

Elbow MR: Ligaments, Tendons, & Osteochondral Injuries



Kirkland W. Davis, MD

Michael J. Tuite, MD

Donna G. Blankenbaker, MD

Jason W. Stephenson, MD

University of Wisconsin

Madison, Wisconsin



Disclosures

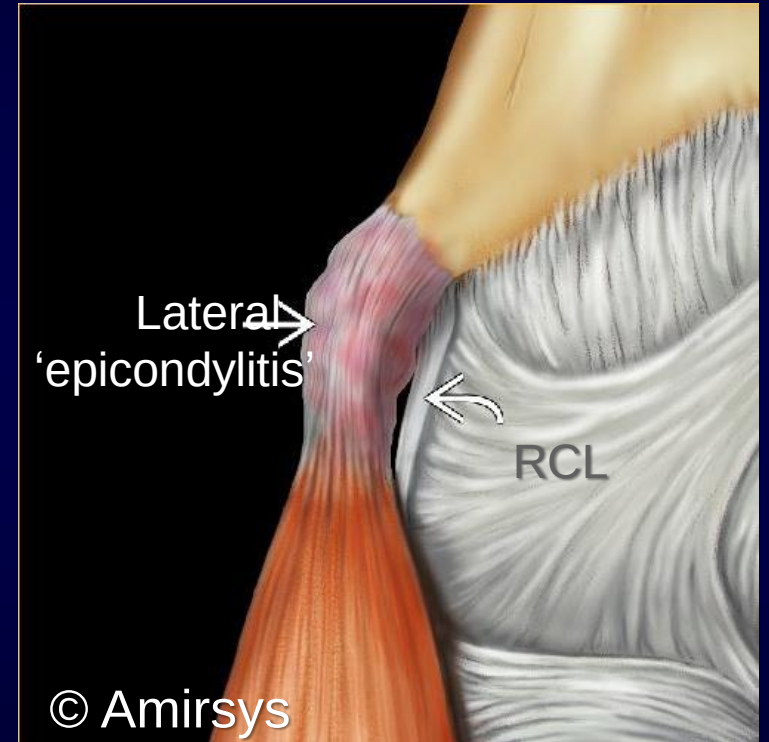
Financial



IA Gd!

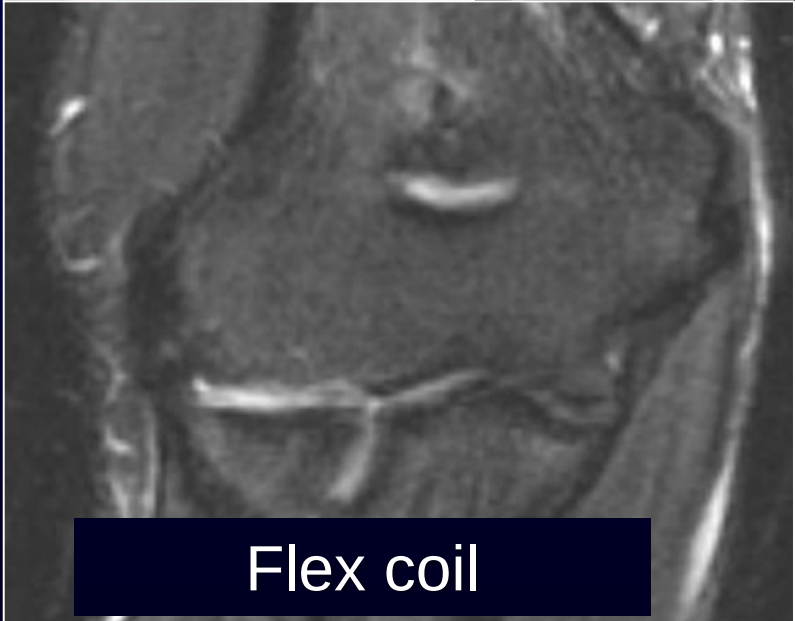
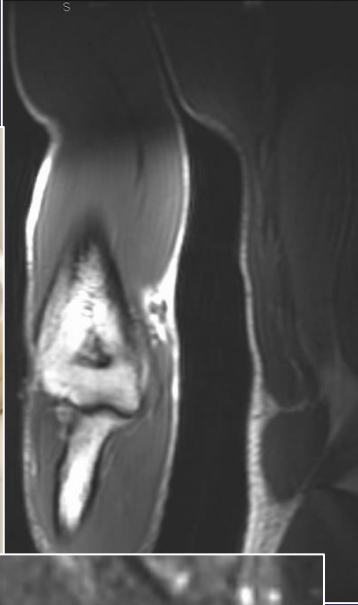
Elbow MR

- Technique & MR anatomy
- “Epicondylitis”
- Tendon Tears
- Throwing elbow injuries
- Dislocations
- Other pathology



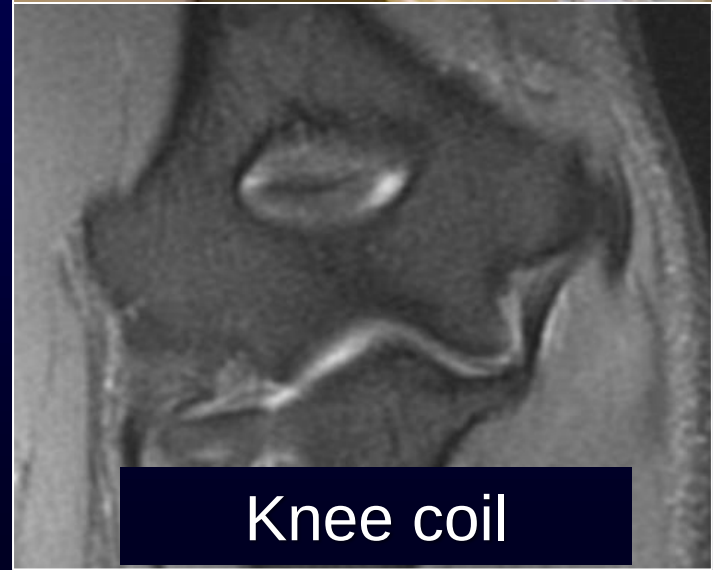
TECHNIQUE

Technique: Setup



Flex coil

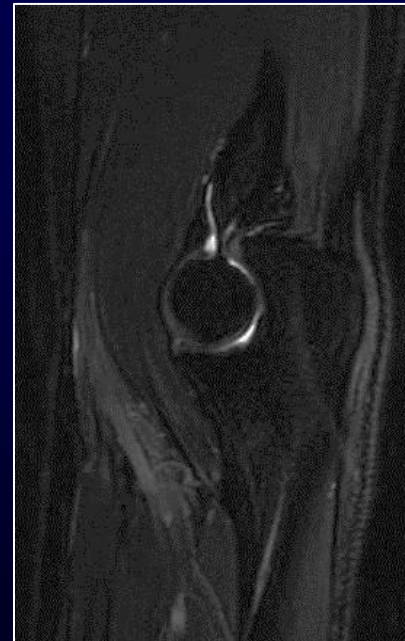
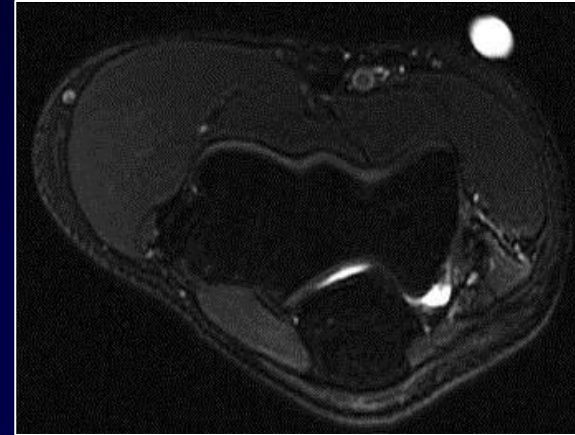
Overhead preferred



Knee coil

Technique: Protocol

- Sequences
 1. Ax FS T2
 2. Sag FS T2
 3. Cor FS Intermed



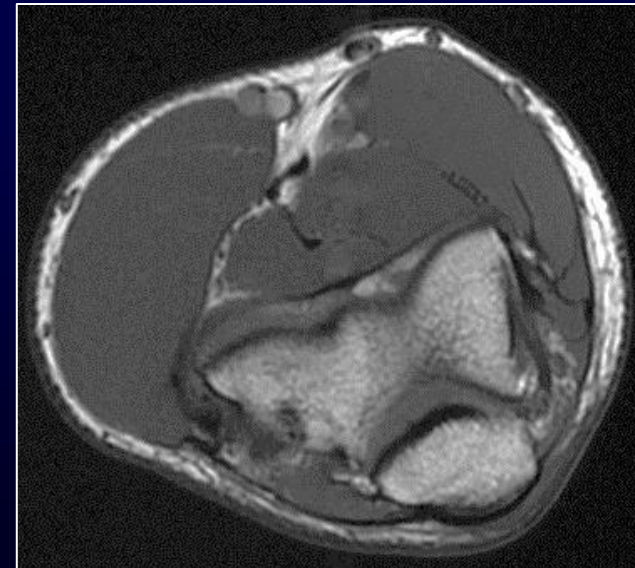
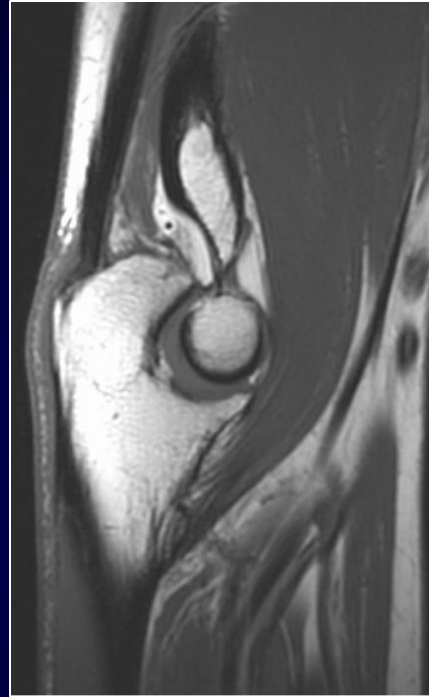
Technique: Protocol

- Sequences
 1. Ax FS T2
 2. Sag FS T2
 3. Cor FS Intermed
 - Epicondylitis / UCL
 4. Cor T1
 5. Ax PD



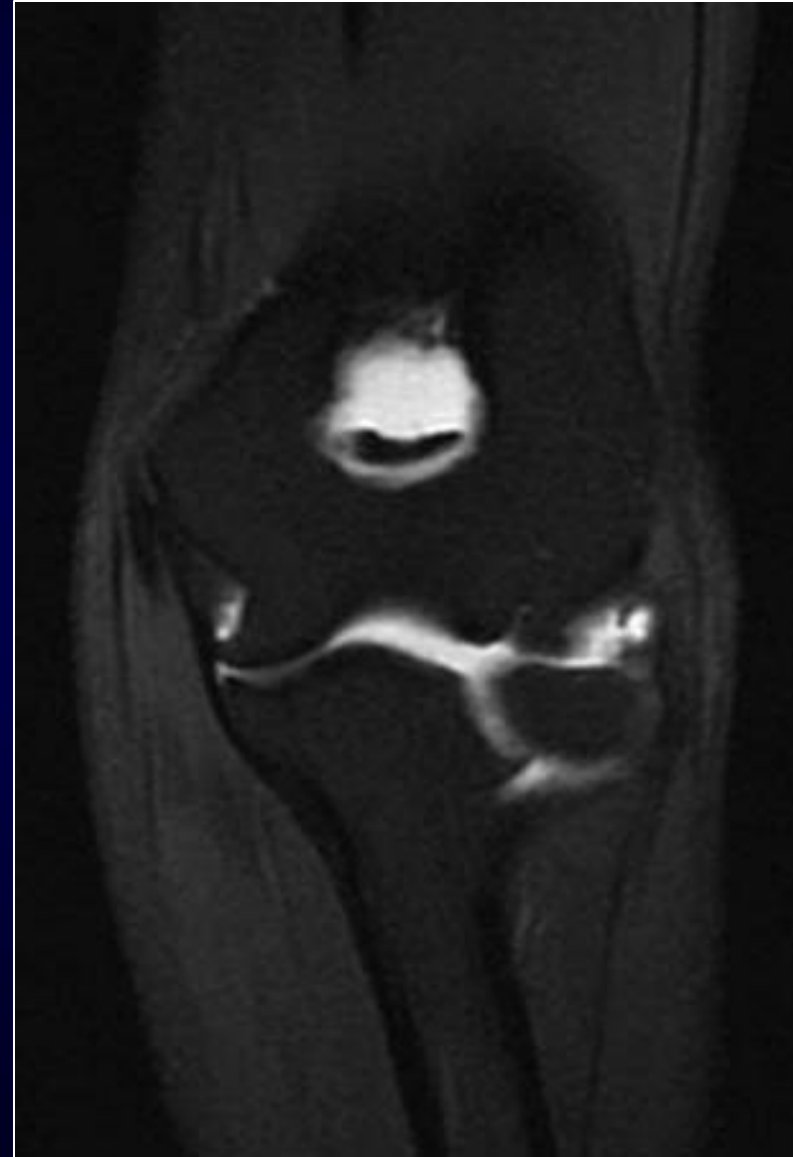
Technique: Protocol

- Sequences
 1. Ax FS T2
 2. Sag FS T2
 3. Cor FS Intermed
 - Biceps / OCD
 4. Sag T1
 5. Ax T1
- 14 cm FOV



Technique: Arthro

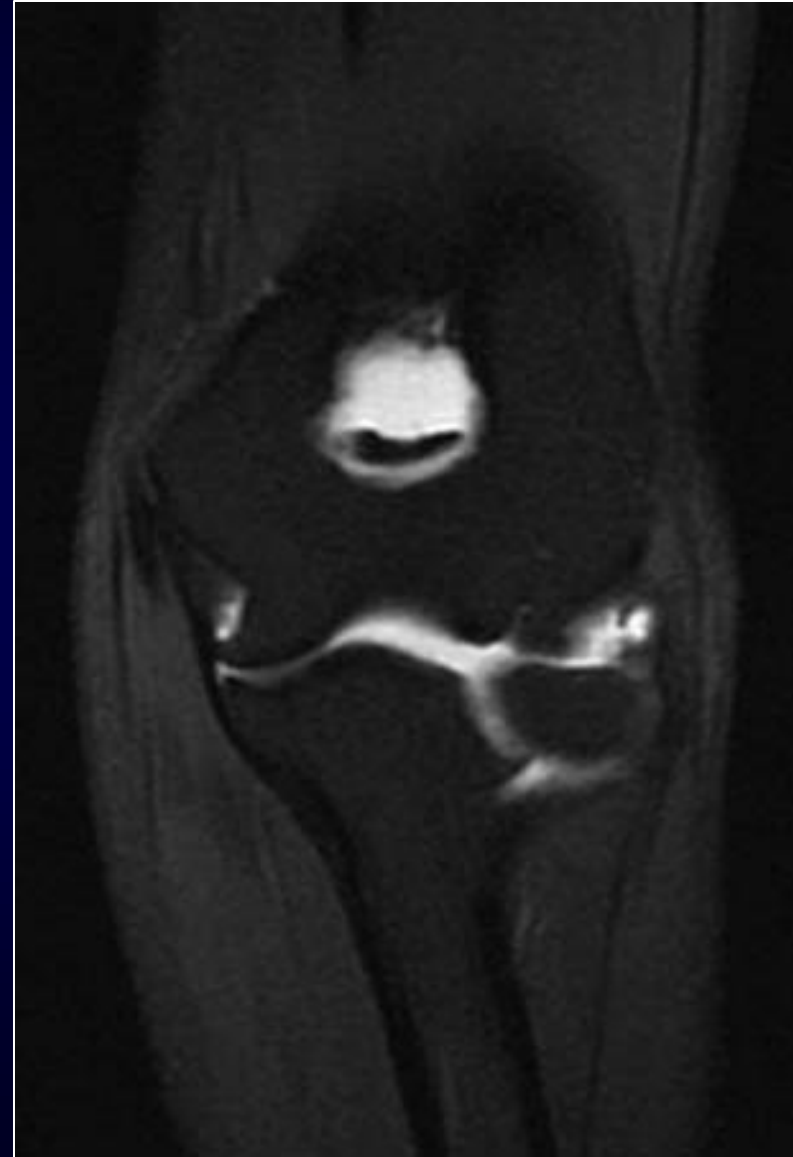
- Our Protocol:
 - Coronal FS T1
 - Coronal FS PD
 - Axial T1
 - Axial FS T2
 - Sagittal FS T1
- 1:200 Gd
- 3-4 mL



Technique: Arthro

Approach:

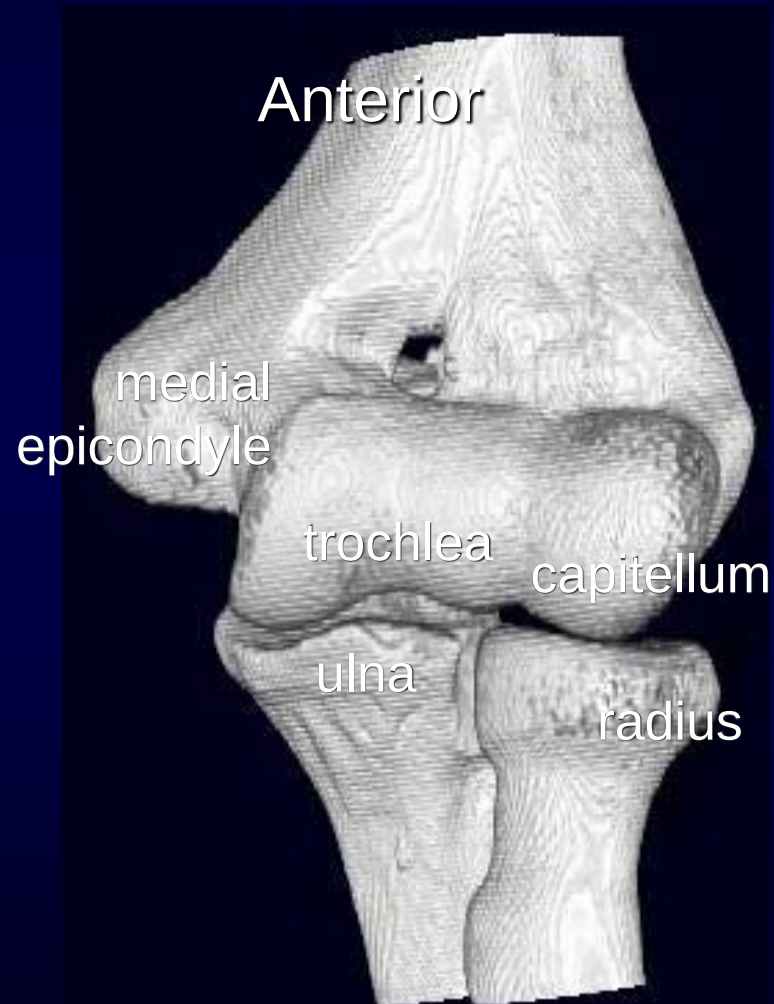
- Lateral – most common
- Posterolateral – if concern for lateral ligaments



