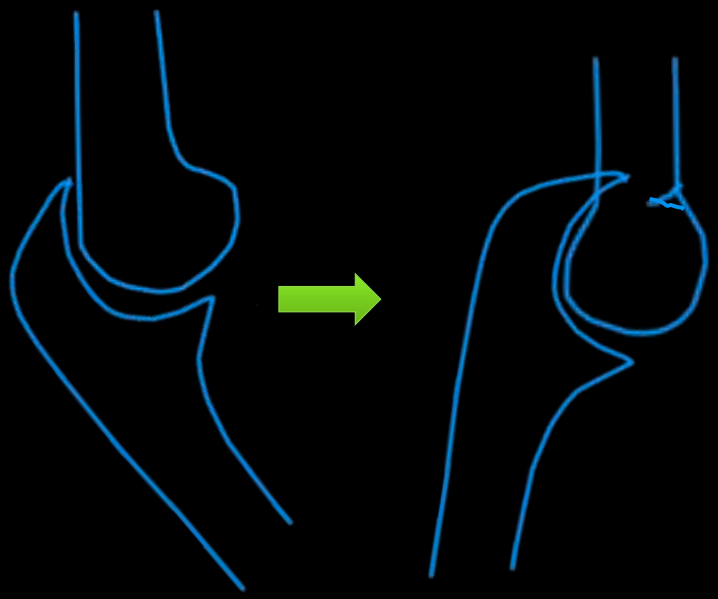
Griffith et al, AJR 2001;176:53-60

Specific Injury Patterns

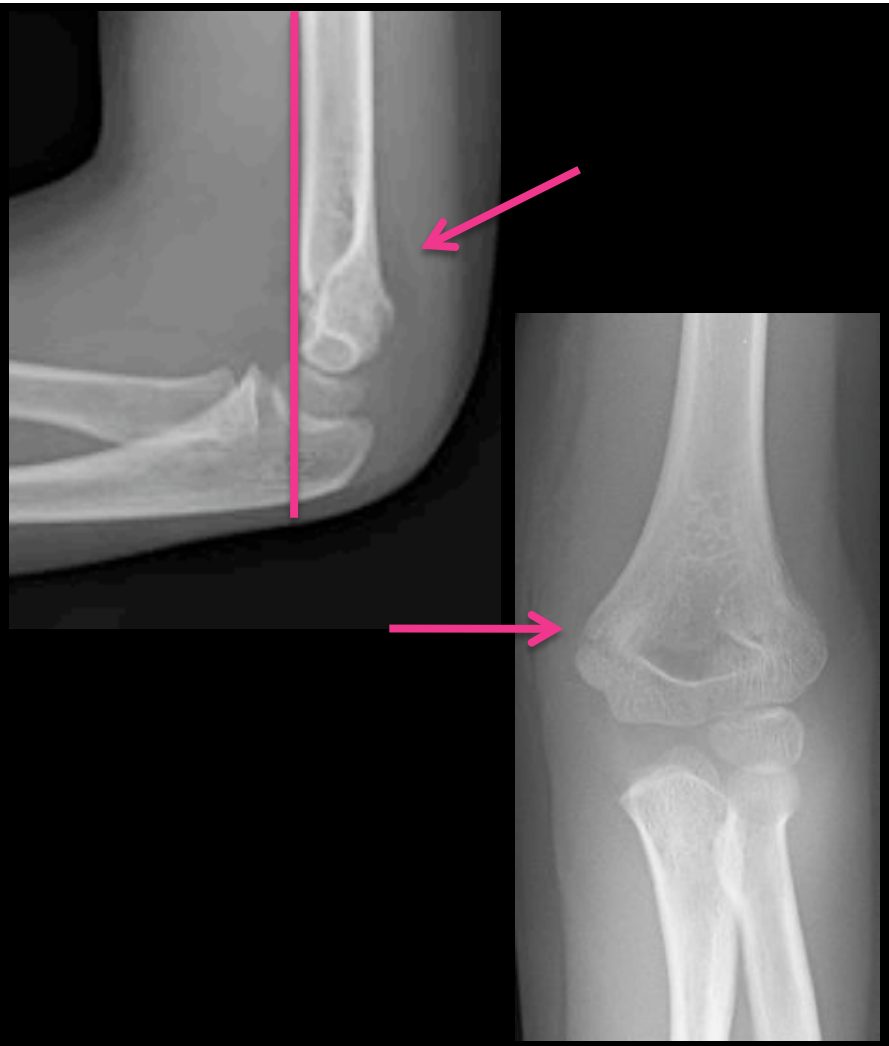
- Distal humerus
  - Supracondylar fx
  - Lateral condylar fx
  - Medial epicondylar fx
  - Transphyseal fx
- Proximal radius
  - Subluxation
    - "Nursemaid's elbow"
  - Fracture
    - Essex Lopresti fx-disloc
- Proximal ulna
  - Fracture
    - Monteggia fx-disloc
- Elbow dislocation
  - Posterolateral dislocation
  - Divergent dislocation

Supracondylar Fracture

- Most common elbow fracture in children < 8 yrs
- Mechanism
  - Hyperextension
    - Tensile failure anterior humeral cortex
    - Compression deformity posterior cortex
    - Loss of normal volar angulation of distal humerus



Supracondylar Fracture

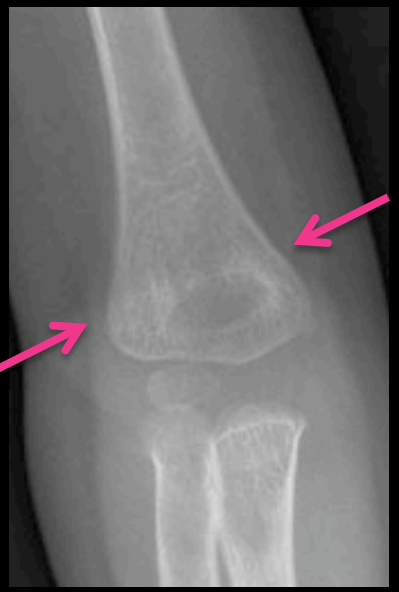


- Lateral radiograph
  - Posterior displacement of capitellum relative to anterior humeral line
  - Fat pad elevation
- AP radiograph
  - Transverse fracture distal humerus, proximal to the humeral condyles

Supracondylar Fracture

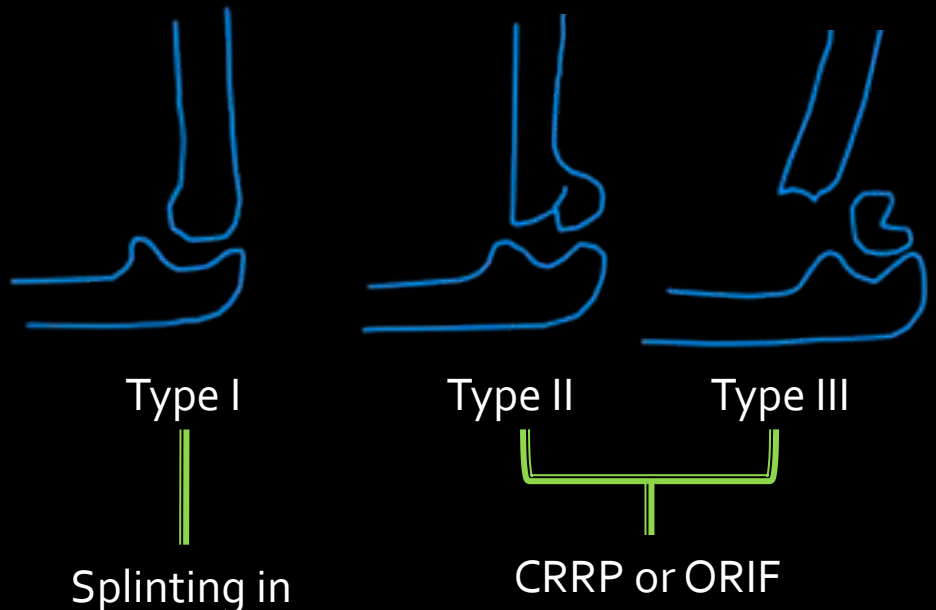
Injury

4 weeks later



Supracondylar Fracture

- Gartland Classification (hyperextension type)
  - Type I: Nondisplaced fx
  - Type II:
    - Posterior angulation or displacement
    - Posterior cortex intact
  - Type III:
    - Displaced fracture
    - Disruption anterior and posterior cortices



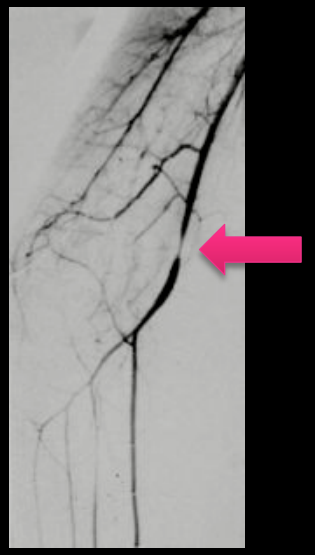
Supracondylar Fracture

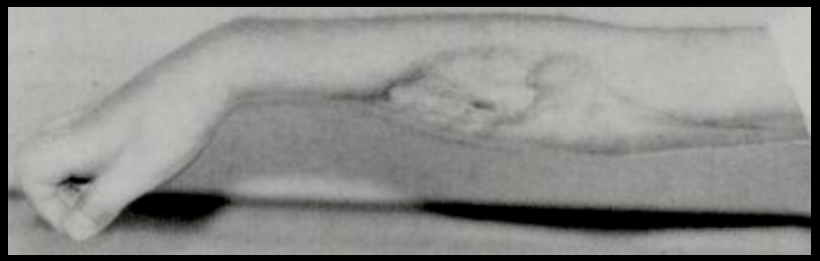
- Flexion type
  - Very rare
    - ~2-4% of supracondylar fractures
  - Fall on flexed elbow
  - Distal fragment displaced anterior to anterior humeral line

Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Supracondylar Fracture

- Complications
  - Vascular injury
    - Brachial artery
    - High energy mechanism
    - Volkmann's ischemic contracture (late)

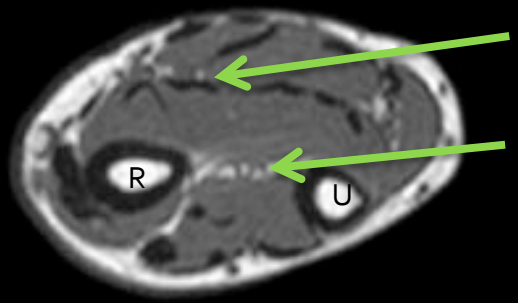


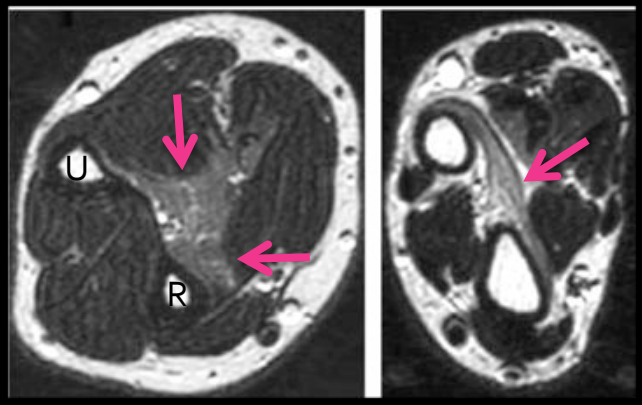


Copley et al, J Pediatr Orthop 1996; 16(1):99-103

Supracondylar Fracture

- Complications
  - Nerve injury
    - Anterior interosseous branch of median nerve
      - Indirect injury by traction
      - May be vulnerable because of relatively fixed position to proximal radius and ulna → tethering of the nerve
      - Inability to flex thumb and index finger distal interphalangeal joints (OK sign)





AIN syndrome: Denervation edema in the flexor pollicis longus, flexor digitorum profundus, and pronator quadratus muscles

Andreisek et al, Radiographics 2006; 26:1267–1287

Supracondylar Fracture

- Complications
  - Premature fusion of trochlear ossification center
  - Cubitus varus

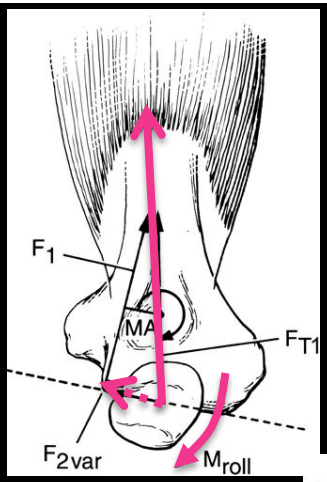
9 year old

Normally, capitellum and trochlea fuse with each other and lateral epicondyle ,before fusing with humerus

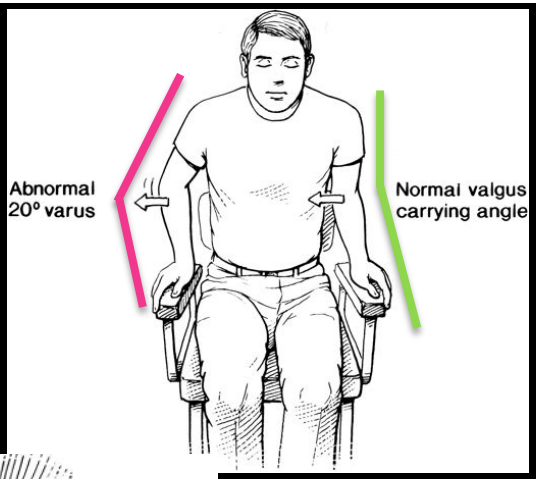
Ecklund, RCNA 2001;29(4):823-841

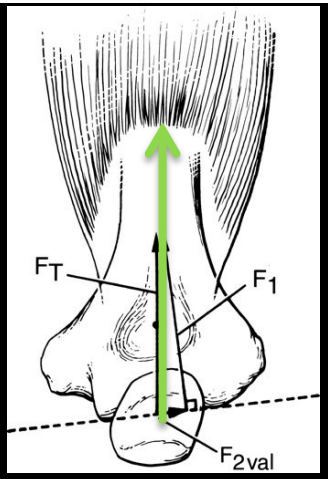
Kim et al, J Pediatr Orthop 2002;22:188-193

