DEPARTMENT OF MEDICAL IMAGING
UNIVERSITY OF TORONTO

MSK MRI
SHOULDER: LABRUM AND CAPSULE

Joint Department of Medical Imaging

University Health Network, Mount Sinai and Women's College Hospitals

ACR EDUCATION CENTER™

Musculoskeletal MR

SHOULDER: GLENOHUMERAL JOINT

Greatest ROM of any joint in the body

Tremendously versatile & mobile

Mobility – at expense of stability

Normal function dependent upon

- Balance between static and dynamic constraints of the joint

SHOULDER: GLENOHUMERAL JOINT

Injury that disturbs balance →

- Biomechanical changes
- Instability

Clinically manifest:

Poorly localized pain/weakness

Mechanical symptoms

- Popping, catching, grinding
- GHJ dislocation

STABILIZING RESTRAINTS: SHOULDER

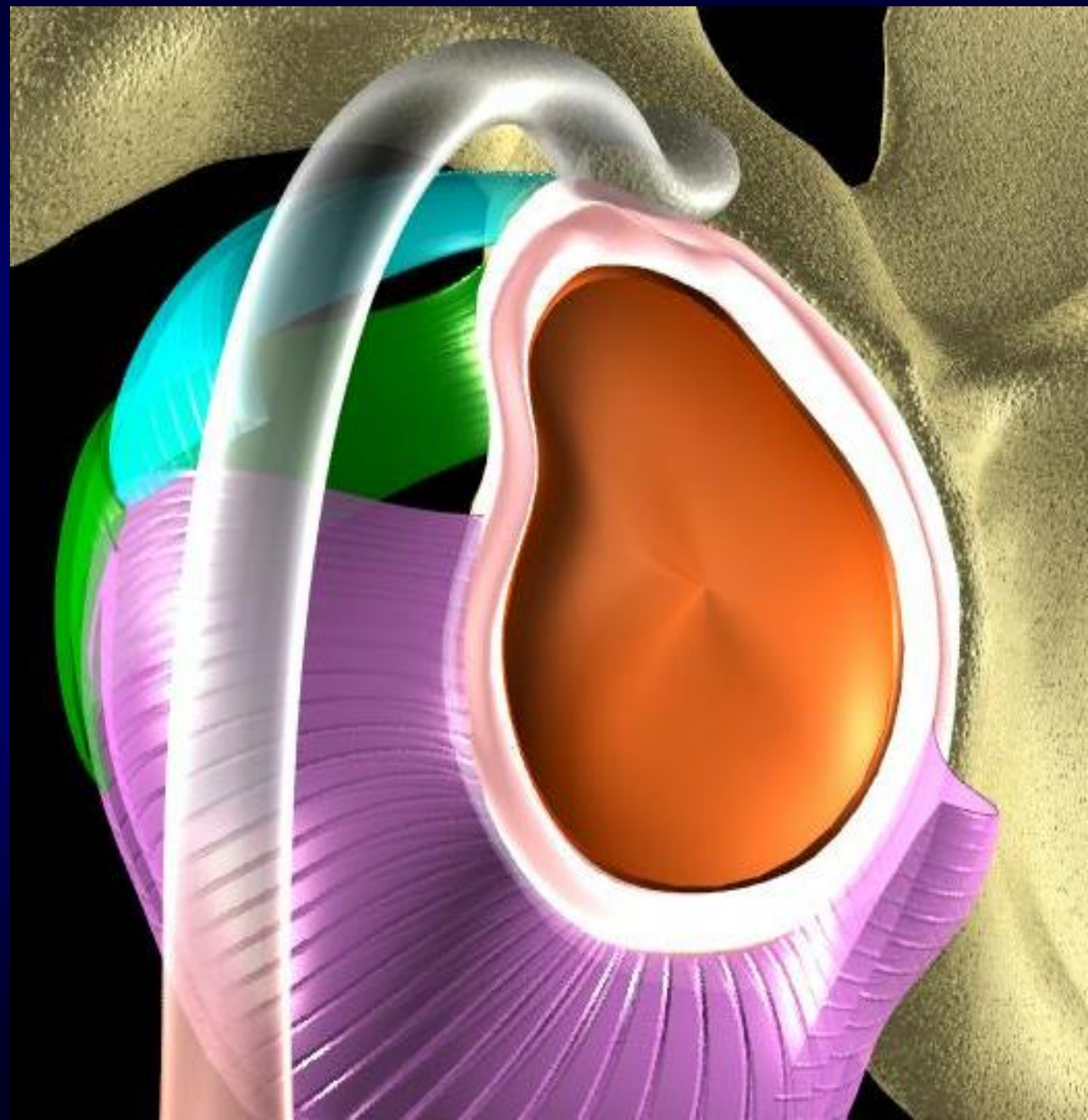
Active (extrinsic)

- Rotator cuff and other musculature

Passive (intrinsic)

- Osseous geometry
- Labrocapsular complex

  Labrum, Capsule and Glenohumeral ligaments



LABRUM

Fibrocartilaginous tissue

Stabilizer - GH joint

Encircles glenoid

Increases depth/volume glenoid 50%

Pressure seal

Primary attachment

- LH Biceps, GH ligaments

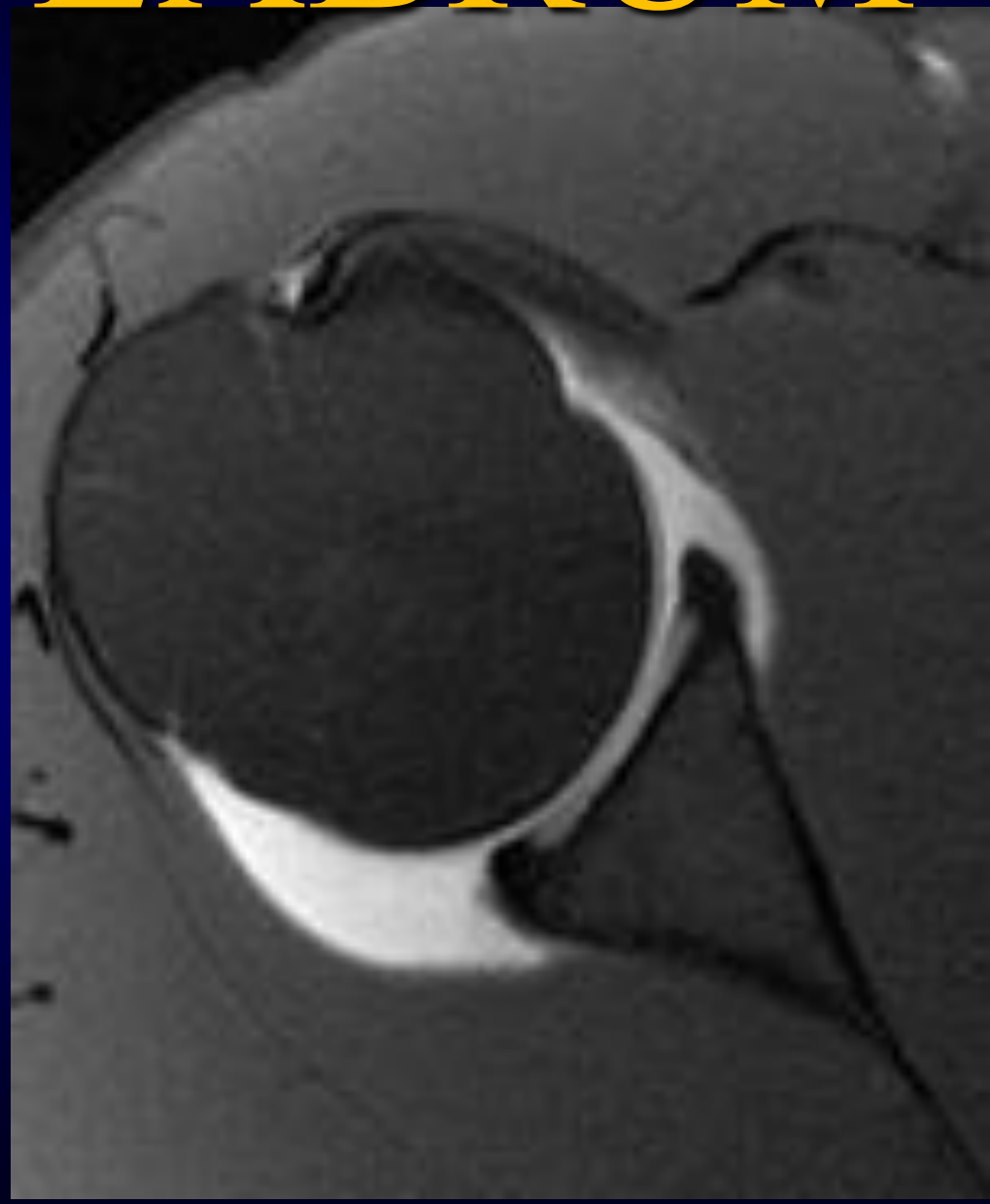
MR IMAGING: LABRUM

Fibrocartilaginous labrum

Usually of low signal on MR sequences

Best evaluated

- MR arthrography



GLENOHUMERAL LIGAMENTS

Critical passive stabilizers GHJ

Condensations joint capsule

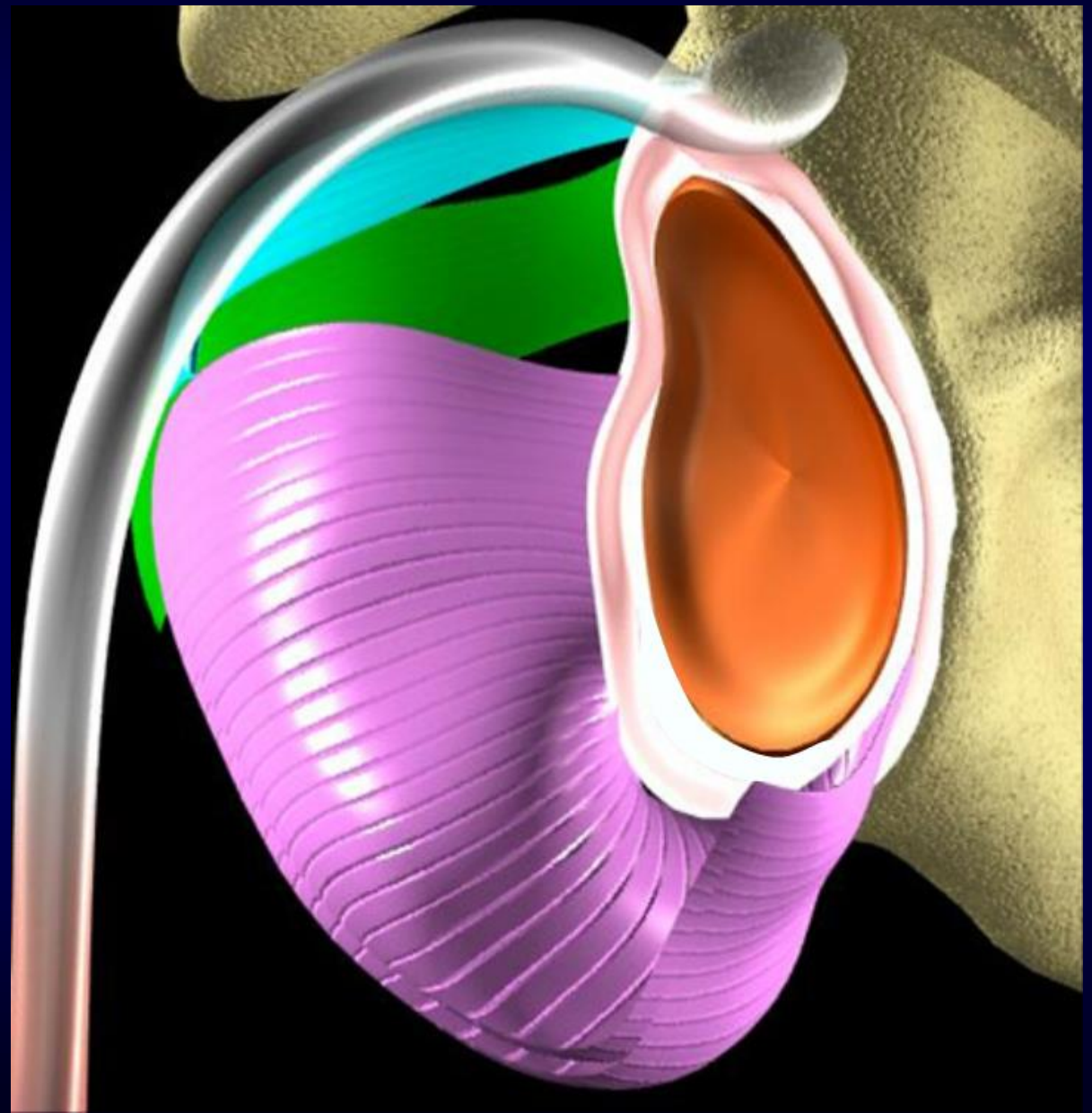
Superior GHL

Middle GHL

- Most variable in size
- Thickened or absent

Inferior GHL

- Ant & Post bands, Axillary recess



INFERIOR GLENOHUMERAL LIGAMENT

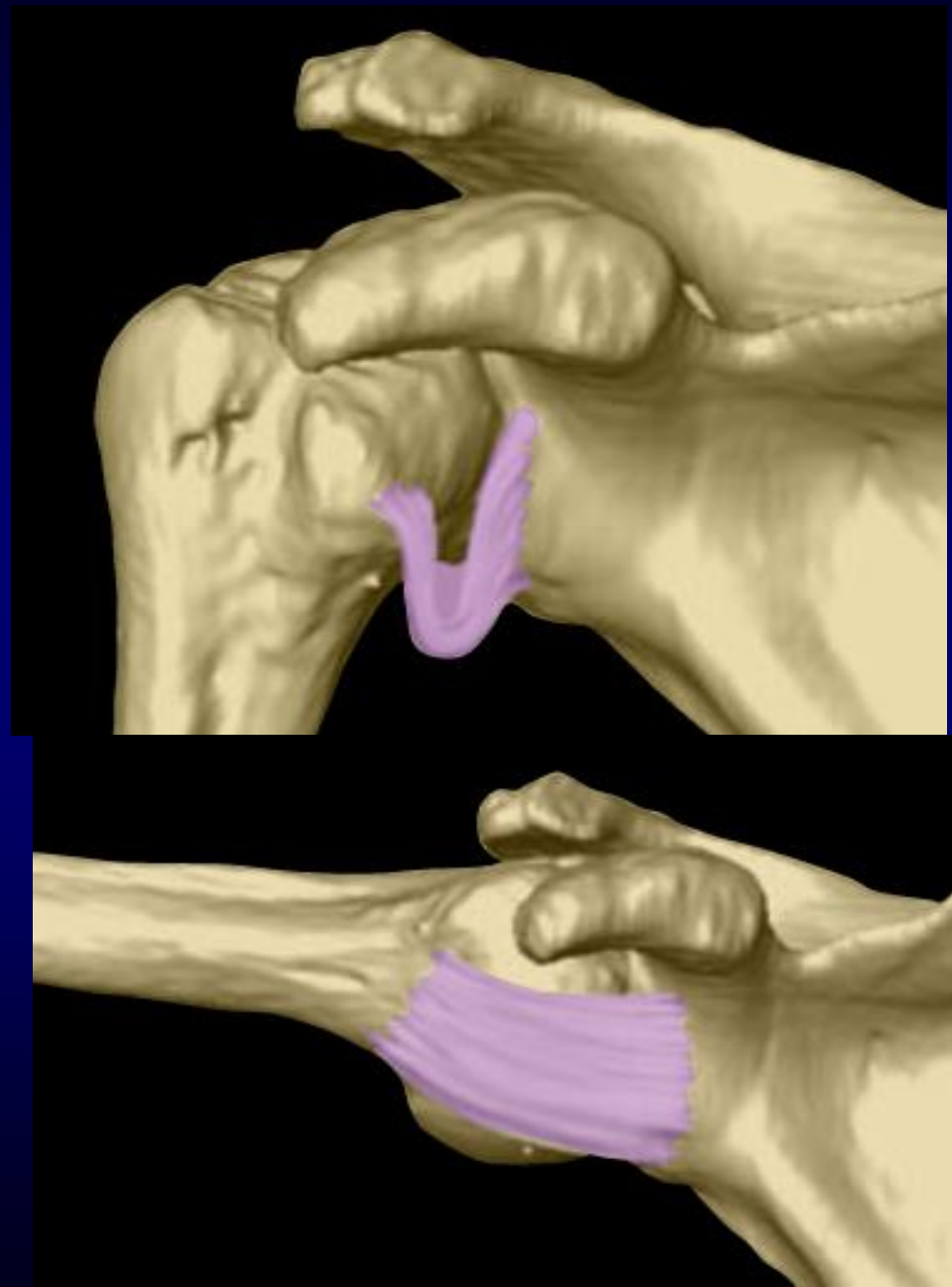
Lax – neutral position

Taught – abduction

"Hammock" humeral head

Major passive stabilizer GHJ

Stability Anterior joint capsule

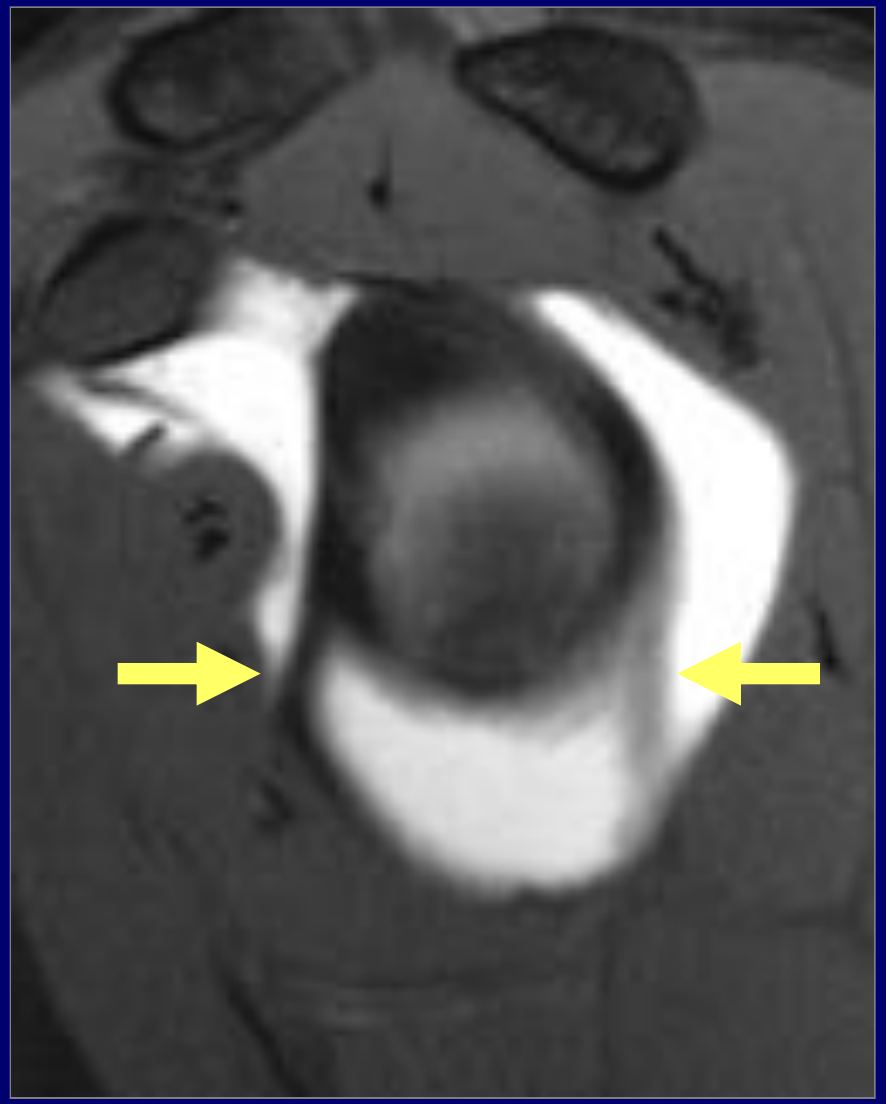


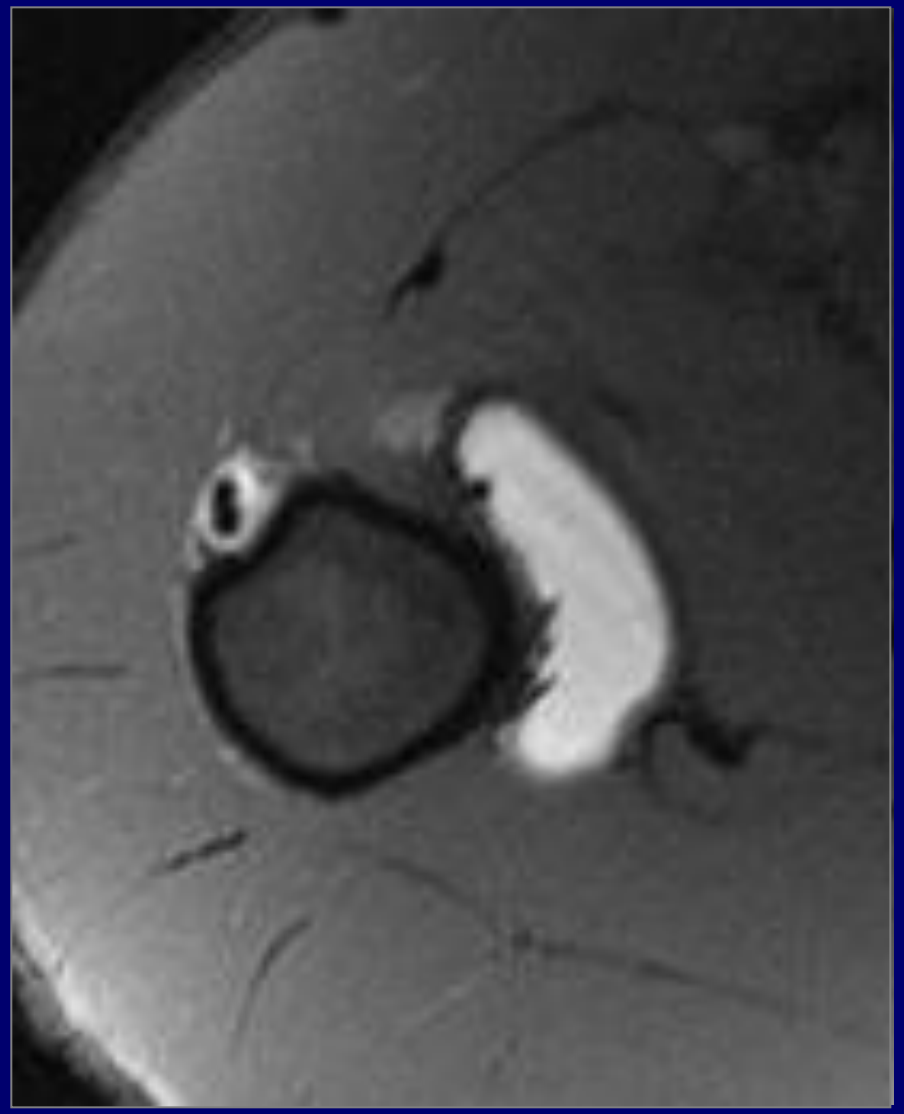
NORMAL GLENOHUMERAL LIGAMENTS

MR - Low signal capsular folds

Best evaluated MR Arthrography

- Axial
- Sagittal oblique





ETIOLOGY SHOULDER INSTABILITY

Traumatic (TUBS) — Microtraumatic — Atraumatic (AMBRI)

Unidirectional — Multidirectional

Less laxity — More laxity

Rationale MR Imaging - Define anatomic lesion(s)
- Cause instability, Result of instability

TYPES OF INSTABILITY

TUBS

Traumatic

Unidirectional

Bankart

Surgery for treatment

AMBRI

Atraumatic

Multidirectional

Bilateral

Rehab

Inferior capsular shift

UNIDIRECTIONAL ANTERIOR SHOULDER INSTABILITY

- Usually related to traumatic dislocation
- Represents 95%-97% of all shoulder dislocations
- Mechanism: classically - abduction with external rotation

ANTERIOR DISLOCATION

Injury Osseous + Soft Tissue restraints

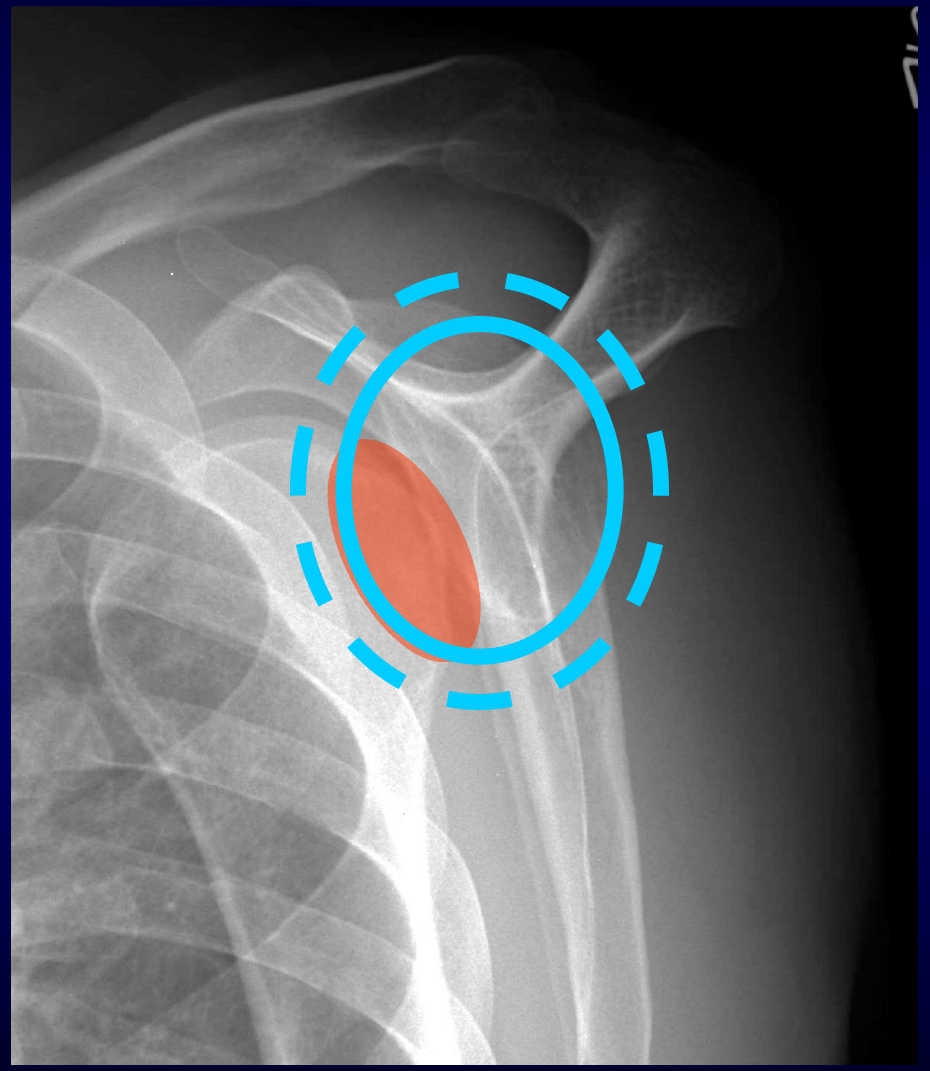
Posterior superior

- Humeral Hill Sachs lesion
- RTC contusion/tear

Anterior Inferior

- Fracture Glenoid rim (osseous Bankart)
- Labrocapsular injuries

  - Detachments from glenoid



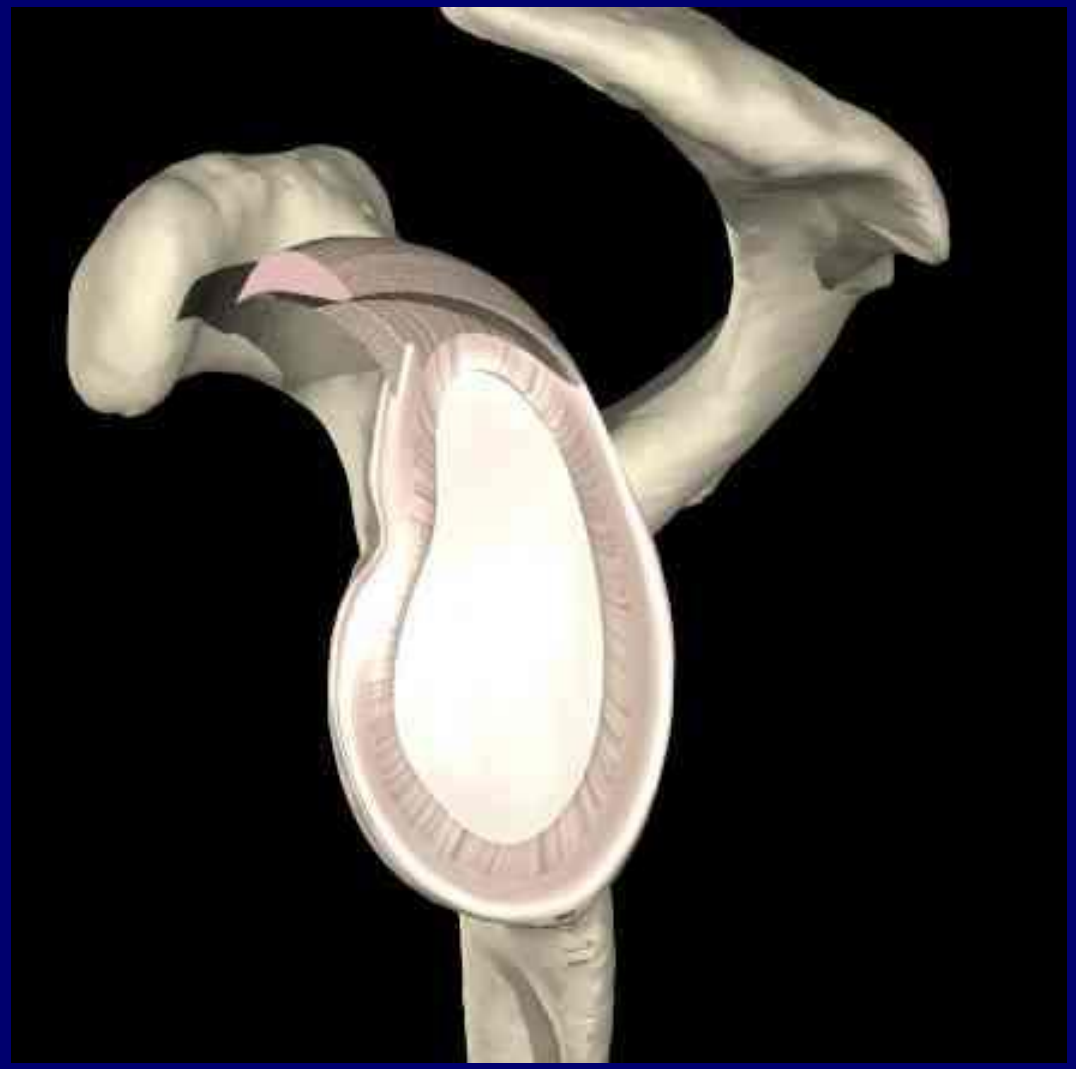
MANAGEMENT PERSPECTIVE INFORMATION CRITICAL TO SURGEON

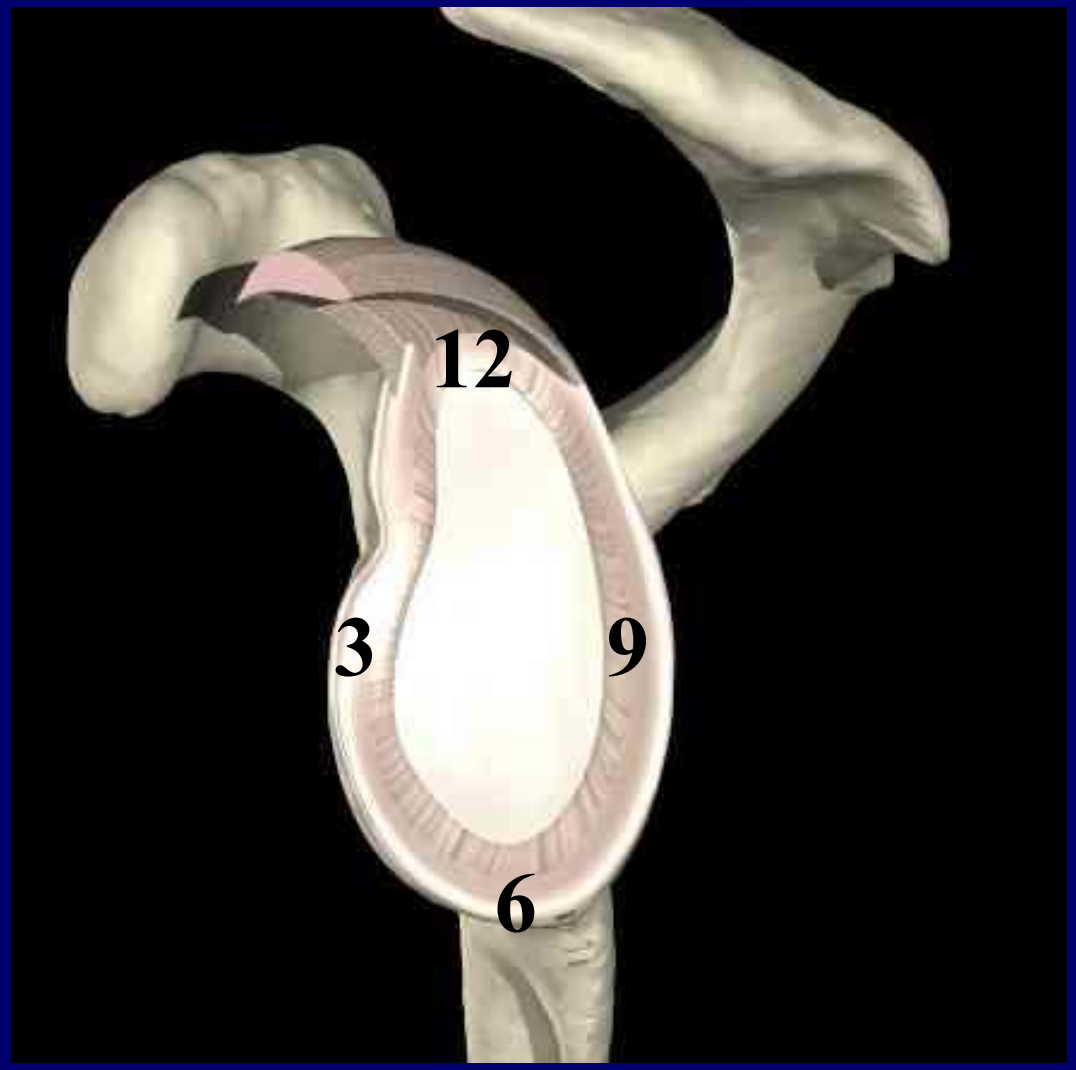
Labral tearing - Extent/Pattern

Capsular glenohumeral ligament lesion (HAGL)