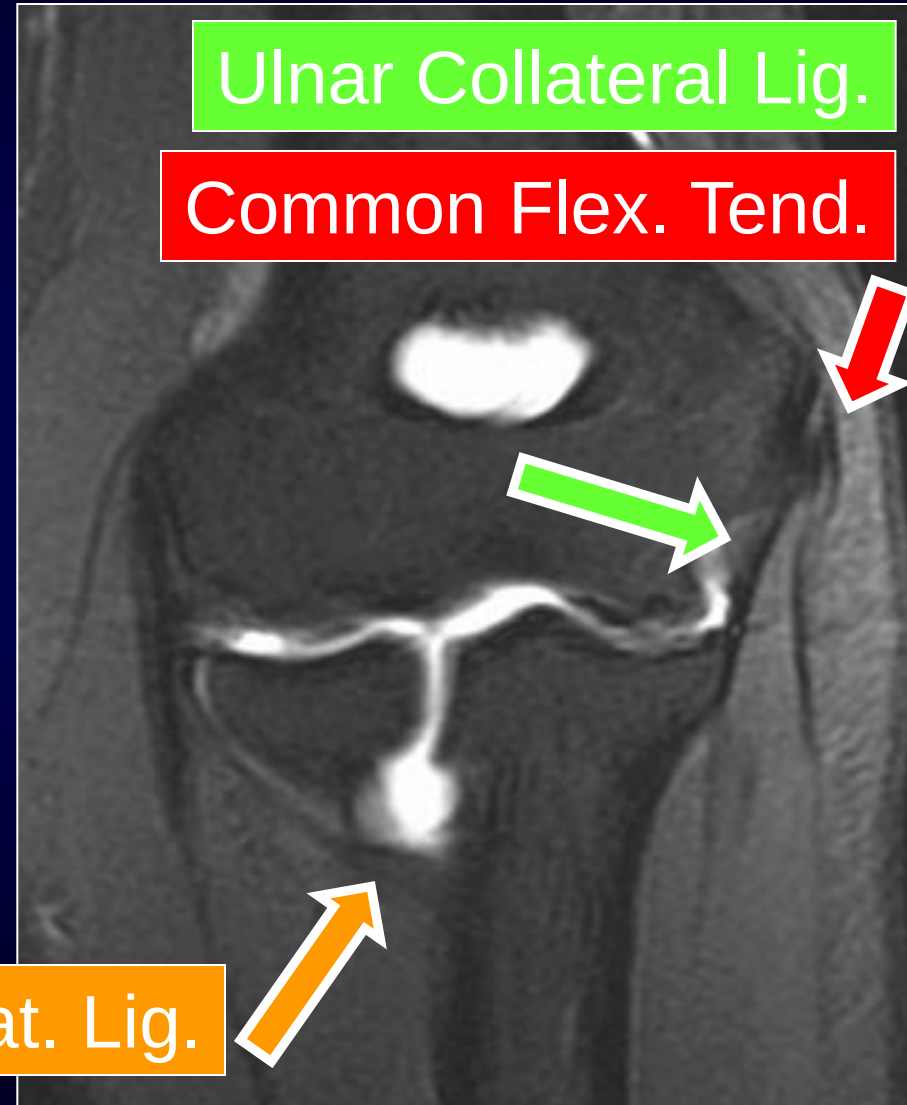
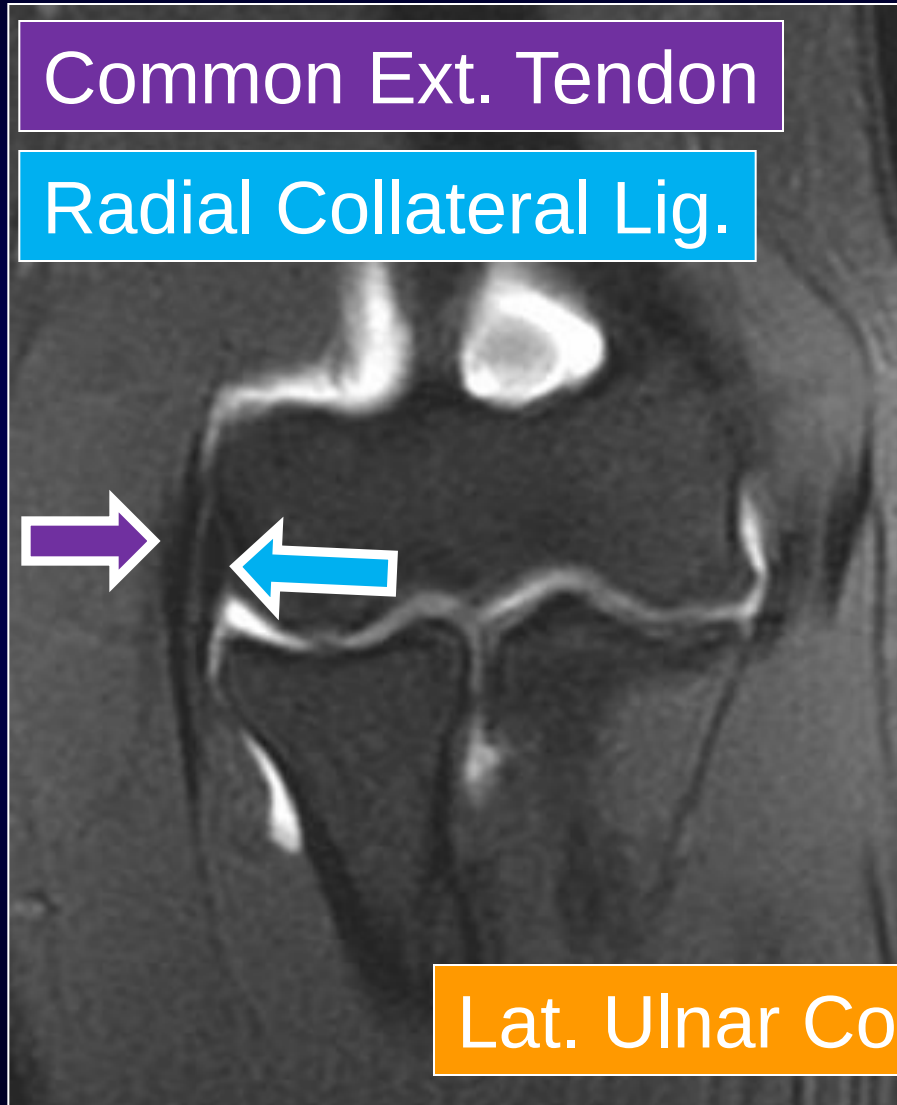
NORMAL ANATOMY

And normal variants

Normal Anatomy



Elbow: Normal Anatomy

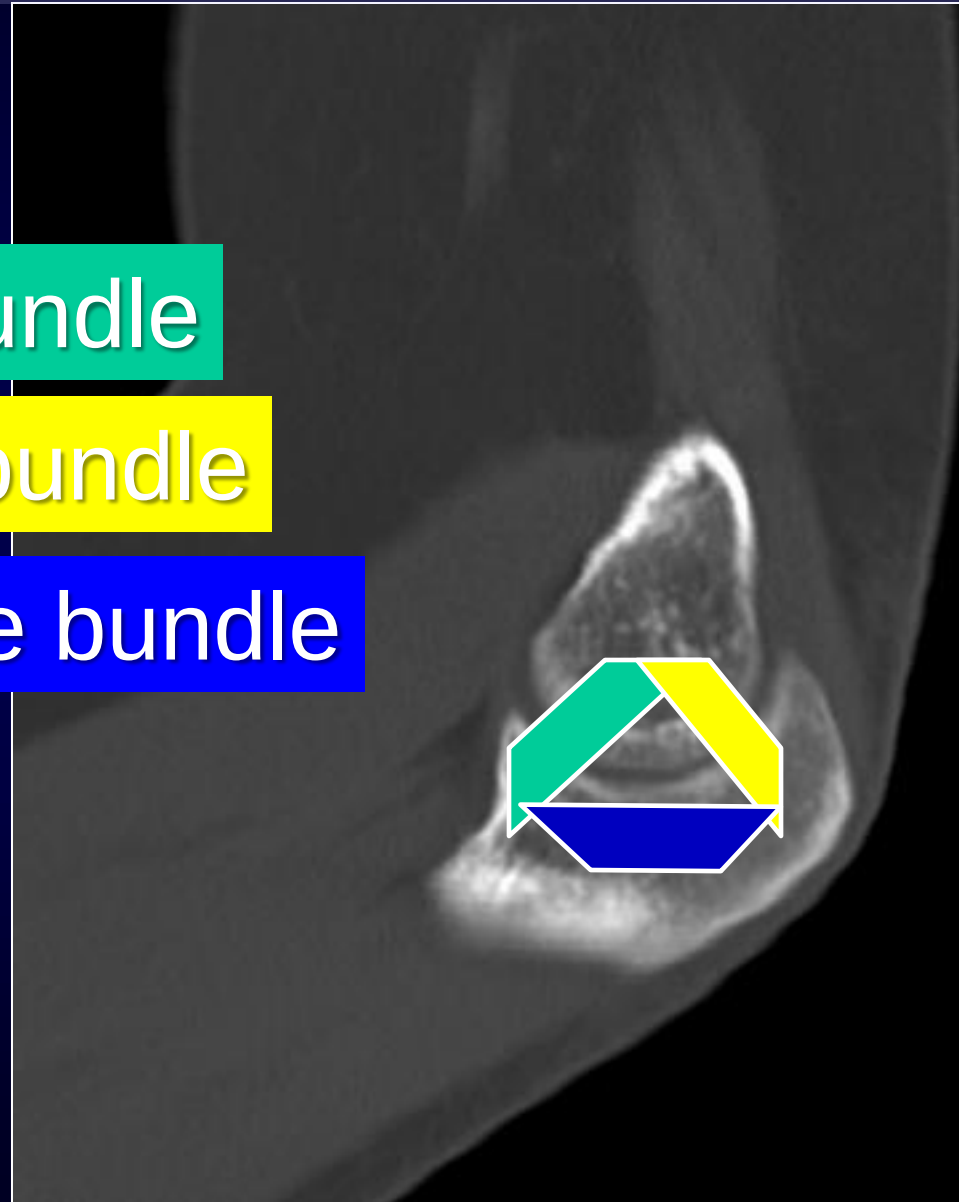


Ulnar C.L.: Normal Anatomy

Anterior bundle

Posterior bundle

Transverse bundle



Normal: 3T



Normal: 3T



Normal: 3T



Normal: 3T

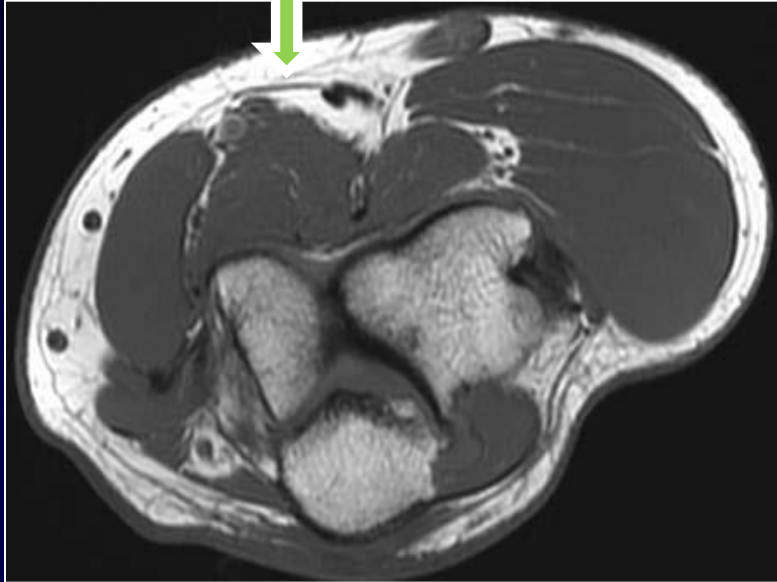


Normal: MR Arthro

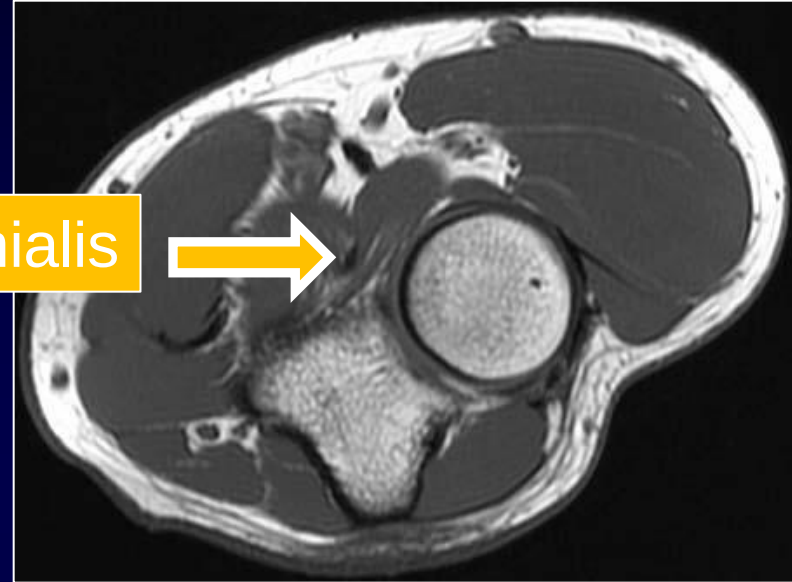


Lacertus

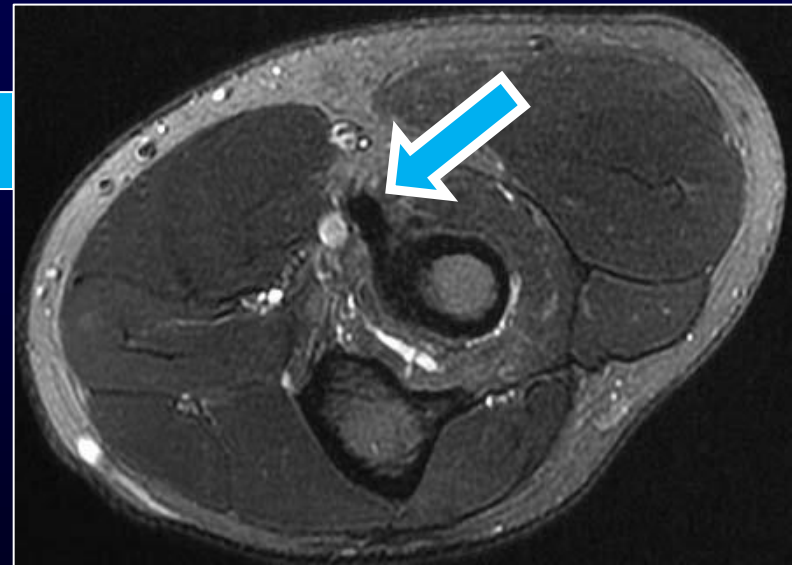
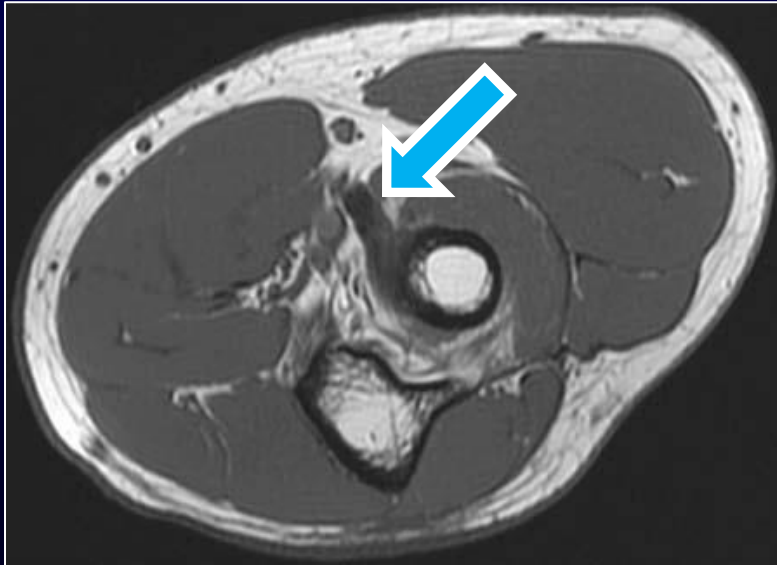
Normal: Biceps