Cubitus Varus and PLRI

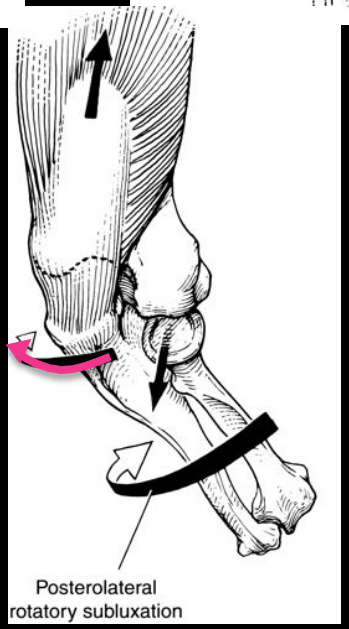


Cubitus varus





Normal triceps force vector



PLRI

O'Driscoll et al, JBJS 2001;83(9):1358-1368

Supracondylar Fracture

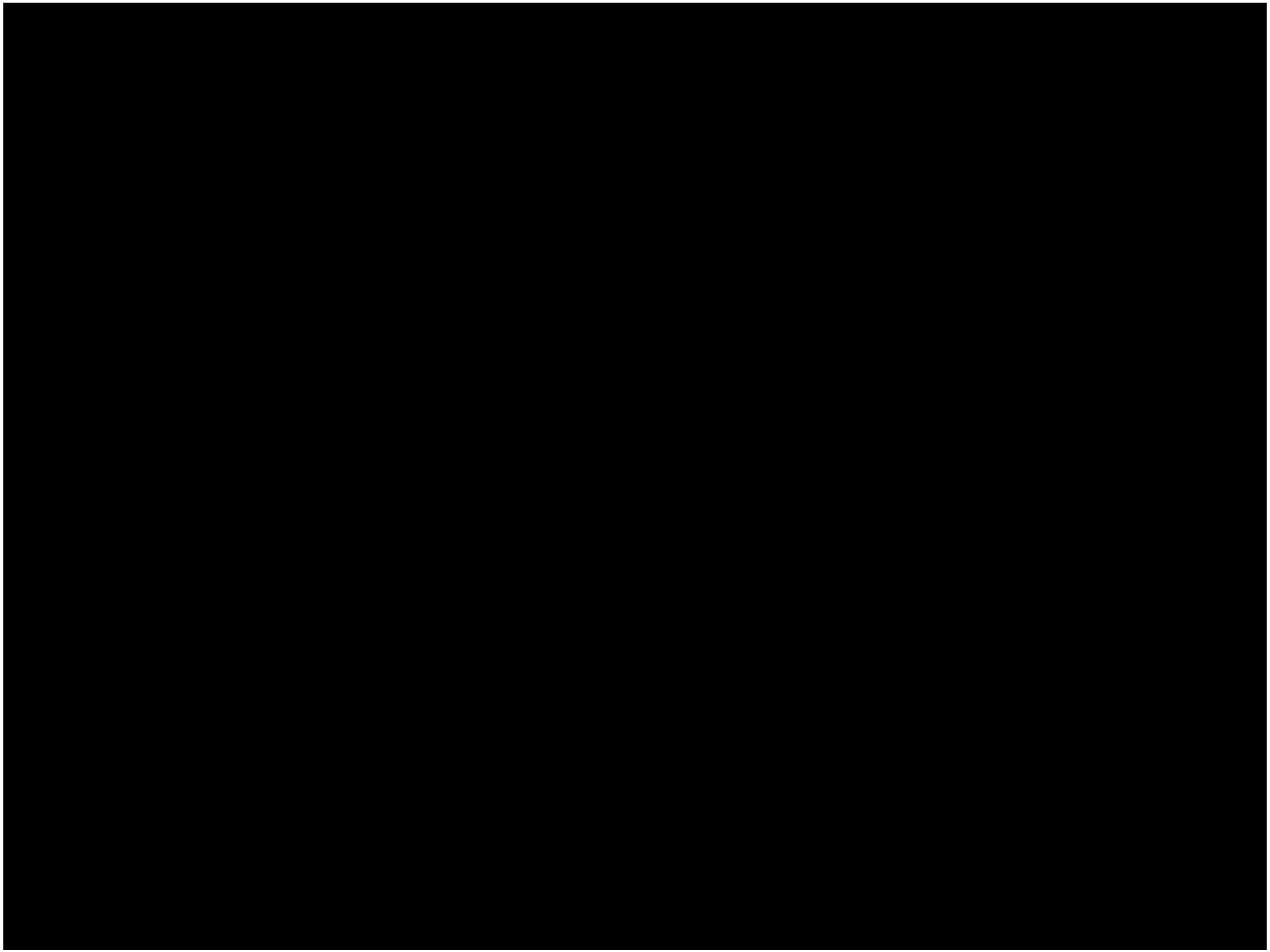
- Complications
  - Fishtail deformity
    - V shaped distal humerus
    - Etiology controversial
      - Premature physeal fusion
      - Avascular necrosis lateral aspect trochlea
    - May lead to restricted range of motion, premature osteoarthrosis

4 years

9 years

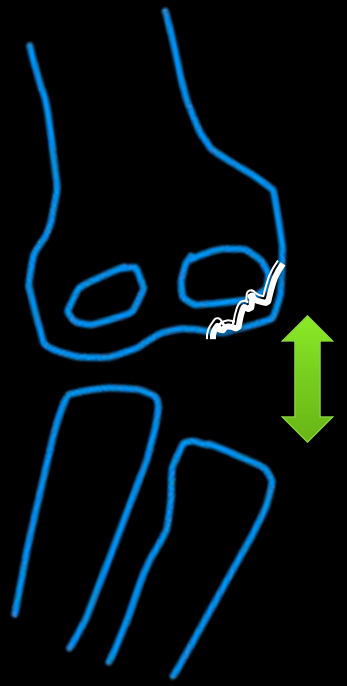
Watershed area of relative hypovascularity at trochlear groove

Bronfen et al, J Pediatr Orthop 2007;27(5):547-50



Lateral Condylar Fracture

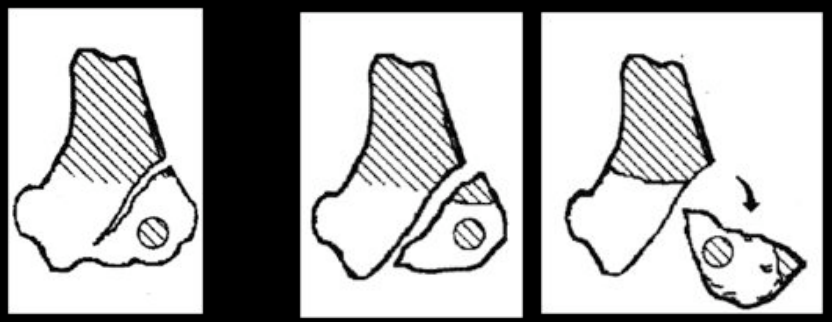
- Second most common pediatric elbow fracture
- Mechanism of Injury
  - Varus angulation with elbow in extension
    - Lateral sided tensile force



Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Lateral Condylar Fracture

- (Jakob) Rutherford classification
  - Based on degree of displacement and articular congruence
  - Type I
    - Extends into cartilaginous epiphysis but not to articular surface
  - Type II
    - Extends through articular surface
    - Mild lateral displacement
    - Unstable
  - Type III:
    - Displaced, frequently rotated fragment
    - Loss of normal relationship of capitellum to radius
    - Unstable



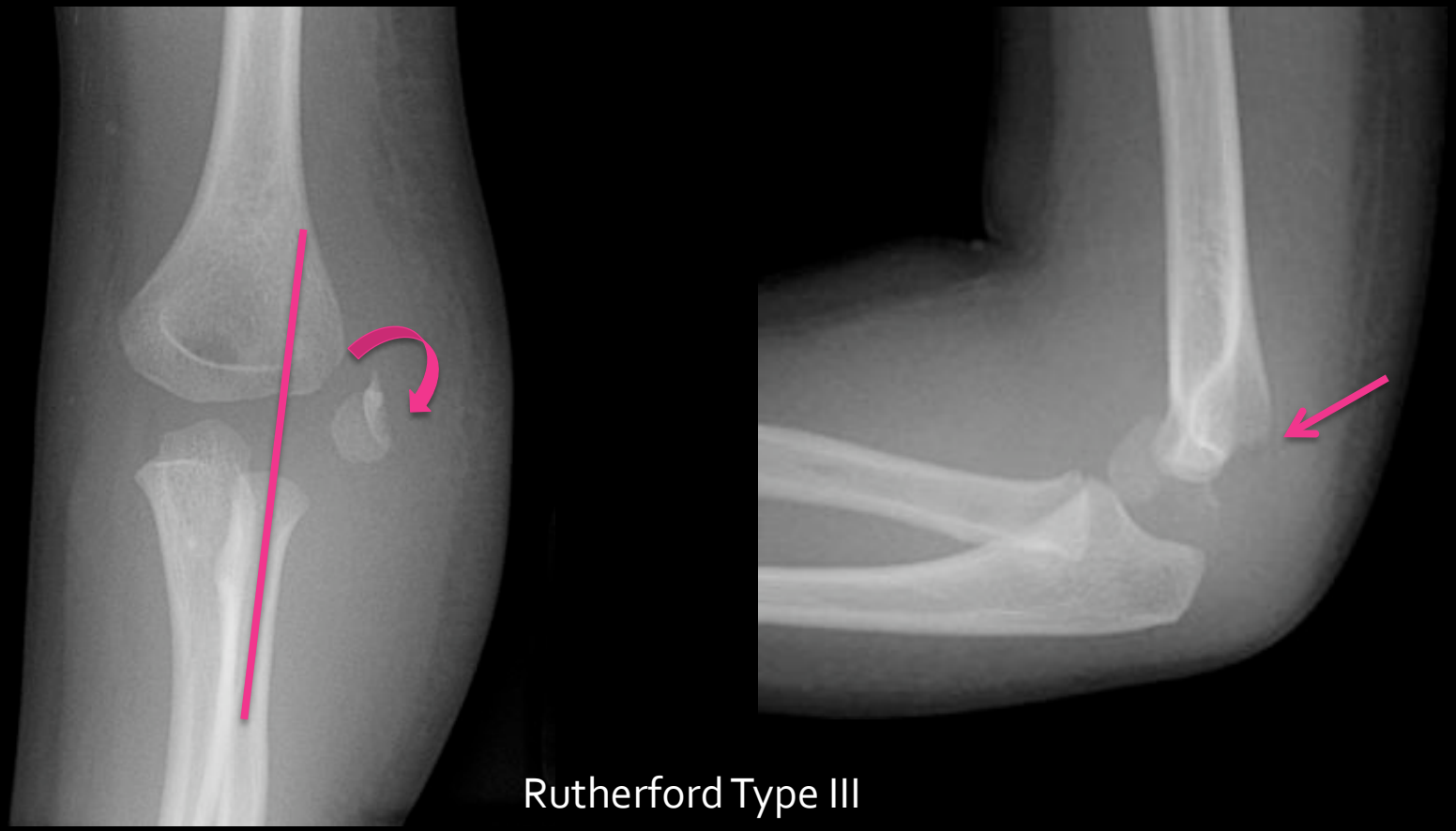
Type I | Type II | Type III

Immobilization

CRRP or ORIF

Beltran et al, Skeletal Radiol 1994; 23:277-281

Lateral Condylar Fracture



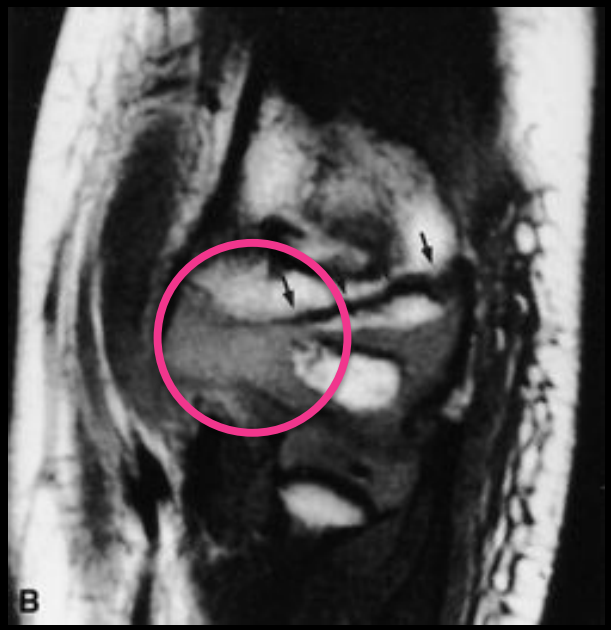
Rutherford Type III

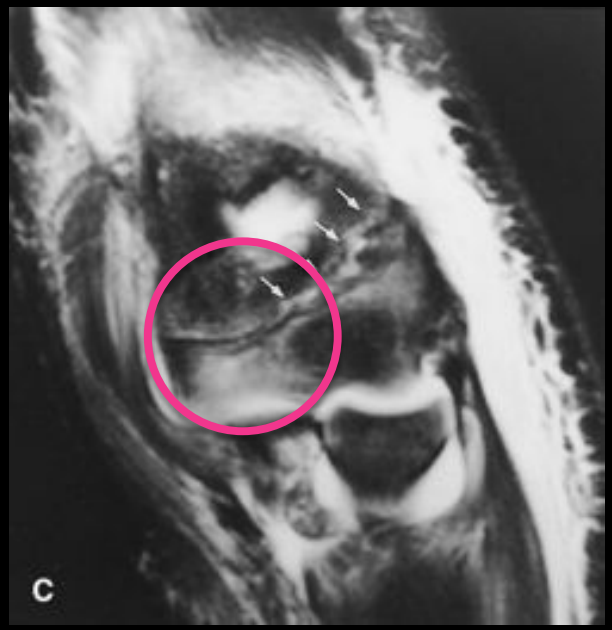
Lateral Condylar Fracture

No definite extension of intraarticular contrast into fracture

Rutherford Type I

Lateral Condylar Fracture

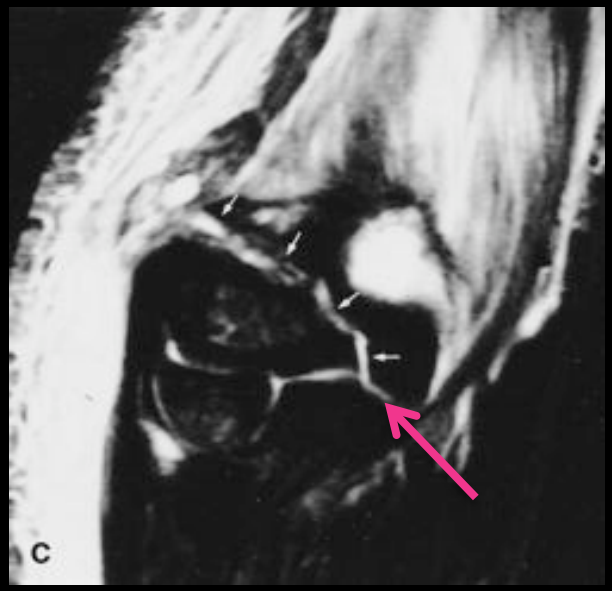




Rutherford Type I

Kamegaya et al, J Pediatr Orthop 1999;19(5):570-2

Lateral Condylar Fracture



Rutherford type II

Kamegaya et al, J Pediatr Orthop 1999;19(5):570-2

Lateral Condylar Fracture

- Complications
  - Non-union
  - Malunion
    - Premature fusion of the capitellar physis
    - Osteonecrosis

