

# MR IMAGING OF THE ROTATOR CUFF

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# MR IMAGING OF THE ROTATOR CUFF

## LEARNING OBJECTIVES

- Review relevant anatomy/MR imaging planes
- Review MR appearance of rotator cuff tears
- Discuss problem rotator cuff tears
- Discuss mimics of rotator cuff tear
- “What the surgeon wants to know”
  - The radiology report

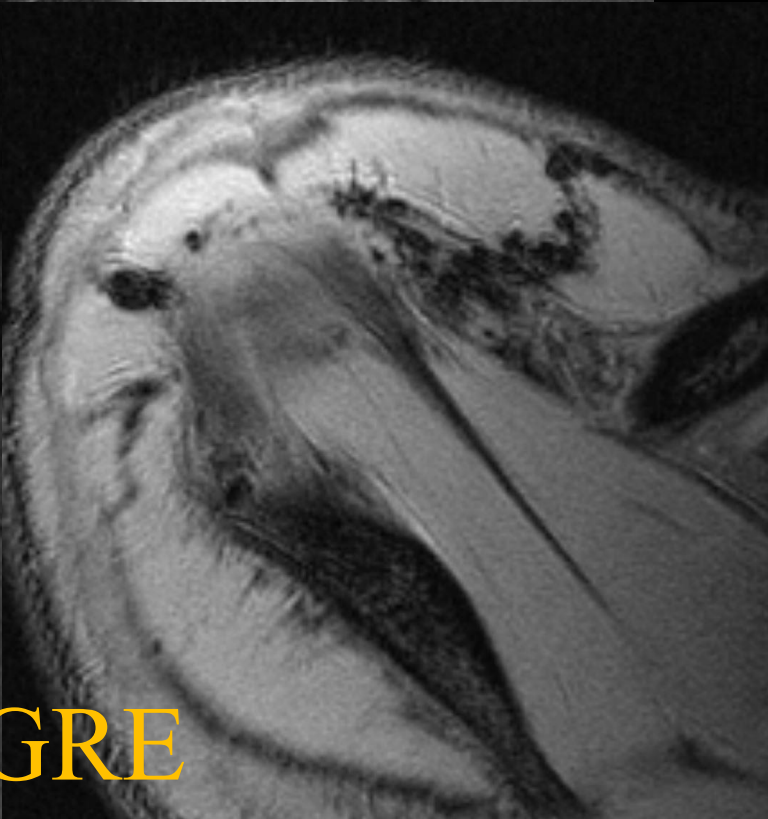
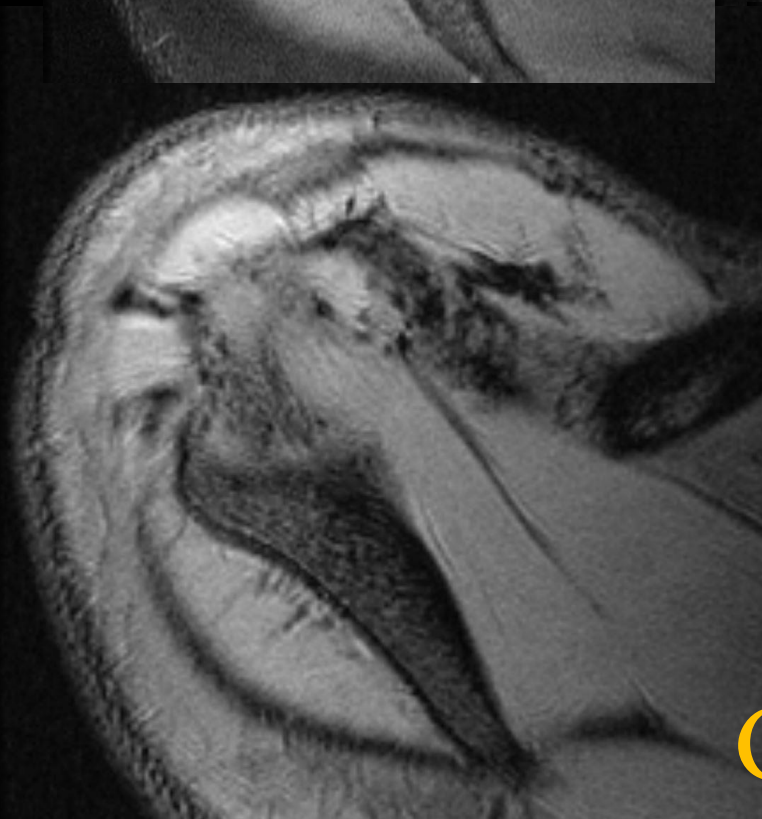
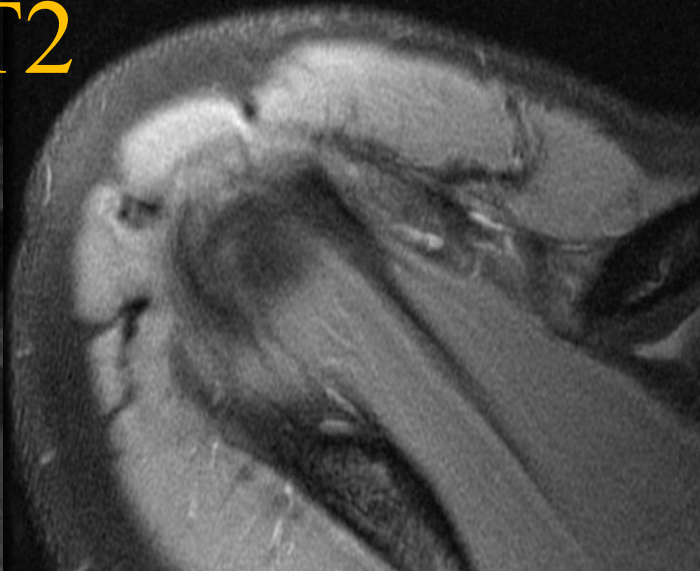
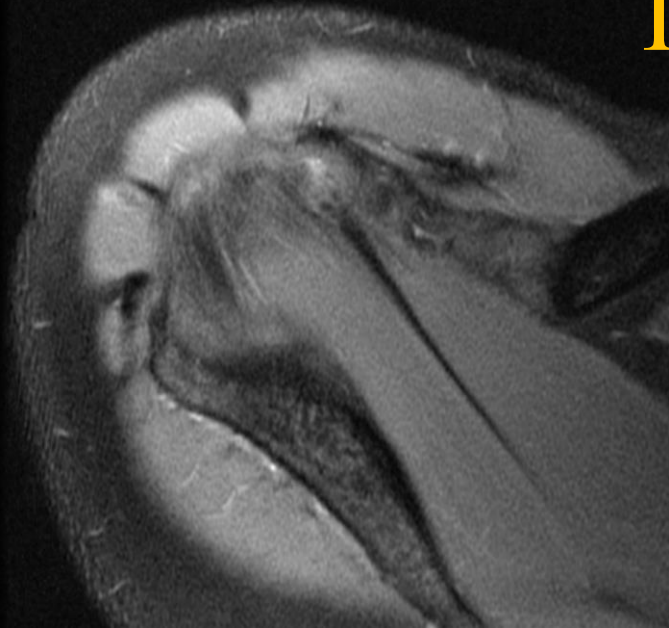
# MR IMAGING ROTATOR CUFF TECHNIQUE

- Coil – dedicated shoulder
- Slice thickness – 3-4 mm
- Matrix – 256x192 or higher to 512
- FOV – 14-16 cm
- Patient position
  - External rotation vs neutral
  - ABER
- Contrast – Indirect or Direct

# MR IMAGING ROTATOR CUFF OUR TECHNIQUE

- Axial T2 FS FSE, Axial GRE
- Coronal oblique PD and FS FSE T2
- Sagittal oblique T1 and FS FSE T2

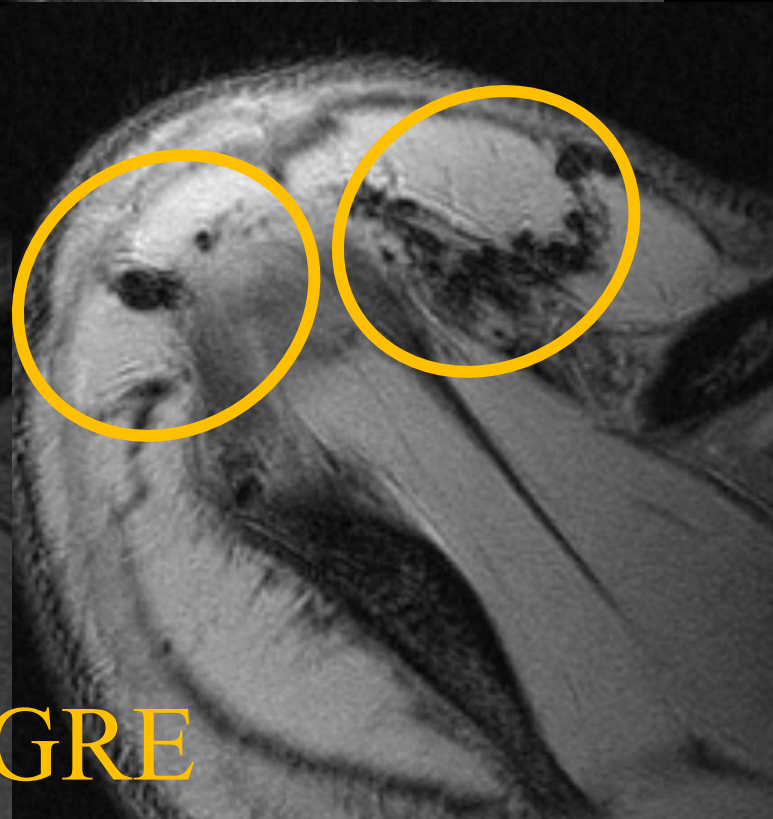
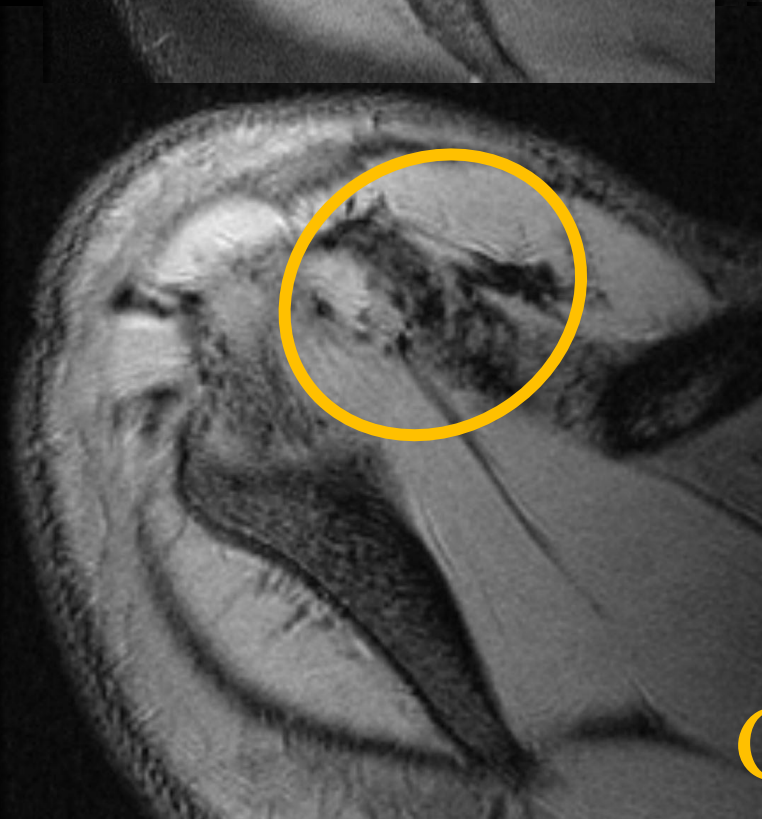
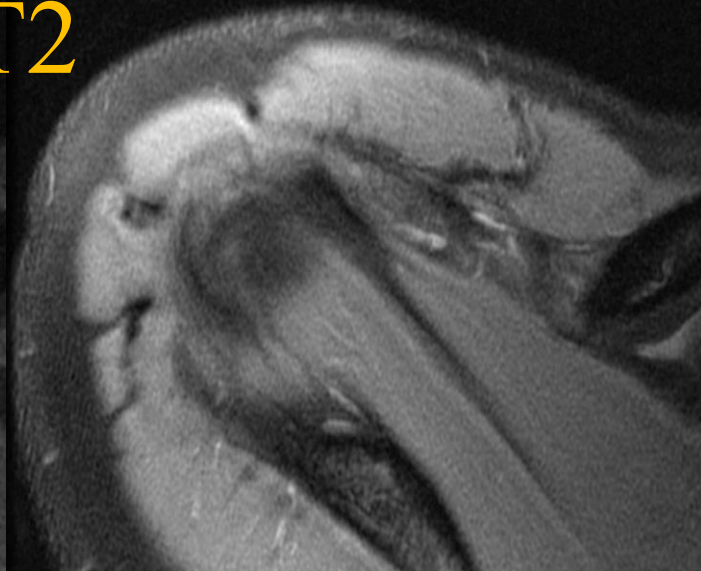
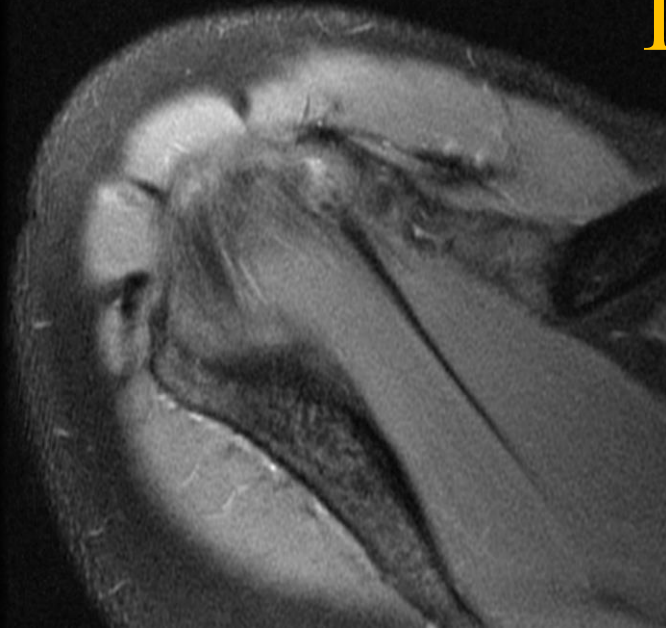
T2



GRE



T2



GRE

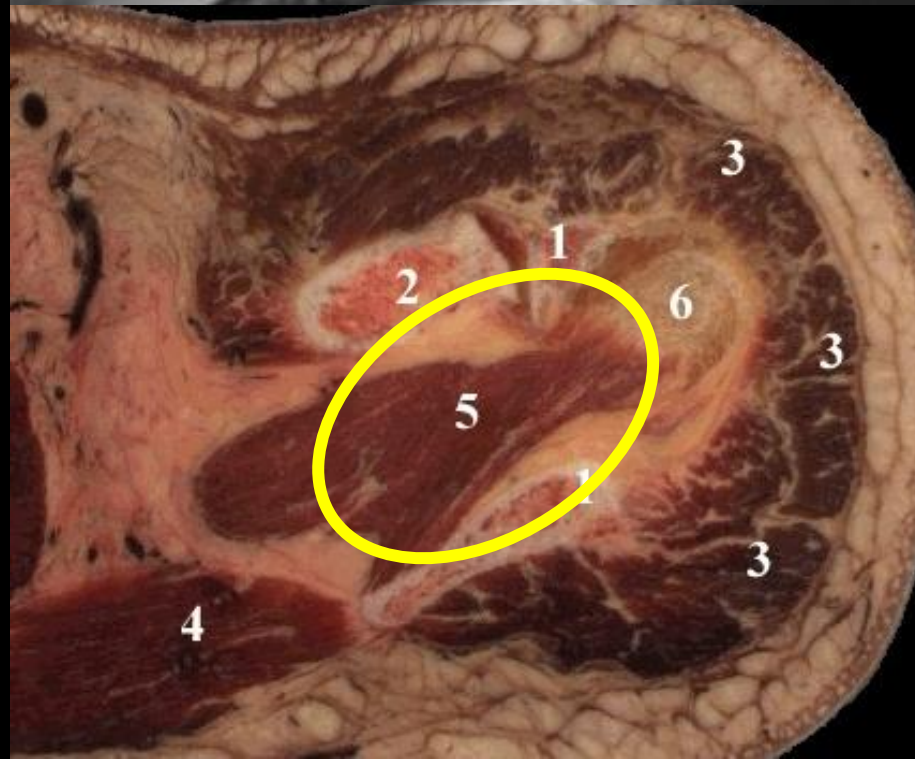
# MR ARTHROGRAPHY TECHNIQUE

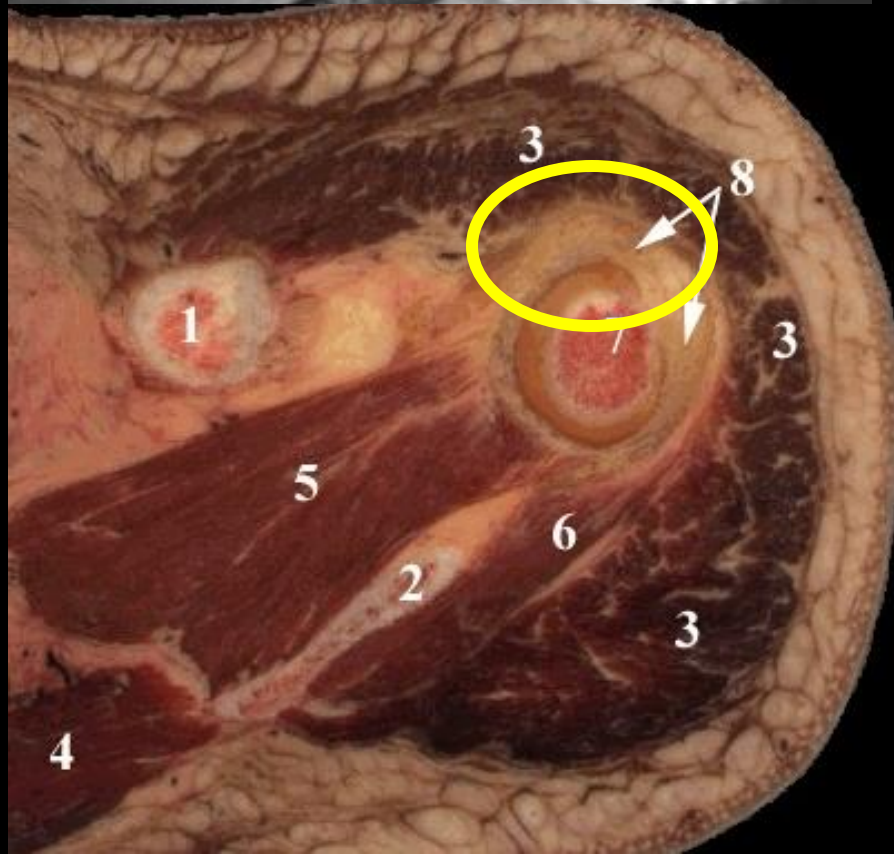
- 12-16cc (I put in less 8-12cc) mixture of contrast and gadolinium (10:10:0.1)
- Axial, oblique sagittal and oblique coronal FS T1-weighted images
- Additional fluid sensitive sequences

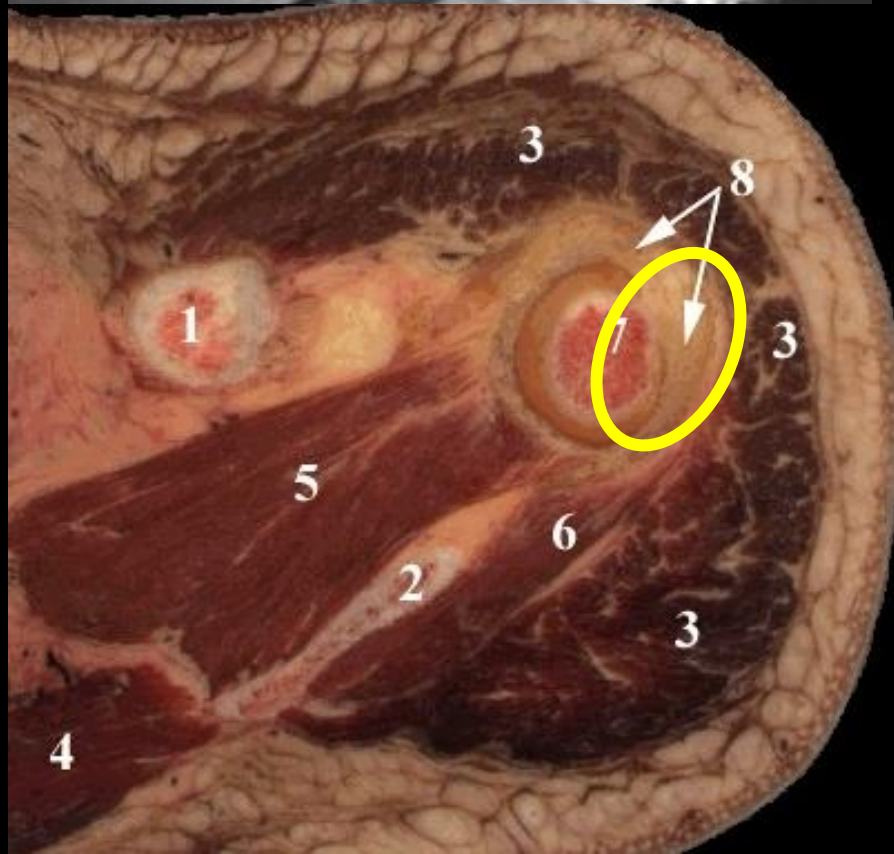
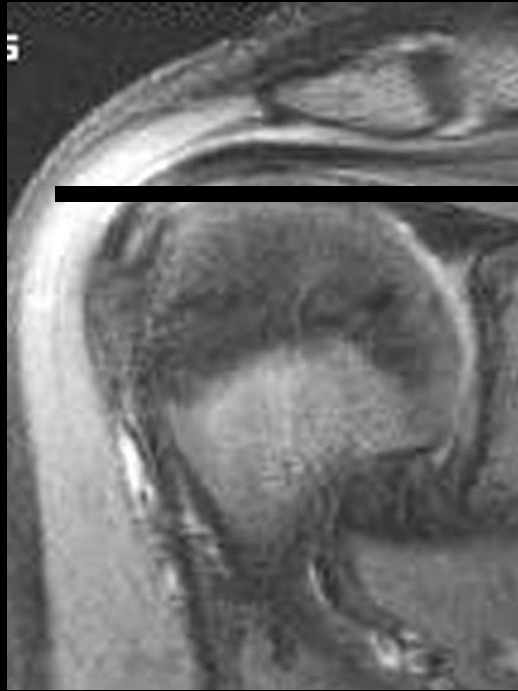
# MR IMAGING PLANES

- Axial
  - Assess subscapularis, biceps tendon
- Coronal oblique
  - Parallel to supraspinatus tendon
  - Assess all tendons
- Sagittal oblique (FSE T2)
  - 90° to coronals
  - Assess all tendons

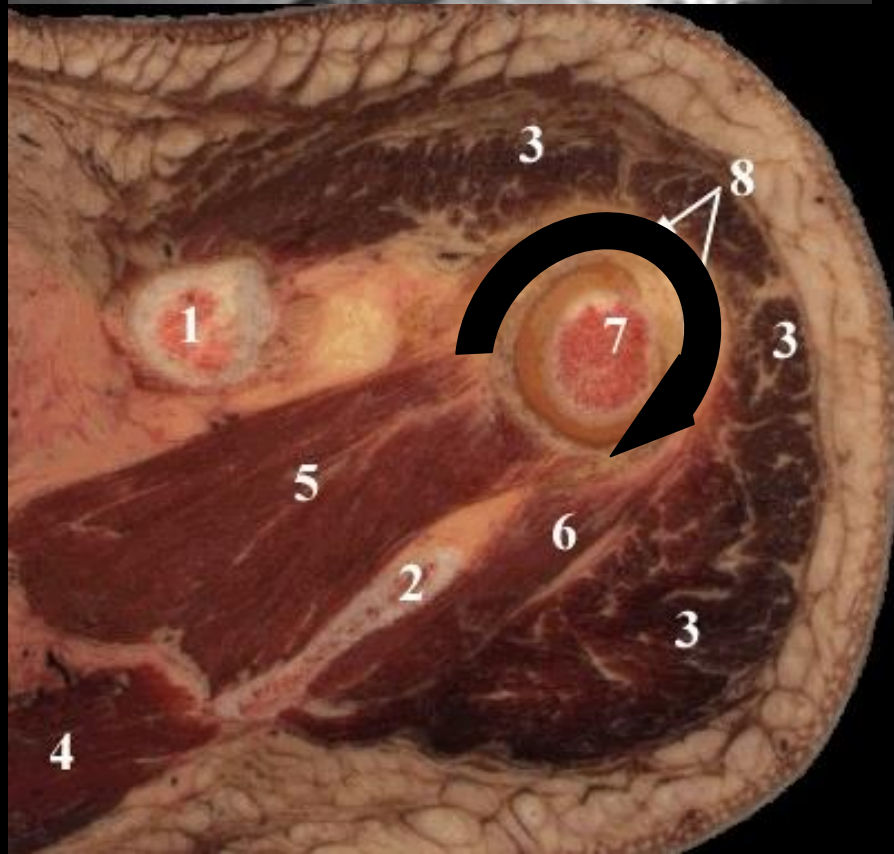


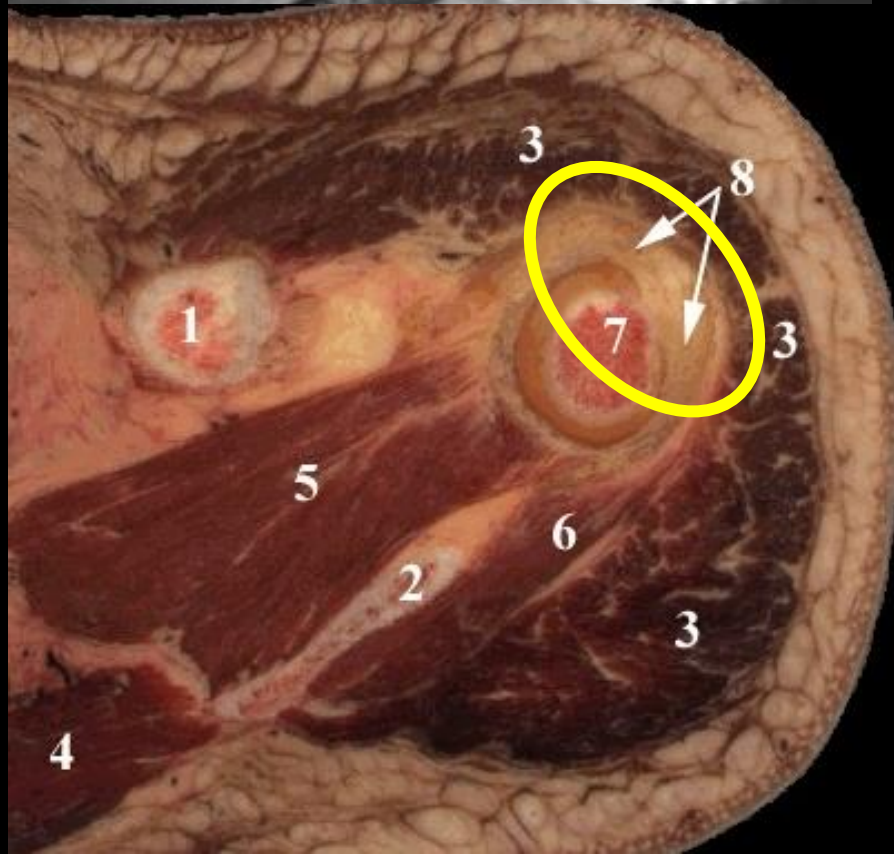










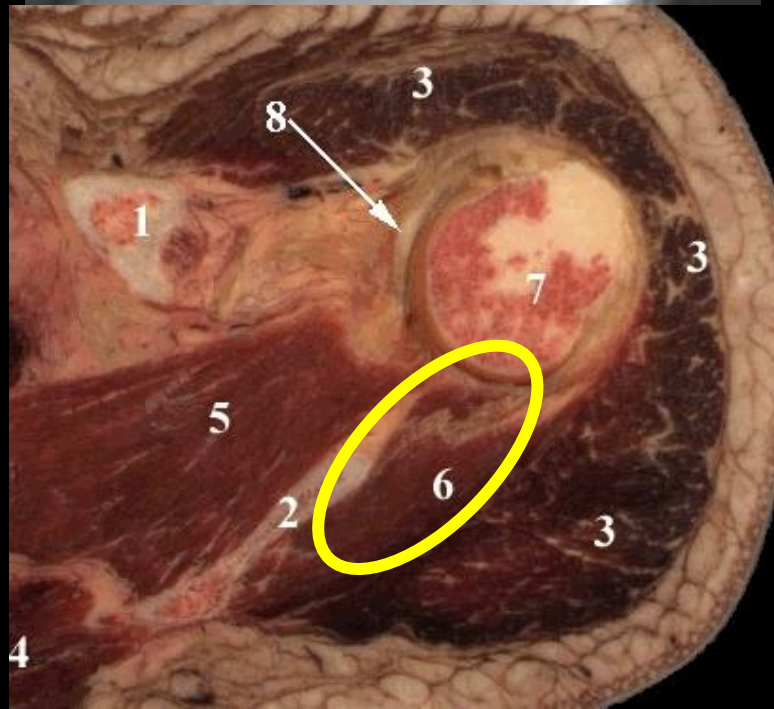
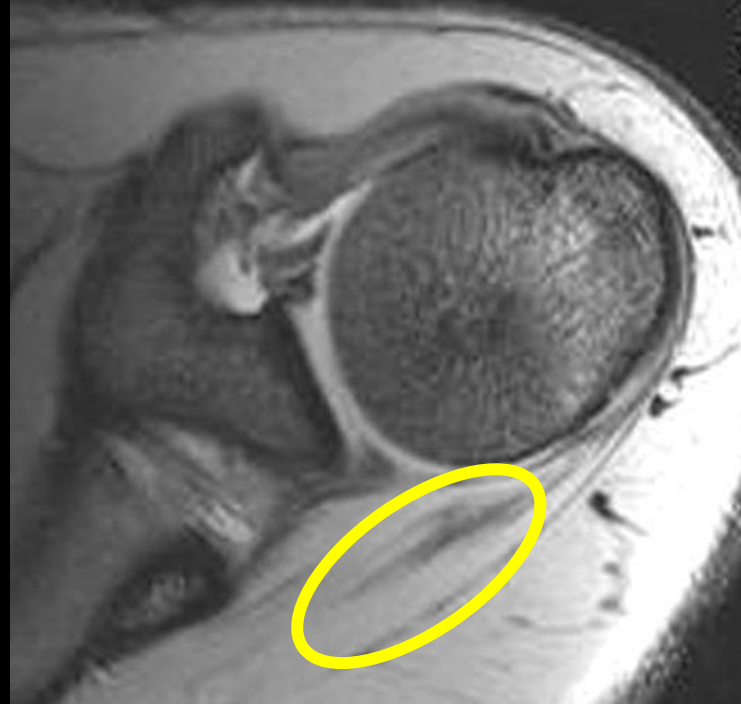


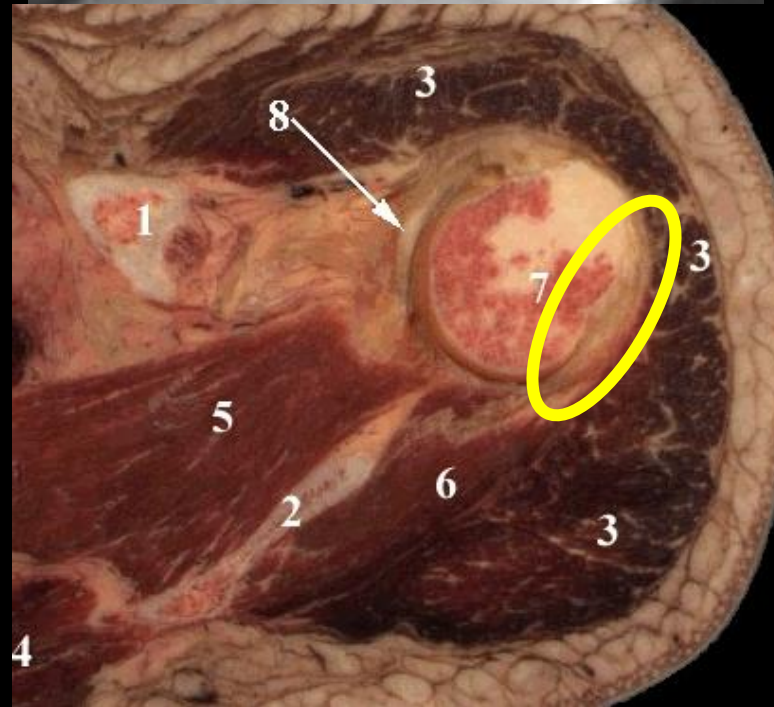
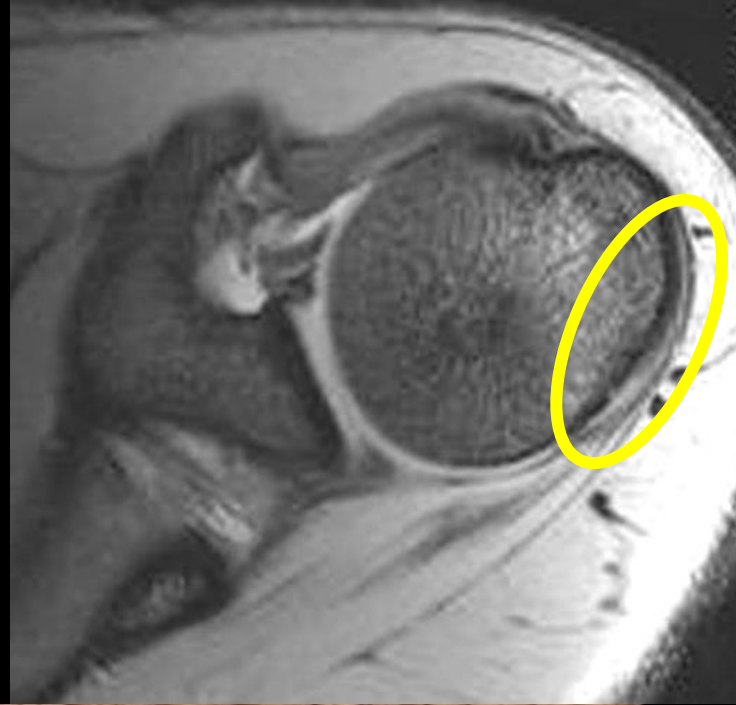














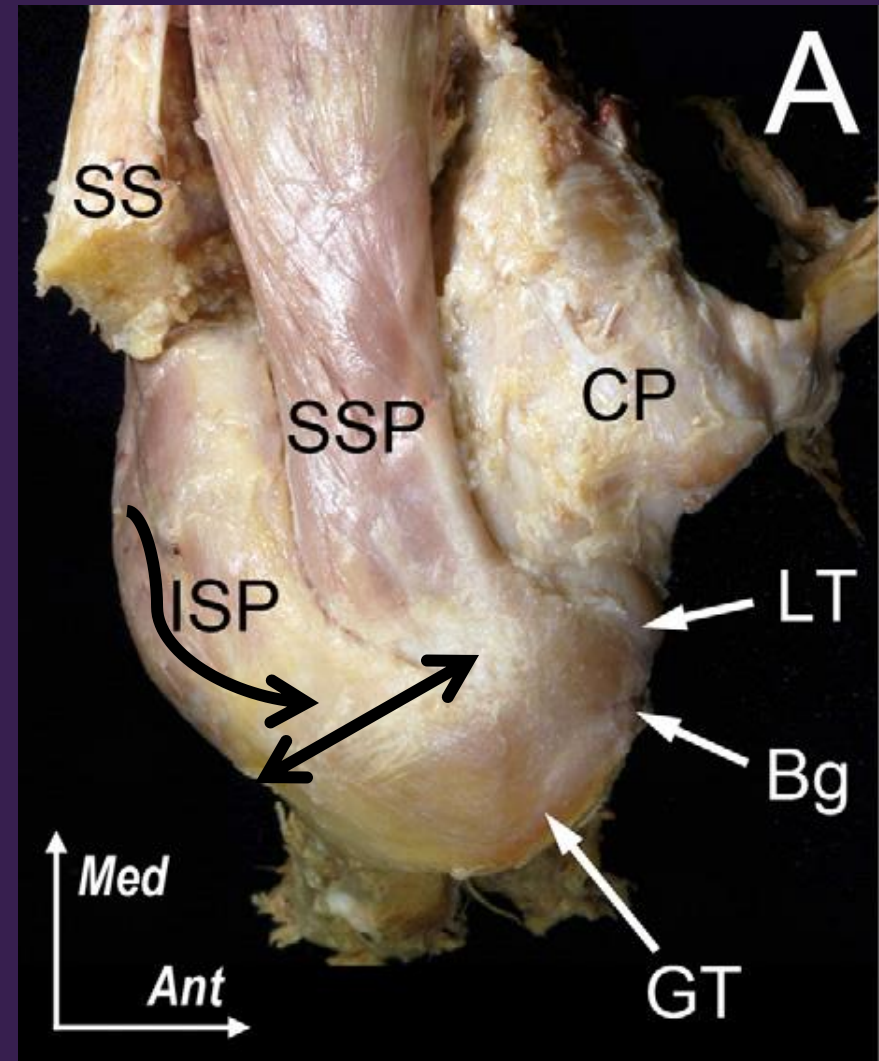
# INFRASPINATUS ANATOMY

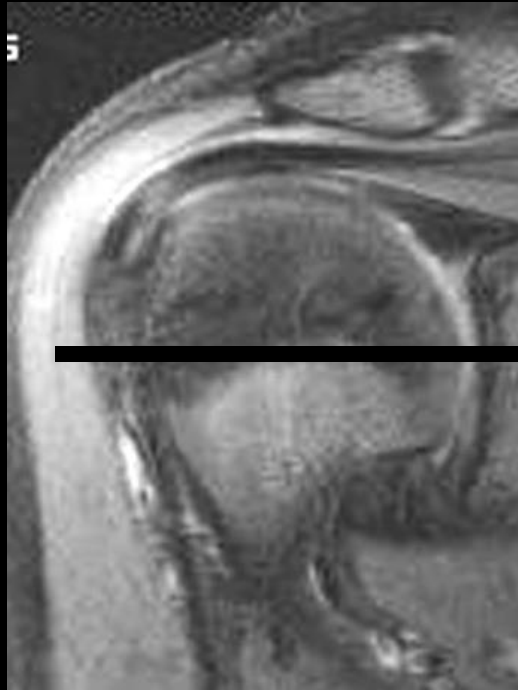
IS tendon curves forward

Large footprint – 3.3 cm

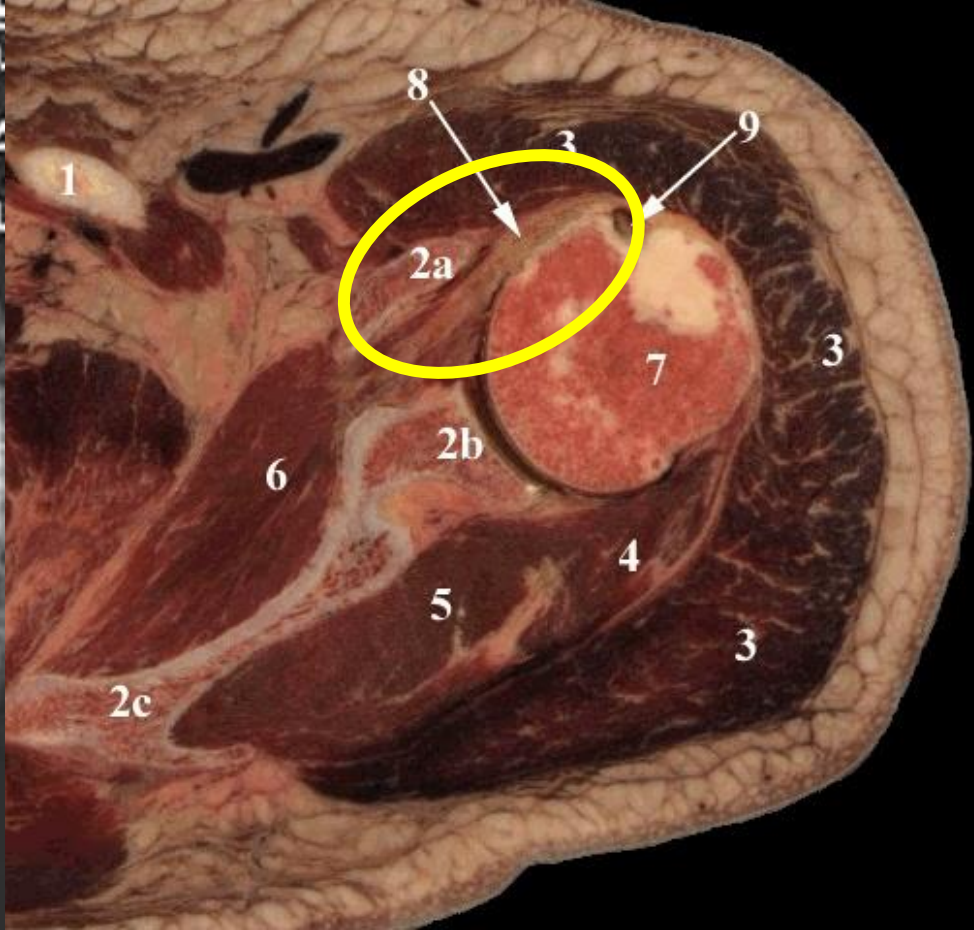
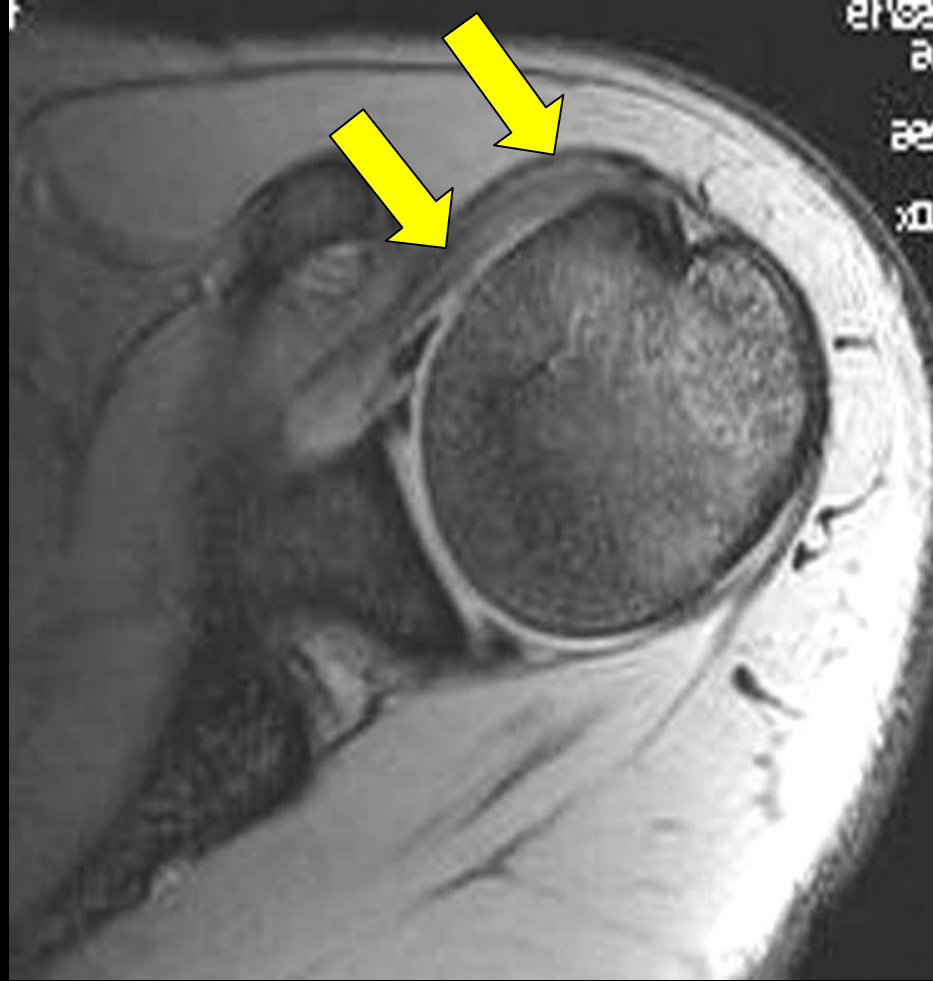
Overlaps SS -12 to13 mm

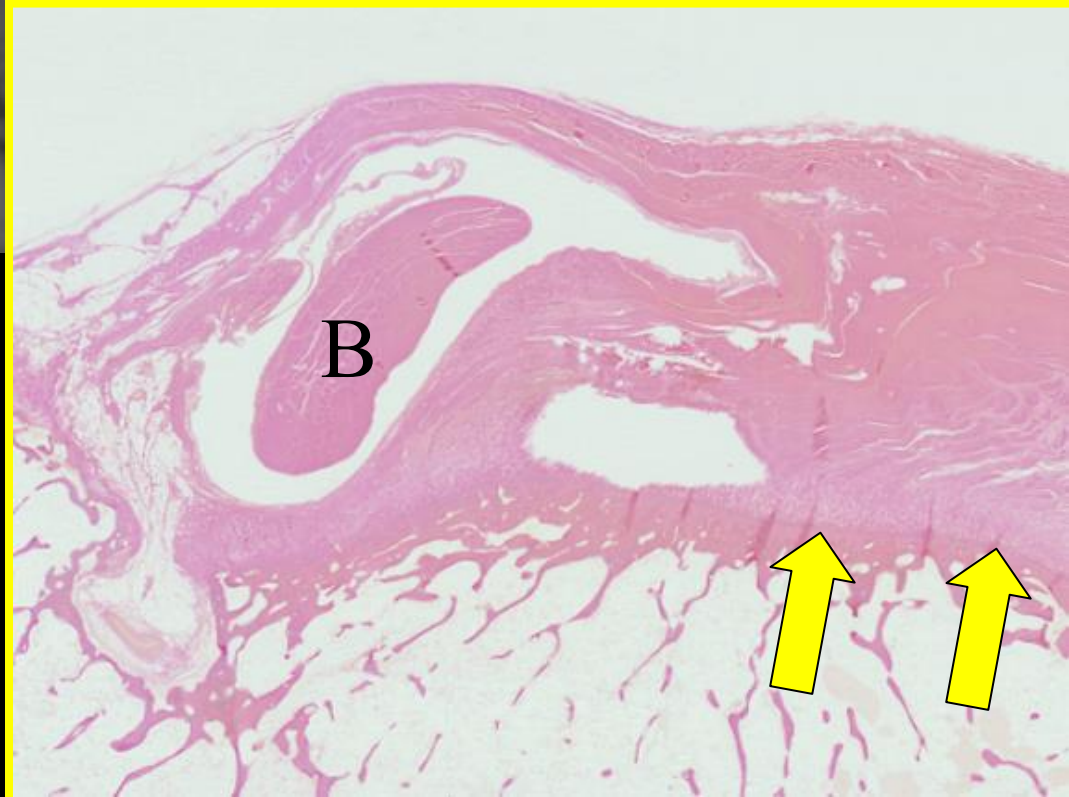
J Bone Joint Surg Am.  
2008;90:962-9



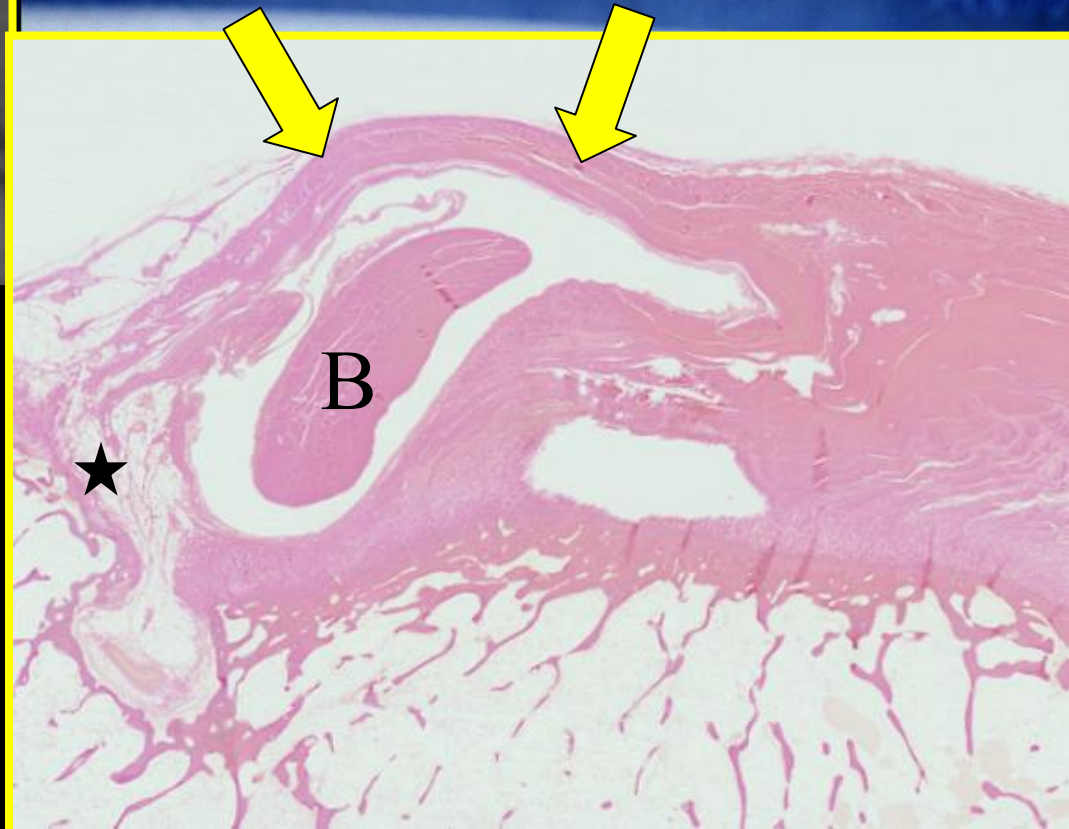
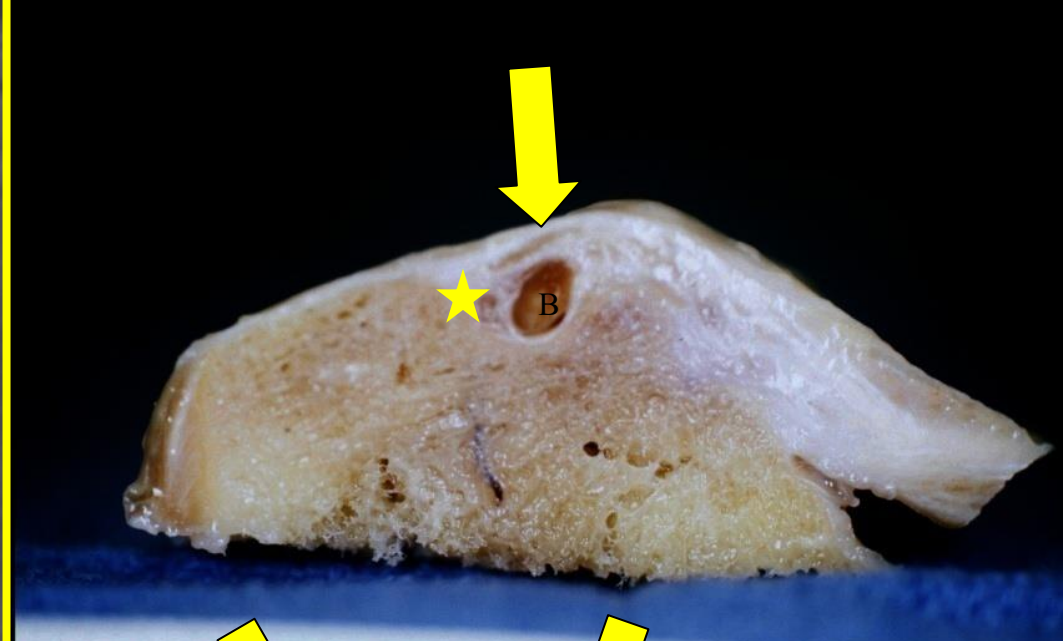
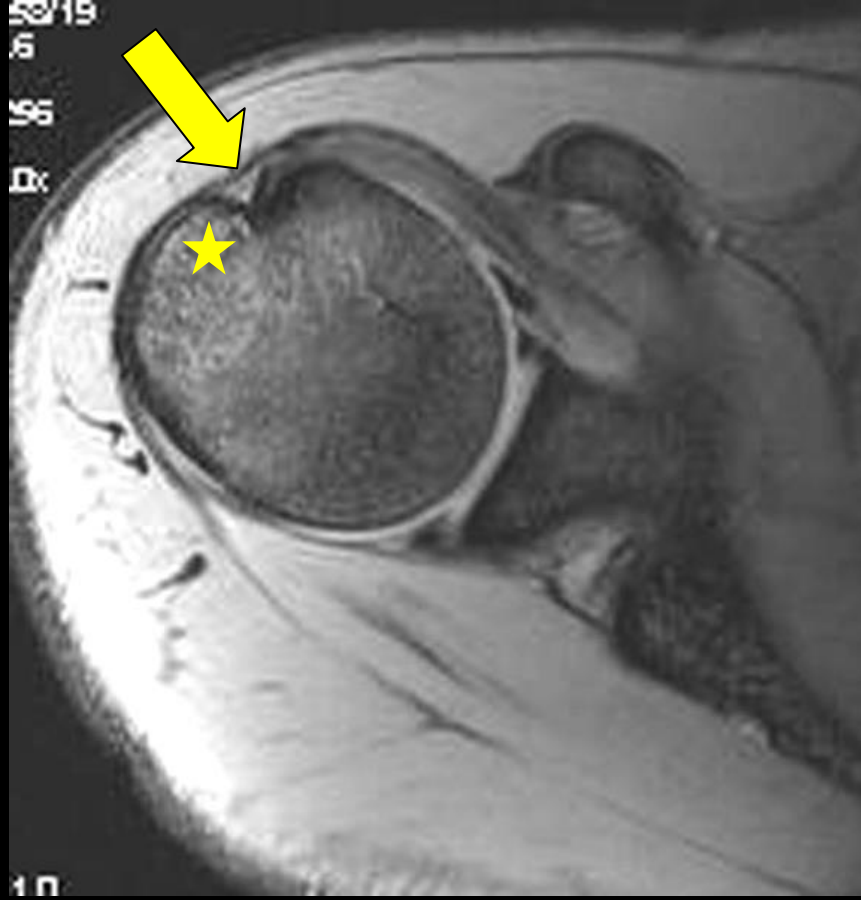




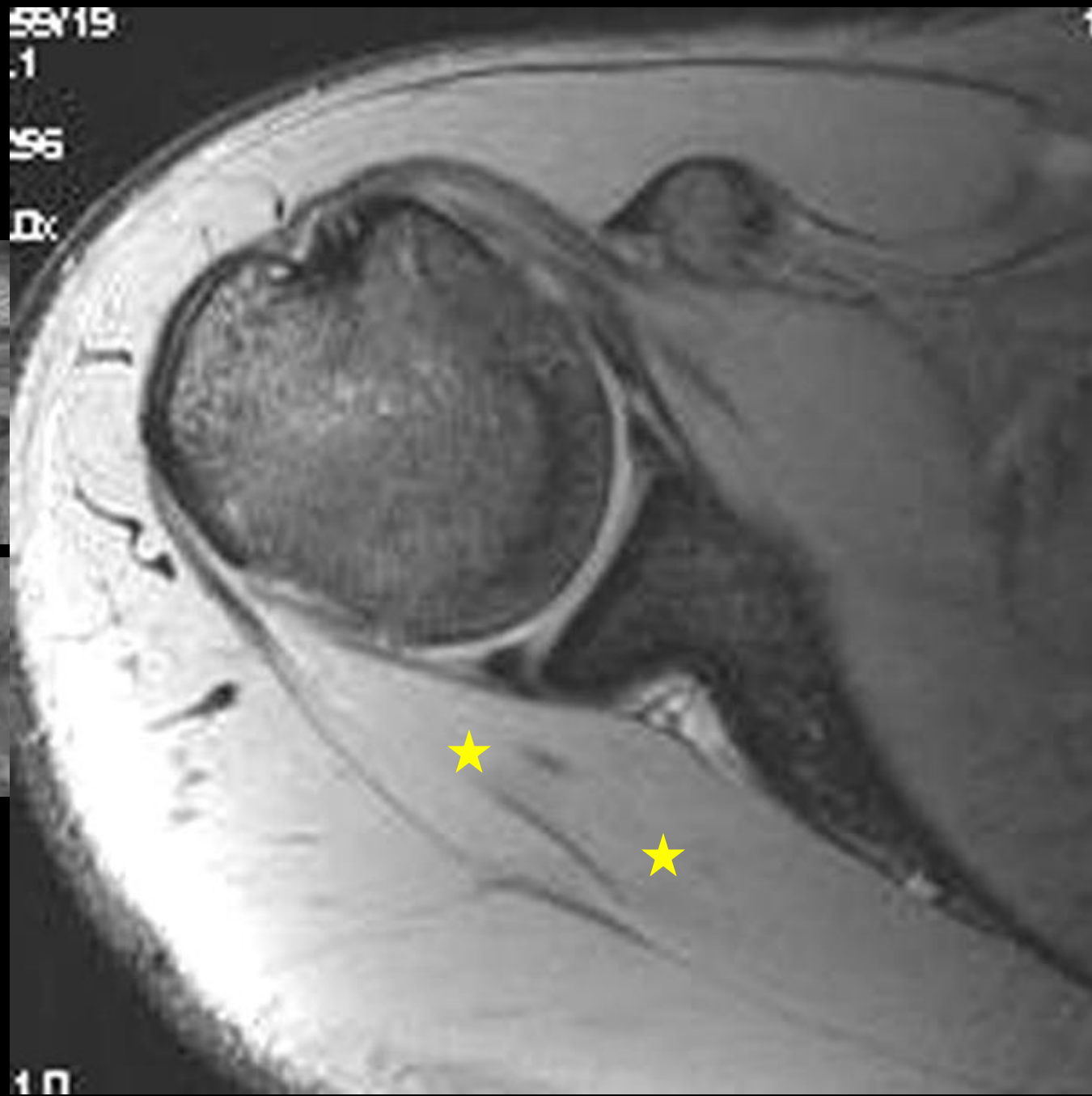










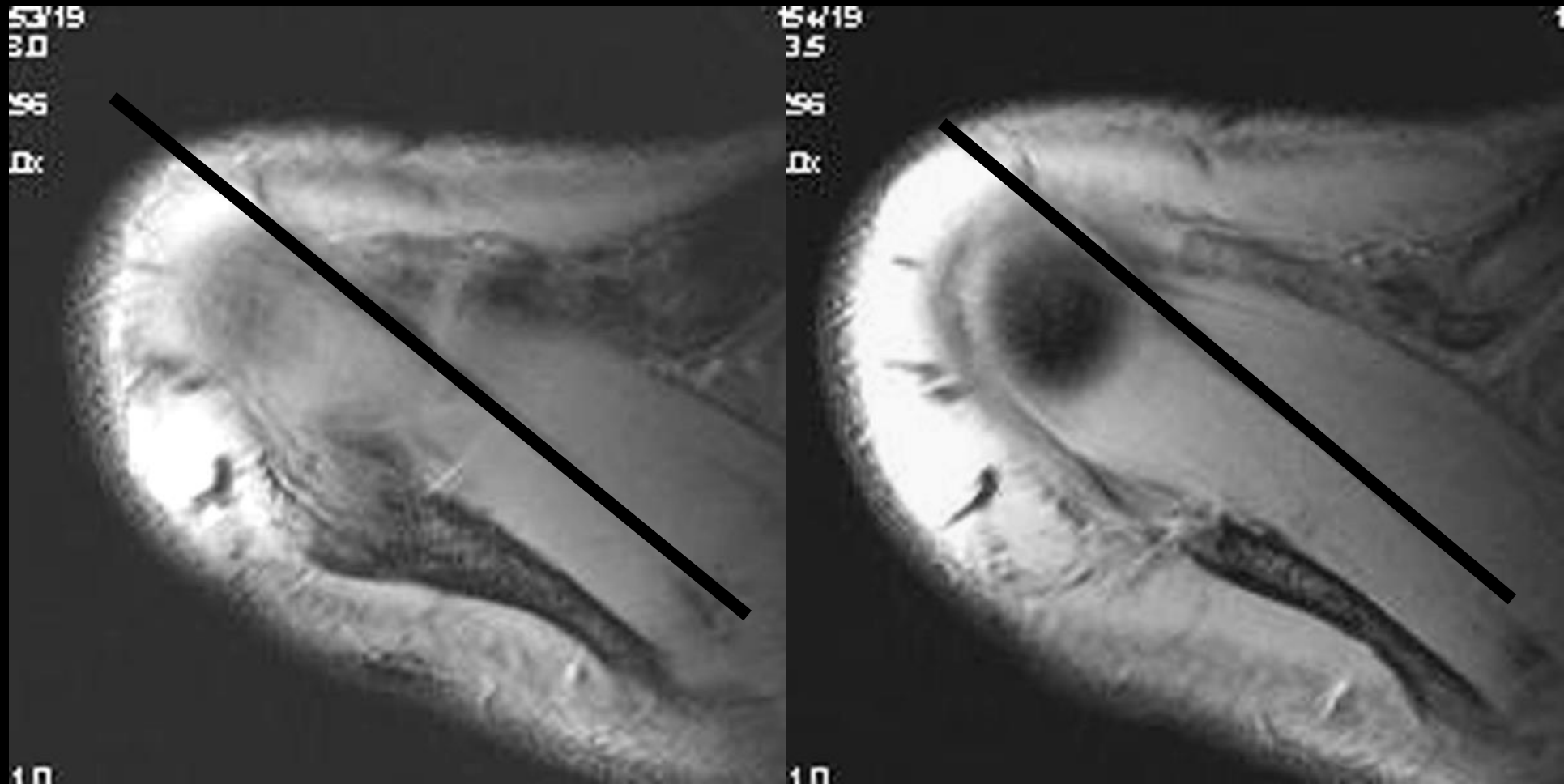


# MR IMAGING PLANES

- Axial
  - Assess subscapularis, biceps tendon
- Coronal oblique
  - Parallel to supraspinatus tendon
  - Assess all tendons
- Sagittal oblique (FSE T2)
  - 90° to coronals
  - Assess all tendons



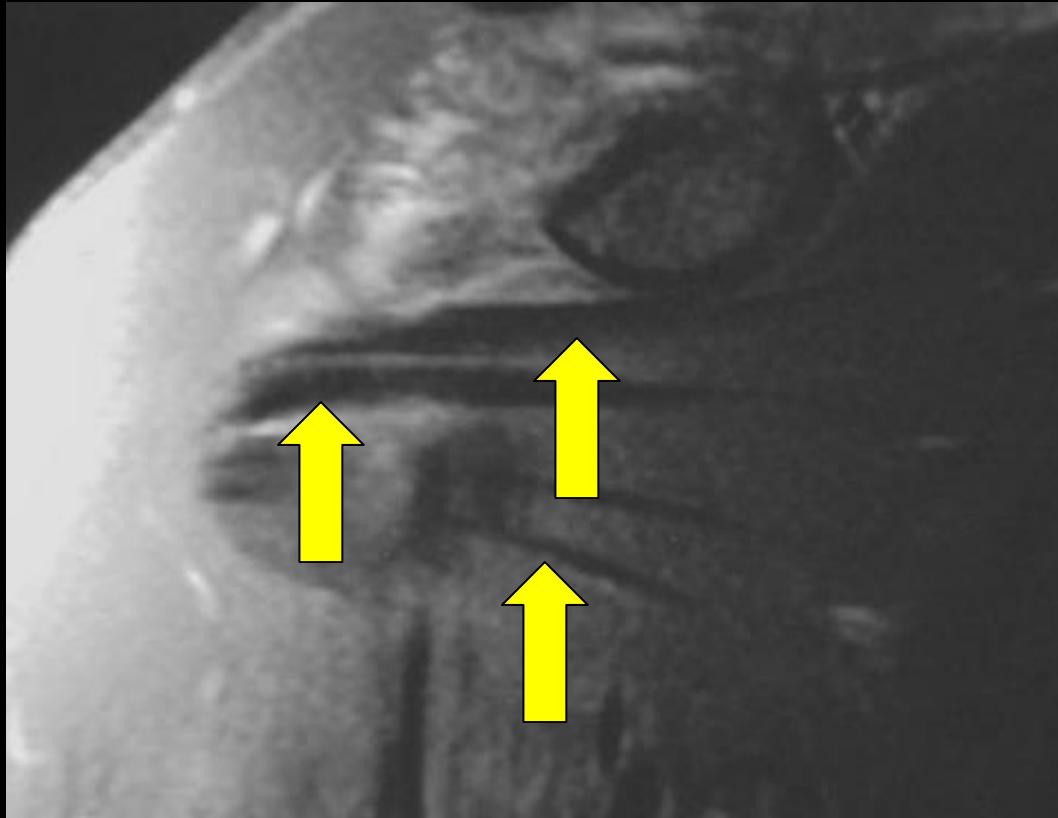
# Parallel to Tendon

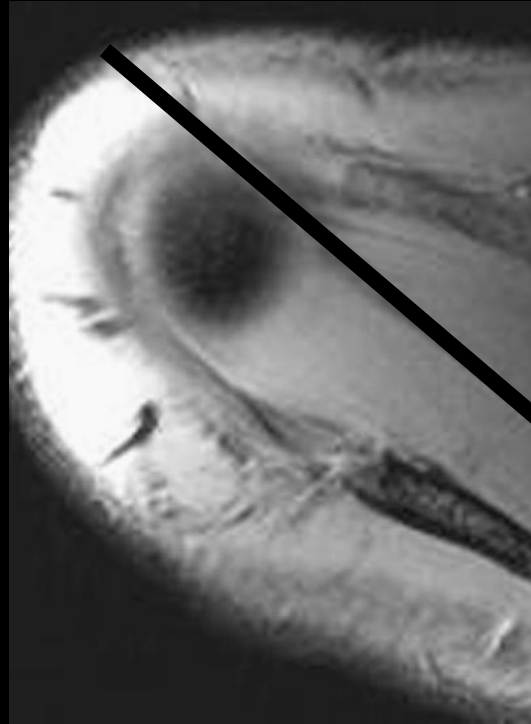


# Coronal Anatomy

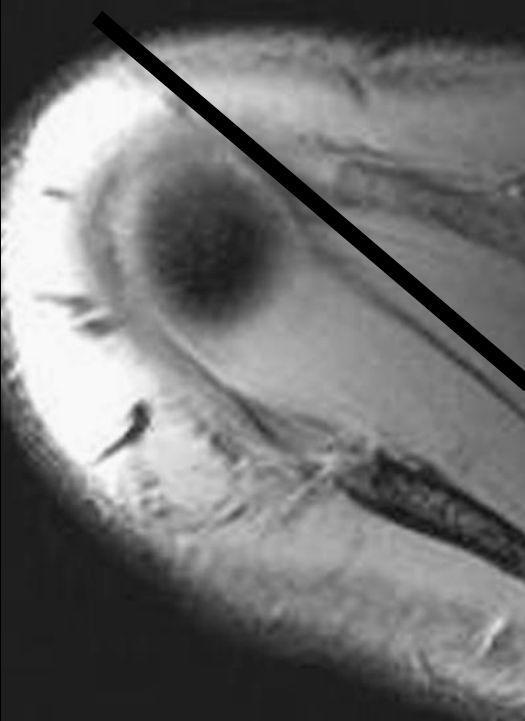


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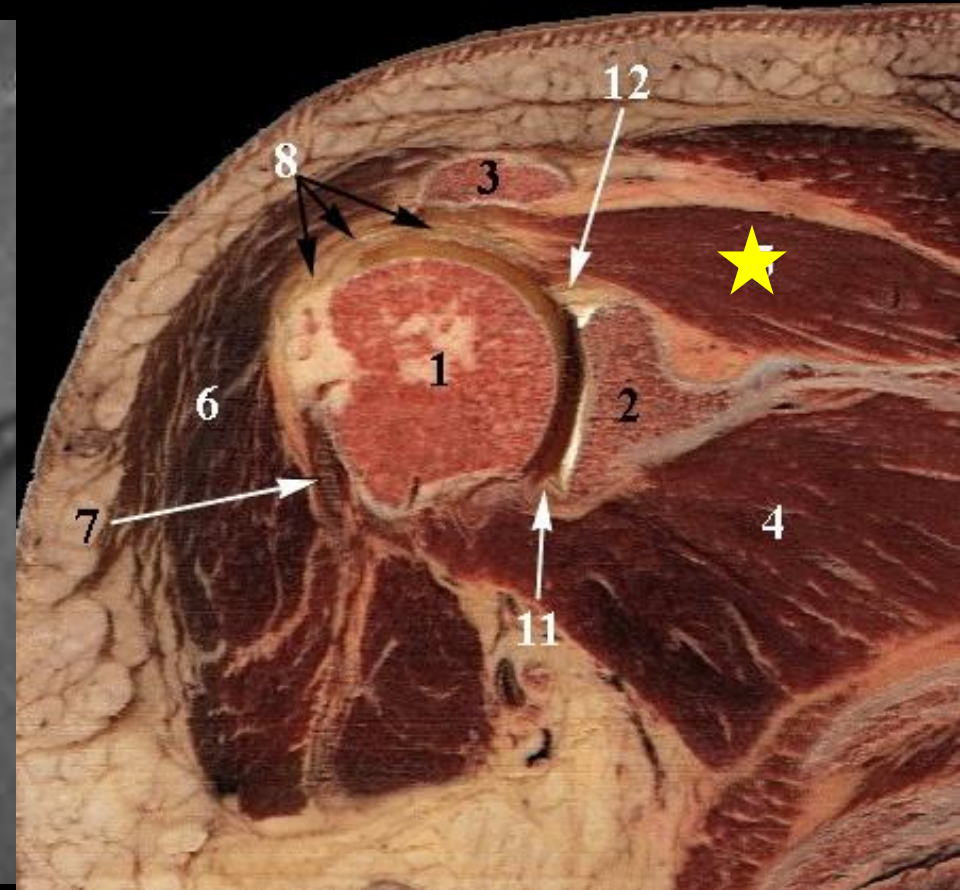






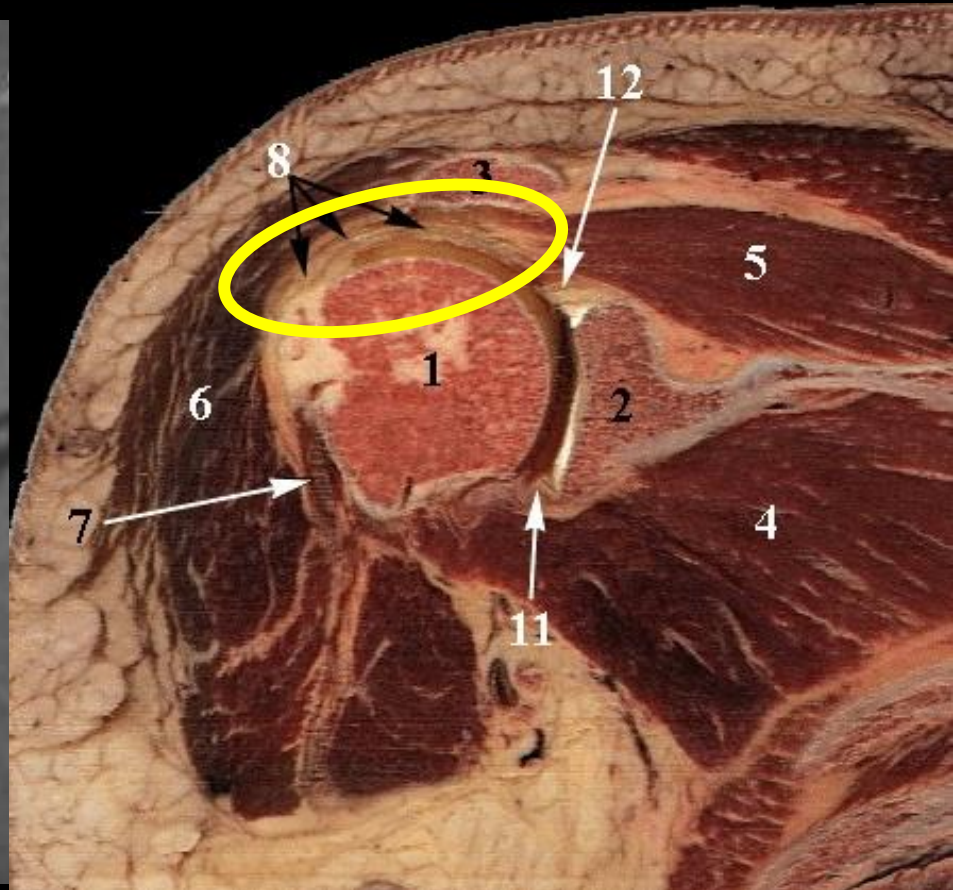
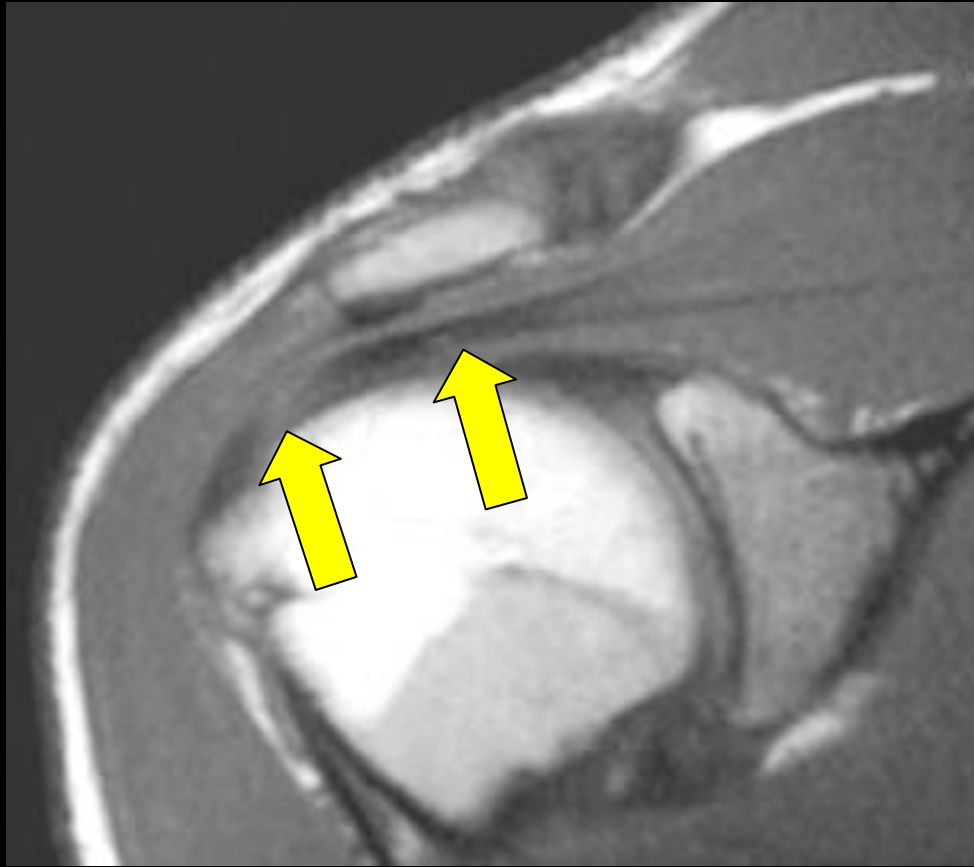


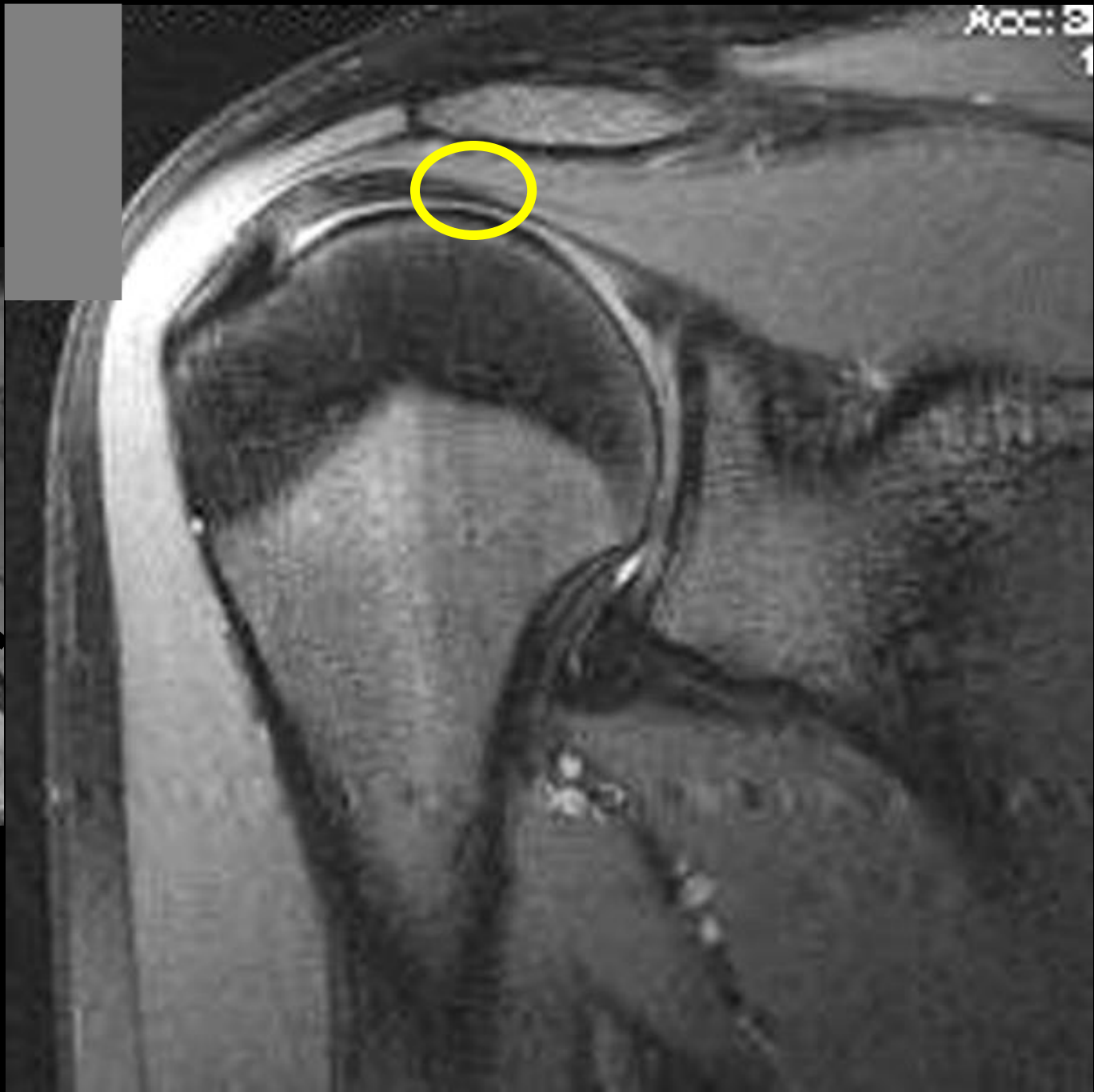
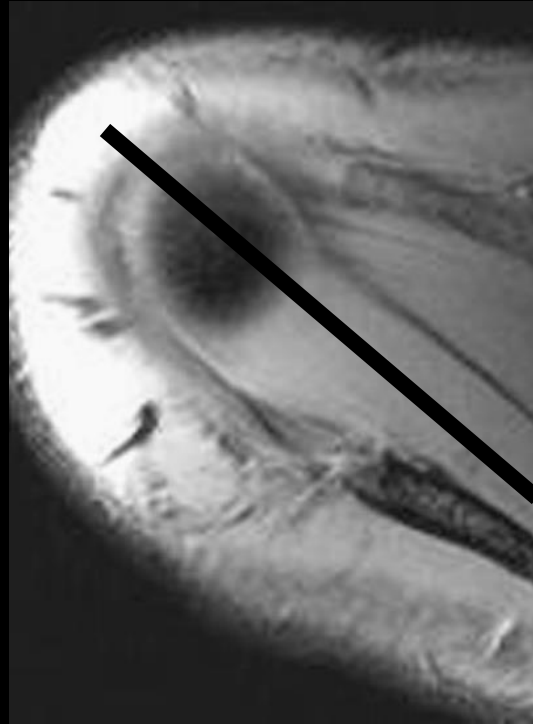
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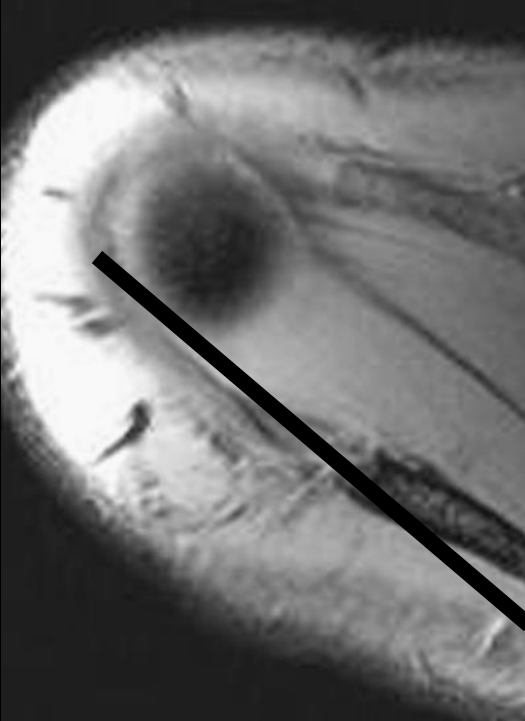




# Coronal Anatomy

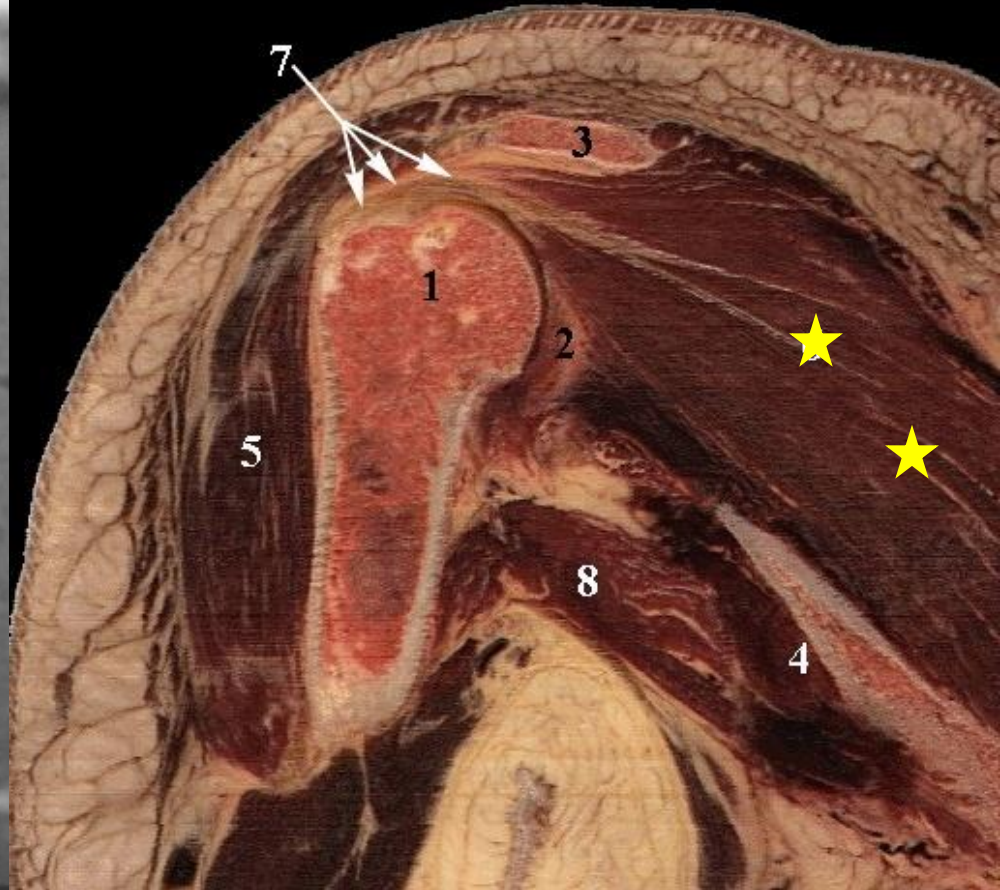






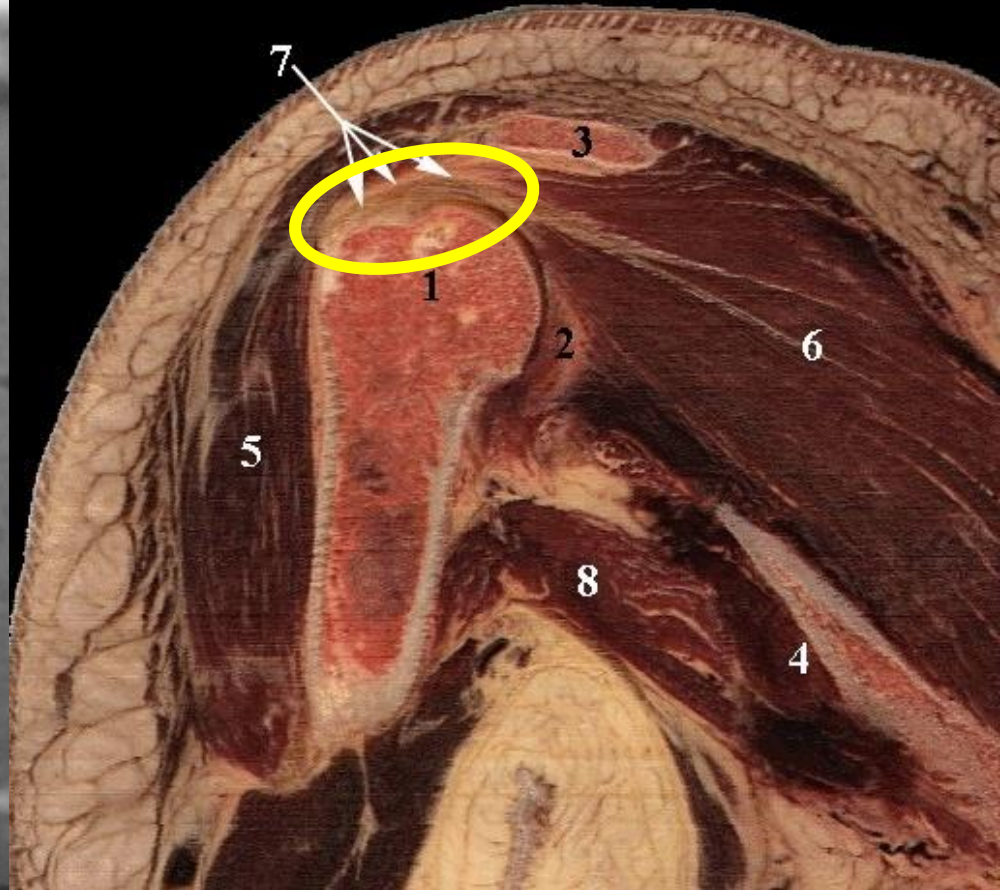


# Coronal Anatomy





# Coronal Anatomy

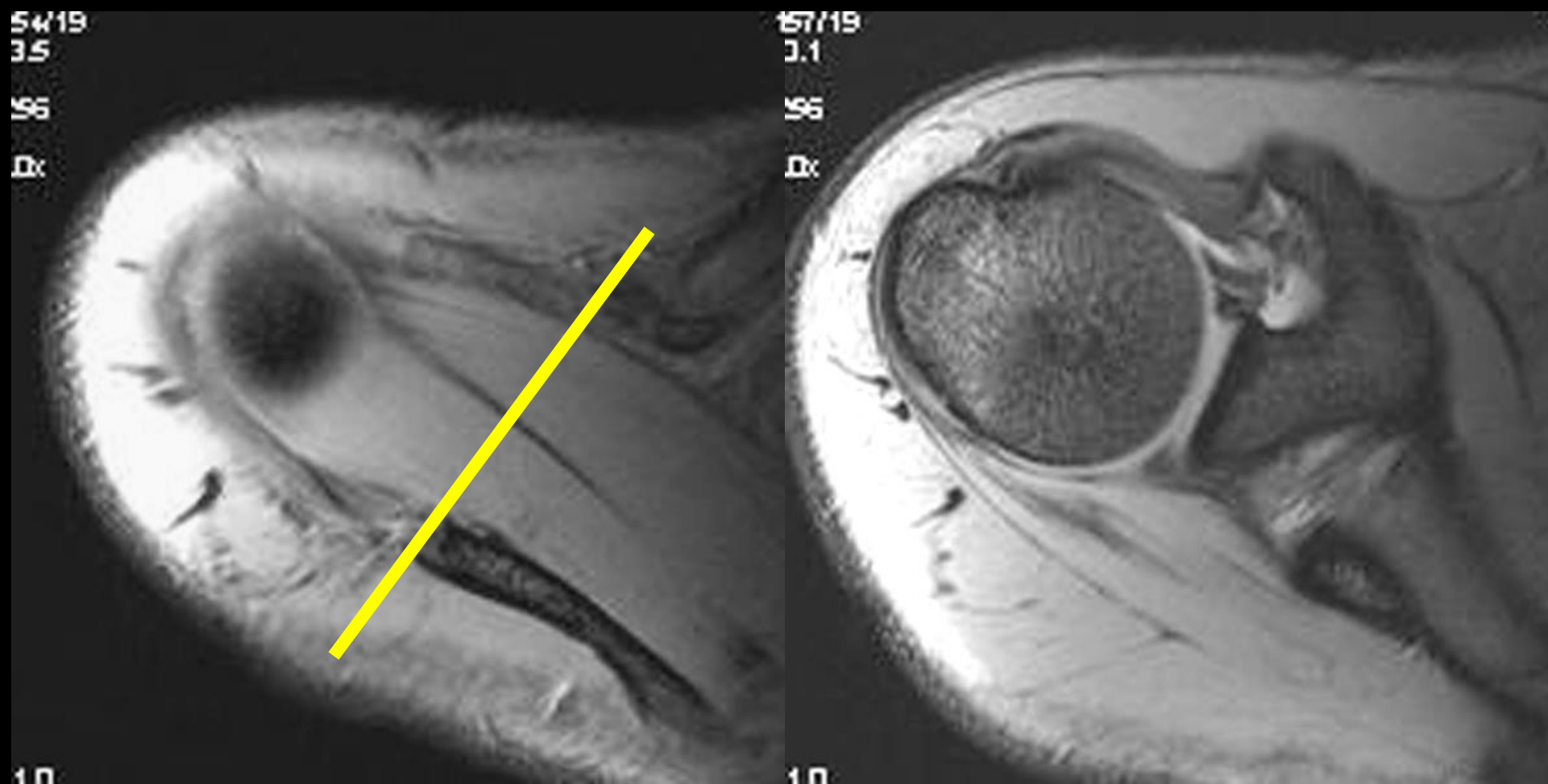




# MR IMAGING PLANES

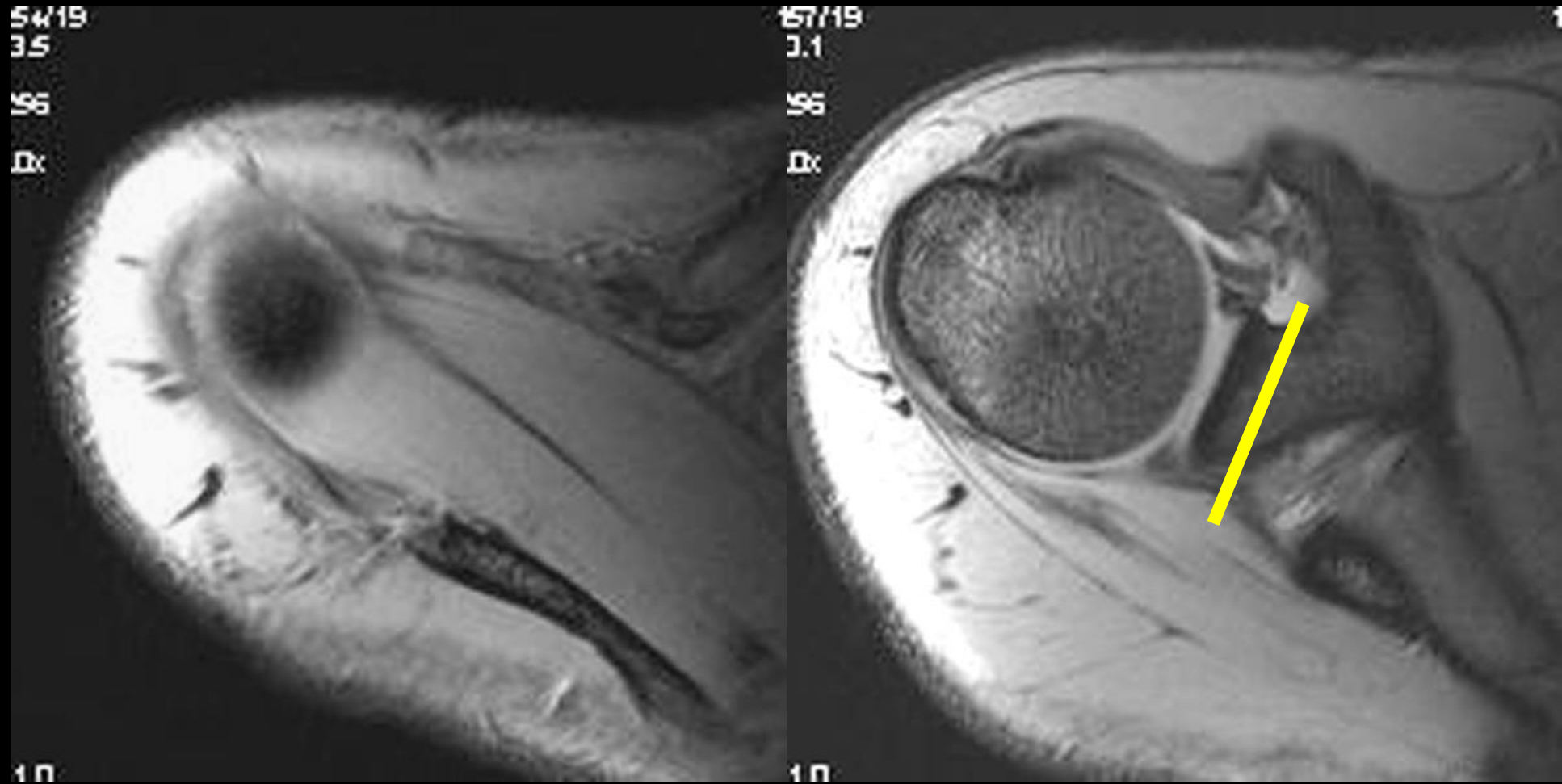
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- Coronal oblique
  - Parallel to supraspinatus tendon
  - Assess all tendons
- Sagittal oblique (FSE T2)
  - 90° to coronals
  - Assess all tendons/muscle bulk

