UPPER EXTREMITY TRAUMA

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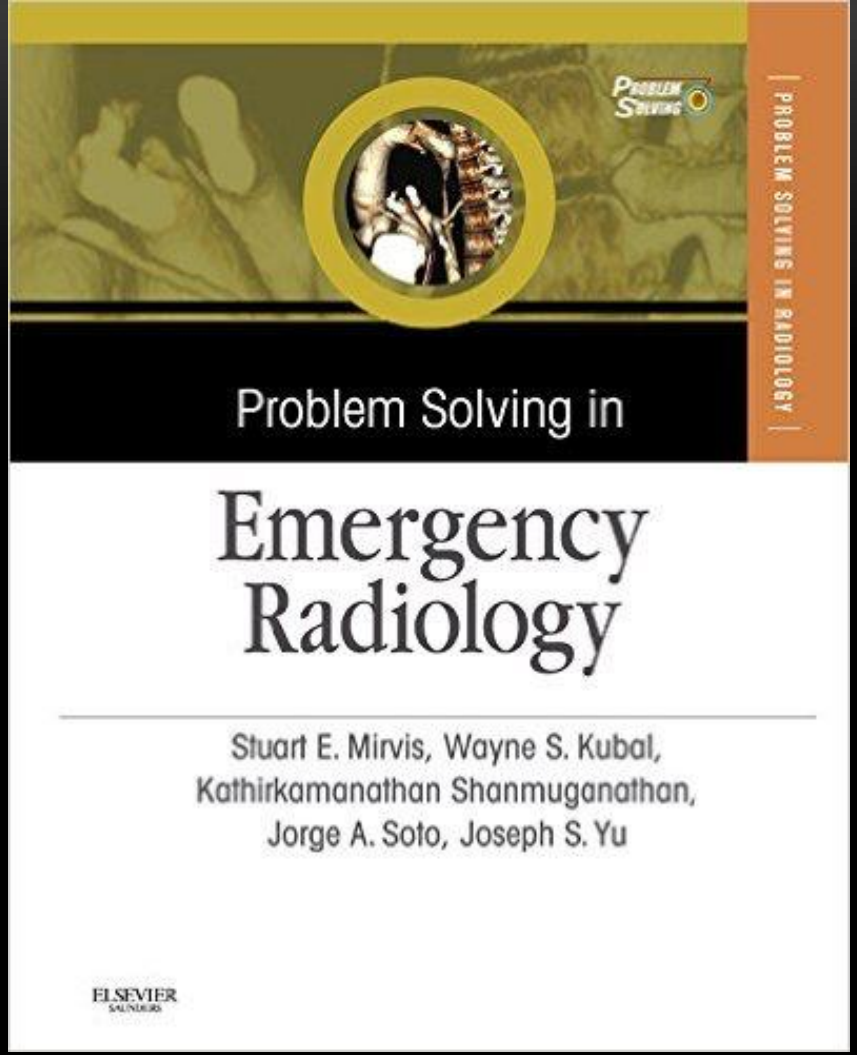
Red Duke Trauma Institute

MEMORIAL HERMANN


PROBLEM SOLVING
PROBLEM SOLVING IN RADIOLOGY
Problem Solving in
Emergency Radiology
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Jorge A. Soto, Joseph S. Yu
ELSEVIER
SAUNDERS

Acknowledgements

- Clark West MD
- Anthony Wilson MD
- Fred Mann MD

Objectives

- Recognize subtle signs of shoulder injury on radiographs
- Understand less common shoulder injuries
- Improve diagnostic yield with cross sectional imaging
- Understand the clinical implication of the injuries

Outline

Basics of Radiography

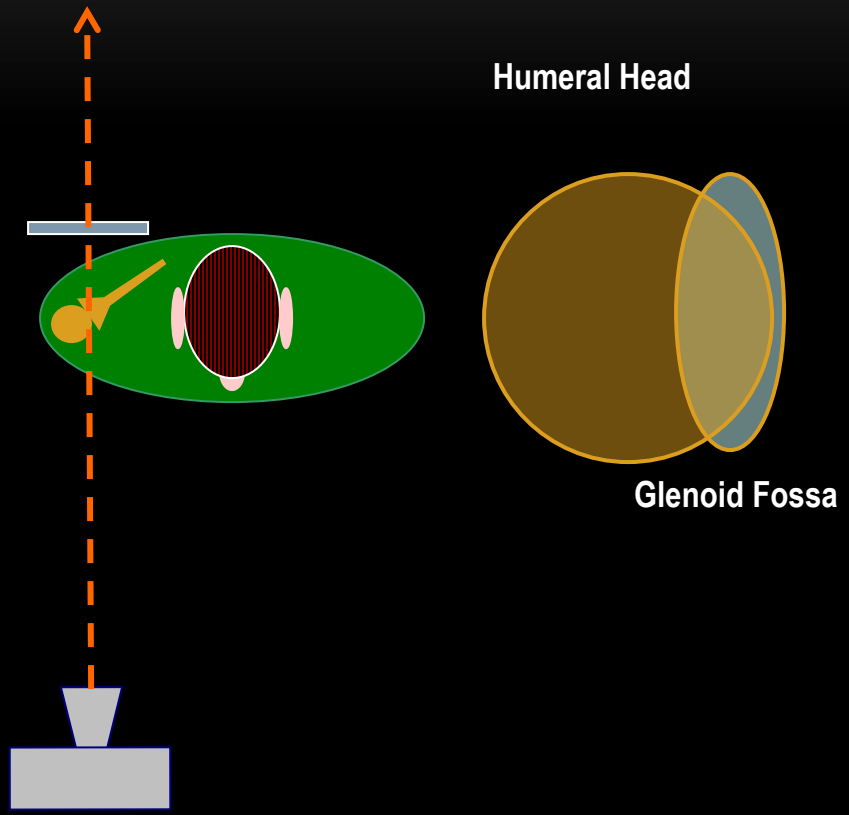
- Dislocations
- Acromioclavicular
- Scapula fractures
- Coracoid fracture
- Scapulothoracic dissociation

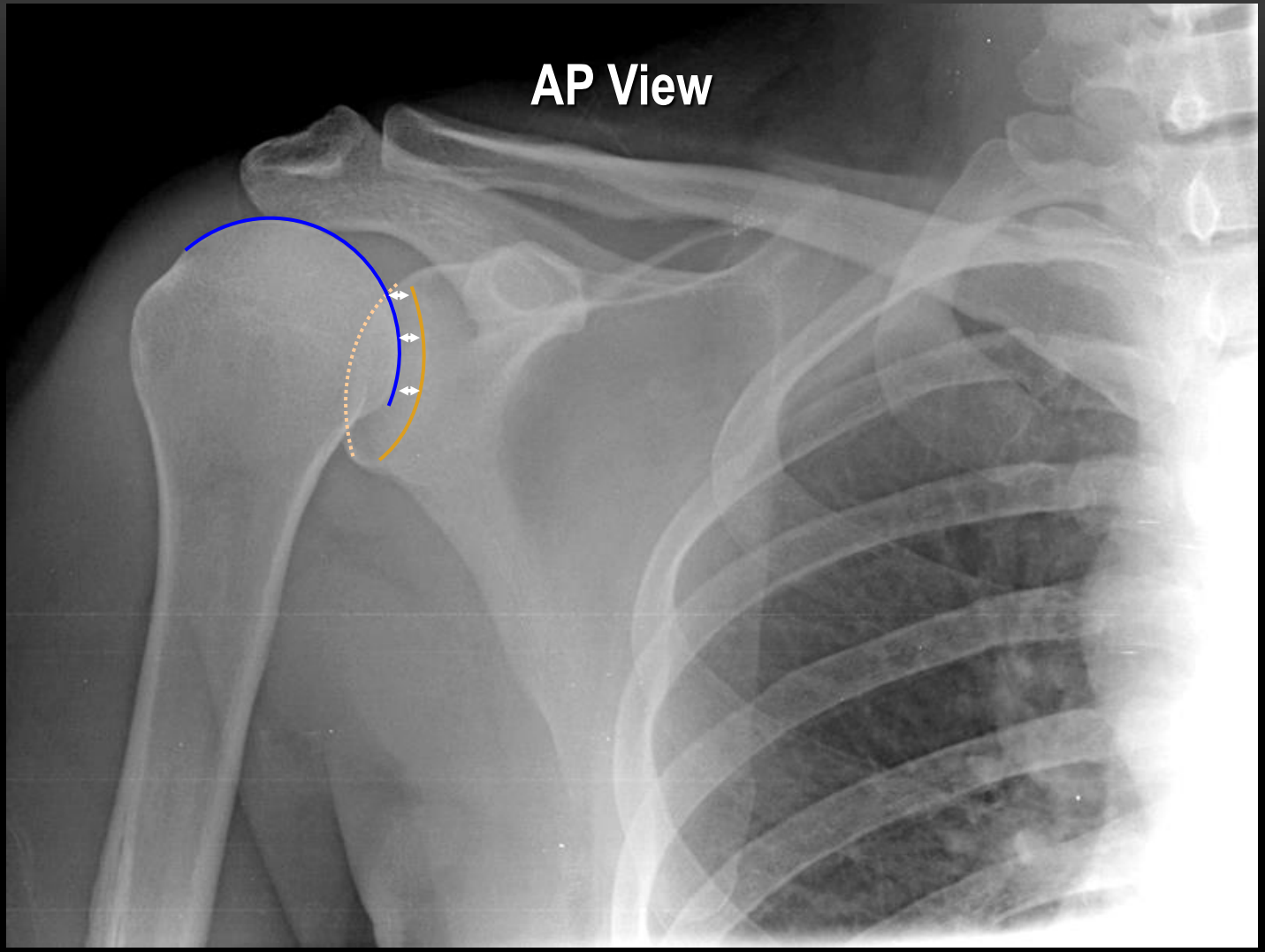
Shoulder - Radiographs

STANDARD VIEWS

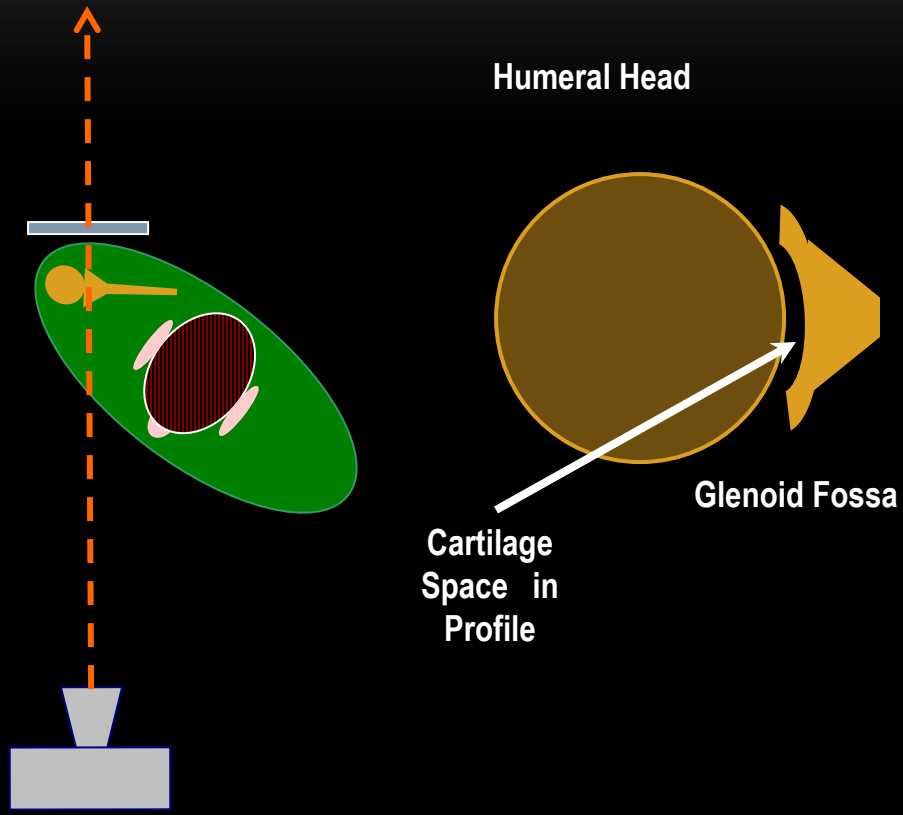
- AP View
- Grashey View
- “Y” View
- Axillary View