Non union

Premature closure

Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Ecklund, RCNA 2001;29(4):823-841

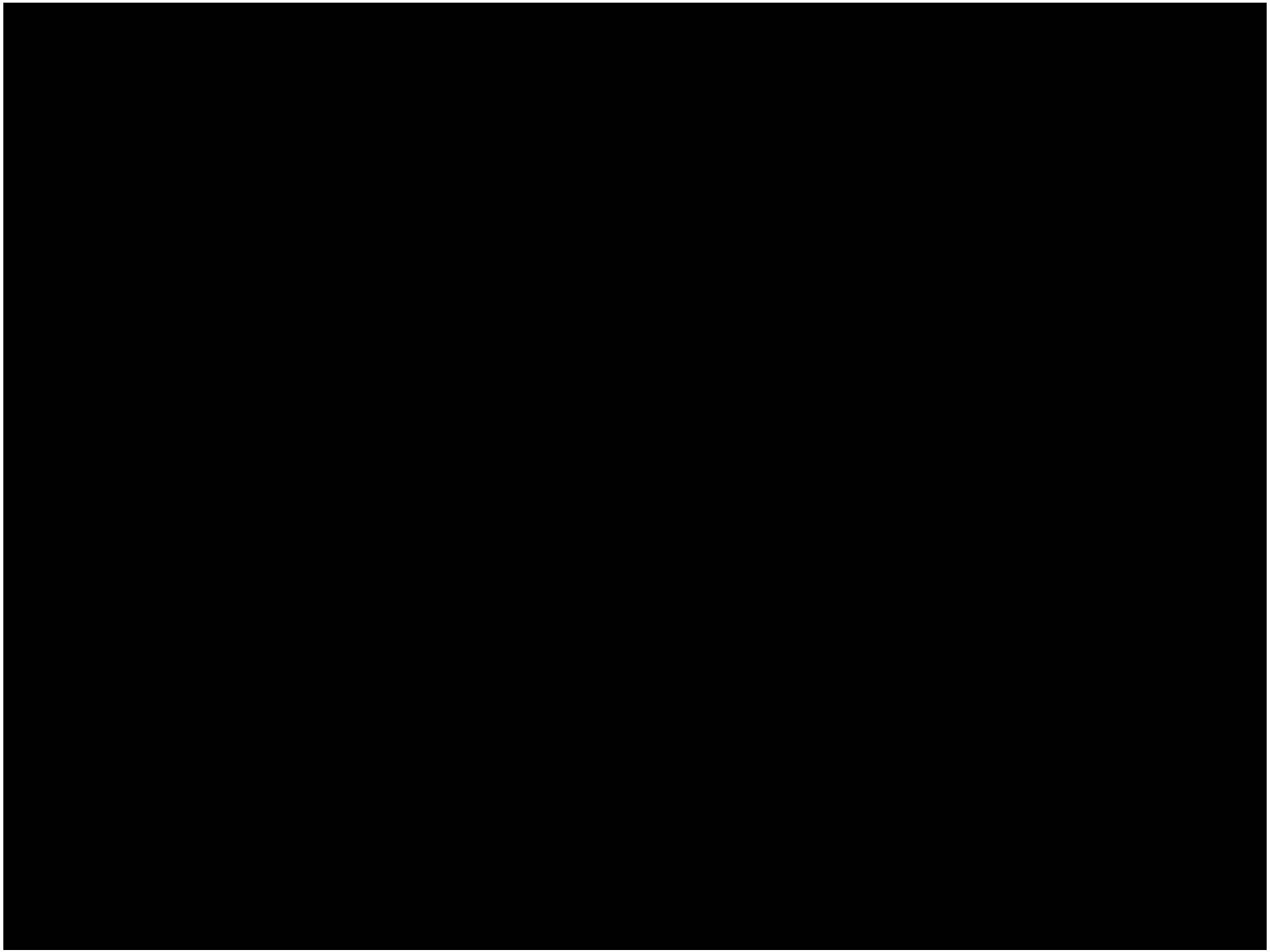
Lateral Condylar Fracture

- Complications
  - Cubitus valgus
  - Tardy ulnar nerve palsy
    - Deficient lateral trochlear lip
    - Lateral shift of the ulna
    - Roof of cubital tunnel compresses ulnar nerve

Cubitus varus

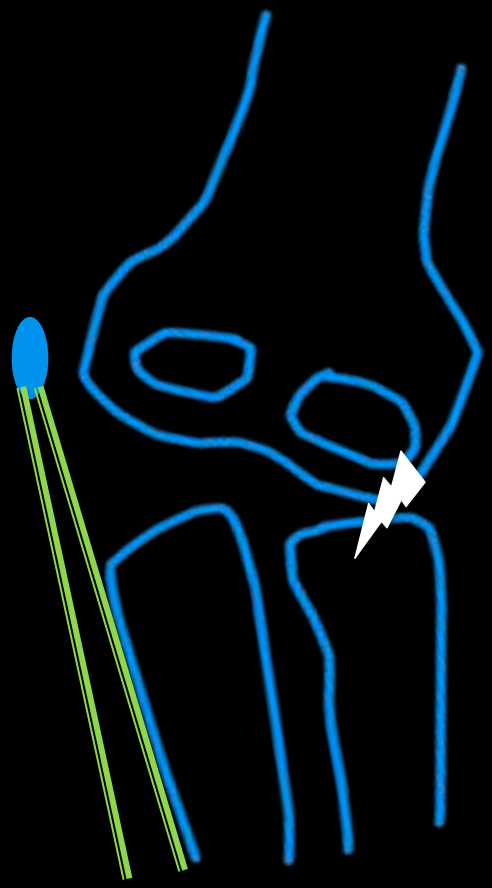
Normal

Wadsworth, Clin Orthop Rel Res 1972;85:127-142



Medial Epicondylar Fracture

- Older children (10-14 yrs)
- Mechanism
  - FOOSH
    - Valgus stress
      - Tensile force on MCL complex and common flexor tendon
      - Failure at growth plate
    - Axial compression
      - Lateral side compression injury



Medial Epicondylar Fracture

- Imaging
  - XR
    - Widened physis
      - Comparison w/ contralateral side useful
    - Associated injuries
      - Osteochondral injury capitellum
      - Proximal radial fracture

Medial Epicondylar Fracture

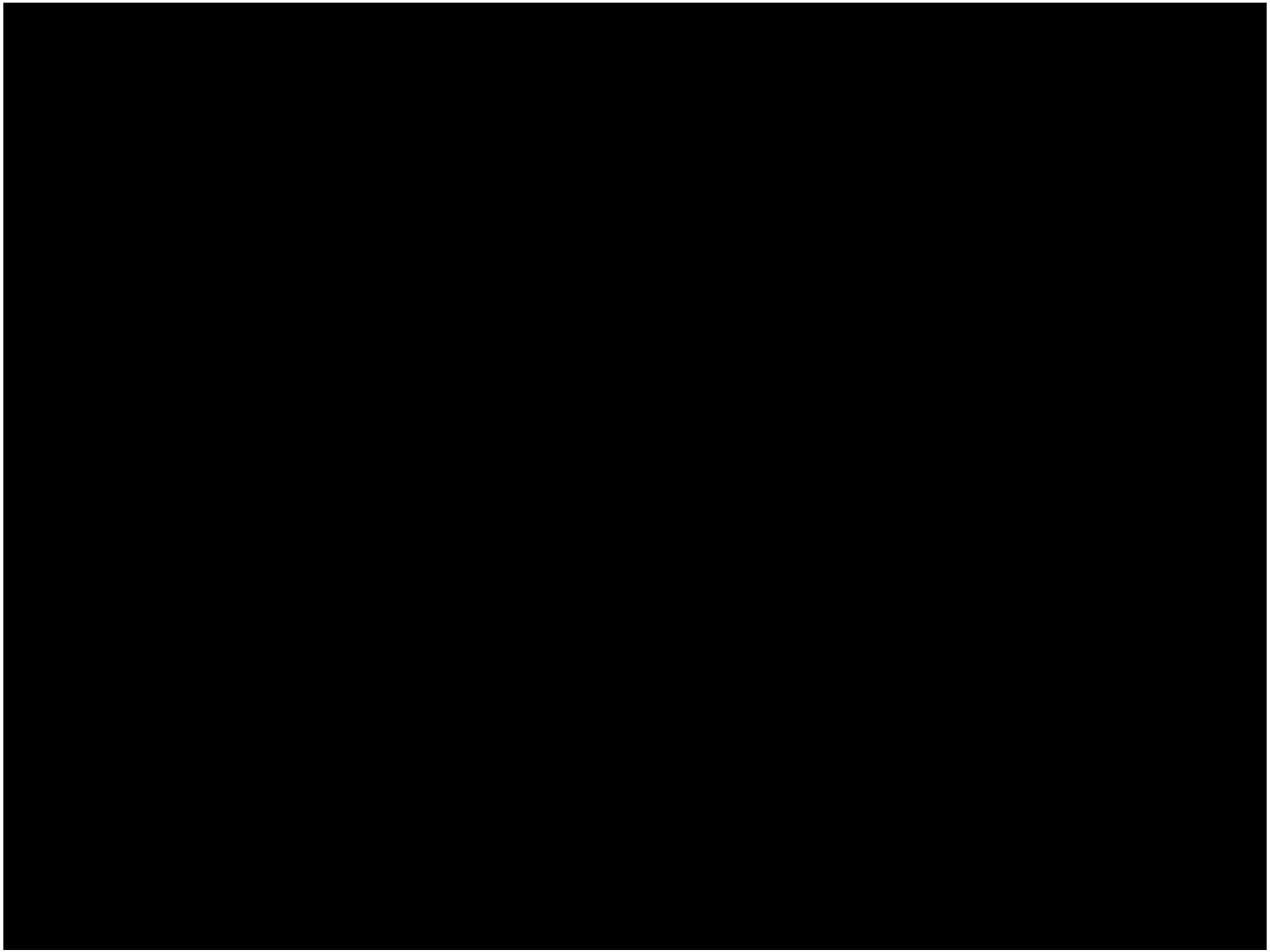
- Complications
  - Medial epicondylar entrapment
    - Transient medial joint space widening
    - Entrapment between trochlea and ulna
    - May mimic a trochlear ossification center
      - Remember CRITOE– "I" before "T"
      - Suspect if trochlear ossification center is seen without medial epicondylar ossification center

Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Medial Epicondylar Fracture

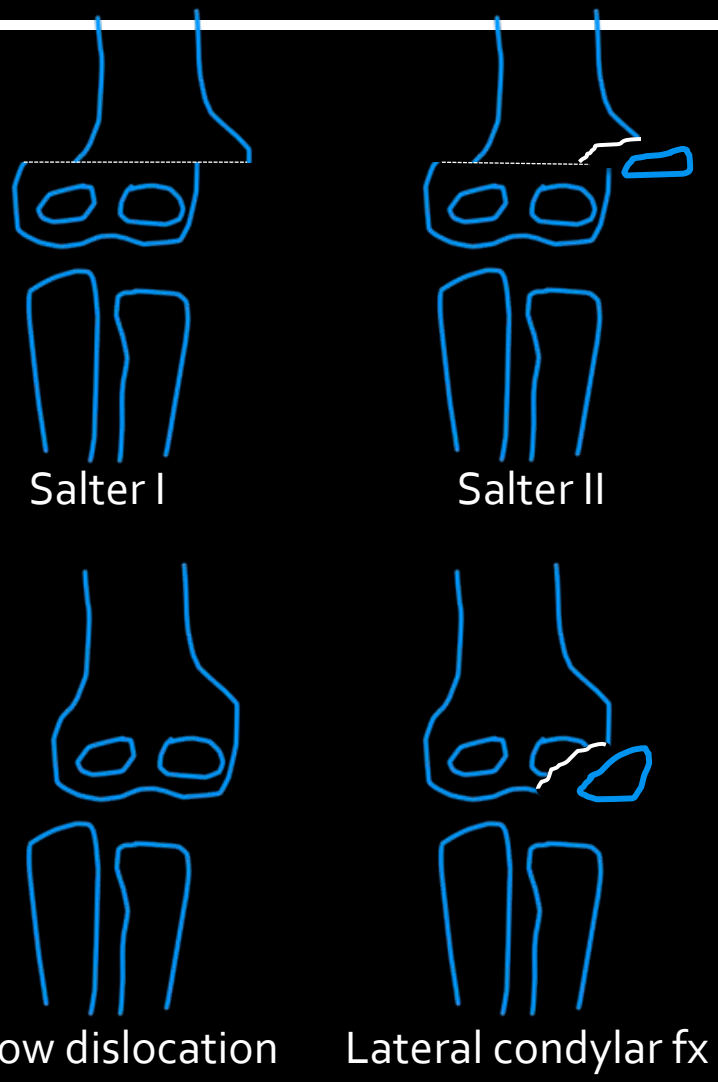
- Management
  - Conservative
    - Nondisplaced or mildly displaced
      - Splinting in 90° flexion
  - Operative
    - Irreducible entrapment in joint
    - Valgus instability
    - Displaced fx in athlete (pitcher, gymnast)