# Sagittal Imaging

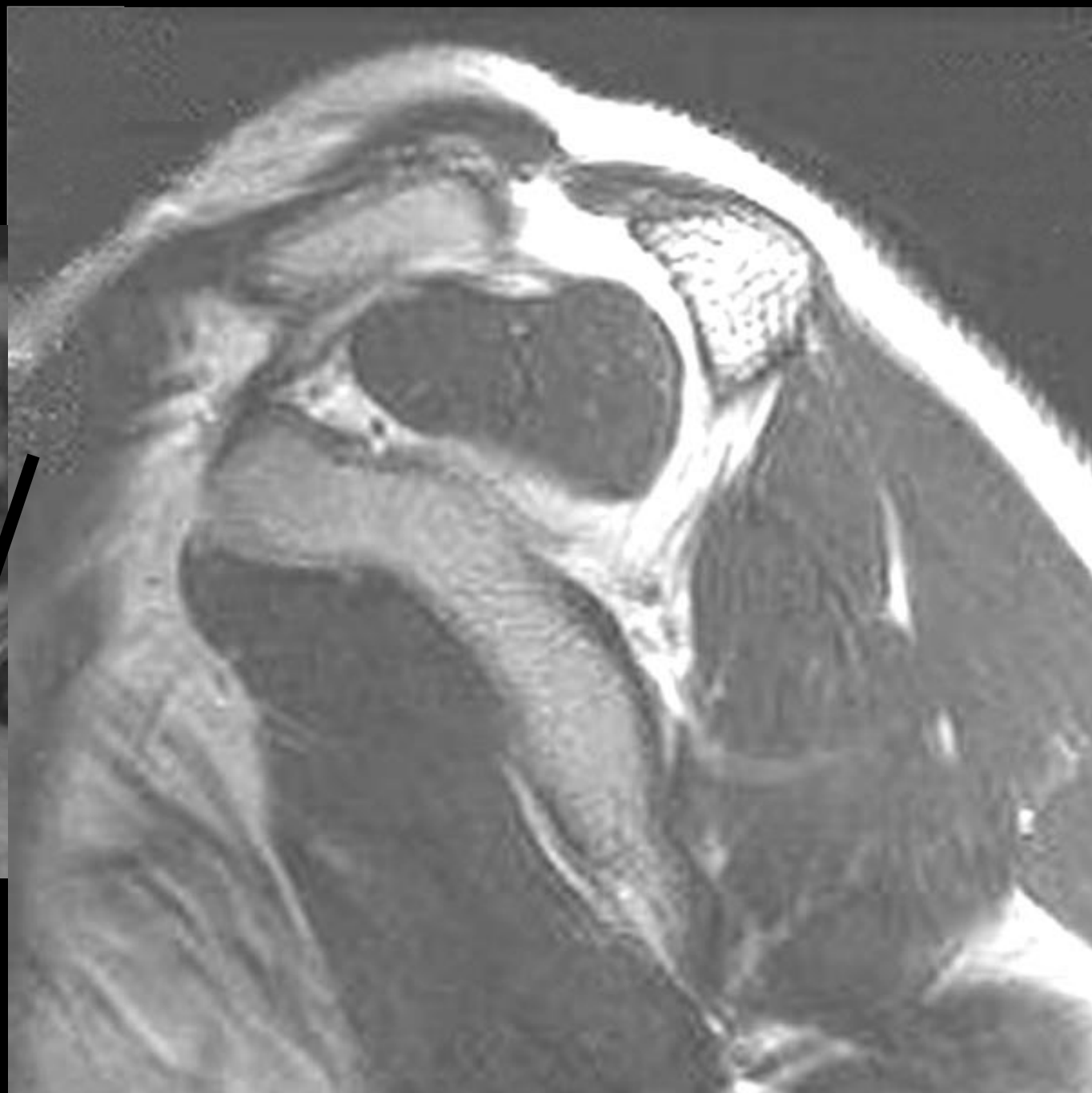




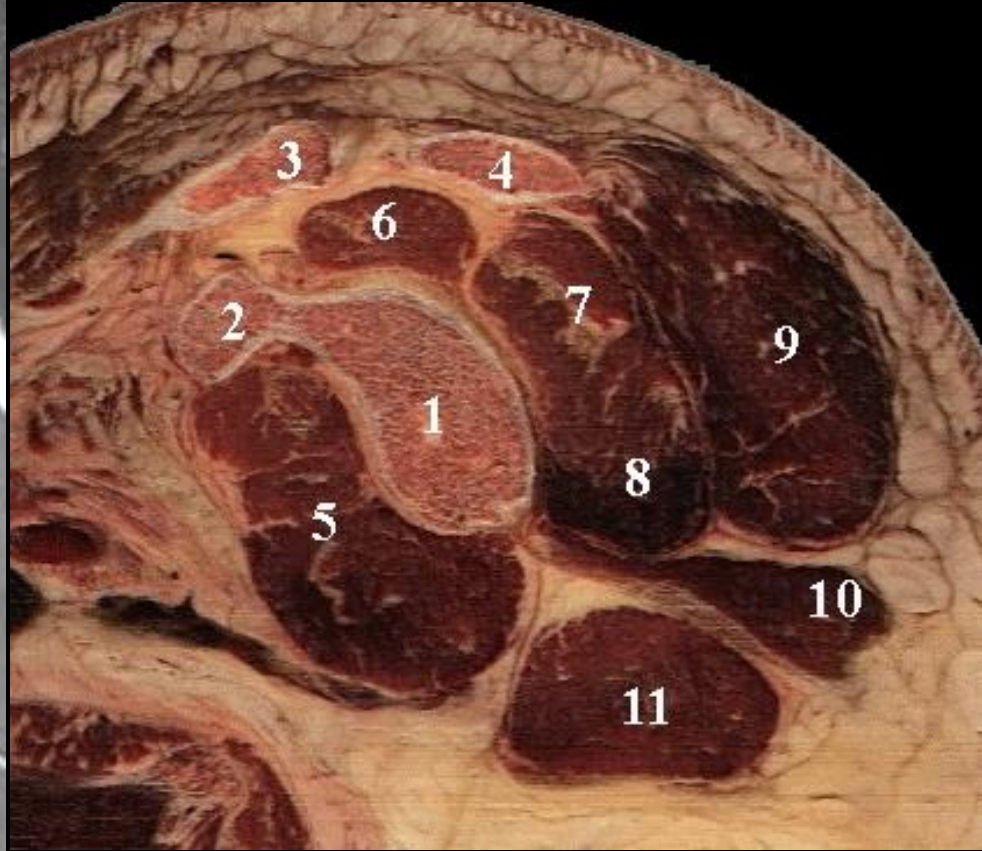
# Sagittal Imaging



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# Sagittal Anatomy



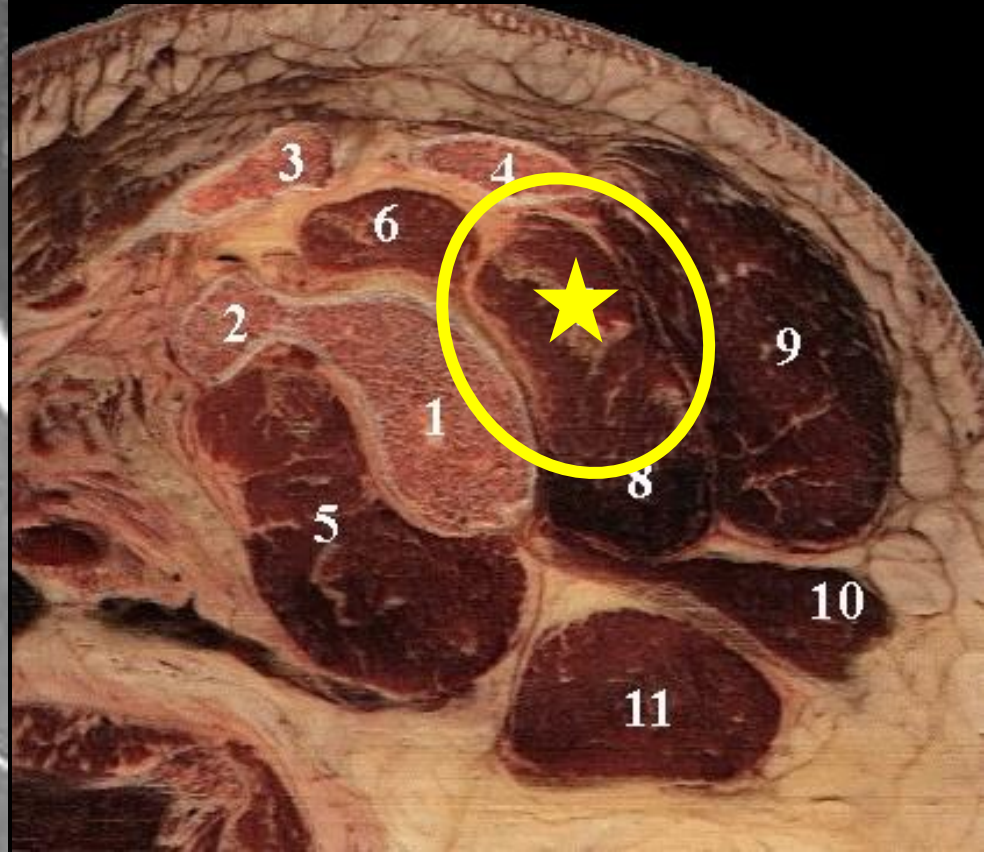


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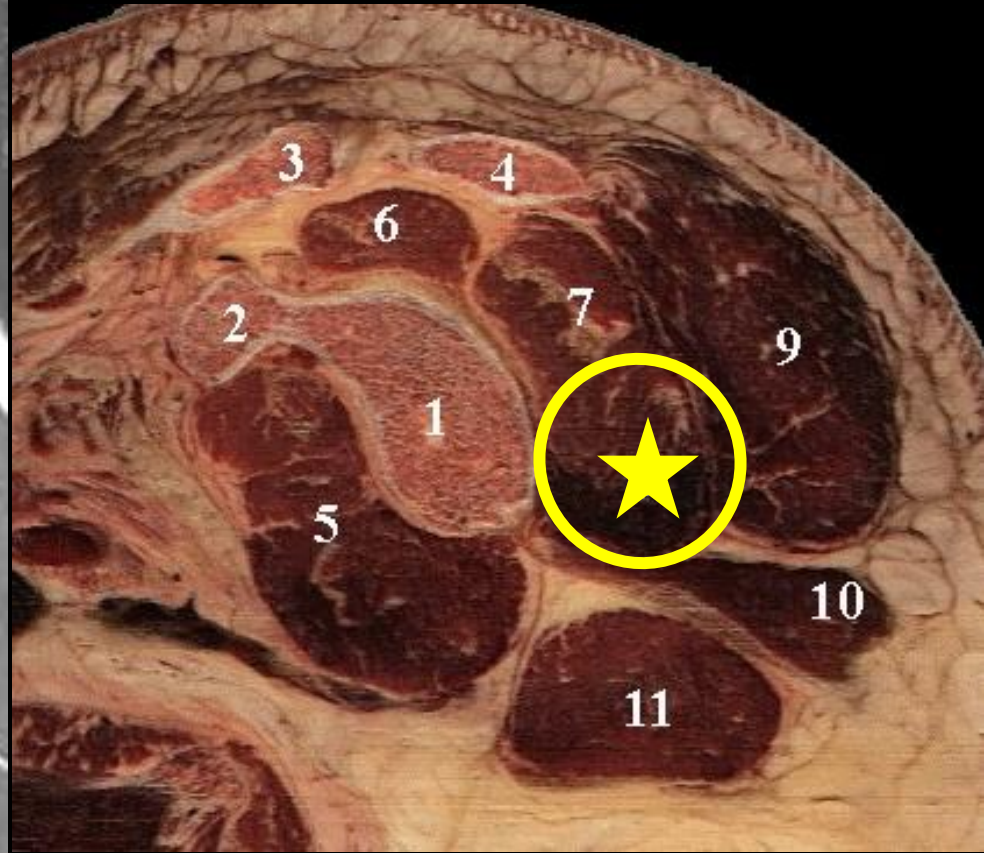




# Sagittal Anatomy

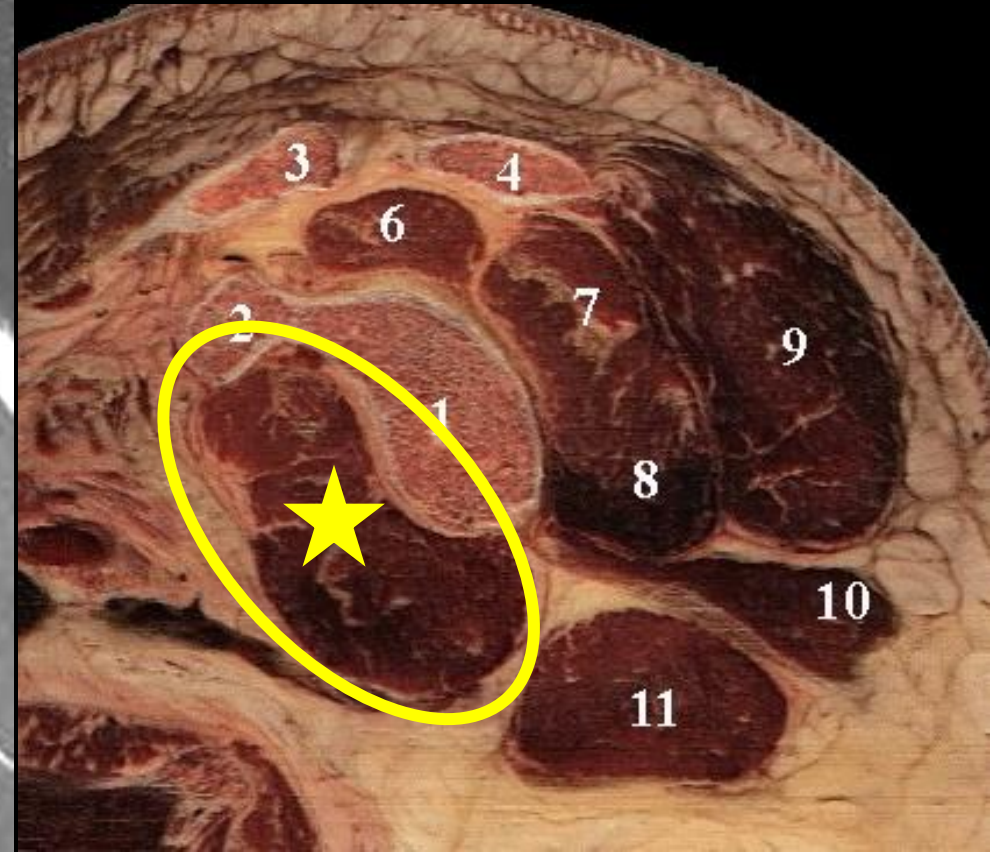


# Sagittal Anatomy

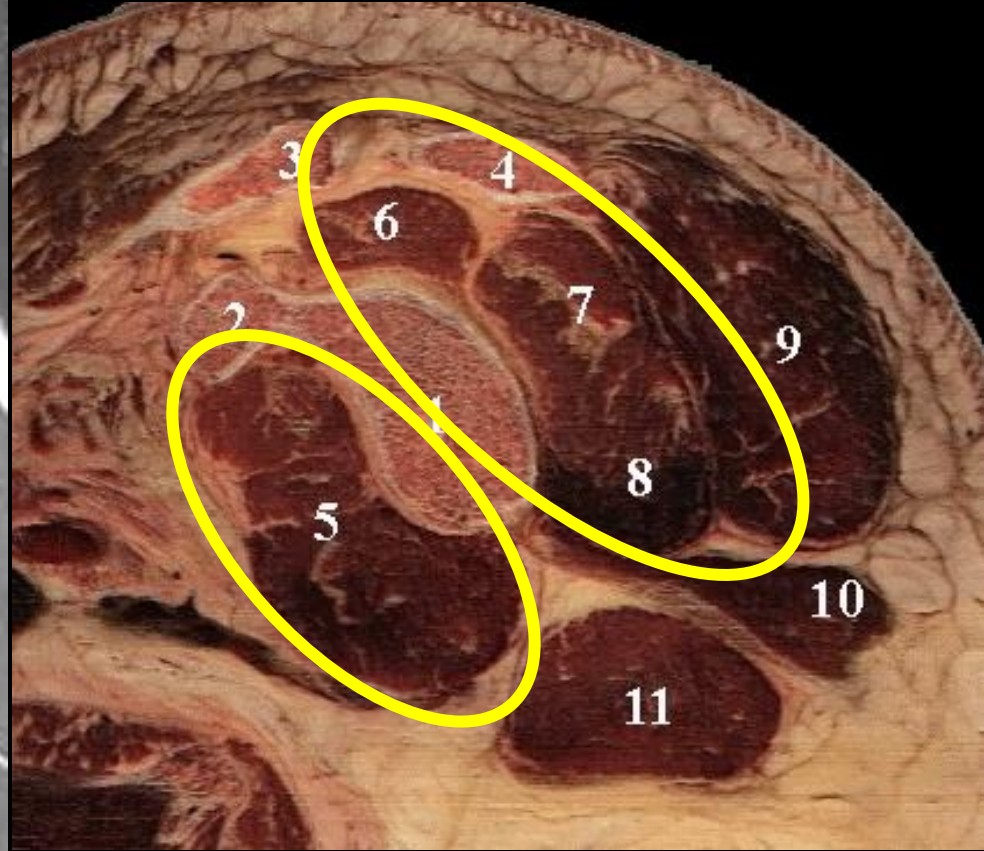




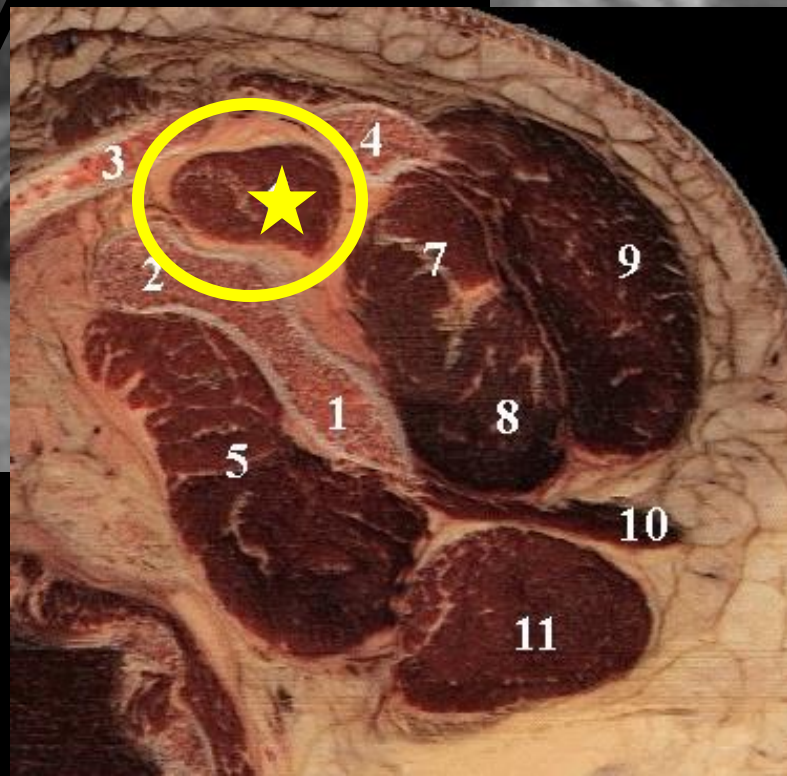
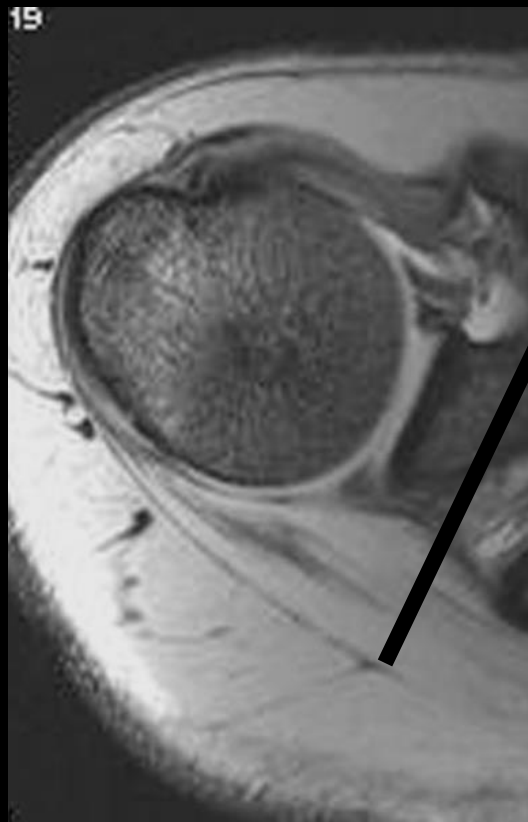
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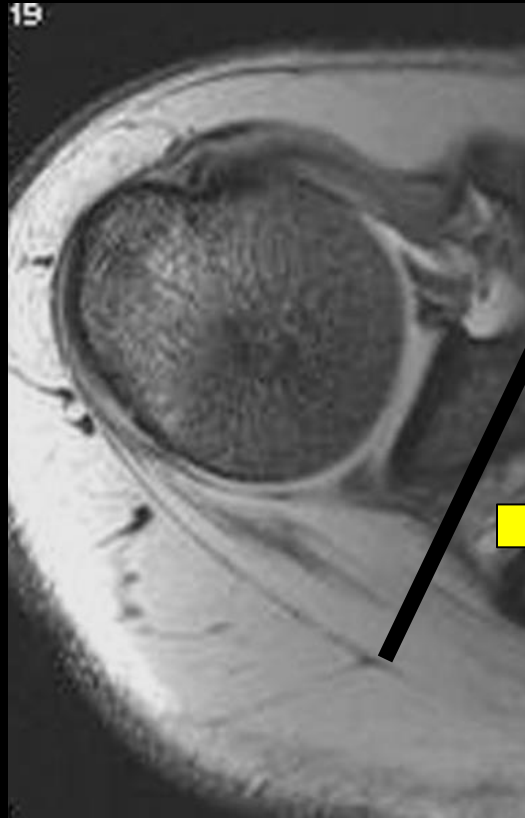
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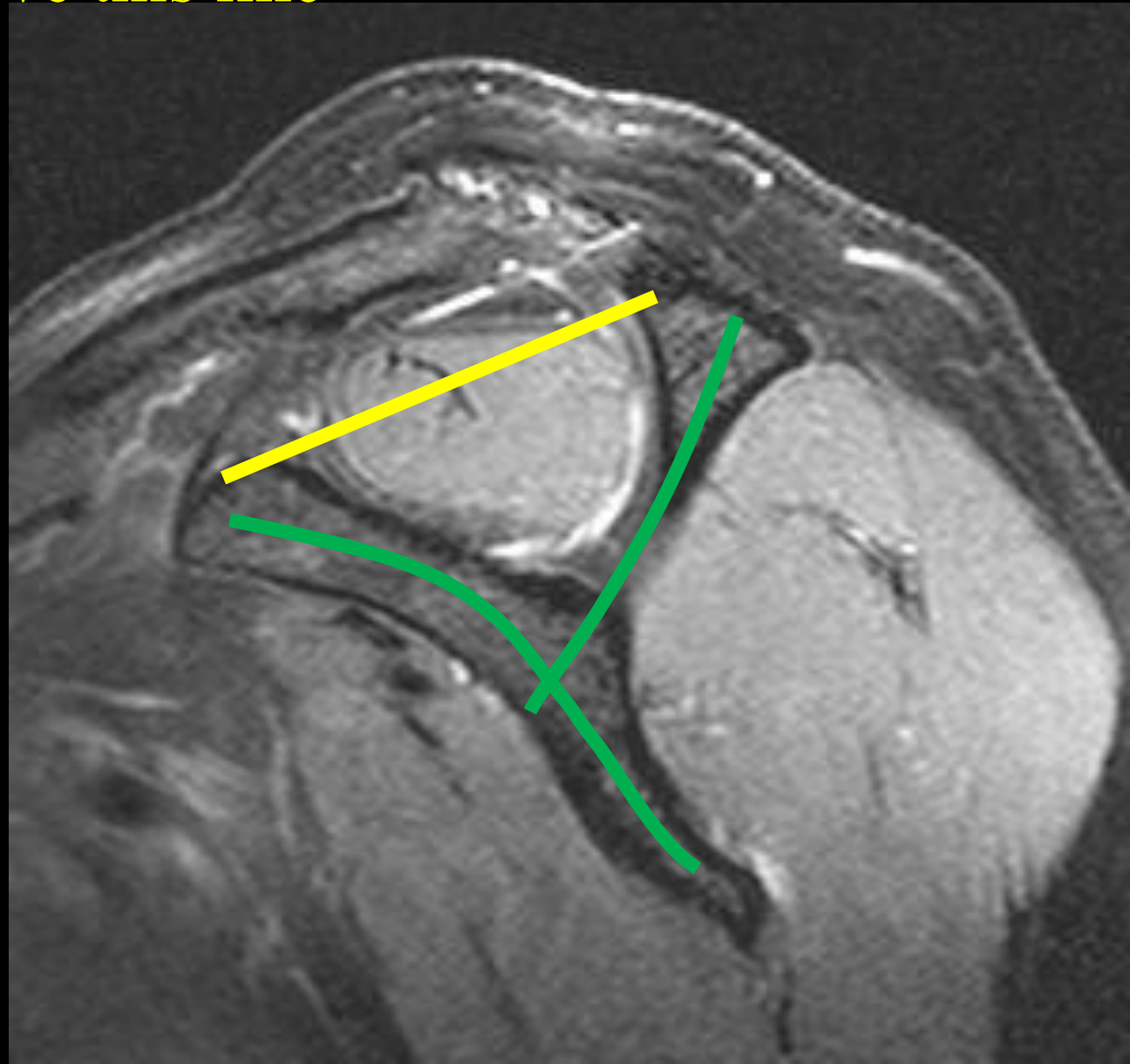
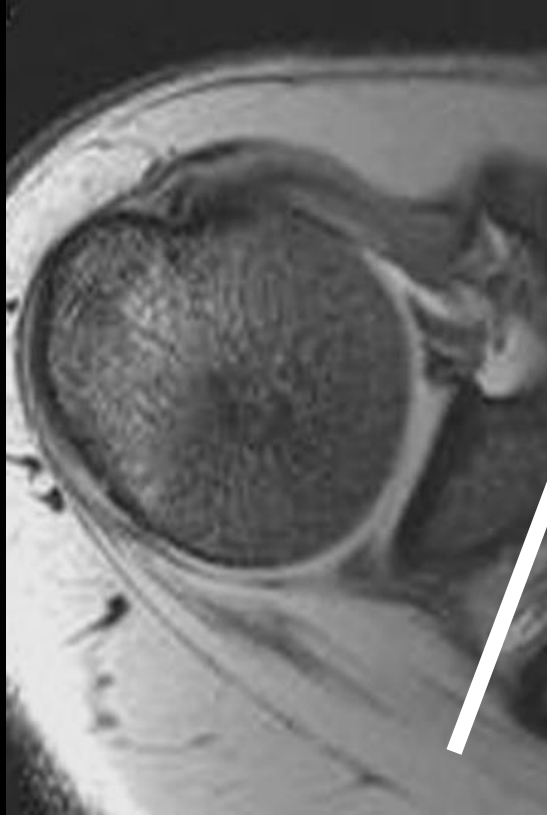




Scapular ratio  
Occupation ratio  
Should be at least 50%

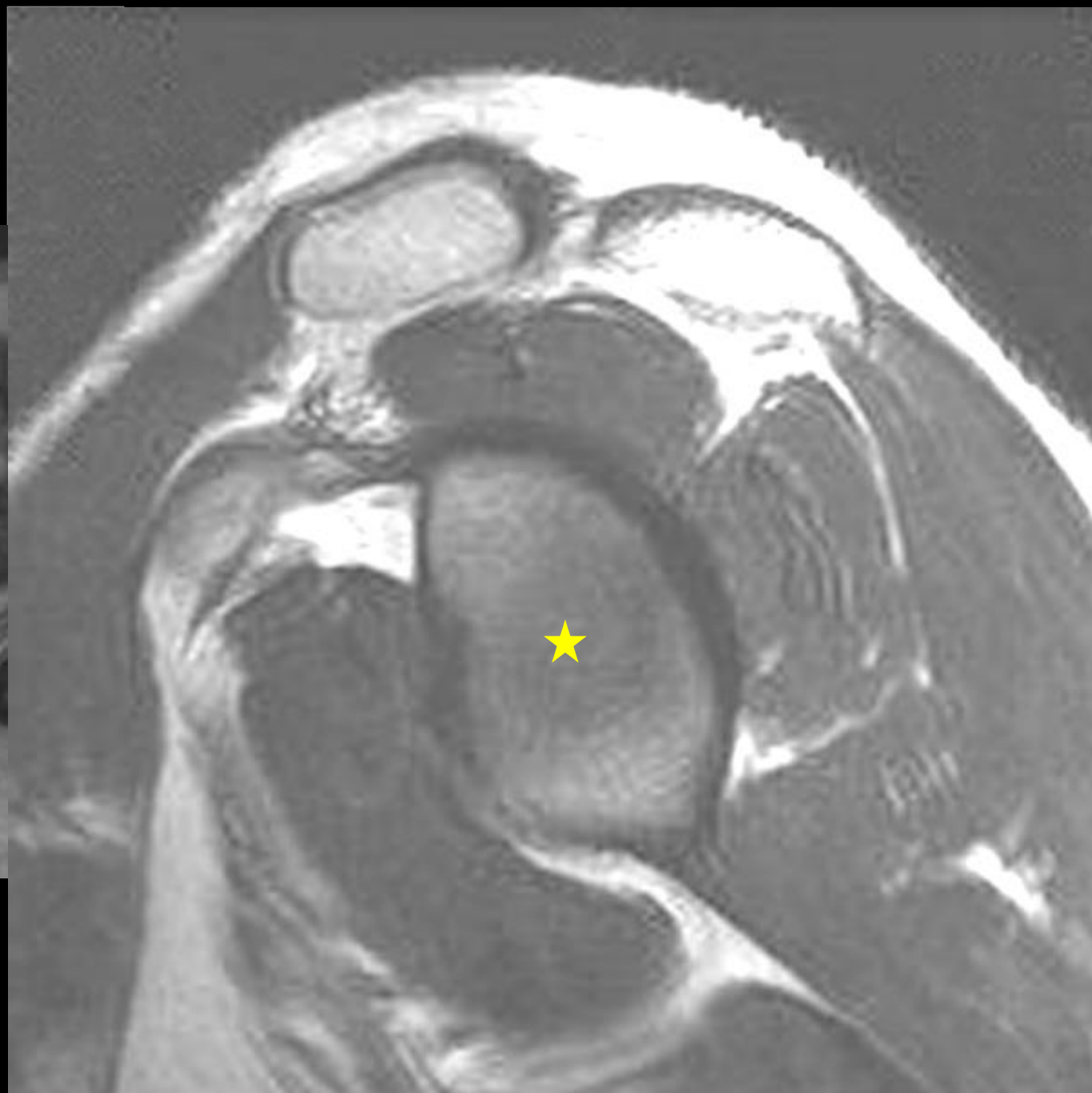


Tangent sign  
Supraspinatus above this line

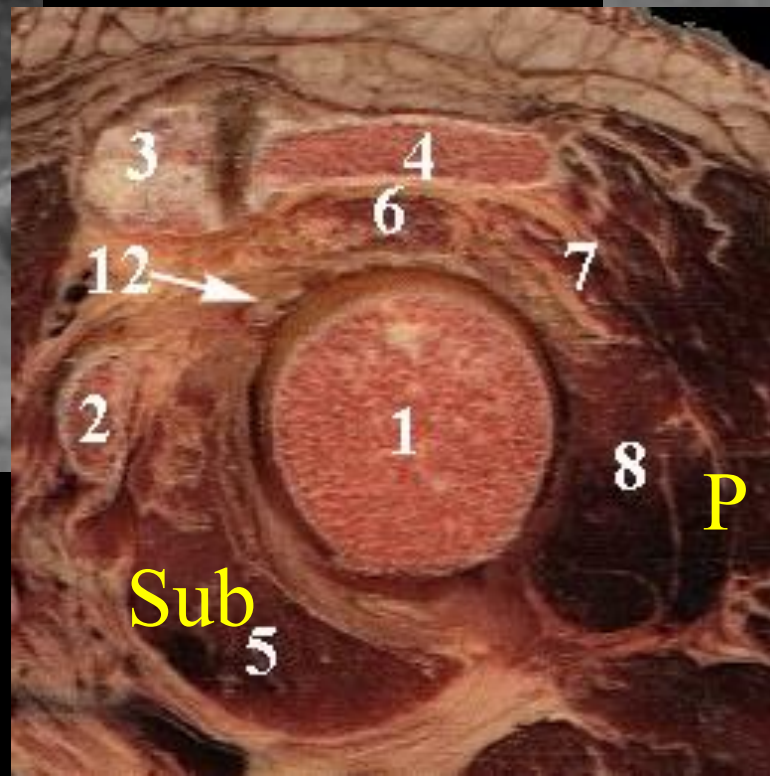
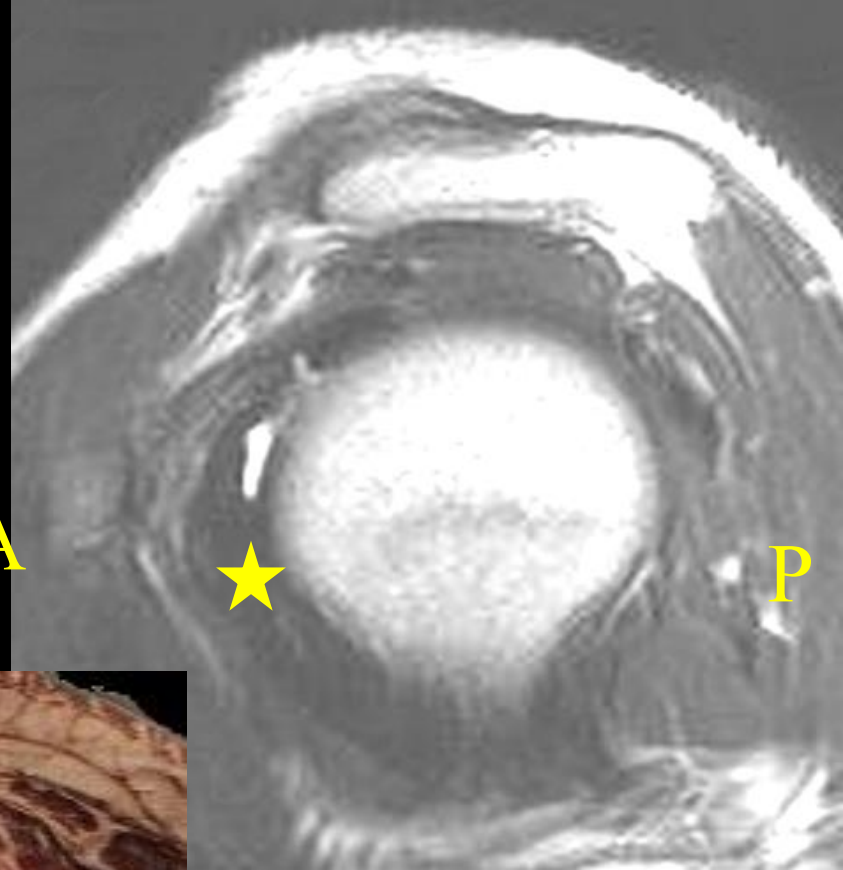
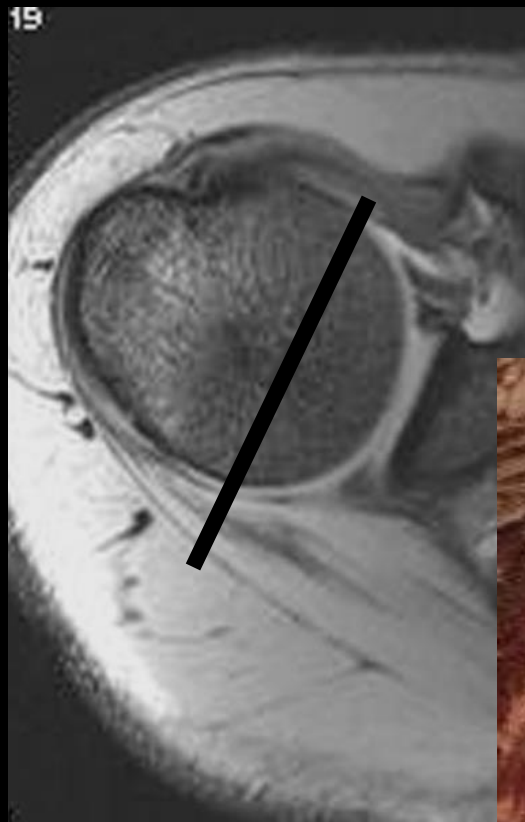


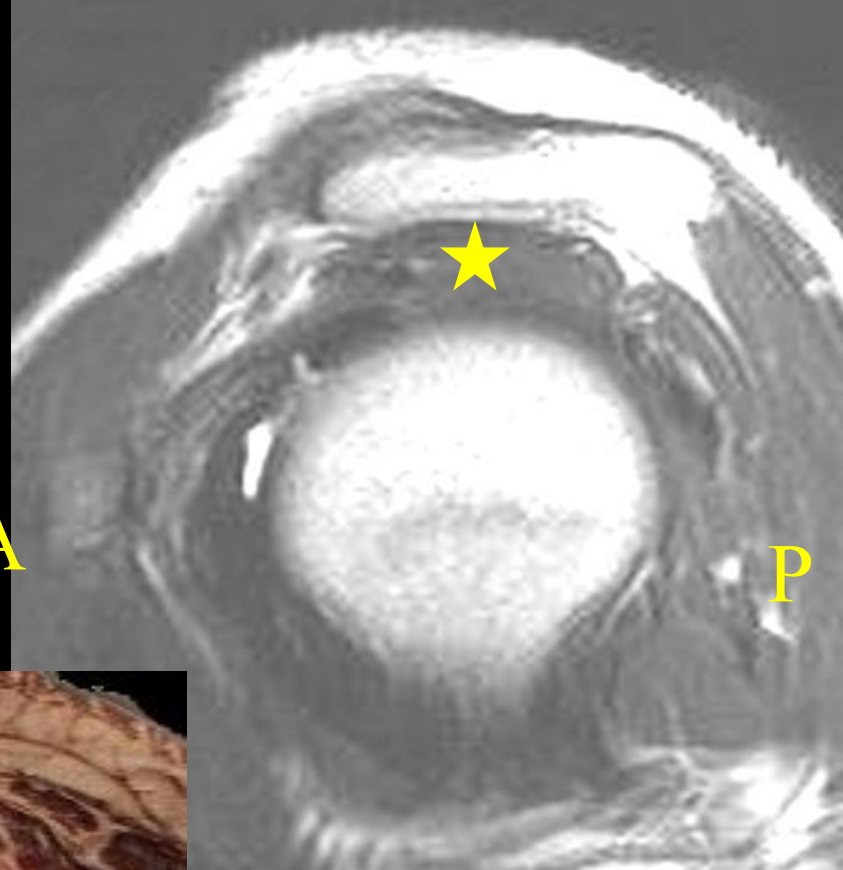
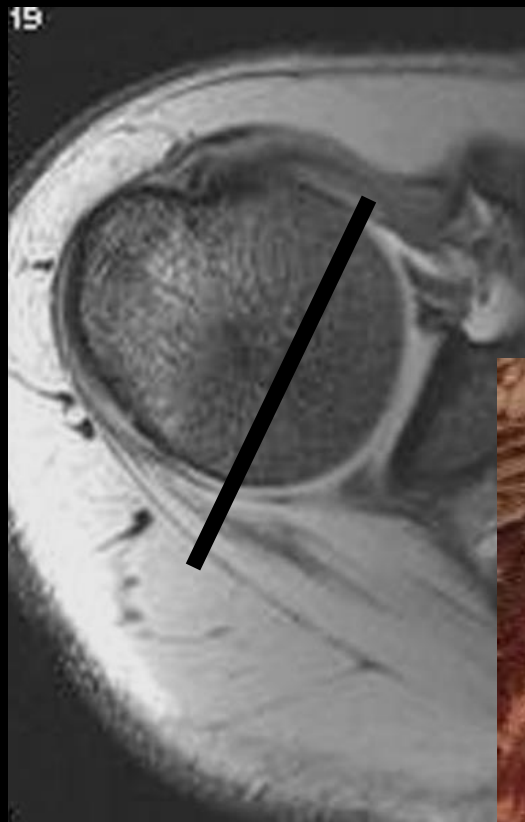


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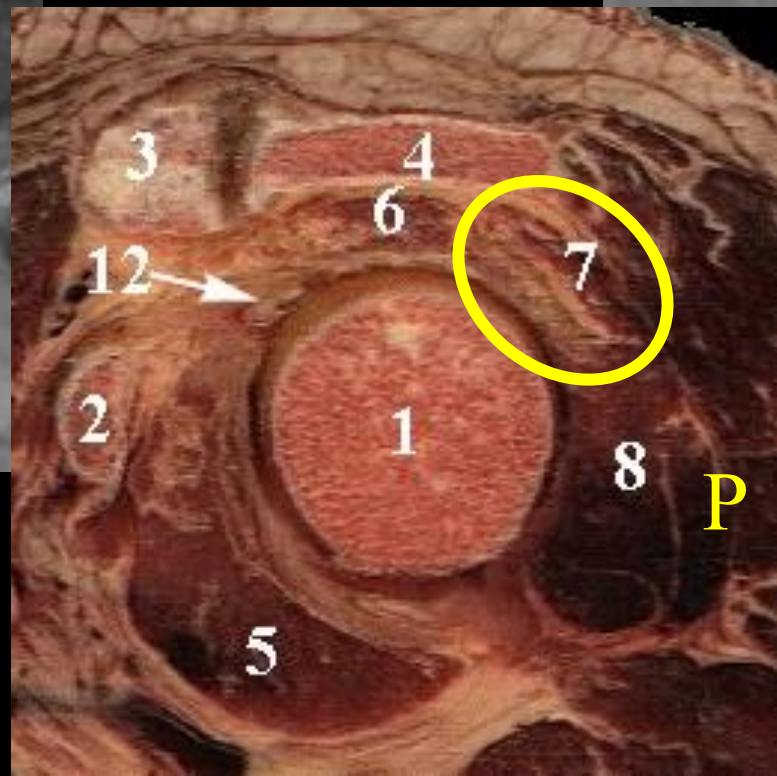
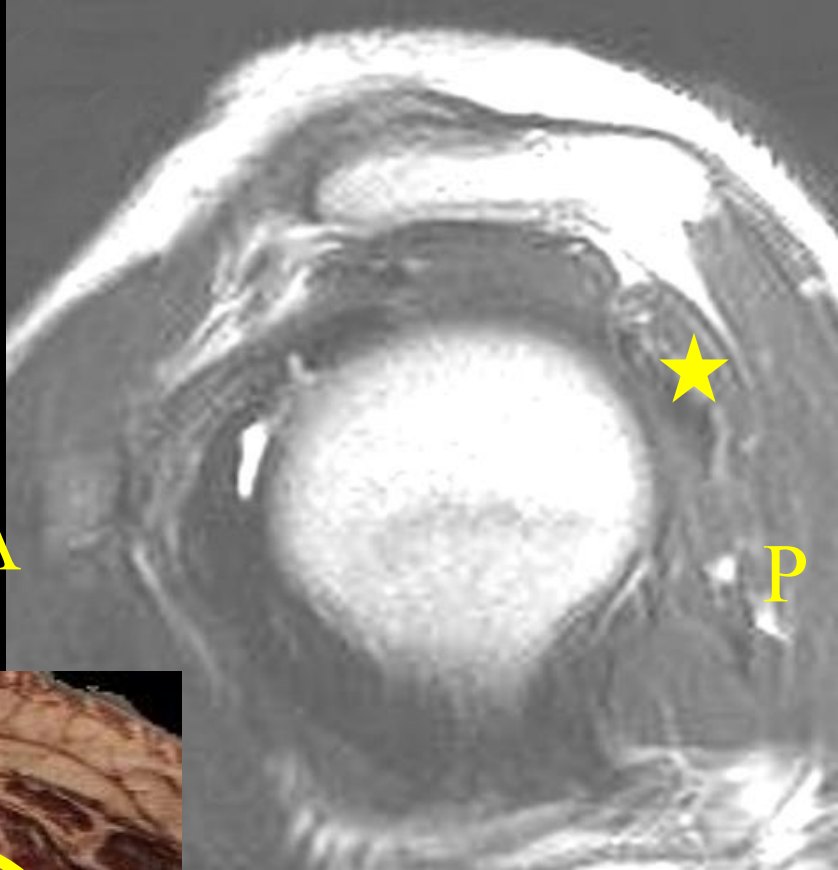
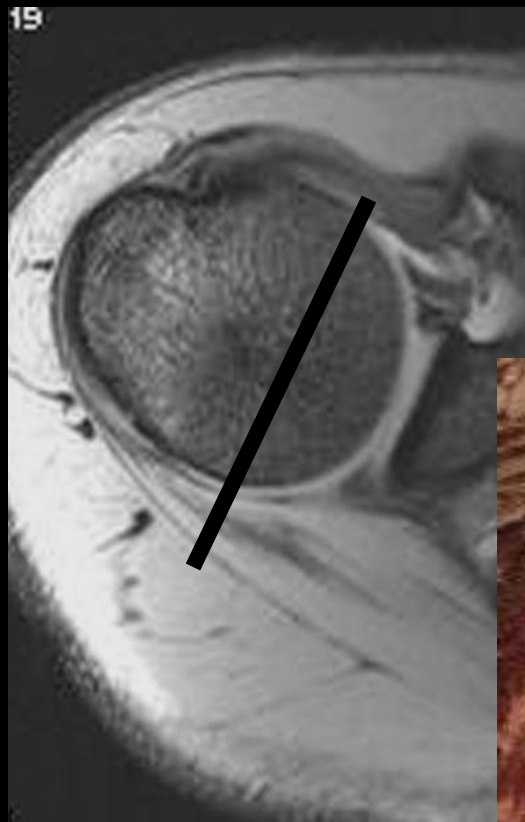


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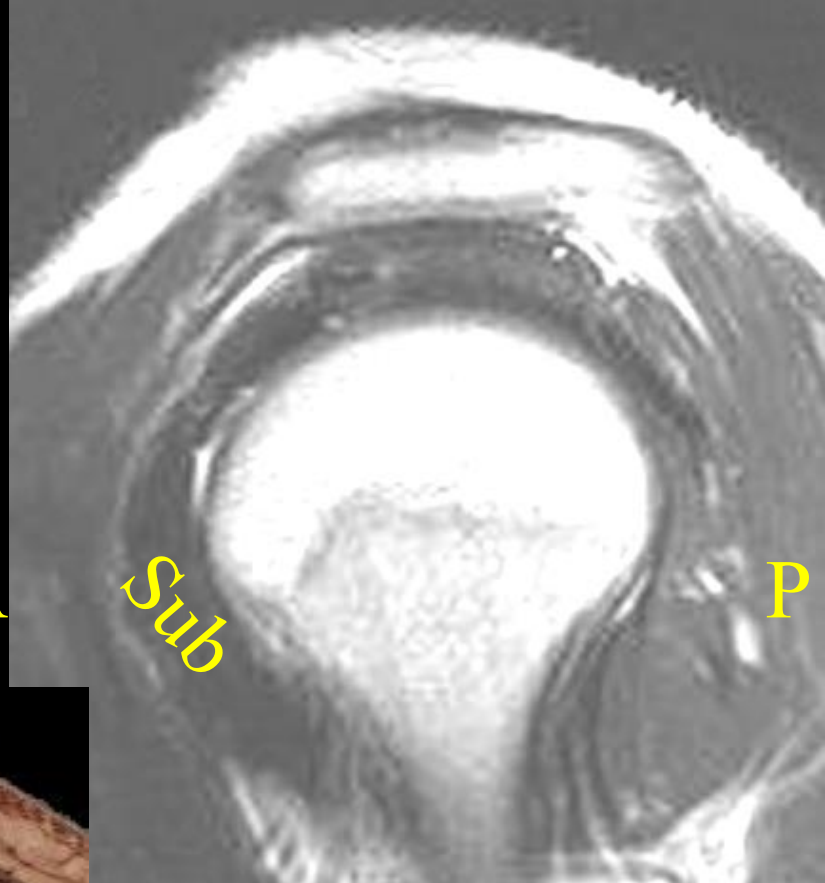
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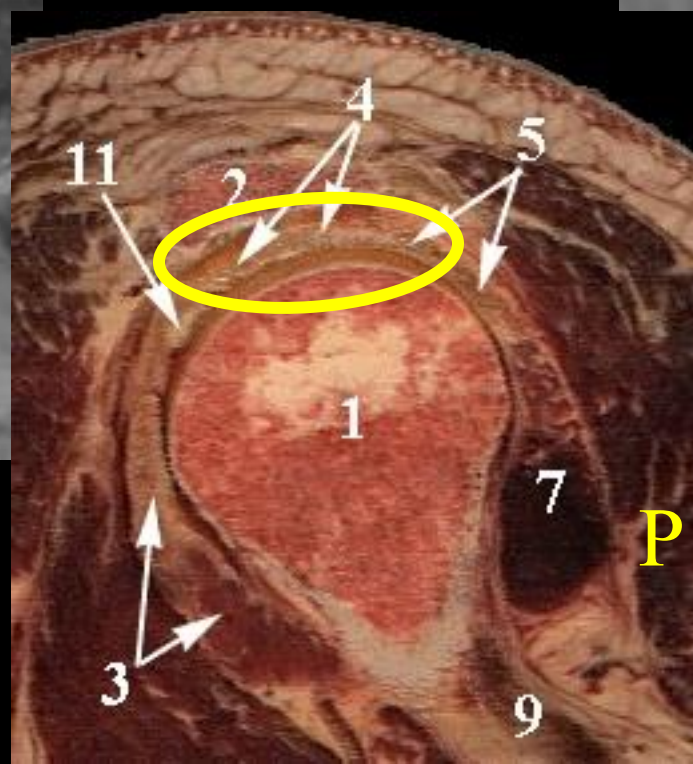
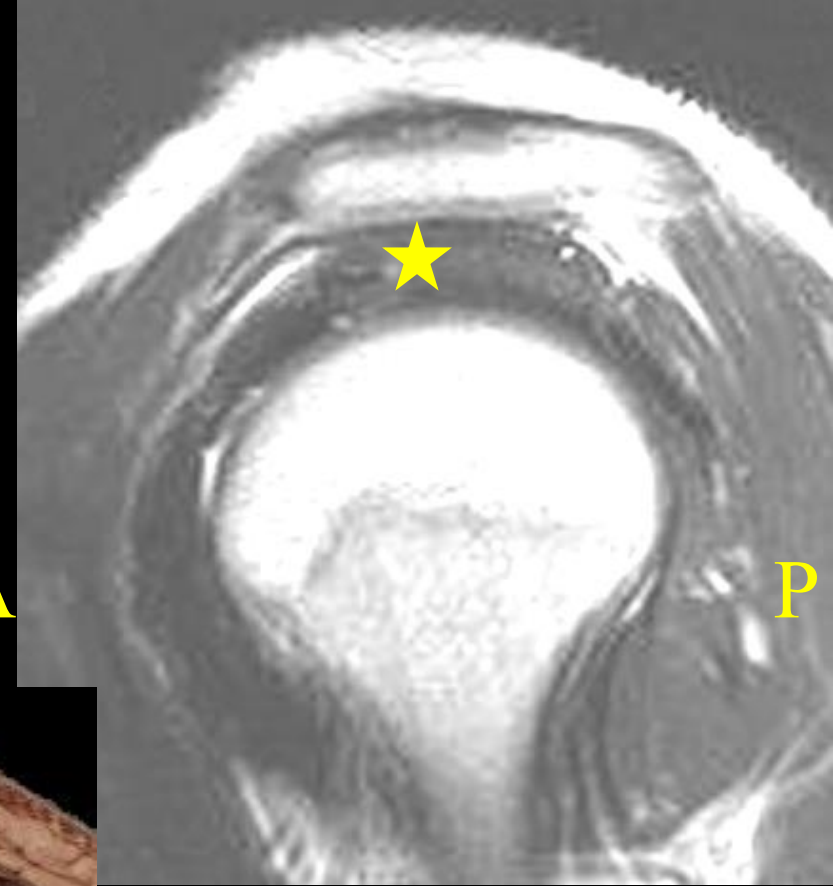
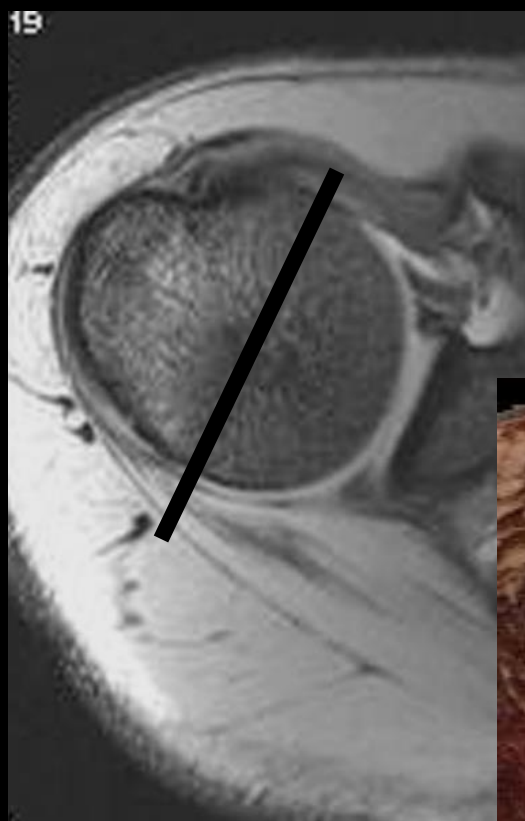


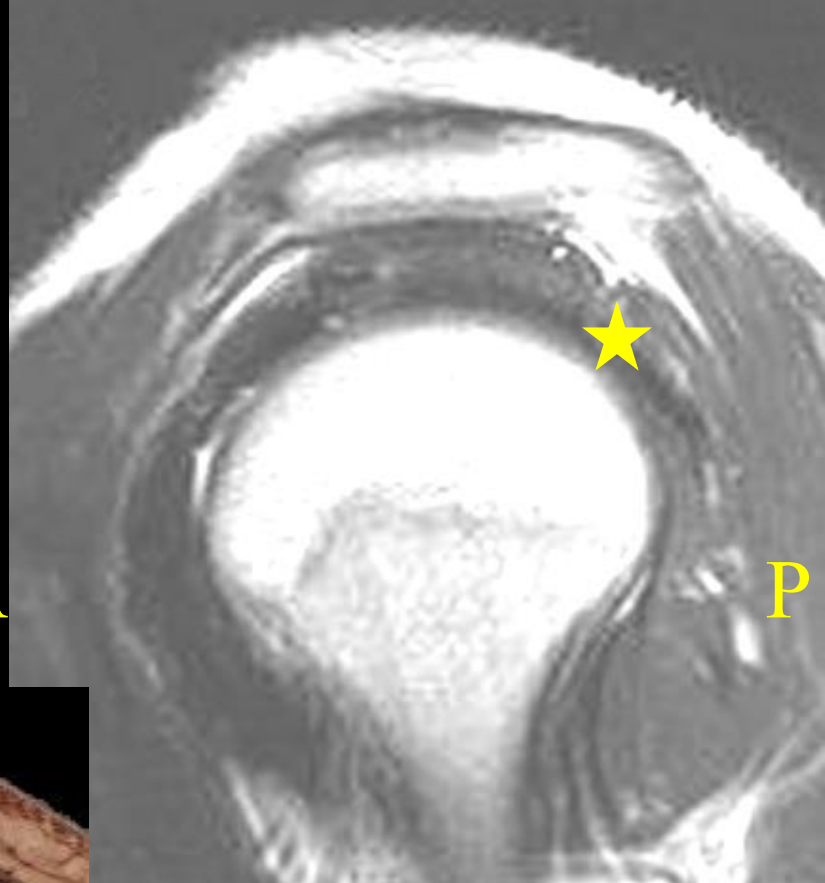
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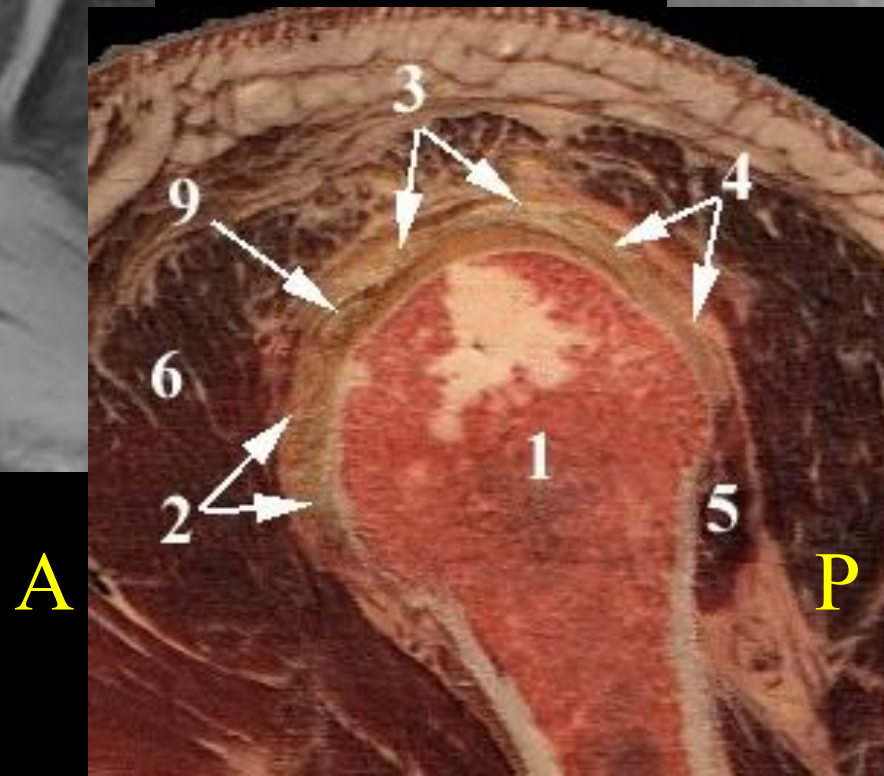
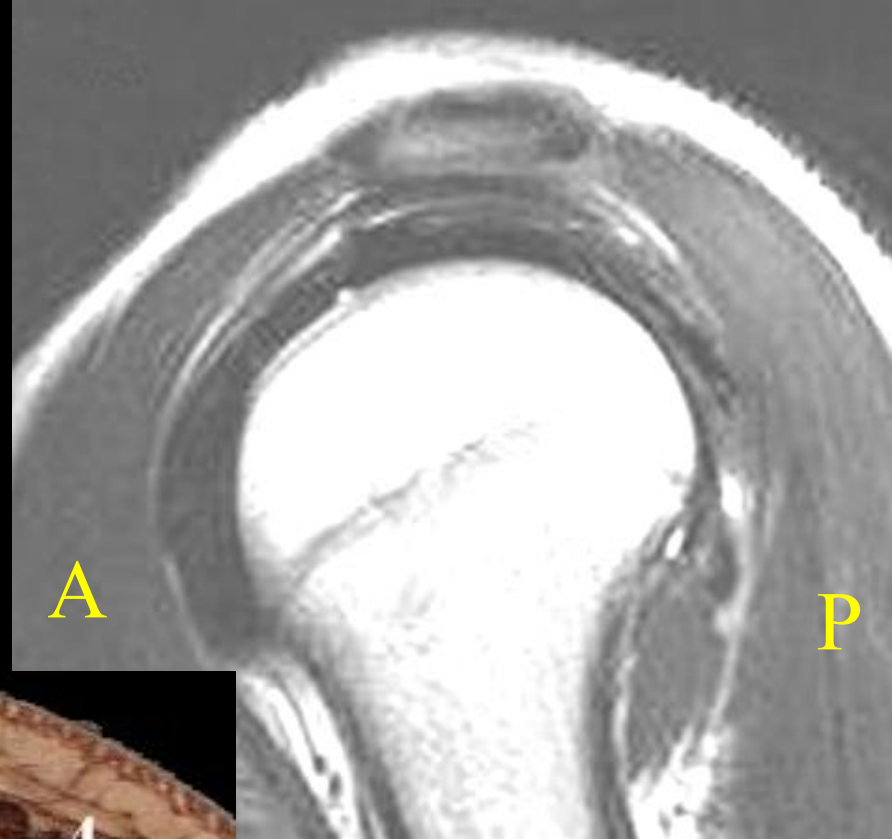


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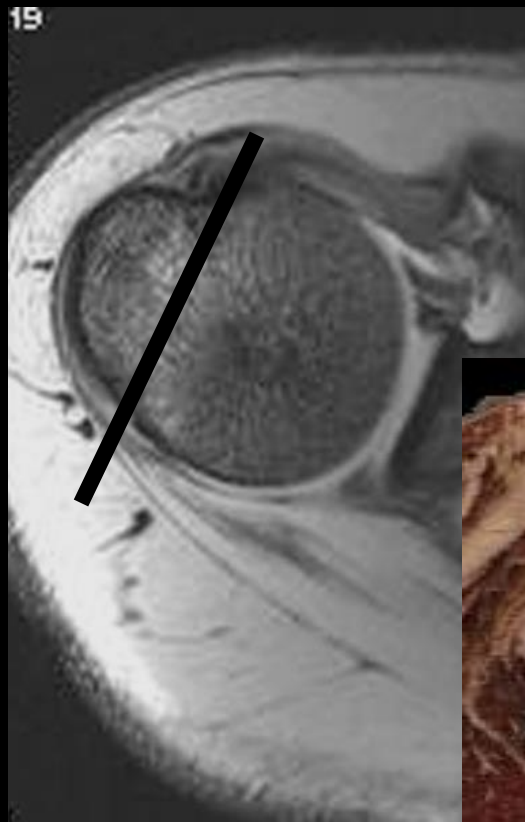
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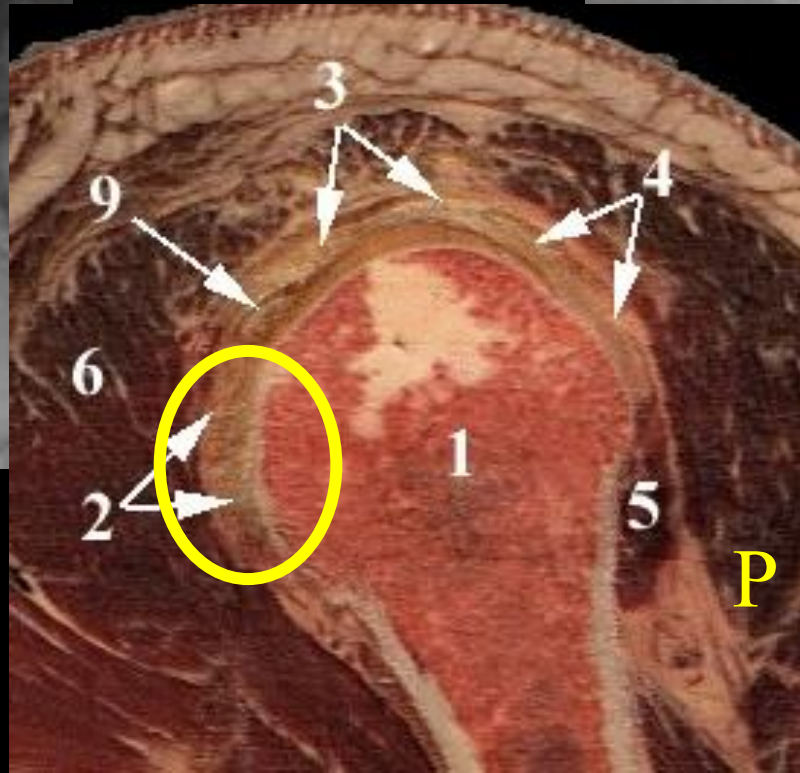
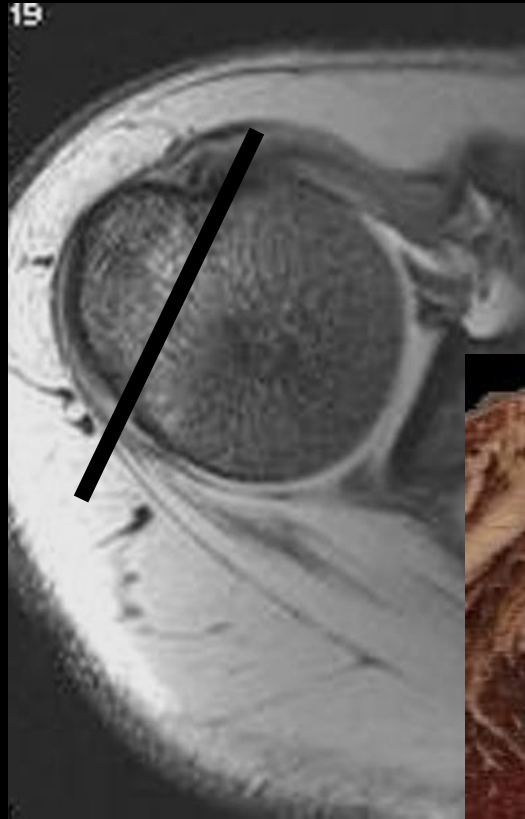




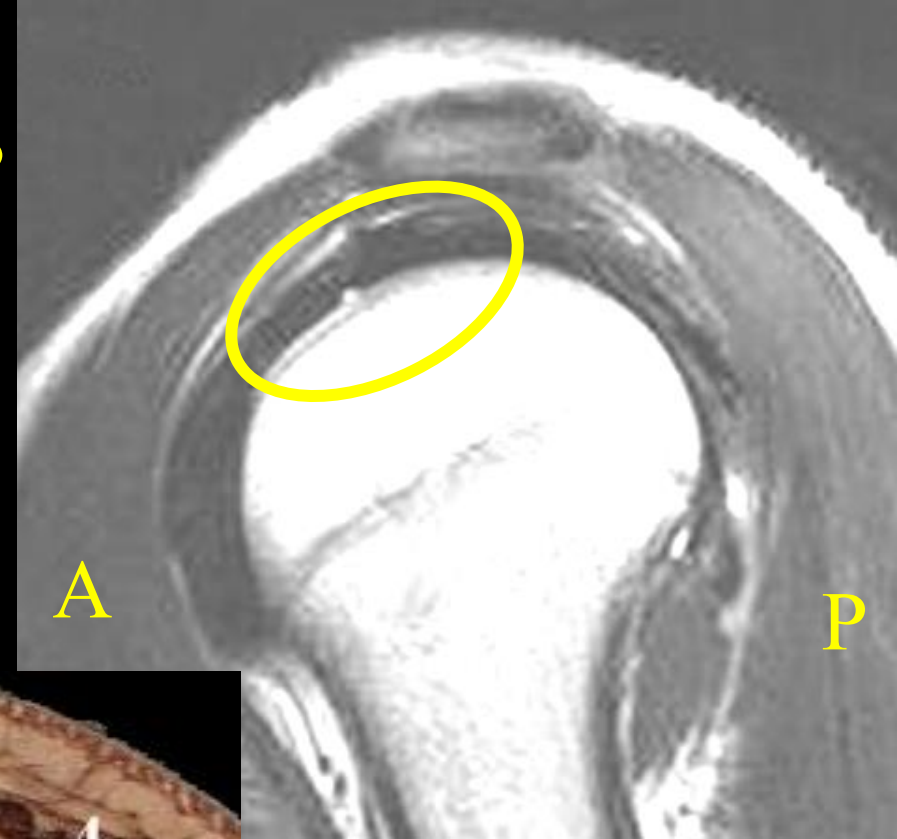
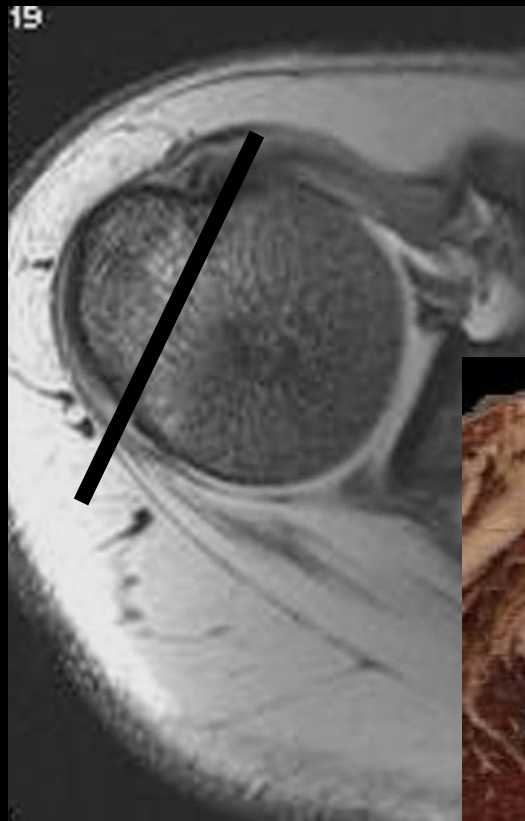




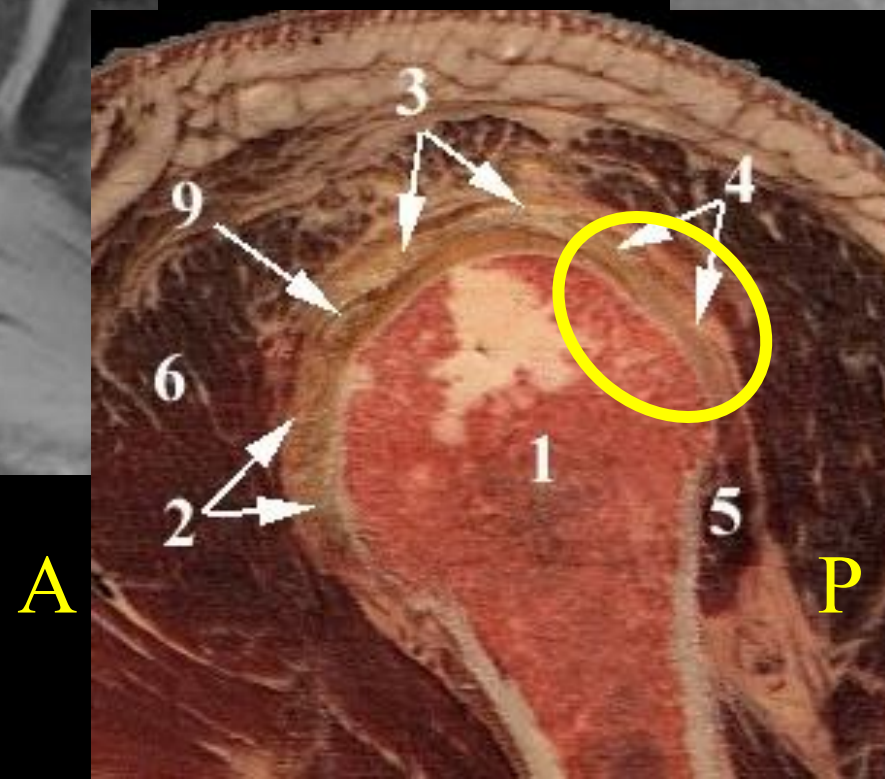
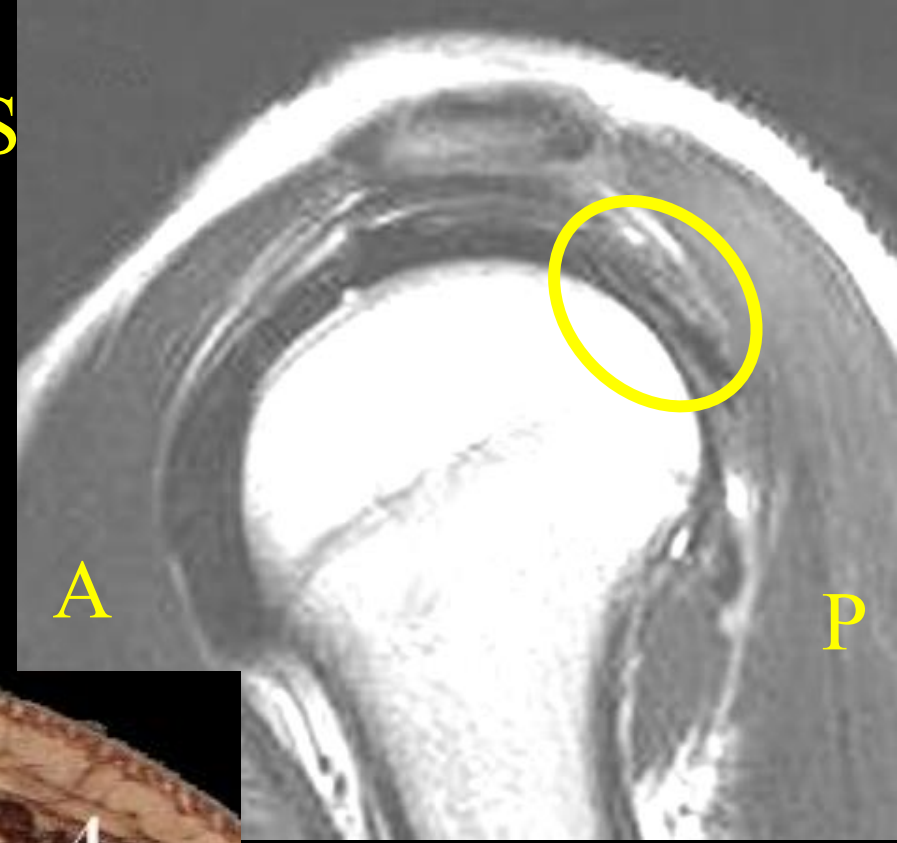
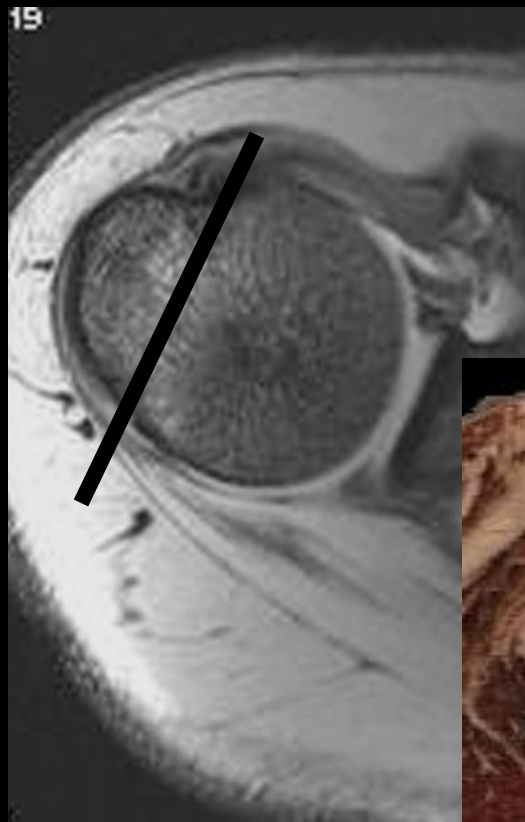
# SUBSCAPULARIS



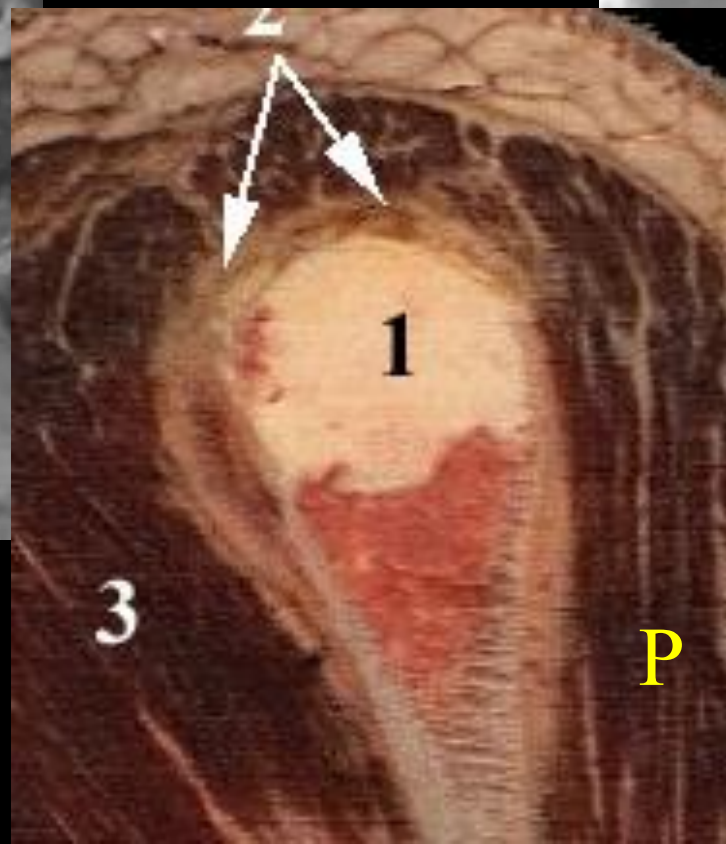
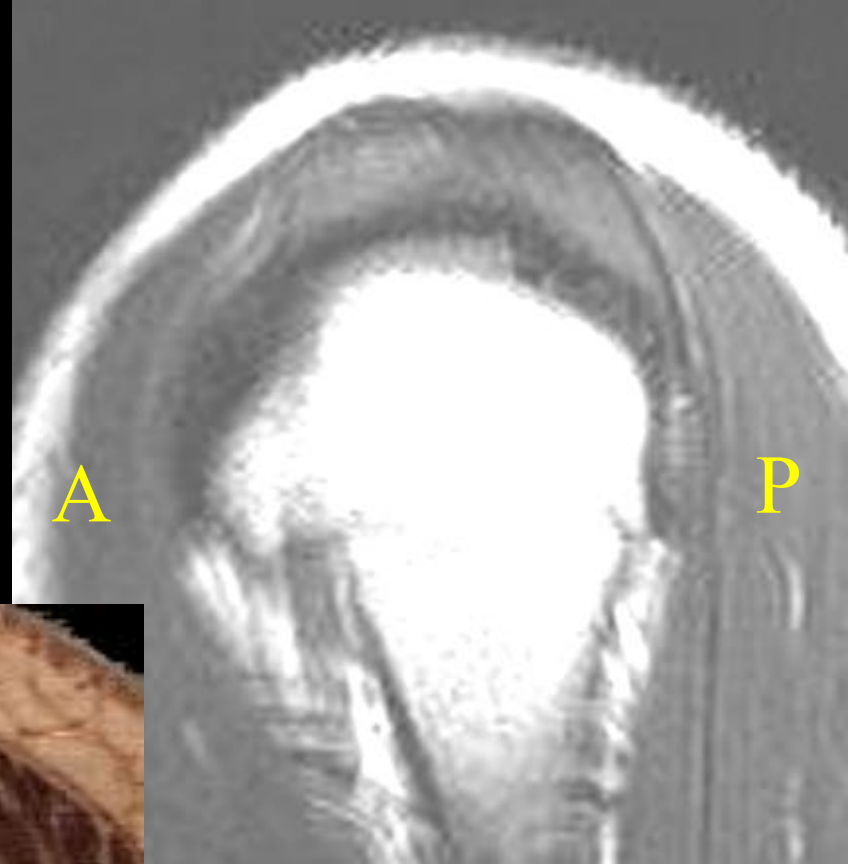
# SUPRASPINATUS



# INFRASPINATUS



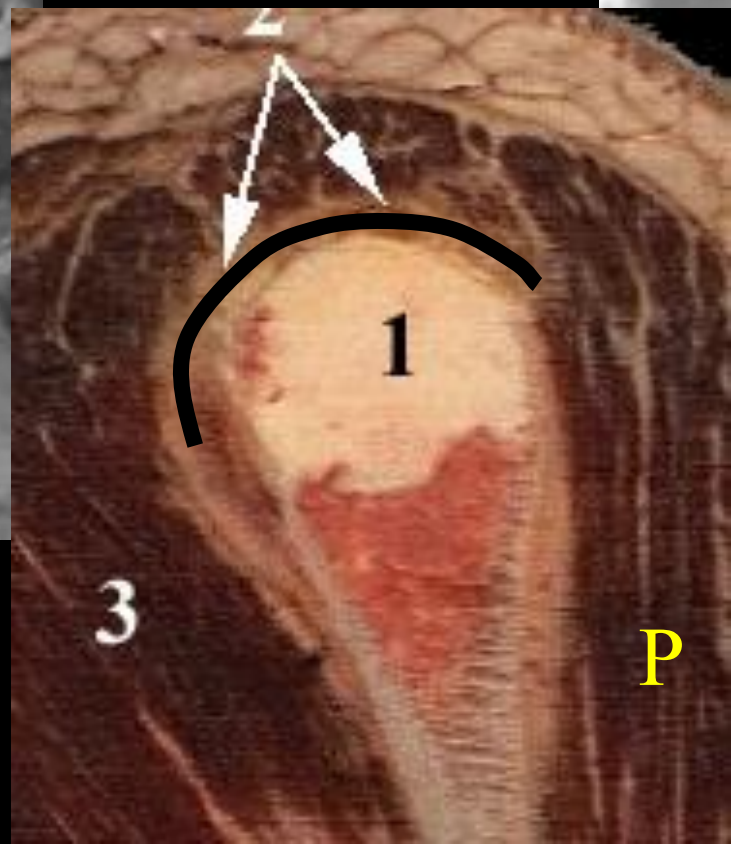




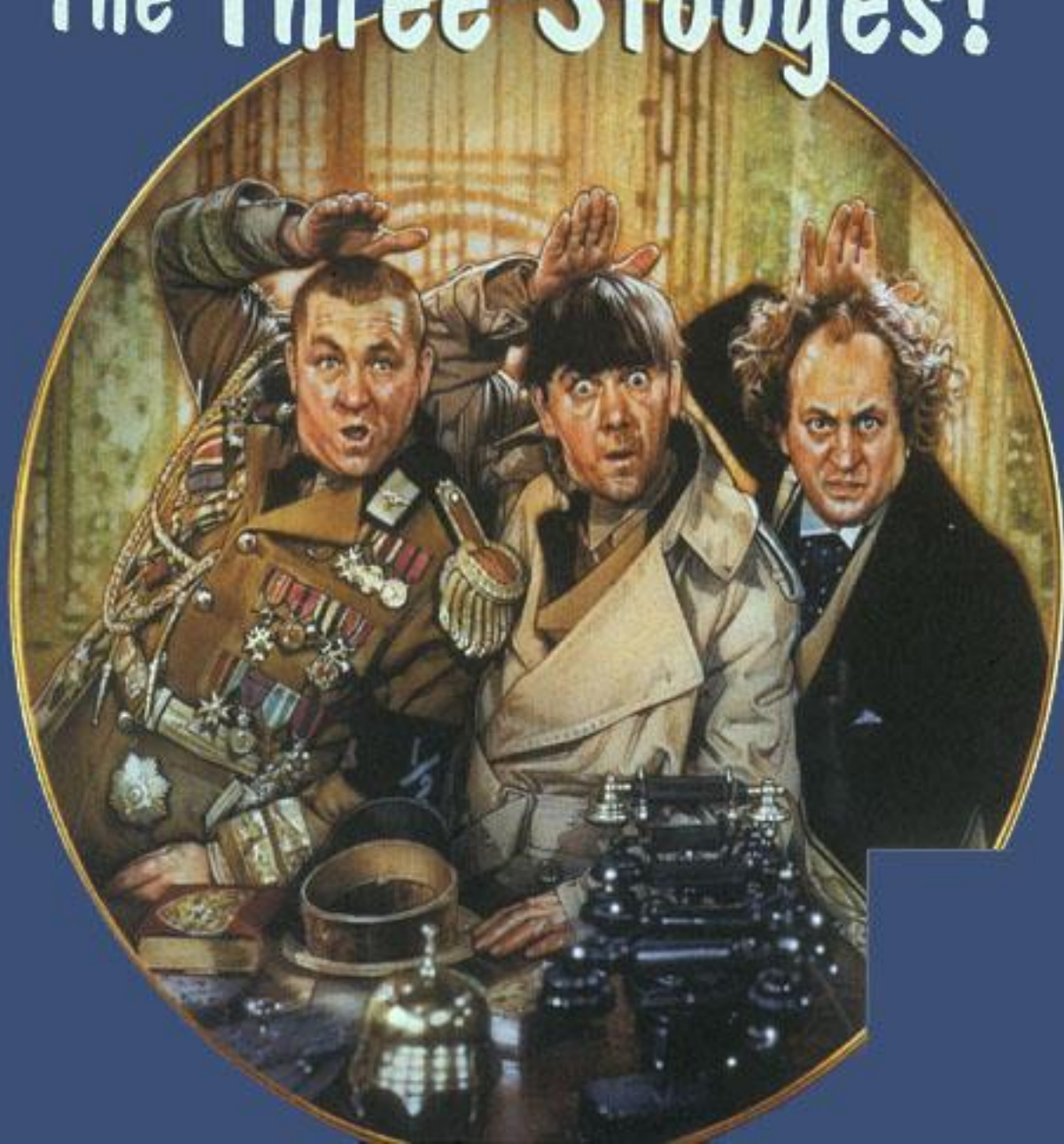
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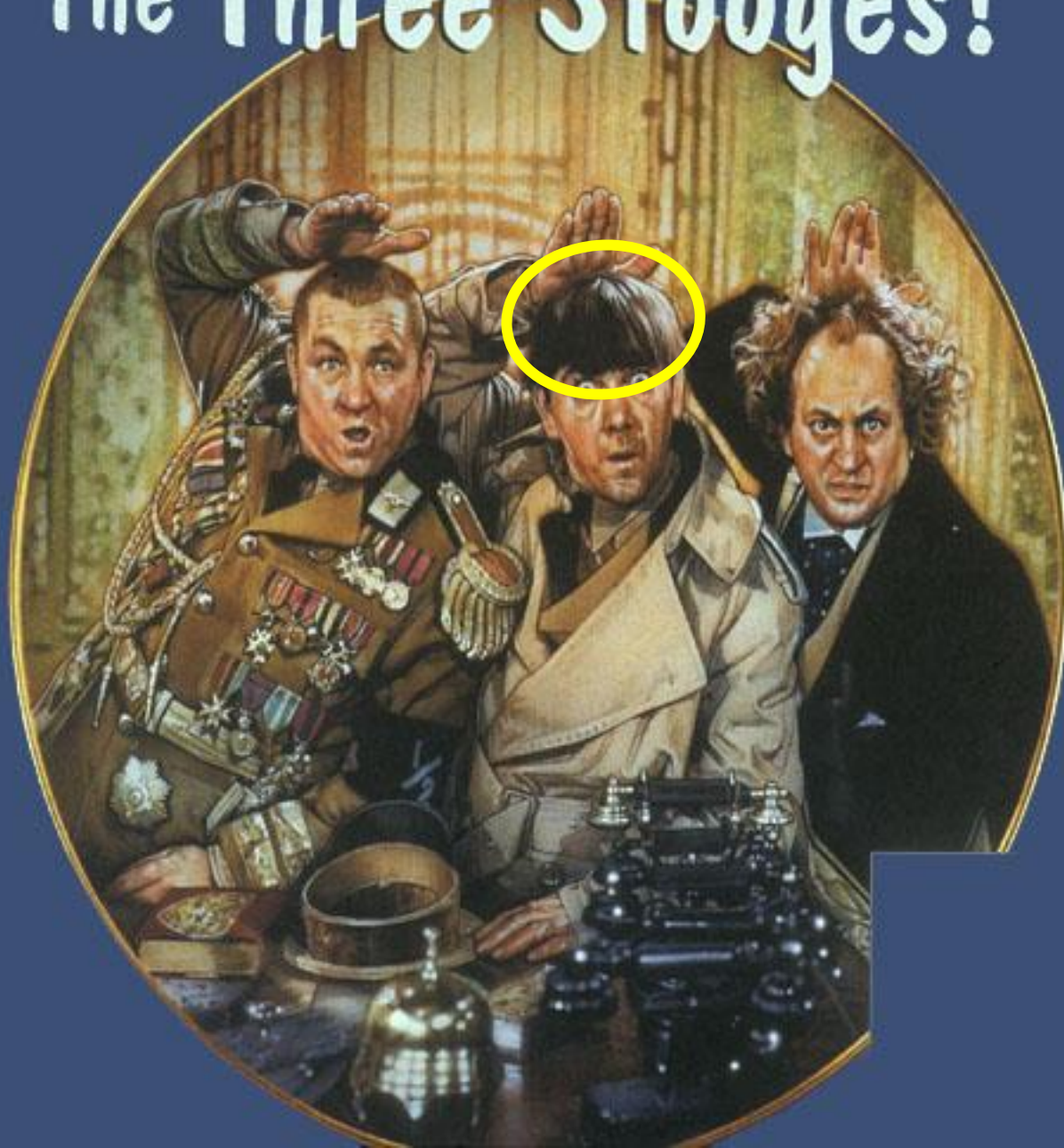


# The Three Stooges!



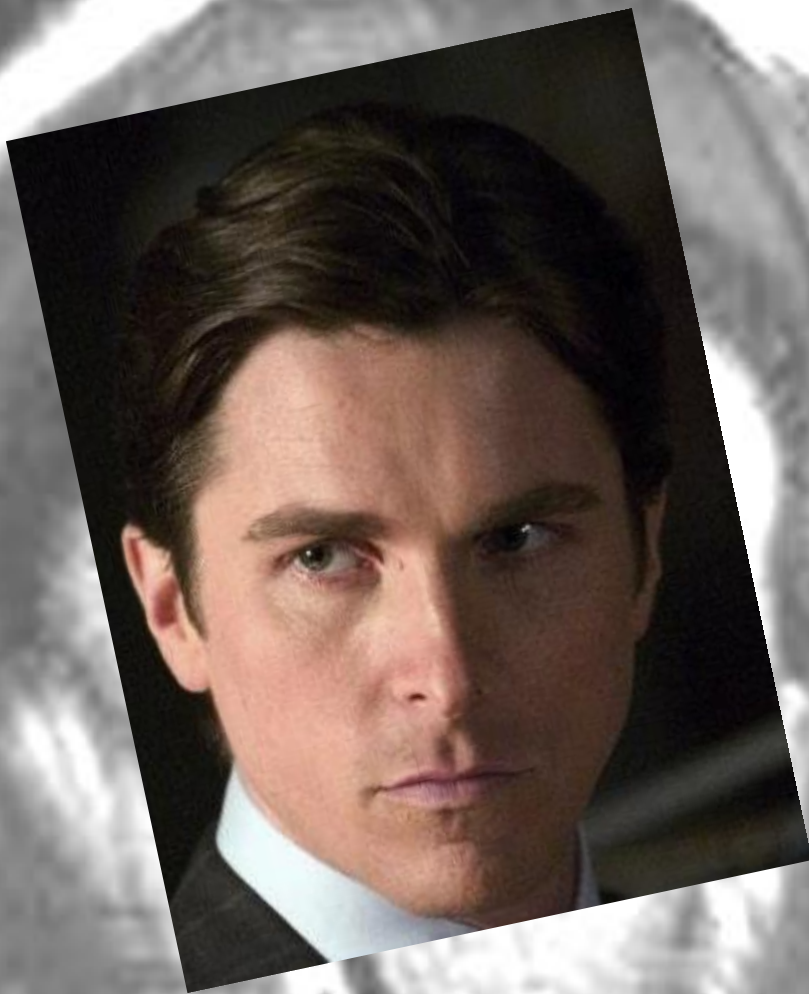


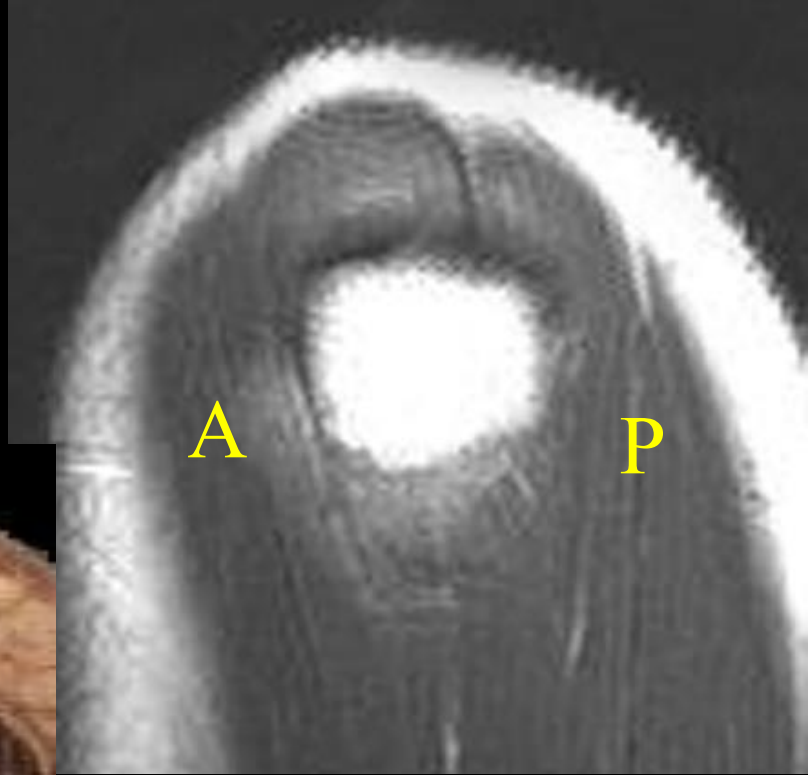
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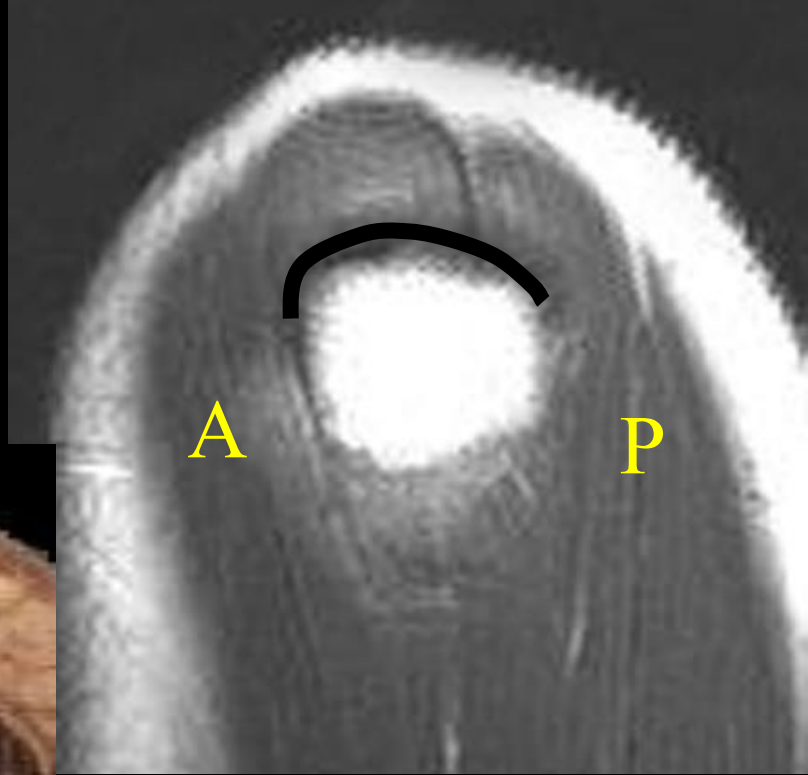














# MRI ROTATOR CUFF TEARS

	<u>SENSITIVITY</u>	<u>SPECIFICITY</u>
MR FTT	80%-100% (92%)	88%-97% (93%)
MR PTT	35%-87% (64%)	71%-83% (92%)
MR IAr FTT	80%-100%	78%-100%
MR IAr PTT	50%-71%	88%
MR DAr FTT	96%	99%
MR DAr PTT	80%-84%	96%-97%

# ROTATOR CUFF TEARS

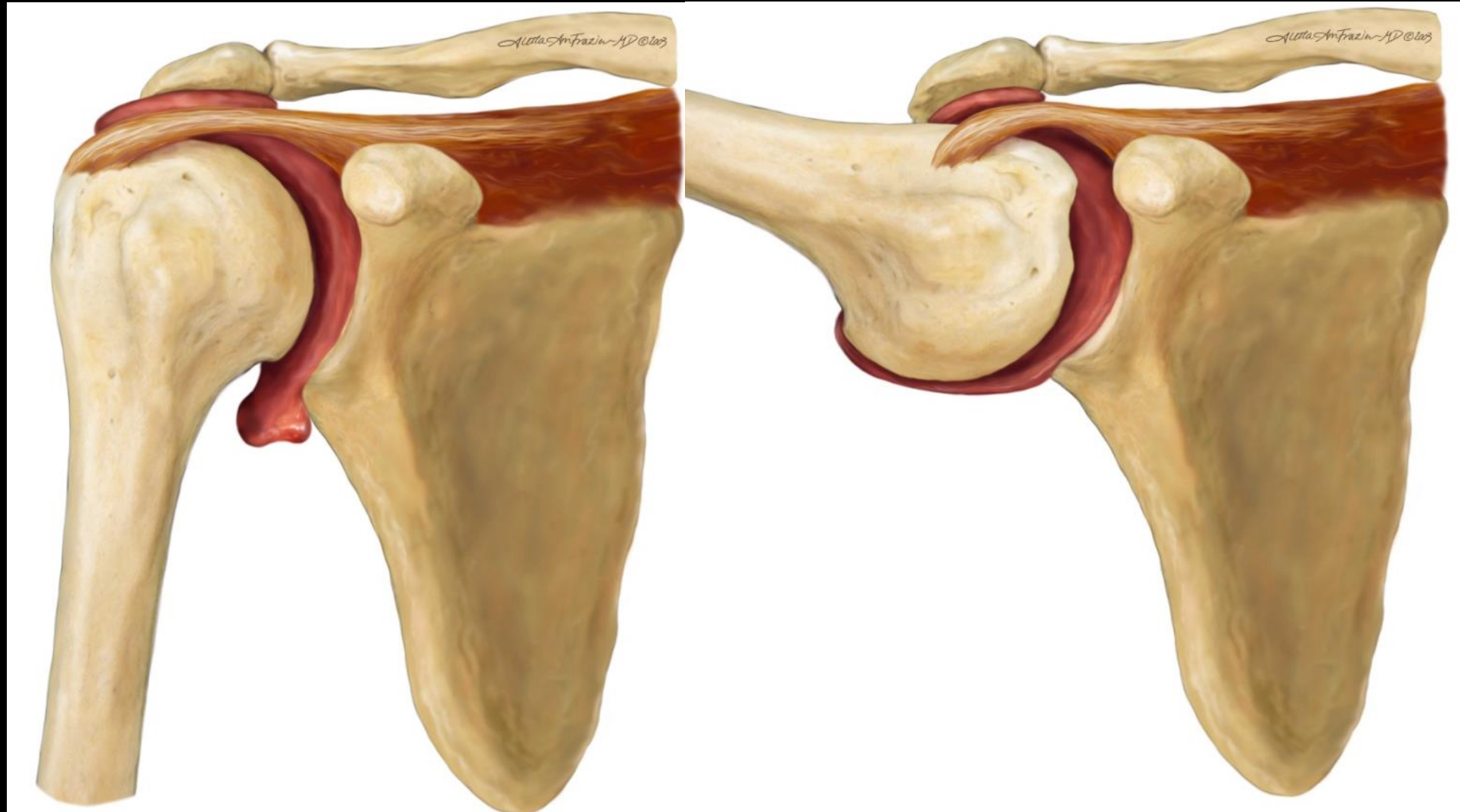
## ETIOLOGY

- Impingement
- Overuse
- Aging
- Chronic inflammatory disease
- Acute trauma
- Instability