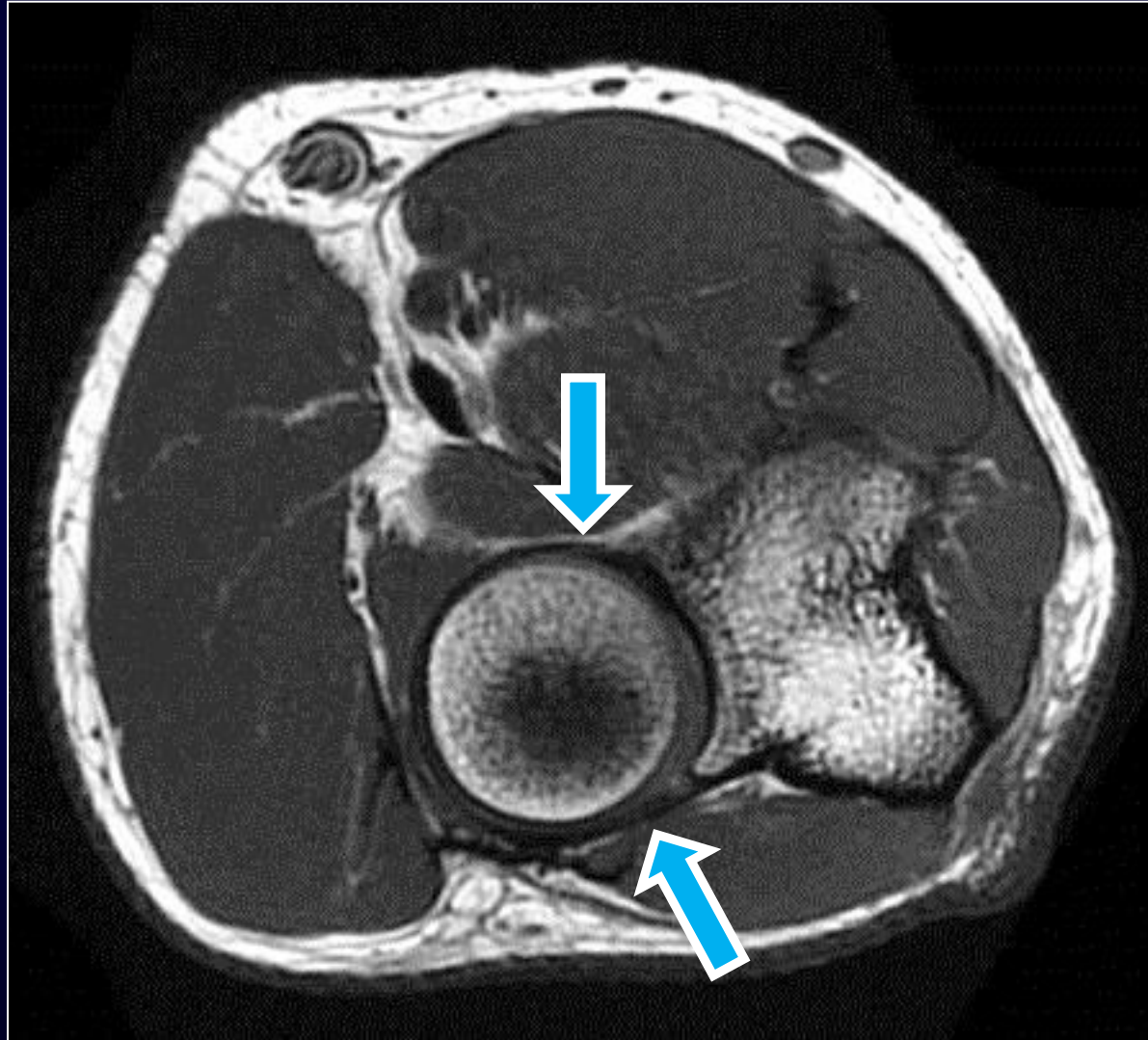
Brachialis



Biceps

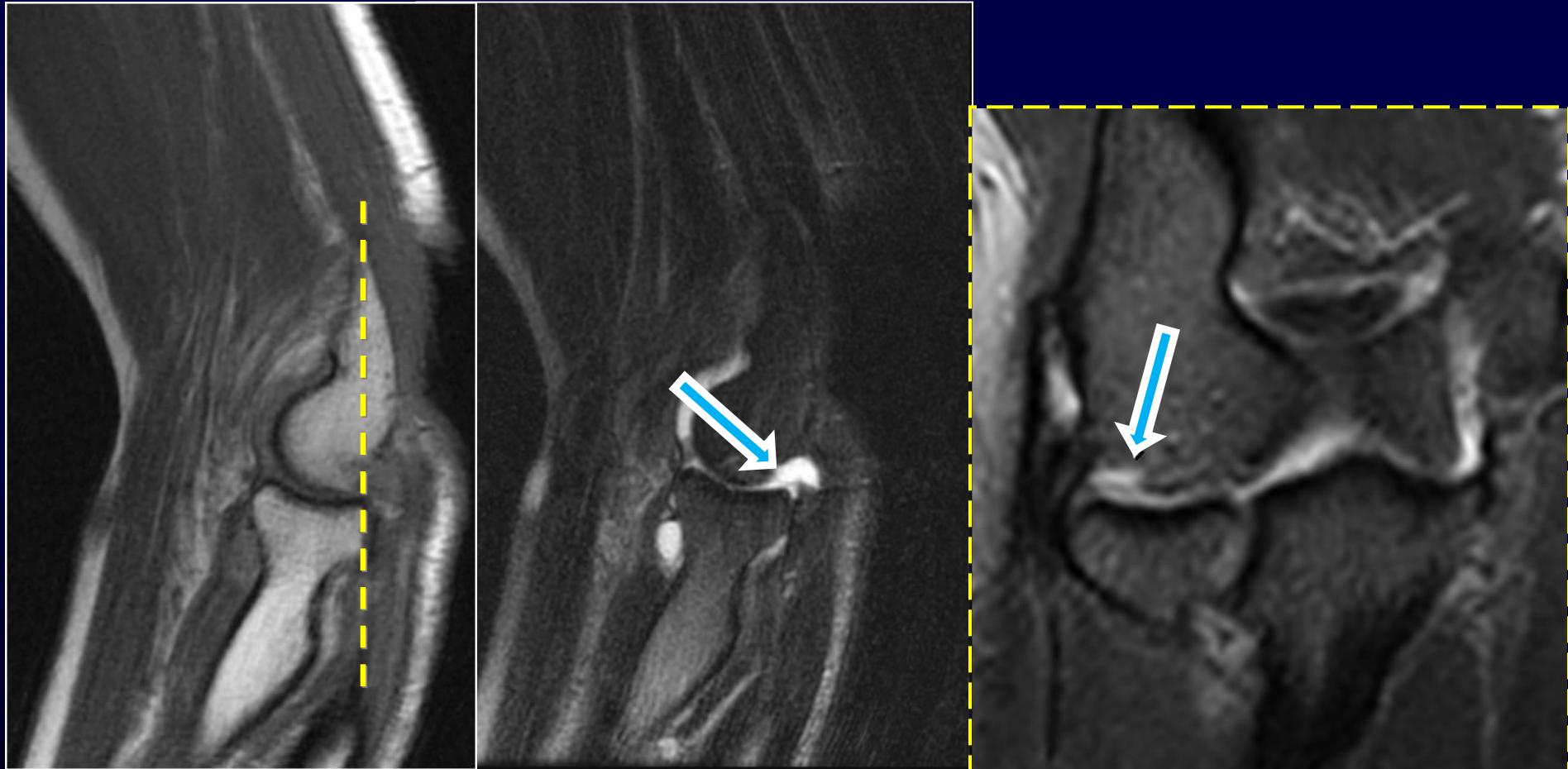


Normal: Annular Ligament



Normal Variants

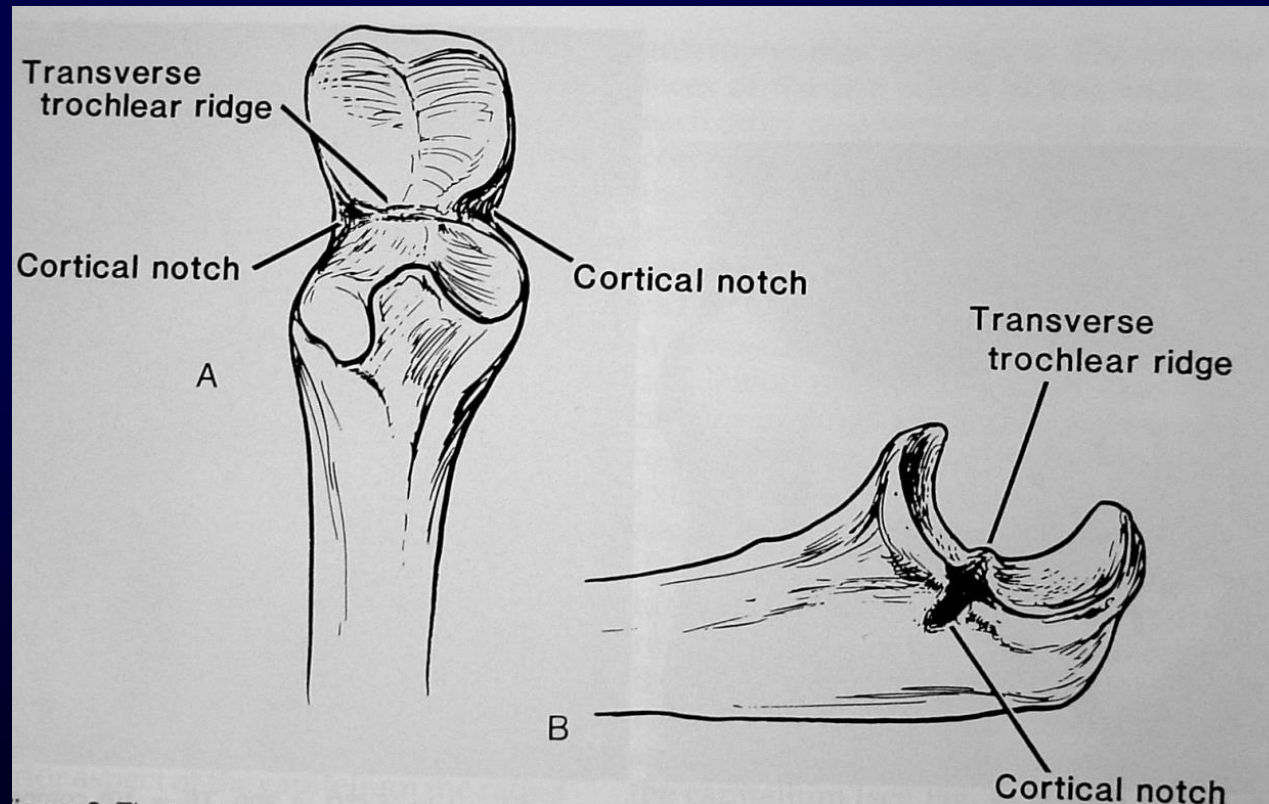
Pseudodefekt of capitellum



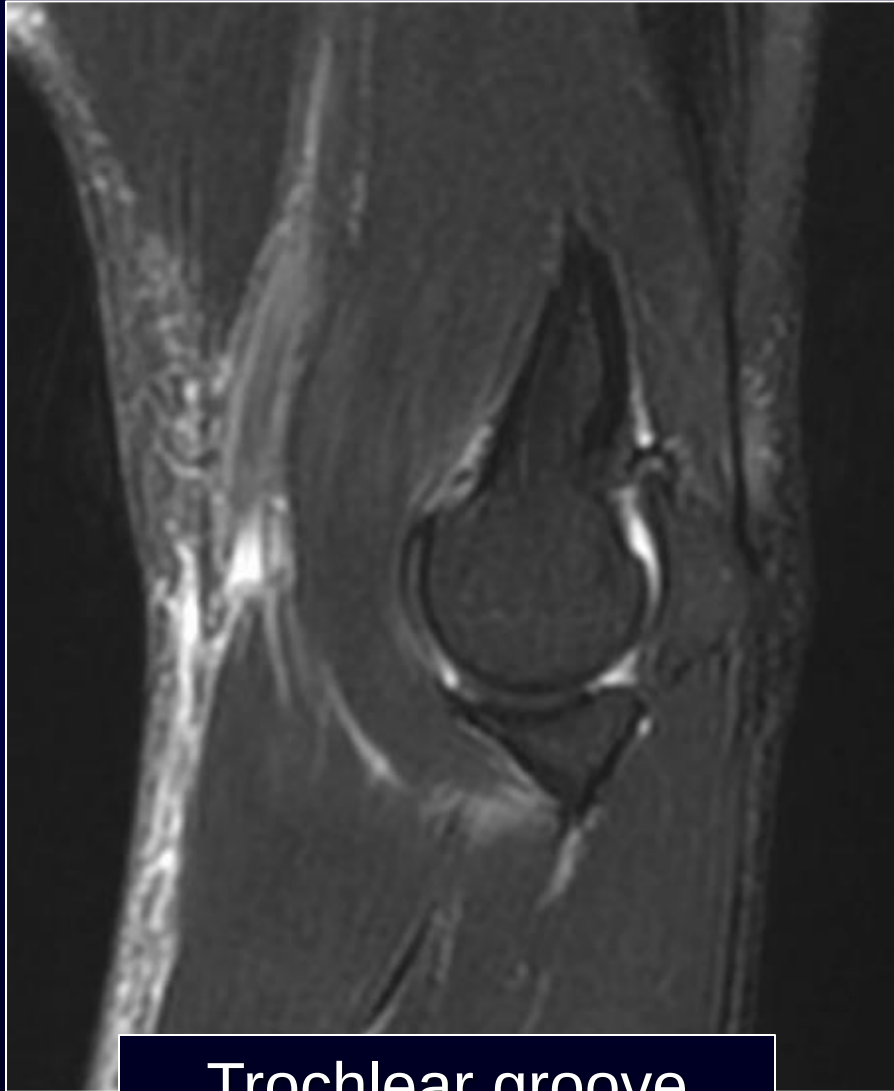
Normal Variants

Trochlear groove (cortical notch)

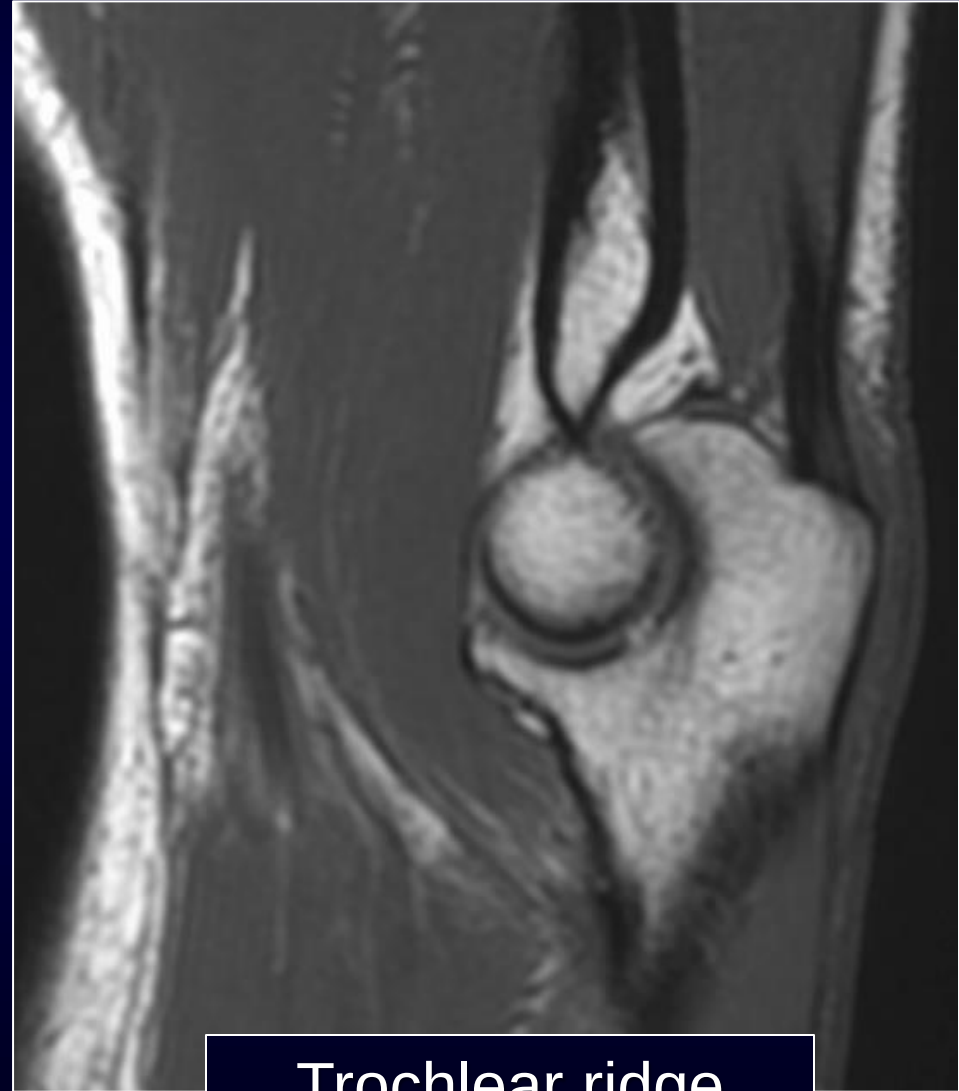
Trochlear ridge (transverse TR)



Normal Variants



Trochlear groove



Trochlear ridge

TENDINOPATHY/ “EPICONDYLITIS”

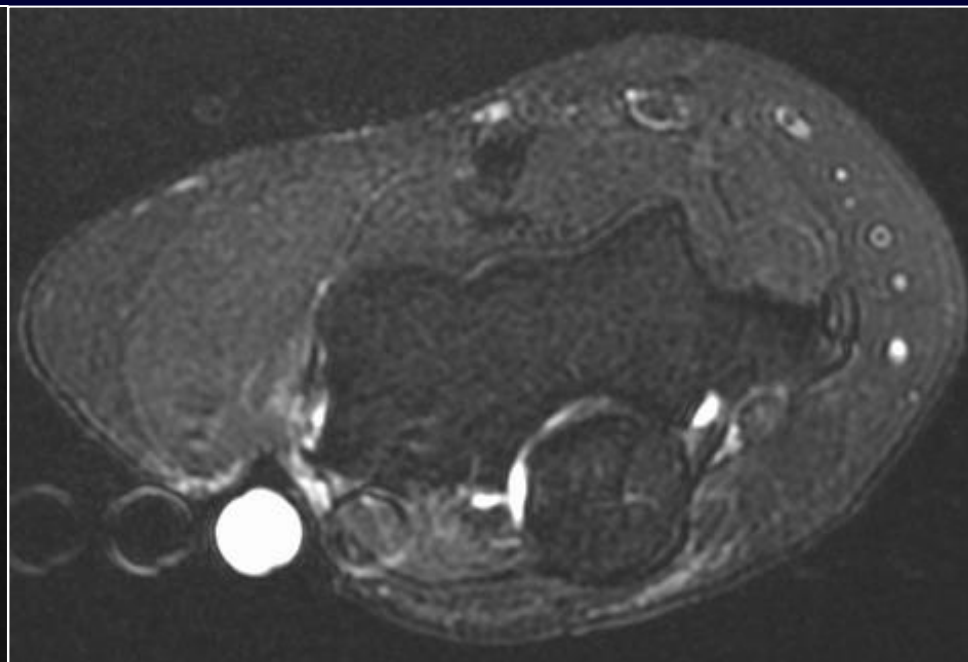
Tennis elbow
Golfer's elbow

Extensor Tendinopathy

- 1-3% annual incidence; 50% tennis players
- “Lateral epicondylitis”
- “Tennis elbow”
- “Lateral epicondylosis”
- “Common extensor tendinosis”



Extensor Tendinopathy

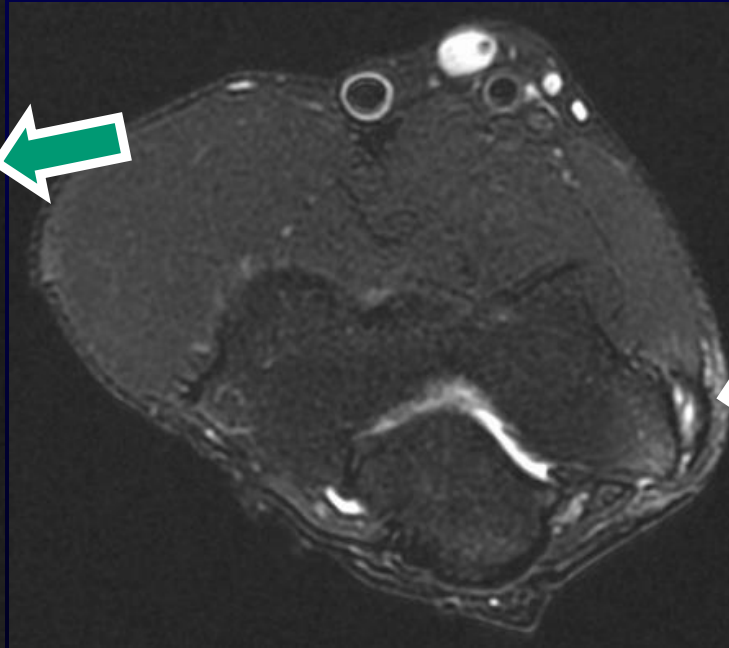
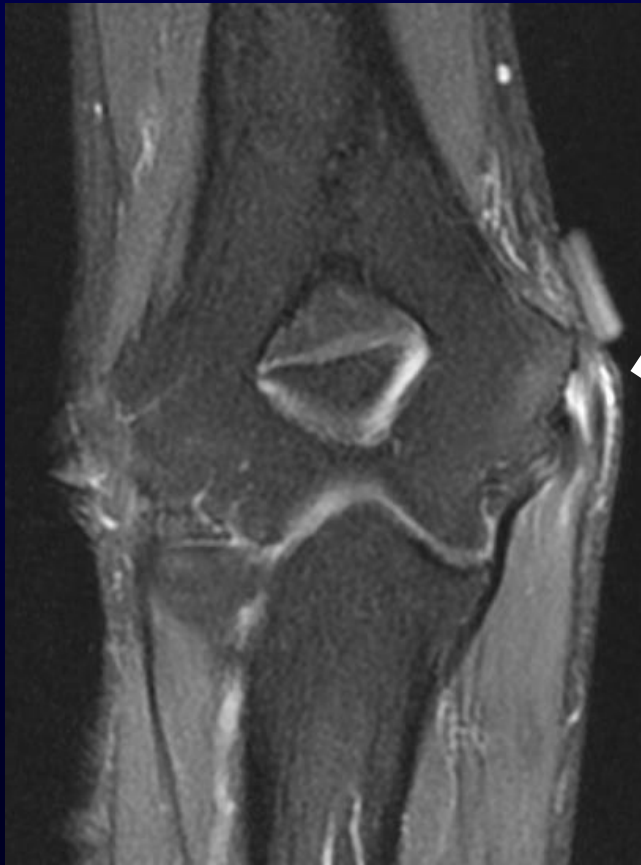


Thickening
↑ signal
Partial tears

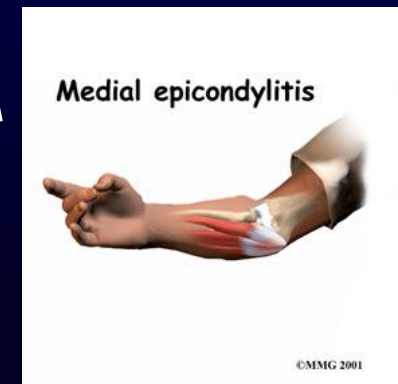


Flexor Tendinopathy

- Golfer's elbow
- Medial "epicondylitis"
- Also weightlifters, bowlers, archery



Thickening
↑ signal
Partial tears



TENDON TEARS

Biceps

Triceps

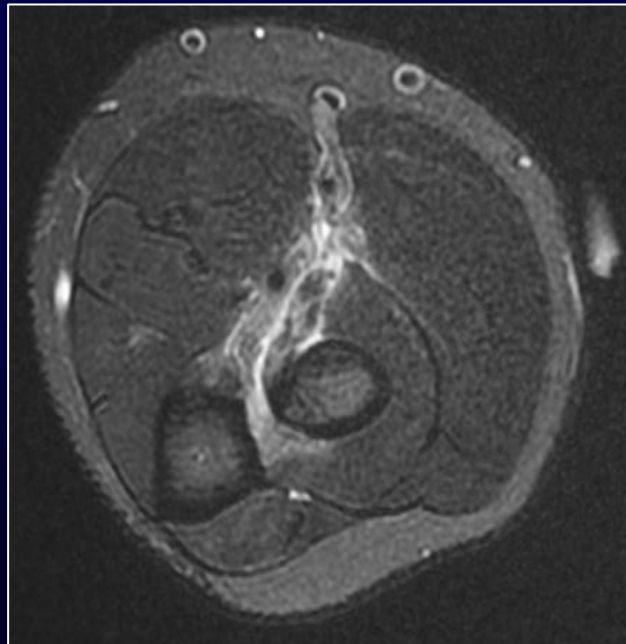
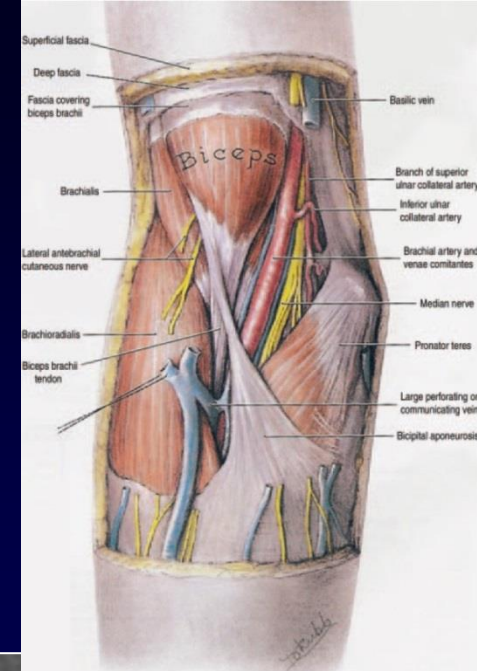
Biceps Tear