Rotator cuff lesion

Osseous deficiency

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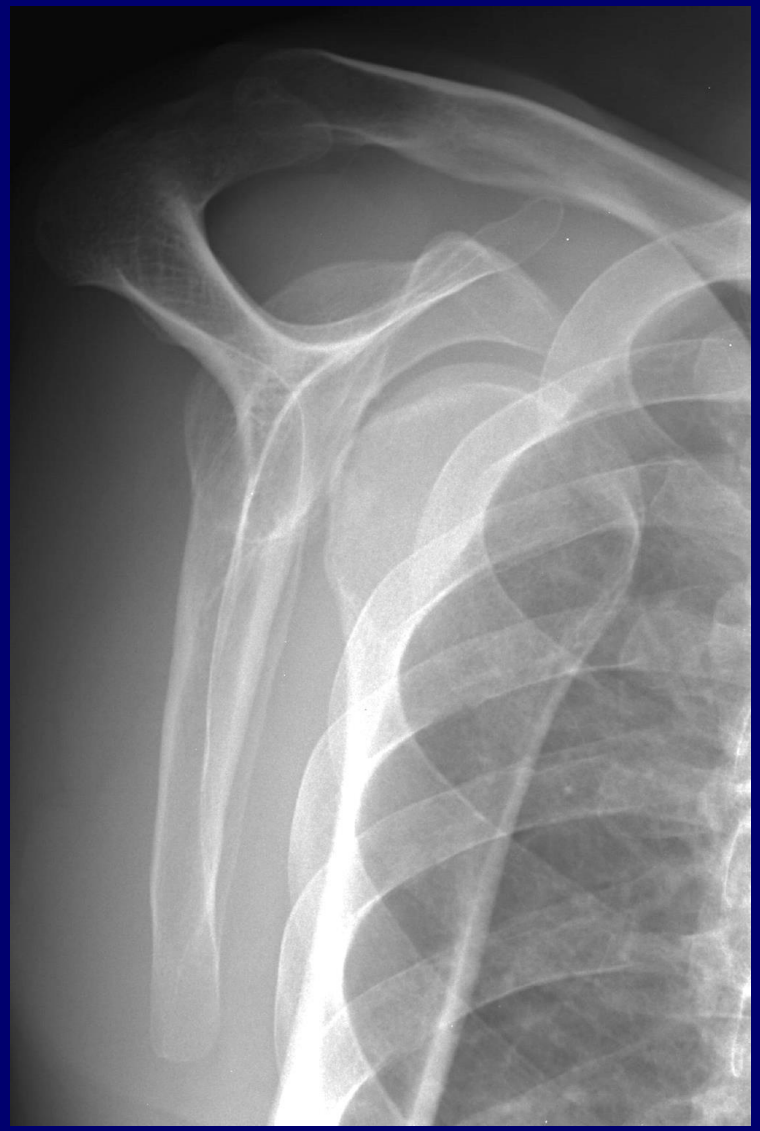
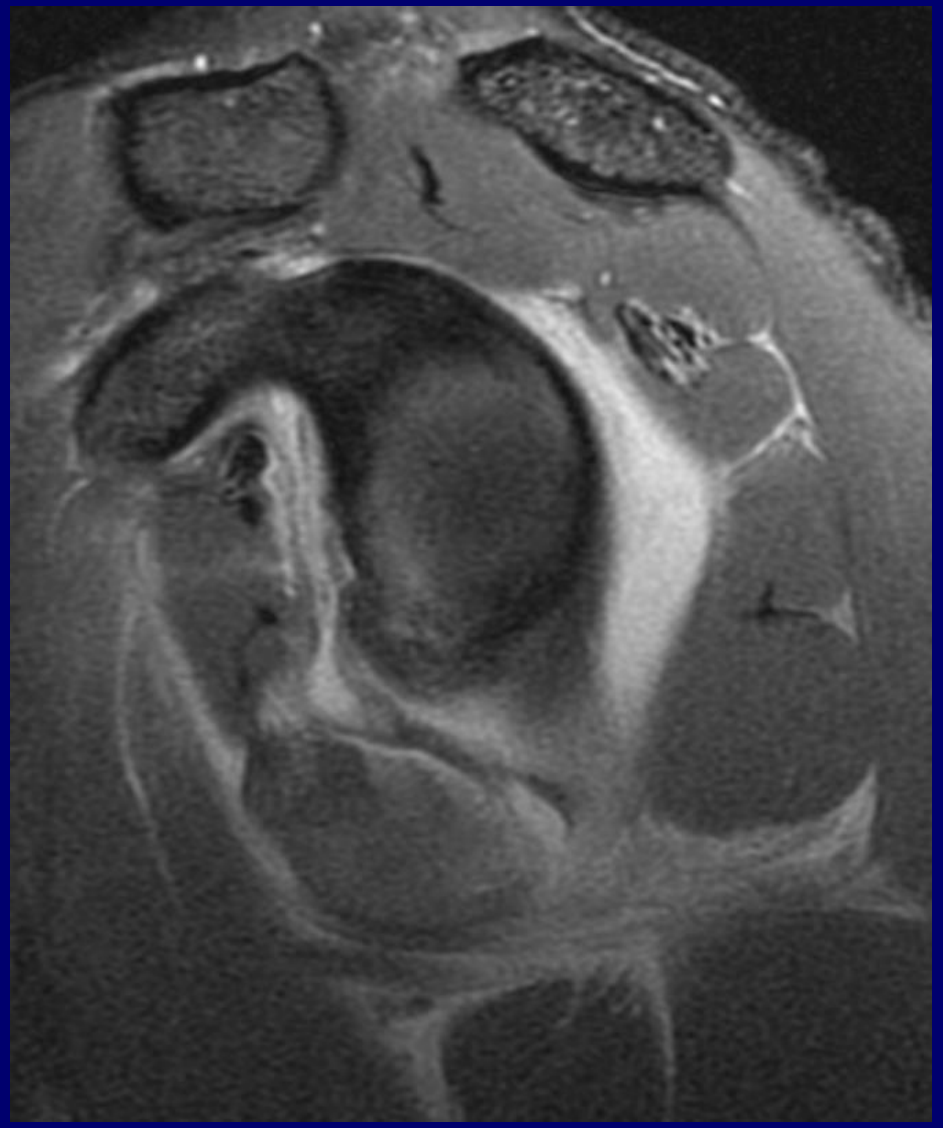
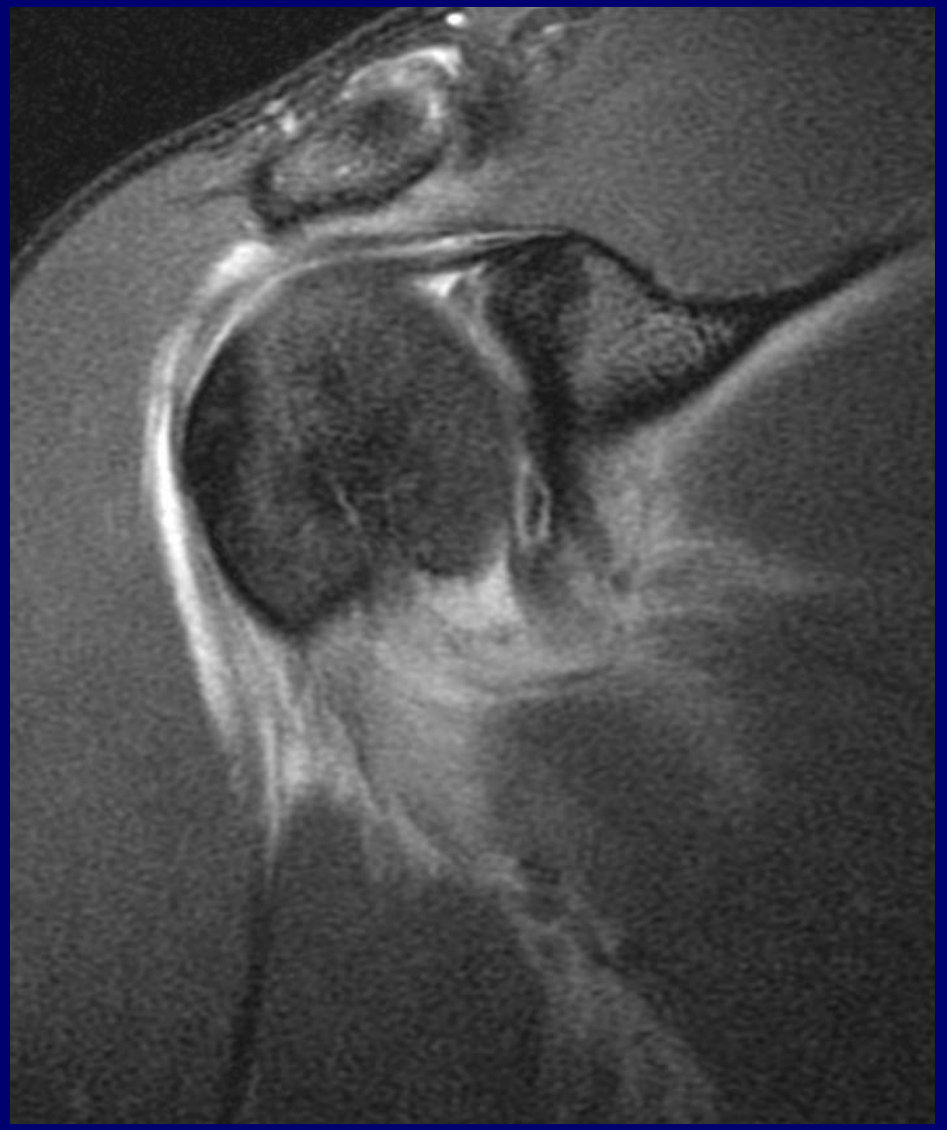
ANTERIOR DISLOCATION



Anterior Dislocation – Bankart Lesion





ANTERIOR DISLOCATION – BANKART LESION

LABROCAPSULAR INJURIES – ANTERIOR DISLOCATION

Avulsive stress - AIGHL

Tearing Anterior/Inferior labrum

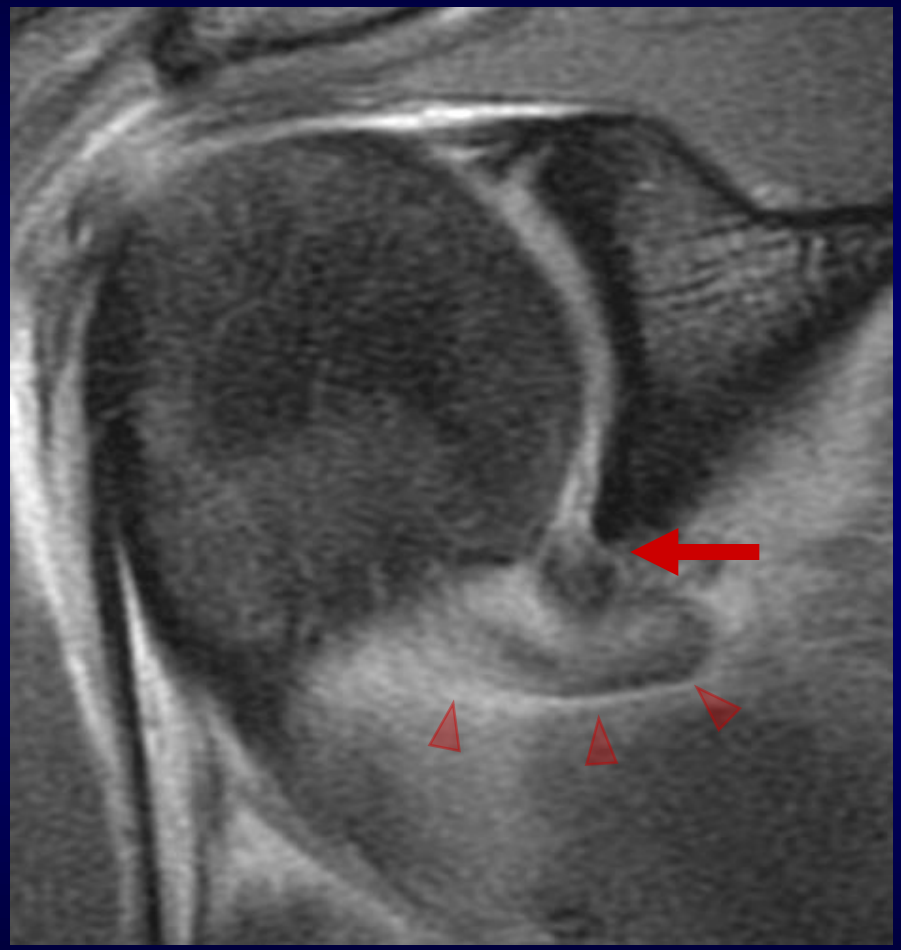
- Weak link

→ Classic ‘Bankart’ lesion

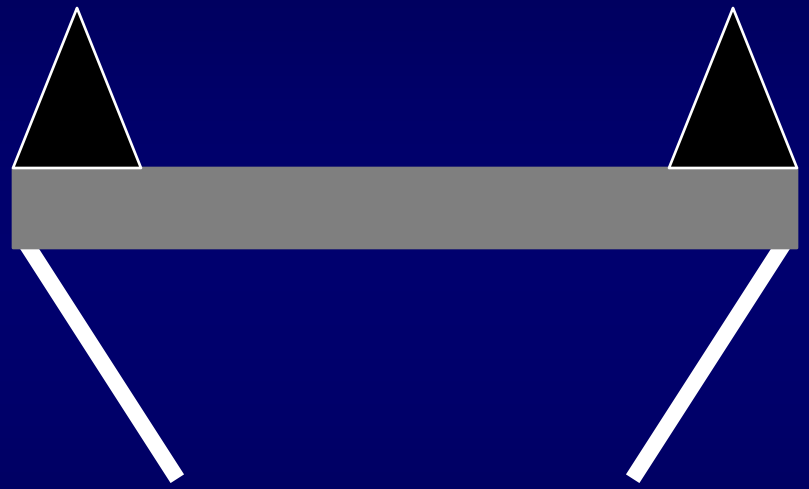
Variants

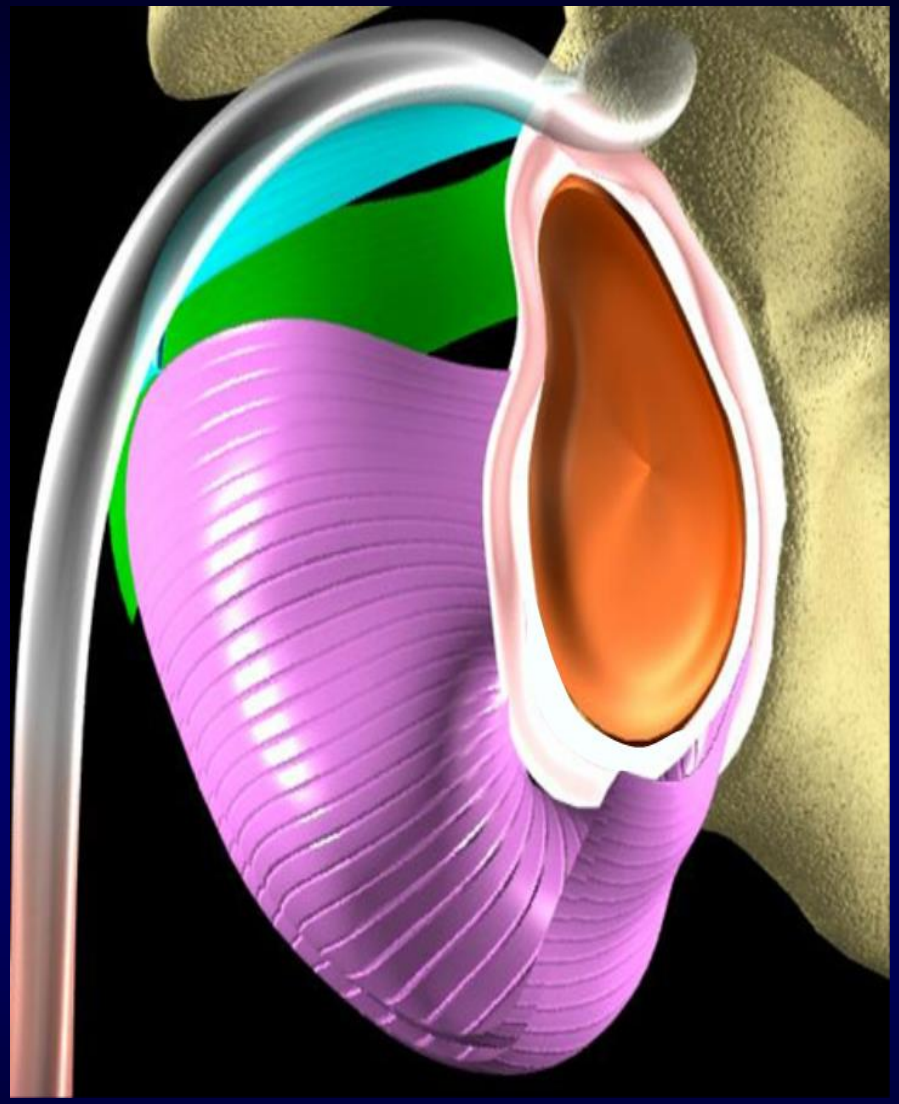
Perthes

ALPSA

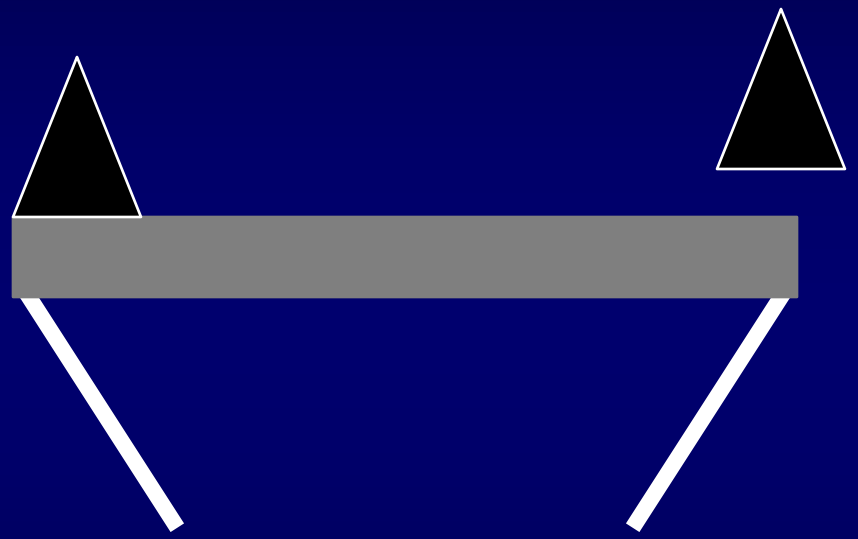


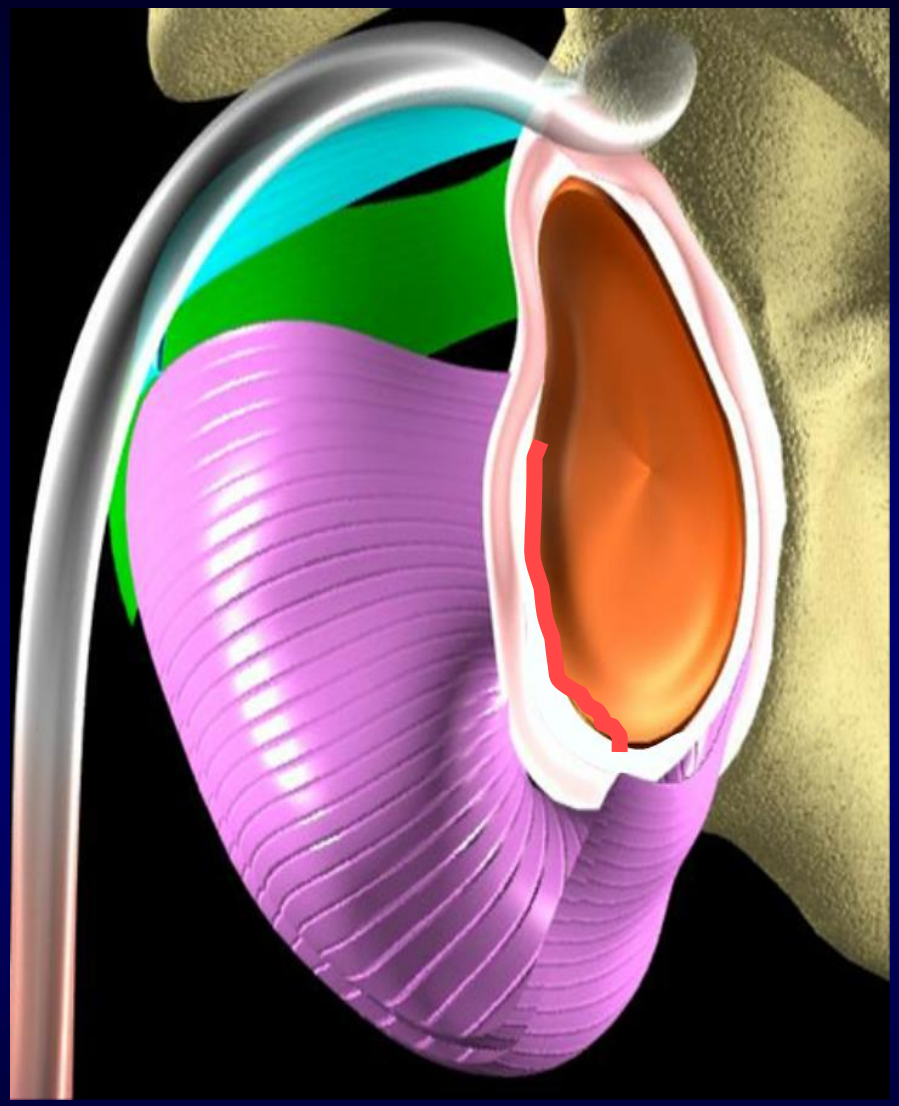
* Potential implications clinical management



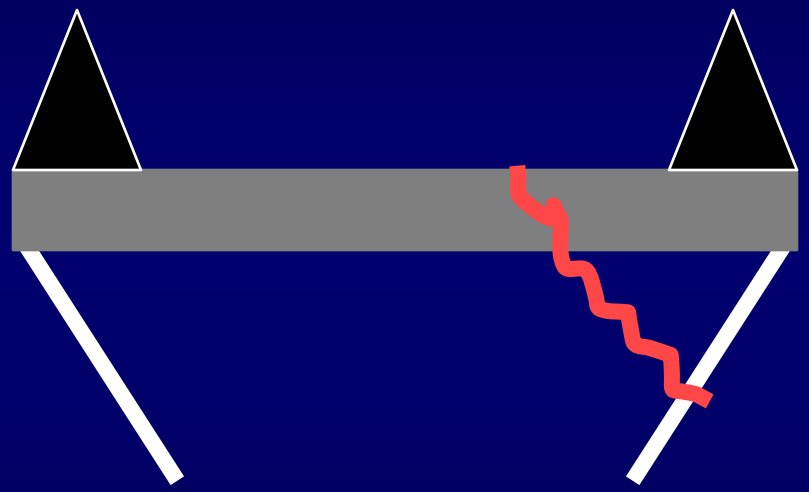


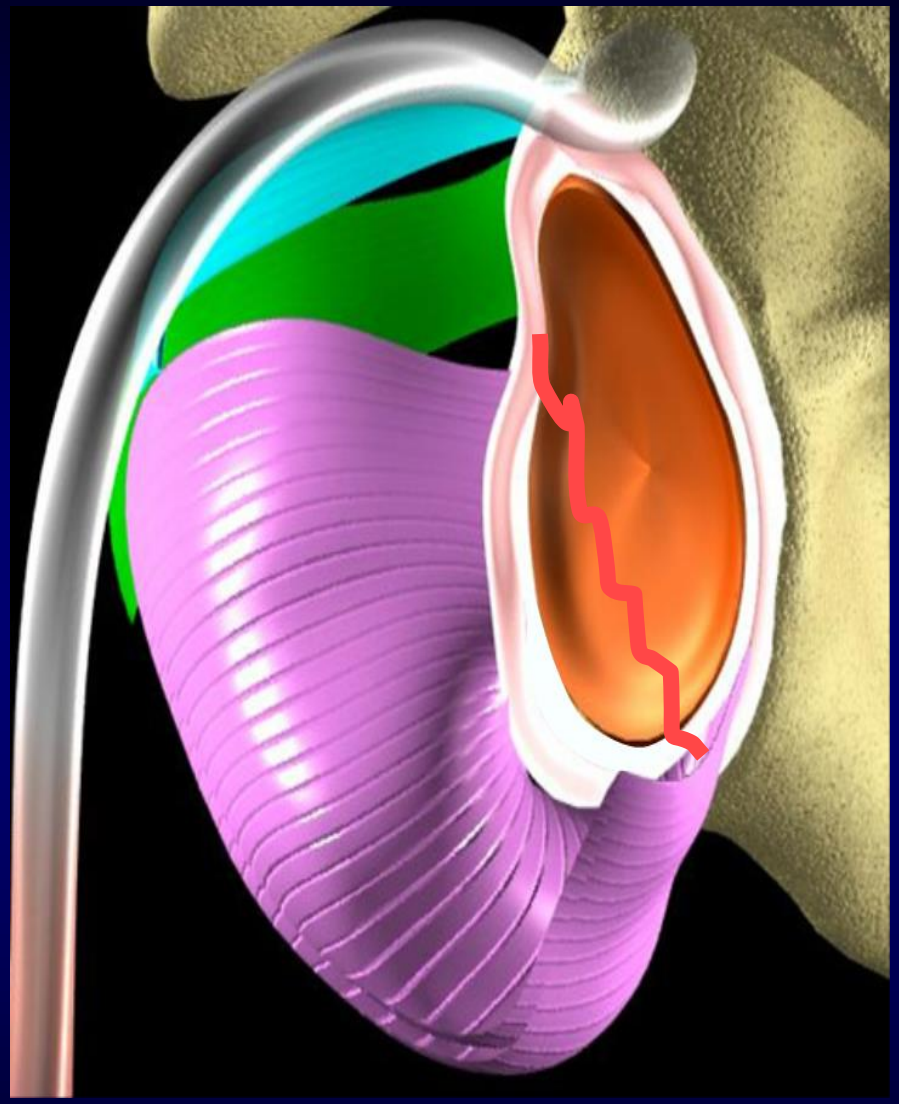
FIBROCARTILAGINOUS BANKART



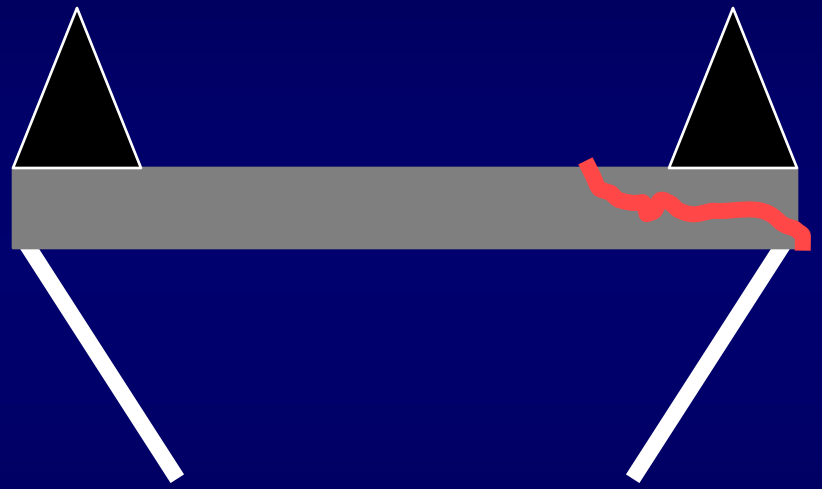


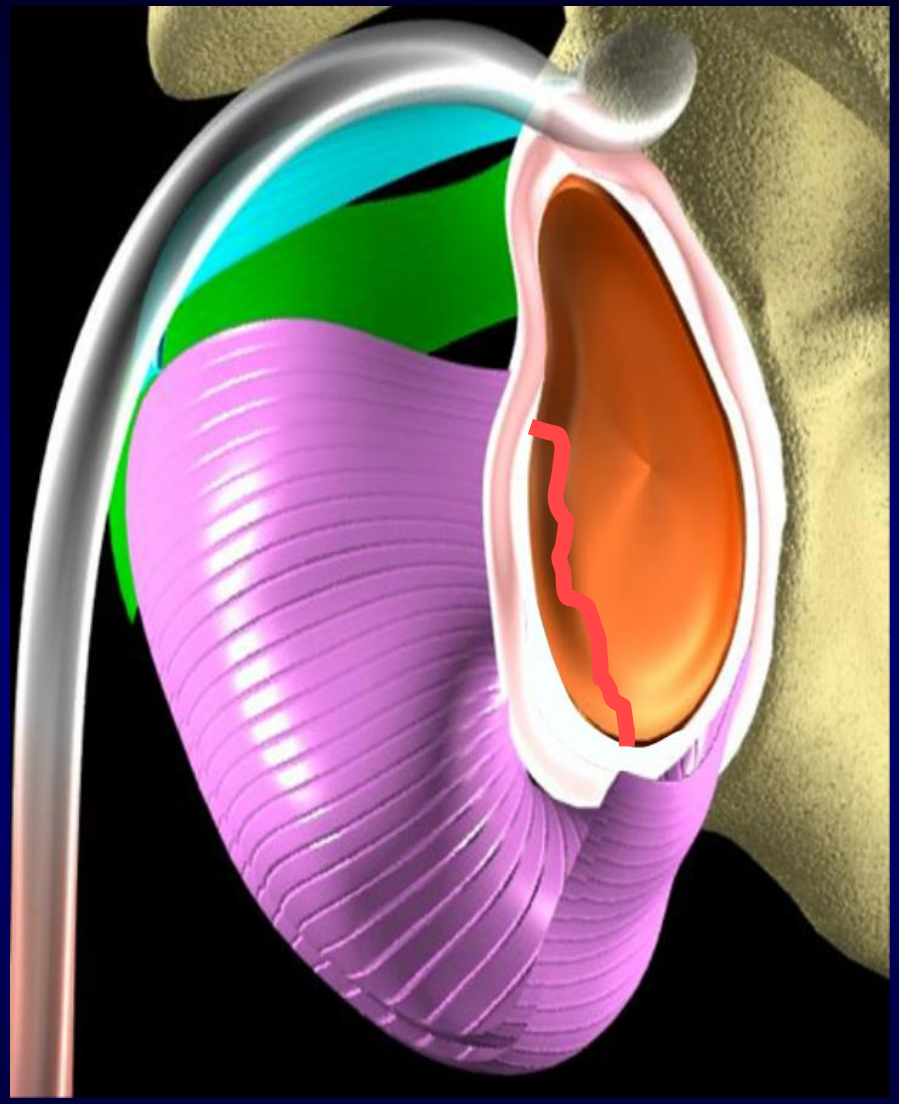
OSSEOUS BANKART





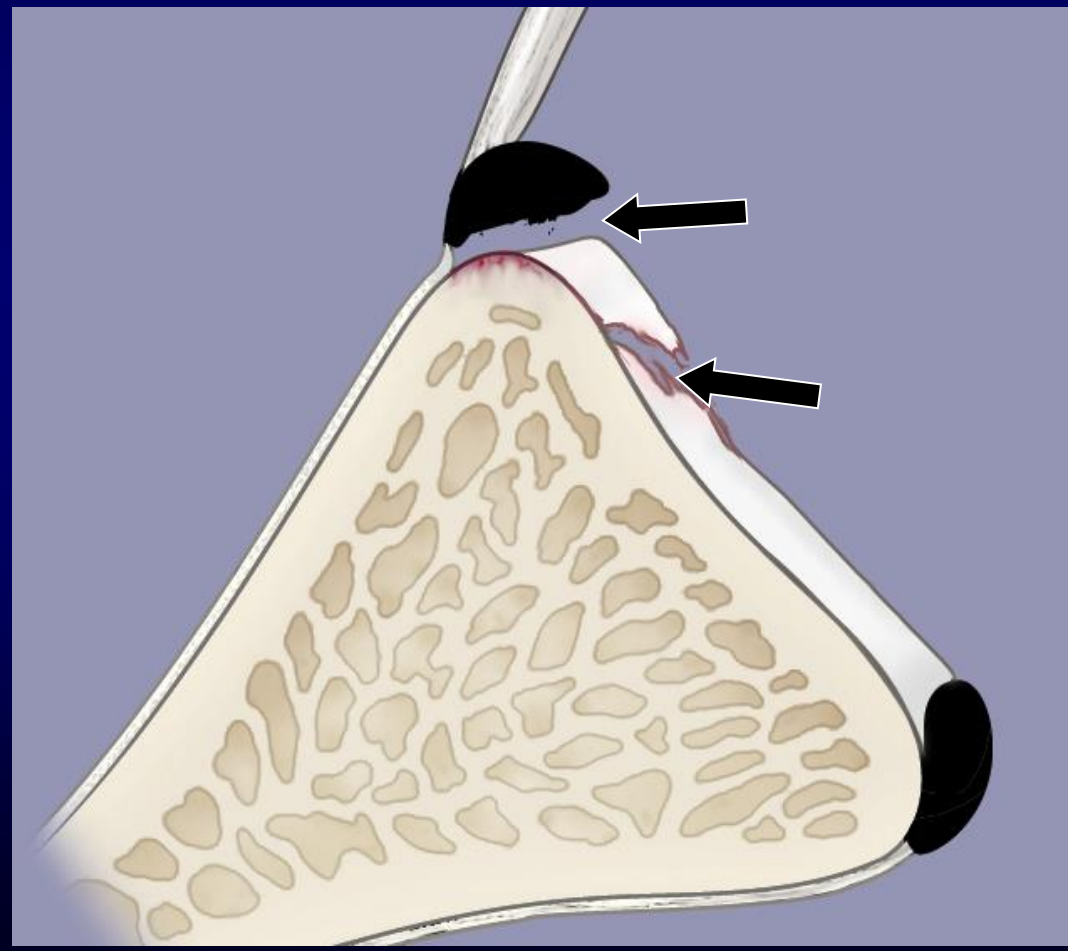
GLAD
GLENOID LABRAL ARTICULAR DISRUPTION



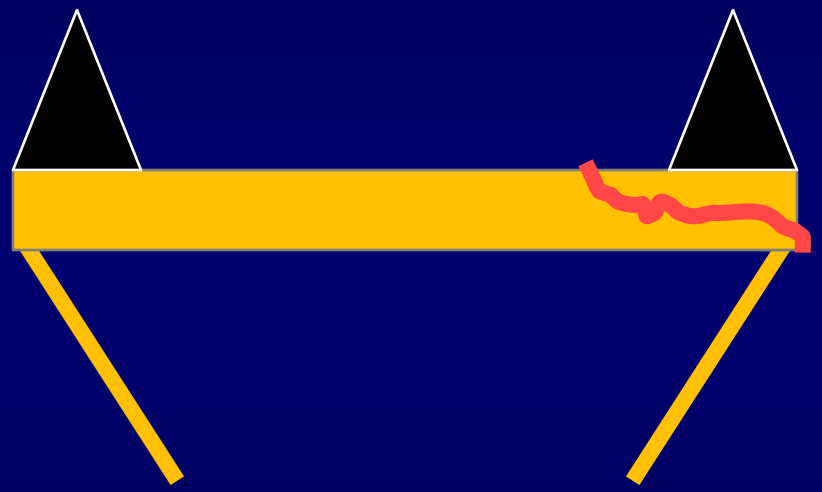


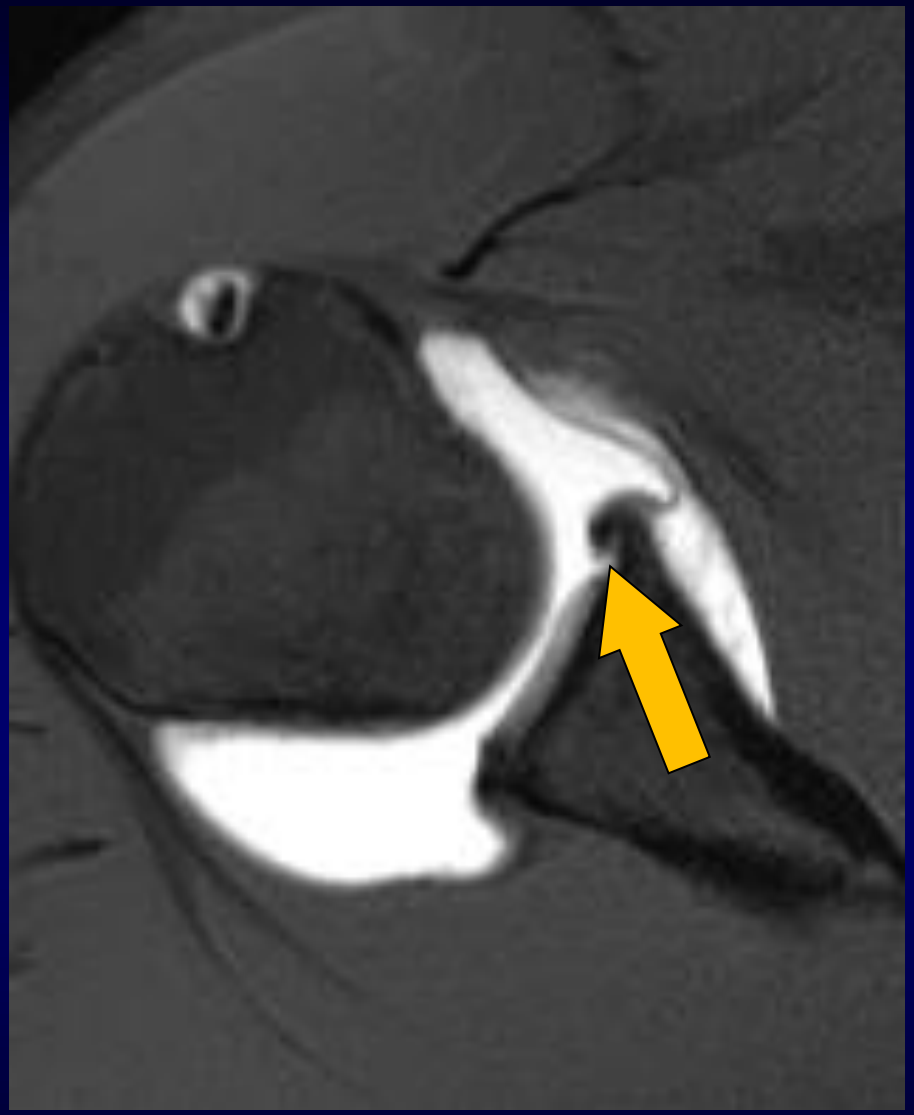
GLAD LESION

- Glenolabral Articular Disruption
- Forced adduction injury (humeral head impacts the glenoid fossa)
- Clinically a stable lesion
- Partial tear anteroinferior labrum/articular, cartilage injury

