Back To Chiropractic Continuing Education Seminars
X-ray of Sport Injuries: Upper Extremity ~ X-Ray ~ 6 Hours

Welcome:
This course counts as 6 Hours of CE for X-ray of Sport Injuries: Upper Extremity ~ X-Ray for the Chiropractic Board of Examiners for the state of California.
This course counts as 6 Hours towards your Radiography Supervisor and Operator
Permit renewal. Course must be completed before your permit expires.
There is no time element to this course, take it at your leisure. If you read slow or fast
or if you read it all at once or a little at a time it does not matter.

How it works:

Go to the home web page backtochiropractic.net to the online registration section.

To download your course or courses click on the Notes and Exam next to the course or courses you registered for. (Be Patient these are large files)

You need THE LATEST version of Adobe Reader, download PDF Reader if you don't have it.

Helpful Hint: Print the exam only and read through the notes on your computer screen and answer the questions as you read.

Printing notes will use a ton of printer ink, so not advised.

Read through course materials.

Take exam; e-mail letter answers in a NUMBERED vertical column to: marcusstrutzdc@gmail.com

Take exam; e-mail letter answers in a NUMBERED vertical column to: marcusstrutzdc@gmail.com

Please include your name, DC license # and course you took.

If you pass exam (70%), I (Marcus Strutz) will email you a certificate, within 24 hrs, if you do not, you must repeat the exam. If you do not pass the second time then you must retake and pay again.

If you are taking the course for DC license renewal you must complete the course by the end of your birthday month for it to count towards renewing your license.

I strongly advise to take it well before the end of your birthday month so you get send in your renewal form early.

If you are taking the X-ray courses and Arthritis course, these courses count toward your Radiography Supervisor and Operator Permit renewal and must be completed by the expiration date on your permit for it to count towards renewing your permit.

The Board of Chiropractic Examiners requires that you complete all of your required CE hours BEFORE you submit your chiropractic license renewal form and fee.

NOTE: It is solely your responsibility to complete the course by then, no refunds will be given for lack of completion.

X-ray of Sport Injuries: Upper Extremity

Review & Case Studies

Jennifer Pedley, CSCS, MS, DC, CCSP, DACBR
Chiropractic Radiologist

jpedley299@yahoo.com
www.jprad.com

Radiography Review of the Upper Extremity

- X-ray search Pattern-ABCs (alignment, bone, cartilage/joint spacing, and soft tissue)
- Review of patient positioning
- Case Studies
  - Find x-ray pathology; Discuss mechanism of Injury (MOI), complications, appropriate advanced Imaging, treatment and referral.

Things to Remember Before We Get Started:

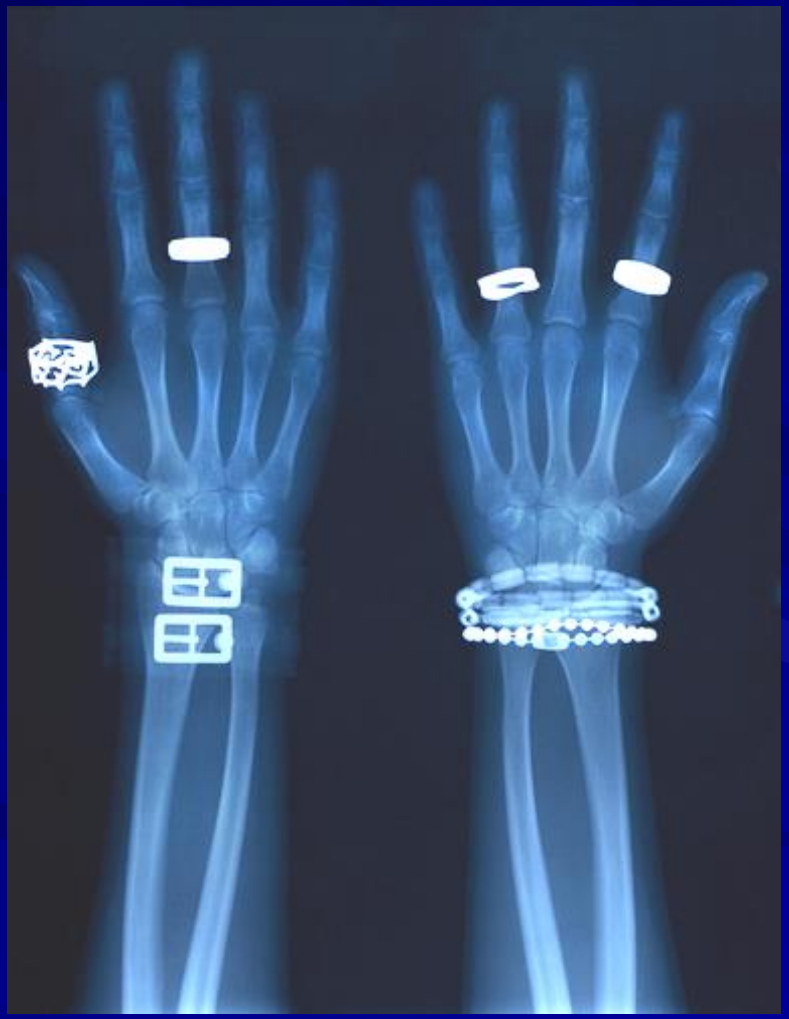
- Radiography positioning book or reference is strongly advised.
  - This presentation is only a review

- When tilting the x-ray tube: For every 5 degrees of rotation or tilting the tube, the tube is moved one inch closer to the patient to reduce distortion/magnification.
  - Example: Tube tilt of 15 degrees= Move tube closer to patient 3 inches

Upper Extremities

- Hand/fingers
- Wrist
- Forearm
  - Ulna
  - Radius
- Elbow
- Shoulder
  - Clavicle
  - AC Joints

Hand



www.interestingxrays.worldpress.com

Hand Radiographs

- PA
- Medial Oblique
- Lateral

- Remember: Trauma always requires more oblique views

PA HAND

- **Focal Film Distance (FFD)** 40”
- **Collimation** 8x10
- **Central Ray (CR)** **3rd metacarpal head**

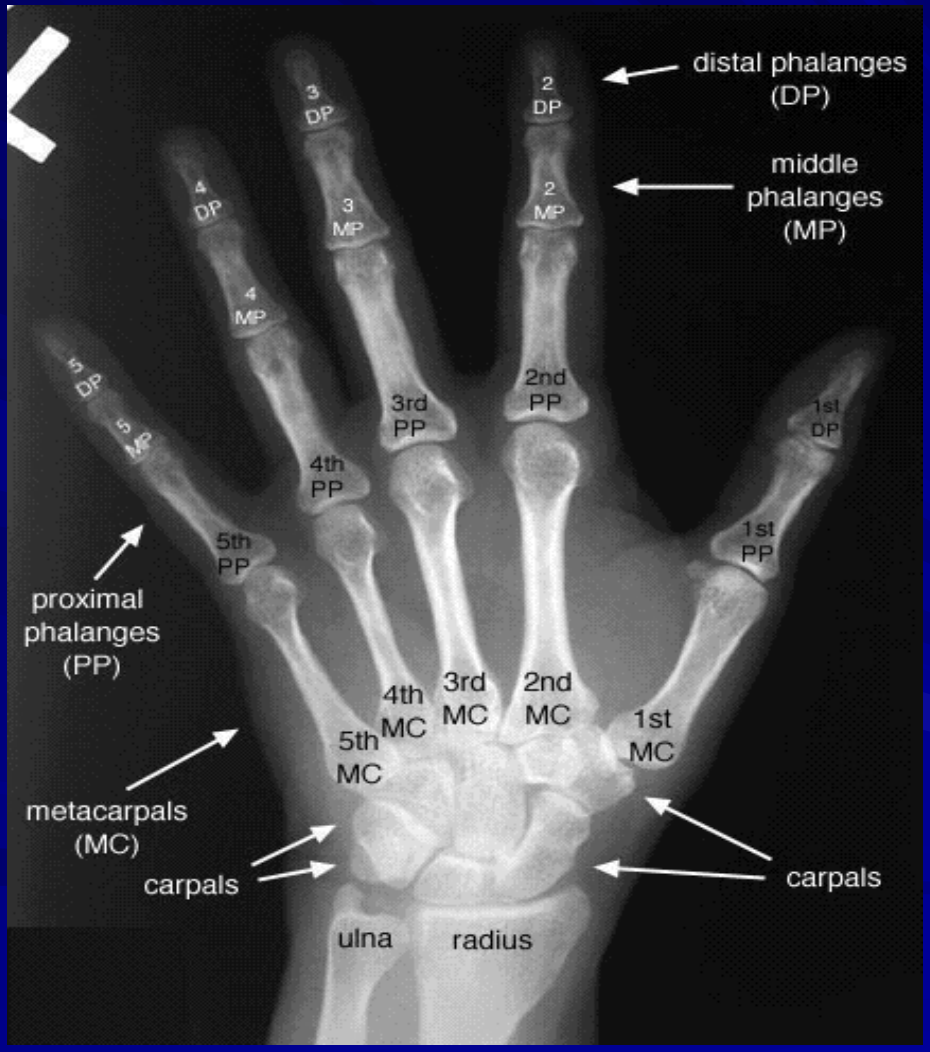
- Remember: We want to evaluate the fingers to distal radius

PA HAND

Structures Visualized

- Metacarpals 1-5
- Carpals - Scaphoid (Navicular), Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
- Proximal and Distal Phalanges/Tufts 1-5
- Middle Phalanges 2-5
- Ulna & Ulnar Styloid
- Radius

PA HAND - Labeled



OBLIQUE HAND

- **Focal Film Distance** 40”
- **Collimation** 8x10
- **Central Ray (CR)** 2nd metacarpal head

OBLIQUE HAND

Structures Visualized

- Metacarpals 1-5
- Carpals - Scaphoid (Navicular), Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
- Proximal and Distal Phalanges/Tufts 1-5
- Middle Phalanges 2-5
- Ulna & Ulnar Styloid
- Radius

LATERAL HAND

- **Focal Film Distance** 40”
- **Collimation** 8x10
- **Central Ray** 2nd metacarpal head

- **Remember: Splay the fingers, parallel to the cassette**

LATERAL HAND

Structures Visualized

- Proximal Phalanges 1-5
- Distal Phalanges 1-5
- Middle Phalanges 2-5
- Distal Tufts 1-5

Fingers

- Same as hand but collimate to the region
- Additional oblique views required

Don’t worry, these should not walk into your office. These are amputated fingers in a jar☺

Case

Hx: 25 yom, skiing accident

PA Hand

Medial Oblique

Volar plate avulsion

- Fracture fragment or avulsion at the first metacarpophalangeal joint
- also known as Gamekeeper's or Skier's Thumb
- Remember: Stress x-rays are not recommended, may induce a Stener's lesion

Gamekeeper's or Skier's Thumb

- Tear of ulnar collateral ligament (mostly distal) by forced valgus mechanism
- Bony avulsion>>>surgical repair

- Referral
  - MR imaging of thumb for Stener's lesion
  - Hand specialist (orthopedic)

Stener's Lesion

- Adductor pollicis tendon between the torn ulnar collateral ligament and it's attachment site. This cannot heal.

- Surgical repair required.

Case

- 15 year-old male wrestler with right hand pain during practice.

Donated by Dr. L. Nicholson

Bar Room Fracture

- Fracture traversing the distal metadiaphysis of the 5th metacarpal.
- Soft tissue edema
- Radial angulation
- Treatment (Tx): Reduction by orthopedist and brace
  - FYI: In state of CA, chiropractors are not allowed to reduce fractures and dislocations.

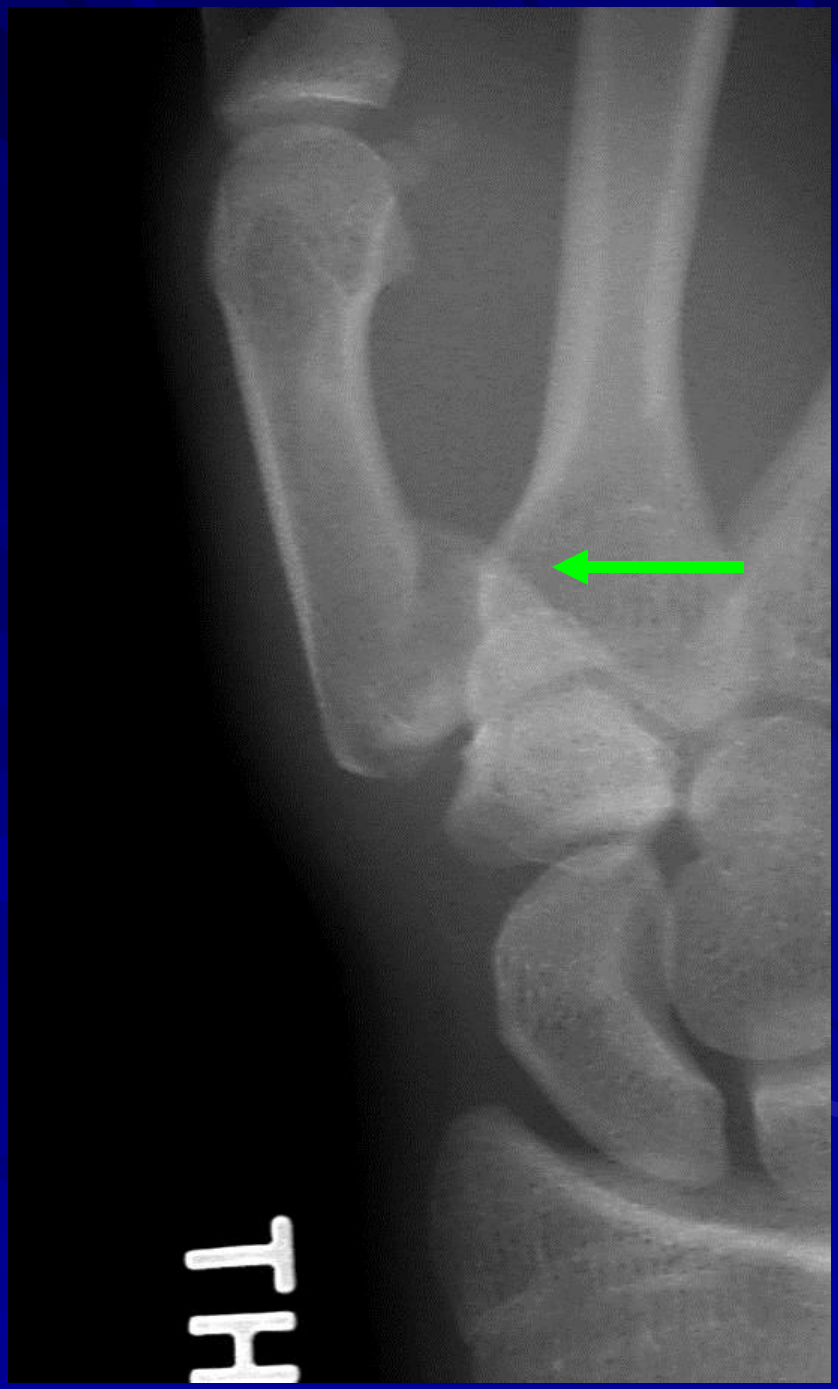
Case

- 15 year old male wrestler with thumb pain during a match.

PA and Oblique Views of the Thumb

Donated by Dr. L. Nicholson

Magnified



Donated by Dr. L. Nicholson

Bennet's fracture-dislocation

- Intra-articular oblique fracture at the base of the first metacarpal

- Mechanism of Injury: axial force on partially flexed 1st metacarpal>>>drives the metacarpal dorsally and radially.
  - Injury to ulnar collateral ligament

Bennet's Fracture-Dislocation

- Referral
  - Hand specialist
  - Surgical: Closed reduction with surgical K-wire, most often
    - Open reduction and internal fixation if large fragment (>25% of base of 1st Metacarpal) and displacement.

Case

- 13 year-old wrestler hyperextended and dislocated finger during a match.

Medial oblique and PA Views

Donated by Dr. L. Nicholson

Magnified 5th finger

Donated by Dr. L. Nicholson

Salter Harris Type II Fracture

- 5th metacarpal; triangular fracture fragment with minimal displacement.
- Brace to stabilize
- Complication
  - Deformity is possible
  - If instability, referral to a hand specialist

Case

- 17 year old male was kicked in the hand while playing soccer.
- Pain and swelling around the proximal interphalangeal joint of right ring finger.