- Quality of tendon stump
- Measure retraction

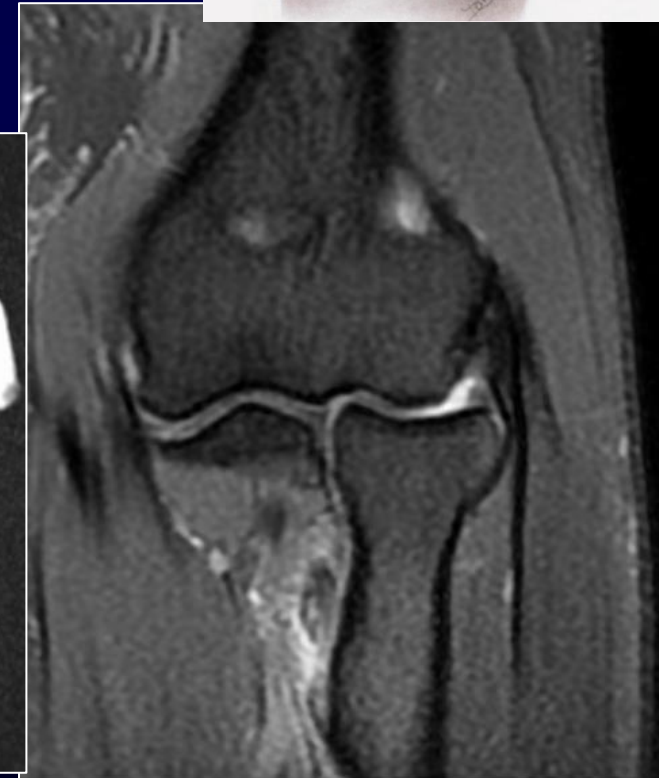


Biceps Tear

- Partial tears: short head
- Lacertus fibrosus: +/- intact w/ complete tears

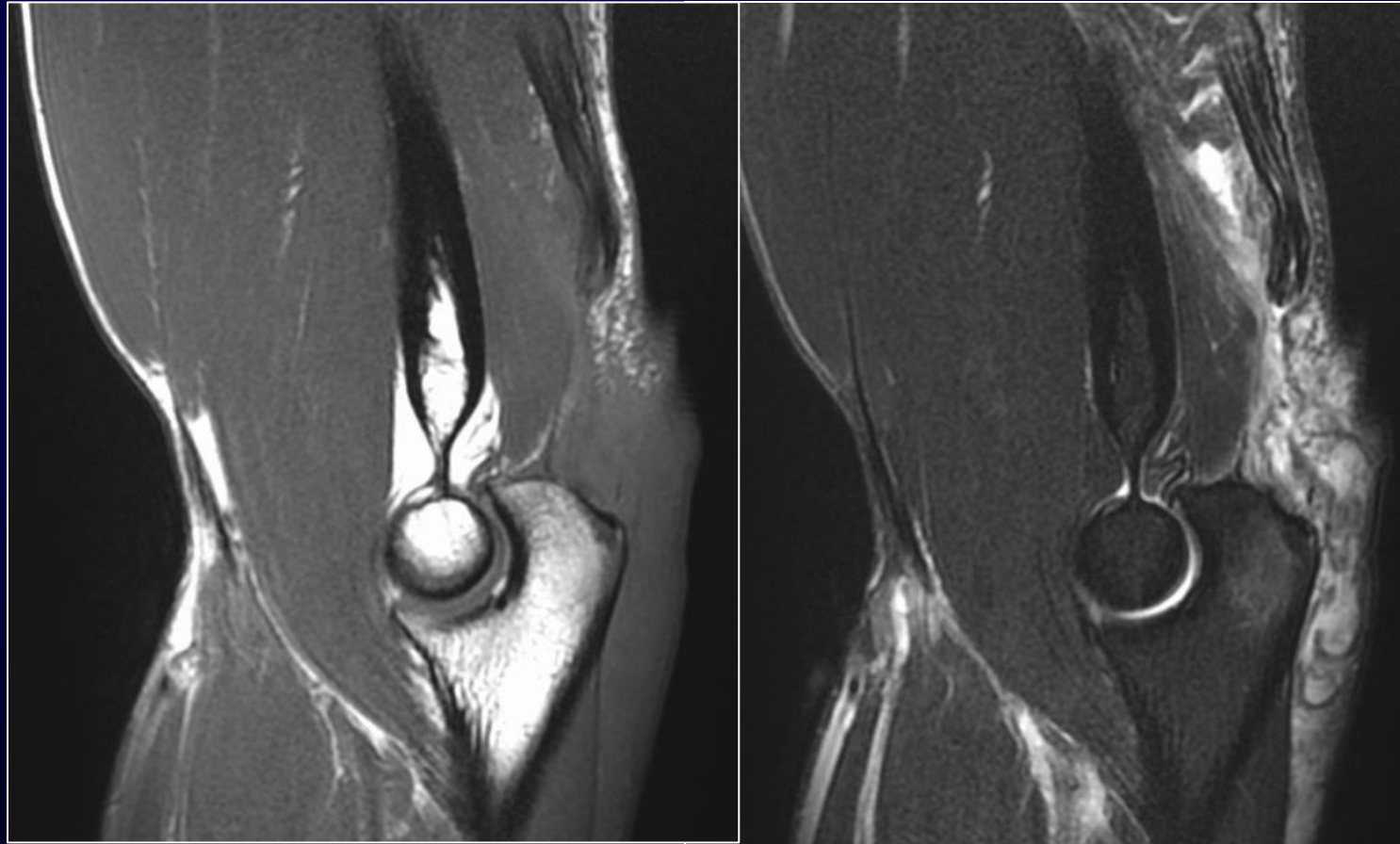


Partial tear



Triceps Tear

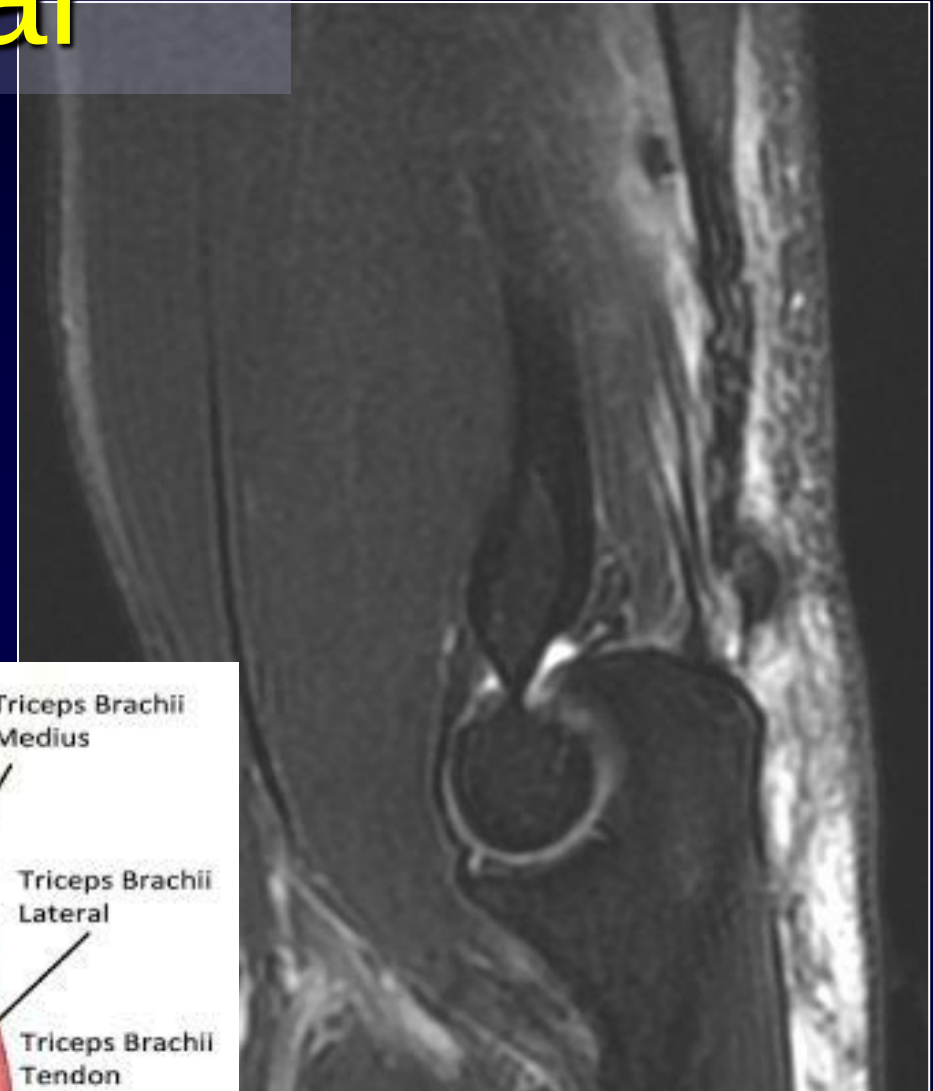
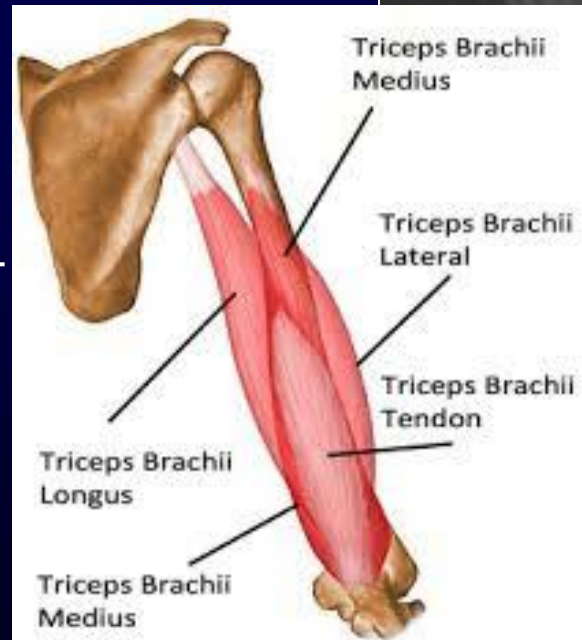
- Less common than distal biceps tears



Triceps Tear

- Less common than distal biceps tears
- Partial tears: deep (medial head) intact
- Medial head enthesis mostly muscle

Downey et al *J Ultrasound Med* 2011



THROWING INJURIES

Valgus extension overload

UCL tears

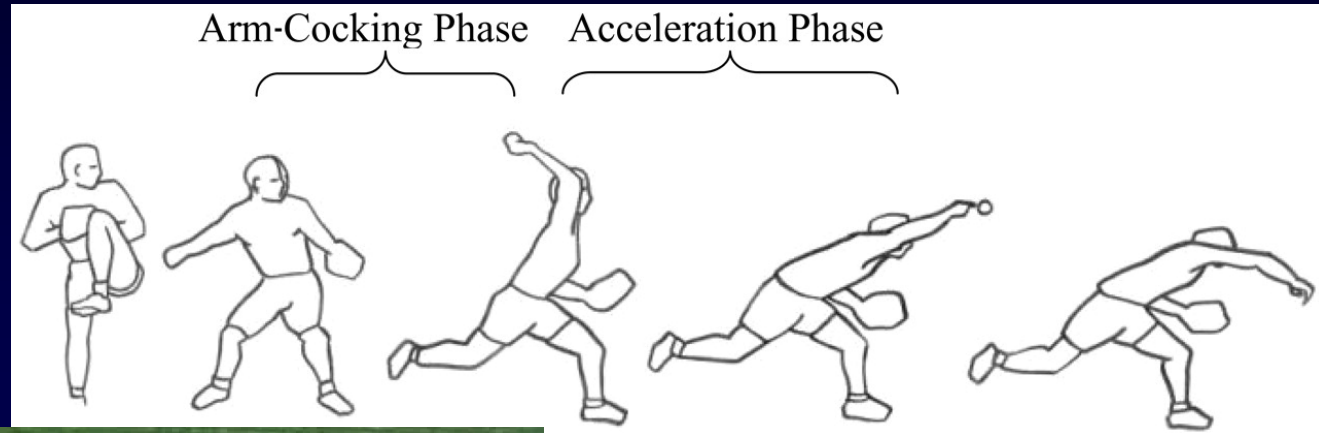
Posteromedial impingement

Throwing Injuries of the Elbow

- 2nd leading cause of missed games in MLB pitchers
- 50% of MLB pitchers during career
- Also tennis, volleyball

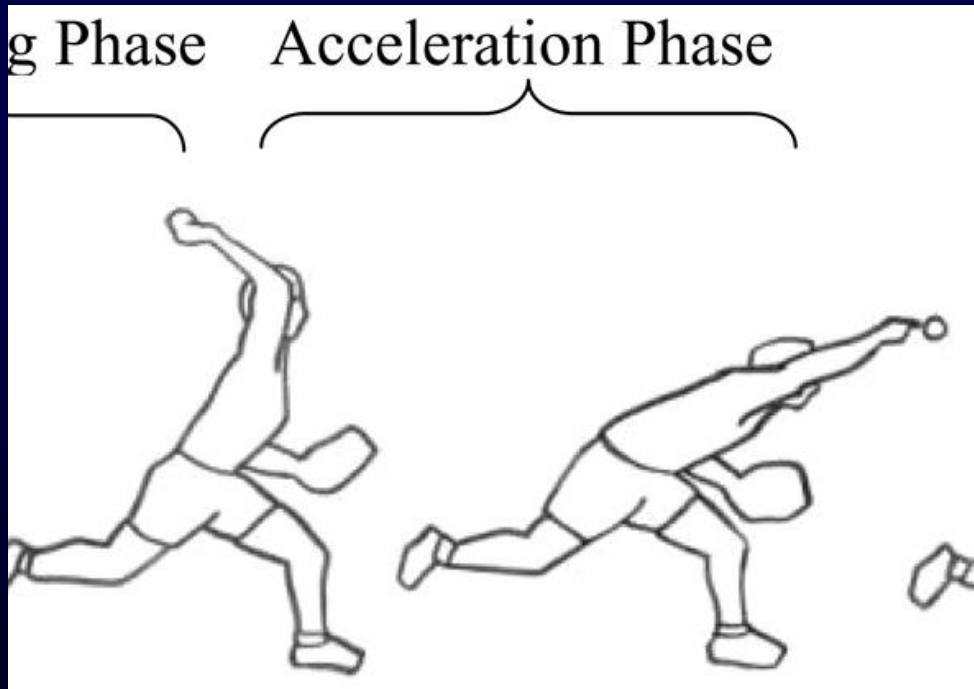


Throwing elbow



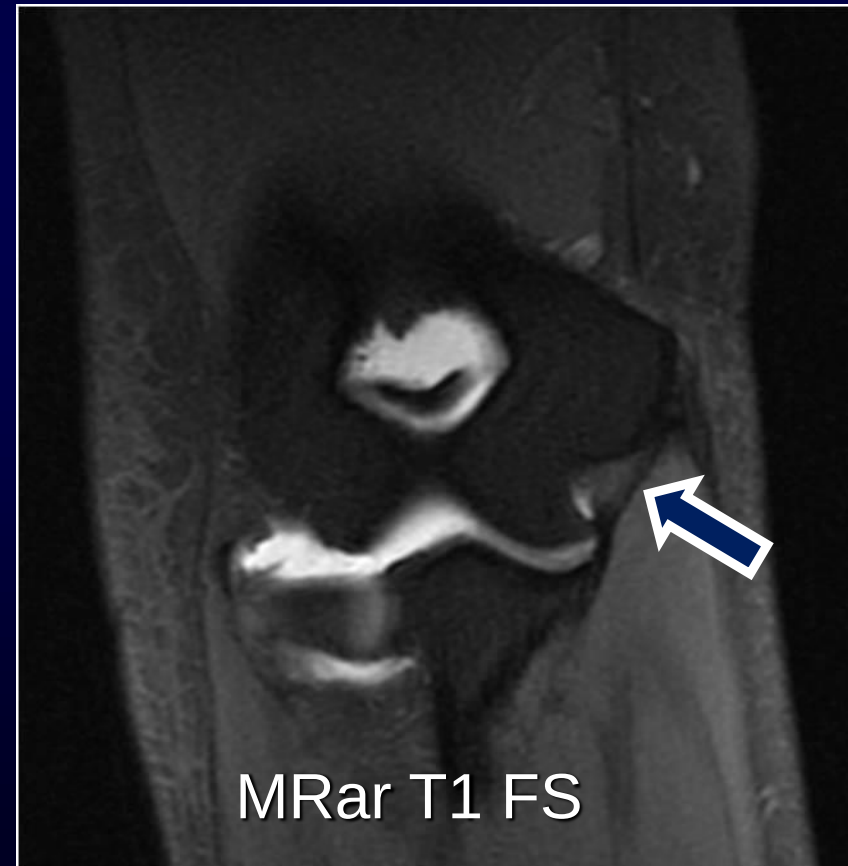
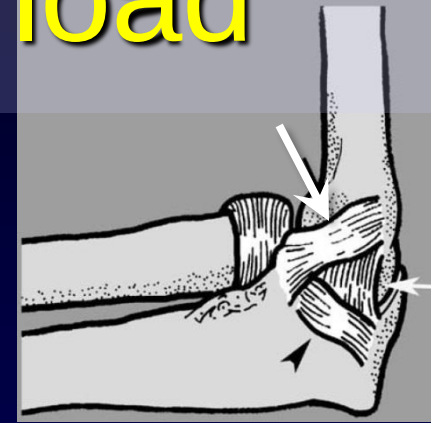
Valgus Extension Overload

- **Valgus** distraction force
- Repetitive forceful **extension**



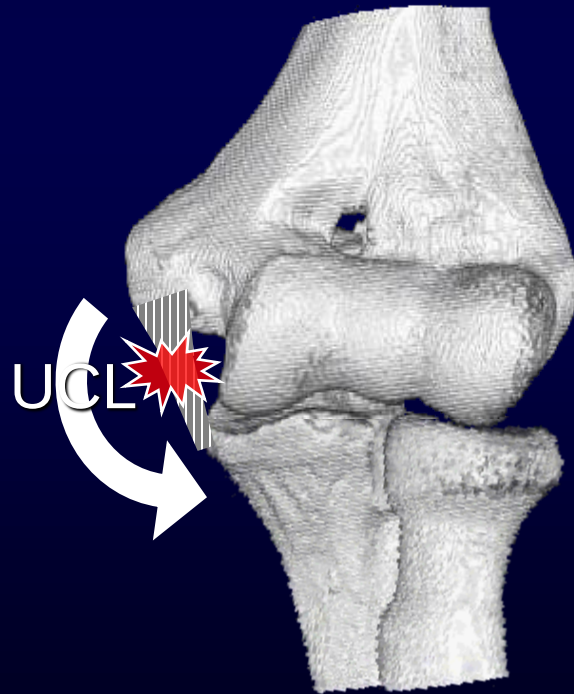
Valgus Extension Overload

- Ulnar collateral ligament stressed



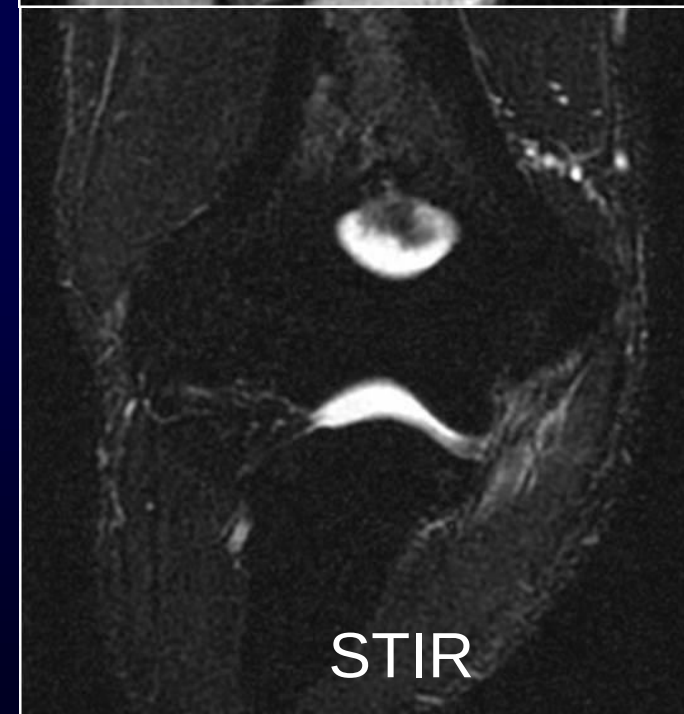
Valgus Extension Overload

- UCL tear



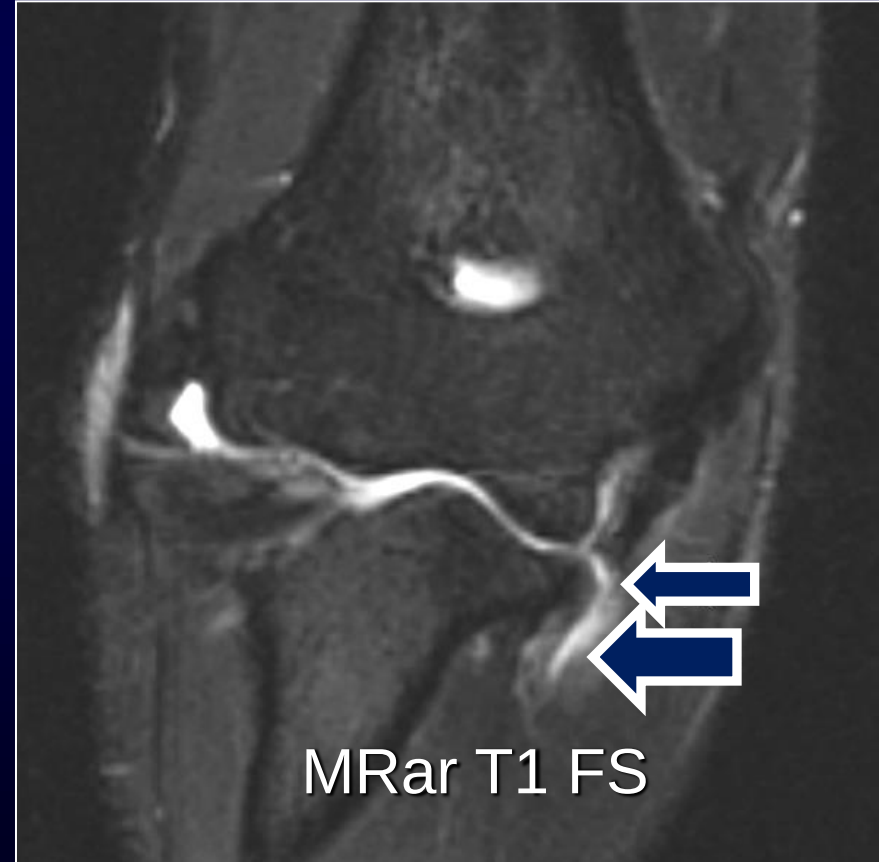
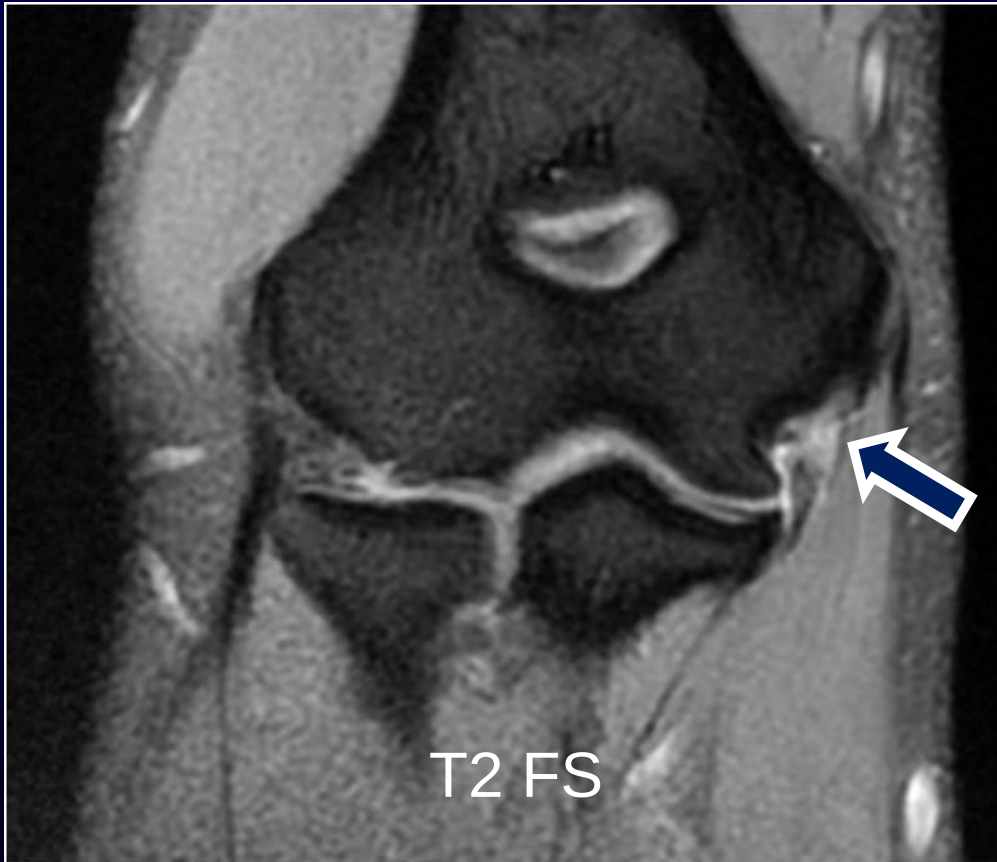
Valgus: UCL