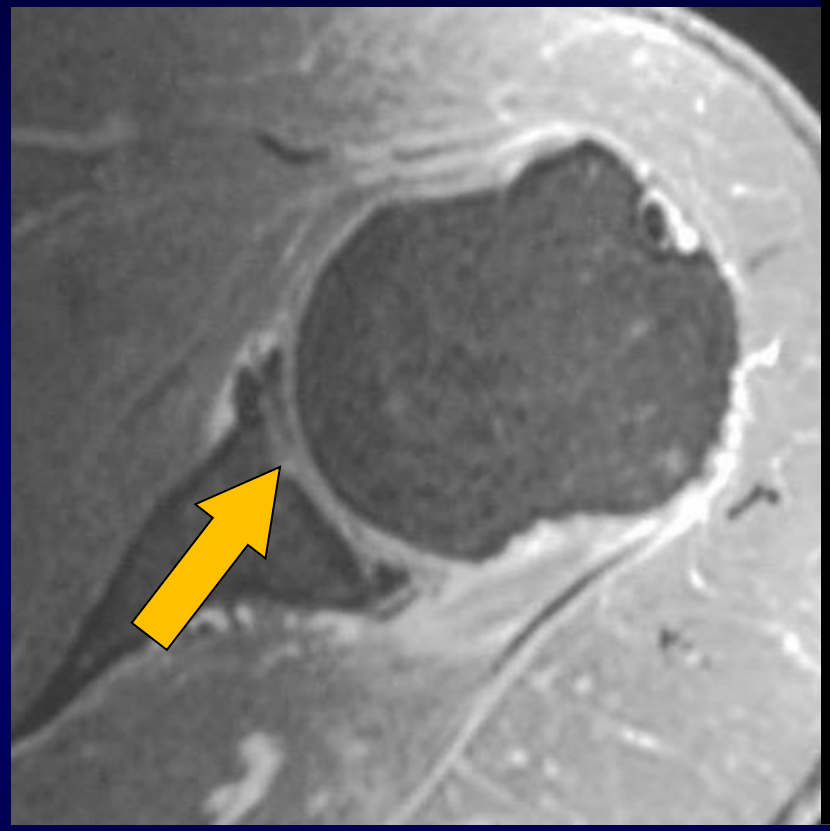


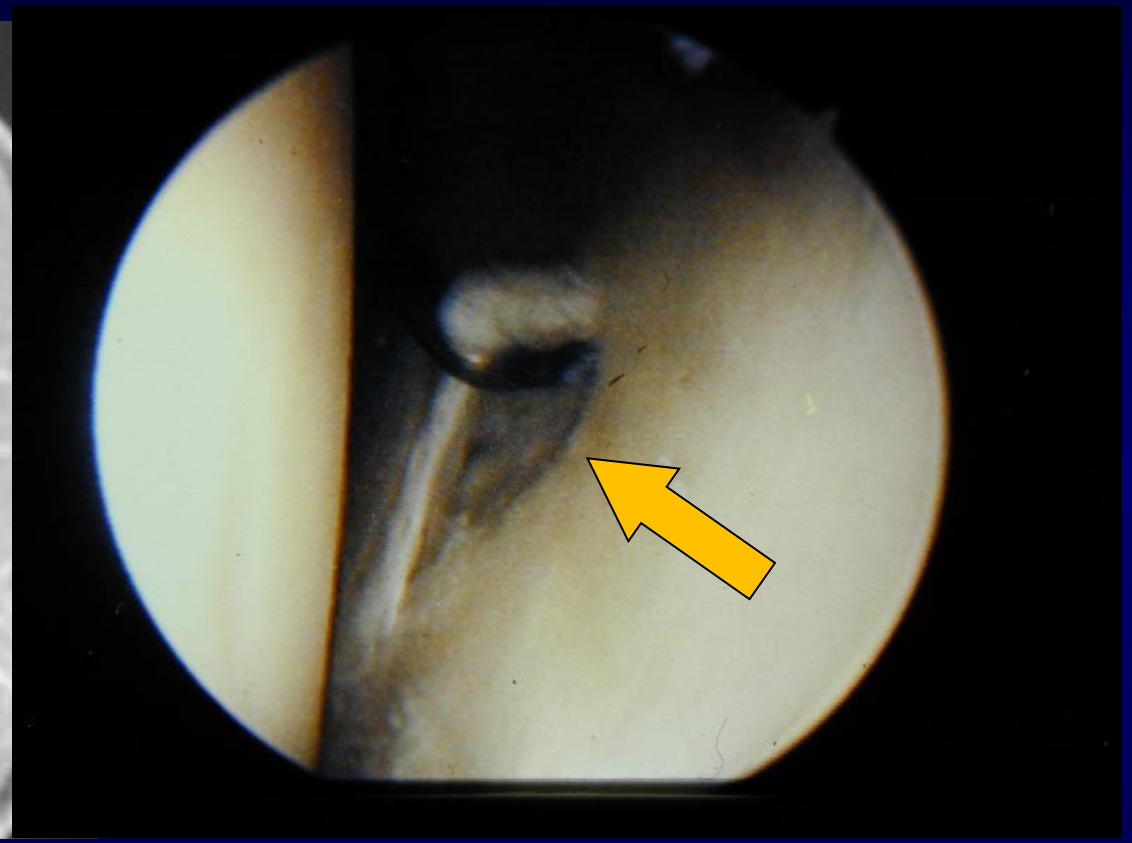
GLAD



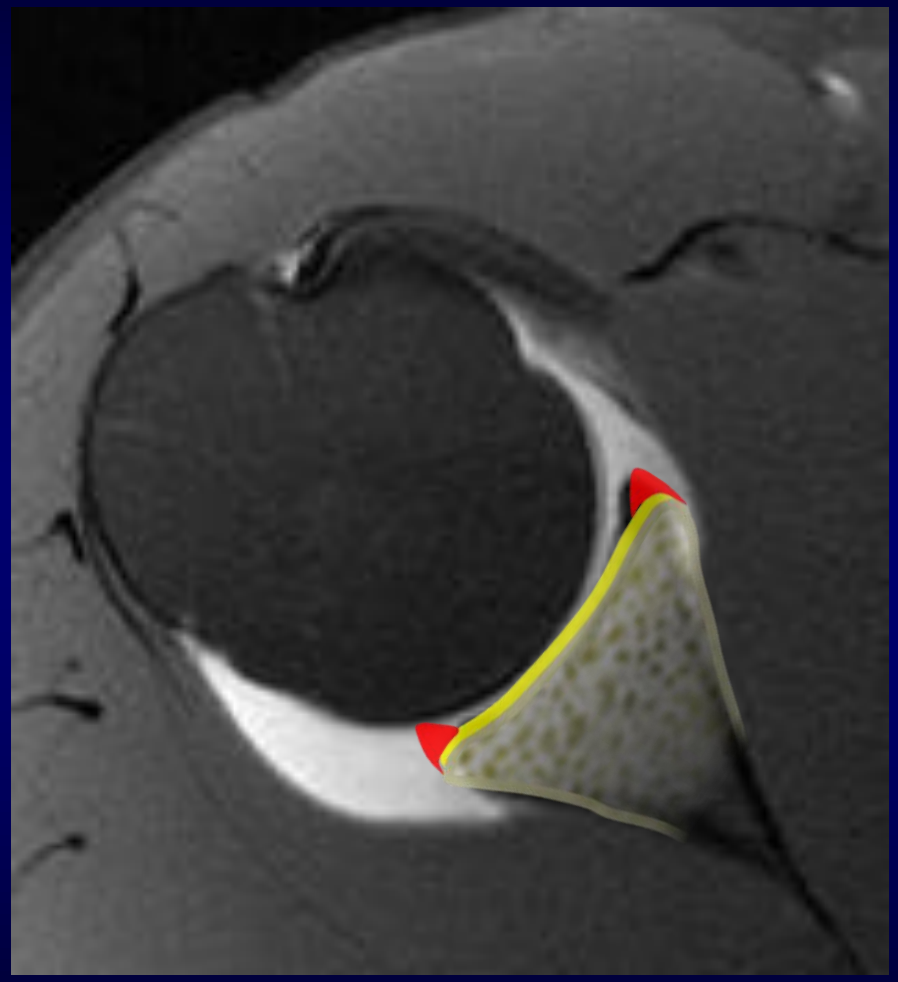


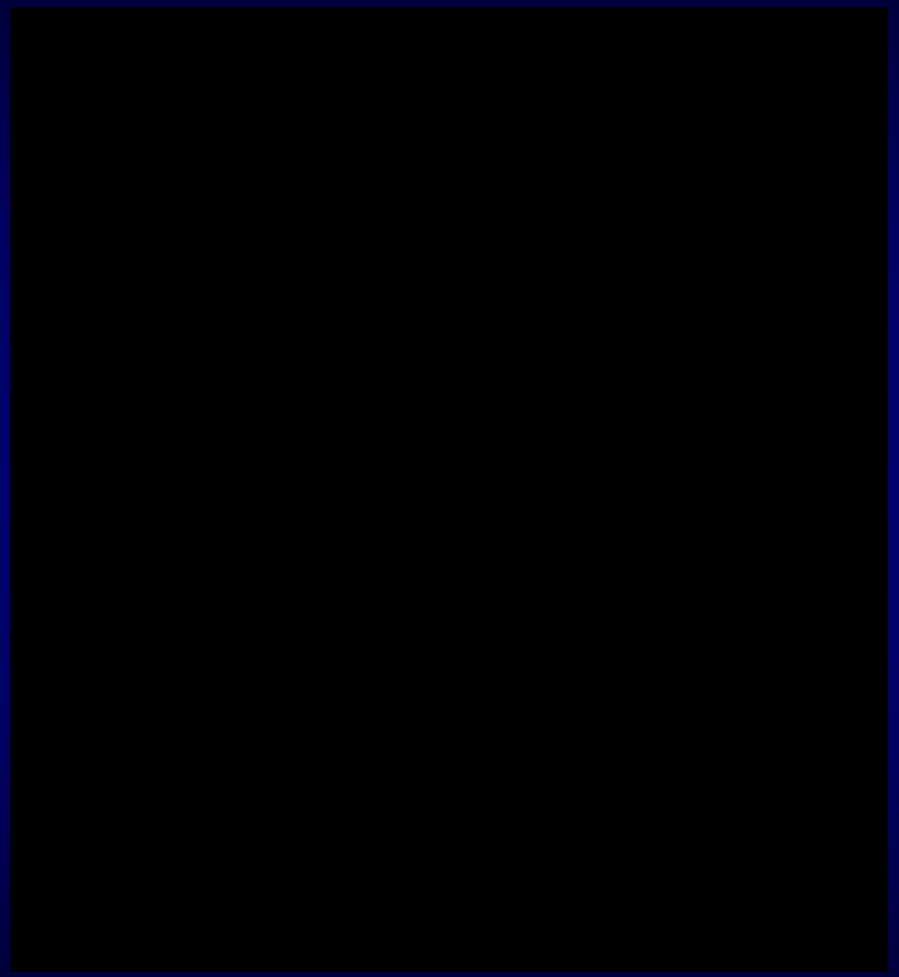
GLAD LESION





LABRAL CAPSULAR ABNORMALITIES

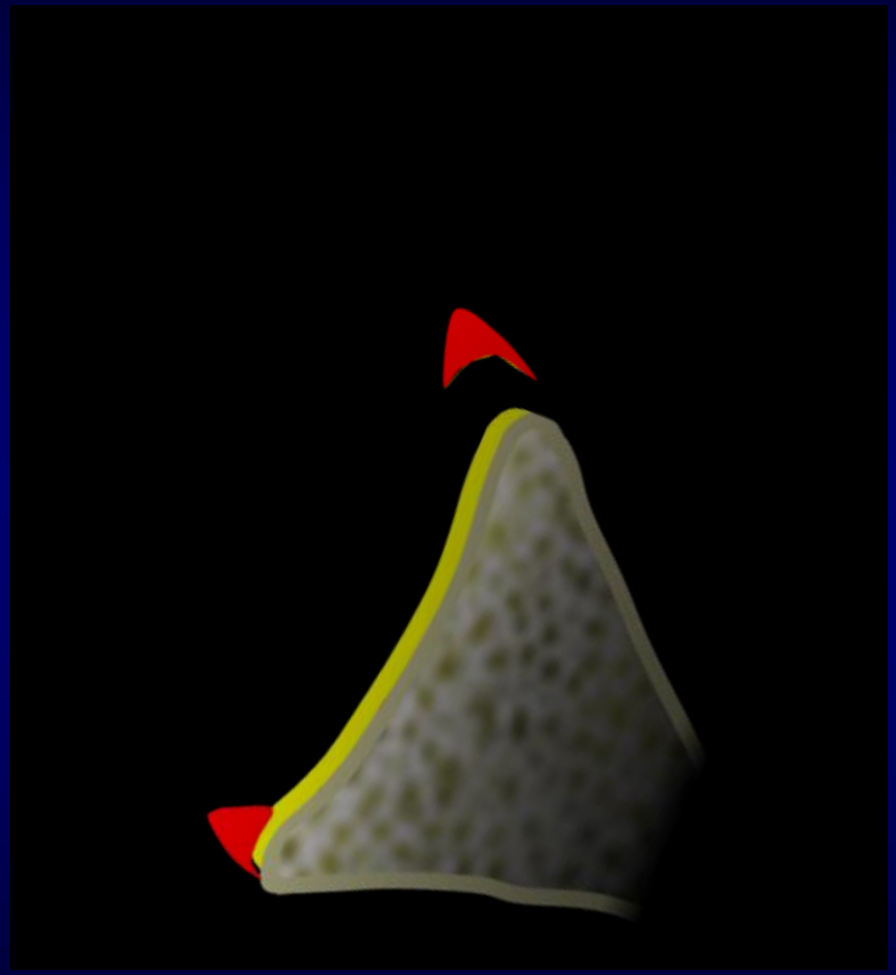


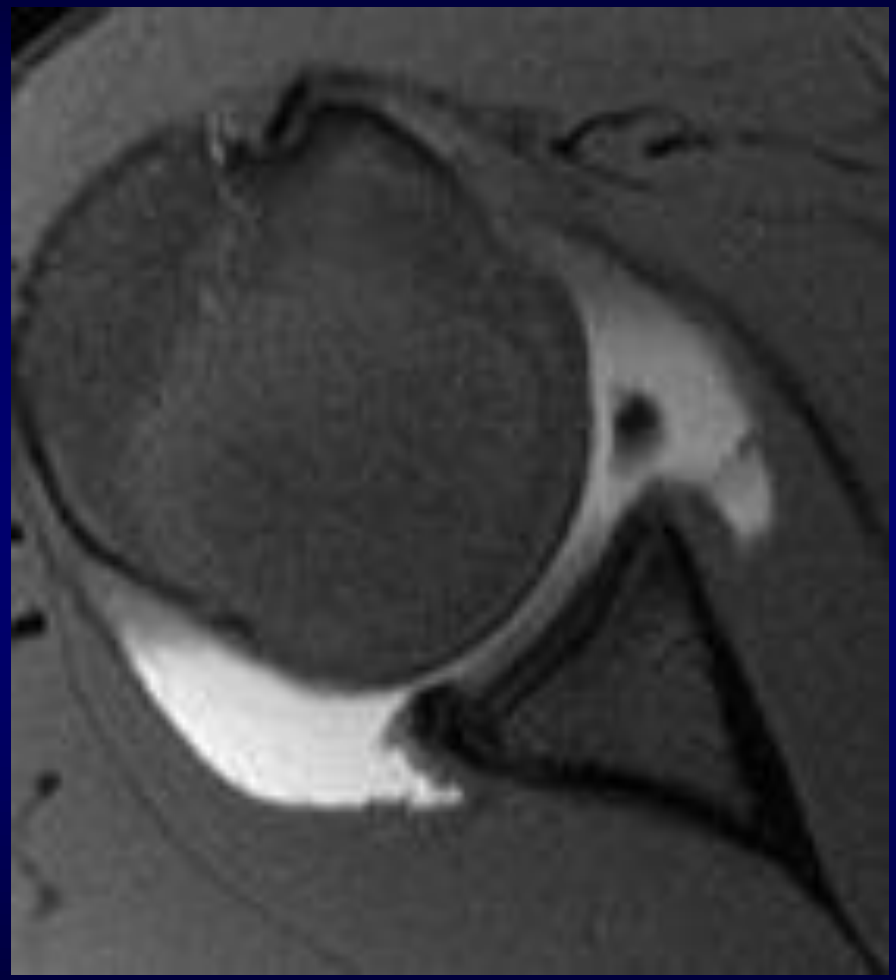


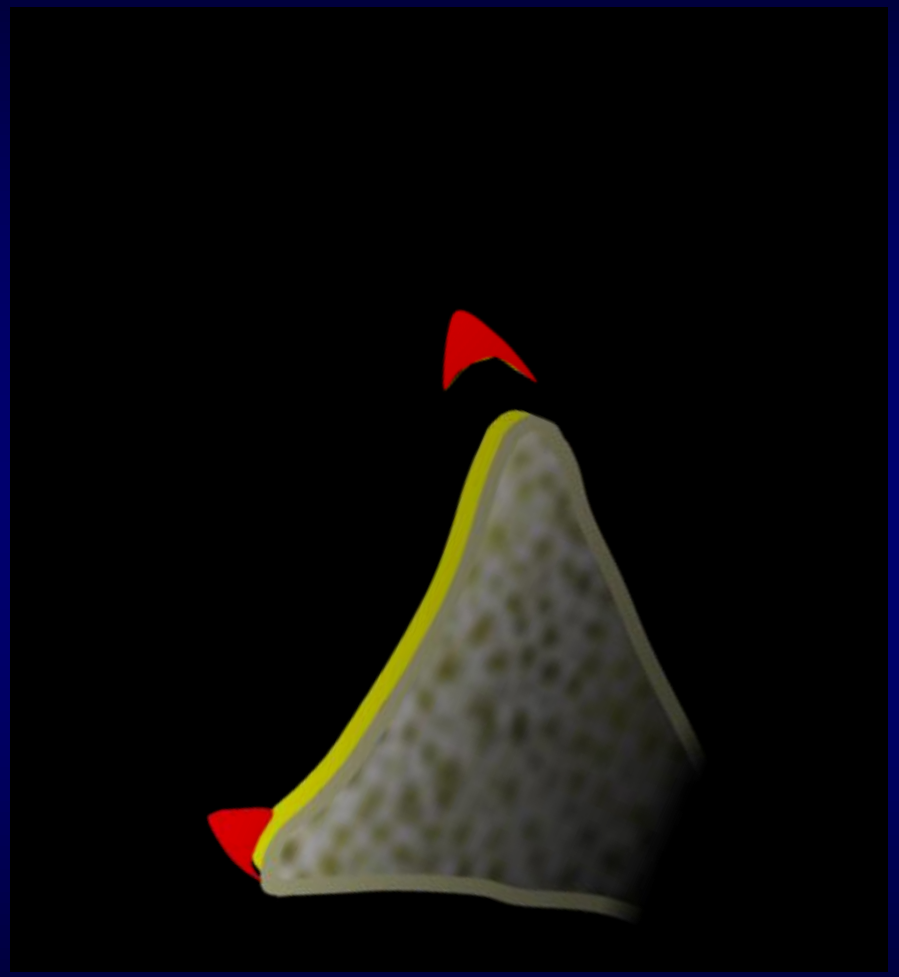
CLASSIC BANKART LESION

- Avulsion of labrum from osseous glenoid
- Periosteal attachment torn

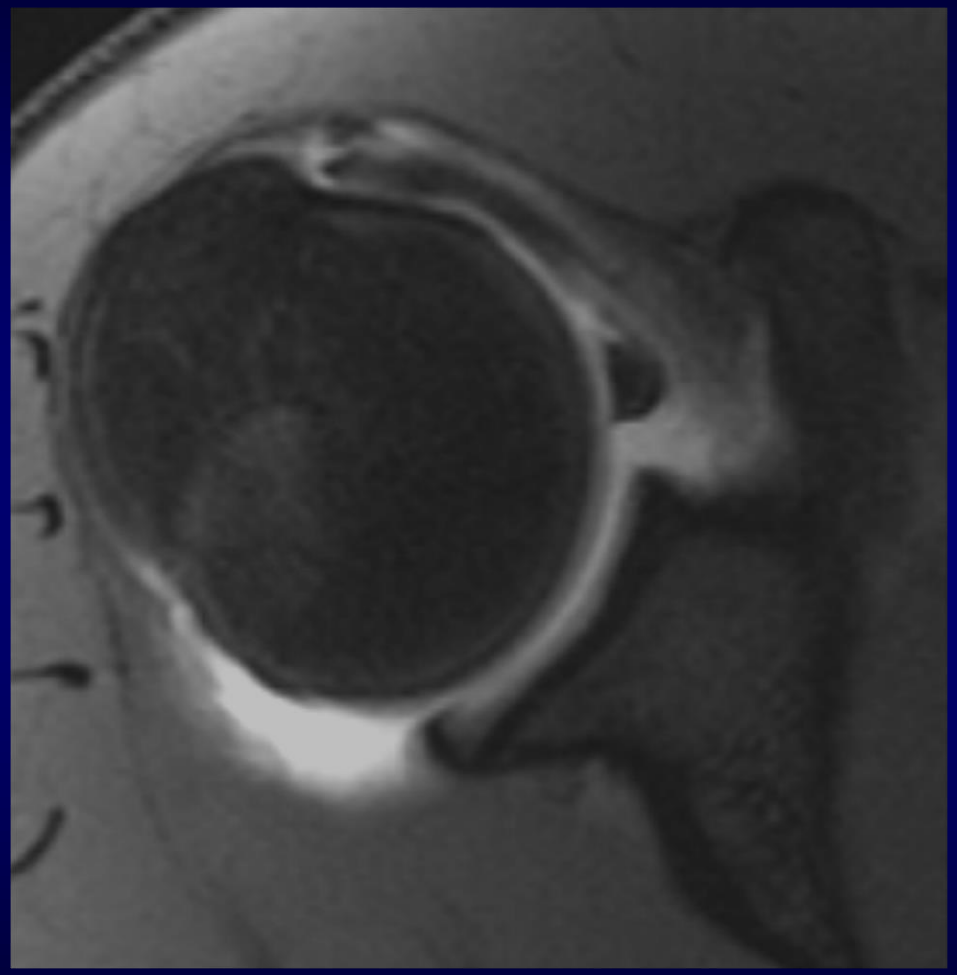
  * Distinguishing feature from others

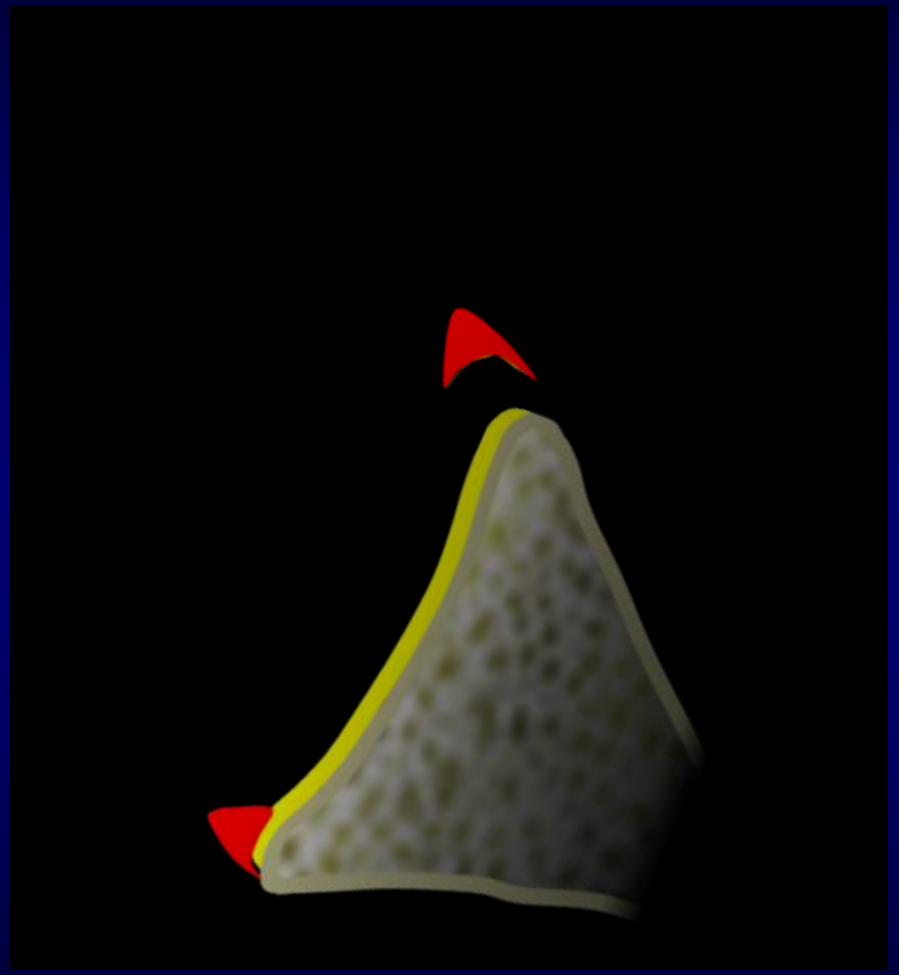




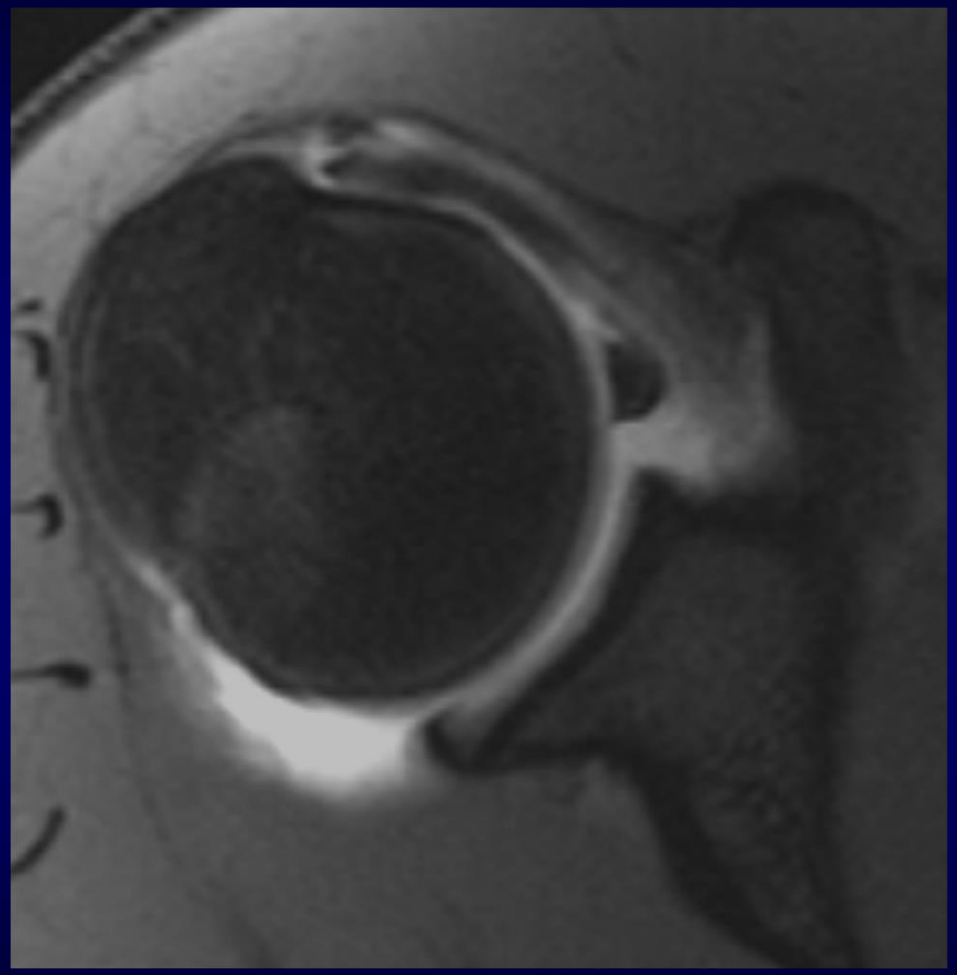


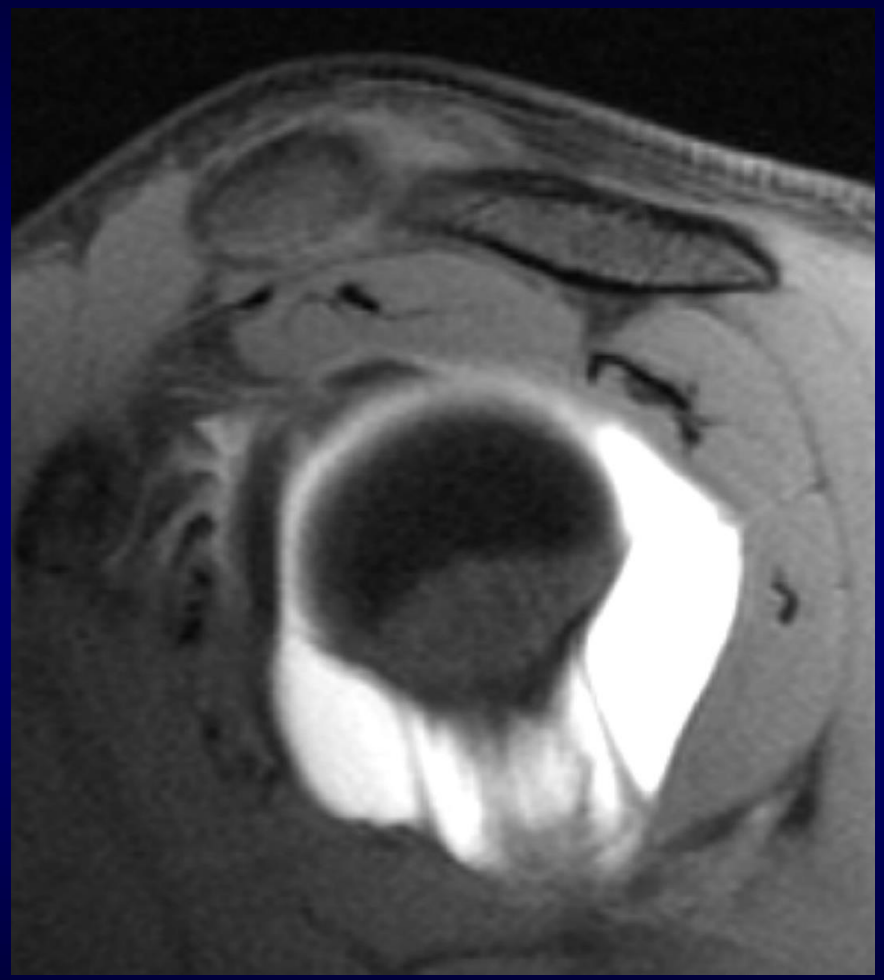
PITFALL - BUFORD COMPLEX

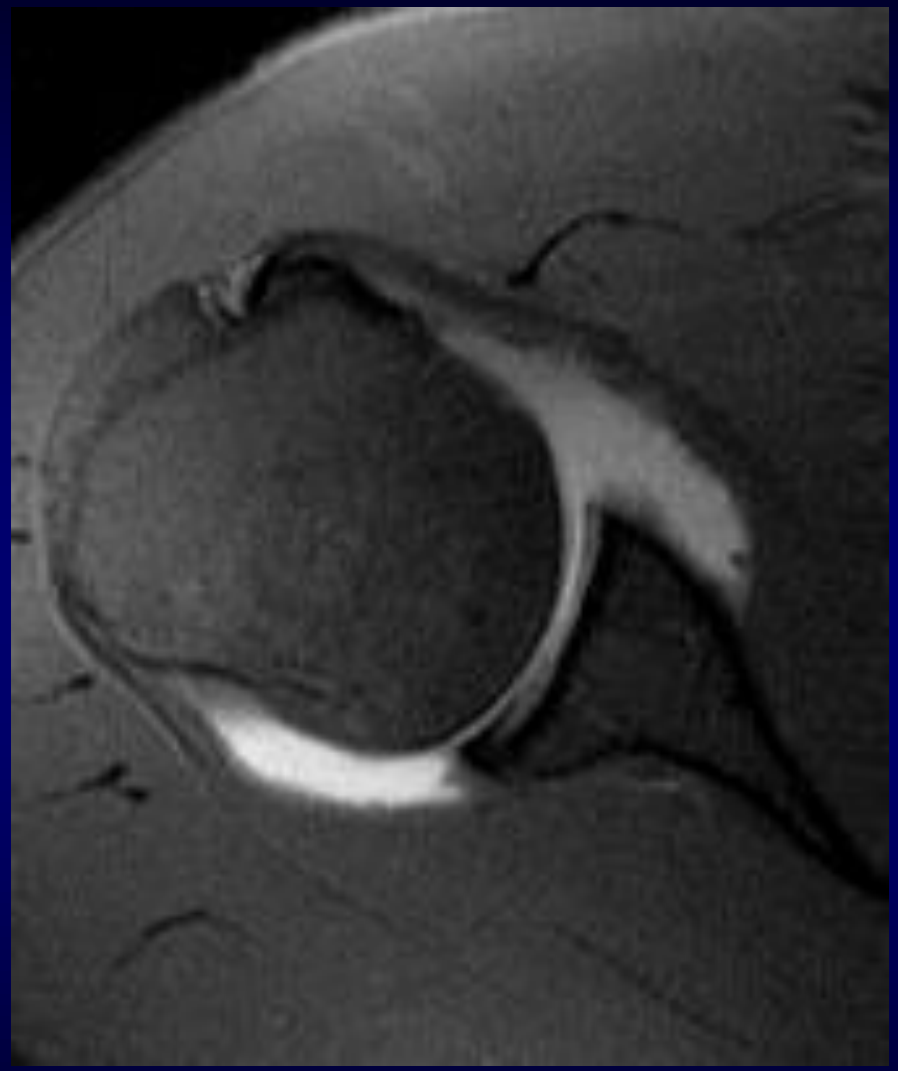


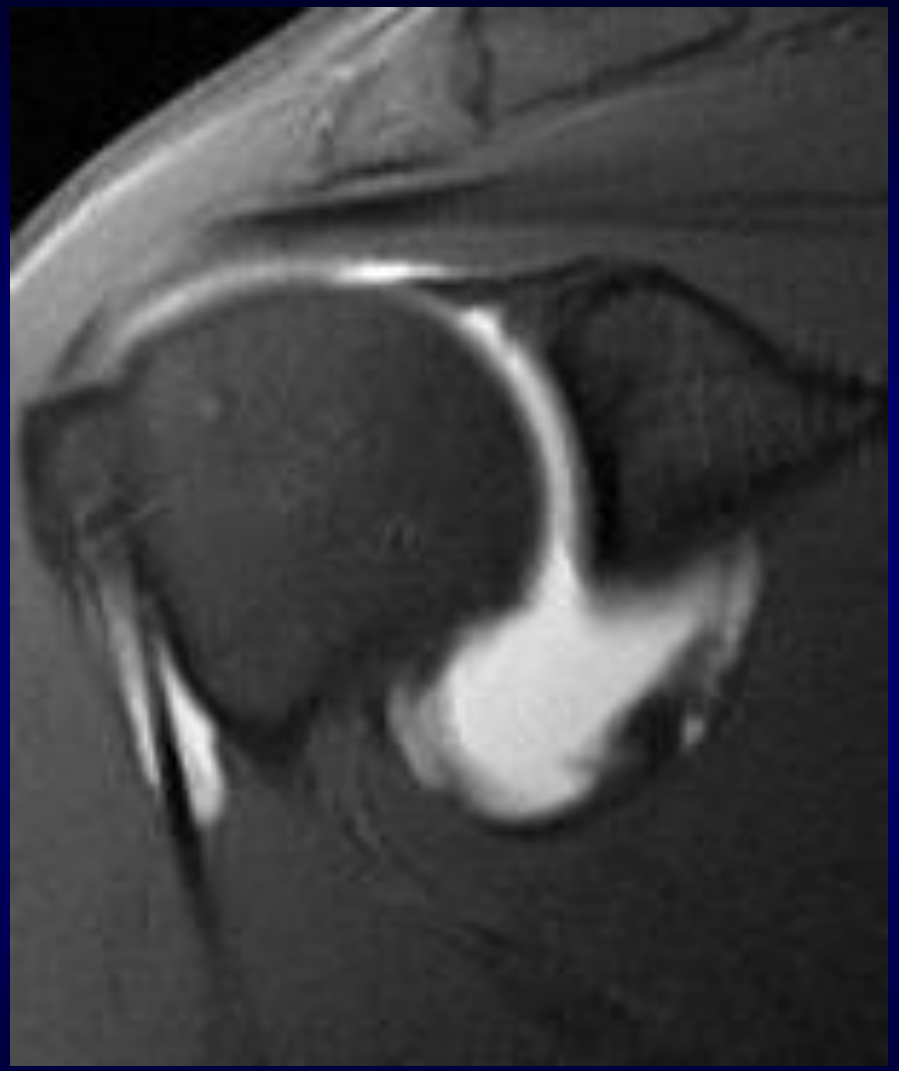


PITFALL - BUFORD COMPLEX









BANKART LESION

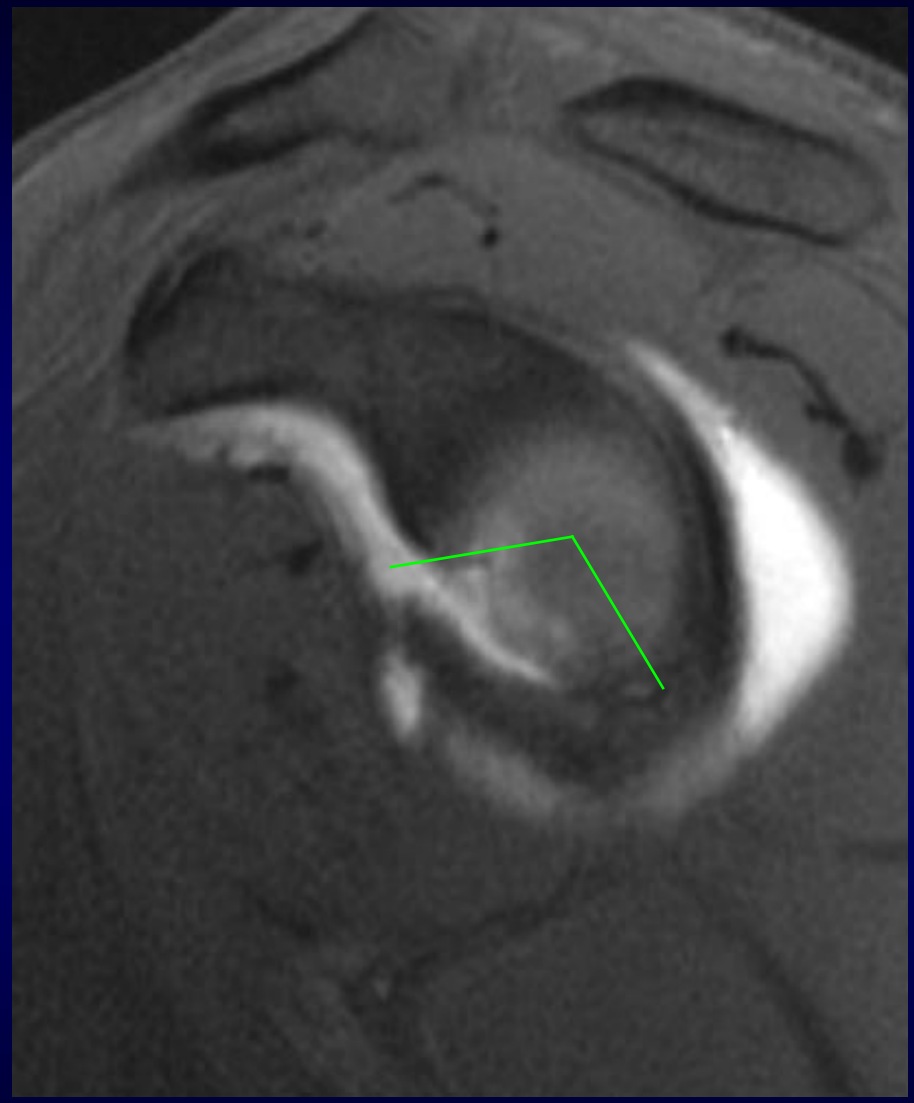
- Anatomic extent tear

  Tear extension

  - ? Posterior extension
  - ? Involve biceps anchor

  Plan anatomic repair

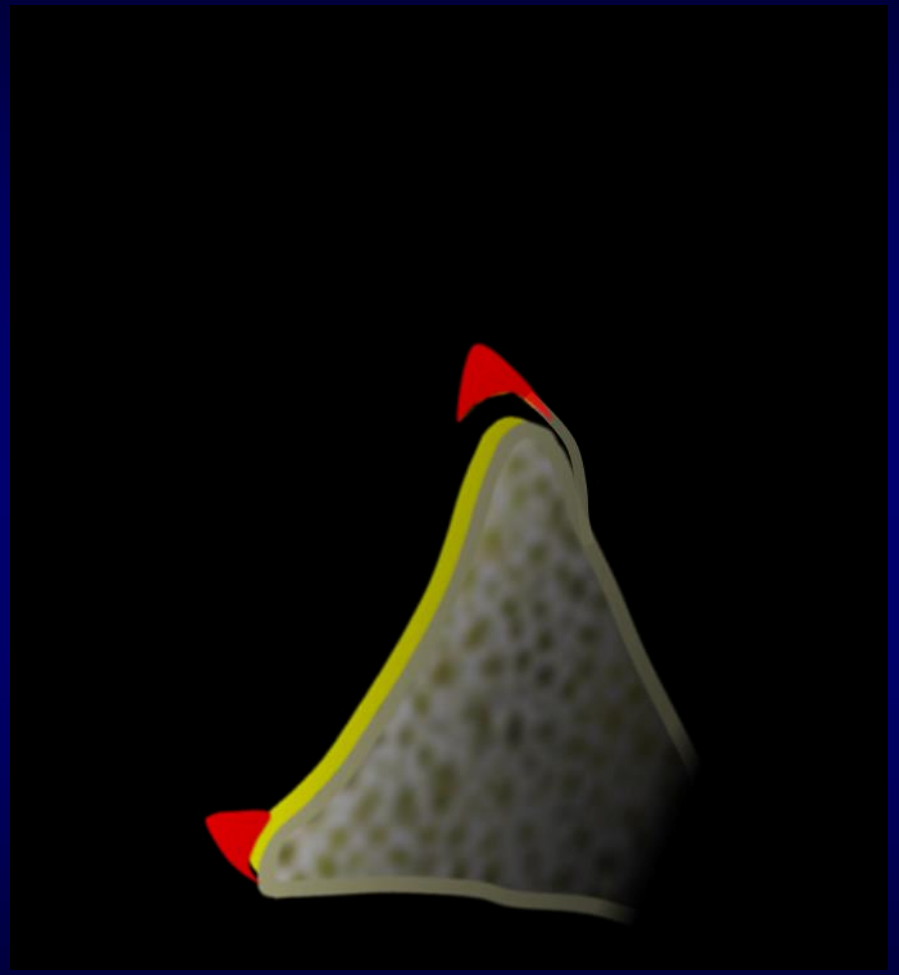
  - Arthroscopic repair
  - Portal placement