PA, Medial Oblique and Lateral Views

Non-Displaced Dorsal Fracture

- Avulsion or direct blow
- Stable
- Treatment: Splint and buddy tape

Case

- Finger pain

Distal Tuft Fracture

- Immobilize

- Associated with infection
  - Remember: Distal tuft fracture adjacent to the nailbed is considered an open fracture
  - Same rule applies for the toes

Wrist & Forearm

Wrist Radiographs

- PA
- Medial Oblique
- Lateral
- PA Ulnar Flexion/Deviation

PA WRIST

- FFD 40
- **CR** midcarpal joint
- **Remember: Loose fist to keep wrist in neutral. If the patient extends the fingers, the wrist automatically goes into flexion position.**

Wrist

Special views of wrist:

- PA projection with clenched fist
  - Stress view for scapholunate dissociation, opening of the joint
- PA angulated scaphoid projection
  - 15 degree cephalad tube tilt (toward elbow) with PA projection with ulnar deviation of the wrist
  - Optimal visualization for a scaphoid fracture (it elongates and magnifies the scaphoid)

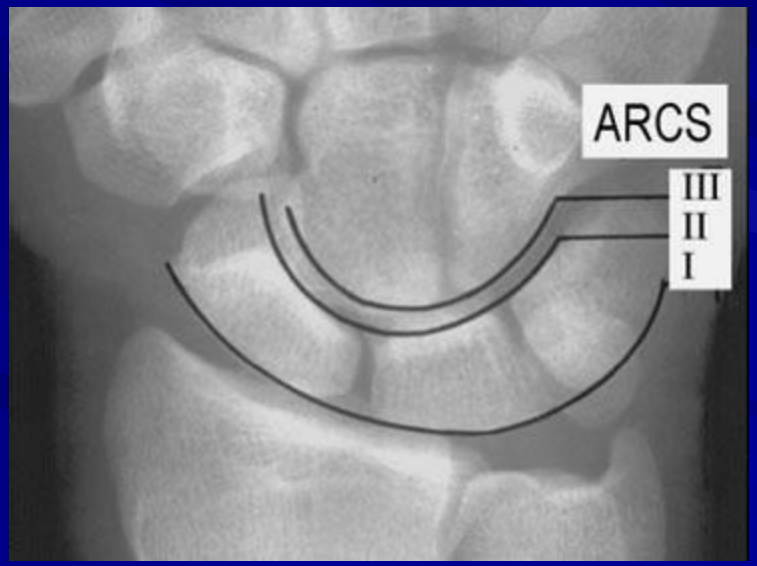
PA WRIST

Structures Visualized

- Metacarpals 1-5
- Carpals - Scaphoid (Navicular), Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
- Ulna
- Ulnar Styloid
- Radius

Alignment Evaluation

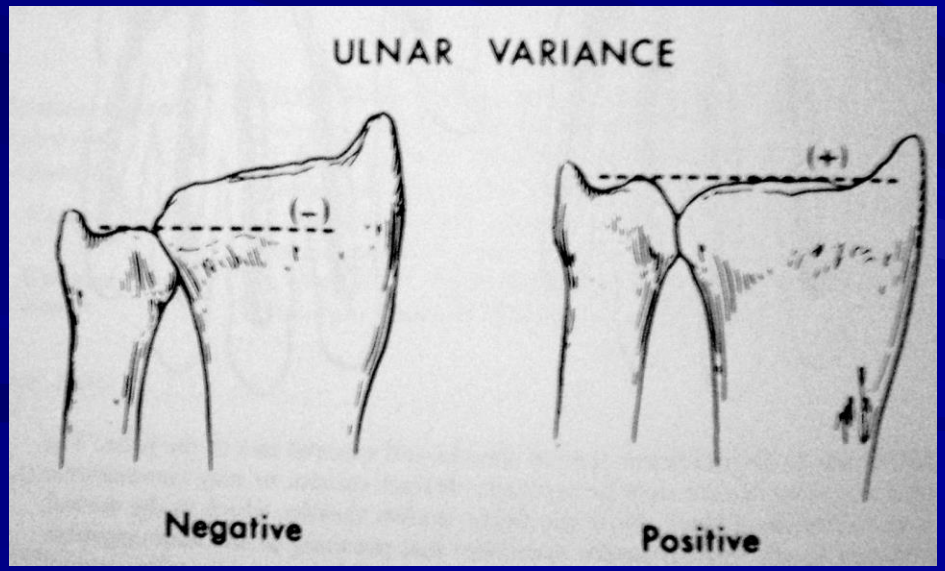
- PA view of the wrist
  - Arc I-III should be aligned in a smooth arc
  - Normal intercarpal joint spaces: 2.0-mm



Resnick, D. Diagnosis of Bone and Joint Disorders, 4th ed. 2002

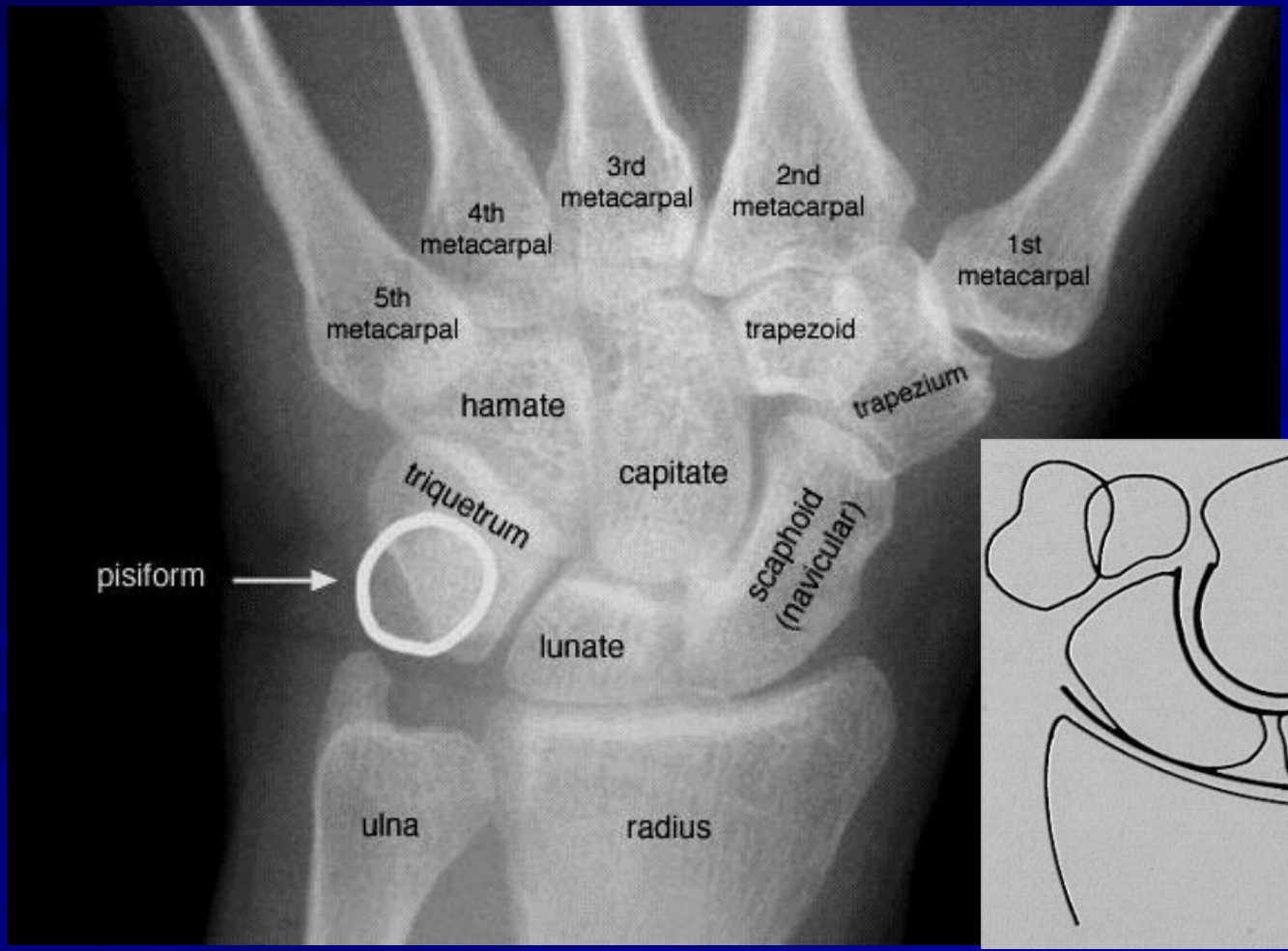
Alignment Evaluation

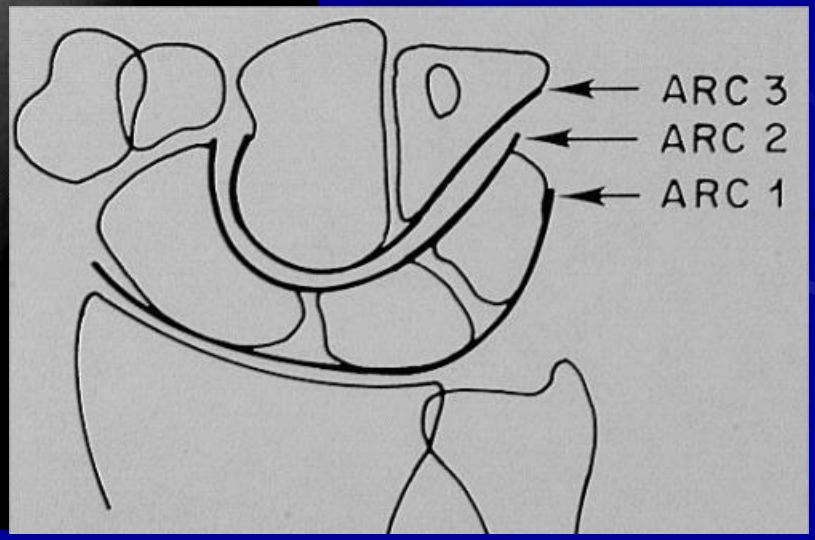
- Negative/Positive ulnar variance relative to the articular surface of the distal radius
  - greater than 2.5-mm is positive for instability or ligamentous disruption.



Resnick, D. Diagnosis of Bone and Joint Disorders, 4th ed. 2002

PA WRIST - Labeled





OBLIQUE WRIST

- **FFD** 40”
- **CR** midcarpal

OBLIQUE WRIST

Structures Visualized

- Metacarpals 1-5
- Carpals - Scaphoid (Navicular), Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
- Ulna
- Ulnar Styloid
- Radius

LATERAL WRIST

- FFD 40”
- CR midcarpal

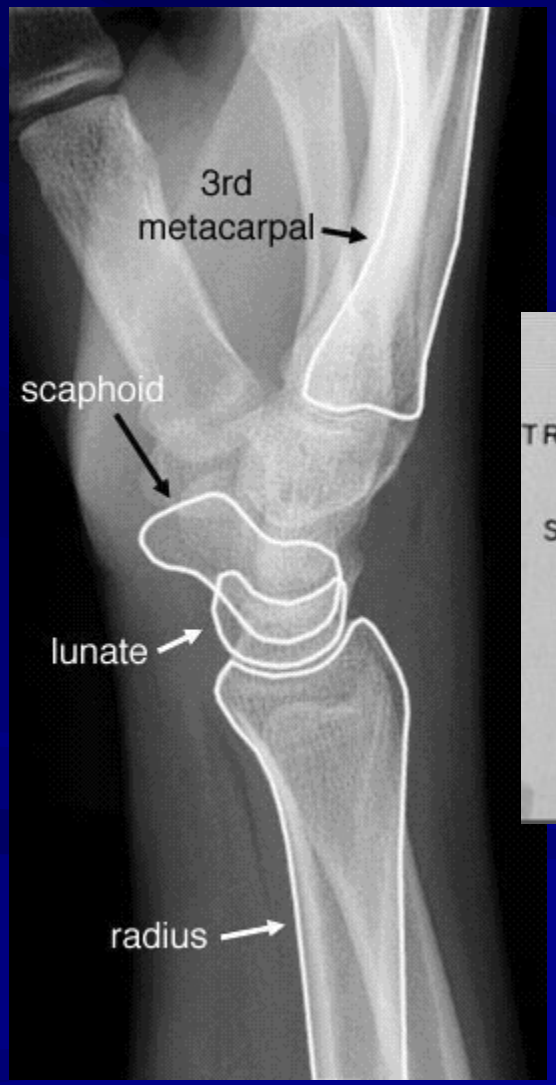
- **This patient should have the fingers straight or extended with the thumb up (abducted) to keep wrist in neutral position.**

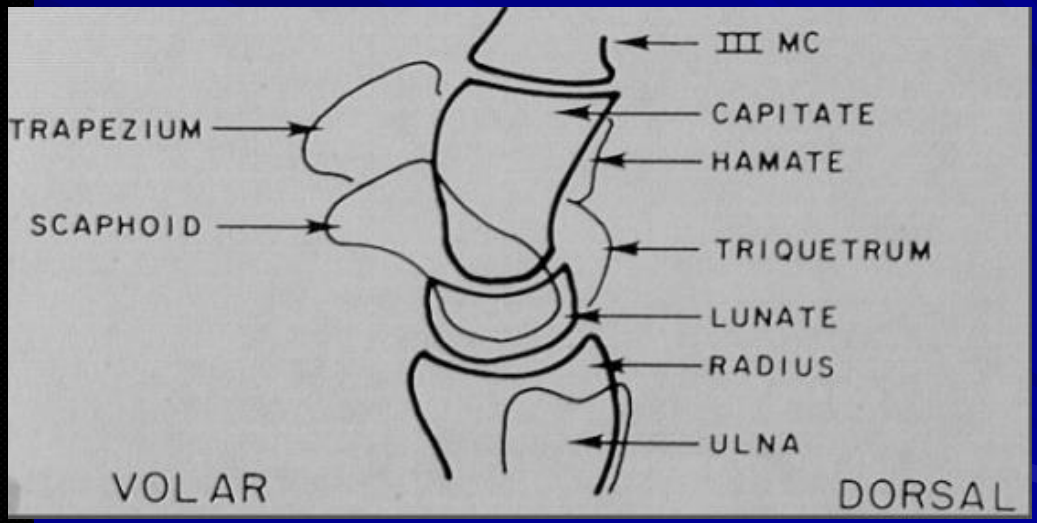
LATERAL WRIST

Structures Visualized

- Scaphoid
- Lunate
- Capitate
- Hamate
- Triquetrum
- Radius & Ulna
- Metacarpals

LATERAL WRIST - Labeled

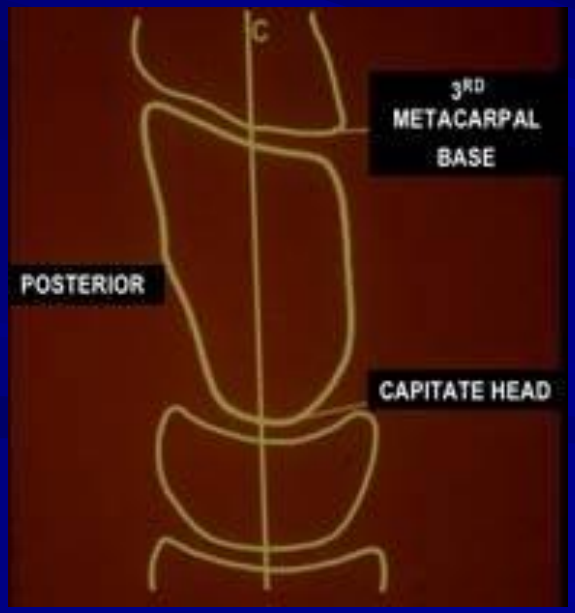




Lateral view of the wrist

- VISI/DISI
  - volar/dorsal intercalated segmental instability when the lunate is abnormally rotated volarly or dorsally due to injury to the ligamentous restraints

- Evaluate for normal alignment of the 3rd metacarpal-lunate-distal radius on the lateral view as shown below.



PA ULNAR FLEXION

- **FFD** 40”
- **CR** midcarpal

- Tip: Keeping the fingers flexed with loose fist would help in positioning the wrist in neutral position.

ULNAR FLEXION

Structures Visualized

- Metacarpals 1-5
- Carpals - Scaphoid (Navicular), Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate
- Ulna
- Ulnar Styloid
- Radius

Forearm

- Plain film radiographs of the Forearm should include the *elbow AND wrist joints* to evaluate the radius and ulna.

- **AP and lateral views**
  - mA=small focal spot
  - Central Ray=midportion of radius/ulna
  - Collimation= 6x12-17

Forearm X-ray Positioning

Remember:

- Needs to include distal & proximal joints>>>wrist & elbow joints

- The lateral view of the forearm should have 90 degree elbow flexion AND the thumb pointing upward or away (abduction) to avoid hand pronation

Case

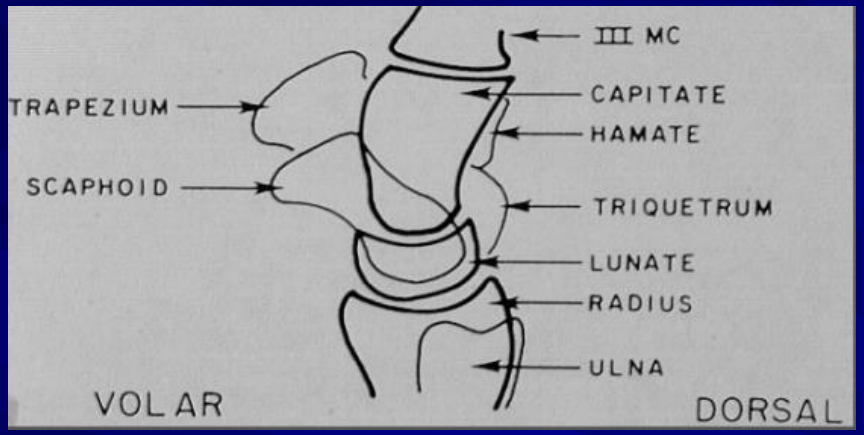
Hx: 22 yom playing basketball, fell on an outstretched hand

PA and Medial Oblique

‘Pie Sign’ indicates rotated lunate

- PA view of wrist
- Scaphoid is also rotated
- Pie sign is triangular appearance of the lunate due to rotation

Lateral Wrist



Scapholunate dissociation

- Widening of the scapholunate joint greater than 2.0-mm
  - Possible scapholunate ligament tear
- Rotation of scaphoid with proximal pole displaced posteriorly and distal pole displaced anteriorly.
- Subtle dorsal rotation of the lunate
- Proximation or migration of the capitate into the scapholunate joint.