- Partial tears



Valgus: UCL

- Complete tears

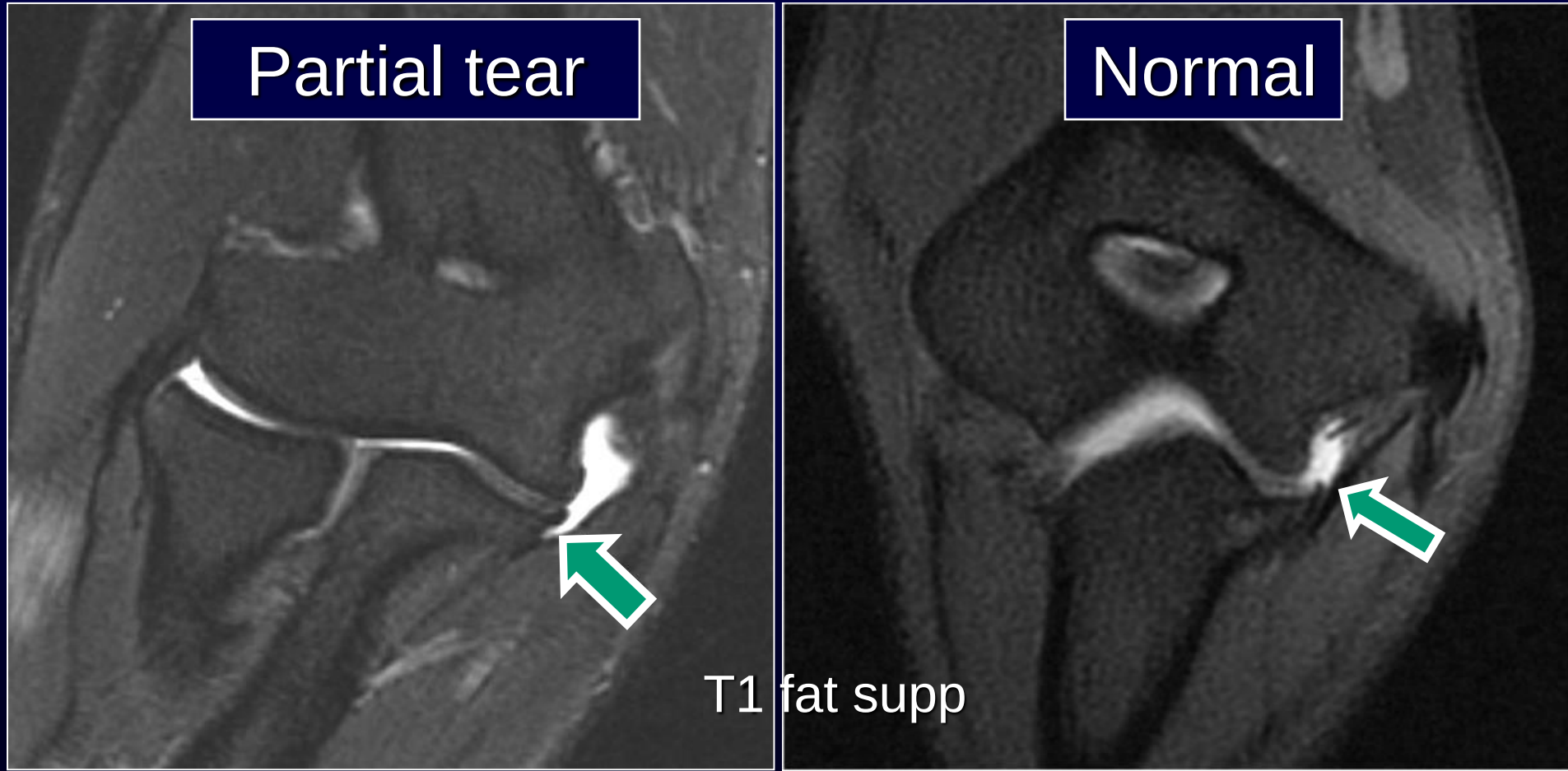


T Sign = Partial Tear

- NI: $\leq 3\text{mm}$, no discontinuity of fibers

Schwartz et al. *Radiology* 1995; 197:297

Munshi et al. *Radiology* 2004; 231:797



Ulnar Collateral Ligament Tears



19 ♂ medial pain

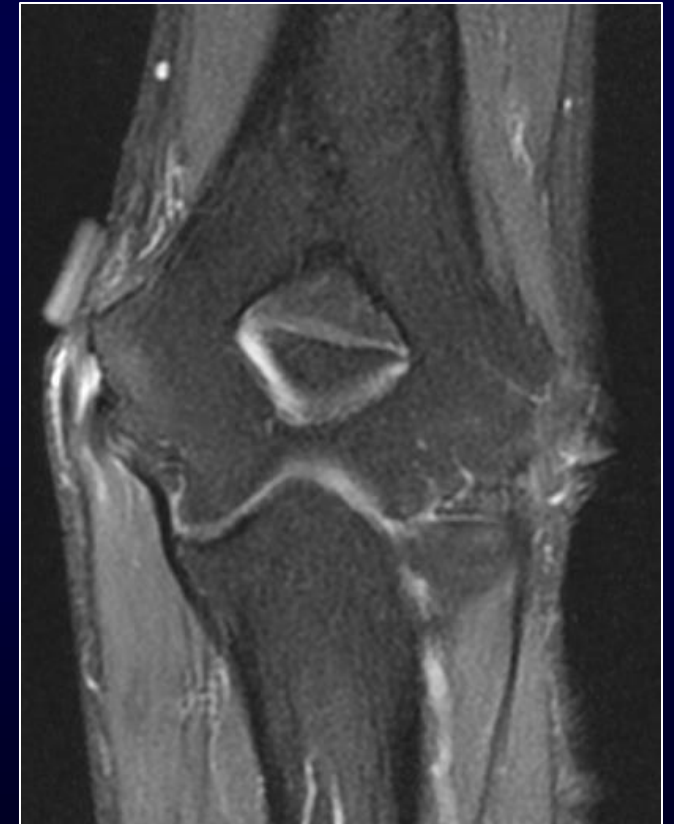
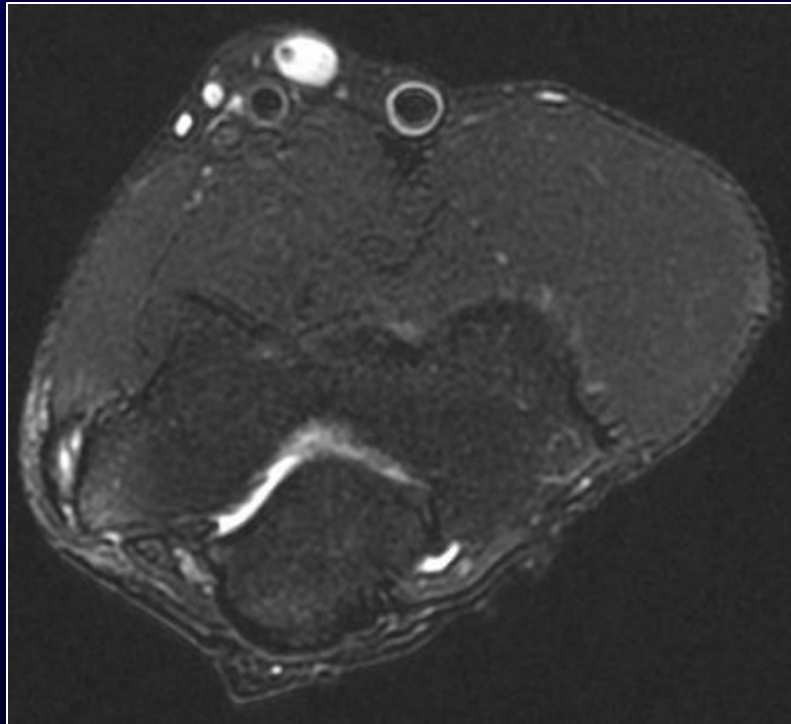
Ulnar Collateral Ligament Tears



17 ♂ medial pain

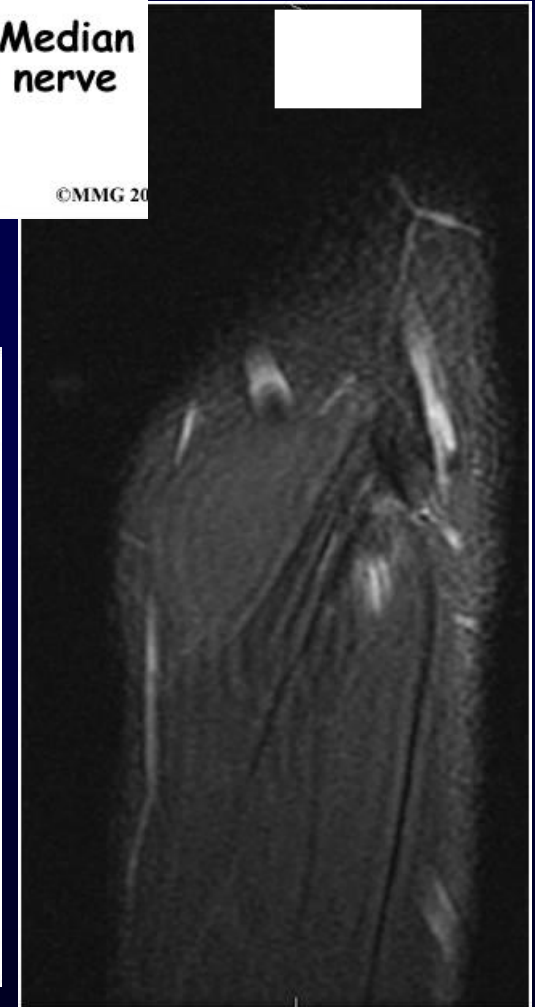
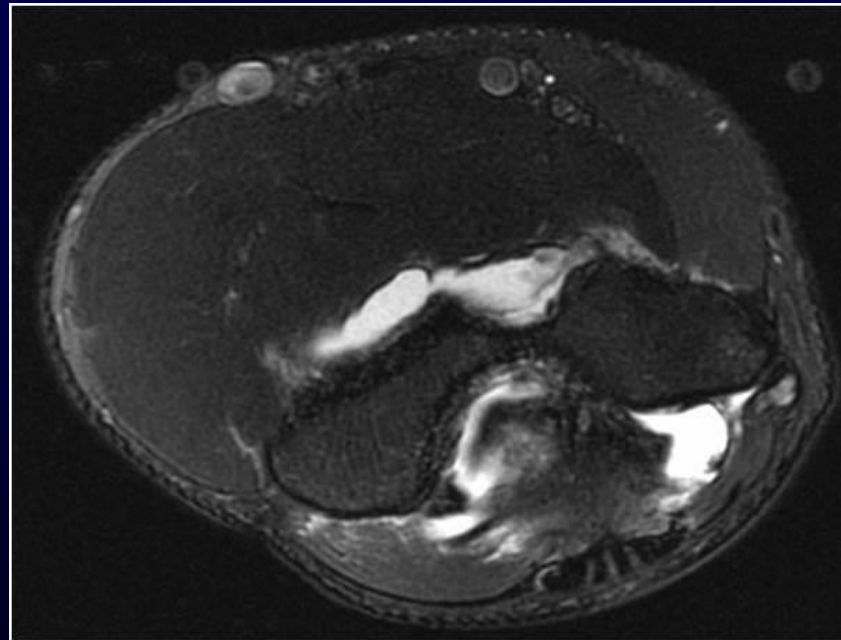
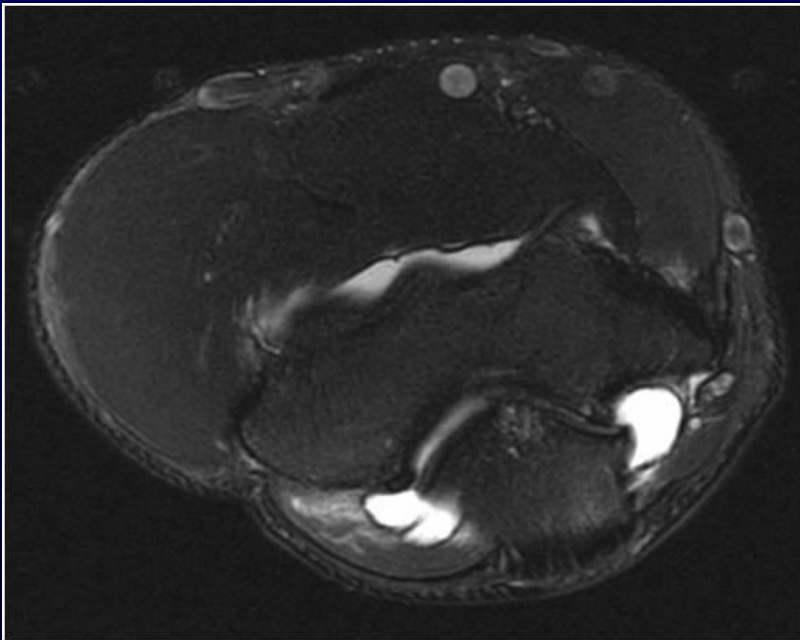
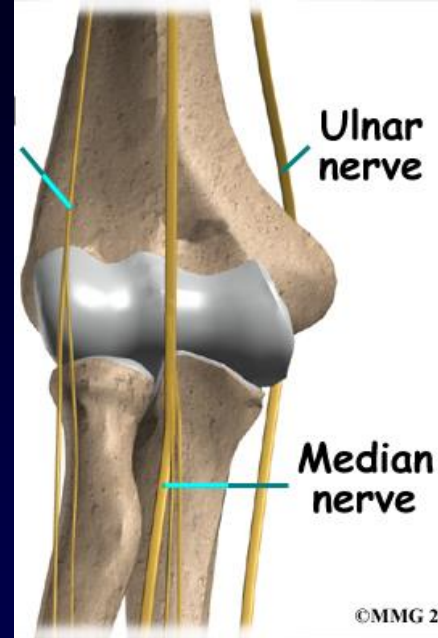
Valgus Extension Overload

1. UCL tear
2. UCL laxity → flexor tendinopathy



UCL laxity

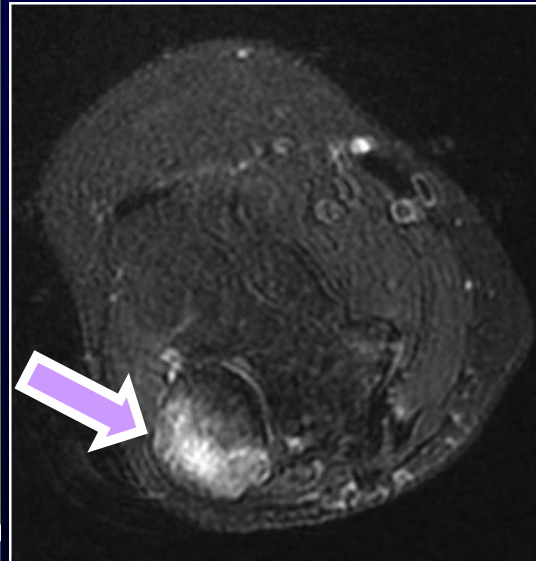
- Flexor tendinopathy
- Ulnar neuritis
 - Repetitive ulnar nerve stretching



Valgus Extension Overload

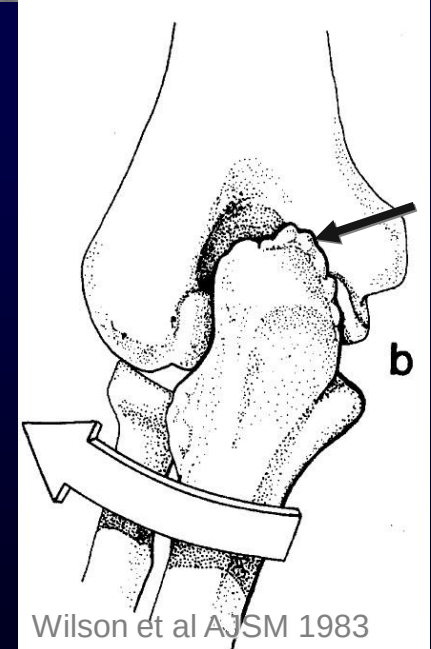
- Olecranon/ulna stress injury / fx
 - a) Abrupt endpoint
 - b) Triceps traction

Schickendantz et al *AJSM* 2002; 30:737



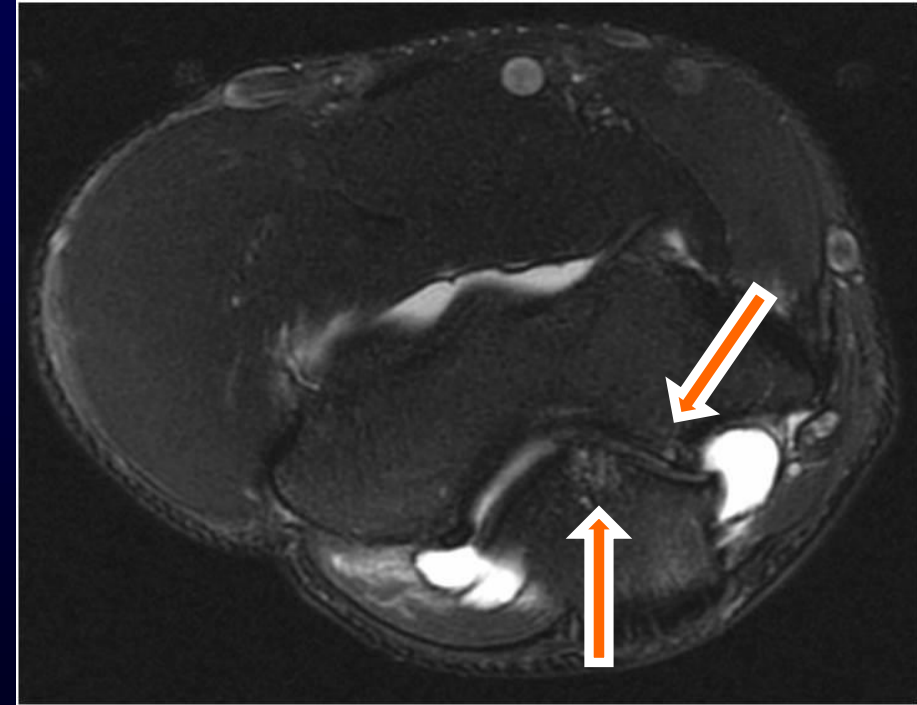
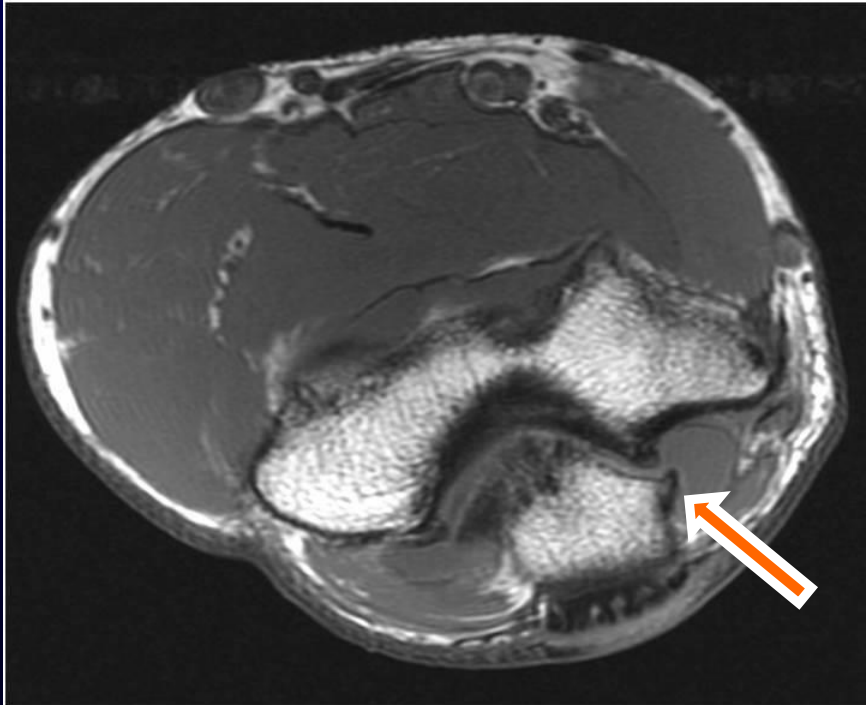
Valgus Extension Overload