# IMPINGEMENT SYNDROME

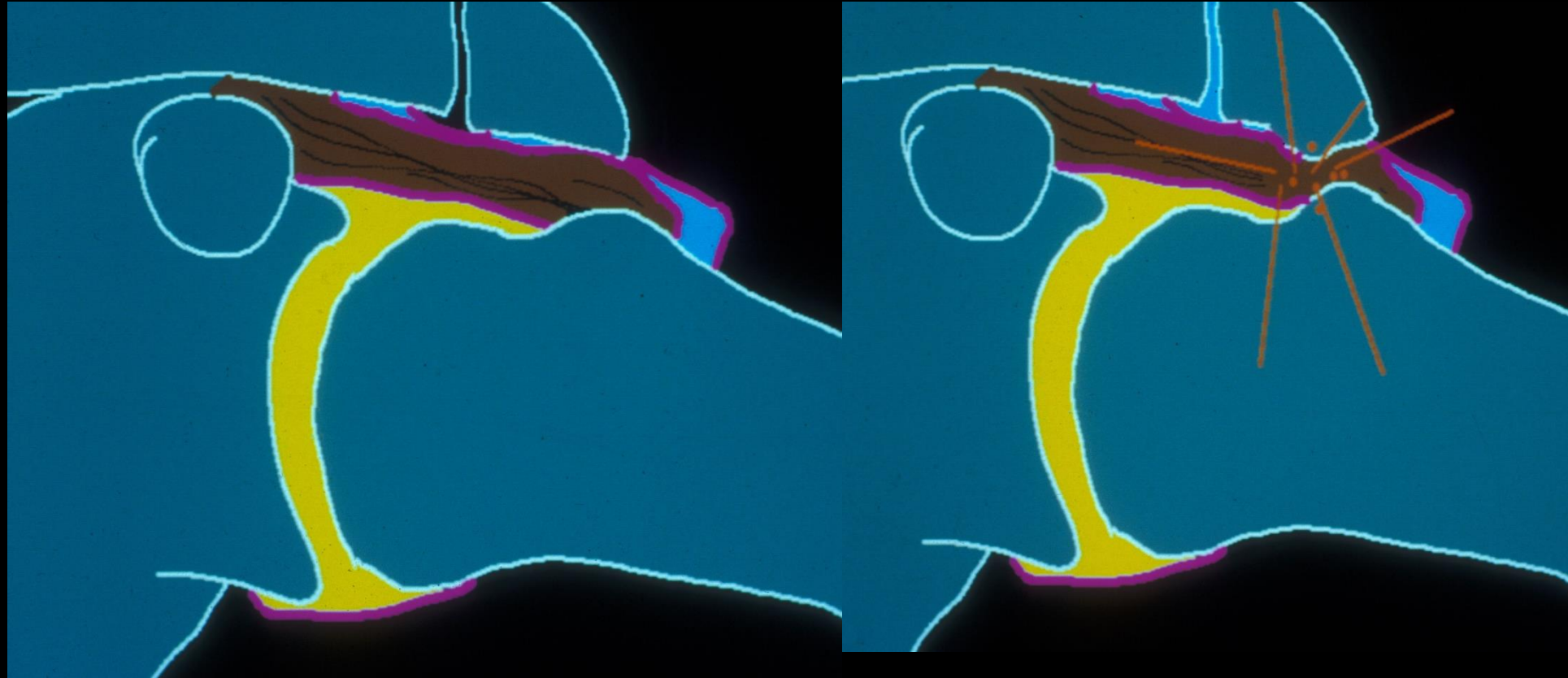
- Clinical – not radiologic diagnosis
  - Pain with abduction and external rotation
  - Pain with elevation and internal rotation (Neer impingement sign)
  - Probably not as important as previously
- Mechanical causes
  - Acromial shape, position
  - AC joint osteophyte
  - Thick coracoacromial ligament
  - Instability

# IMPINGEMENT SYNDROME





# IMPINGEMENT SYNDROME



# ROTATOR CUFF TEARS

## NEER STAGING

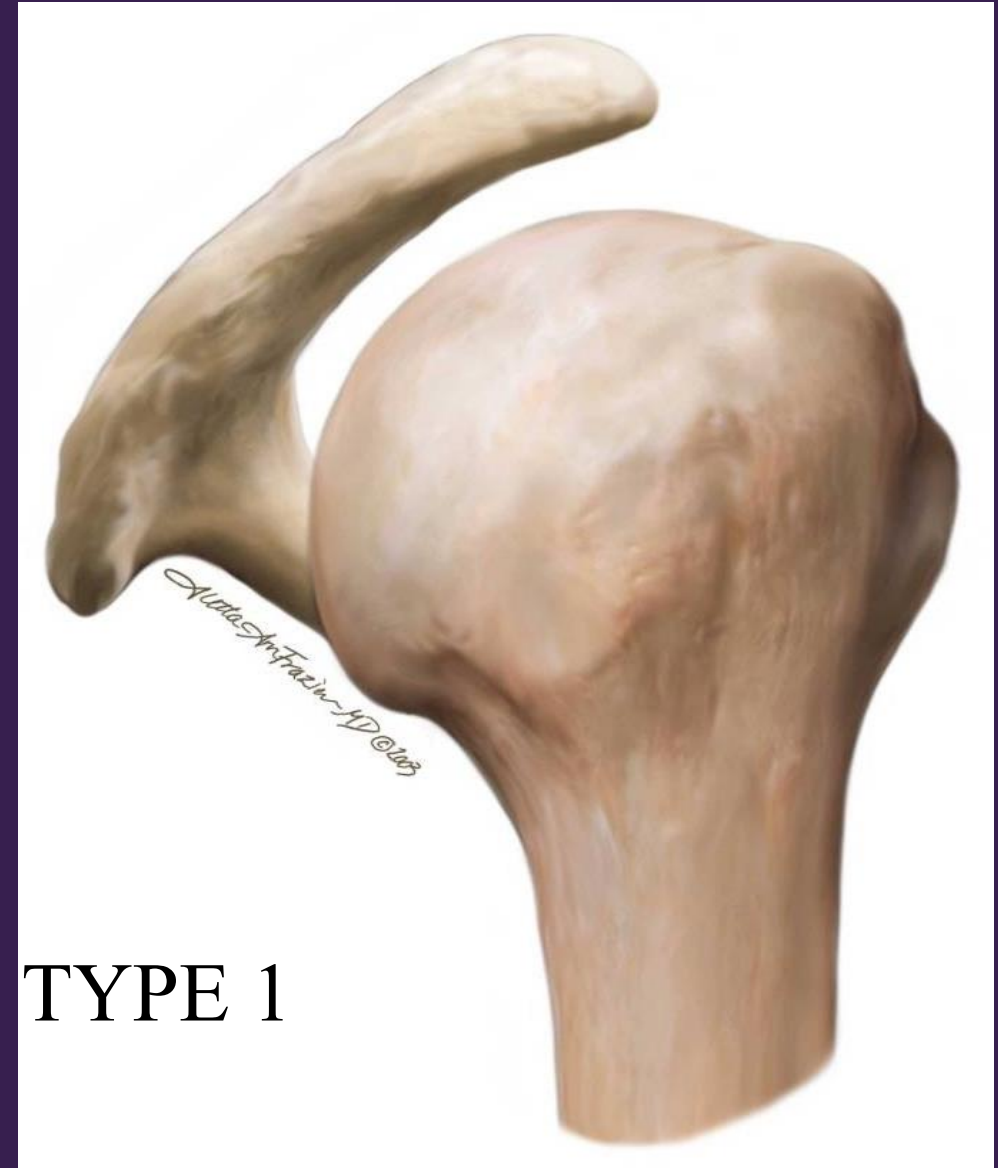
- Stage I (<25 y/o)
  - Edema / hemorrhage
- Stage II (25-40 y/o)
  - Fibrosis / thickening
- Stage III (>40 y/o)
  - Partial / Complete Tear

# ACROMIAL SHAPE

- Shape
  - Type I
  - Type II
  - Type III
- Lateral Downsloping
- Anterior Downsloping
- Os acromiale

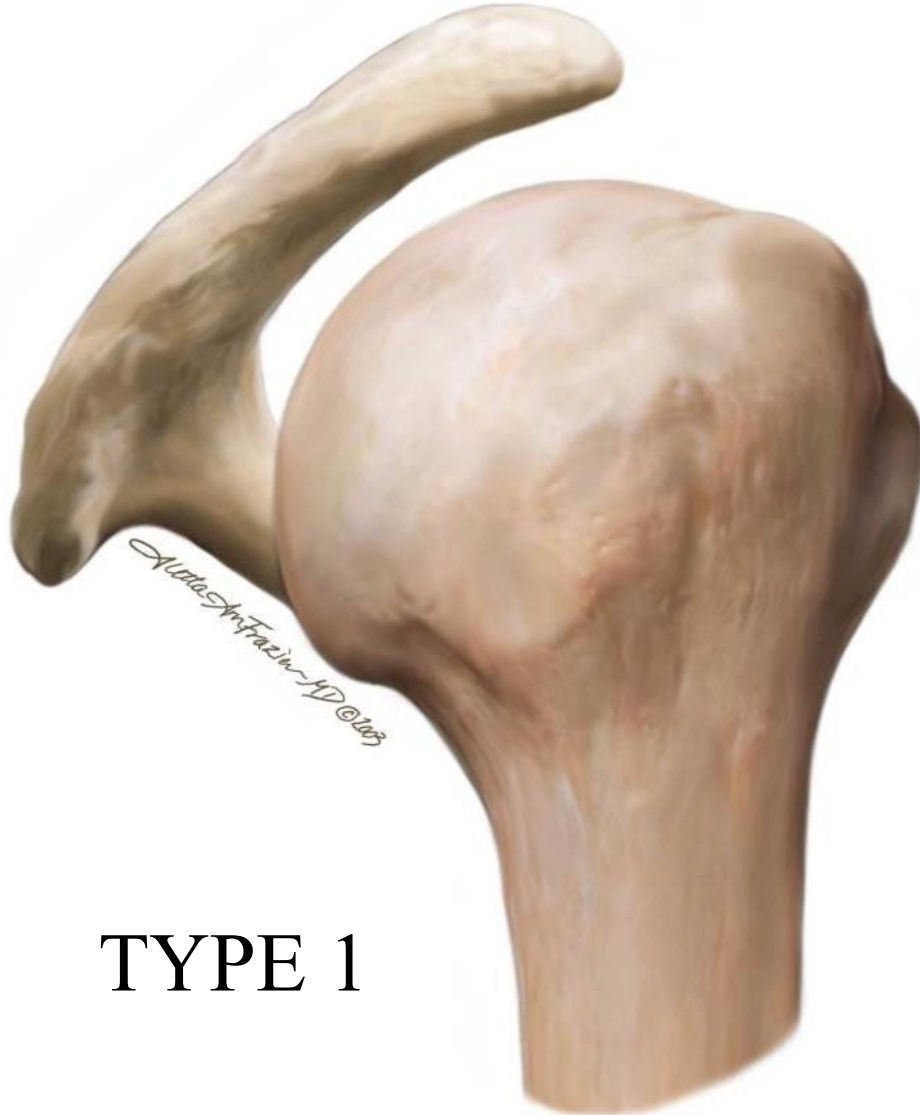
# ACROMIAL SHAPE

- Increase in number increases risk of tear
- Type I - flat
- Type II – curved
- Type III – hooked
- Assess on sagittal images
- Not reproducible

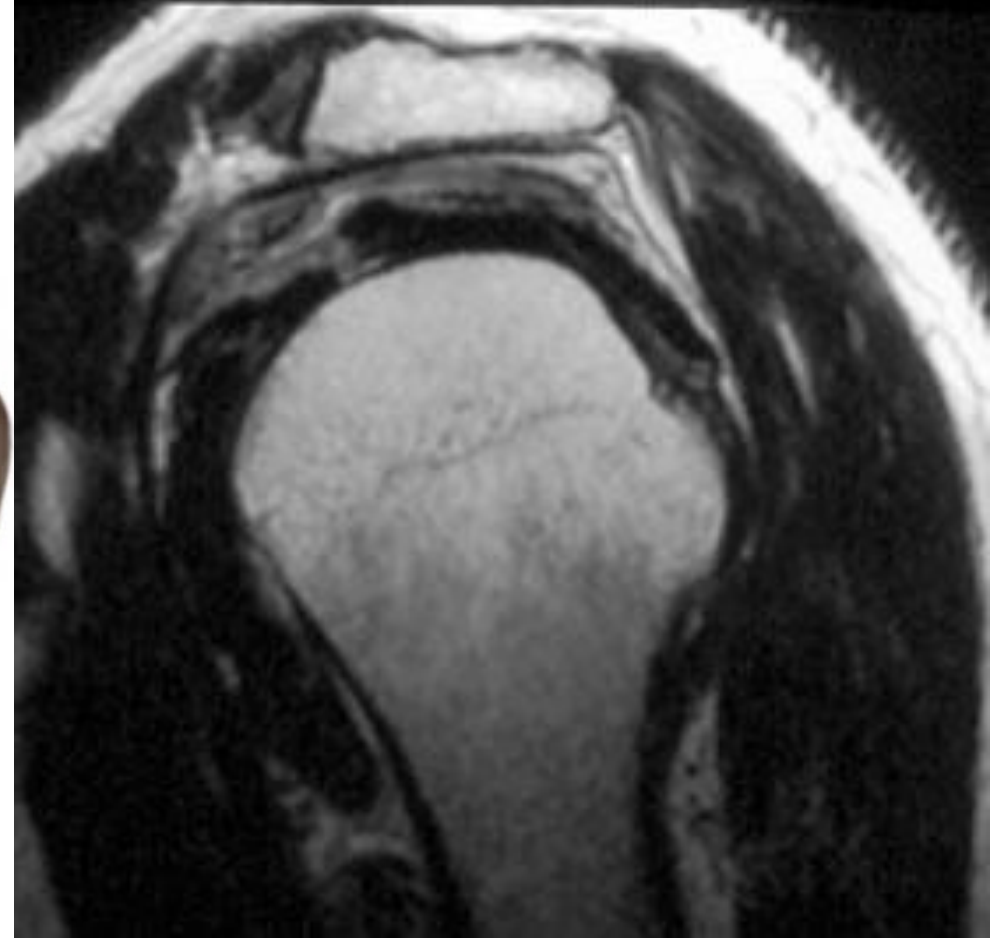




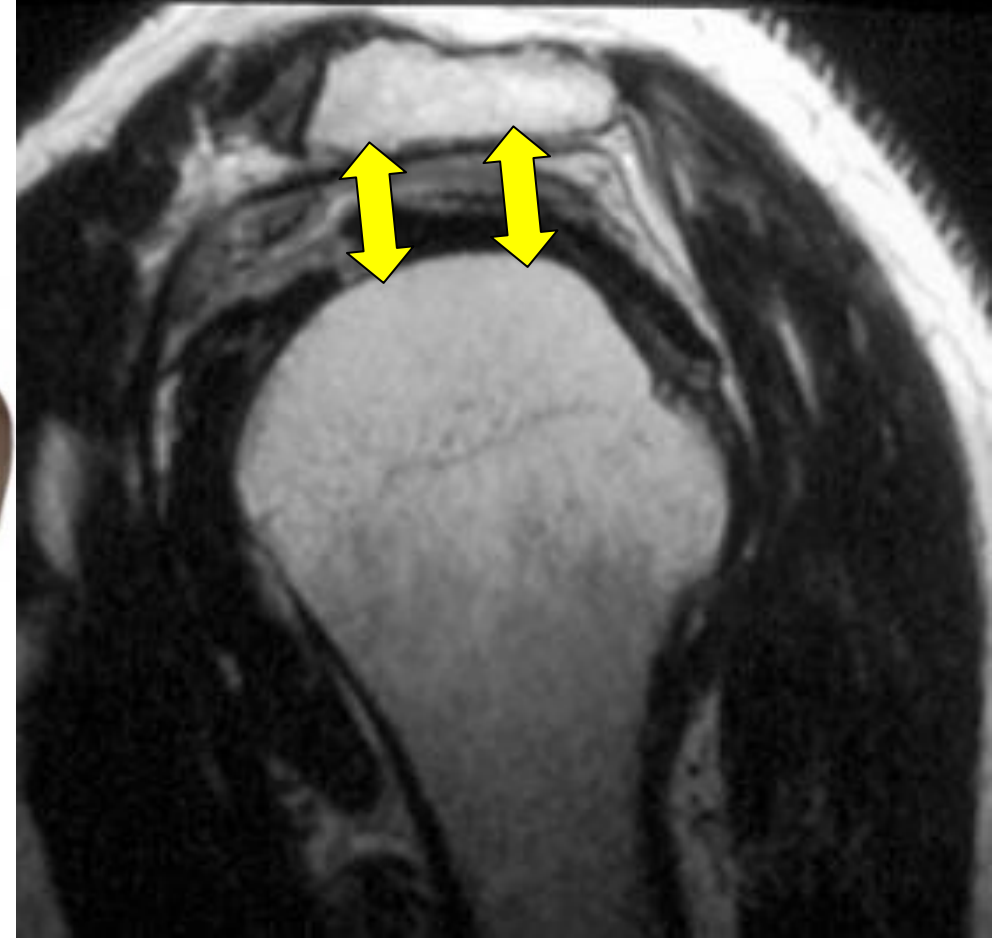
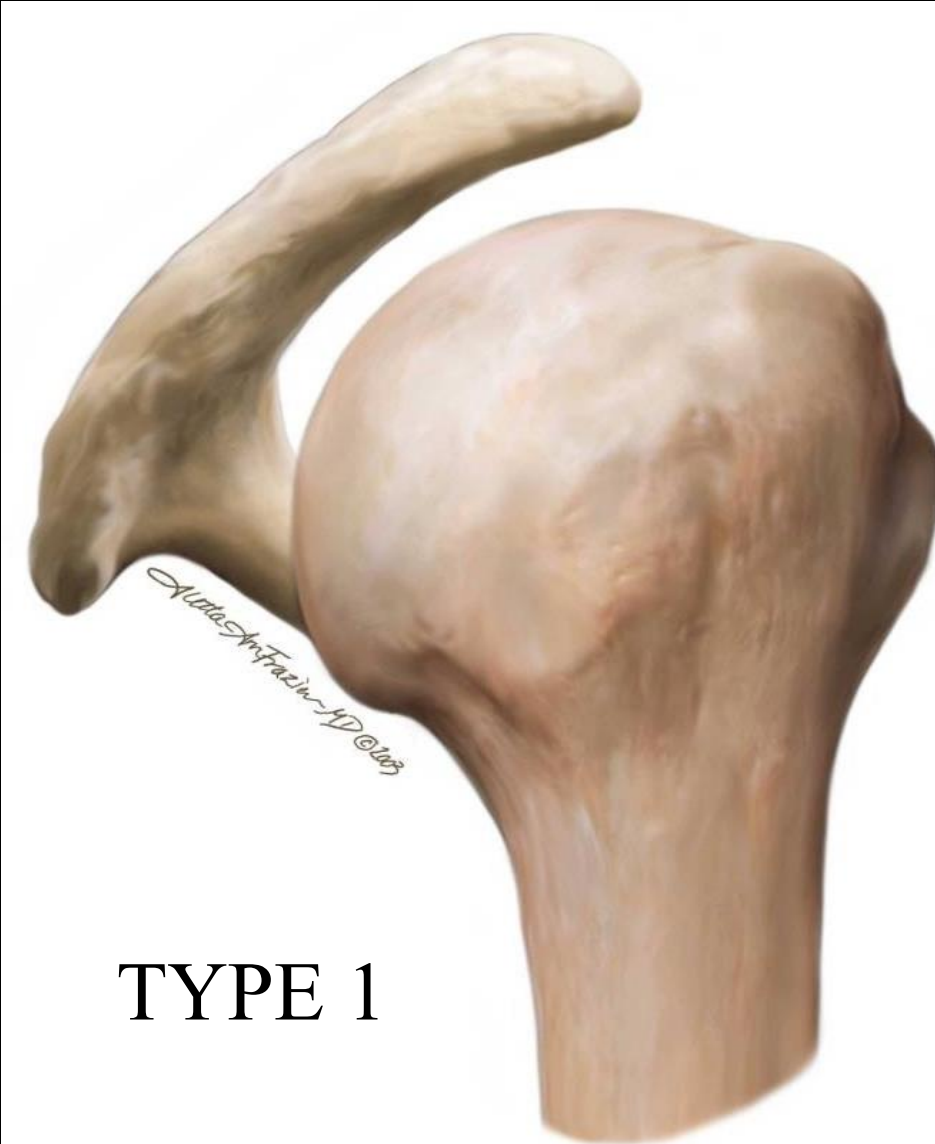
# ACROMIAL SHAPE



TYPE 1



# ACROMIAL SHAPE



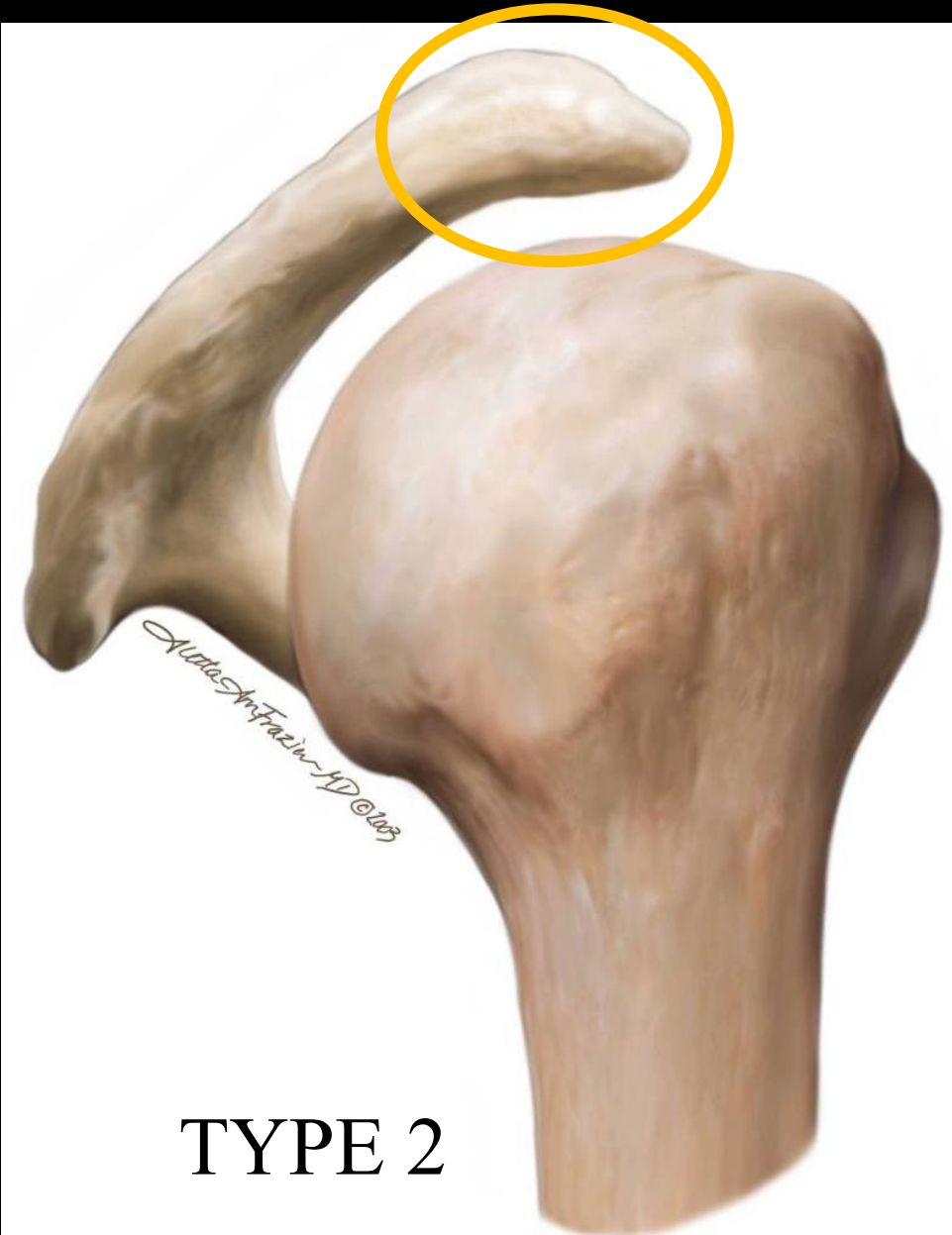
# ACROMIAL SHAPE



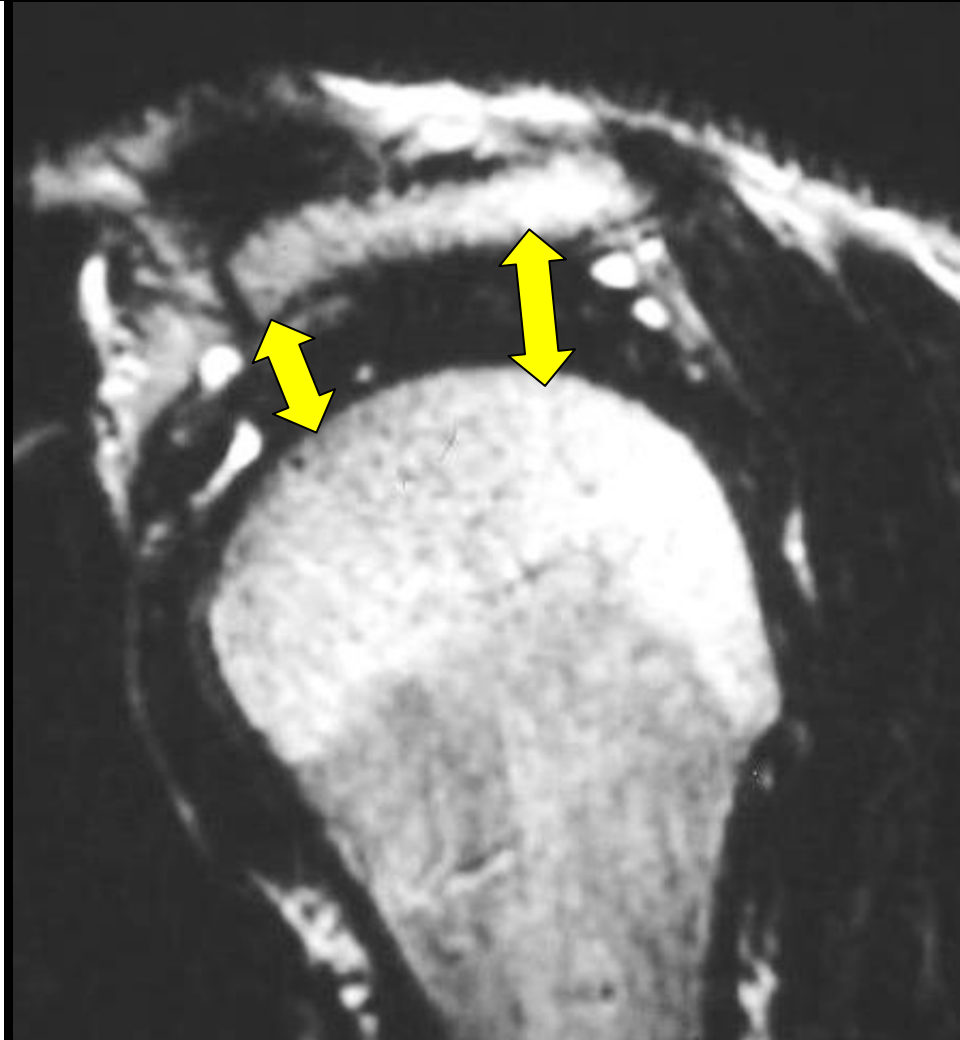
TYPE 2



# ACROMIAL SHAPE

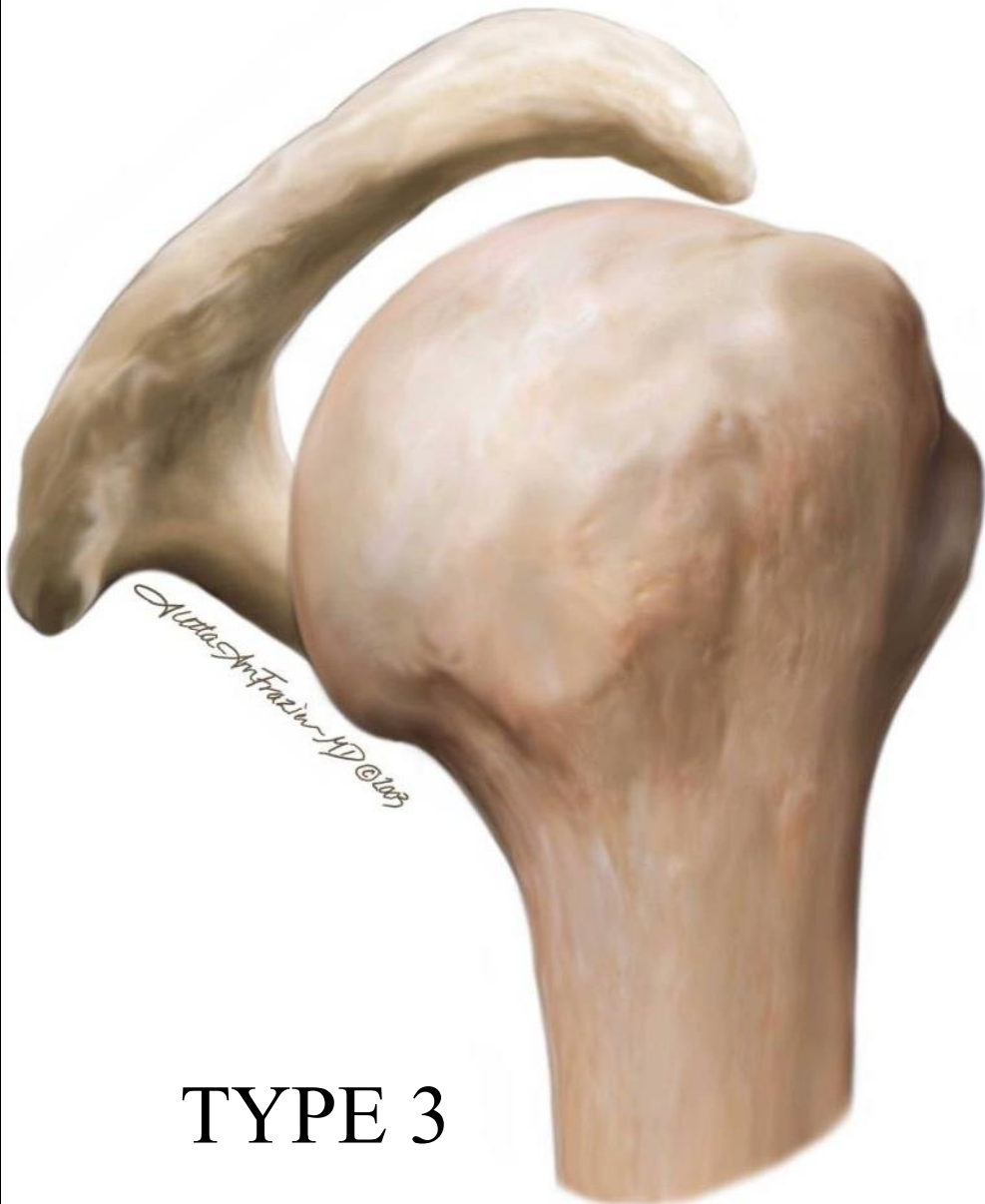


TYPE 2

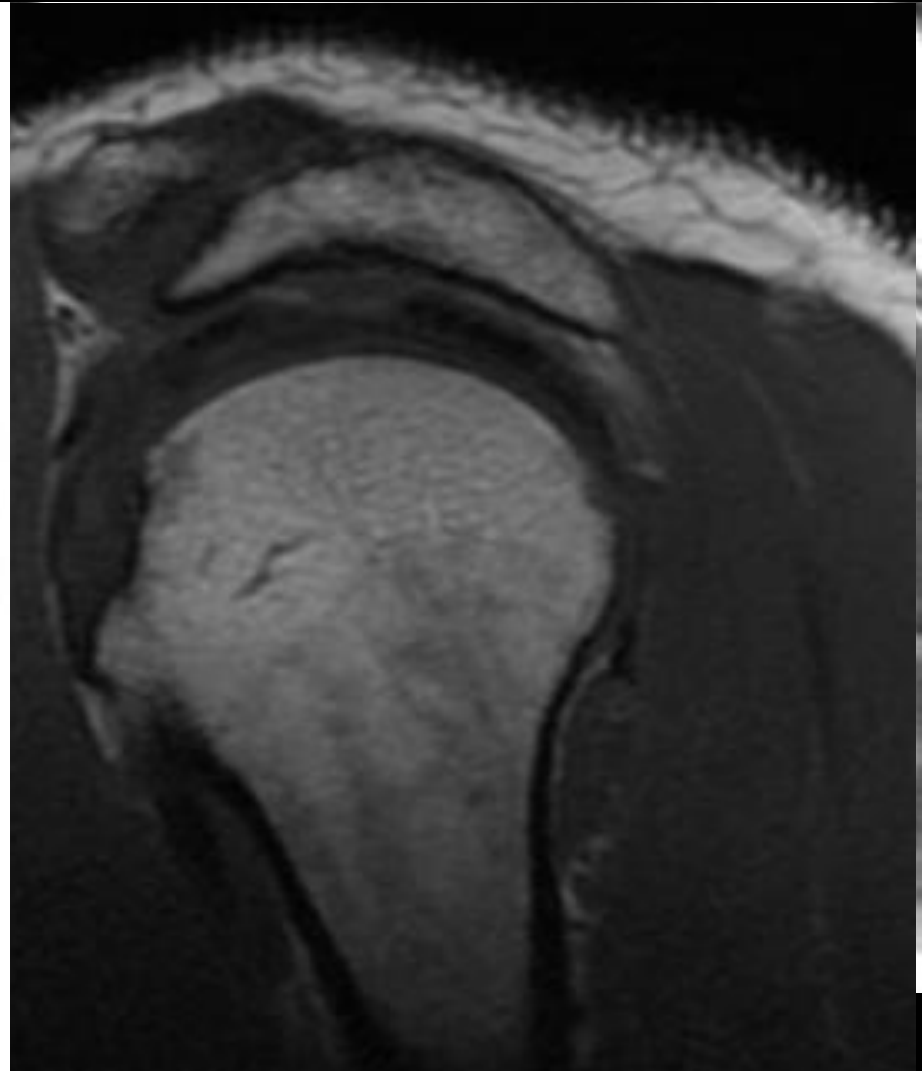




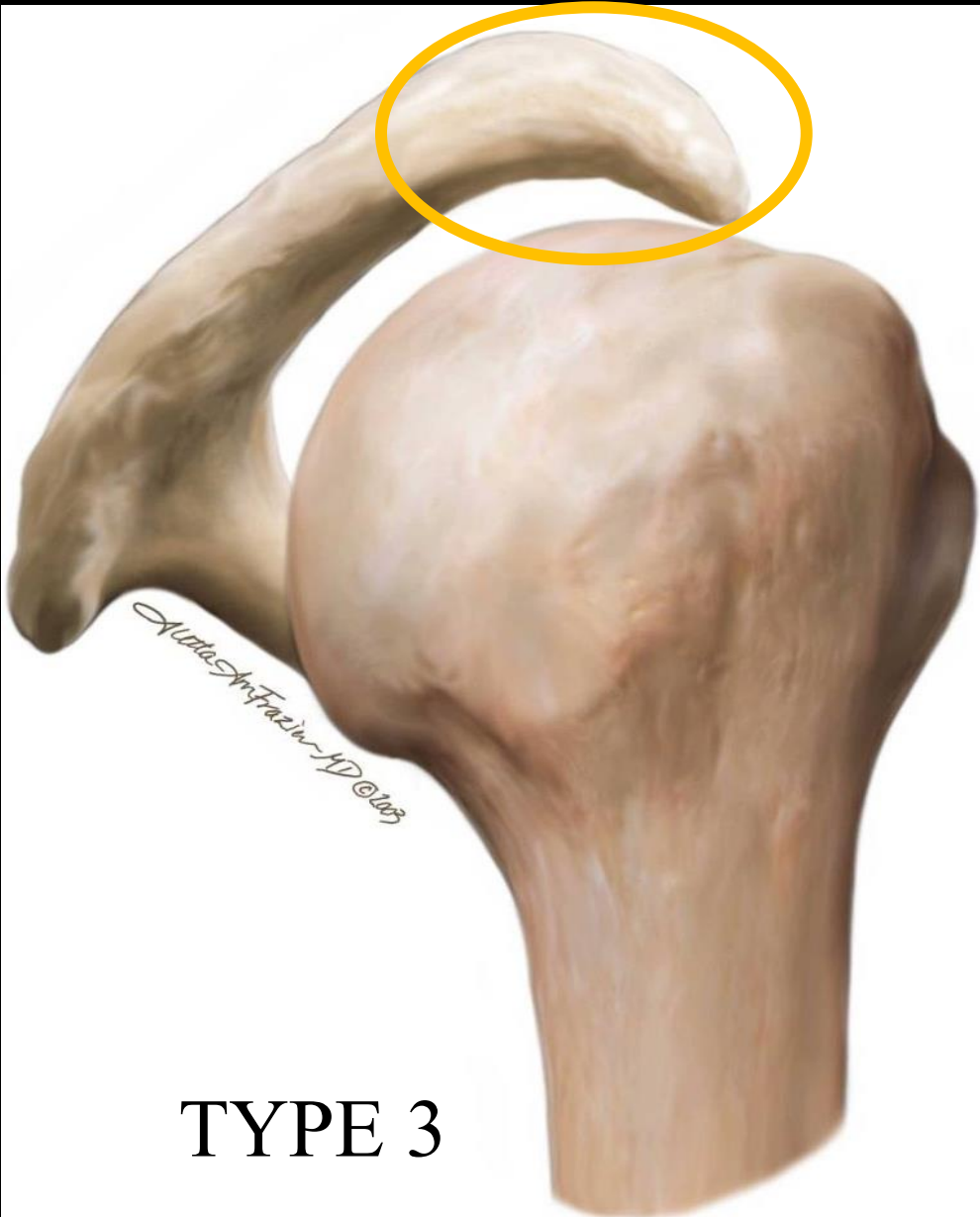
# ACROMIAL SHAPE



TYPE 3



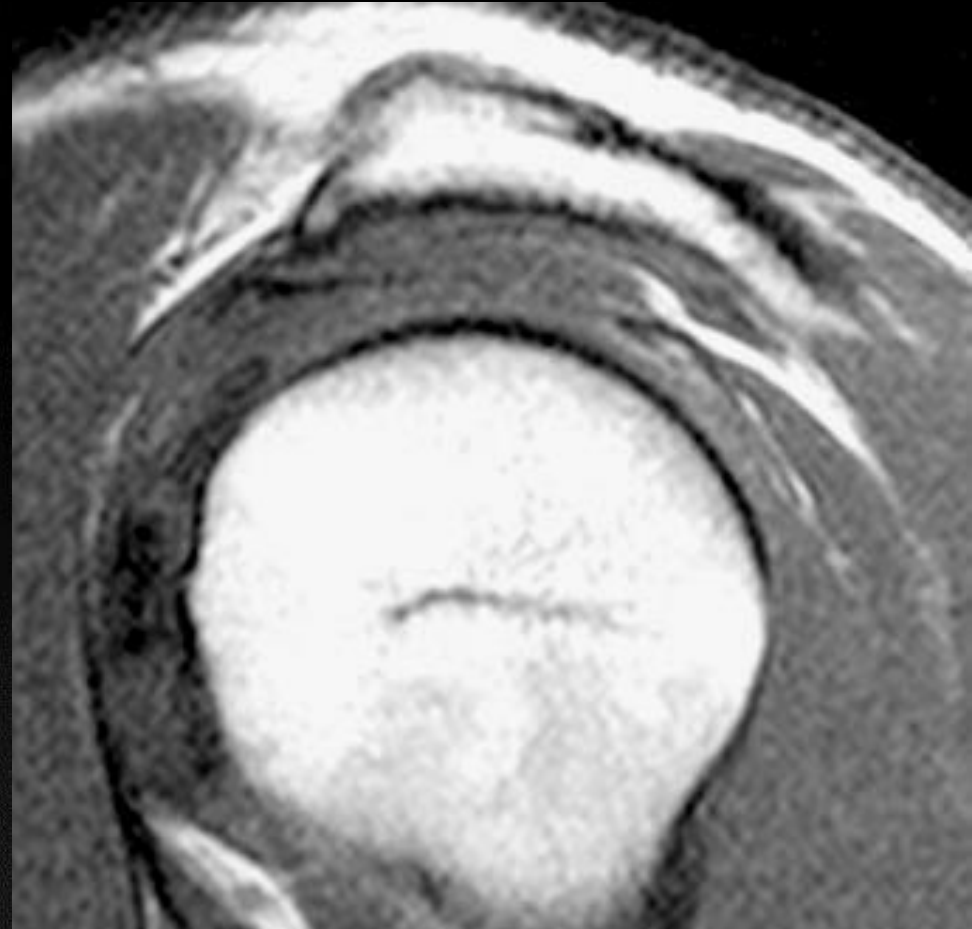
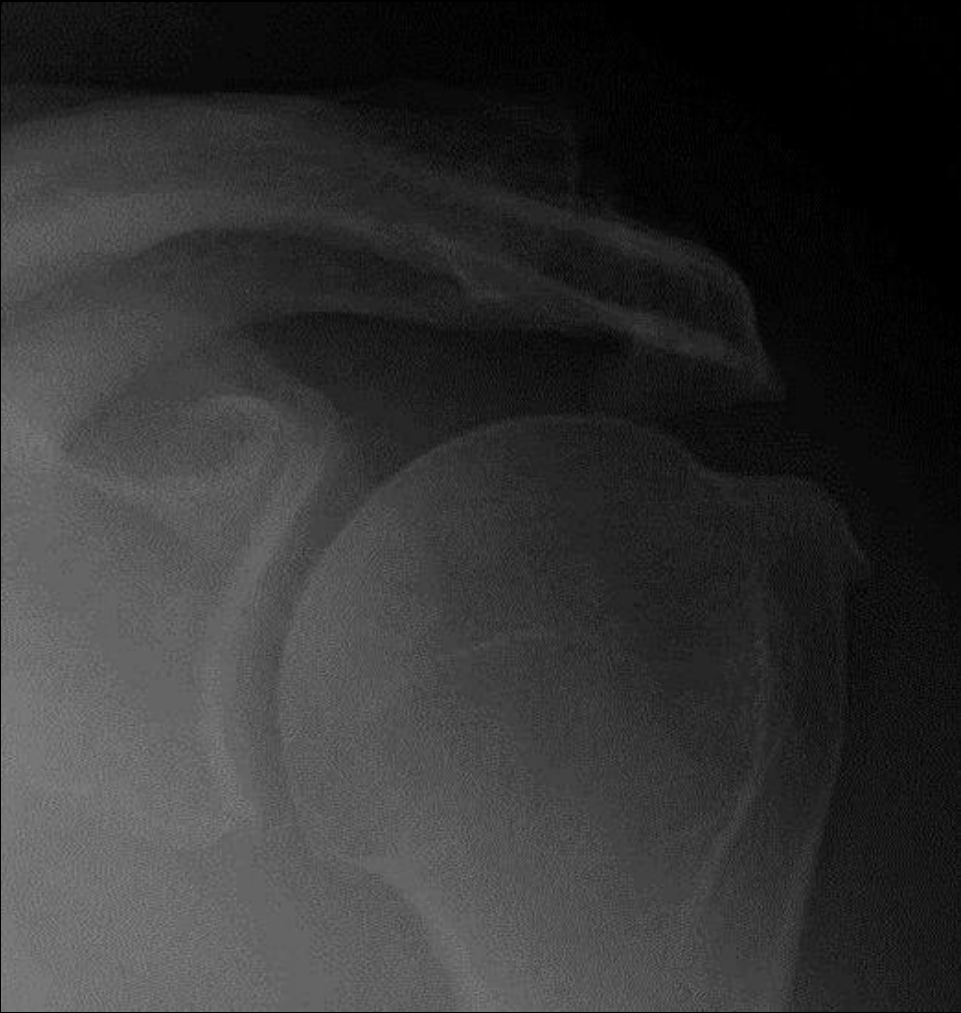
# ACROMIAL SHAPE



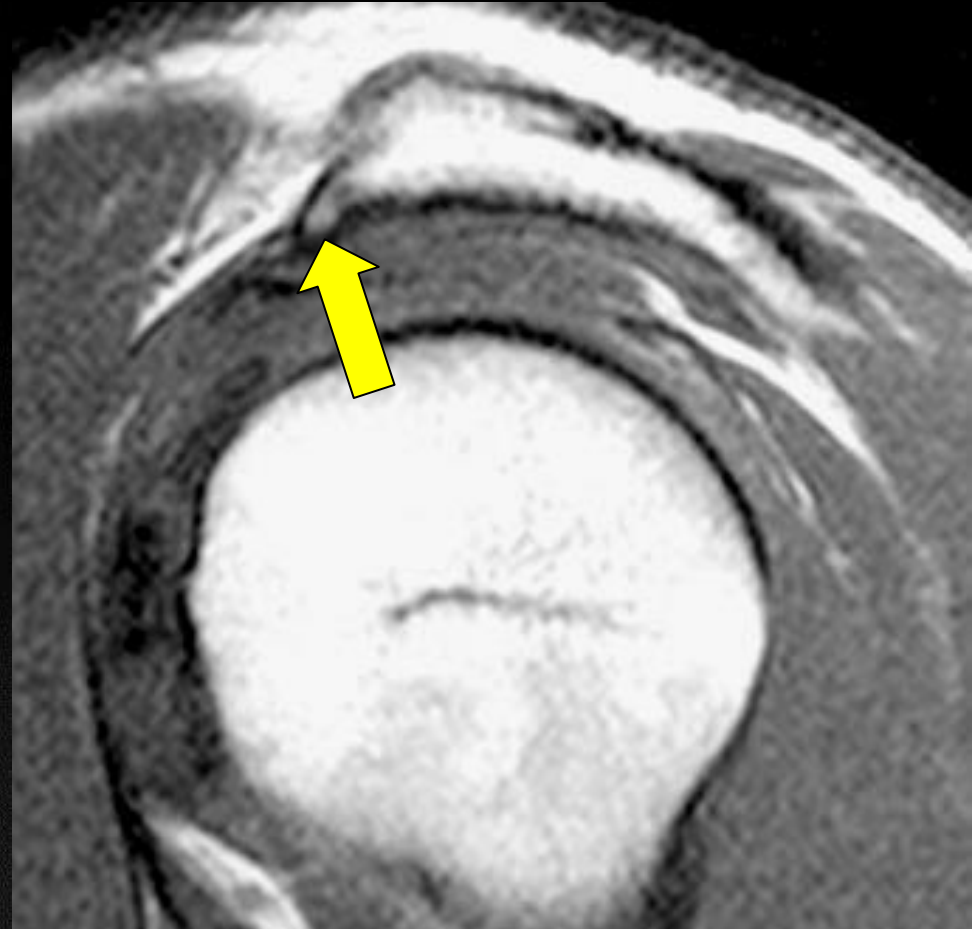
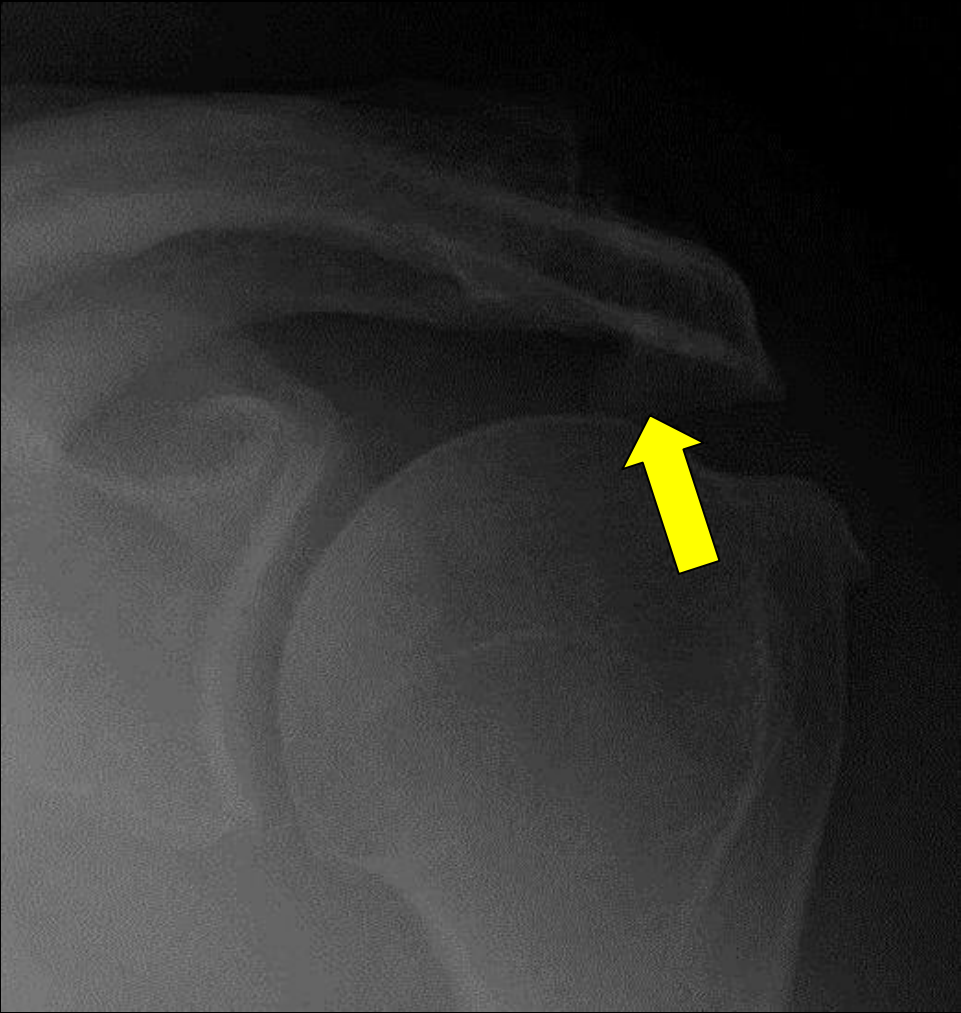
TYPE 3



# SUBACROMIAL SPUR



# SUBACROMIAL SPUR





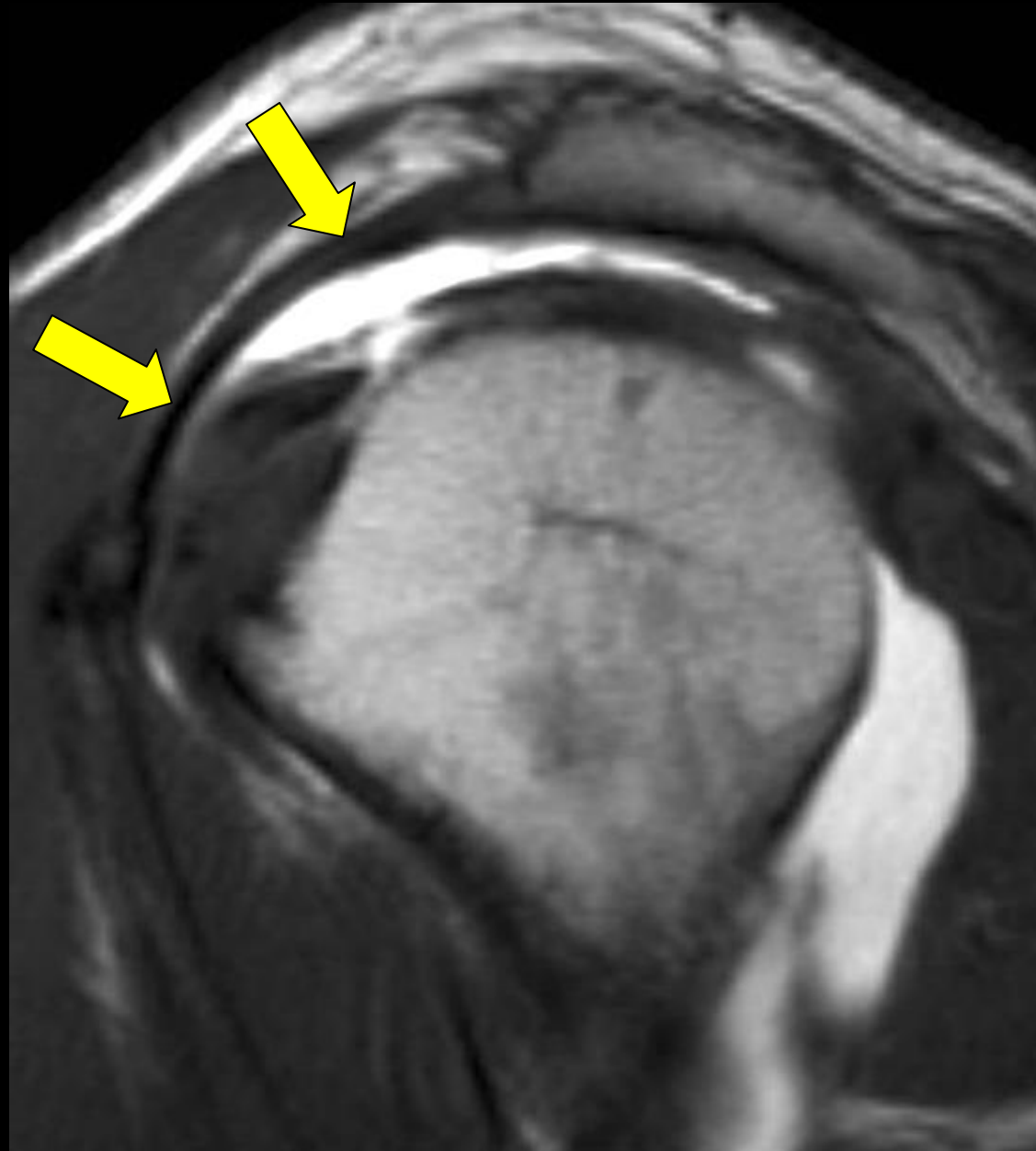
# AC JOINT OSTEOPHYTES



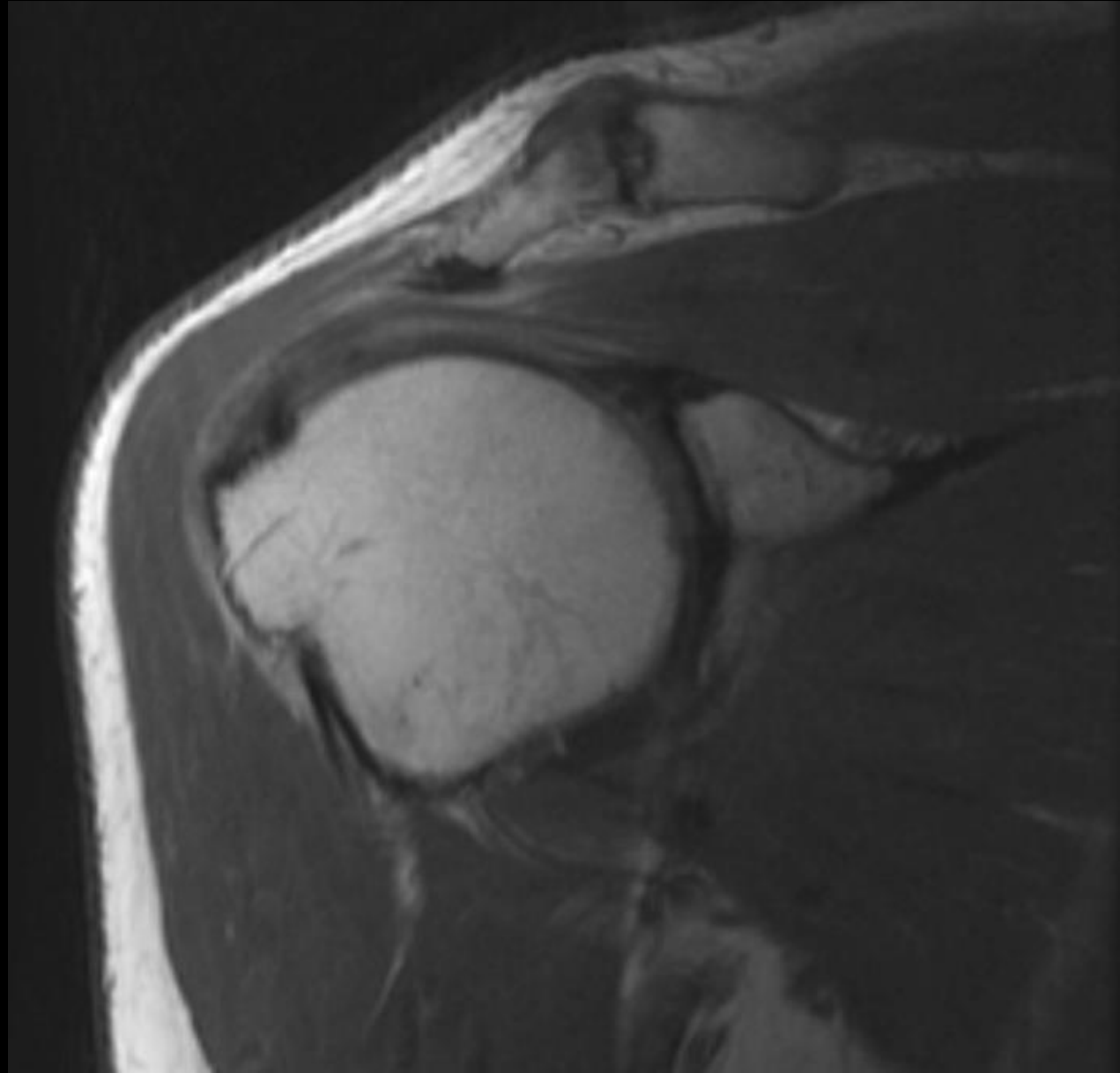
# AC JOINT OSTEOPHYTES



# CORACOACROMIAL LIGAMENT

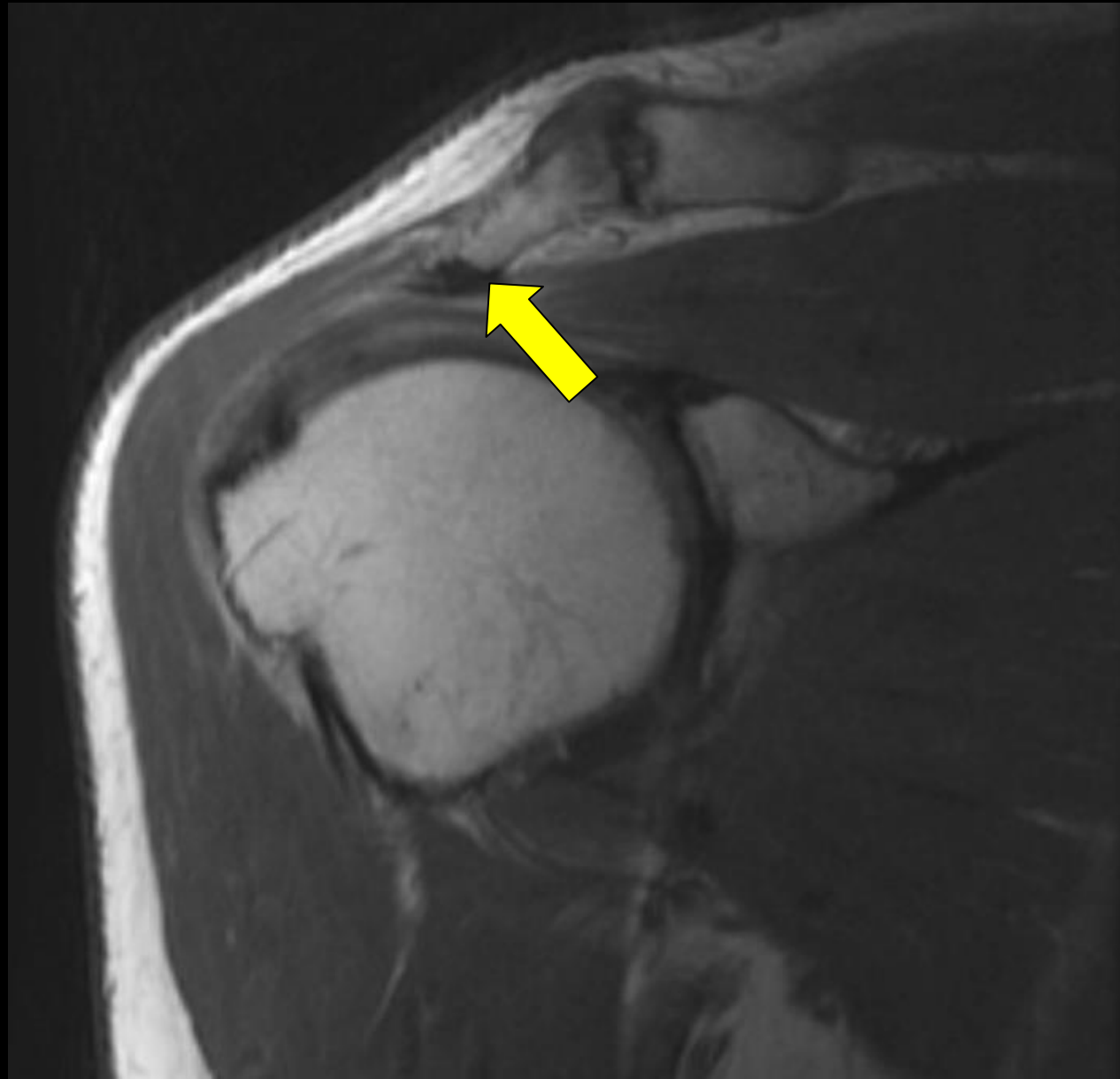


# ACROMIAL DOWNSLOPING

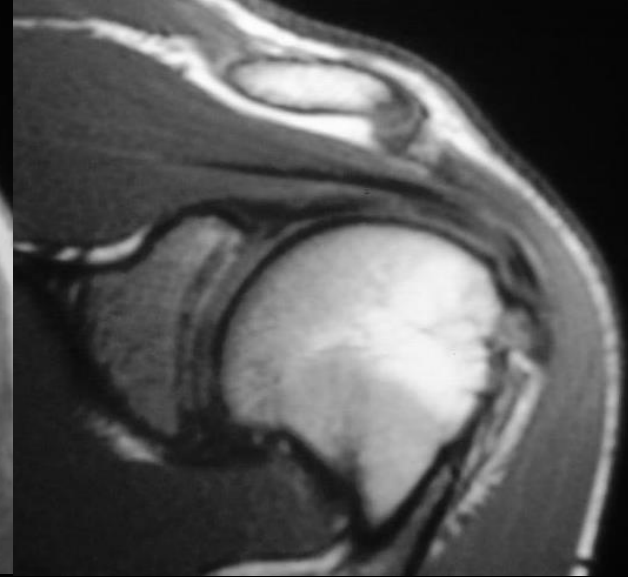
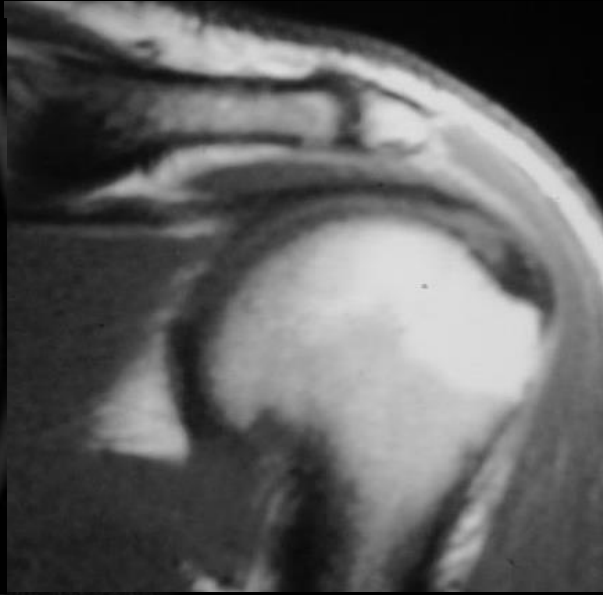
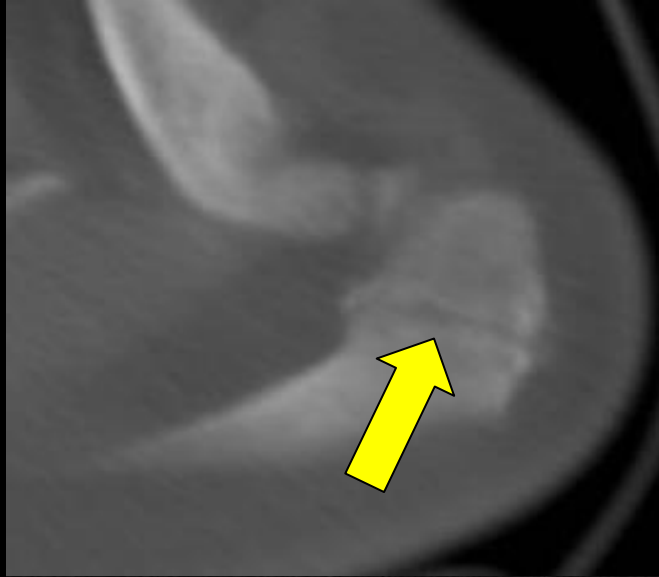




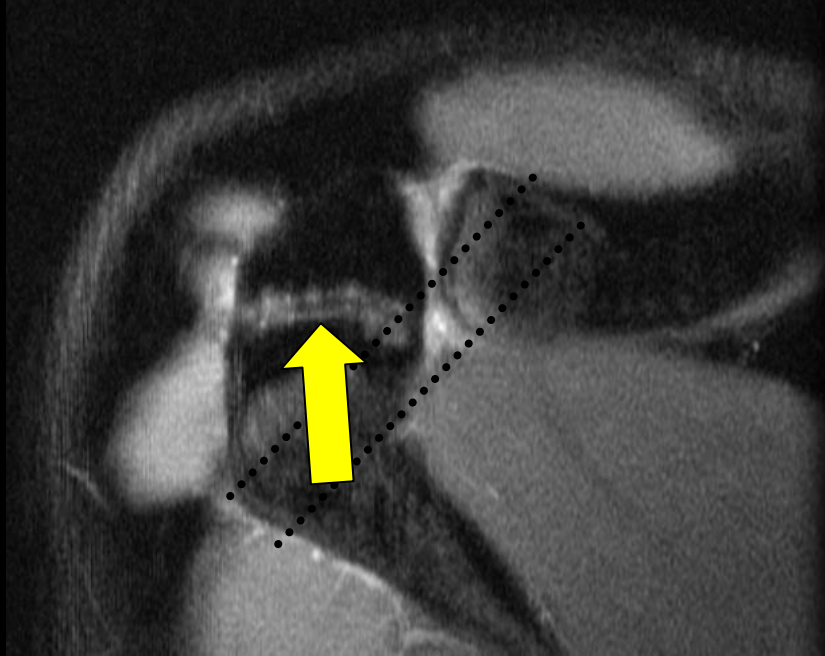
# ACROMIAL DOWNSLOPING



# OS ACROMIALE



U1



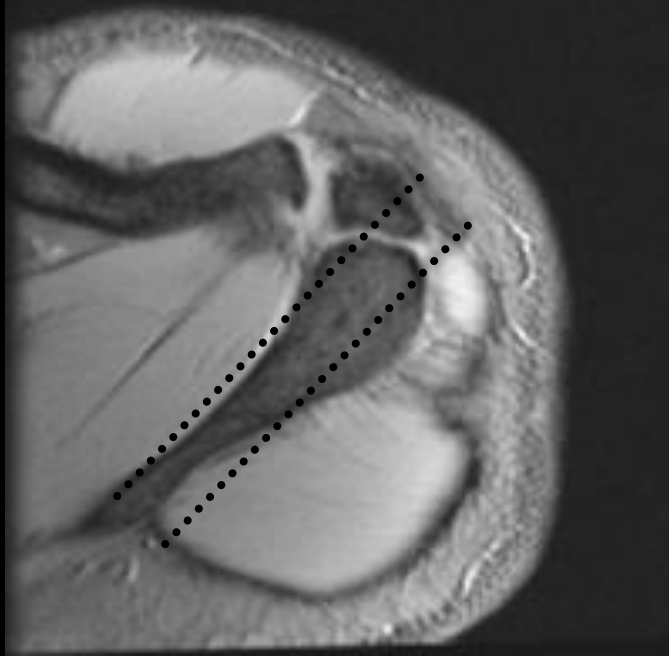
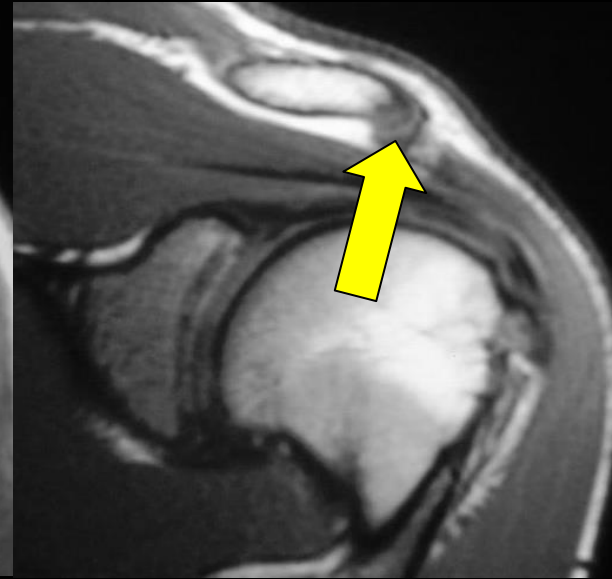
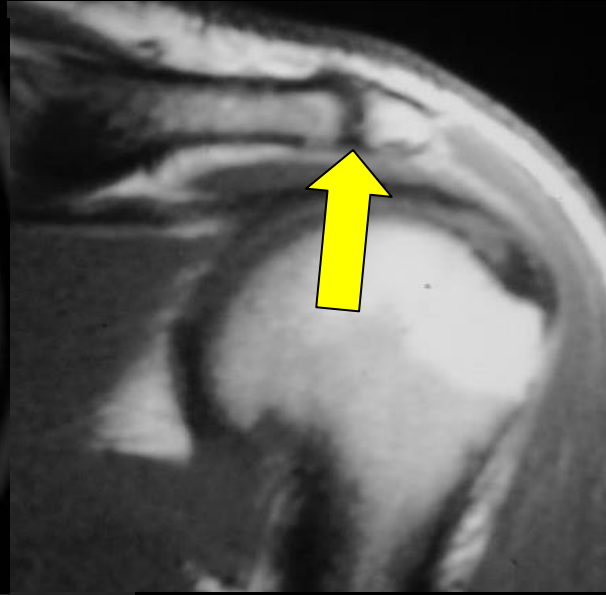
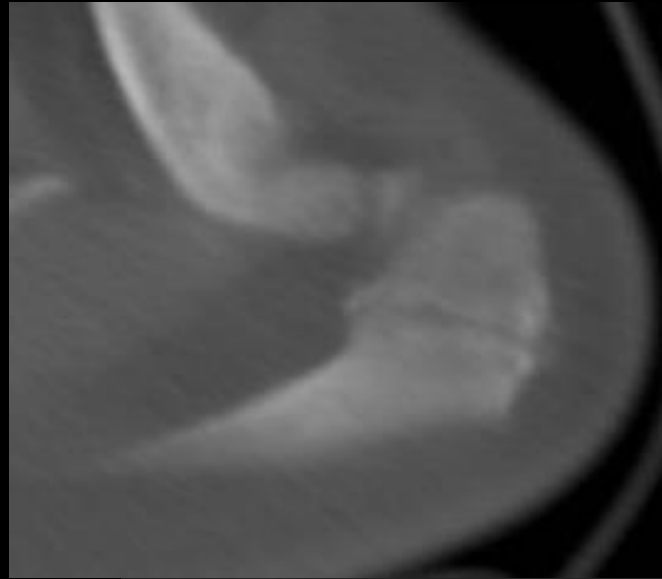
Increased risk rotator cuff tear?

Best seen on axial images

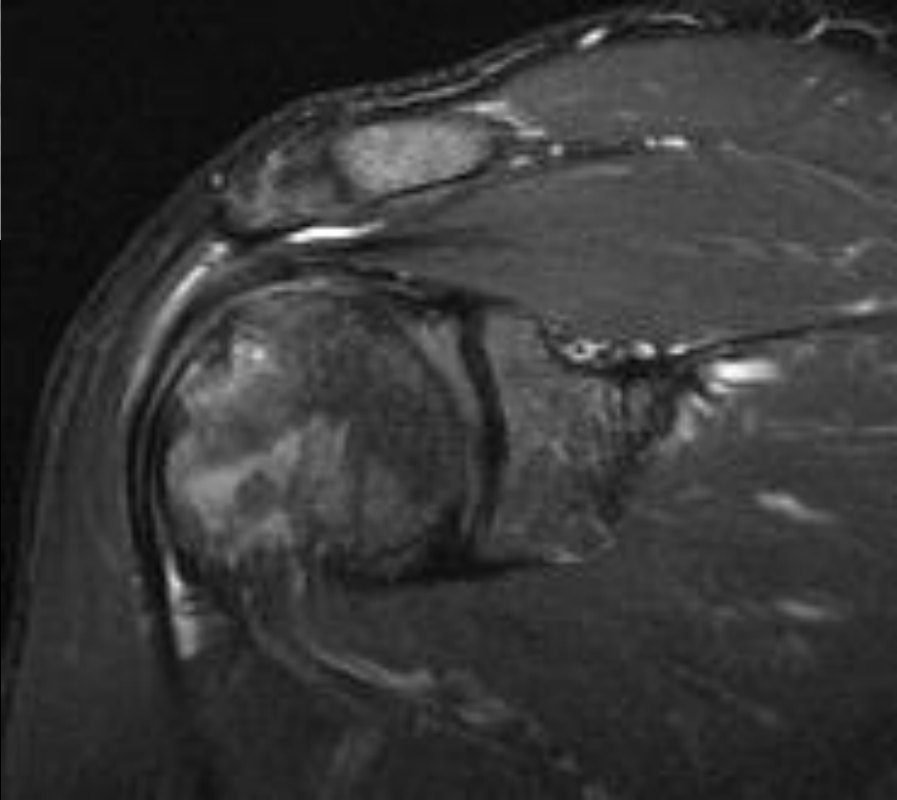
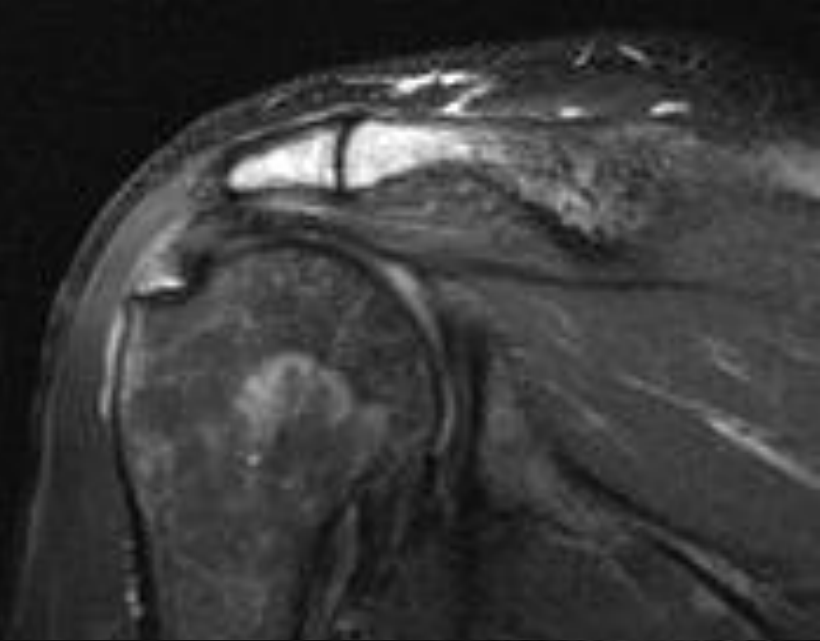
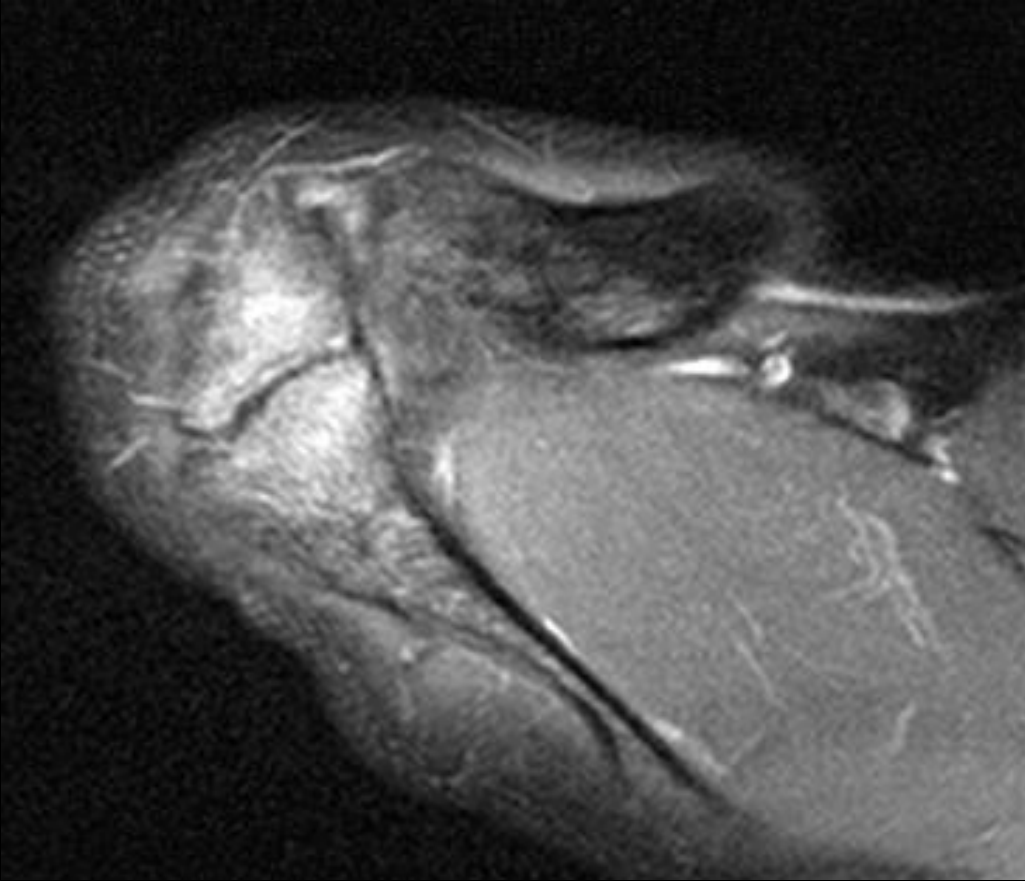
Post-traumatic etiology

High signal intensity in cleft more likely symptomatic

# OS ACROMIALE



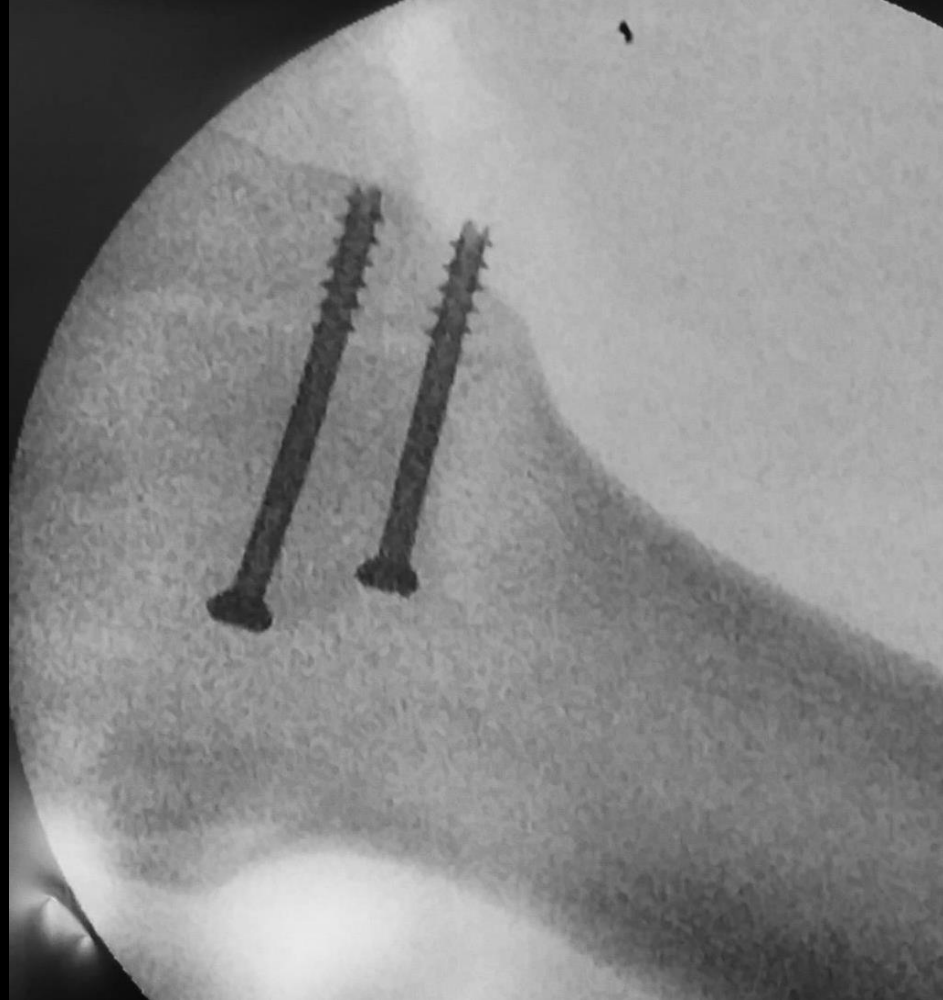
Incidence 1.3% - 15%  
Bilateral 33% - 62%  
Fuses normally age 20-25



Symptomatic os acromiale

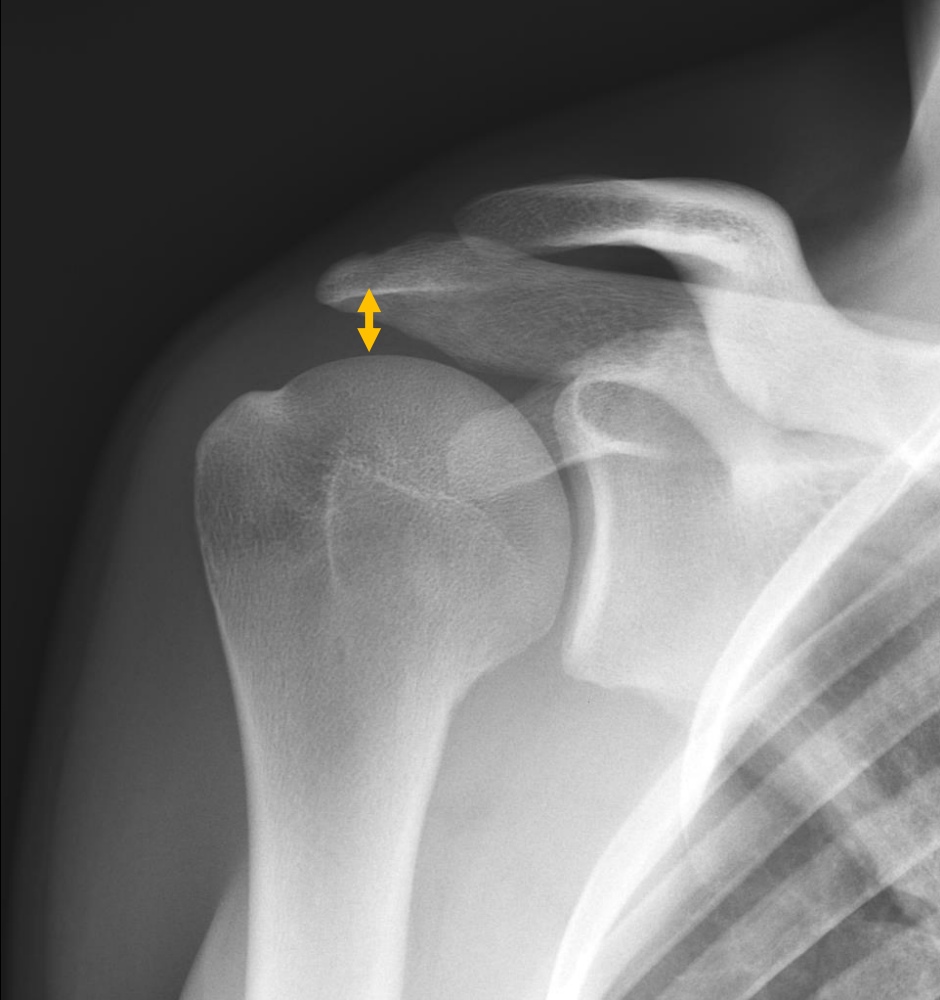






# ROTATOR CUFF TEAR RADIOGRAPHY

- Cysts in the greater and lesser tuberosity have a high association with rotator cuff pathology; **Posterior “cysts” do not**
- Decreased space between the humeral head and acromial undersurface also associated with rotator cuff pathology
  - Normal >7mm
  - 5-7mm abnormal
  - <4/5 mm rotator cuff tear

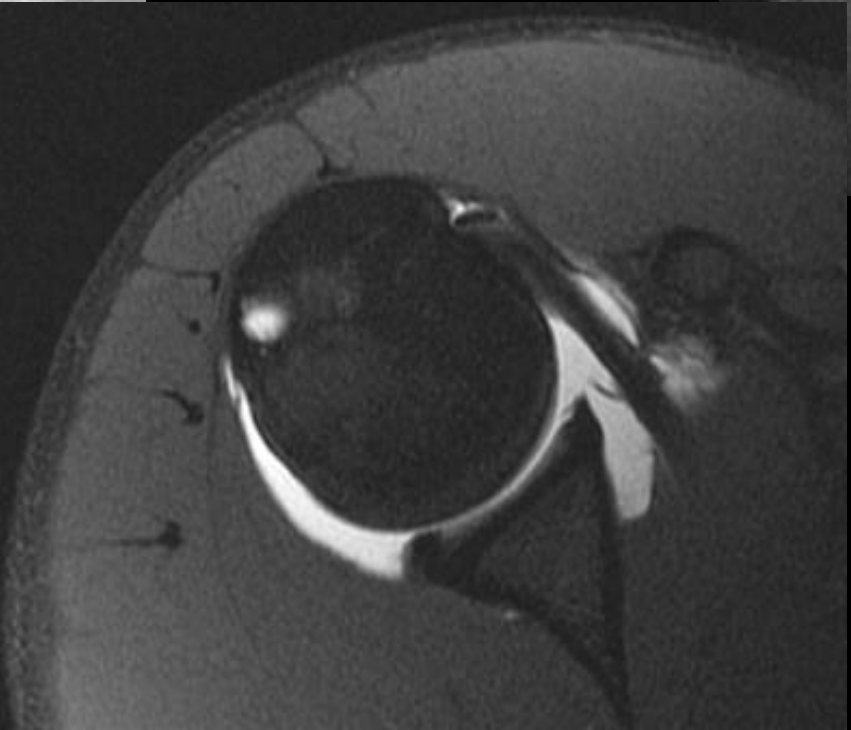
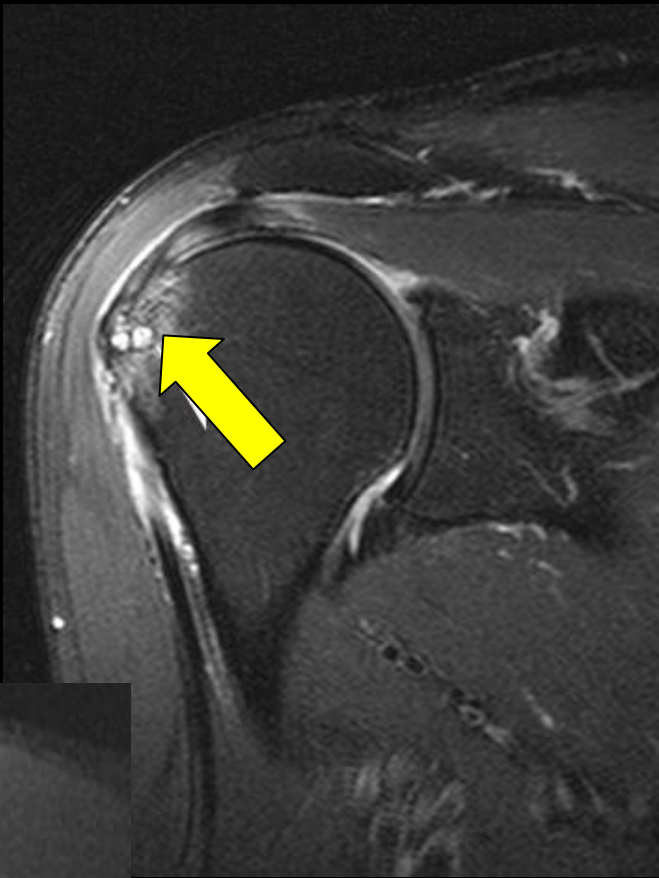
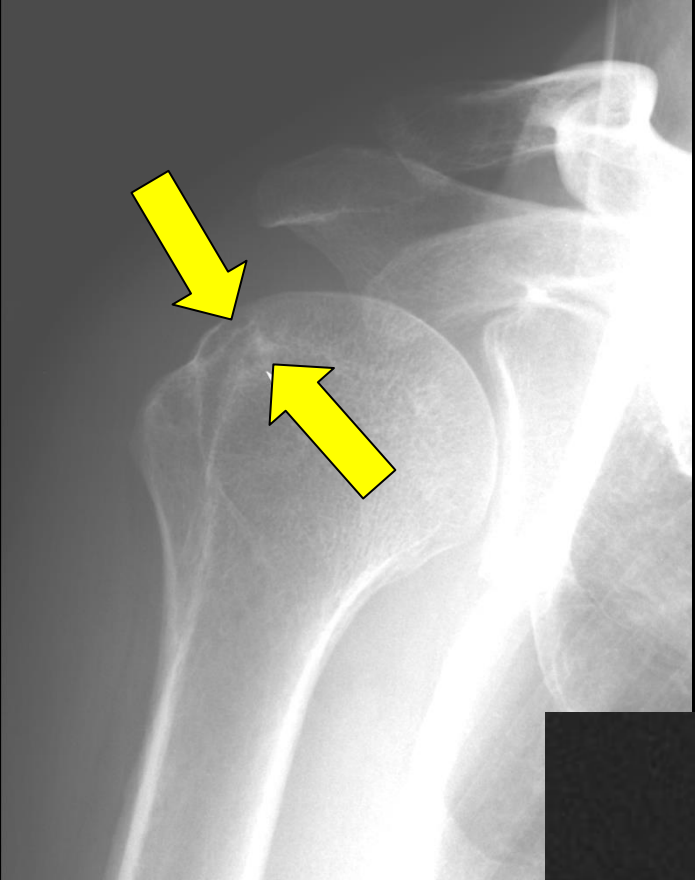


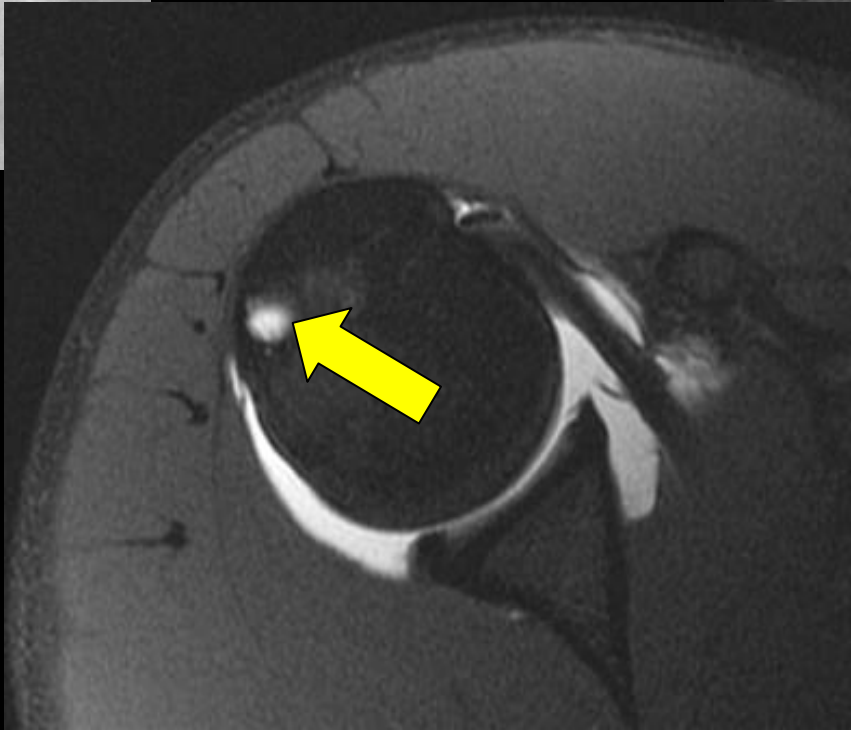
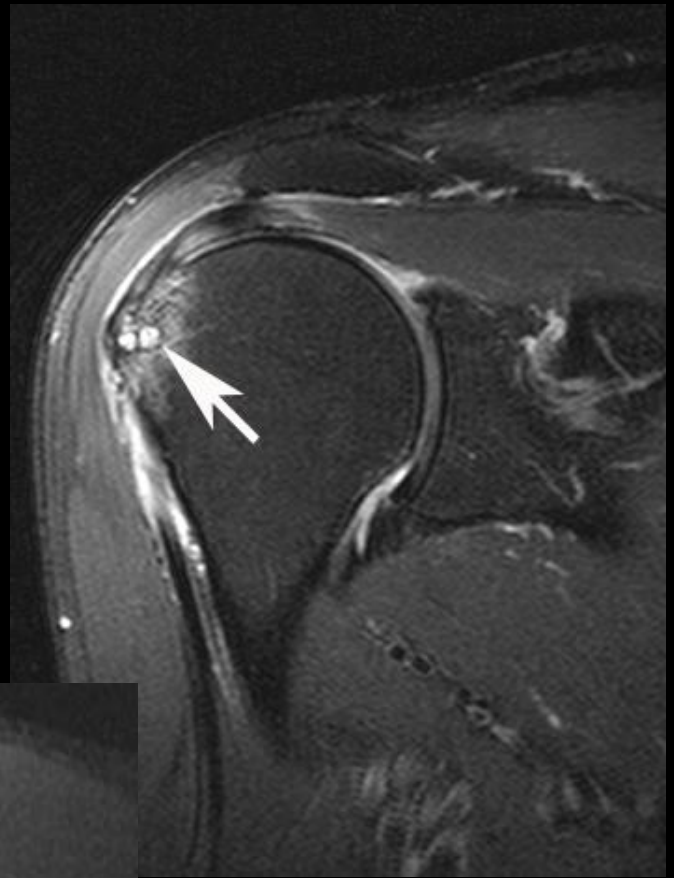
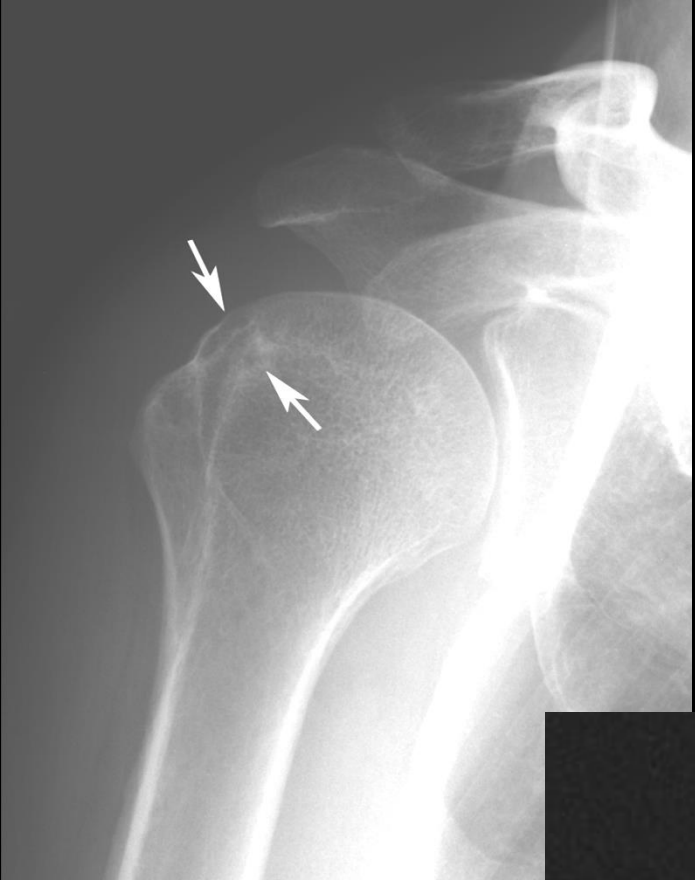
Normal