Scapholunate Dissociation

- Complication
  - Instability
  - Early degeneration
- Referral
  - Hand specialist
    - Splint wrist or surgical K-wire open reduction to the widened scapholunate joint

Case

Hx: 8 yom with wrist pain

PA and Medial Oblique

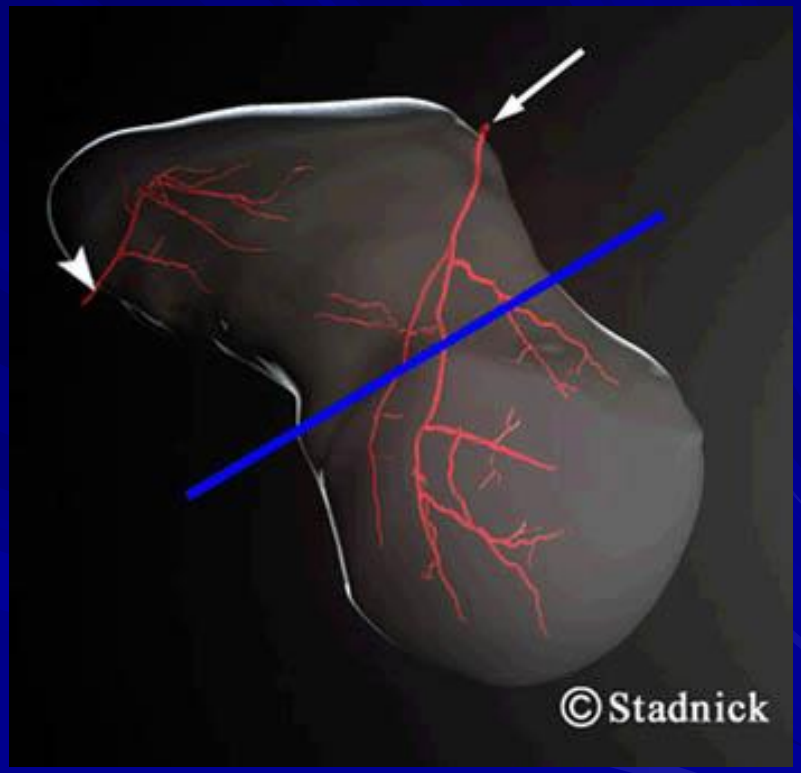
PA spot view of the scaphoid

Radiographic Findings

- A linear radiolucency traverses the entire waist of the scaphoid bone
- Anatomic alignment is normal
- Mild soft tissue swelling

Scaphoid Fracture

- **Sites**
  - Tuberosity
  - Distal body
  - Waist= most common site; 70%
  - Proximal Pole= 20%
- **Healing time**
  - Tuberosity= 4-6 weeks
  - Distal body
  - Waist= 6-8 weeks+
  - Proximal Pole



www.radsource.us

Resnick D. Diagnosis of Bone and Joint Disorders, 4th ed. 2002; 2842-7.

Scaphoid Fractures

- **Complications**
  - Delayed non-union and Non-union with proximal pole fracture
  - Ischemic necrosis (avascular necrosis)

- **Follow-up**
  - MRI
  - Hand specialist/orthopedic surgeon consultation

Resnick D. Diagnosis of Bone and Joint Disorders, 4th ed. 2002; 2842-7.

Case

Hx: 30 year-old female (yof) with wrist pain

PA, Lateral, and Medial Oblique Views

John Hunter, MD
www.mypacs.net

PA Ulnar Deviation

John Hunter, MD
www.mypacs.net

Radiographic Findings

- Widening of the scapholunate joint space, 4-5-mm.
  - Terry Thomas Sign
- Slight proximal migration of the capitate
- Dorsal Intercalated Segmental Instability of the lunate (posterior rotation); Pie Sign
- Small well-defined round radiopacity anterior to distal radius is calcific tendinitis
  - Keats T. Atlas of Normal Roentgen Variants That May Simulate Disease, 4th ed. 1988.
- Mild soft tissue swelling

Scapholunate Dissociation & DISI of the Lunate

- Remember: Normal scapholunate joint space measures 2.0-mm. This is over 4-5 mm: **instability**

- Follow-up: MRI and hand specialist

Complications

- Look for scaphoid fracture
- Early Degenerative joint disease (DJD)

Mann F, MD et al. Radiographic Evaluation of the Wrist: What Does The Hand Surgeon Want to Know? Radiology; 184(1). July 1992, 15-24.

Case

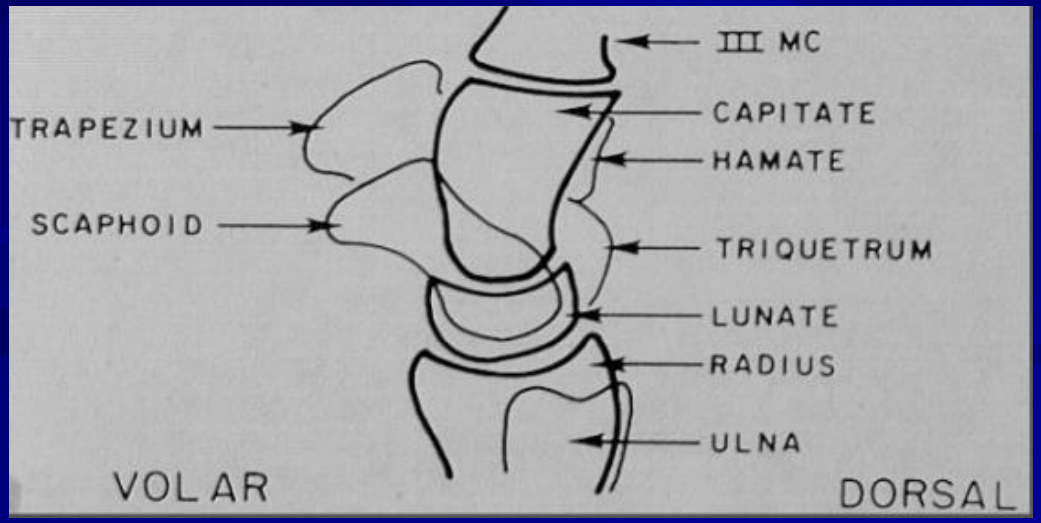
Hx: 35 yom, bicyclist flipped forward

PA, Medial Oblique, and Lateral Views of the Wrist

ACR Learning File

Magnified Lateral View

- Fracture only seen on the lateral view.



Triquetral Fracture

- Dorsal fracture fragment= Triquetral fracture
- The Lateral view is the Best view to demonstrate the triquetral fracture.
- 2nd most common carpal bone to fracture (most common is scaphoid)

Mechanism of Injury

- Direct Blow (transverse fracture) or
- *Avulsion>>Hyperextension + ulnar deviation of the wrist*
  - Ulnar styloid or the hamate pins the triquetrum resulting in a shearing force of triquetrum>>>dorsal chip fracture and avulsion of ligaments

Follow-up

- Immobilize 6 weeks

Hocker K & Mensckik A. Chip Fractures of the Triquetrum, Mechanism, Classification, and Results. J Hand Surg (Br), Oct 1994; 19(5):584-8.

Resnick, D. Diagnosis of Bone and Joint Disorders, 4th edition. 2002

Case

Hx: 26 yom snowboarder, fell on an outstretched hand

PA, Medial Oblique, and Lateral Views of the Wrist

ACR learning file

PA Ulnar Deviation with 15 Degree Cephalad *(towards elbow)* Tube Tilt

ACR learning file

Radiographic Findings

- The lunate is anterior to the remaining carpal bones.

AND

- The lunate is also rotated 90 degrees counterclockwise; alignment parallel with the distal radius.

    PA projection: **Pie sign**

- There is no scaphoid fracture

Anterior Lunate Dislocation

Complications

- Compression of the carpal tunnel (flexor digitorum superficialis and flexor digitorum profundus tendons) & Median nerve
- **Torn Triangular fibrocartilage complex** (TFCC)

Follow-up

- Orthopedic hand surgeon/specialist
- Surgery: ORIF- open reduction internal fixation
  - Surgical Kirschner (stainless steal, K-wires) wires

Kang HJ, et al. Palmar Divergent Dislocation of Scaphoid and Lunate. Yonsei Medical J.:44(6);1091-3, 2003.

Case

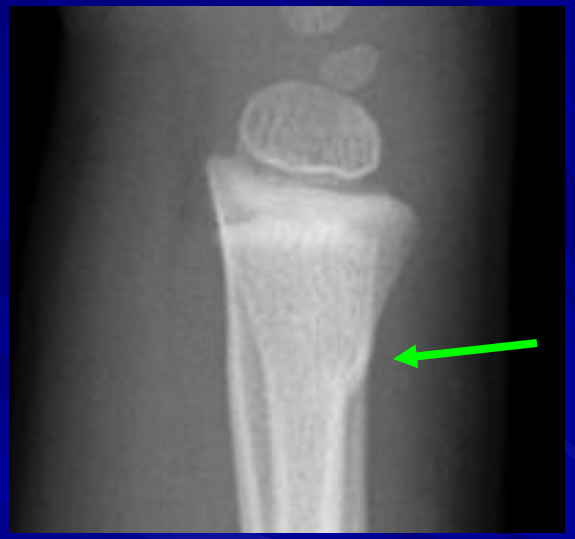
Hx: 4 yof with distal arm and wrist pain

PA and Lateral Views of the Wrist

John Hunter, MD www.mypacs.net

Radiographic Findings

- Buckling along the posterolateral aspect of the distal radial metaphysis.



- Mild soft tissue swelling and mild dorsal angulation of the distal radius

Torus Fracture

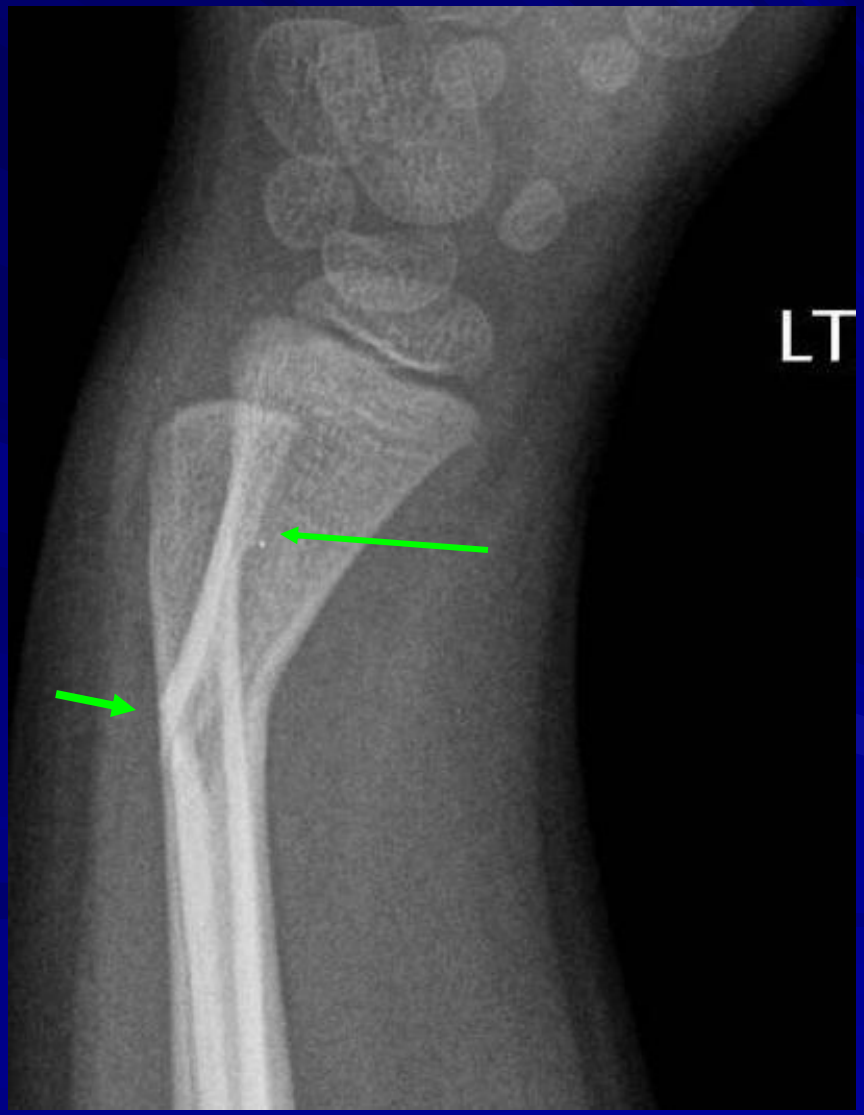
- An incomplete fracture; Stable
  - *Requires immobilization*
- Metaphyseal or metadiaphyseal
- Follow-up
  - Immobilization/Cast for 3-4 weeks

Case

Hx: 6 yof fell while skateboarding

PA and Medial Oblique

Lateral View



Diagnosis

- **Greenstick Fracture:** an incomplete fracture of the distal radial metadiaphysis with anterolateral angulation of the distal fracture fragment; This is a nearly complete fracture with some attachment of the periosteum.

- **Torus Fracture** of the distal metaphysis of the ulna

Greenstick and Torus Fracture

Follow-up

- Refer to orthopedic pediatrician
  - Reduce and Cast (Closed reduction)

Case

Hx: 22 yom skateboarding accident

PA, Medial Oblique & Lateral Views

Comminuted Fracture of Distal Radius

- Metaphyseal fracture with extension to the articular surface.
- Unstable when extending to articular surface.
- Referrral
  - Orthopedic
    - Reduce and Cast (closed reduction)>>>re-xray
    - Or, open reduction with internal or external fixation.

Case

Hx: 38 yof fell on outstretched hand while playing basketball

PA View of the Wrist

www.uwec.edu

Lateral View of the Wrist

www.uwec.edu

Radiographic Findings

- Complete fracture of the distal radius with dorsal and slight lateral angulation of the distal radial fragment.
- Intra-articular fracture of the distal radius extends medially
- Positive ulnar variance and widening of the distal radioulnar joint
  - ***TFCC or interosseous membrane injury***
- Arc I-III are not aligned

Colle's Fracture

- Complete fracture of distal radius; Fracture fragment angulated dorsally
- 50% have ulnar styloid fracture >>>Triangular fibrocartilage tear

Follow-up

- Orthopedic surgeon referral
  - Immobilization and Surgery

Colle's Fracture

Follow-up

- Orthopedic surgeon referral
  - Immobilization and Surgery
    - Closed reduction + Cast below elbow to metacarpals
    - Open reduction
      - External fixation
      - Internal fixation

Colle's Fracture

Complications

- Axial foreshortening of the distal radius may result in decreased grip strength or function
  - Permanent disability

- Chronic Regional Pain Syndrome
  - Aka Reflex Sympathetic Dystrophy Syndrome

Aydog S , et al. Rehabilitation After Colle's Fracture. Journal of Islamic Academy of Sciences, 1994; 7:4, 247-50.

Case

Hx: 14 yof

Oblique and AP Views of the Forearm

John Hunter, MD www.mypacs.net

Lateral and Oblique Views

John Hunter, MD
www.mypacs.net

PA View of Wrist and Long Bones

John Hunter, MD
www.mypacs.net

Radiographic Findings

- Complete horizontal fracture of the distal one third of the radius with dorsal and radial angulation of the distal fragment
- Complete fracture or avulsion of the ulnar styloid
- Mild widening of the distal radioulnar joint
- **Positive ulnar variance**
  - Disruption of the interosseous membrane with instability of the distal radioulnar joint
    - Mann, et al. Radiographic Evaluation of the Wrist: What Does The Hand Surgeon Want to Know. Radiology, July 1992; 184(1), 15-24.