- “Posteromedial impingement”
 1. Olecranon osteophytes
 2. Trochlea chondral lesion
 3. Loose bodies



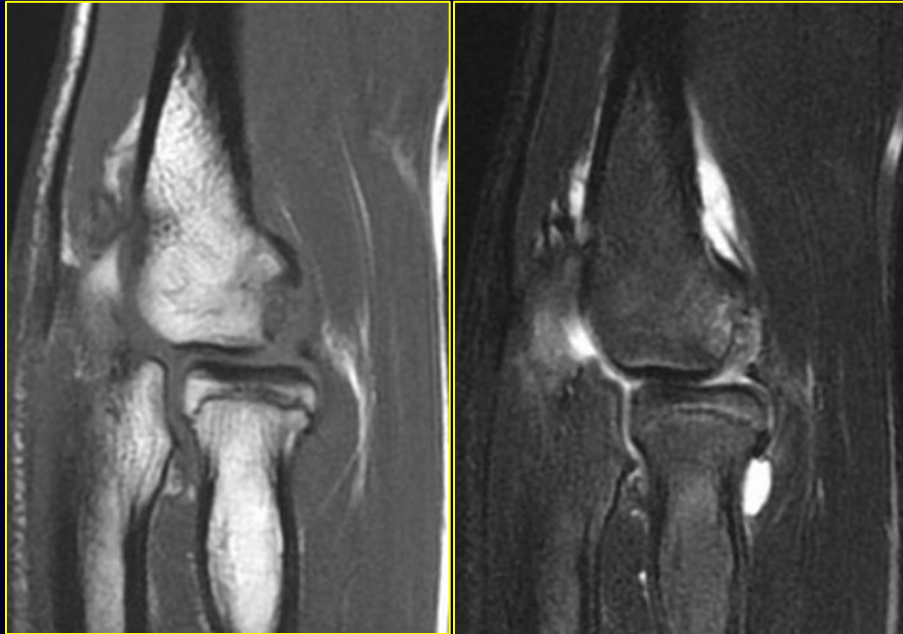
#1 elbow surgery in throwers

Posteromedial impingement

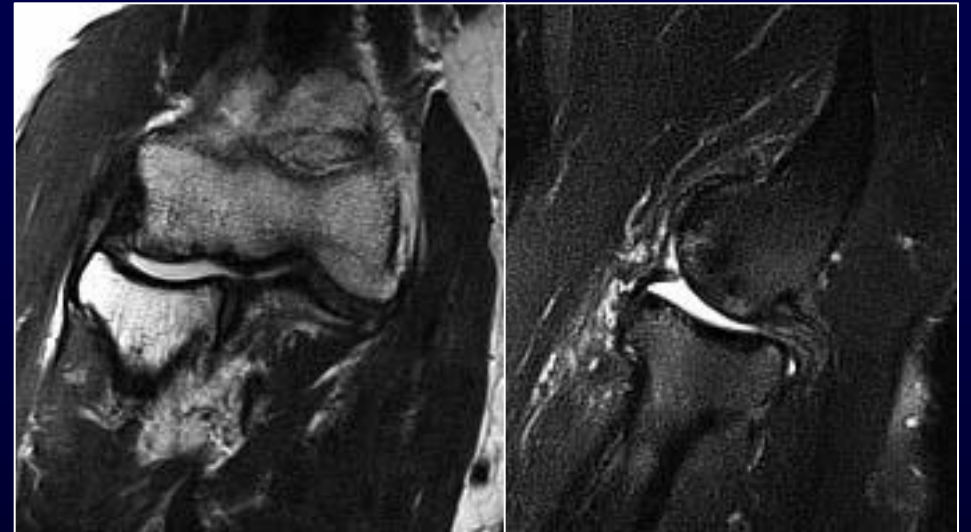


Other Osteochondral Lesions

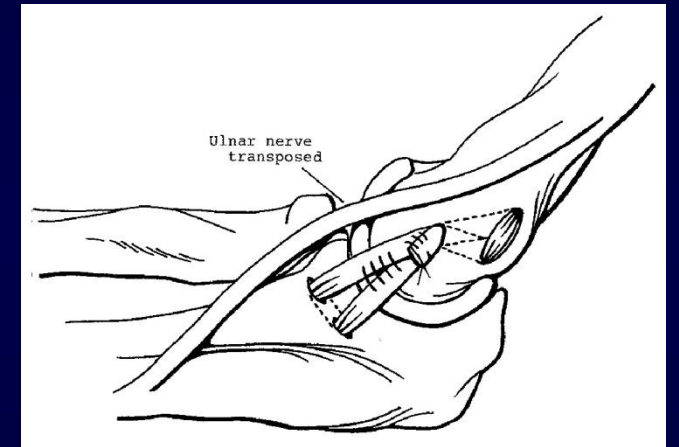
- Capitellum OCD covered in “Pediatric Sports Injuries – Upper Extremity”



51 ♂ chronic pain
Endstage DJD



Treatment / Post-op: UCL reconstruction



Azar et al *AJSM* 2000

UCL partial tear



DISLOCATIONS

Ligament Tears: UCL, RCL, LUCL

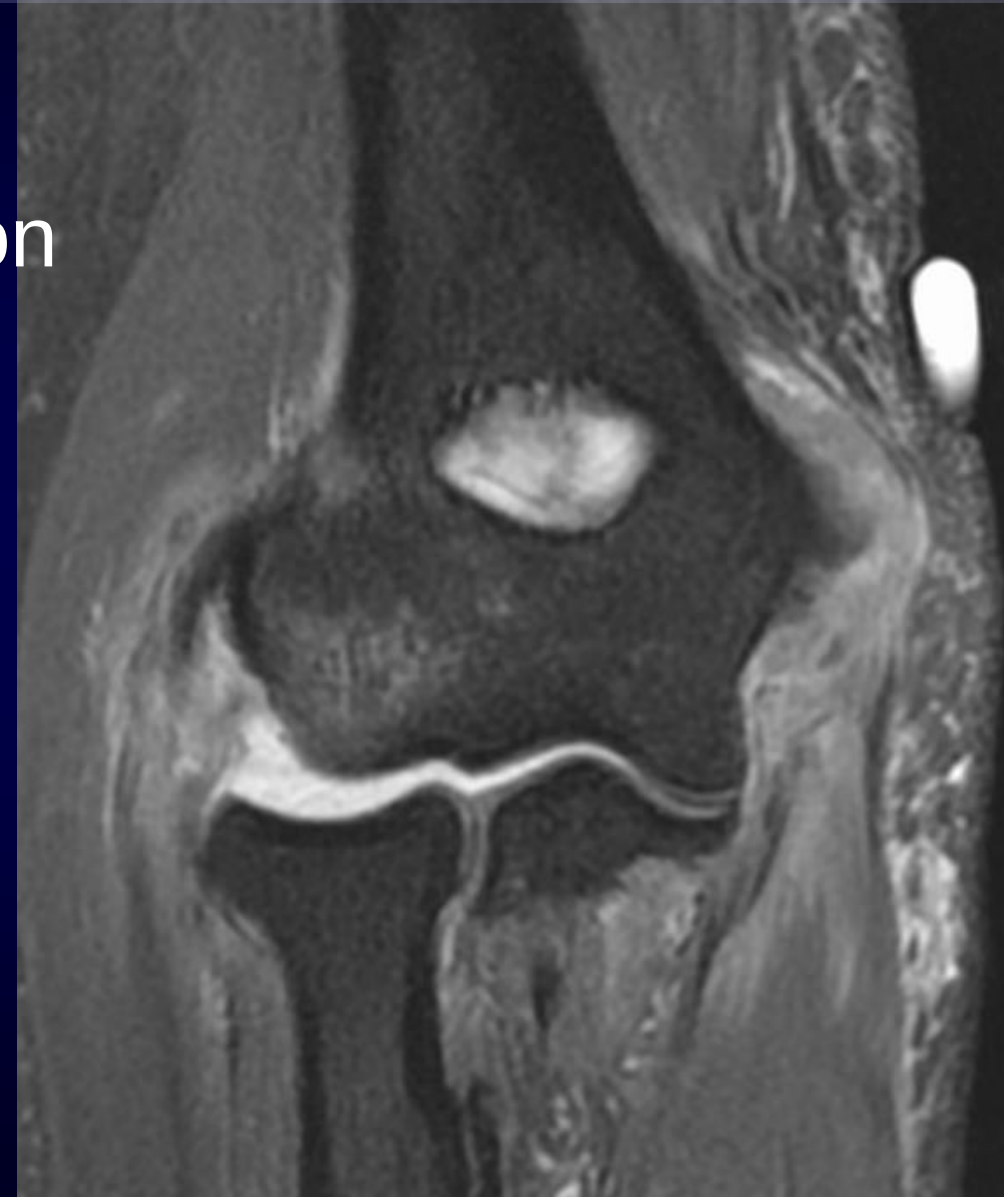
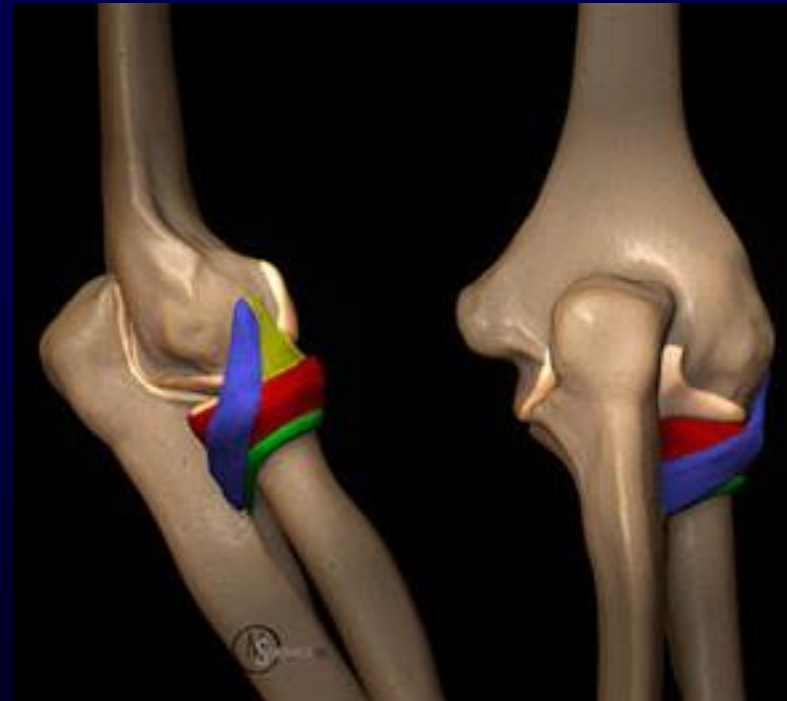
Fractures: Coronoid Process, Radial Head

Elbow Dislocation



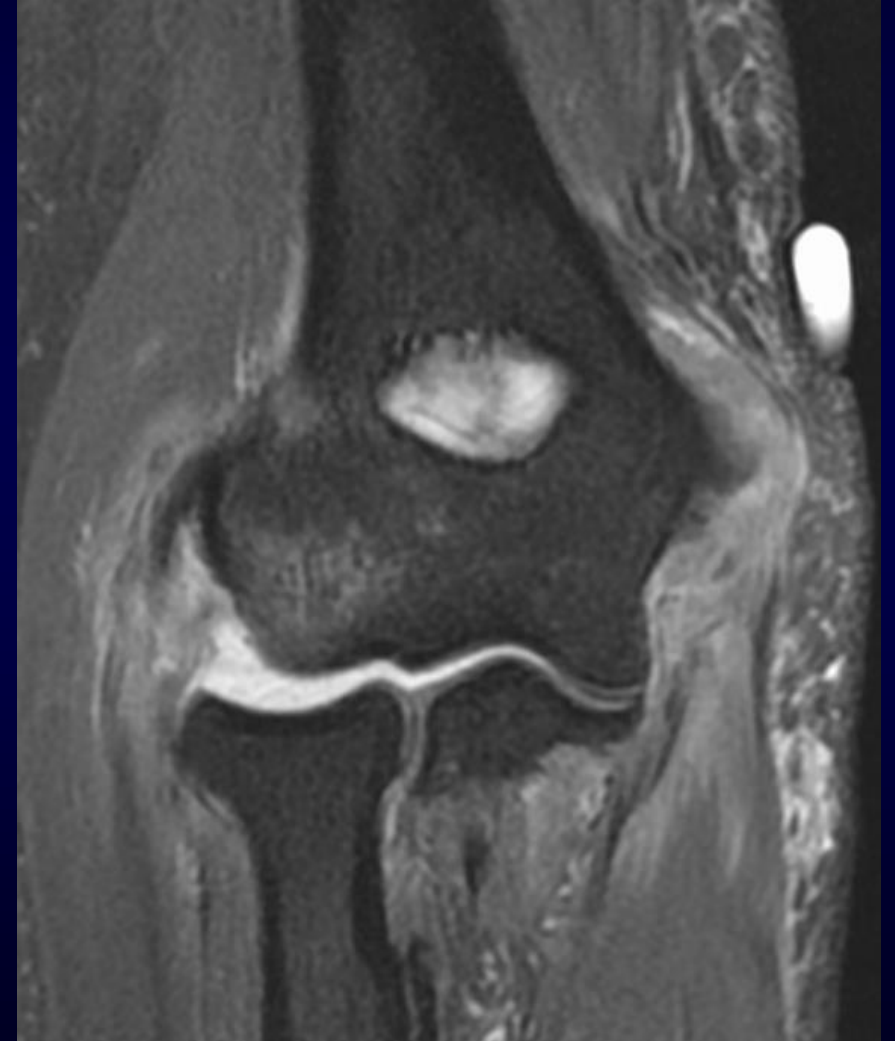
Elbow Dislocation

- Tear UCL and RCL & LUCL
- Axial load + valgus, supination



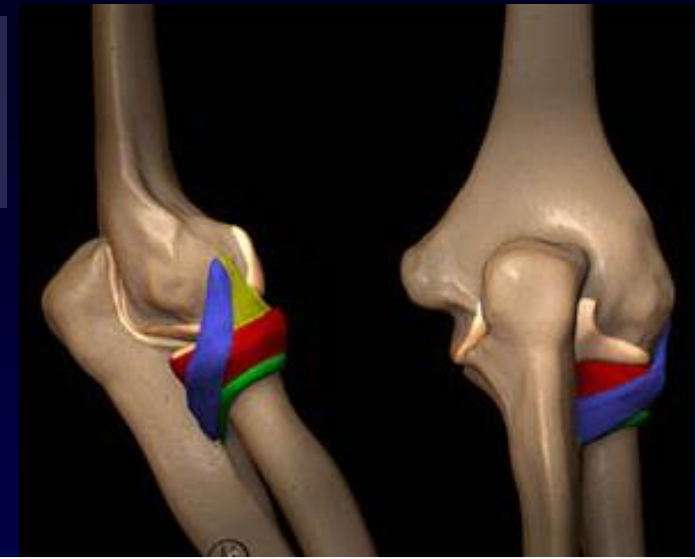
Elbow Dislocation

- Tear UCL and RCL & LUCL
- Axial load + valgus, supination
- If no fx and no 'dorsal sag'
 - Typically heals in 6 wks



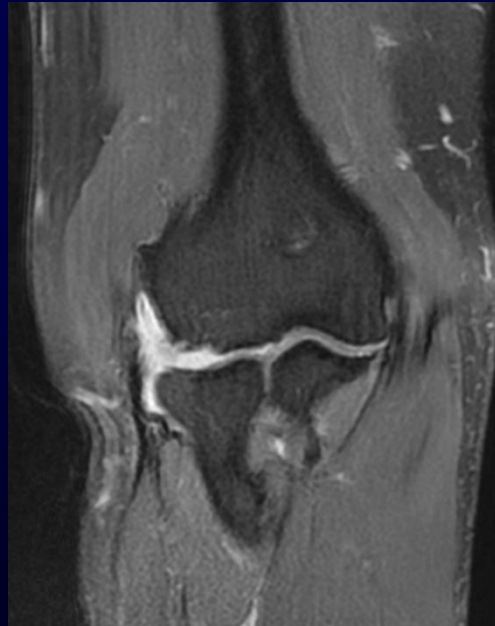
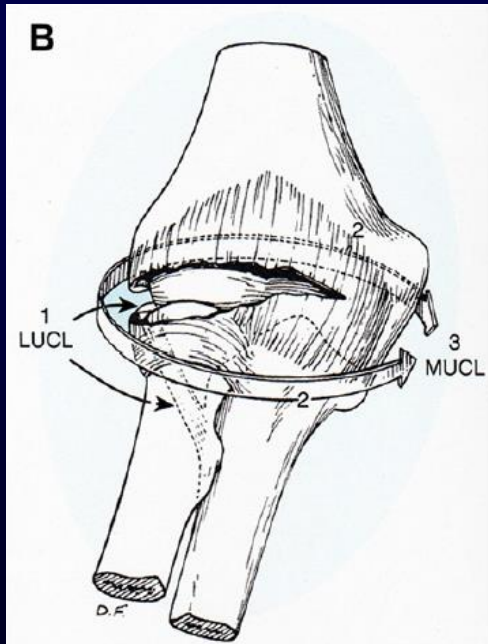
Elbow Dislocation

- If fx (esp coronoid process fx)
 - Lateral Ulnar Collateral lig may not heal



Elbow Dislocation

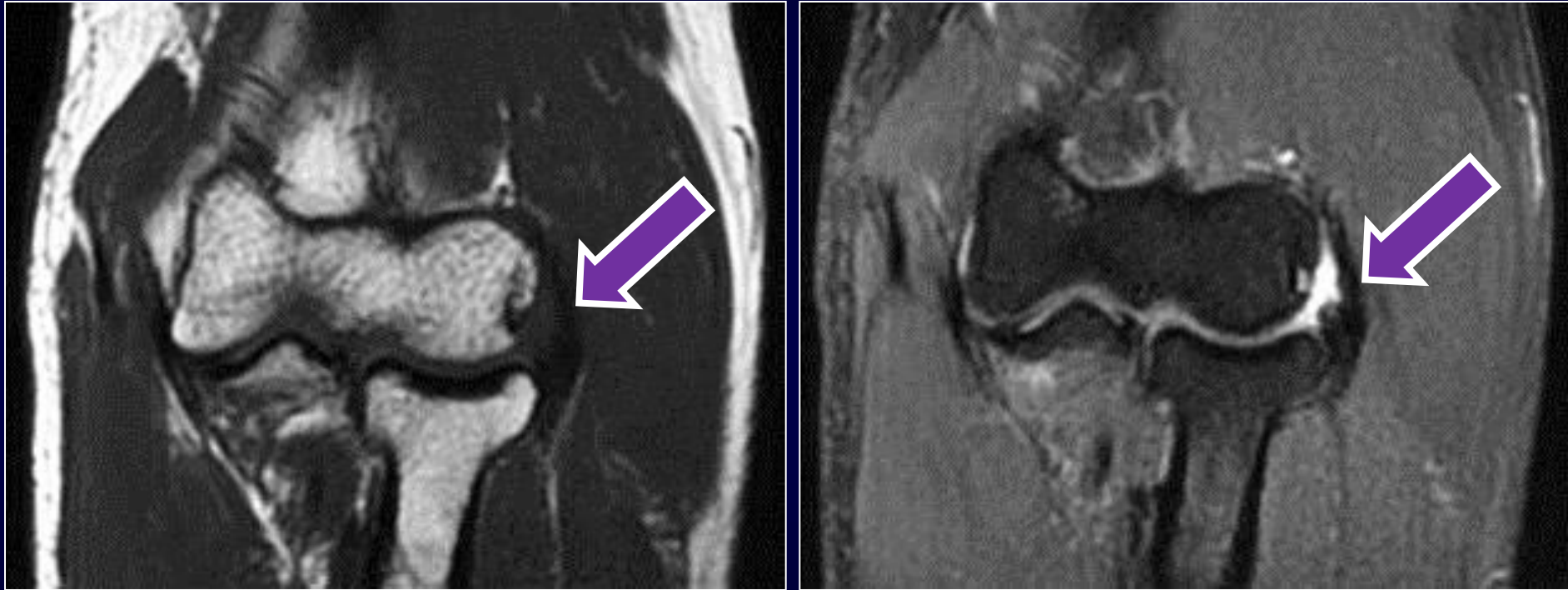
- If fx (esp coronoid process fx)
 - Lateral Ulnar Collateral lig may not heal
 - Can develop “posterolateral rotatory instability”