Rotator cuff tear

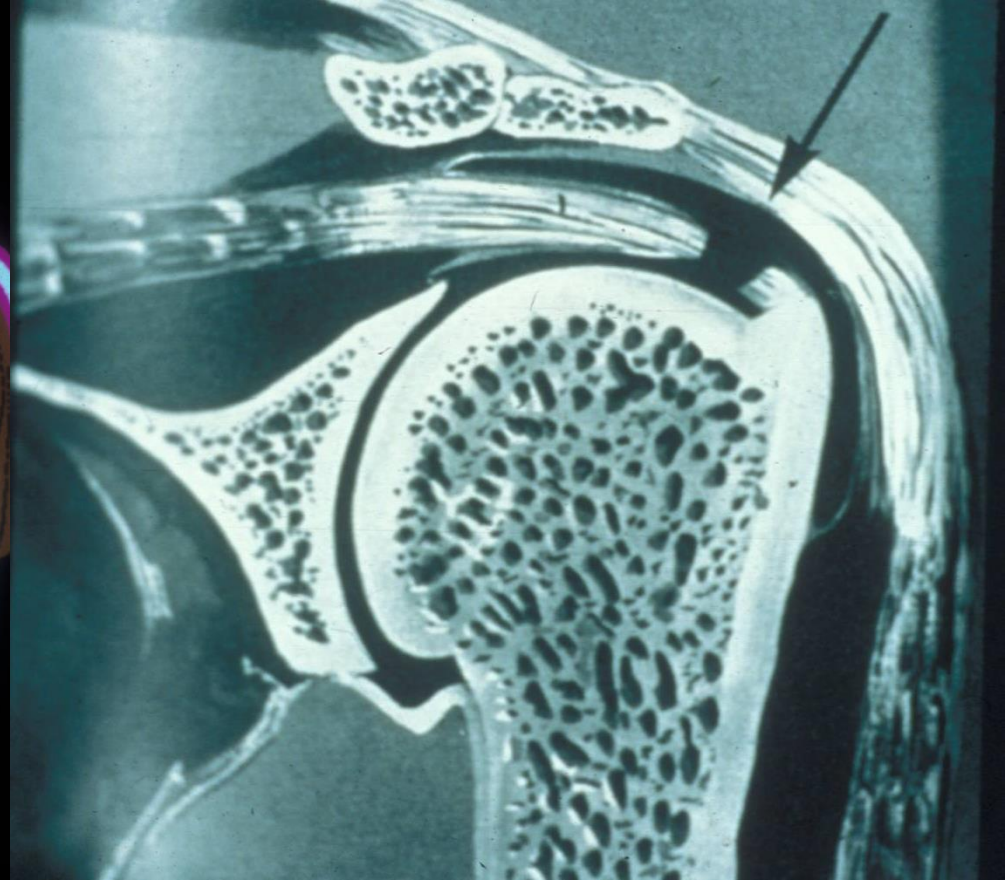
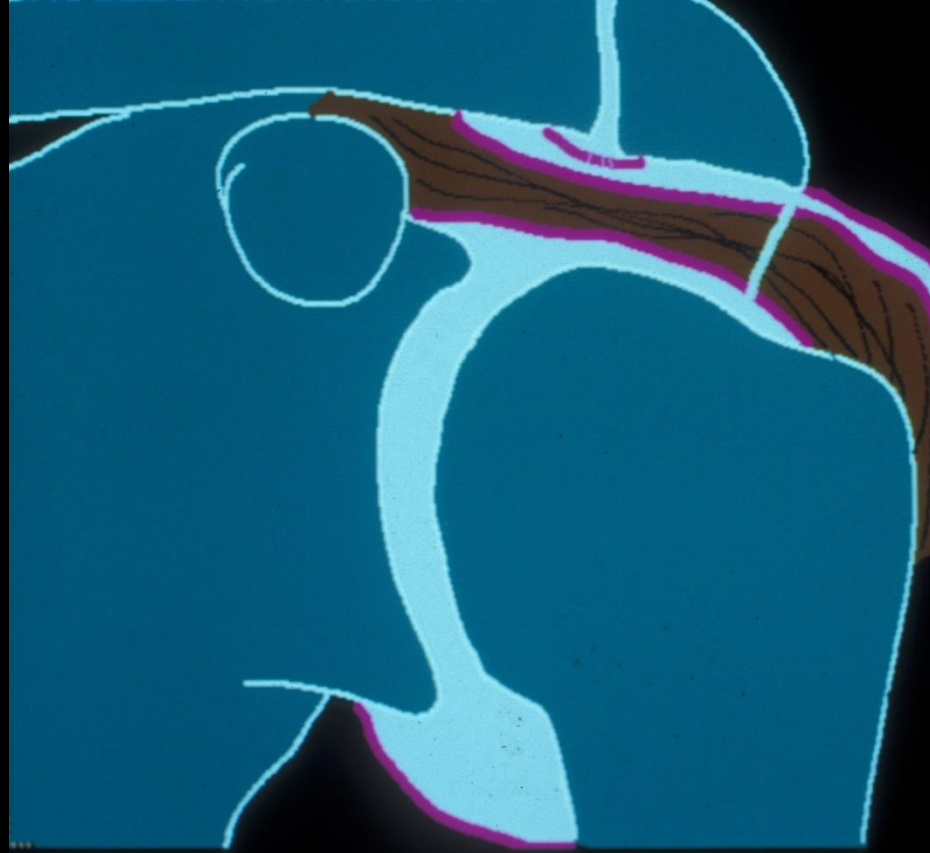




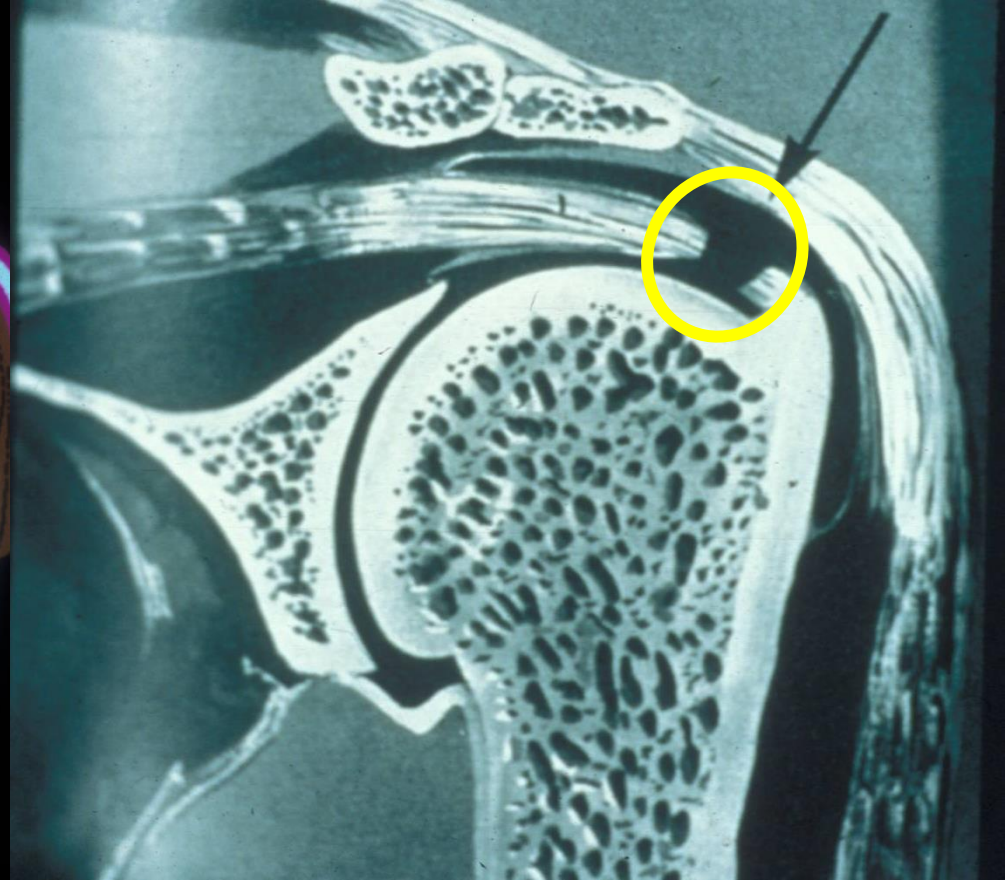
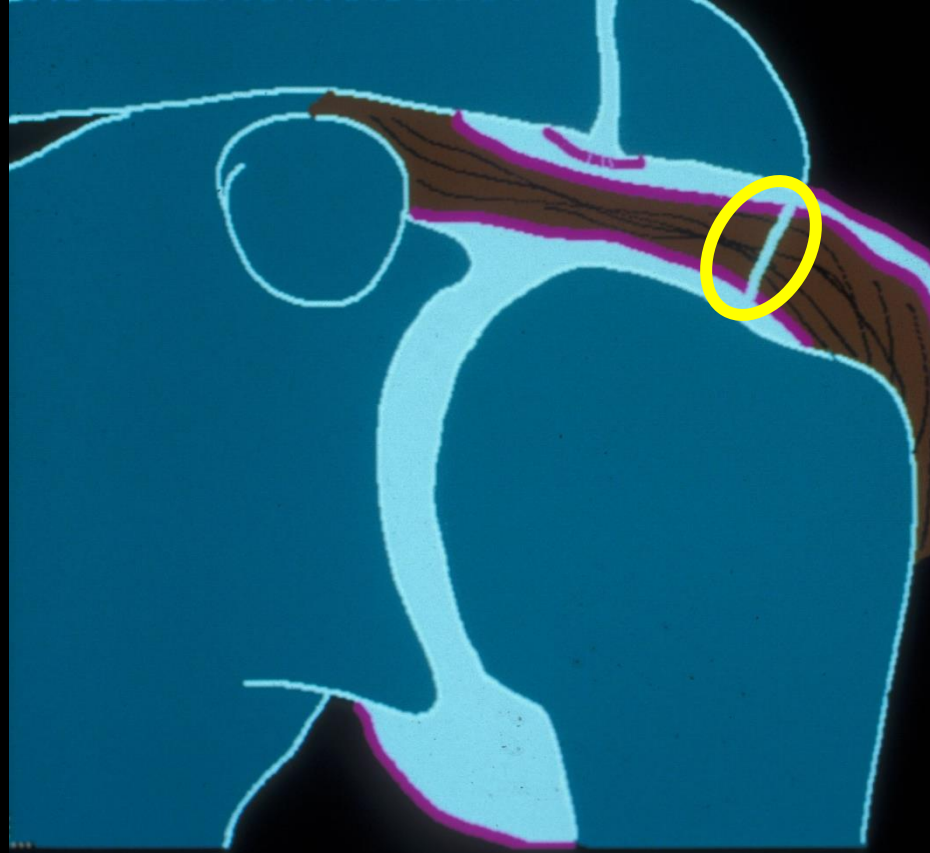


# ROTATOR CUFF TEAR FULL THICKNESS

- Communication between joint and subacromial/subdeltoid bursa
- Increased fluid signal intensity in focus of tendon defect
  - At tendon attachment
  - Critical zone

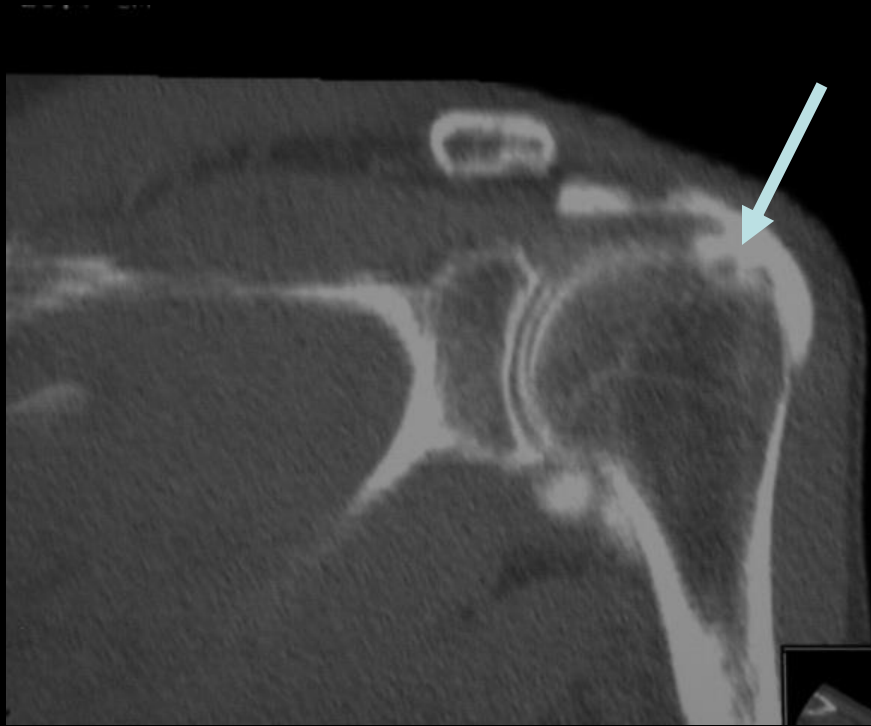




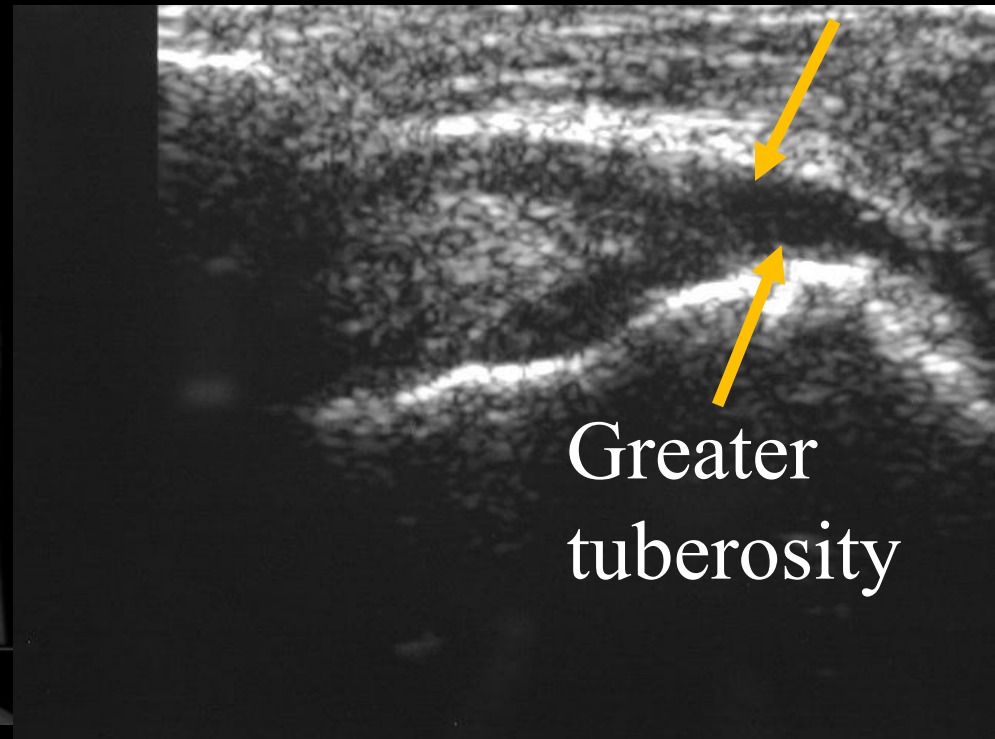




# CT and Ultrasound

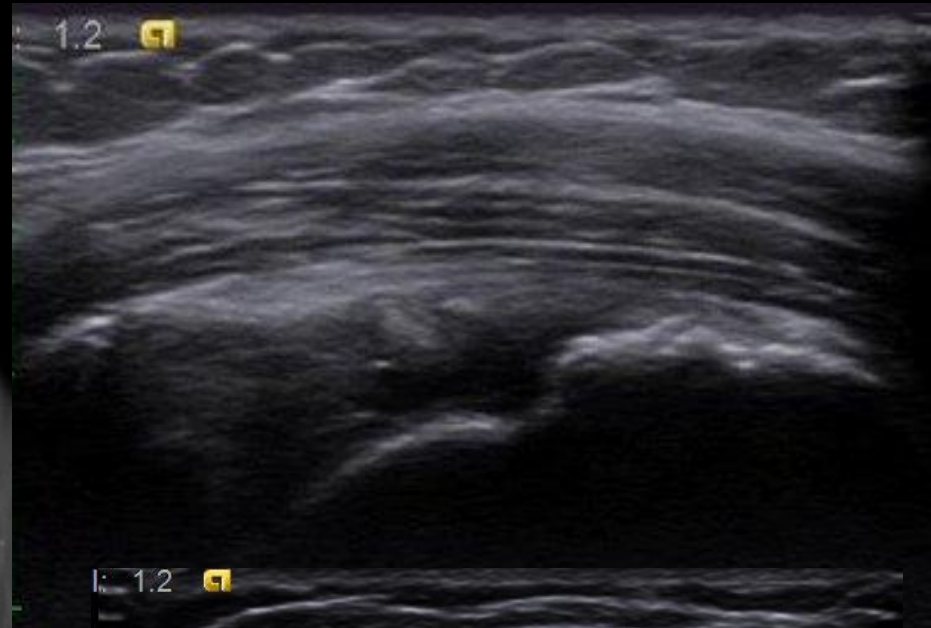


Coronal CT

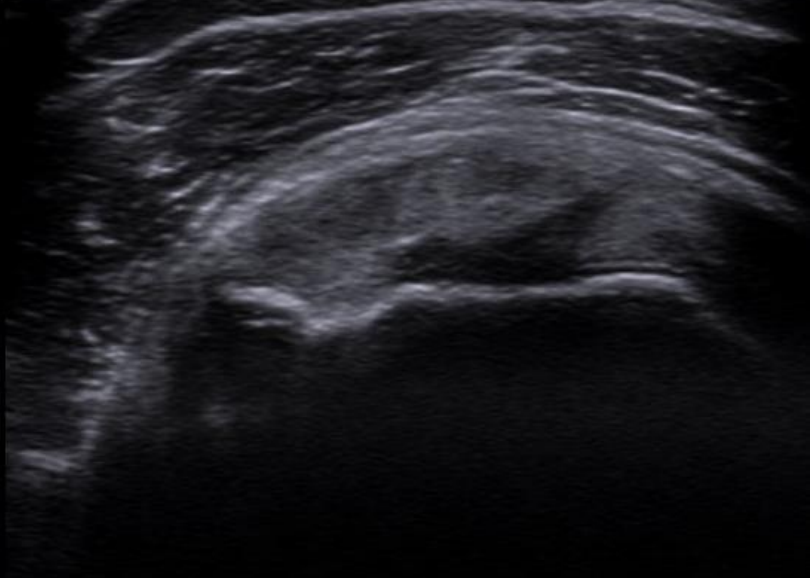


**US findings of tear –**  
Hypoechoogenicity that  
replaces hyperechoic normal  
tendon

# CT and Ultrasound



**Longitudinal**



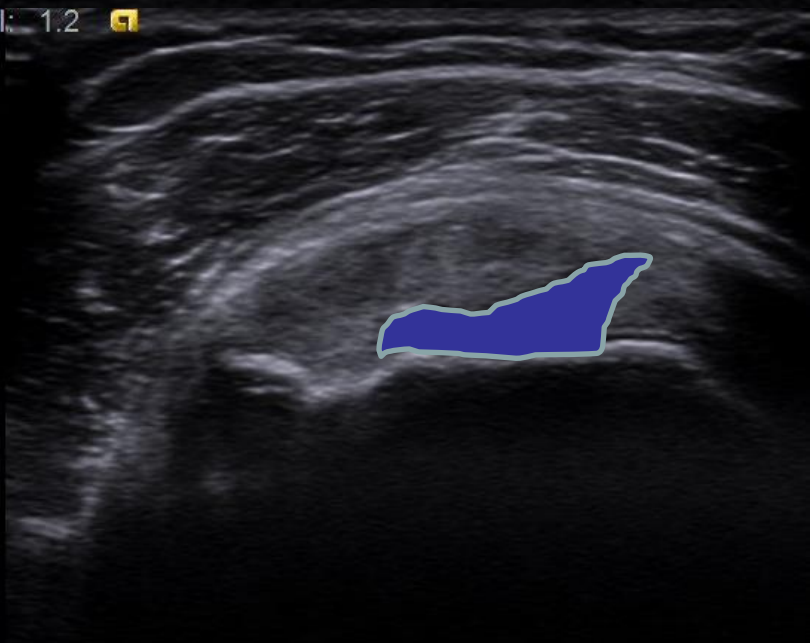
**Sagittal**



# CT and Ultrasound

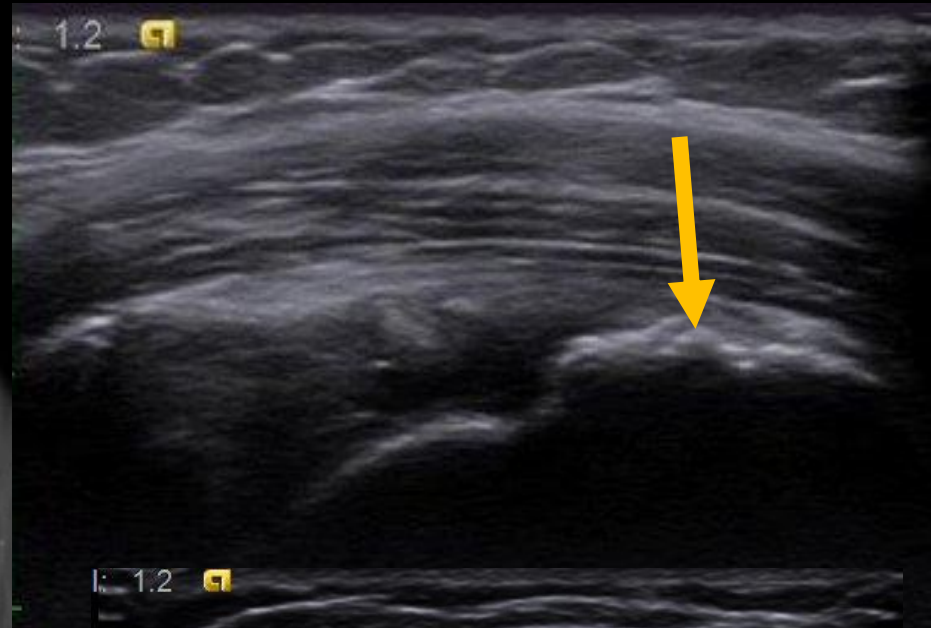


**Longitudinal**

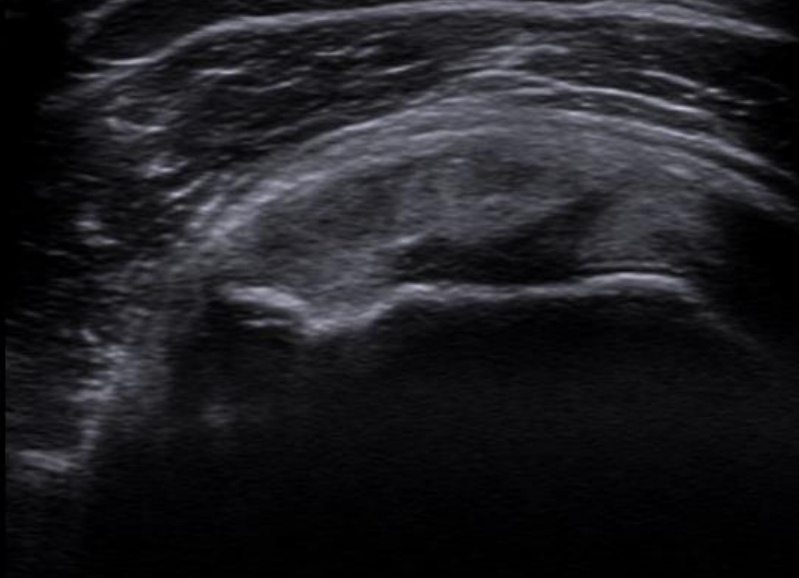


**Sagittal**

# CT and Ultrasound



**Longitudinal**



**Sagittal**

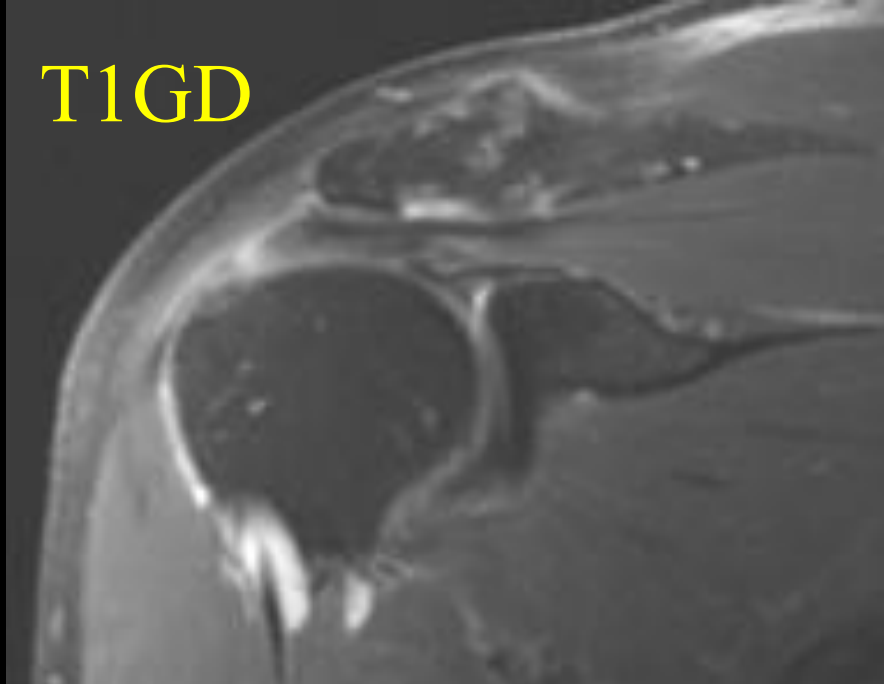
# ROTATOR CUFF TEAR FULL THICKNESS

- Important associated findings/descriptors
  - Which tendons involved (portion of superior cuff)
  - Size of tear
  - Quality of the remainder of the cuff
  - Retraction of musculotendinous junction
  - Muscle atrophy
  - Fluid subacromial/subdeltoid bursa
  - Fluid (intramuscular cyst/ganglion) along tendon

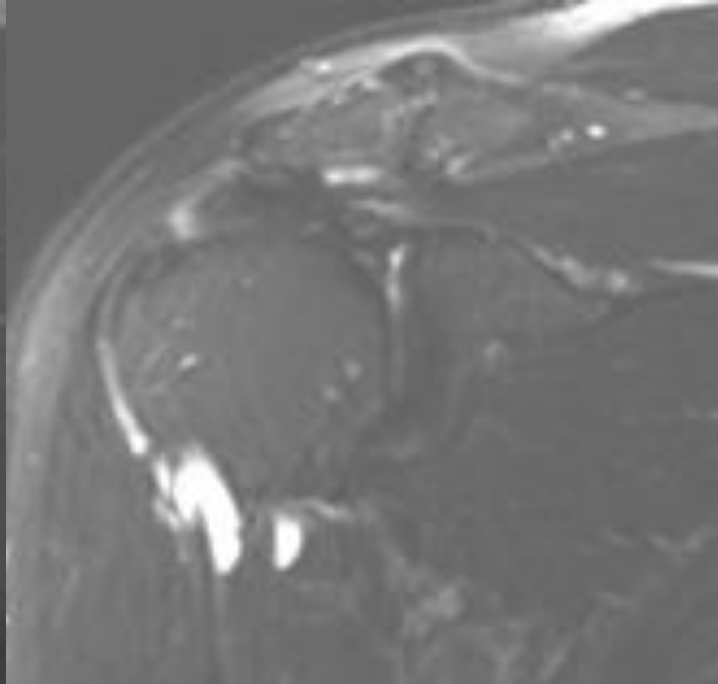
# ROTATOR CUFF TEAR FULL THICKNESS

- Which tendons involved/Size of tear
  - Supraspinatus/Infraspinatus (Superior Cuff)
  - Subscapularis
  - 0-2cm mild; 2-3cm moderate;  
3-4cm large; >4cm massive

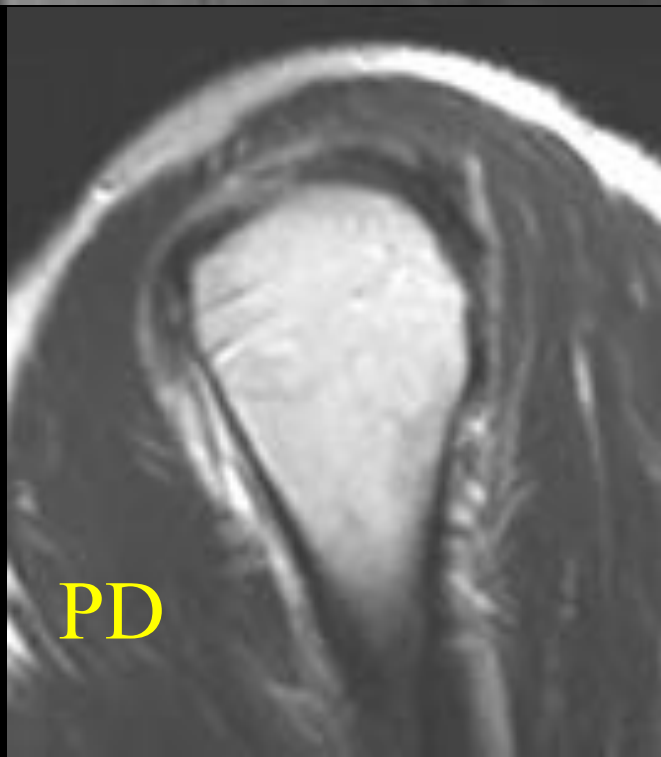




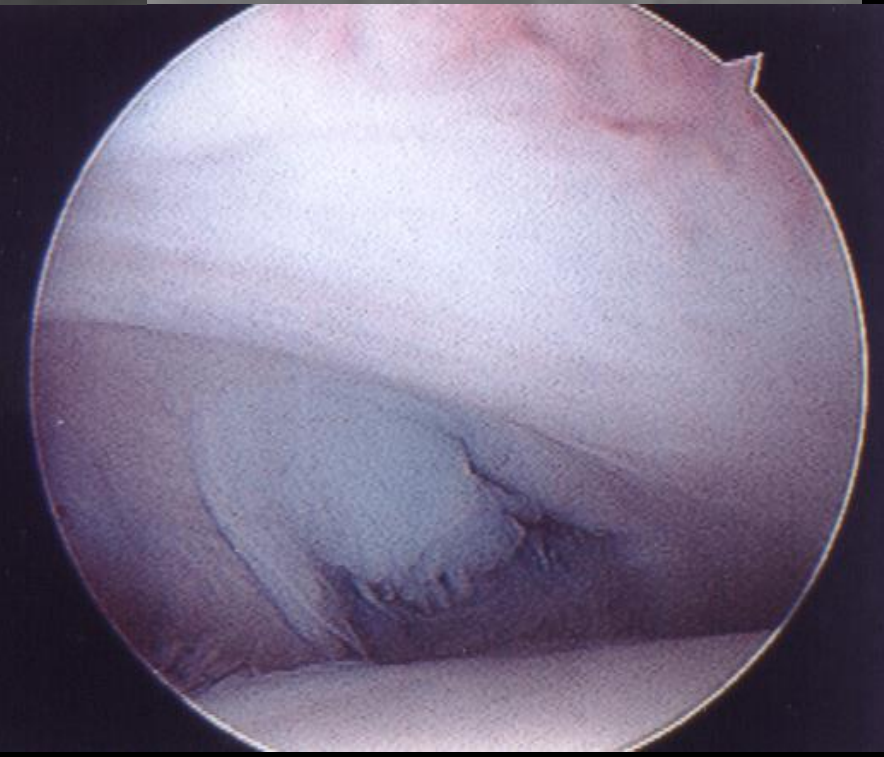
T1GD

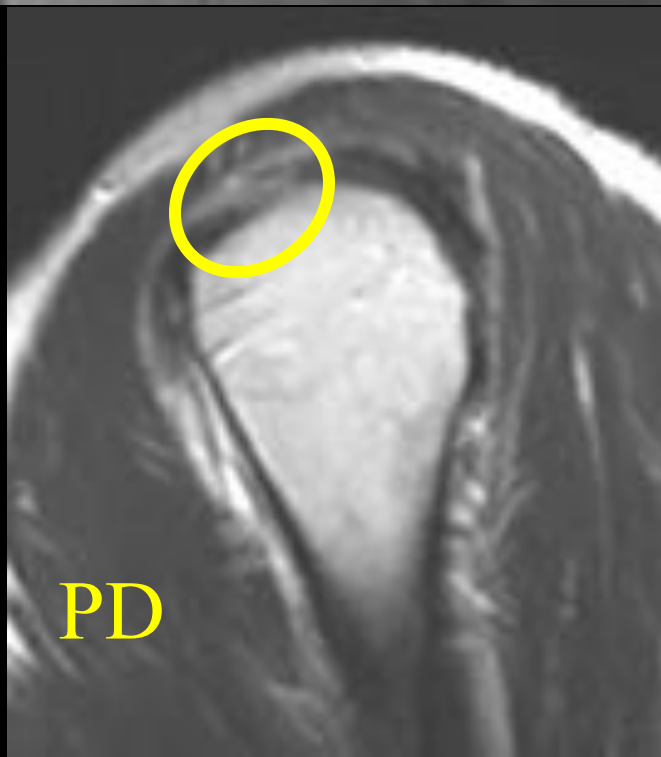
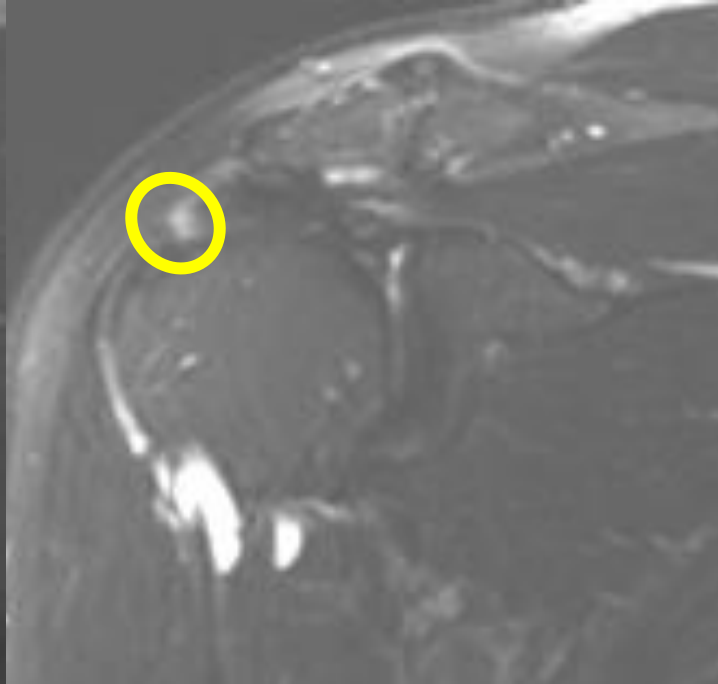
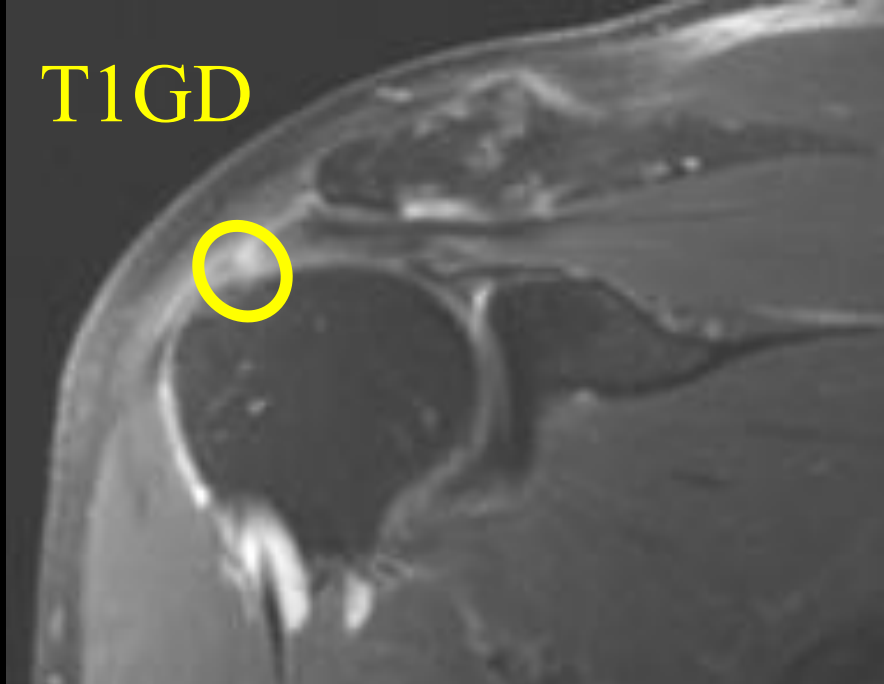


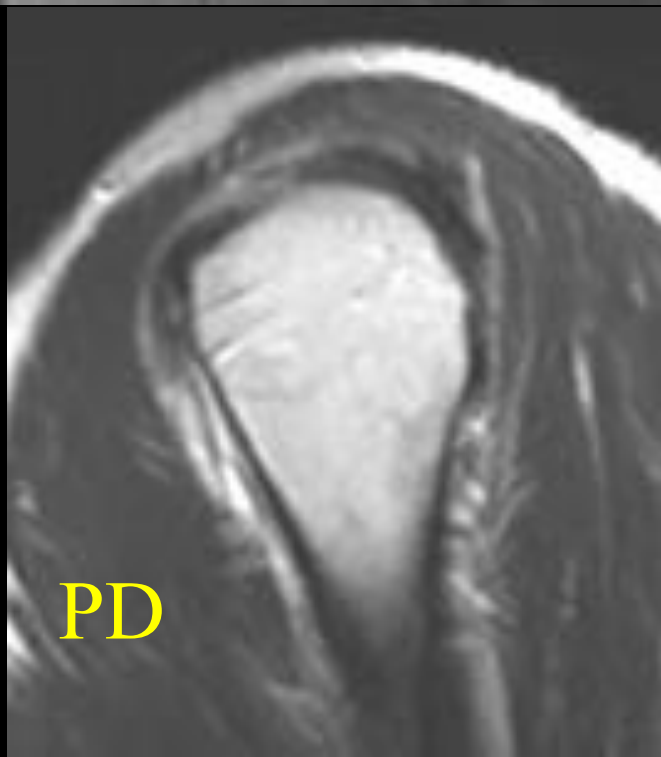
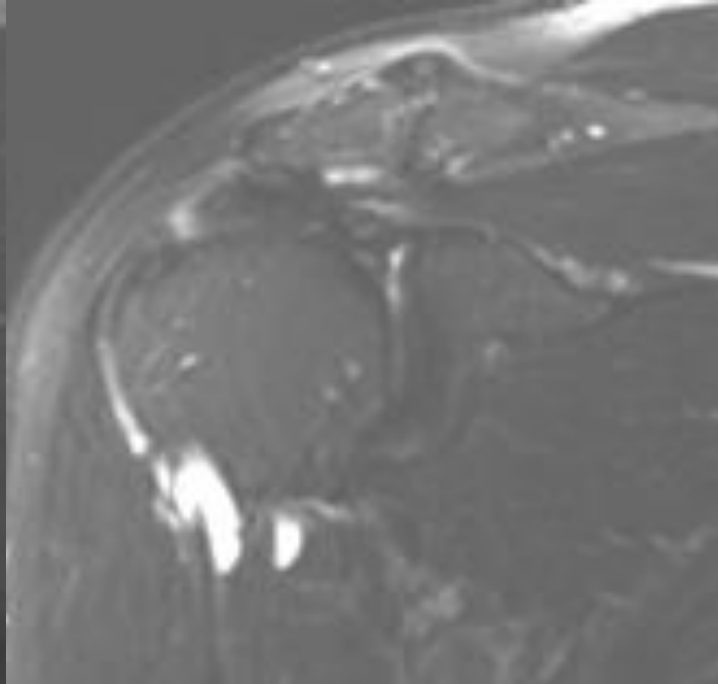
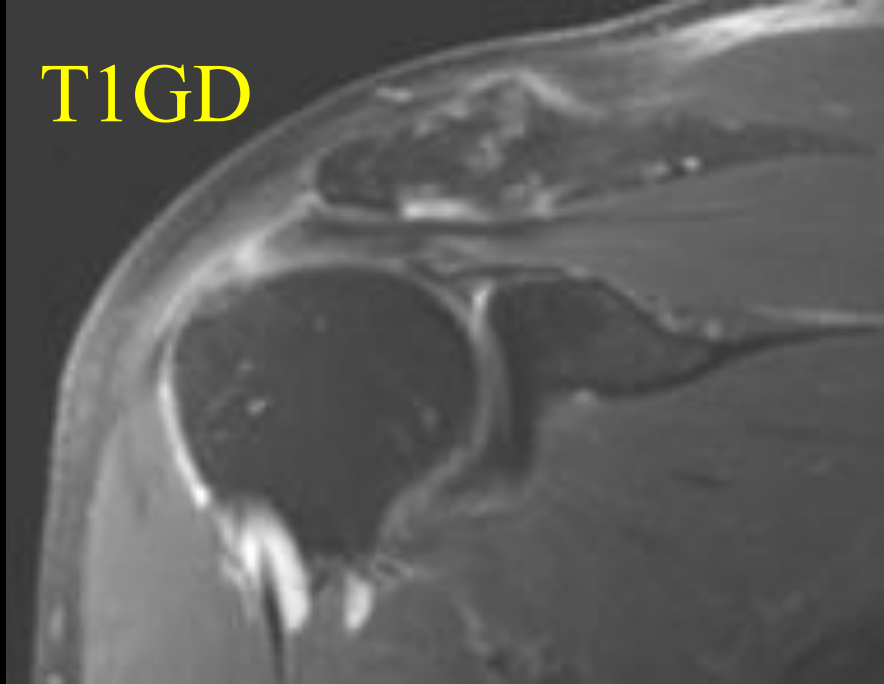
T2



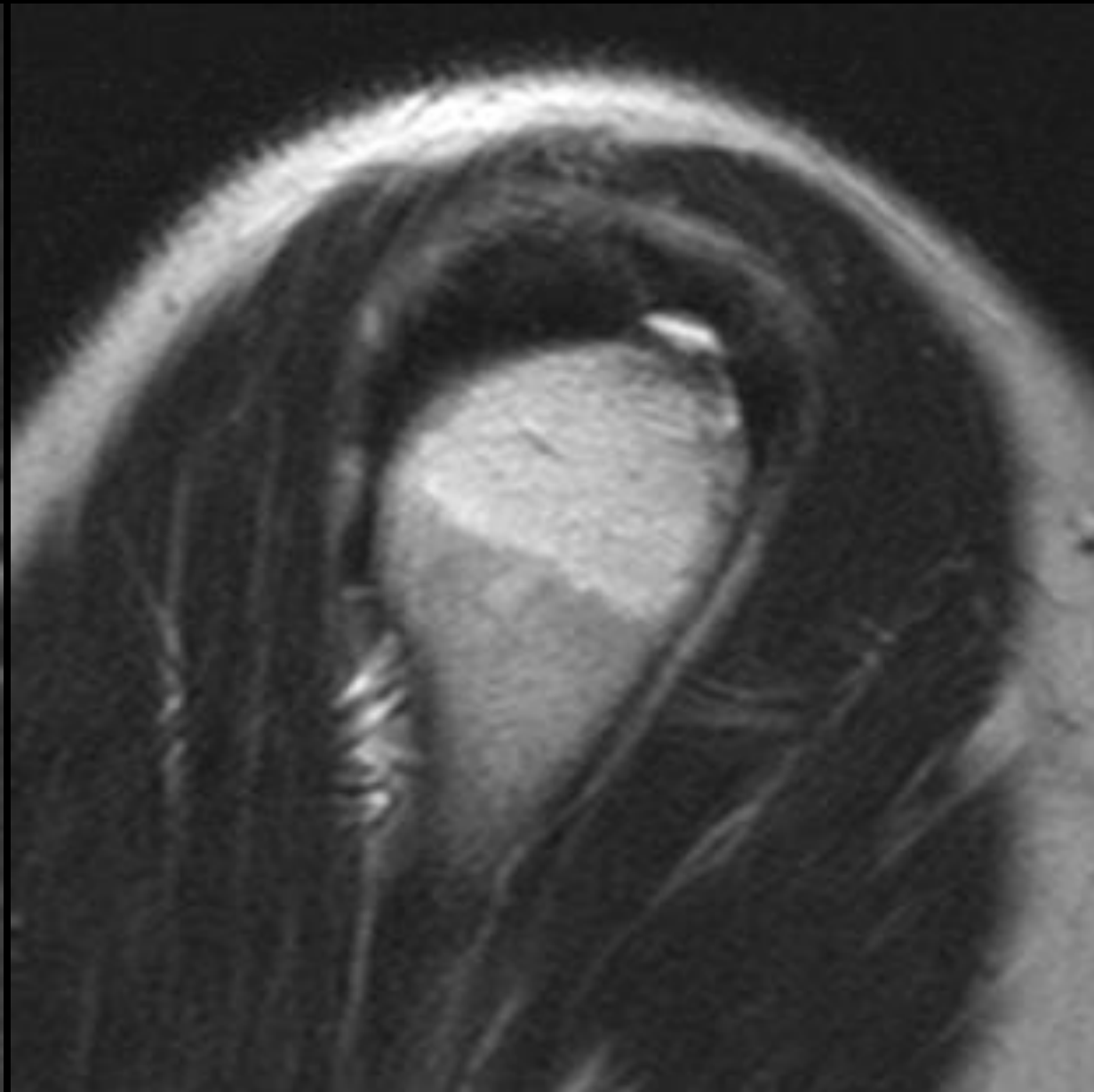
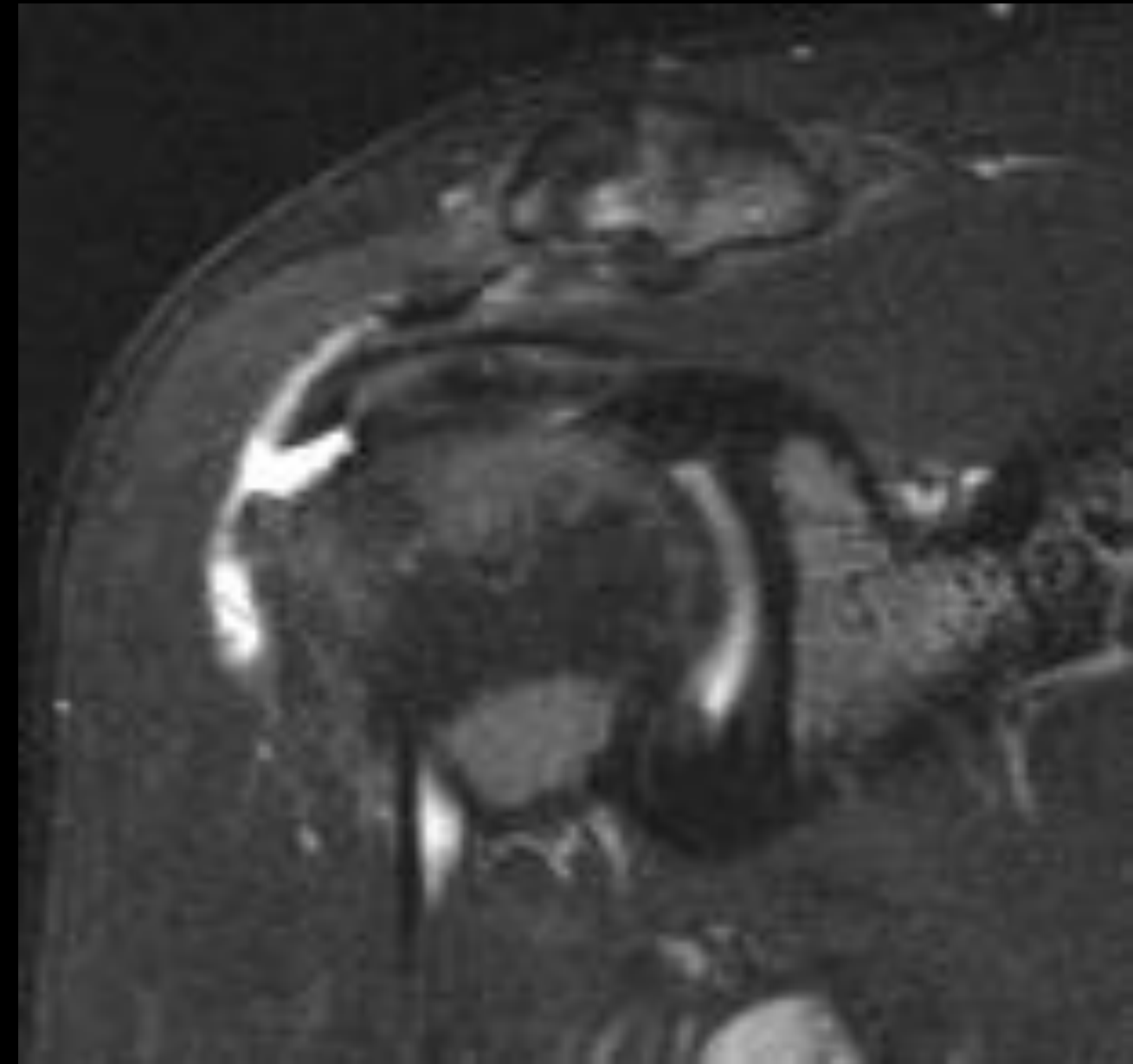
PD





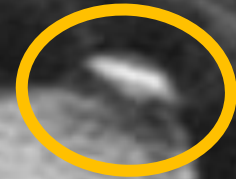


# Full Thickness Tear

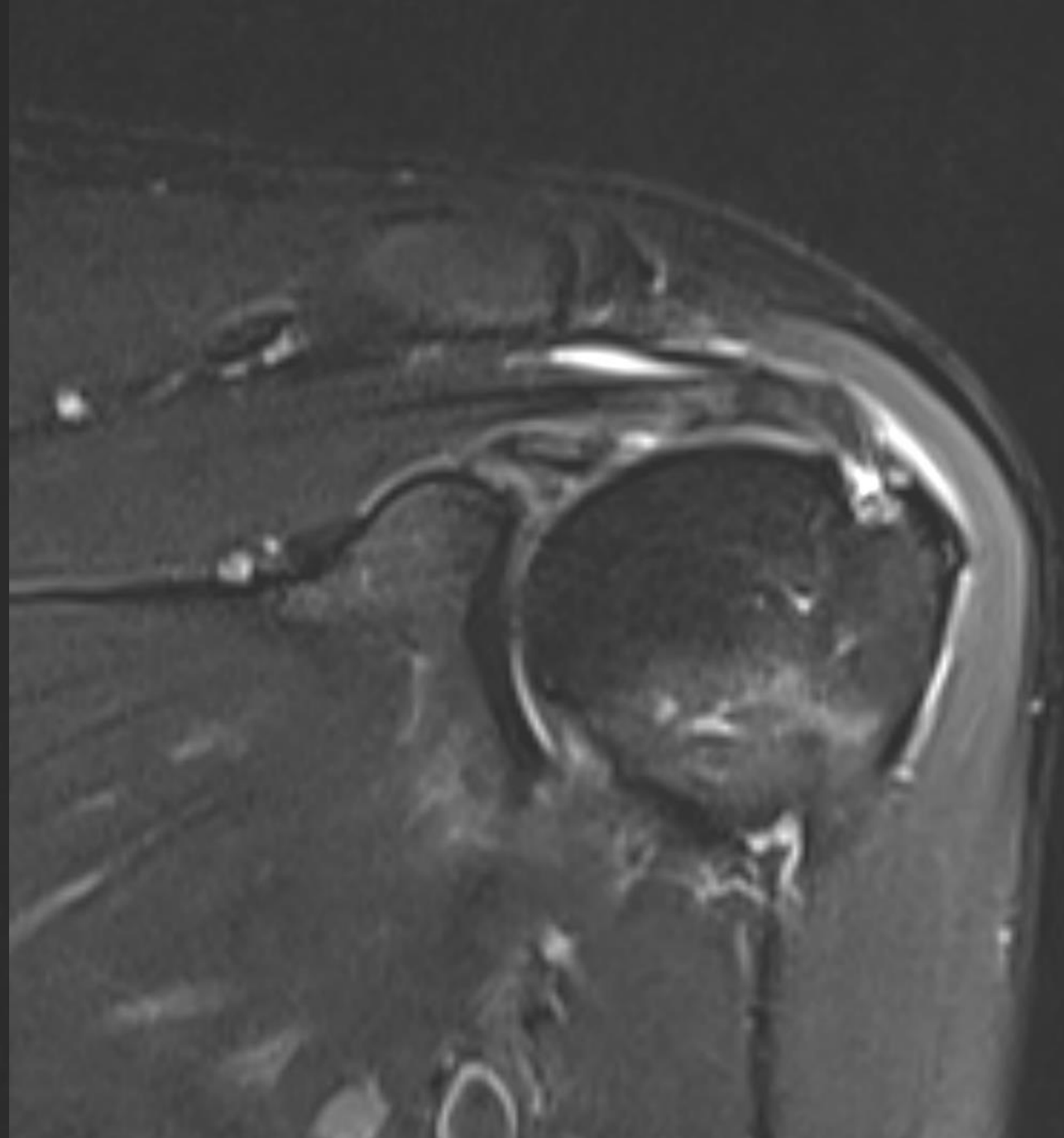
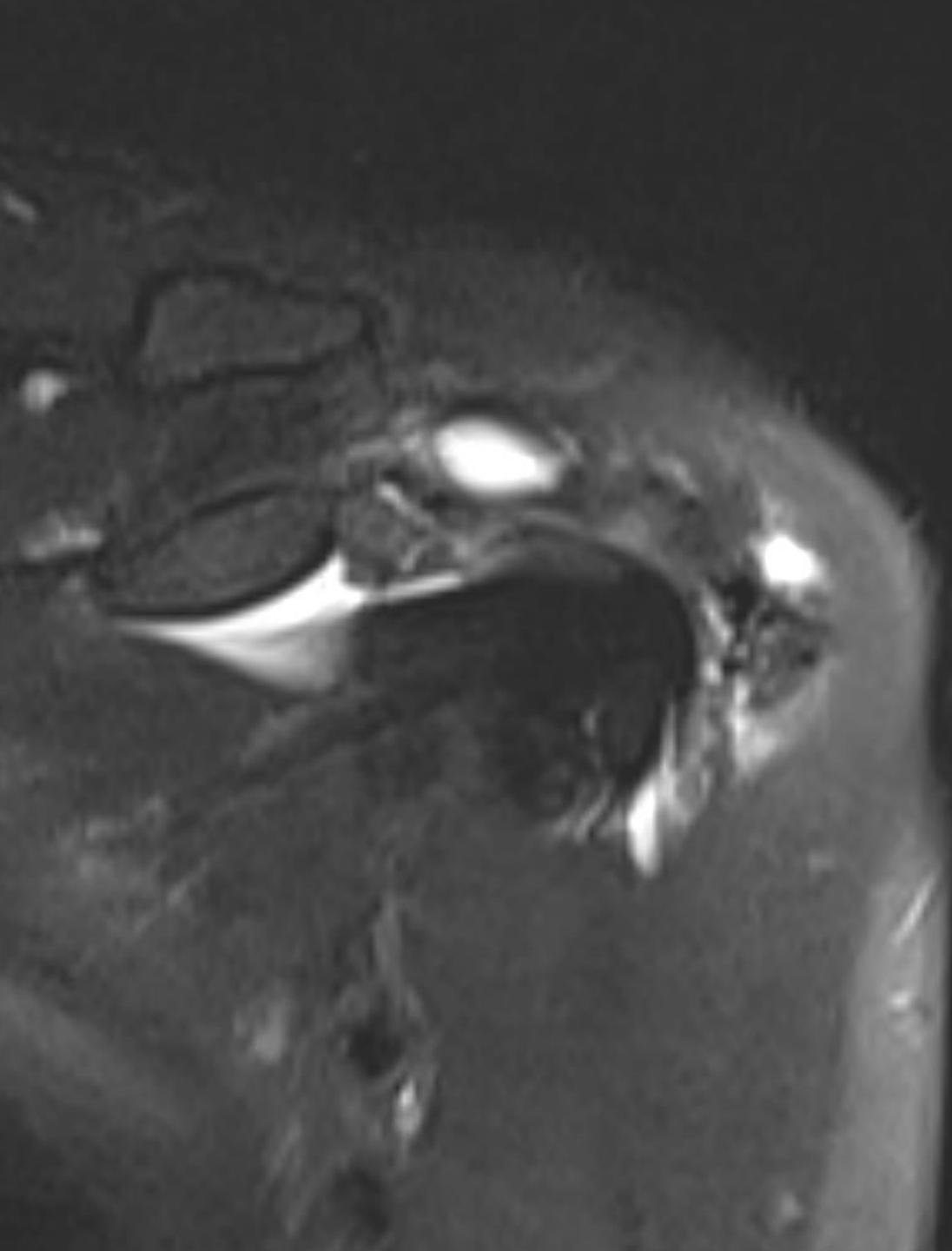


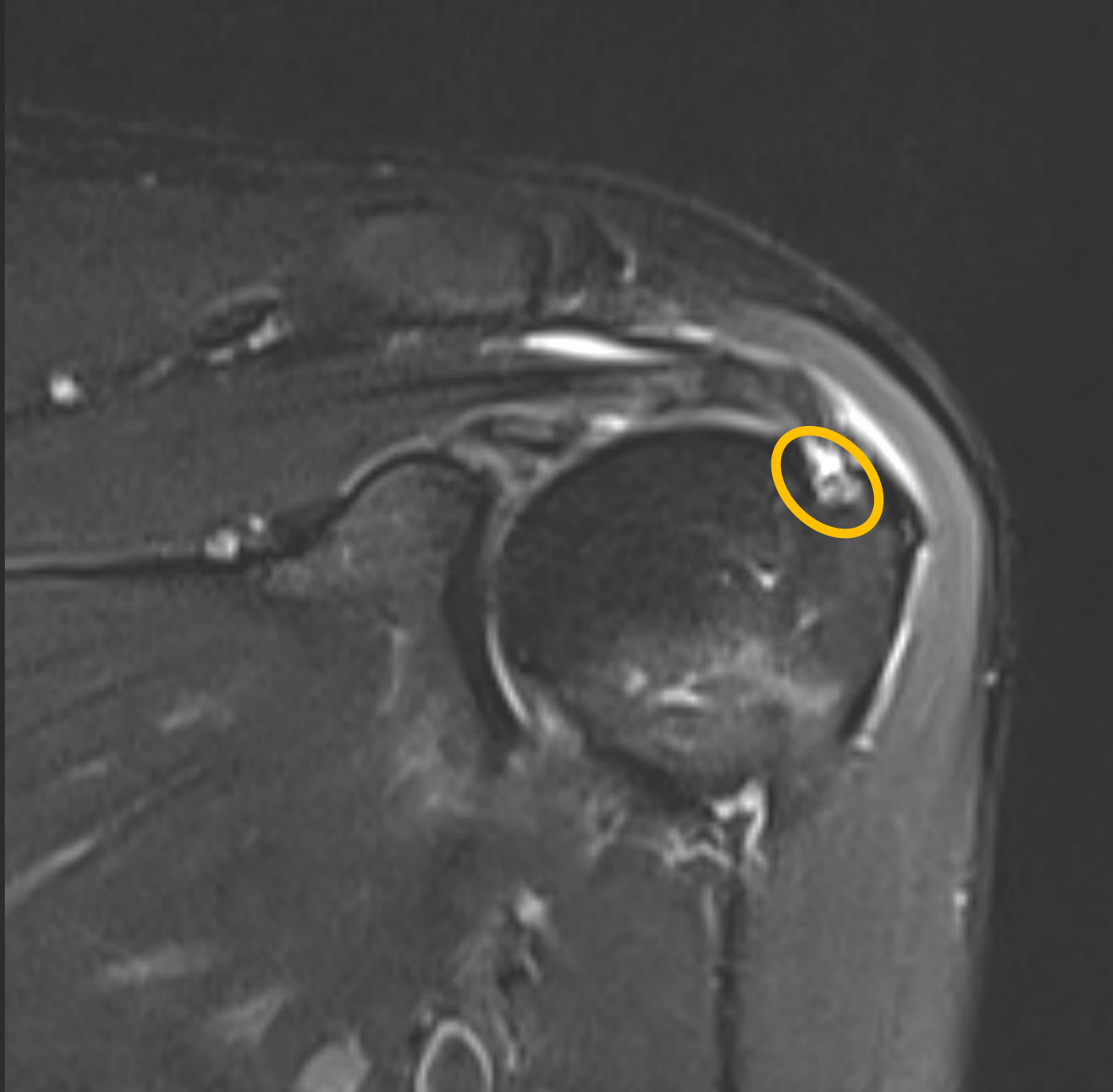


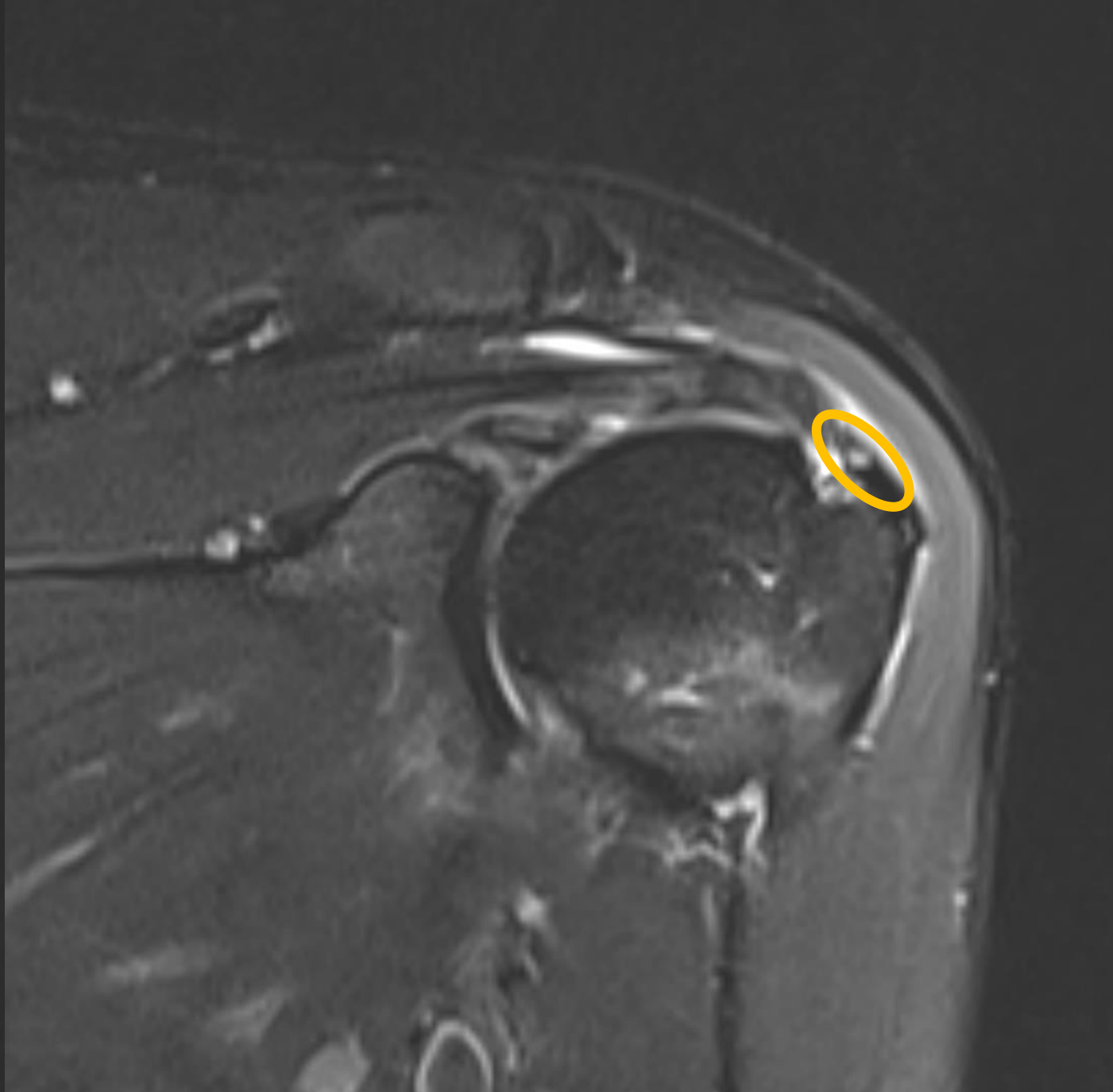
# Full Thickness Tear



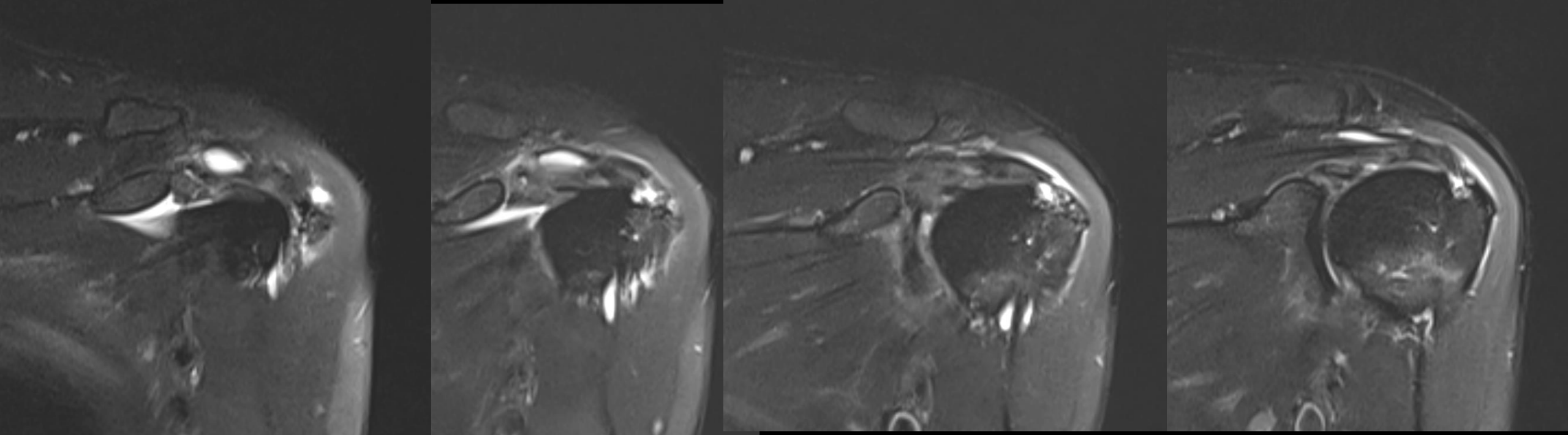
LOOK AT THE ANTERIOR LEADING EDGE







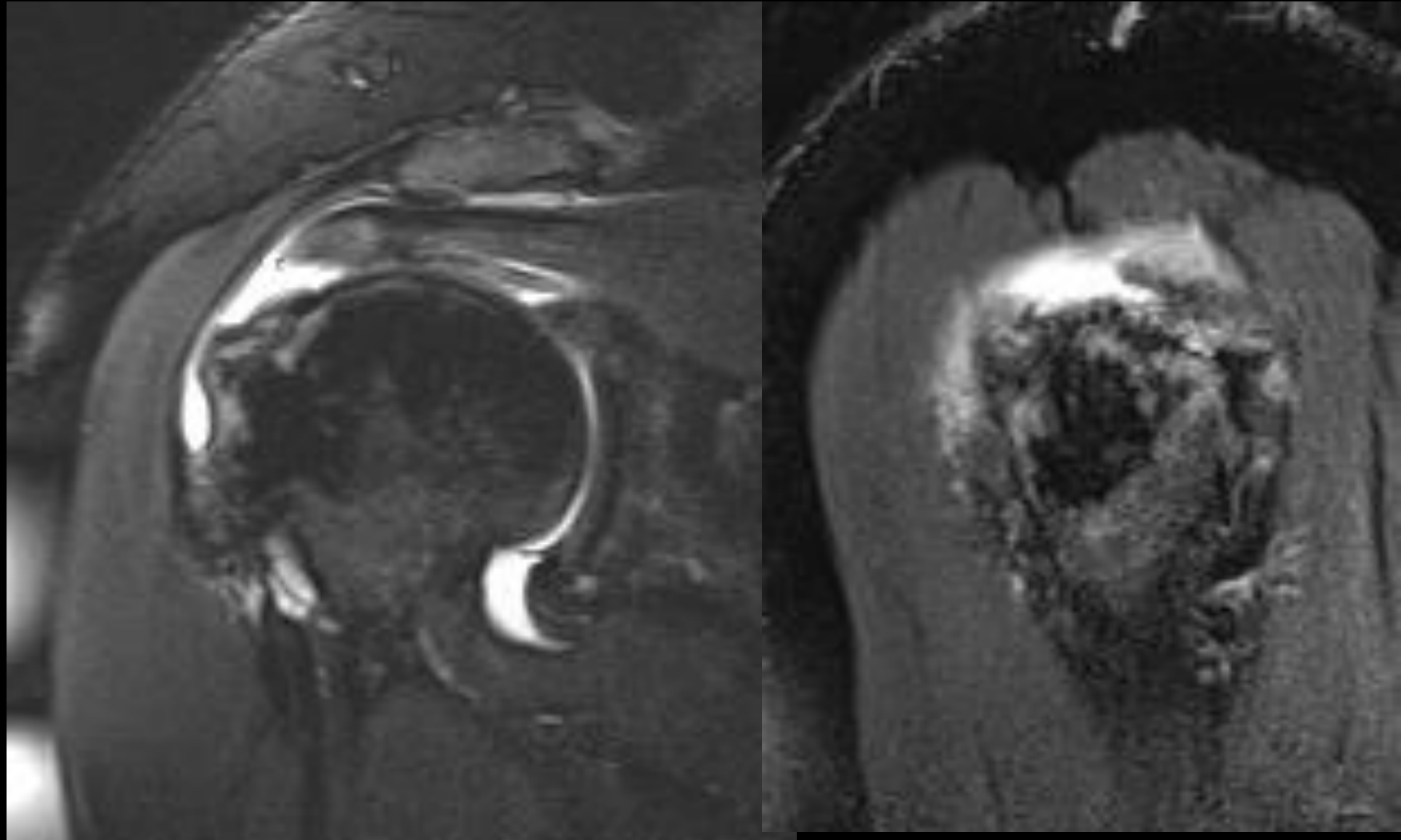




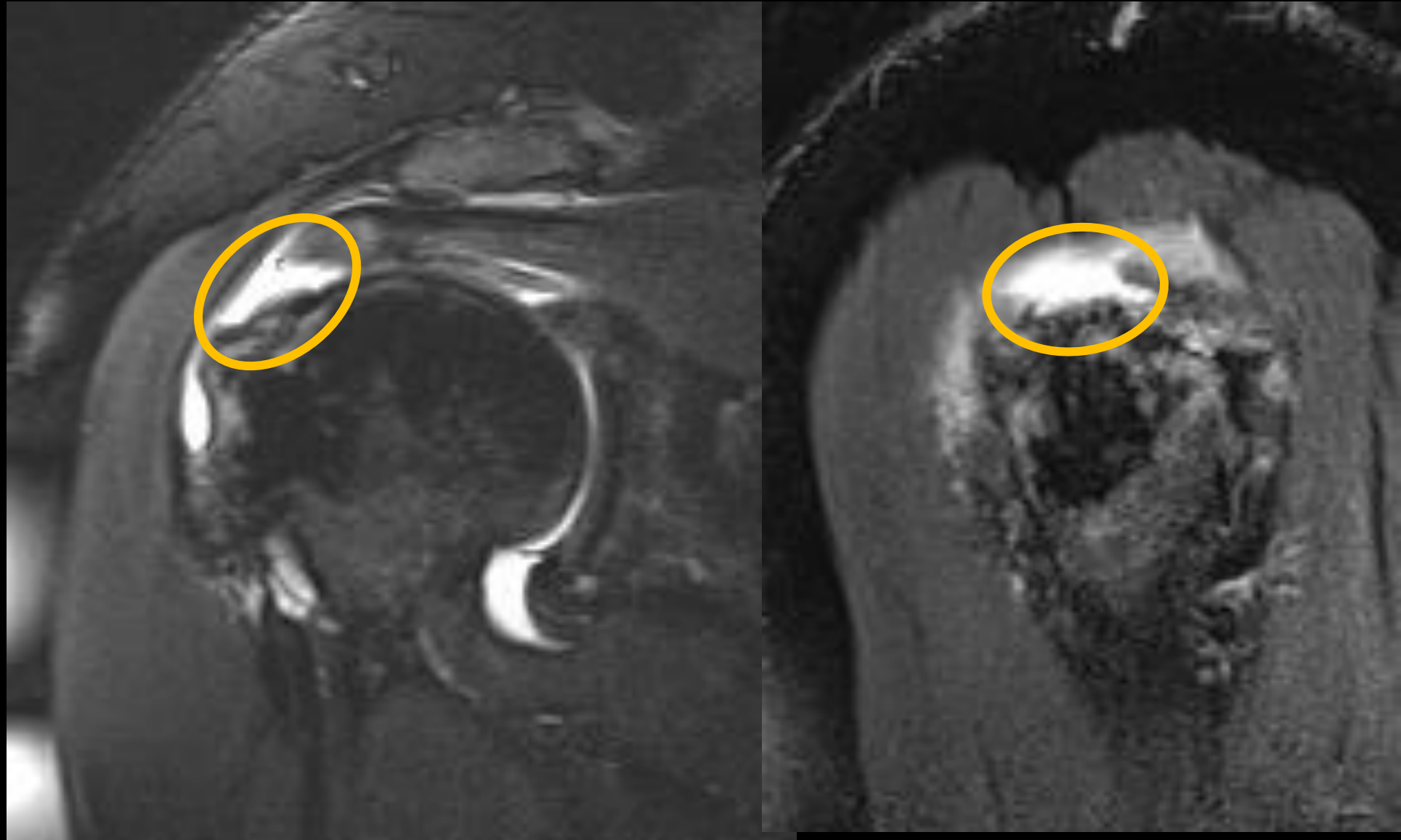
Obliquely-oriented focal full-  
thickness tear

**LOOK AT THE ANTERIOR LEADING EDGE**

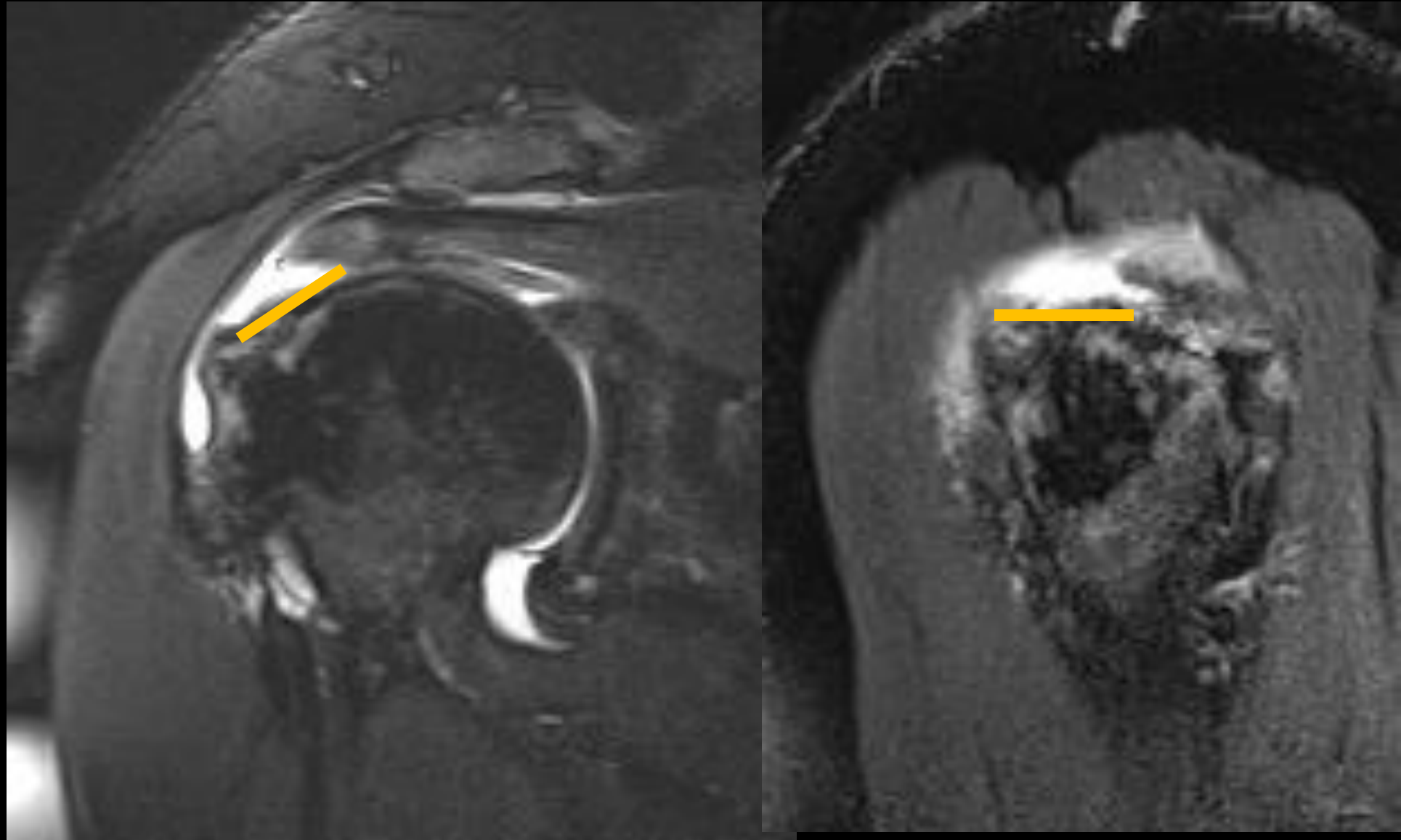
# Full Thickness Tear



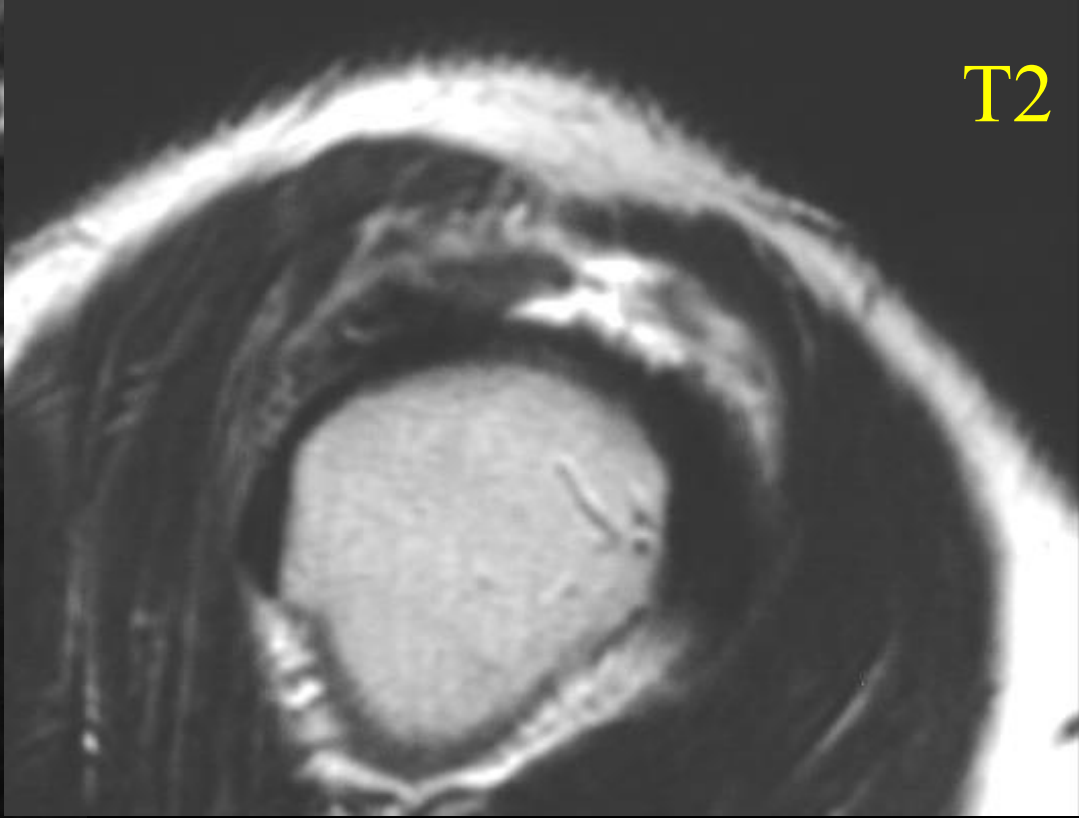
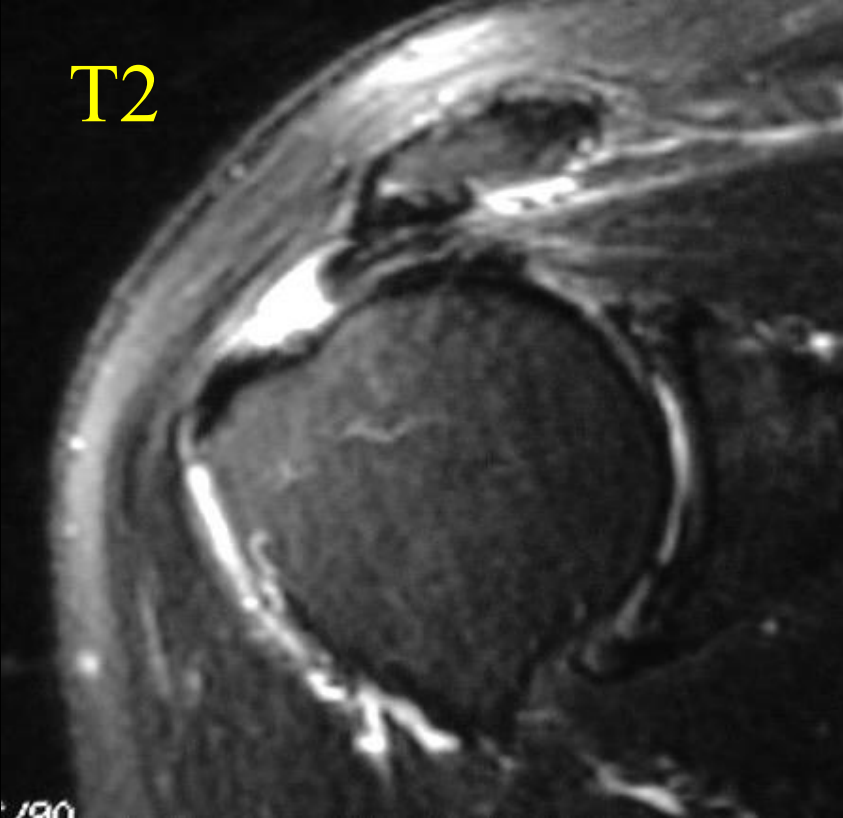
# Full Thickness Tear

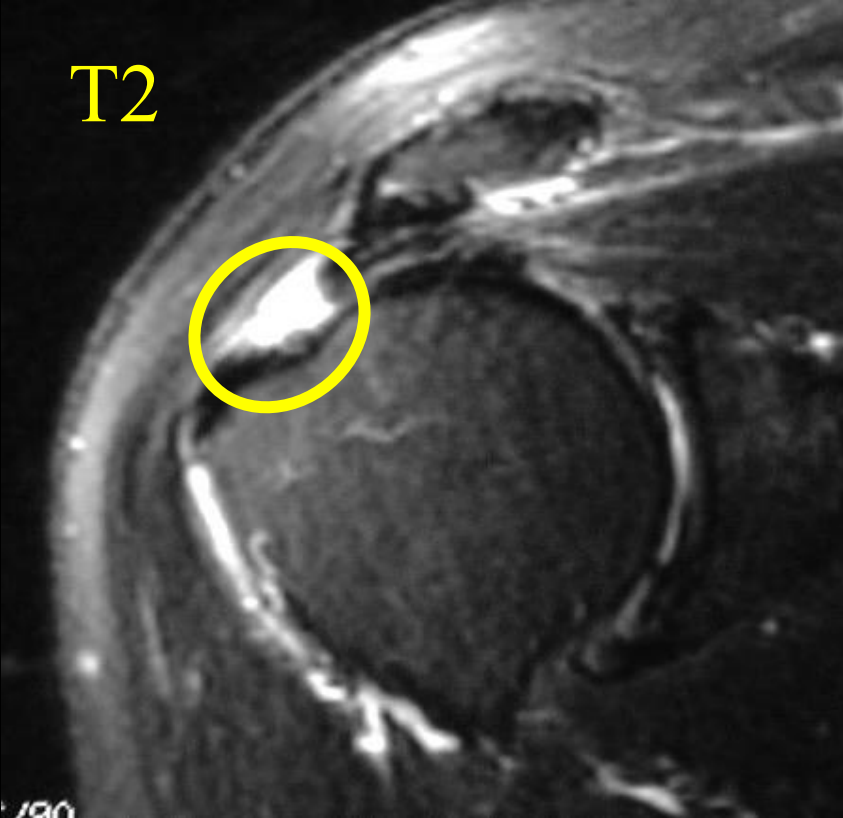


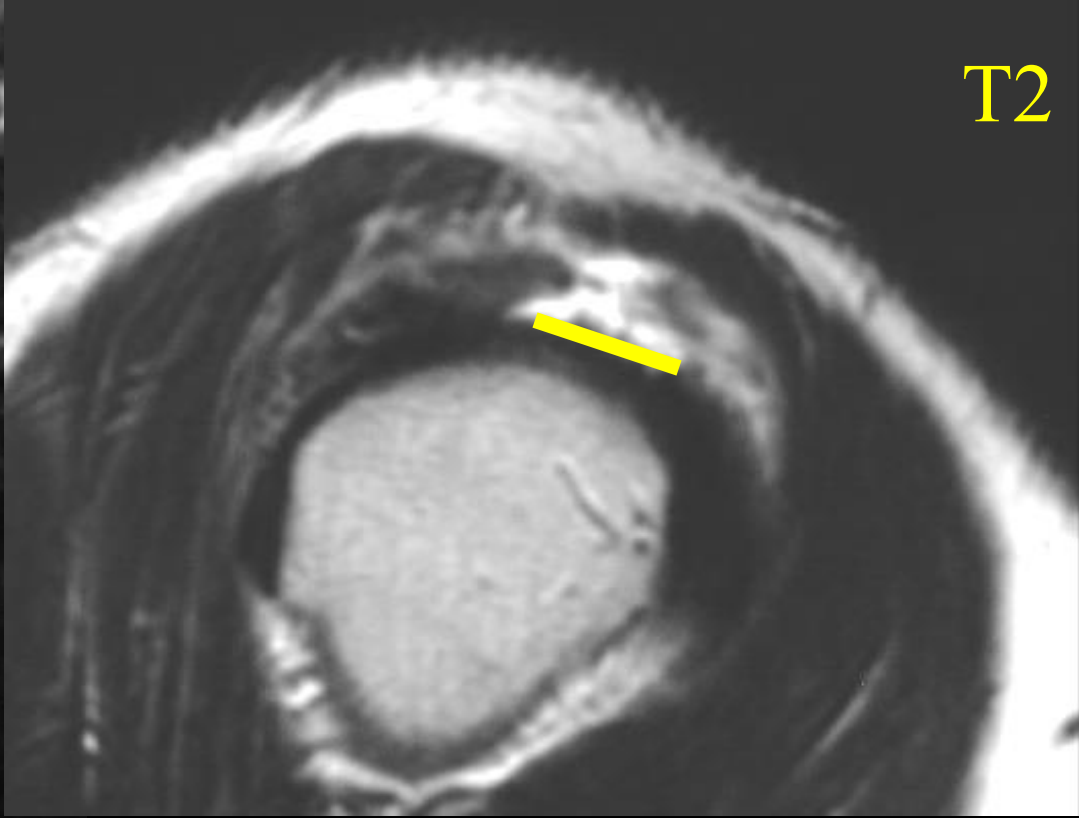
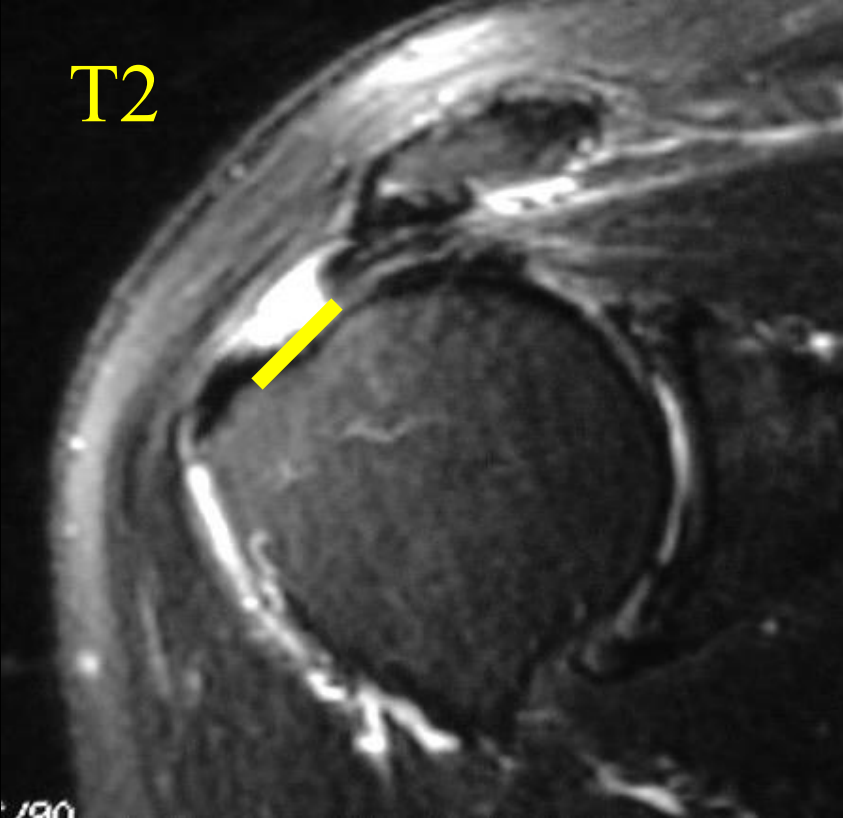
# Full Thickness Tear

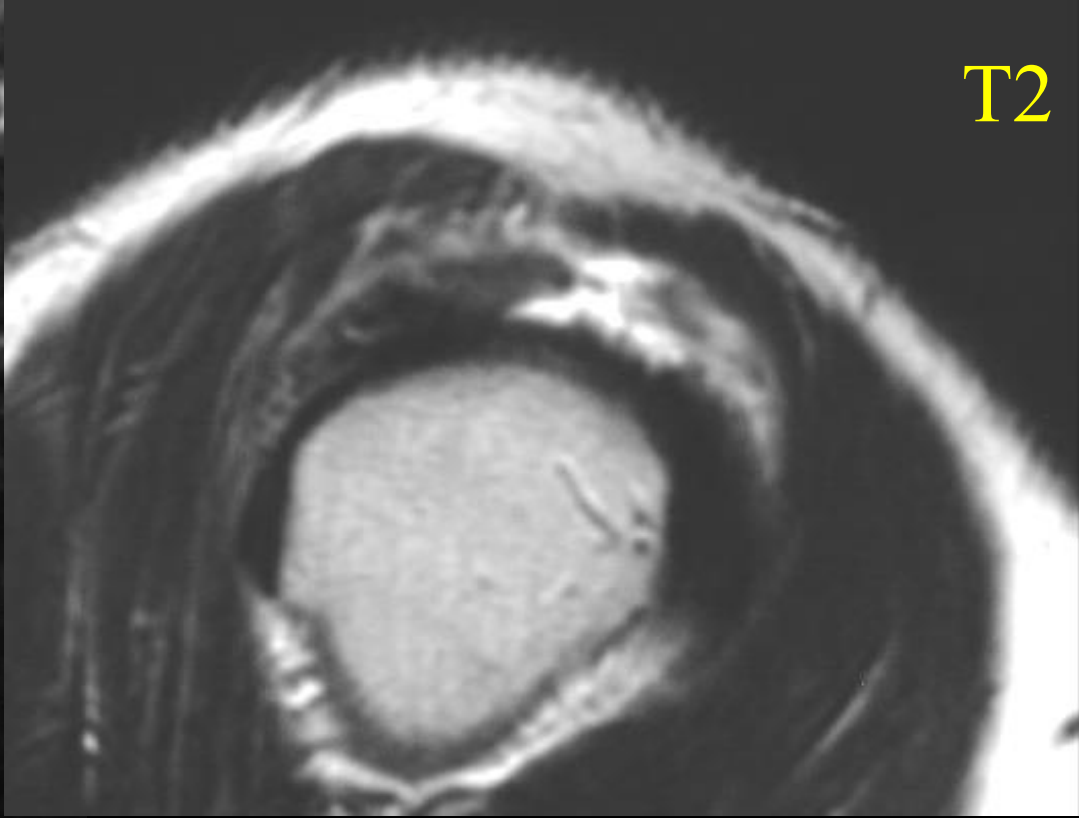
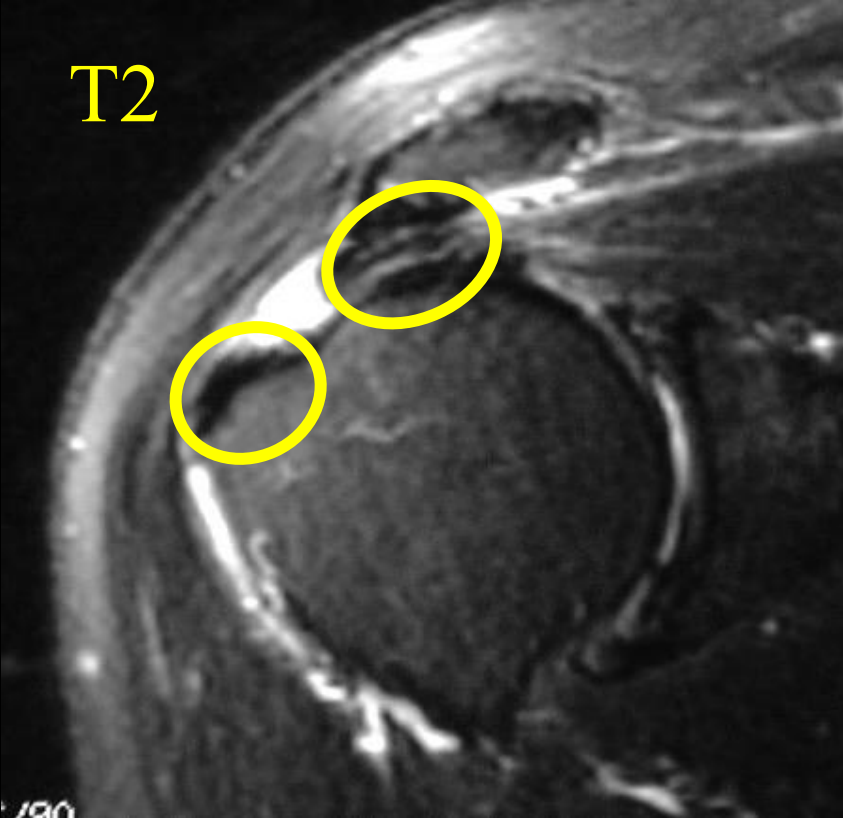




