

Radial Head and Neck Fractures

Thomas Krupko M.D.

Assistant Professor – Orthopaedic Trauma

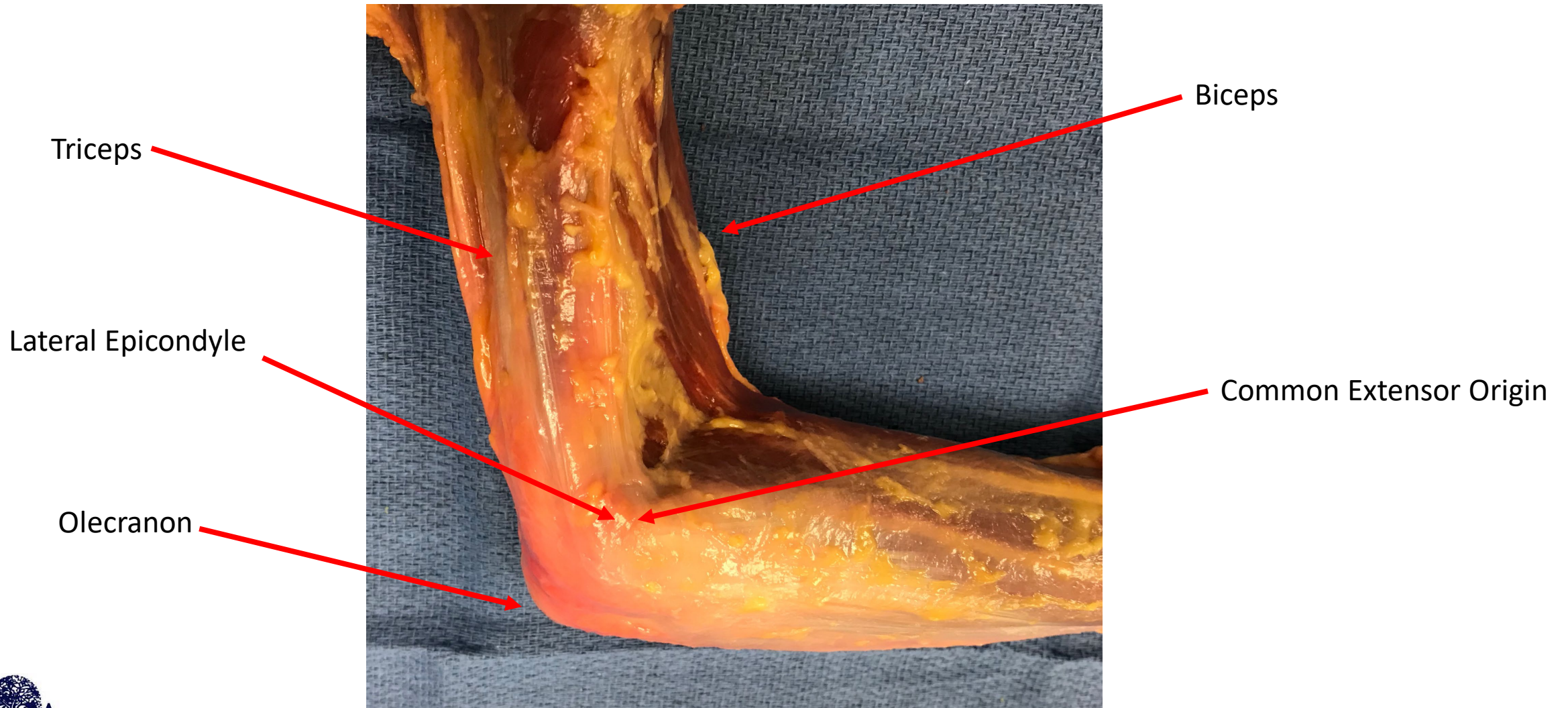
University of Florida

Objectives

- **Anatomy**
- **Elbow Instability**
- **Radial head fractures**
 - **Classification**
 - **Treatment**
- **Radial neck fractures**
 - **Treatment**
- **Essex-Lopresti Injuries**