AP View

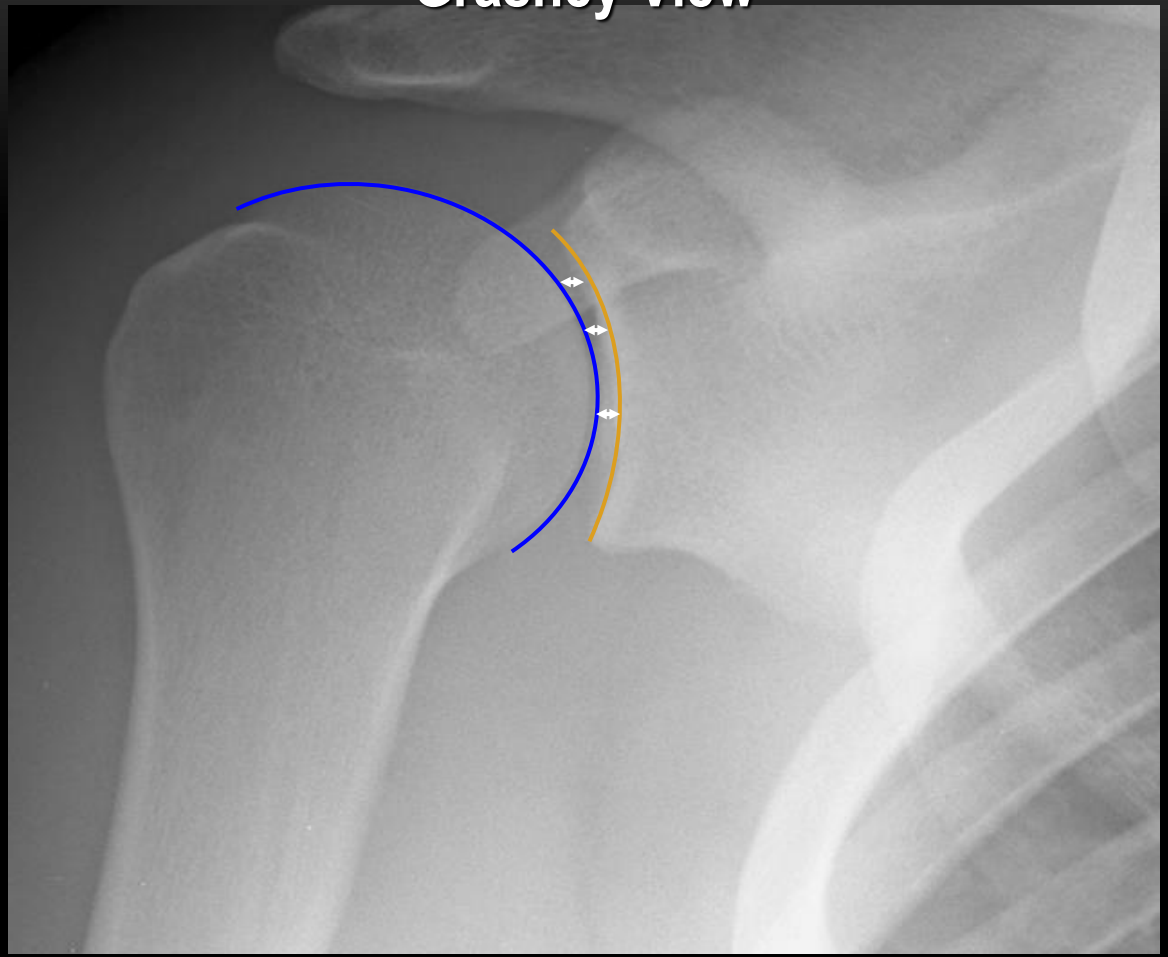



AP View

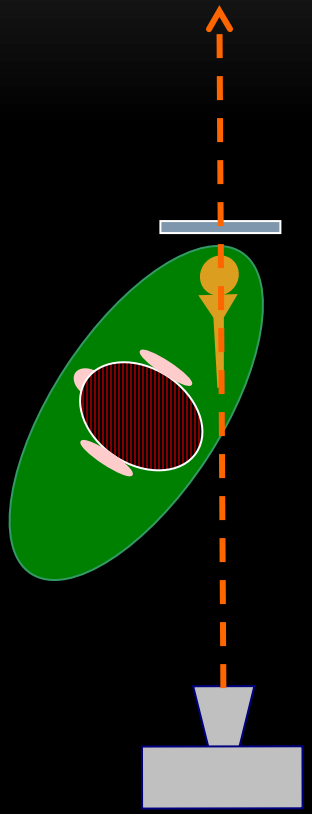
Grashey View

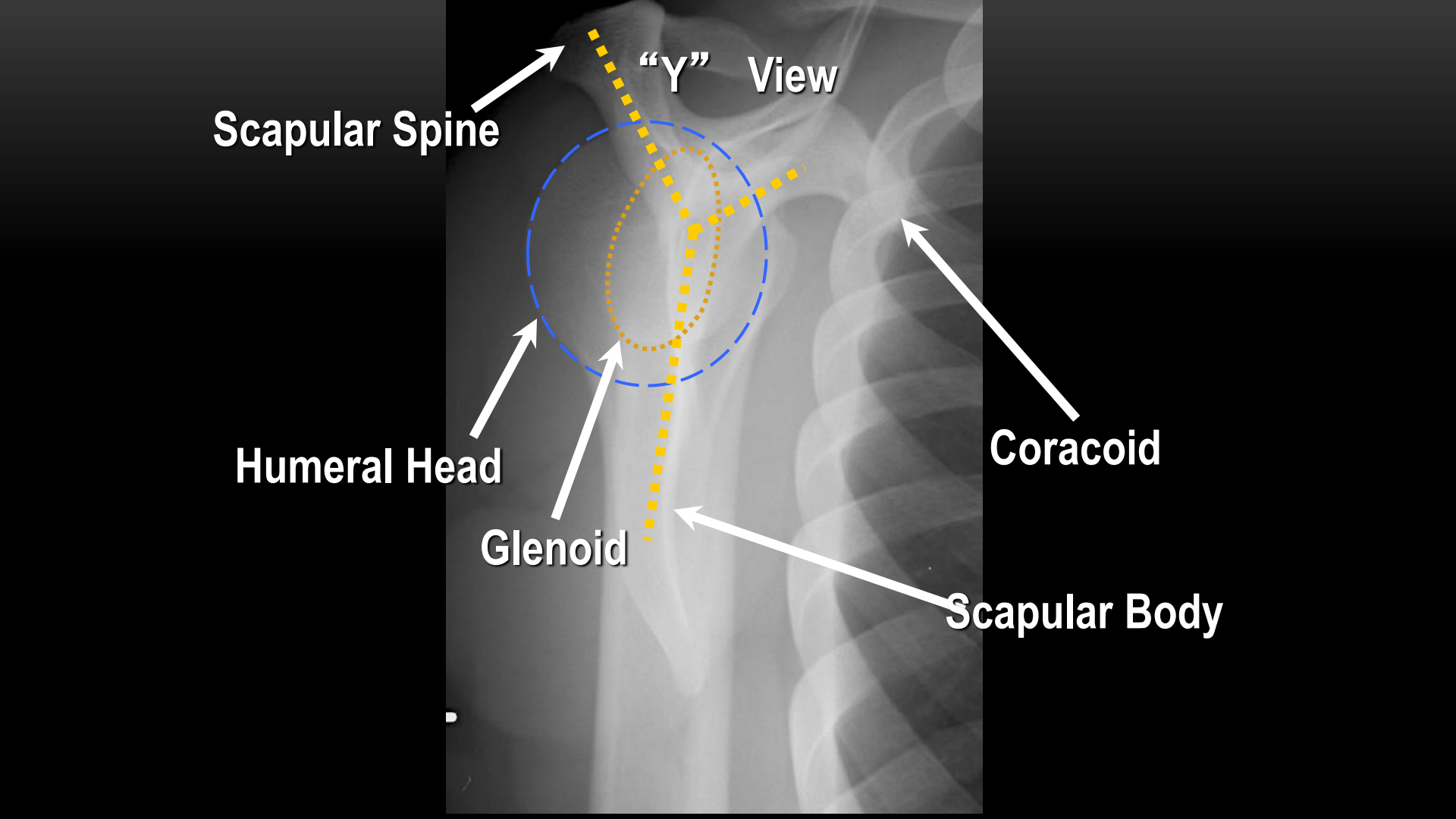


Grashey View

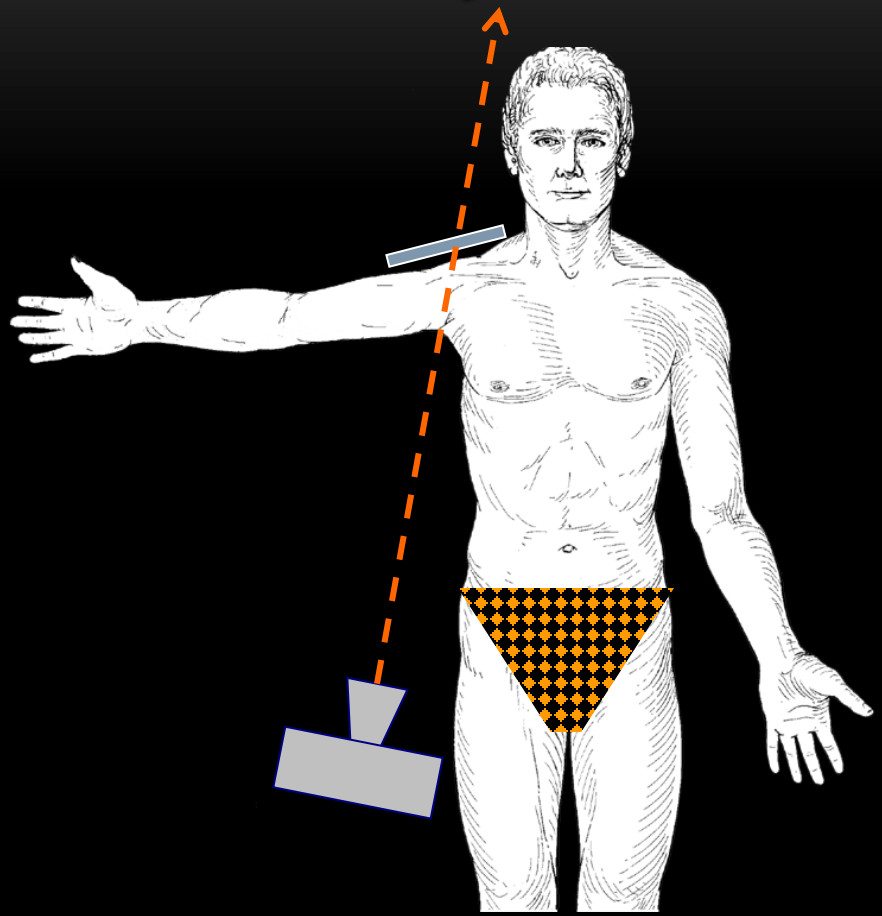


“Y” View

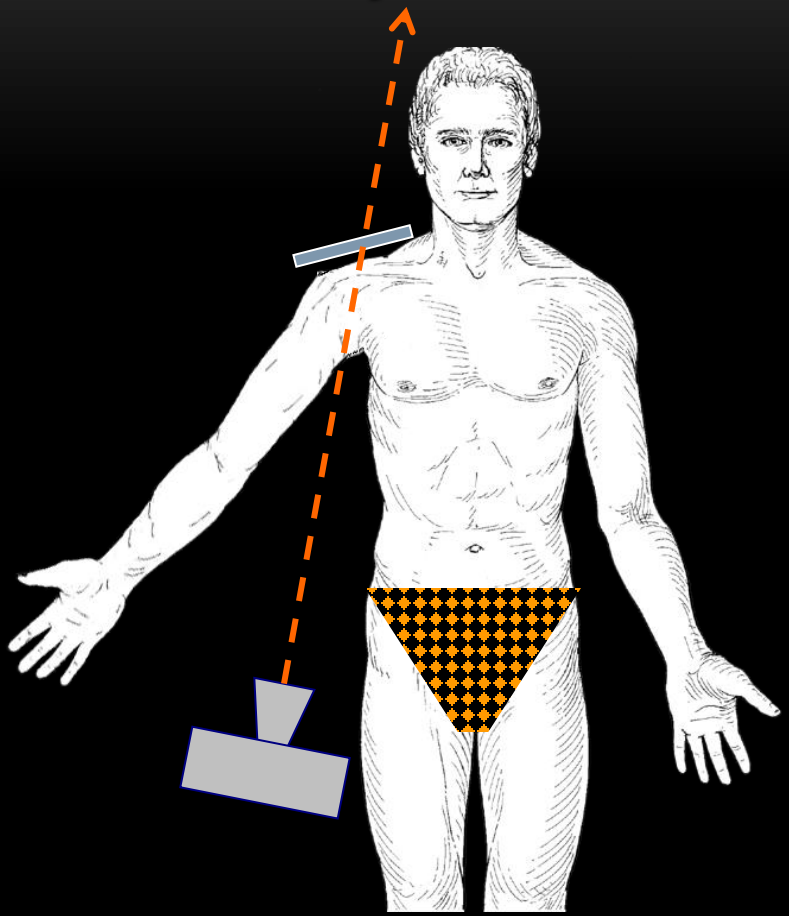



Scapular Spine
"Y" View
Humeral Head
Glenoid
Coracoid
Scapular Body

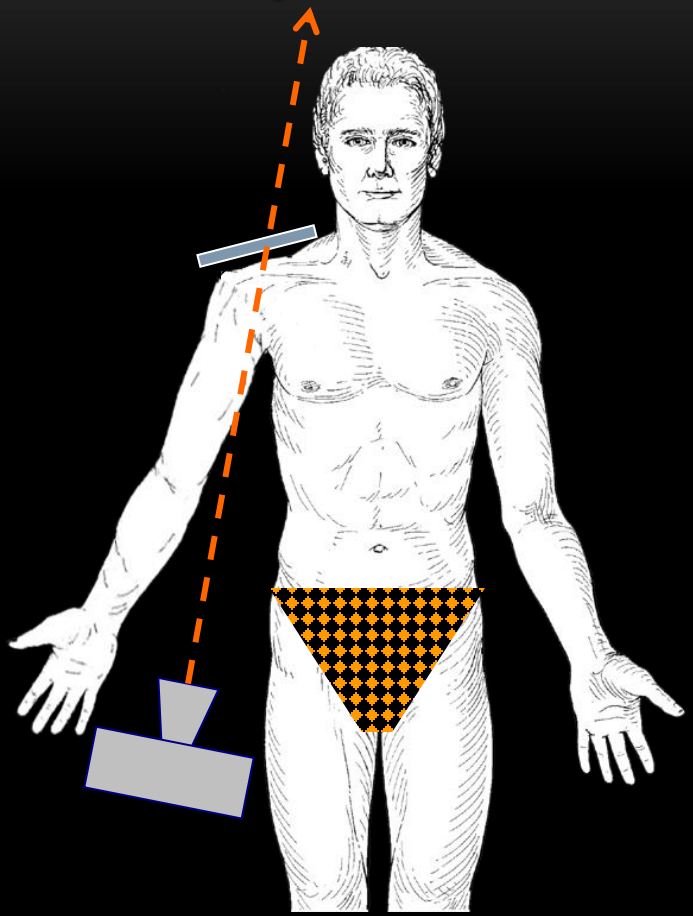
Axillary View

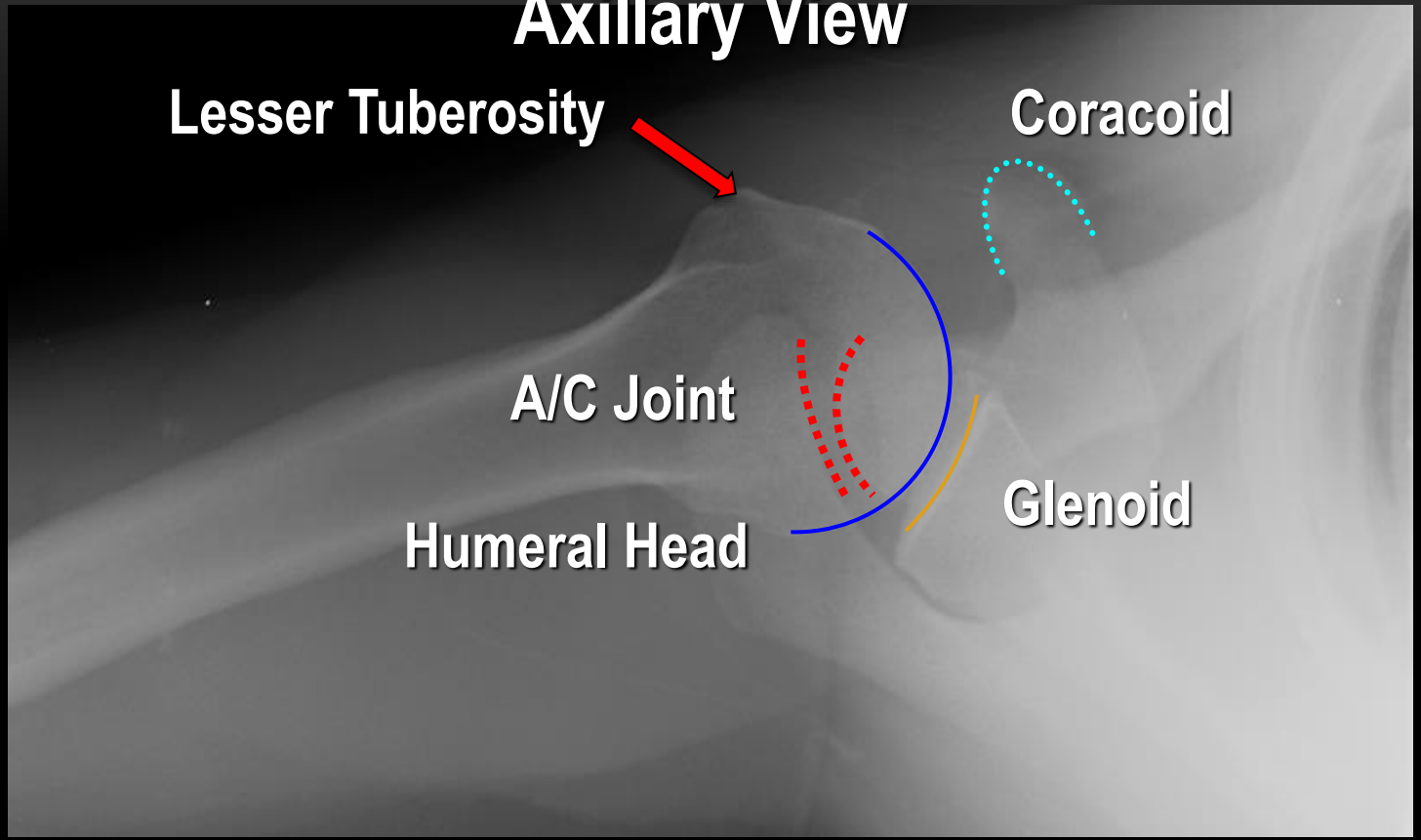


Axillary View



Axillary View




Axillary View
Lesser Tuberosity
Coracoid
A/C Joint
Glenoid
Humeral Head

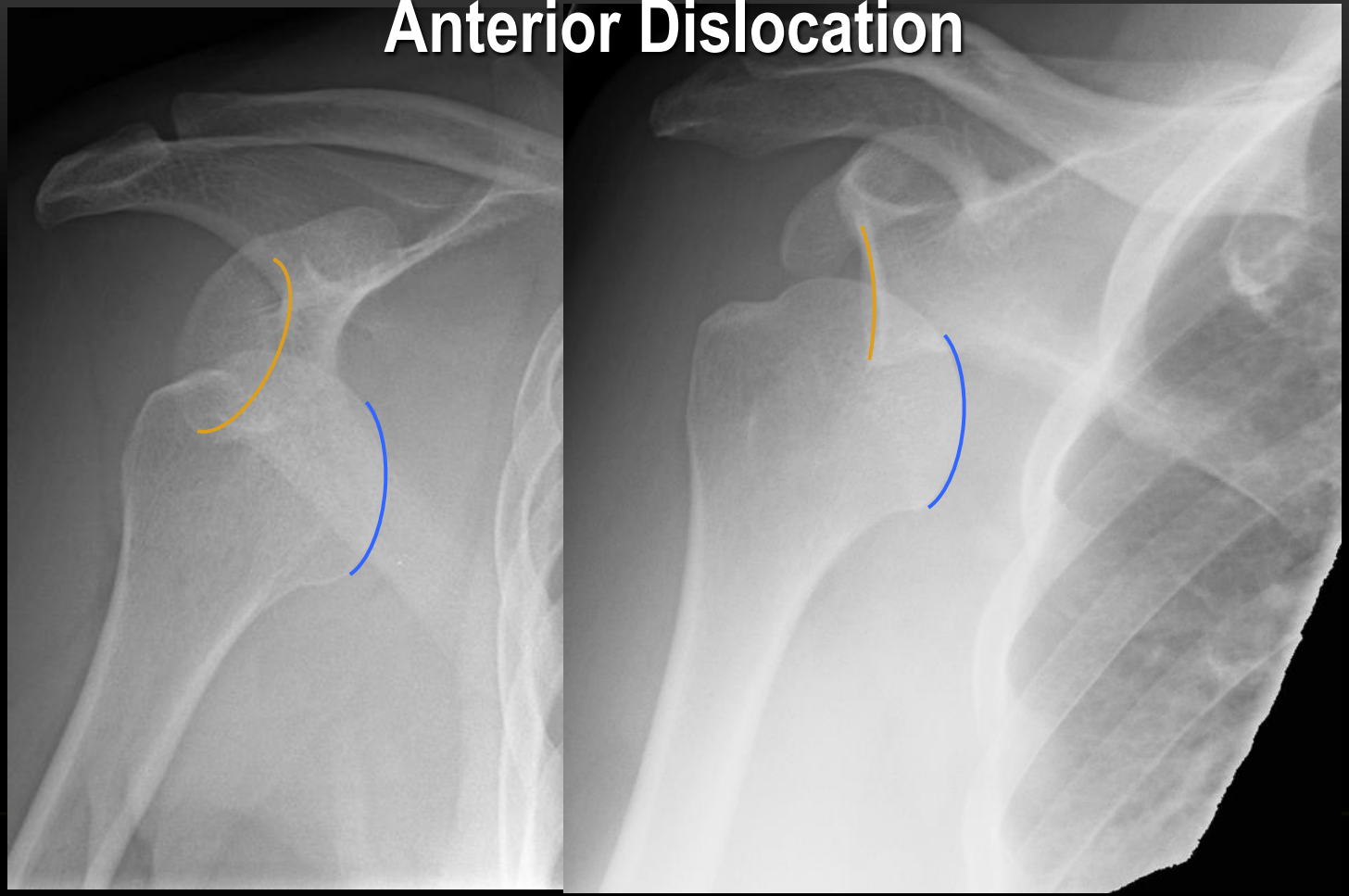
Dislocations

Shoulder joint - Dislocation

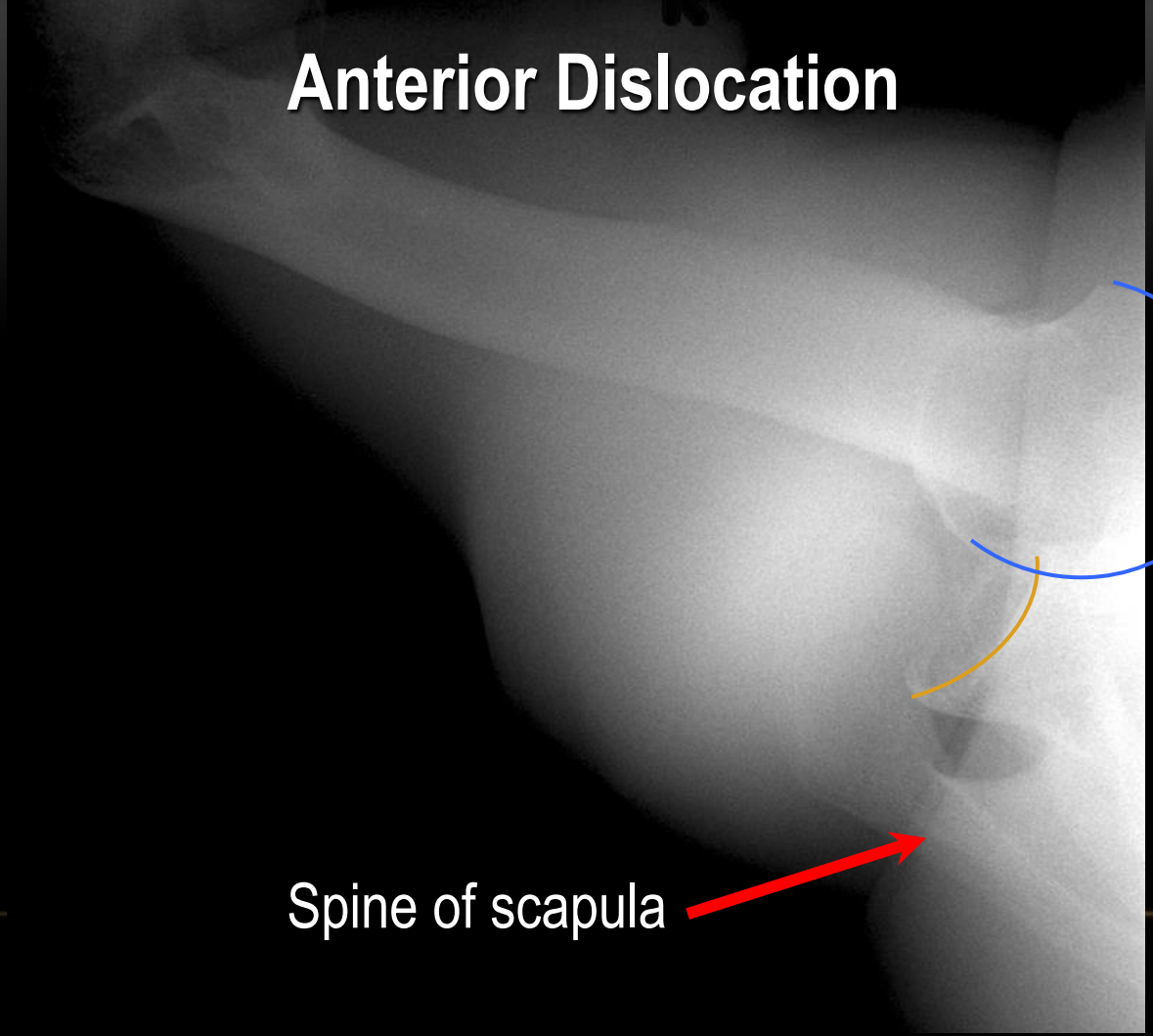
- Anterior 95%+
  - Includes Inferior (Luxatio Erecta)
- Posterior 4%+
- Other <1%
  - Includes Intrathoracic