Radial Collateral Ligament Tears

- Commonly torn during dislocations
- MR: wavy, increased SI, partial or complete disruption
- Arthro: leaking contrast
- Ca++ with chronic tears

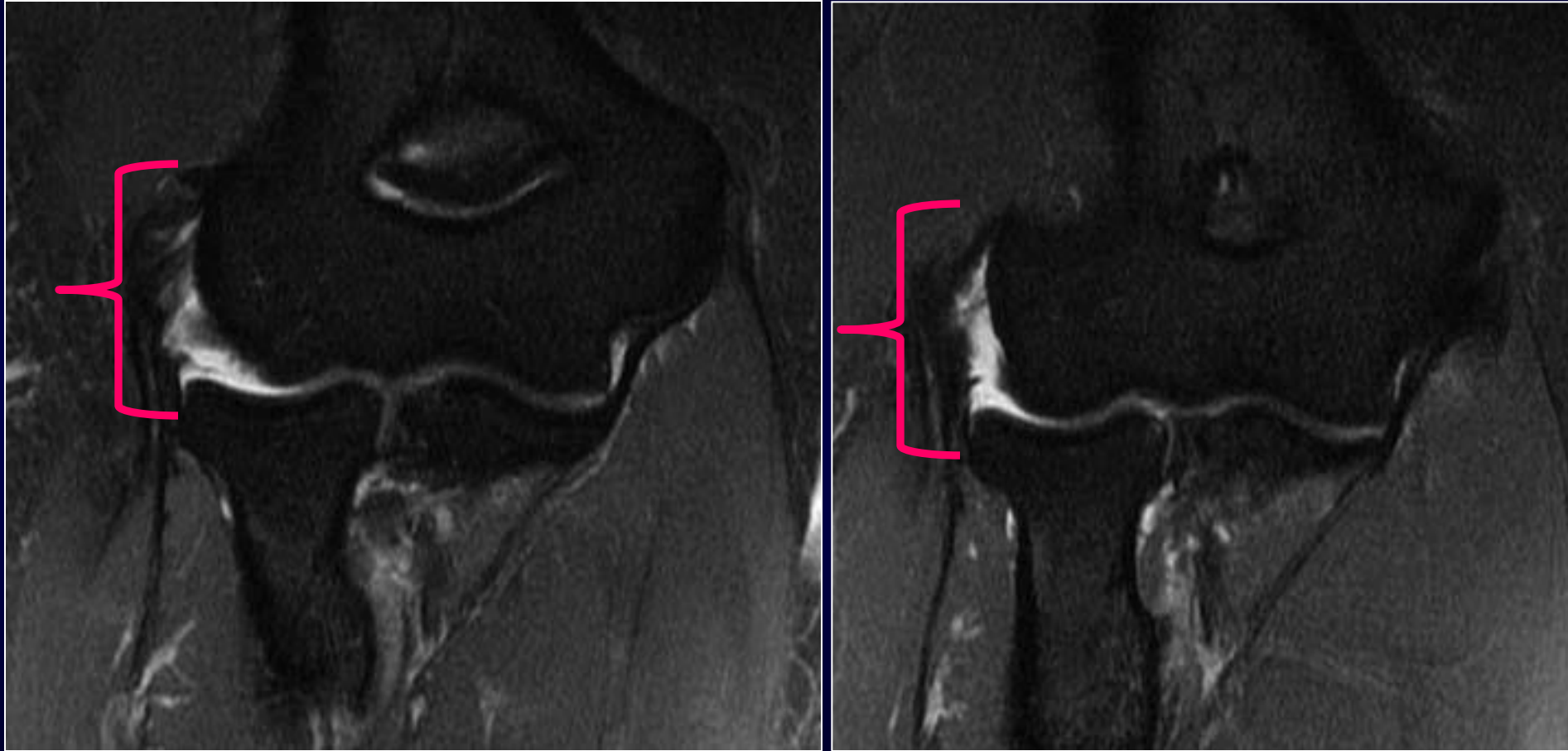
Radial Collateral Ligament Tears



45 ♂ r/o biceps tear

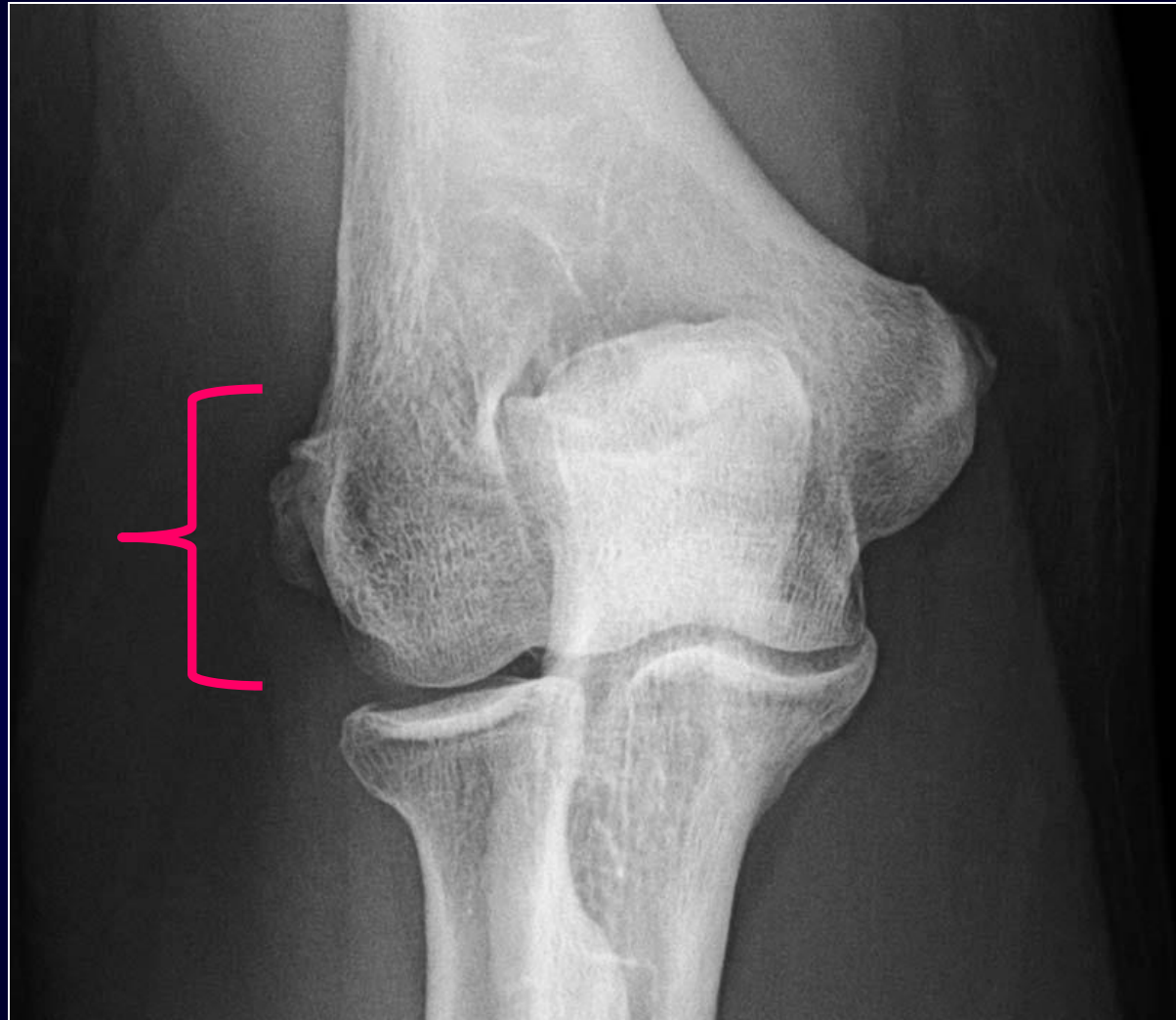
Radial Collateral Ligament Tears

& Extensor tendon tear



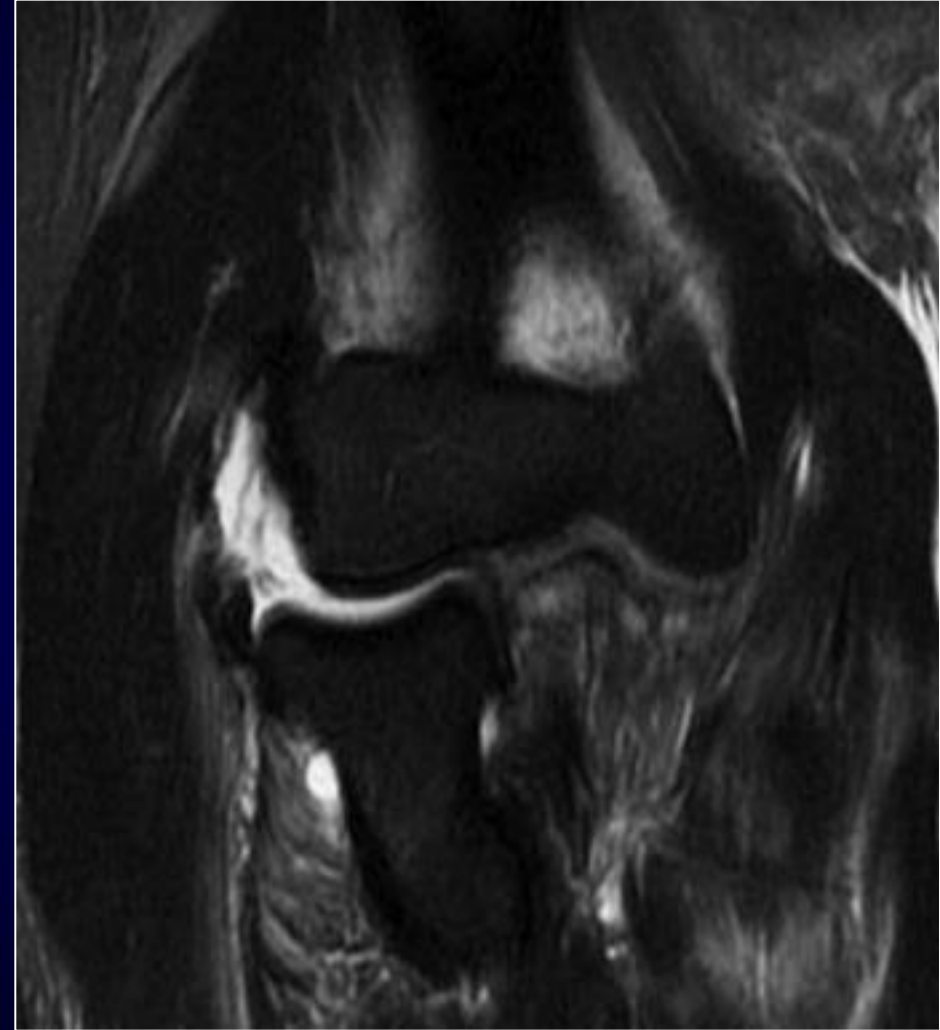
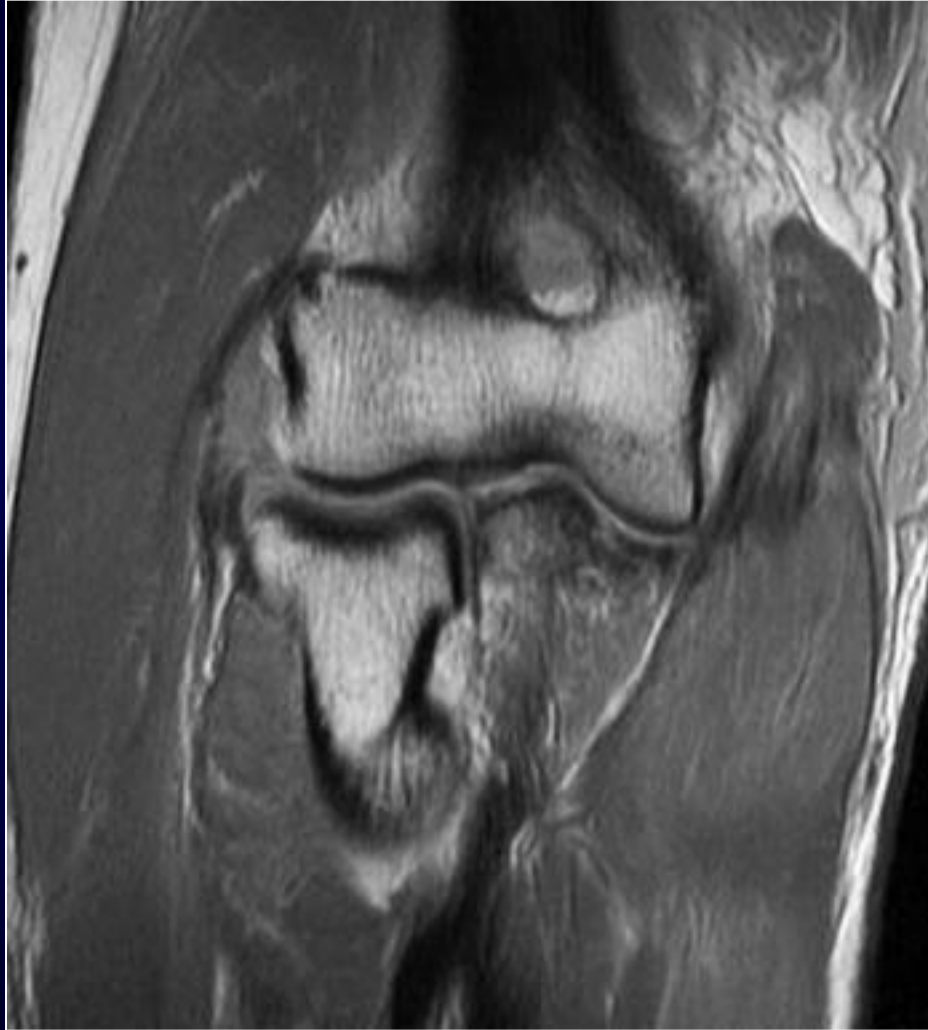
57 ♂ r/o biceps tear, also lateral pain

Radial Collateral Ligament Tears



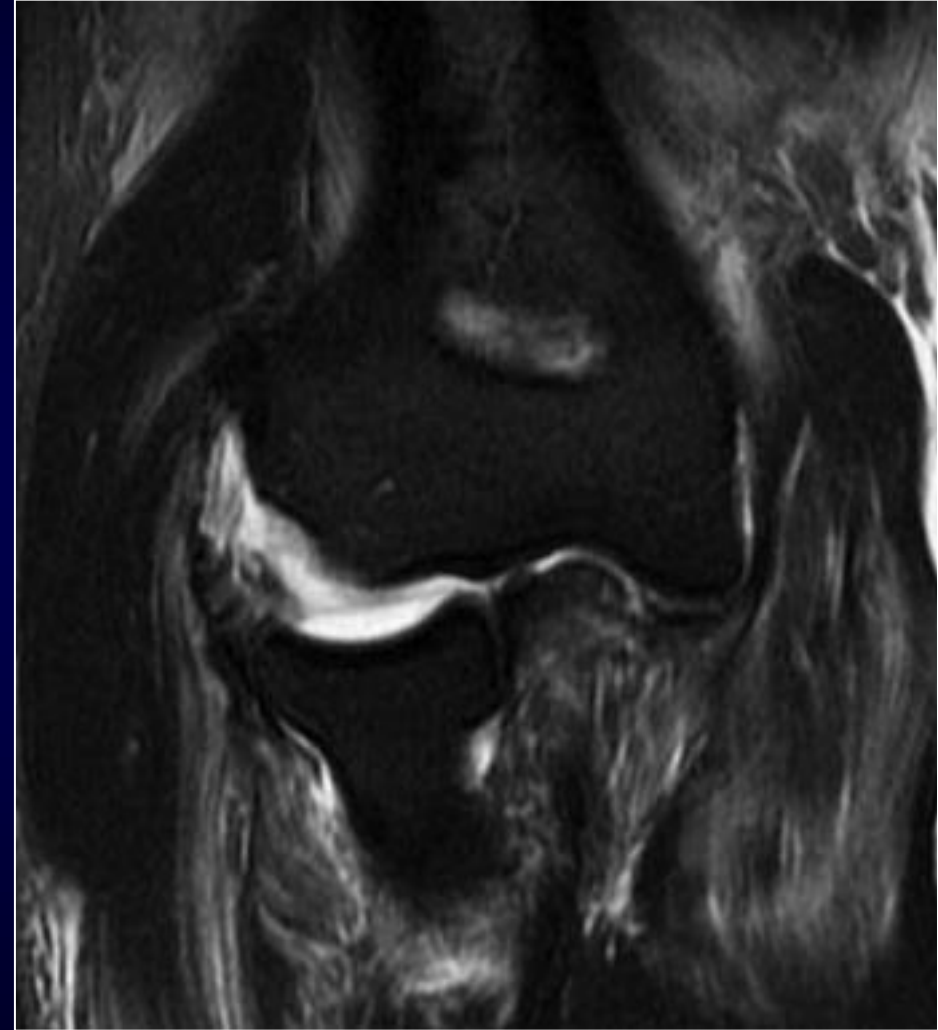
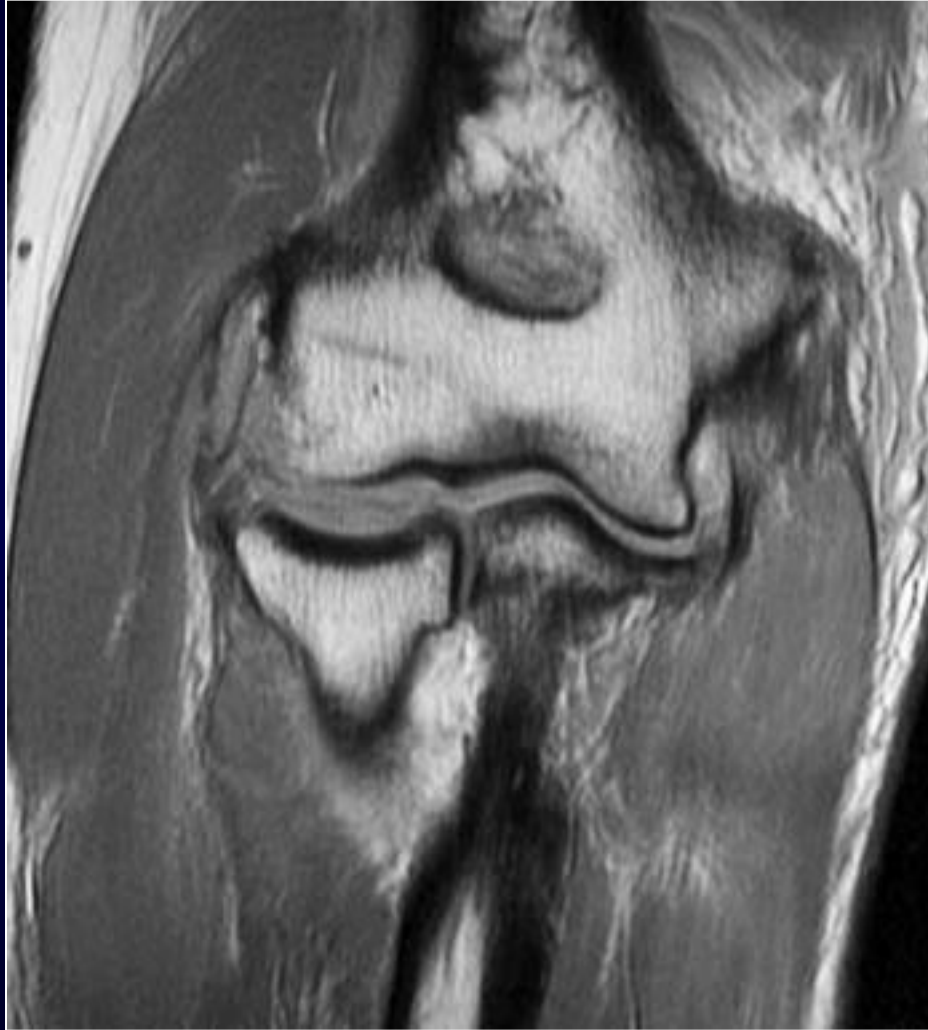
57 ♂ r/o biceps tear, also lateral pain