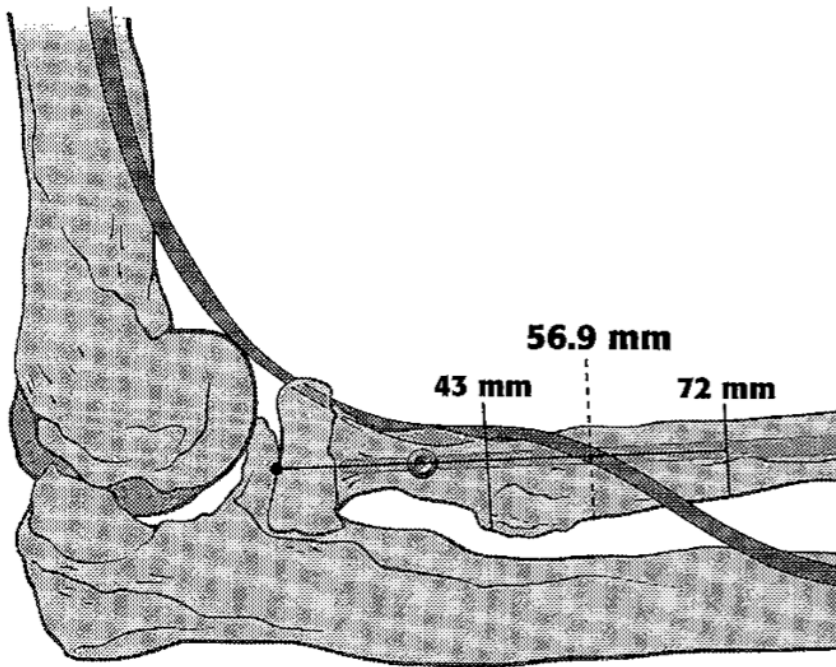
Anatomy

Anatomy – Superficial Lateral Elbow

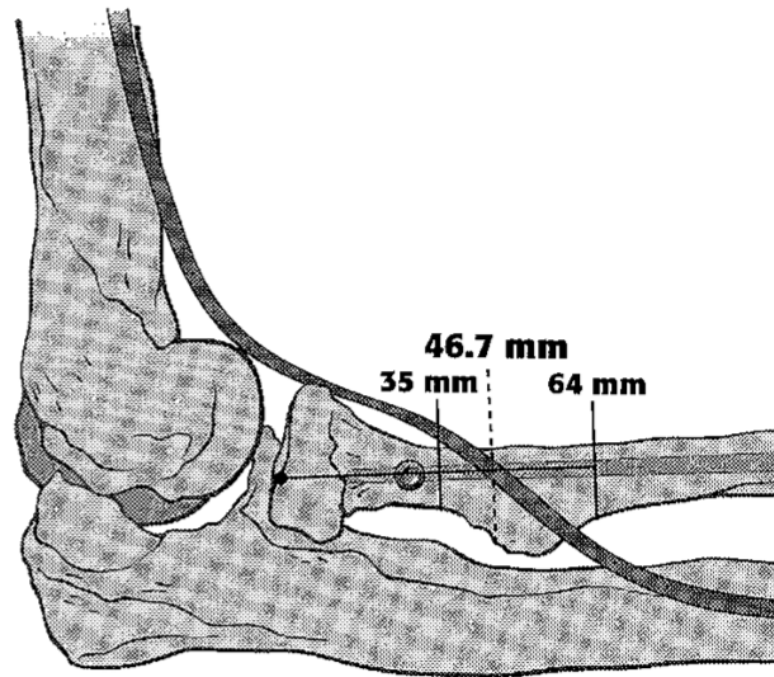


Anatomy - PIN

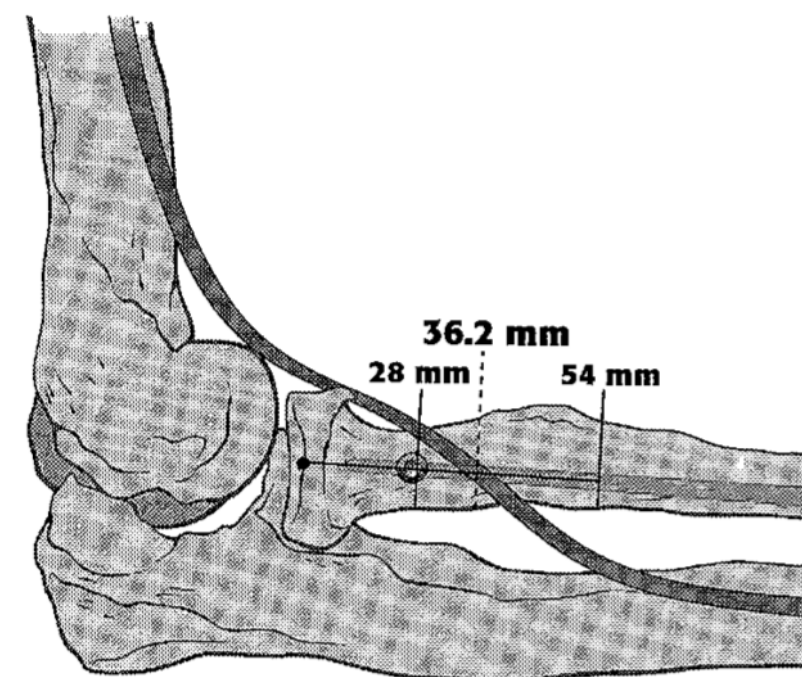
Pronation



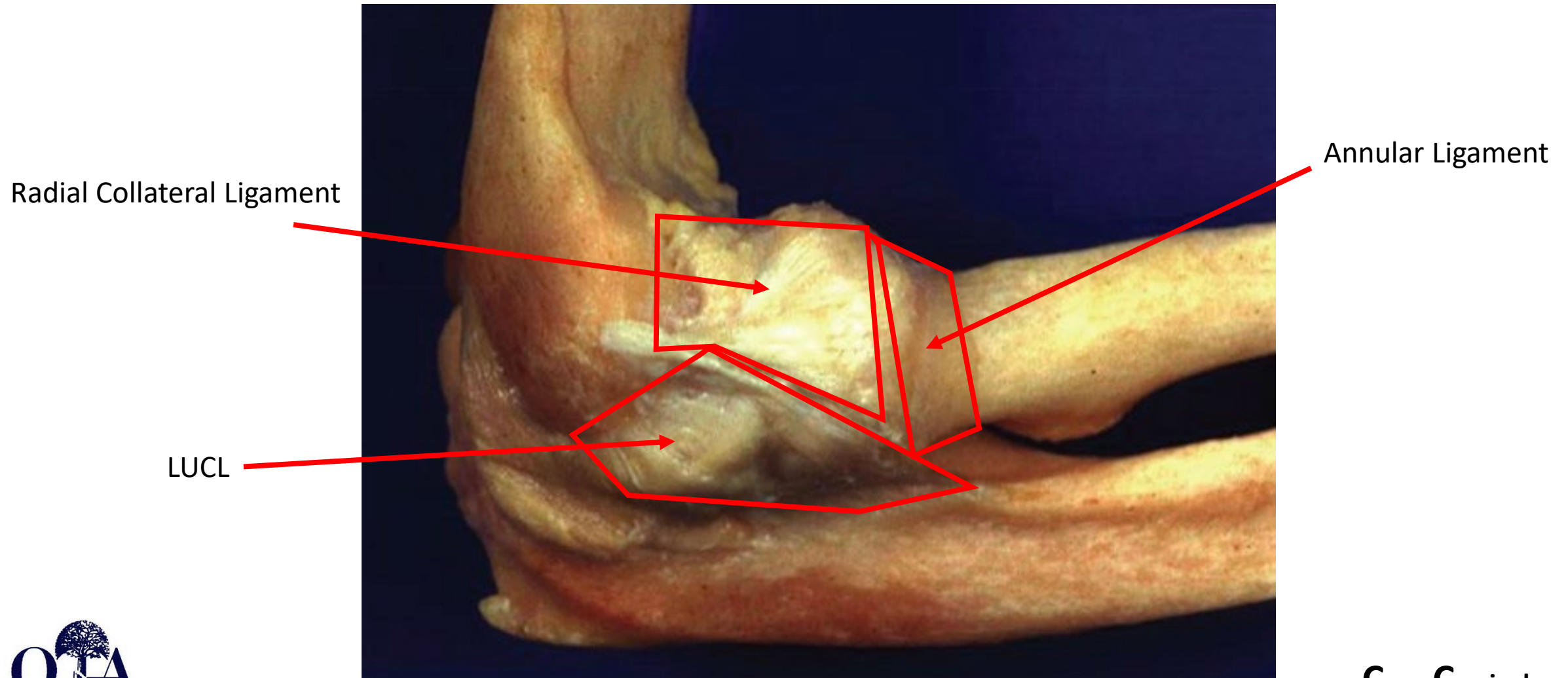
Neutral



Supination

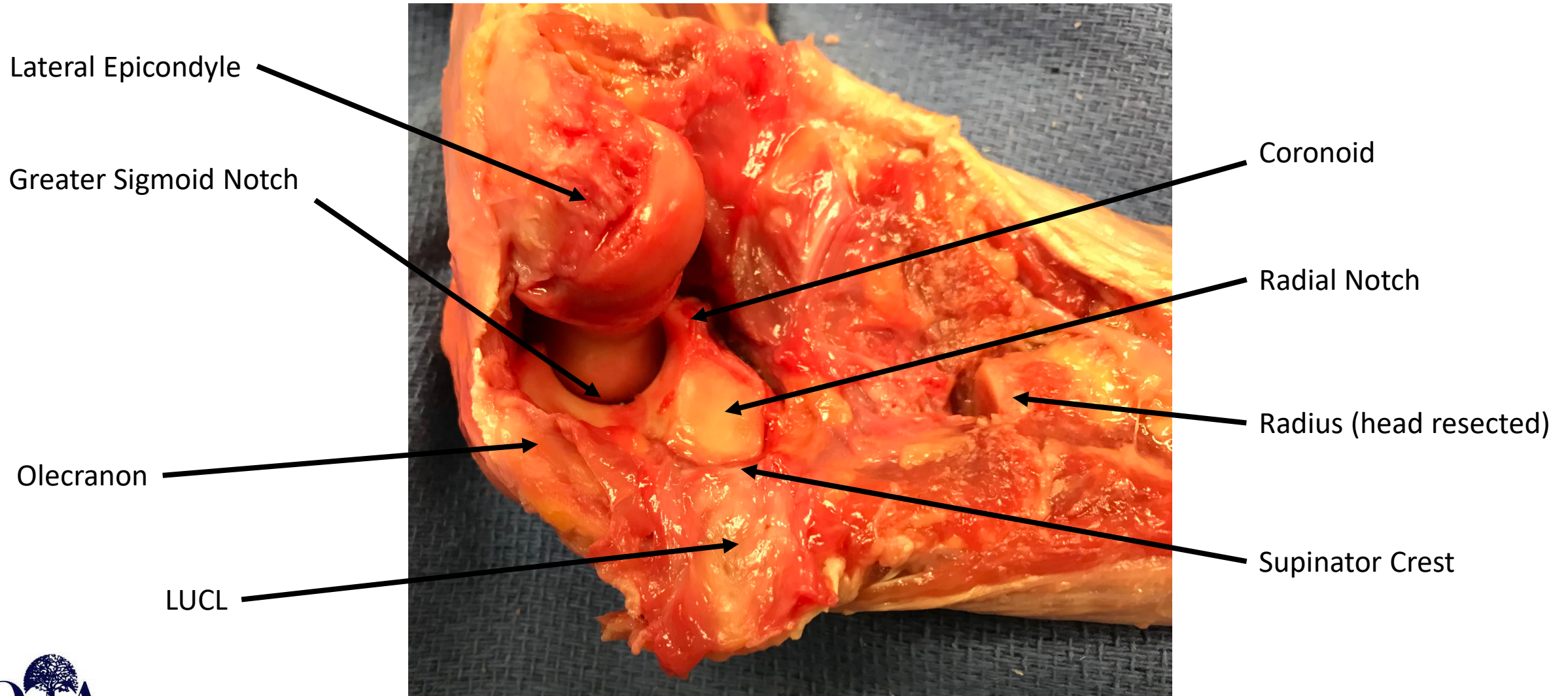


Anatomy – Deep Lateral Elbow

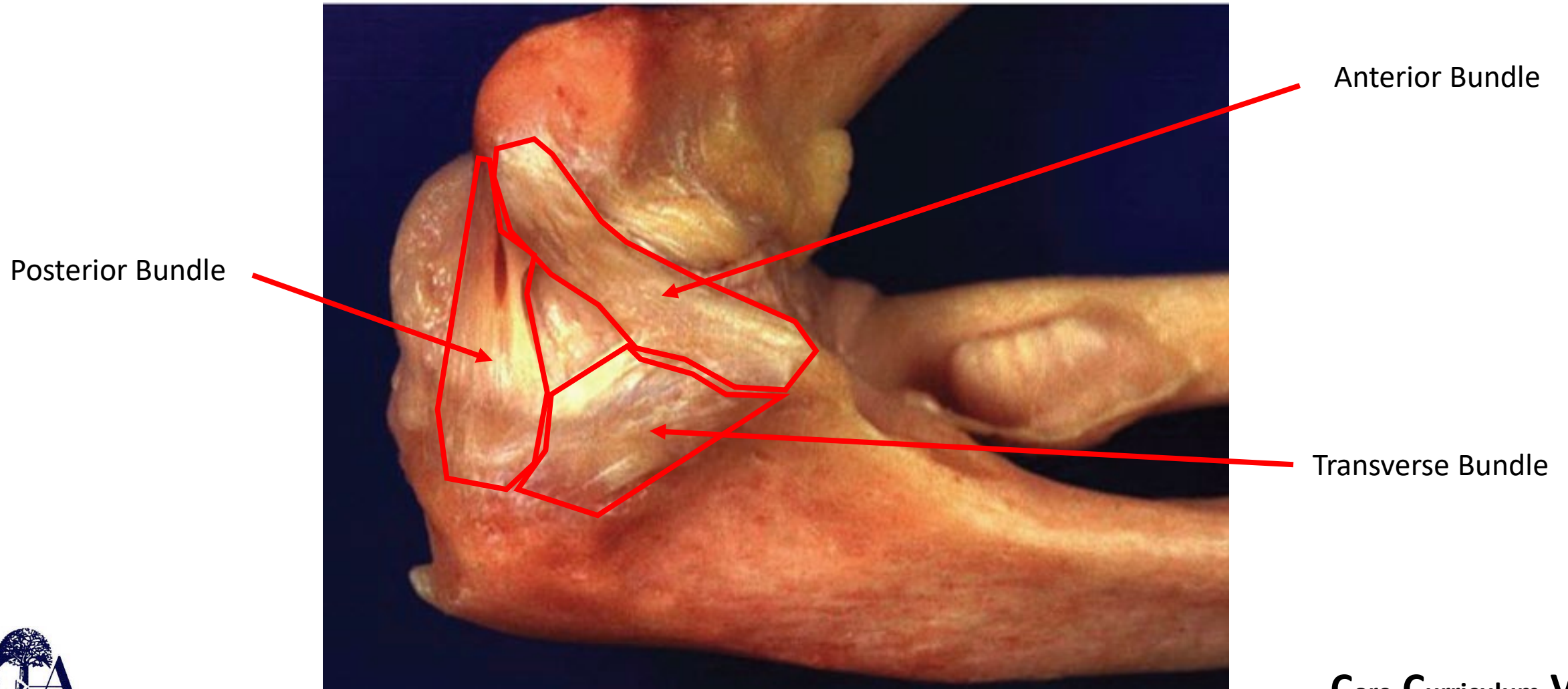


Reference: Rockwood and Green's - Figure 32.2

Anatomy – Lateral Elbow



Anatomy – Medial Elbow



Reference: Rockwood and Green's - Figure 32.2

Elbow Stability

Elbow Stability

- **Static**

- **Ulna-humeral joint**
- **Radio-humeral Joint**
- **LUCL**
- **Anterior bundle of MCL**

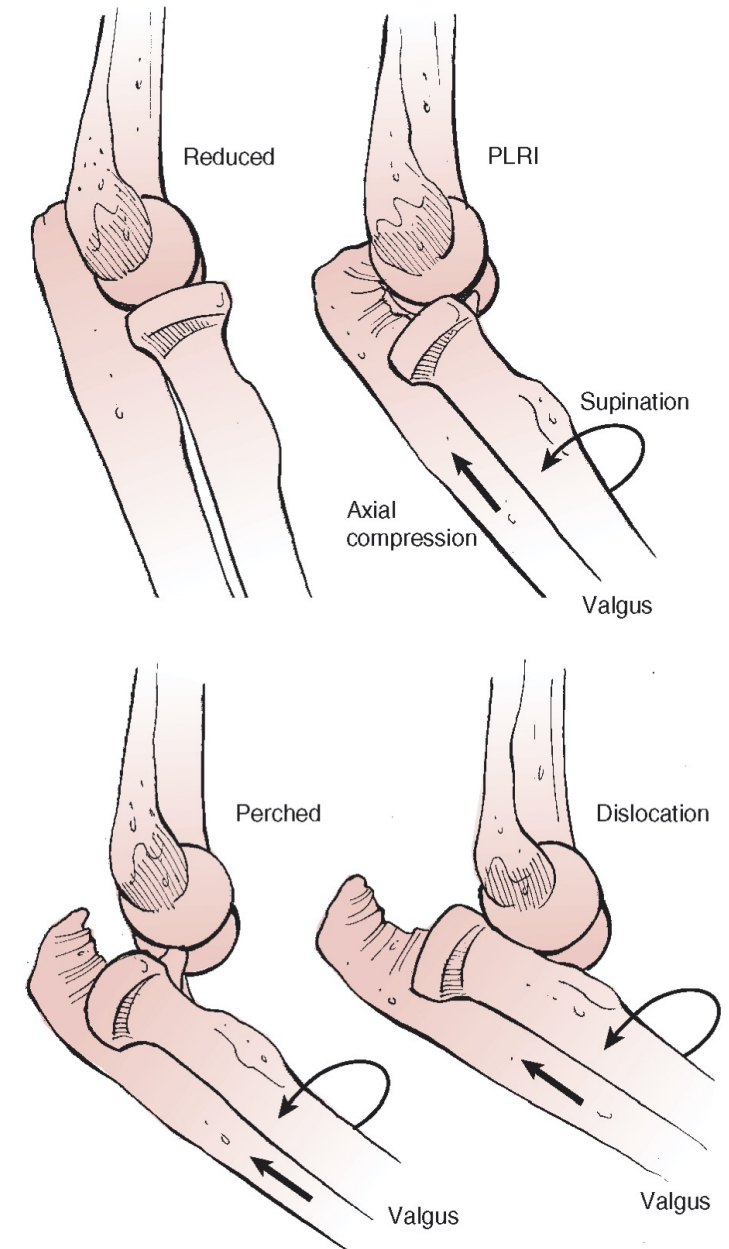
- **Dynamic**

- **Common flexor origin**
- **Common extensor origin**
- **Biceps**
- **Brachialis**
- **Triceps**

- **Radius resists axial load and valgus**

Mechanism of Injury

- Typically fall onto outstretched hand
 - Axial loading
 - Valgus force
- Radial head/neck fractures occur along a spectrum of elbow instability
- Any treatment requires complete understanding of the injured bone and soft tissue
 - CT scan can provide valuable info