Fall while skating

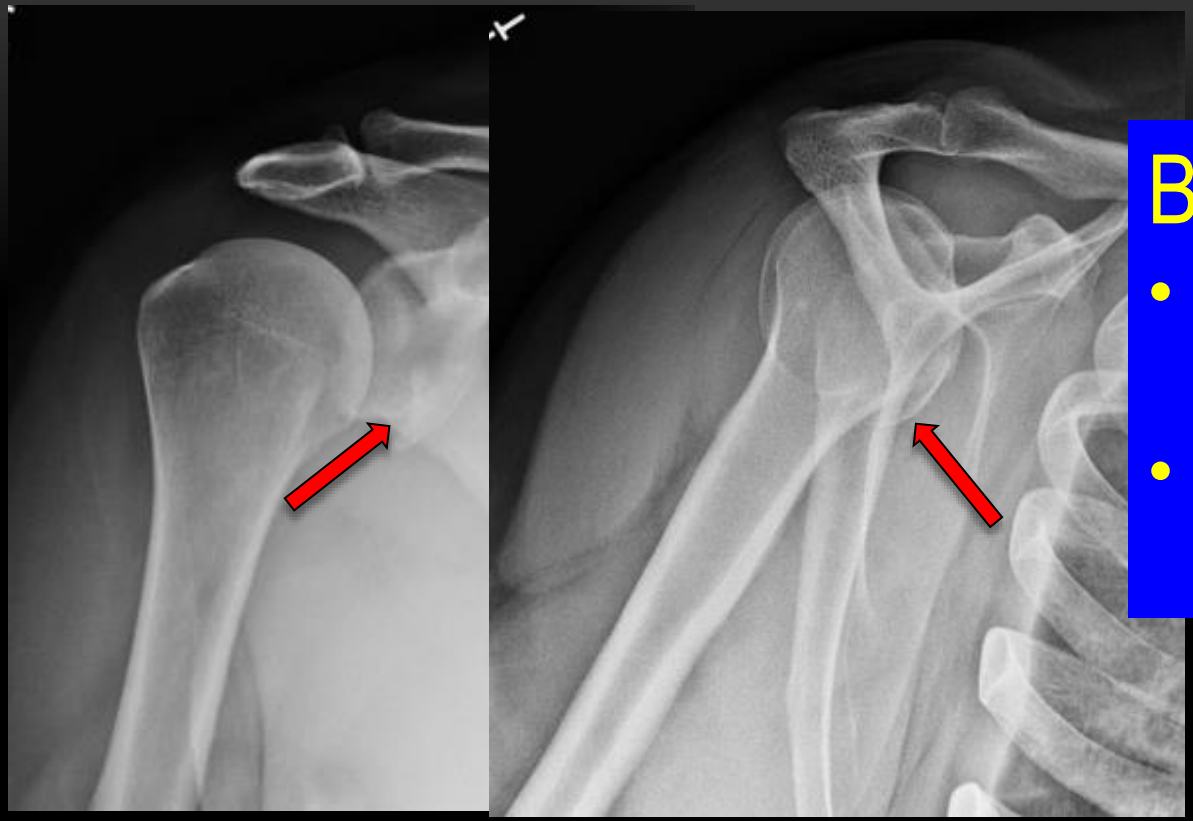
Anterior Dislocation



Anterior Dislocation



Bike accident , shoulder pain



Bony Bankart

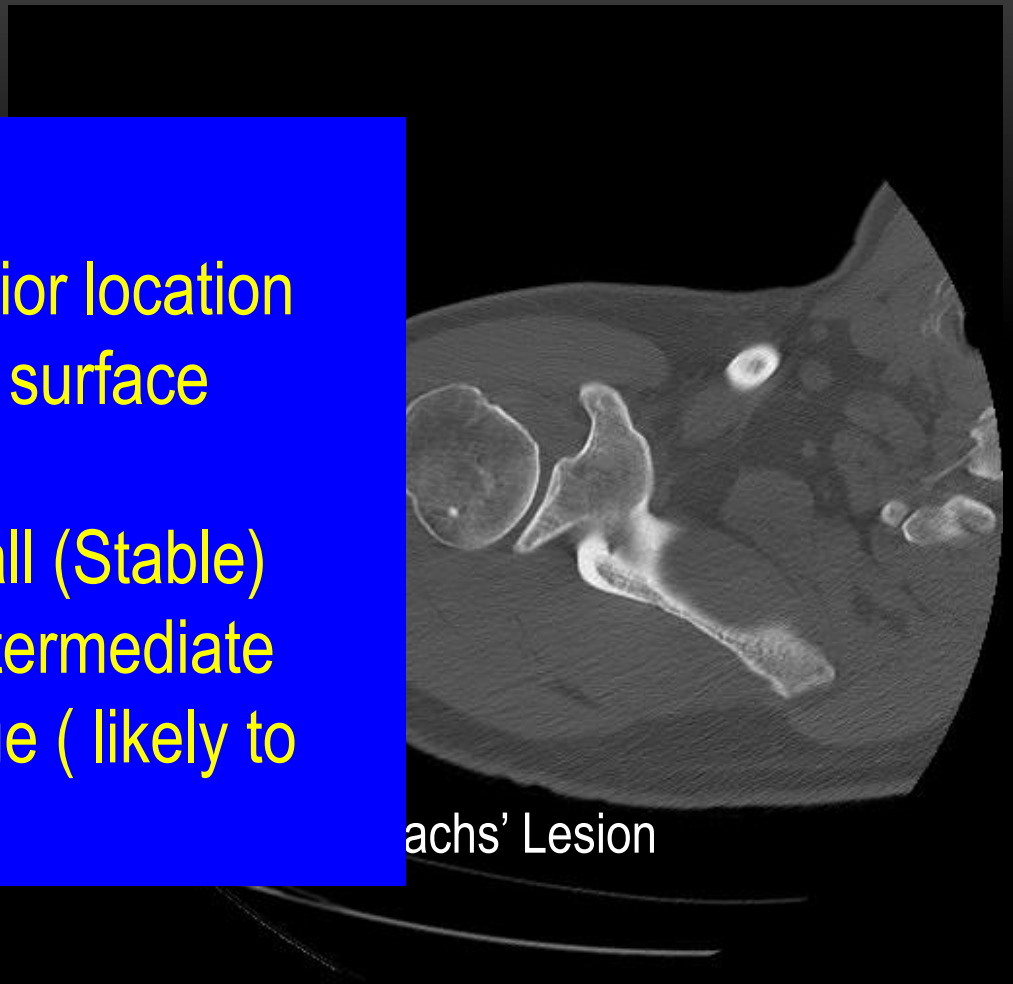
- 15% incidence after initial dislocation
- 35% only visible post-reduction

Bony Bankart

Lets get more detail…. CT

Hill Sachs’

- Posterosuperior location
- % of articular surface involved
  - <20% Small (Stable)
  - 20-40% Intermediate
  - >40% Large (likely to engage)



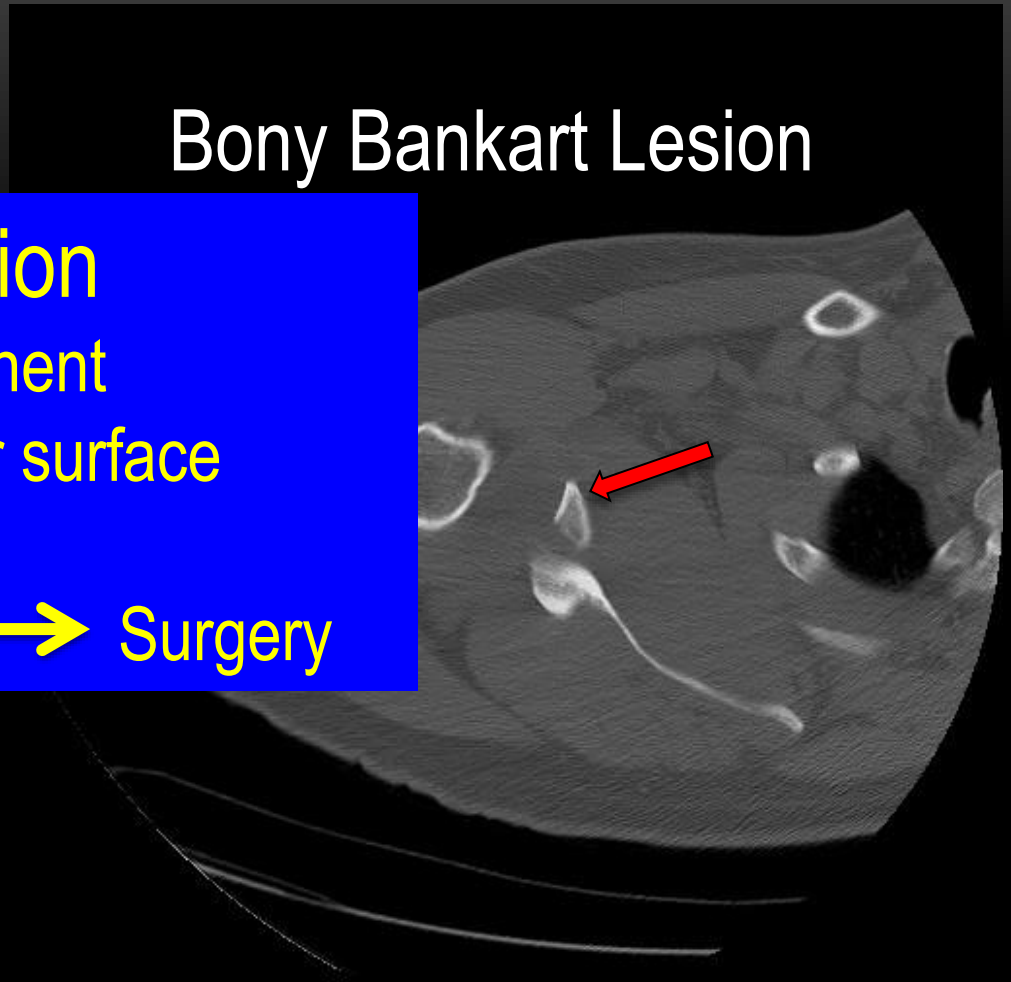
achs’ Lesion

Richards, Rebecca D., et al. "Hill-Sachs lesion and normal humeral groove: MR imaging features allowing their differentiation." *Radiology* 190.3 (1994): 665-668.

Bony Bankart Lesion

Bankart lesion

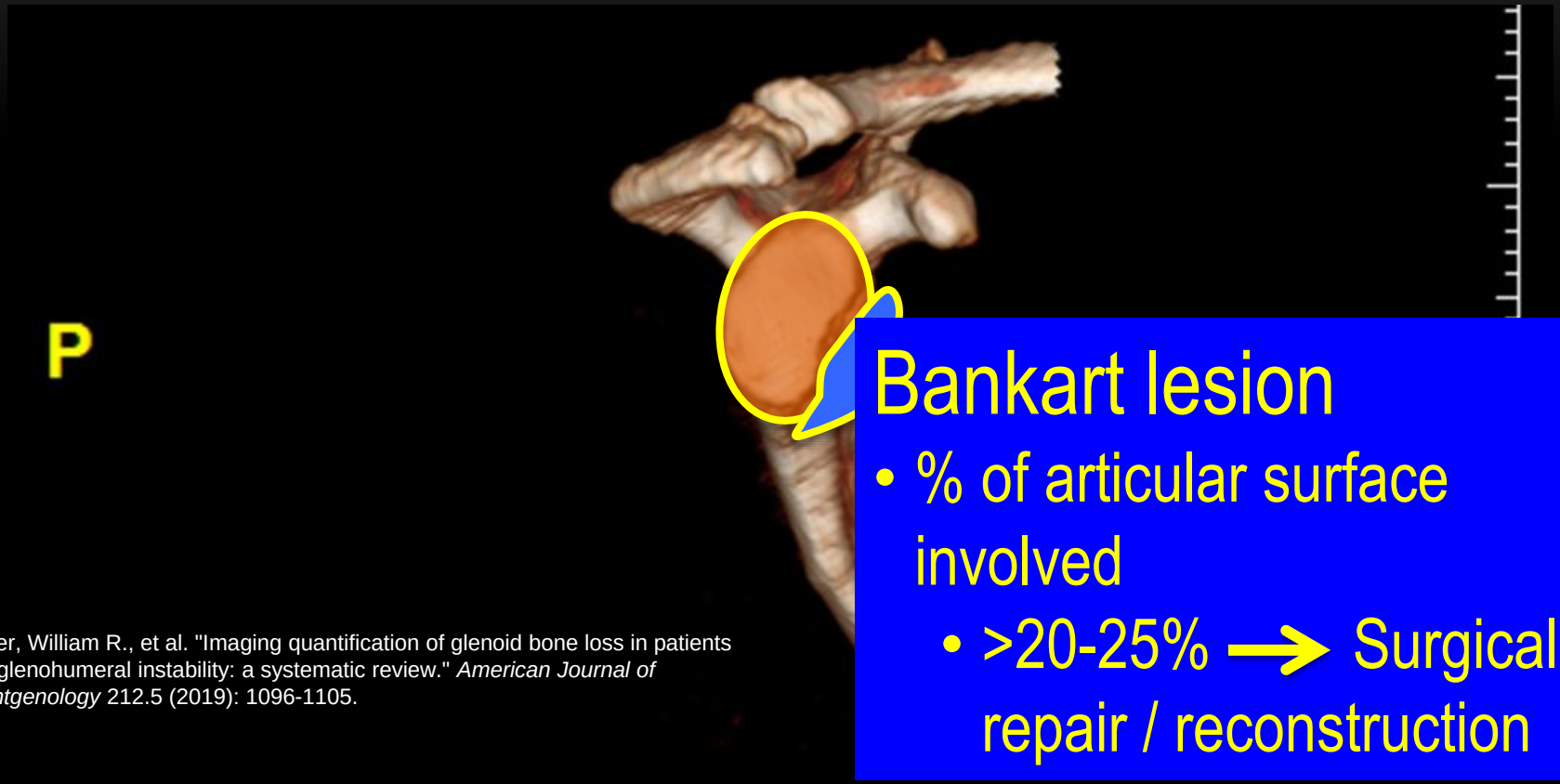
- Bony component
- % of articular surface involved
  - >20-25% → Surgery



So how can we calculate this articular surface involvement ?


P
A


P
A

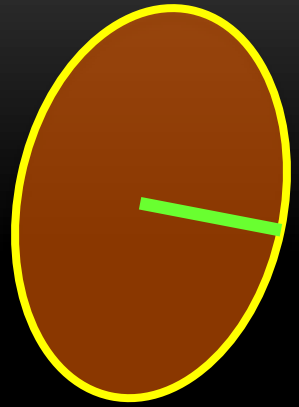


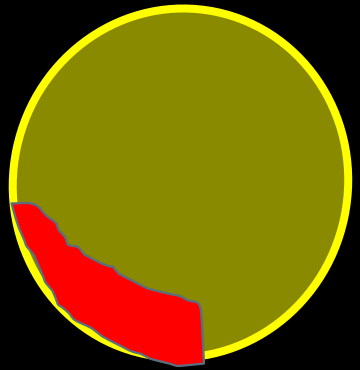
Bankart lesion

- % of articular surface involved
  - >20-25% → Surgical repair / reconstruction

Walter, William R., et al. "Imaging quantification of glenoid bone loss in patients with glenohumeral instability: a systematic review." *American Journal of Roentgenology* 212.5 (2019): 1096-1105.

Glenoid





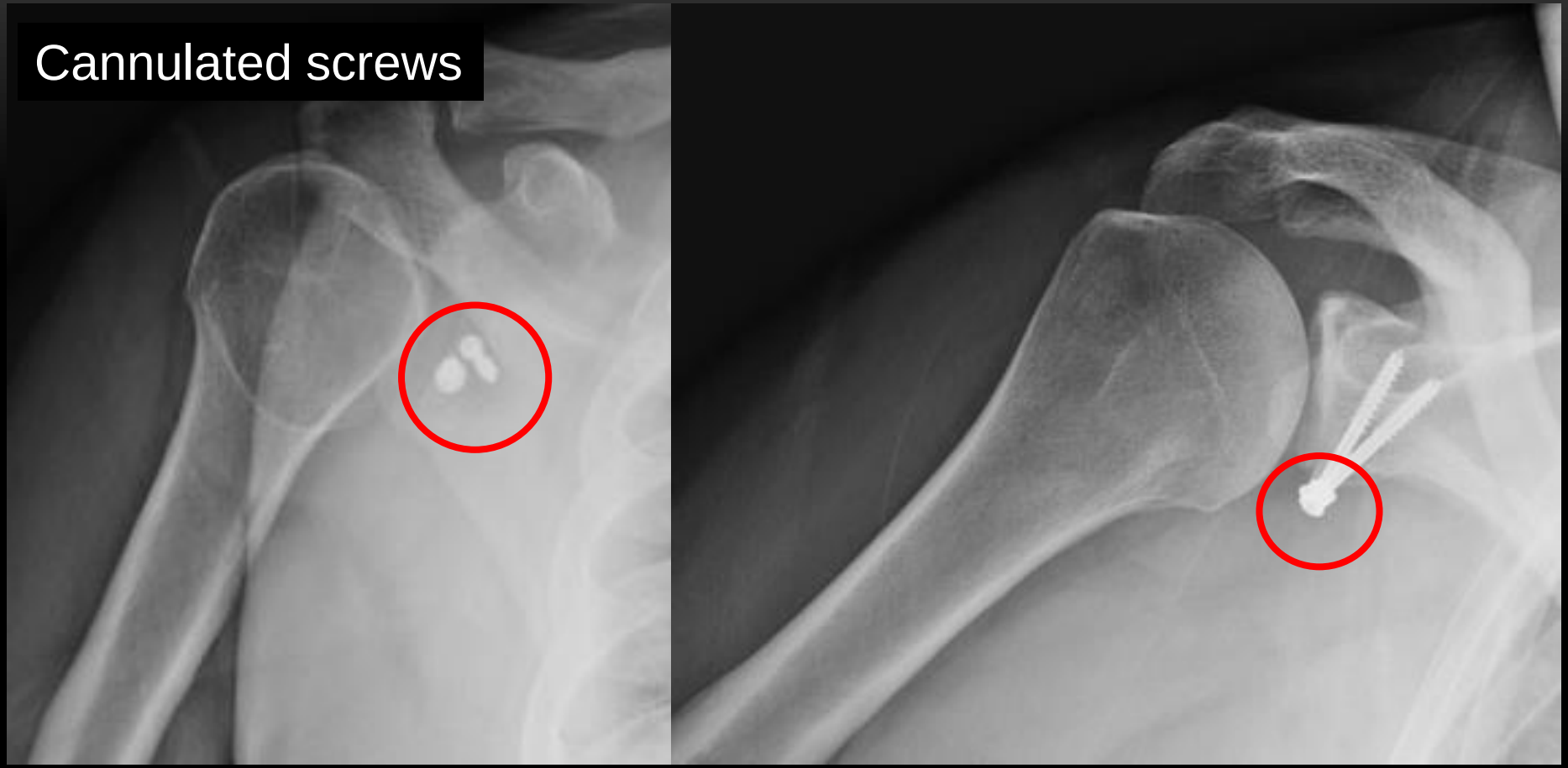
Humeral head

On track / Off track lesion

- On track
  - Less severe
  - Humeral head still centered on glenoid
  - Hillsachs' defect smaller than glenoid
- Off track
  - More severe
  - Hillsachs' larger than glenoid track

How do you treat ?

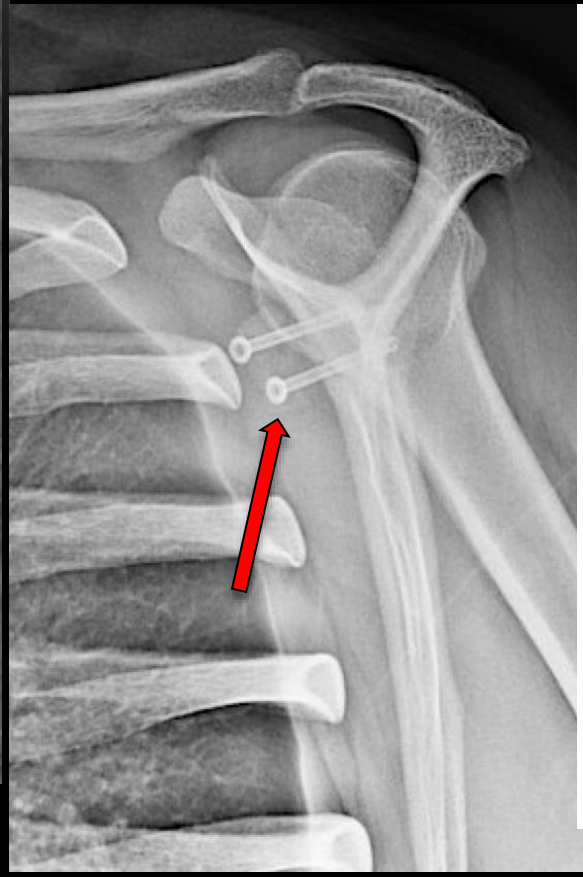
Cannulated screws

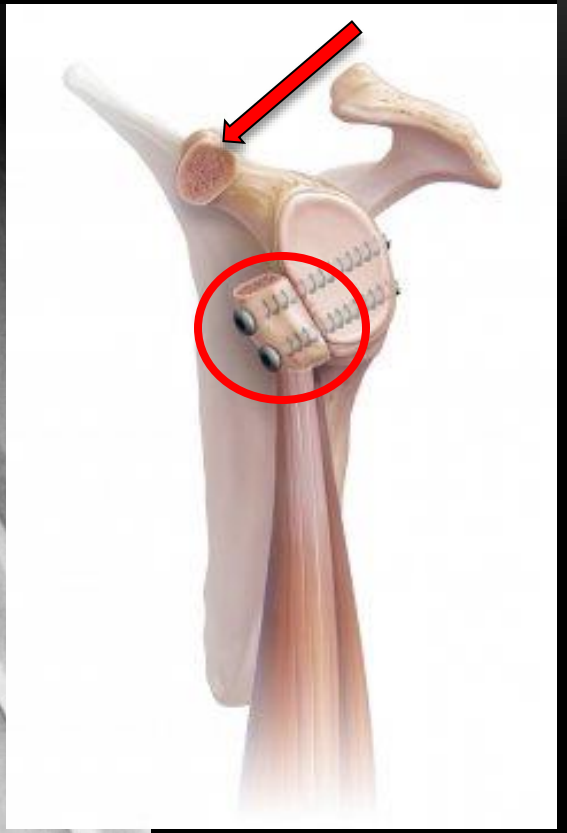


38 year old - subluxation

Glenoid Attrition

Laterjet procedure – Coracoid resected





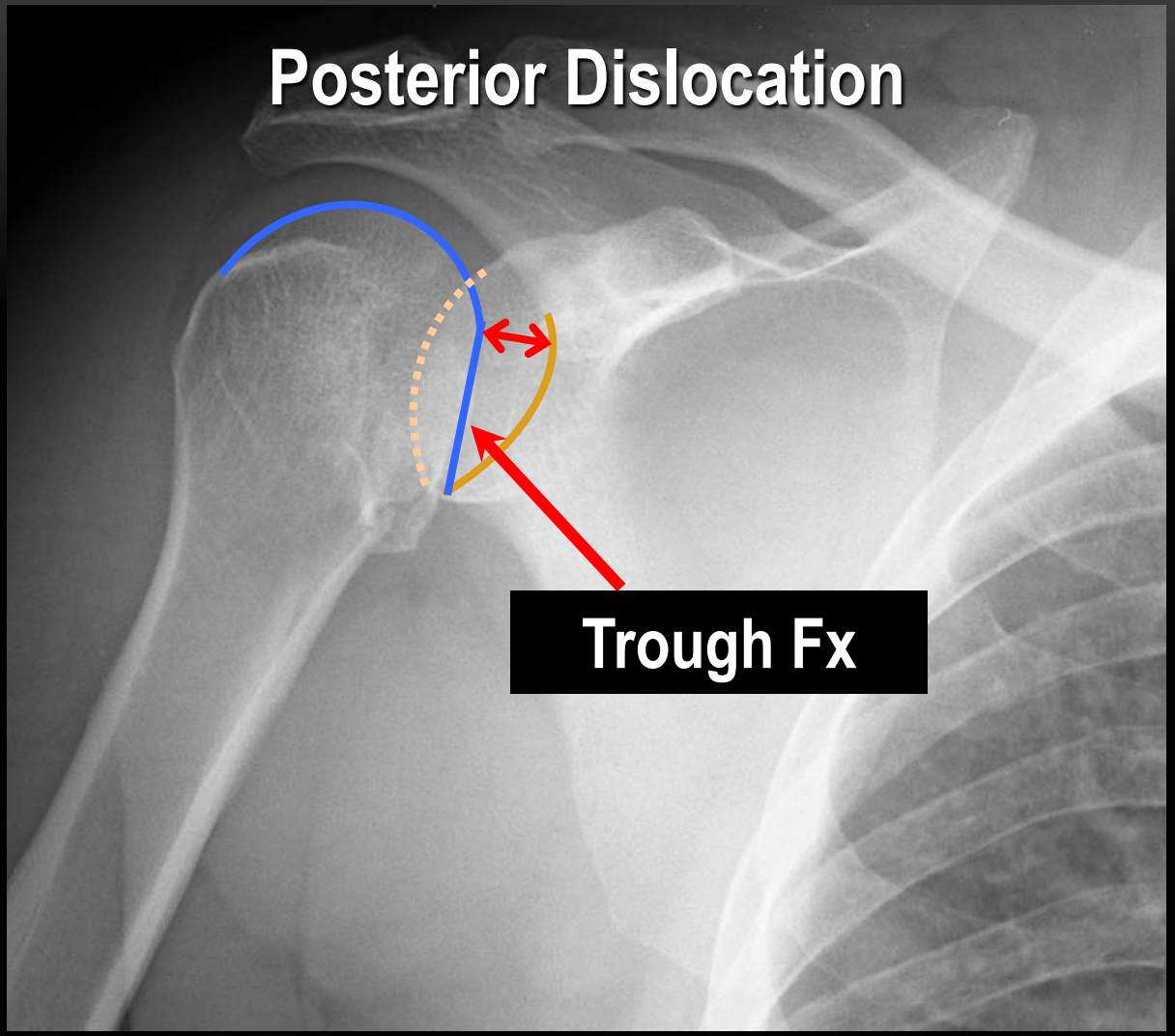
What the surgeon wants to know?
Anterior dislocation