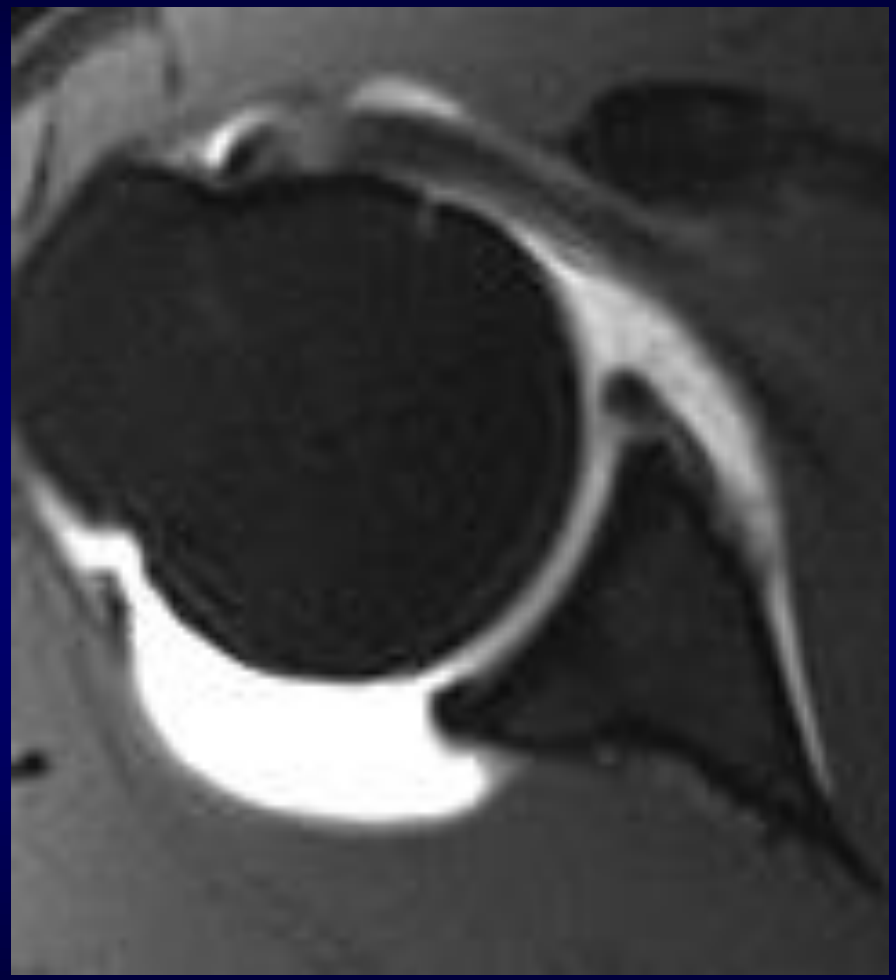


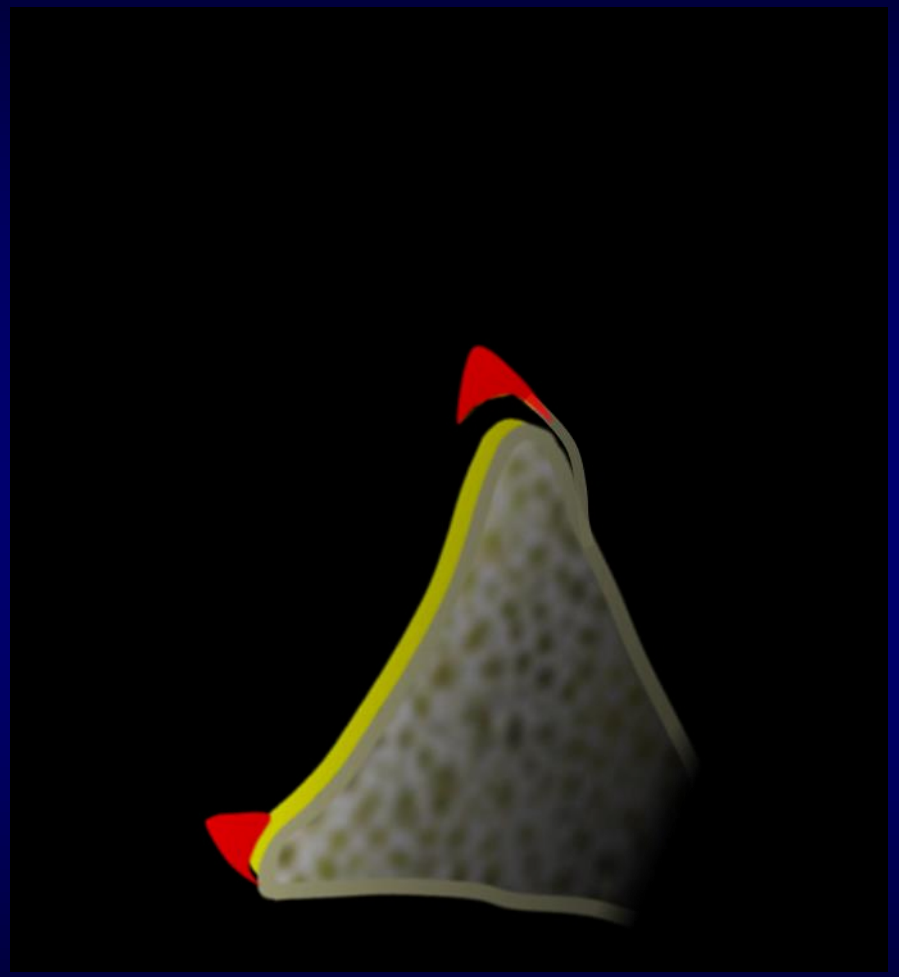
PERTHES LESION

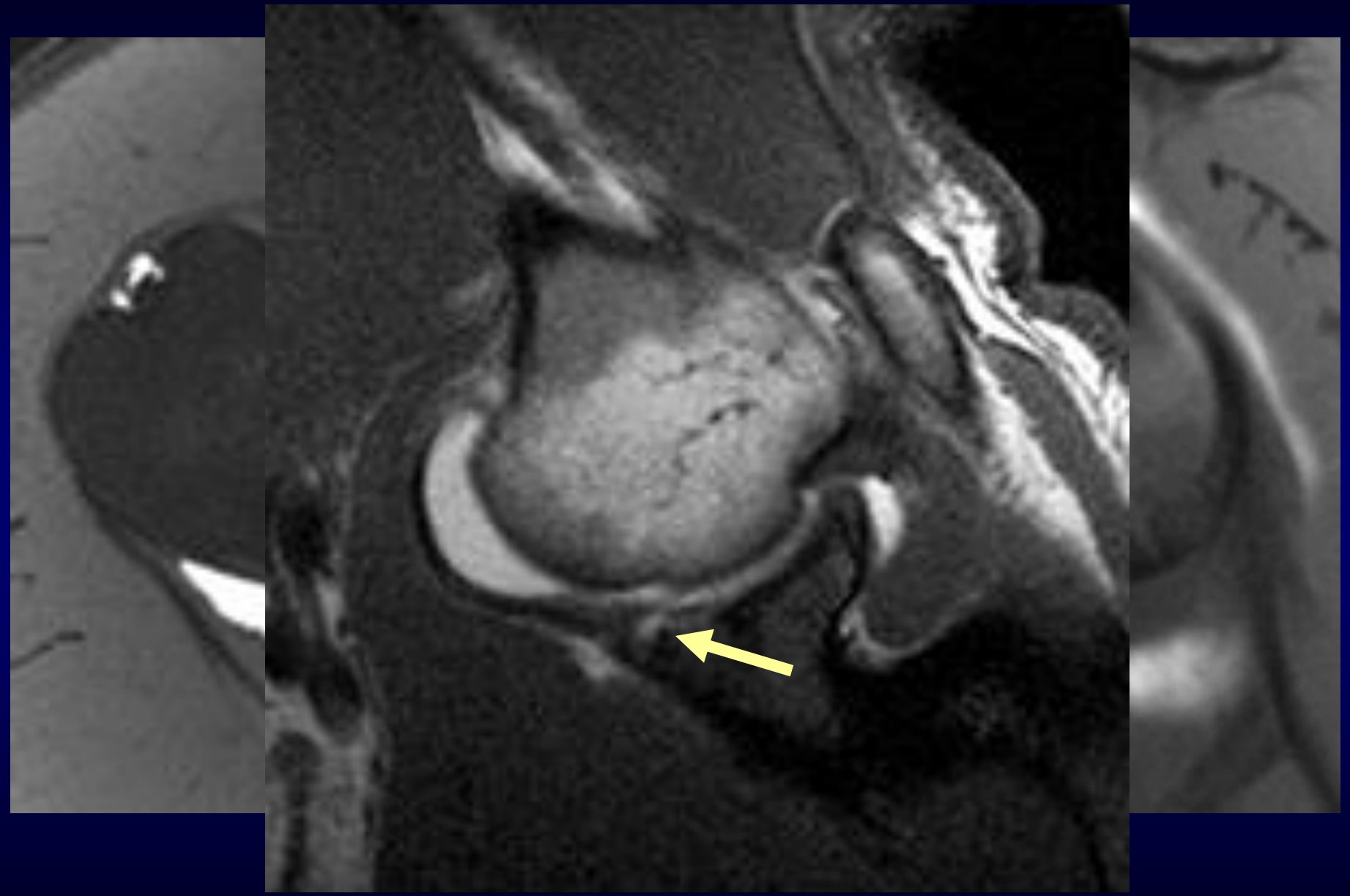
- Nondisplaced avulsion of labrum from glenoid
- Scapular periosteal attachment intact

  * ABER



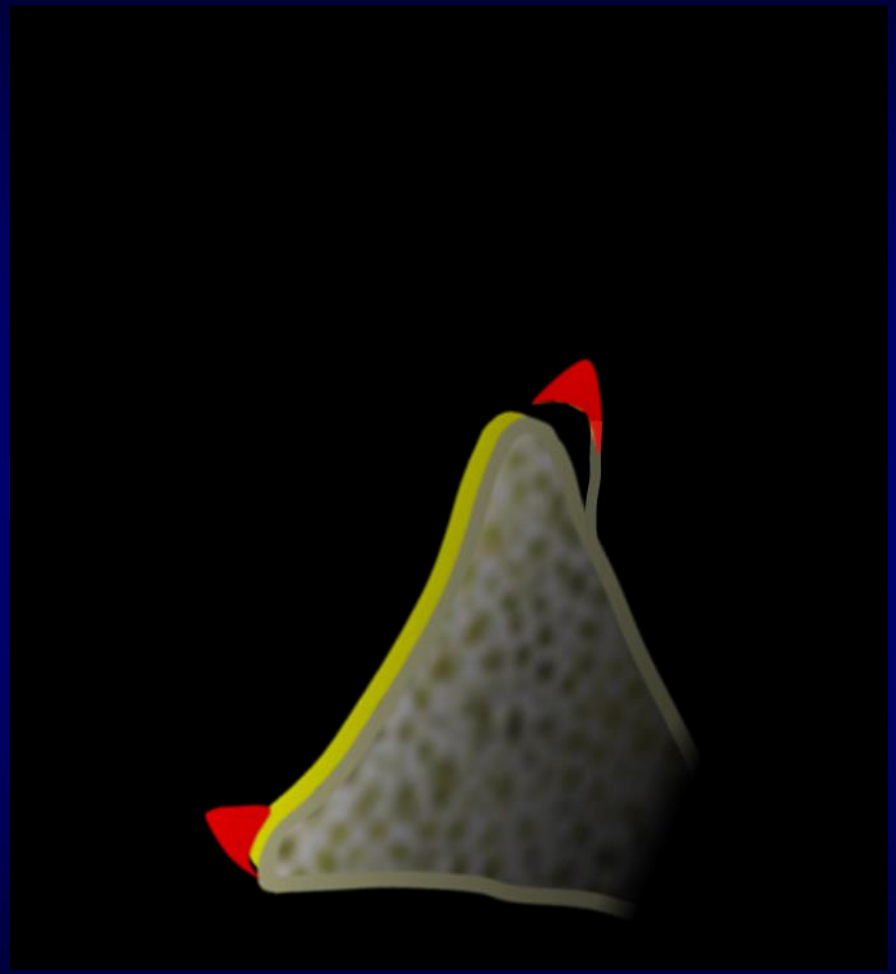


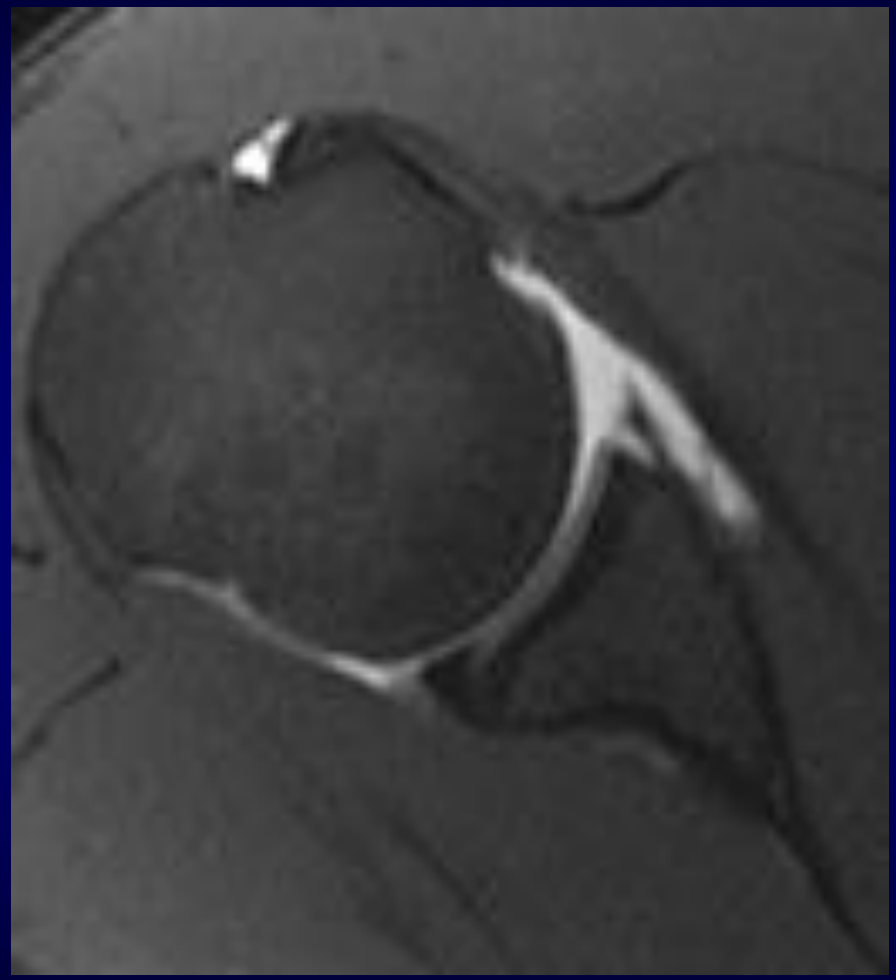


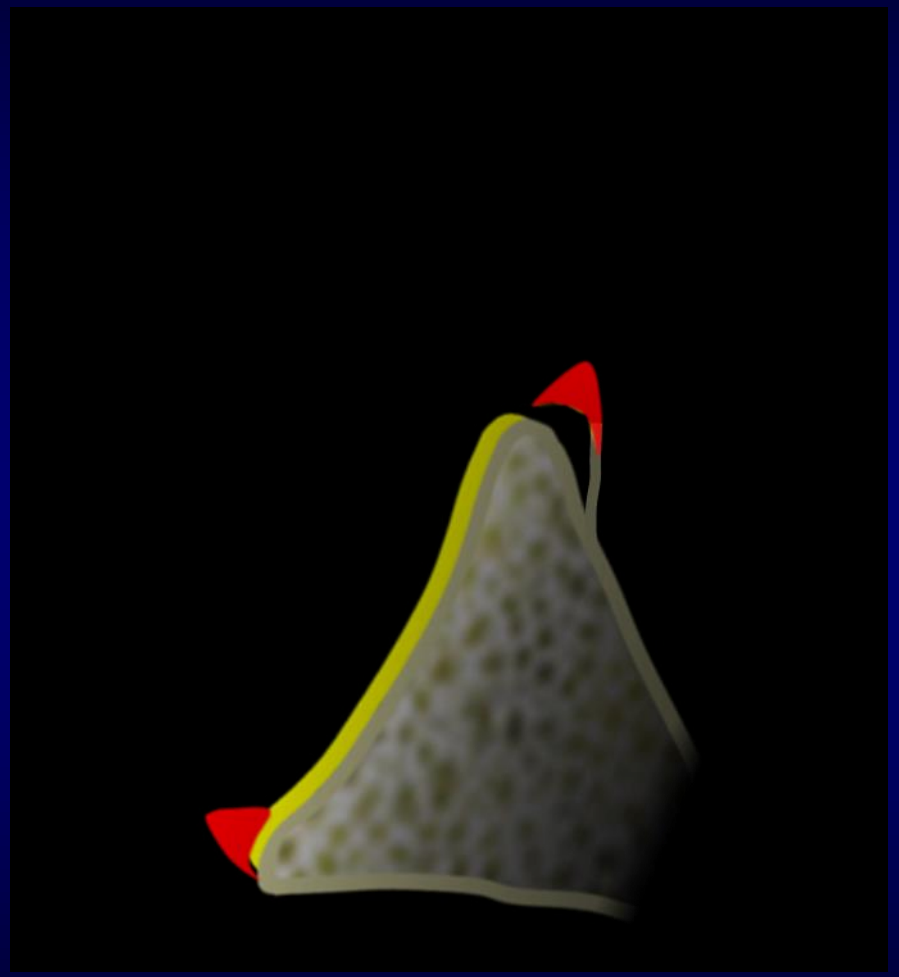


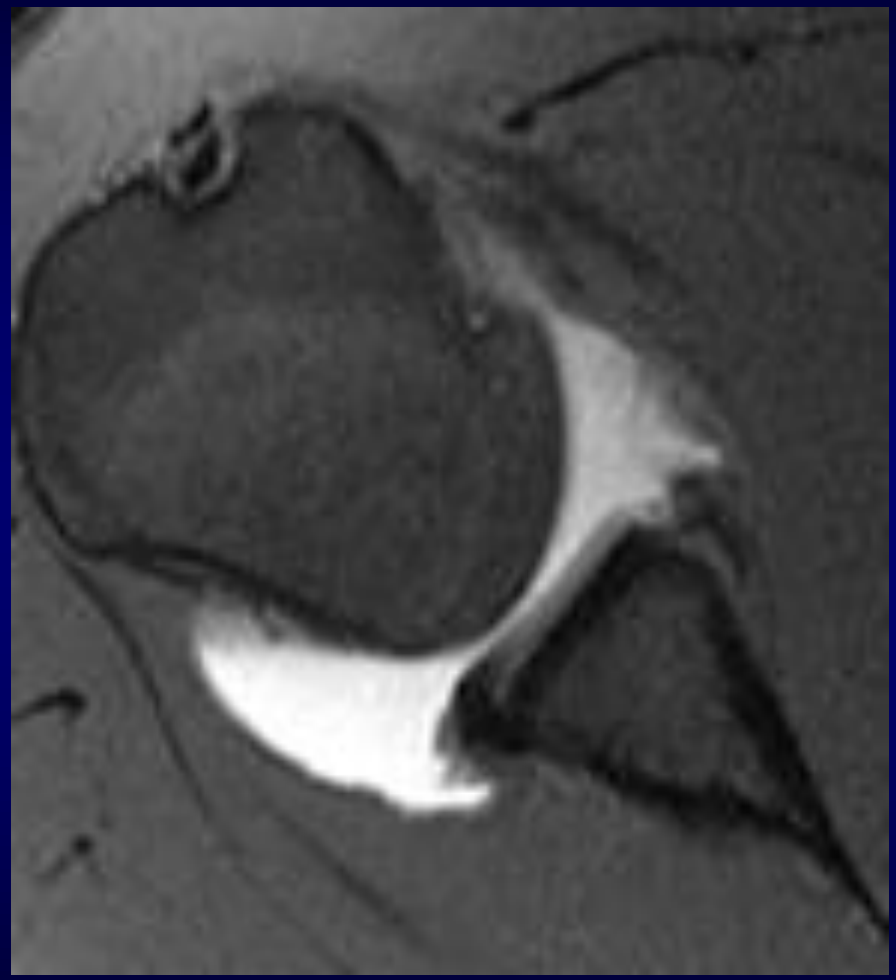
ALPSA LESION

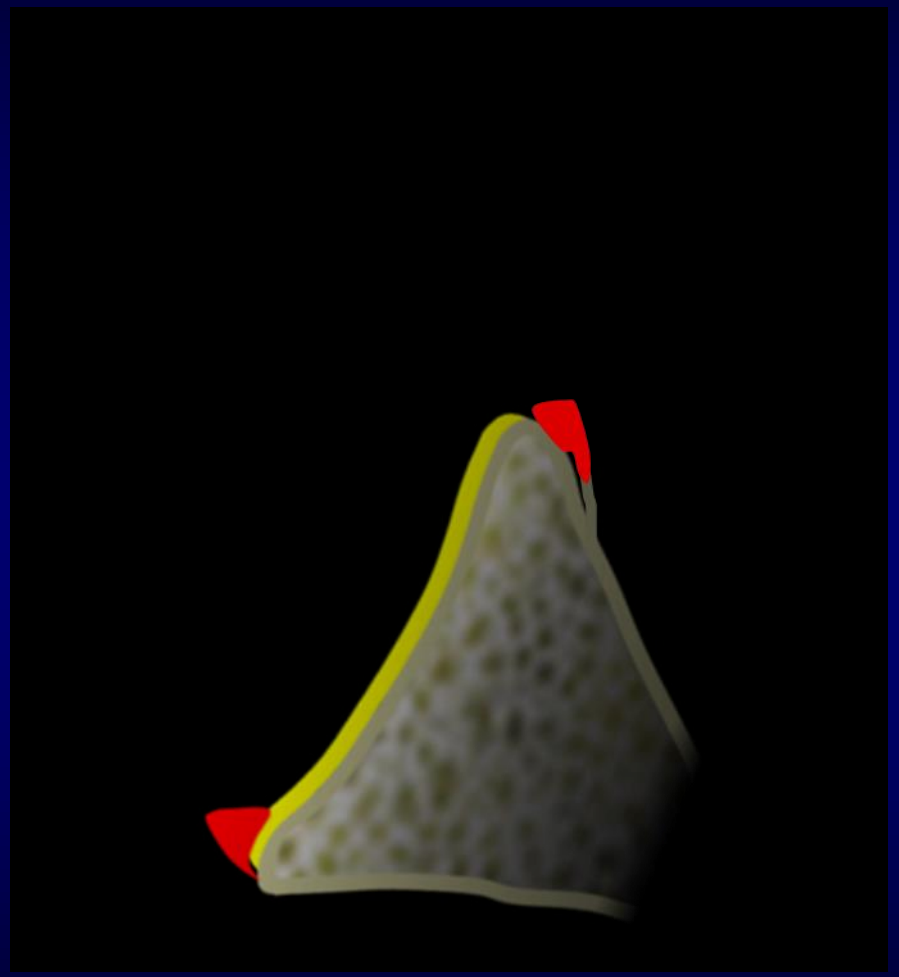
- Anterior Labroligamentous Periosteal Sleeve Avulsion
- Avulsion labrum from glenoid + displacement
- Intact scapular periosteum
  - * fragment displaces & rotates inferomedially

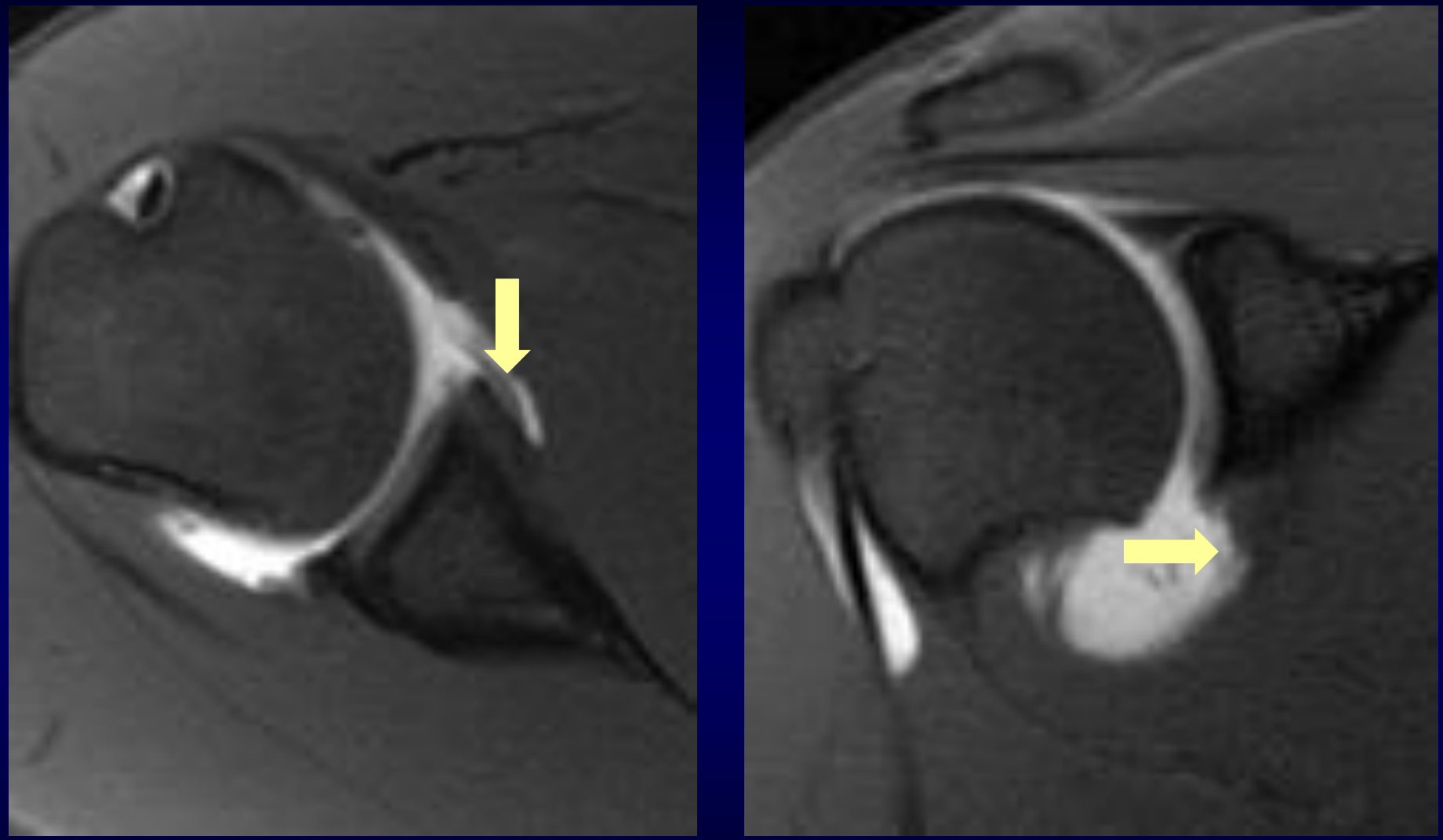












ADHERENT ALPSA (SCARRED BANKART LESION)

Important implications for surgical management

- Cursory arthroscopic exam anteroinferior quadrant unremarkable
- Surgical identification critical
  - Mobilization/dissection
  - Repair

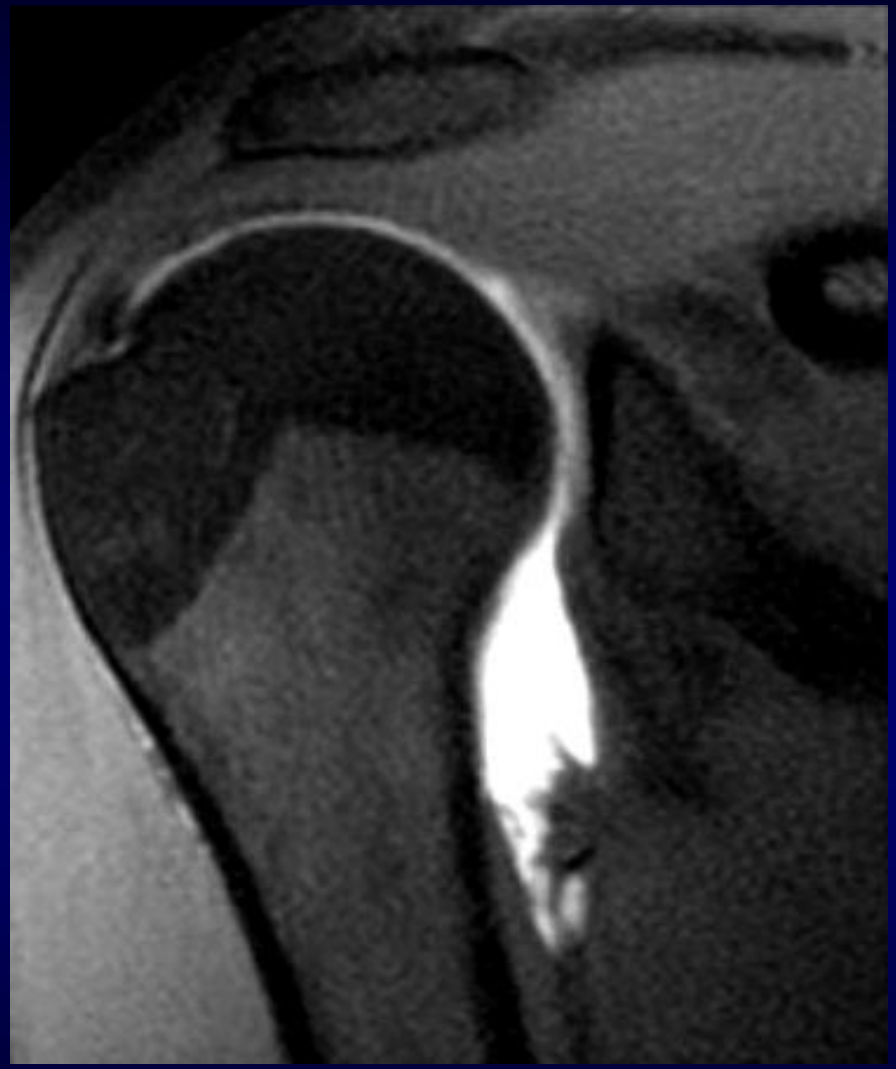
Failure anterior labrocapsular tissues may also occur

- Humeral origin GHL

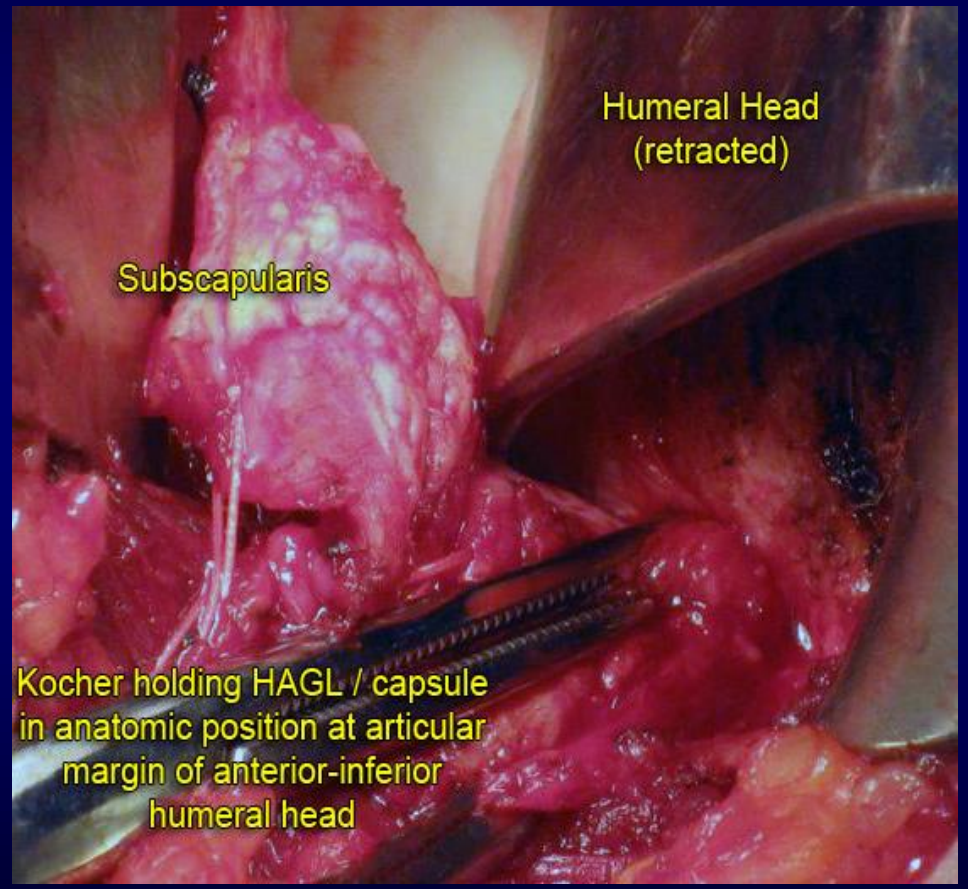
HAGL lesion

- More common – 1st time dislocators > 35yrs

< 30 yrs - labral tears




large HAGL
lesion



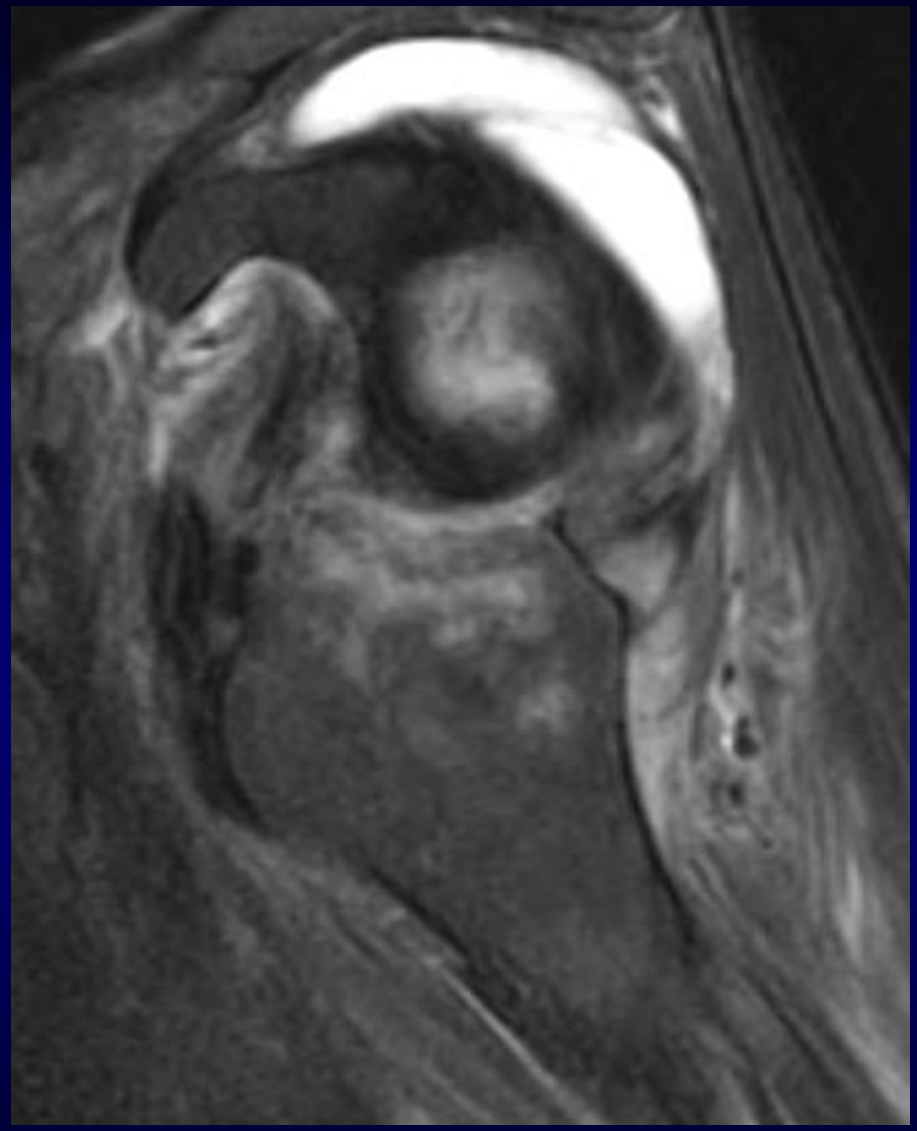
- Partial/Incomplete tears
  - Managed conservatively
- Complete tears
  - HAGL
    - Osseous avulsion (BAGL)
  - Prone - recurrent instability
  - Open surgical repair