Copyright © 2010 Wolters Kluwer Health | Lippincott Williams & Wilkins

Elbow Instability

Stable

Unstable



Simple dislocation



Radial Head Fx



Radial Head Fx
+ Dislocation



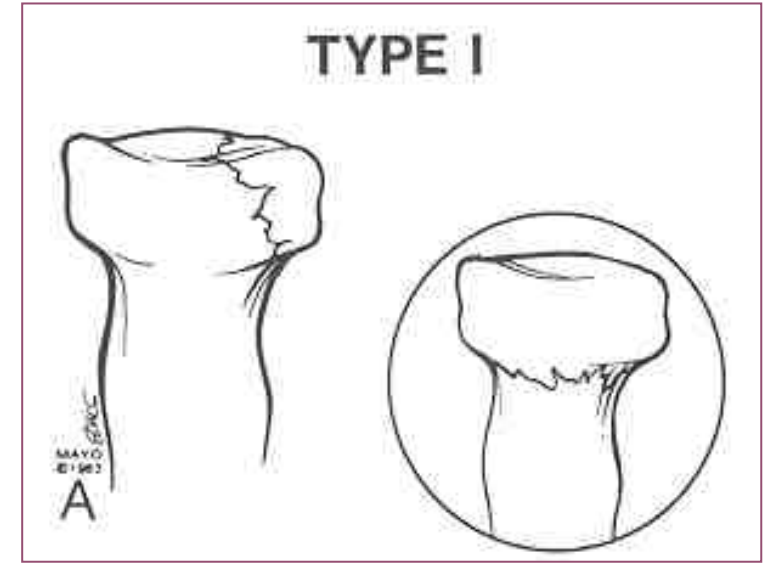
Post Trans
Olecranon Fx
Dislocation



Terrible Triad

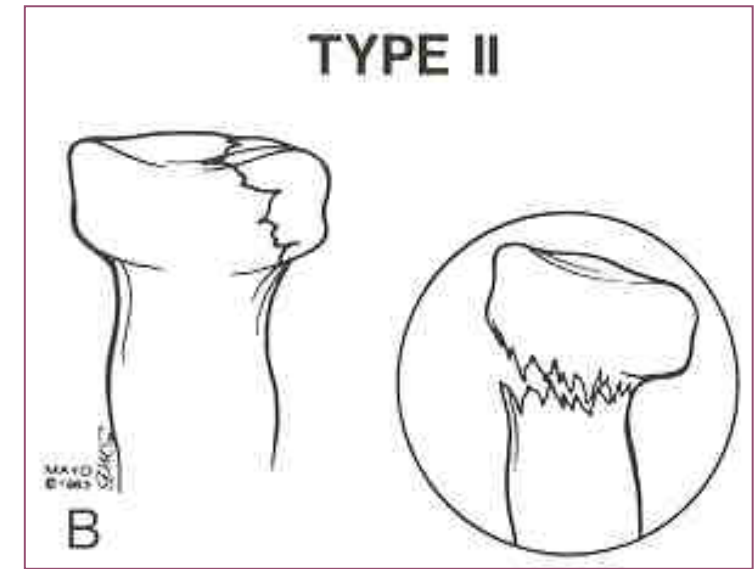
Radial Head Fractures

- Mason Classification – Type 1
 - Non- displaced fx or minimally displaced (<2mm)
 - No mechanical block to forearm rotation



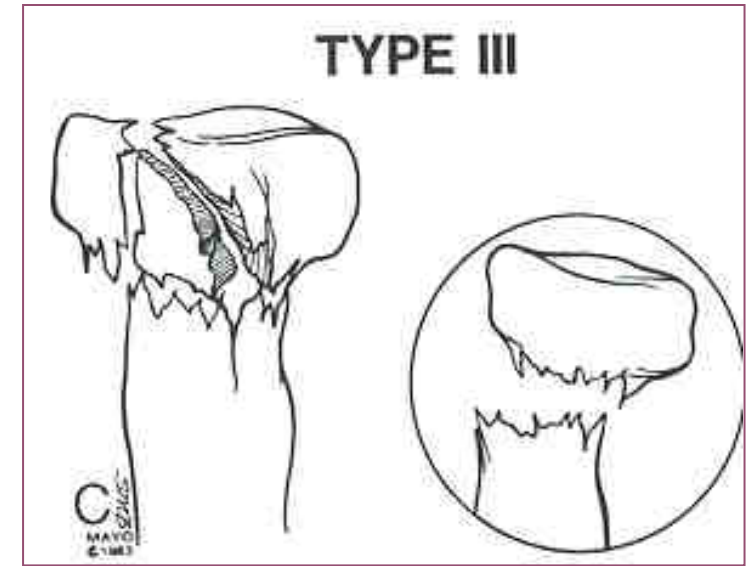
Radial Head Fractures

- Mason Classification – Type 2
 - Displaced >2mm or angulated
 - Possible block to rotation



Radial Head Fractures

- Mason Classification – Type 3
 - Comminuted
 - Displaced
 - Obvious block to rotation

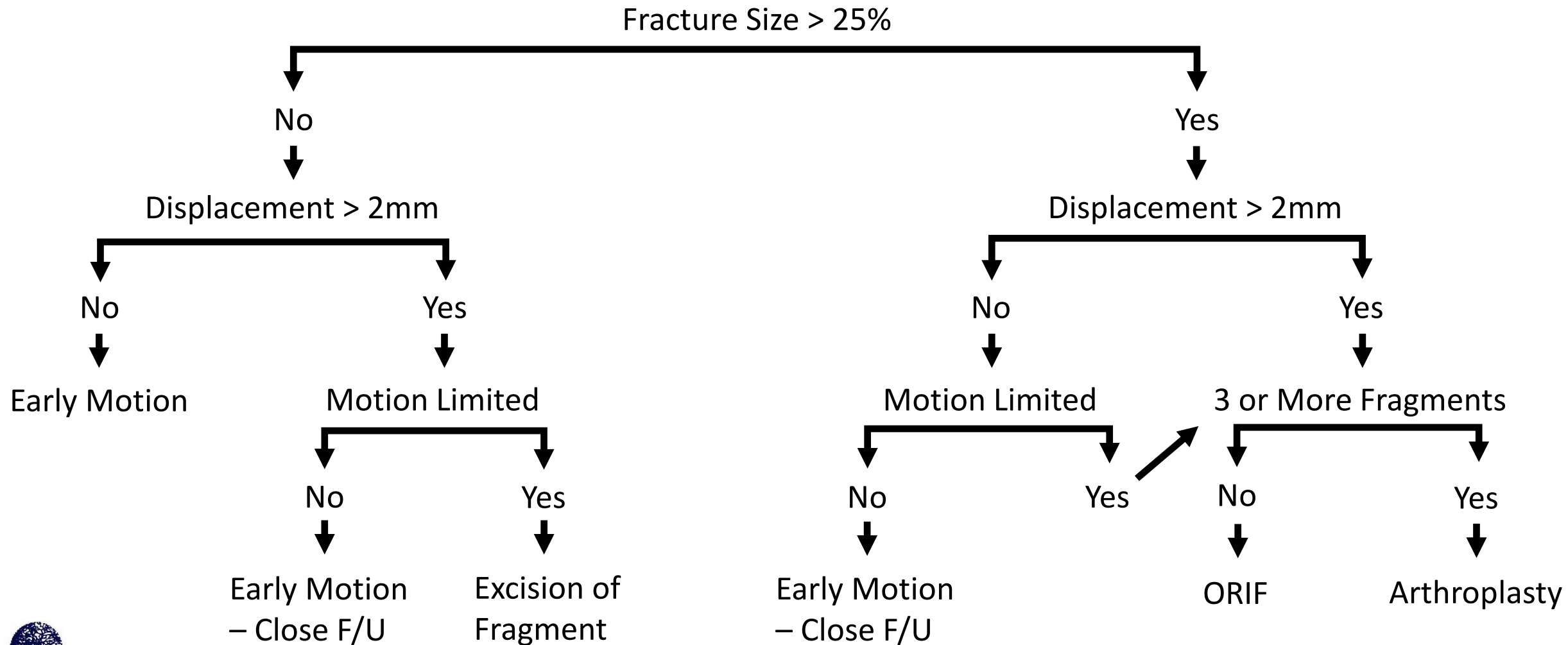


Radial Head Fractures

- Mason Classification – Type 4
 - Hotchkiss Modification
 - Bridges the gap with more complex elbow instability
 - Radial head fx with elbow dislocation
- Beware LUCL avulsion and coronoid fx (terrible triad)

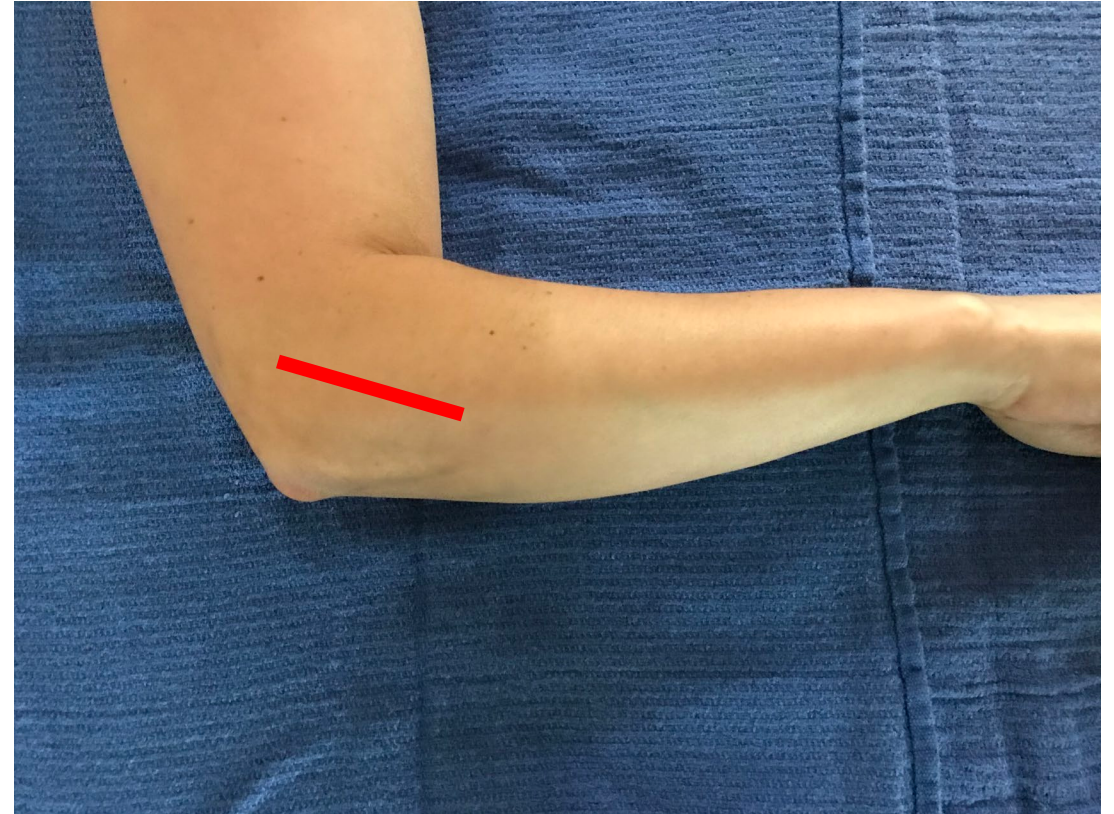


Radial Head Fractures – Treatment Algorithm



Lateral Elbow – Approaches

- **Kocher**
 - Most often utilized for radial head
 - Interval
 - Anconeus – Radial Nerve
 - ECU – PIN
 - 5cm incision from lateral epicondyle distally
 - Angled posteriorly 30-45 degrees
 - Often deep soft tissues will be disrupted by injury



[OTA Online Video](#)