- Bony glenoid (Bankart) component
- Size of bony glenoid – how much of the articular surface ? >20 -25%
- How big is the Hill Sachs' lesion? >40%
- Soft tissue component (MRI)

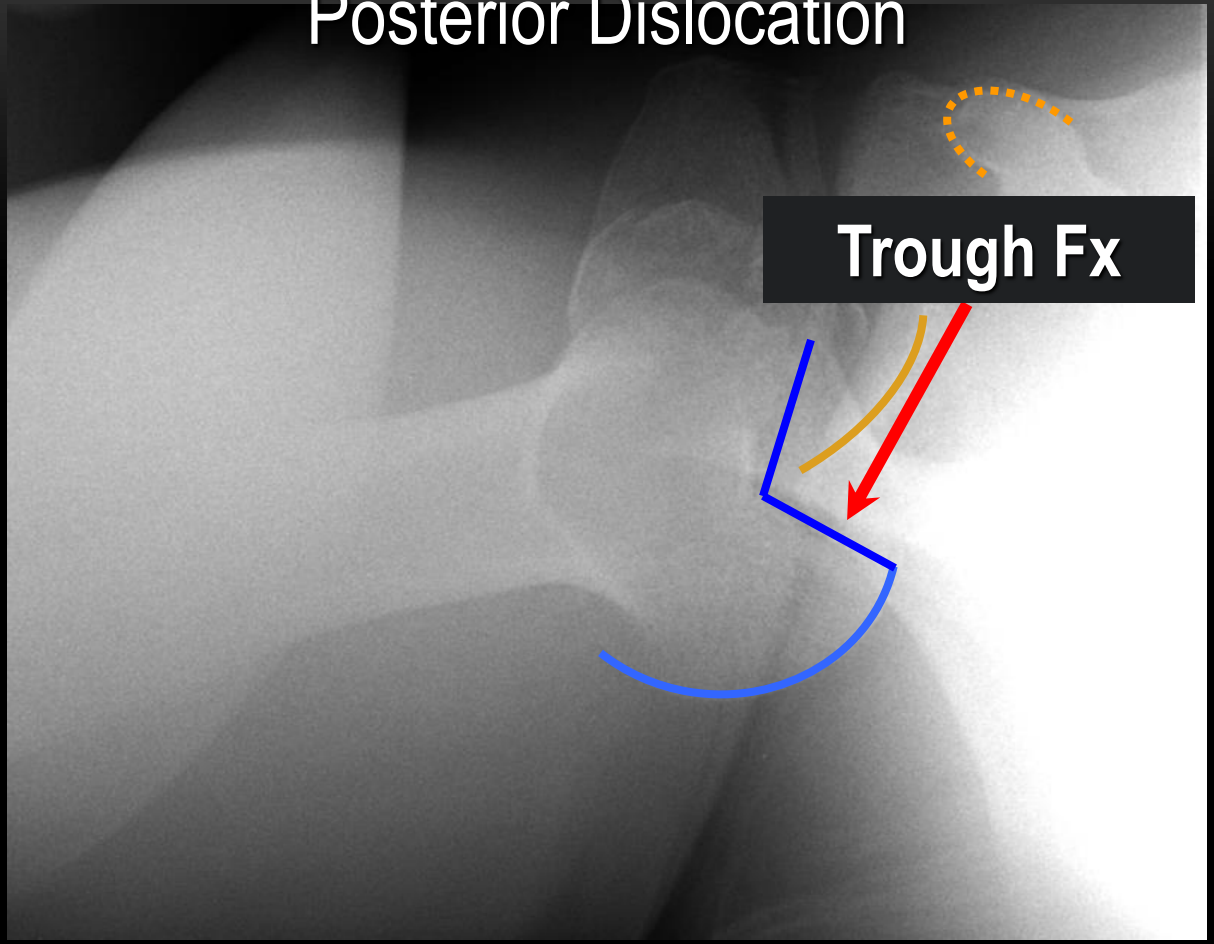
Posterior dislocation

Posterior Dislocation

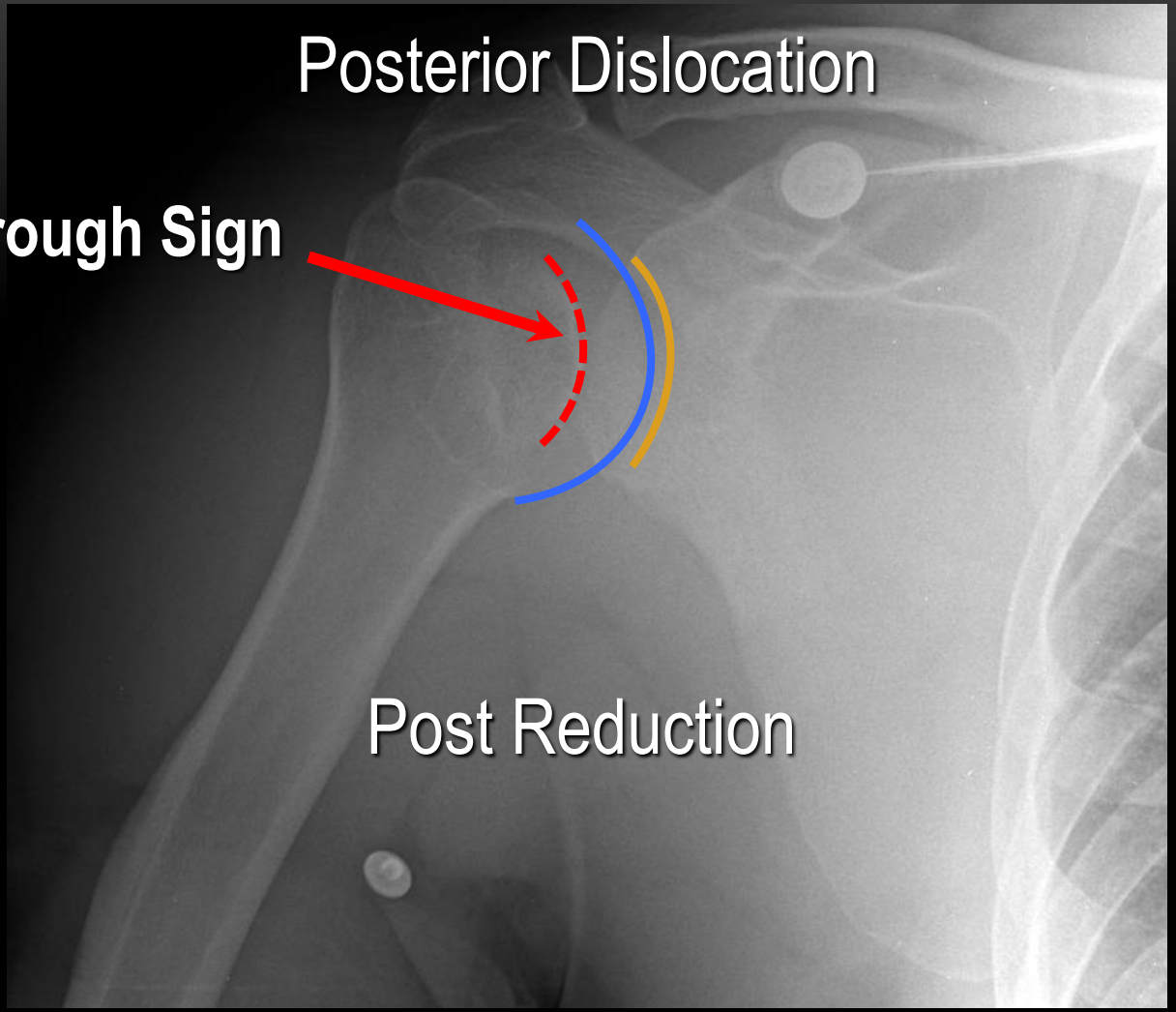
- Clinically & radiographically occult
  - 60% Missed Initially
- Arm fixed in internal rotation