ORIF



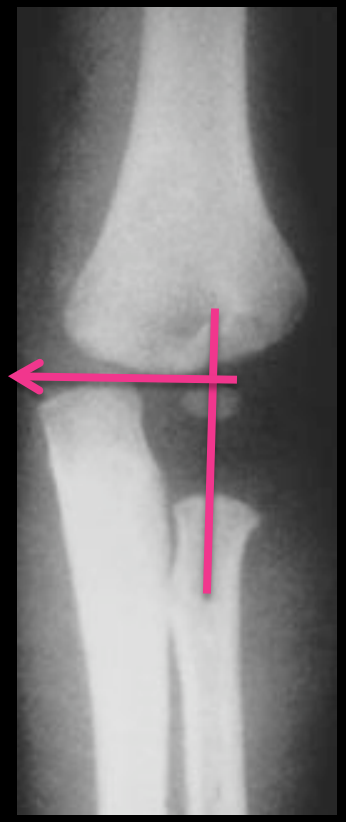
Distal Humeral Epiphysis Fracture-Separation

- aka Transphyseal fx
  - Fracture through the physis
  - Salter I or II Injury
- Mechanism of injury
  - Twisting or pulling injury → shearing stress
  - Birth injury (neonates)
  - Non accidental trauma



Distal Humeral Epiphysis Fracture-Separation

- Imaging
  - X-ray
    - Posteromedial displacement of the radius and ulna with respect to distal humerus
    - Radiocapitellar line preserved



20 mo old boy

36 mo old boy

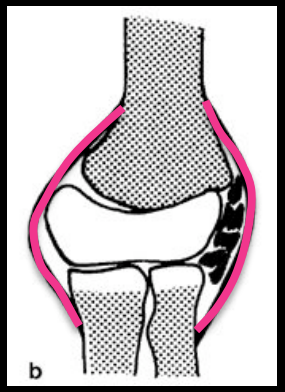
Oh et al, J Pediatr Orthop 2000;20 (2):173-176

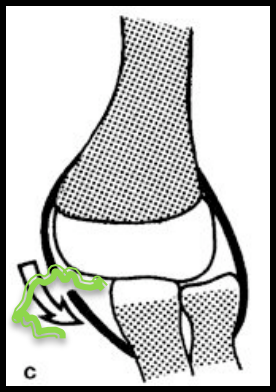
Distal Humeral Epiphysis Fracture-Separation:

- Imaging
  - X-ray
    - Indistinguishable from elbow dislocation if capitellum unossified
      - Arthrogram
        - Epiphyseal fracture-separation: Normal
        - Dislocation: Contrast extravasation from torn joint capsule

Epiphyseal separation

Elbow Dislocation

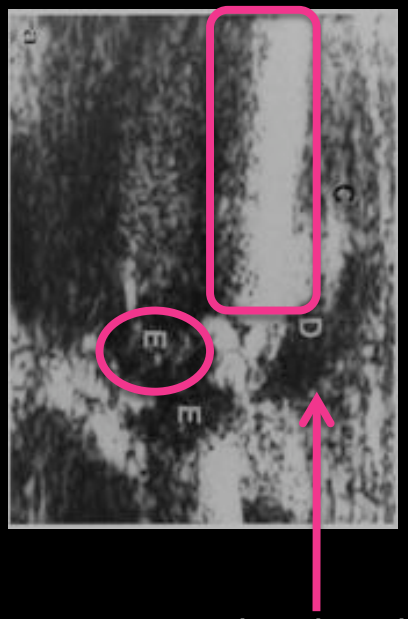


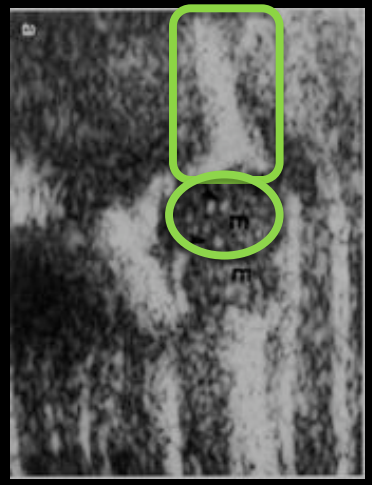


Oh et al, J Pediatr Orthop 2000;20 (2):173-176
Ziv et al, Pediatr Radiol 1996;26:493-496

Distal Humeral Epiphysis Fracture-Separation

- Imaging
  - Ultrasound
    - Malalignment between the humeral shaft and distal epiphysis
    - Blood and debris in the joint space



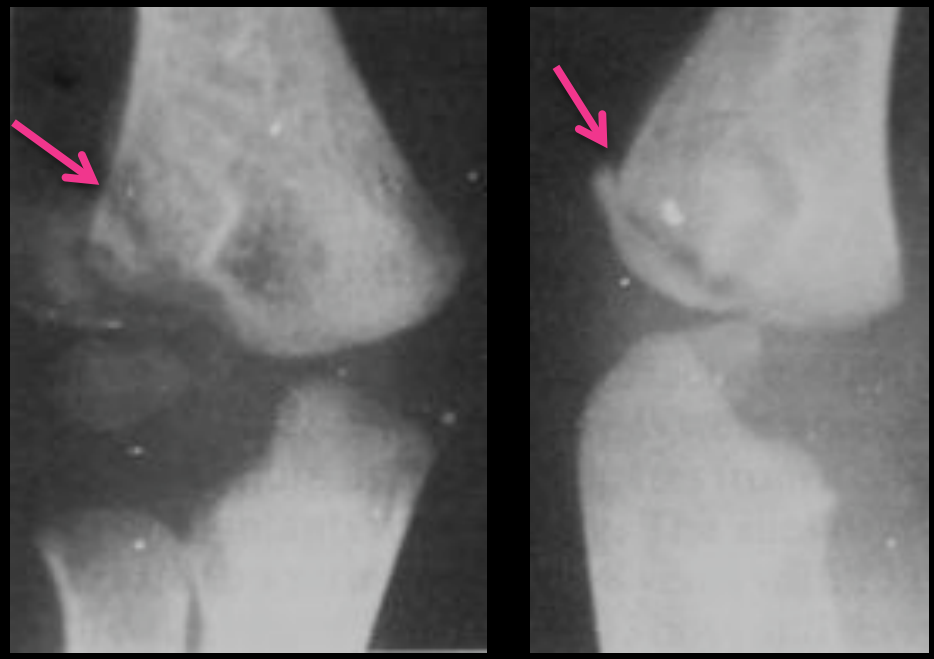


Normal

Ziv et al, Pediatr Radiol 1996;26:493-496

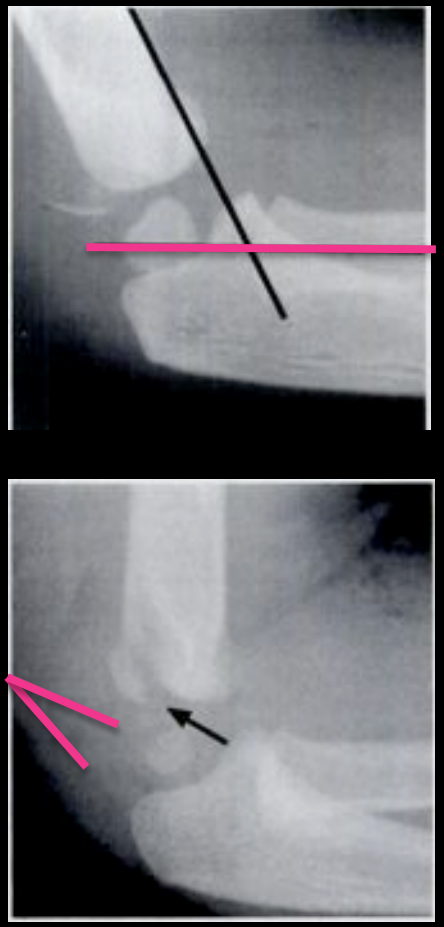
Distal Humeral Epiphysis Fracture-Separation

- Imaging
  - Salter II
    - Fracture fragment from the metaphysis
    - Mimics lateral condylar fracture