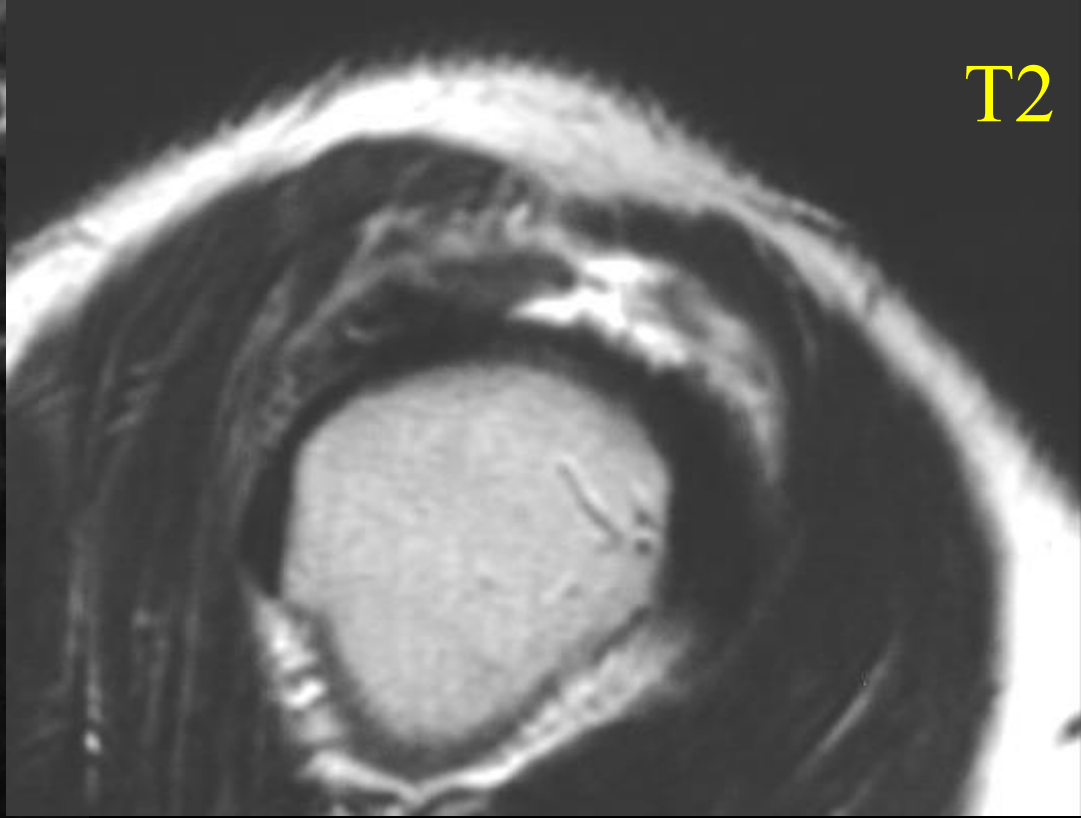
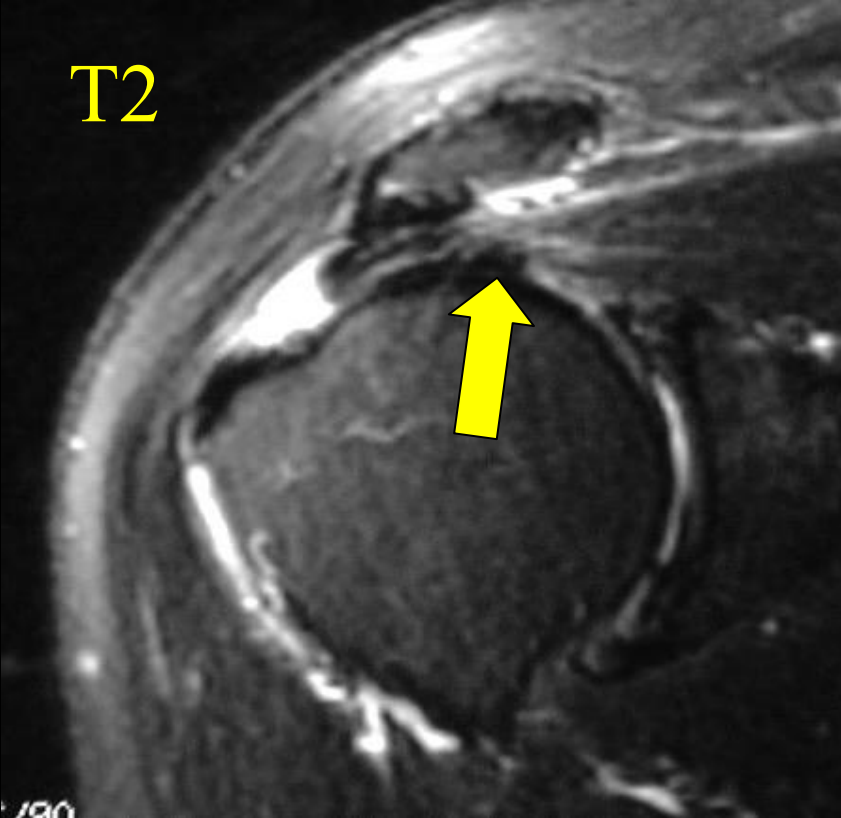


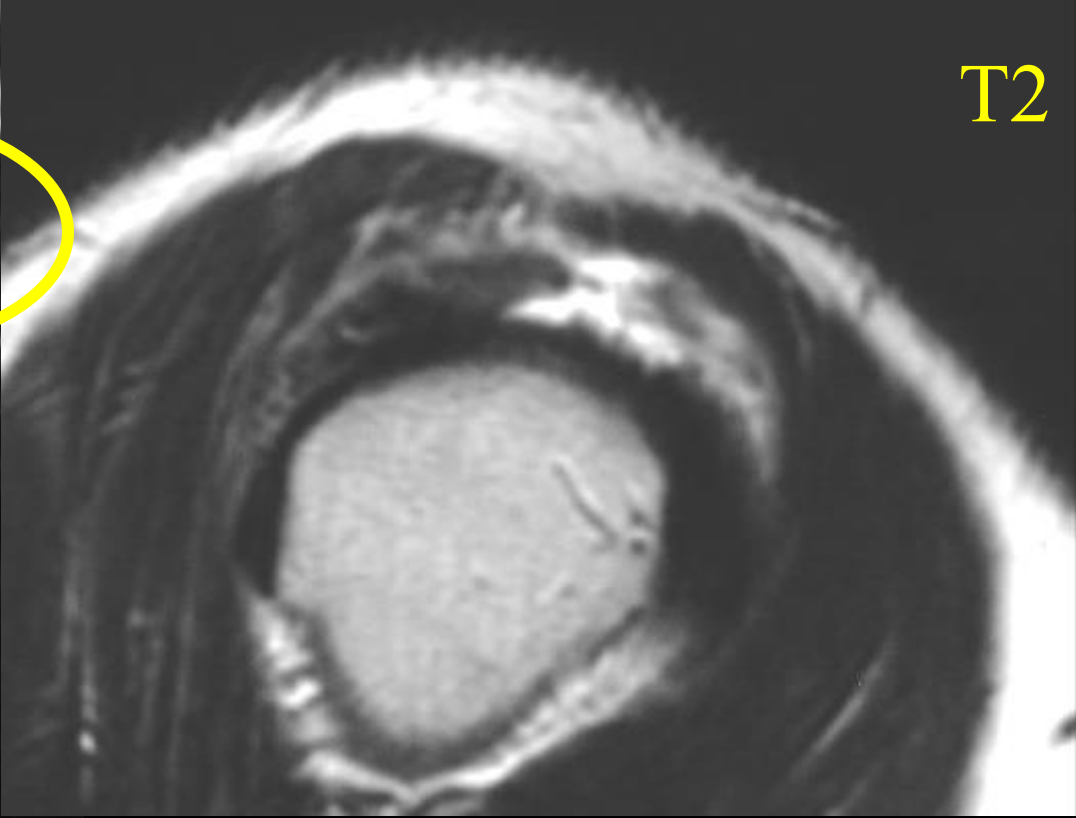
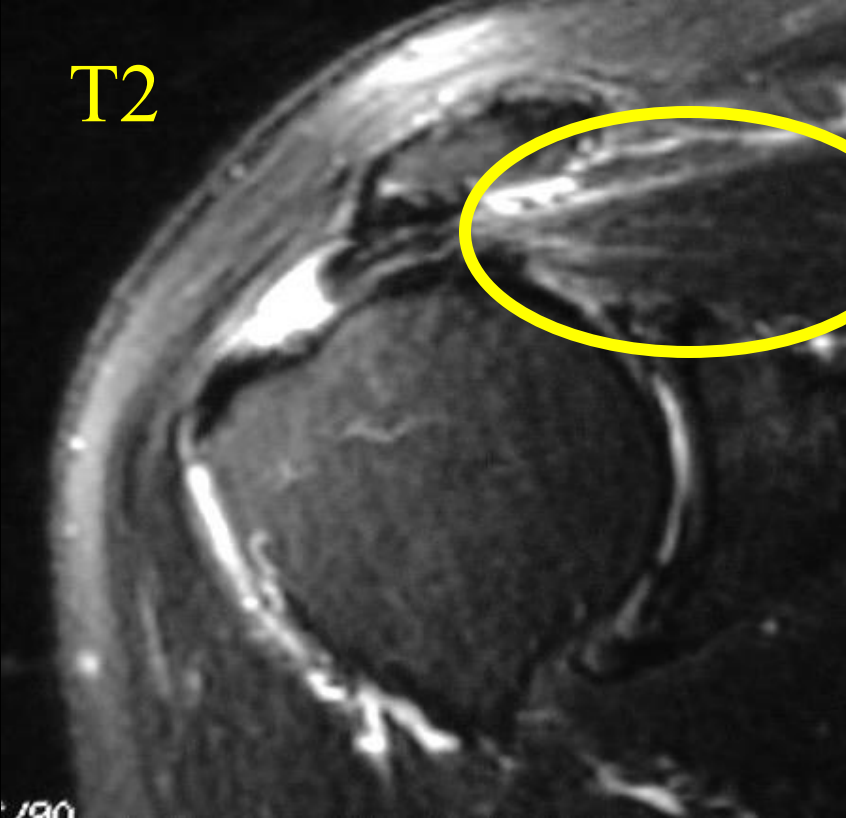


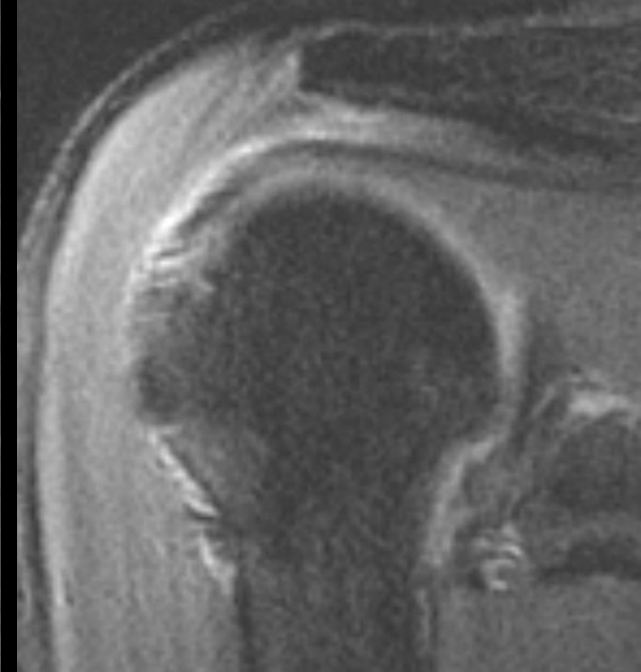
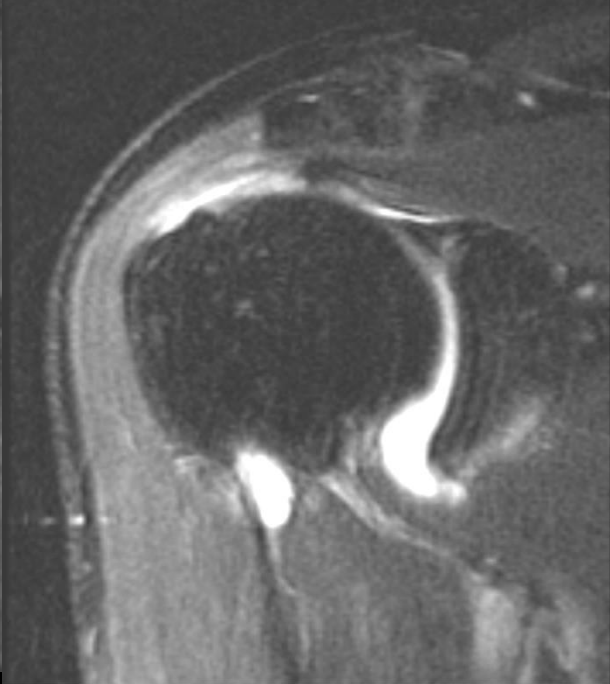
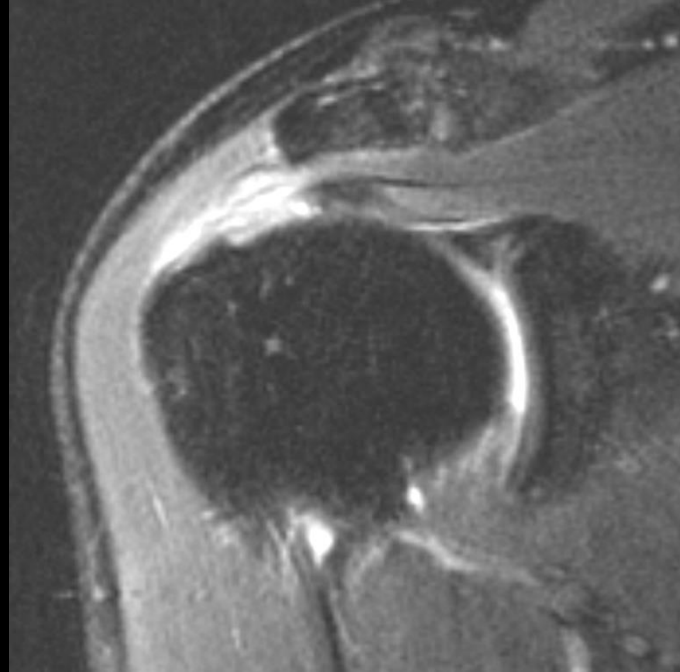


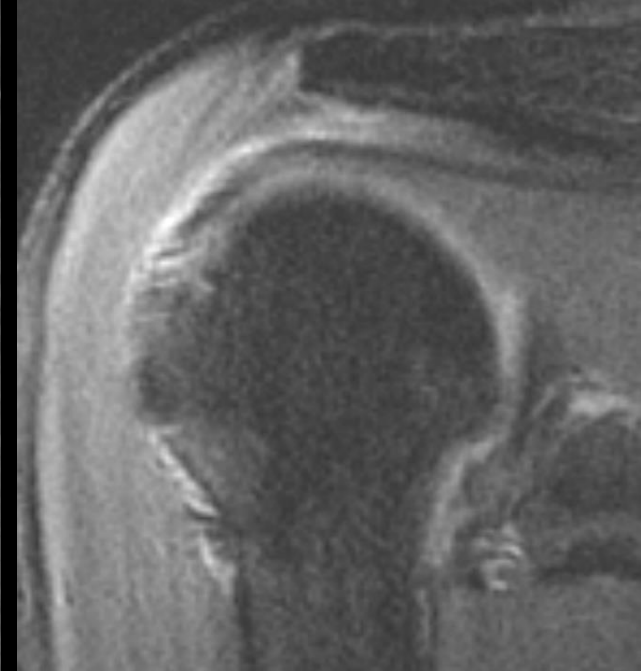
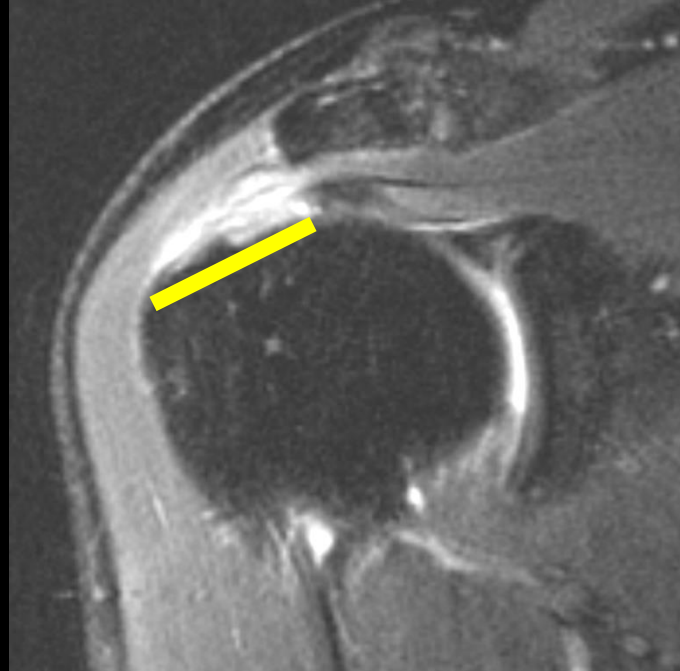




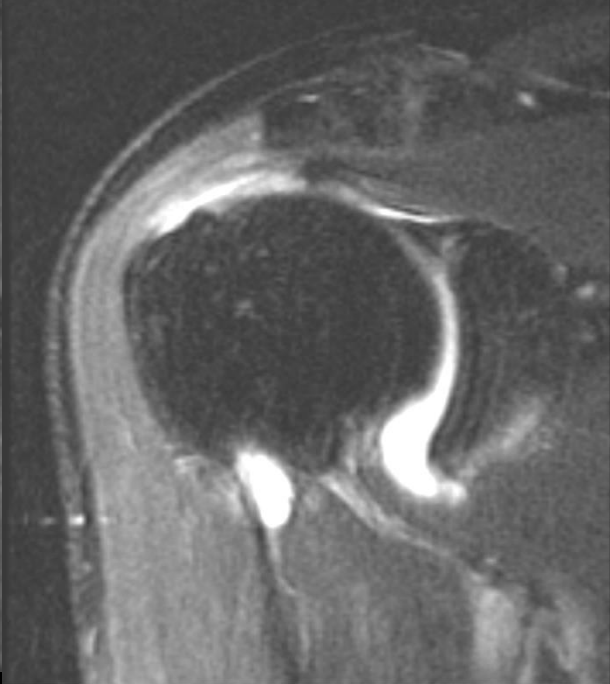
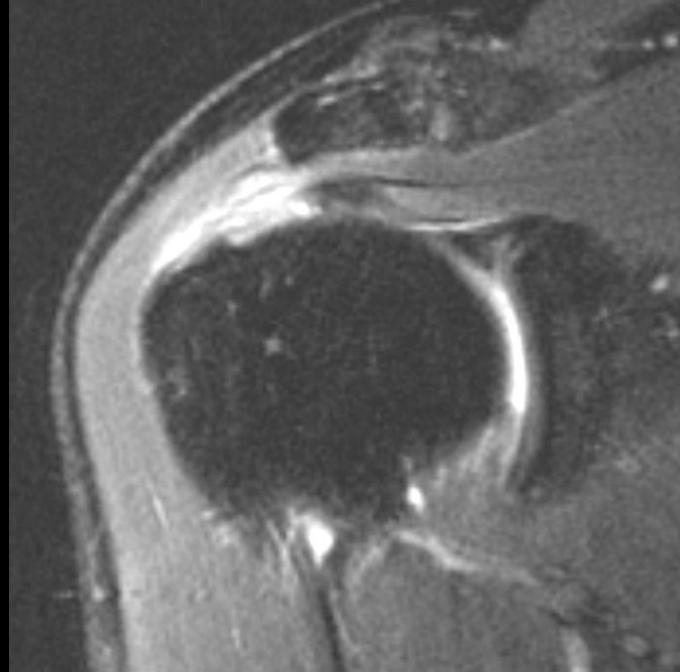


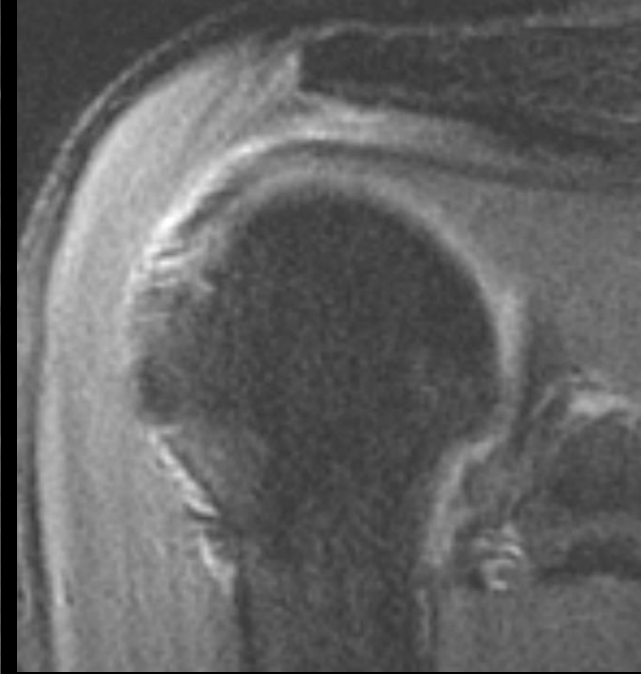
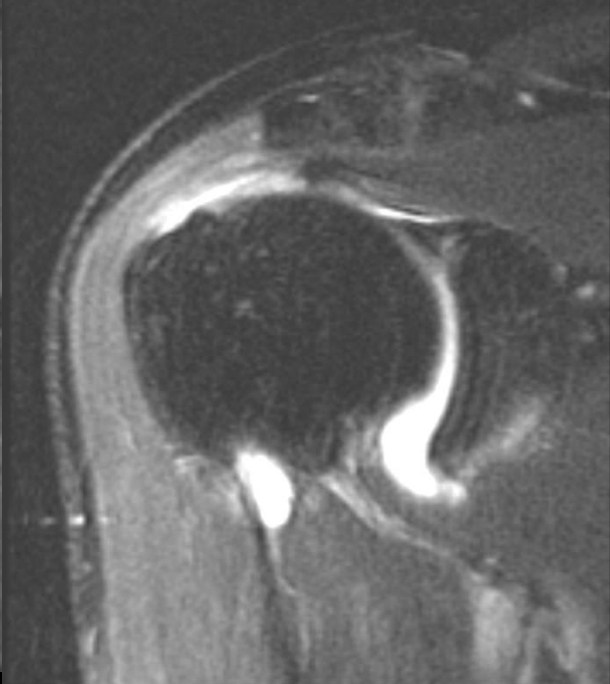
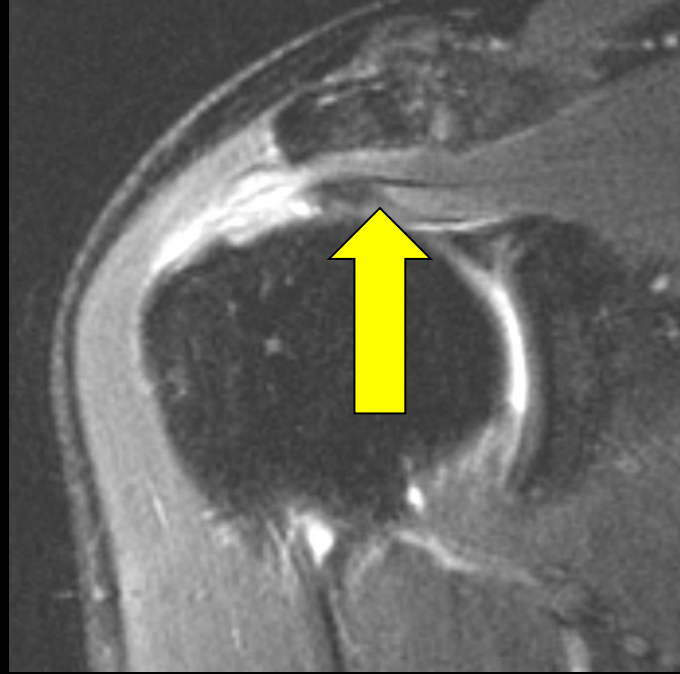


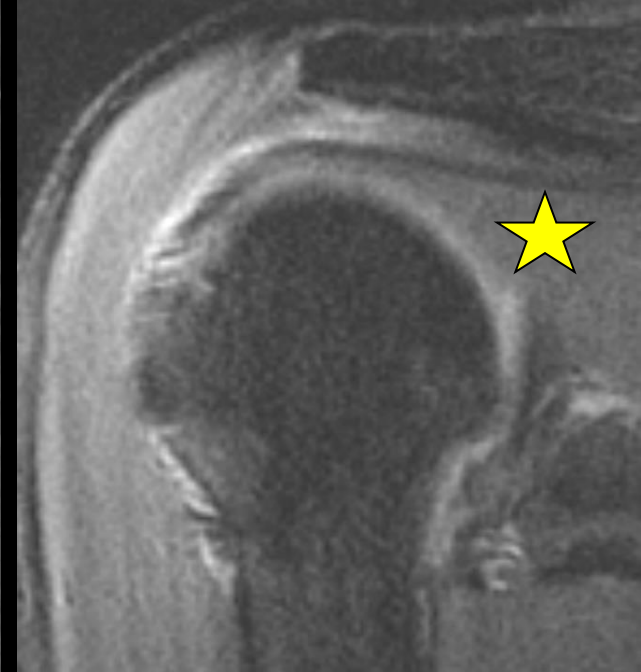
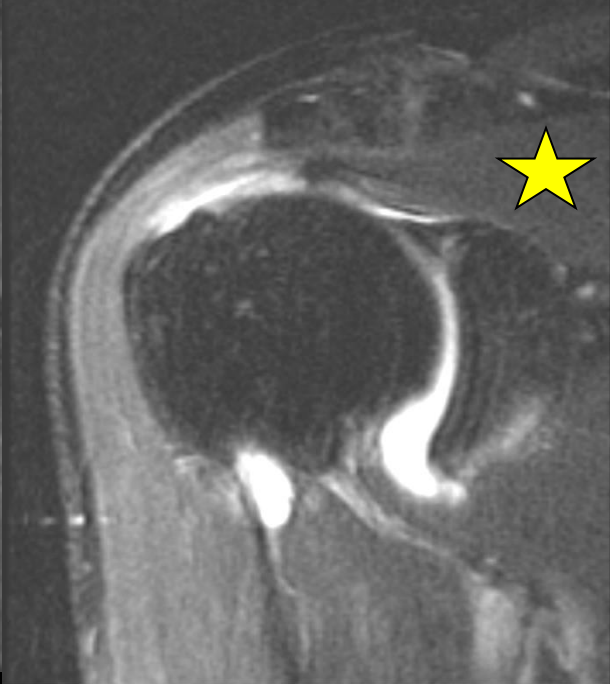
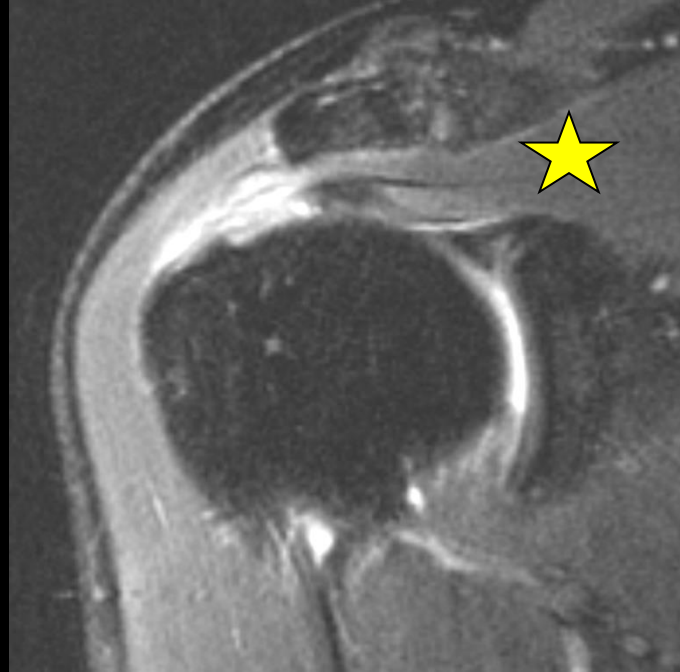














T2





T2



T2



T2



T2





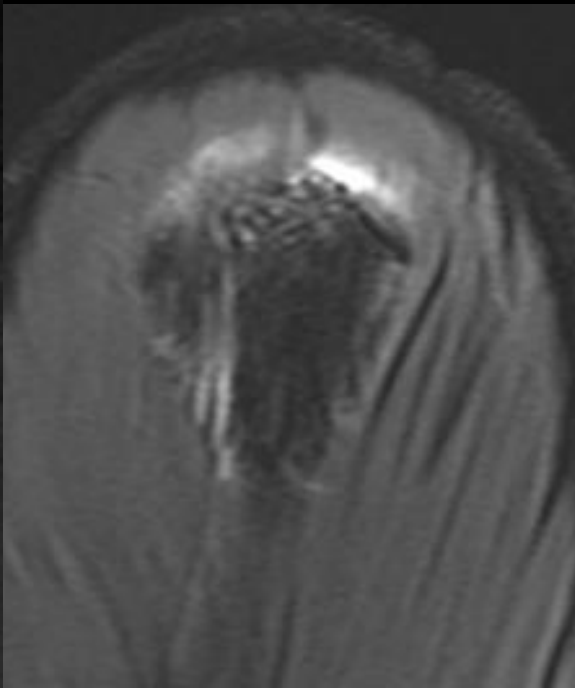
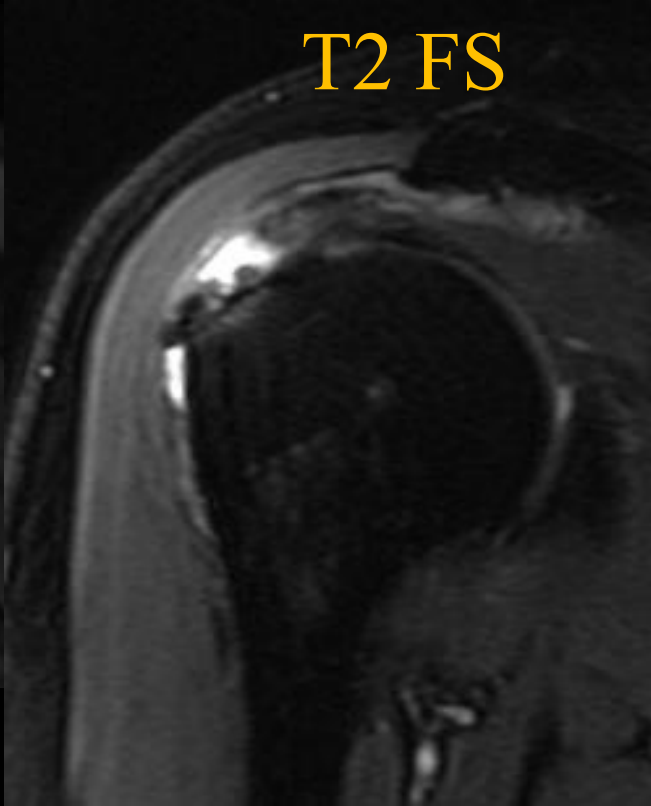
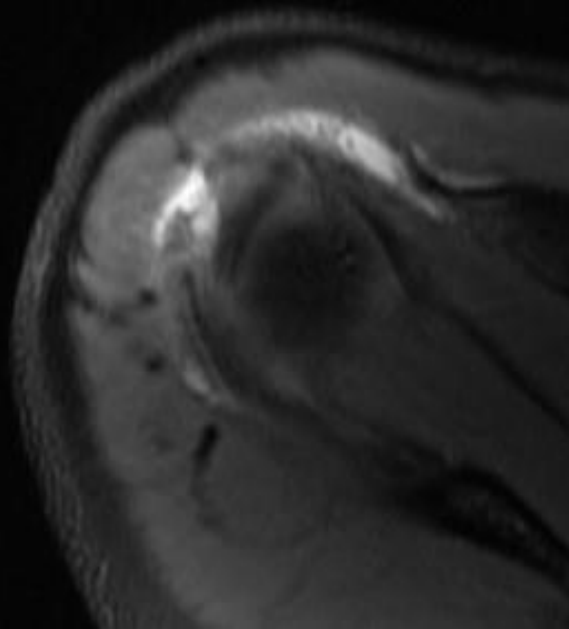
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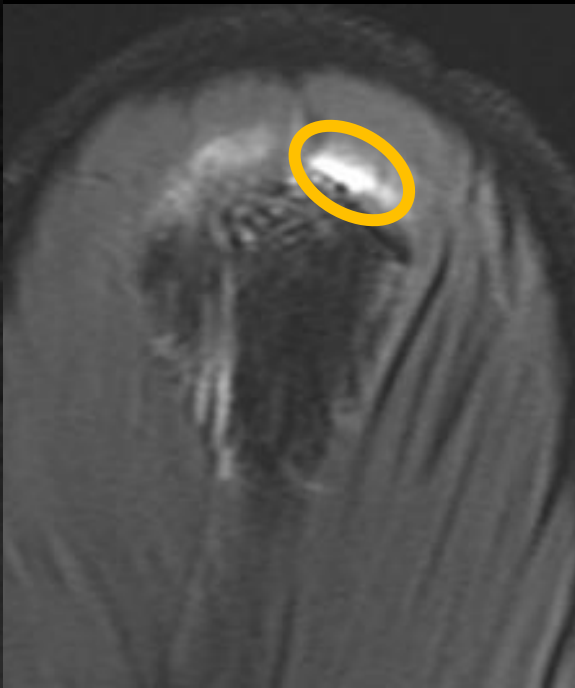
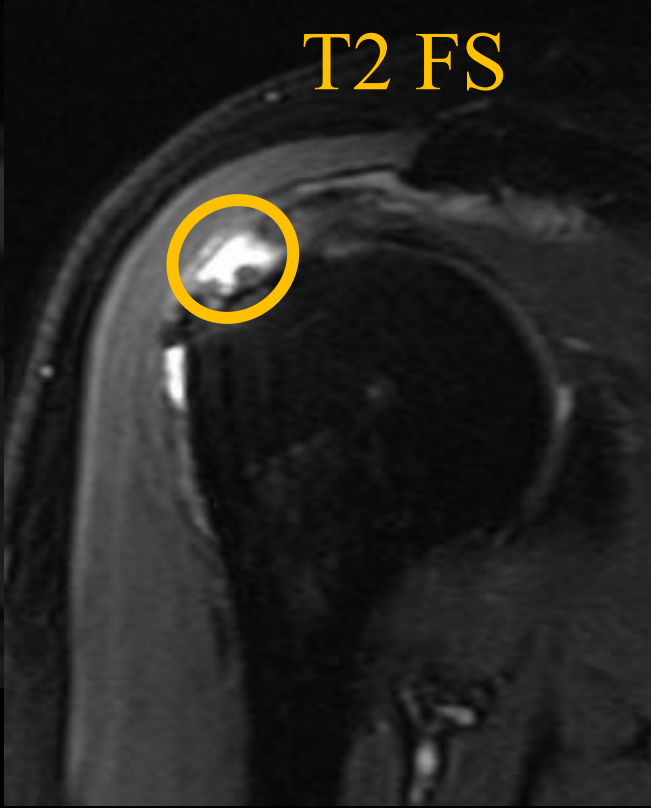
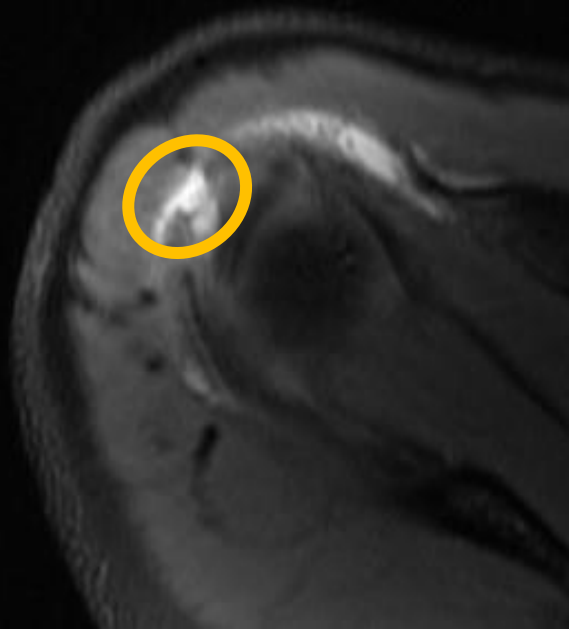
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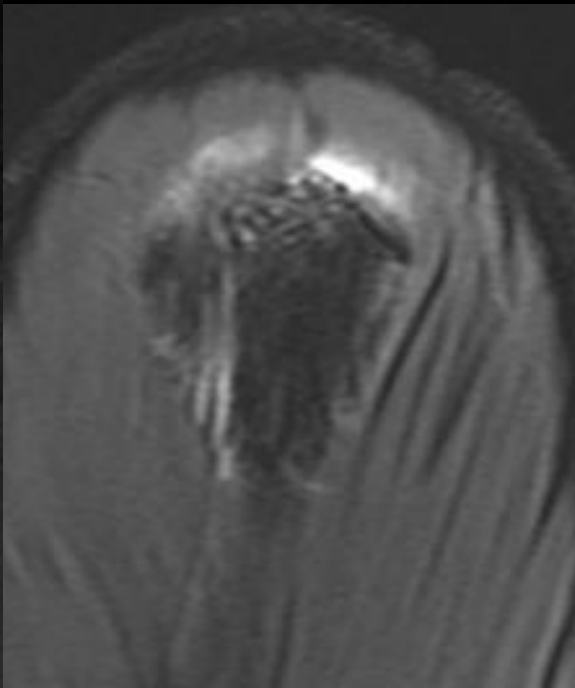
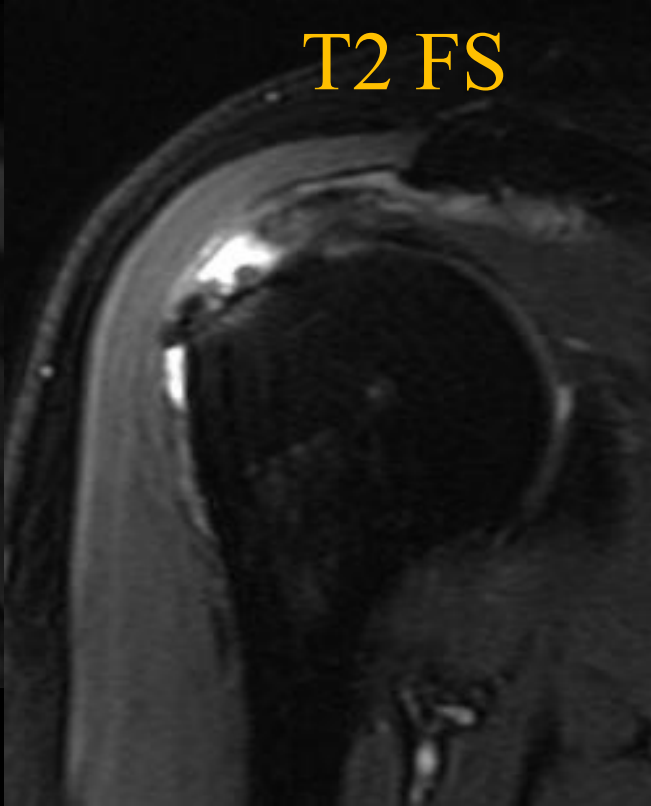
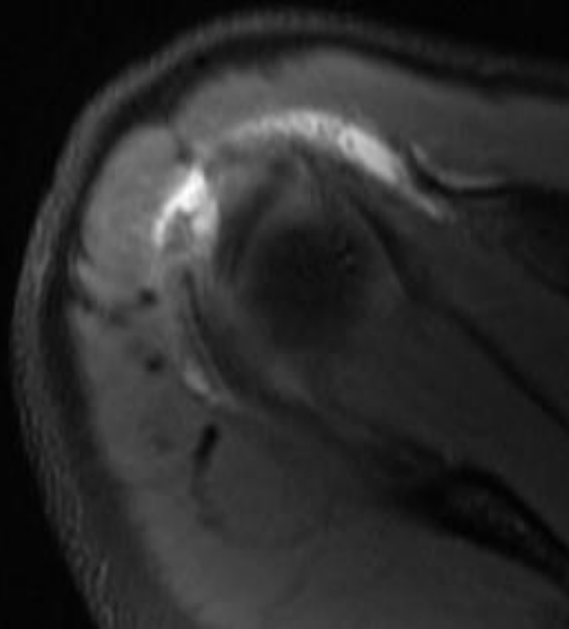


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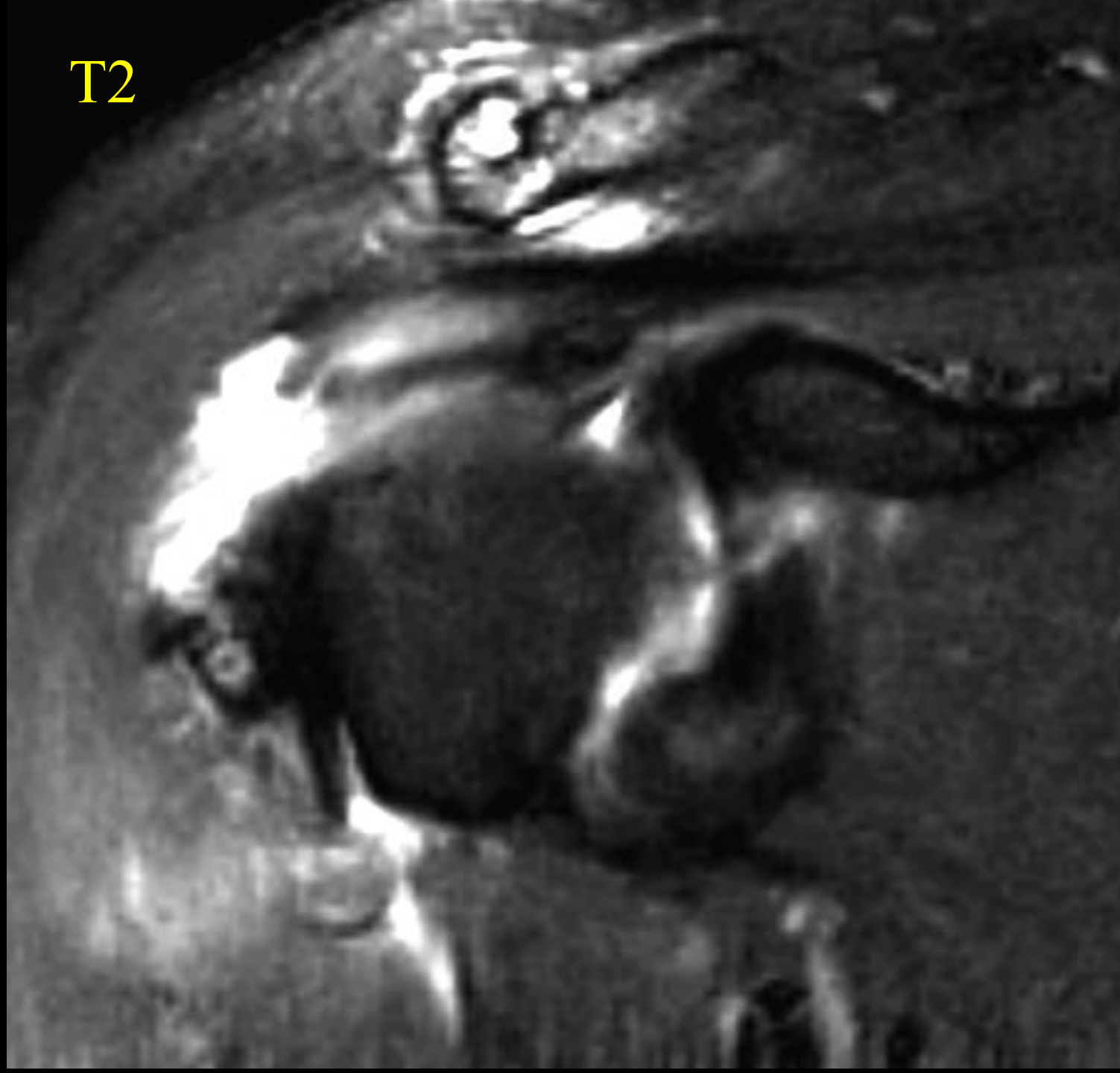




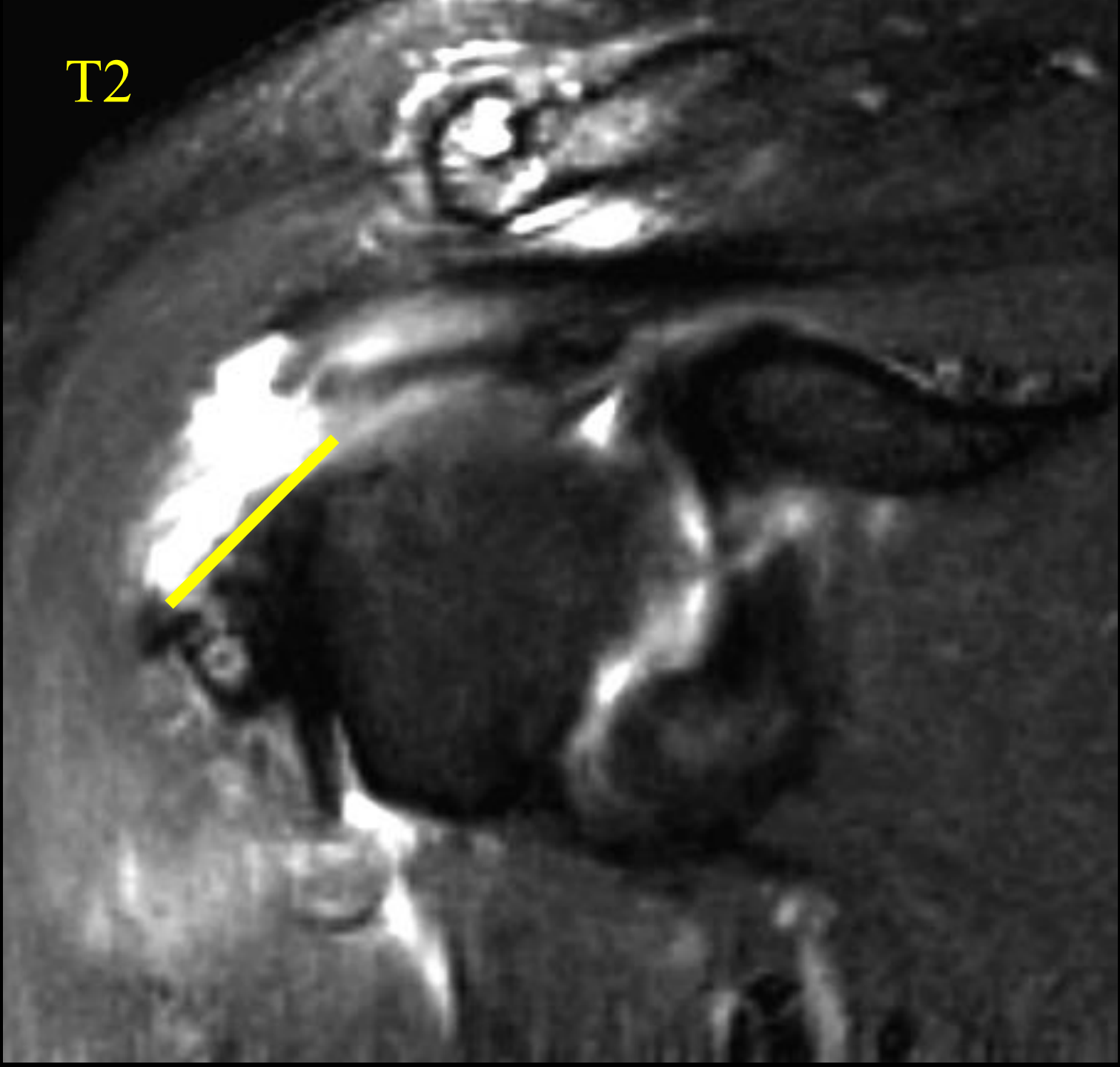




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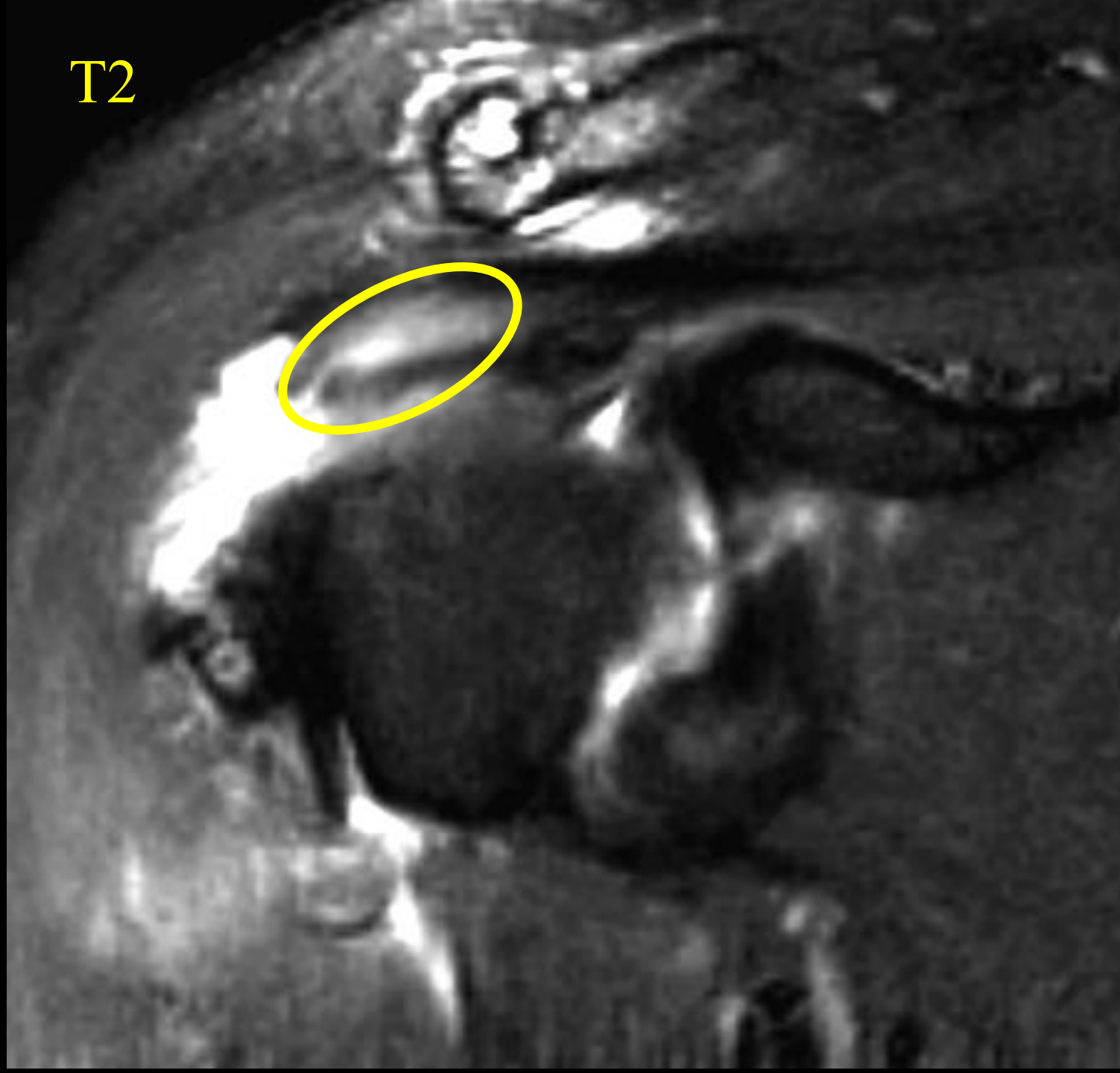


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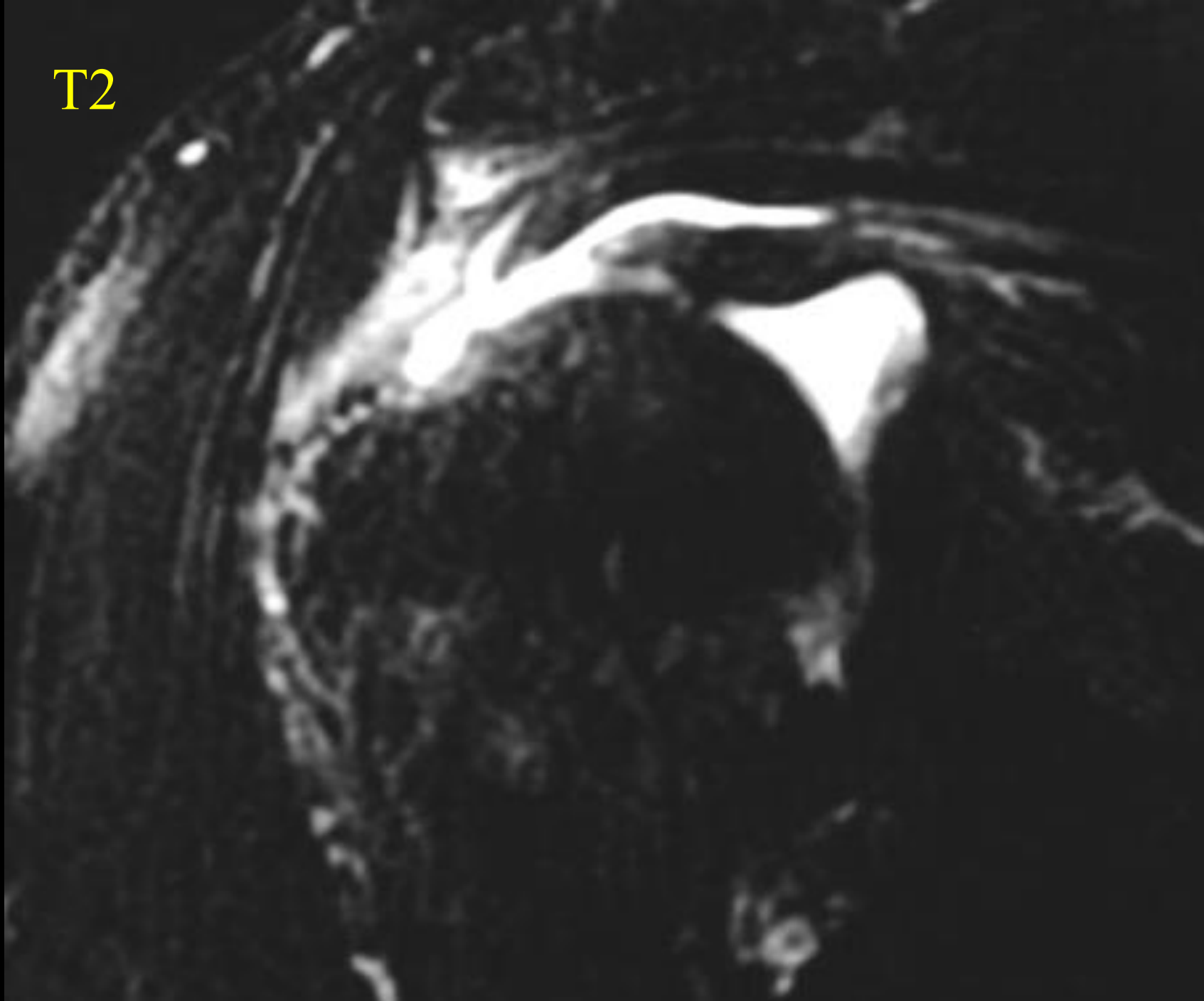




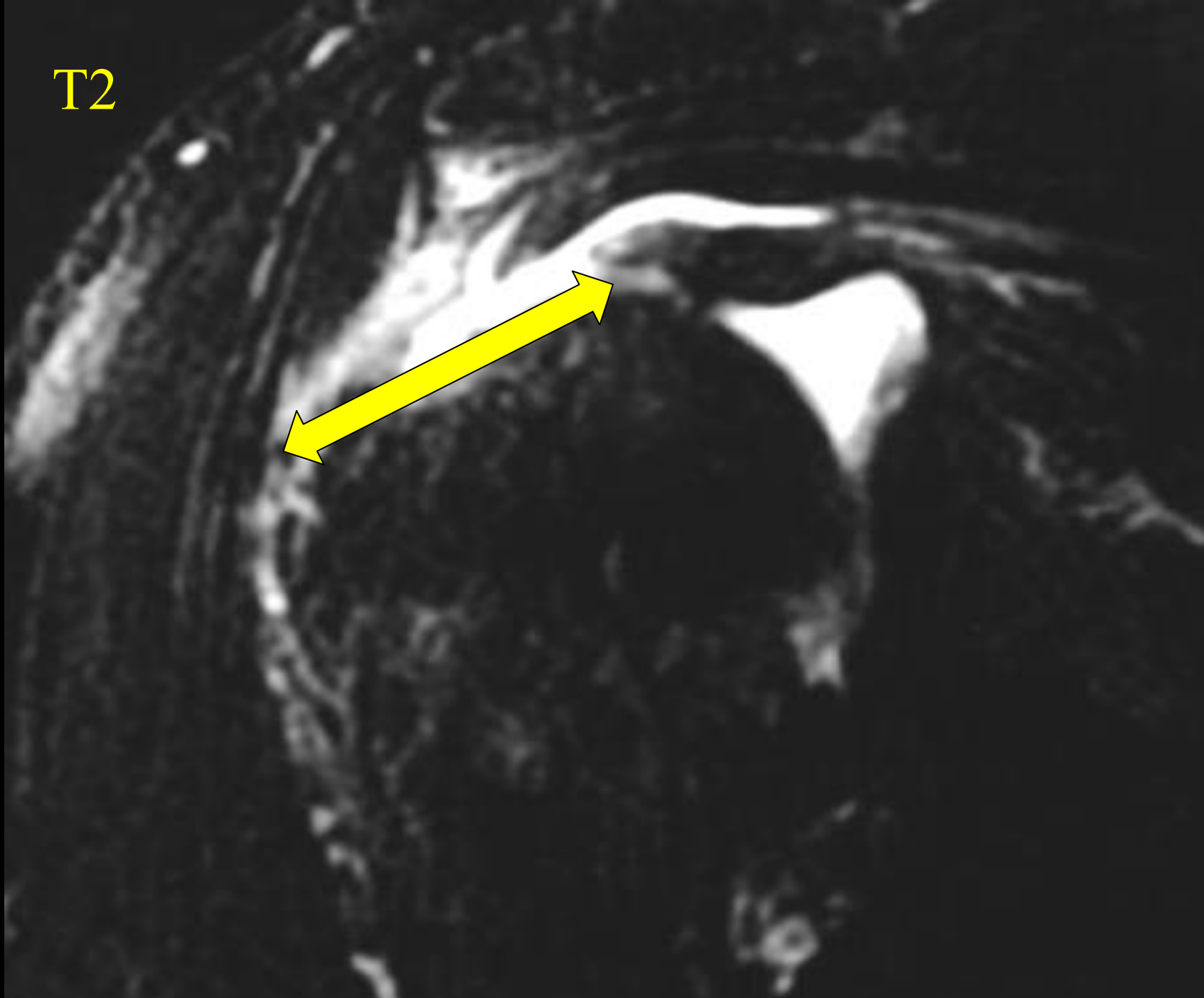
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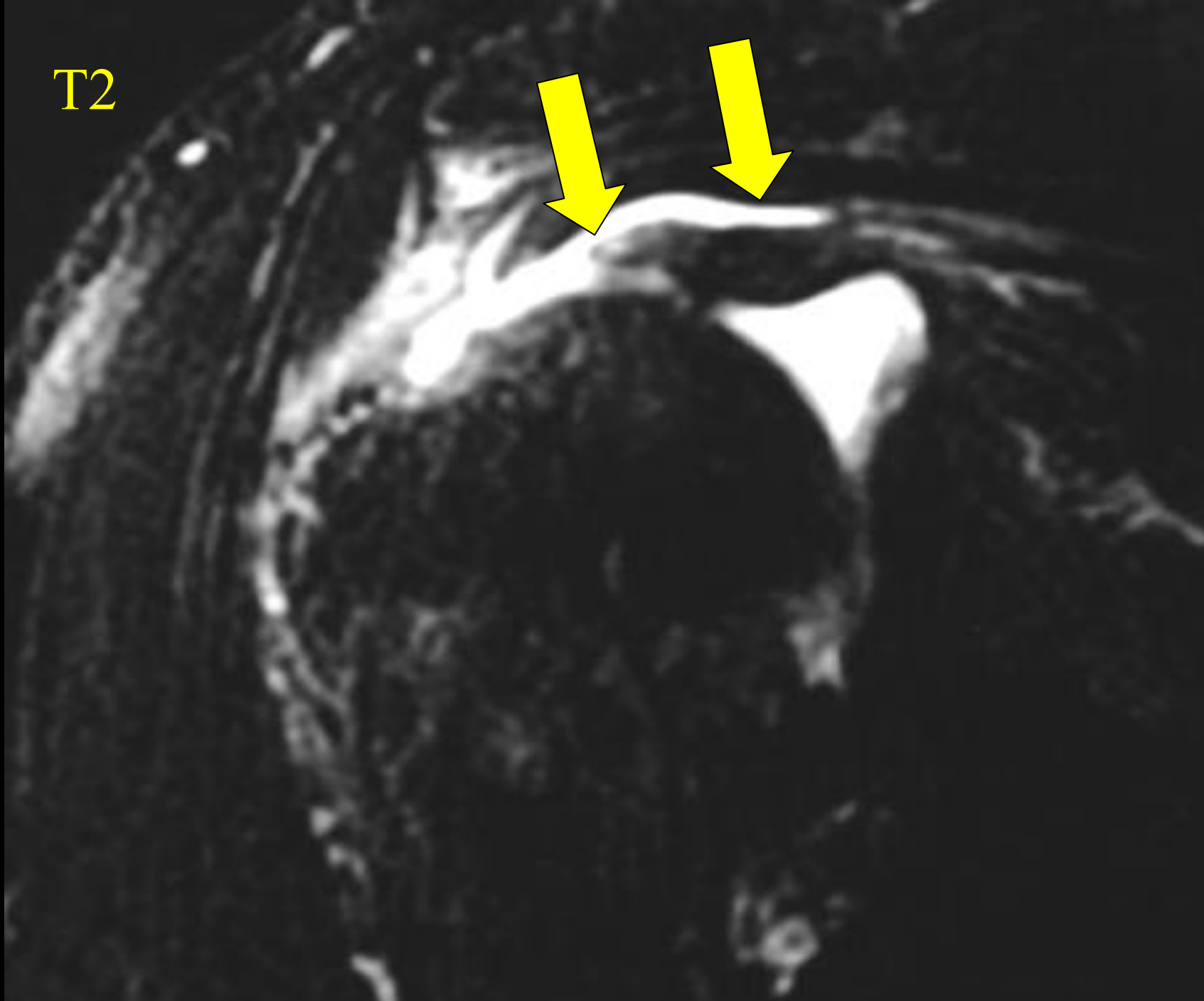
T2



T2

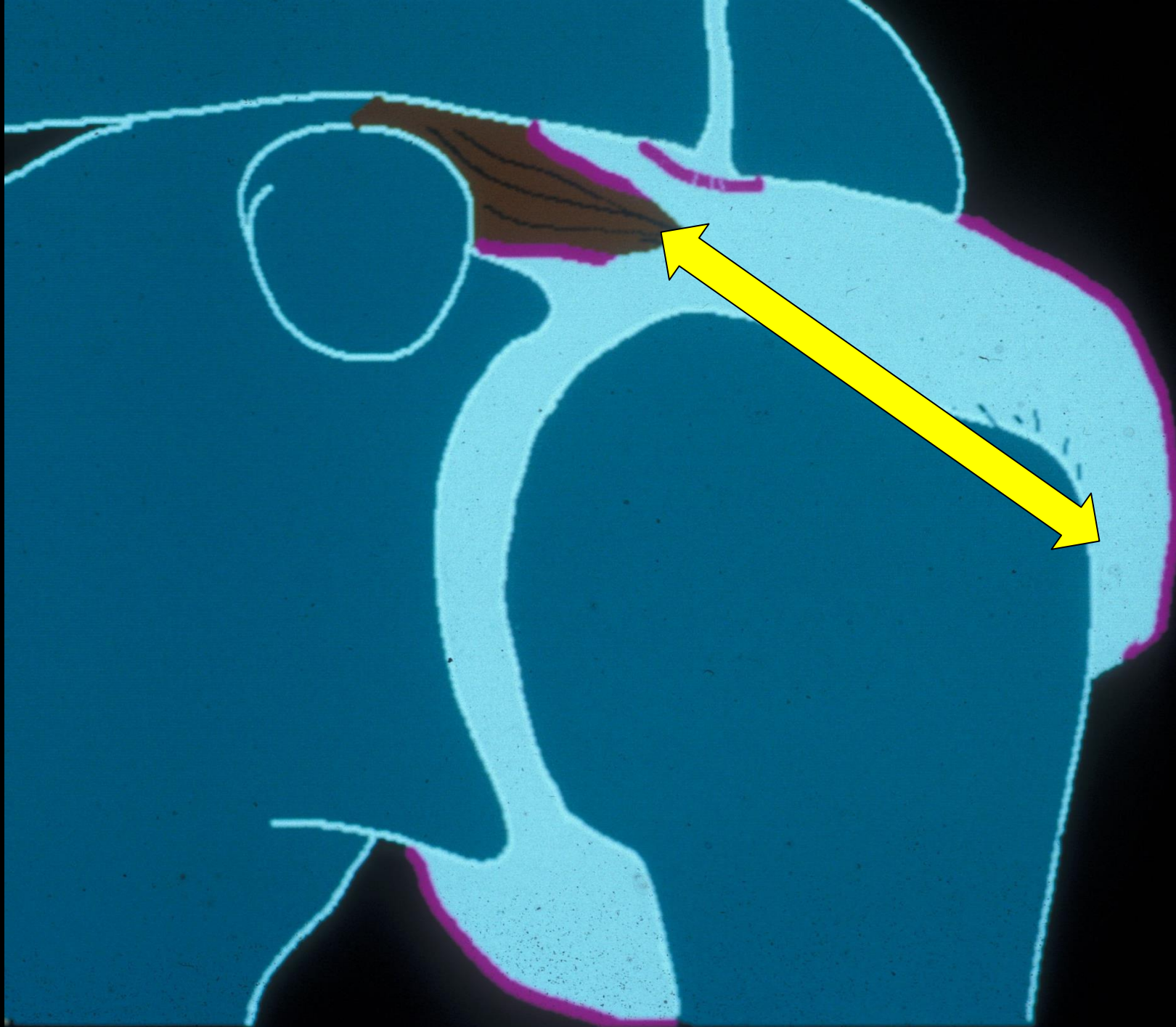


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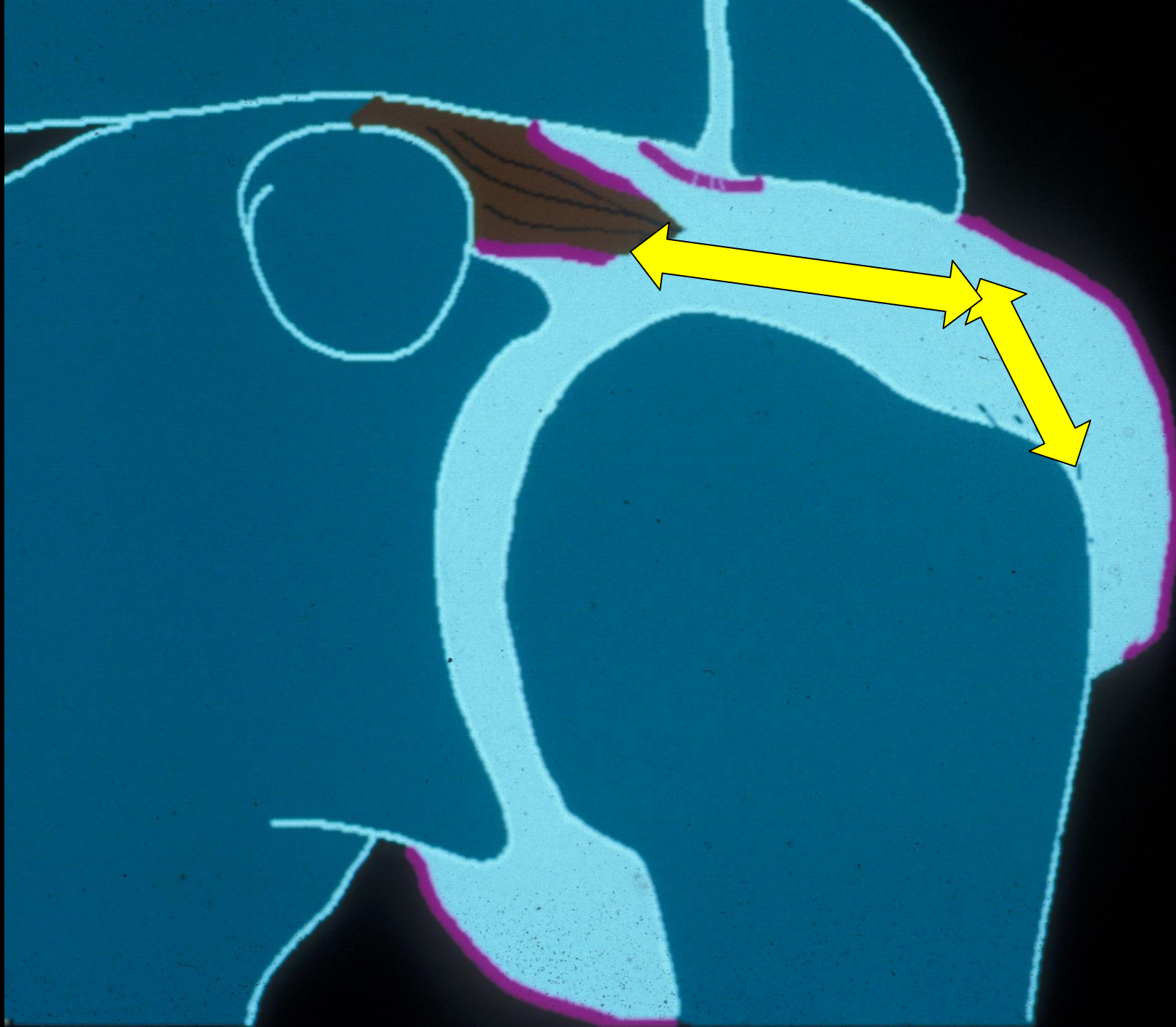


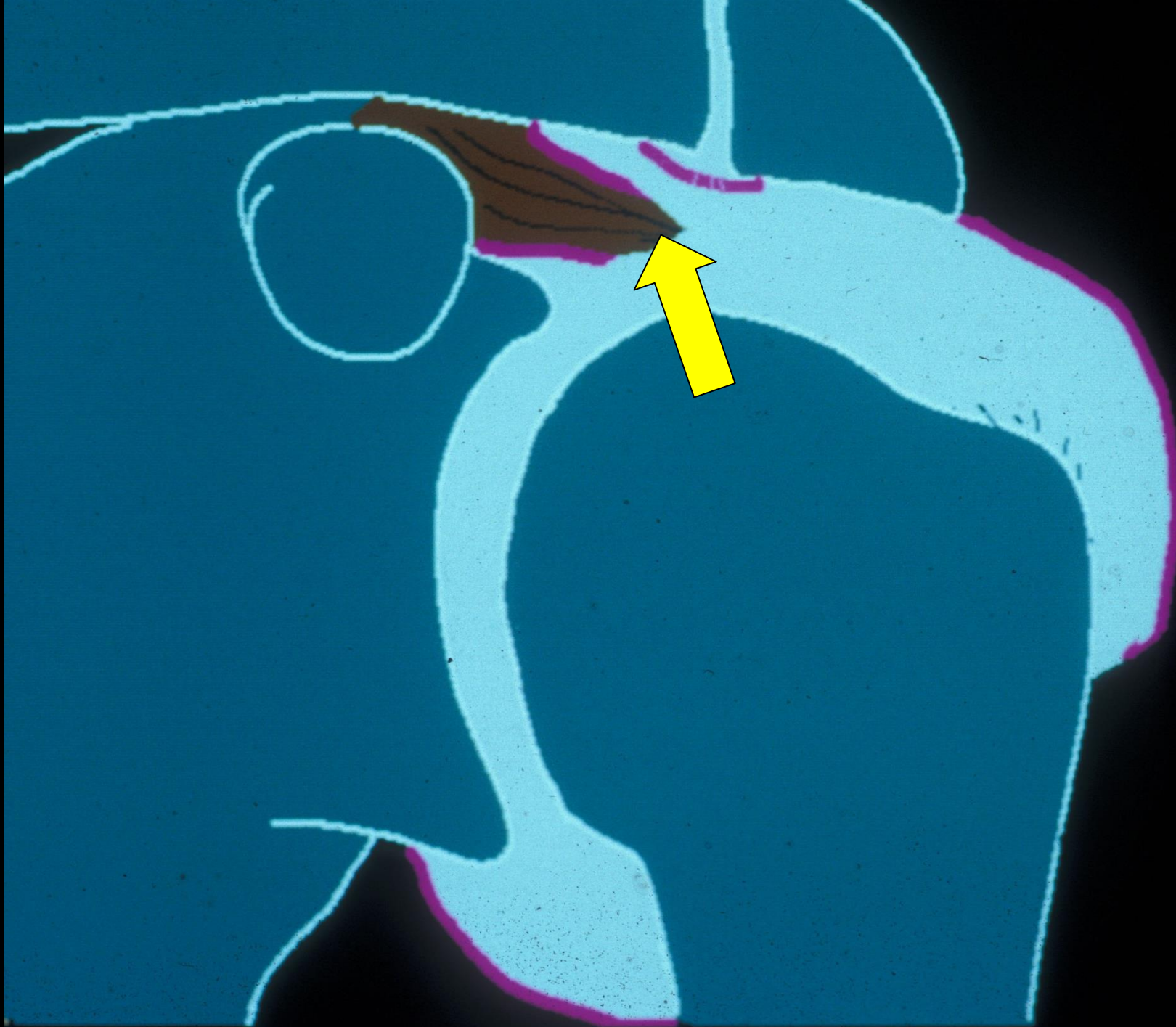






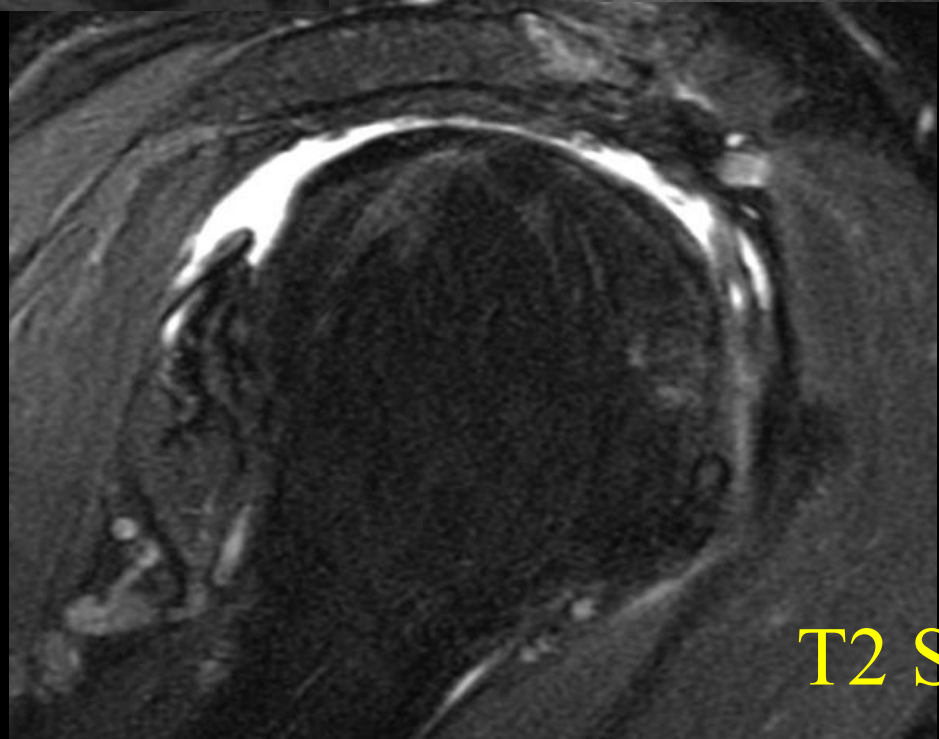
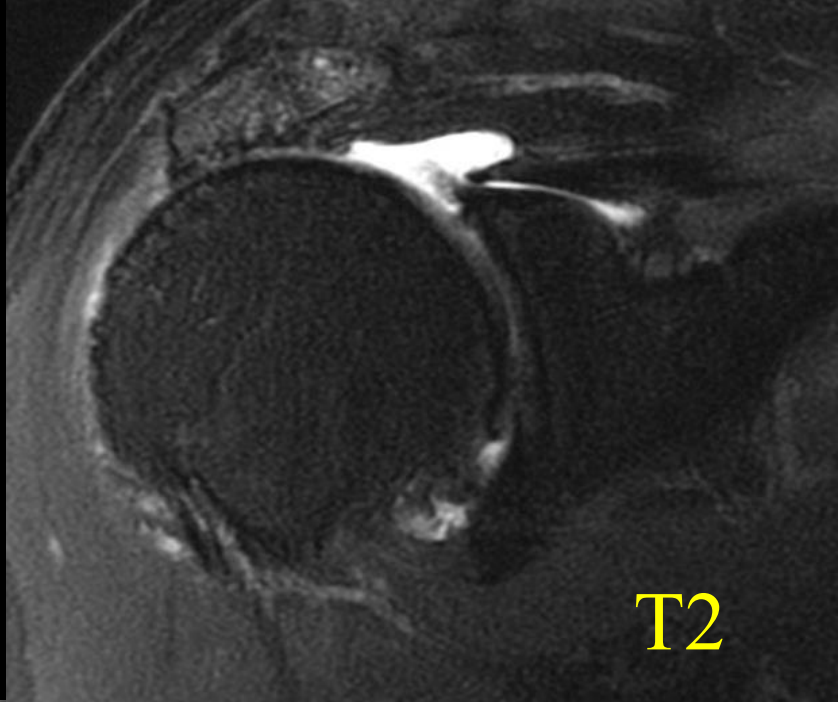
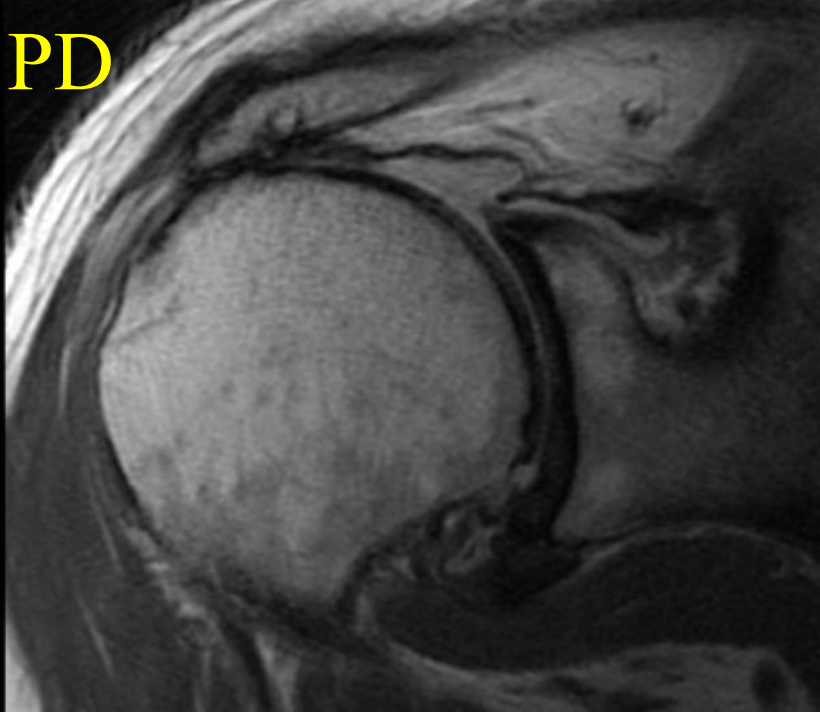






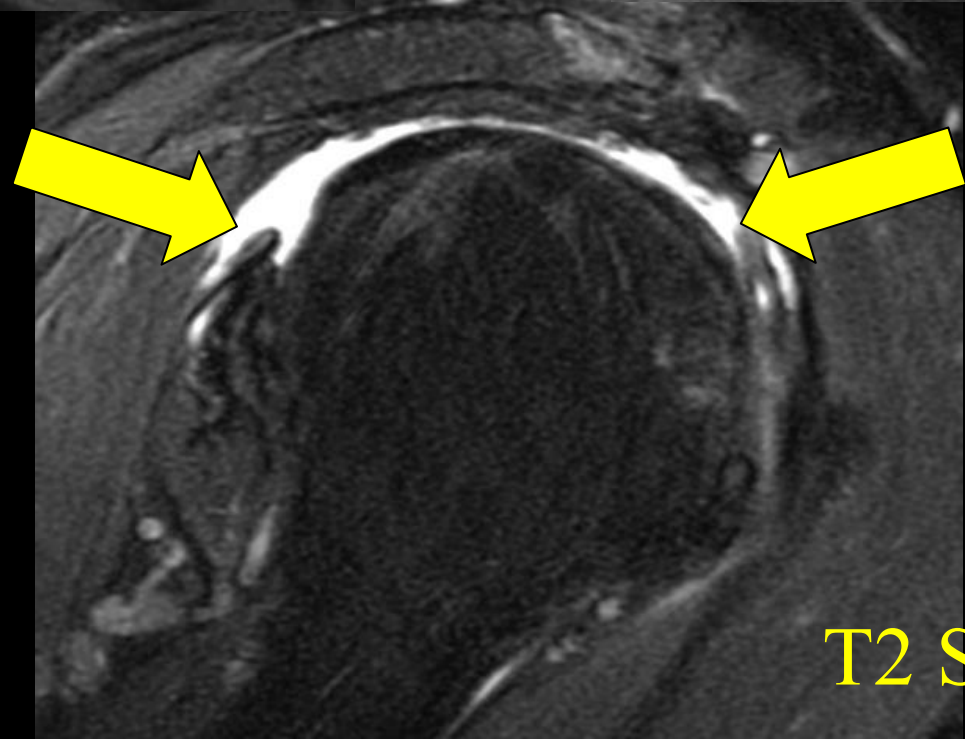
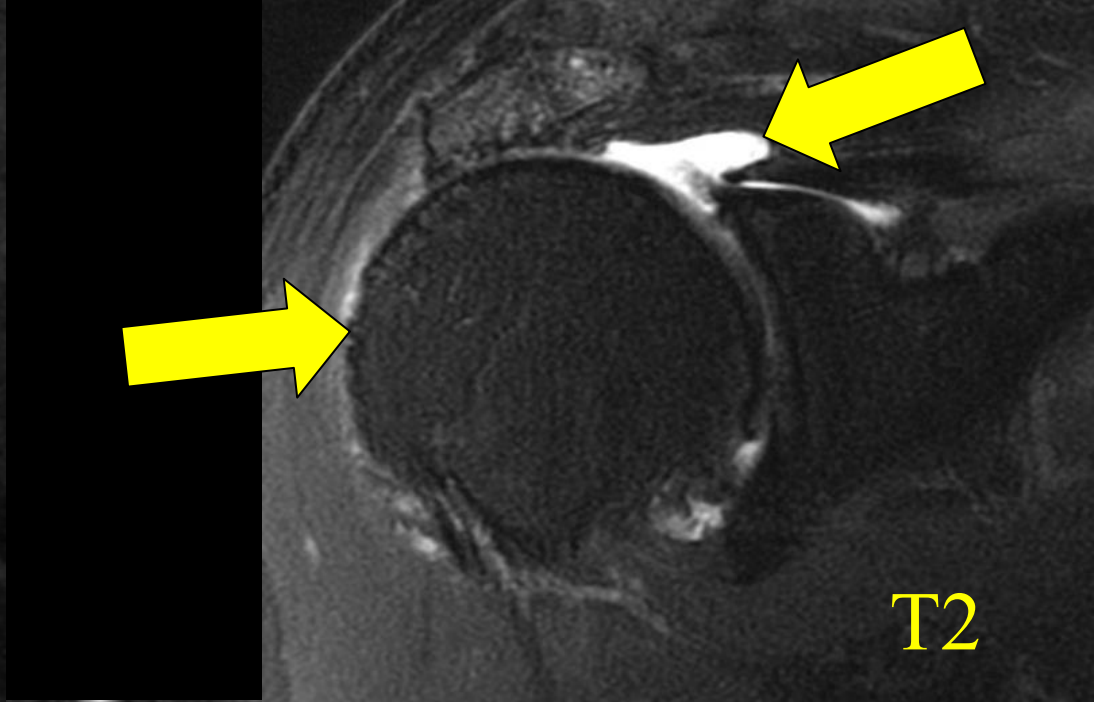
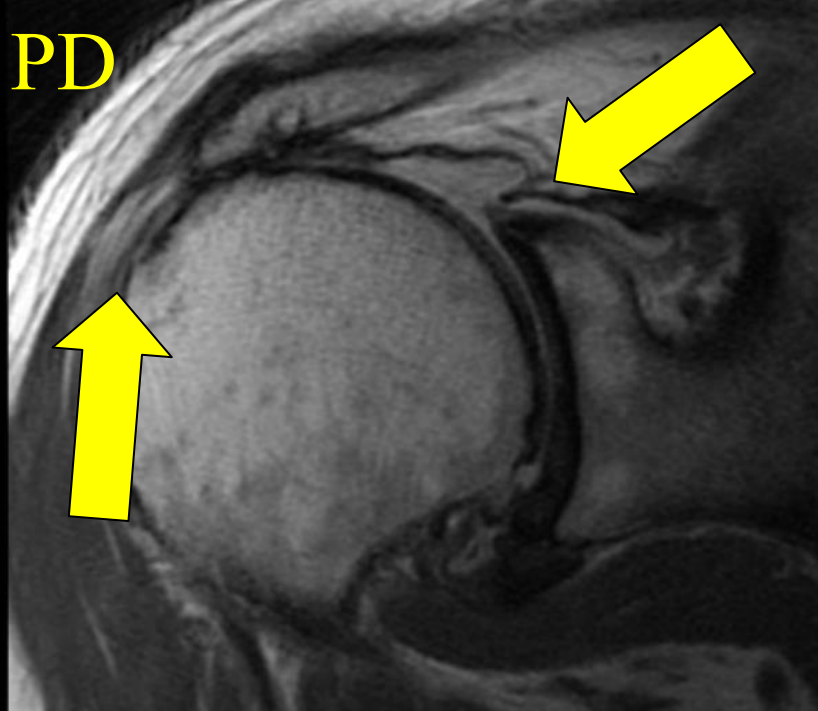


PD



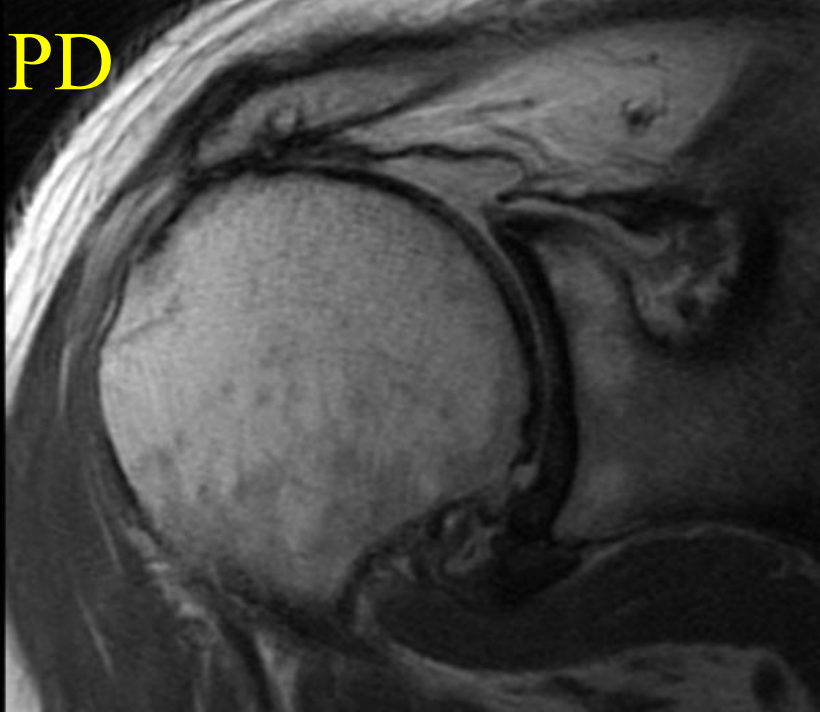
T2 SAG

PD

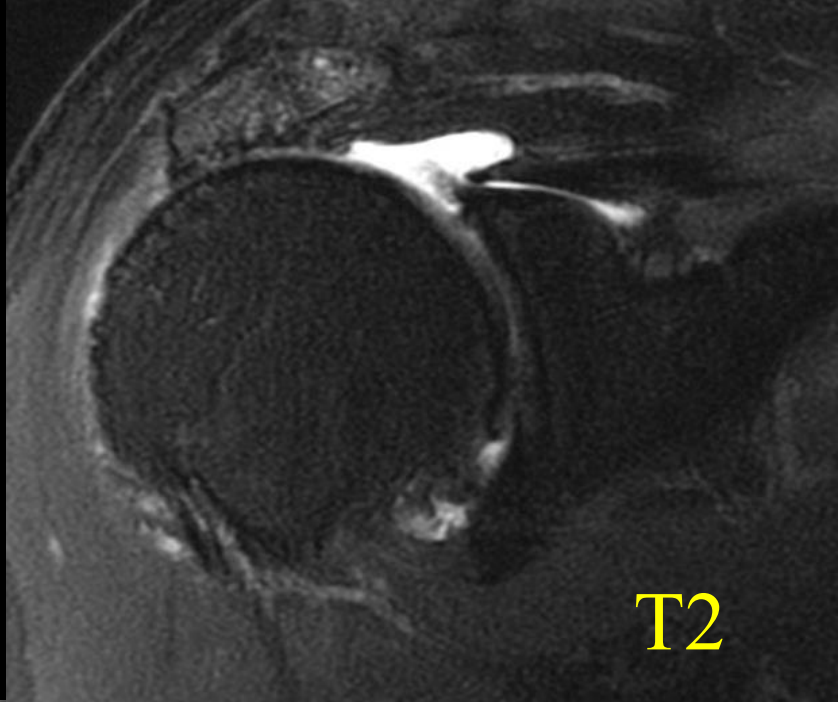


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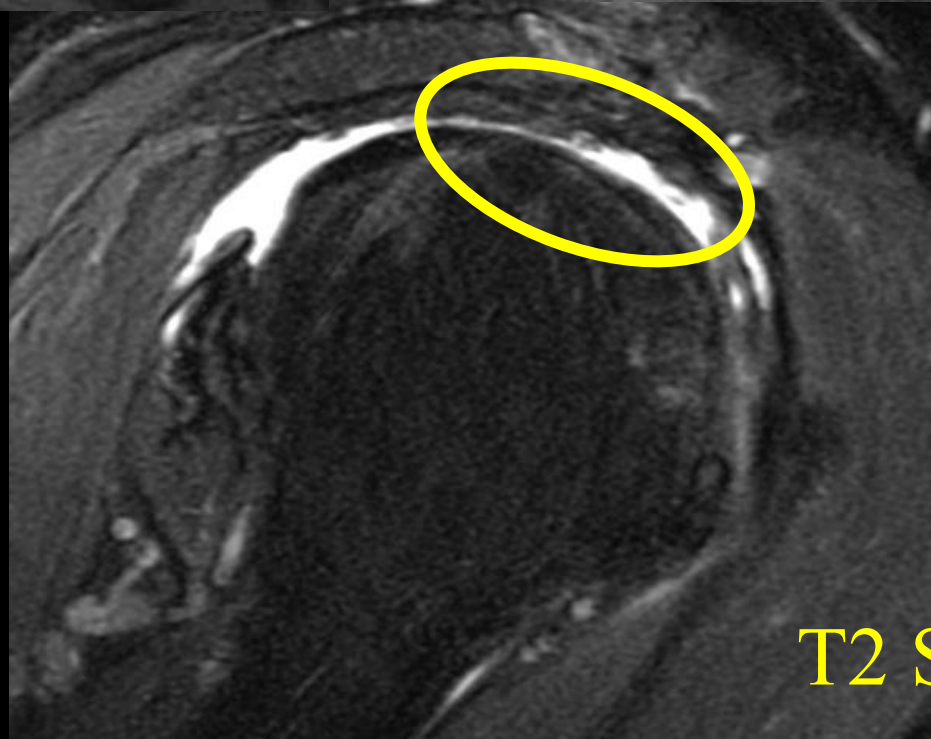
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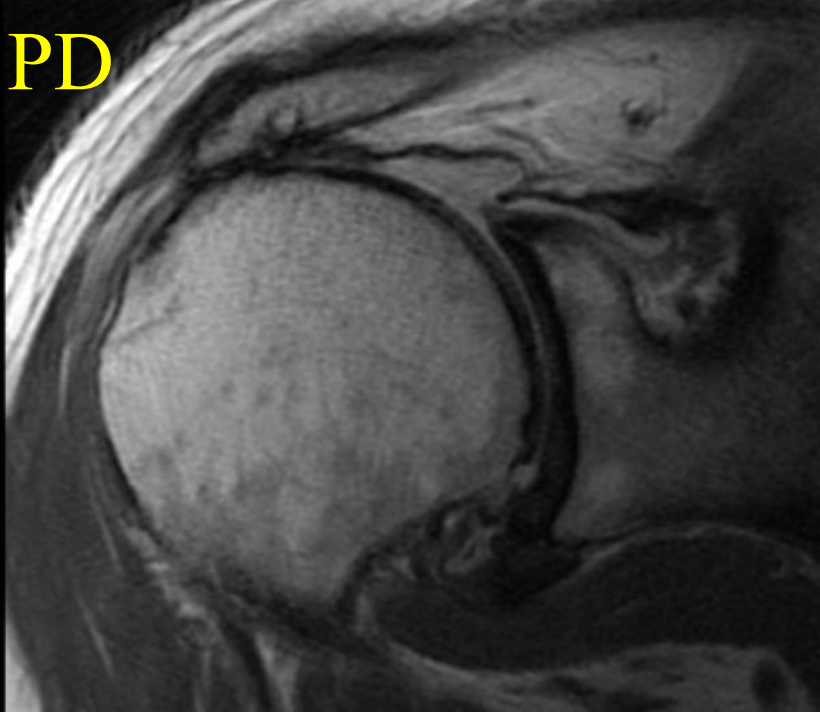


T2 SAG

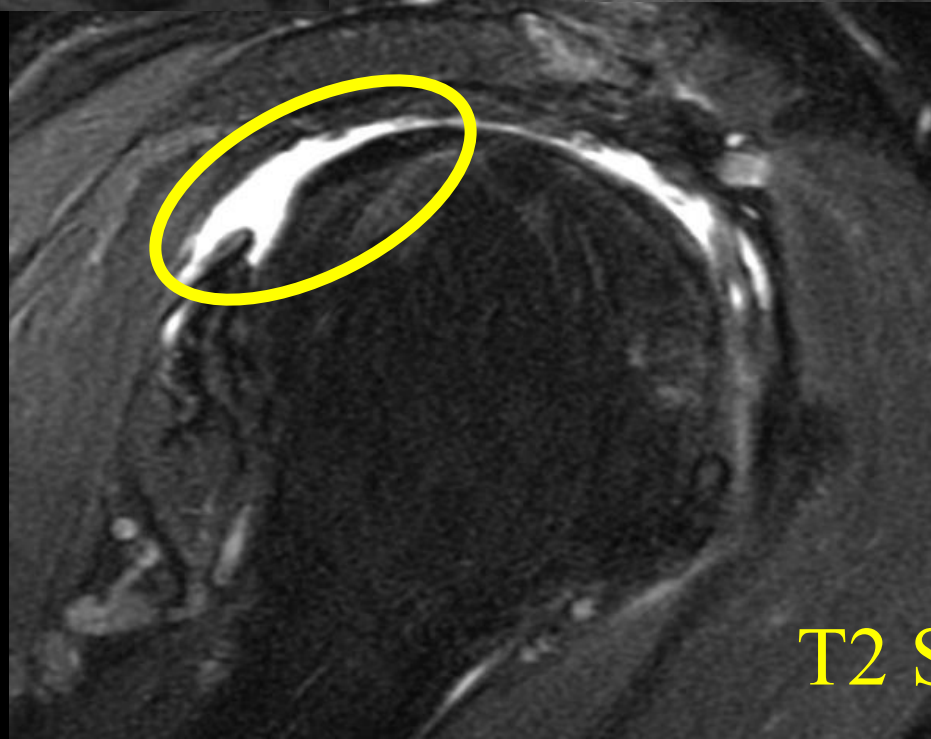
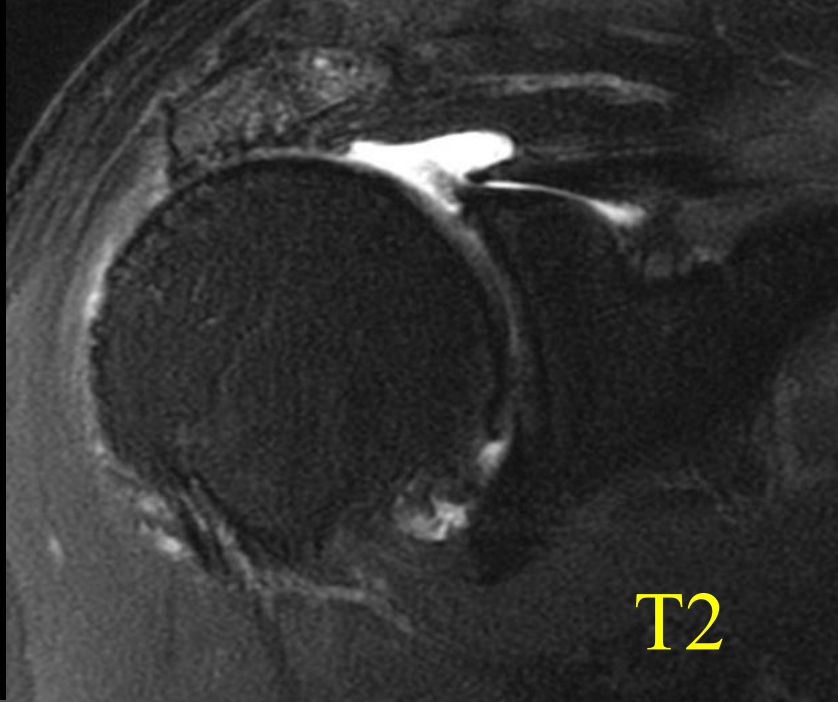