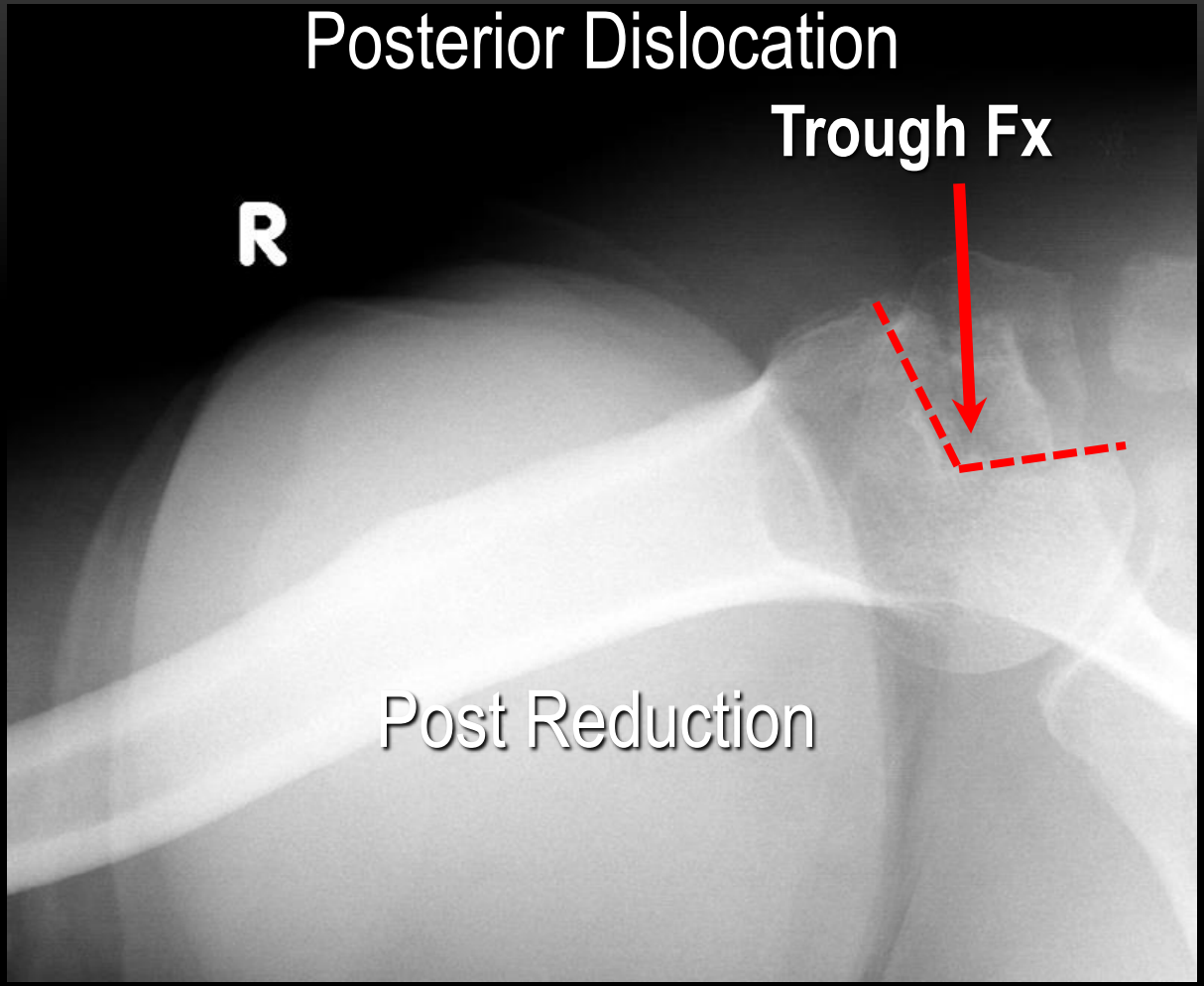

Posterior Dislocation
Trough Fx

Posterior Dislocation

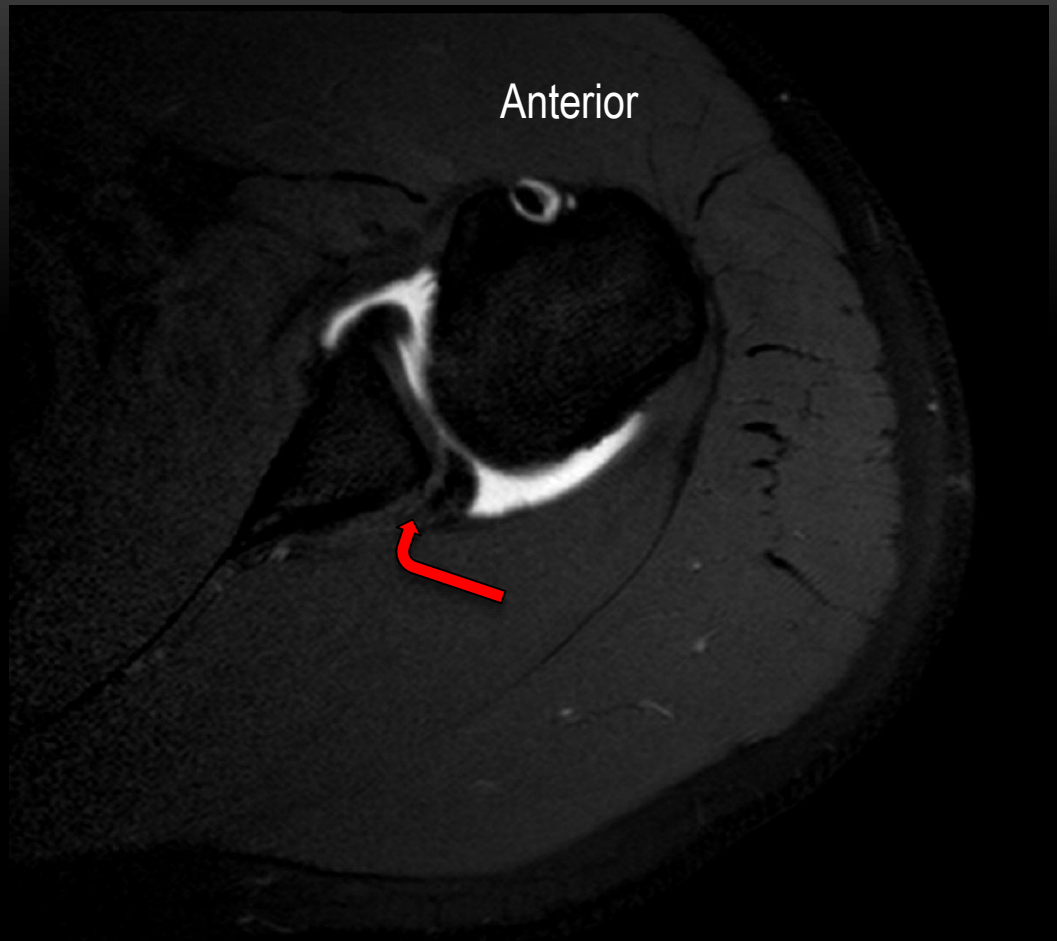


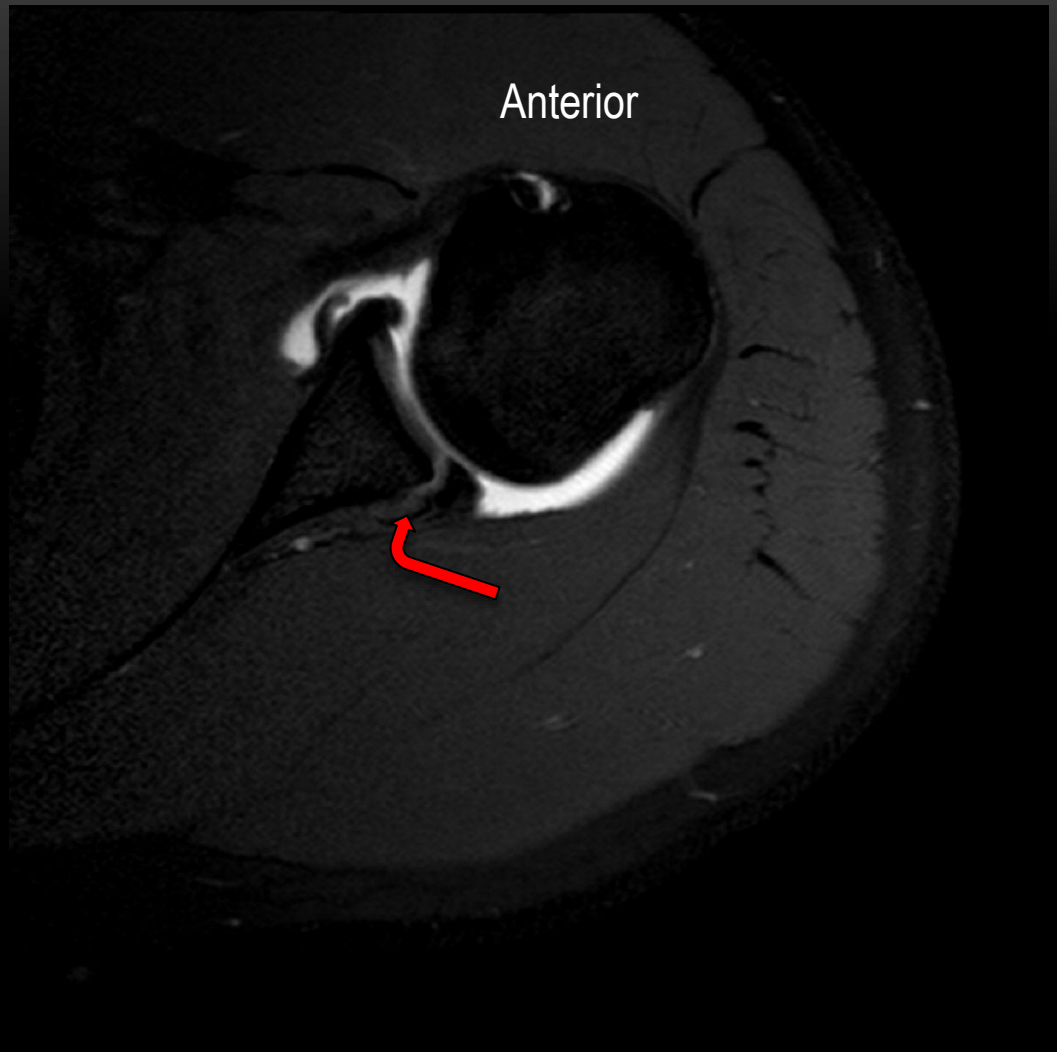
Posterior Dislocation

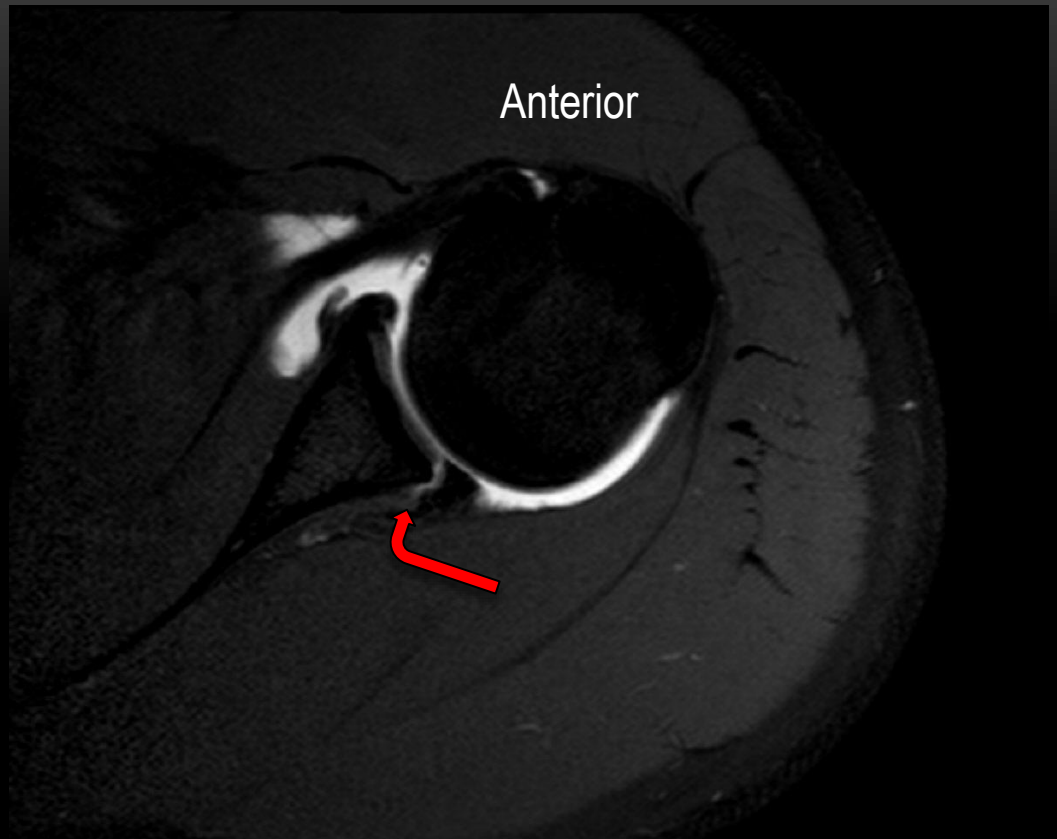



Posterior Dislocation
Trough Fx
R
Post Reduction

Posterior dislocation in a football player
Pre Operative evaluation


Anterior


Anterior



Bony component (Reverse Bankart) with a labral tear

What the surgeon wants to know?
Posterior dislocation

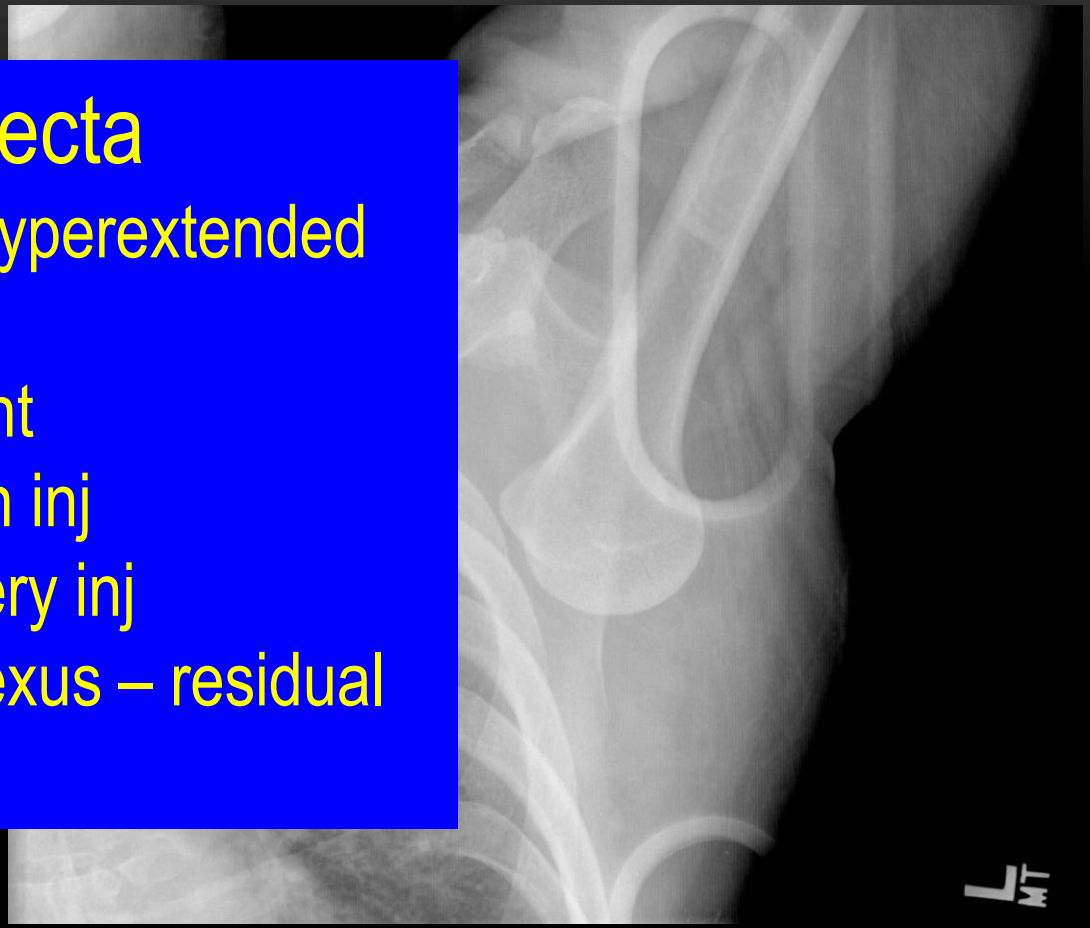
- Bony glenoid (Reverse Bankart) component
- How big is the “Trough fracture” of the humeral head?
- Soft tissue with Reverse Bankart lesion
- Other ligamentous injury (MRI)

Rare dislocations

Luxatio erecta

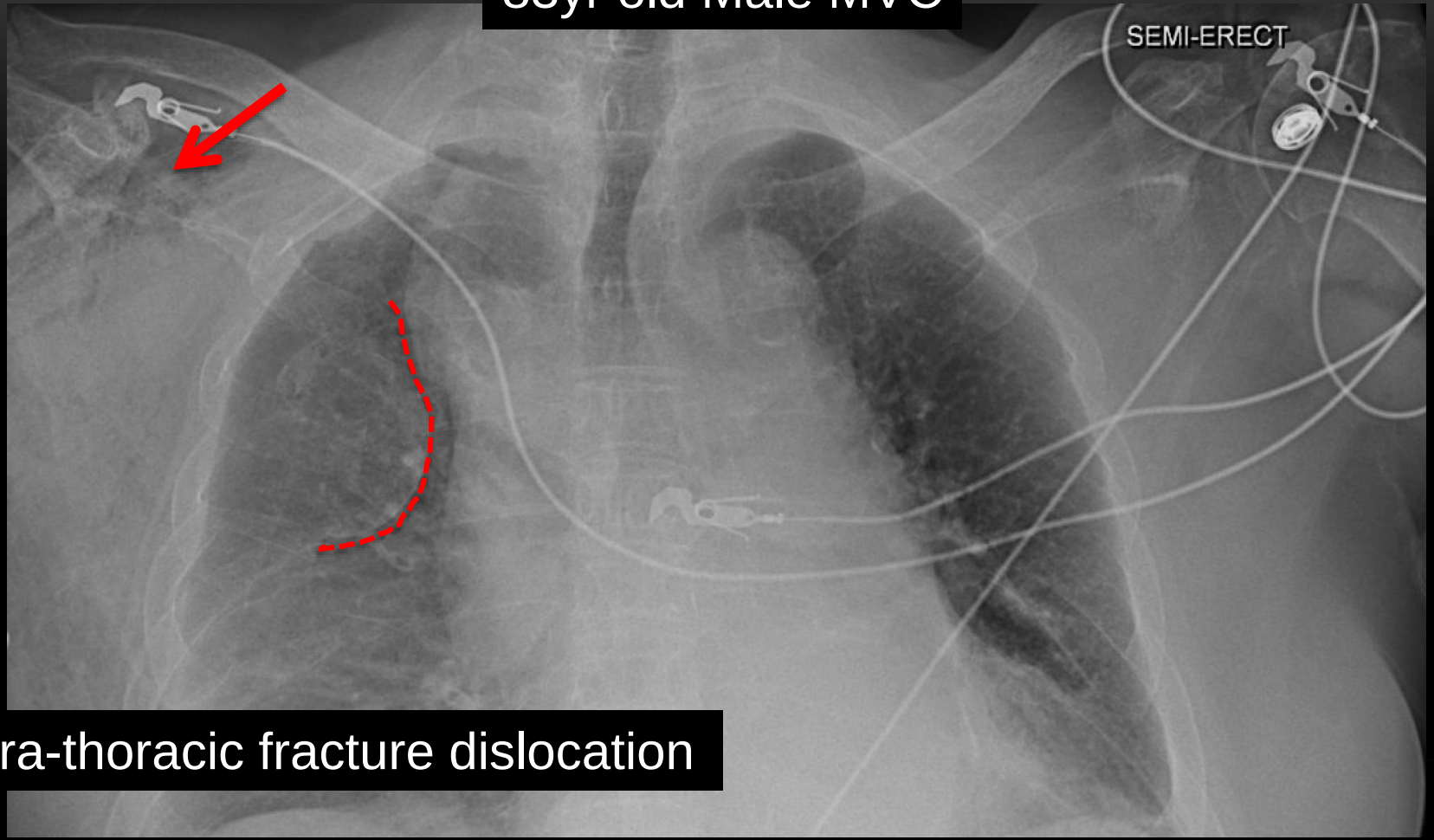
Luxatio Erecta

- Abducted hyperextended fall
- Capsule rent
- Axillary vein inj
- Axillary artery inj
- Brachial plexus – residual injury

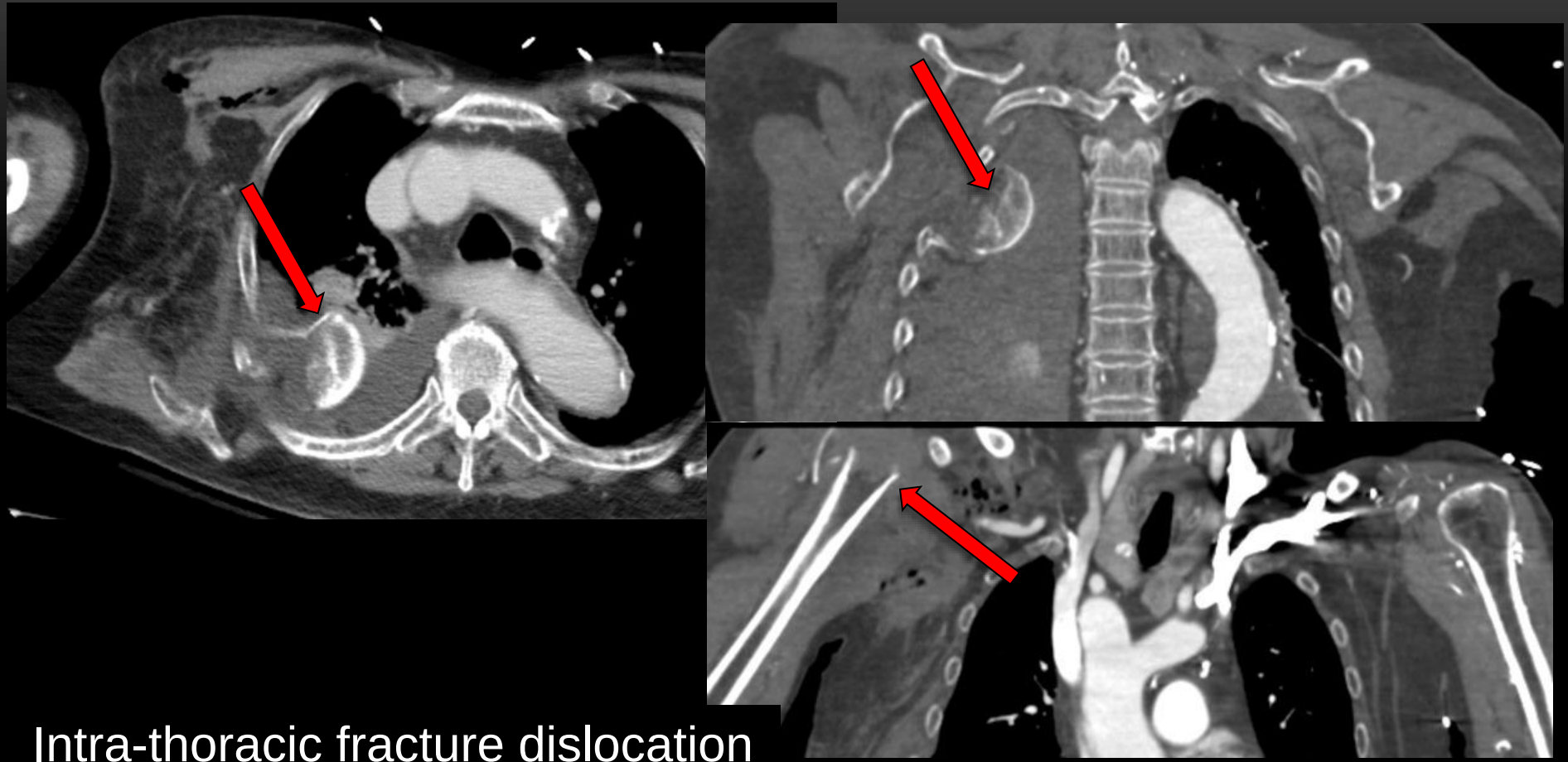


Intra-thoracic dislocation

83yr old Male MVC

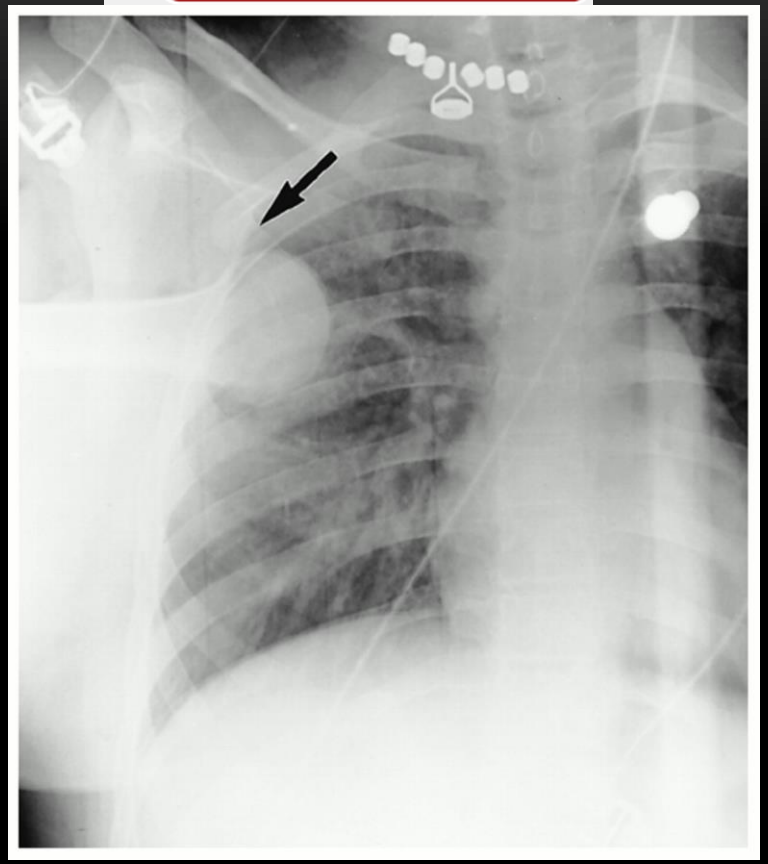


Intra-thoracic fracture dislocation



Intra-thoracic fracture dislocation

JBJS The Journal of Bone and Joint Surgery



Fracture-Dislocation of the Humerus with Intrathoracic Displacement of the Humeral Head. A Case Report*
J Bone Joint Surg Am. 1998;80(6):889-91.

Acromioclavicular joint

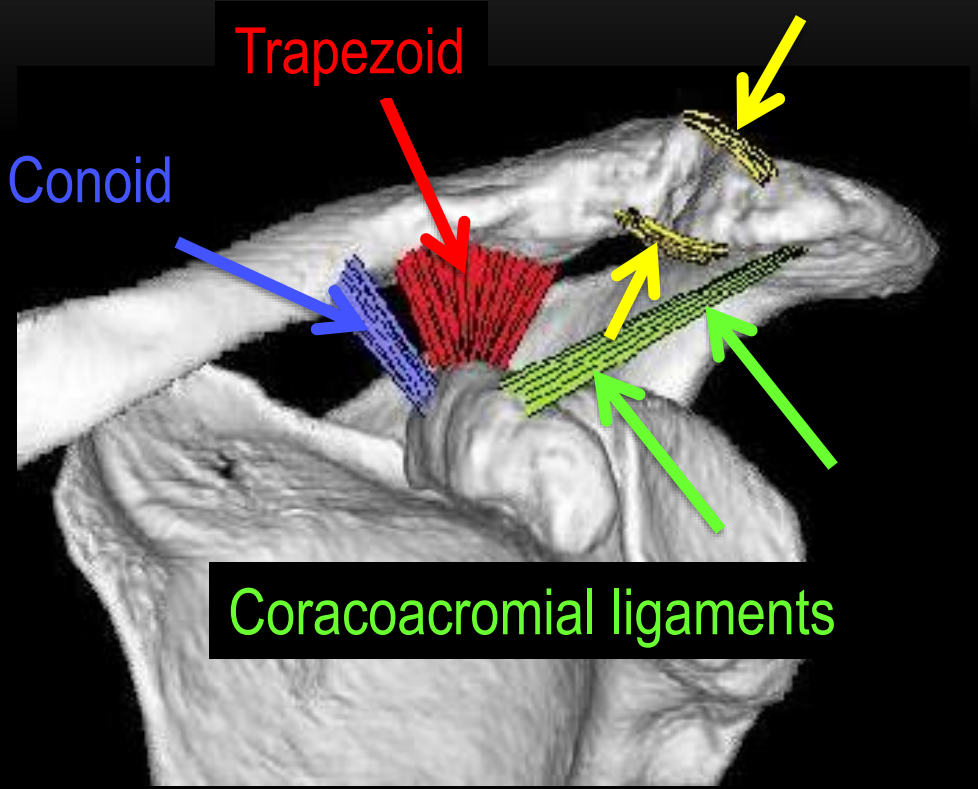
Acromioclavicular joint

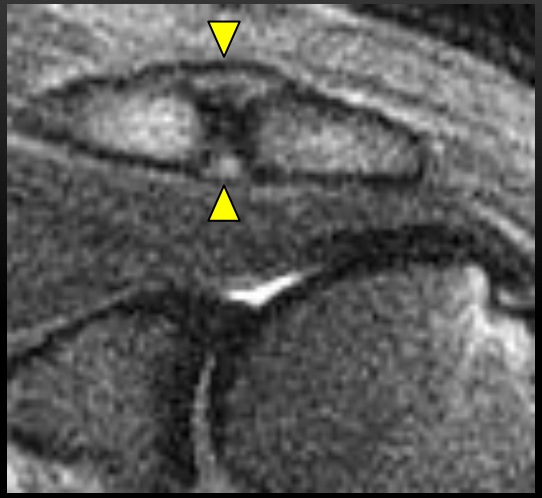
- Ligamentous injury
- Coracoclavicular component more important
- MRI if worried about soft tissue injury

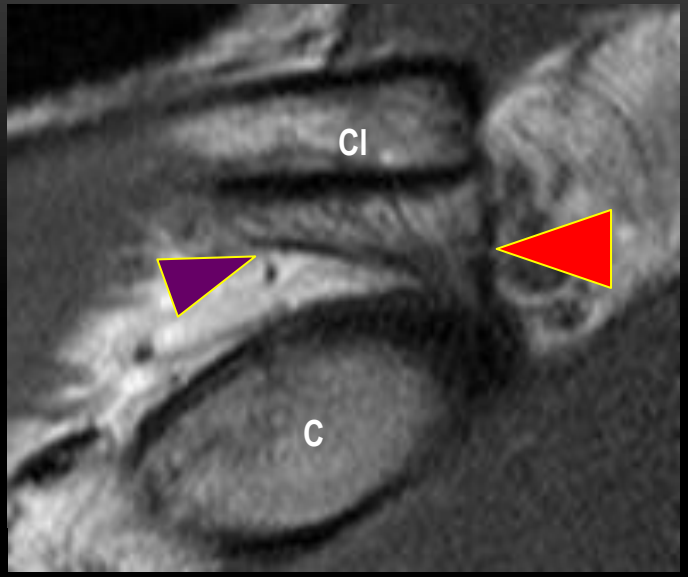
- No need to do weight bearing comparative views