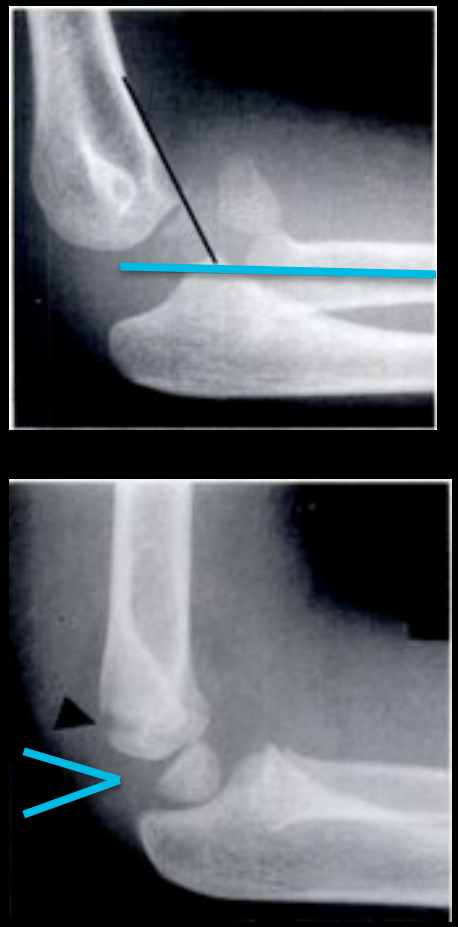
Ruo, Clinical Radiol 1987;38:635-637

Distal Humeral Epiphysis Fracture-Separation



Hinges posteriorly, opens anteriorly

Lateral Condylar Fracture

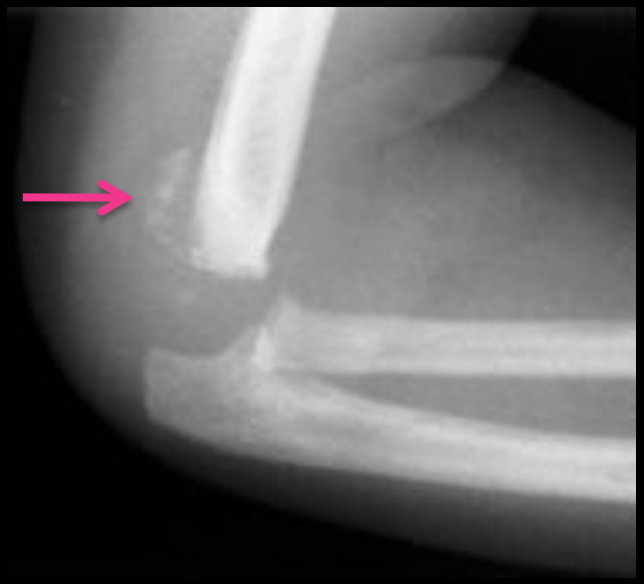


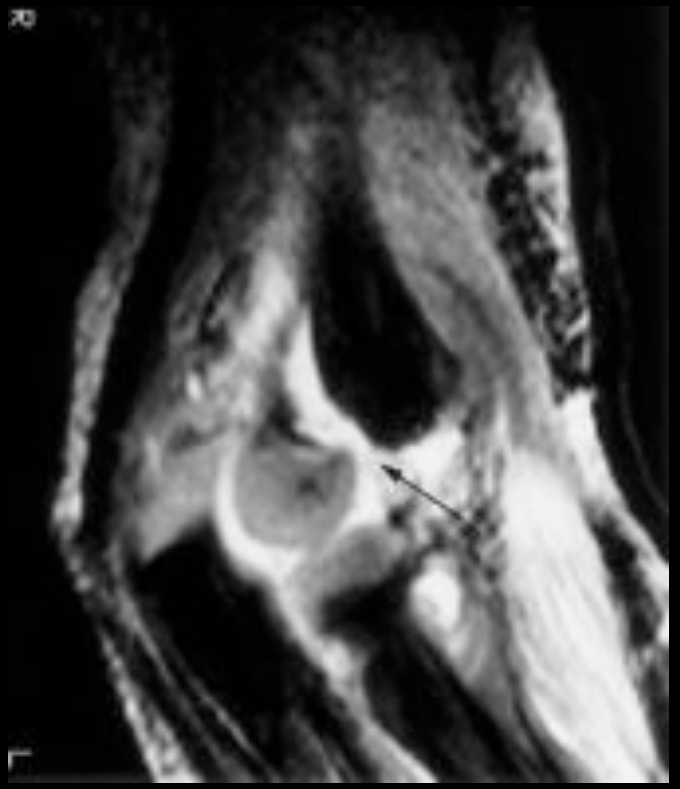
Hinges anteriorly, opens posteriorly

Jager & Hoffman, JBJS (Br) 1991;73B:143-146

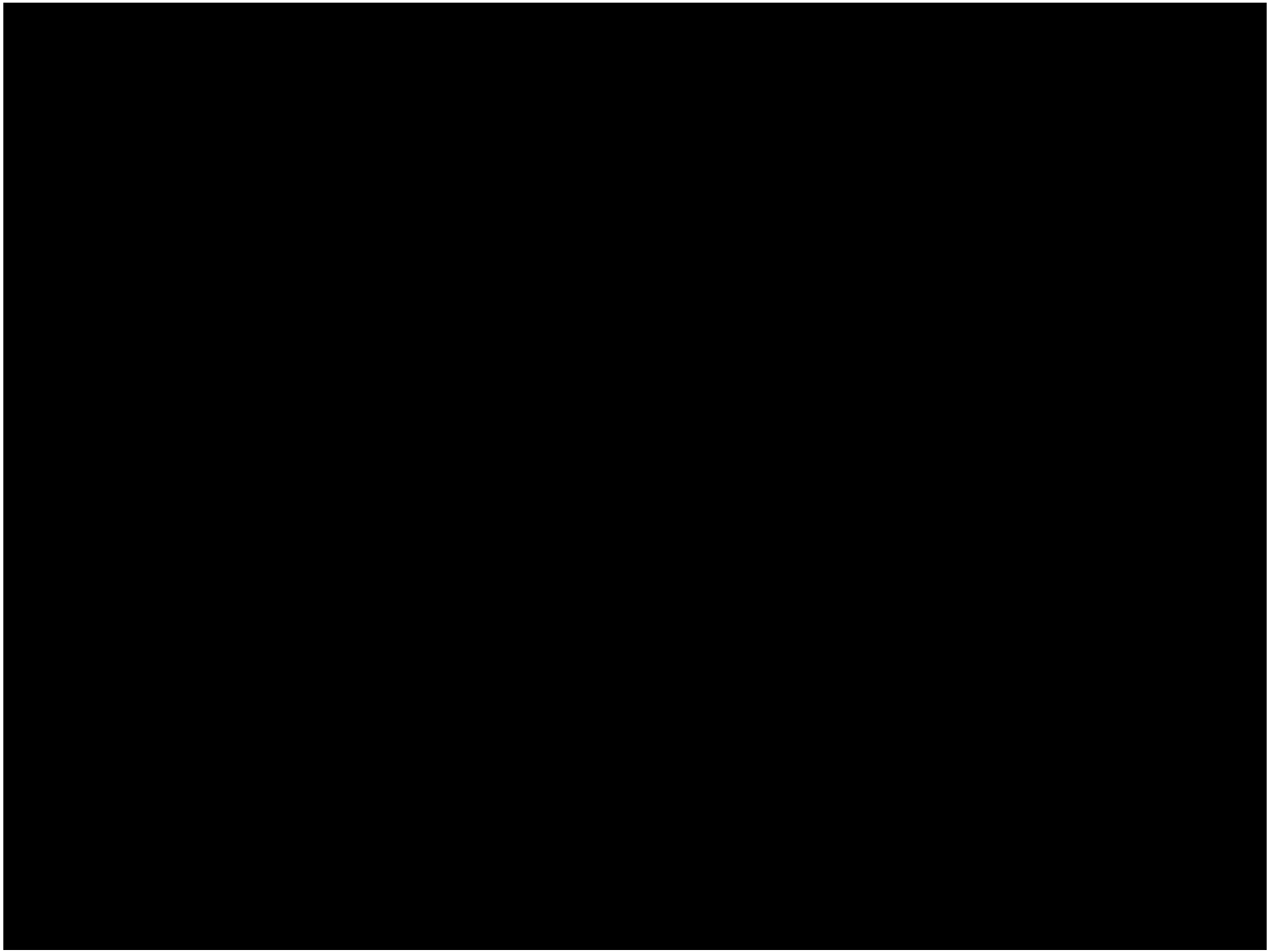
Distal Humeral Epiphysis Fracture-Separation:

- Imaging
  - MRI



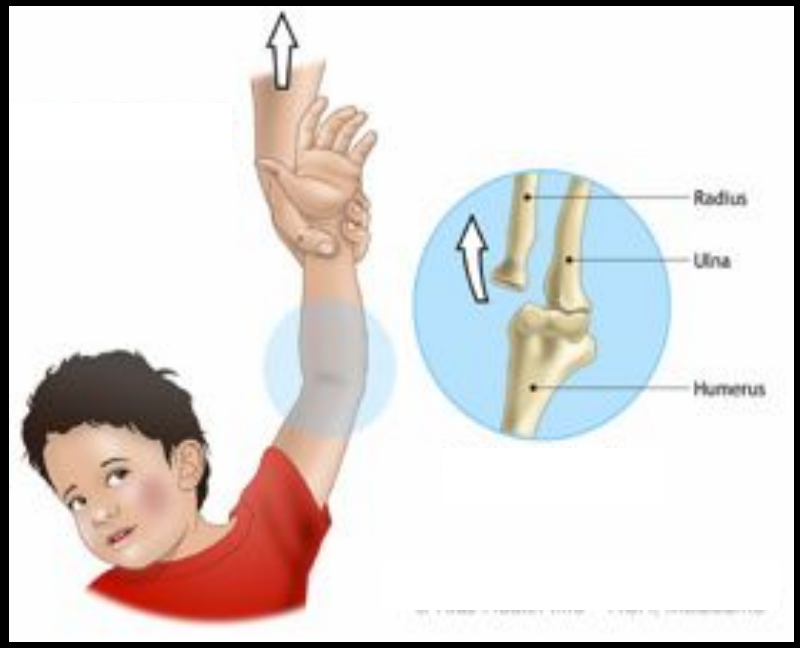


Carey et al, Skeletal Radiol 1998;27:250-255



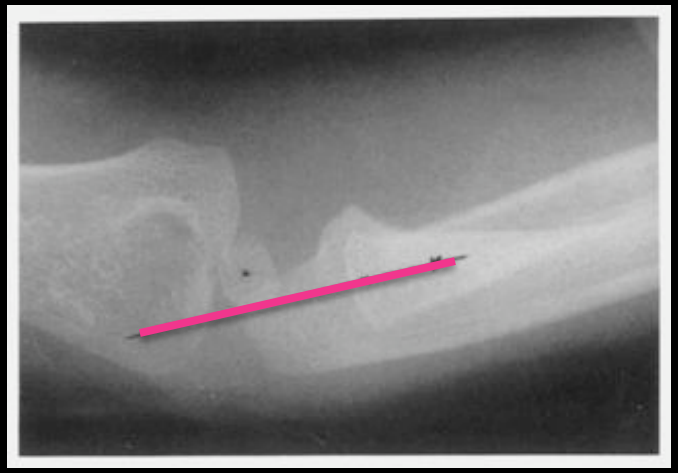
Radial Head Subluxation

- "Nursemaid's elbow" or "pulled elbow"
- Most common traumatic elbow injury in children
- Average age 2-4 years
- Mechanism of injury:
  - Sudden longitudinal traction with forearm in pronation



Radial Head Subluxation

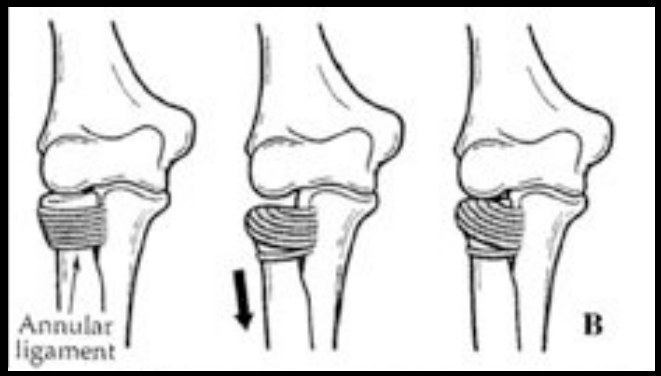
- Imaging
  - XR
    - Abnormal radiocapitellar line



Synder, J Emergency Med 1990;8:265-269

Radial Head Subluxation

- Imaging
  - US / MRI
    - Annular ligament
      - Tear
      - Entrapment between radial head and capitellum

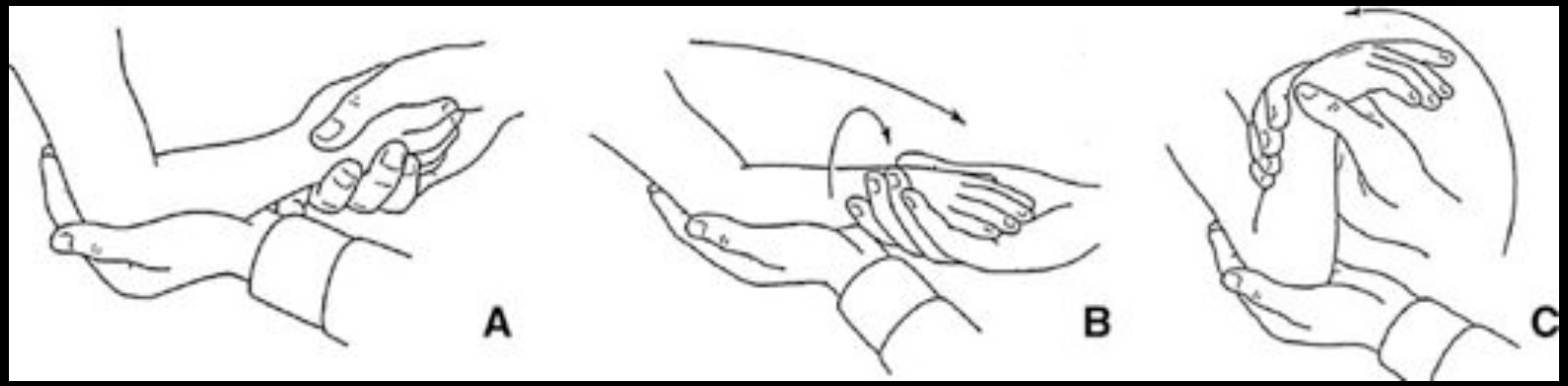


Normal Subluxed

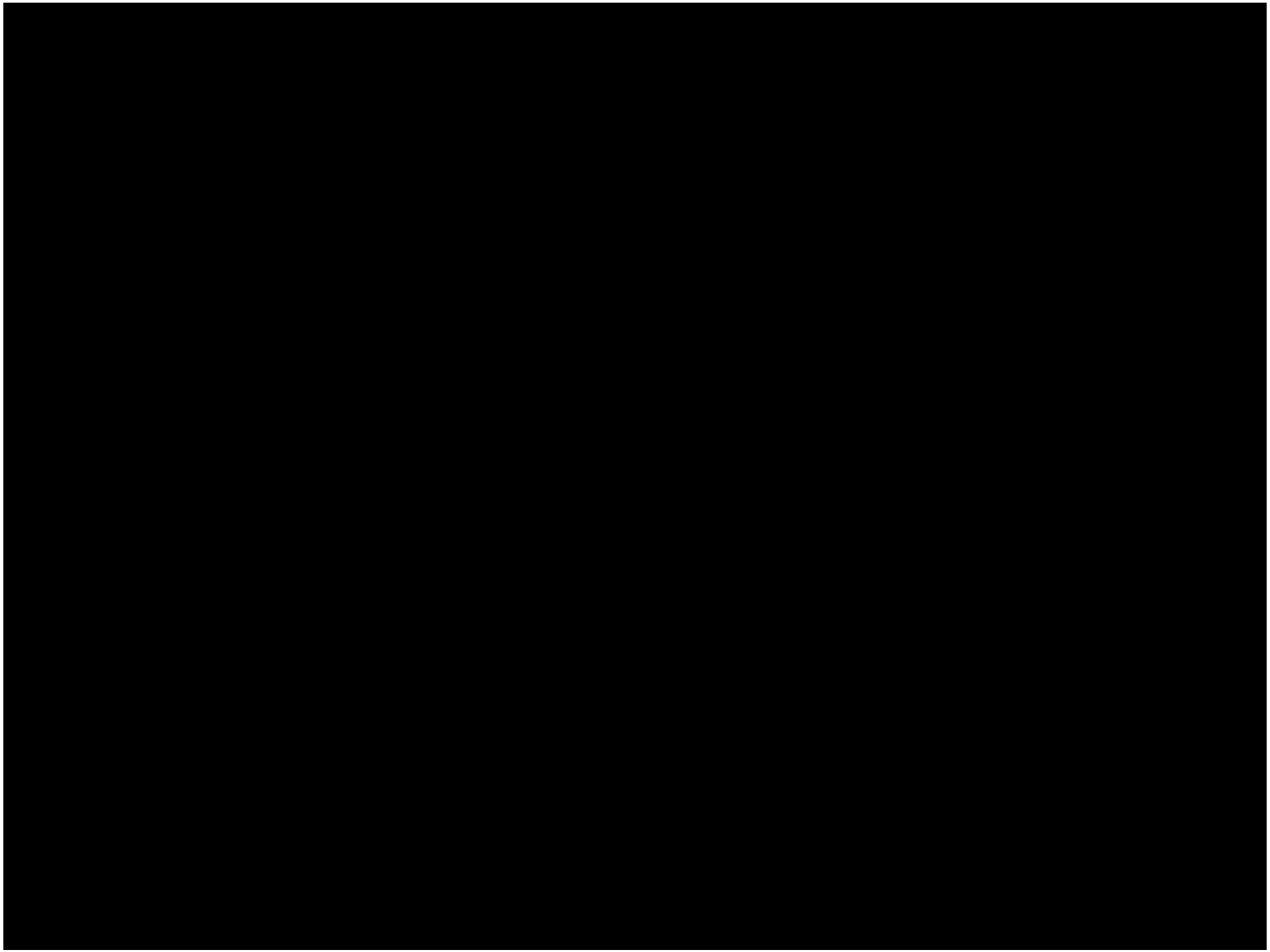
Diab et al, J Child Orthop 2010;4:539-543