Galeazzi Fracture

Age

- Bimodal, 5-14 yoa & 60-69 yoa

Location

- Distal one third of the radius complemented by dislocation of the distal radioulnar joint

Complication

- Non-union
- Redislocation

Galeazzi Fracture

Follow-up

- Orthopedic surgeon
  - Open or Closed Reduction
  - Cast for 6-12 weeks

www.emedicine/medscape.com “Radius, Distal Fractures”

Elbow

Elbow

- AP
- Medial Oblique
- Lateral
- Tangential (Jones)

AP ELBOW

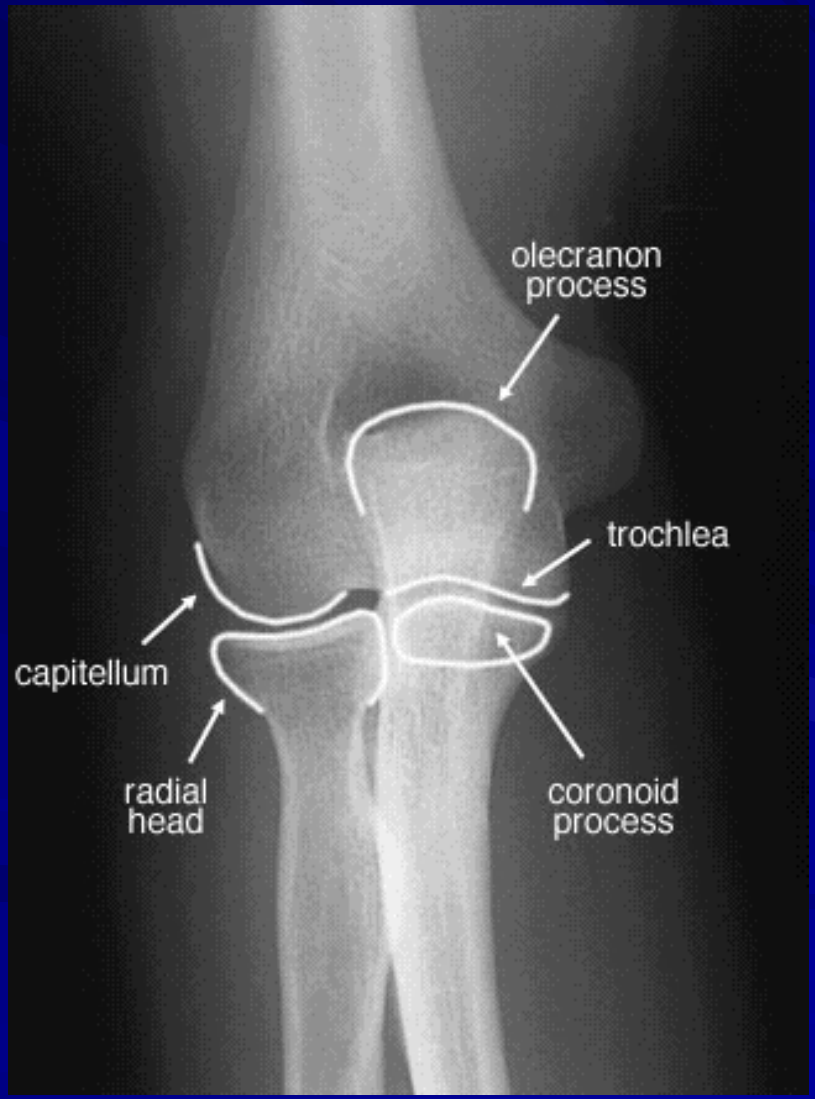
- **FD** 40”
- **CR** Joint Line
- Remember: Hand is supinated

AP Elbow

Structures Visualized

- Radial Head
- Olecranon Process
- Capitellum
- Trochlea
- Coronoid Process

AP ELBOW - Labeled



MEDIAL OBLIQUE ELBOW

- **FFD** 40”
- **CR** Joint Line

- **Remember: Hand is pronated**

MEDIAL OBLIQUE ELBOW

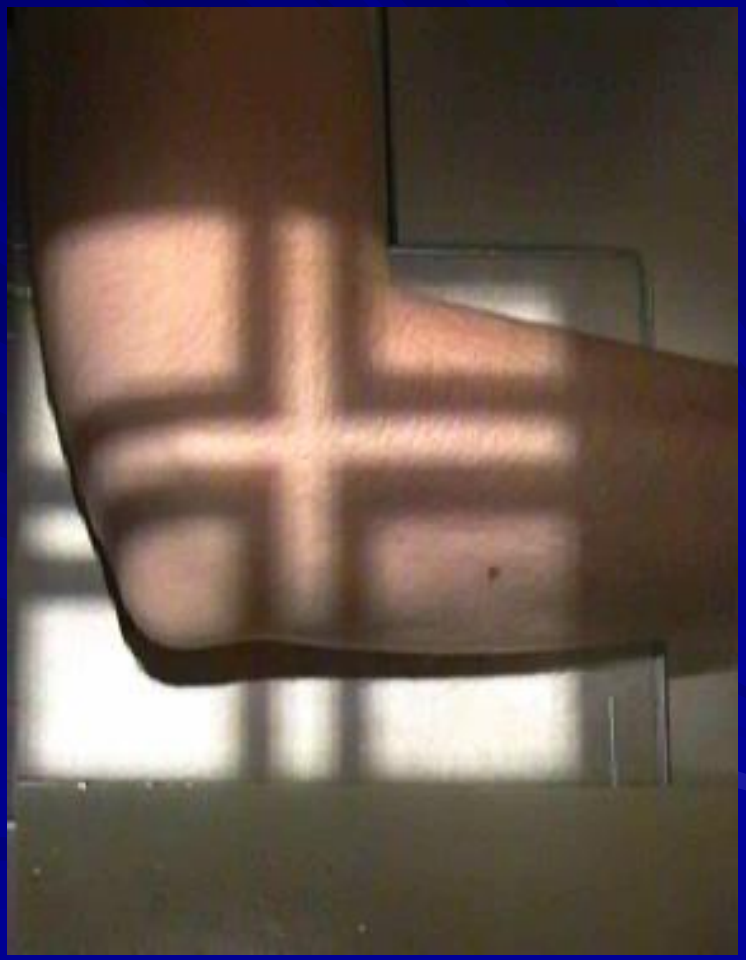
Structures Visualized

- Olecranon Fossa
- Medial Epicondyle
- Lateral Epicondyle
- Supracondylar Ridge
- Olecranon process
- Coronoid Process
- Radial Head

LATERAL ELBOW

- **FFD** 40”
- **CR** Joint Line

- Remember: Elbow flexed at 90°, point thumb up or abduct.

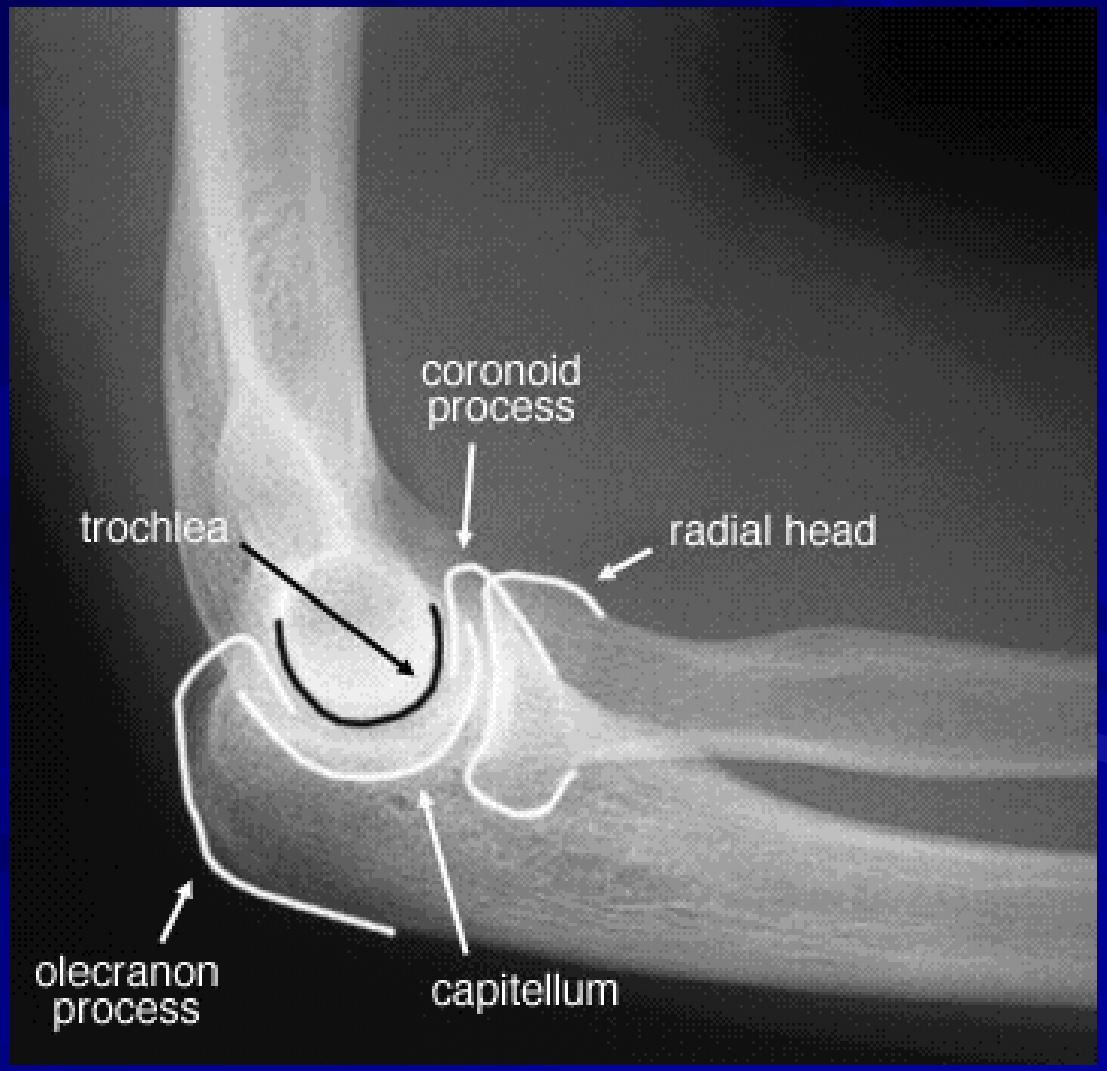


LATERAL ELBOW

Structures Visualized

- Capitellum/Trochlea Superimposed
- Olecranon Process
- Coronoid Process
- Radial head and neck
- Radial Tuberosity
- Supinator Fat Line
- Olecranon fossa
- Coronoid Fossa

LATERAL ELBOW - Labeled



TANGENTIAL ELBOW (JONES VIEW)

- **FD** 40”
- **CR** Joint Line
- Hand - palm on shoulder

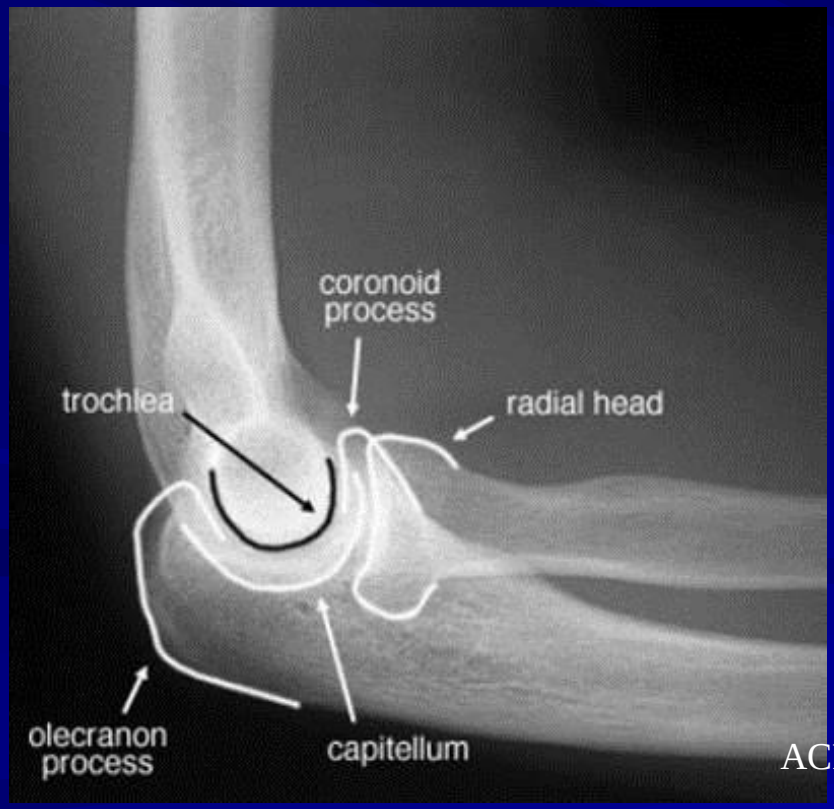
TANGENTIAL ELBOW

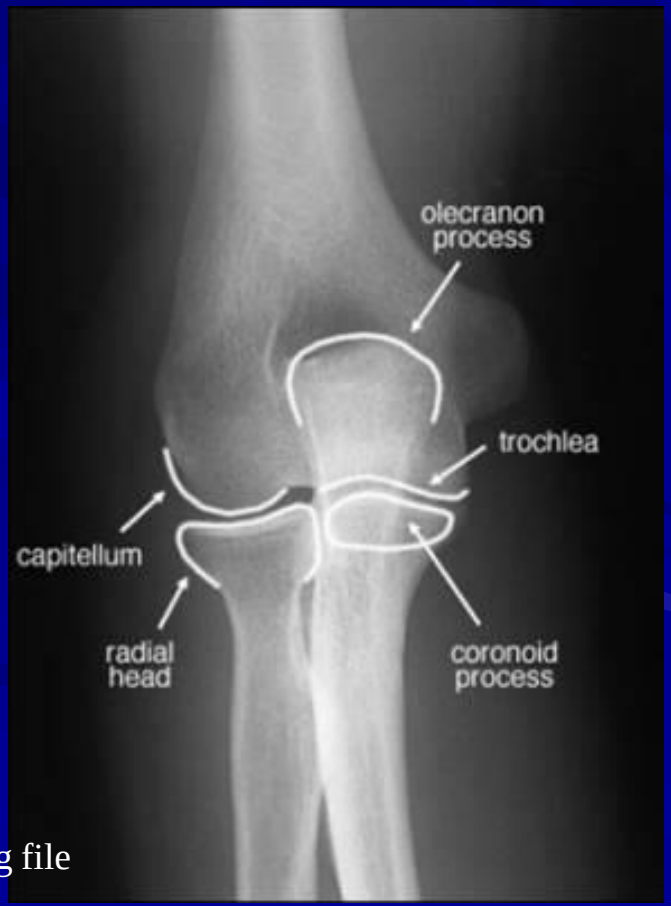
Structures Visualized

- Olecranon Process
- Trochlea
- Radial Head
- neck of Radius
- Radial Tuberosity
- Medical Epicondyle
- Olecranon Fossa
- Ulnar Groove

Normal Elbow- 4 Views

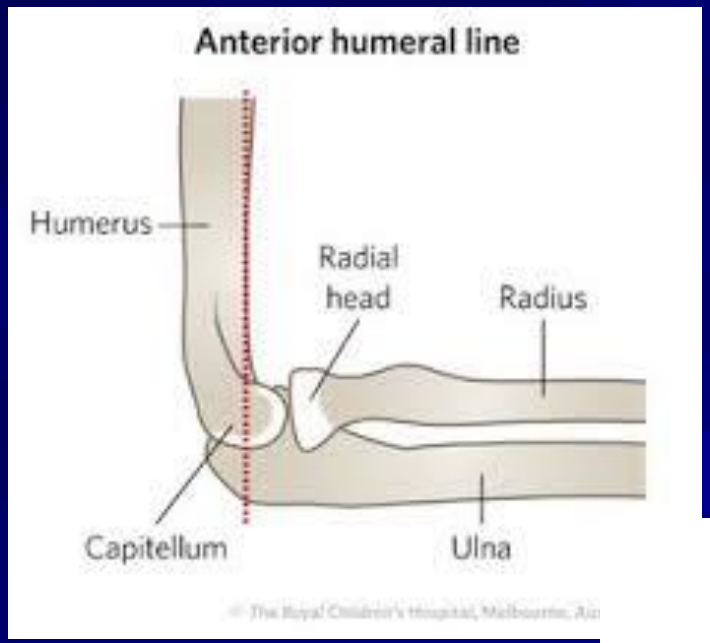
- AP, Medial Oblique, Lateral and Tangential views

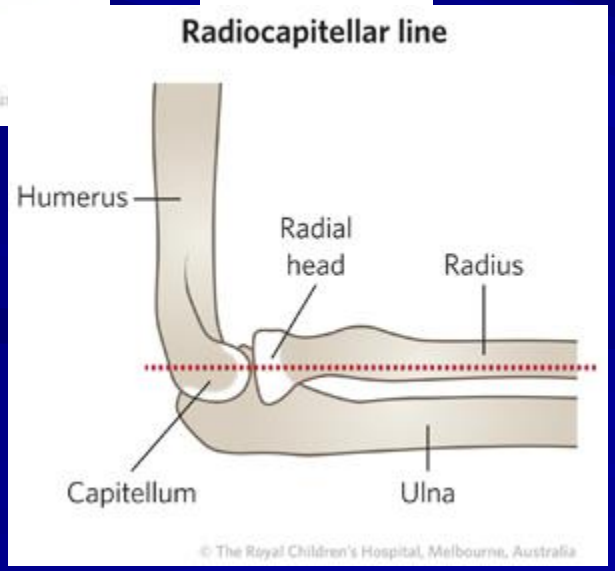




ACR learning file

Alignment Evaluation on the lateral and AP radiographs





www.rch.org.au

- Anterior humeral line- normally intersects the middle one third of the capitellum from the anterior aspect of the humerus.
- Radiocapitellar line- normally intersects the midportion of the distal radius to the midportion of the capitellum.