Radial Collateral Ligament Tears



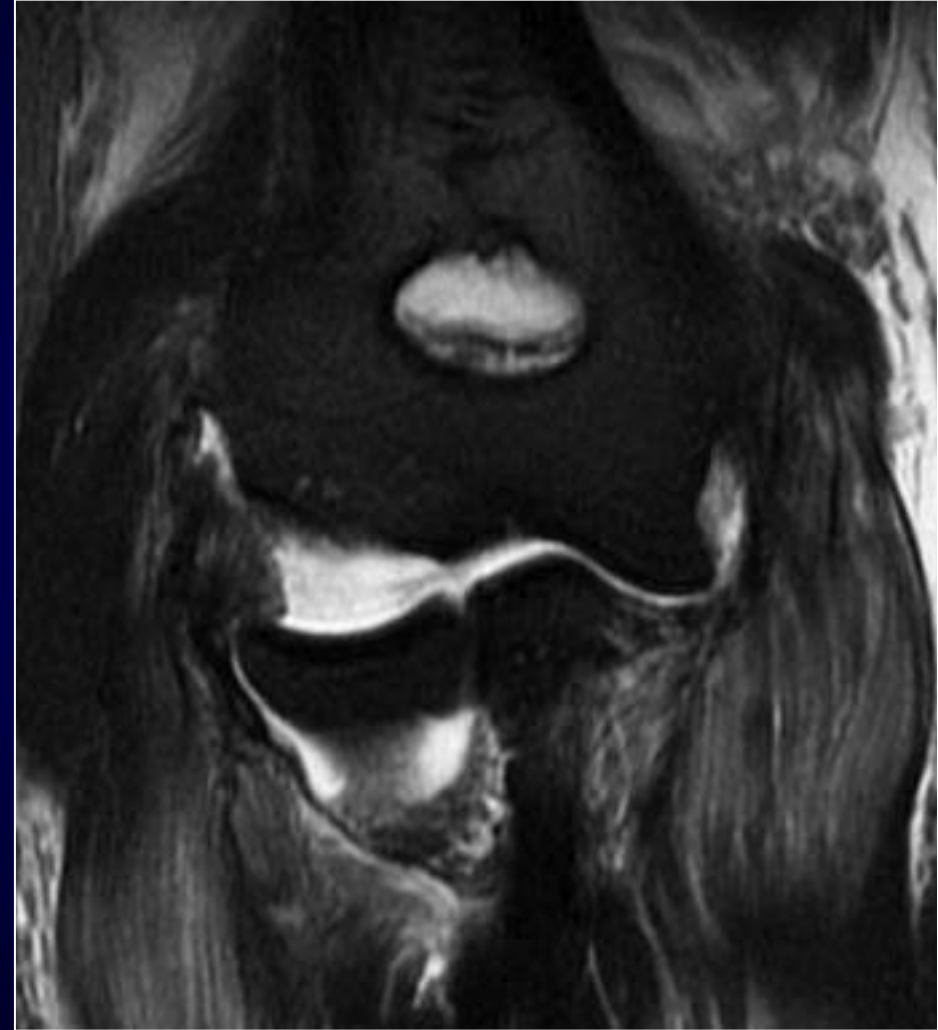
63 ♂ fell on ice

Radial Collateral Ligament Tears



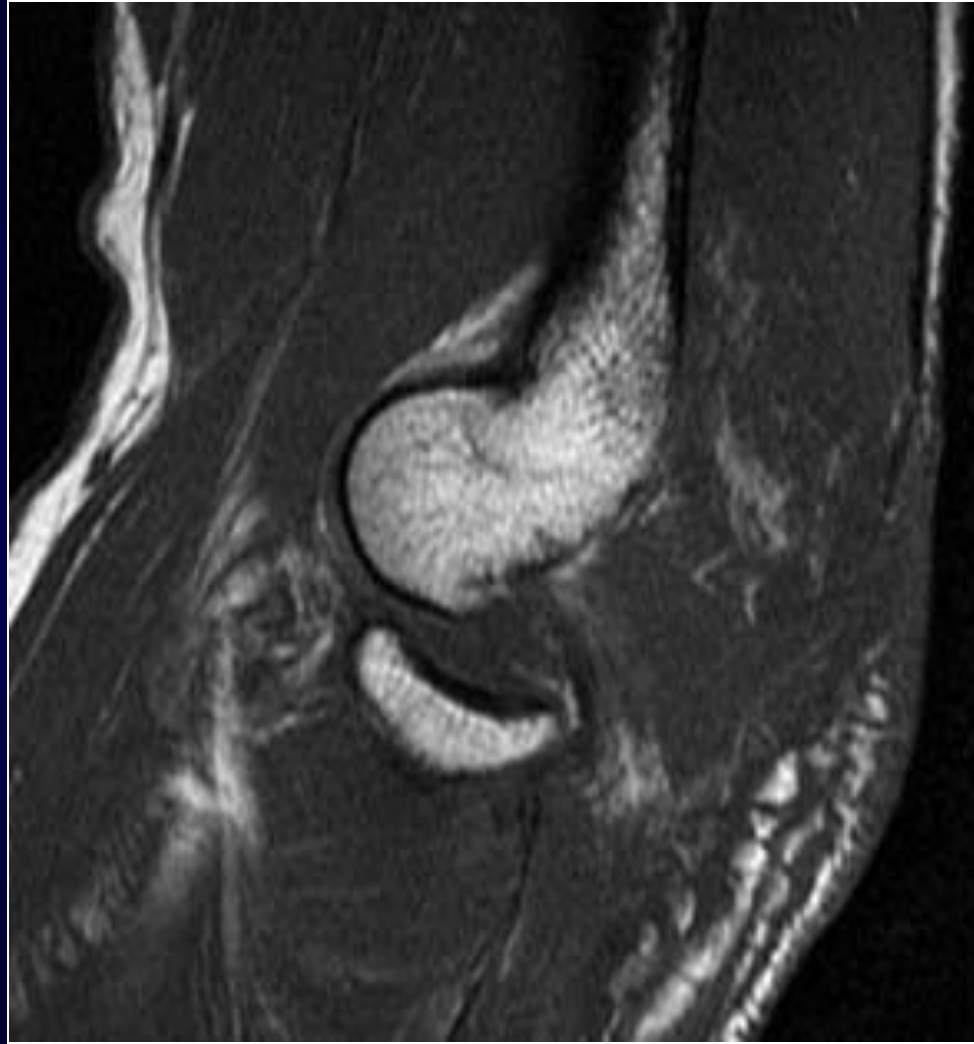
63 ♂ fell on ice

Radial Collateral Ligament Tears



63 ♂ fell on ice

Radial Collateral Ligament Tears



63 ♂ fell on ice

LUCCL Tears

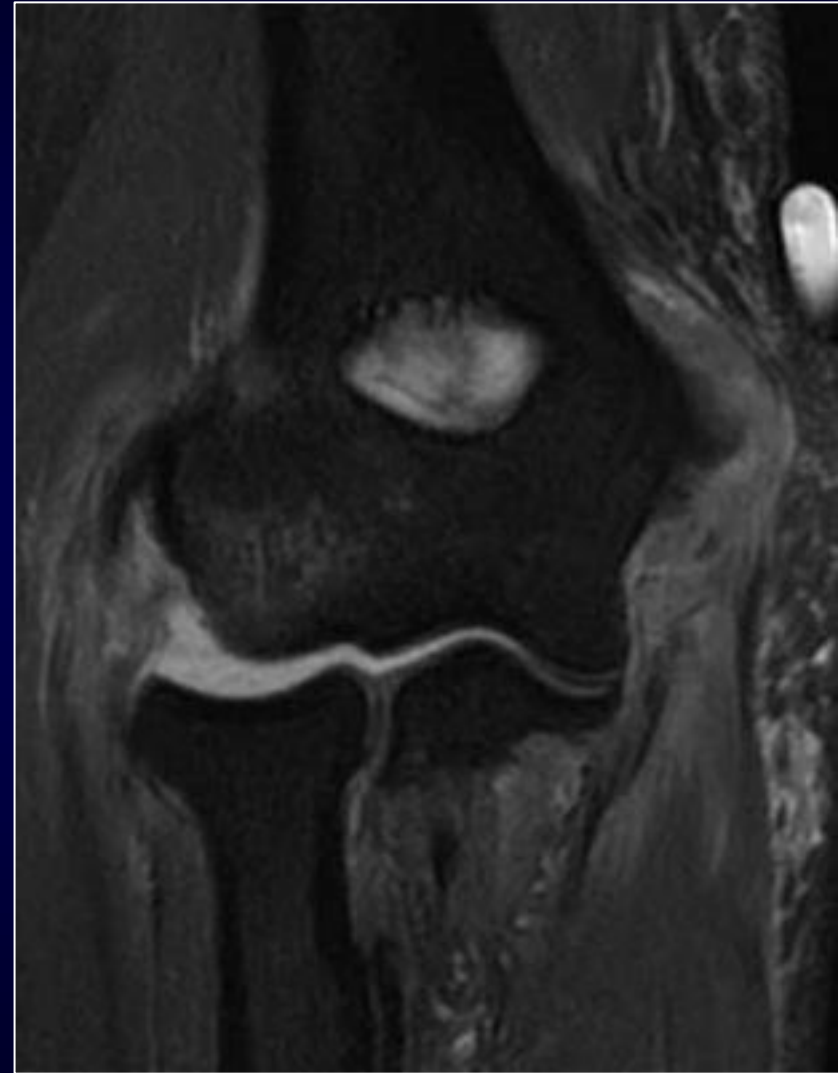
- Lateral Ulnar Collateral Ligament
 - Ulnar band of the Lateral Collateral Ligament
- Posterior to RCL
- Runs behind radial neck
- Inserts on supinator crest of ulna
- Prevents posterolateral rotatory instability (PLRI)
 - pain, clicking, apprehension in extension
- MR: proximal disruption, ↑ signal
 - May be difficult to discern when normal or torn

LUCL Tears



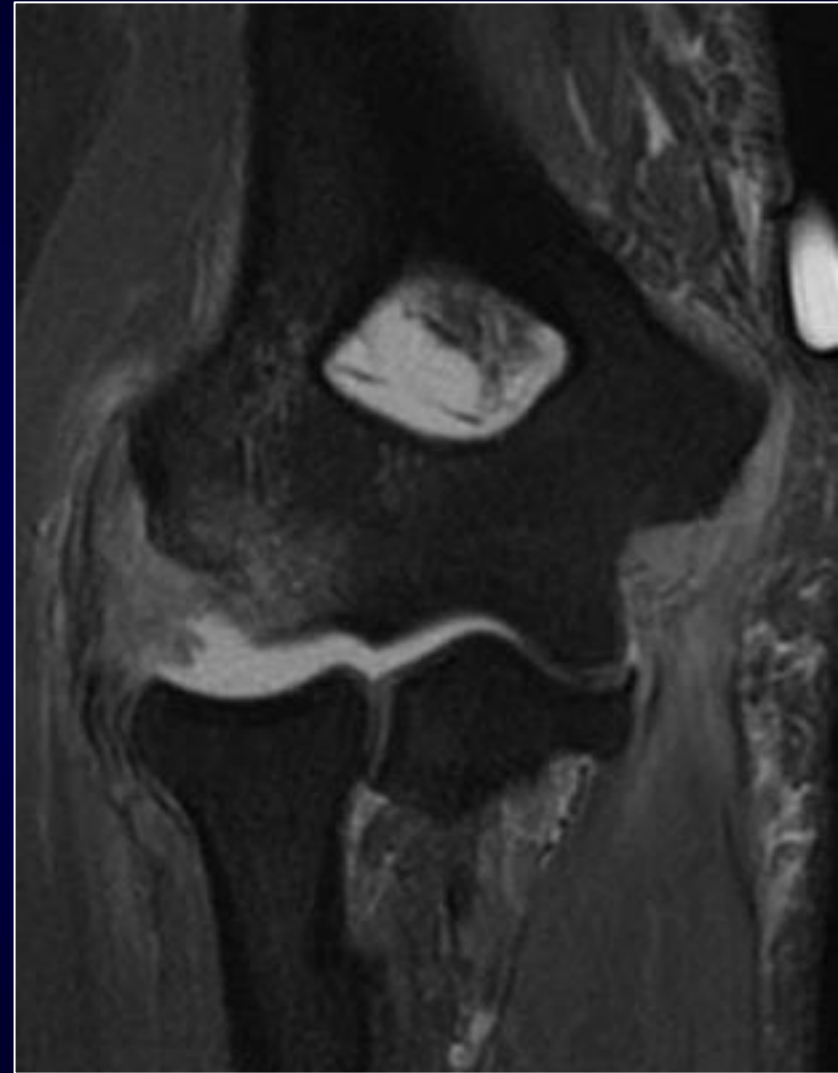
65 ♂ with chronic instability

LUCI Tears



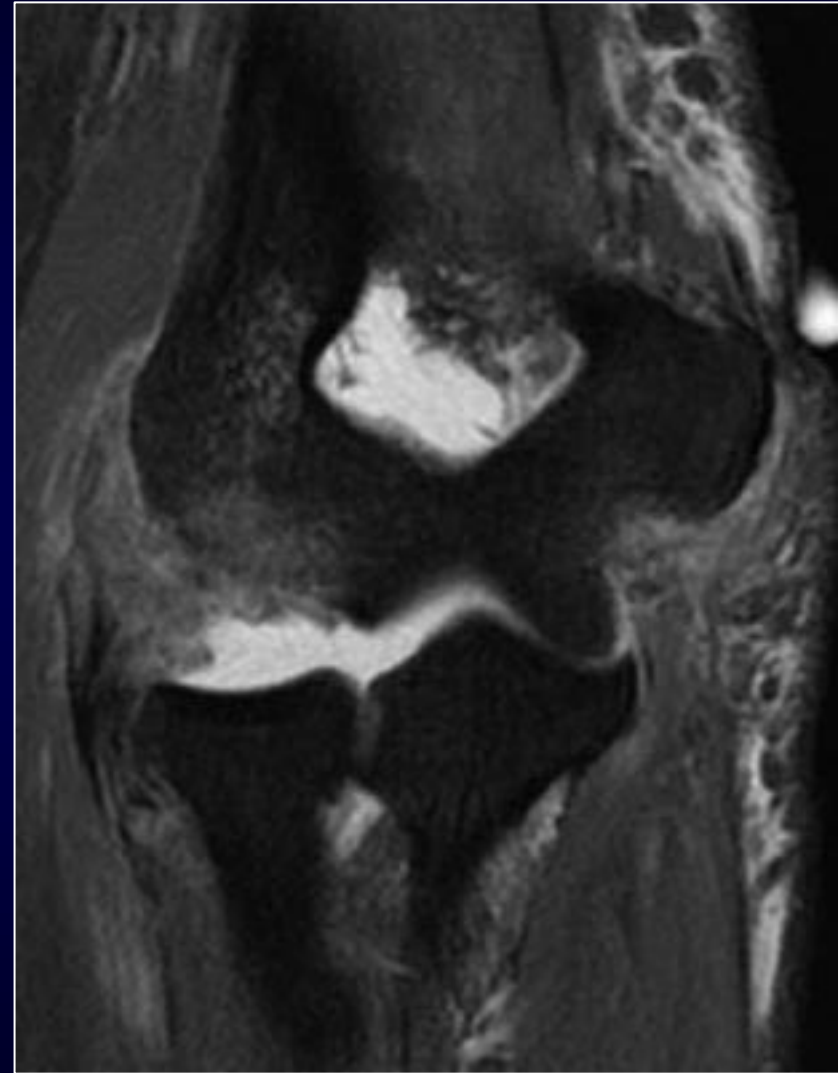
44 ♂ Fell on ice 1 mo ago

LUCIL Tears



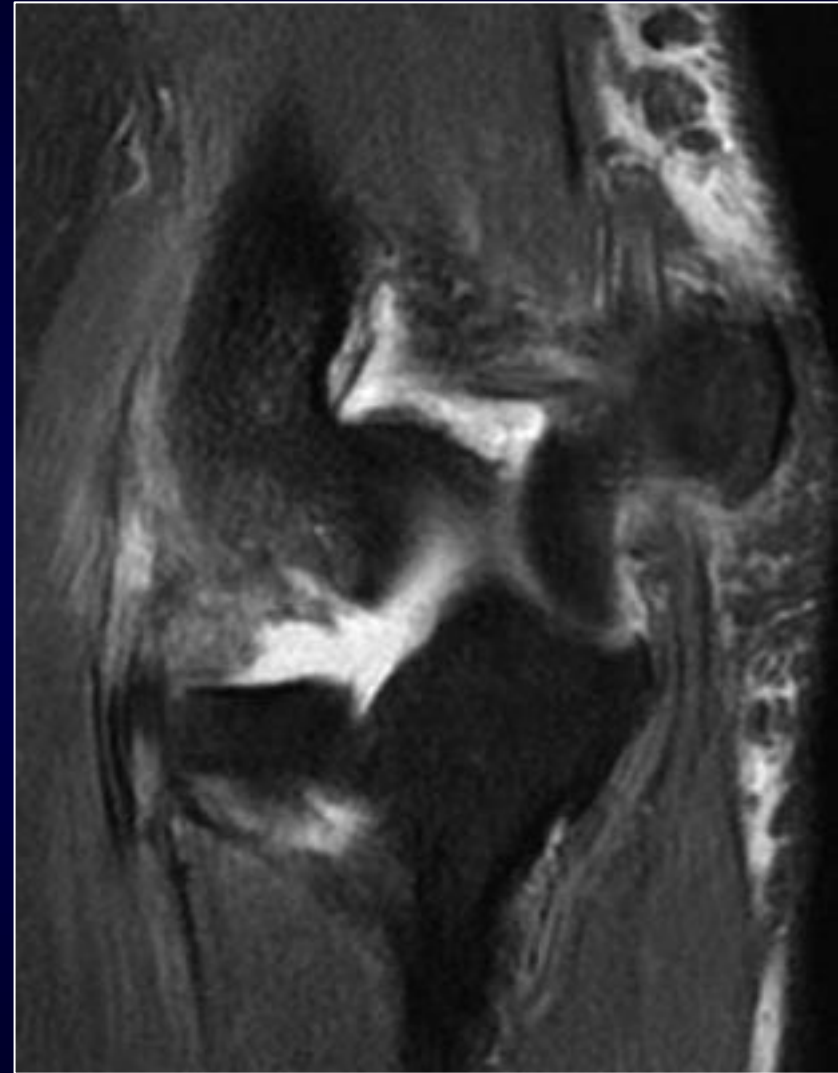
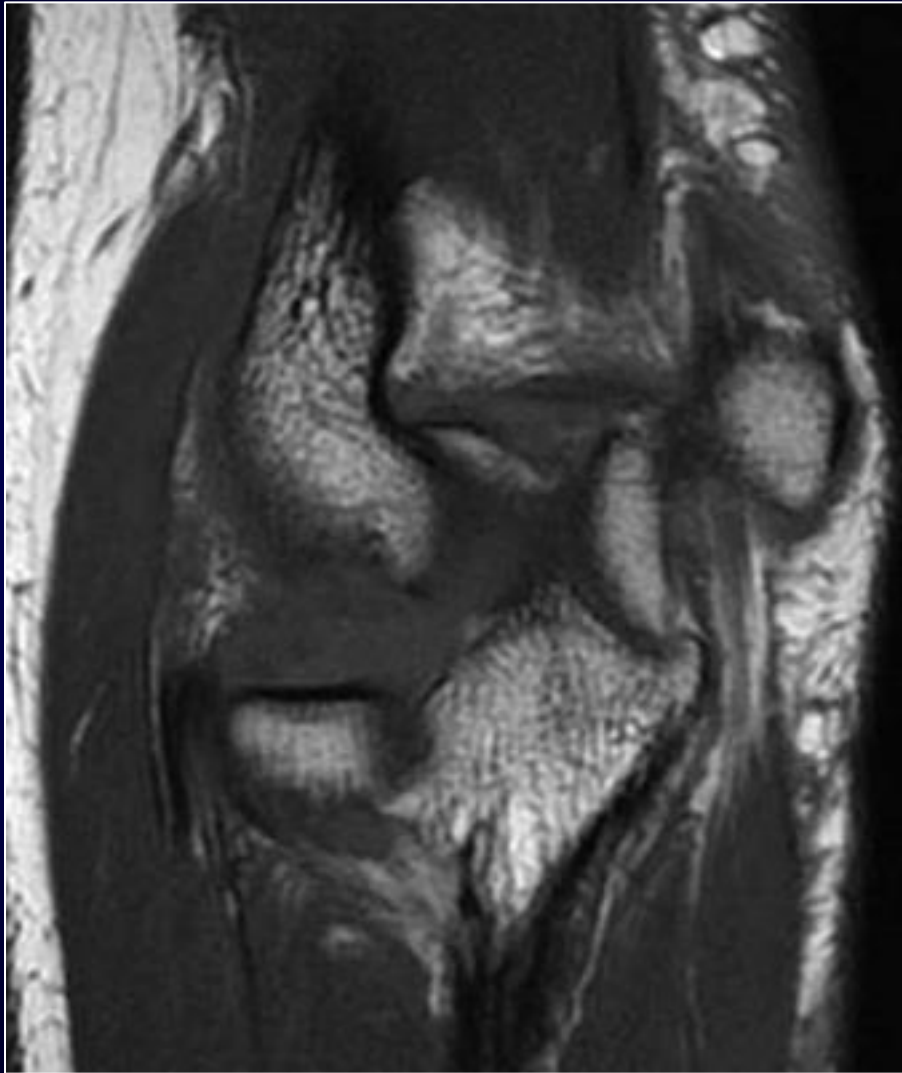
44 ♂ Fell on ice 1 mo ago

LUCI Tears



44 ♂ Fell on ice 1 mo ago

LUCCL Tears



44 ♂ Fell on ice 1 mo ago

Key Points

- Lateral “epicondylitis”: Comm Ext tendinopathy
- Biceps rupture: if aponeurosis intact → no retraction
- Throwers: UCL tear & posteromedial impingement
- Dislocations: multi-ligament injuries
- Don’t forget the LUCL!