Radial Head Subluxation

- Management
  - Reduction by pronation of forearm and elbow flexion

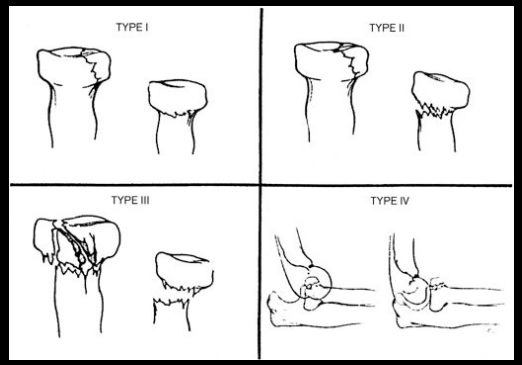


Diab et al, J Child Orthop 2010;4:539-543



Proximal Radial Fracture

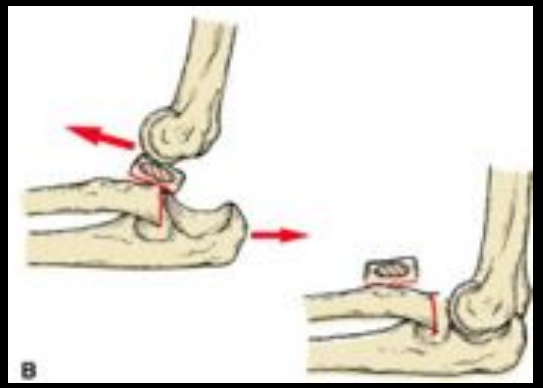
- Mechanism of injury
  - FOOSH
    - Valgus force
    - Axial compression (lateral side)
- Associations
  - Medial epicondyle avulsion
  - DRUJ dislocation (Essex Lopresti fracture-dislocation)
- Mason classification (adults)

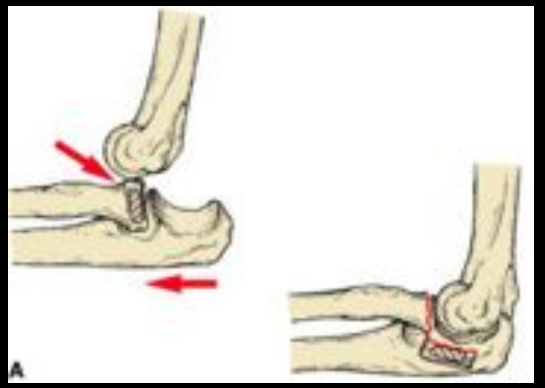


Malvik et al, J Pediatr Orthop 2003;12(1):63-68

Proximal Radial Fracture

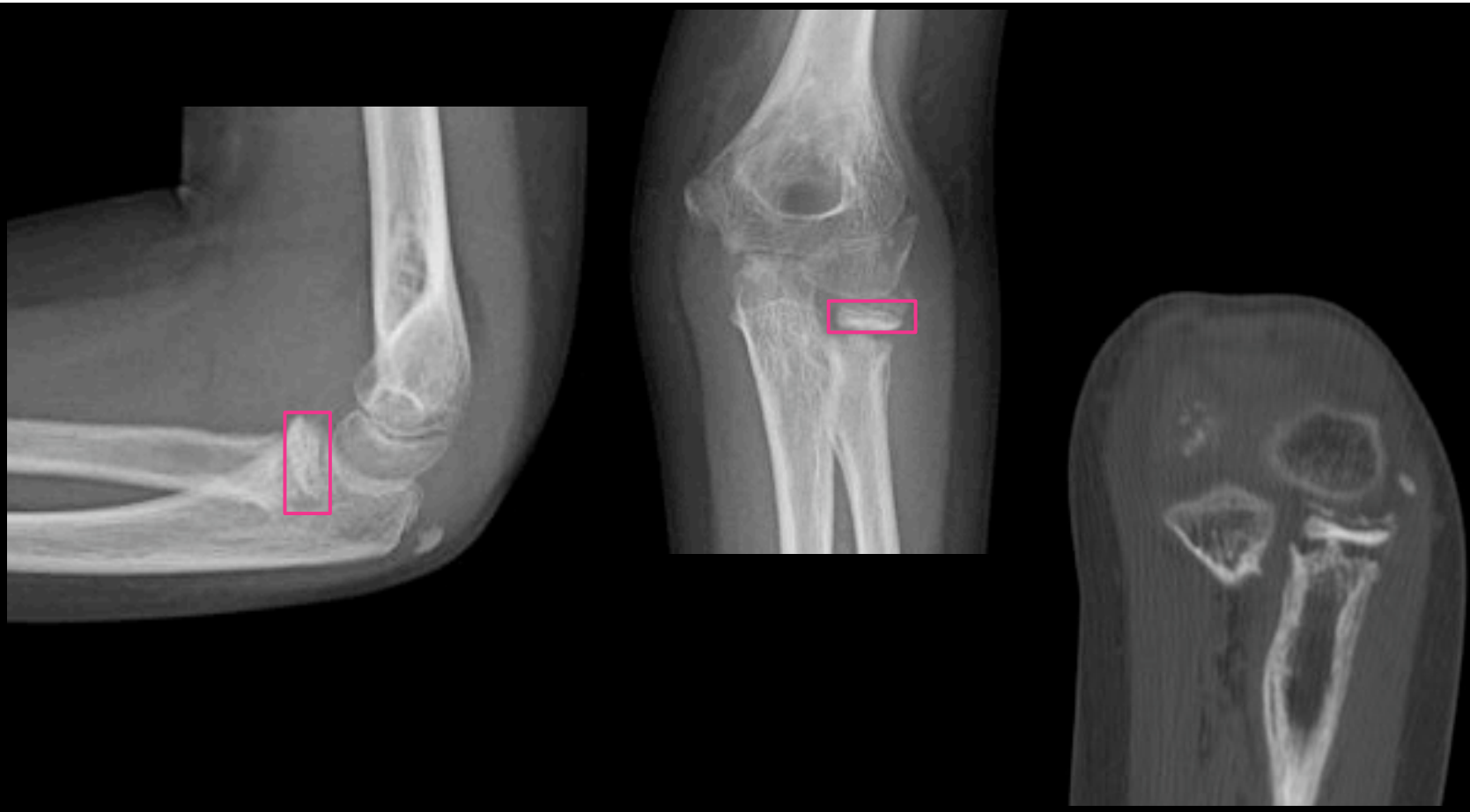
- Posterior elbow dislocation
  - Fracture during dislocation
    - Anterior displacement radial head
  - Fracture during relocation
    - Posterior displacement radial head





Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

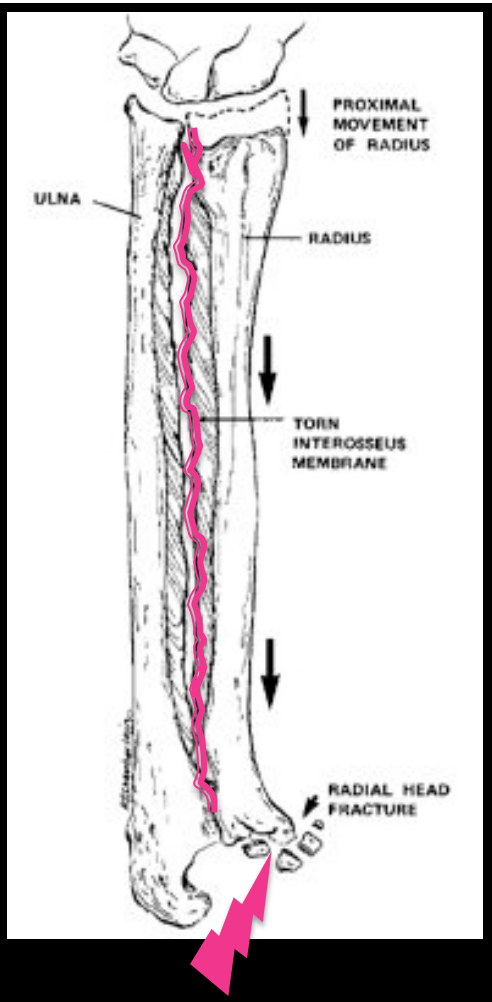
Proximal Radial Fracture



Courtesy Jerry Dwek , MD

Essex Lopresti Fracture-Dislocation

- Proximal radial fracture + DRUJ dislocation
- Rare
- High energy injury mechanism
  - Longitudinal compression force
  - Interosseous membrane disruption

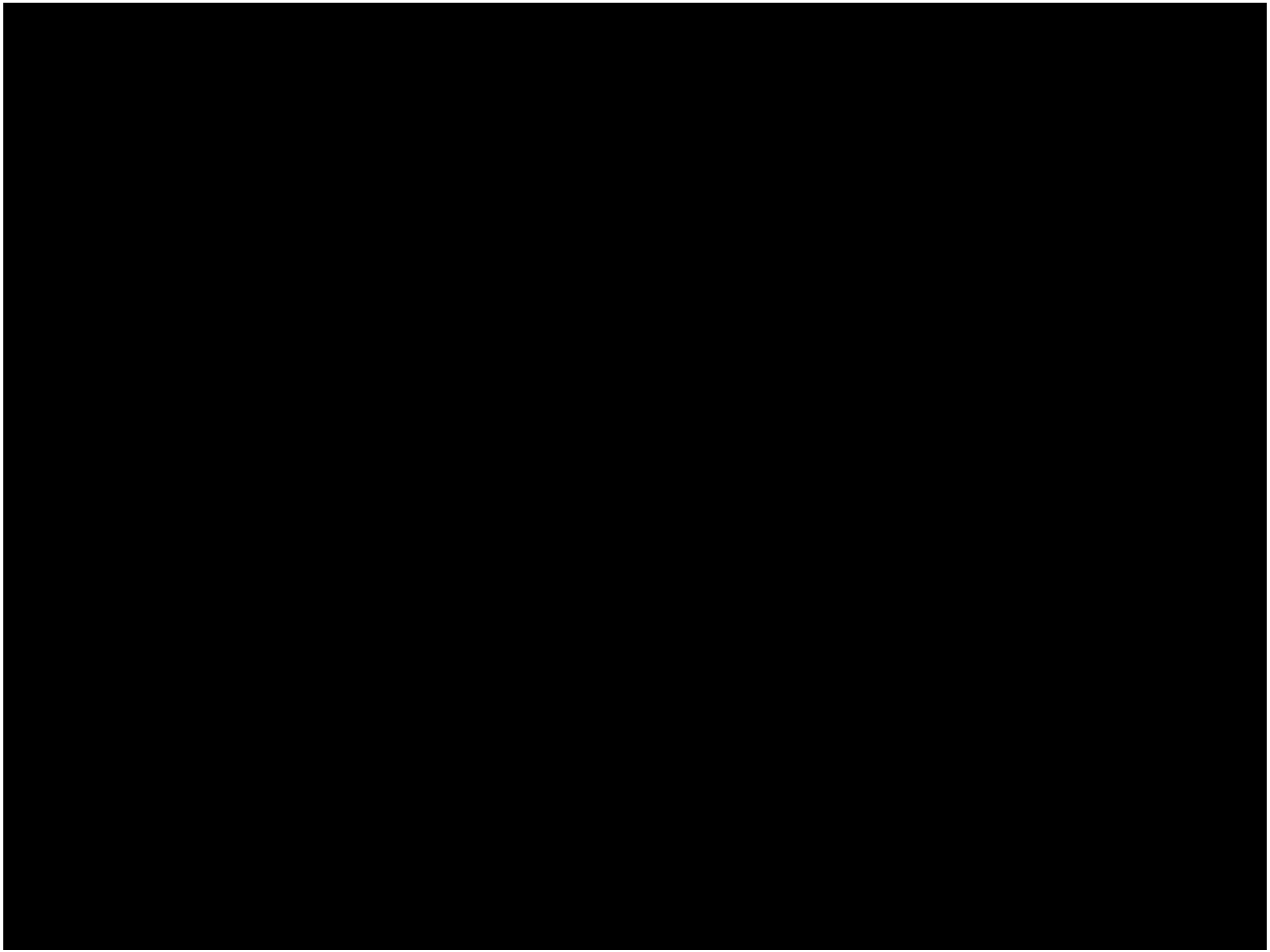


Bock et al, Skeletal Radiol 1992;21:315-317

Essex Lopresti Fracture-Dislocation

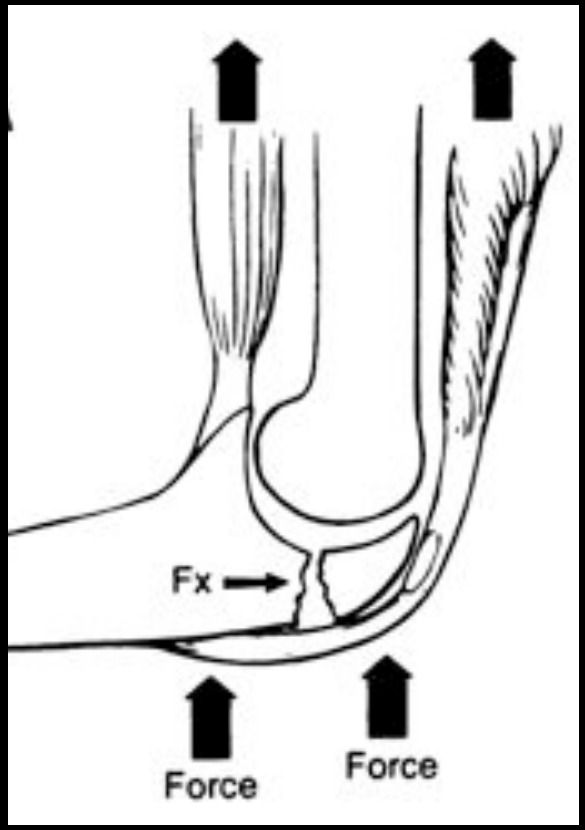
- Imaging
  - Severely comminuted radial head fracture
  - Shortening / proximal migration of radius
  - DRUJ diastasis
    - Ulnar positive variance
  - ± Distal radial or scaphoid fracture

Bock et al, Skeletal Radiol 1992;21:315-317



Olecranon Fracture

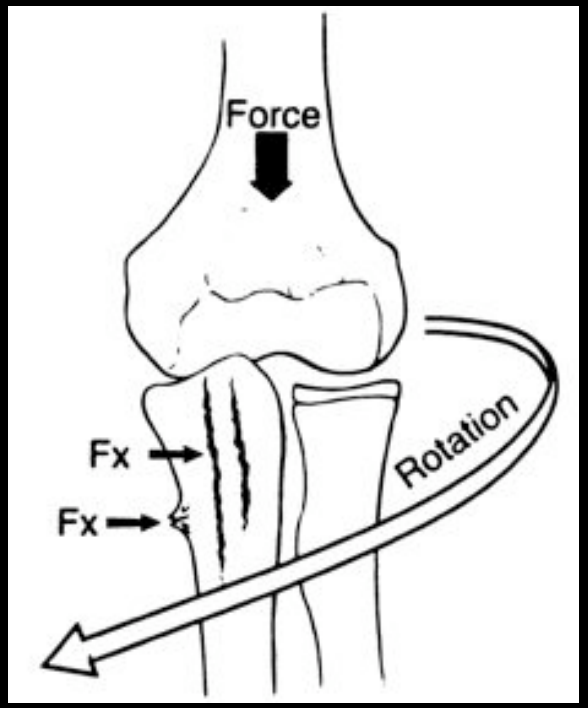
- Transverse fracture
  - Mechanism of Injury
    - Axial compression
      - Fall on a flexed elbow
      - Direct blow to olecranon