Capsular Fat Pad Signs

- Anterior fat pad can be seen normally BUT should not be bowed or extended (sail sign indicating pathology or fracture).
- Posterior fat pad sign is ALWAYS bad. Always assume a fracture until proven otherwise.

Case

- 6 yom with elbow pain

Lateral and AP Views

Donated by Dr. Nicholson

Magnified

Radiographic Findings

- Supracondylar fracture- horizontal fracture line traverses the medial cortex and extends to the lateral cortex of the distal humerus, superior to the condyles >>very difficult to see.

However…..

- Positive posterior and anterior fat pad signs or fullness anterior and posterior to the elbow joint>>>>assume there is a fracture!!!!

Supracondylar Fracture

- Most common elbow fracture in children

- Mechanism: FOOSH (falling on outstretched hand) with hyperextension of the elbow

Complication

- Injury to the radial nerve; other>>>median and ulnar nerve.

Follow-up

- If no angulation, rotation or displacement of the fracture fragment= cast to immobilize.

- Orthopedic pediatrician

Case

- Two athletes with elbow pain

AP and Lateral View of the Elbow of Patient #1

AP and Lateral View of the Elbow of Patient #2

www.imageinterpretation.co.uk

Radiographic Findings:

First patient

- ***Chisel Fracture*** with linear fracture line of the articular surface of the distal radial epiphysis

- Positive posterior and anterior fat pad sign

Radiographic Findings

Second patient

- ***Radial neck fracture*** with complete fracture & cortical off-set on the lateral view
- Displacement of the anterior capsular fat pad (sail sign)
- Malalignment of the radiocapitellar line with anterior angulation of radial head

Radial Head Fracture

Clinically, positive fat pad sign= Fracture

Radial Head Fracture

- **Treatment**
  - Undisplaced radial head fracture: closed reduction/cast & early mobilization
  - Rule of 3's (Mason classification) for Nonsurgical Treatment
    - Fracture involves less than 1/3 of articular surface
    - Less than 30 degree angulation
    - Less than 3.0-mm displacement of the fracture fragment(s)

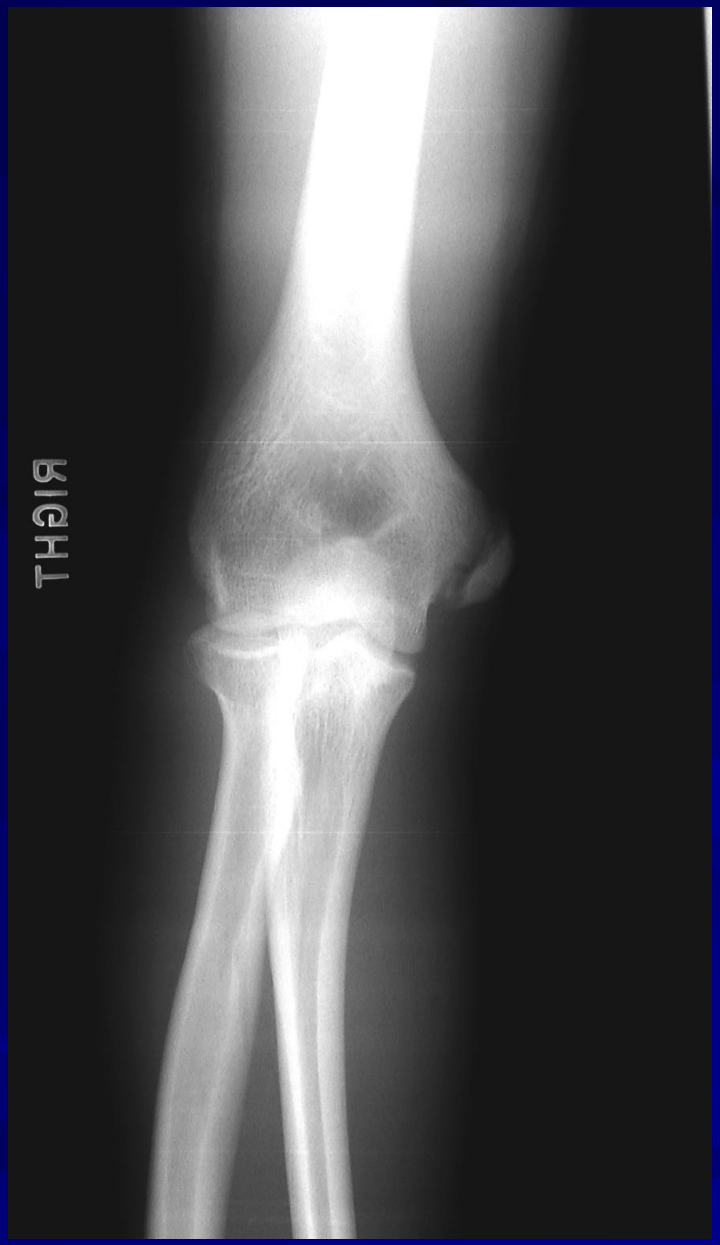
Radial Head Fracture

- Orthopedic surgeon referral
  - ORIF (open reduction internal fixation)
    - When the Rule of 3's do not apply
    - Instability
    - Redislocation

Rabin S, MD. Radial Head Fractures. www.emedicine/medscape.com May 2009.

Case

- 14 year-old male with elbow pain

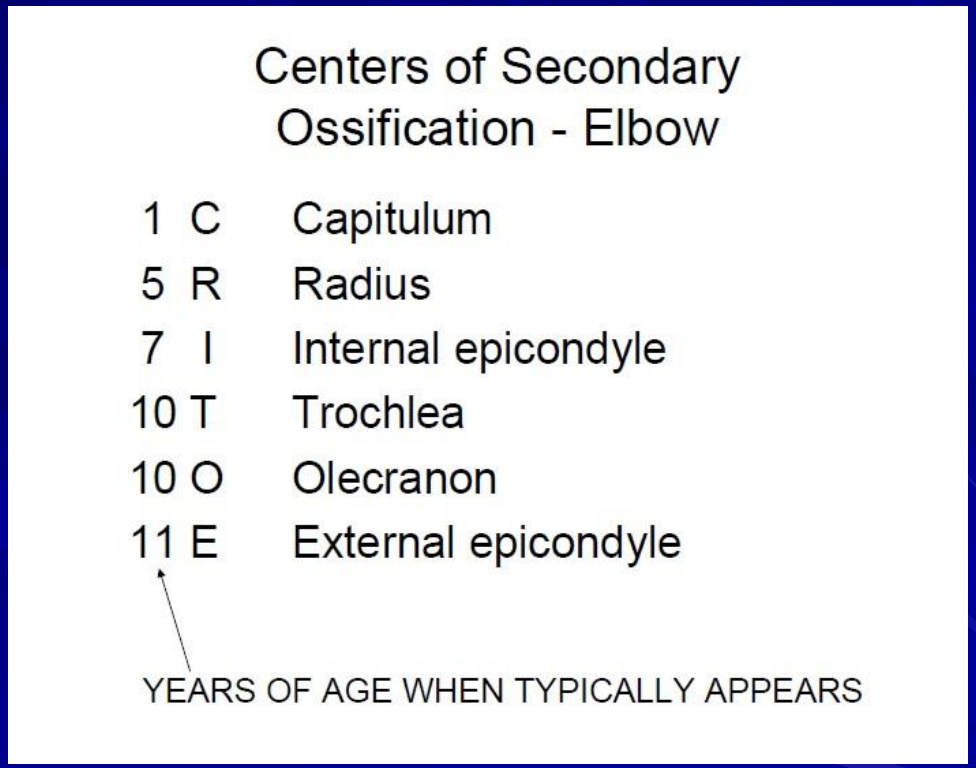


Donated by Dr. Nicholson

Compare to the normal x-ray study of a 14 yom. Where is the abnormality?

Different Patient: normal x-ray of 14 year-old male

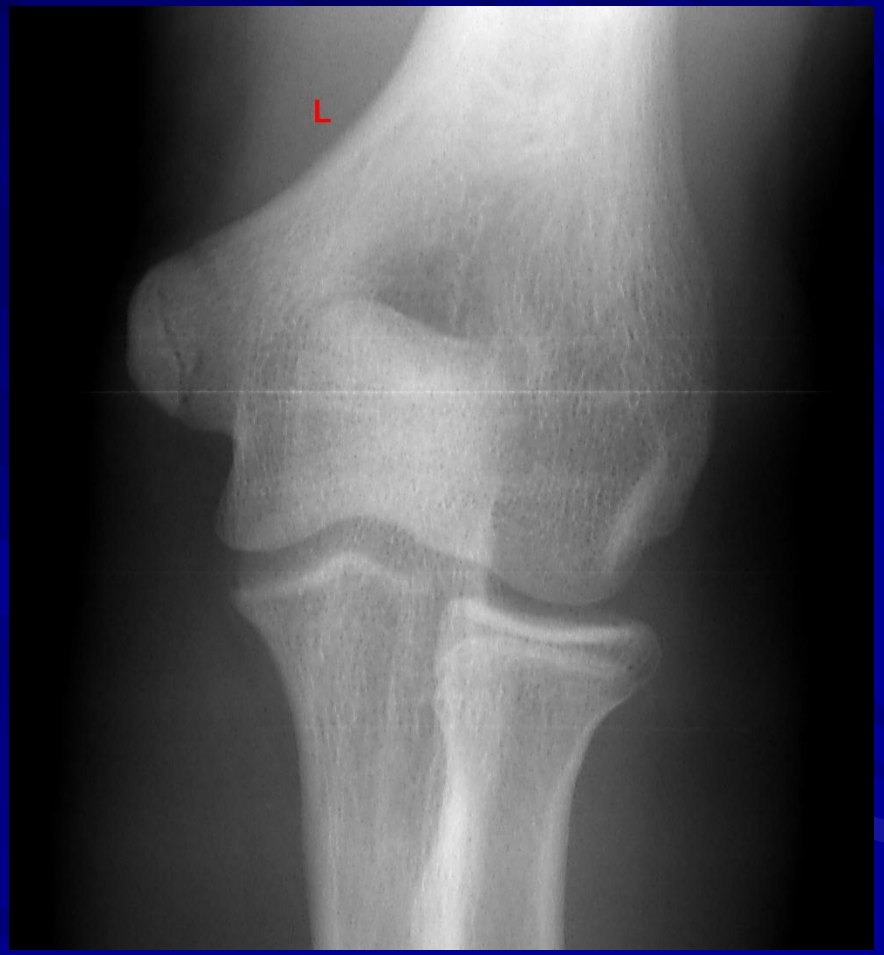
- Capitellum, trochlea, proximal radius, & olecranon fuses by 14-15 yoa.
- Lateral and Medial epicondyle fuses by age 20.



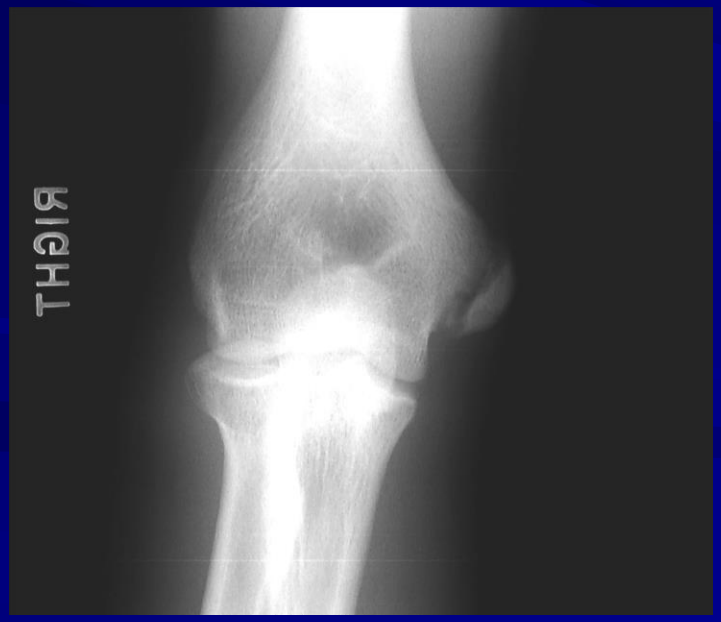
Little Leaguer's Elbow

- Traction apophysitis of the medial epicondyle
  - Repetitive trauma or falling on outstretched hand (FOOSH) with valgus force
- 10-25 % of young pitchers from repetitive throwing.
- Immobilize/cast

4 Weeks Later



Initial X-ray



Case

- Hx: 18 yom, lateral elbow pain for 4 months

Radioluency along the articular surface of the capitellum; subtle flattening.

AJR Dec 2005; 185 (6), 1453-9.

Osteochondritis Dessicans

- Mechanism of Injury: repetitive, valgus stress or trauma to poor vascularized capitellum
- Adolescent athletes: baseball pitchers and gymnasts
- S/S: pain, tenderness, swelling over lateral elbow
- Follow-up: MRI without contrast

MRI Sagittal T1 and T2 Weighted

Capitellum: Disruption of the articular cartilage with abnormal crescenteric subchondral high signal intensity. This is unstable.

AJR Dec 2005; 185 (6), 1453-9.

Advanced Imaging

- MRI: most common; used for early detection
- MSK ultrasound
- Size, location and stability
  - Unstable: disrupted articular cartilage
    - Determines treatment or surgery

Shoulder

Shoulder

- AP Internal Rotation
- AP External Rotation
- Baby Arm and/or Scapular Y and/or Axillary Oblique view

AP SHOULDER (internal rotation)

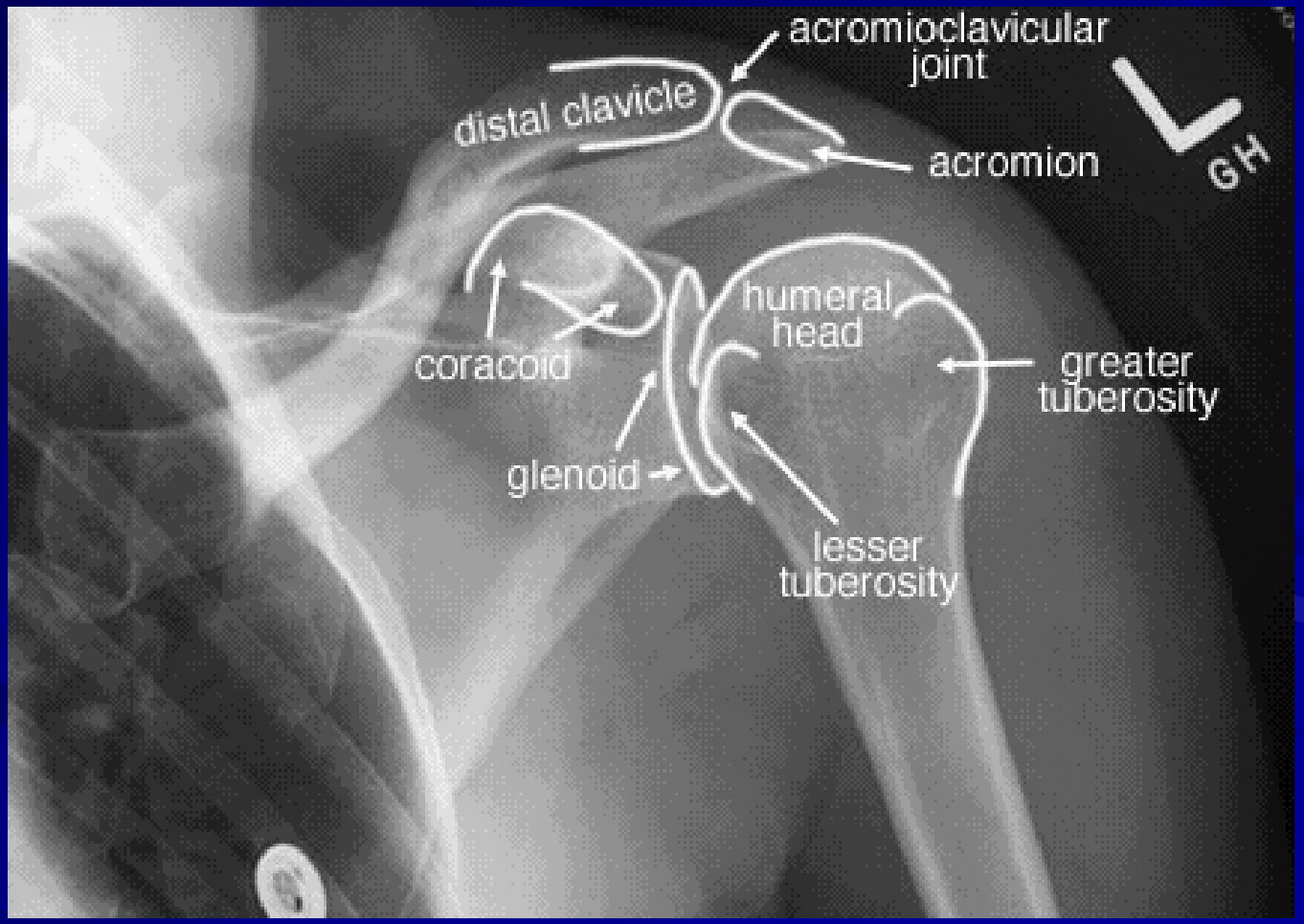
- **FFD** 40”
- **Collimation** 10x12
- **CR** 1” below coracoid process