OSSEOUS LESIONS

- Greater tuberosity/coracoid
- Osseous Bankart
- Hill Sachs lesion

Clinical significance

Potential compromise
static stability GHJ



HILL SACHS LESION

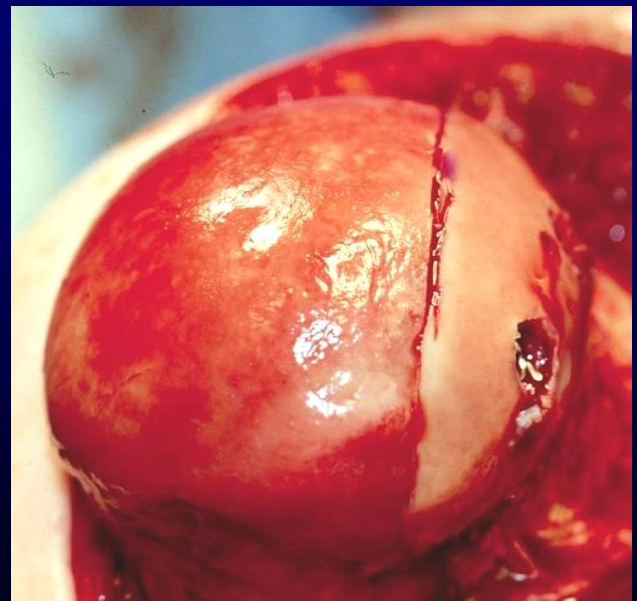
- Important - large engaging lesions

Rare lesions

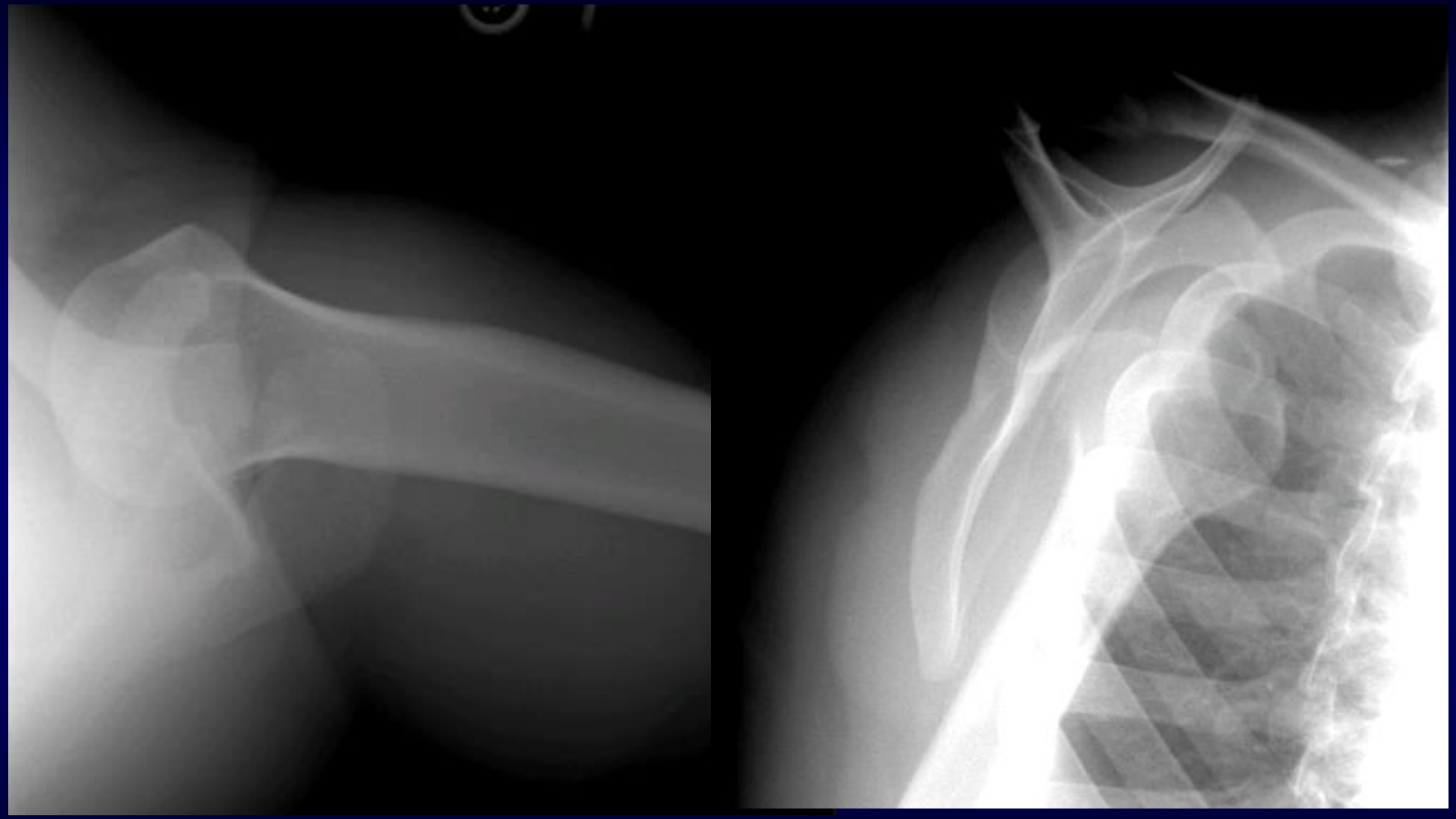
→ Recurrent/irreducible dislocation

Rotation osteotomy

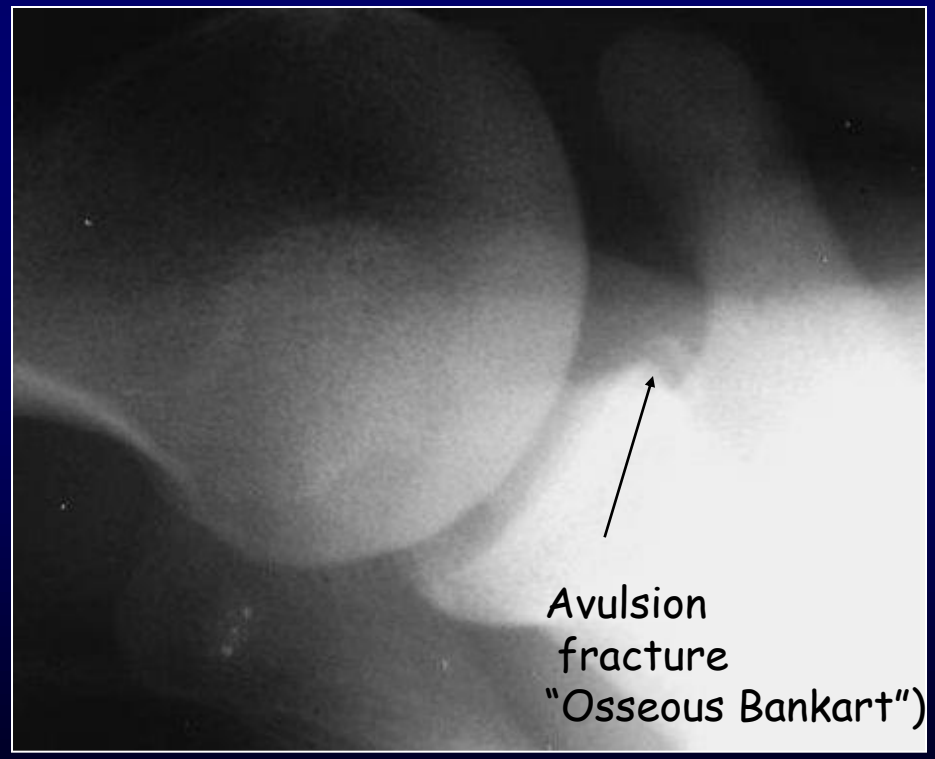
Osteoarticular allograft

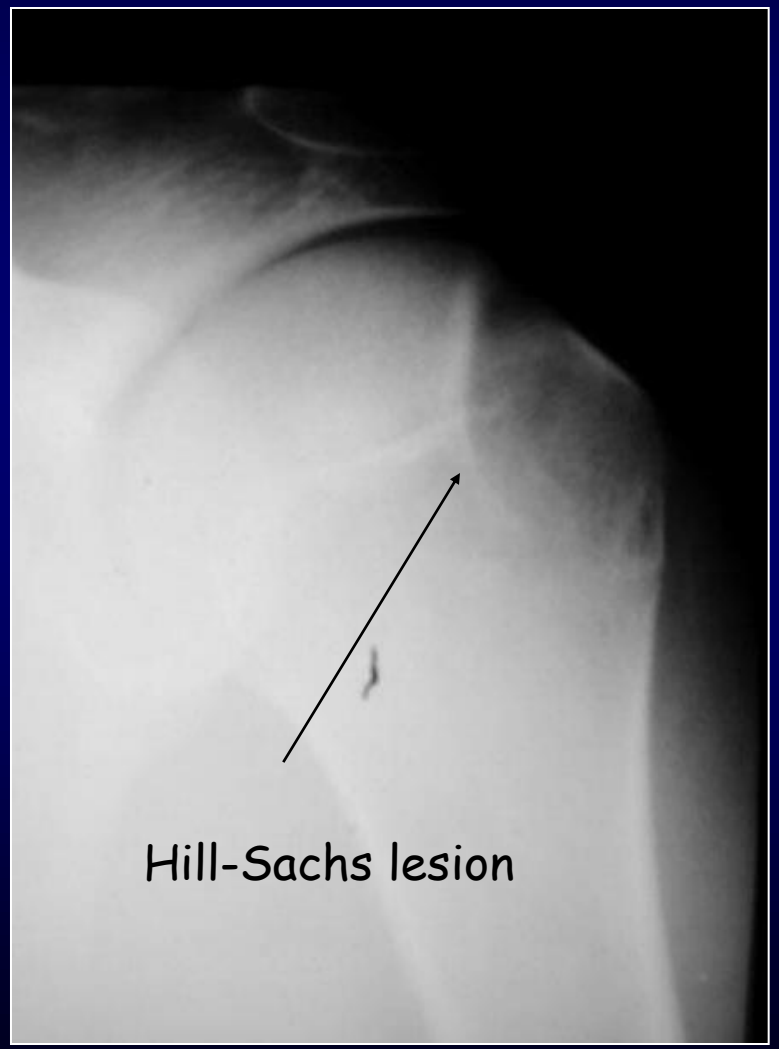


ANTERIOR DISLOCATION

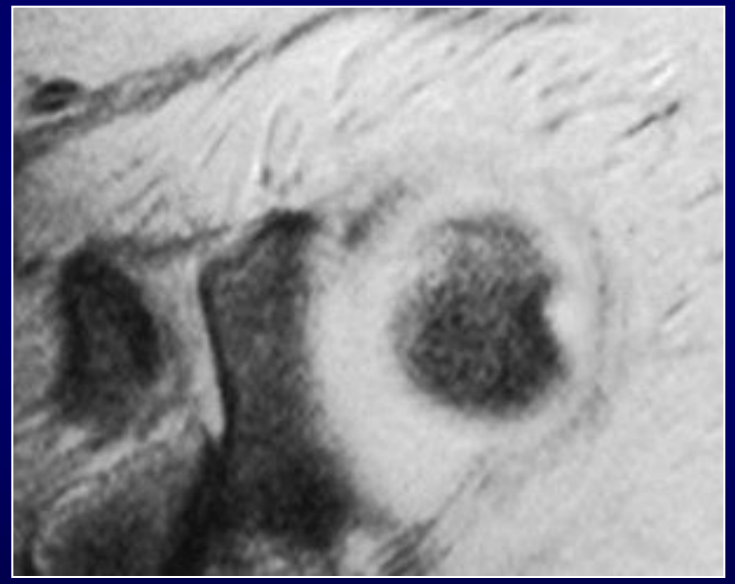


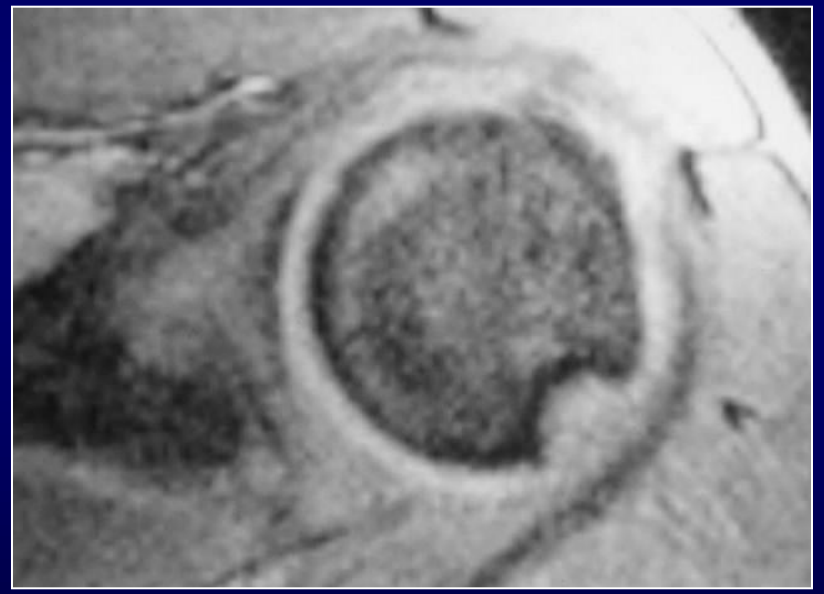
OSSEOUS PATHOLOGY: RADIOGRAPHS



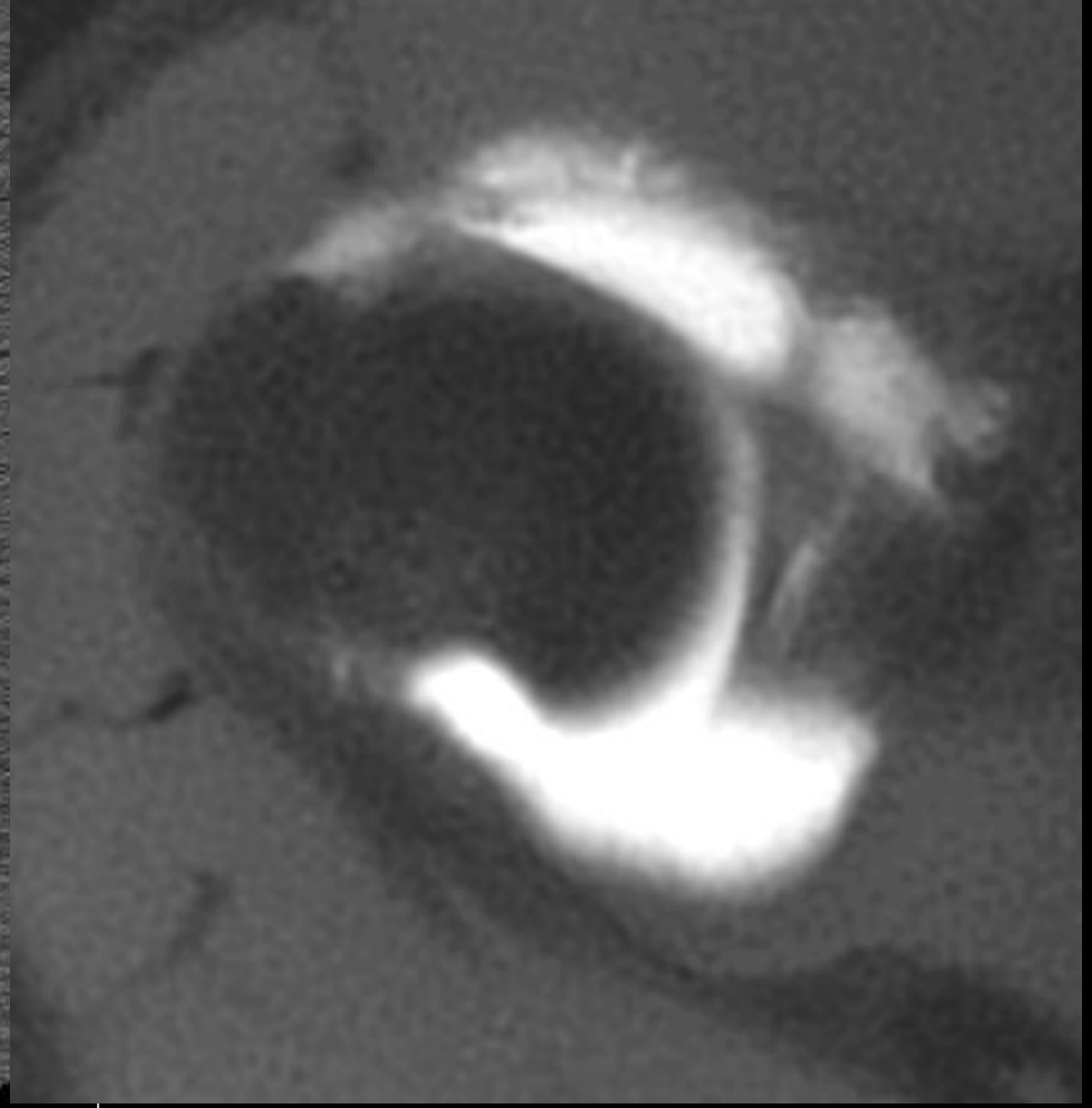


OSSEOUS PATHOLOGY

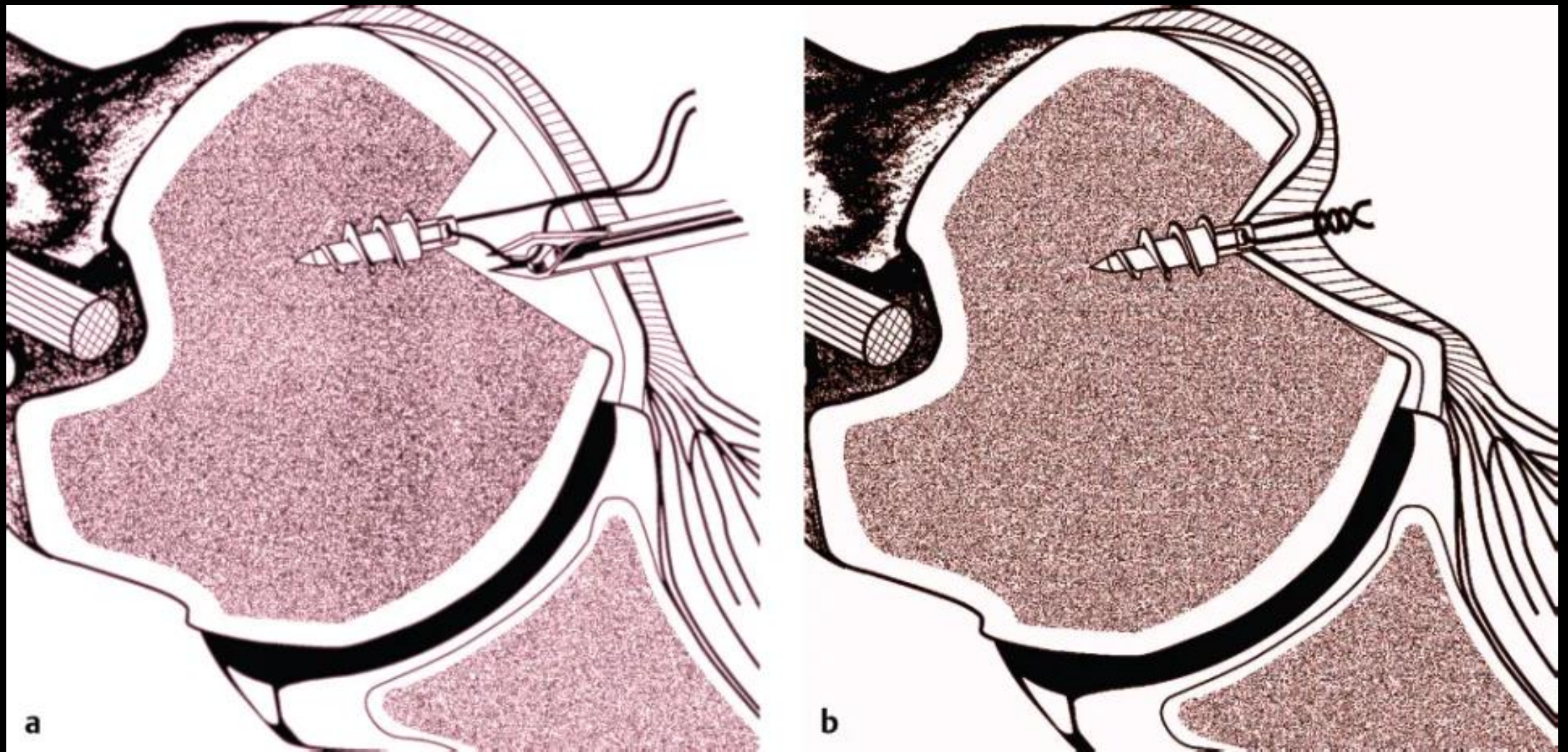


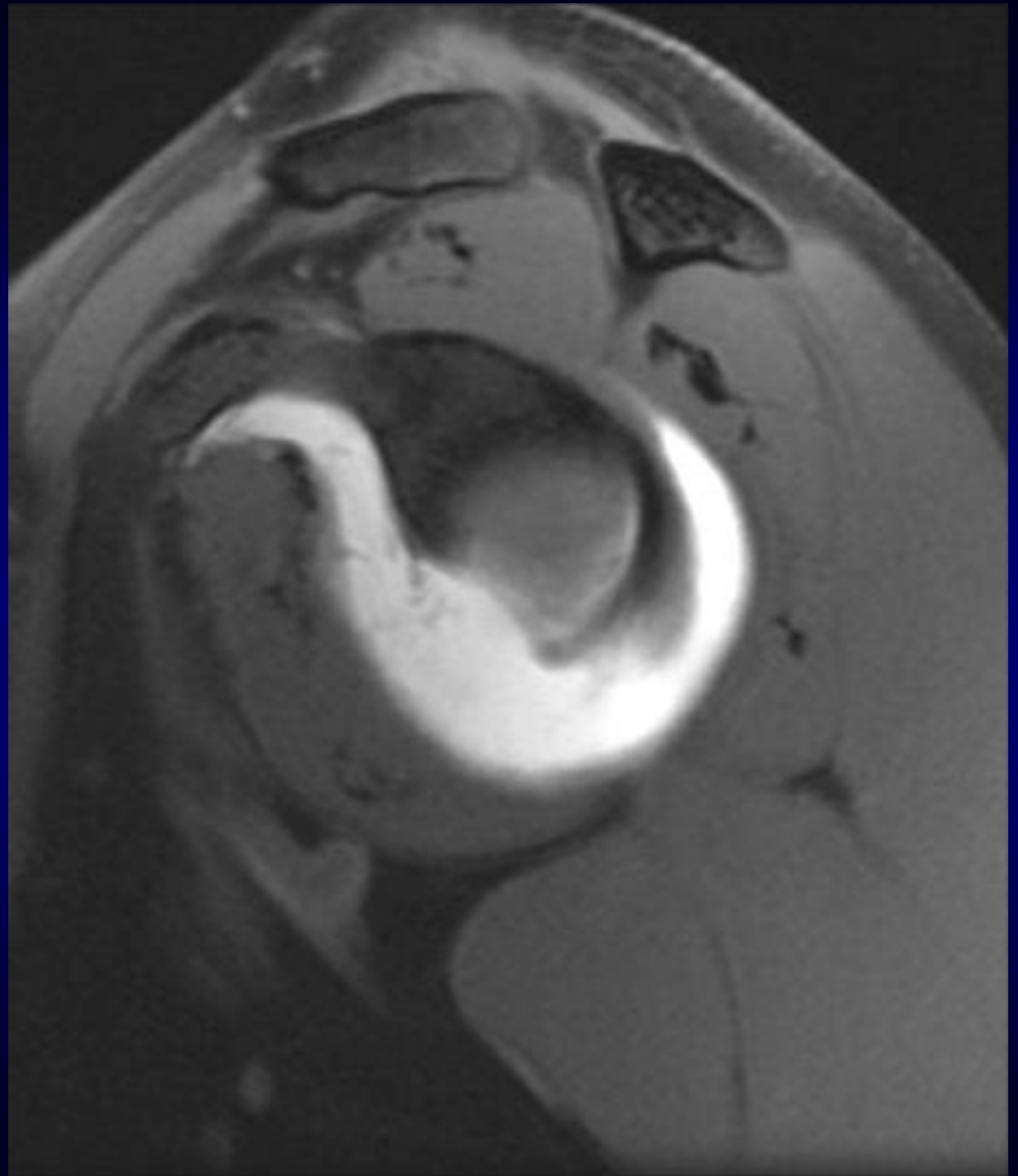


Hill Sachs lesions – first 2 slices of the humeral head
At or above coracoid level



REMPLISSAGE



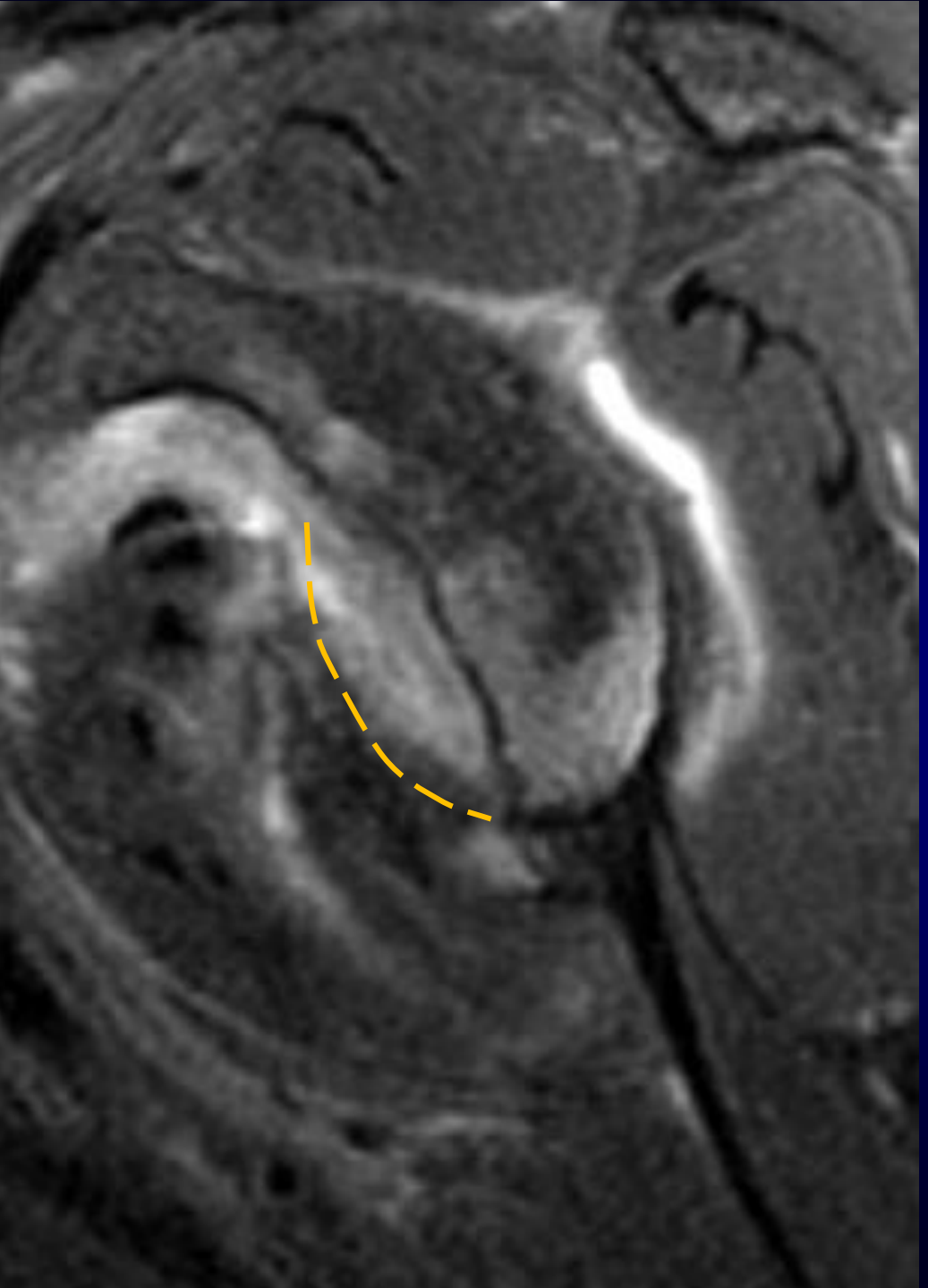


OSSEOUS BANKART

Compromise static stability

→ Impaired containment humerus

- *>25-30% AP glenoid*
- *SI length > max radius glenoid*



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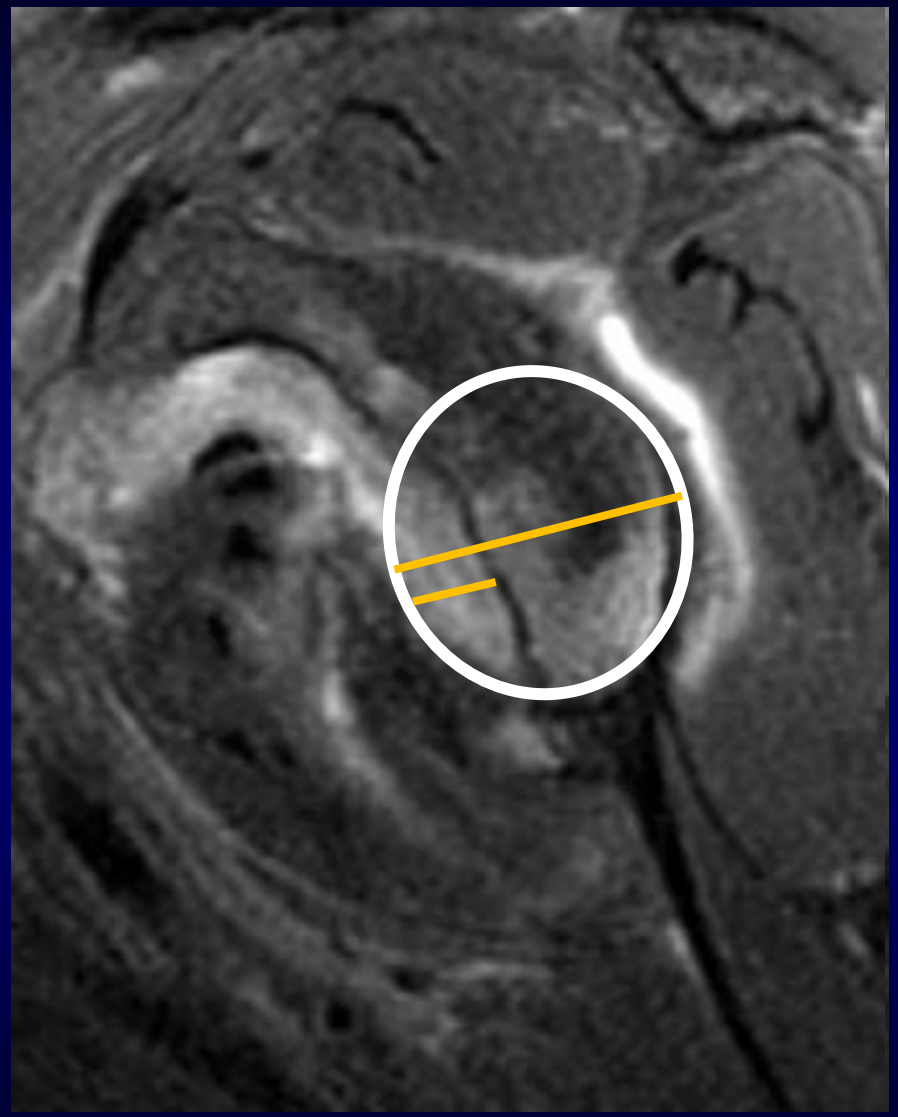

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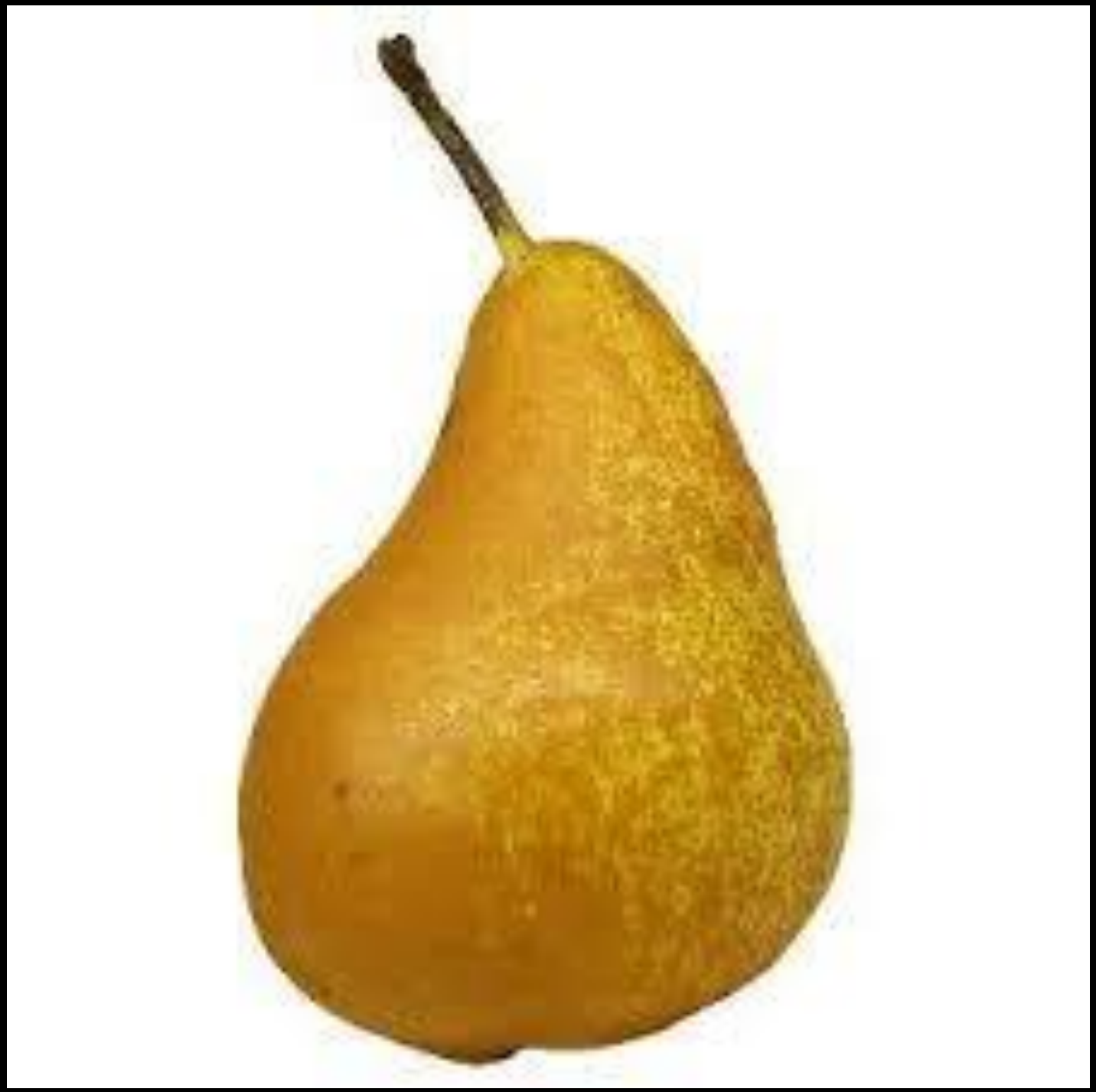
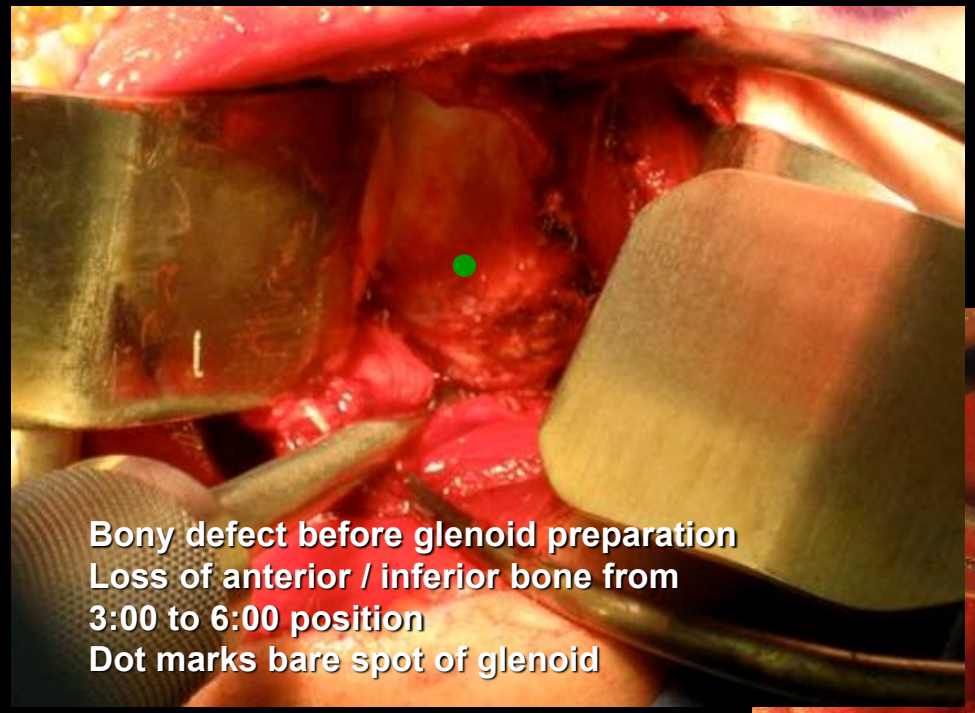
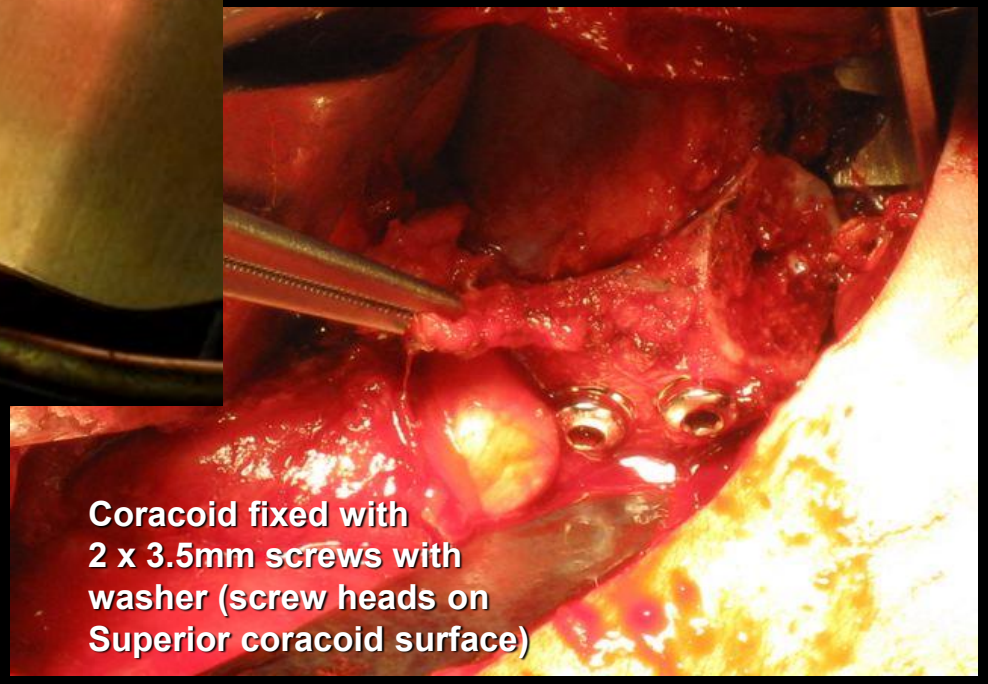
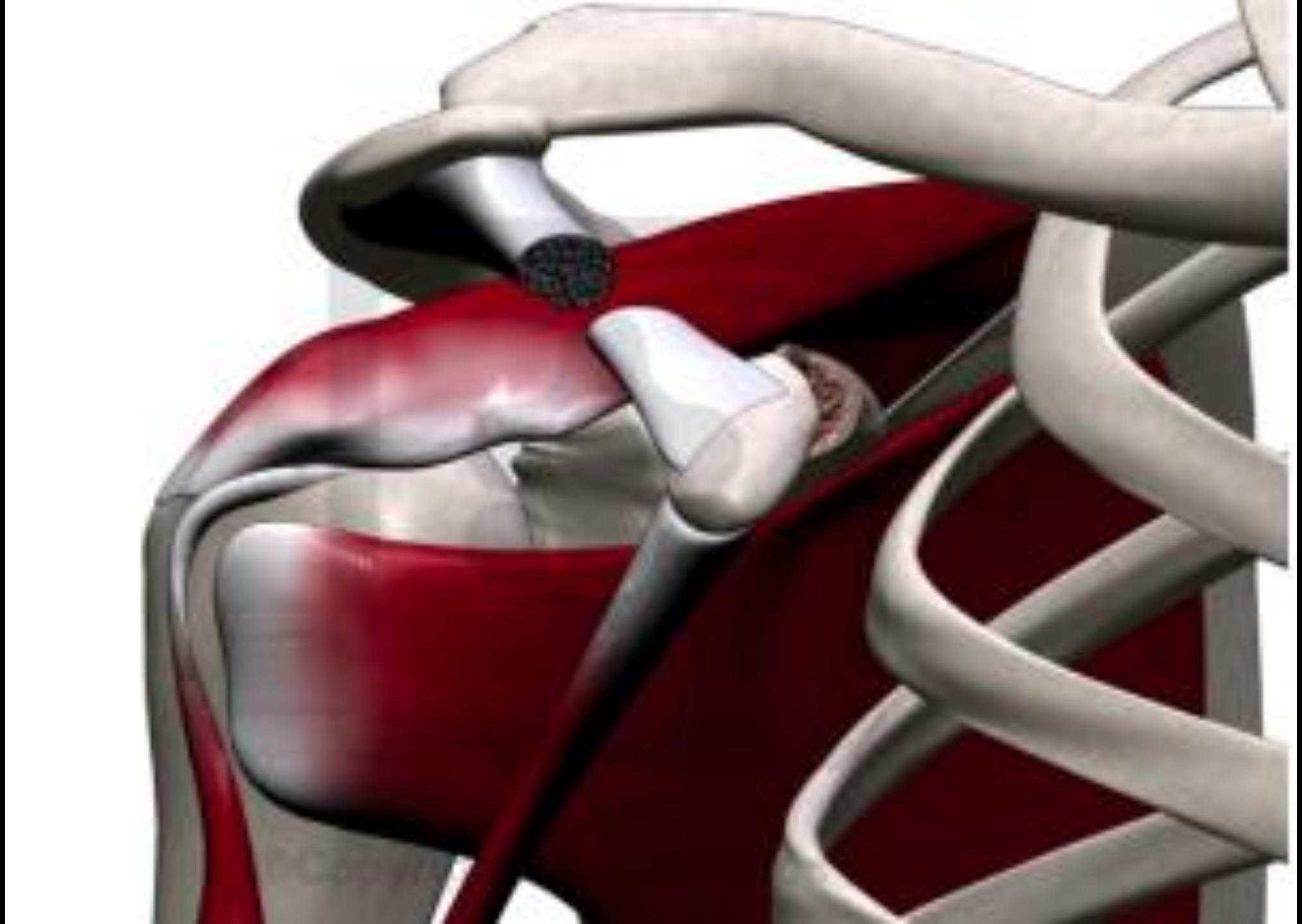