John et al, Radiographics 1996; 16: 1443-1460

Olecranon Fracture

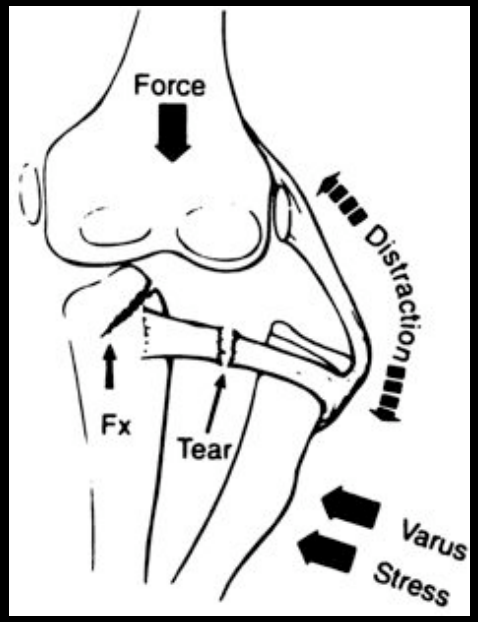
- Longitudinal fracture
  - Mechanism of injury
    - Hyperextension
    - Axial compression
    - Rotational stress



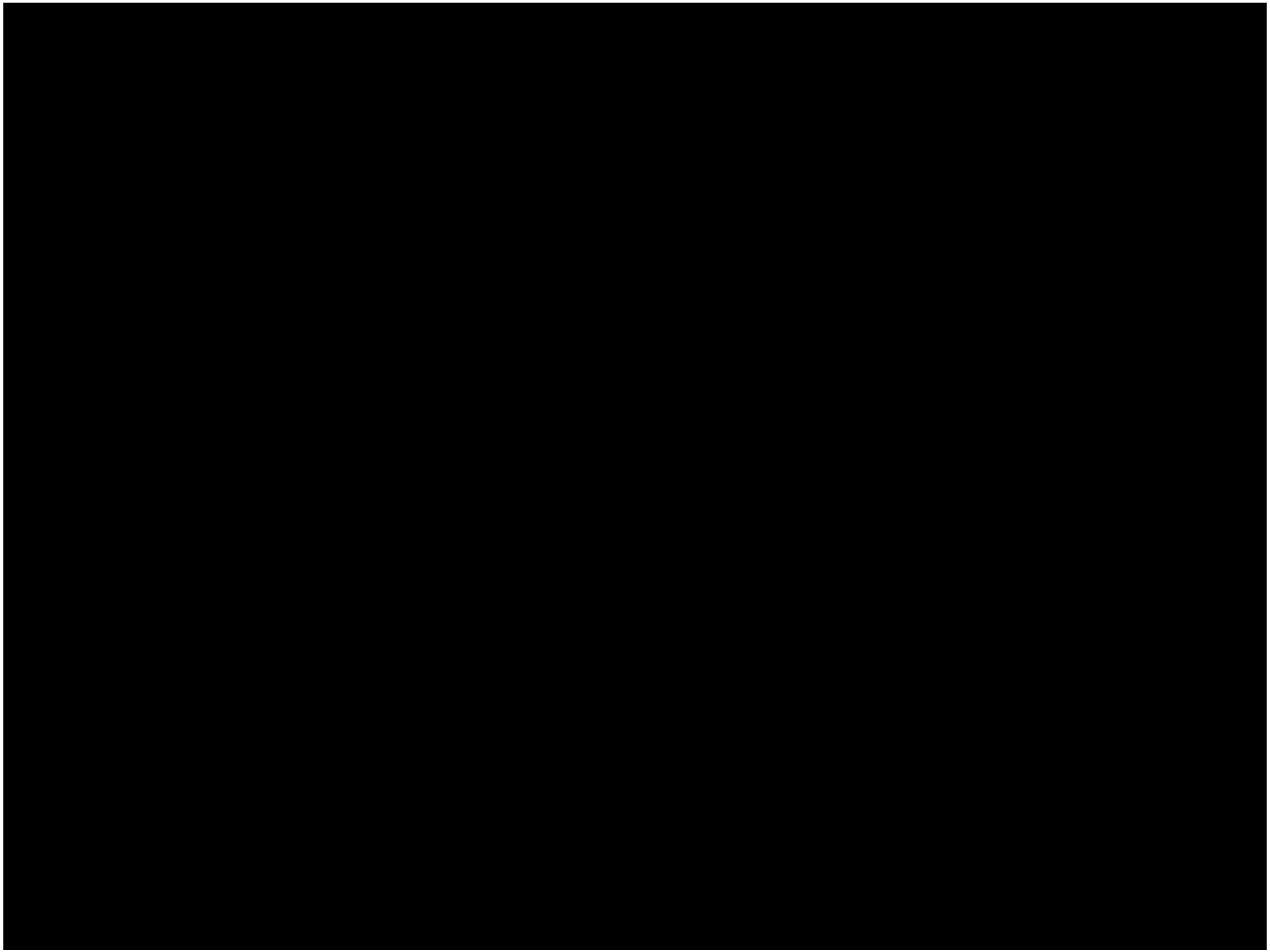
John et al, Radiographics 1996; 16: 1443-1460

Olecranon Fracture

- Monteggia fracture-dislocation
  - Fracture proximal third ulna + radial head dislocation
  - Mechanism
    - Hyperextension
    - Axial compression
    - Varus stress



John et al, Radiographics 1996; 16: 1443-1460

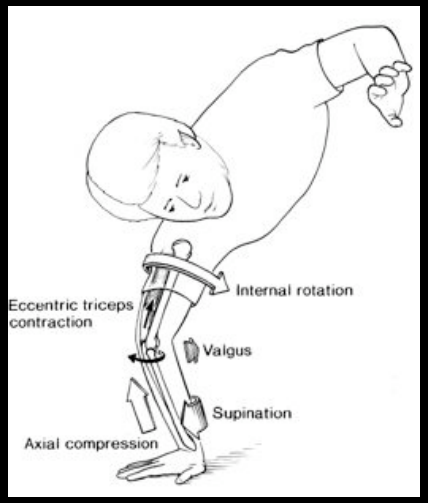


Elbow dislocation

- Displacement of proximal forearm with respect to humerus
  - Posterior
    - Posterolateral
    - Posteromedial
    - Divergent
  - Anterior
    - Anteromedial
    - Anterolateral
- Associated fractures
  - Medial epicondyle avulsion
  - Coronoid process fx
  - Radial head/neck fx
  - Lateral condyle fx
  - Olecranon fx

Posterolateral Elbow Dislocation

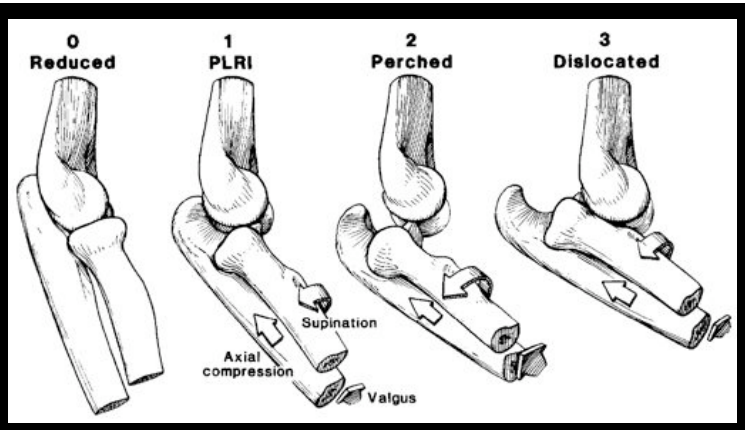
- Mechanism of injury
  - FOOSH
    - Valgus stress
    - Axial compression
    - Supination forearm

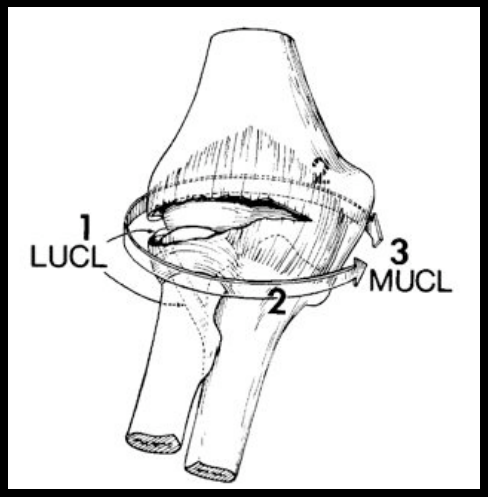


O'Driscoll et al , JBJS 2000;82(5):724-738

Rasool, JBJS 2004;86-B:1050-1058

Posterolateral Rotary Instability



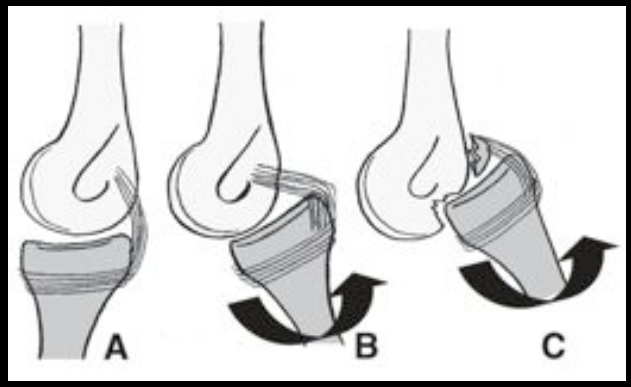


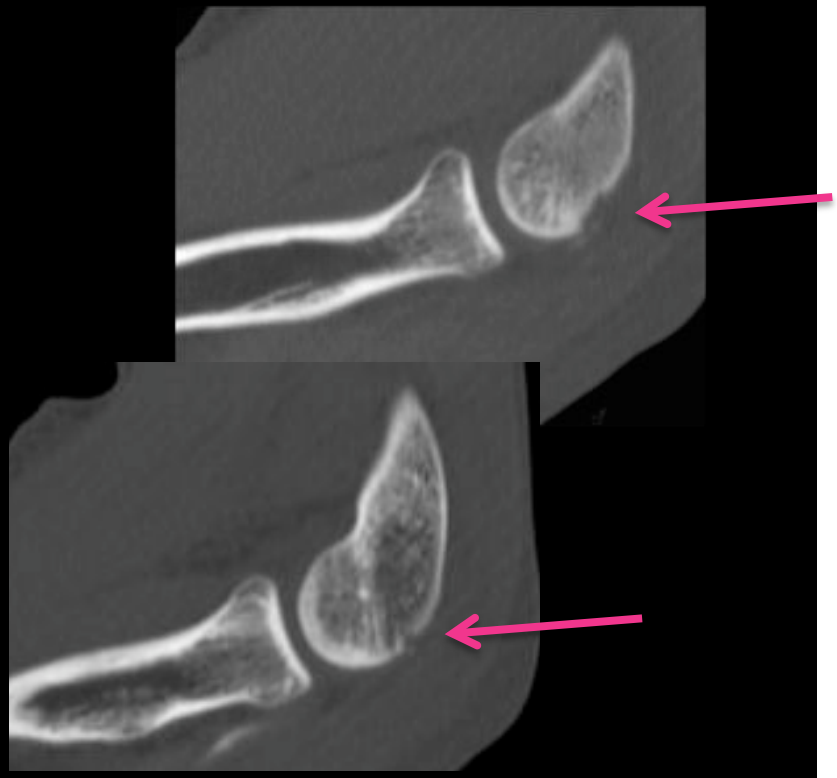
- O'Driscoll stages
  - Stage I
    - Posterolateral subluxation
    - LUCL injury
  - Stage II
    - Subluxation , coronoid perched on trochlea
    - Further LCL complex injury
    - Anterior and posterior capsule injury
  - Stage III
    - Complete dislocation
    - MCL complex disruption
      - IIIA: Posterior band injury
      - IIIB: Complete disruption