SHOULDER INTERNAL ROTATION

Structures Visualized

- Coracoid Process
- Greater and Lesser Tuberosities
- Glenoid
- AC Joint
- Acromion
- Ribs/lung
- Scapula
- Clavicle

SHOULDER INTERNAL ROTATION - Labeled

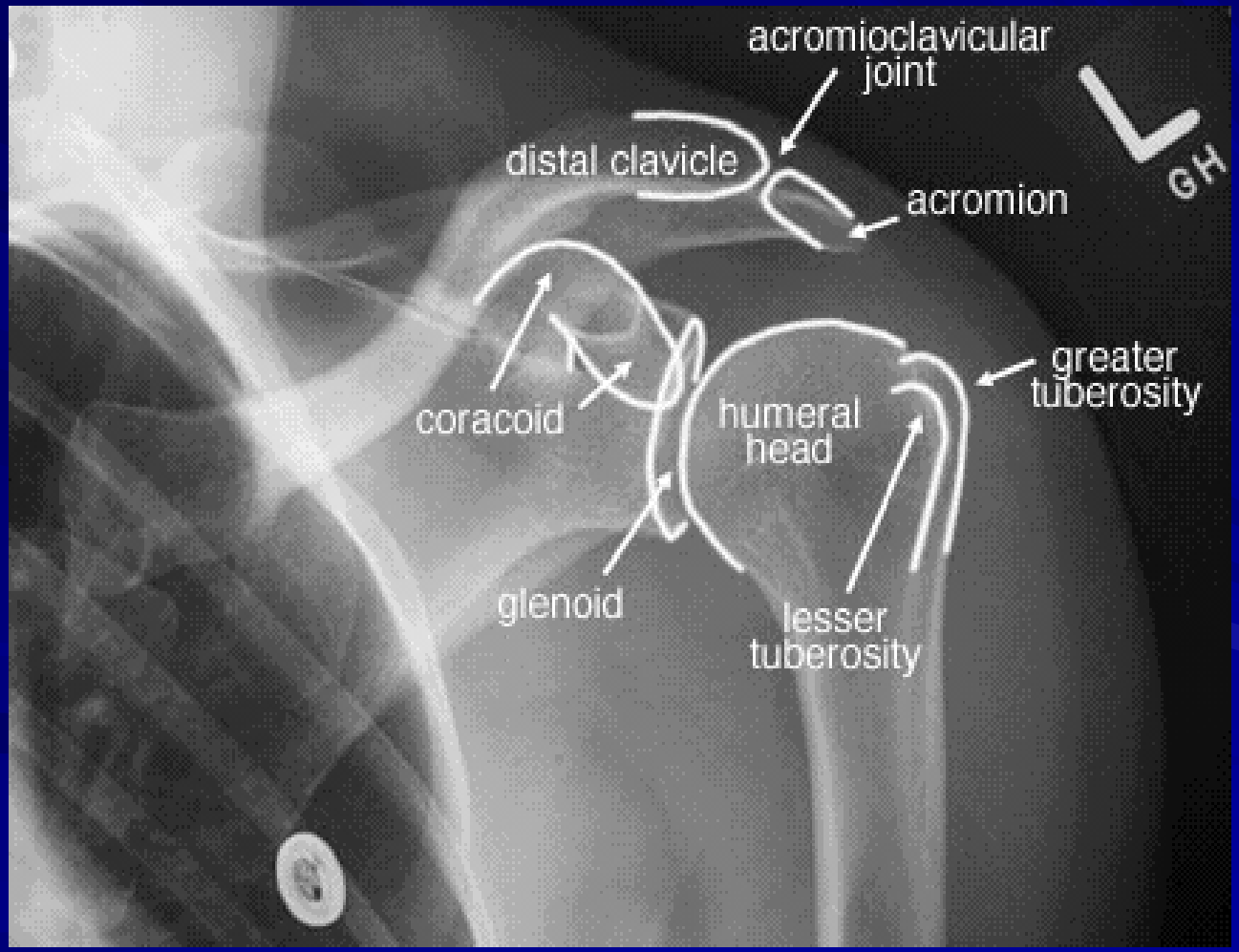


SHOULDER EXTERNAL ROTATION

Structures Visualized

- Coracoid Process
- Greater and Lesser Tuberosities
- Glenoid
- AC Joint
- Acromion
- Ribs/lung
- Scapula
- Clavicle

SHOULDER EXTERNAL ROTATION - Labeled



BABY ARM (SHOULDER)

- **FFD** 40”
- Collimation 10x12 landscape
- **CR** 1” below coracoid process

BABY ARM SHOULDER

Structures Visualized

- Coracoid Process
- Greater and Lesser Tuberosities
- Glenoid
- AC Joint
- Acromion
- Ribs/lung
- Scapula
- Clavicle

PA Oblique or Scapular Y View

- **Patient: Anterior oblique with shoulder against the bucky/grid; arm at patient's side, internally rotated.**
- **FFD** 40”
- **Collimation** 10x12
- **CR** midpoint of vertebral border of the scapula

Cornuelle, et al. Radiographic Anatomy &Positioning. 1998

PA Oblique or Scapular Y View

www.eorif.com

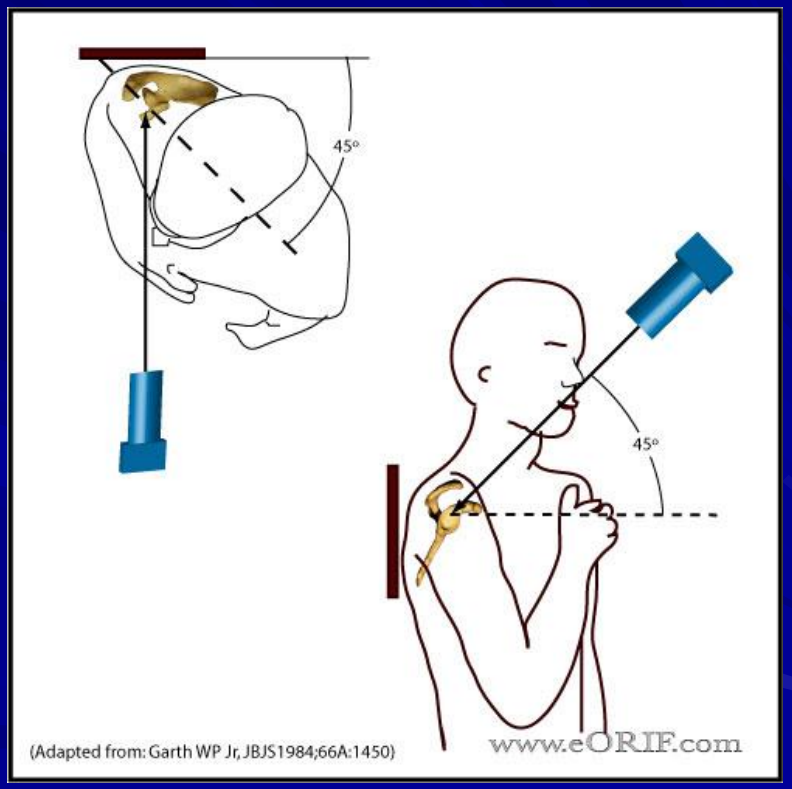
Apical Oblique (Garth) View

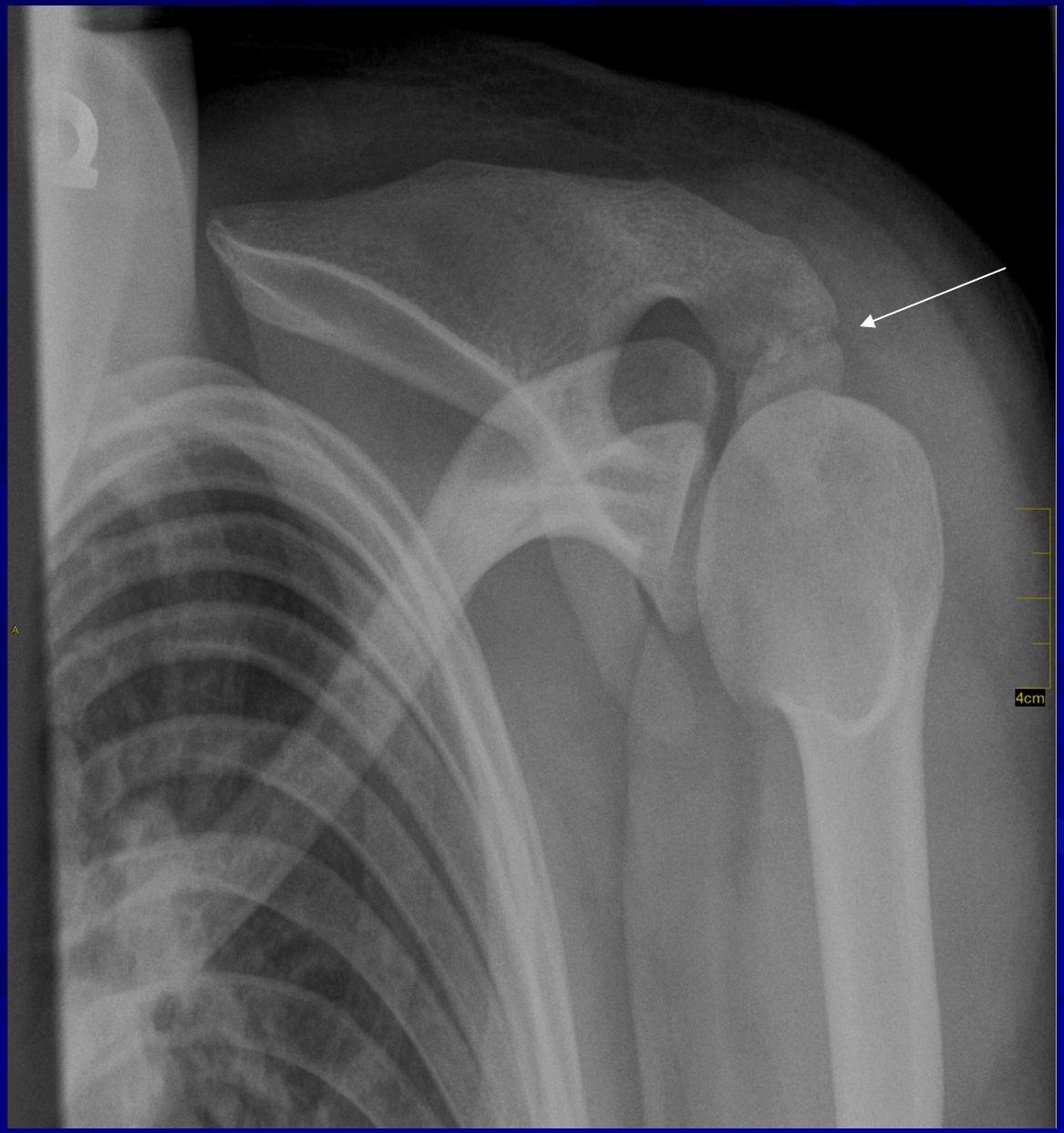
- Supine; 45 degree posterior oblique; arm adduction + internal rotation

- FFD 40 (31inches)

- CR GH joint

- Tube tilt 45 degrees caudad



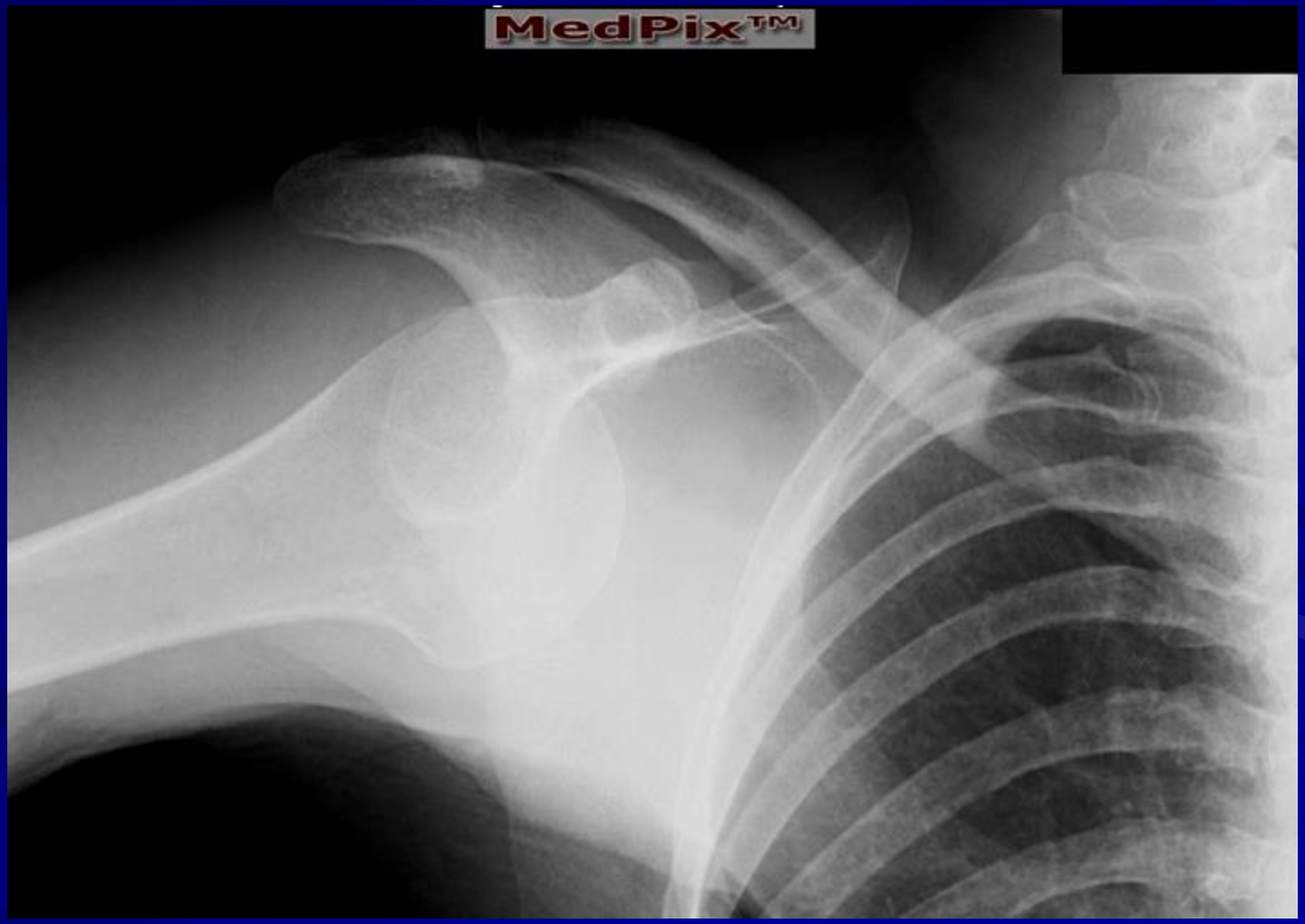


Arrow is indicating a normal variant, os acromiale.

Case

Hx: 30 yof previous sports injuries and history of right shoulder dislocation

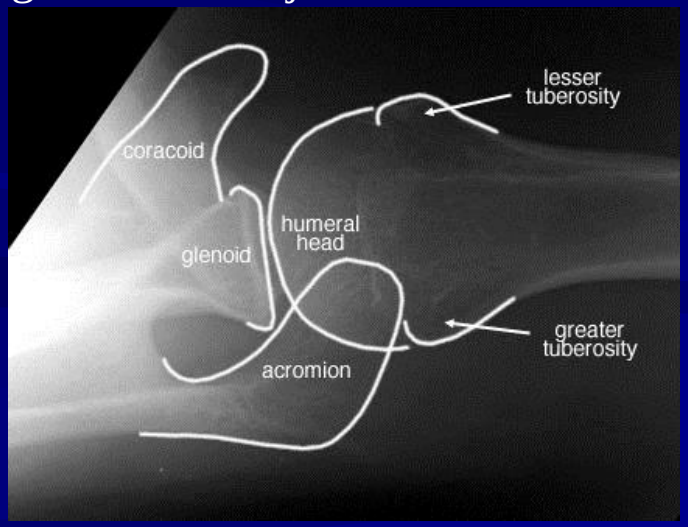
AP view



Axillary View

Abnormal articulation of the glenohumeral joint

Normal articulation of the glenohumeral joint.



www.ucsf.edu

Anterior Dislocation

- Anterior and medial displacement
  - Most common location is subcoracoid

- Flattening of the posterolateral aspect of humeral head= Hill Sach Deformity (seen on the axillary view)

  - The posterolateral aspect the humeral head contacted the anterior,inferior aspect of the glenoid during anterior dislocation.