Lateral Elbow – Approaches

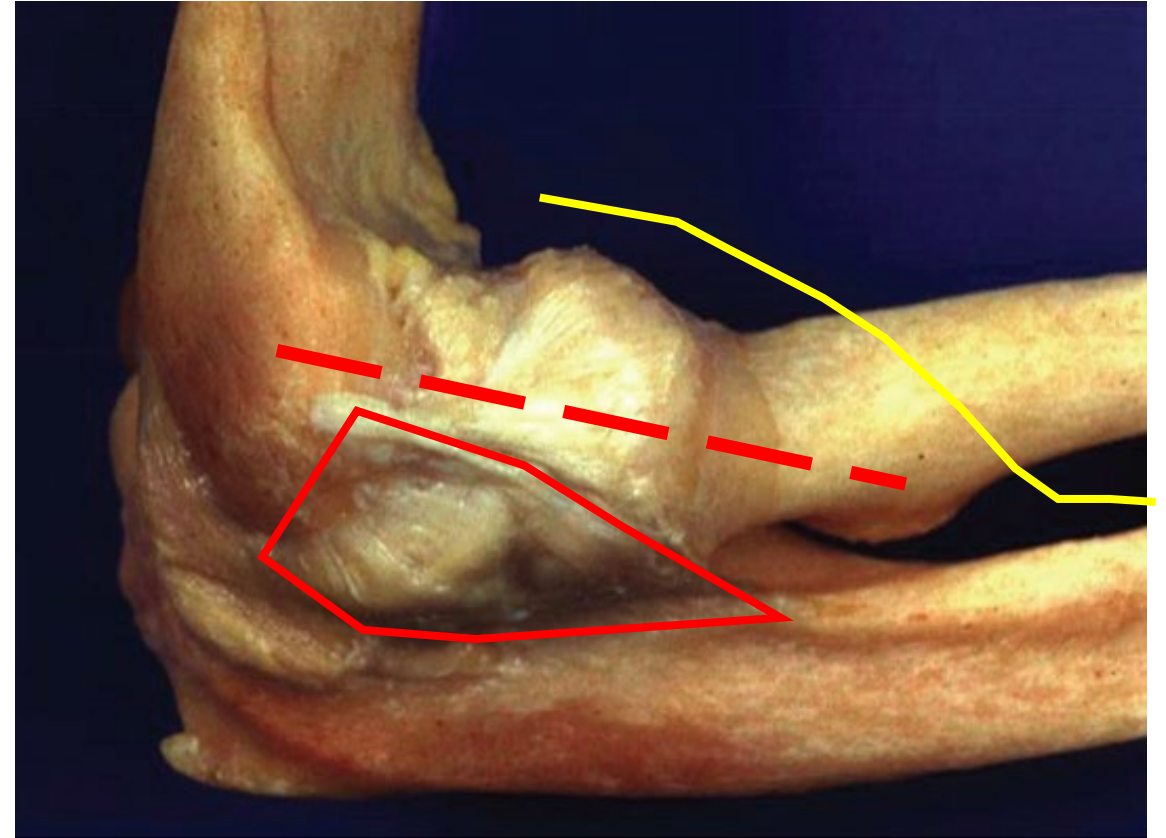
- **Kocher Pitfalls**

- **Damage to LUCL**

- Stay on anterior half of radial head

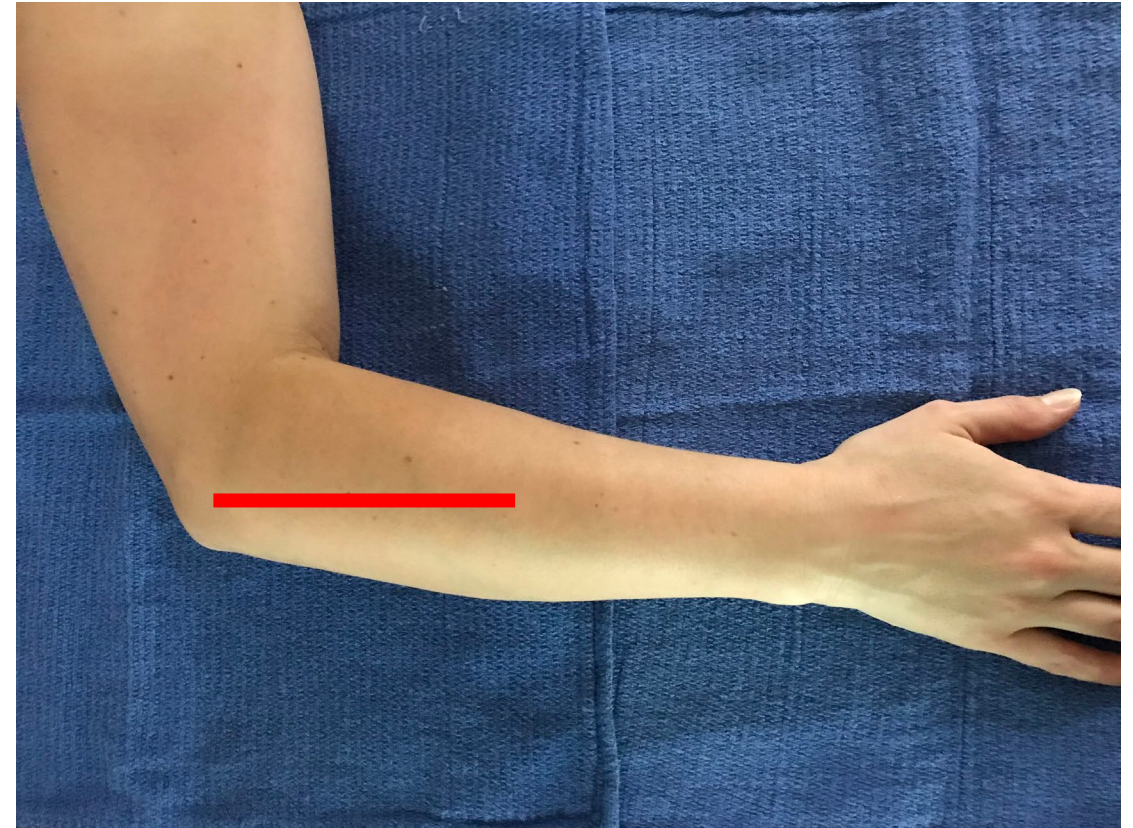
- **Damage to PIN**

- Pronate the arm to move nerve distally
 - Carefully dissect distal to annular ligament



Lateral Elbow– Approaches

- **Kaplan**
 - Distal extension becomes dorsal Thompson approach
 - More often used for radial neck/proximal radial shaft fx's
 - Interval
 - ECRB – Radial nerve or PIN (variable)
 - EDC – PIN
 - 10cm incision from lateral epicondyle to Lister's Tubercle



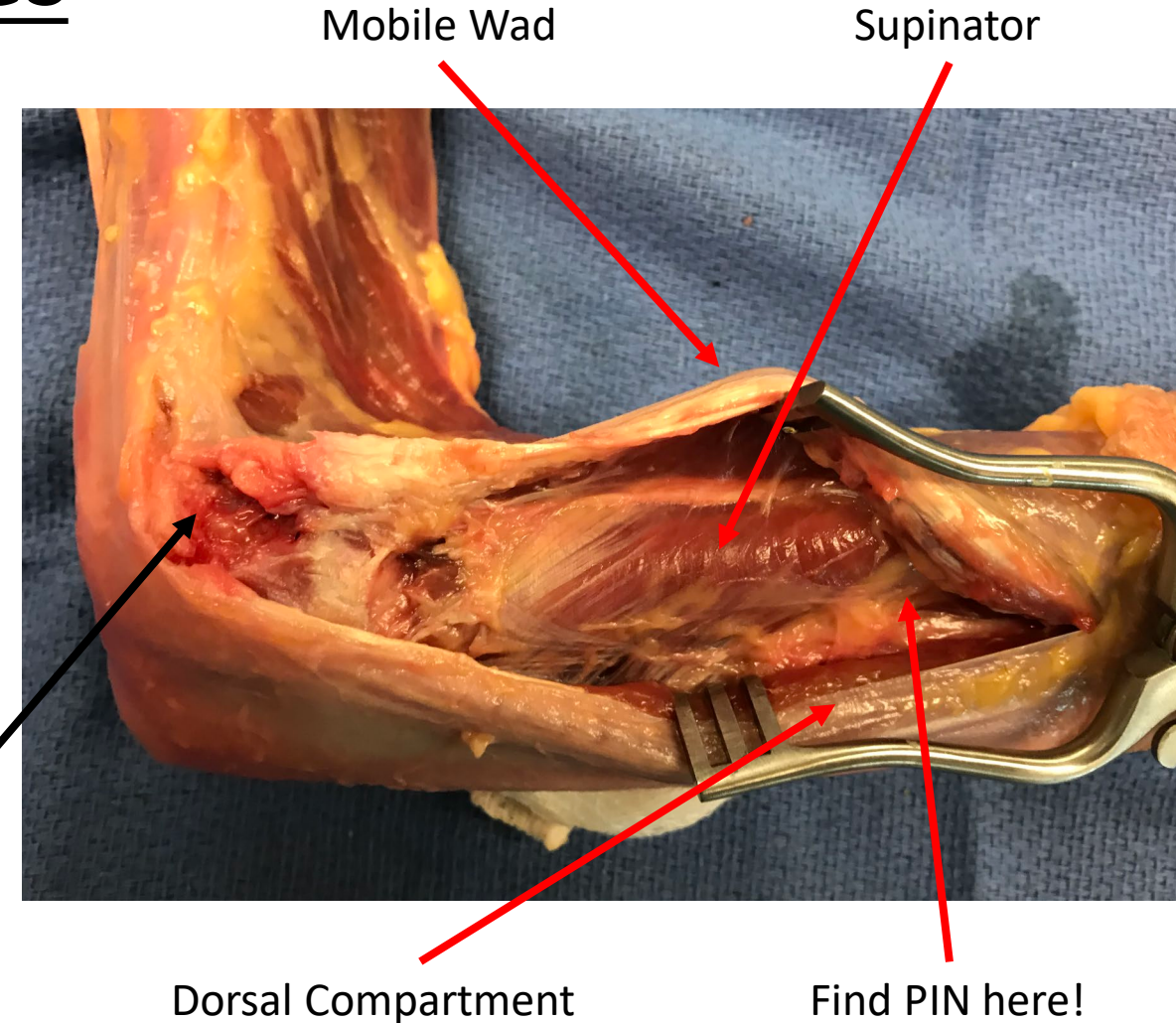
Lateral Elbow— Approaches

- **Kaplan Pitfalls**

- **PIN injury**

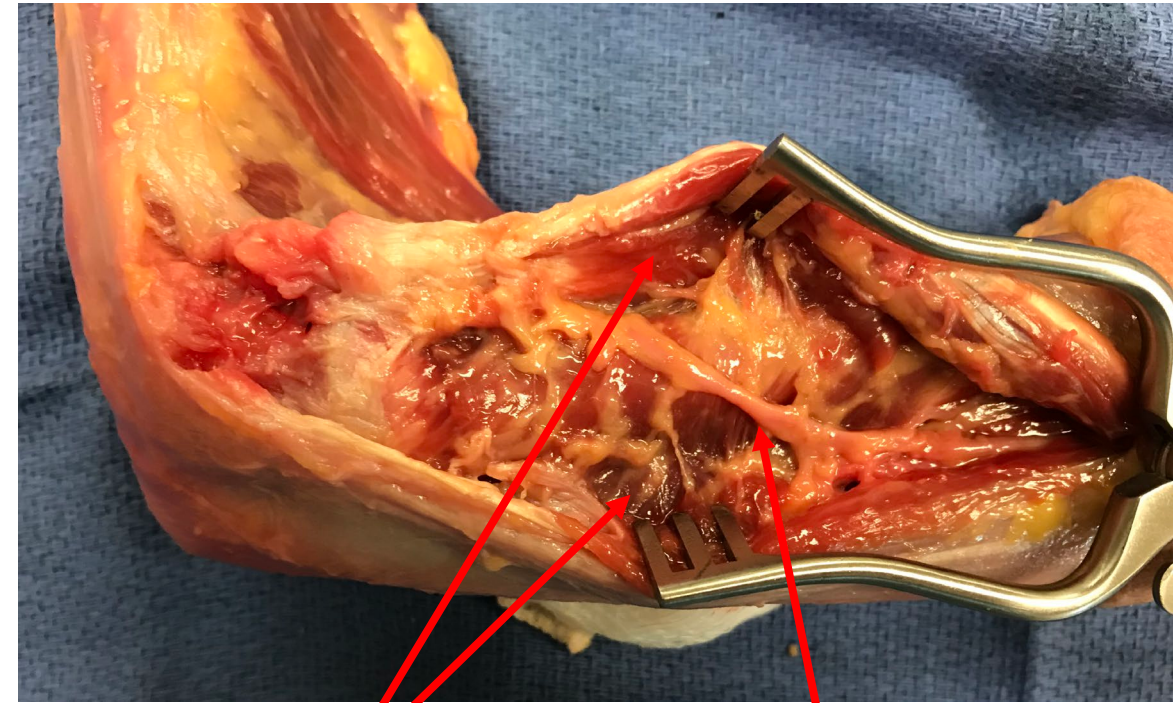
- Palpable between two heads of supinator.
 - Distal dissection can be utilized to locate the nerve (see image)
 - Can also split supinator (next slide)