PD



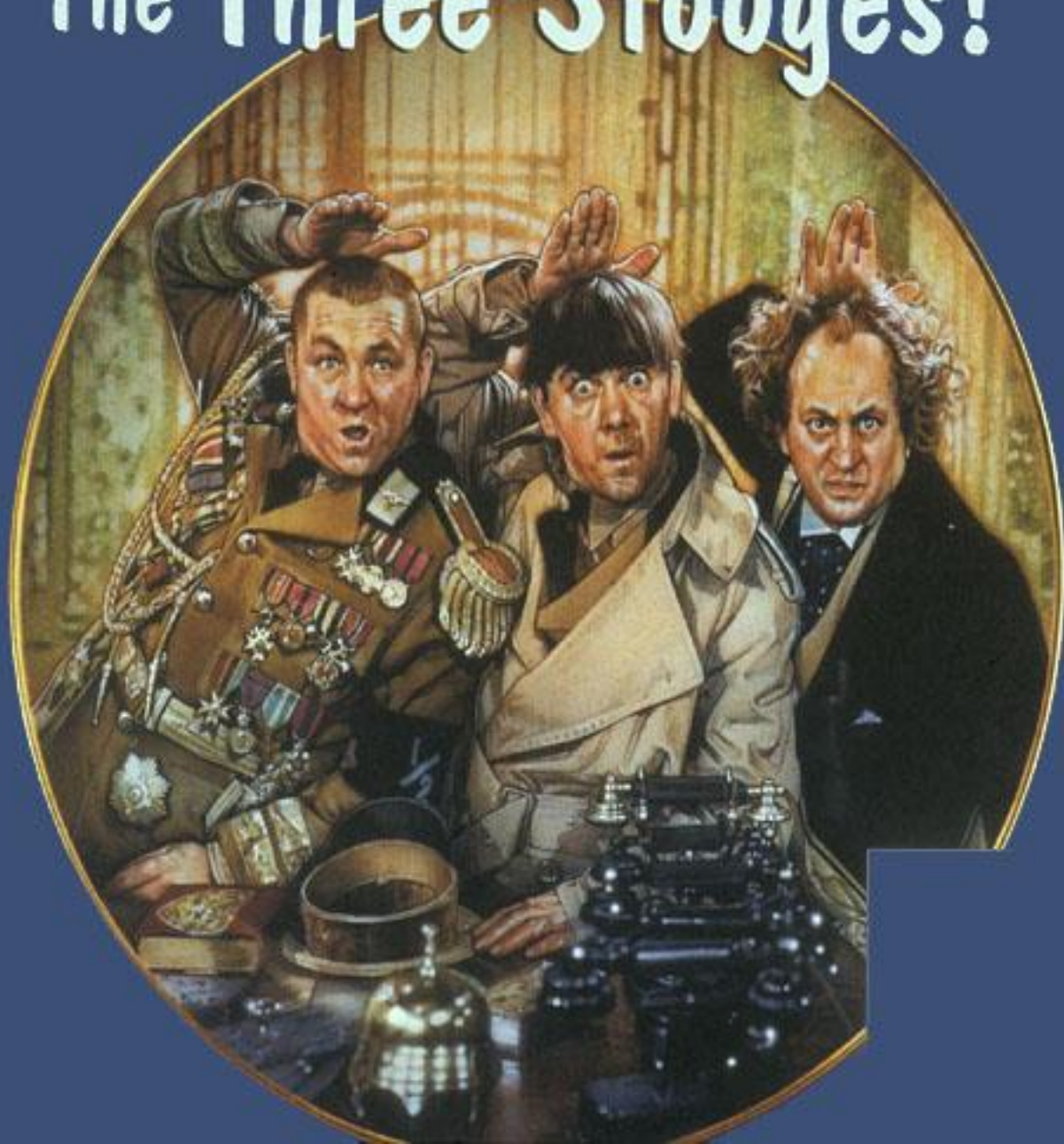
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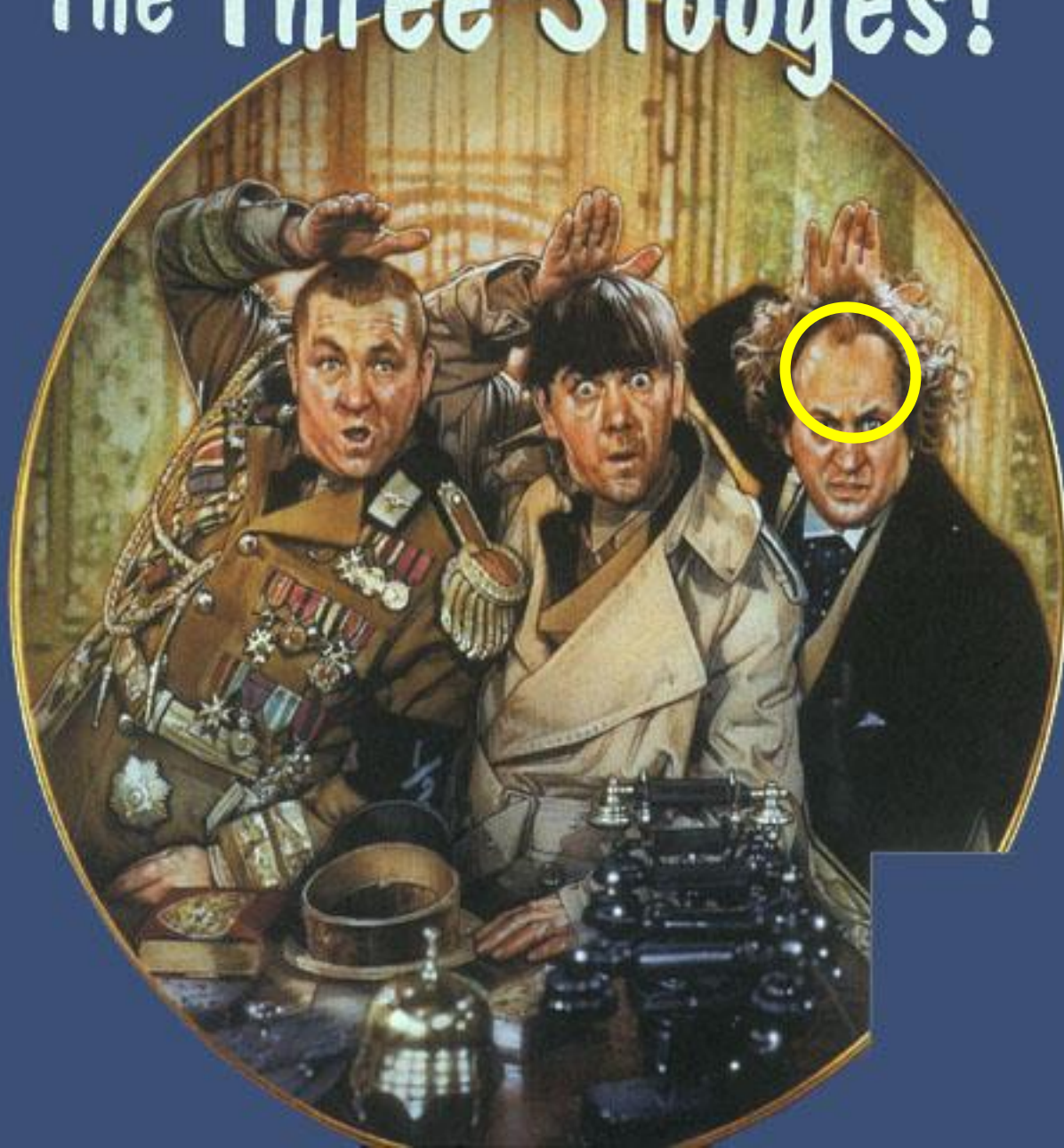
T2 SAG



# The Three Stooges!

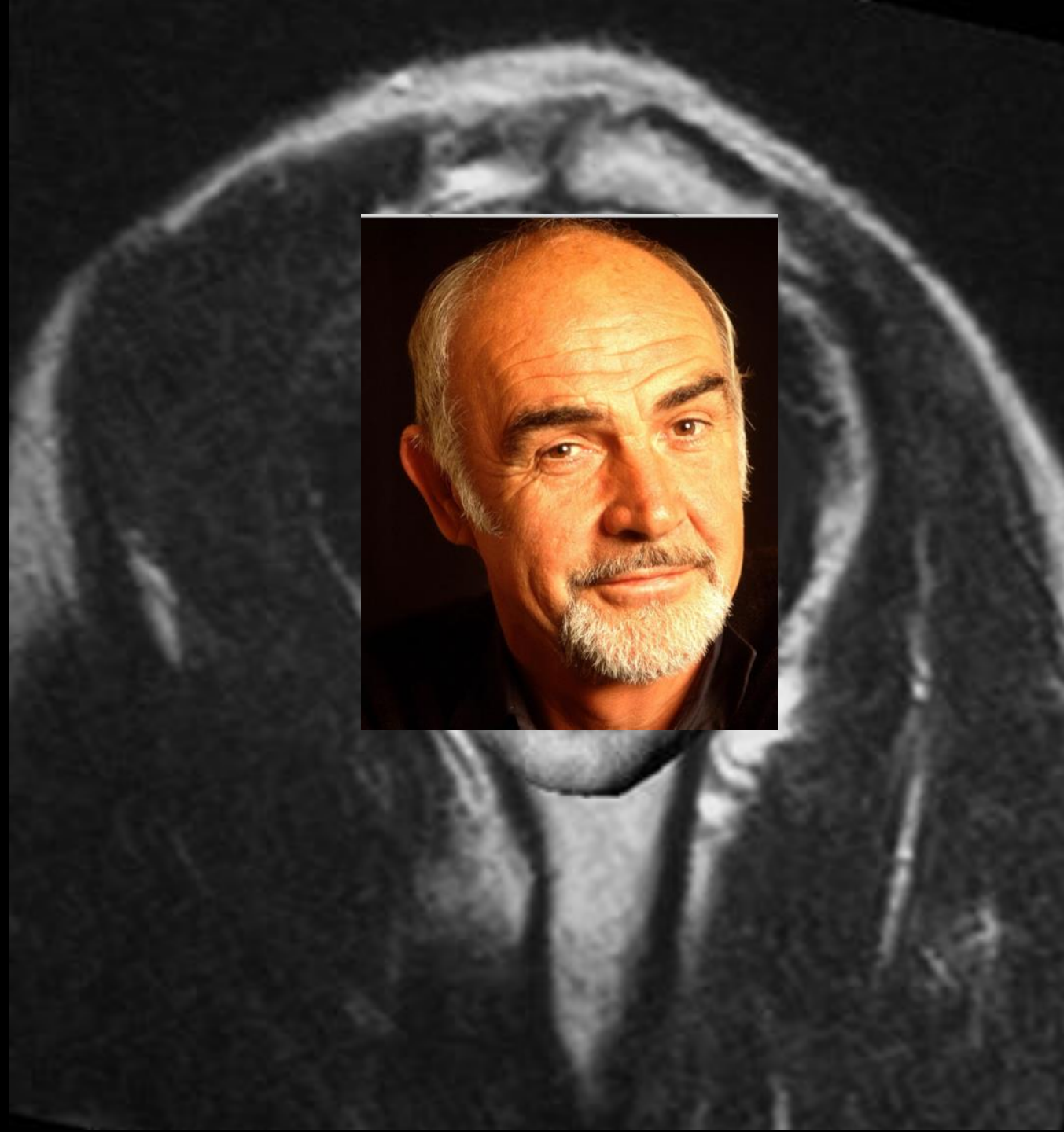


# The Three Stooges!



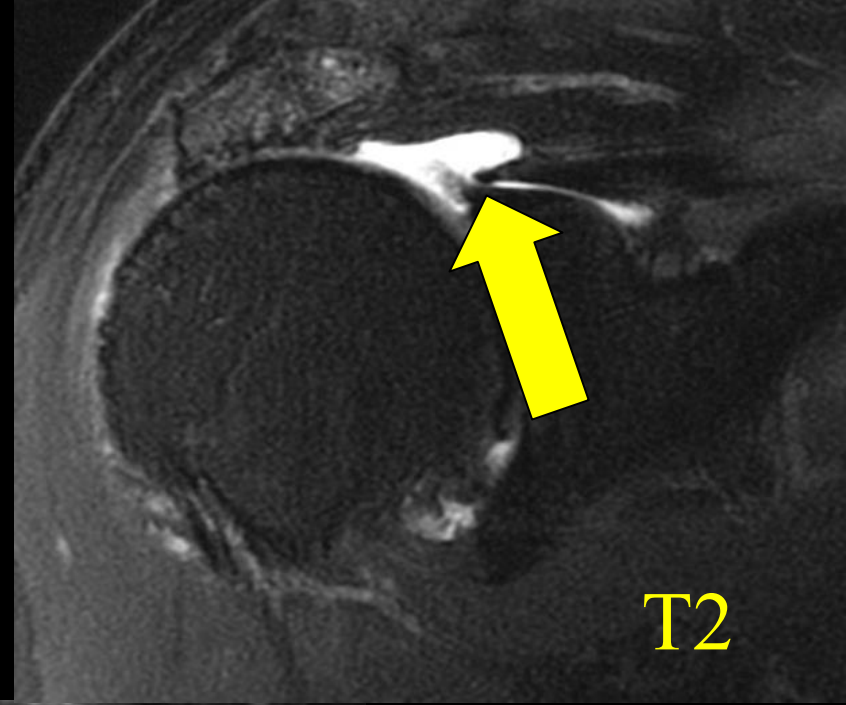
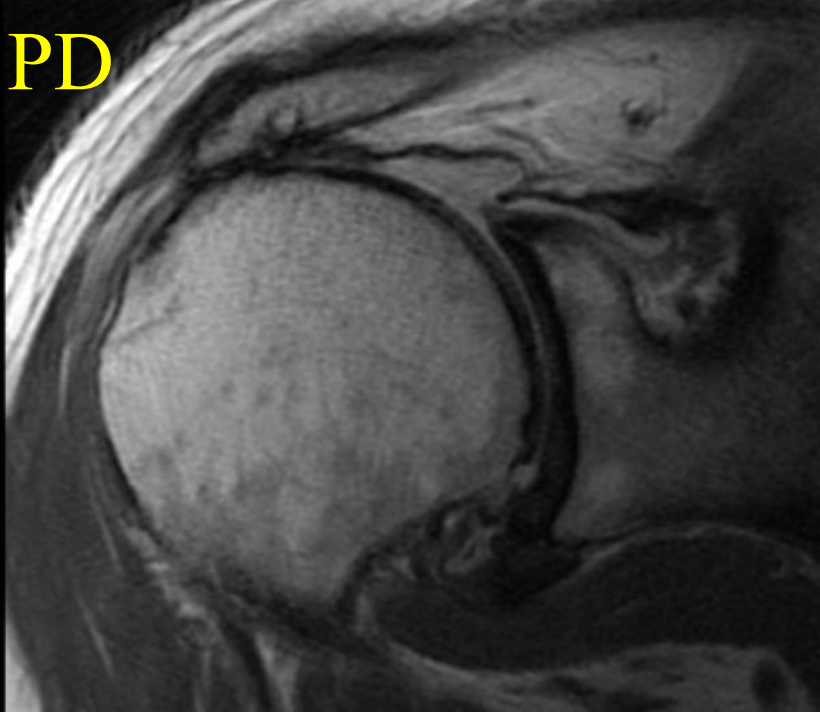




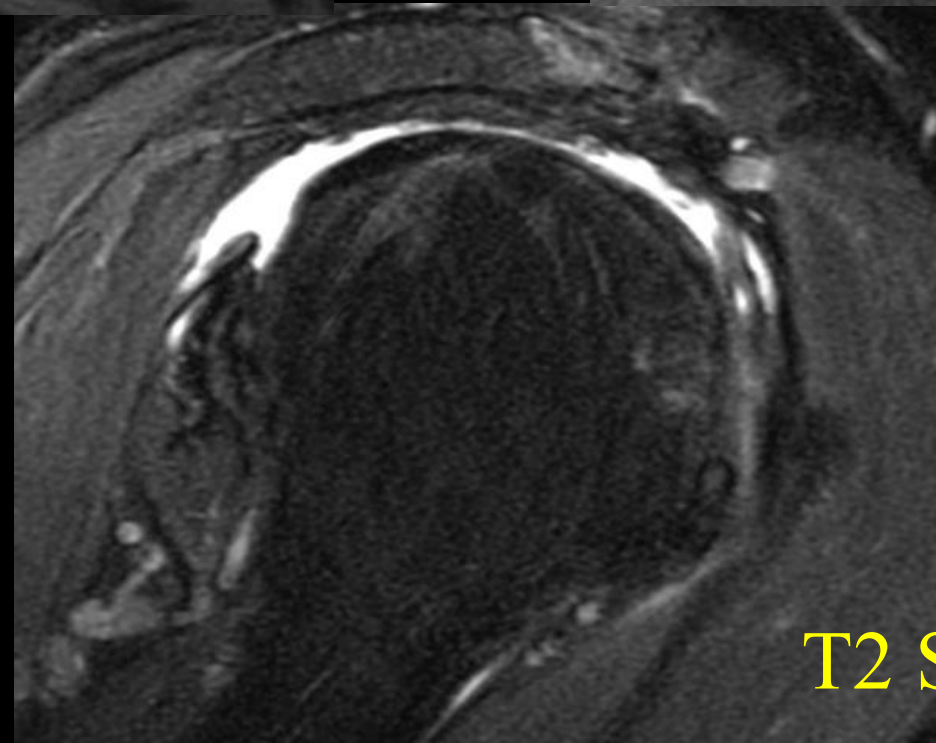




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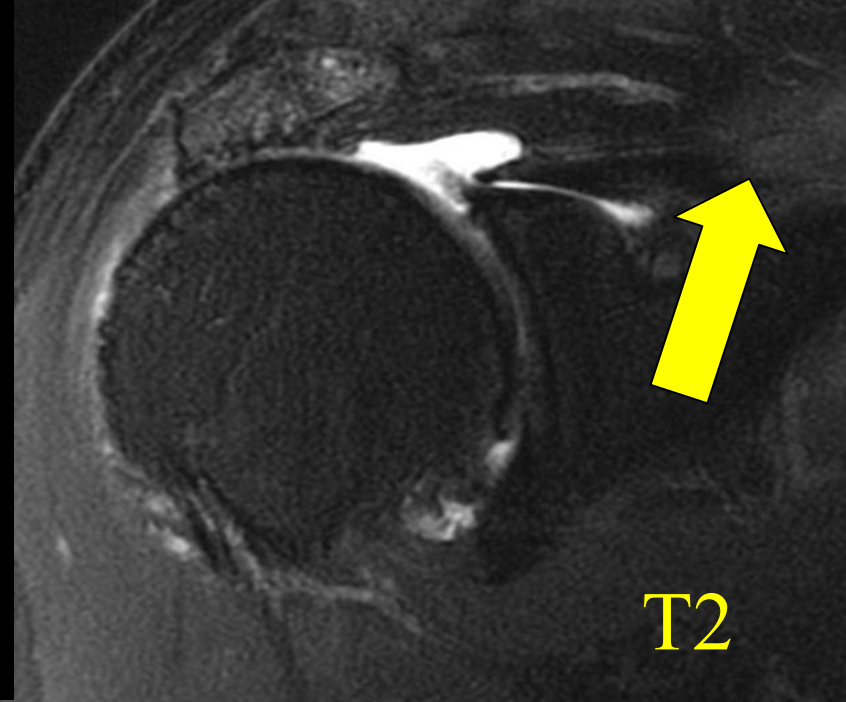
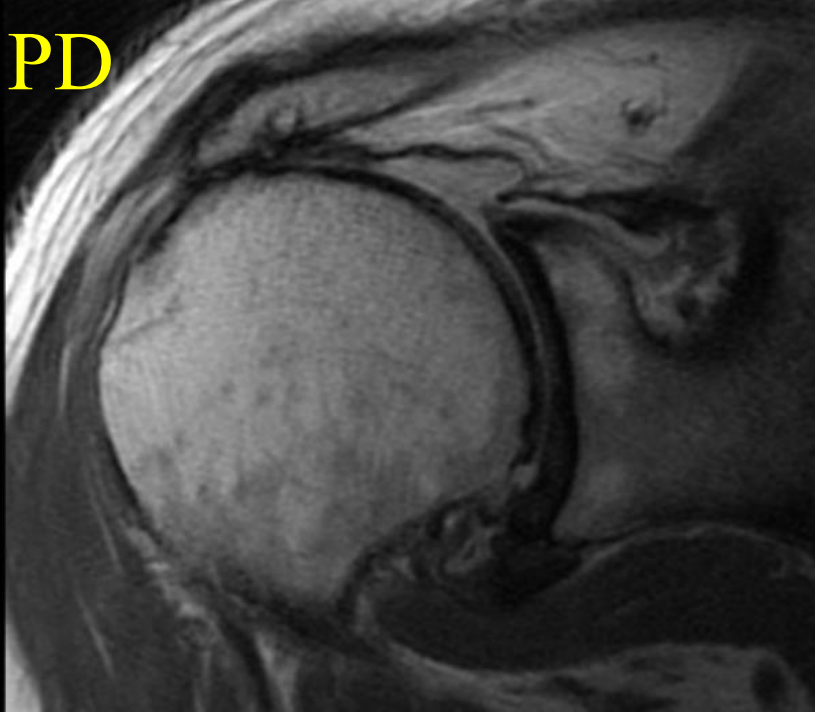


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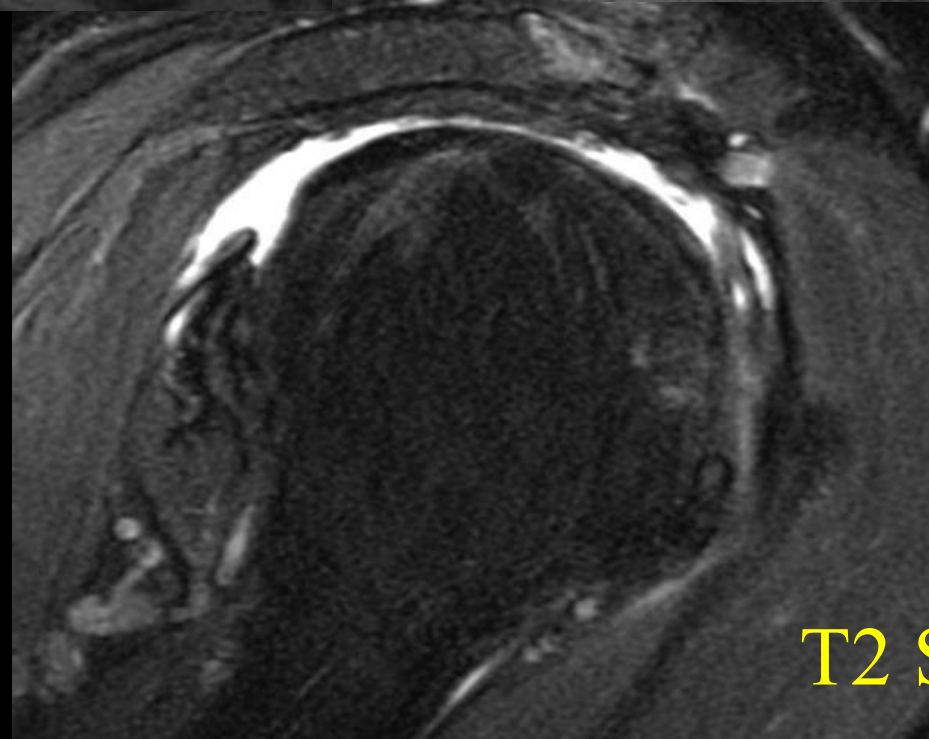


T2 SAG

PD

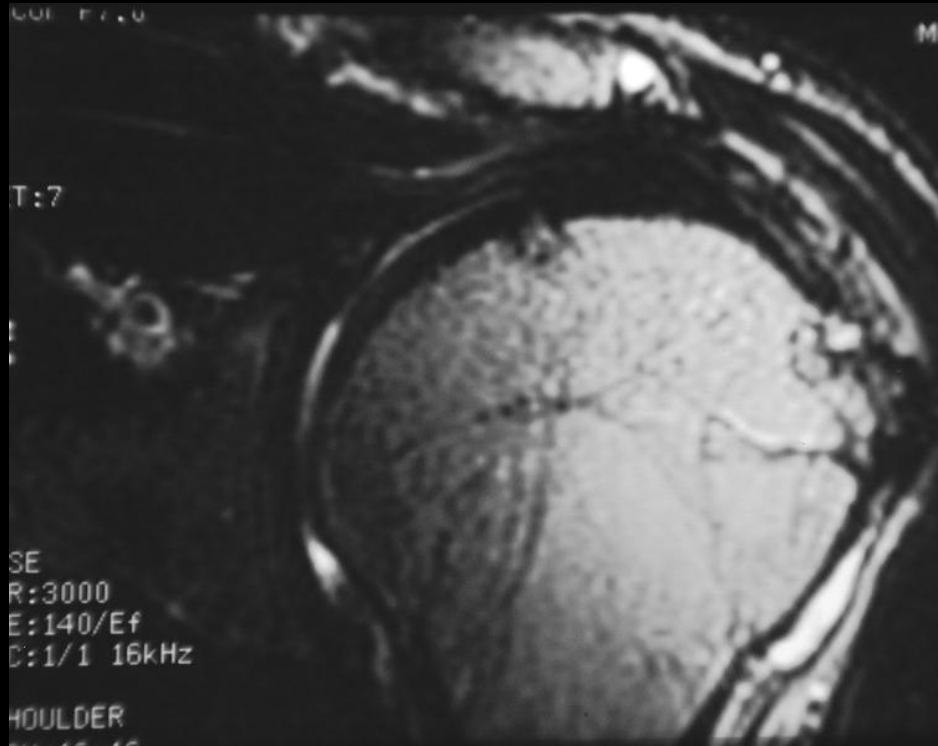


T2

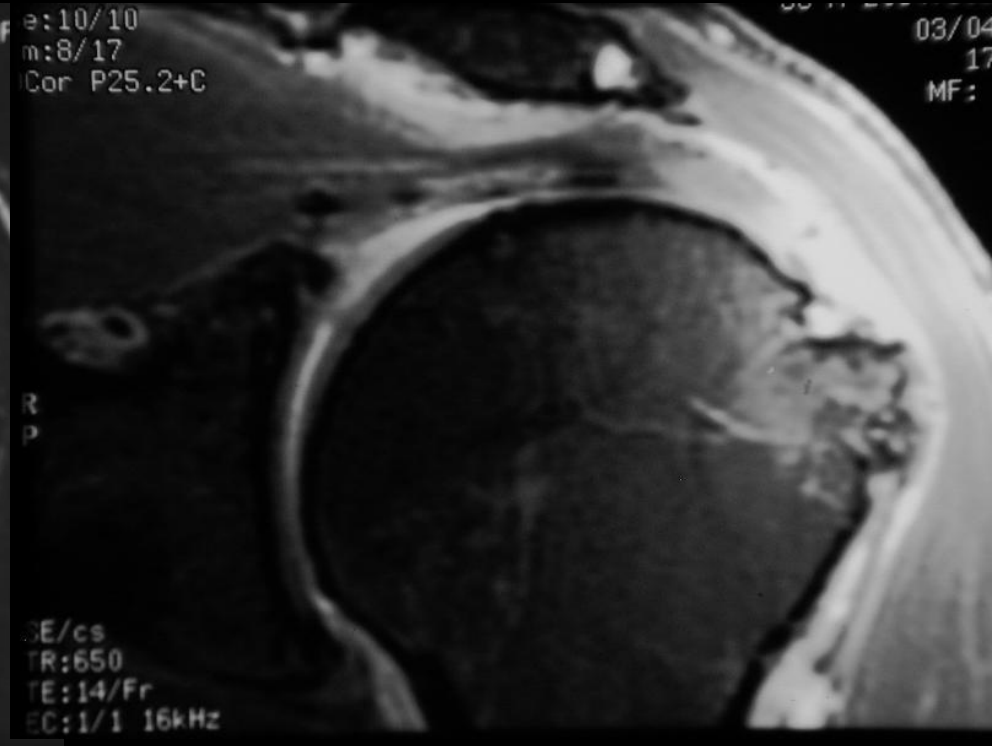


T2 SAG

# Full Thickness Tear



T2



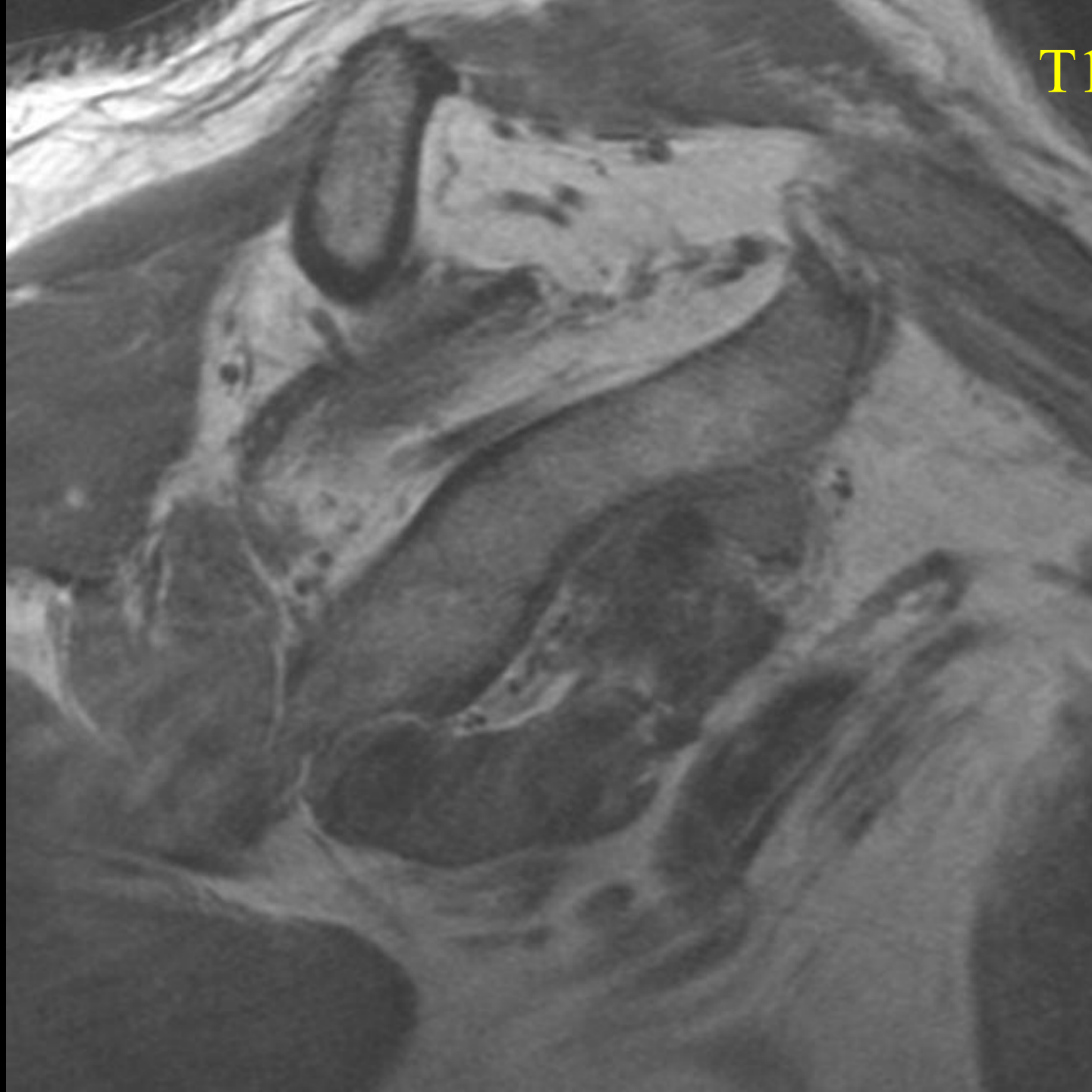
T1 GD

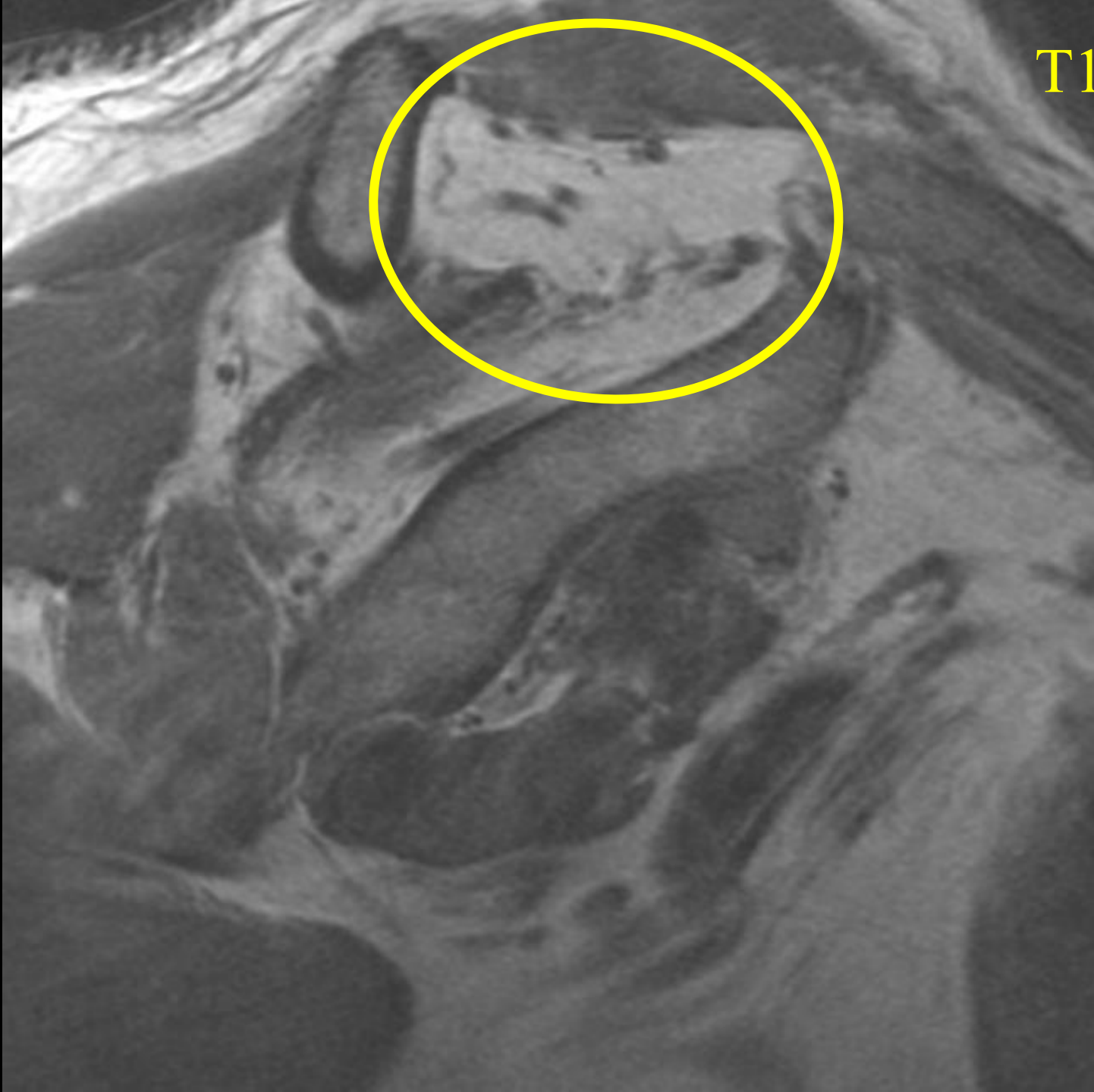
# ROTATOR CUFF TEAR FULL THICKNESS

- Retraction of musculotendinous junction
  - Normal at 12:00
  - Retraction overcalled, in my experience
  - Defines ease of primary repair
- Muscle atrophy
  - Goutallier scale (muscle vs. fat content)
  - Volume (fill > 50%/60% supraspinatus fossa)
  - Intrinsic fat content



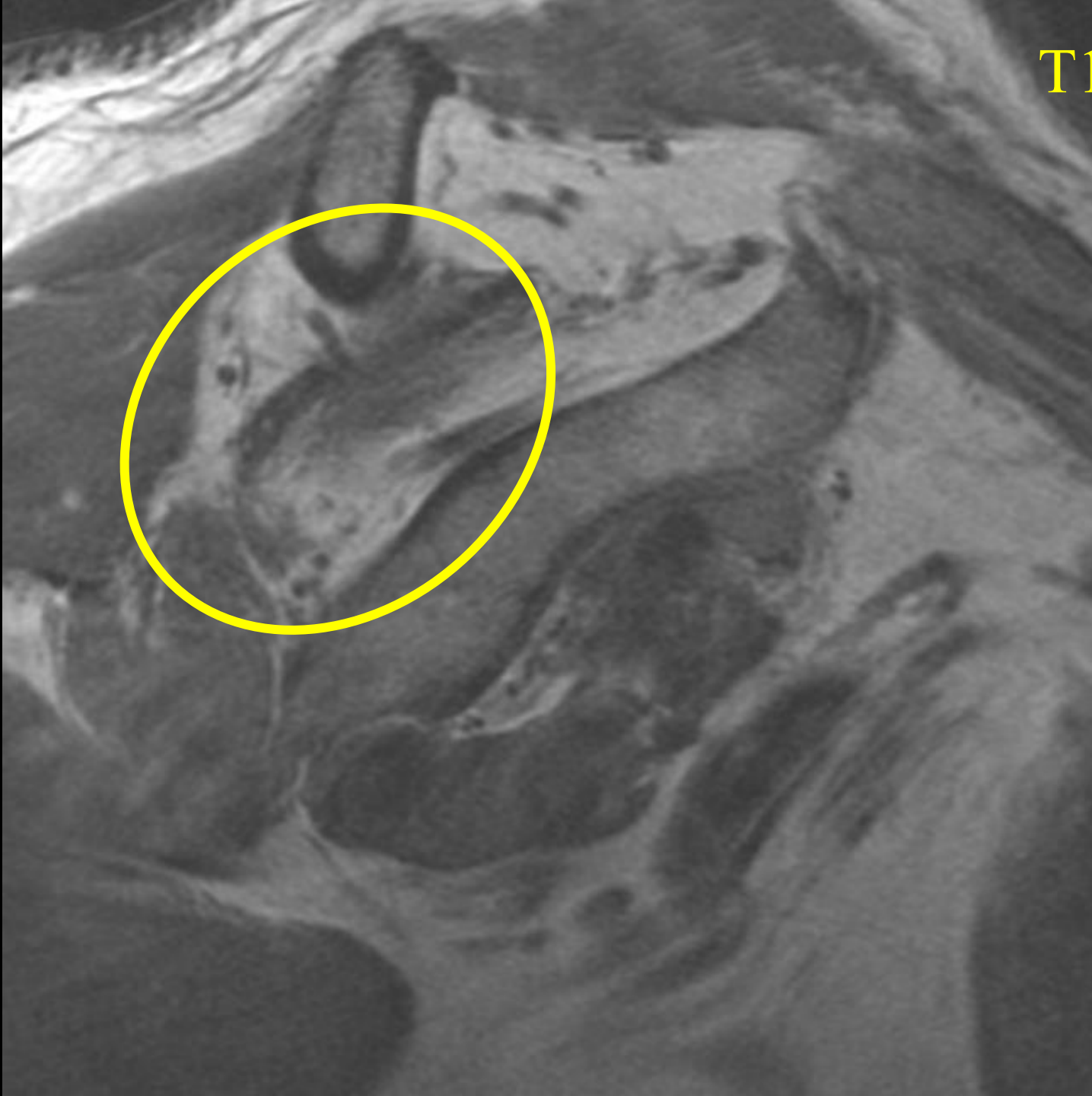
T1 SAG





T1 SAG

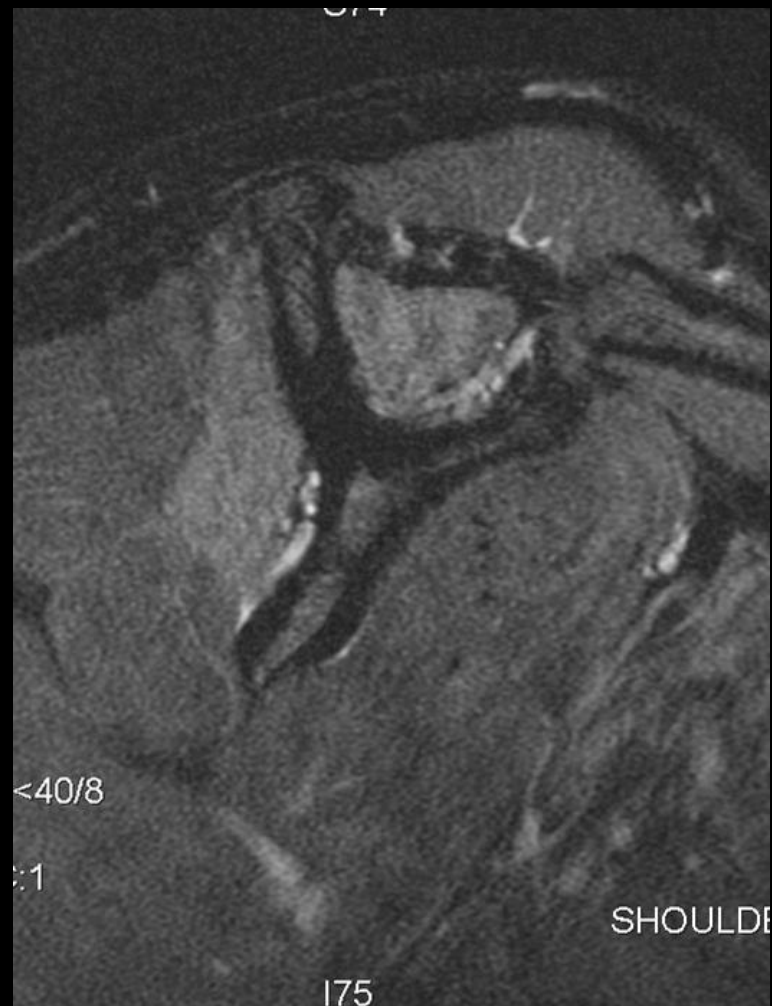
T1 SAG



# ACUTE BRACHIAL NEURITIS PARSONAGE TURNER SYNDROME



T1



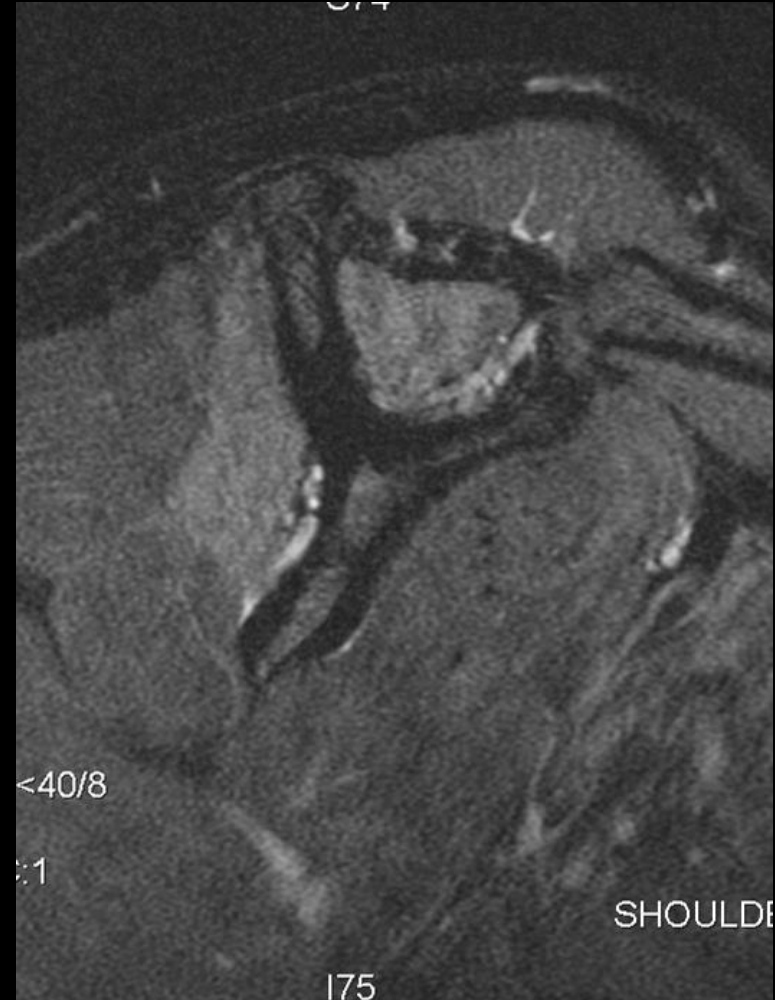
T2



# ACUTE BRACHIAL NEURITIS PARSONAGE TURNER SYNDROME



T1

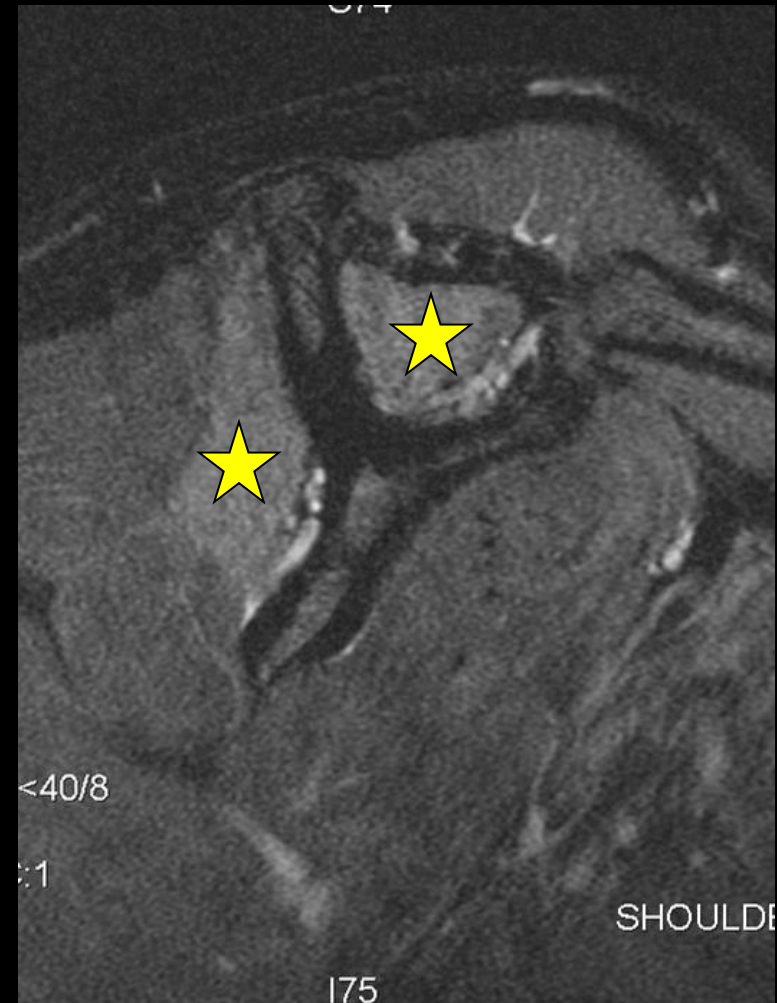


T2

# ACUTE BRACHIAL NEURITIS PARSONAGE TURNER SYNDROME



T1

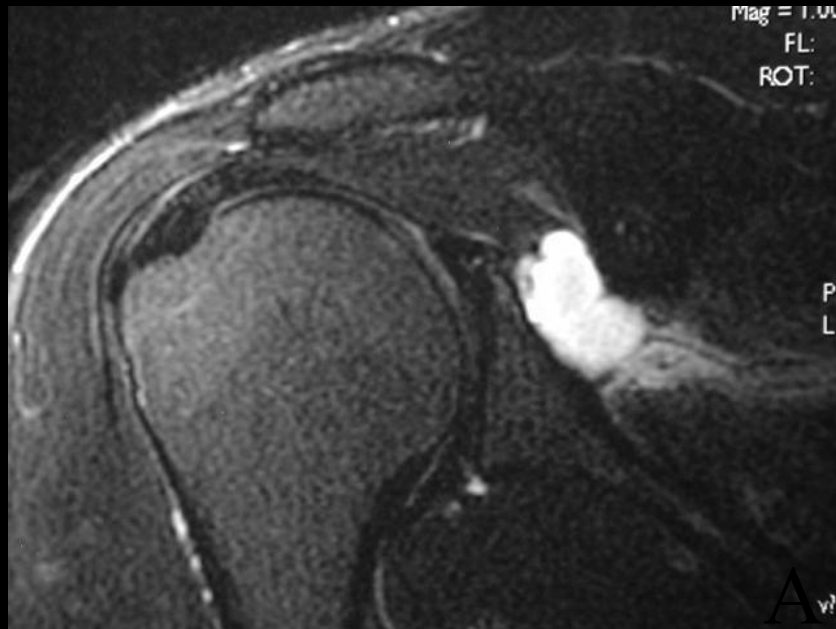


T2

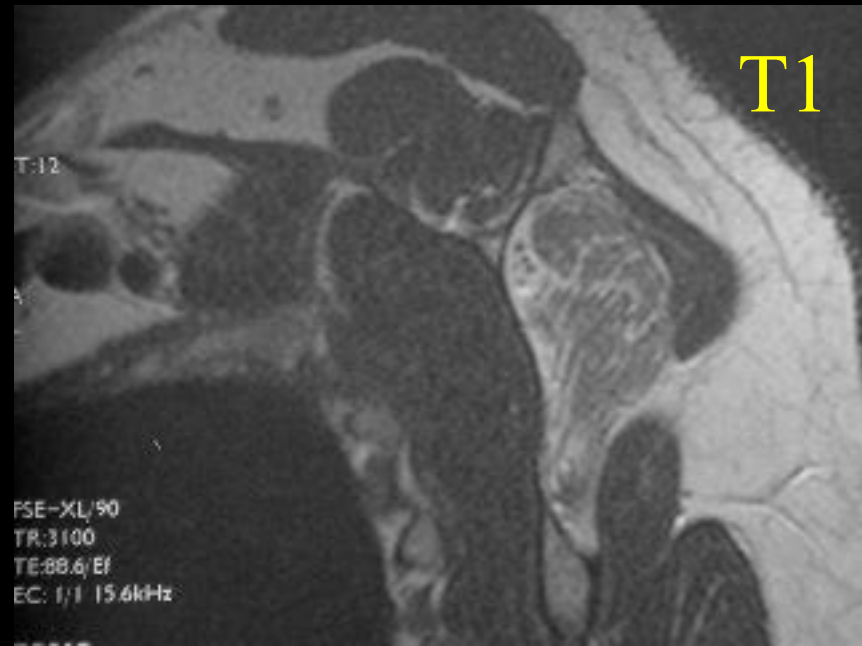
# SUPRASCAPULAR NERVE IMPINGEMENT

- Suprascapular Notch
  - Suprascapular/ Infraspinatus innervation
- Spinoglenoid Notch
  - Infraspinatus innervation
- Atrophy of SSM and ISM
- Look for mass in region of suprascapular notch

# Spinoglenoid Notch Entrapment



T2



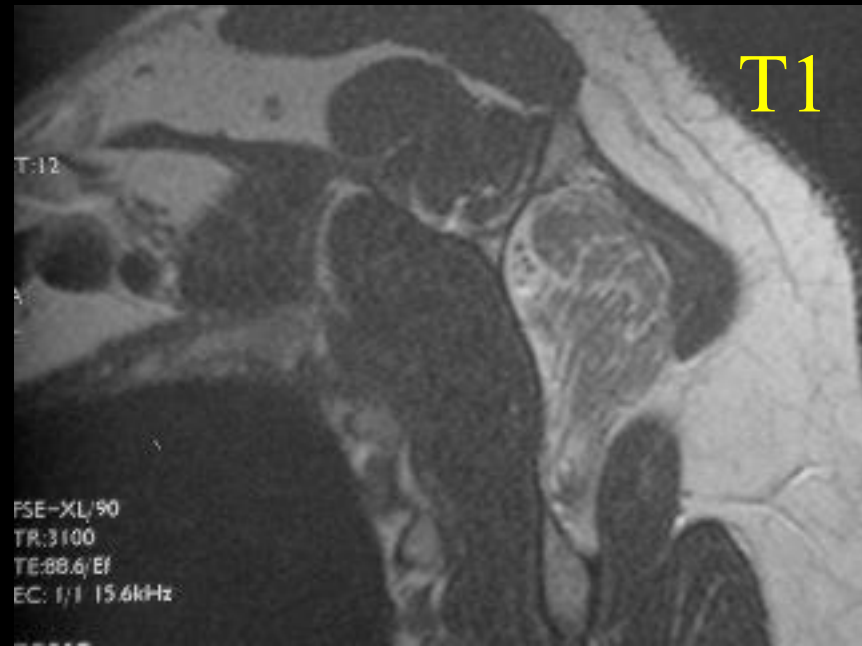
Infraspinatus atrophy



# Spinoglenoid Notch Entrapment

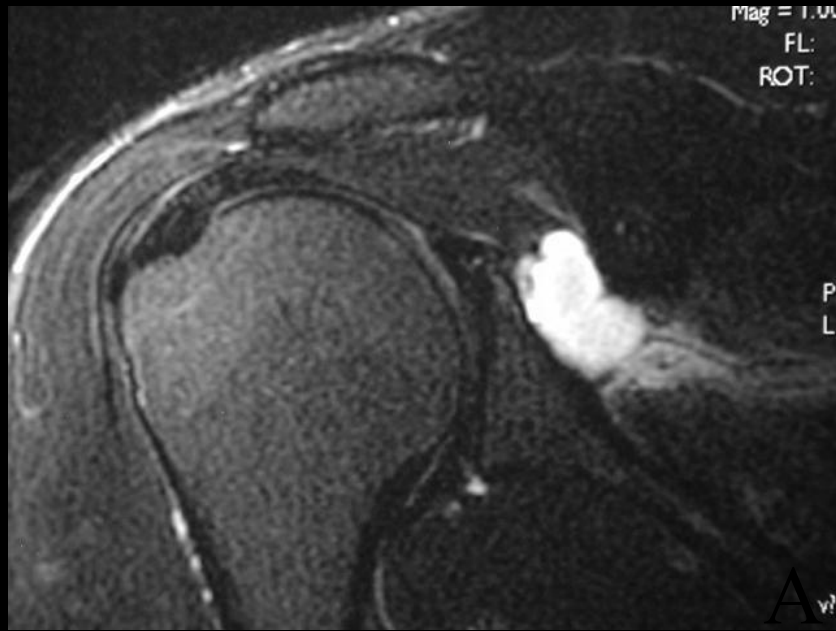


T2



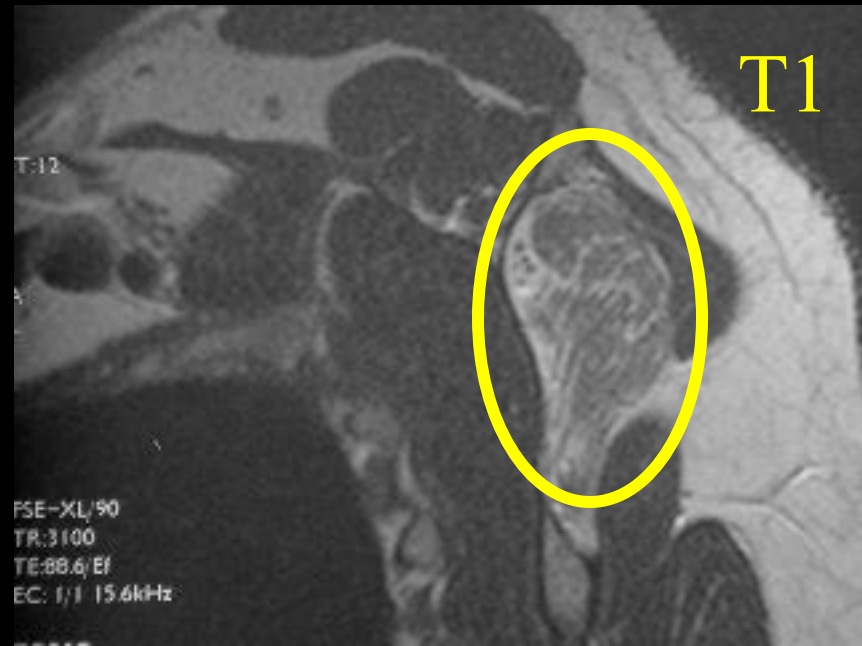
Infraspinatus atrophy

# Spinoglenoid Notch Entrapment



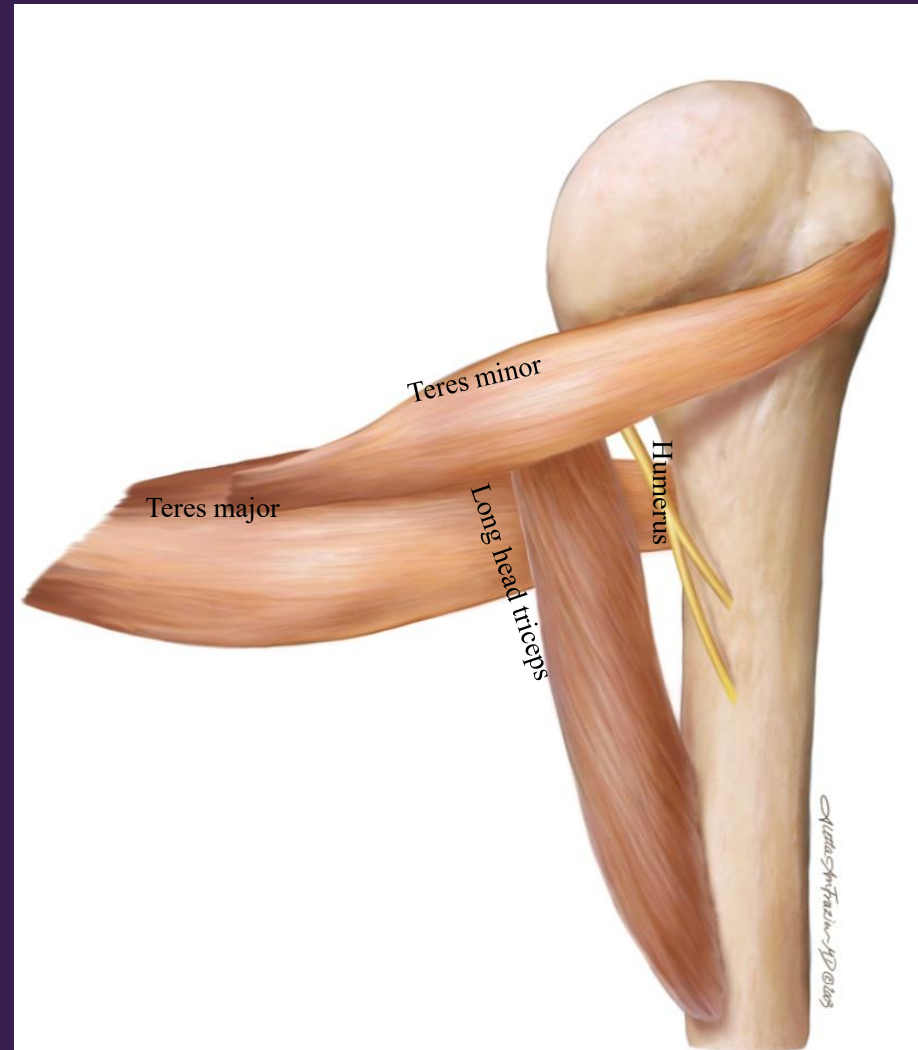
T2

Infraspinatus atrophy



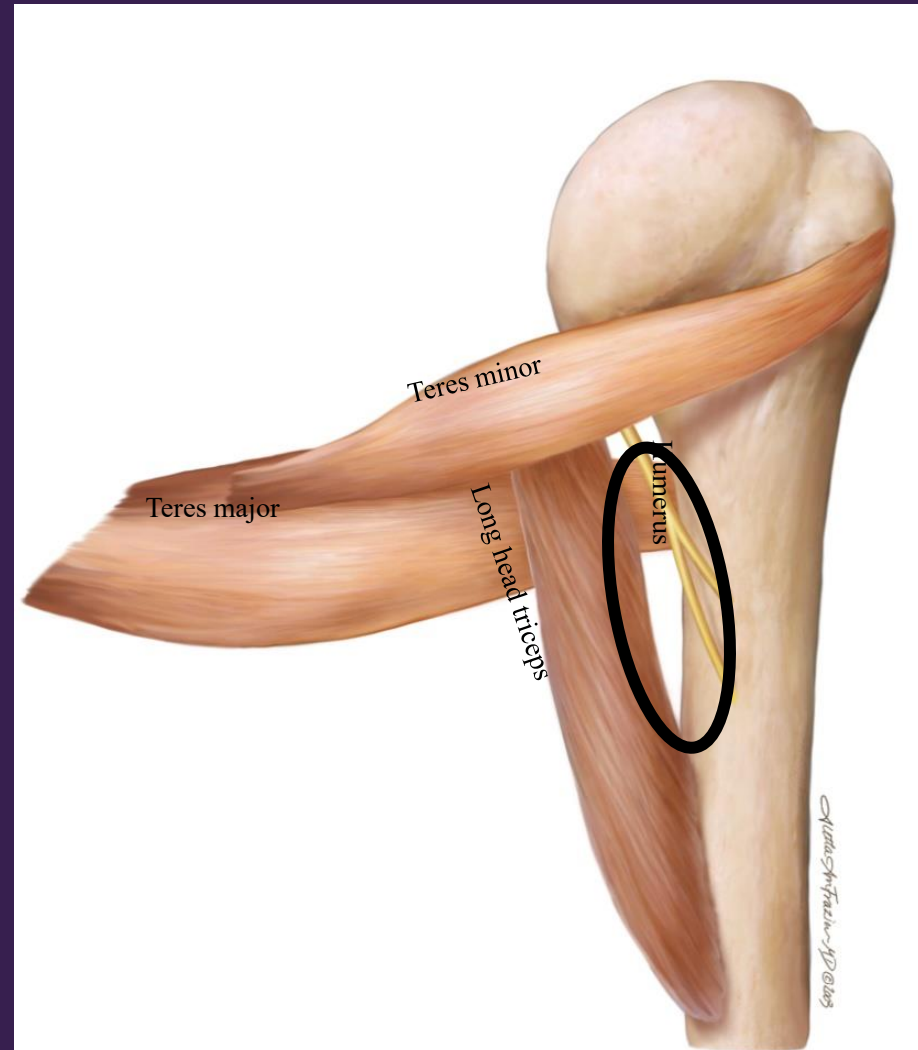
# QUADRILATERAL SPACE SYNDROME

- Axillary nerve compression
- Fibrous band
- Pain, paresthesia
- Atrophy of deltoid and teres minor
- Weightlifters



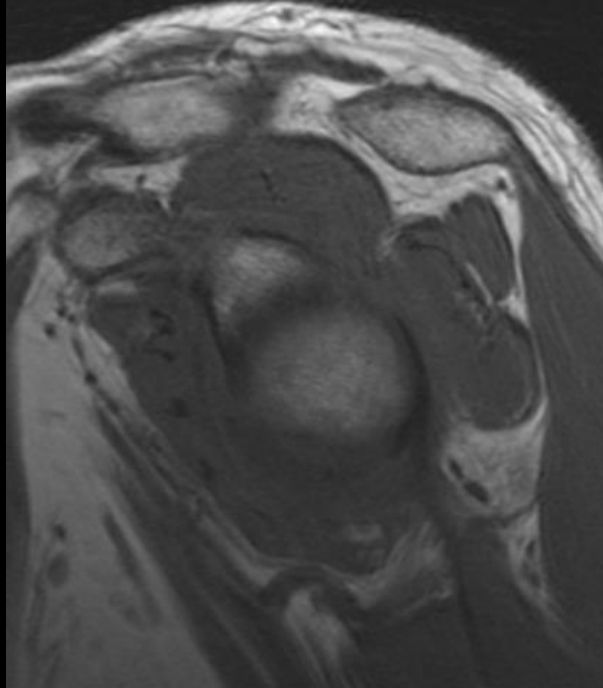
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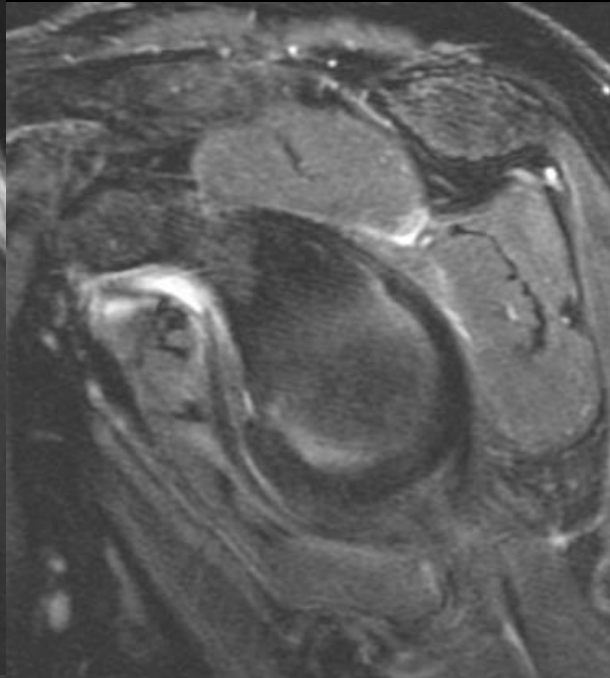




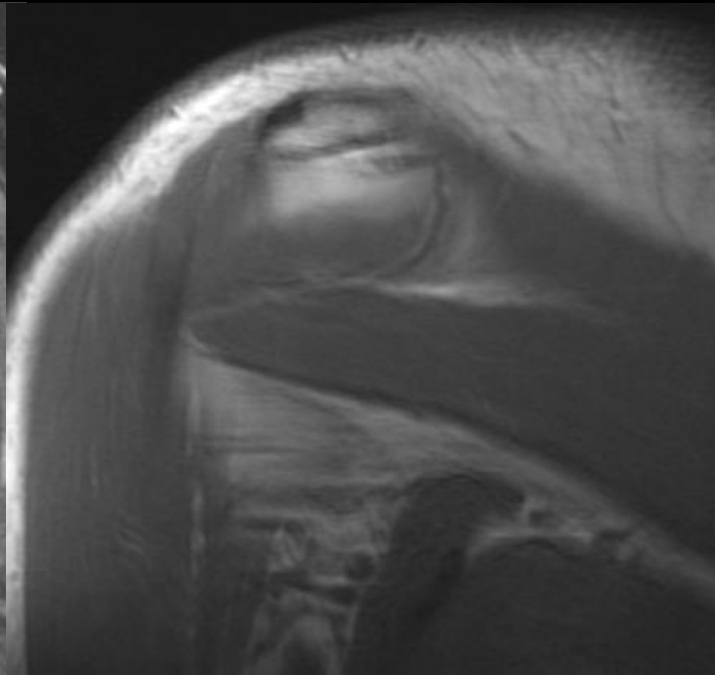
# ISOLATED TERES MINOR ATROPHY



T1

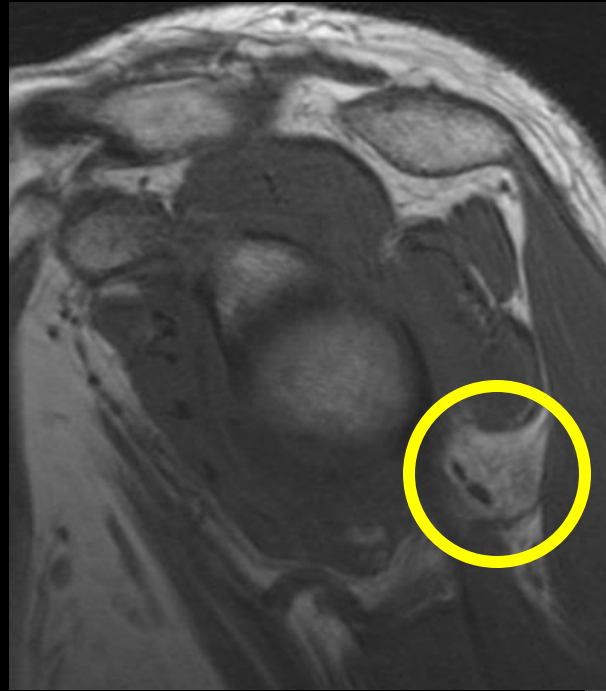


T2

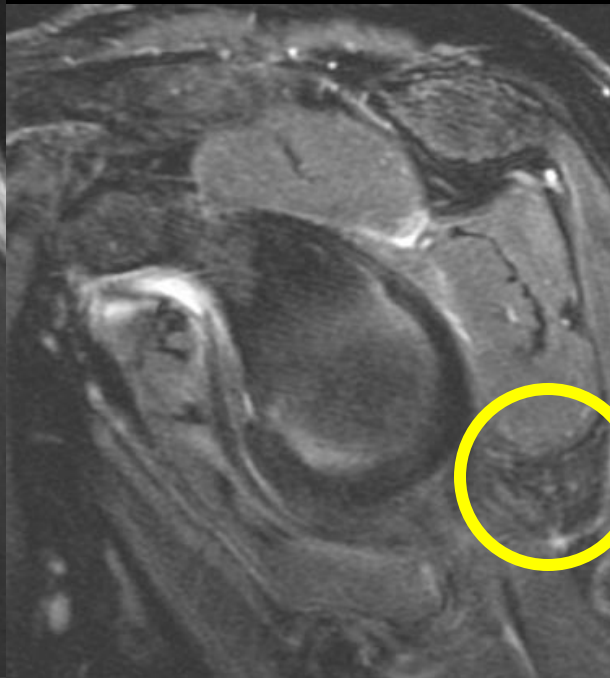


T1

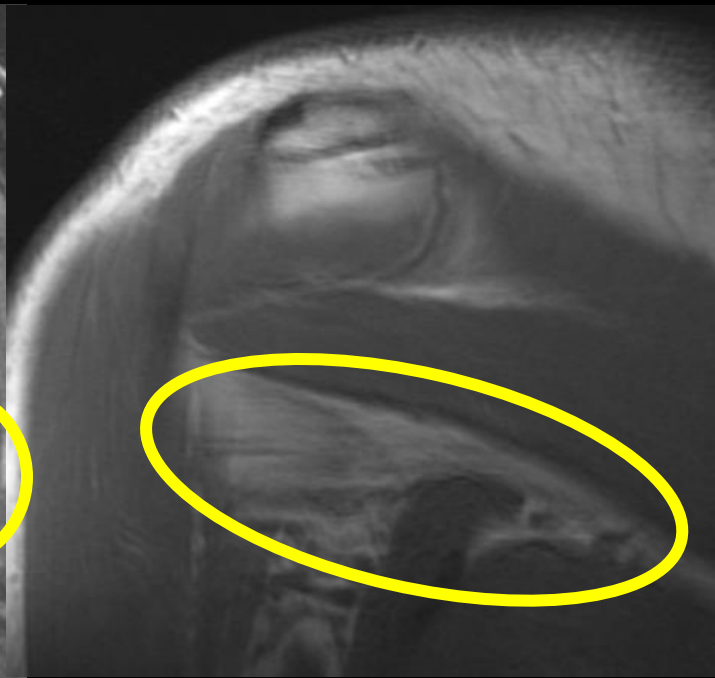
# ISOLATED TERES MINOR ATROPHY



T1

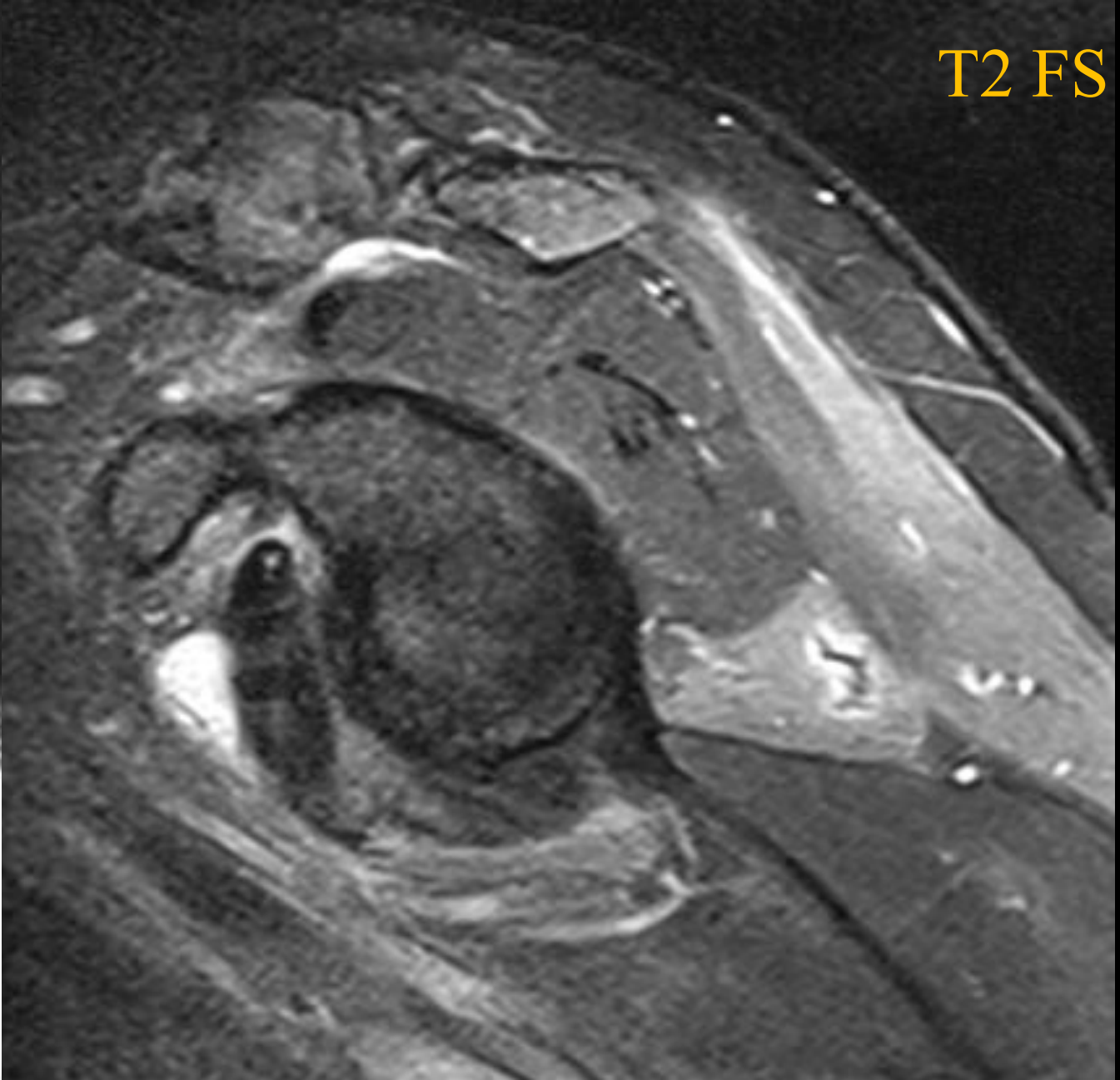
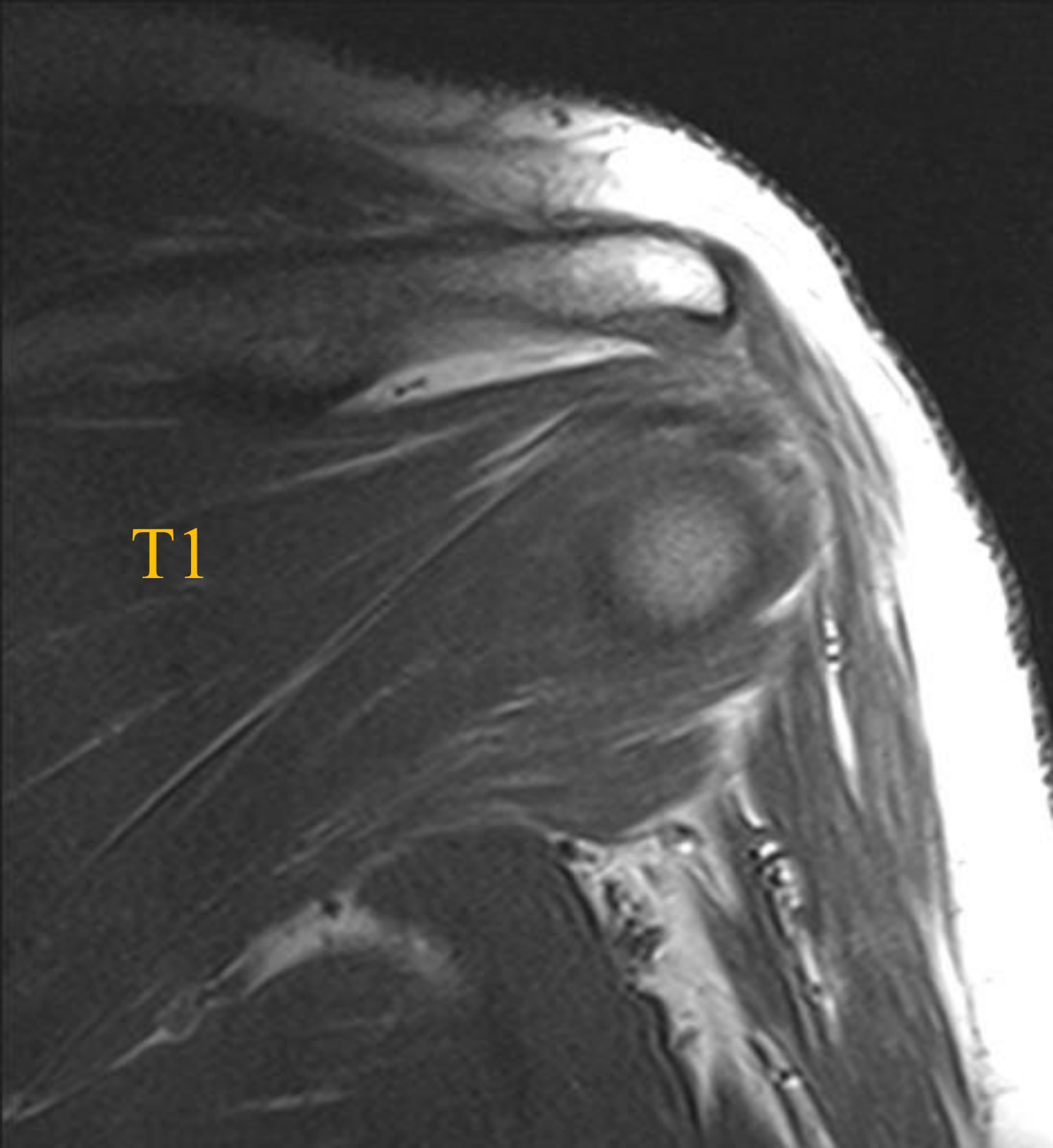


T2



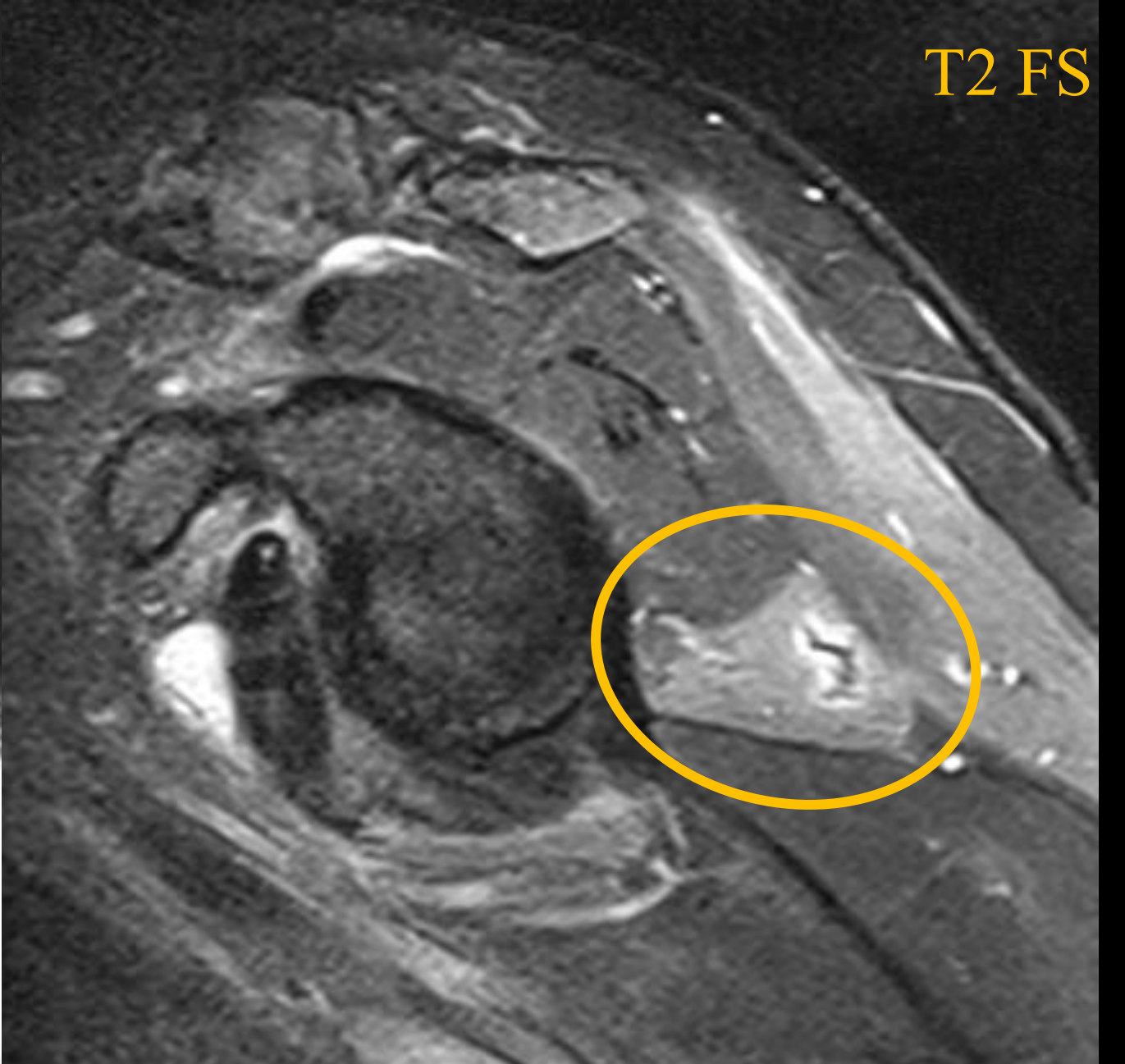
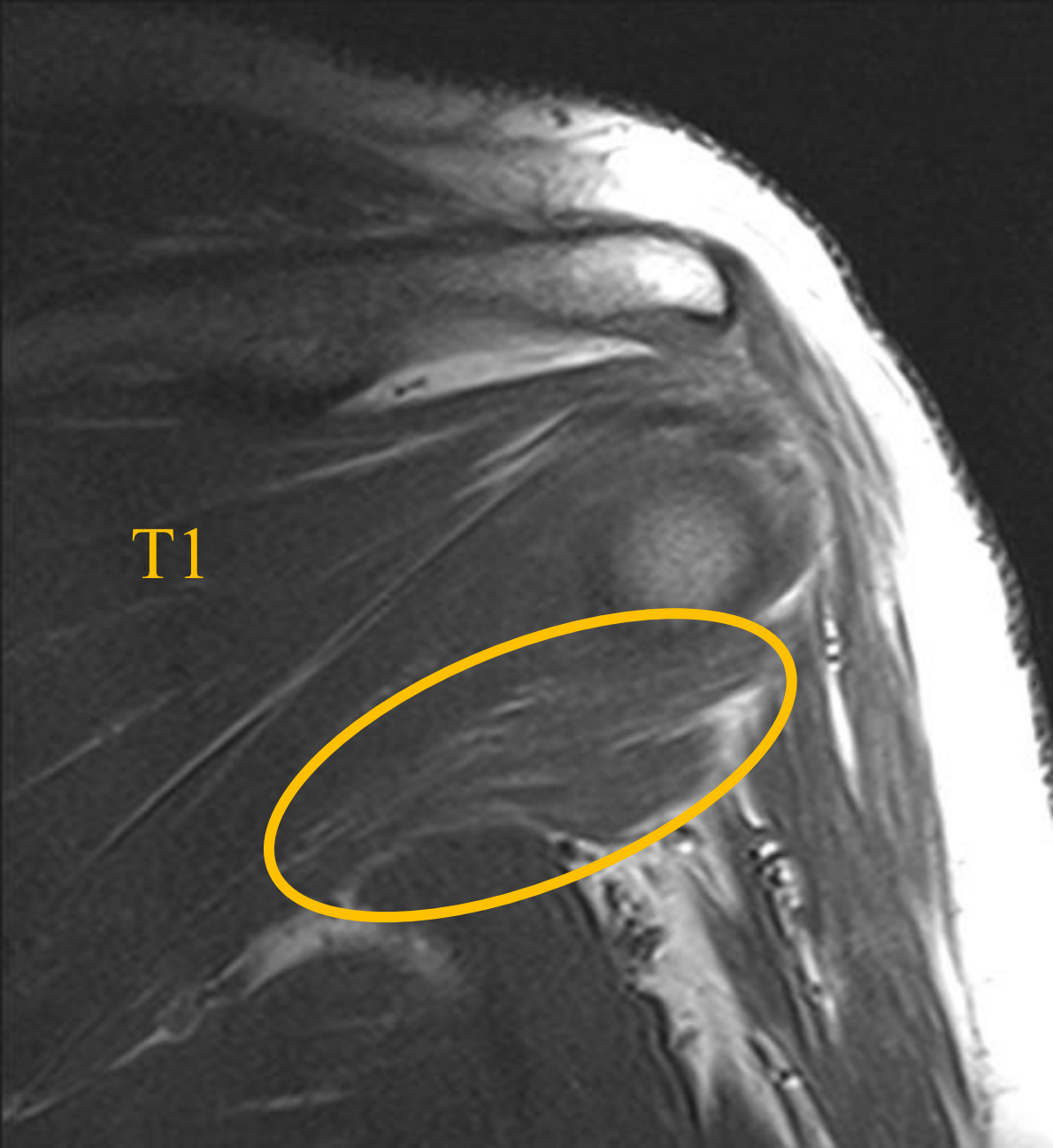
T1

# QUADRILATERAL SPACE SYNDROME



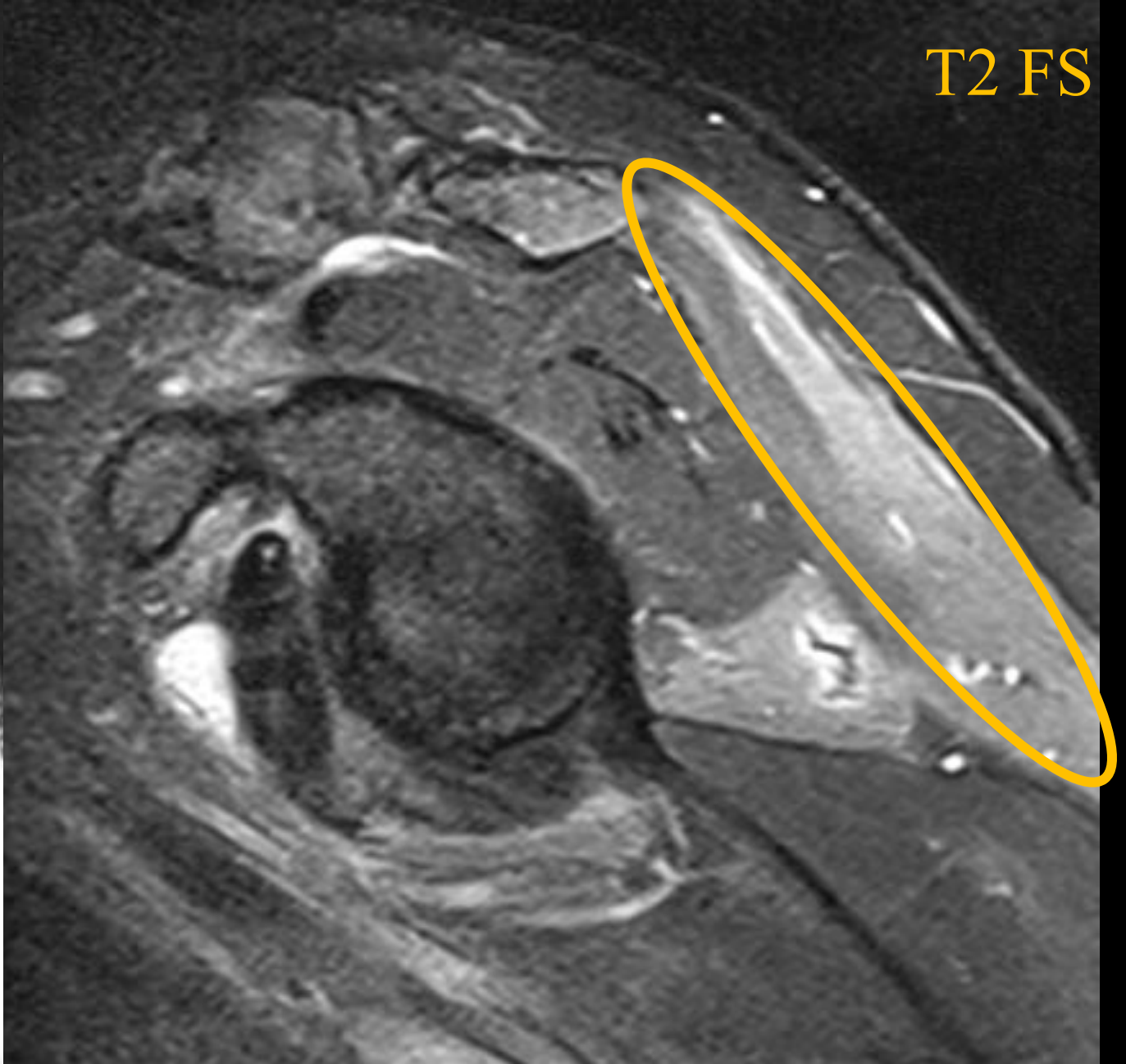
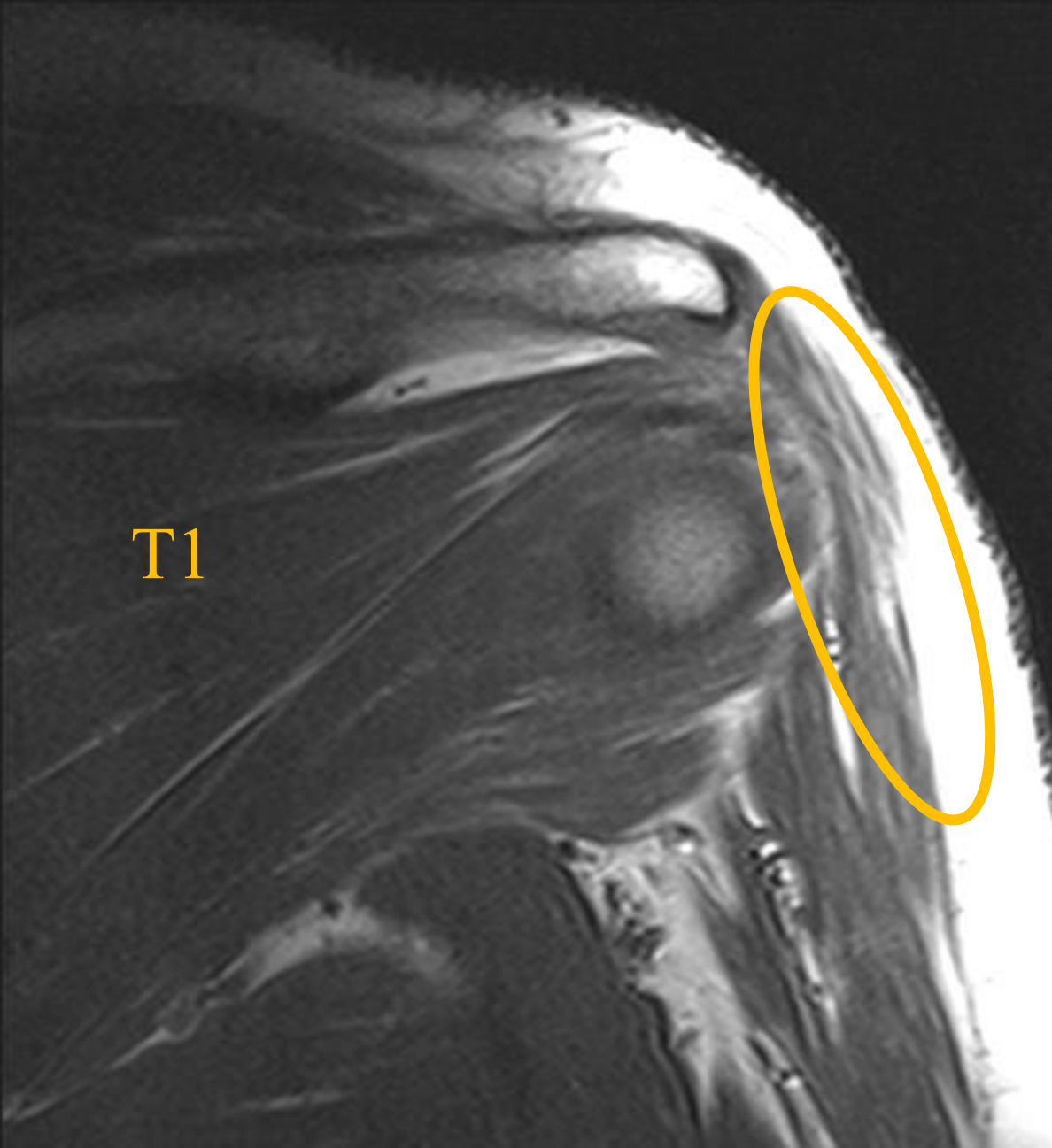


# QUADRILATERAL SPACE SYNDROME



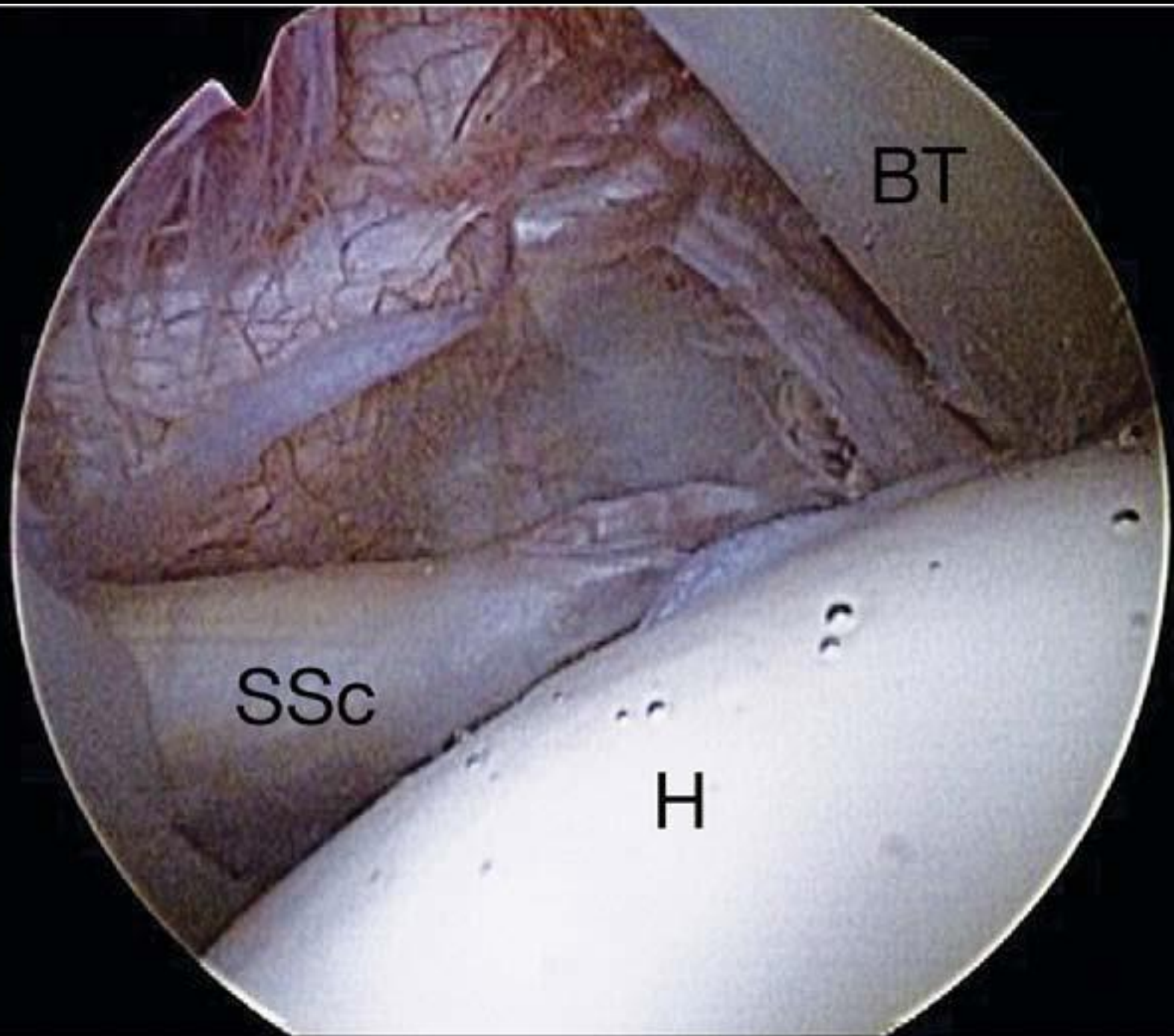


# QUADRILATERAL SPACE SYNDROME



# SUBSCAPULARIS TEAR

- Abnormal lift-off test on physical examination
- Look for abnormalities of lesser tuberosity
- Uncommon (under-recognized) – 5%-27% of all tears
  - LHBT dislocation (49%)
- Look for on **axial** and sagittal planes
  - Coronals anteriorly also helpful
- Devastating to surgeon if missed
- Easy to miss on arthroscopy (Only superior 25% of tendon visible on routine arthroscopy)