Complication

- Labroligamentous tear
- Instability
- Degeneration

Shoulder Dislocations

- Posterior (rare)
  - Mechanism of injury (MOI) is forced adduction, internal rotation; or fall on extended + internal rotated arm
  - Clinical presentation= arm in adduction & internal rotation; flattened anterior deltoid; and prominent acromion and coracoid
- Anterior (most common)
  - MOI is direct impact with forced abduction, external rotation and extension
  - Location= subcoracoid, subglenoid and subclavicular
  - Clinical presentation= flattened deltoid; arm in abduction & external rotation

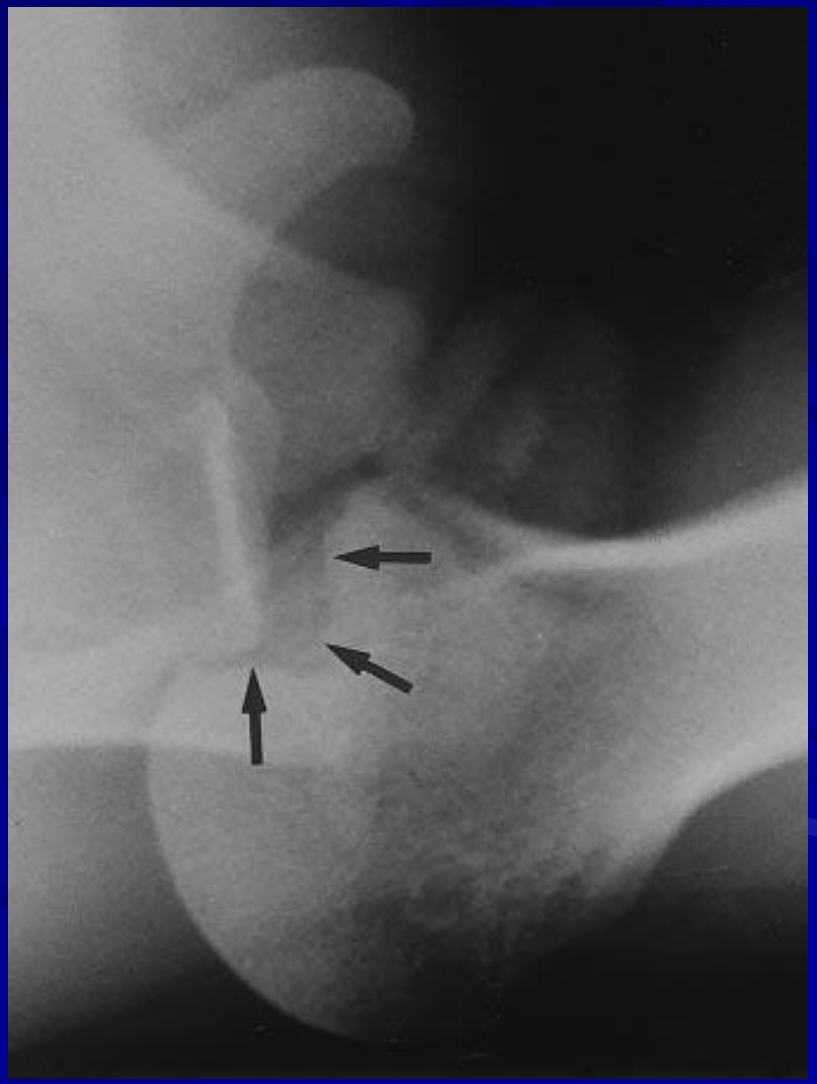
Anterior Humeral Dislocations

- Injury to brachial plexus and/or axillary nerve
- Tear of the labrum, capsule, ligaments, rotator cuff and bicep tendon; bone contusion or fracture
- Instability

Posterior Humeral Dislocation

- Anteromedial flattening of humeral head
- Posterior labral tear
- Fracture/avulsion of lesser tuberosity at the attachment site of the subscapularis

Posterior Humeral Dislocation



Radiology 2002; 224: 485-486

Treatment

- Reduction and immobilization
- Labroligamentous repair

Complications

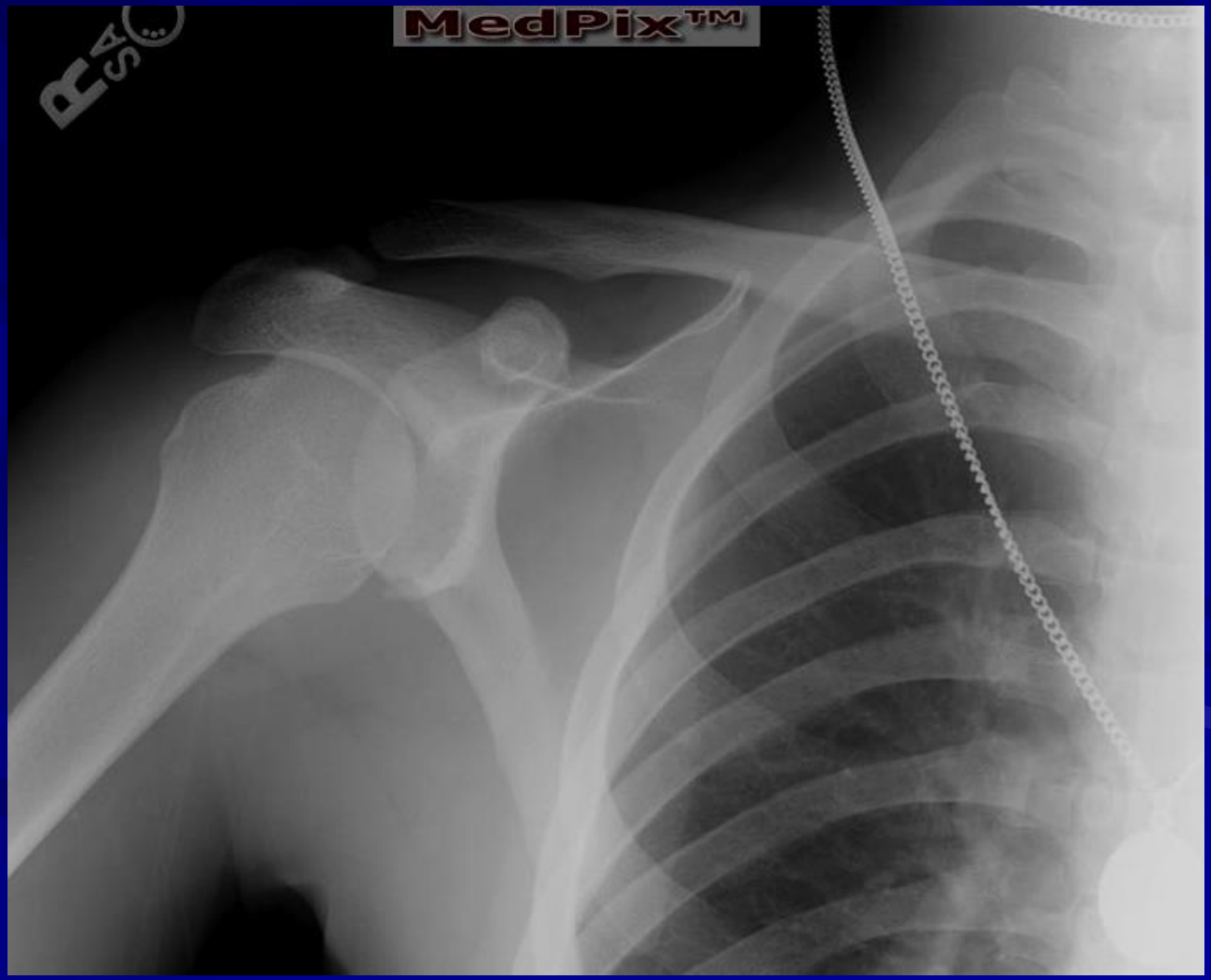
- –Instability & recurrent dislocations
- – Degeneration

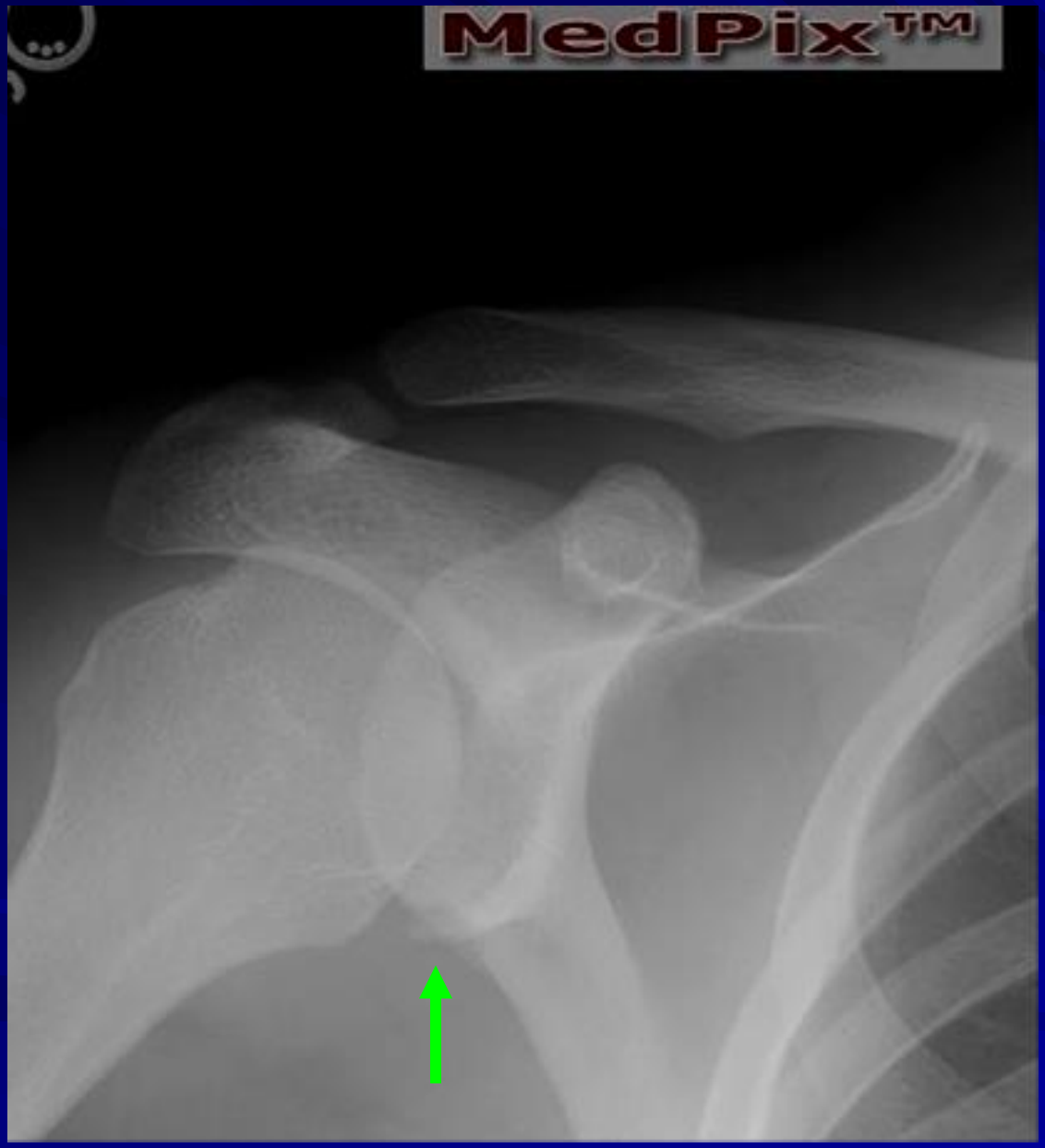
Case

Hx: Chronic shoulder pain

What type of previous injury did this patient likely have based on the radiographic findings?

AP External Rotation





- Osseous roughening or remodeling of the anterior, inferior glenoid>>**Bankart Lesion**
- Flattening of posterolateral proximal humeral head>>>**Hill Sach deformity**

Previous Bankart Lesion and Hill Sach Deformity

- Clinically correlate for previous trauma and anterior shoulder dislocation.
- Follow-up: MRI, if clinically necessary.

Case

- Rugby player with shoulder pain.

AP internal and external oblique, & Scapular Y Views

AC Separation/Sprain-Grade III

- Widening of the acromioclavicular and coracoclavicular joint= Grade III

- Mechanism of Injury
  1. Direct impact to tip of shoulder forcing acromion process posterior, inferior and medially while clavicle is pushed against rib cage
  2. FOOSH (falling on outstretched hand)- long axis upward force

- Association
  - Contusion to distal clavicle

Grade 1-6

Type	Anatomy	Radiographic findings	Prognosis
I **Sprain**	Stretching of AC ligament AC joint is stable CC ligament intact	Only seen on stress views of injured and uninjured shoulders=widening of AC joint	No instability
II **Subluxation**	Partial or complete rupture of AC ligament Partial, but not complete, disruption of CC ligament	Widening of AC joint but a normal coracoclavicular distance Stress films may still be required to demonstrate widening of both AC joint and CC space	May require arthroplasty
III	Disruption of both AC and CC ligaments	Widening of both the AC and CC spaces on routine erect film	Internal fixation
IV **Posterior**	AC and CC ligaments disrupted but coracoacromial ligament remains intact	Distal end of clavicle lies inferior and posterior to acromion seen best on axillary view	
V **Inferior**	AC and CC ligaments disrupted Coracoacromial ligament remains intact Sternoclavicular separation occurs as well	Marked widening of both the AC and CC space Sternoclavicular dislocation	
VI	Distal end of clavicle displaced inferiorly and lodges in biceps and coracobrachialis muscles	Distal end of clavicle comes to lie inferior to acromion	

Measurements on X-ray

- Acromioclavicular joint width
  - <5mm
  - Right and left differ by no more than 2-3 mm
- Coracoclavicular distance
  - <11-13 mm
  - Right and left differ no more than by < 5 mm

AC Joint Radiographs

- AP Non-weight bearing & Weight bearing views
- 10-15 cephalad tube tilt
- Can perform at 72 inches to decrease magnification

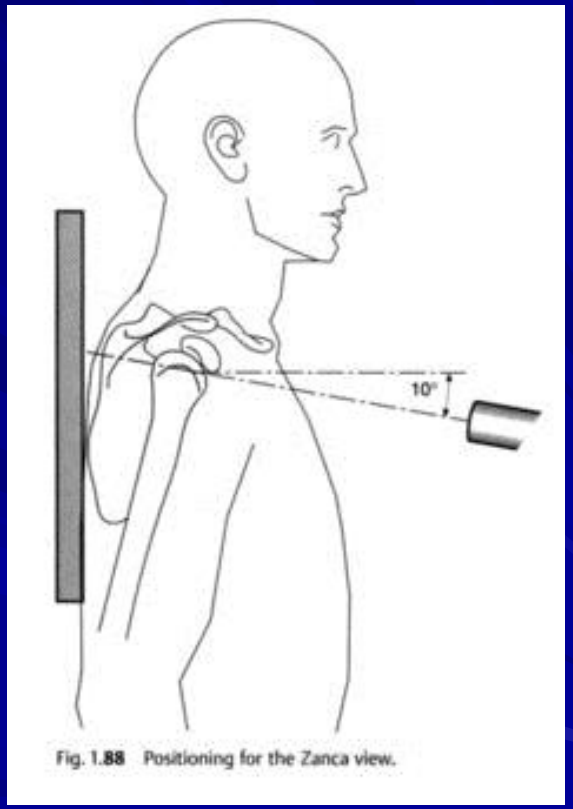


Fig. 1.88 Positioning for the Zanca view.