Lateral Epicondyle



Lateral Elbow— Approaches

- **Kaplan Pitfalls**
 - **PIN injury**
 - Palpable between two heads of supinator.
 - Image shows supinator split and nerve exposed

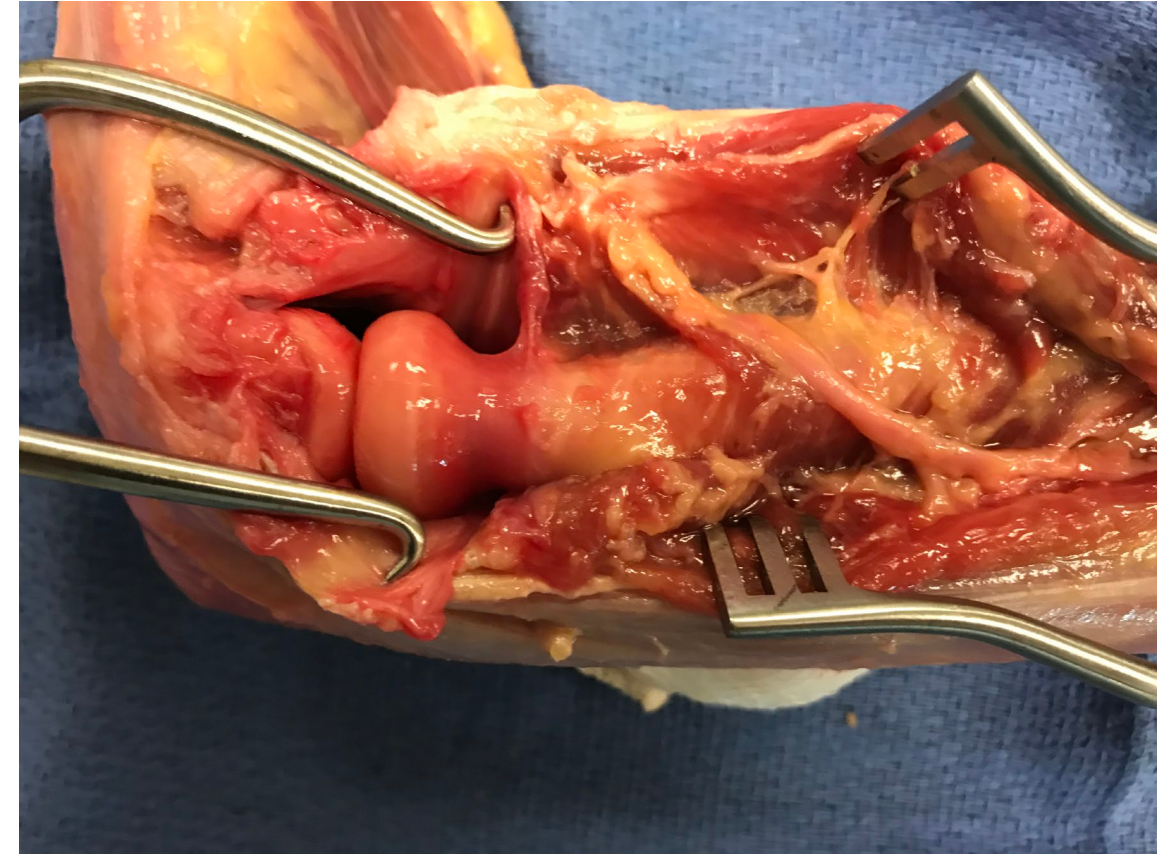


Supinator (Superficial head split)

PIN

Lateral Elbow— Approaches

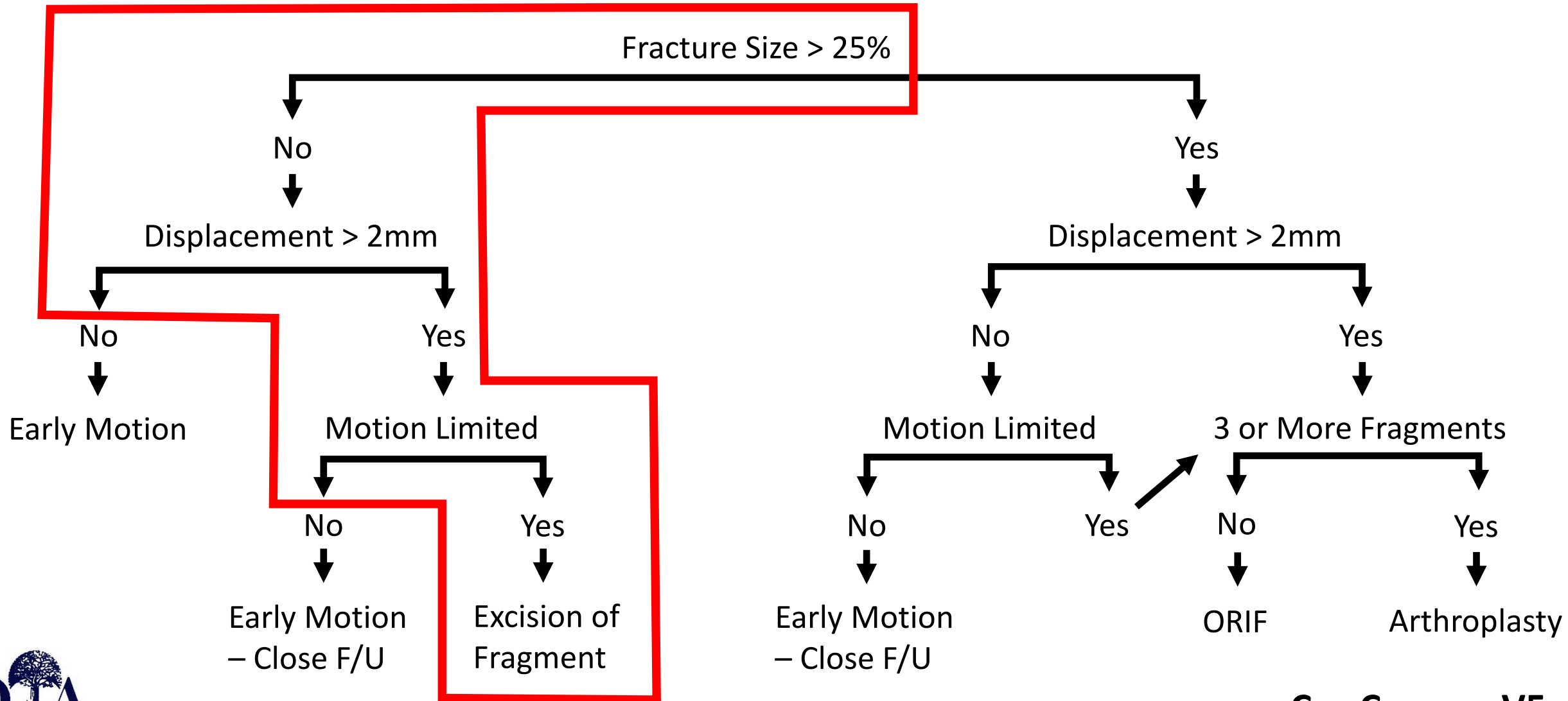
- **Kaplan Pitfalls**
 - **PIN injury**
 - Final approach gives significant exposure of radial head, neck, and proximal shaft for more complex fractures



Lateral Elbow – Less Common Approaches

- EDC Split
 - Roughly half way between Kocher and Kaplan
 - Pros and Cons the same as these approaches
- Modified Boyd
 - Posterior approach
 - Elevate LUCL from lateral epicondyle
 - Can be used for combined olecranon/radial head fxs
 - Possible risk of synostosis
 - See references for complete technique

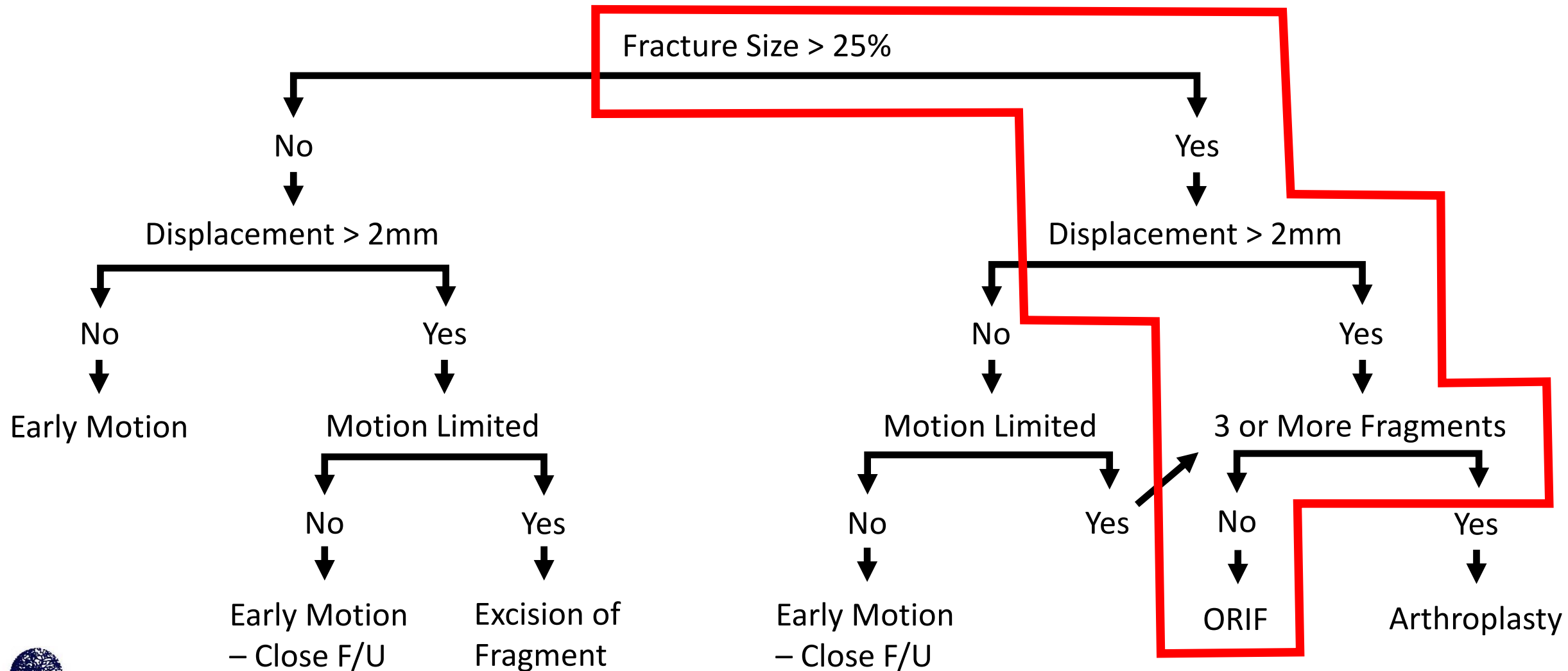
Radial Head Fractures – Treatment Algorithm



Radial Head Fractures – Excision

- Isolated radial head (stable joint)
 - Partial or complete resection can be a reliable option
 - Beware subtle instability
 - May lead to PLRI or radial shortening long term
- Radial head fx with ulno-humeral or longitudinal instability
 - Complete resection is contra-indicated
 - Partial resection a viable treatment option for small fragments (<25% of joint)

Radial Head Fractures – Treatment Algorithm



Radial Head Fractures - ORIF

- **Articular fx**
 - Anatomic reduction
 - Compression
- **Implants**
 - Mini-frag screws
 - Headless compression



Radial Head Fractures - ORIF

- **Articular fx**
 - Anatomic reduction
 - Compression
- **Implants**
 - **Headless compression**
 - Tripod Technique
 - See references for technique guide