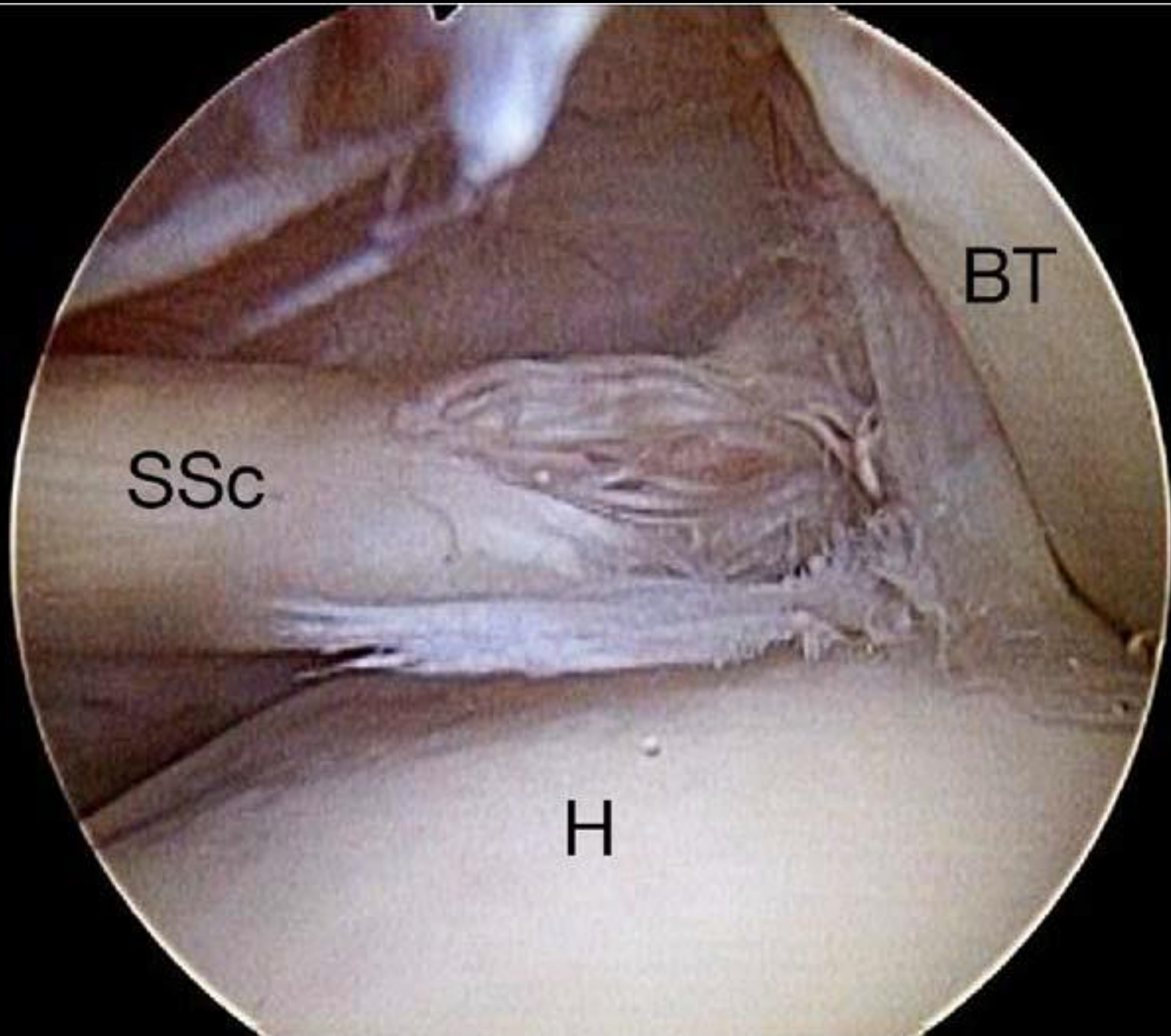


BT

SSc

H



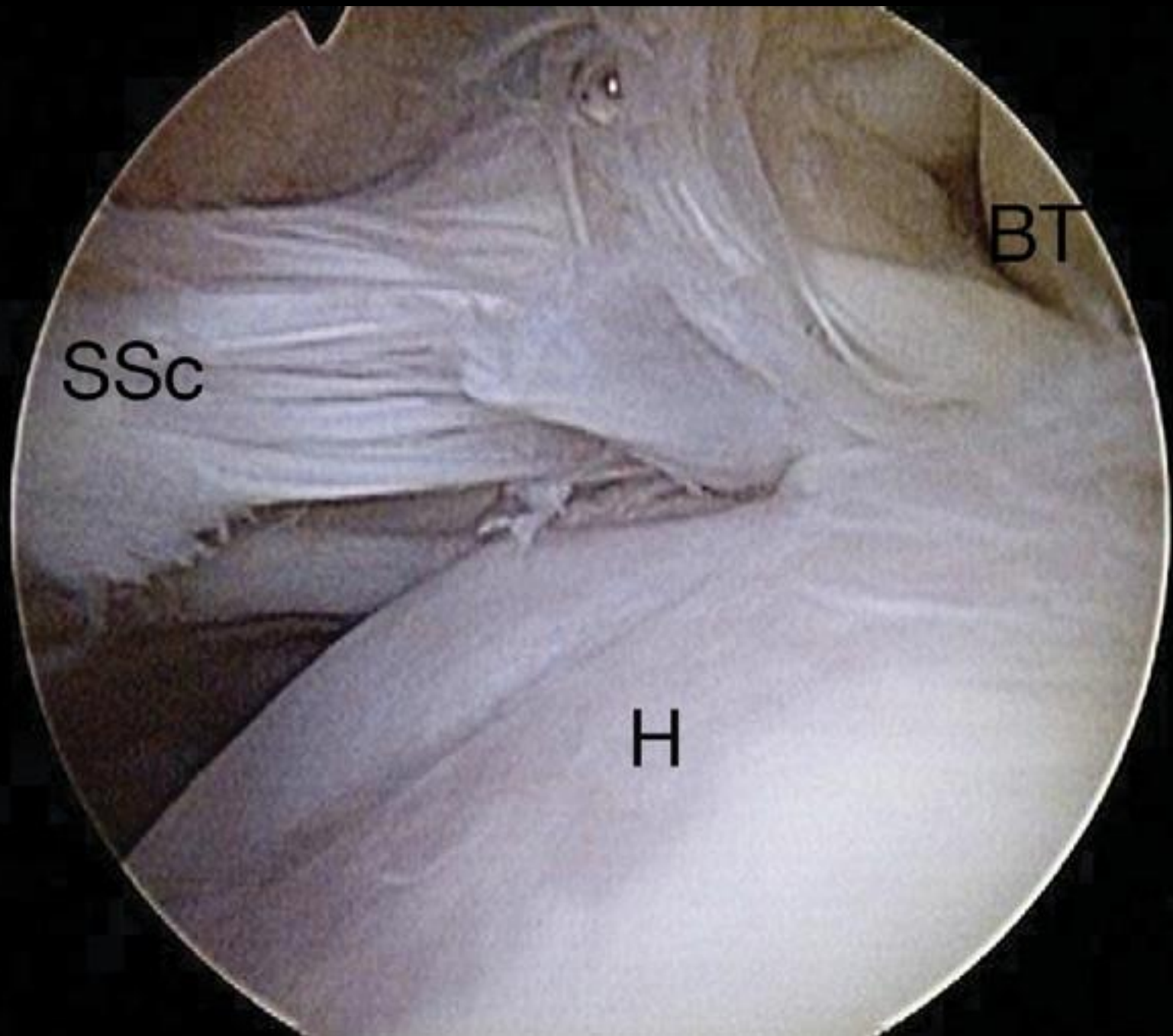


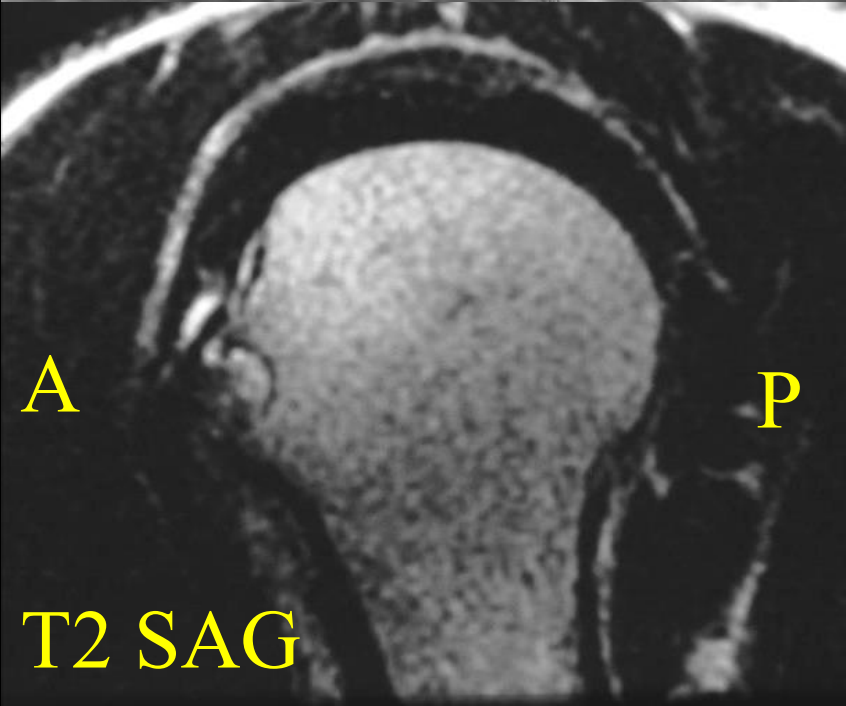
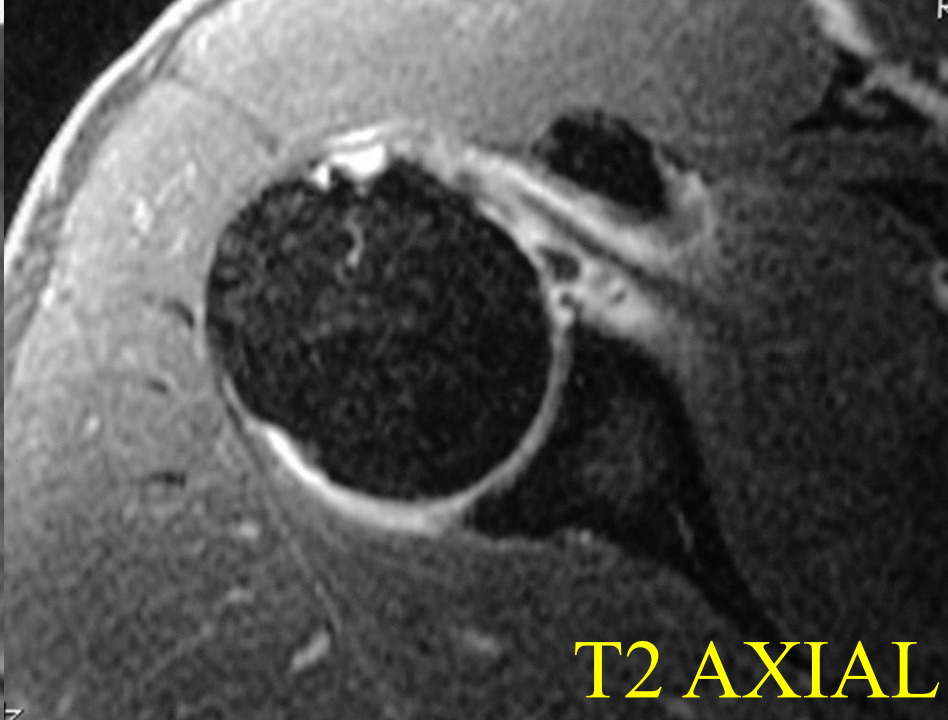
BT

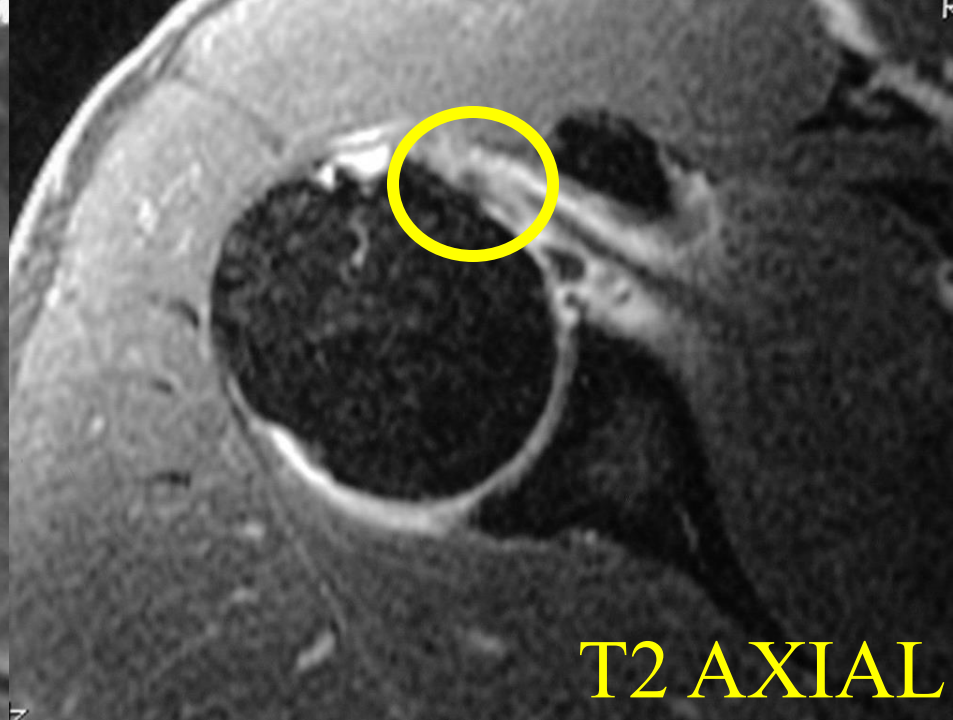
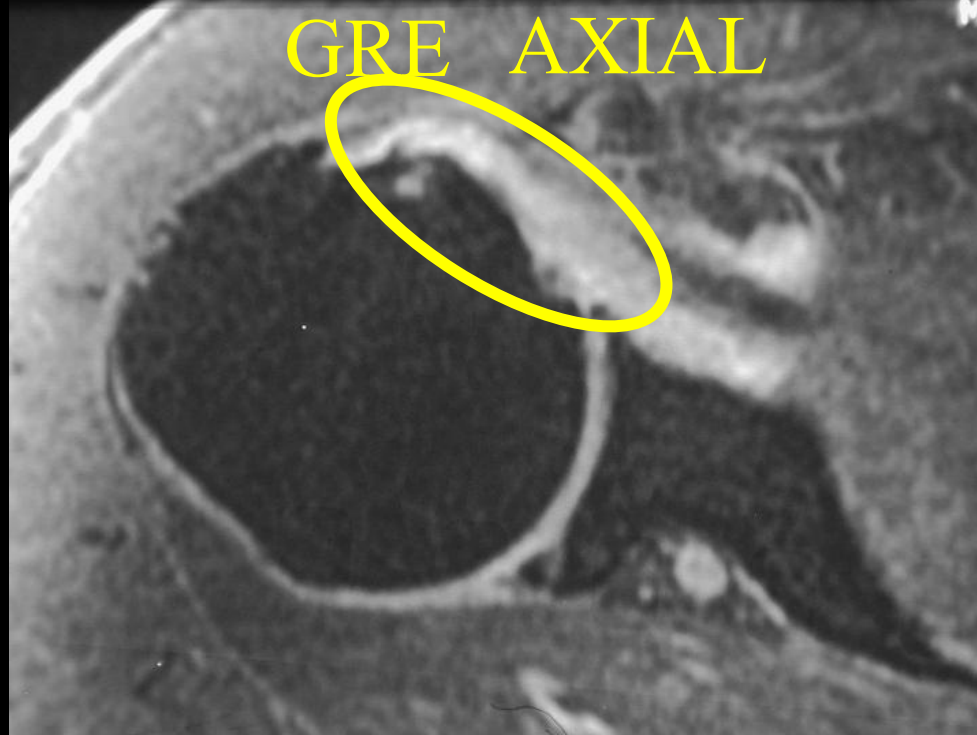
SSc

H

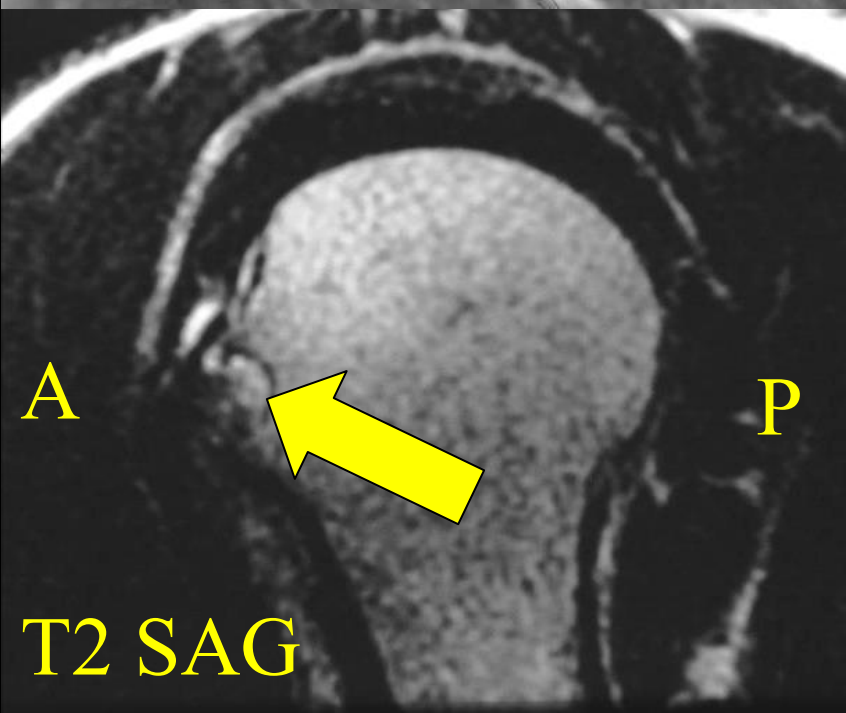
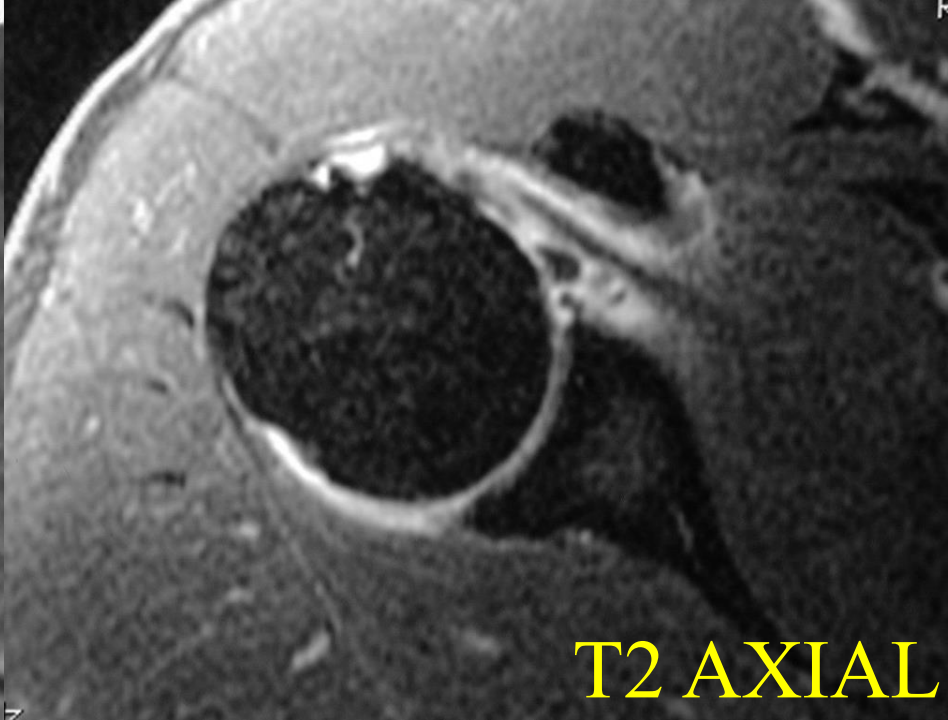




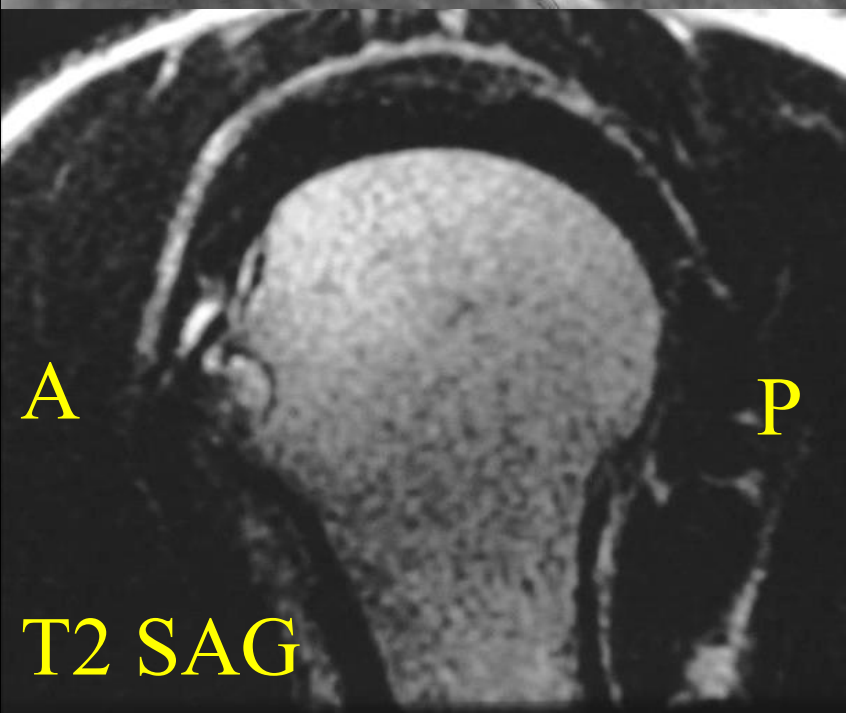
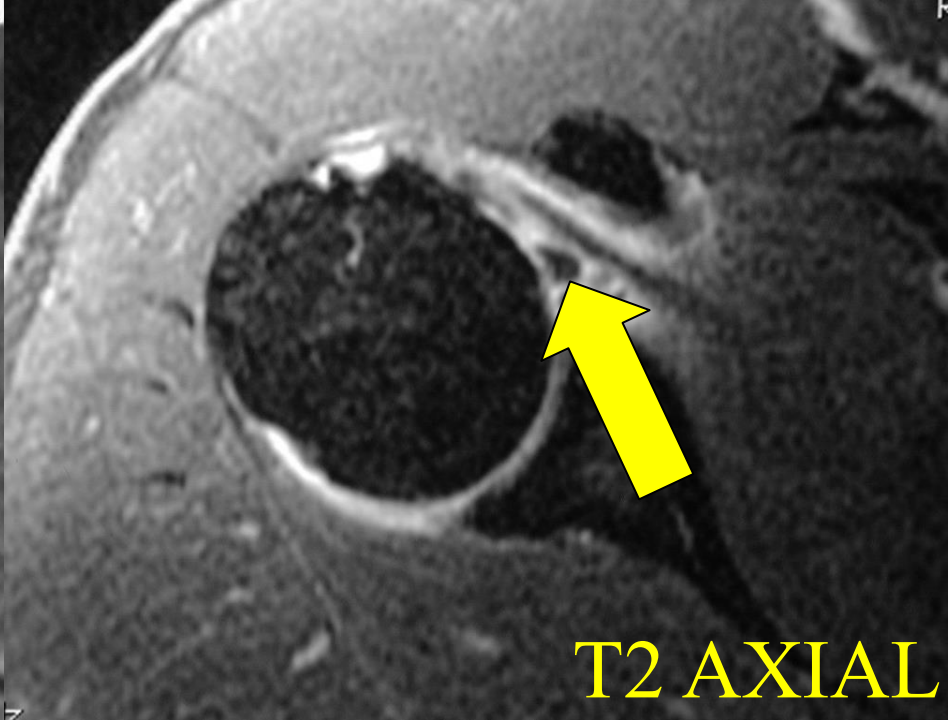




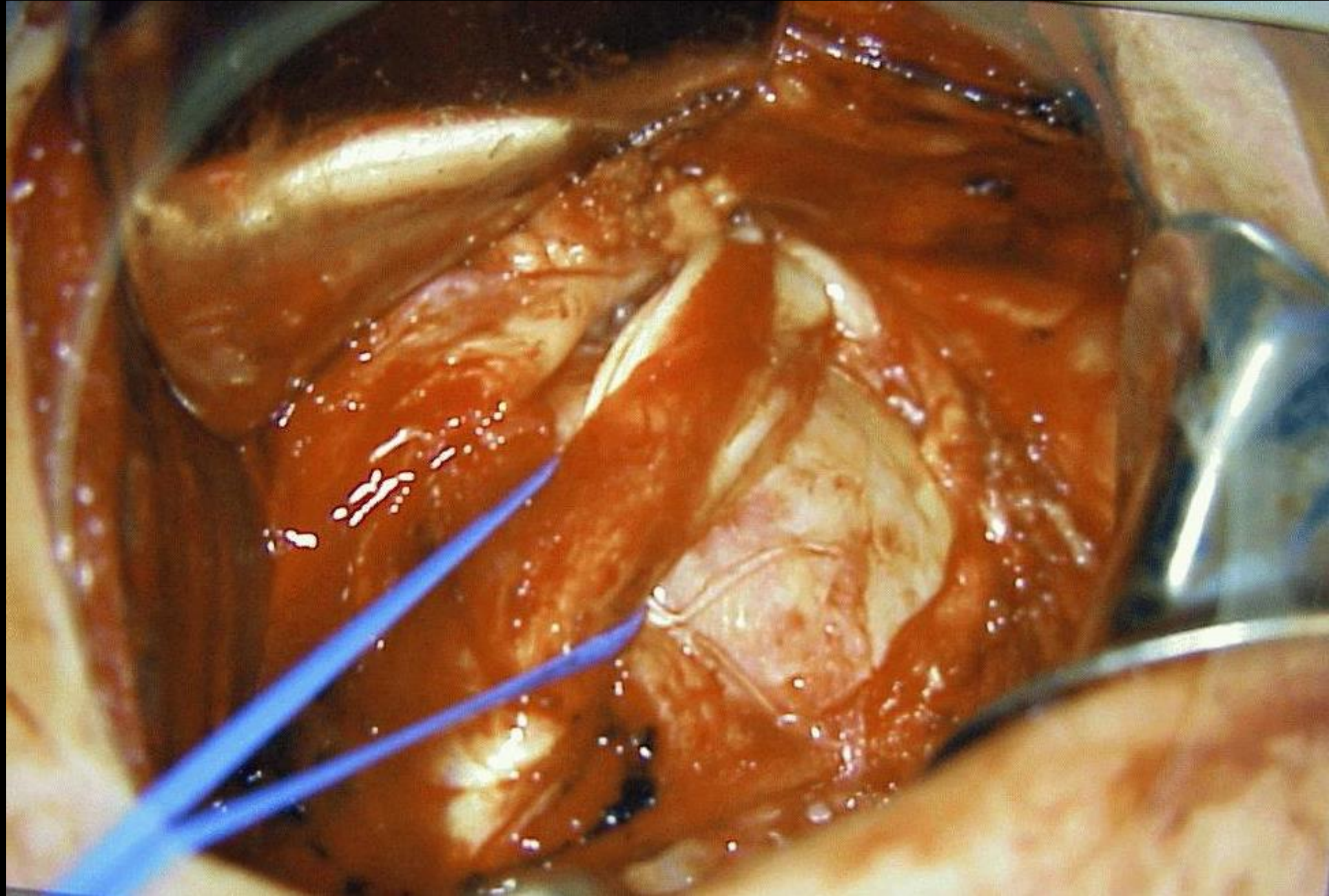






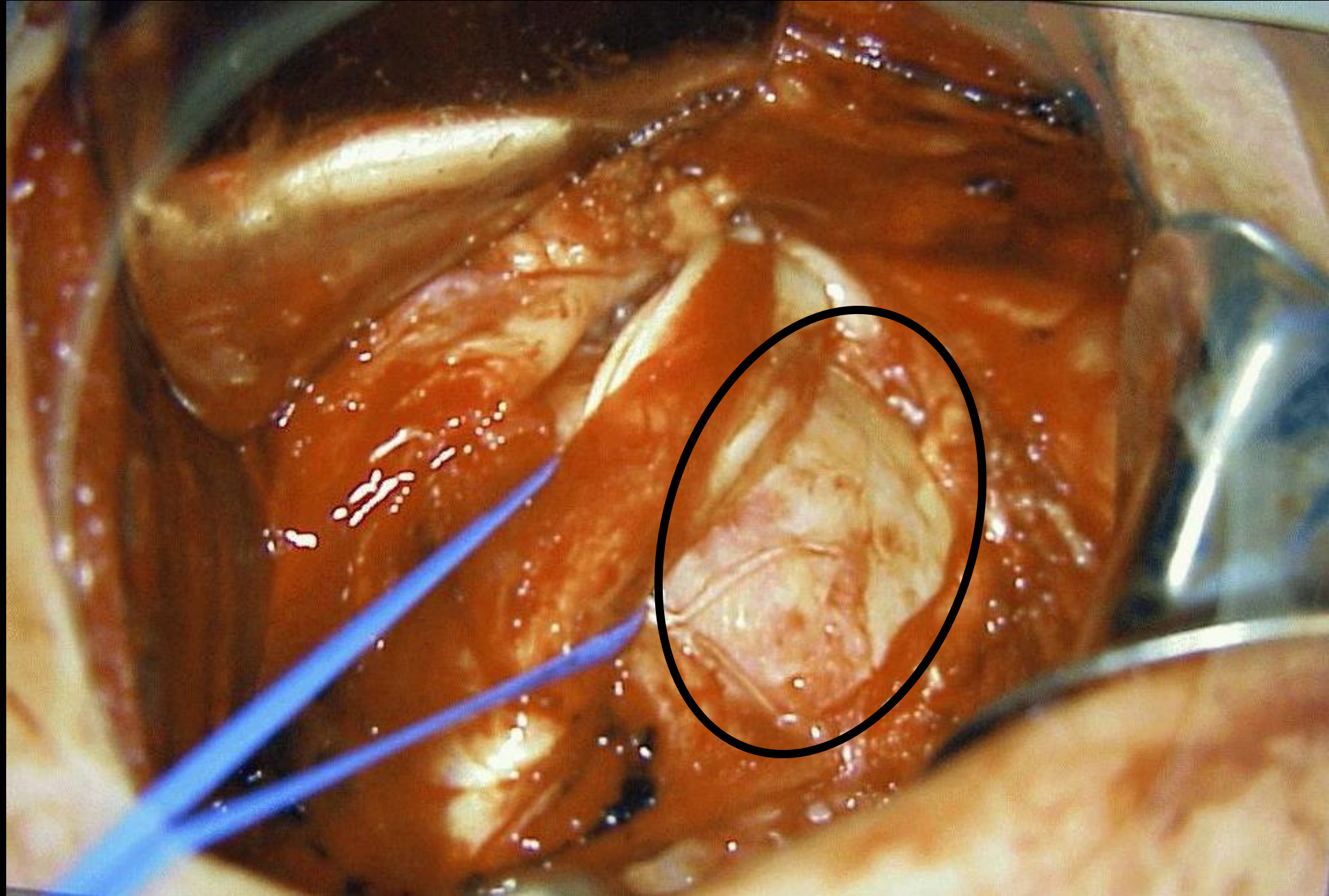


# SUBSCAPULARIS TEARS



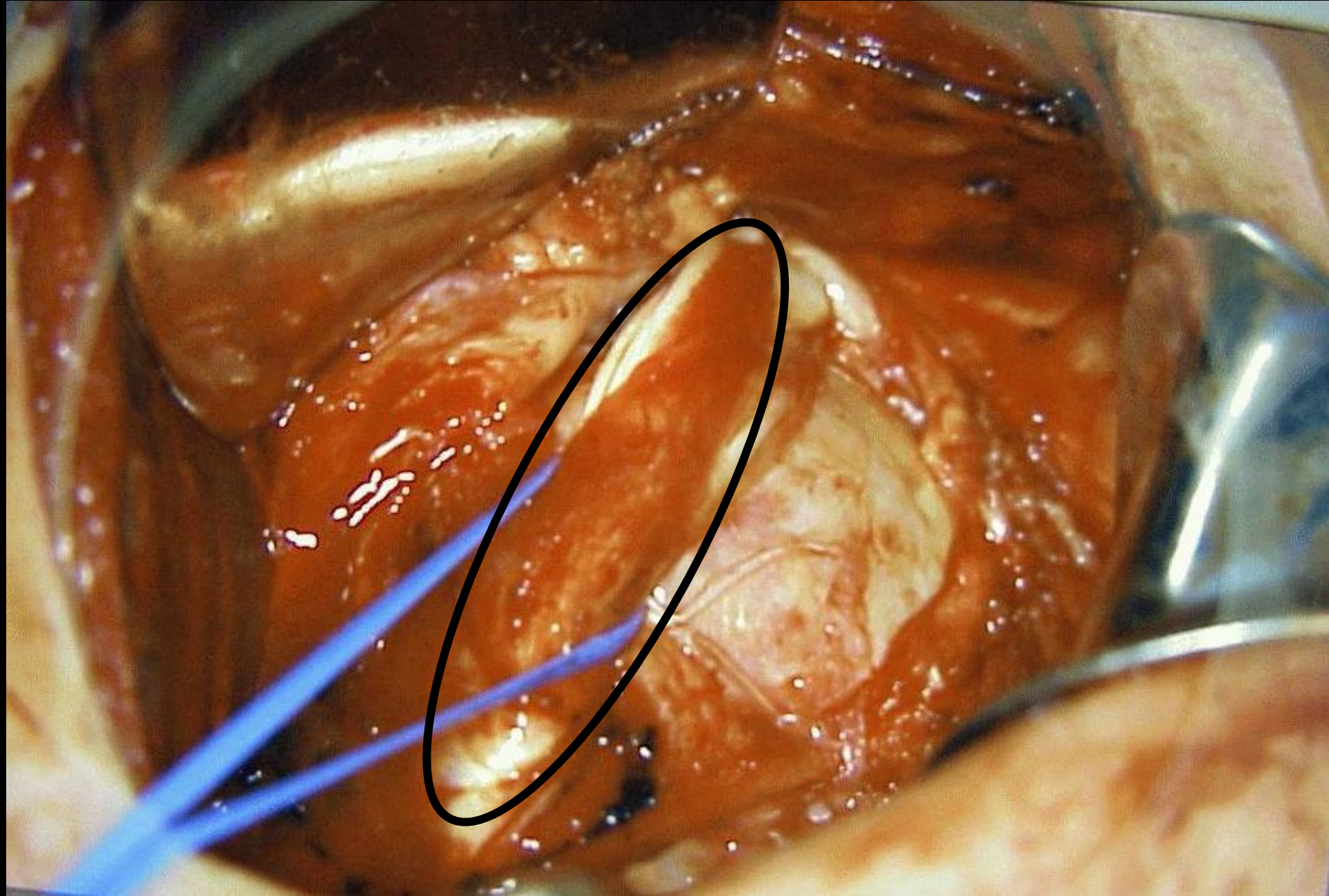


# SUBSCAPULARIS TEARS

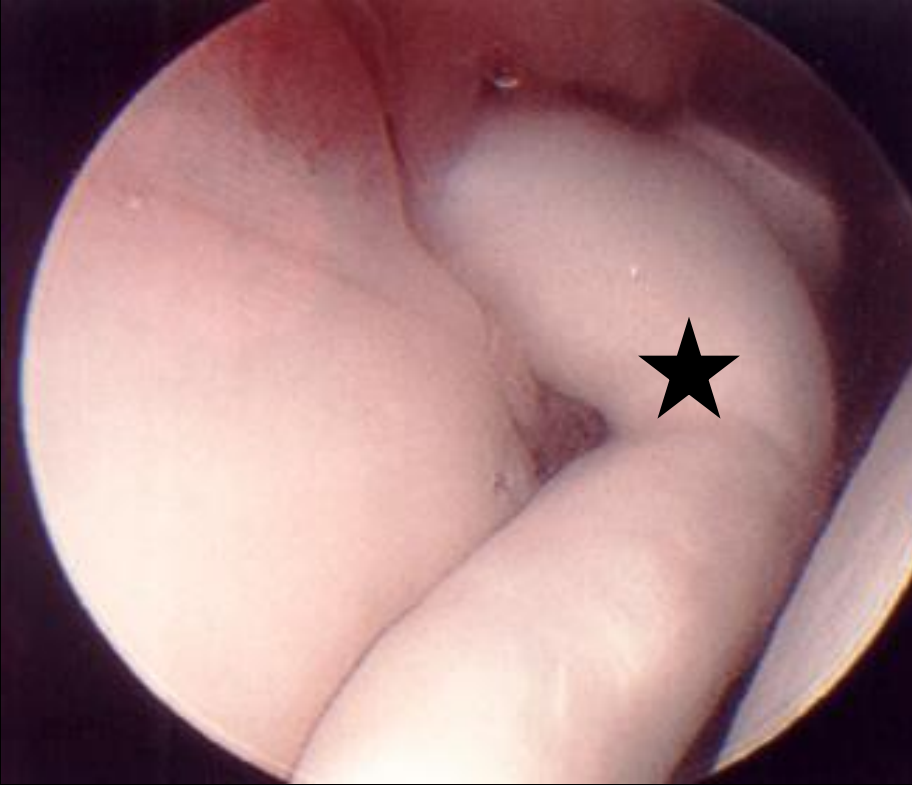




# SUBSCAPULARIS TEARS



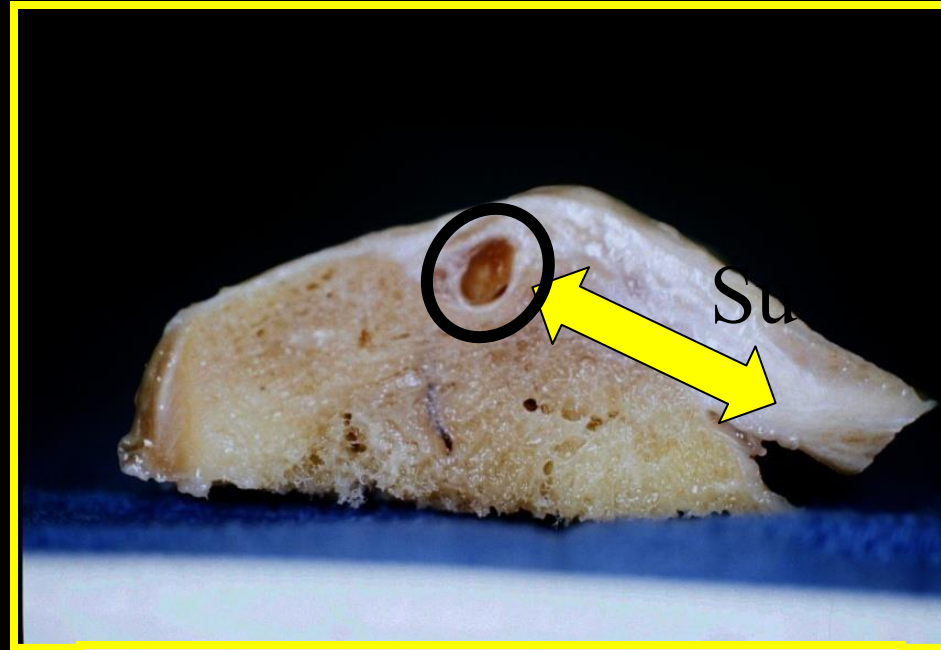




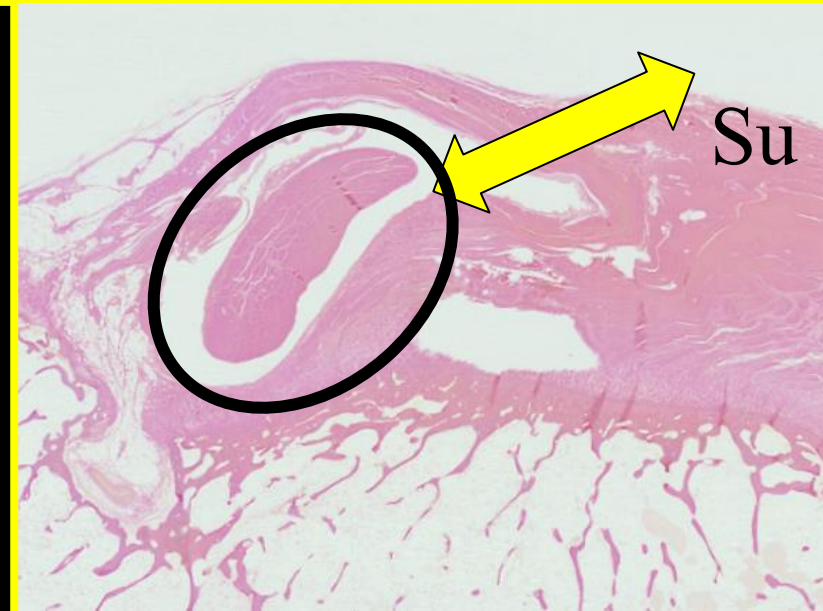
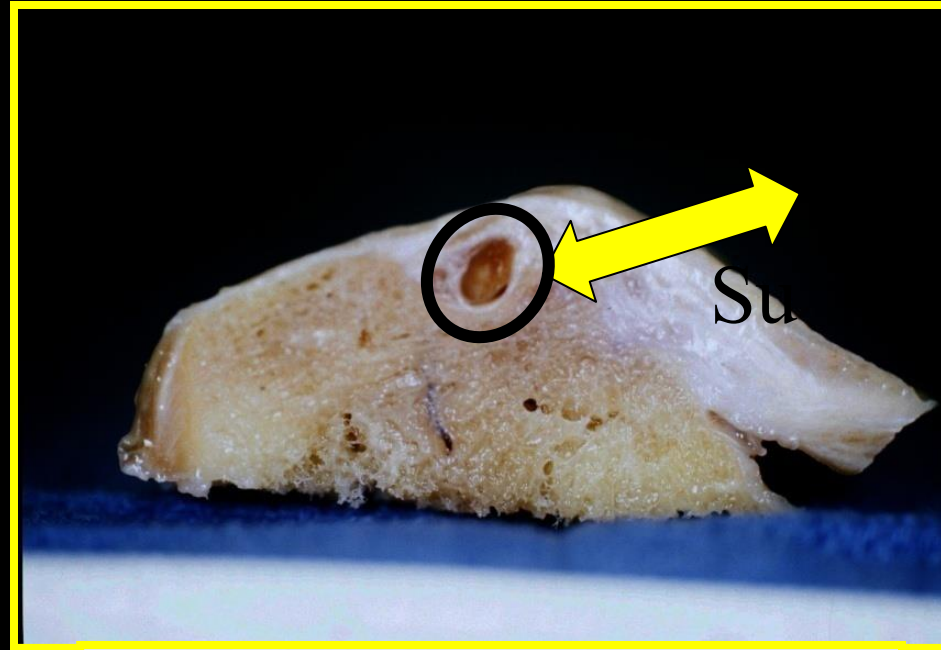
# SUBSCAPULARIS TEAR



# SUBSCAPULARIS TEAR

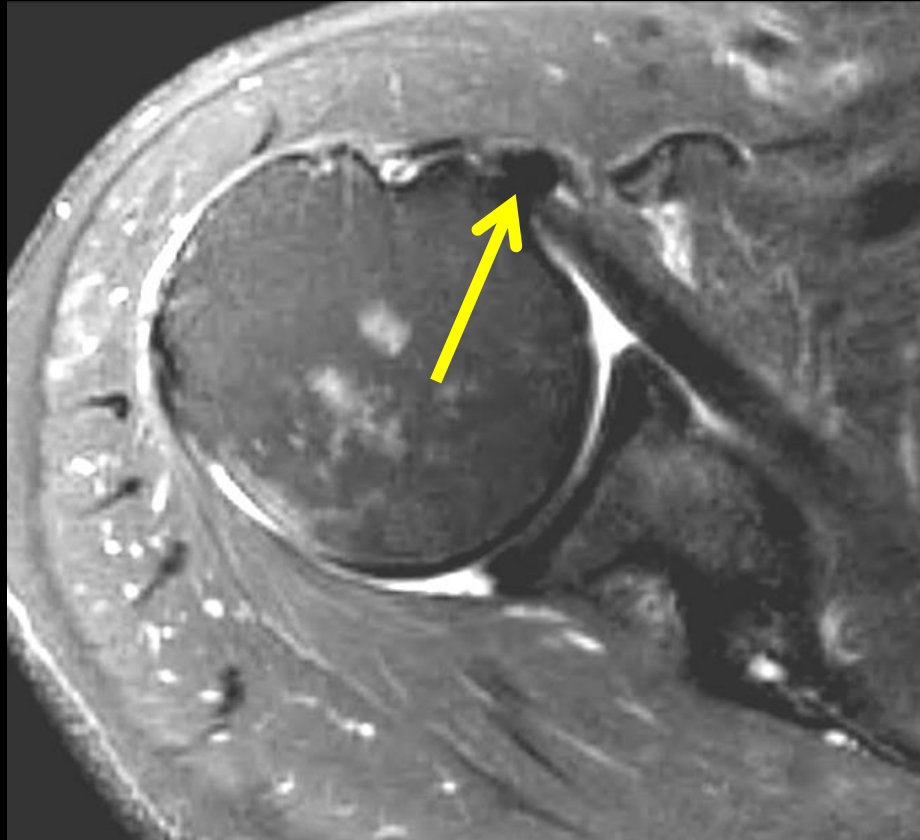


# SUBSCAPULARIS TEAR

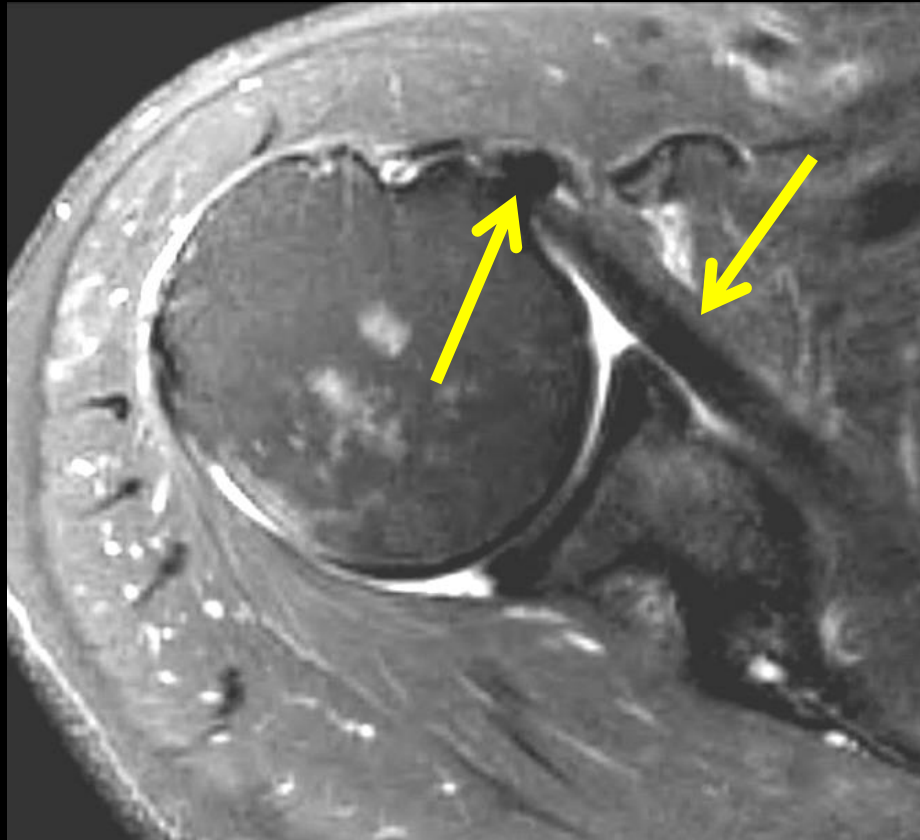




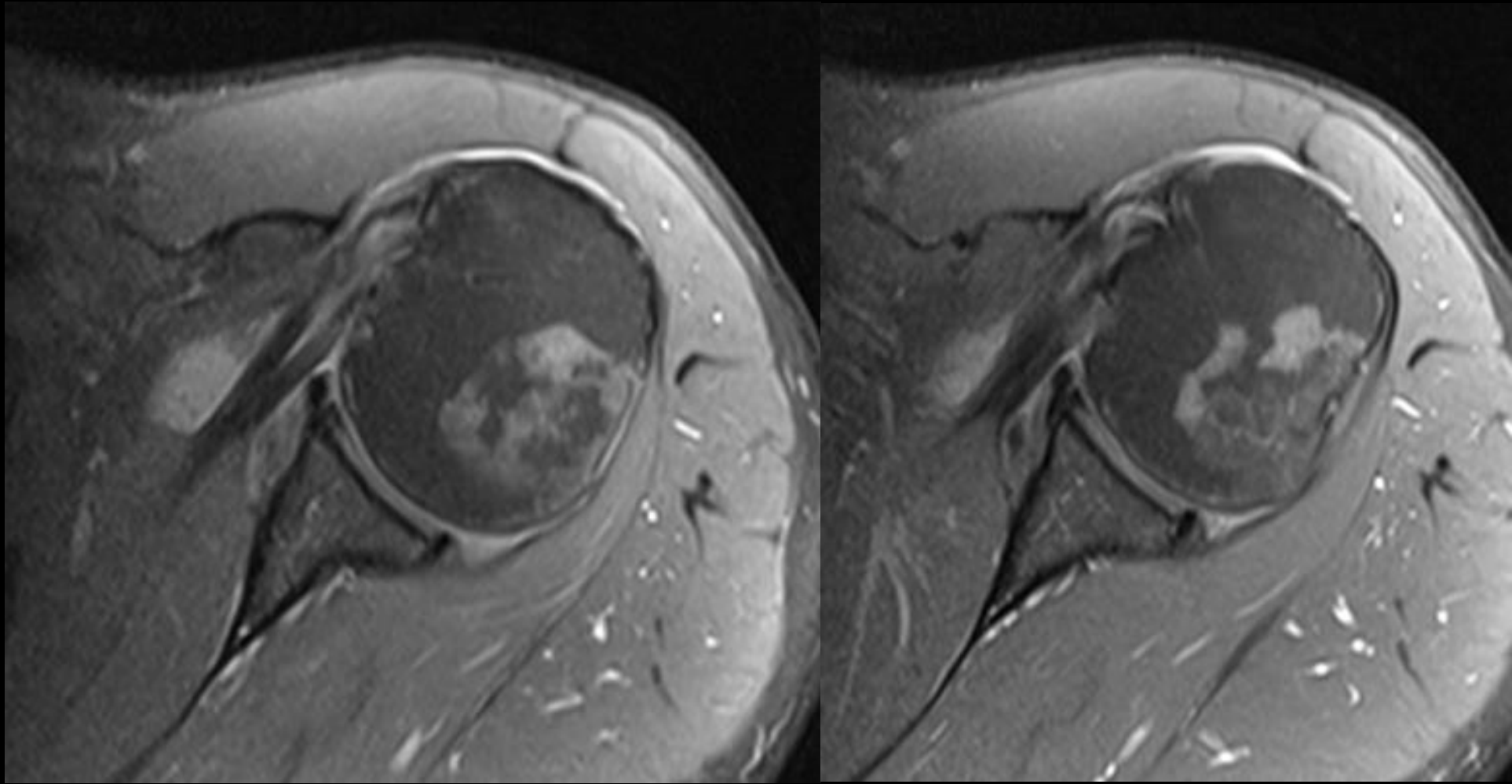
# EXTRAARTICULAR BICEPS DISLOCATION



# EXTRAARTICULAR BICEPS DISLOCATION

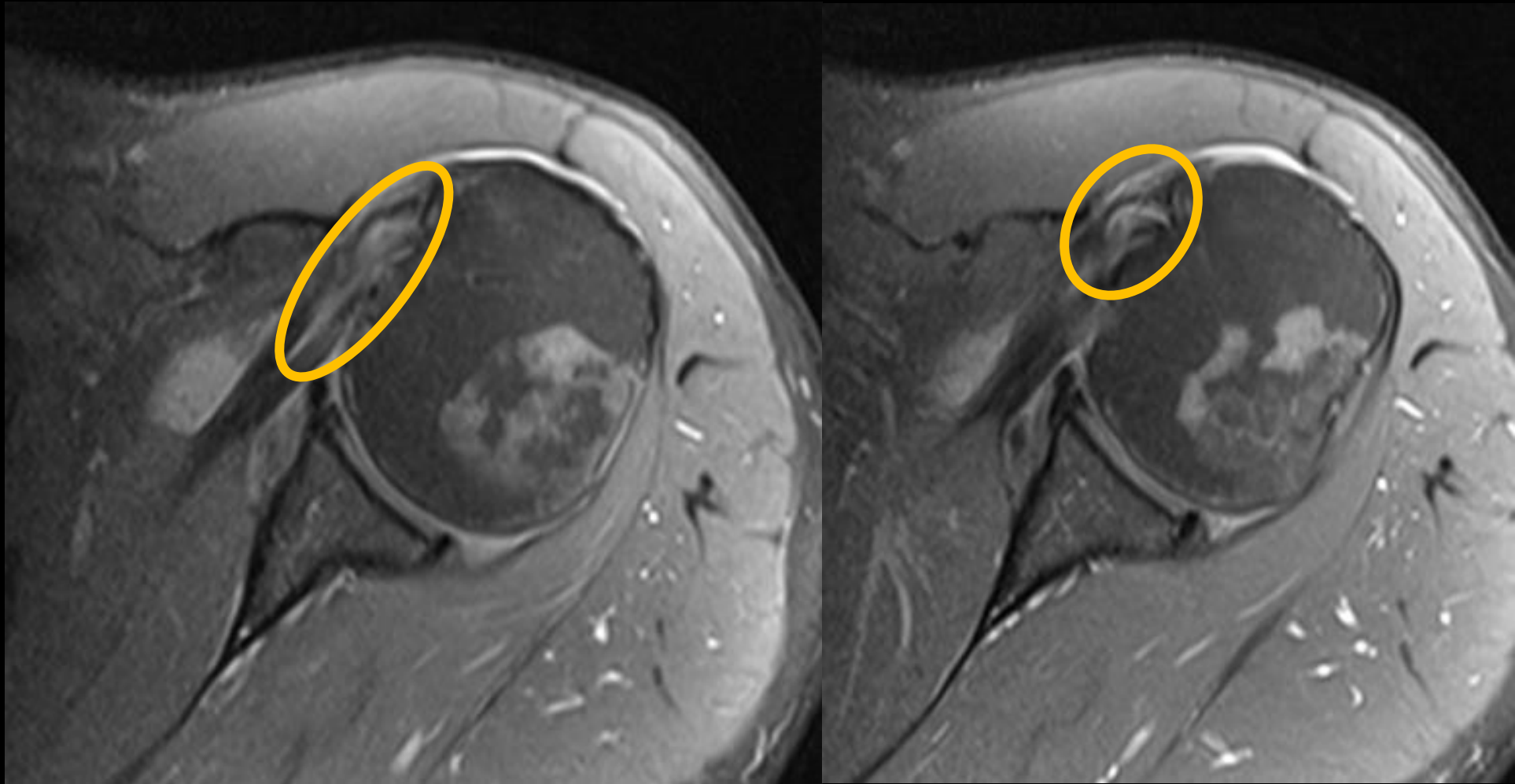


# Subscapularis Tear



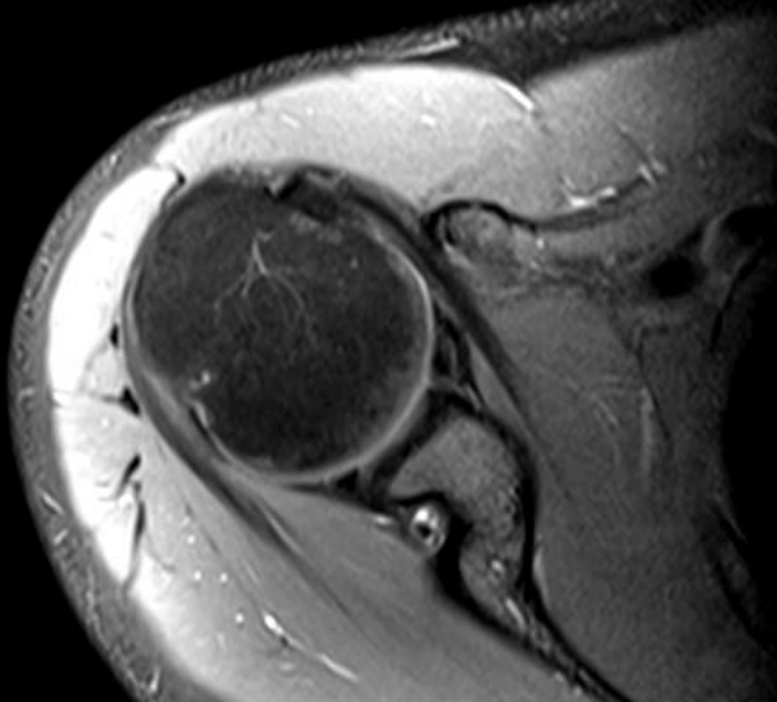
LHBT into delamination of subscapularis

# Subscapularis Tear



LHBT into delamination of subscapularis



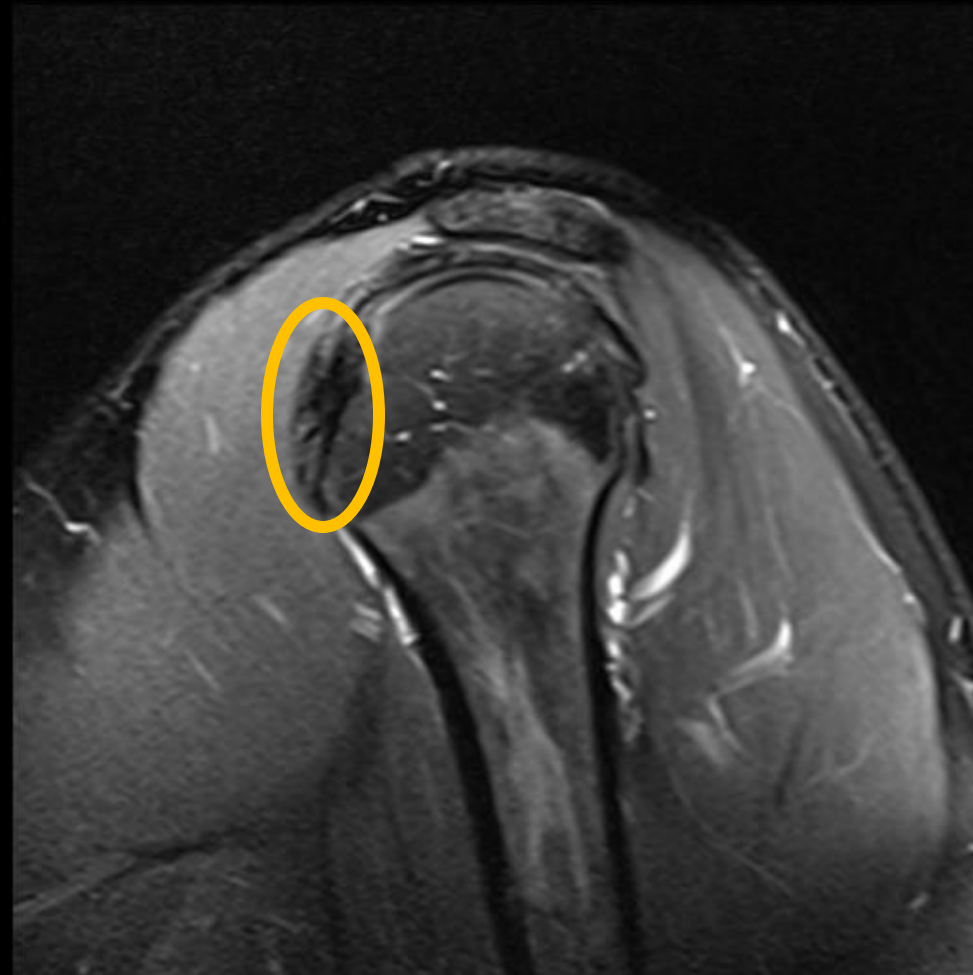


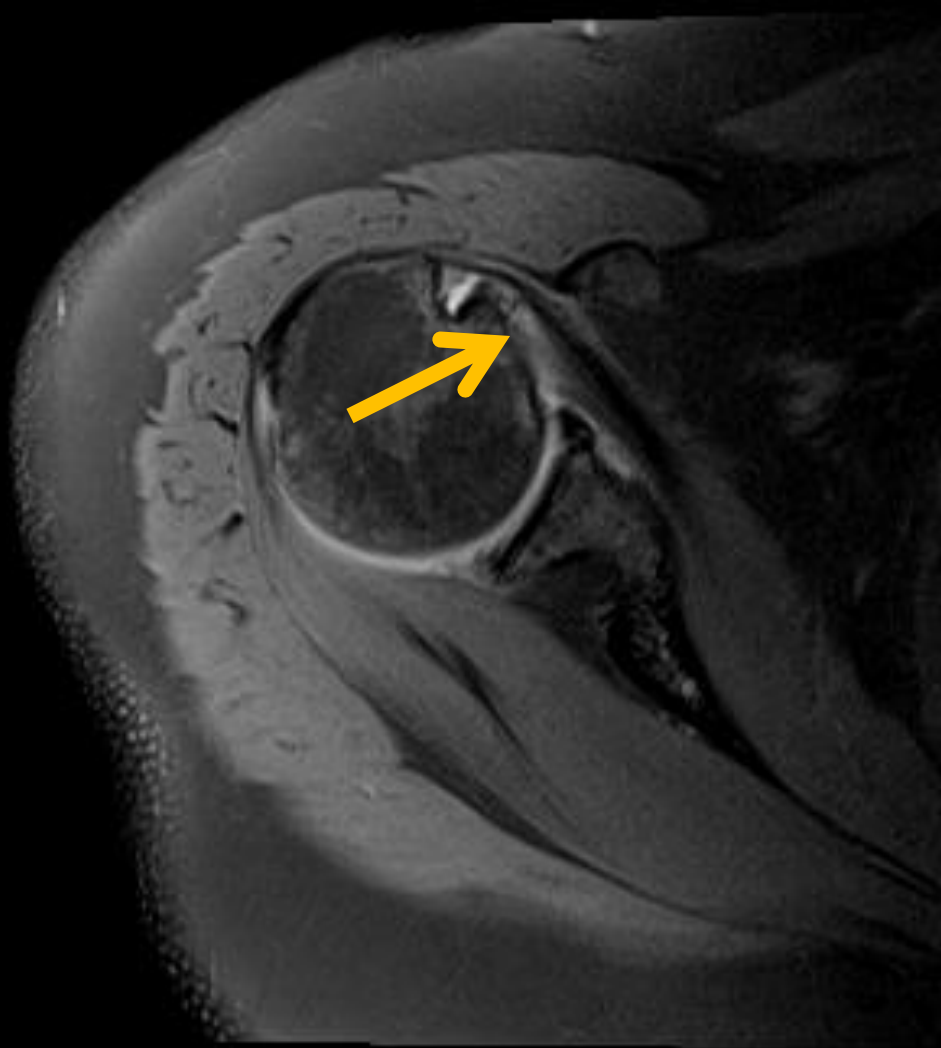
## Normal Subscapularis

- Multipennate tendon
- Inferior 1/3<sup>rd</sup> muscular

## Look at sagittals!!

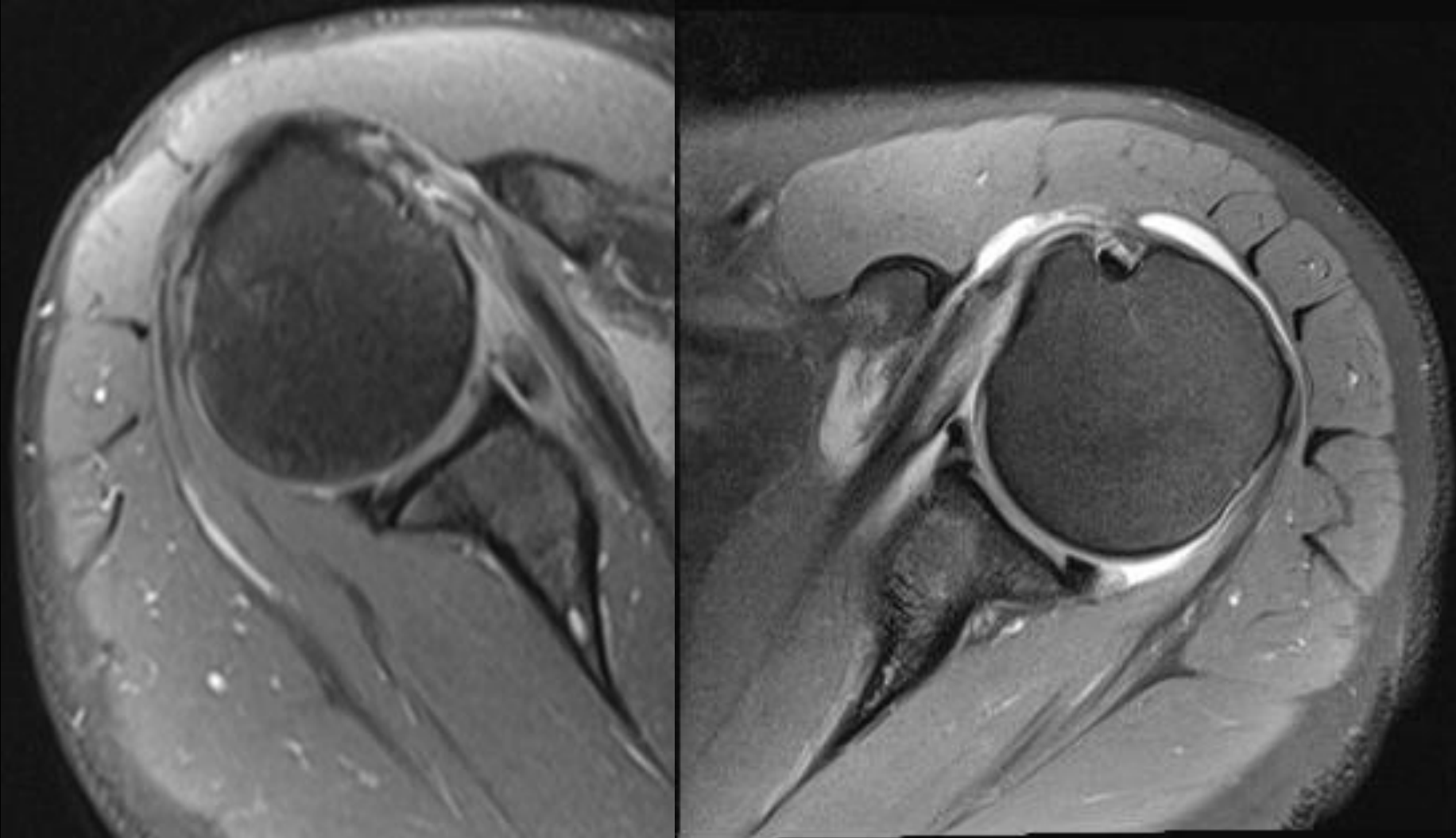
- Medial to LHBT groove
- Oval black tendon



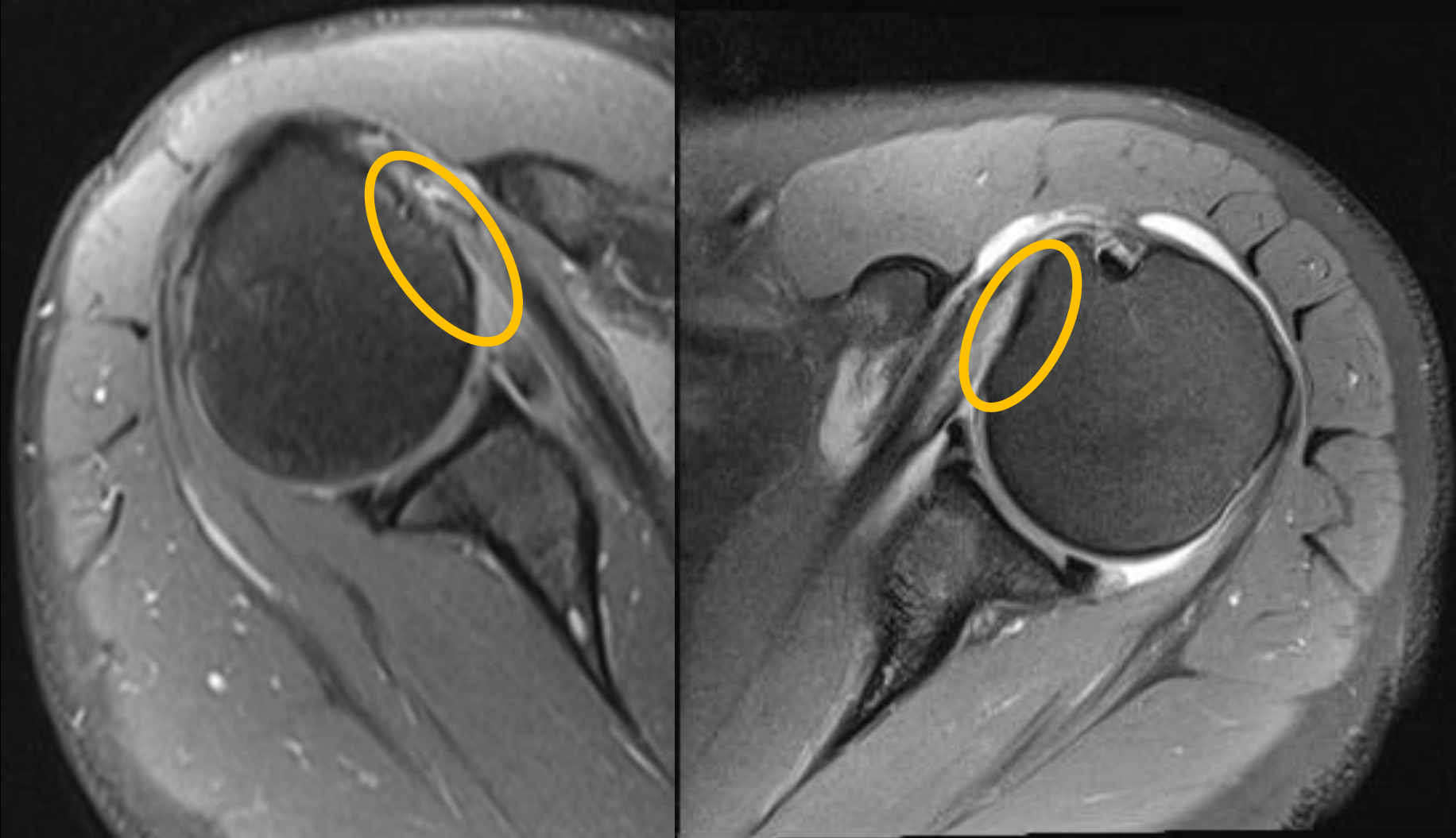


Subscapularis tears are commonly missed  
Look for high signal in footprint medial to LHBT groove

Skeletal Radiol (2013)

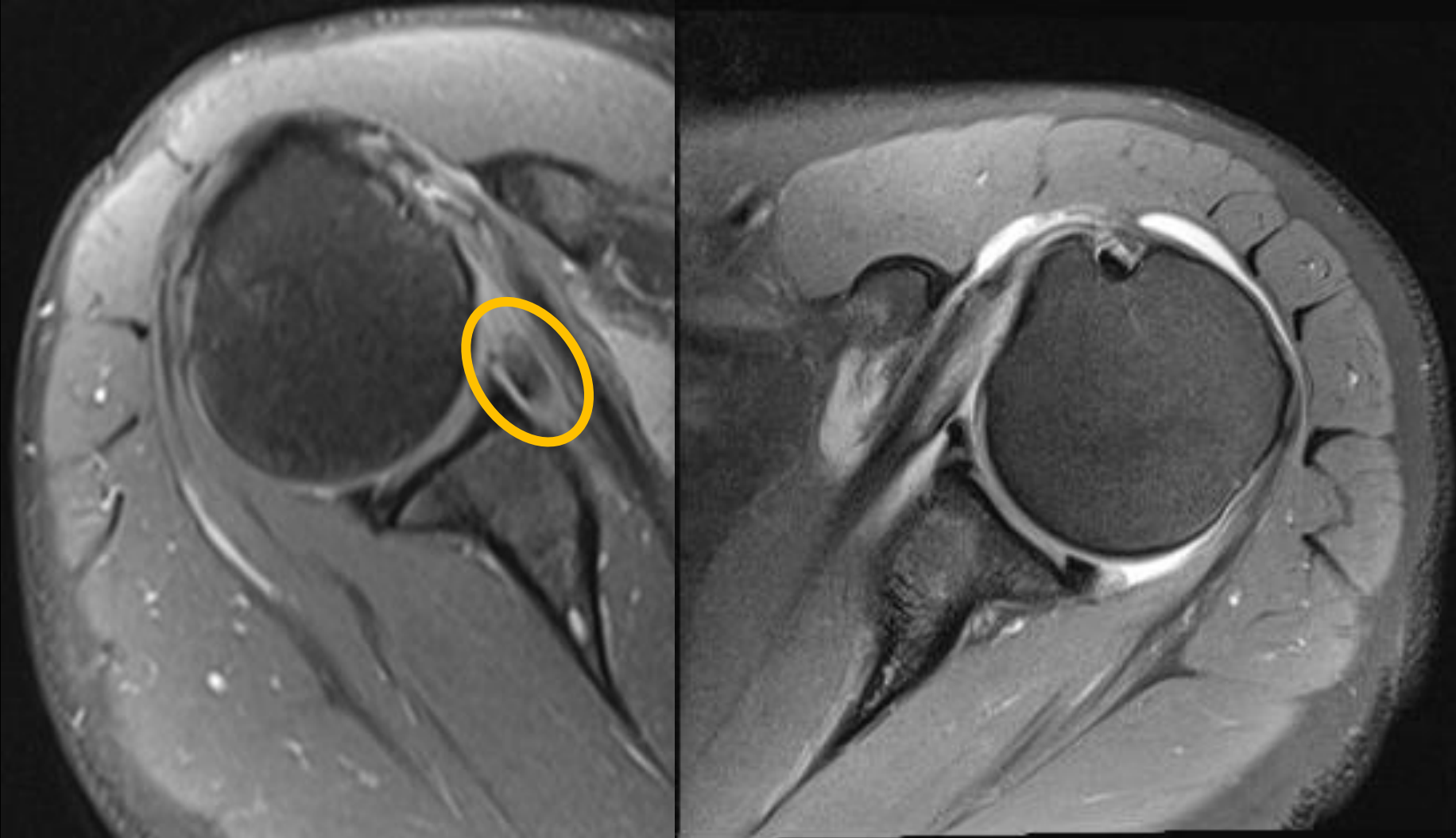


**SUBSCAPULARIS TEAR**



**SUBSCAPULARIS TEAR**



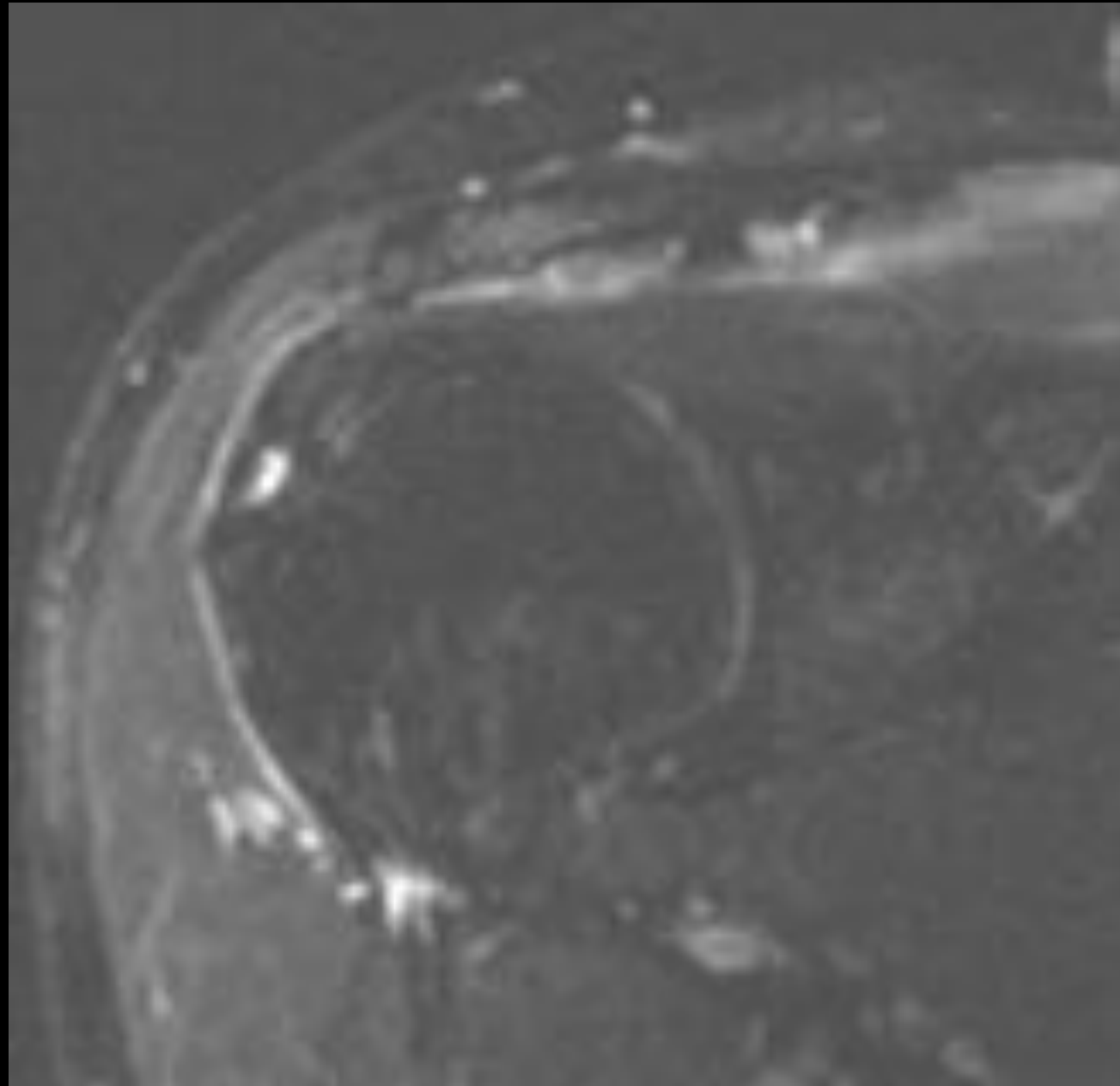


**SUBSCAPULARIS TEAR**

# ROTATOR CUFF TEAR PARTIAL THICKNESS

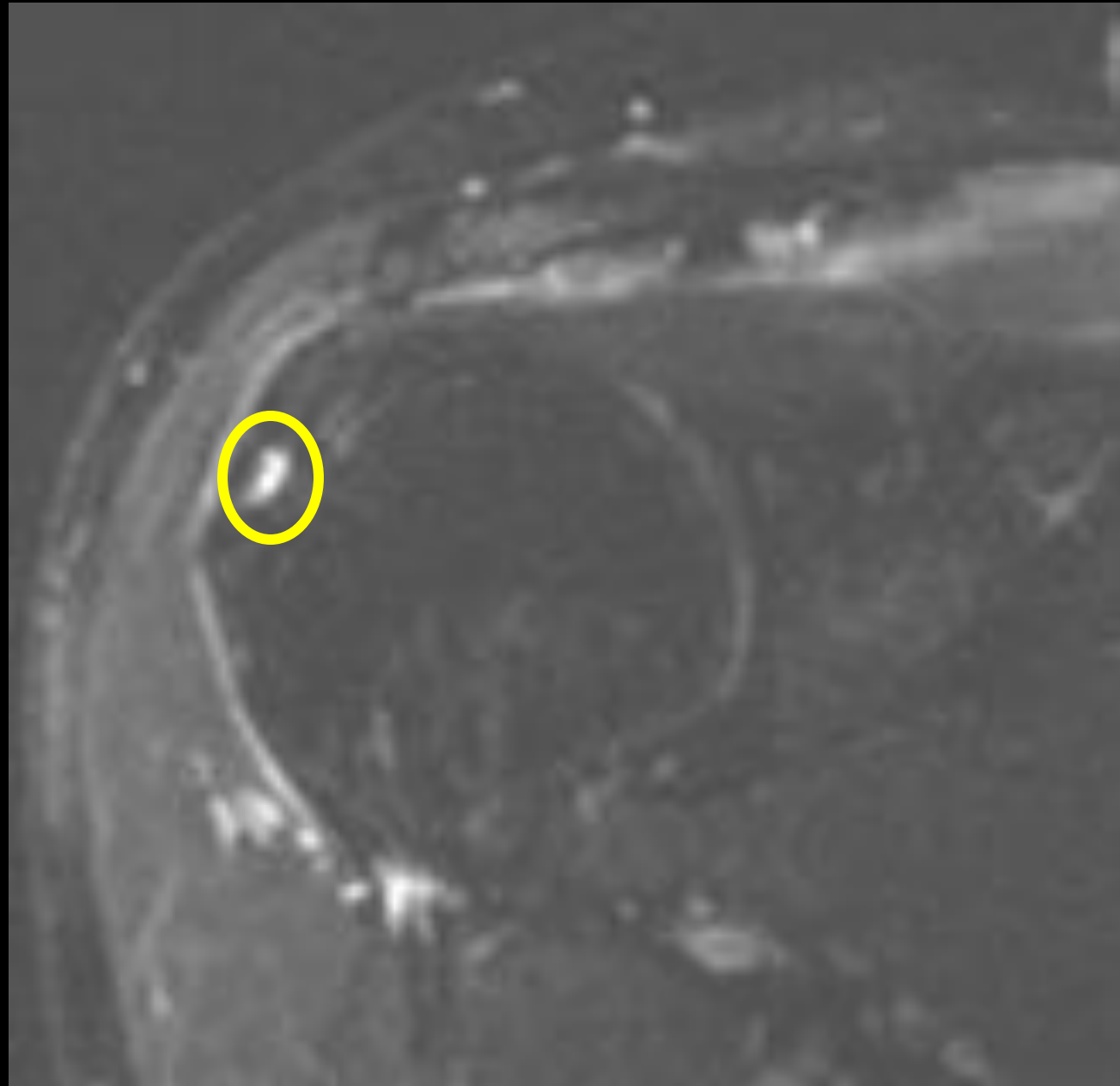
- Twice as common as full thickness
- Intrasubstance - most common but not seen on arthroscopy
- Articular side - more common (3-4 to 50X)
- Bursal Side - least common
  - Poor response to conservative treatment
- Increased detection
  - Contrast
  - ABER
- Significant if >50% of tendon thickness