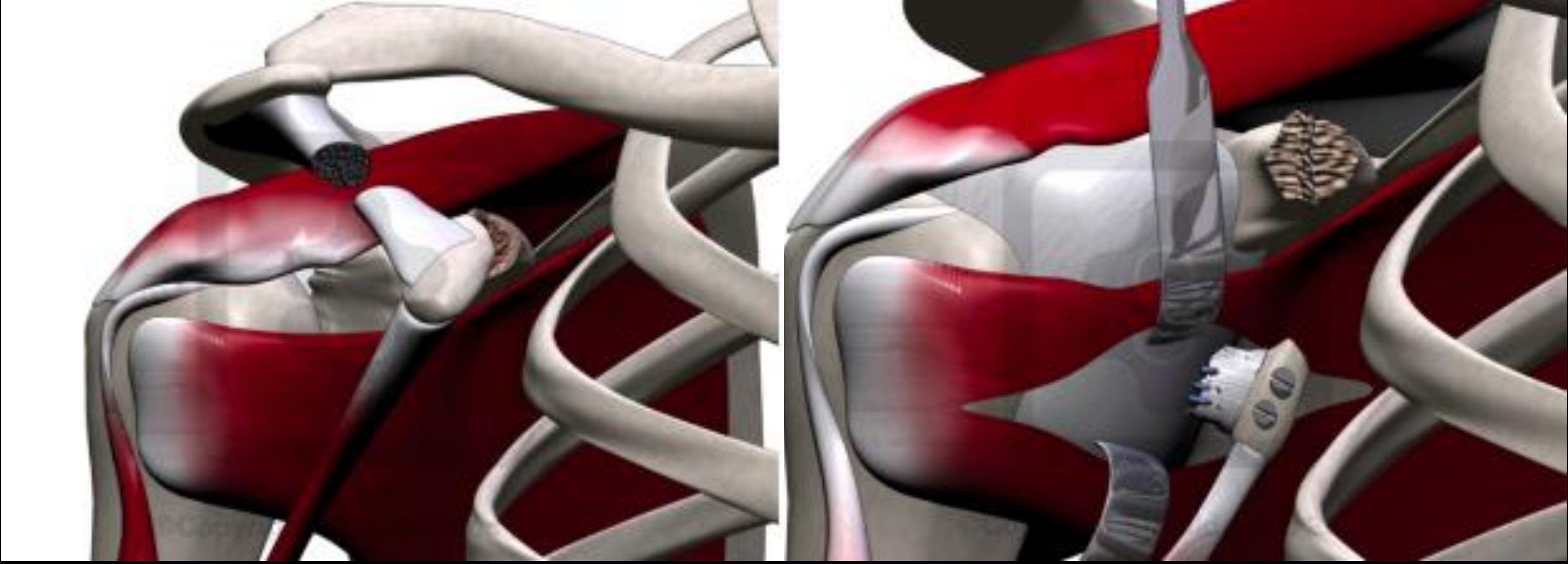
GLENOID DEFICITS - REPAIRED OPEN SURGICAL PROCEDURE

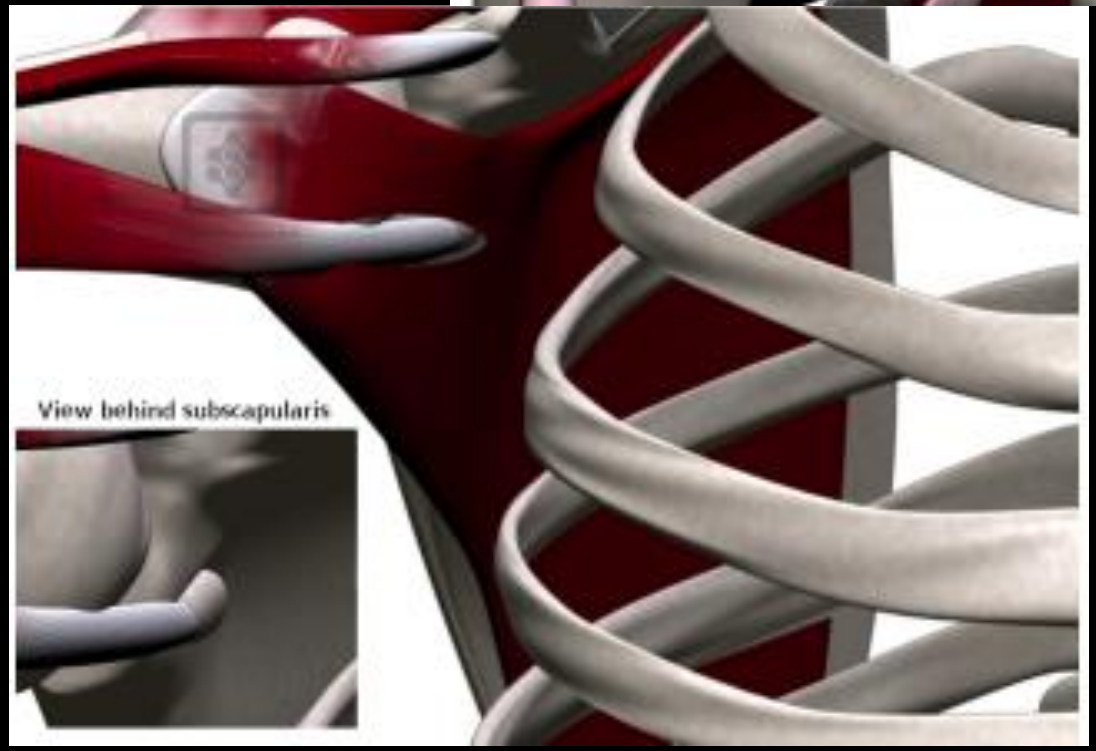
OSSEOUS RECONSTRUCTION OR BUTTRESS (BRISTOW/LATARJET)

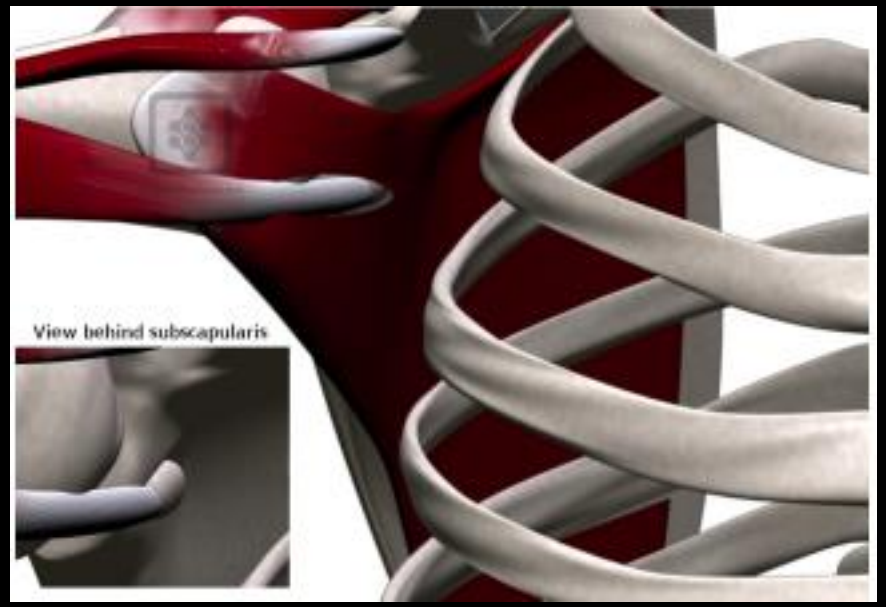




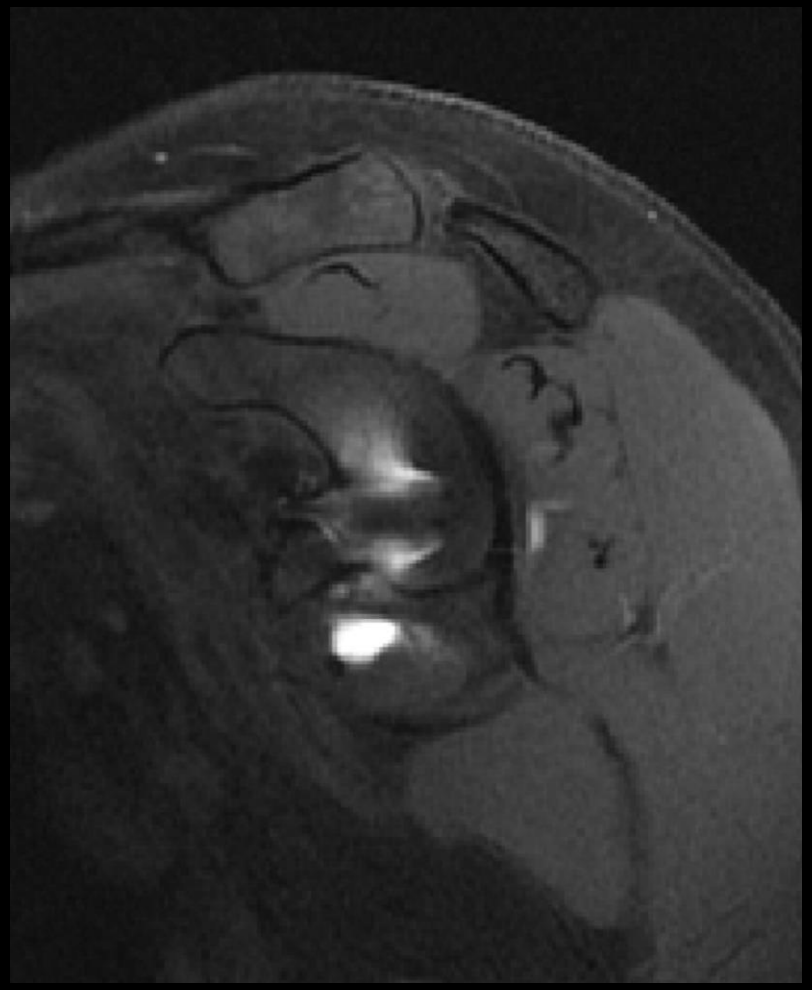




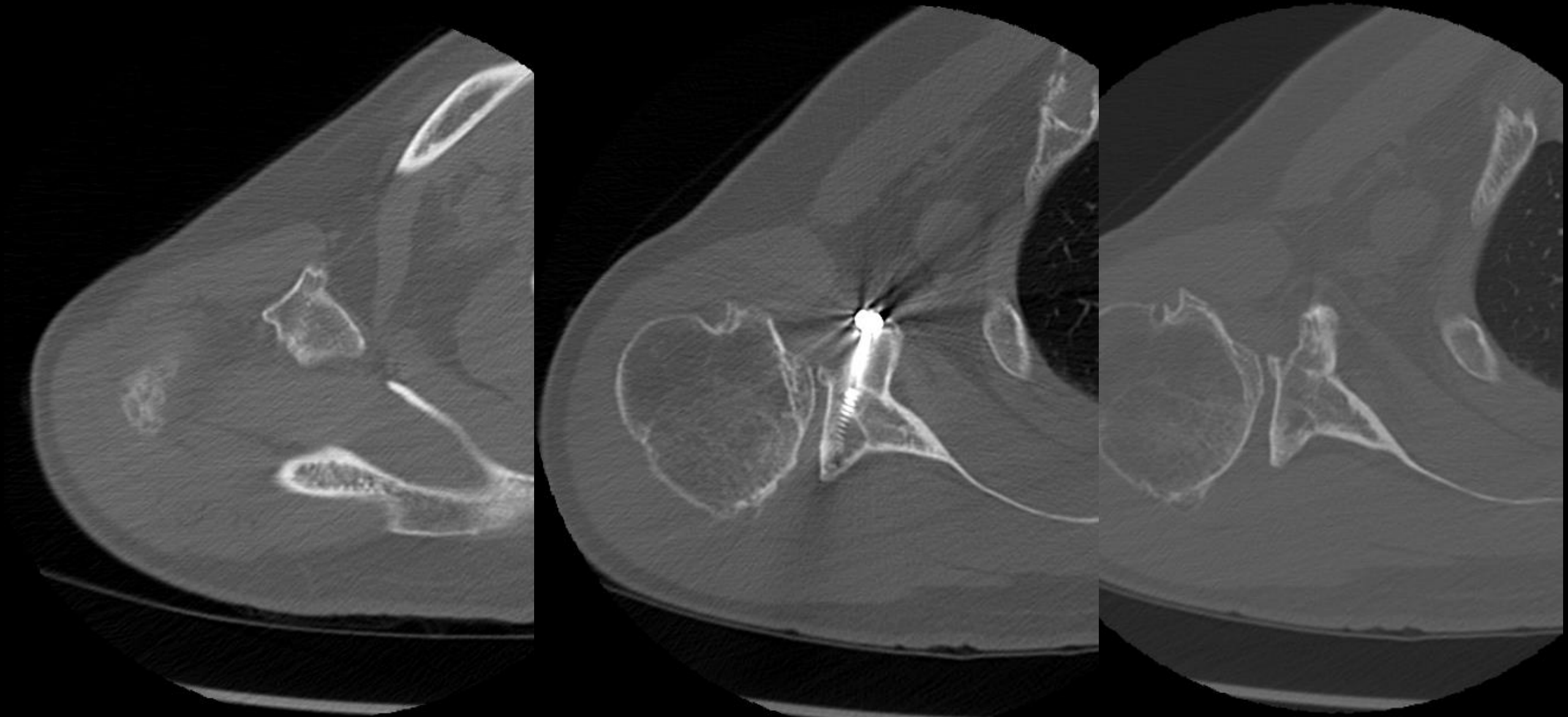

View behind subscapularis


View behind subscapularis

BRISTOW/LATARJET



BRISTOW/LATARJET



BANKART AND HILL-SACH "ON-TRACK/OFF-TRACK"

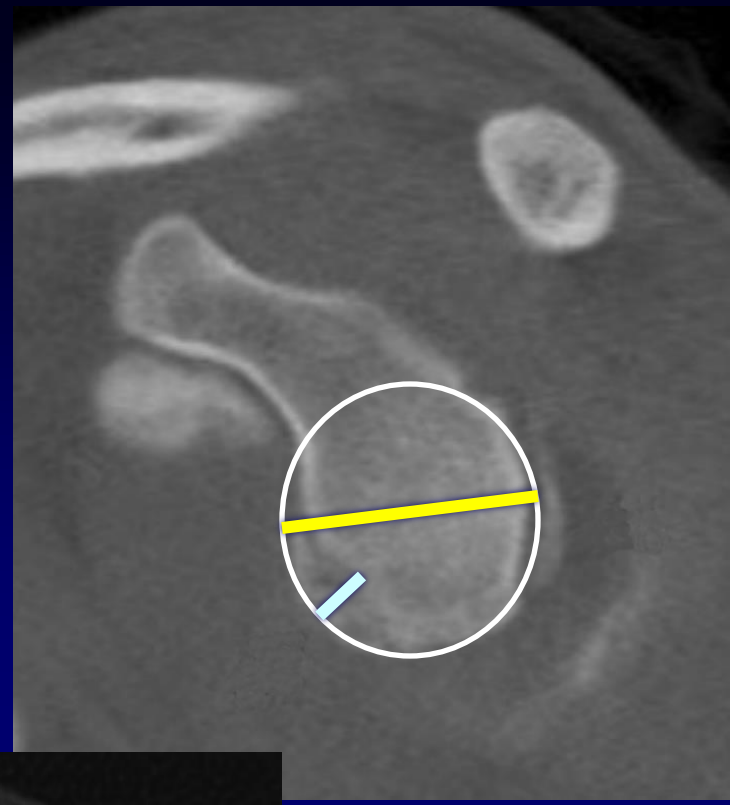
Osseous Bankart >20% AP diameter of glenoid

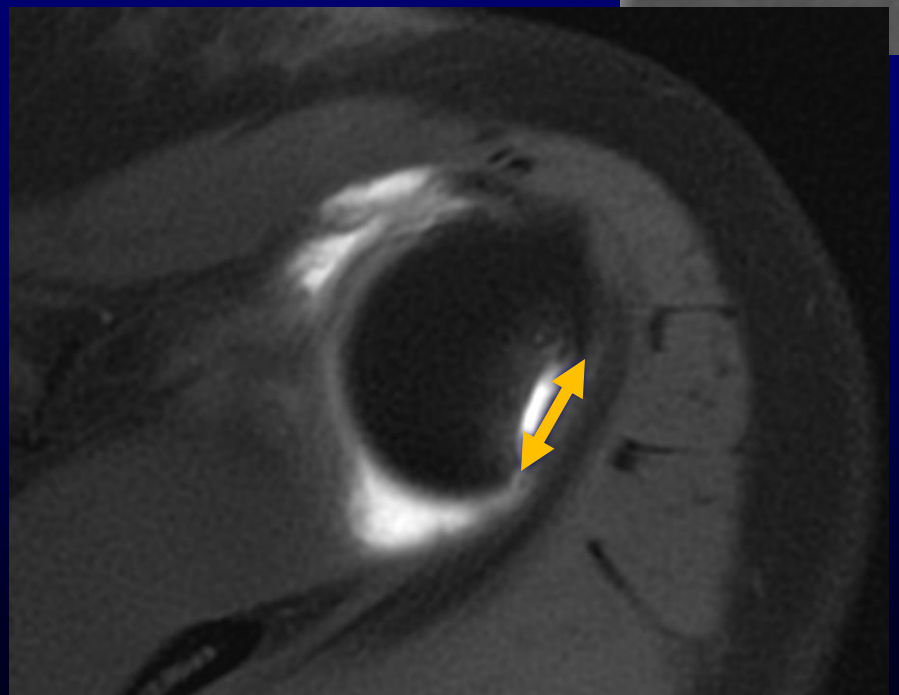
Glenoid tract= (0.83 x D) – d

Hill-Sachs interval = medial border Hill-Sachs to tendon attachment

If Hill-Sachs interval > Glenoid tract, lesions can "engage" aka "**off-track**"

AJR 2015; 205:848-852





SURGICAL REPAIR ANTERIOR GH INSTABILITY

- Usually reserved - failure conservative treatment
- First-time dislocation elite athlete (timing within season)

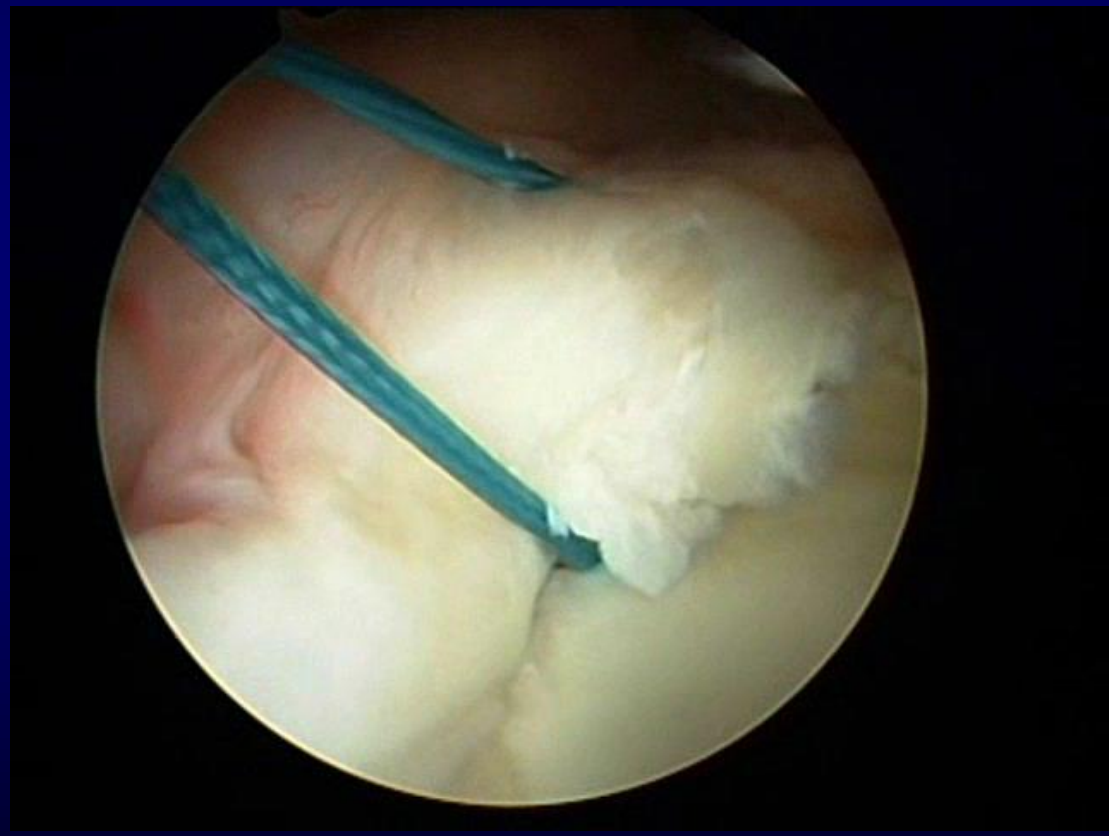
No consensus repair technique; *

- Arthroscopic vs open

arthroscopic anatomic repair

MR imaging findings

- Specific to procedure performed



* Freedman KB, et al. Am J Sports Med. 2004 ;32(6):1520-7

INDICATIONS MR IMAGING POST-INSTABILITY REPAIR

Secondary degenerative arthritis

- Anatomy altering procedures

Recurrent instability *

- Soft tissue/bone deficiency
  - Reinjury
  - Repair failure

MRI POST- INSTABILITY REPAIR

- Utilize MR arthrography
- Diagnostic criteria - preop labrum

Fluid into or beneath labrum

Absence or displacement labrum

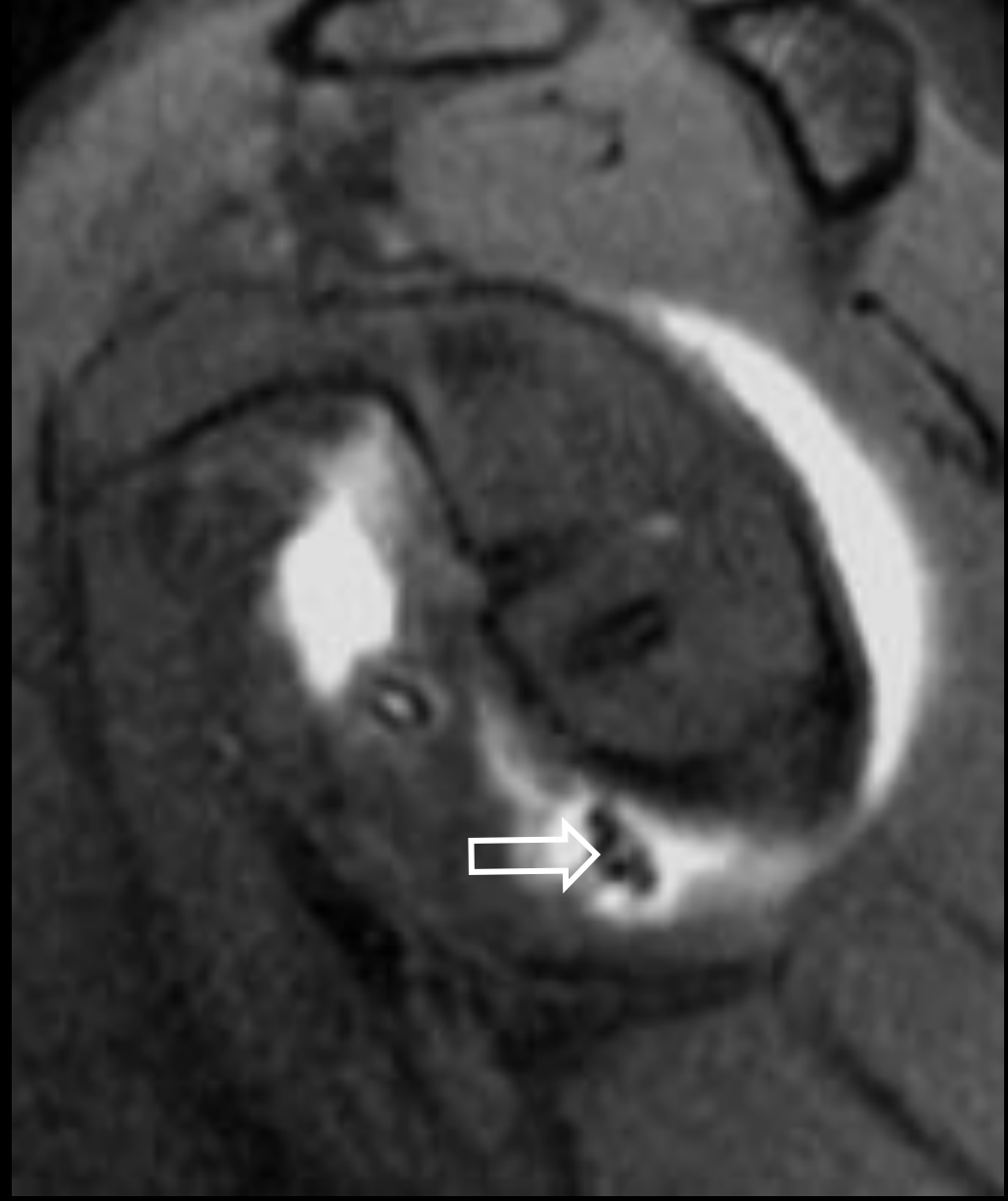
Accuracy of diagnosis recurrent tears

89%-97%

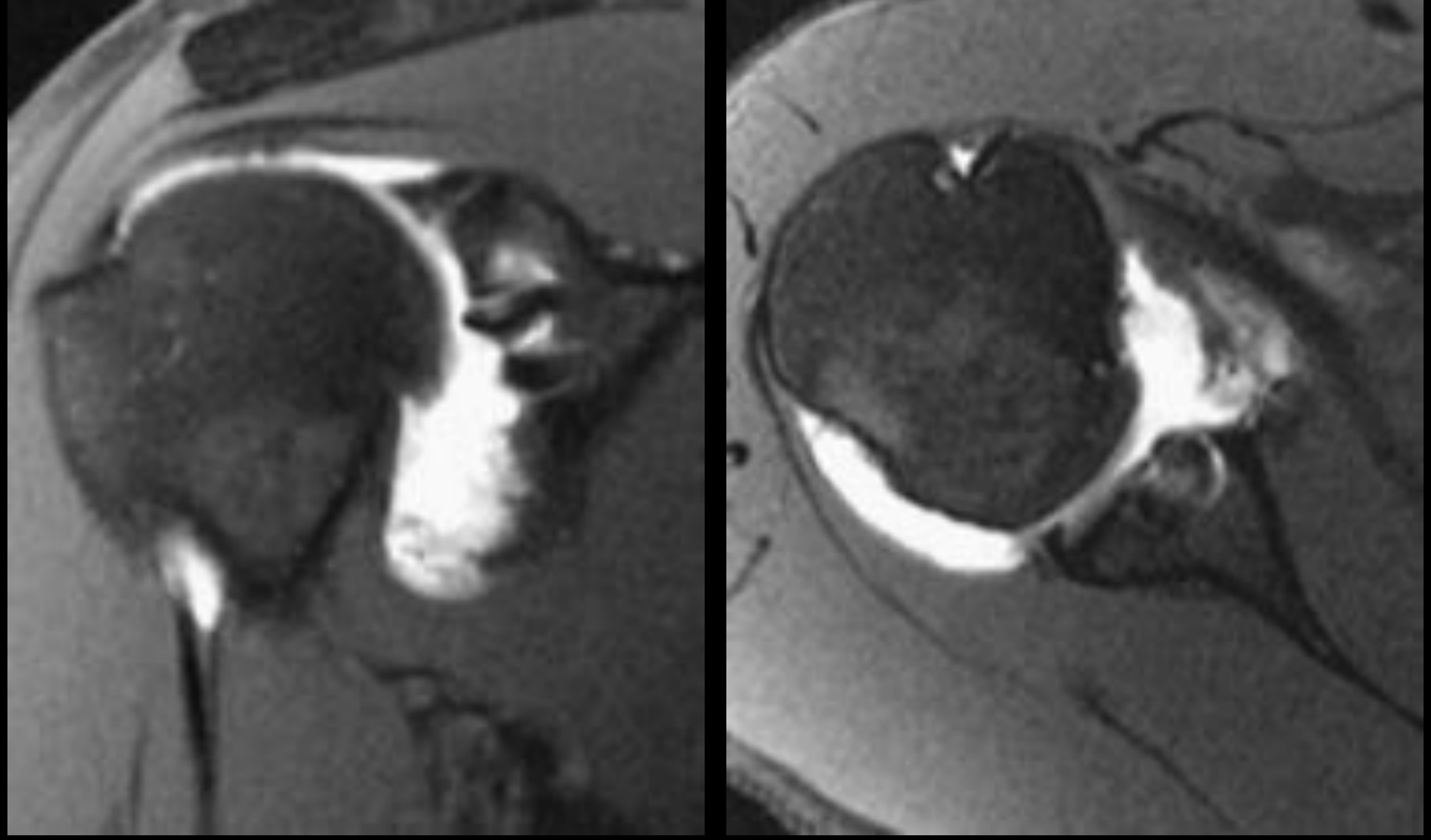
Probyn L et al. Radiology. 2007; 245:814

TP Antero-inferior Labral Tear

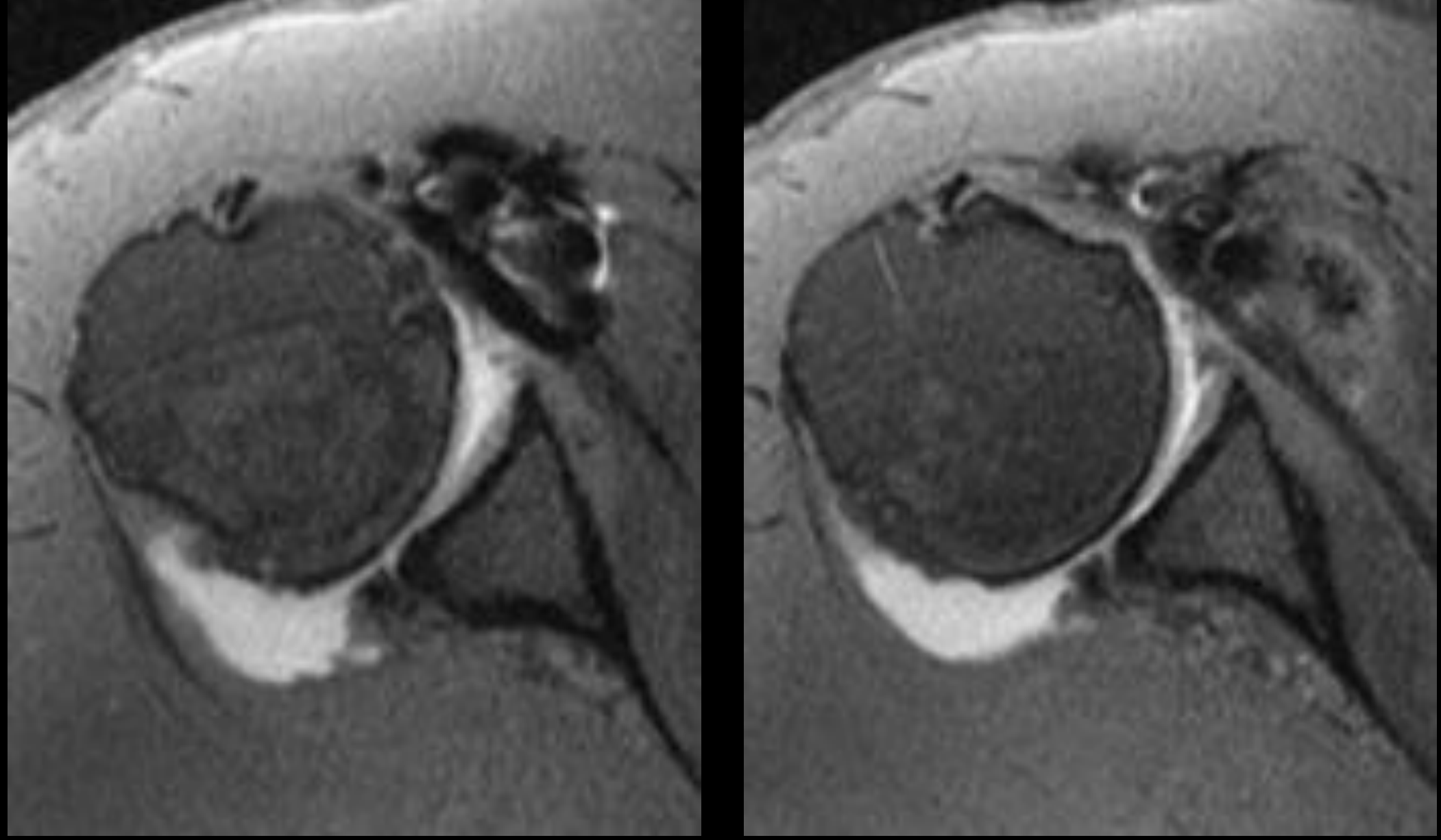
18 y.o. M -recurrent instability 1 year post anterior capsular stablilization + Bankart repair
TP Anterior Inferior Labral Tear



Bankart repair: recurrent instability



Recurrent instability: osseous and soft tissue deficiency



Putti-Platt: secondary degenerative osteoarthritis

POSTERIOR GLENOHUMERAL INSTABILITY

Usually 2˚ traumatic dislocation

<u>Direct trauma</u>

Anterior trauma - shoulder

Axial load - flexed, adducted, internally rotated arm

<u>Indirect trauma</u>

Violent muscle contraction
(seizures, electric shock)