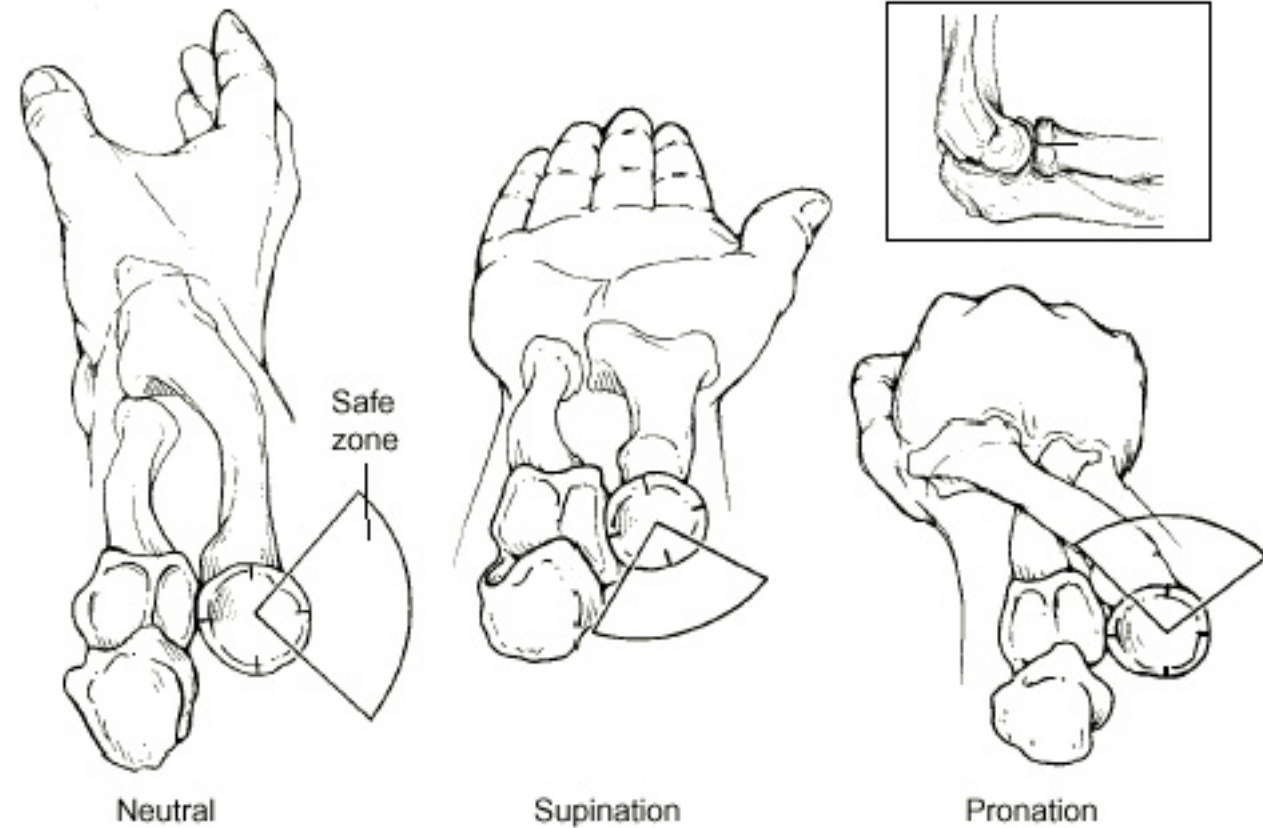
Radial Head Fractures - ORIF

- **Articular fx**
 - Anatomic reduction
 - Compression
- **Implants**
 - Periarticular locking plates

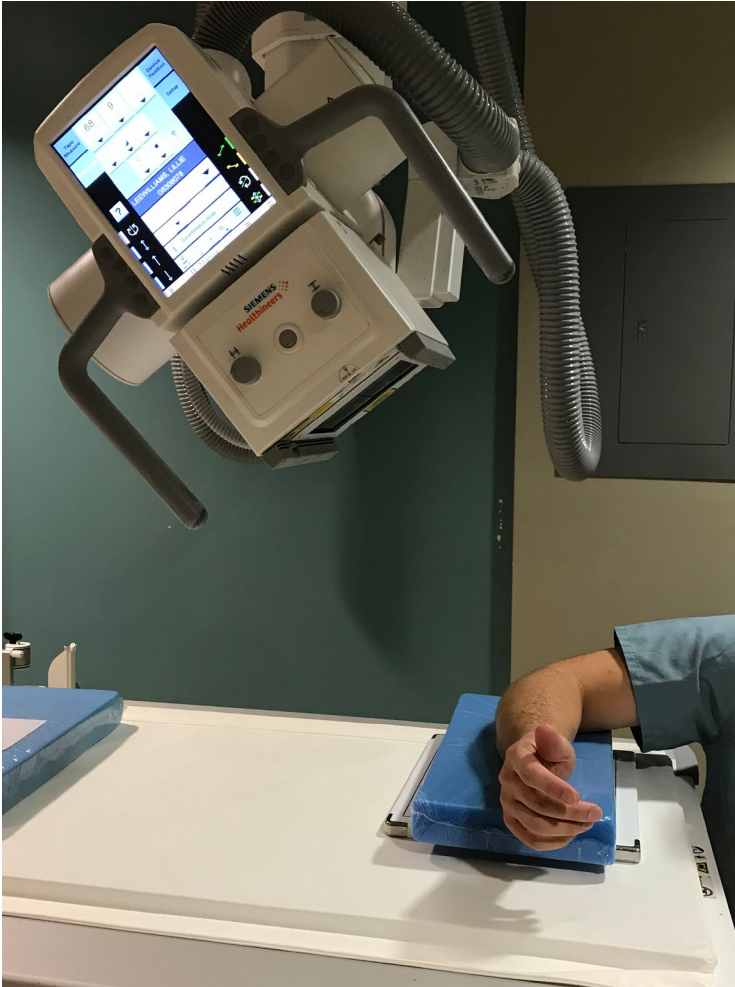


Radial Head Fractures – Implant Placement

- Care must be taken to keep implants out of the proximal radio-ulnar joint
 - Block to supination and pronation
- Safe zone
 - 100 degree area
 - Between tip of radial styloid and Lister's Tubercle



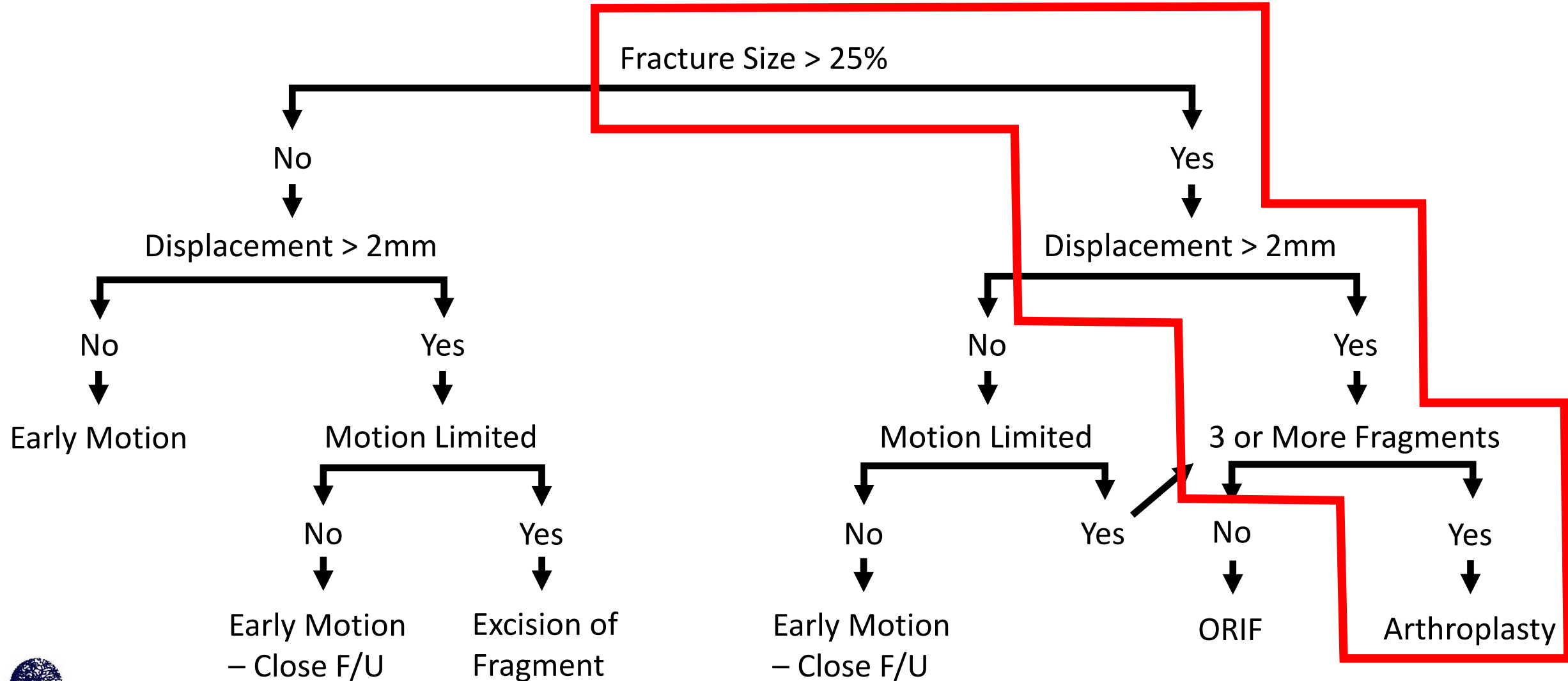
Radial Head Fractures – Greenspan View



Radial Head Fractures – Intra-op Greenspan



Radial Head Fractures – Treatment Algorithm



Radial Head Fractures - Replacement

- **Head options**

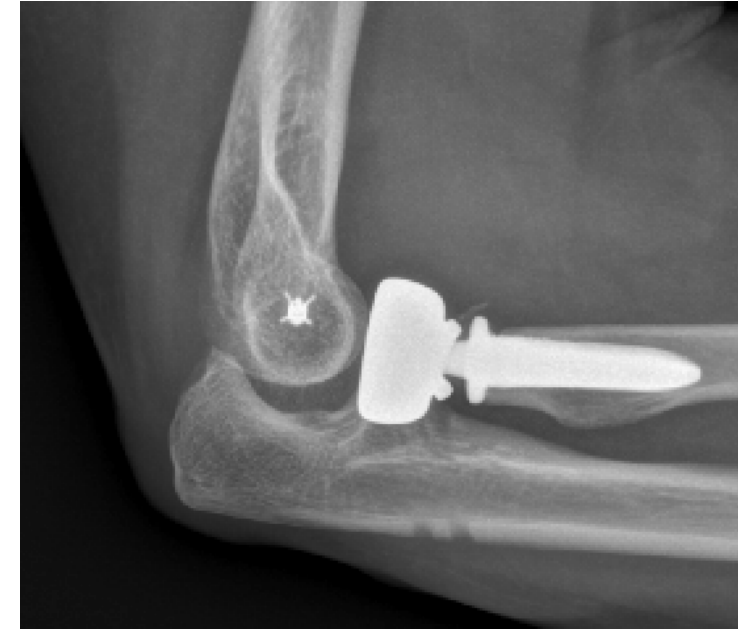
- **Round**
 - Easier placement
- **Eccentric**
 - Mimics native anatomy
 - More difficult to place
- **Bipolar**
 - Articulates at the head/neck junction
 - Dislocation can occur

- **Stem options**

- **Smooth**
 - Loose fitting stem
 - Allows implant to find proper alignment
- **Porous/Pressfit**
 - Can loosen causing pain
 - Can result in dilatory remodeling
- **Cemented**
 - Typically used for salvage