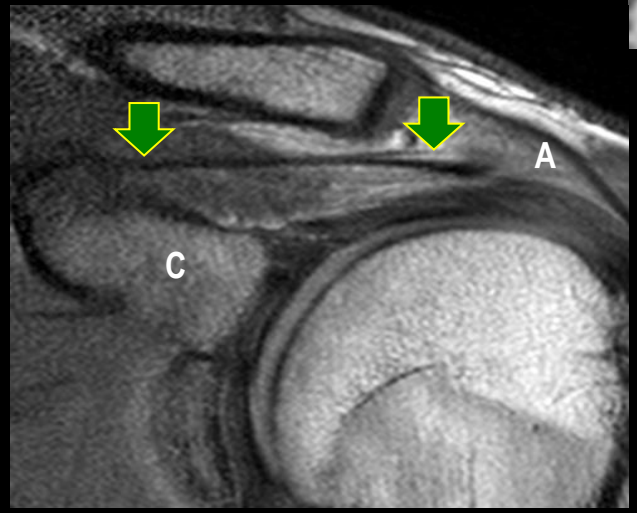
Coraco-Clavicular (CC) lig

- Trapezoid
- Conoid









Acromioclavicular ligament

Conoid portion of CC ligament

Trapezoid portion of CC ligament

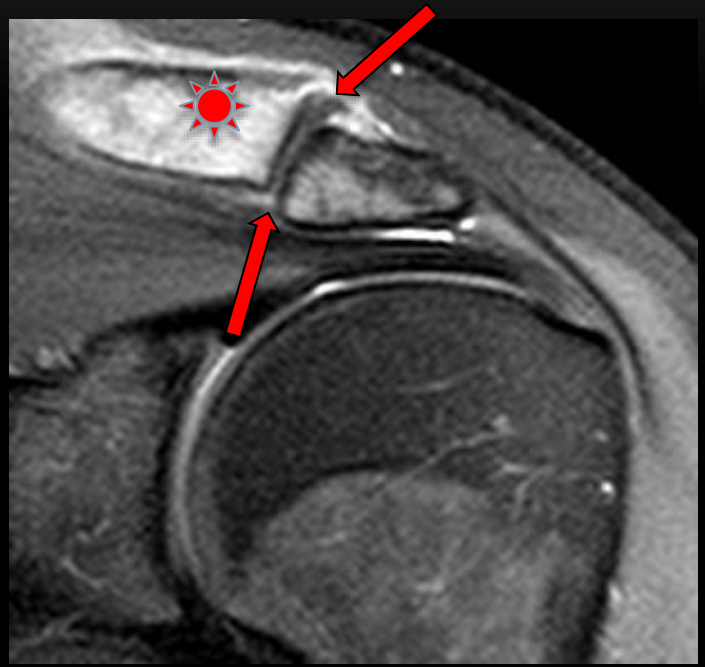
Coraco-acromial ligament

Acromioclavicular Injuries

- Acromioclavicular ligament (AC)
- Coracoclavicular ligament (CC)
- Injuries – Classification
  - I: Sprained but intact AC and CC
  - II: Disrupted AC, sprained but intact CC
  - III: Disrupted AC and CC
  - IV: Posterior displacement of clavicle, buttonholing through trapezius muscle

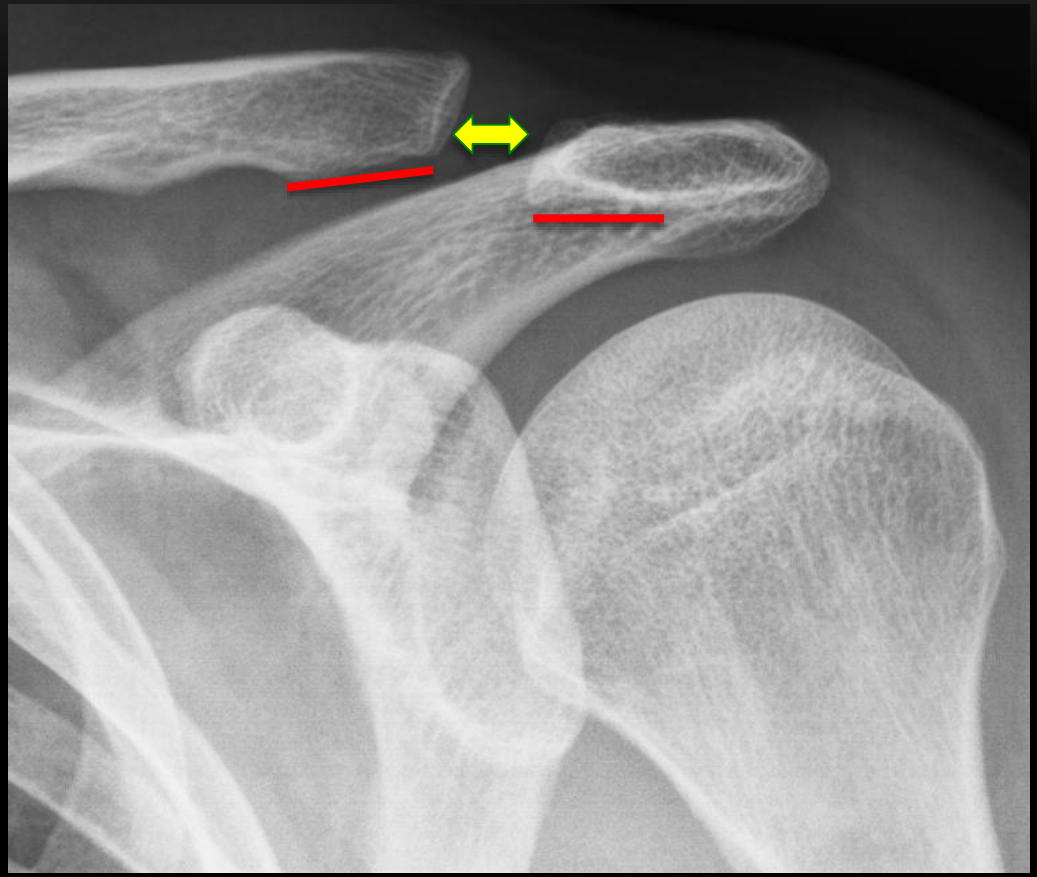
Antonio, Gregory E., et al. "MR imaging appearance and classification of acromioclavicular joint injury." *American Journal of Roentgenology* 180.4 (2003): 1103-1110.

Grade 1 AC injury



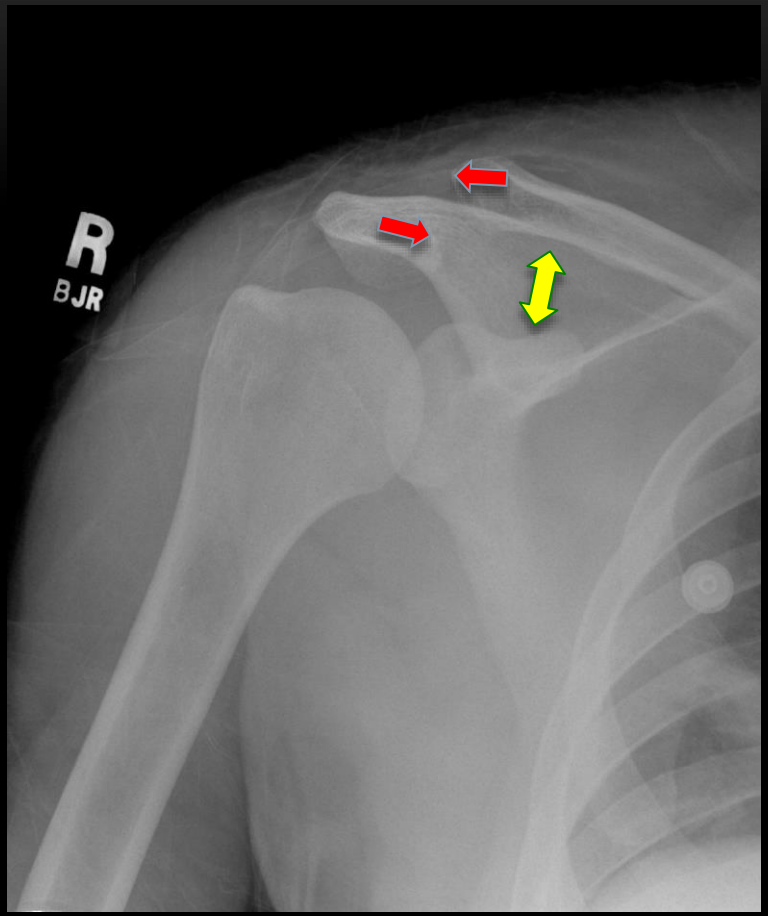
Ernberg, Lauren A., and Hollis G. Potter. "Radiographic evaluation of the acromioclavicular and sternoclavicular joints." *Clinics in sports medicine* 22.2 (2003): 255-275.

Grade 2 AC injury



Grade 3 AC injury

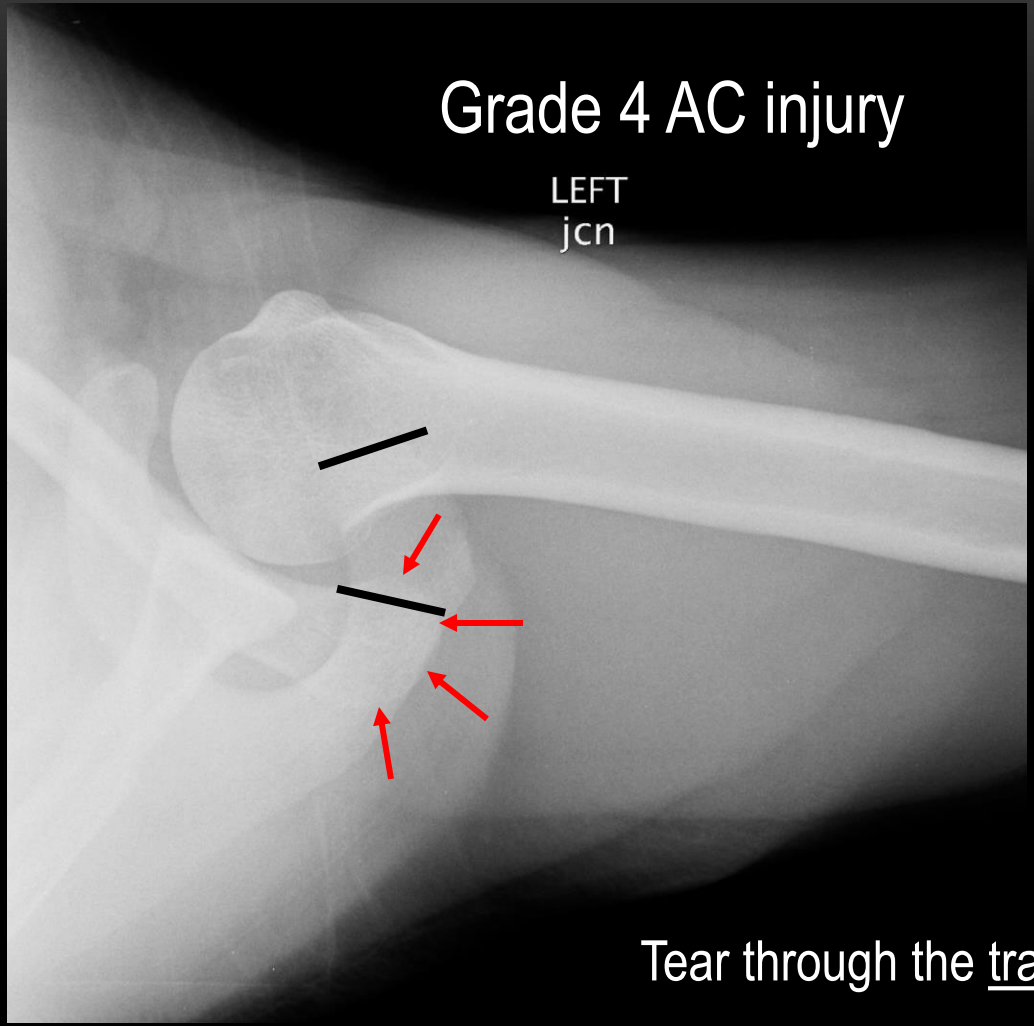
AC space more than 6 -7 mm



CC space more than 11-14 mm

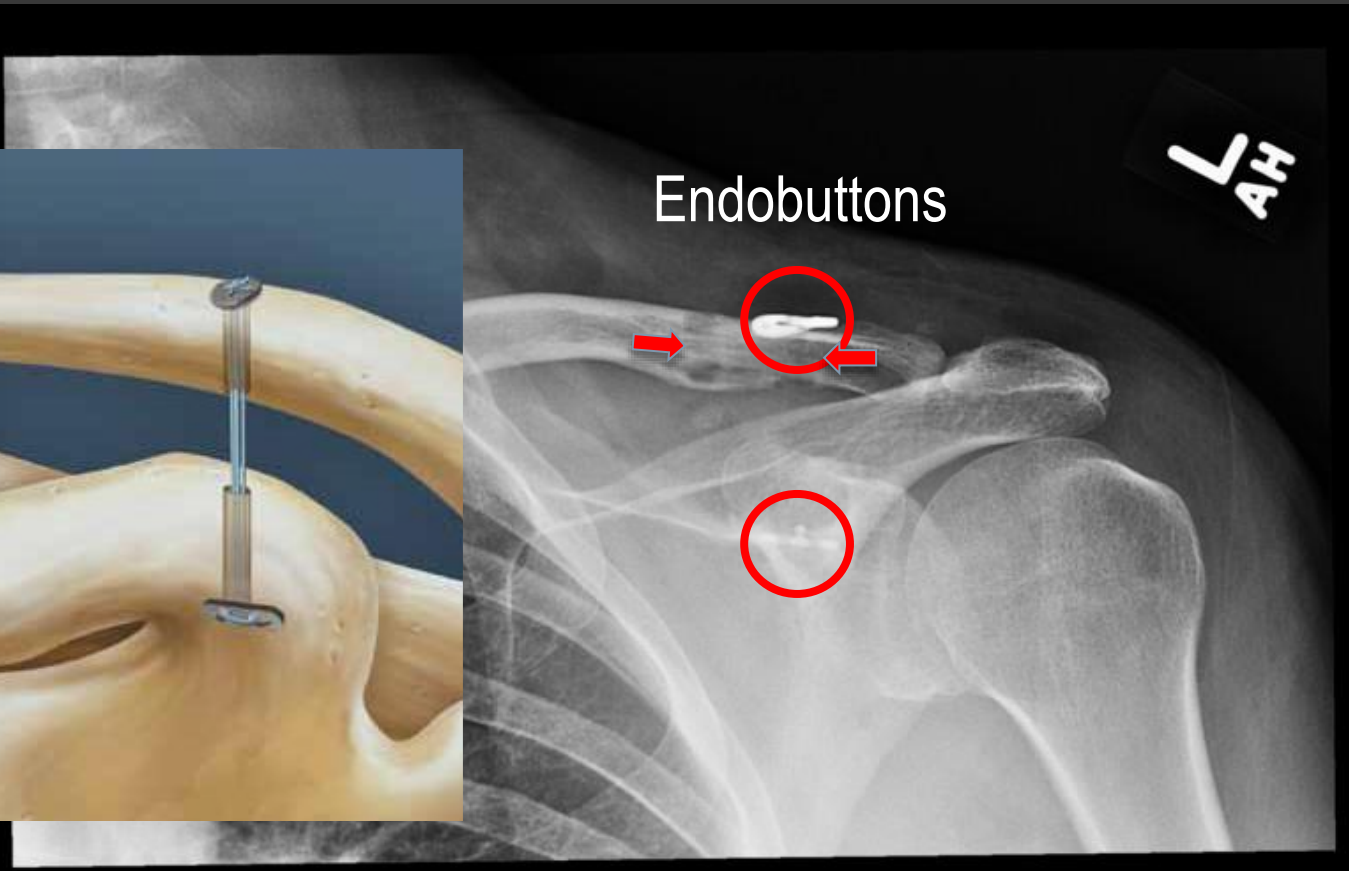
33 year old
Volleyball injury

Grade 4 AC injury



Tear through the trapezius

How do you treat ?



© Arthrex AC Tightrope ®

Tightrope fixation of CC joint

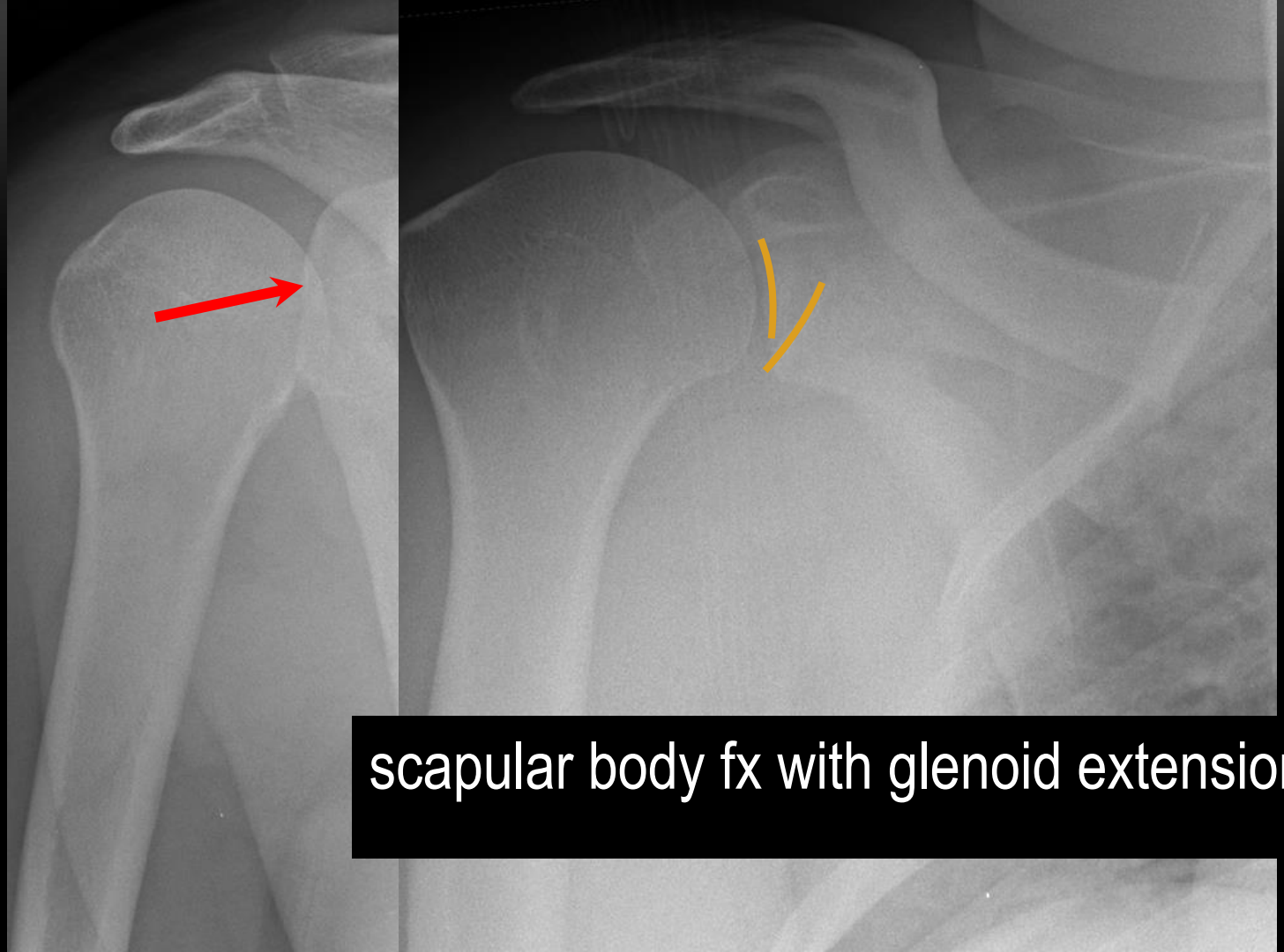
What the surgeon wants to know?
AC / CC joint injury

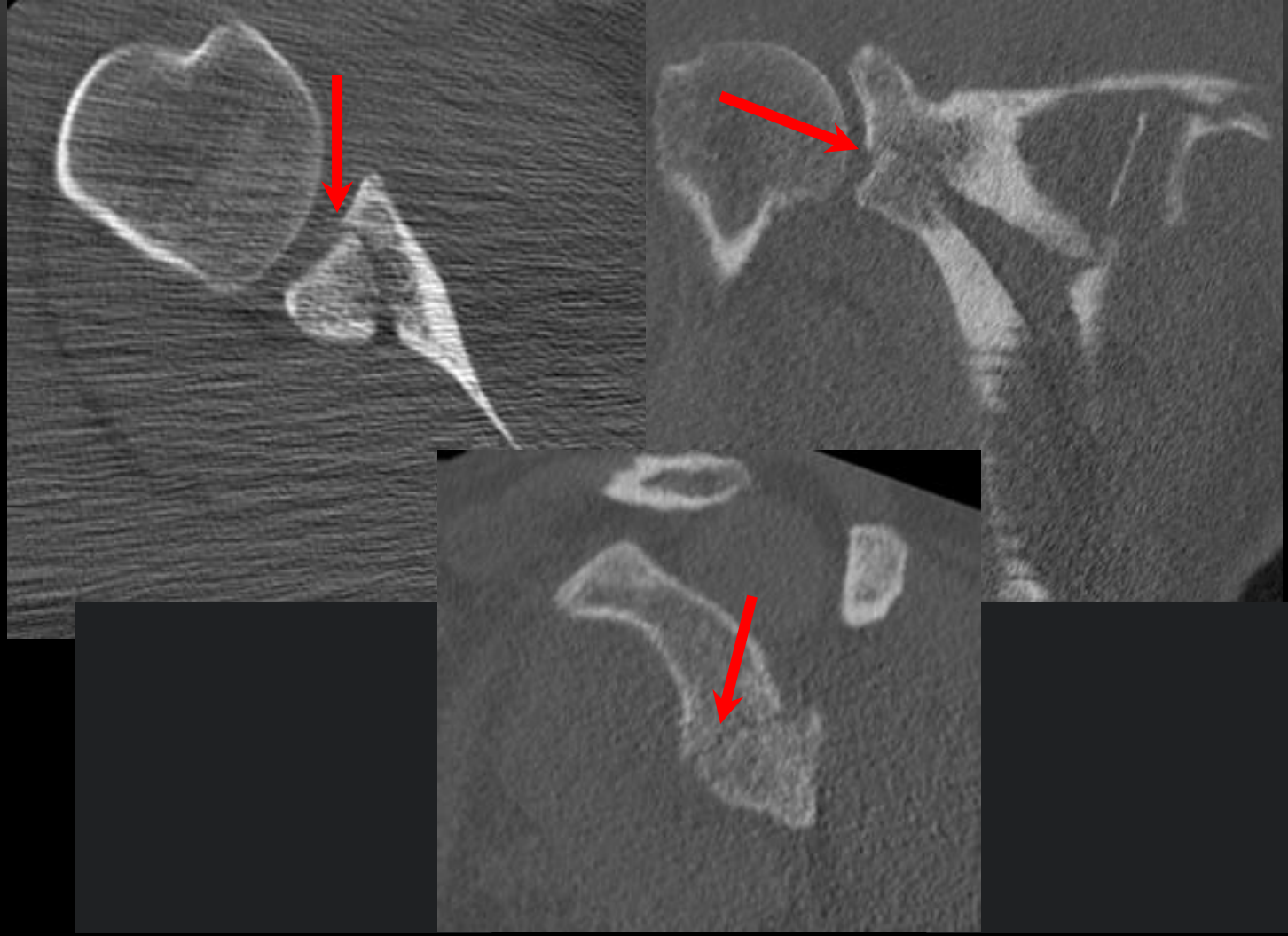
- Integrity of the CC (Coraco-Clavicular) joint
- Soft tissue damage
  - trapezius muscle tear
  - Open fracture