POSTERIOR DISLOCATION

Rare Injury

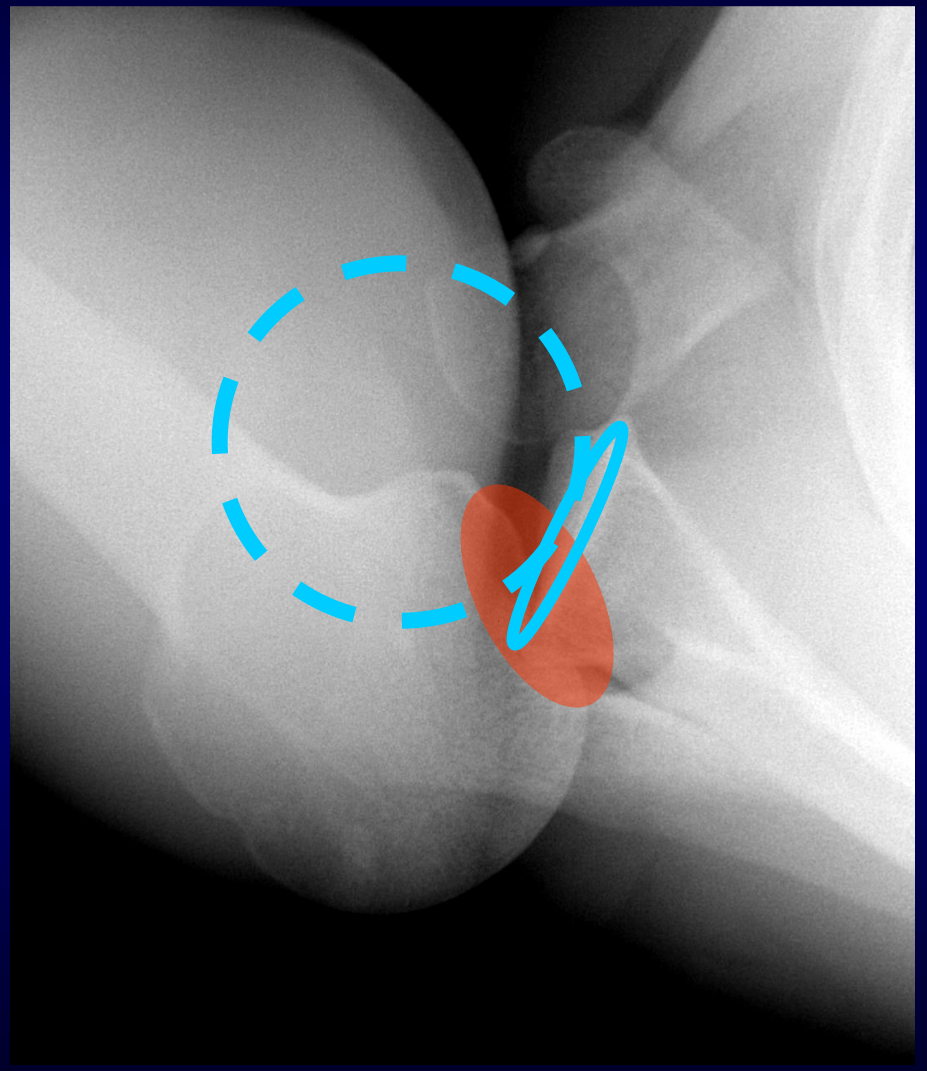
< 5% GHJ dislocations

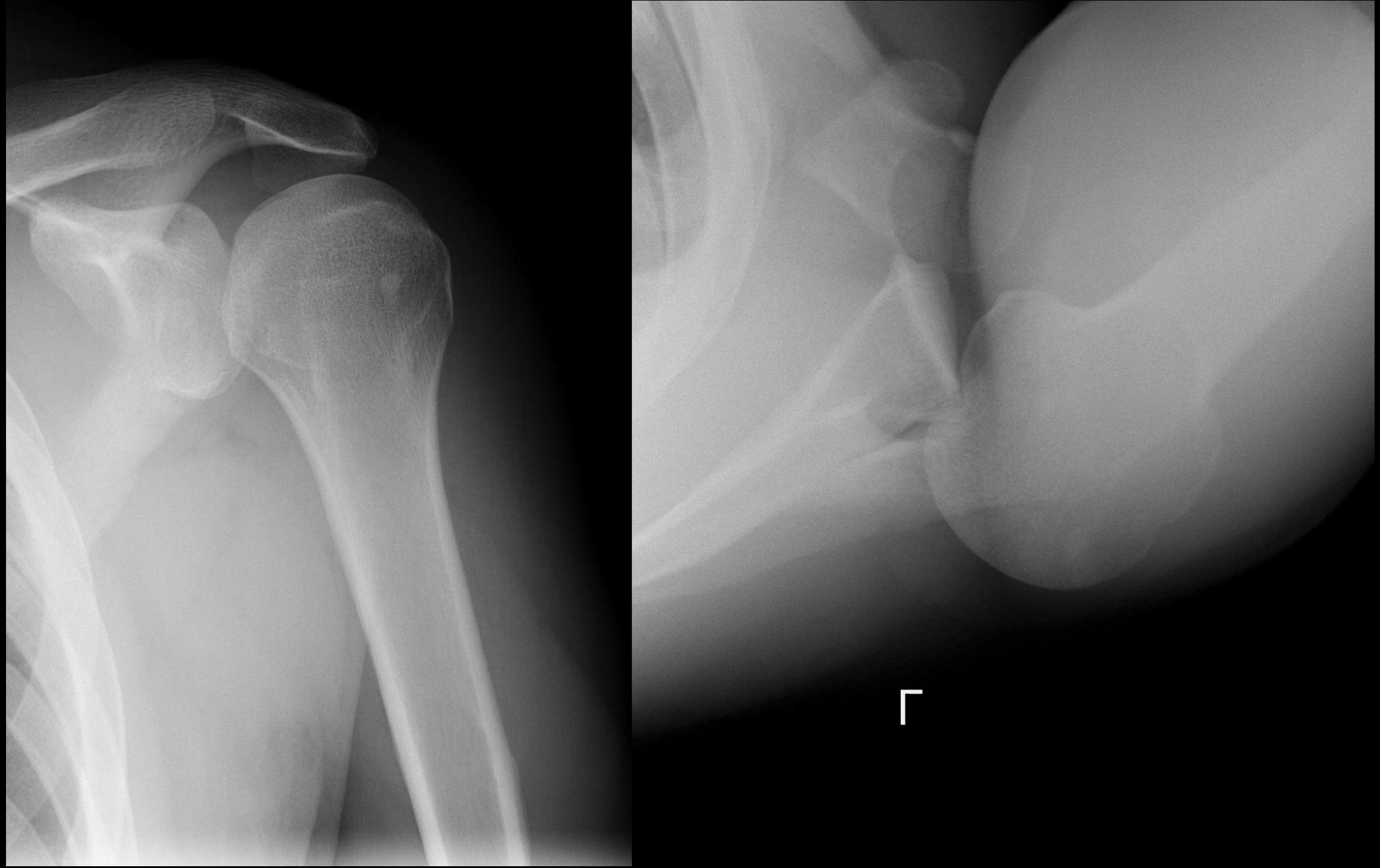
Anterior

- Humerus reverse Hill Sachs
- Rotator cuff contusion/tear

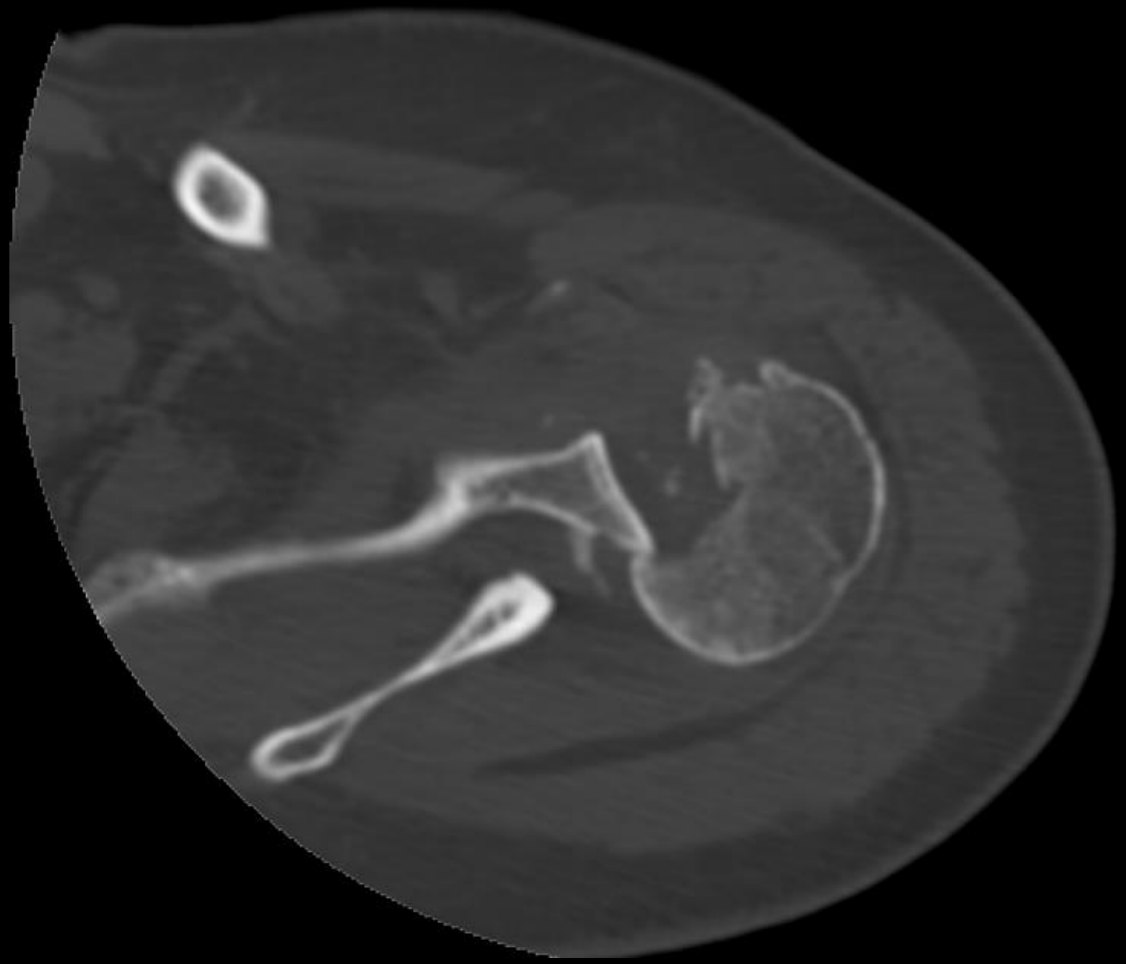
Posterior

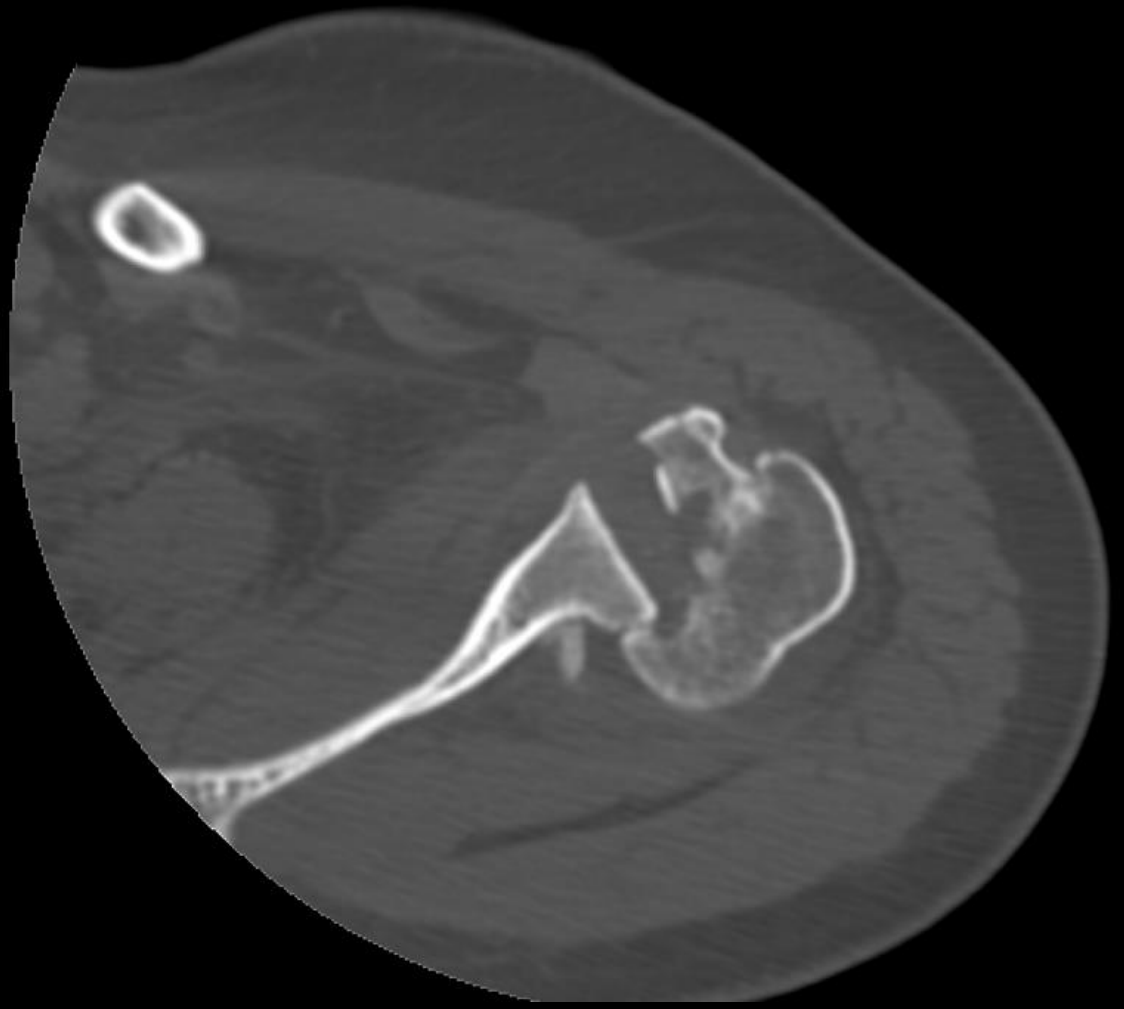
- Reverse Bankart Fx (glenoid)
- Labrocapsular injuries

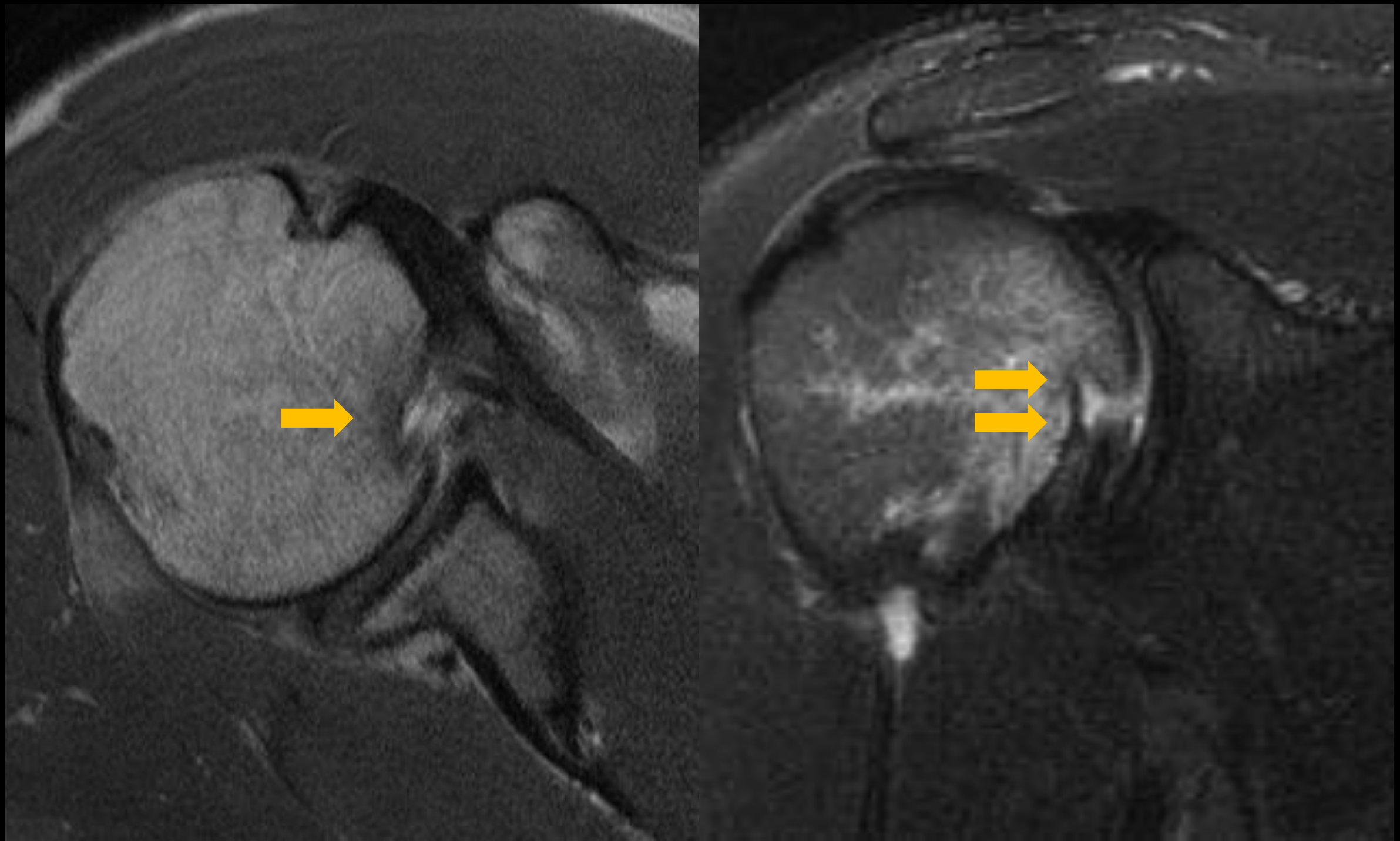





L
47







LABRAL LESIONS - POSTERIOR DISLOCATION

- Similar spectrum findings anterior dislocation

Reverse Bankart lesions

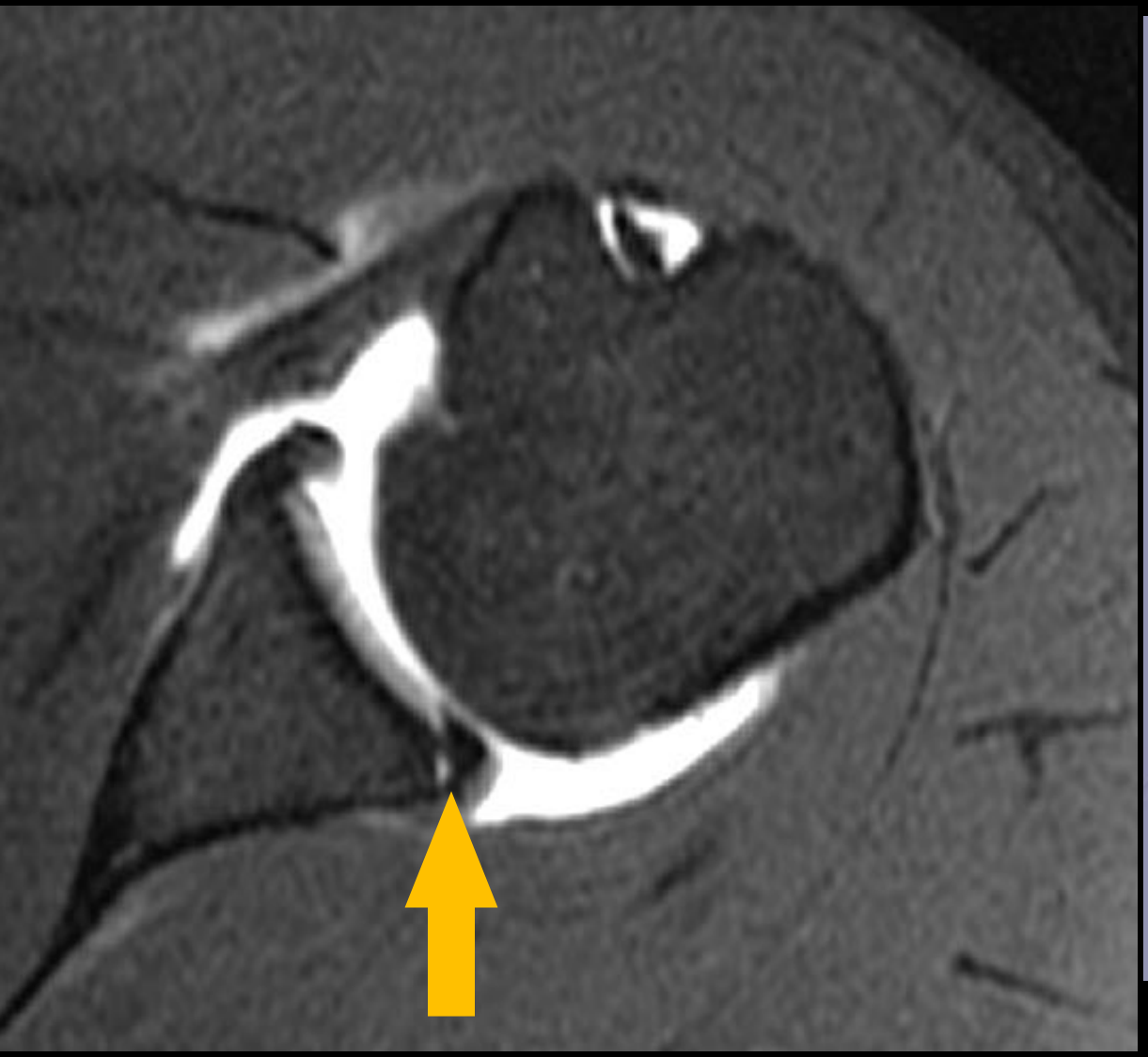
POLPSA lesions

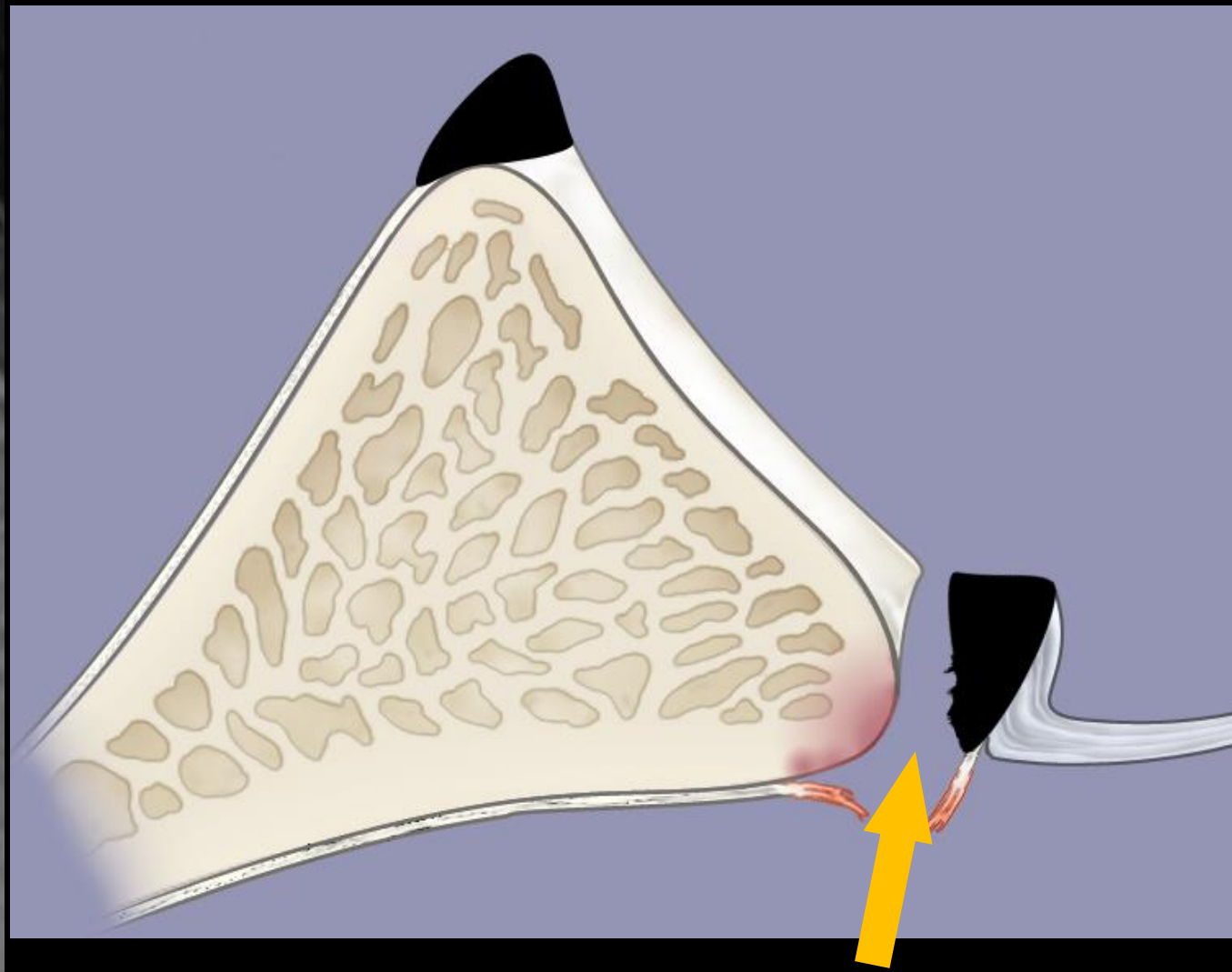
Reverse HAGL (uncommon)

POSTERIOR LABRAL TEAR

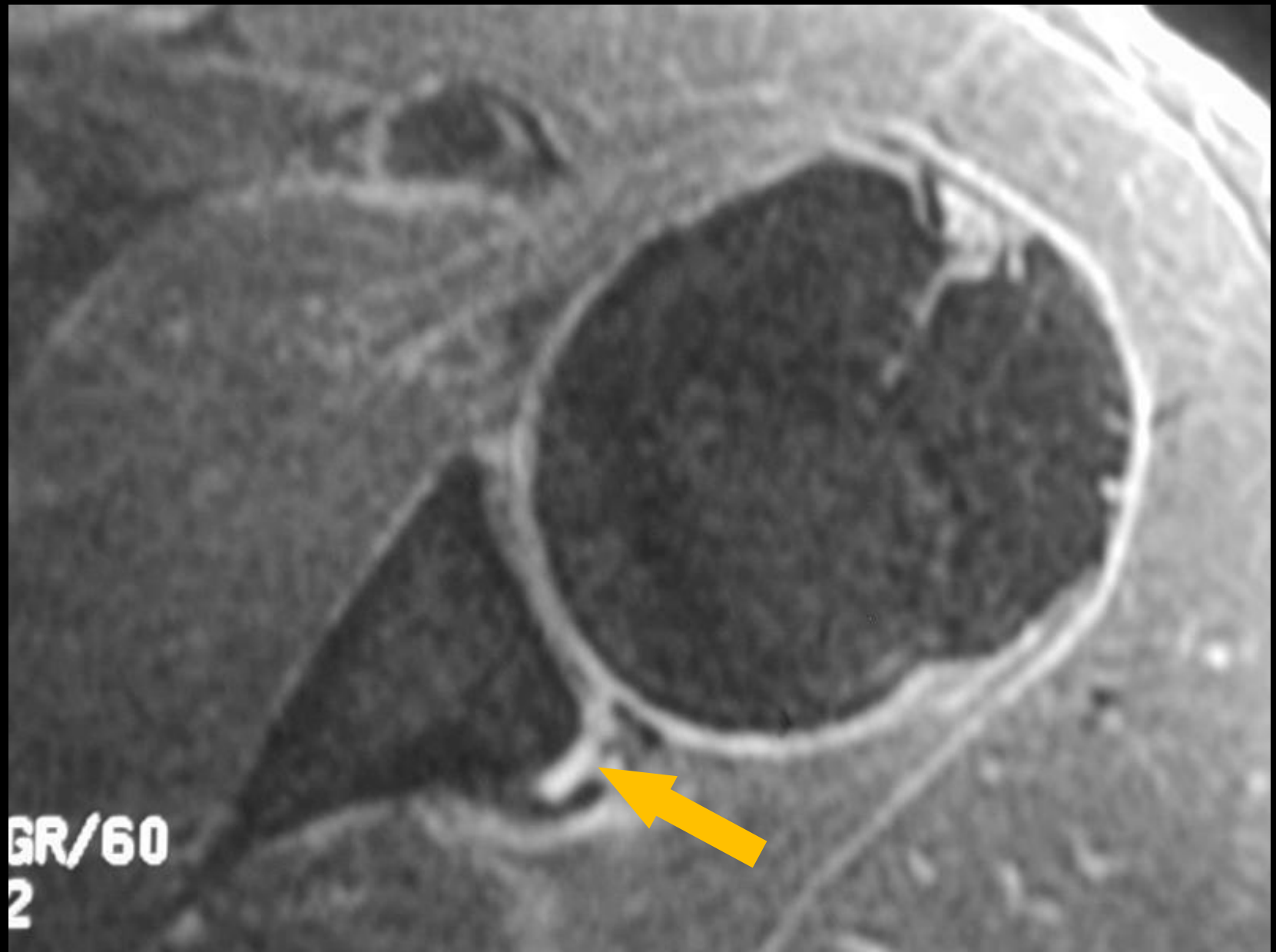
- Common in weightlifters
- Extension from superior labral tear
- Retroverted glenoid
- Perilabral cysts
- Easy for arthroscopist to miss
  - Look from anterior portal

POSTERIOR LABRAL TEAR





POSTERIOR LABRAL TEAR

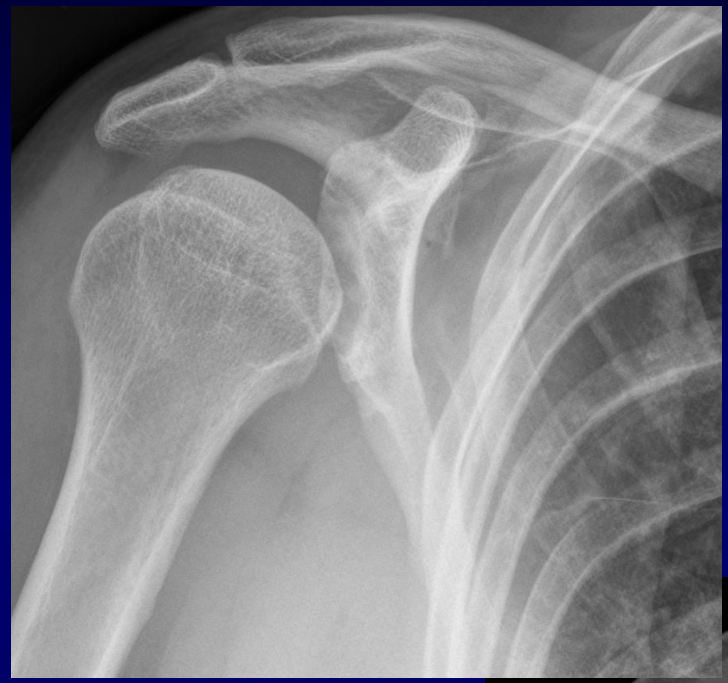


GLENOID DYSPLASIA

Hypoplasia inferior and posterior glenoid

Glenoid retroversion (normal <7 degrees retroversion)

Associated posterior head subluxation and posterior labral tears



AJR 2005;184: 984-988.

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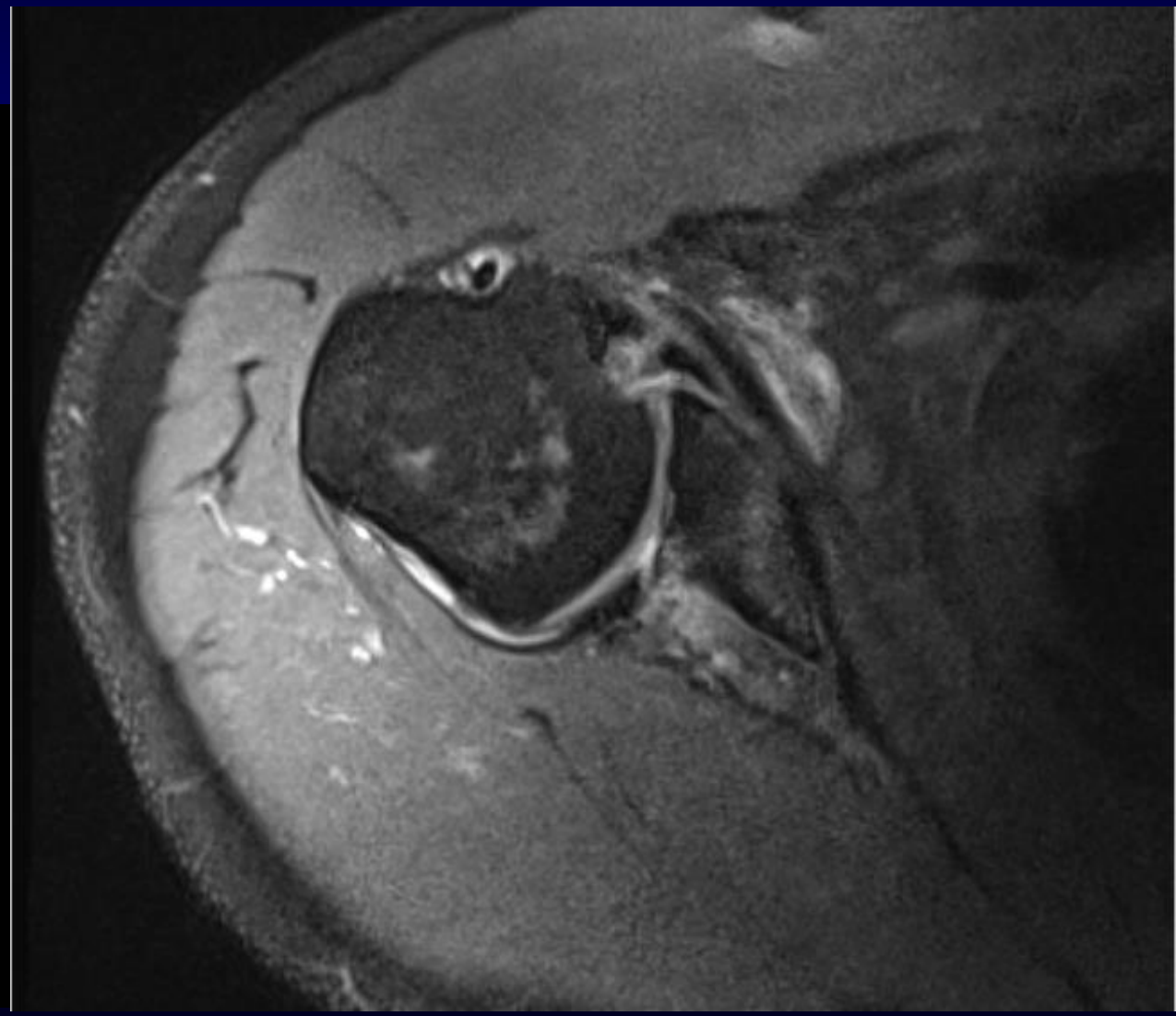


MULTIDIRECTIONAL INSTABILITY

- Refers to instability in >1 direction
- Related to ↑ looseness/laxity of supporting capsuloligamentous structures

Congenital - atraumatic (bilateral)

or

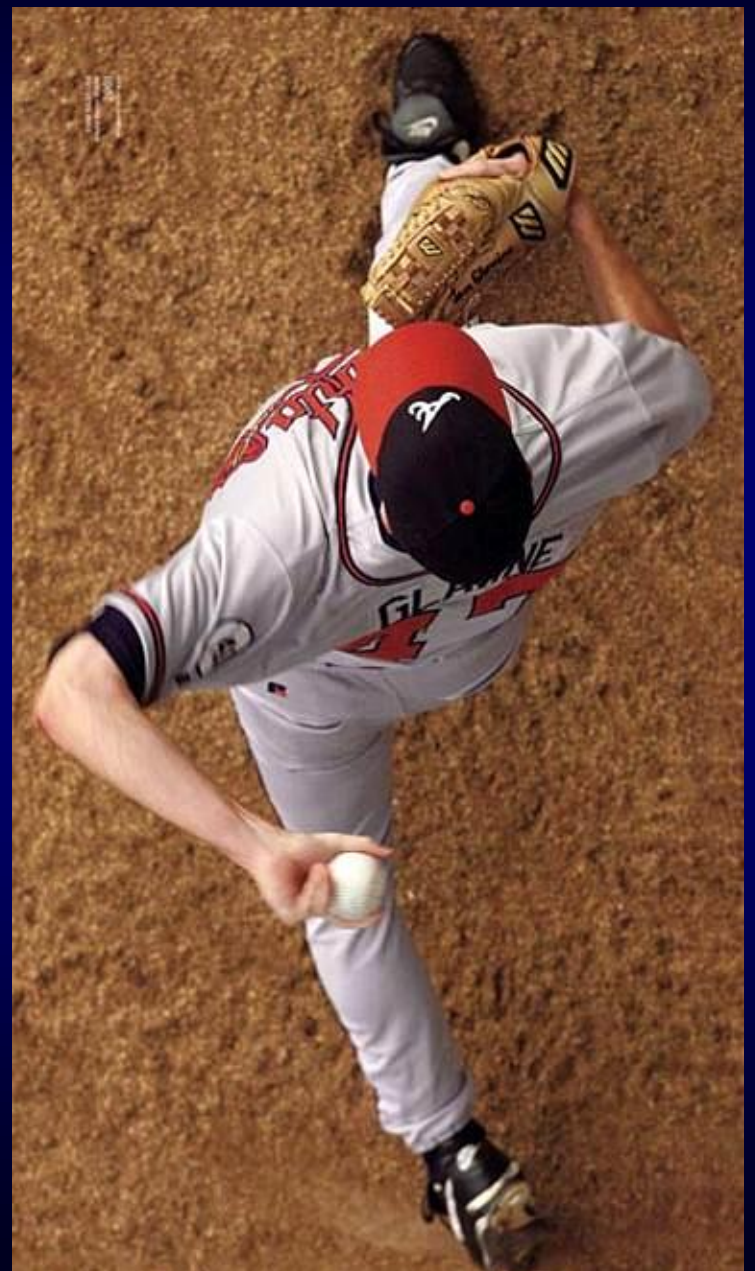
Developed – microtraumatic athletes

ACQUIRED –MULTIDIRECTIONAL INSTABILITY

- Seen in patients active in overhead sports
  (baseball, tennis, gymnastics, etc)

- Repetitive stretching capsule to extreme ranges of motion

→ Microtraumatic injury
  capsule, ligaments, labrum
  alterations joint proprioception
  predisposition to joint dislocation



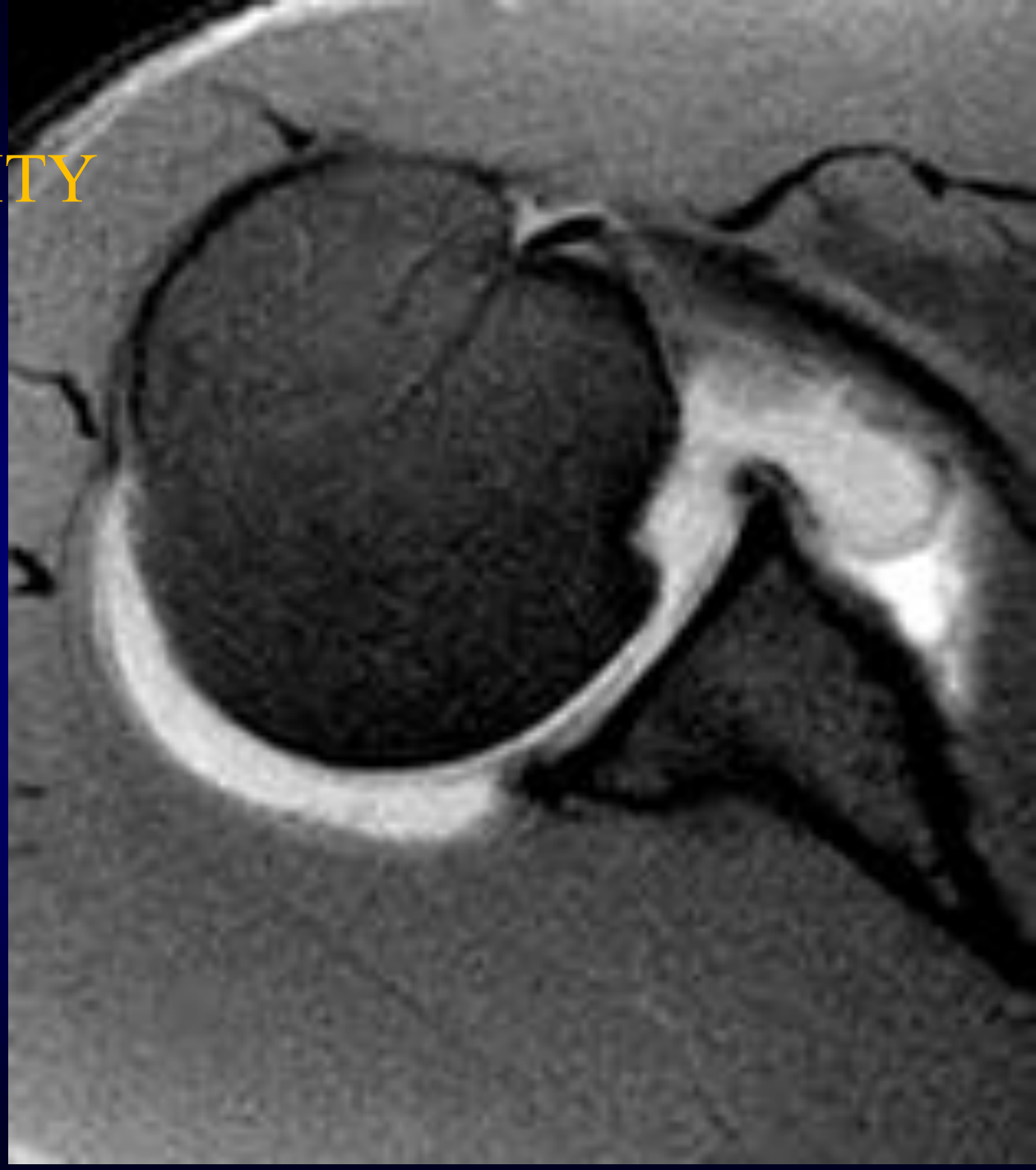
MR IMAGING: FINDINGS

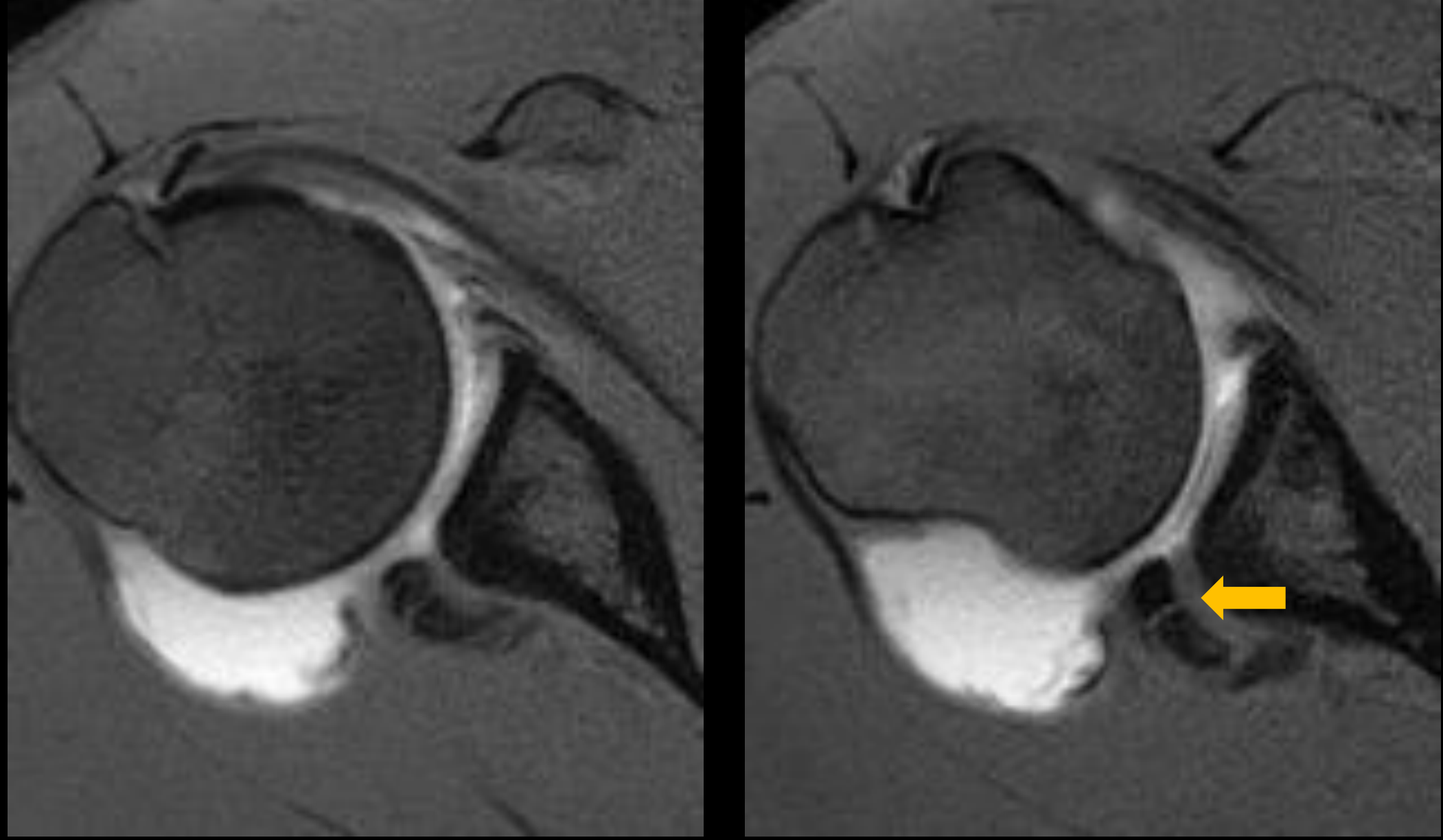
MULTIDIRECTIONAL INSTABILITY

- Capacious joint capsule
- Joint subluxation
- Labral tearing
- +/- Hallmarks - joint dislocation