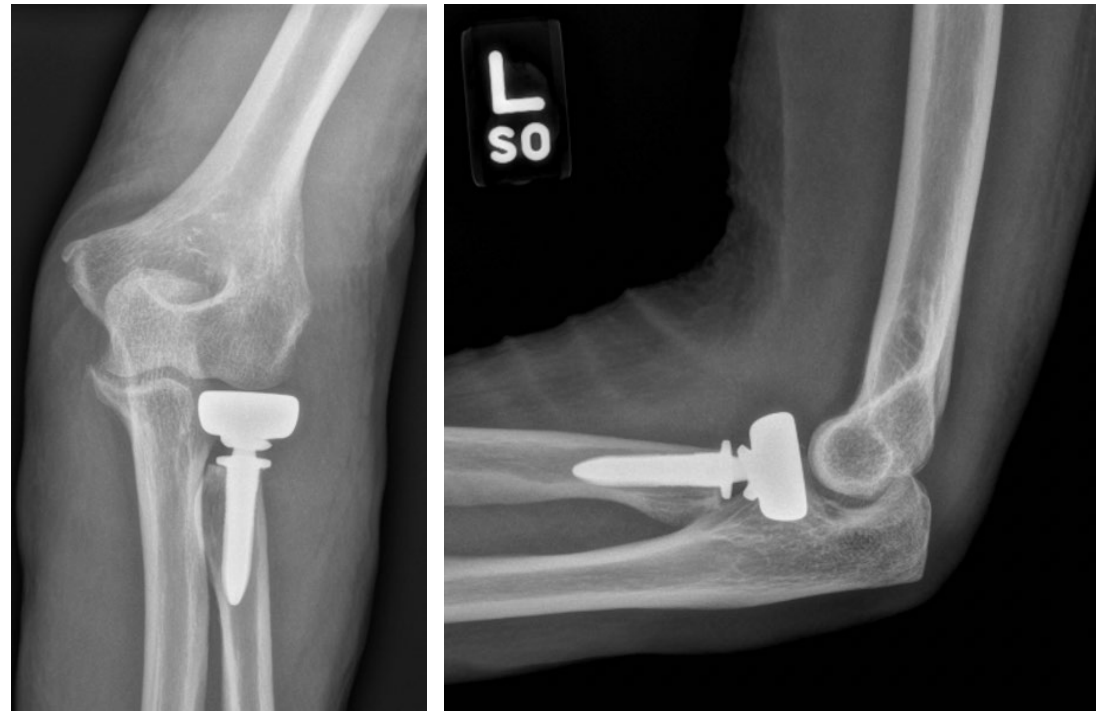
Radial Head Fractures - Overstuffing

- Radial head height typically 0.9mm proximal to lateral coronoid process
- Only 2mm overstuffing causes 1mm of ulno-humeral gapping
- Common complication
 - Especially in unstable elbows that allow for the placement of large implants
- Leads to....
 - Possible increased rate of capitellar erosion
 - Decreased flexion
 - Medial subluxation of the ulna

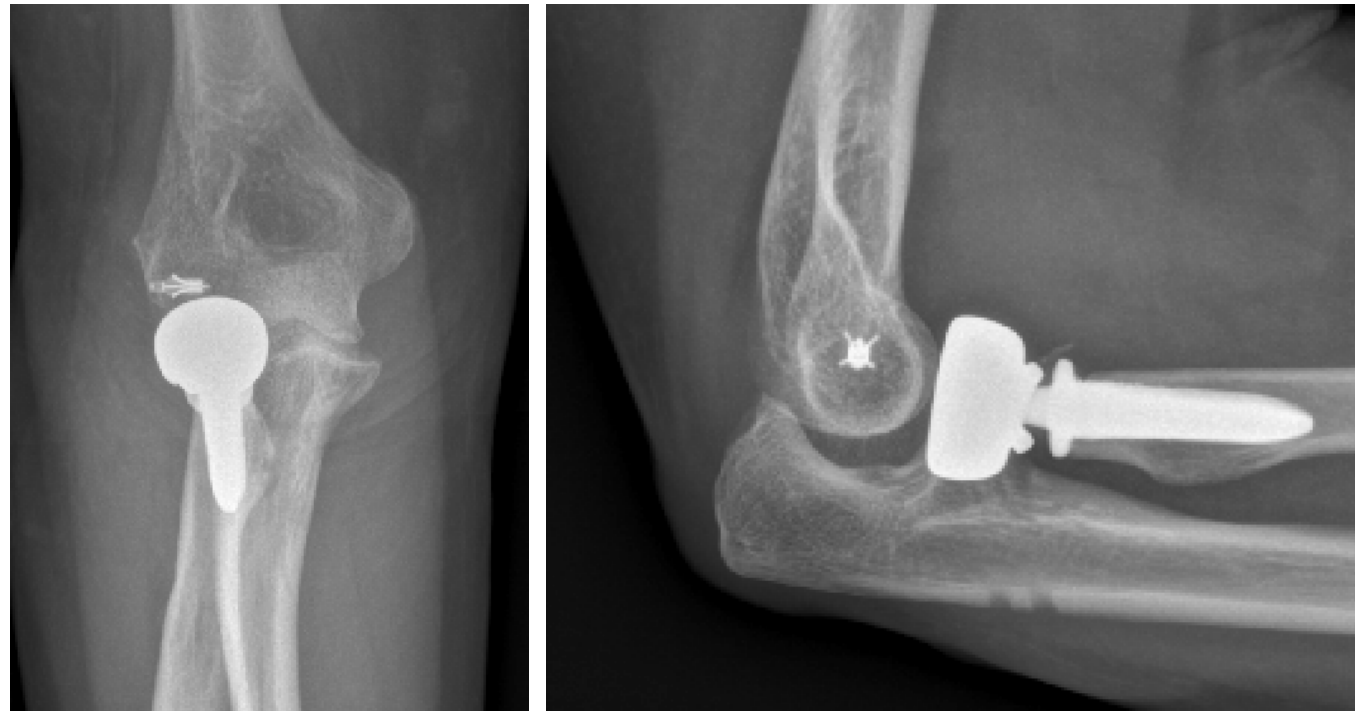


Radial Head Fractures - Overstuffing

Correct Size

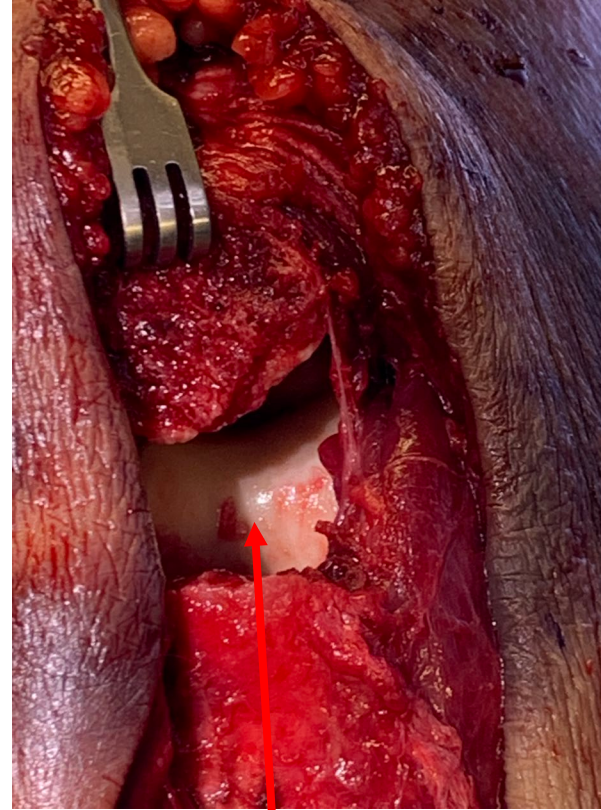


Overstuffed

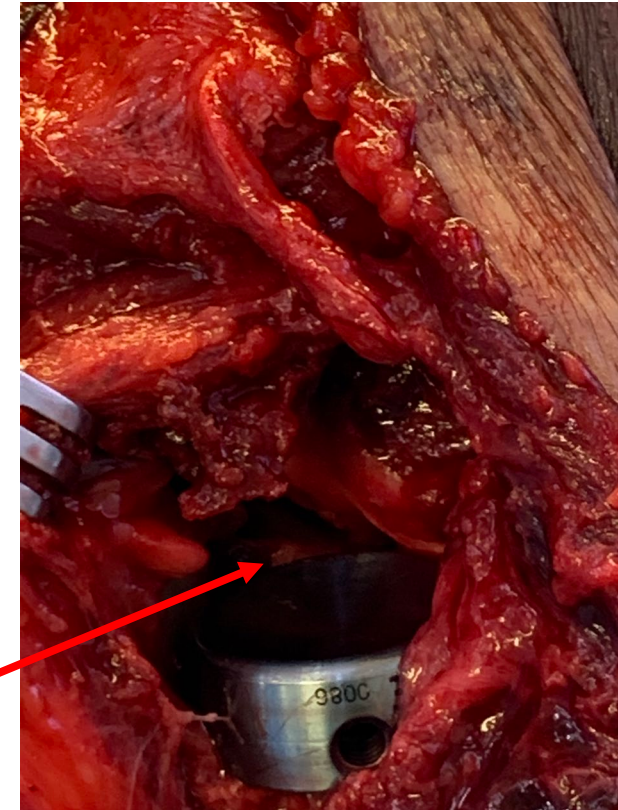


Radial Head Fractures - Overstuffing

- **Direct visualization**
 - Most accurate way to determine appropriate head size
 - Radial head should be just at or proximal to radial notch of the ulna
 - Pictures show appropriate placement
- **Intra-op Fluoro**
 - Needs to be assessed in flexion and extension
 - Less reliable
 - > 6mm overstuffing must be present to consistently be seen on fluoro



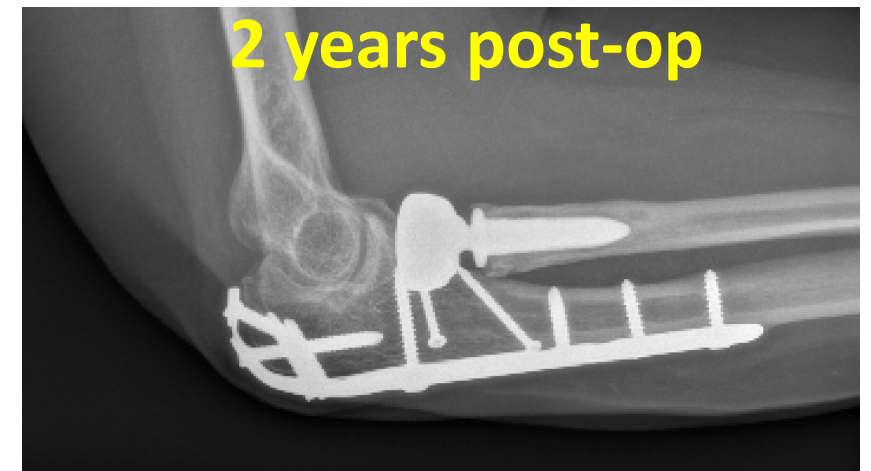
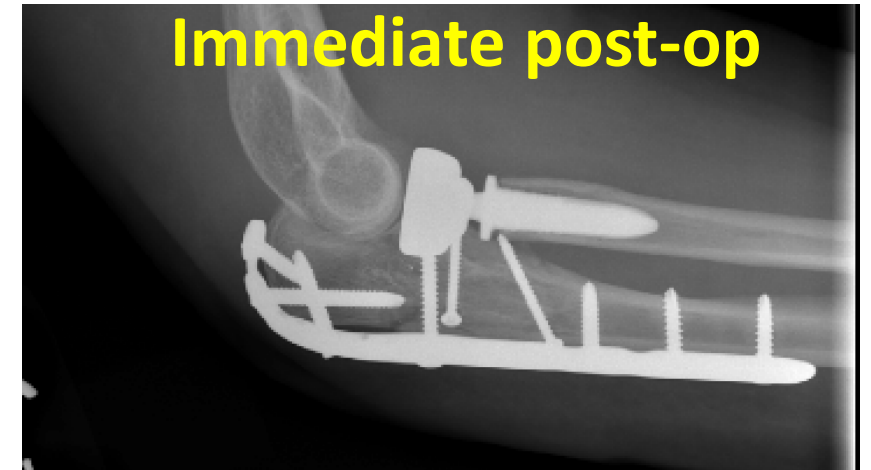
Radial notch



Core Curriculum V5

Radial Head Fractures – Stem Loosening

- Occurs with press-fit stems
- Typically within 1 year of surgery
- Significant dilatory remodeling of the proximal radius can also occur
- Removal of the implant may lead to proximal migration of the radius
- Cemented arthroplasty can be used for salvage if needed