Scapula fractures

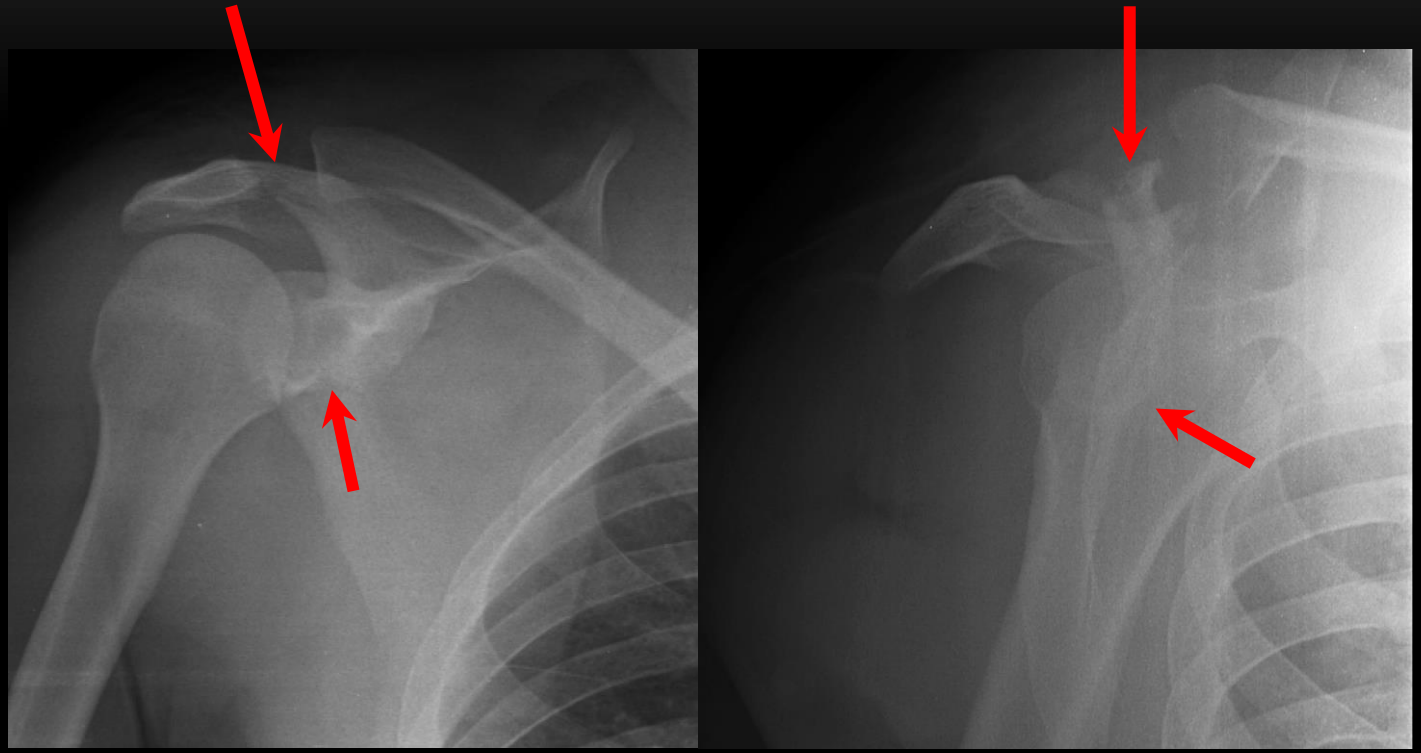
Scapular Fractures

- Direct trauma
- High energy
- Associated severe injuries


scapular body fx with glenoid extension

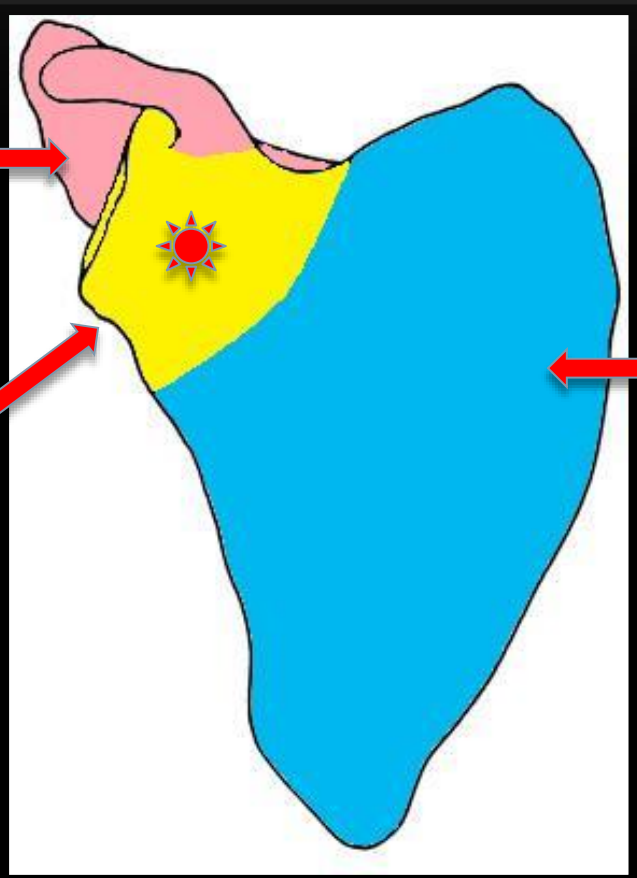


Scapular fractures - typically associated with severe injuries



Zdravkovic and Damholt - zones

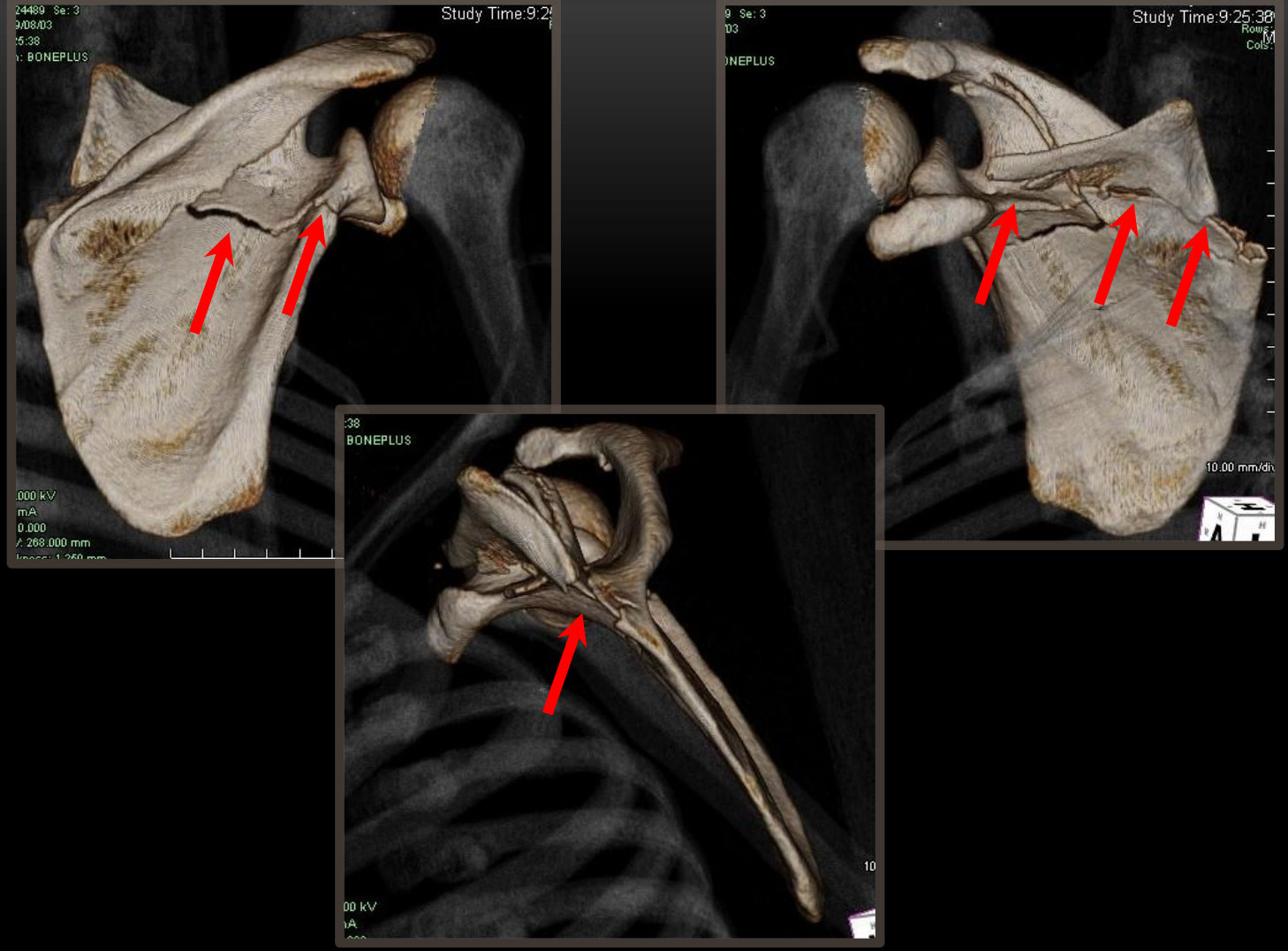
Apophyseal Fractures
Acromion & Coracoid



Superior Lateral Angle Fractures – Glenoid Neck and Glenoid Articular Surface

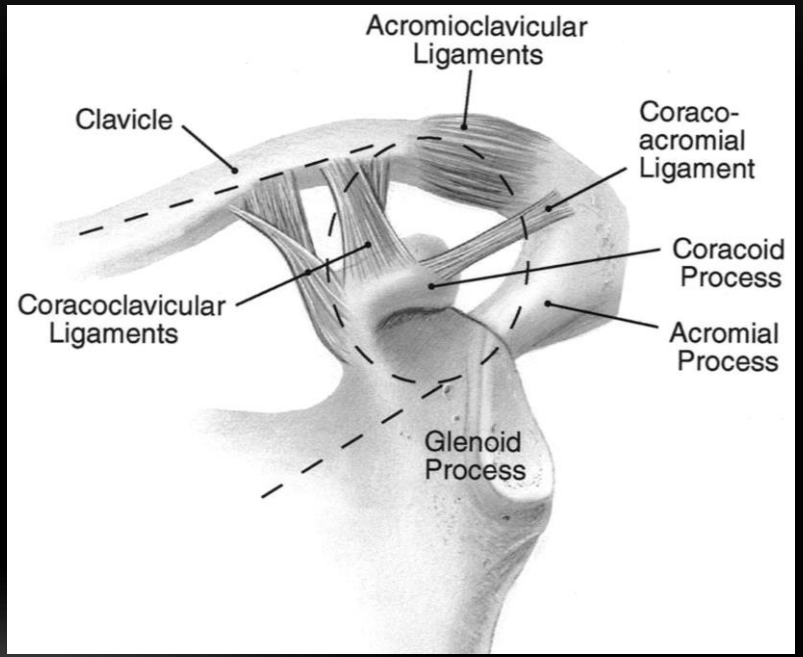
Body fractures

Nau, T., N. Petras, and V. Vécsei. "Fractures of the Scapula-Classification and Treatment Principles." *Osteosynthesis and Trauma Care* 12.04 (2004): 174-179.

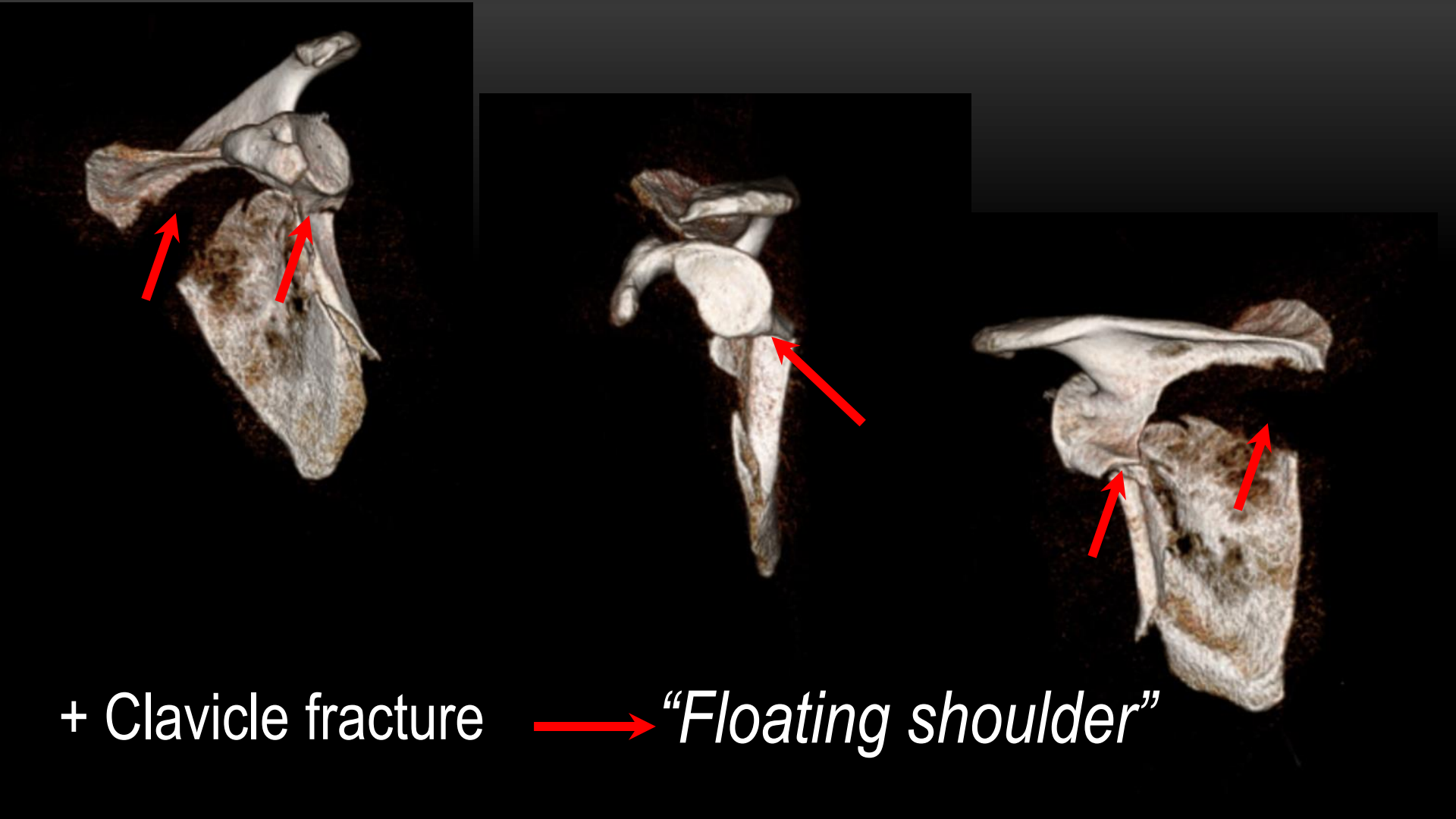

Study Time:9:2
BONEPLUS
Study Time:9:25:38
BONEPLUS
10.00 mm/div
BONEPLUS

“Floating Shoulder”

- Ipsilateral clavicle and scapula (glenoid neck) fracture
- Suspensory ligaments complex disruption



Van Noort, A., et al. "The floating shoulder A MULTICENTRE STUDY." *Journal of Bone & Joint Surgery, British Volume* 83.6 (2001): 795-798.


+ Clavicle fracture
"Floating shoulder"

Rx Floating shoulder – ORIF Scapula

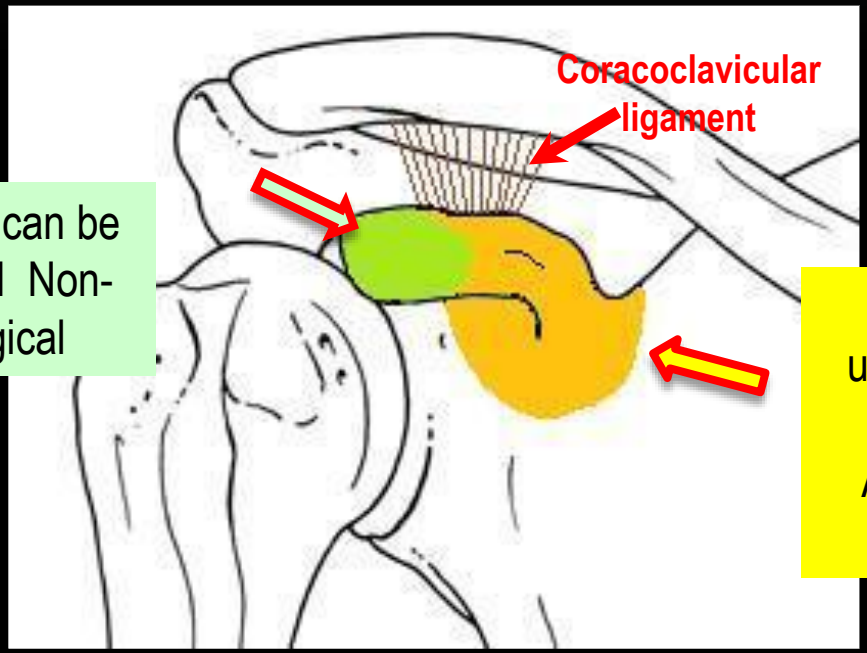
Egol, Kenneth A., et al. "The floating shoulder: clinical and functional results." *J Bone Joint Surg Am* 83.8 (2001): 1188-1194.