- Retroversion glenoid

  ? cause or consequence





Hockey player – “Shoulder instability”

– History symptomatic joint subluxation

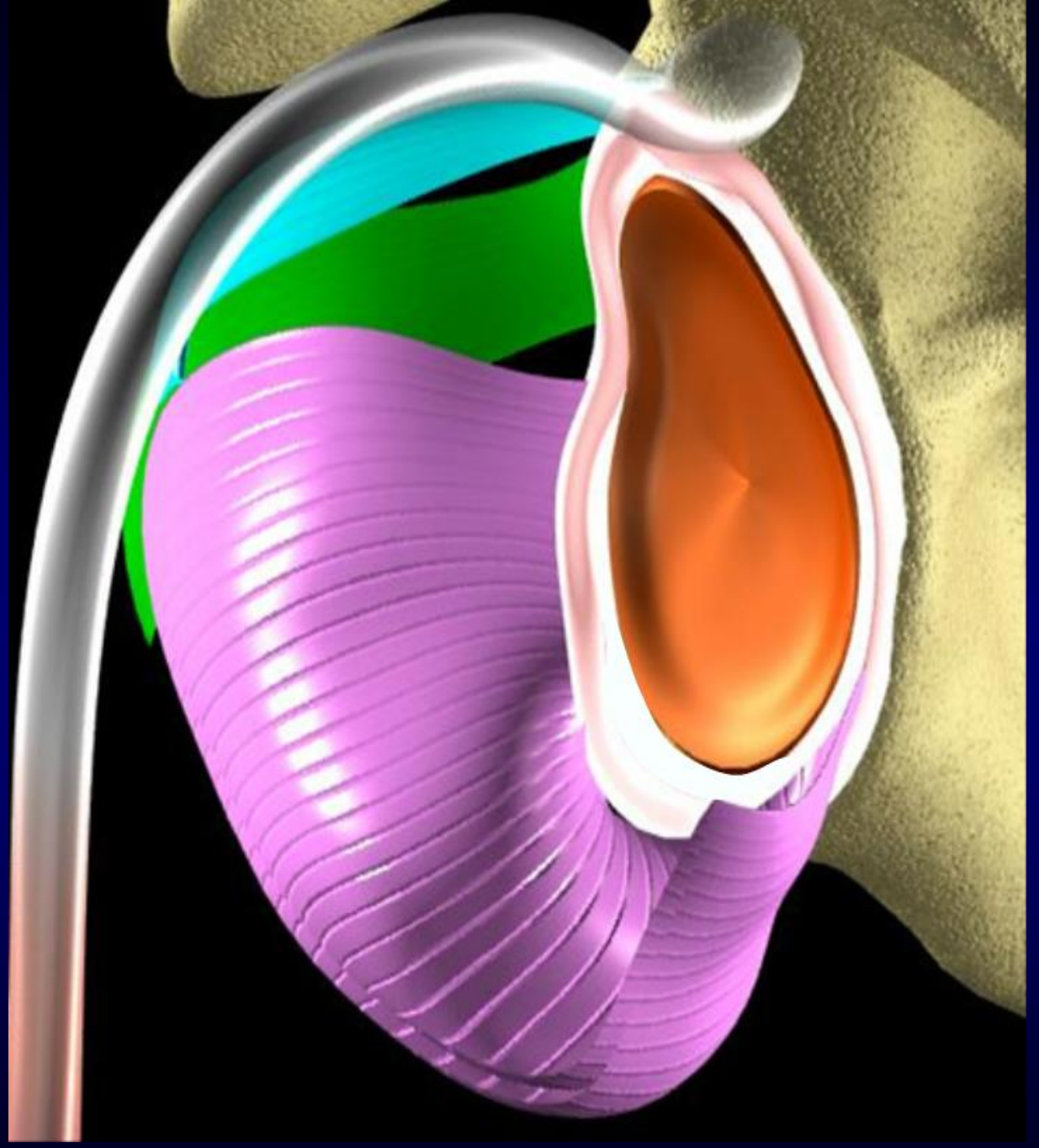
SLAP LESIONS

Tears superior labrum ant-to-post involving biceps anchor

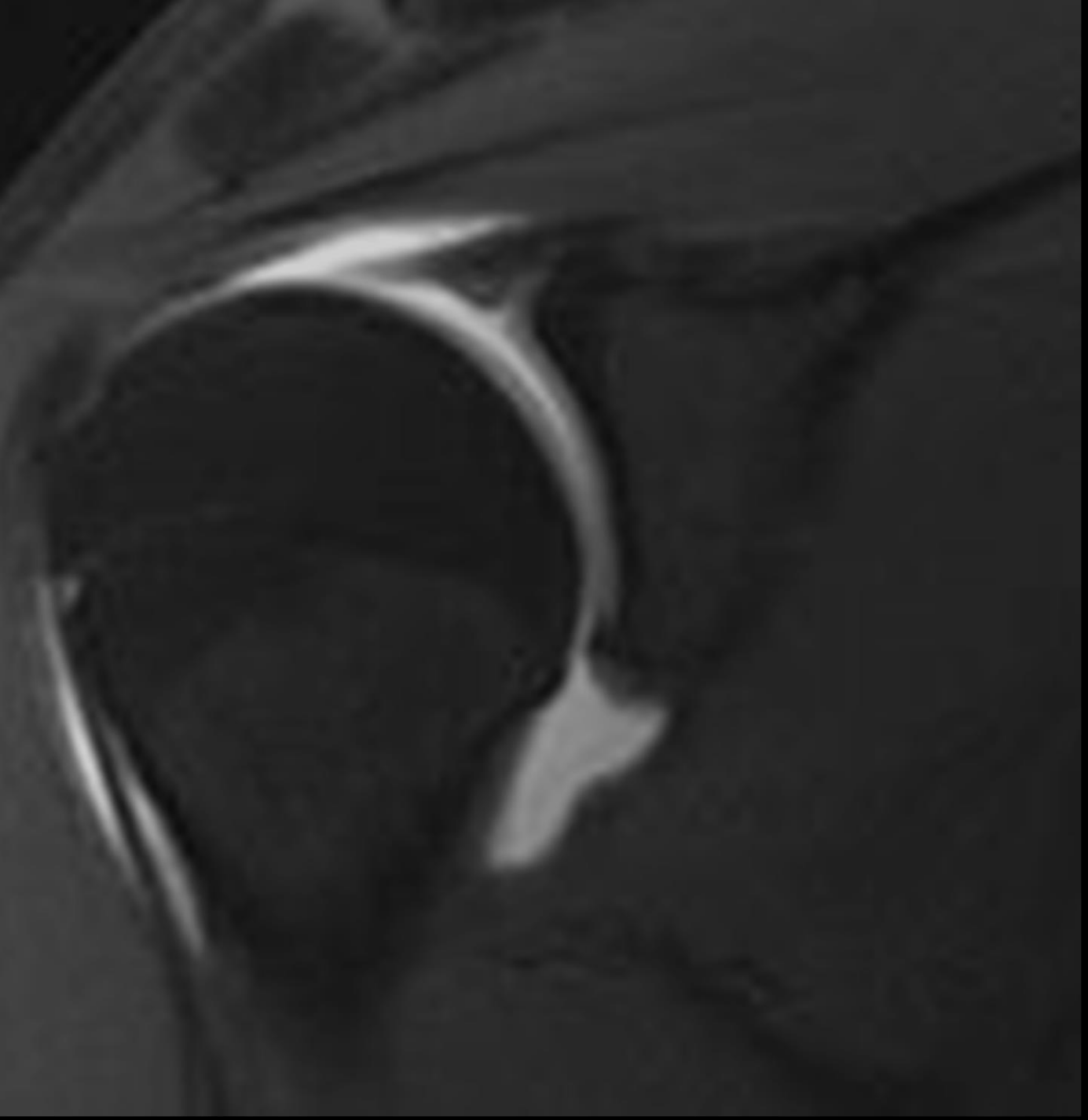
Etiology - Traction (LHB)
- Compression (grinding)

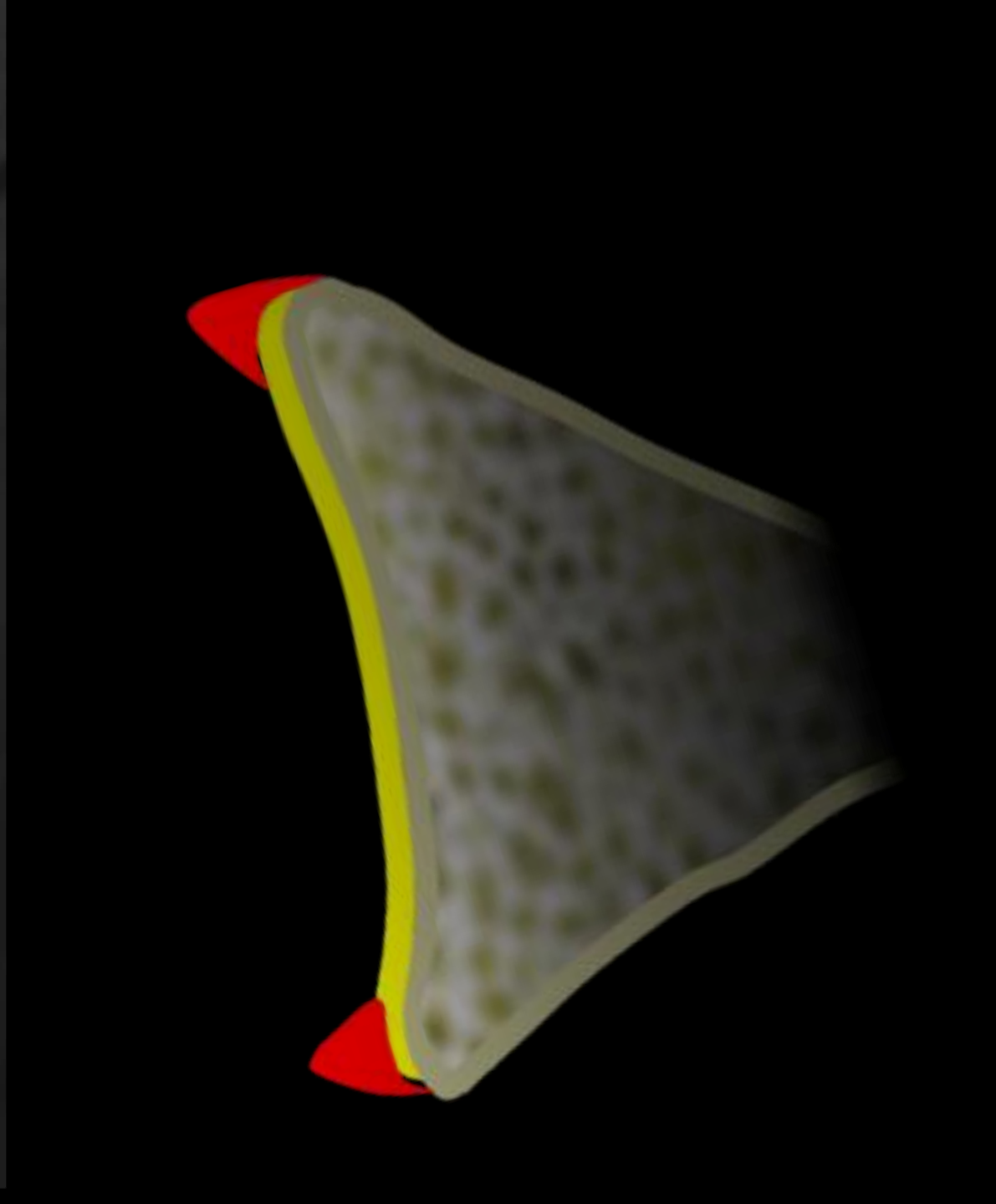
Initially classified 4 types

Subclassification 10+ types

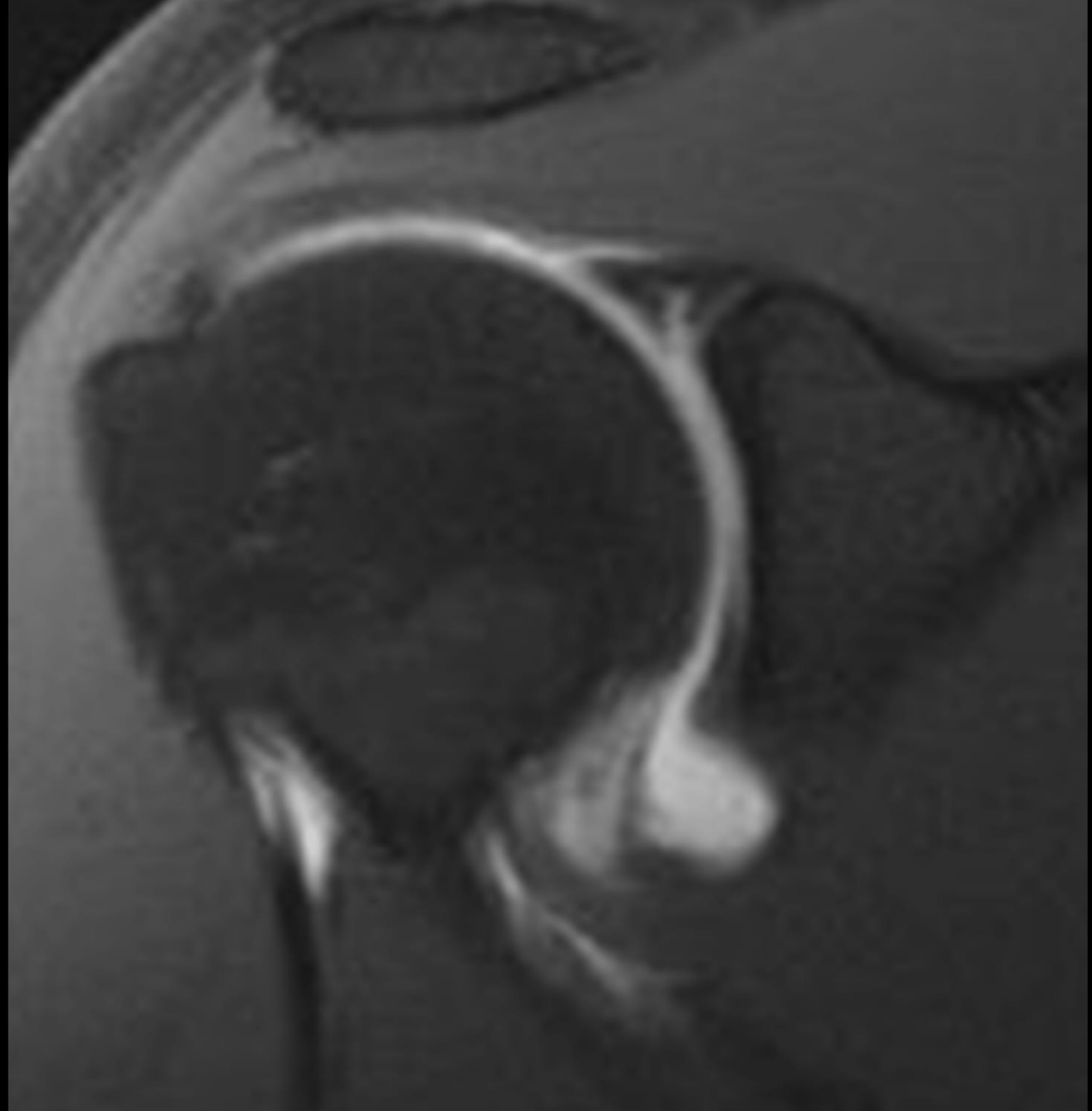


Synder SJ, et al. Arthroscopy 1990

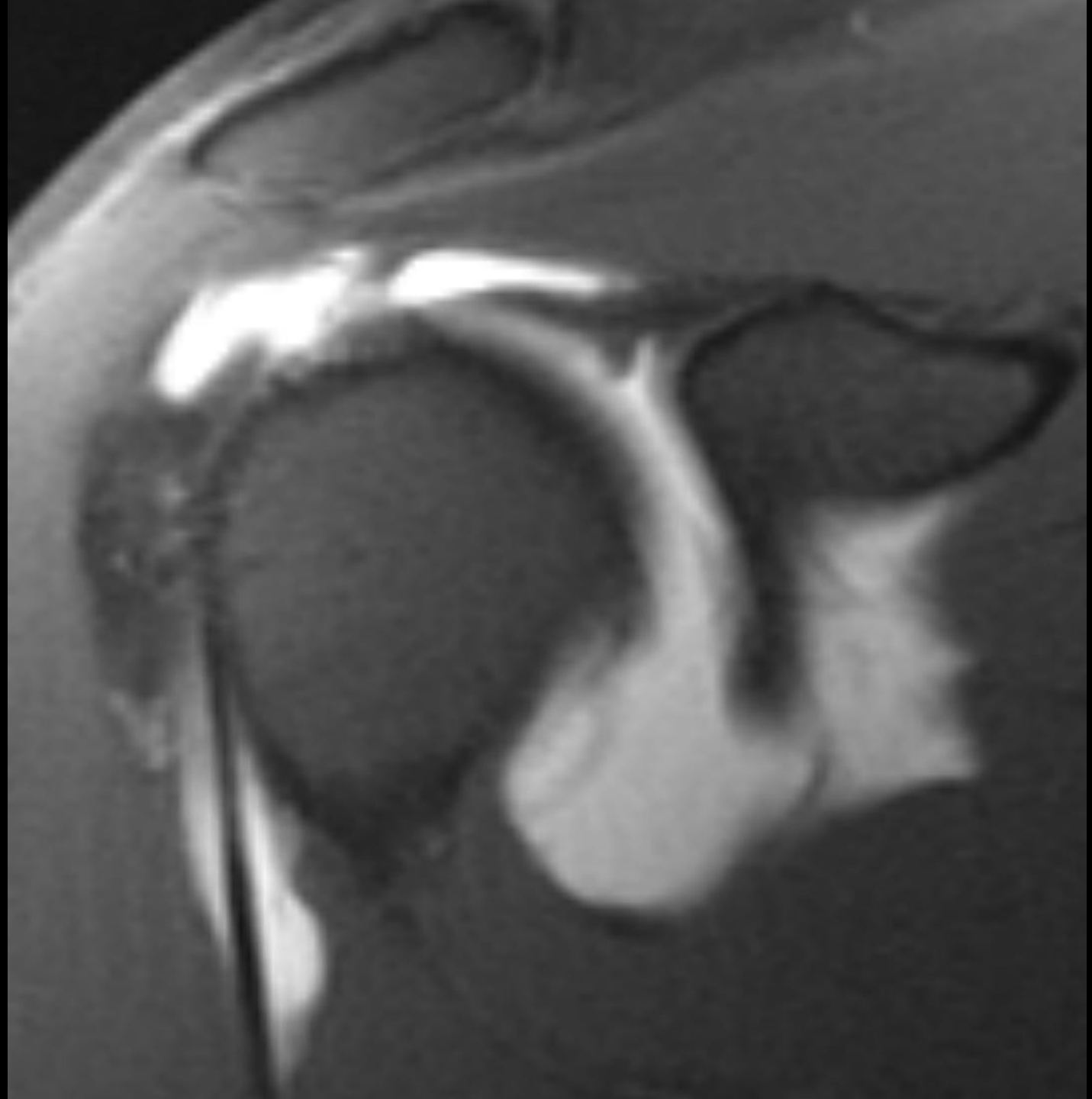




SLAP



SUBLABRAL RECESS



(irregular margins, separation labrum, extension post to anchor, lateral extension)

SLAP I

Fraying superior labrum

- Intact stable anchor
- Common – older patients, athletes

SLAP II

Superior labral tear, detachment biceps anchor

- Most common true tear
- May resemble sublabral recess

SLAP III

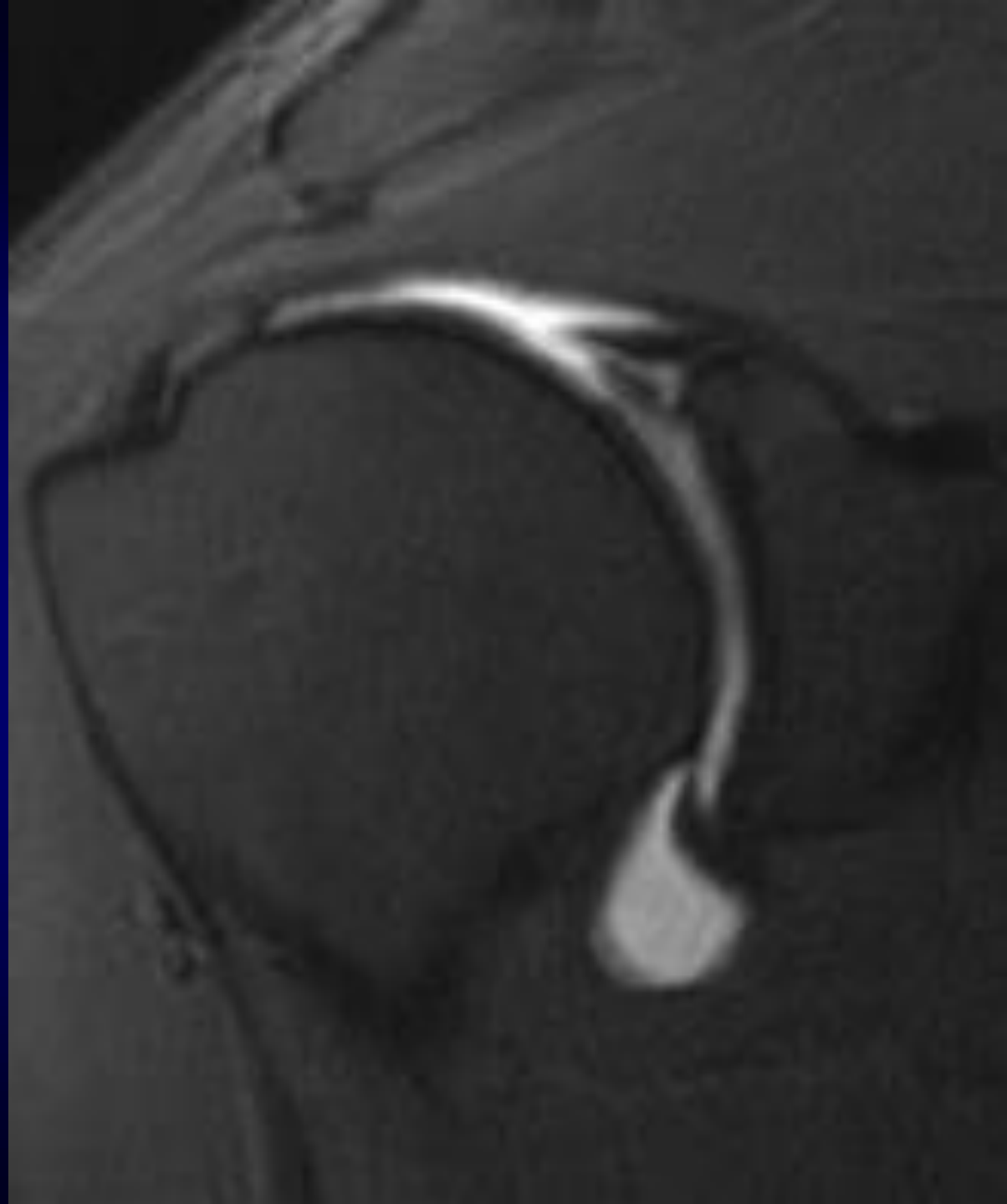
Bucket handle tear sup labrum

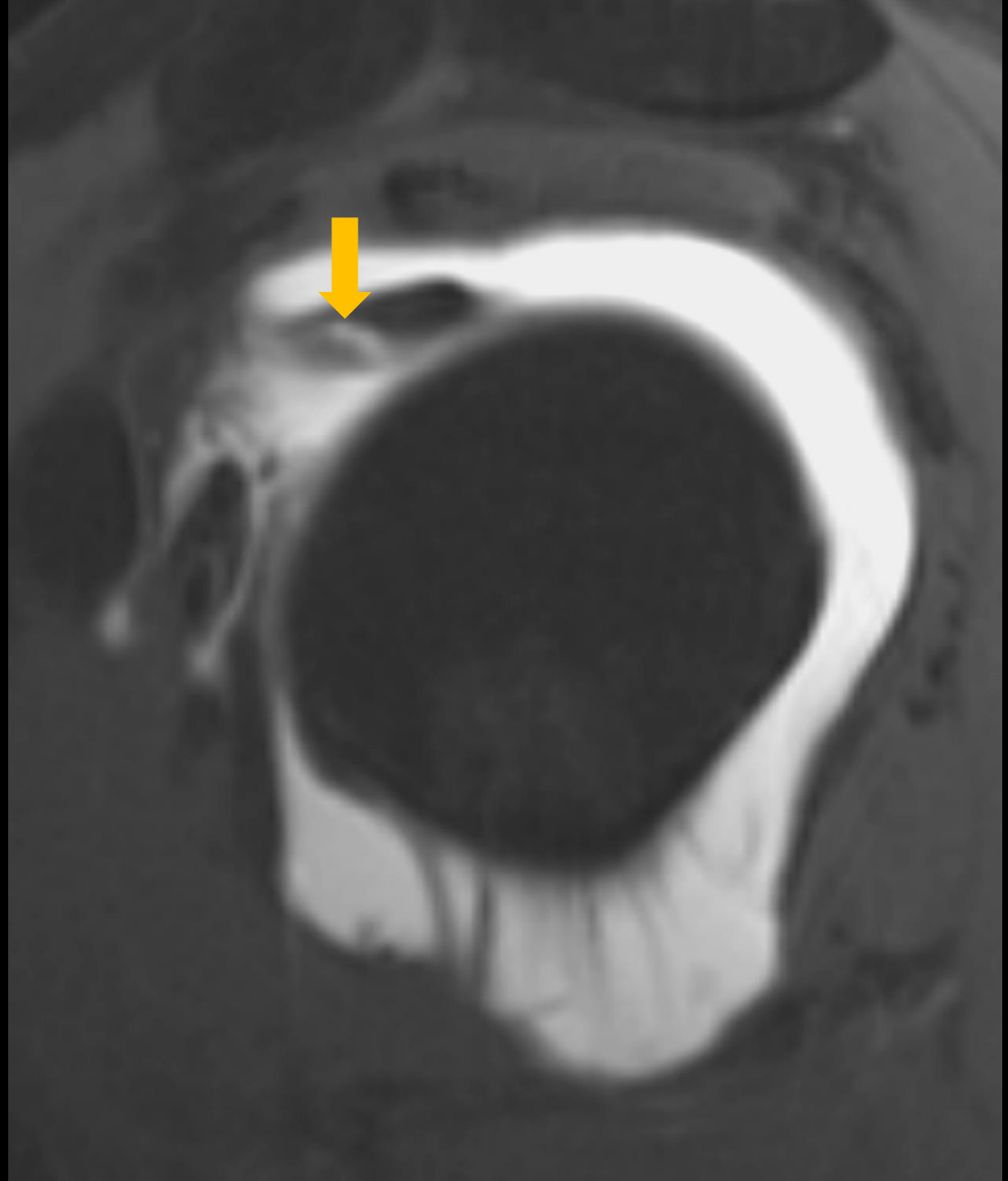
- Intact biceps anchor

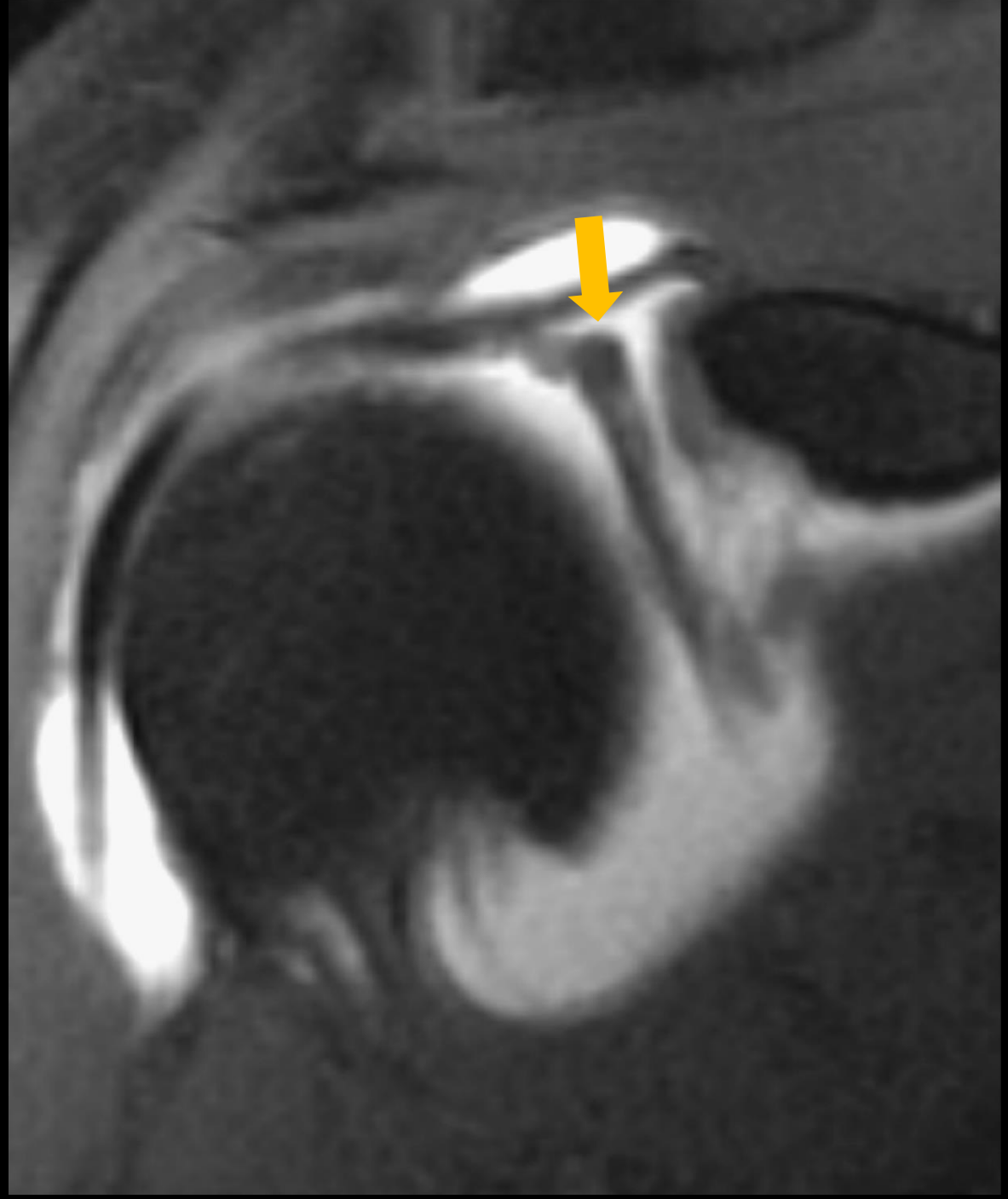
SLAP IV

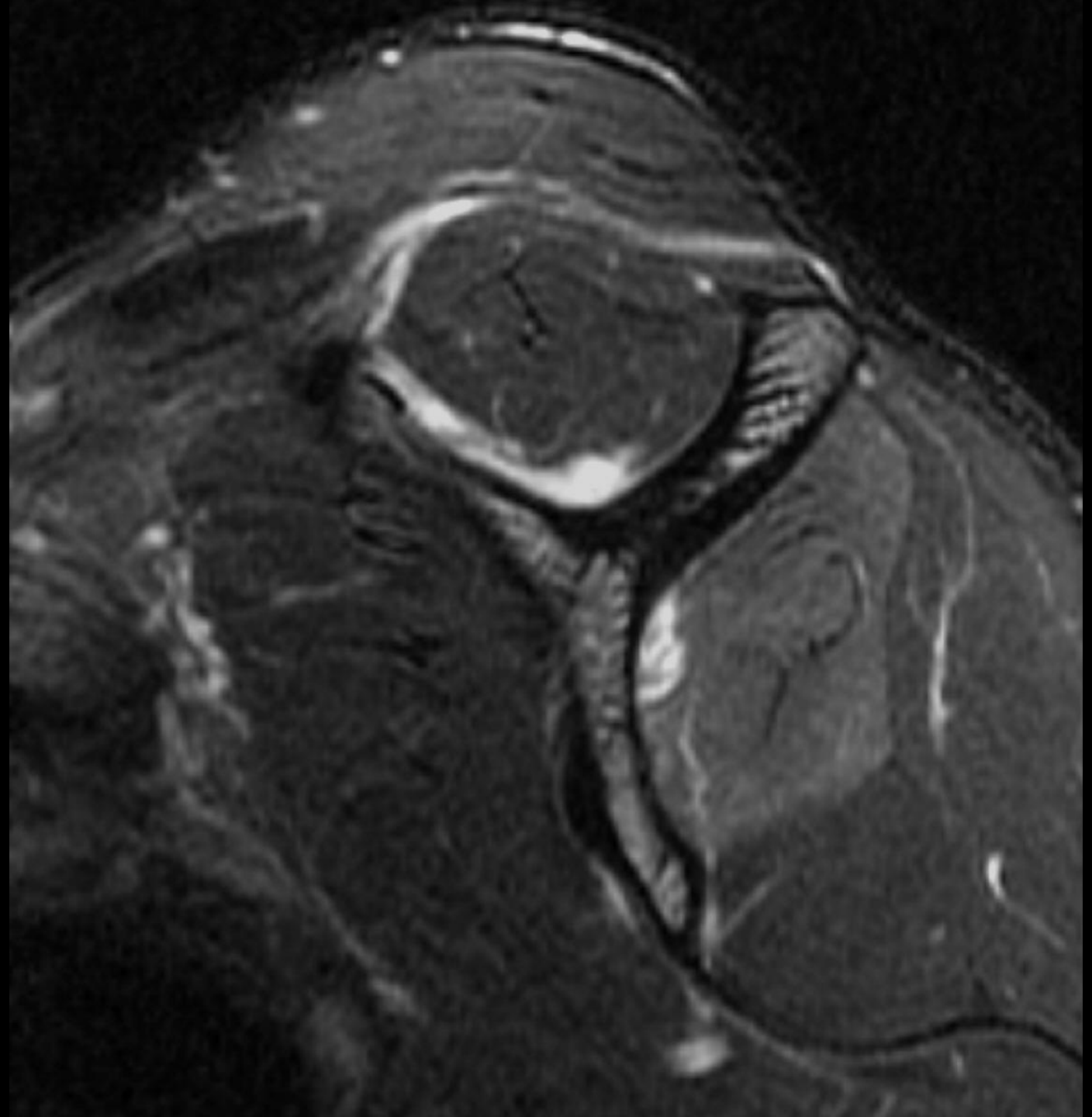
Tear sup labrum extending into biceps tendon

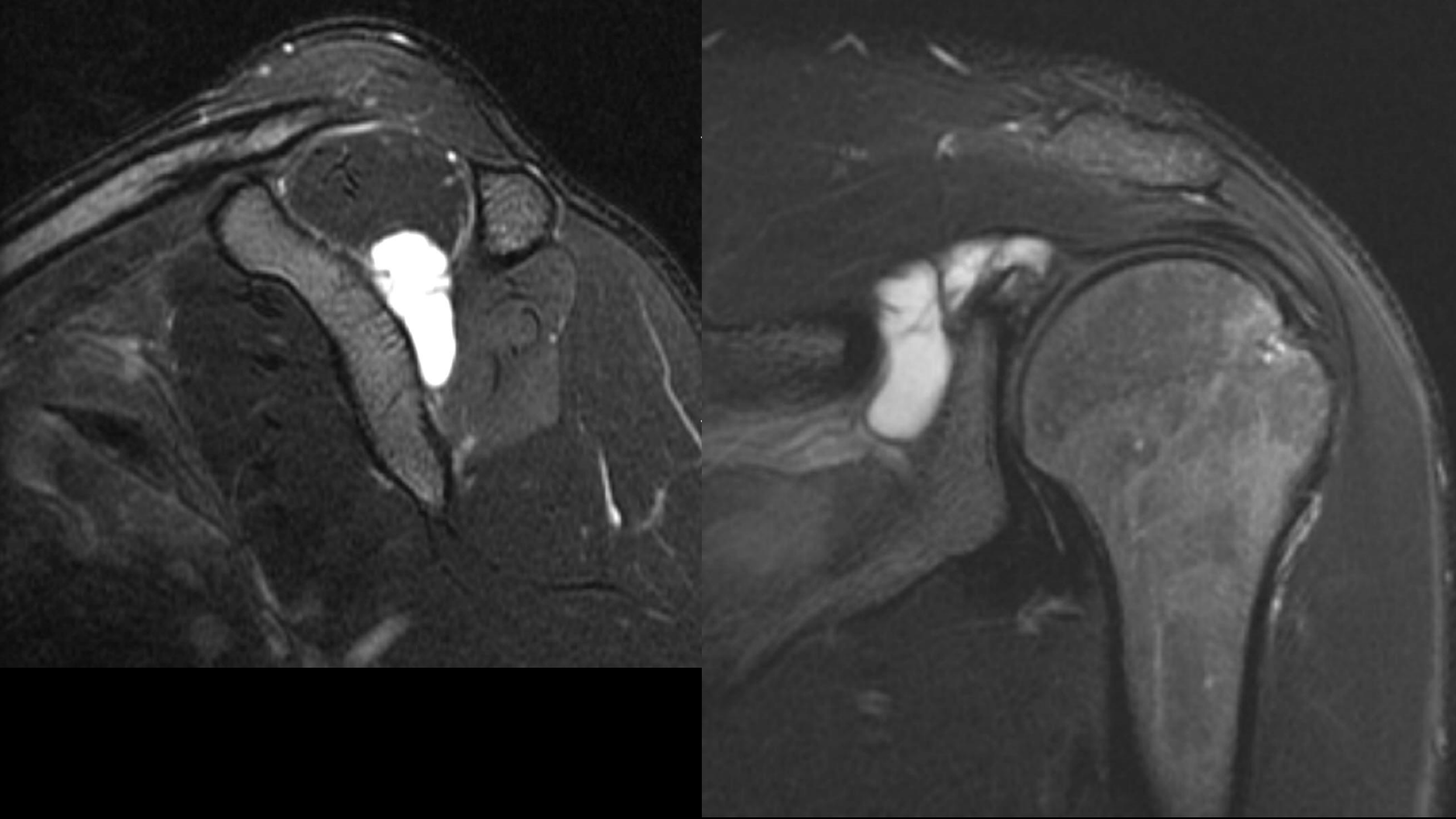
- Unstable biceps anchor + tendon











SUMMARY

Physiologic and MR Imaging

Anatomic restraints GHJ

- Labroligamentous soft tissues
- Osseous (humerus, glenoid)

MRI findings

- Glenohumeral dislocation
- Postoperative Instability repair

Features – Important to surgical planning and management