10-15 Cephalad Tube Tilt of AC Joint- Stress Views

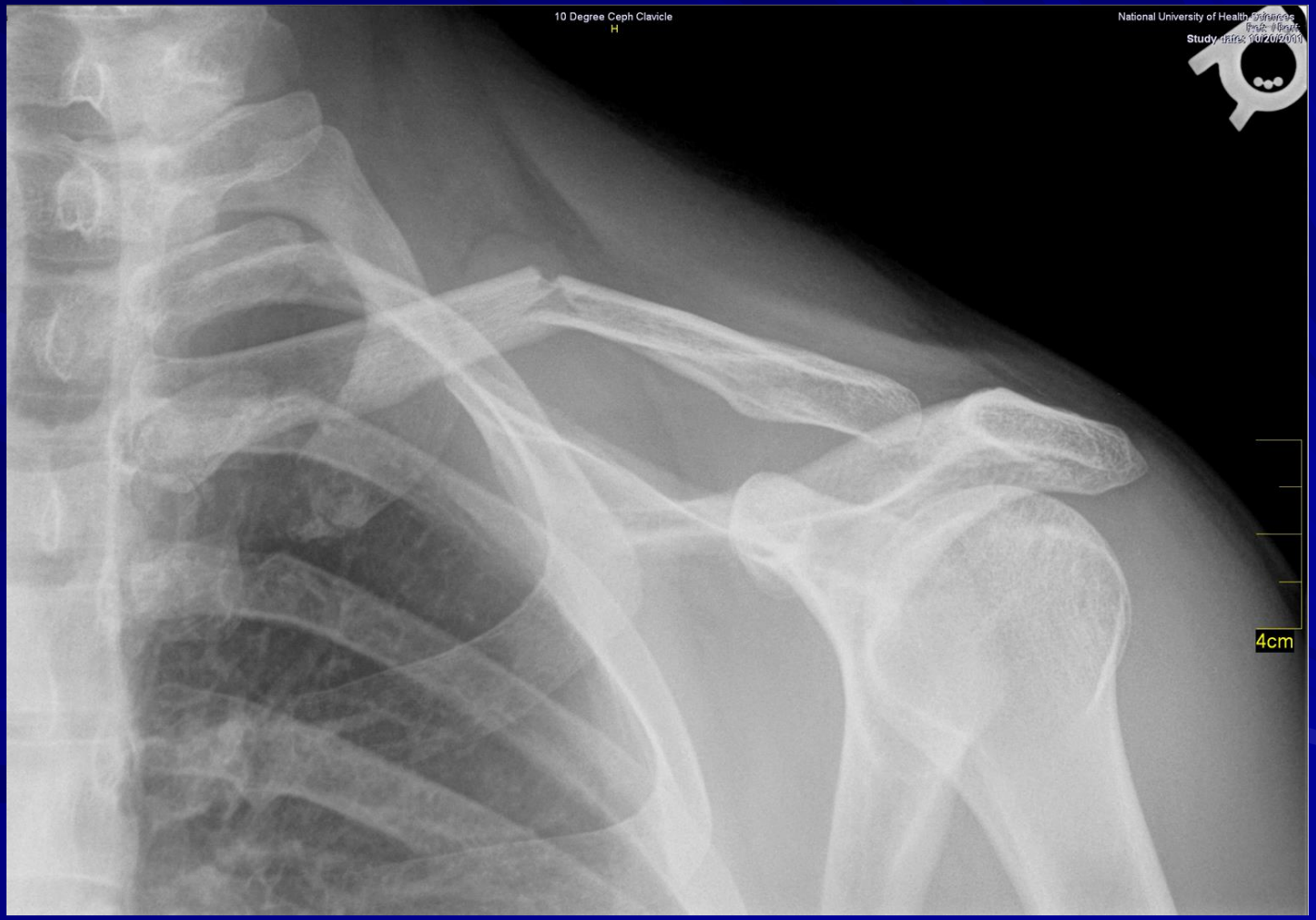
Complications

- Instability
- Post traumatic osteolysis of the clavicle (PTOC)

Case

- 26 yom with severe right shoulder pain while playing flag football. Patient landed on shoulder.

AP 10 degree cephalad tilt



1 month, 2 months, 3 months later

Clavicle Fracture

- Location= most common middle 1/3
- MOI= fall on outstretched hand; or direct fall onto tip of shoulder
- S/S= Patient holds arm with neck tilted to the side of fracture and contralateral rotation
- Complications
  - Non union
  - Thoracic outlet syndrome
  - Pseudo-arthrosis

Treatment of Clavicle Fracture

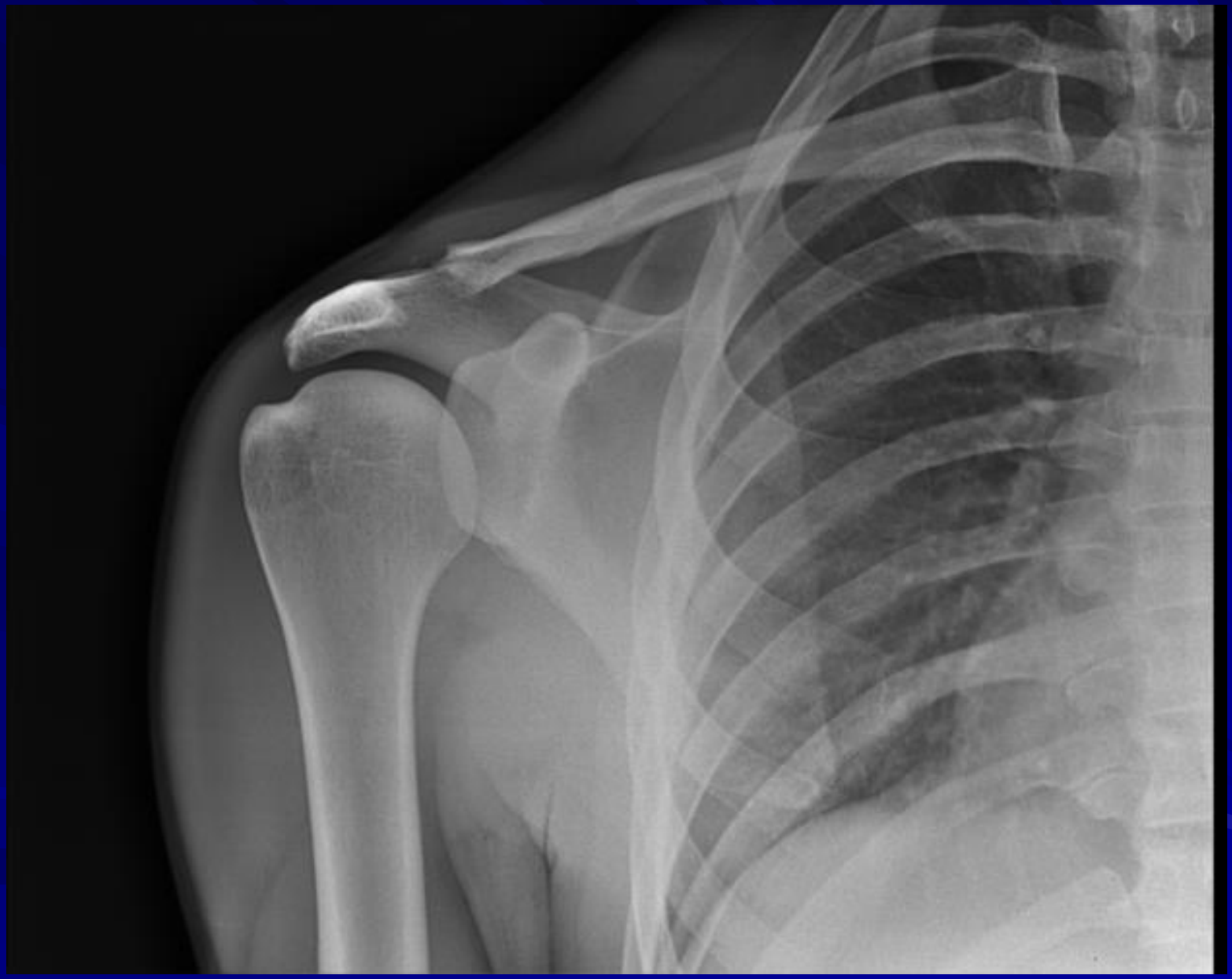
- Nothing
- Immobilization with Figure 8 brace for 6-8 weeks followed by gentle isometric and mobilization exercises
  - Brace for additional 3-4 weeks
- Surgical (rare)

FYI: Clavicle Radiographs

- AP Clavicle
  - No tube tilt; central ray is mid-clavicle
- AP Axial
  - Central ray midclavicle, 25-30 degree cephalad tube tilt to project the clavicle above the thorax
  - Can perform PA with caudad tube tilt

Case

- 31 yom shoulder trauma 3 months ago and still has pain.



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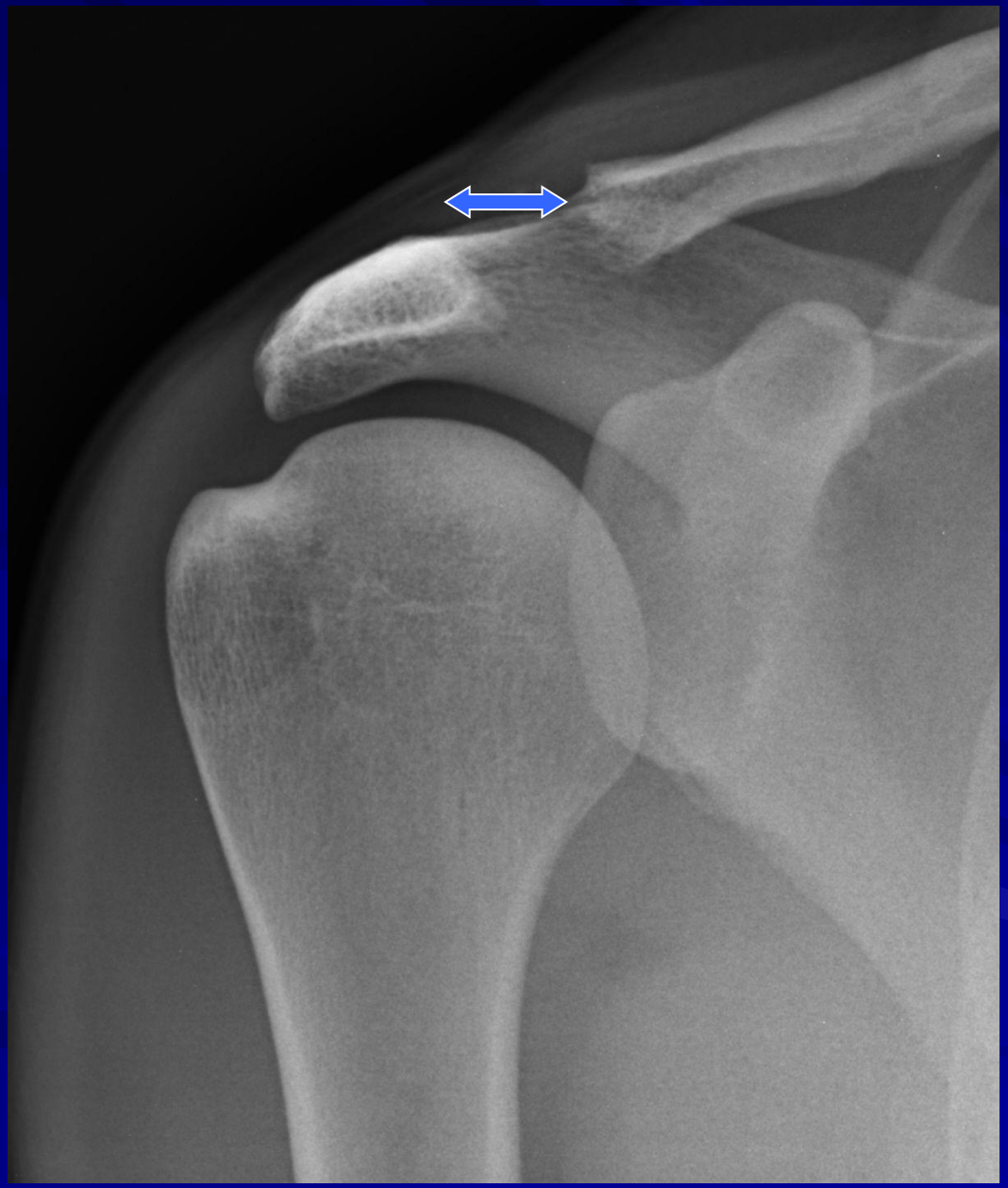


www.radiopaedia.org

PTOC-post traumatic osteolysis of the (distal) clavicle

- Mimics infection, tumor, and hyerparathyroidism
- Mechanism of Injury: direct trauma to AC joint or repetitive, strenuous activity
- Late teens to 40 years of age
- Signs & Symptoms: unilateral pain weeks to months after injury; pain is at the AC joint OR gradual onset of pain
- Weightlifting, handball, and baseball

Radiographic findings

- Loss of bone density and osteolysis of the subarticular bone of distal clavicle
- Lytic or erosive changes of subchondral bone within 3 months of injury
  - Findings as early as 2-3 weeks on xray
- Typically 1-3 mm of osteolysis

Outcome of PTOC

- 4-6 months to resolve
- Rest or eliminate the stress, ice, immobilize
- MRI may be helpful (but not always necessary) for further evaluation demonstrating bone marrow edema, joint effusion and widening of the AC joint.

Mestan M, Bassano J. Posttraumatic osteolysis of the distal clavicle: analysis of 7 cases and a review of the literature. *JMPT* 2001;24(5):356-361.

Resnick, D, Niwayama, G. *Diagnosis of Bone and Joint Disorders*, 3rd ed. Philadelphia: W.B. Saunders, 1995.

Yochum T, Rowe L. *Essentials of Skeletal Radiology*, 3rd ed. Baltimore: Williams & Wilkins, 2005.

Case

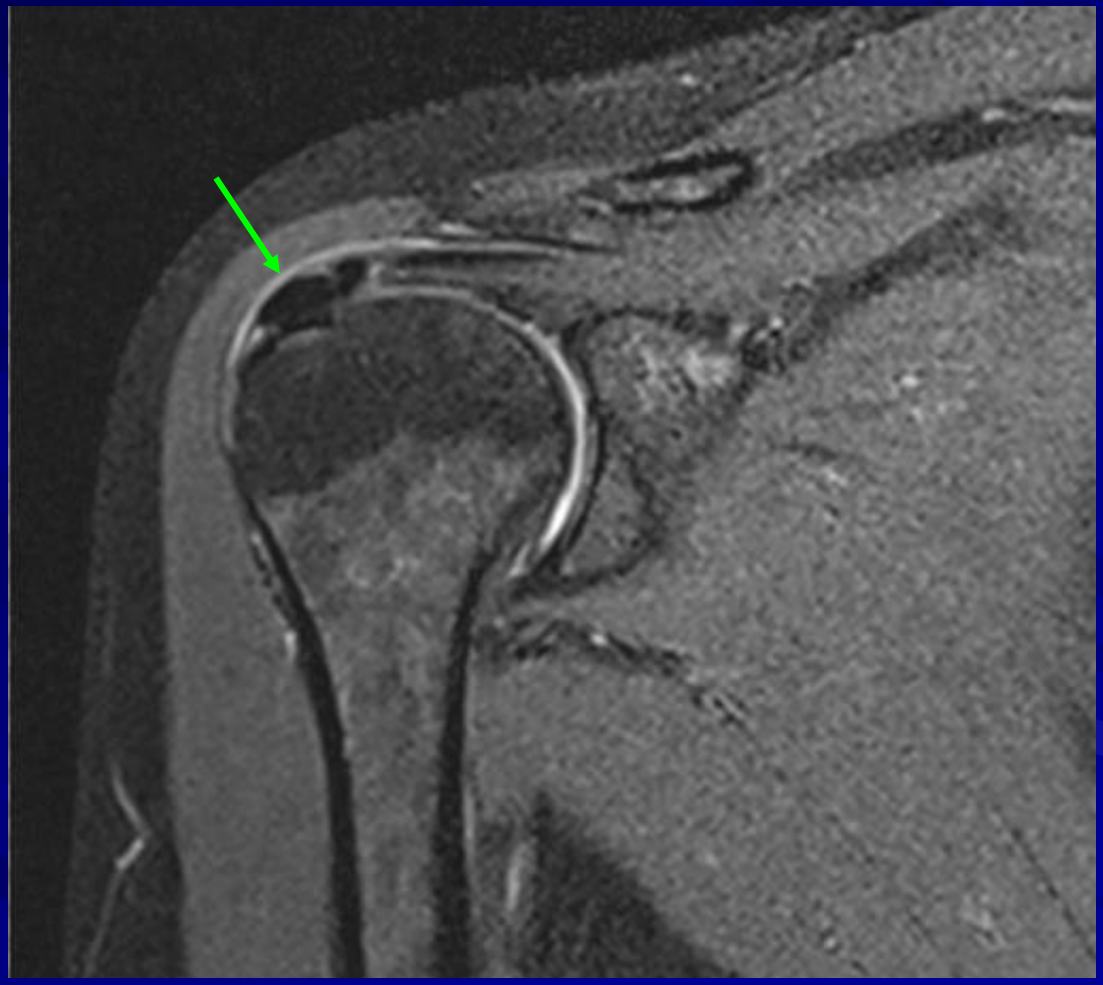
- 35 yom, surfer with sharp pain of the shoulder

AP external humeral rotation

Calcific Tendinitis of Supraspinatus

- Aka hydroxyapatite deposition disease
  - Ligaments, Tendons, Bursae and Capsule
- Cause: decreased oxygen tension, leading to fibrocartilagenous metaplasia and secondary mineralization
  - Trauma, degeneration
- Treatment
  - Anti-inflammatories; corticosteroid
  - Ultrasound; Laser
  - Shockwave therapy
- Surgical option when no relief in 6-12 months

MRI Proton Density



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Thank You ☺