What the surgeon wants to know? Scapular fractures

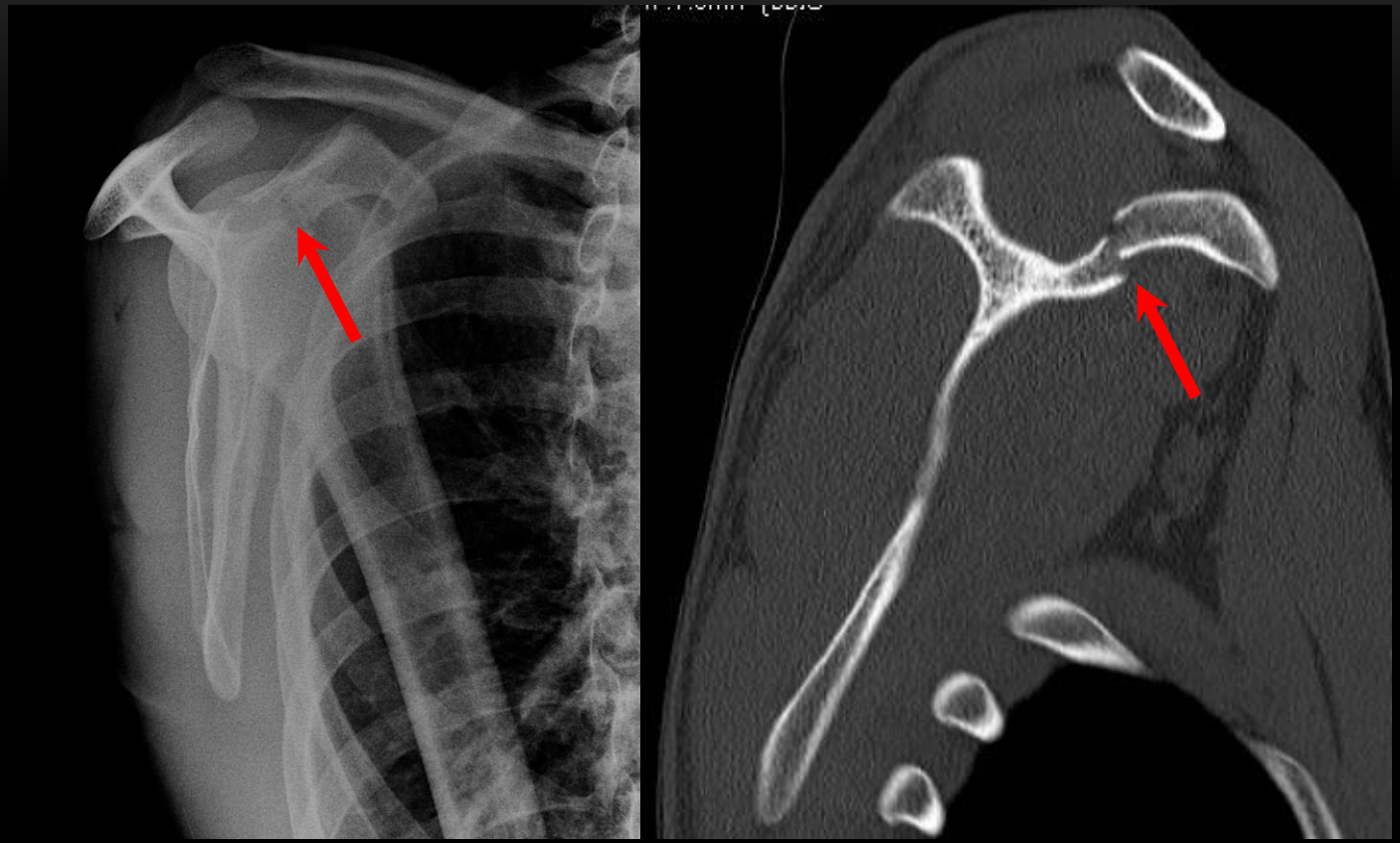
- Articular involvement
- Glenoid neck involvement
- Associated injuries
  - Bony , ligamentous
  - neurovascular

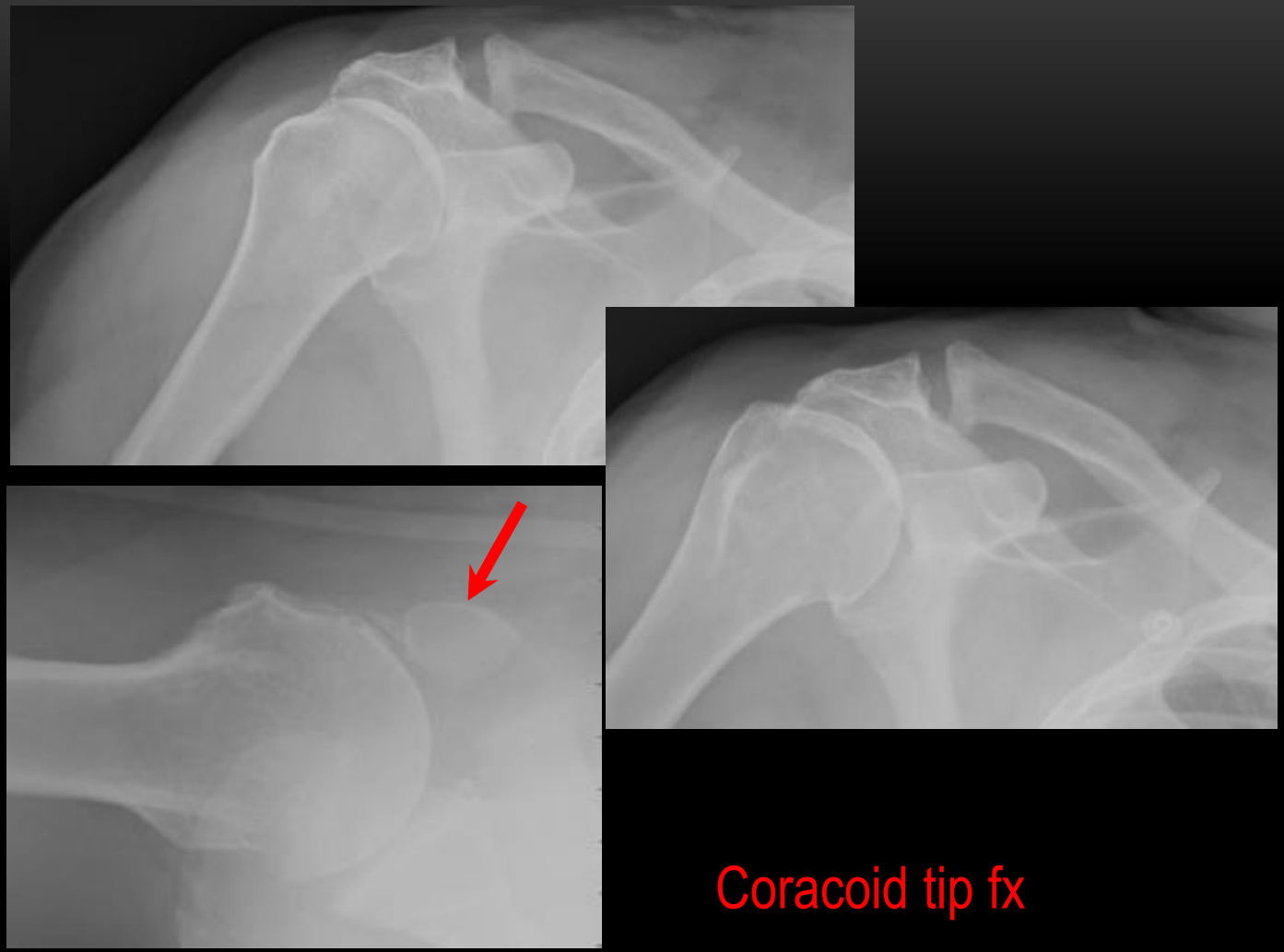
Coracoid process

Ogawa Classification - Coracoid Fractures

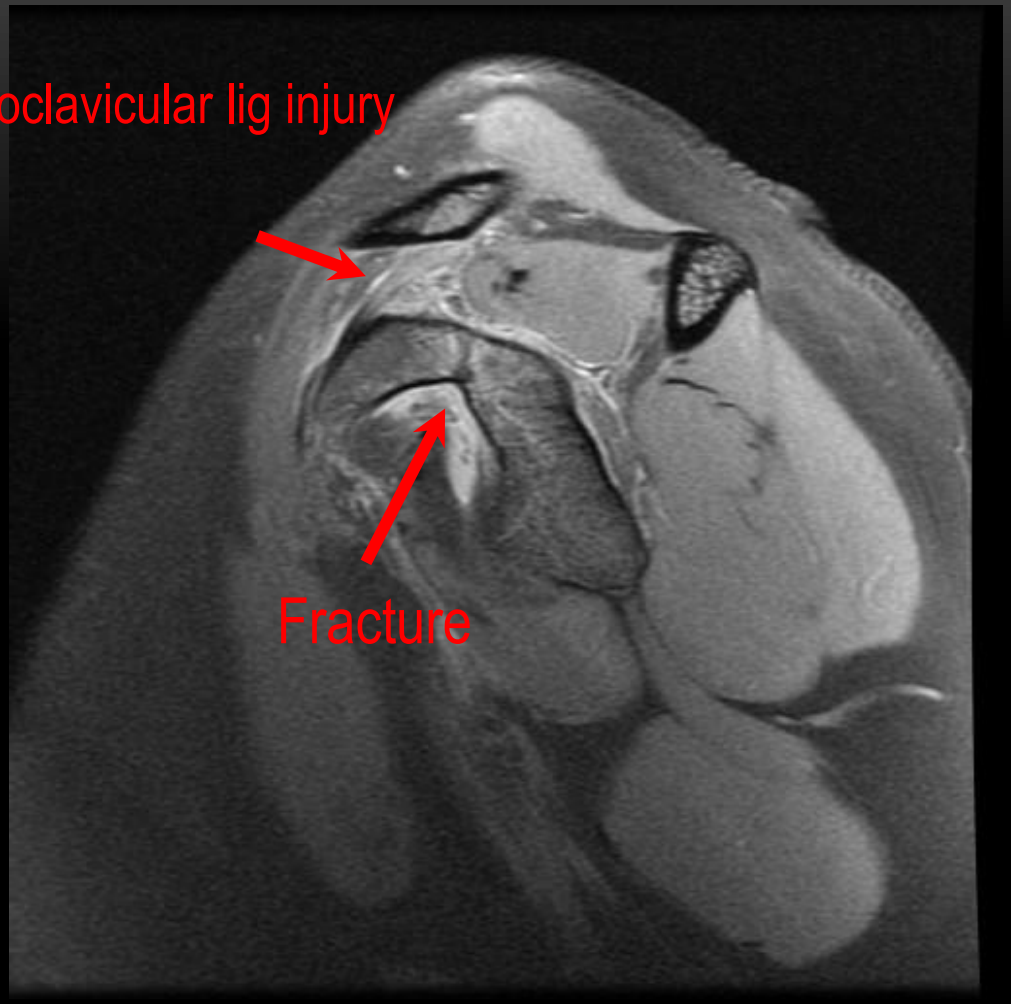


Ogawa, Kiyohisa, et al. "Fractures of the coracoid process." *Journal of Bone & Joint Surgery, British Volume* 79.1 (1997): 17-19.





Coracoid tip fx


Coracoclavicular lig injury
Fracture

What the surgeon wants to know?
Coracoid fractures

- Location of fx in the coracoid process
- Involvement of coracoclavicular ligament
- Associated injuries
  - Bony , ligamentous

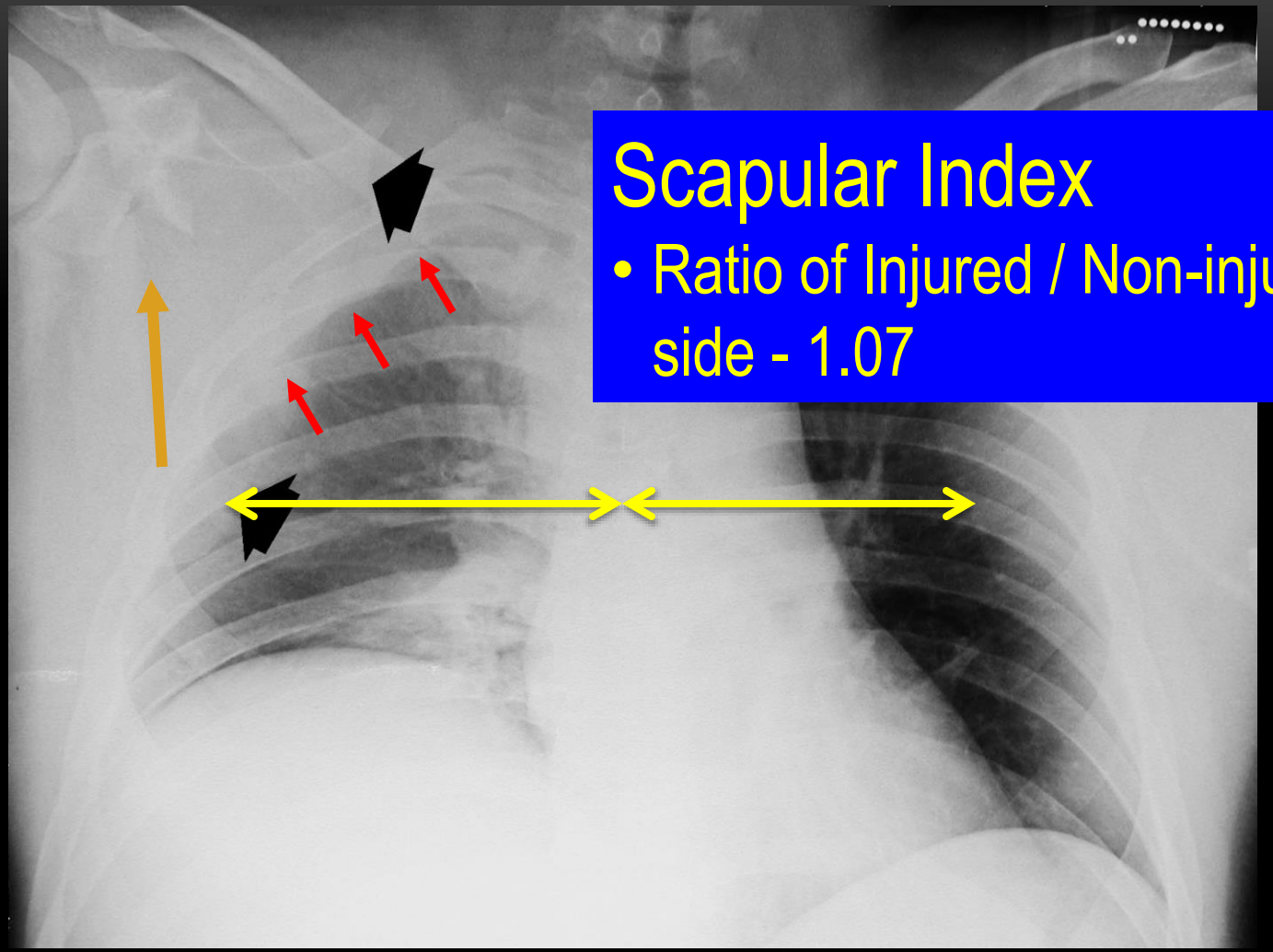
Scapulothoracic dissociation

Scapulothoracic dissociation

Closed forequarter amputation

- Muscular disruption
- Vascular disruption
- Brachial plexus disruption
- Flail limb
- Dismal prognosis

DO NOT MISS

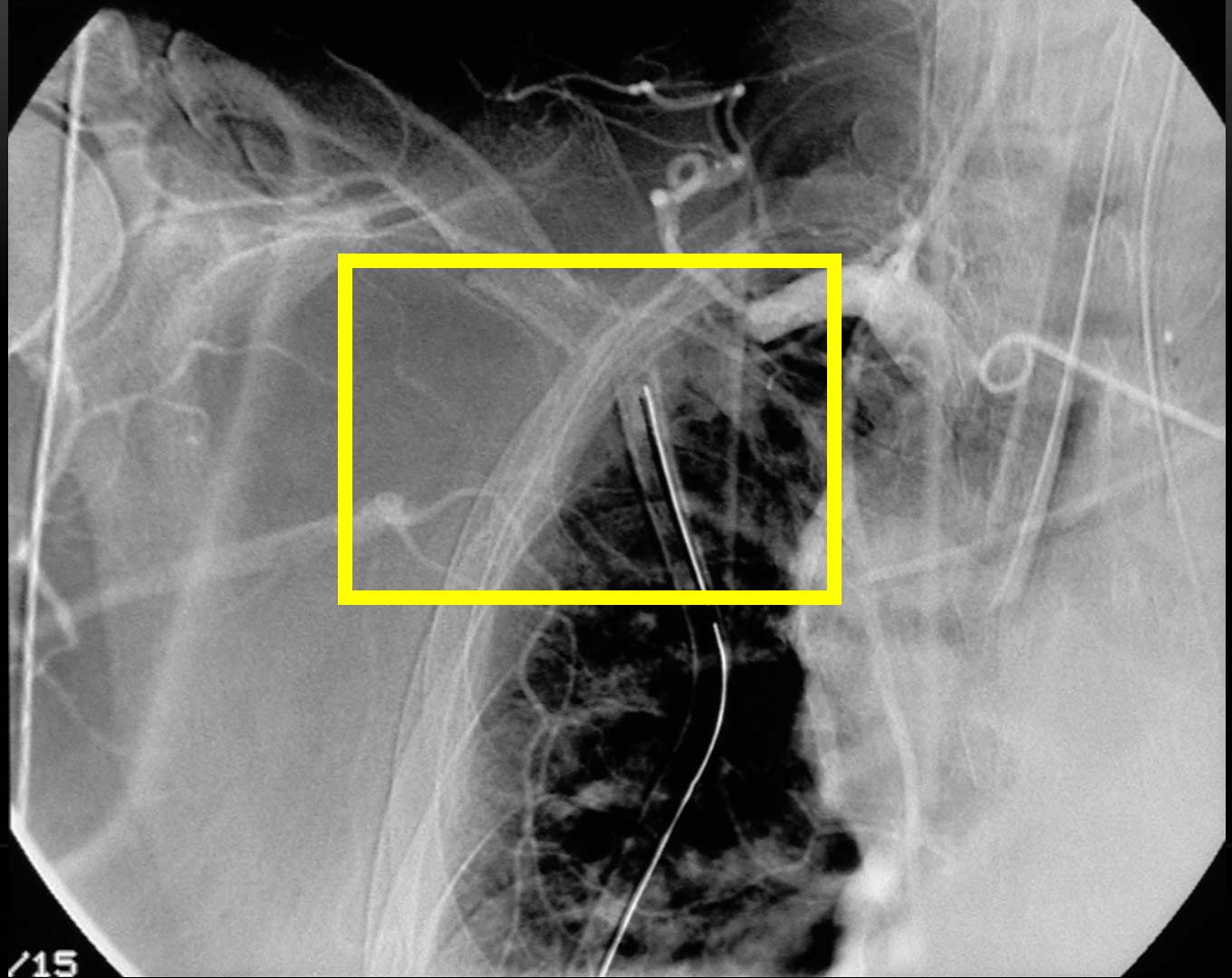

Scapular Index
• Ratio of Injured / Non-injured side - 1.07

Scapulothoracic dissociation - associations

- Lateral scapular displacement
- Scapular fx
- Extrapleural hematoma
- Sternoclavicular dislocation
- Diastatic clavicle fx

Pt presents as absent pulse in the wrist!

- Look for proximal cause of absent pulse! – CTA or conventional angiography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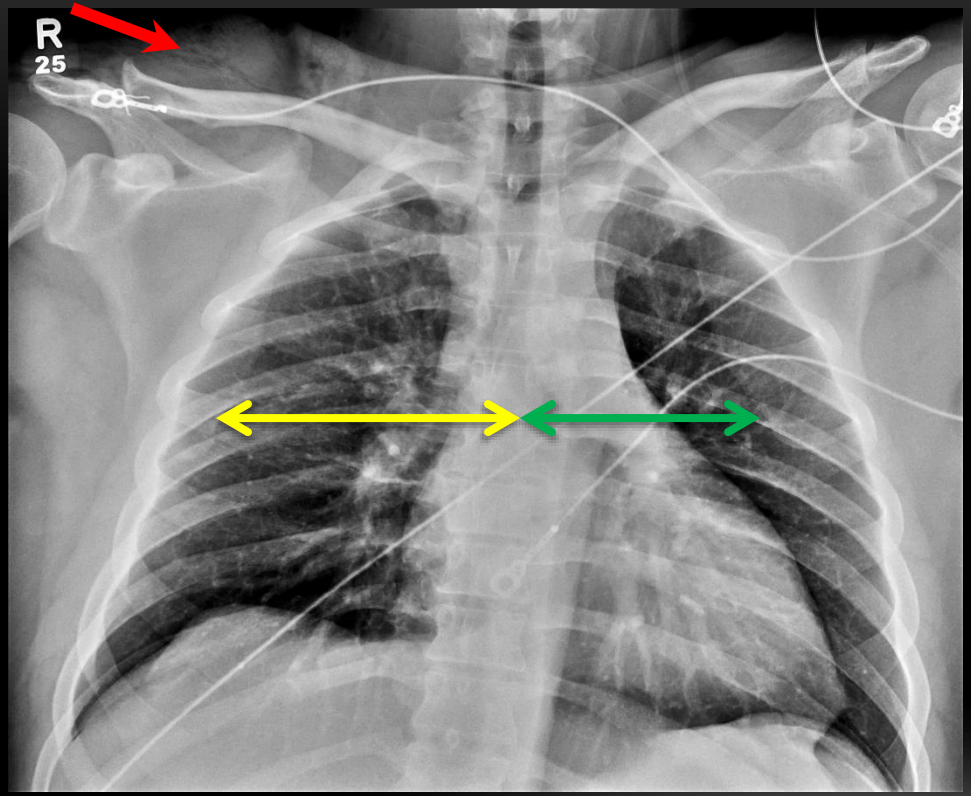
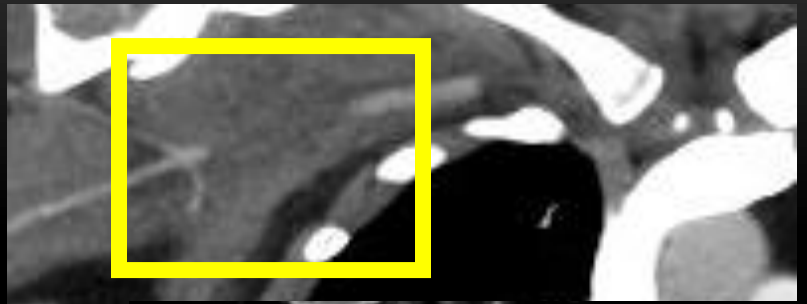
Scapulothoracic dissociation





Summary

- Adequacy of radiographs
- Dislocations – bony articular involvement
- Coracoclavicular ligament involvement in AC injuries
- Coracoid root injury
- Scapula – neck & articular zone

- Think of Scapulothoracic dissociation!

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Thank you for your attention!

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