Radial Head Replacement – Outcomes

- Mid to long term outcomes are good to excellent typically
- Elbow stiffness is most common complication
 - Average approx. 10-135 degrees
- Loss of flex/ext strength of approx. 10%
- Peri-implant lucency common, but rarely requires revision
- Rate of OA approx 30%

Radial Neck Fractures

Radial Neck Fractures - Treatment

- **Similar to radial head**
- **Non displaced**
 - Non-op
- **Displaced**
 - No block to motion
 - Non-op
 - Block to motion
 - ORIF



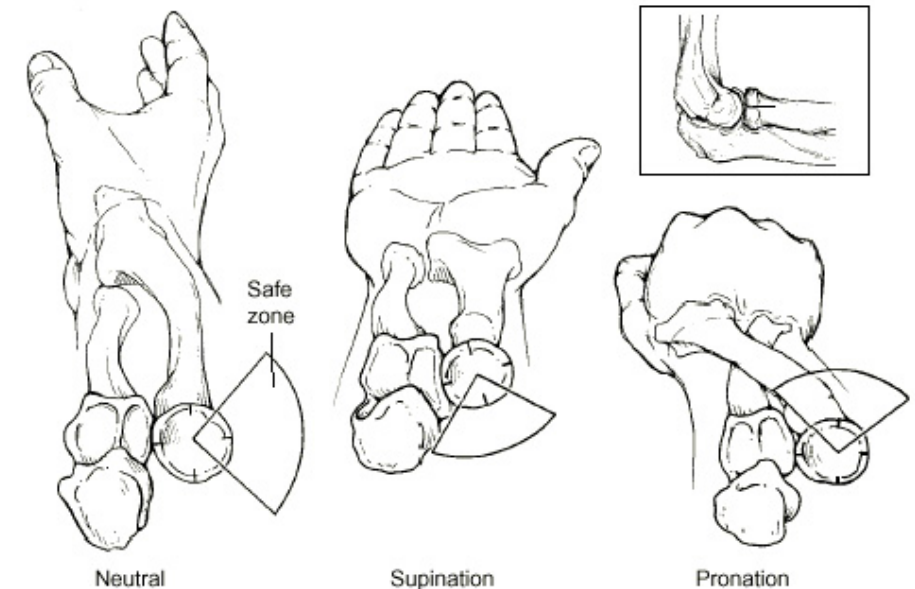
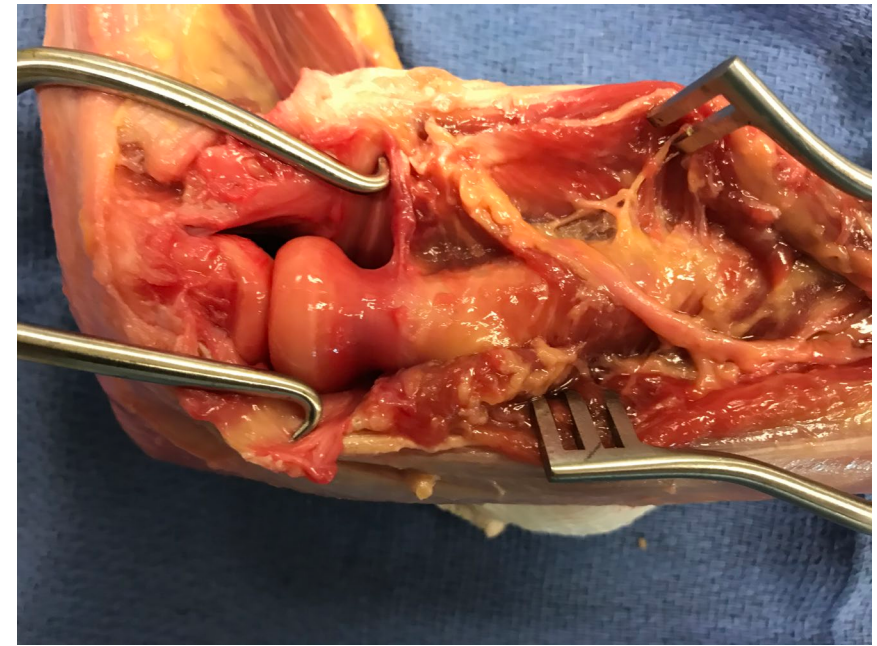
Radial Neck Fractures - ORIF

- **Kocher approach**
 - Transverse neck fractures
- **Kaplan/Thompson approach**
 - Extension into the proximal radius
- **Kickstand screws**
 - Simple fx patterns only
- **Plating (mini-frag vs anatomic)**
 - Comminution



Complications

- **Similar to radial head**
 - PIN injury
 - Impingement of implants
 - Stiffness
 - Most common
 - Functional ROM of flexion/extension is 30-130 degrees



Essex-Lopresti Injuries

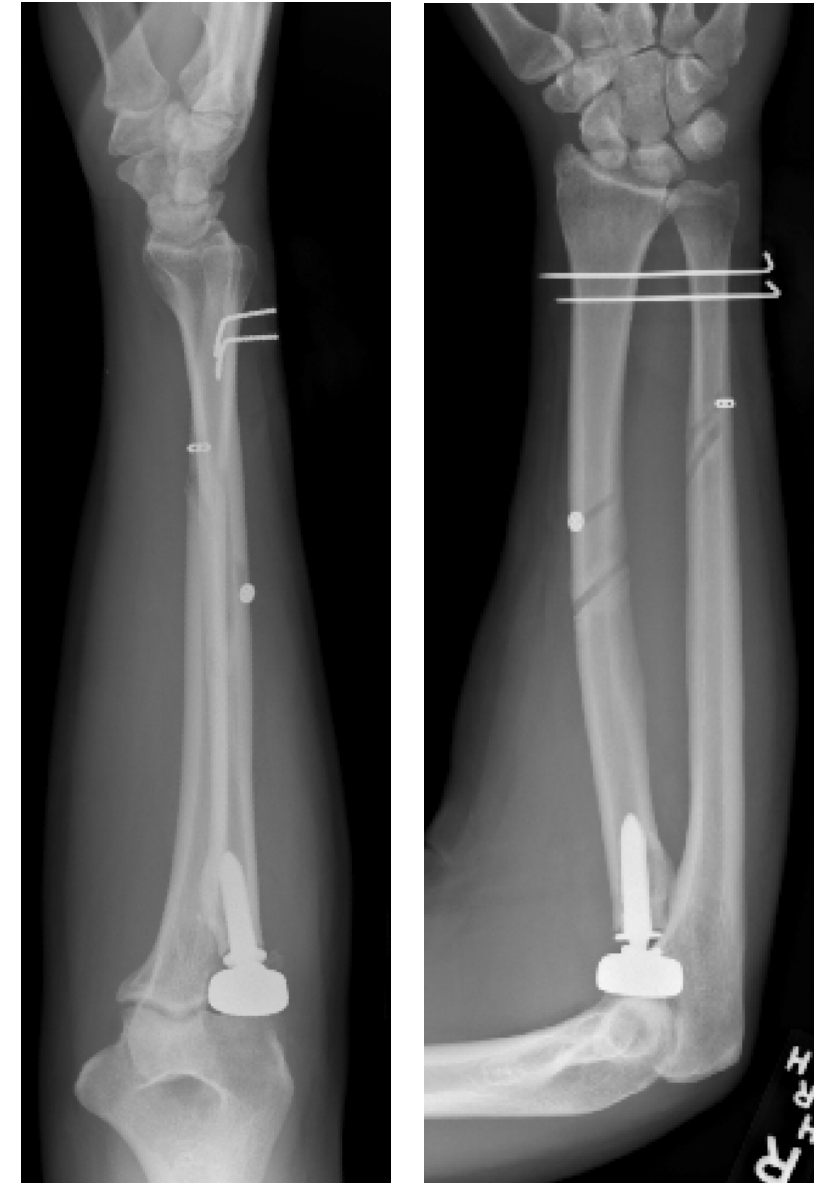
Essex-Lopresti Injuries

- **Radial head/neck fracture with:**
 - Interosseous membrane disruption
 - DRUJ disruption
- **Physical exam**
 - Palpation of DRUJ for tenderness and shucking of the joint is critical
- **Radiographs**
 - Be sure to evaluate entire film
 - Contralateral films may help in diagnosis



Essex-Lopresti Injuries

- **Treatment (Controversial!!)**
 - Step 1 – Obtain contralateral films
 - Step 2 – Pin the DRUJ vs repair of TFCC
 - Attempt to match contra side
 - Step 3 – ORIF or arthroplasty of radial head
 - Step 4 – Possible reconstruction of interosseous ligament
- **Pre-op contralateral films are essential to restore length and wrist alignment**



Post-op Protocol

My Post-op Protocol

- For all stabilized fxs and dislocations regardless of fixation
- Initially
 - Immobilization for 10-14 days
- Secondly
 - Early ACTIVE range of motion
 - Allows dynamic stabilizers to help hold reduction of joint
 - Will reduce pseudosubluxations
 - Limits elbow stiffness
- Some limit active shoulder abduction if LUCL was repaired

Summary

- **Anatomy**
 - Lateral elbow ligaments and PIN location are critical
- **Elbow Instability**
 - Make sure that you understand the injury
- **Radial head fractures**
 - Classification (Mason)
 - Treatment
- **Radial neck fractures**
 - Treatment
- **Essex-Lopresti Injuries**
 - Don't miss!

References

- Acevedo DC, Paxton ES, Kukelyansky I, Abboud J, Ramsey M. Radial head arthroplasty: state of the art. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2014 Oct 1;22(10):633-42.
- Cheung EV, Steinmann SP. Surgical approaches to the elbow. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2009 May 1;17(5):325-33.
- Grassmann JP, Hakimi M, Gehrman SV, Betsch M, Kröpil P, Wild M, Windolf J, Jungbluth P. The treatment of the acute Essex-Lopresti injury. The bone & joint journal. 2014 Oct;96(10):1385-91.
- Hildebrand AH, Zhang B, Horner NS, King G, Khan M, Alolabi B. Indications and outcomes of radial head excision: a systematic review. Shoulder & elbow. 2020 Jun;12(3):193-202.
- Lipman MD, Gause TM, Teran VA, Chhabra AB, Deal DN. Radial head fracture fixation using tripod technique with headless compression screws. The Journal of hand surgery. 2018 Jun 1;43(6):575-e1.
- Marsh JP, Grewal R, Faber KJ, Drosdowech DS, Athwal GS, King GJ. Radial head fractures treated with modular metallic radial head replacement: outcomes at a mean follow-up of eight years. JBJS. 2016 Apr 6;98(7):527-35.
- Ring D. Radial head fracture: open reduction–internal fixation or prosthetic replacement. Journal of shoulder and elbow surgery. 2011 Mar 1;20(2):S107-12.

References

- Ring D, Quintero J, Jupiter JB. Open reduction and internal fixation of fractures of the radial head. JBJS. 2002 Oct 1;84(10):1811-5.
- Robinson PM, Li MK, Dattani R, Van Rensburg L. The Boyd interval: a modification for use in the management of elbow trauma. Techniques in hand & upper extremity surgery. 2016 Mar 1;20(1):37-41.
- Smith GR, Hotchkiss RN. Radial head and neck fractures: anatomic guidelines for proper placement of internal fixation. Journal of shoulder and elbow surgery. 1996 Mar 1;5(2):113-7.
- Soyer AD, Nowotarski PJ, Kelso TB, Mighell MA. Optimal position for plate fixation of complex fractures of the proximal radius: a cadaver study. Journal of orthopaedic trauma. 1998 May 1;12(4):291-3.
- Tabor JO, Bosse MJ, Sims SH, Kellam JF. Iatrogenic posterior interosseous nerve injury: is transosseous static locked nailing of the radius feasible?. Journal of orthopaedic trauma. 1995;9(5):427-9.
- Tashjian RZ, Katarincic JA. Complex elbow instability. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2006 May 1;14(5):278-86.
- Tejwani NC, Mehta H. Fractures of the radial head and neck: current concepts in management. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2007 Jul 1;15(7):380-7.