Medial epicondylar avulsion

O'Driscoll et al , JBJS 2000;82(5):724-738

Posterolateral Elbow Dislocation





Osborne Cotterill lesion

Courtesy Jerry Dwek, MD

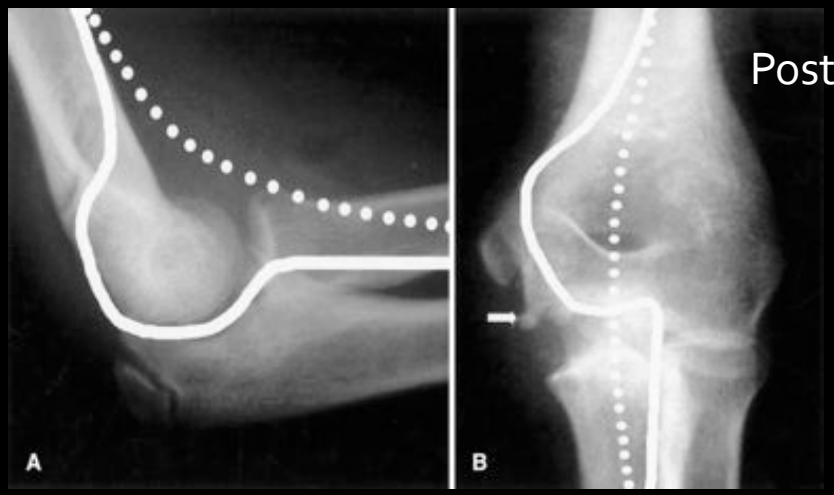
Posterior Elbow Dislocation

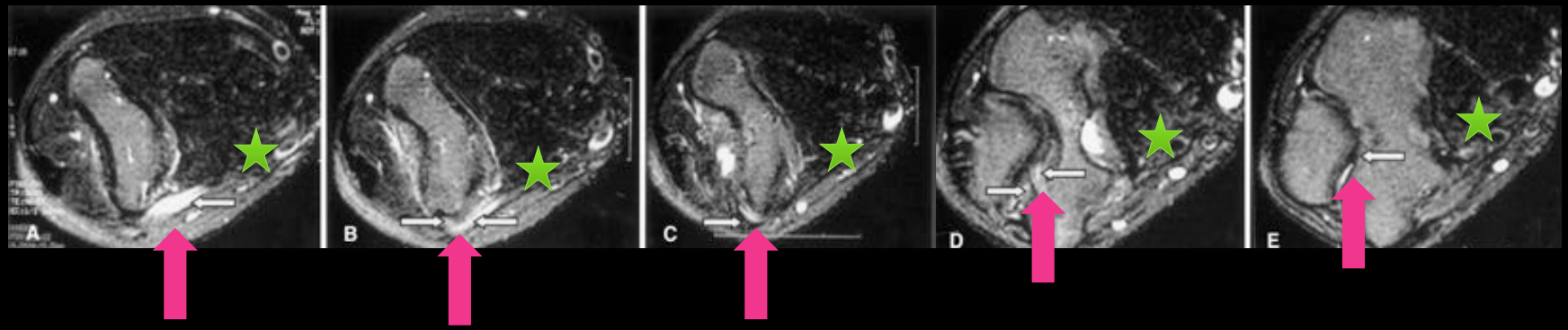
- Complications
  - Vascular injury
    - Brachial artery (rare)
  - Neurologic injury
    - Median nerve
      - Entrapment in joint or in fracture during closed reduction
    - Ulnar nerve

4 months after dislocation

Green & Swiontkowski, Skeletal Trauma in Children, 4th ed. 2008 Elsevier

Median Nerve Entrapment





Akansel et al, Skeletal Radiol 2003;32:537-541

Other Elbow Dislocations

Posteromedial dislocation

Anterior dislocation

Rasool, JBJS 2004;86-B:1050-1058

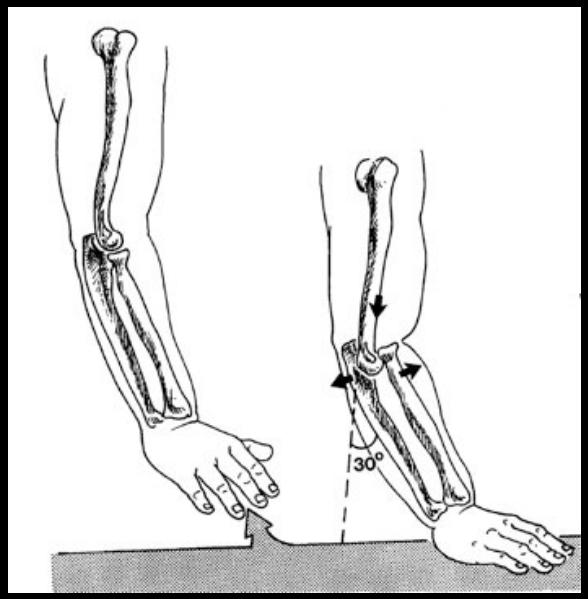
Divergent Elbow Dislocation

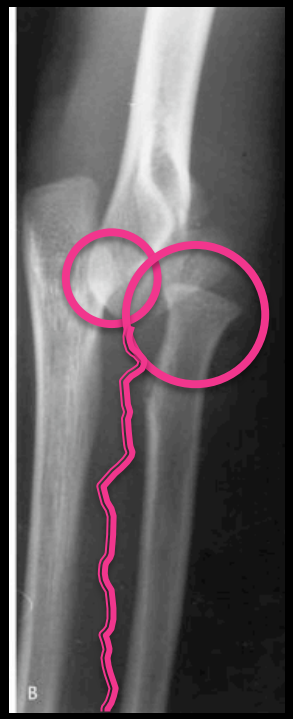
- Dislocation of all three articulations of the elbow
  - Radius and ulna dislocate in divergent directions
- Very rare
- Specific to pediatric population

Rasool, JBJS 2004;86-B:1050-1058

Divergent Elbow Dislocation

- Mechanism of injury
  - Axial compression, elbow extended, forearm pronated
    - Posterior dislocation ulna
      - Coronoid process shear fx
    - Lateral dislocation radial head
      - Lateral ligament disruption
    - Humerus diverges proximal radius and ulna
      - Interosseous membrane rupture
      - Distal radial fracture





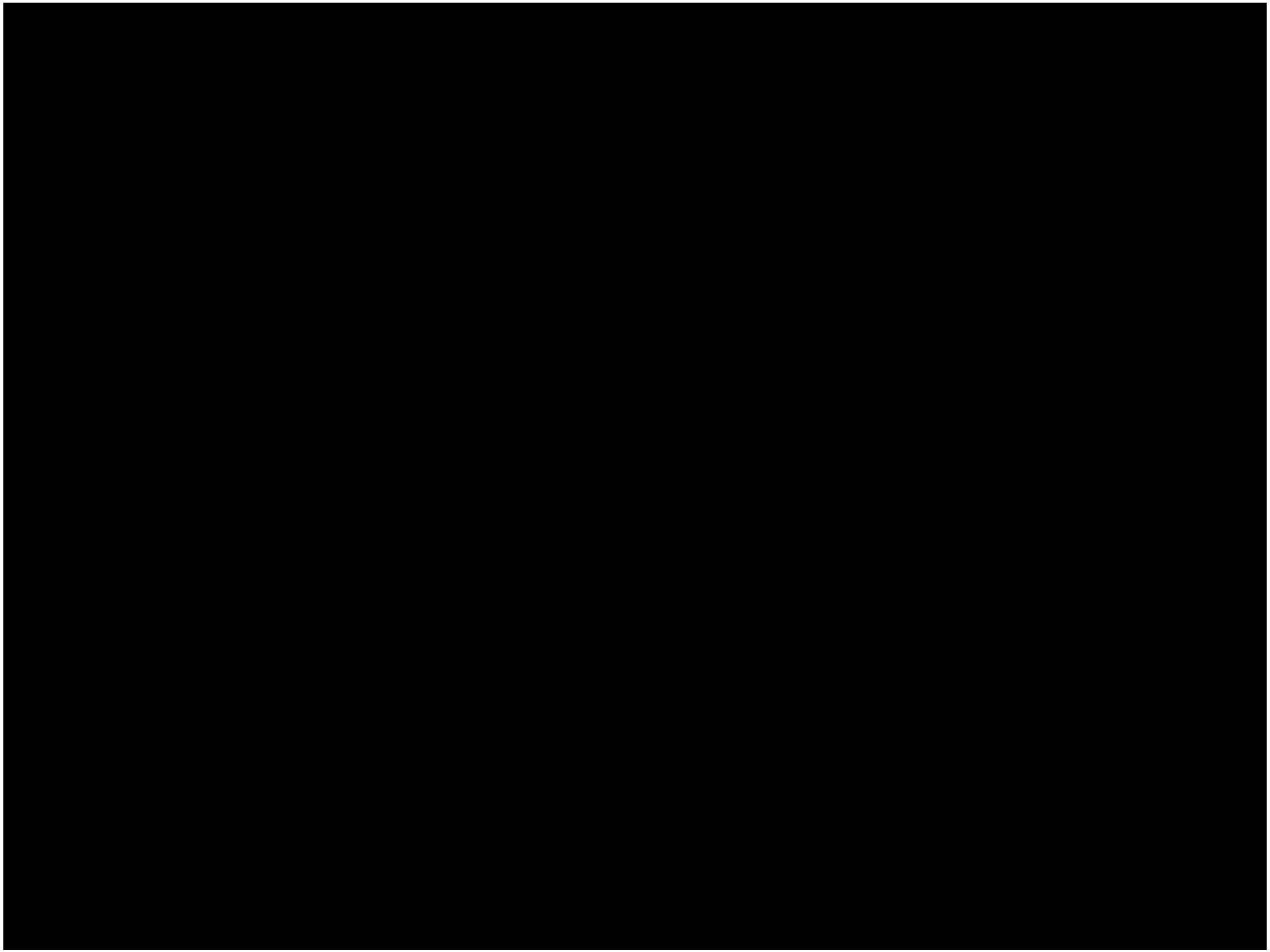
Altuntas et al, J Pediatr Orthop 2005;25:317-321

Divergent Elbow Dislocation

w/ coronoid process fracture

& distal radial fracture

Nanno et al, J Orthop Trauma 2007; 21(2):145-149



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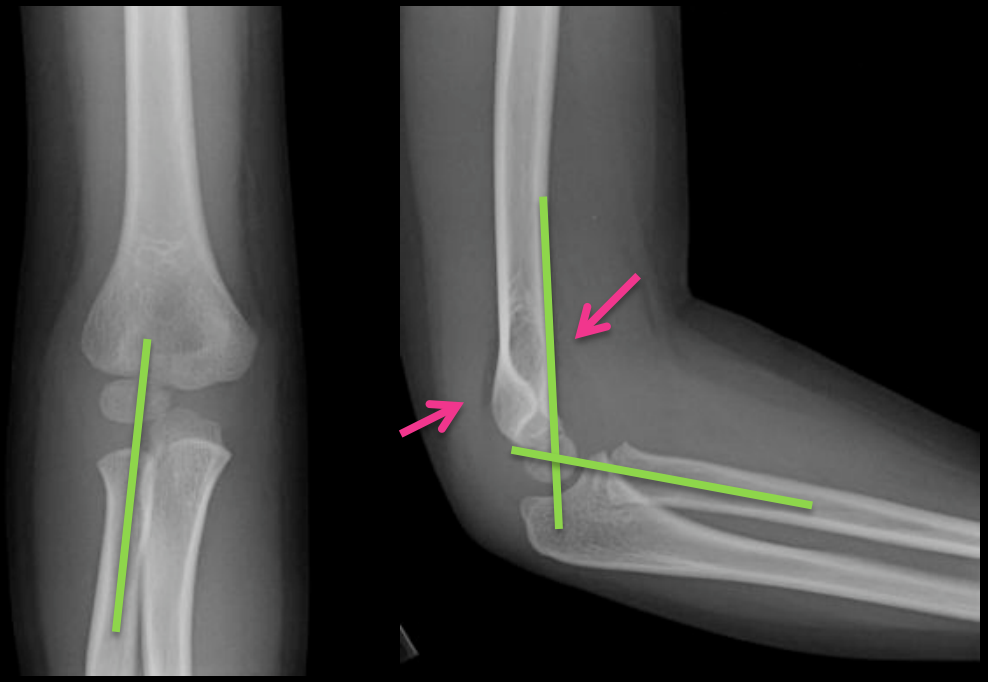


FINDINGS?

RECOMMENDATIONS?

Findings:

- No acute fracture
- Joint effusion, concerning for occult fracture

Recommend:

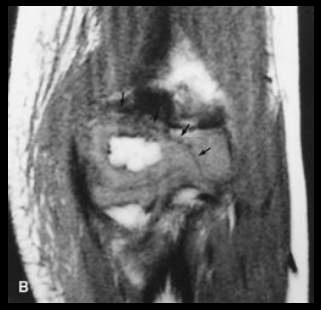
- Follow up radiographs
- (Consider ultrasound to ✓ for lipohemarthrosis)

2

Patient A

Patient B

Rutherford type I



Rutherford type II

IS THERE A DIFFERENCE BETWEEN THESE TWO FRACTURES?

MANAGEMENT?

Findings:

- Nondisplaced lateral condylar fractures
- Relationship of capitellum to radius is maintained
- Extension to articular surface cannot be assessed

- Arthrography or MRI may be obtained for further evaluation, if clinically indicated

Kamegaya et al, J Pediatr Orthop 1999;19(5):570-2

3

IS MY PATIENT'S FRACTURE HEALING PROPERLY?

6 year old with acute injury

7 months later

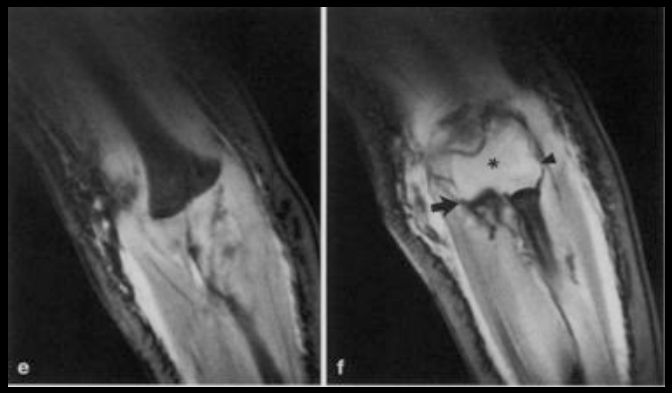
Answer: NO

Findings:

- Displaced lateral condylar fracture
- Subsequent development of fishtail deformity

4

3 mo old boy with arm swelling, no known trauma



Distal humeral epiphyseal fracture-separation

DIFFERENTIAL DIAGNOSIS?

RECOMMENDATIONS?

Findings:

- Medial displacement of radius and ulna relative to distal humerus
- Radiocapitellar line cannot be assessed

DDX:

- Distal epiphyseal fracture separation
- Posteromedial elbow dislocation (less likely)

Recommendations:

- Consider arthrography, US or MRI
- Talk to clinician re: possibility of non-accidental trauma

Nimkin et al, Pediatr Radiol 1995;25:562-565

5

DIAGNOSIS?

RECOMMENDATIONS?

Findings:

•Radius and ulna dislocated in opposite directions, indicating divergent elbow dislocation

Recommend :

•Radiographs of the forearm and wrist to ✓ for distal radial fracture

Altuntas et al, J Pediatr Orthop 2005;25:317-321

THANK YOU

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