# Intrasubstance Tear



T2

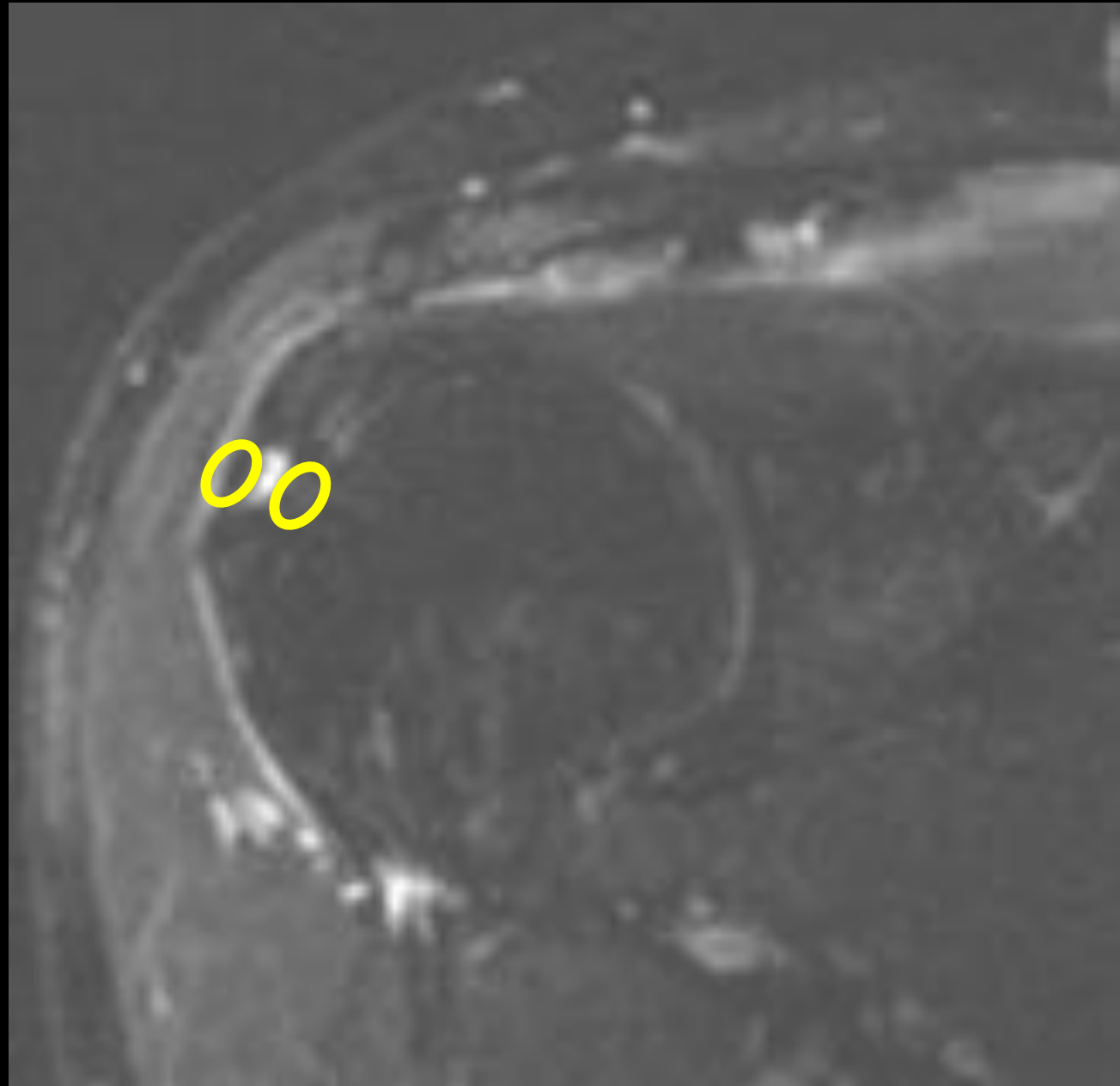
# Intrasubstance Tear



T2

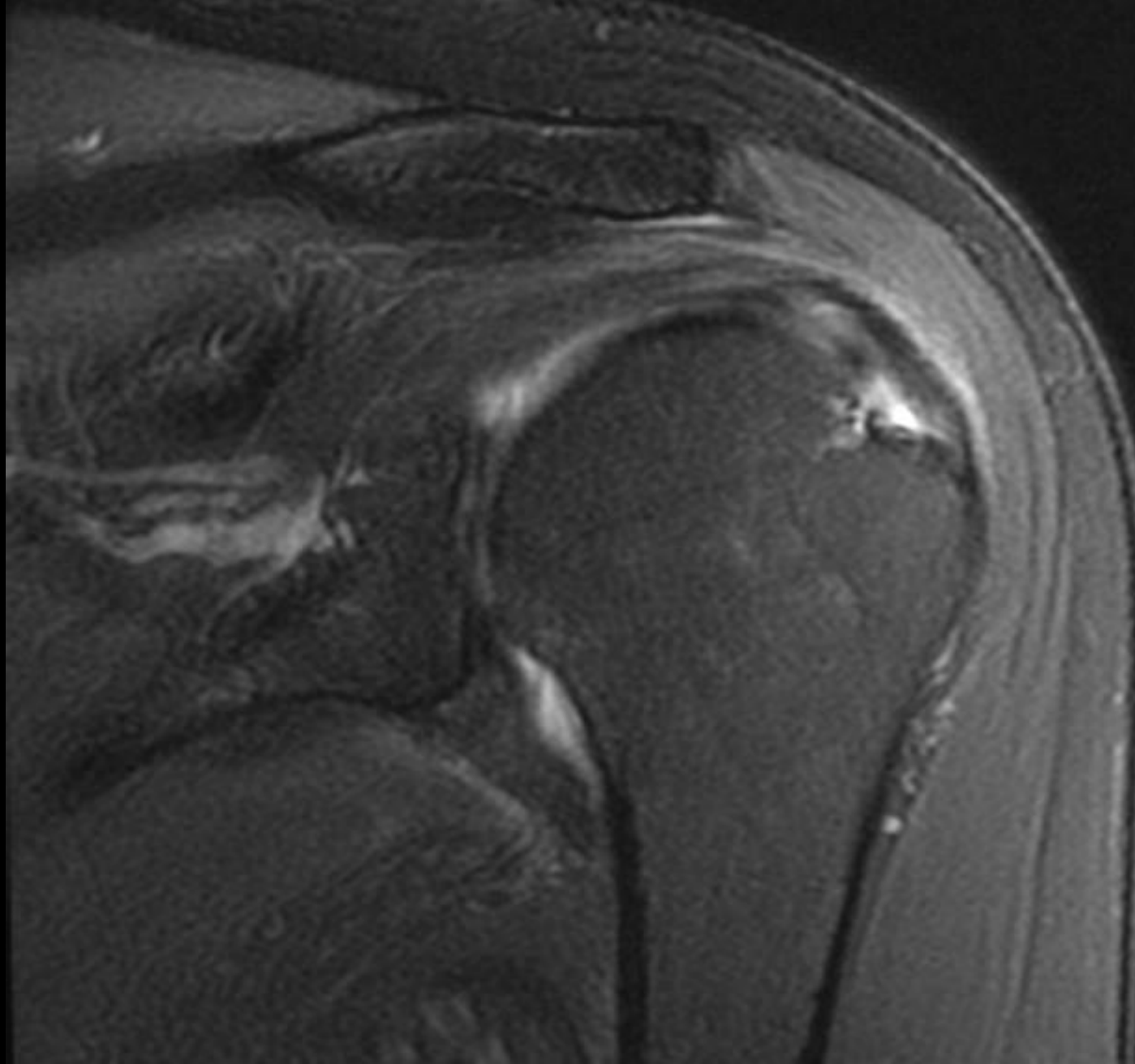


# Intrasubstance Tear



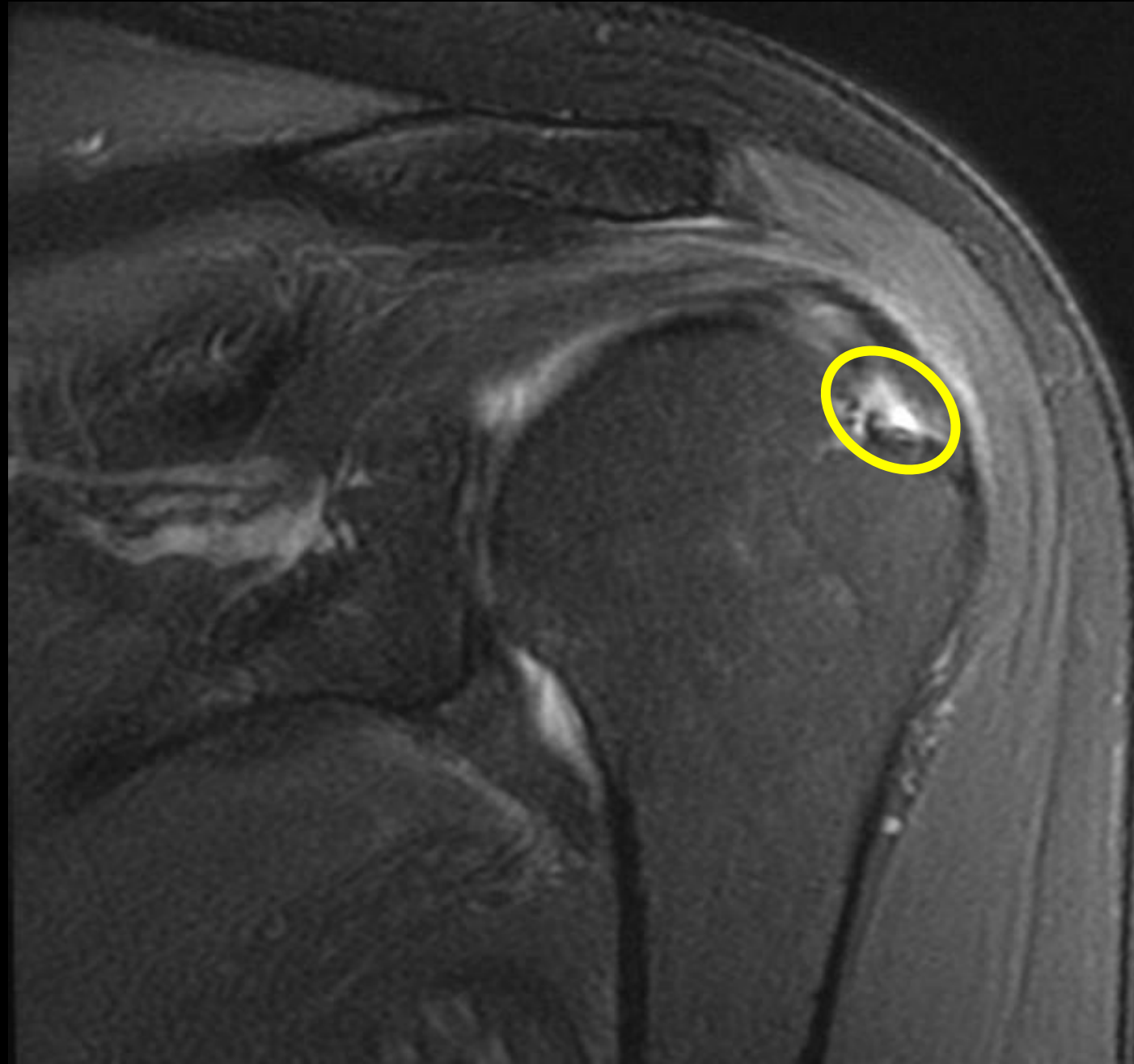
T2

# Small Partial Undersurface Tear



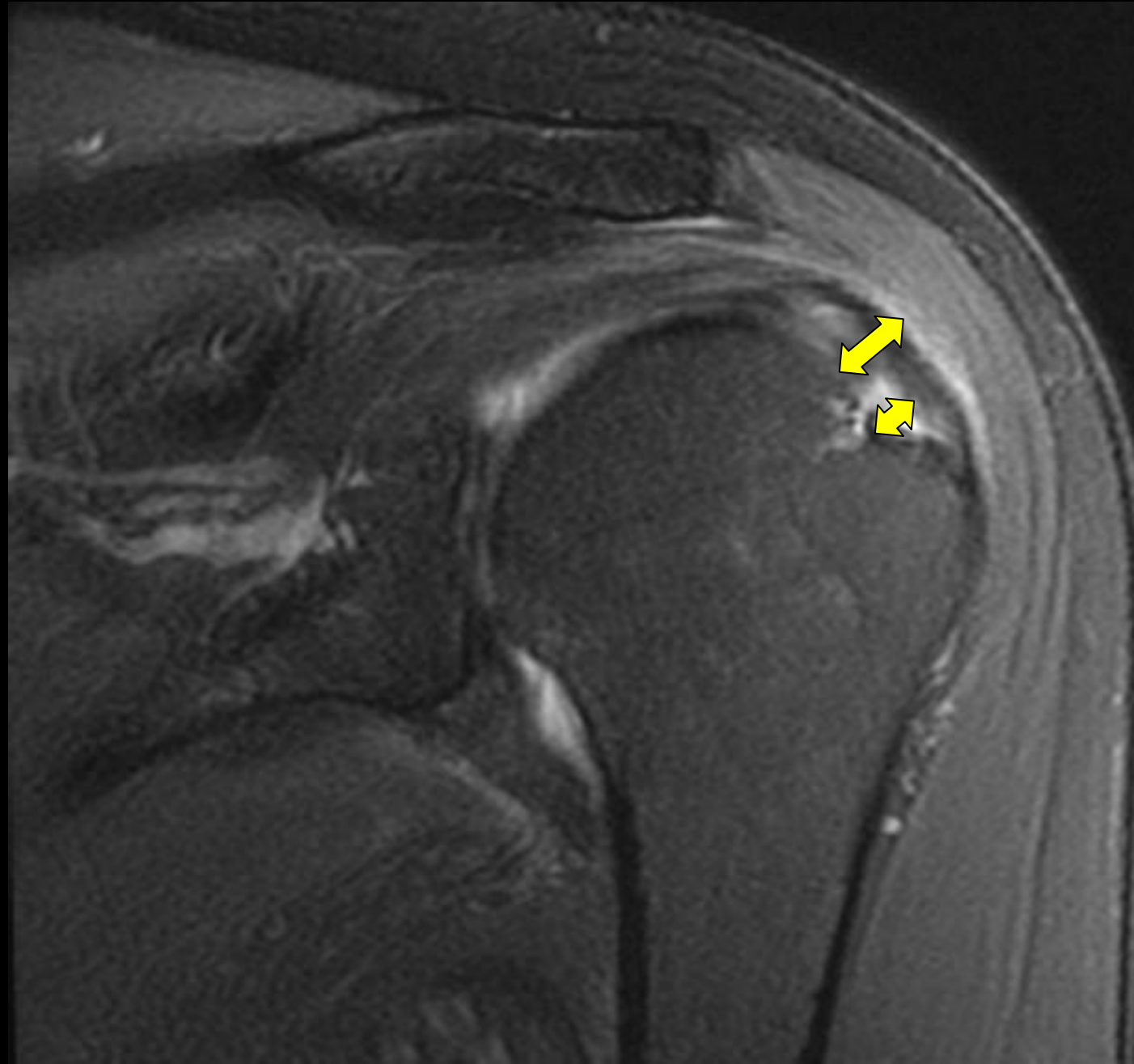
T2

# Small Partial Undersurface Tear



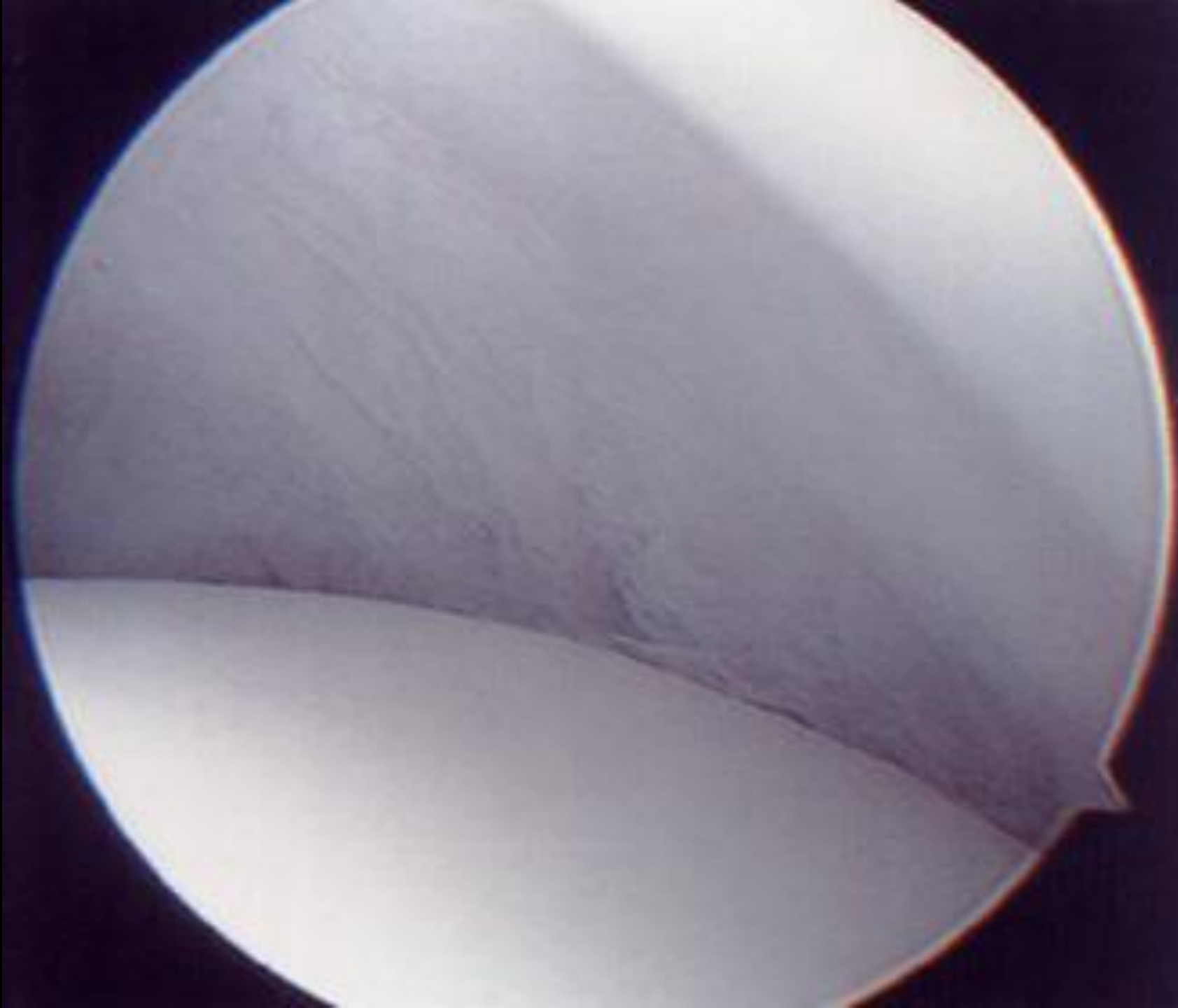
T2

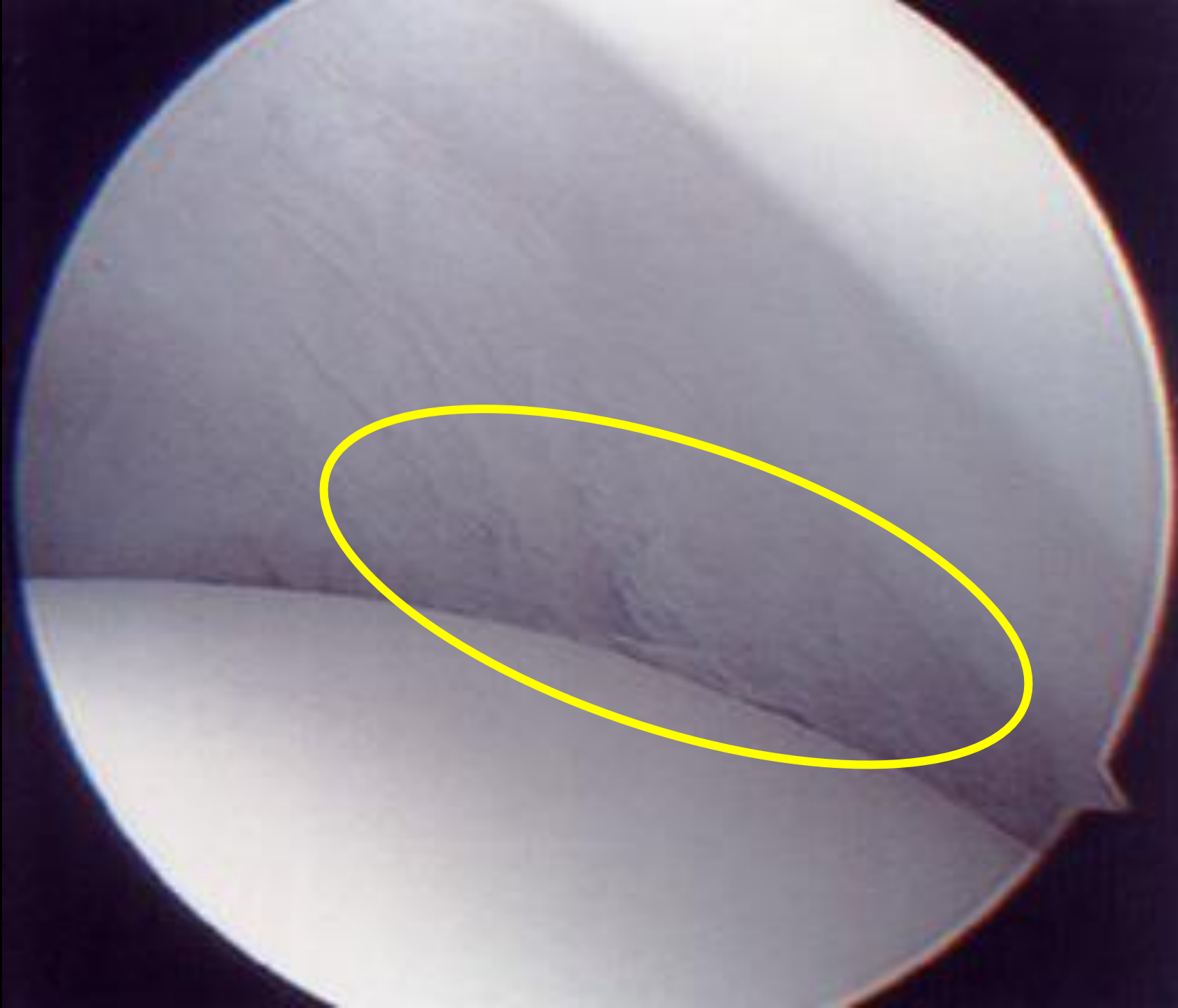
# Small Partial Undersurface Tear



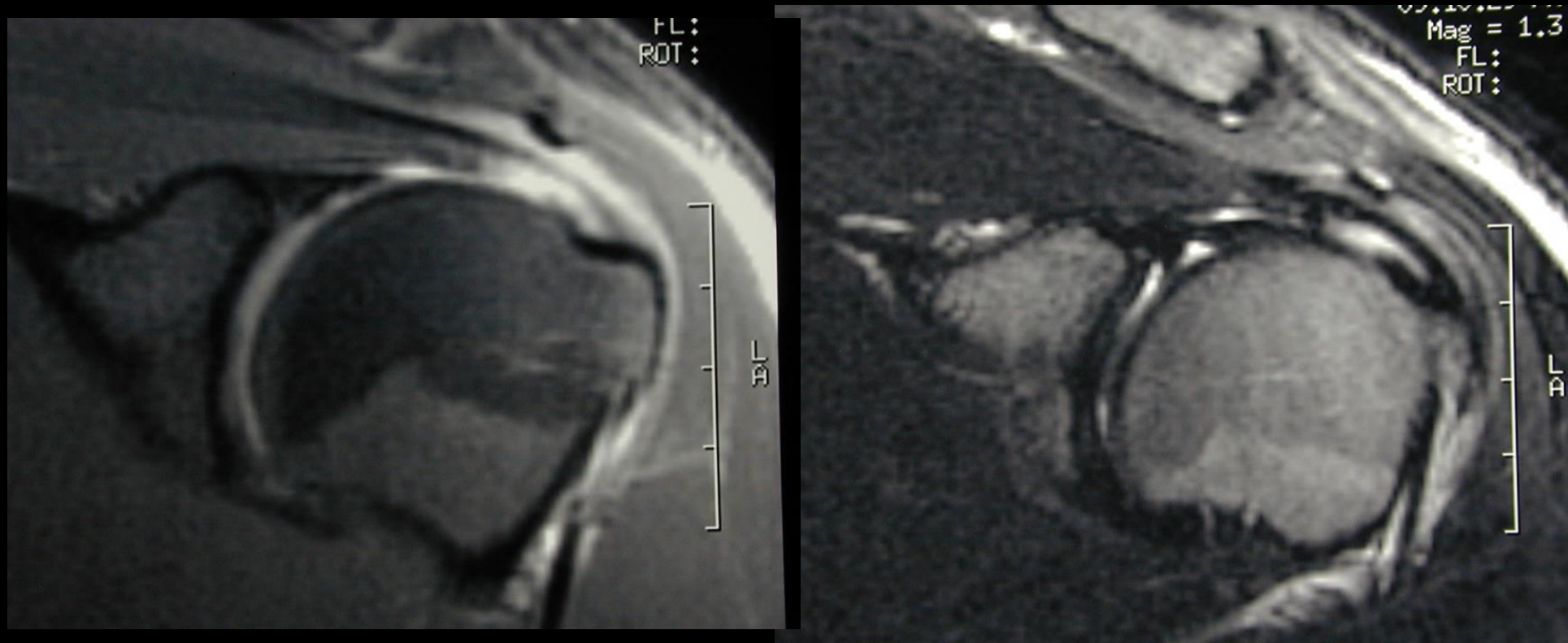
T2







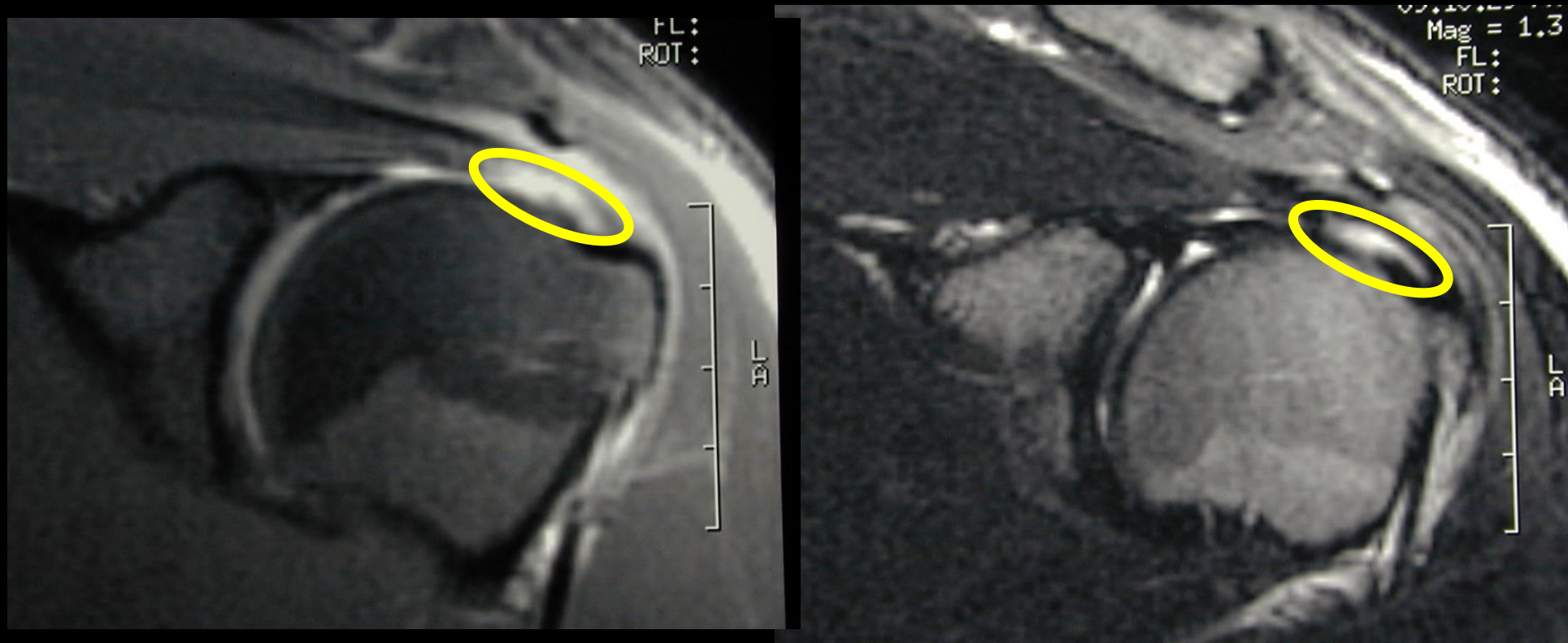
# Large Partial Undersurface Tear



**T1 GD CORONAL**

**T2 CORONAL**

# Large Partial Undersurface Tear

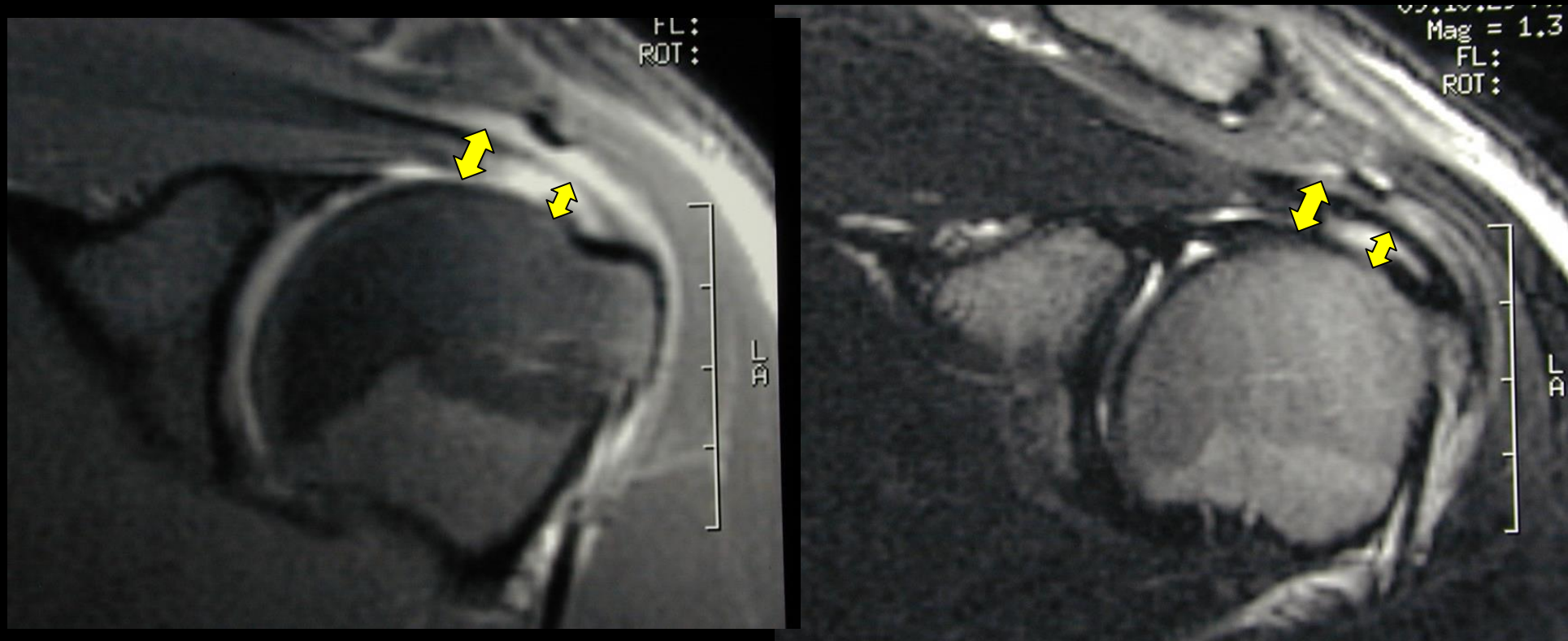


T1 GD CORONAL

T2 CORONAL



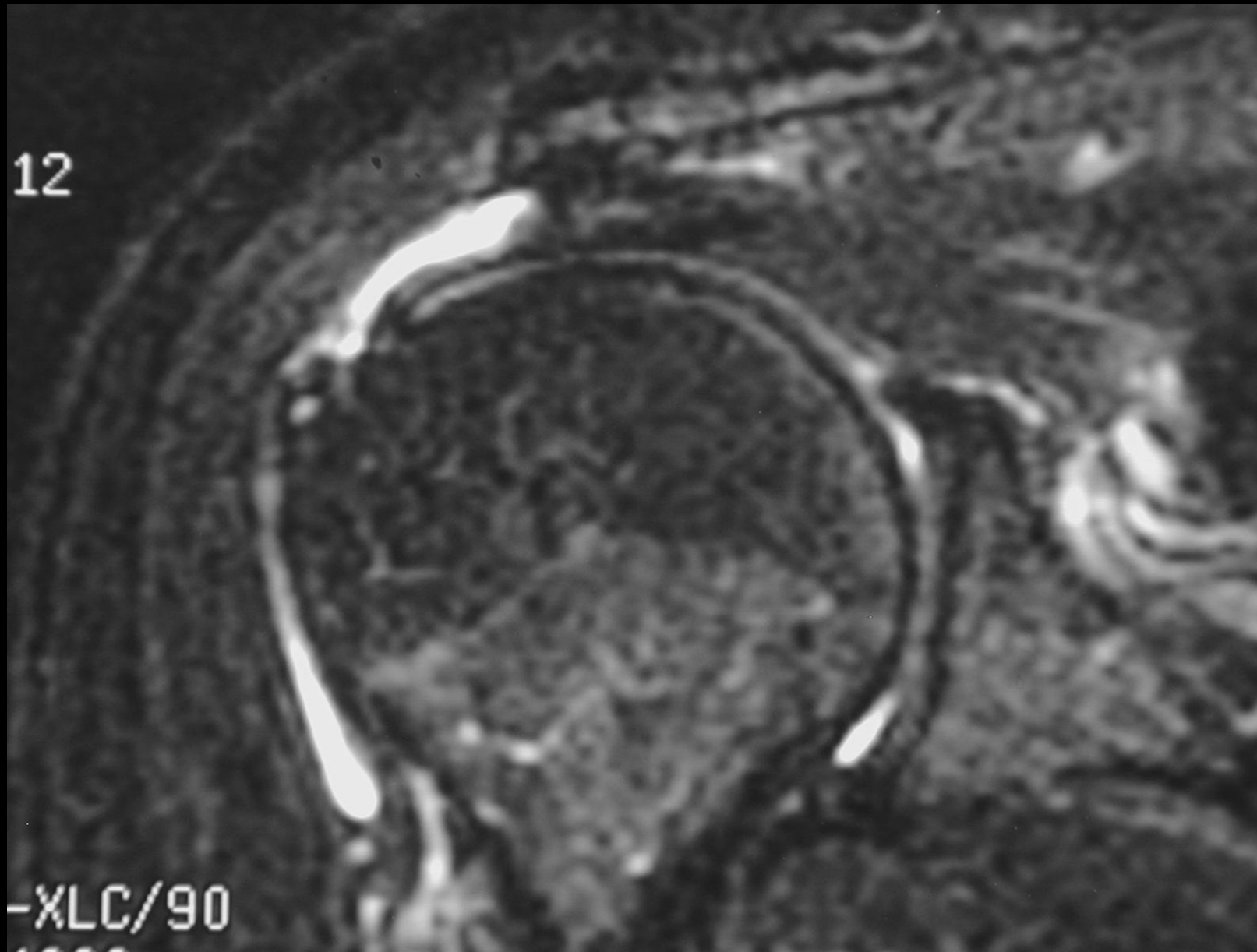
# Large Partial Undersurface Tear



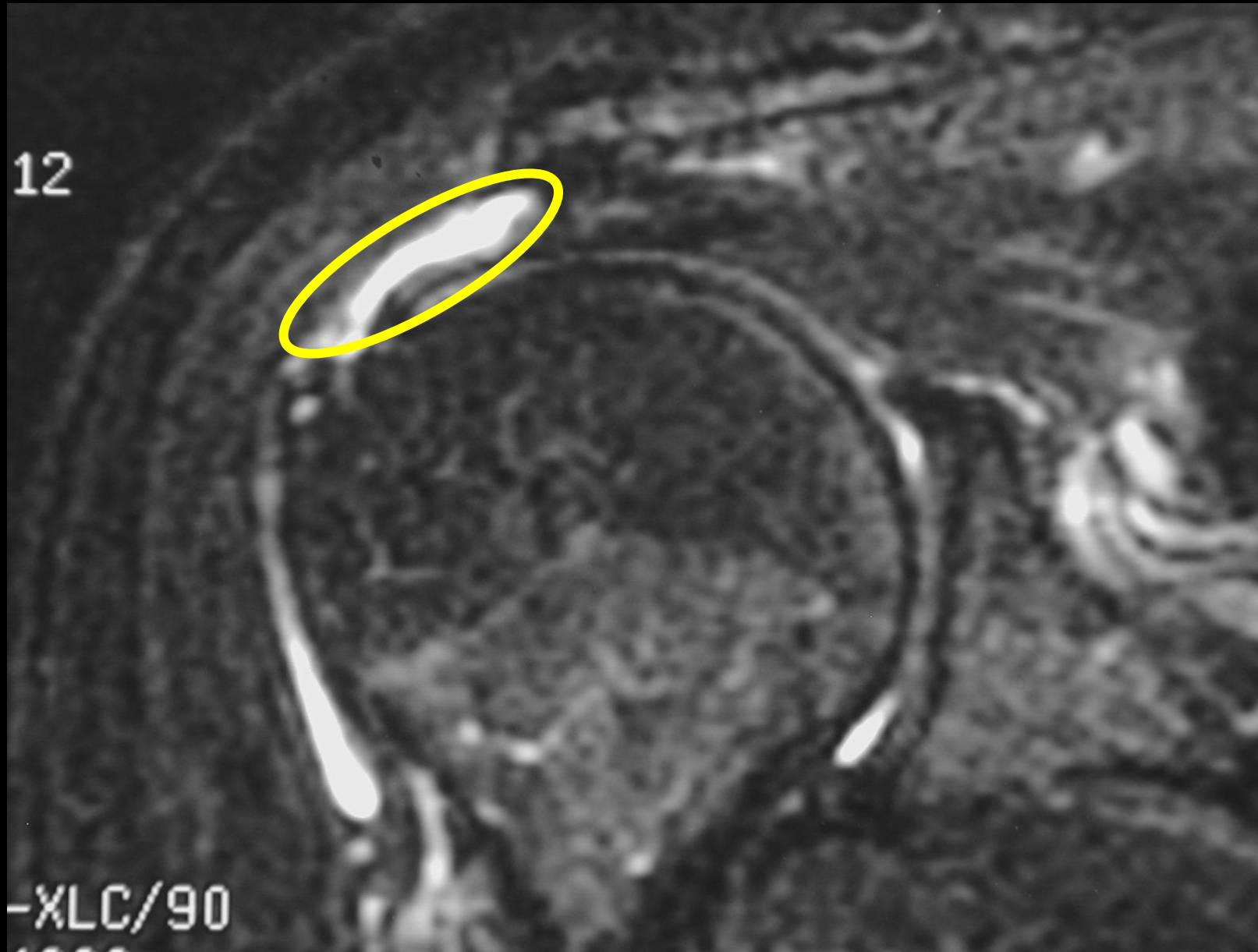
**T1 GD CORONAL**

**T2 CORONAL**

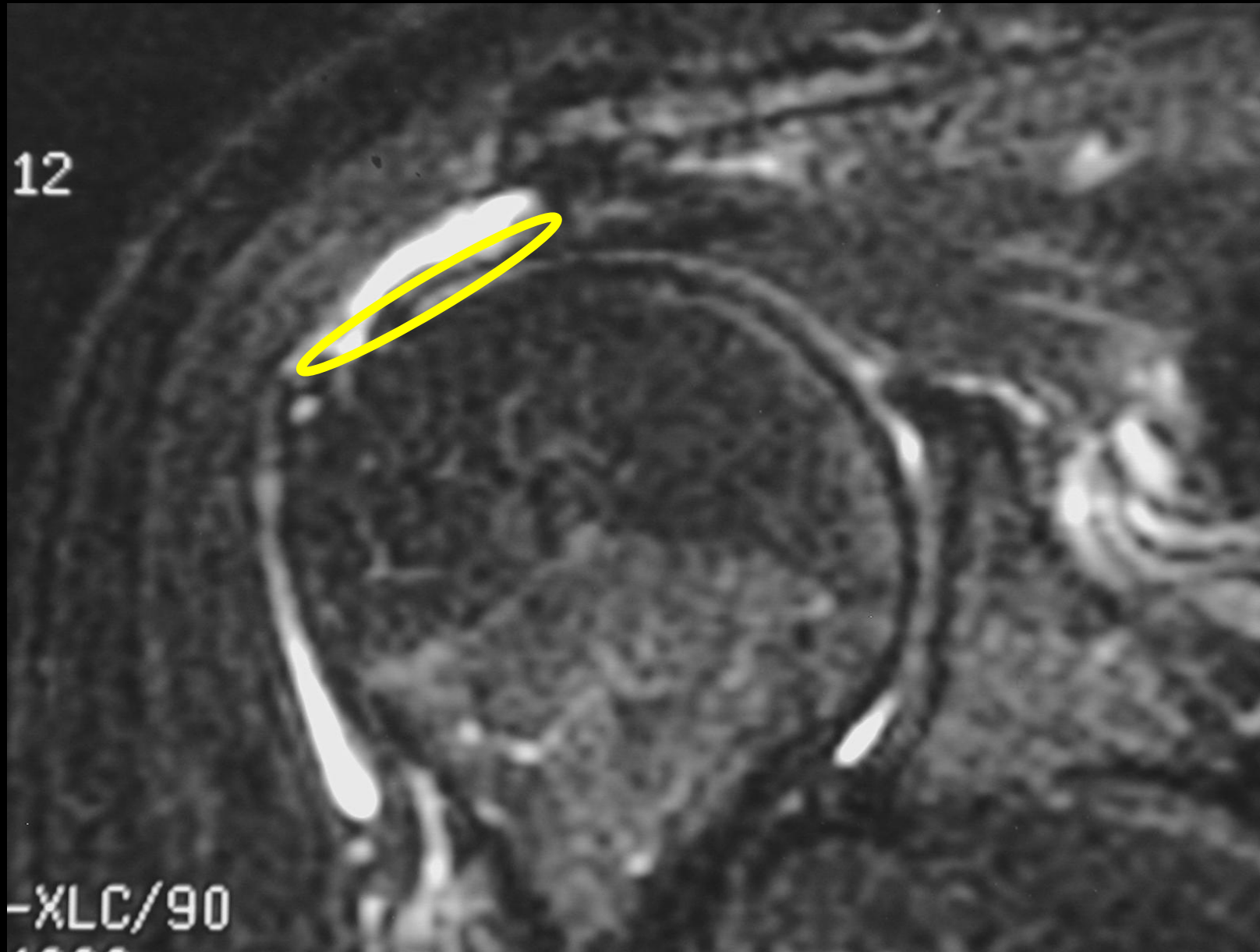
# Large Partial Bursal Tear



# Large Partial Bursal Tear

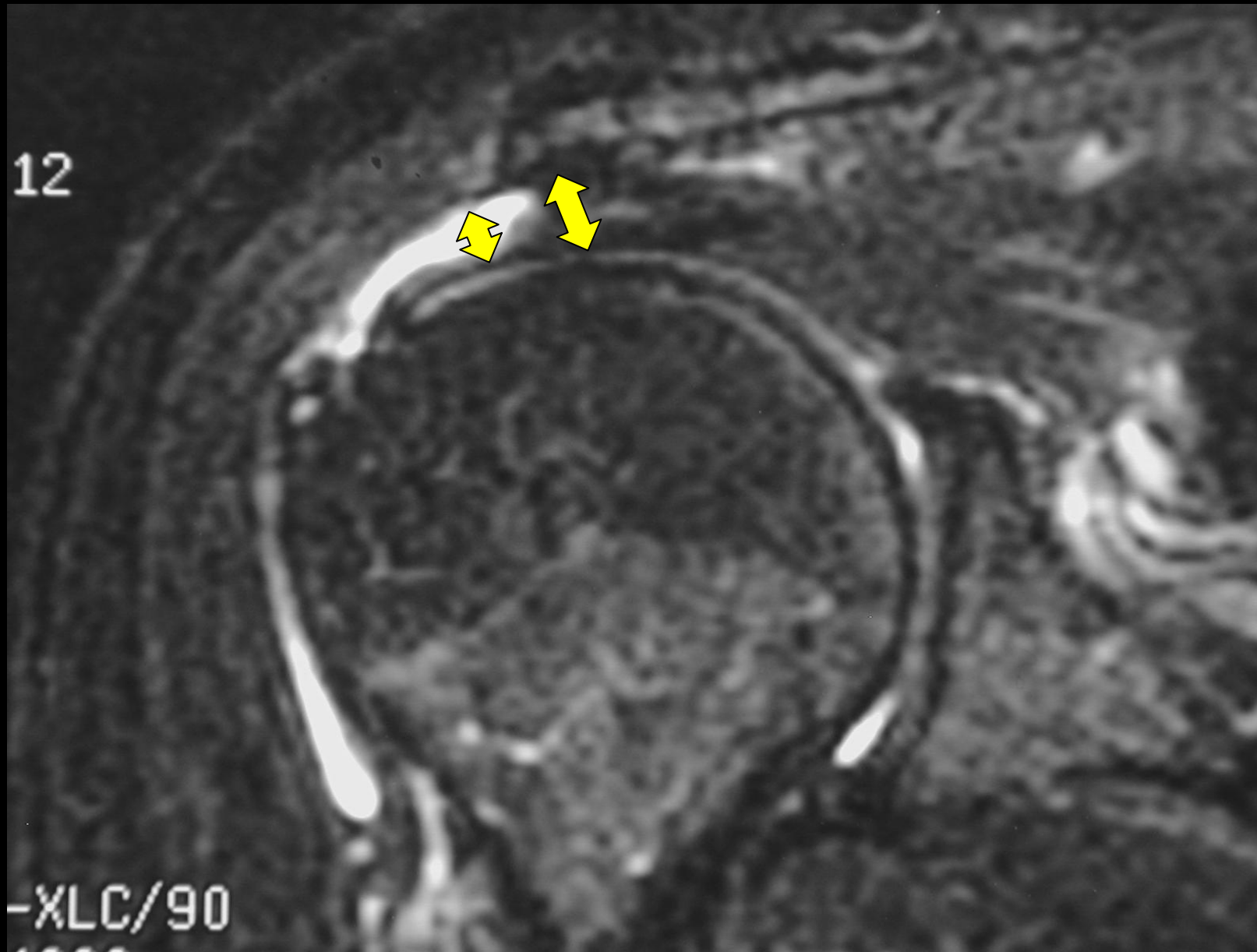


# Large Partial Bursal Tear

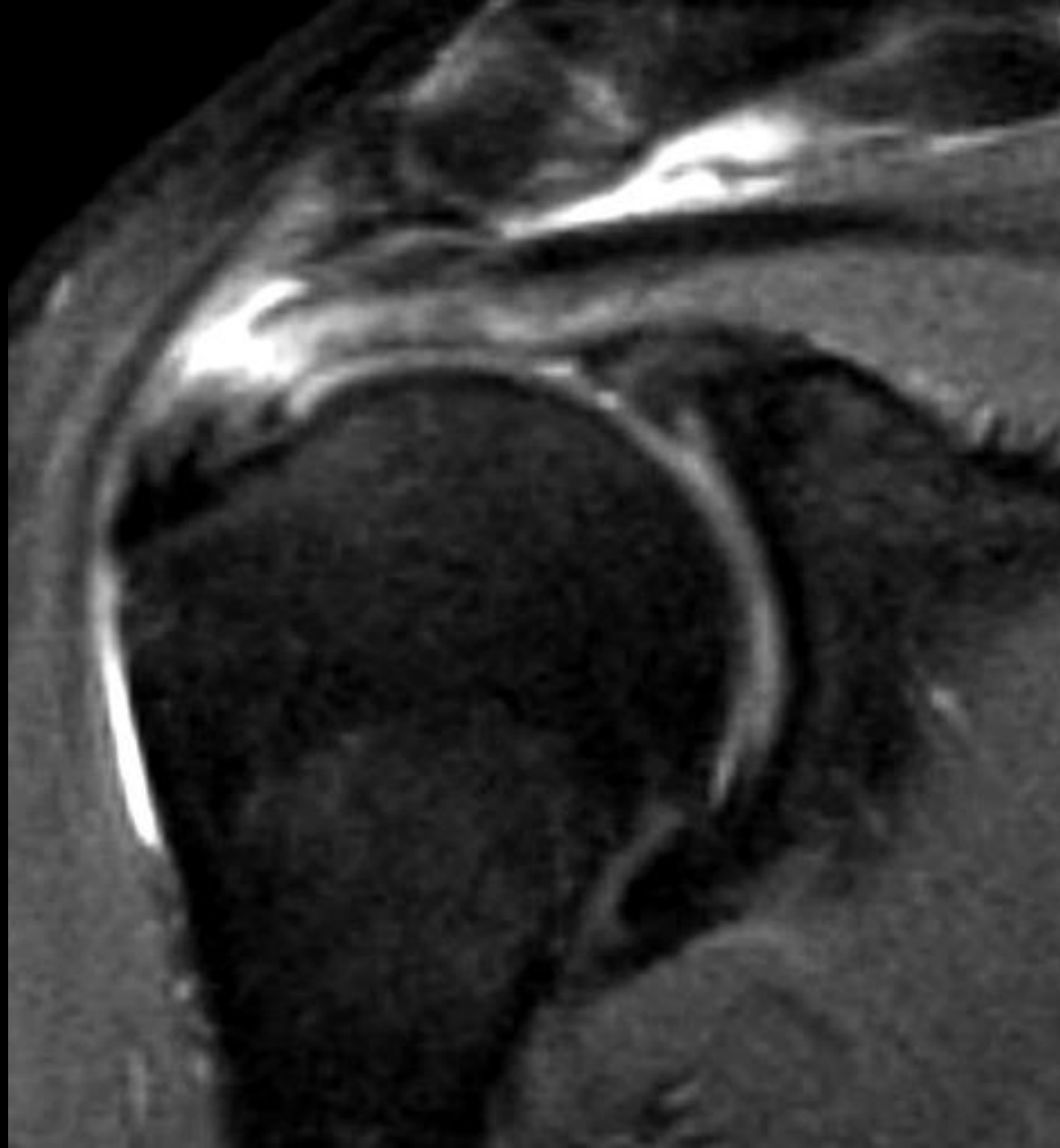




# Large Partial Bursal Tear



# Large Partial Bursal Tear



**T2 CORONAL**

# Large Partial Bursal Tear



**T2 CORONAL**

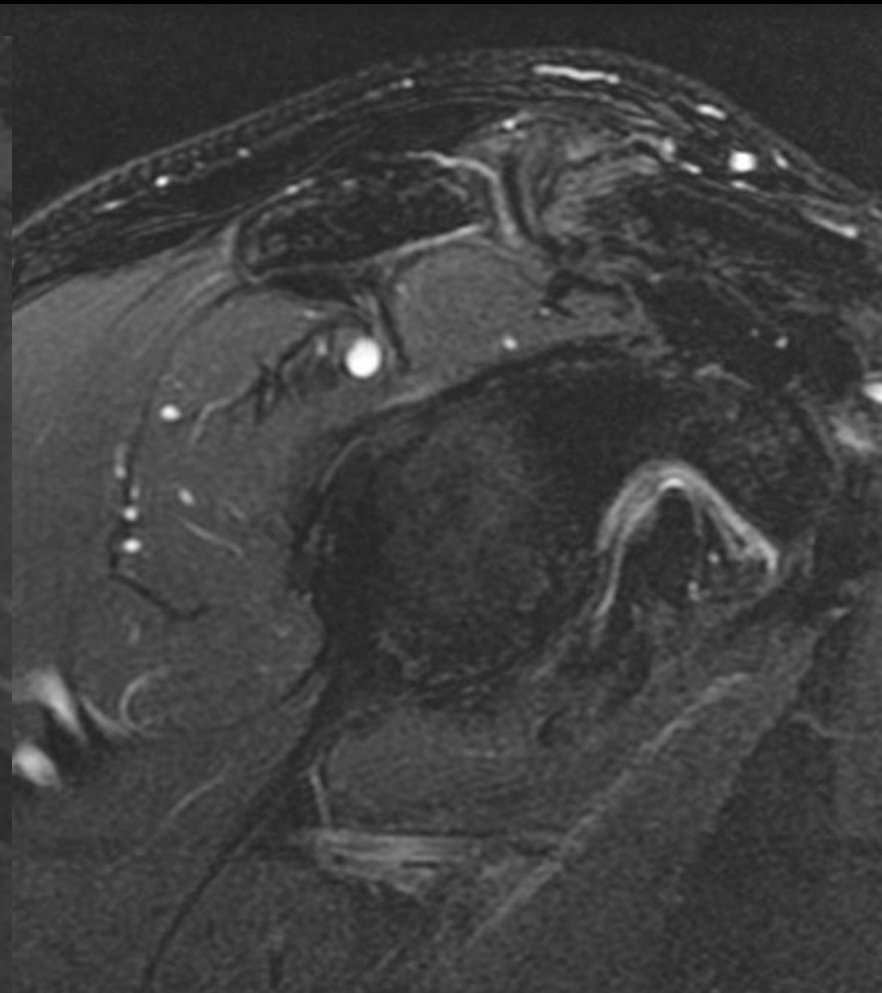
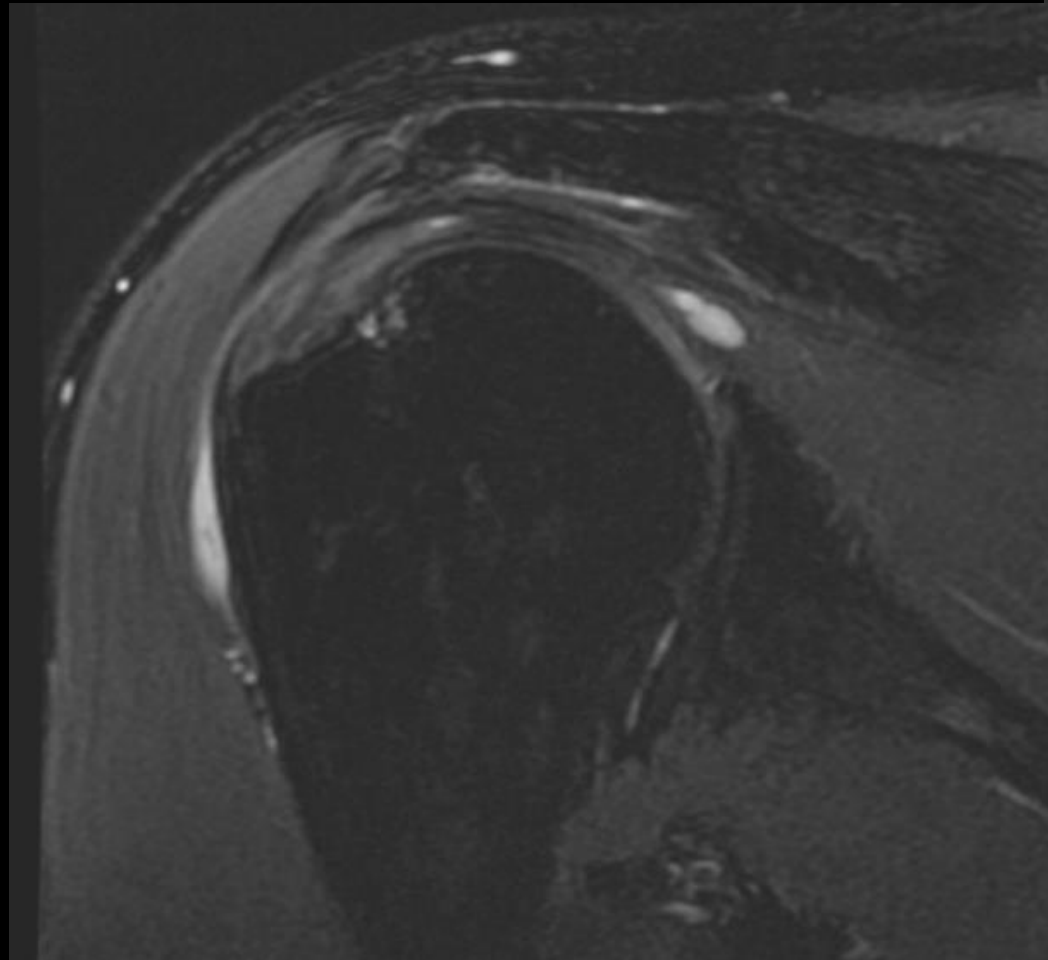
# Large Partial Bursal Tear



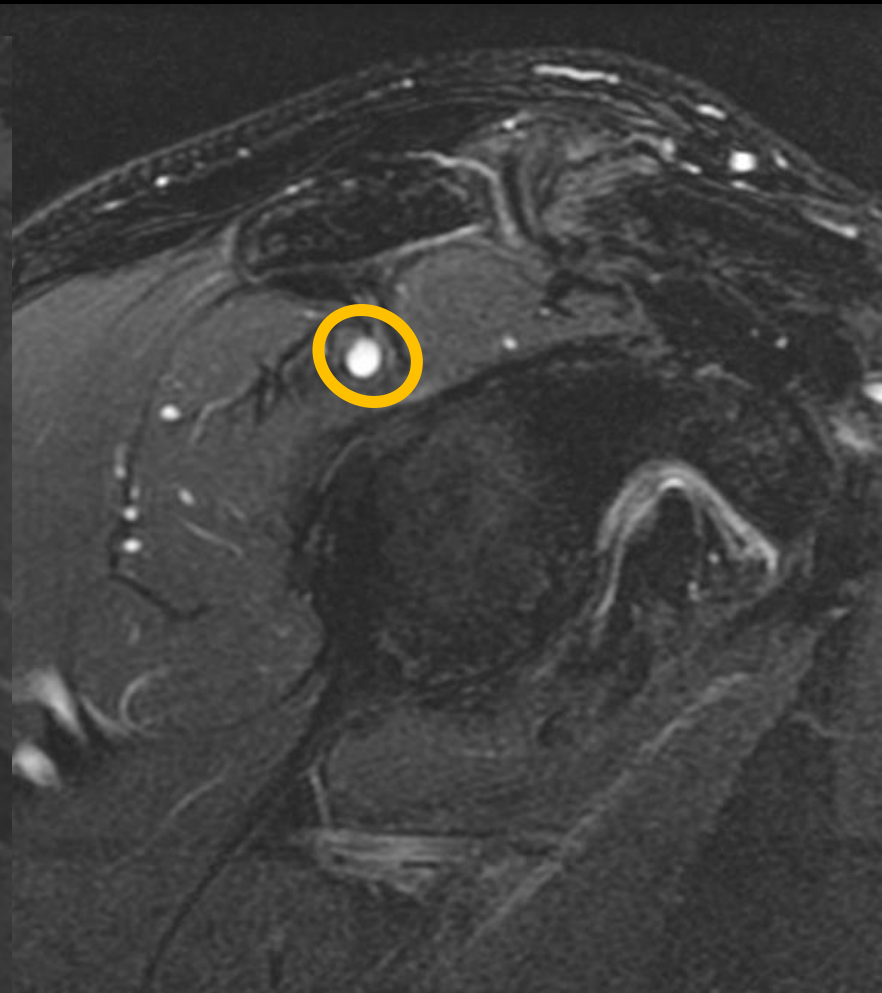
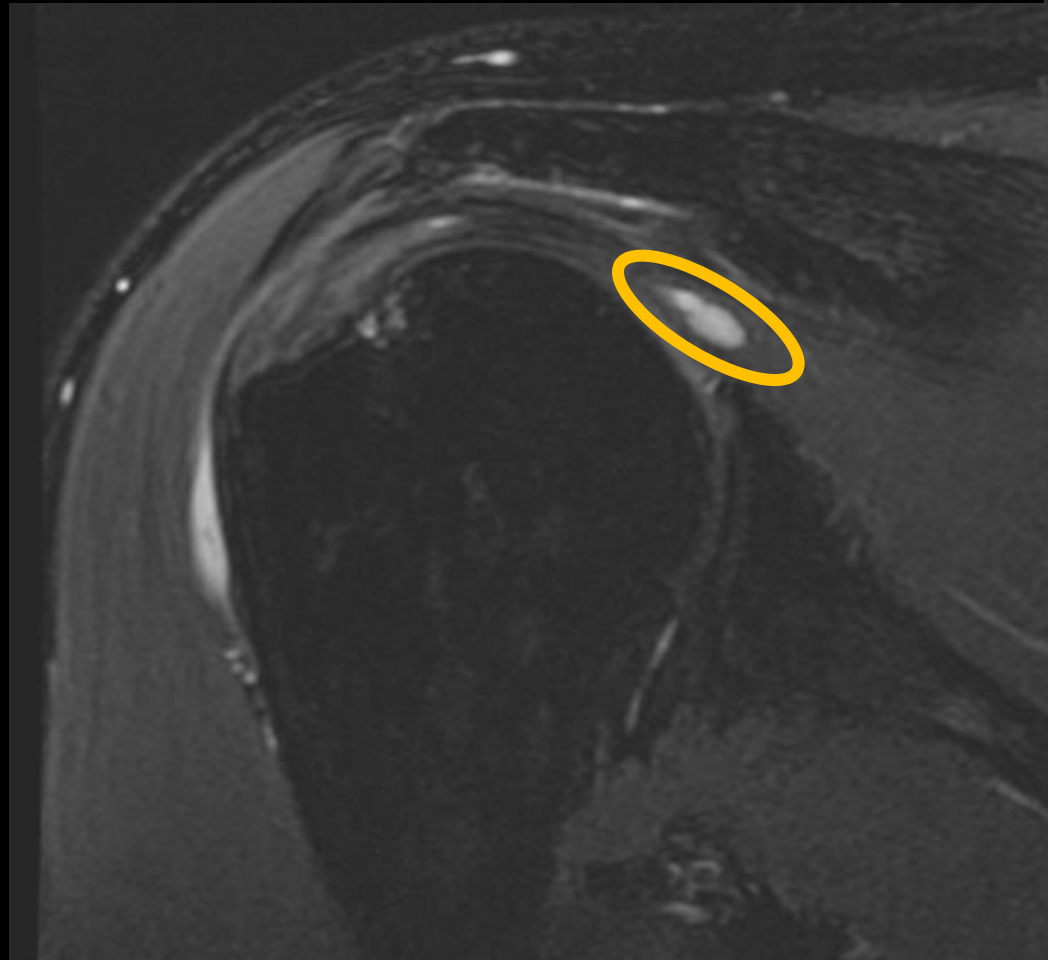
**T2 CORONAL**



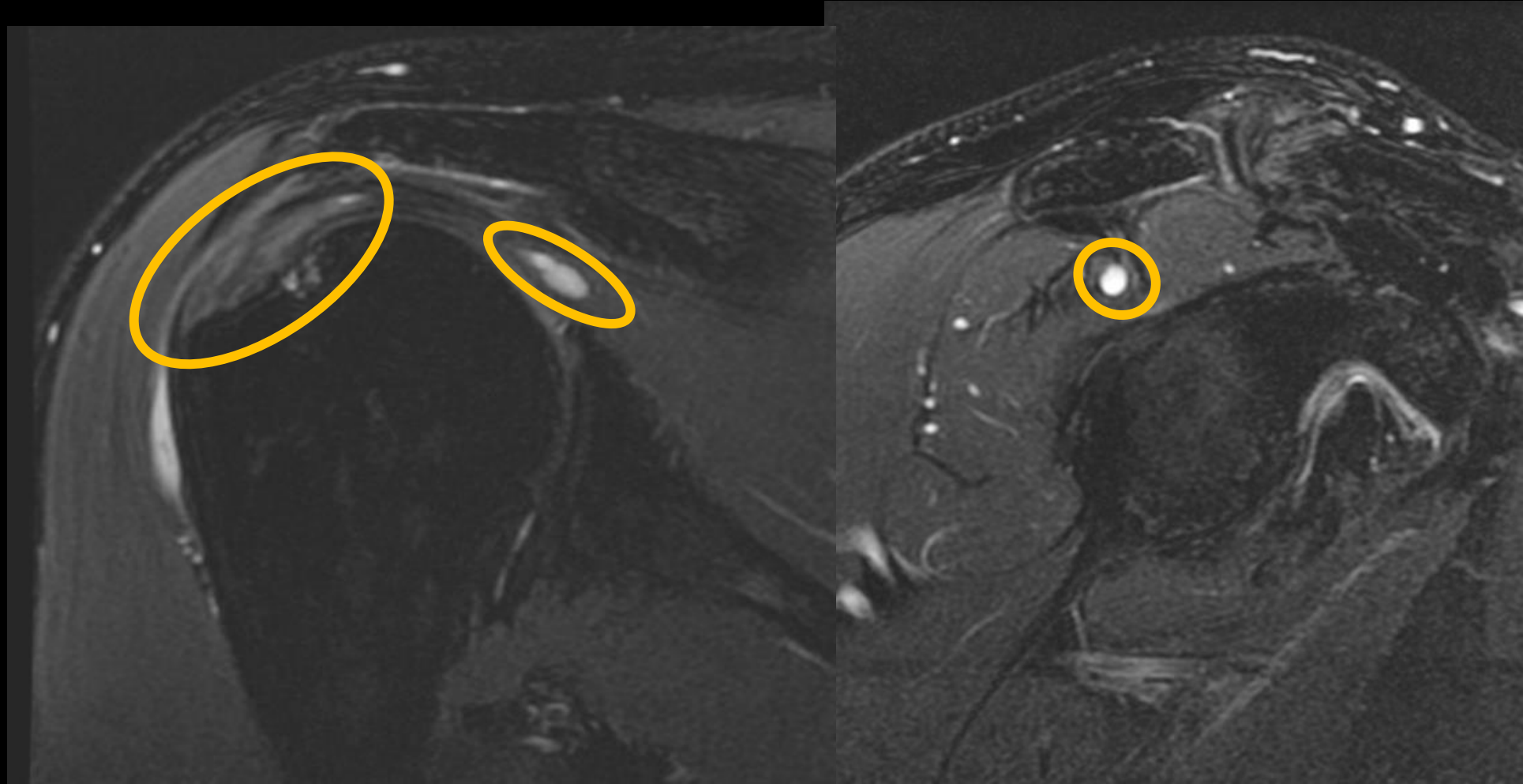
# Intratendinous Ganglion/Cyst



# Intratendinous Ganglion/Cyst

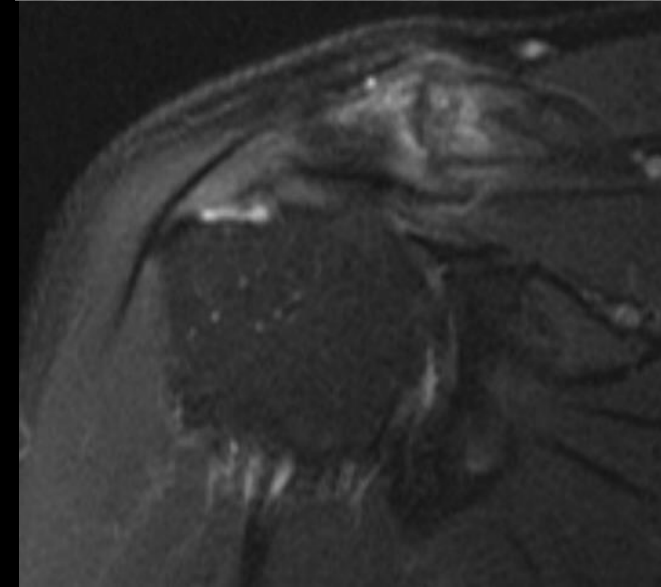
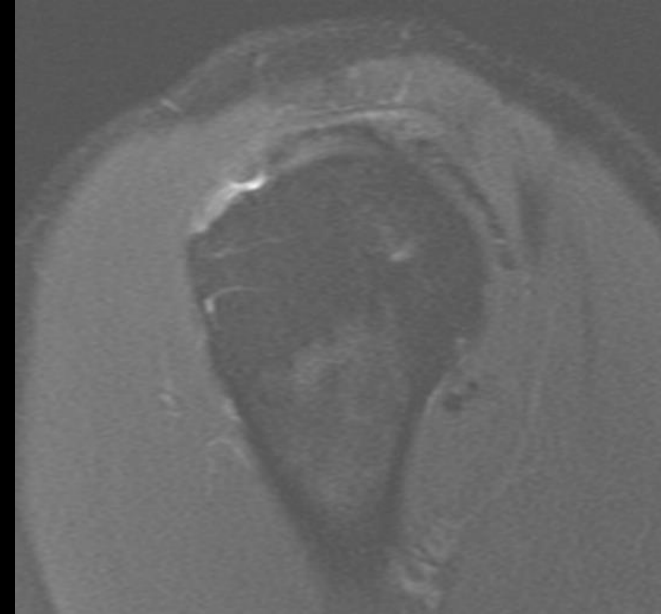


# Intratendinous Ganglion/Cyst



# RIM RENT TEAR

- Seen in young patients
- Usually anterior
- Intrasubstance vs partial undersurface
- PASTA (partial articular side tendon avulsion)/PAINT (posterior articular surface intratendinous tear)

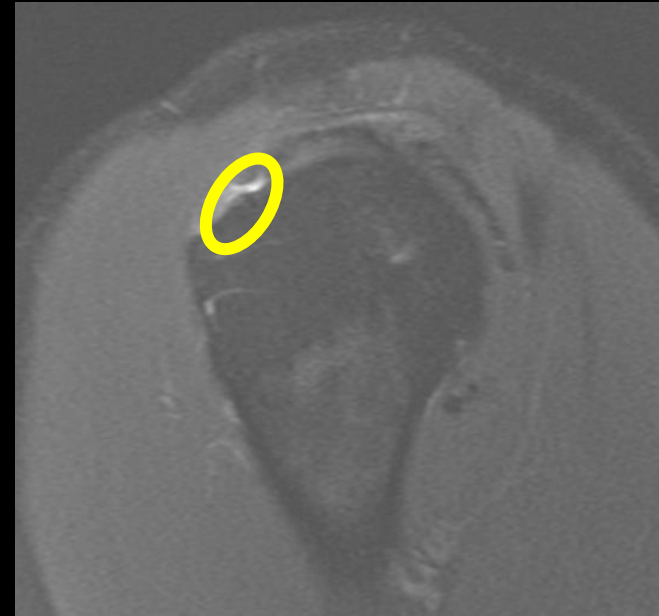


T2



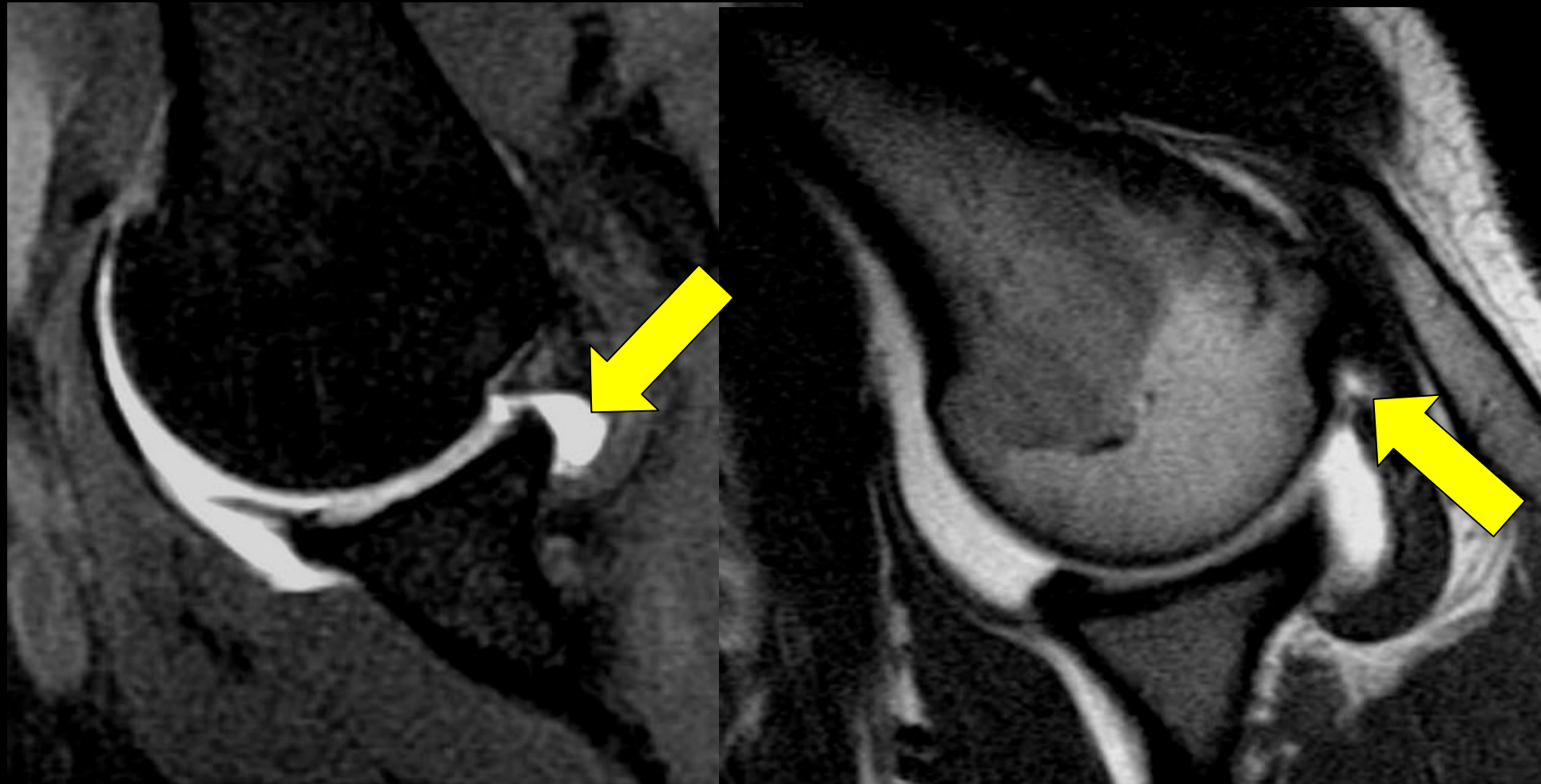
# RIM RENT TEAR

- Seen in young patients
- Usually anterior
- Intrasubstance vs partial undersurface
- PASTA (partial articular side tendon avulsion)/PAINT (posterior articular surface intratendinous tear)



T2

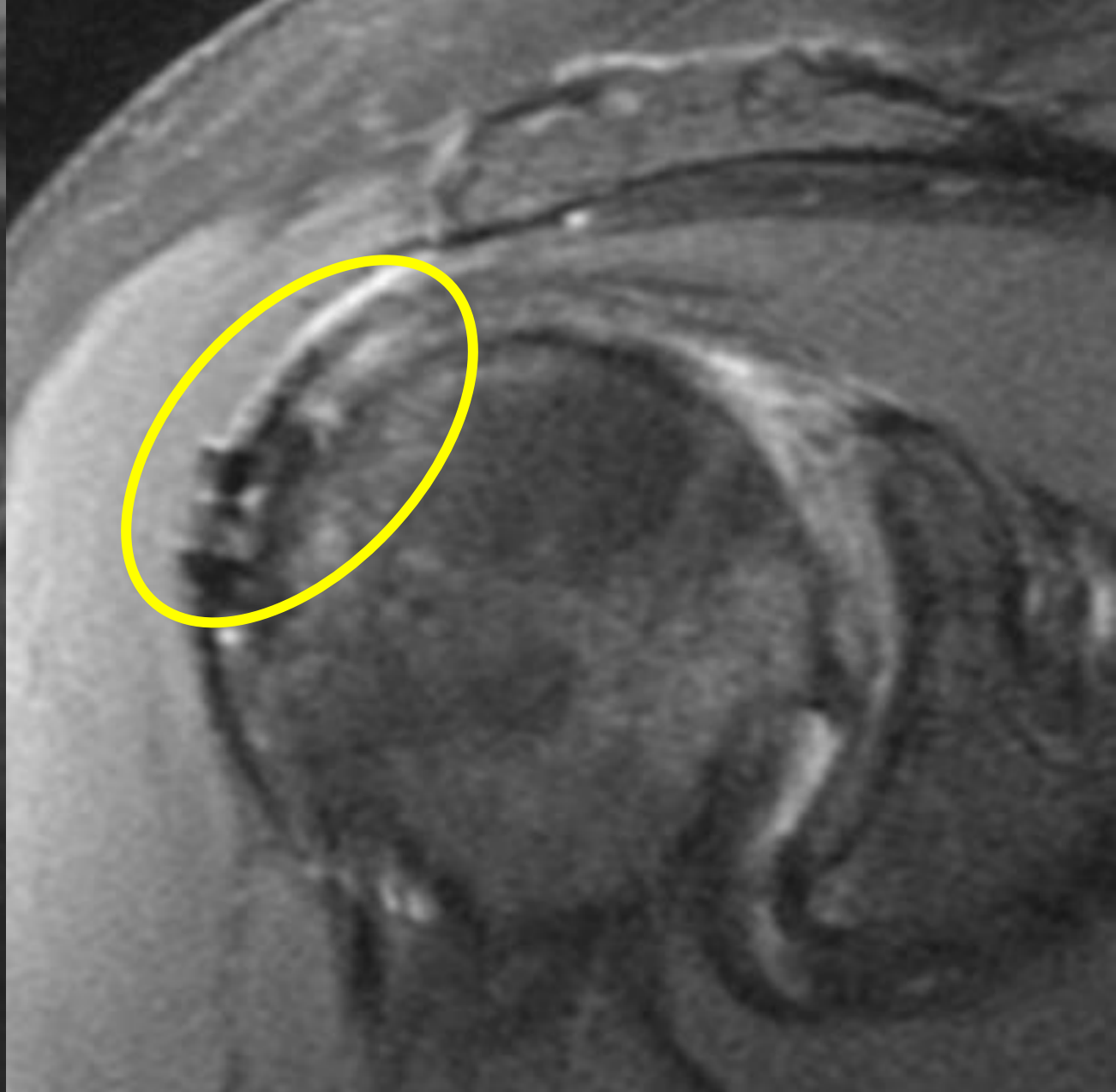
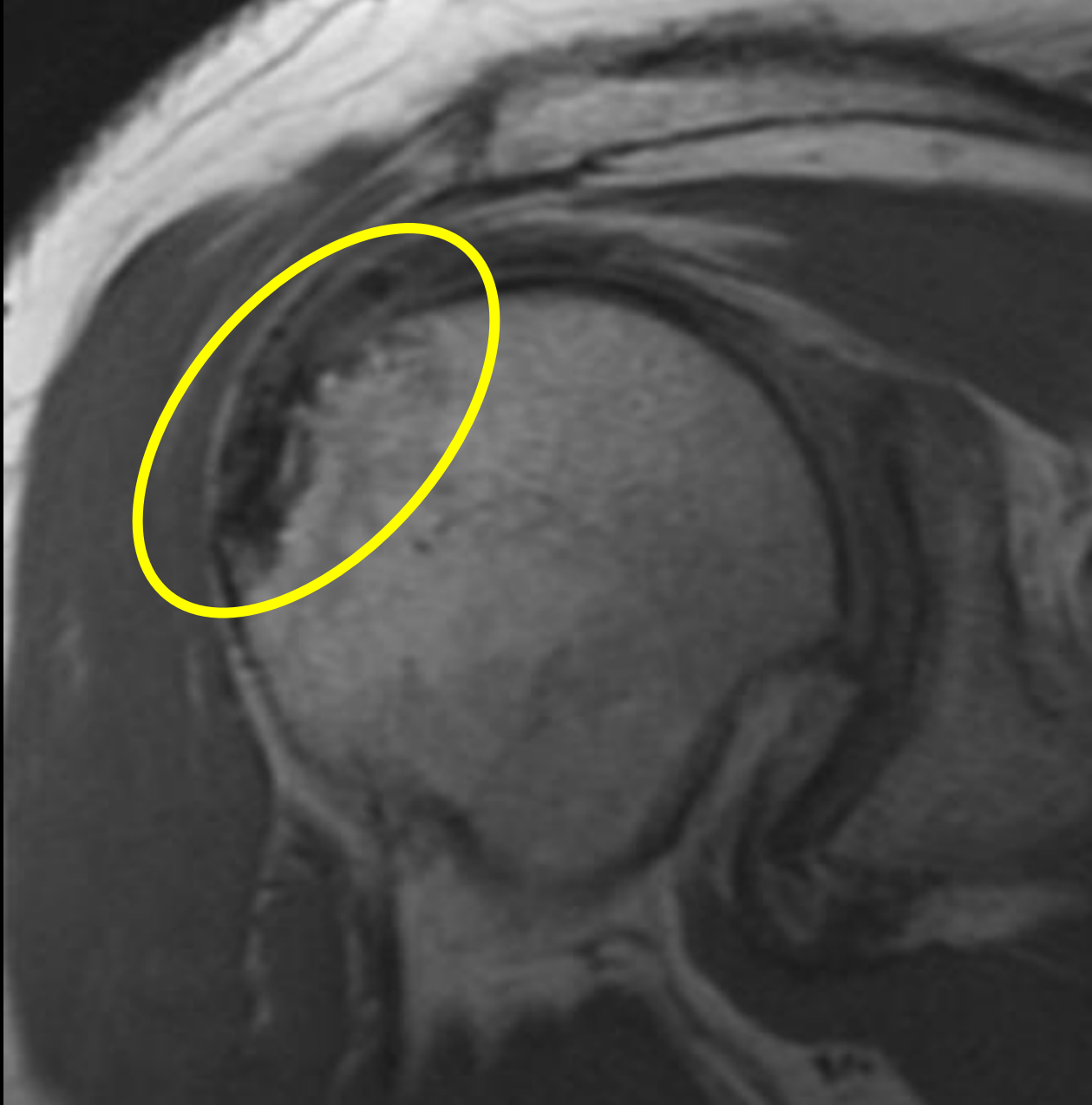
# Intrasubstance vs Partial US Value of ABER



MR ARTHROGRAPHY

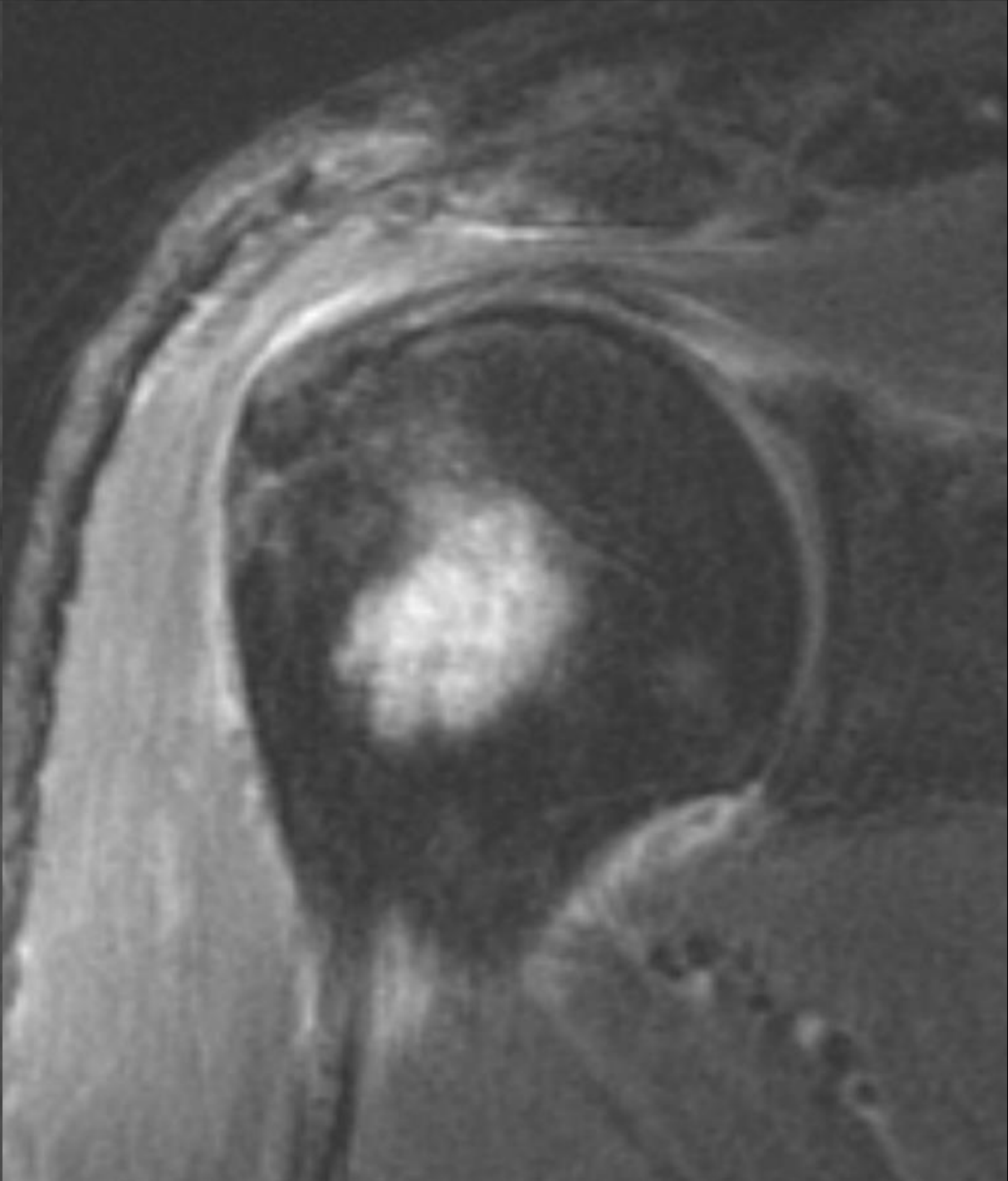
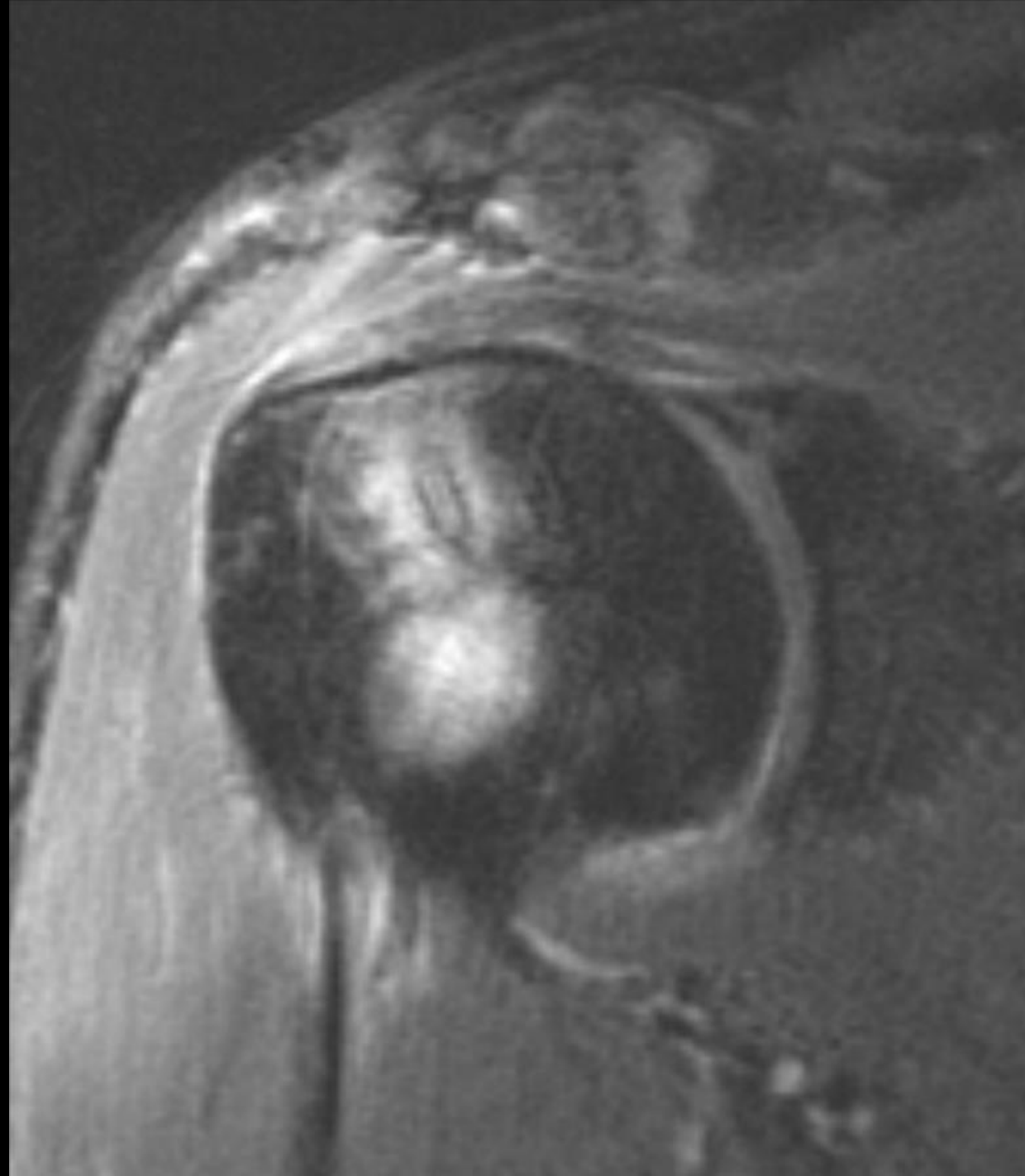
# POST-OPERATIVE SHOULDER MR IMAGING

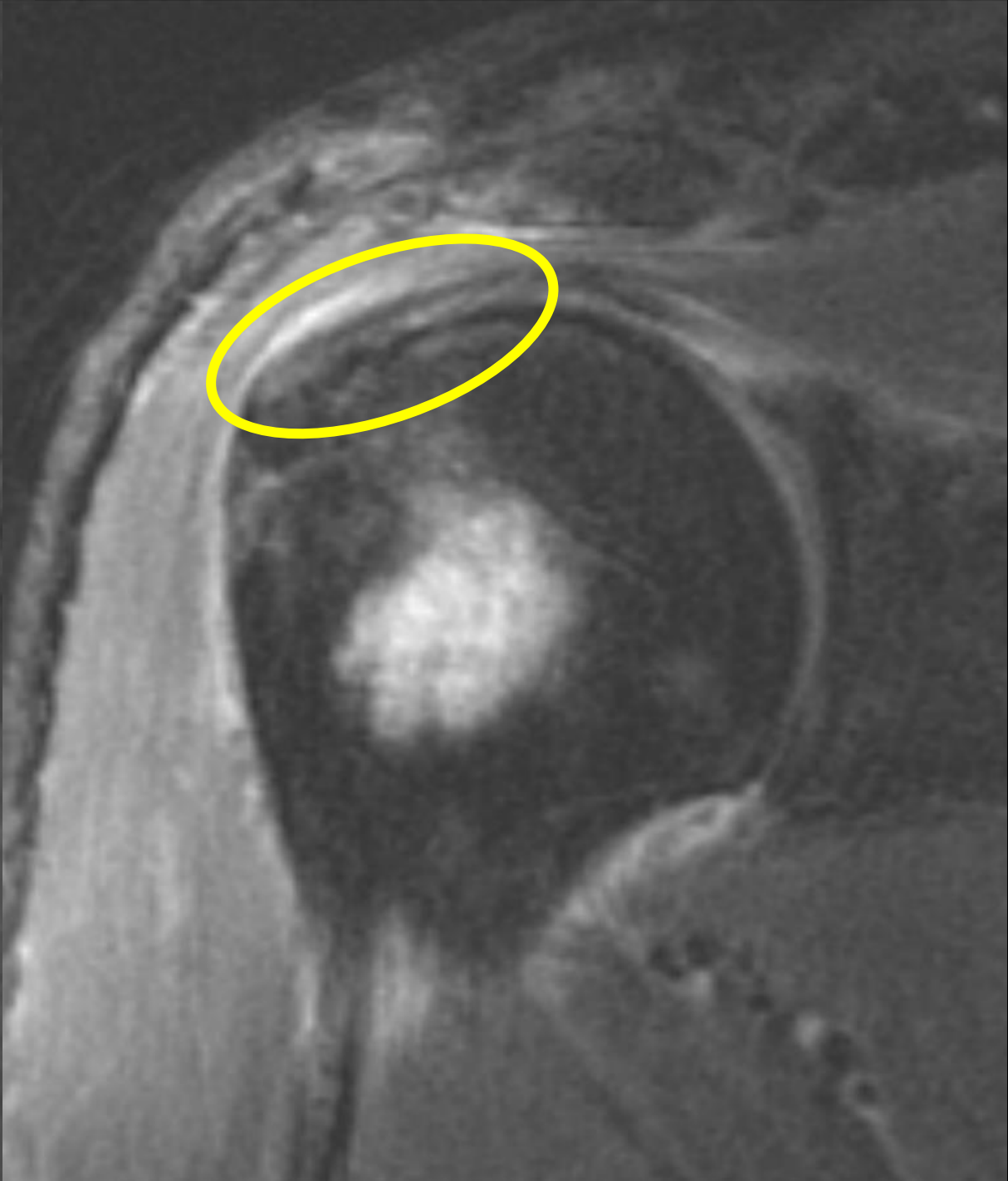
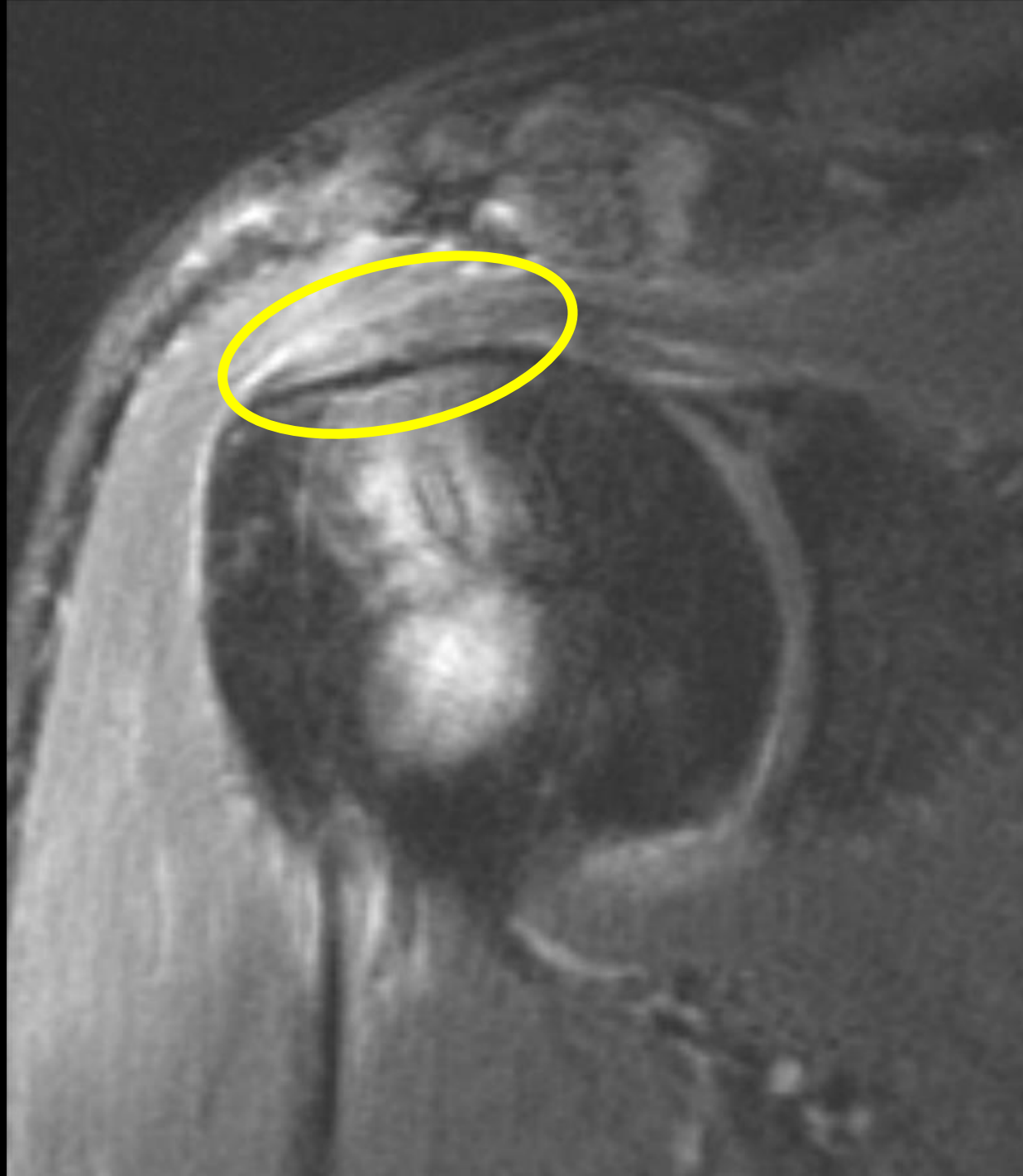
- Metal artifact decreased with STIR and increased bandwidth
- Surgical repair does not create a watertight seal
- Full thickness re-tear discontinuity with high signal/gad (arthrogram) particularly if >10mm
- Partial thickness tear fluid/gad (arthro)
- Other complications: deltoid tear/dehiscence, osteonecrosis (AVN), anchor displacement

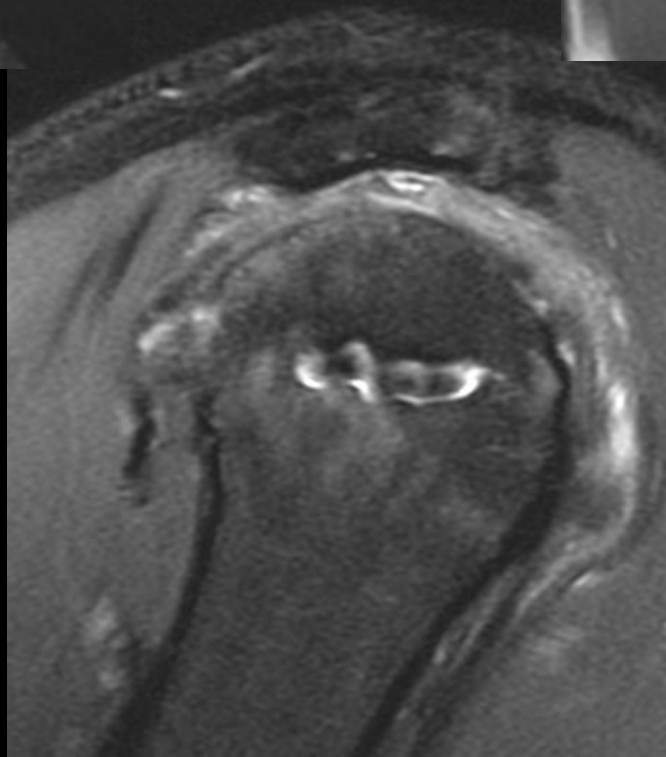
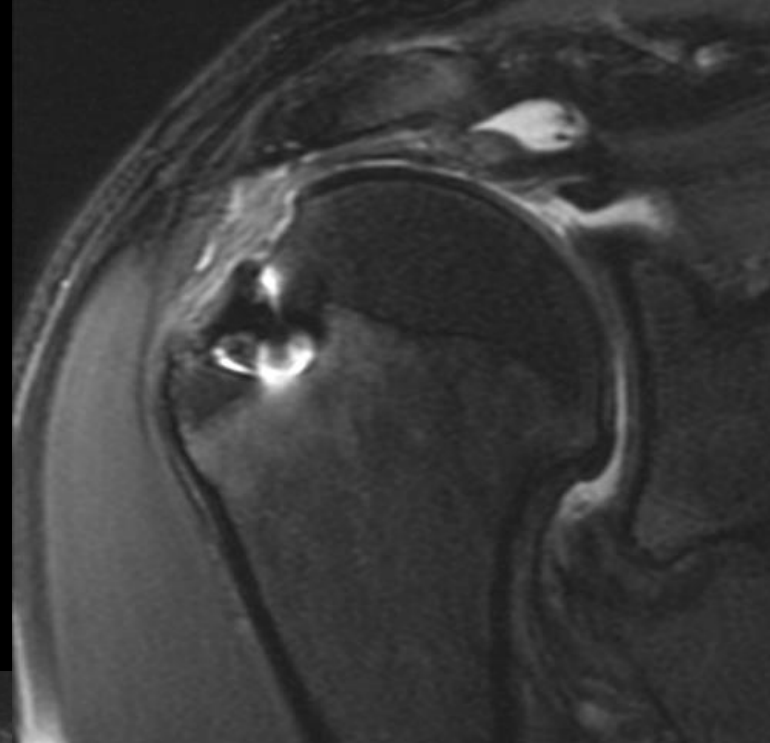
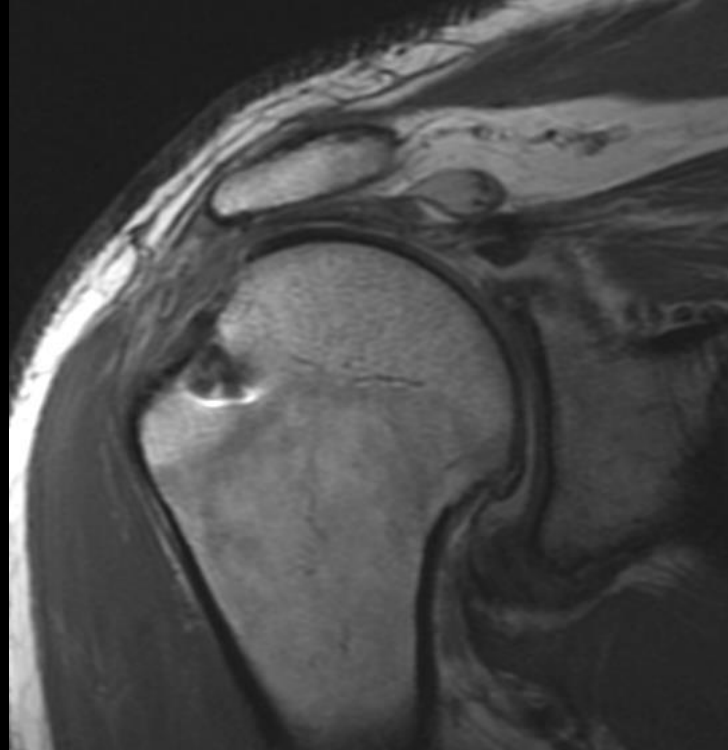


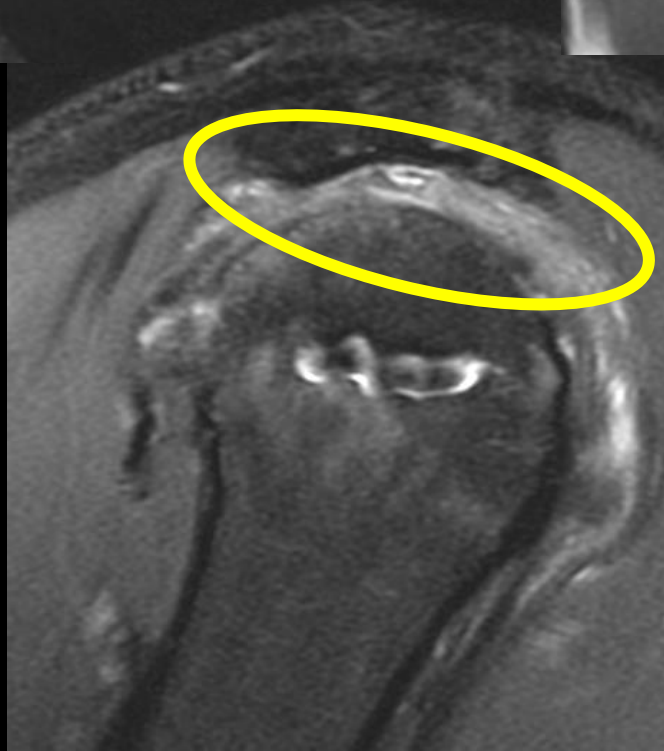
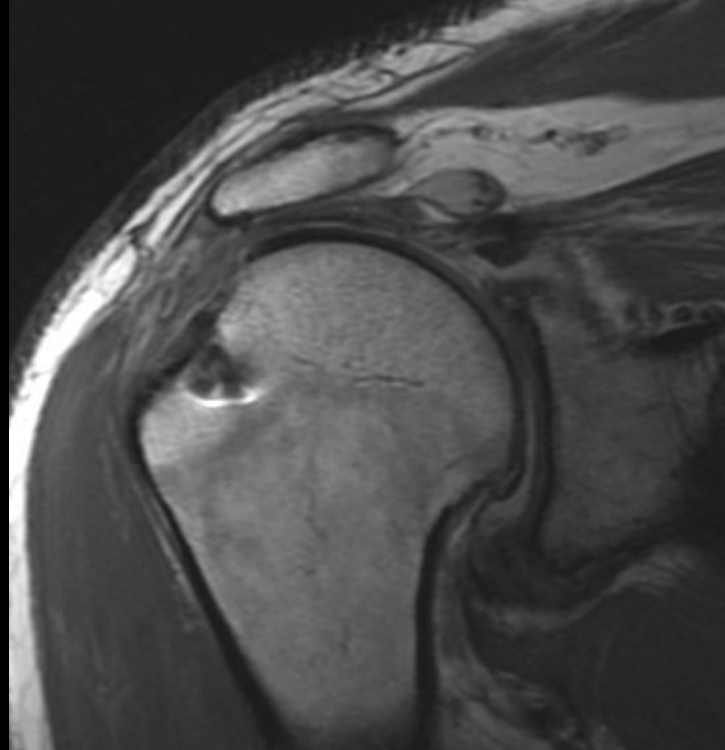
**Normal post-operative rotator cuff**





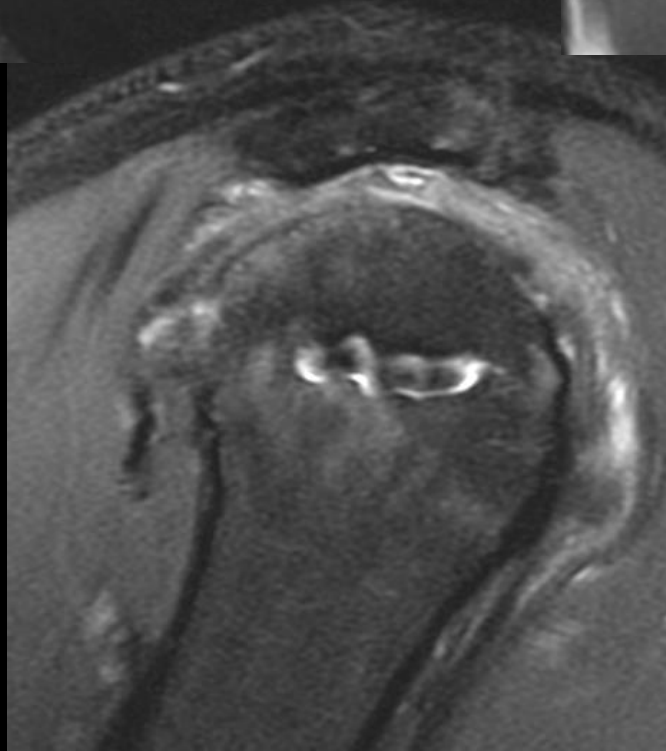
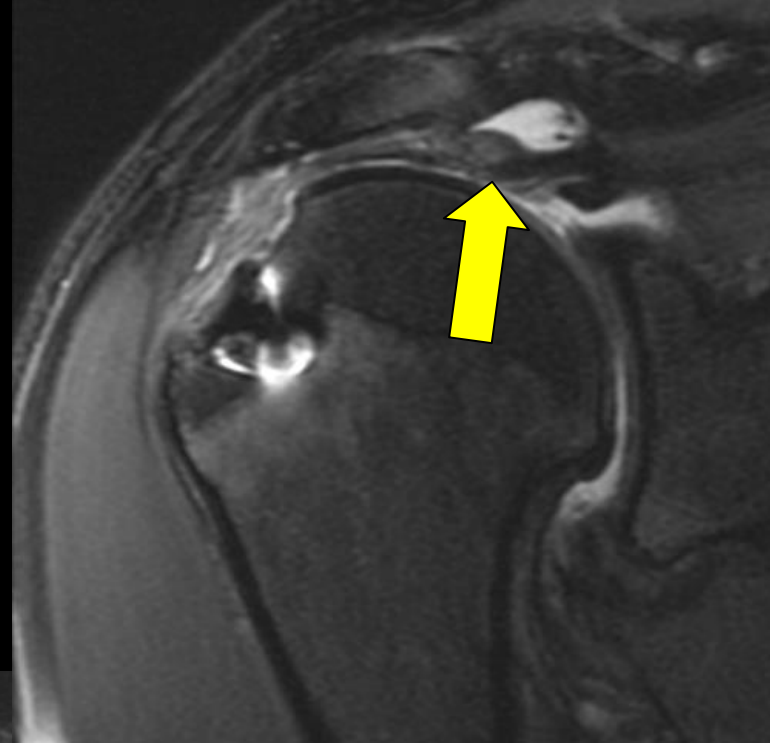
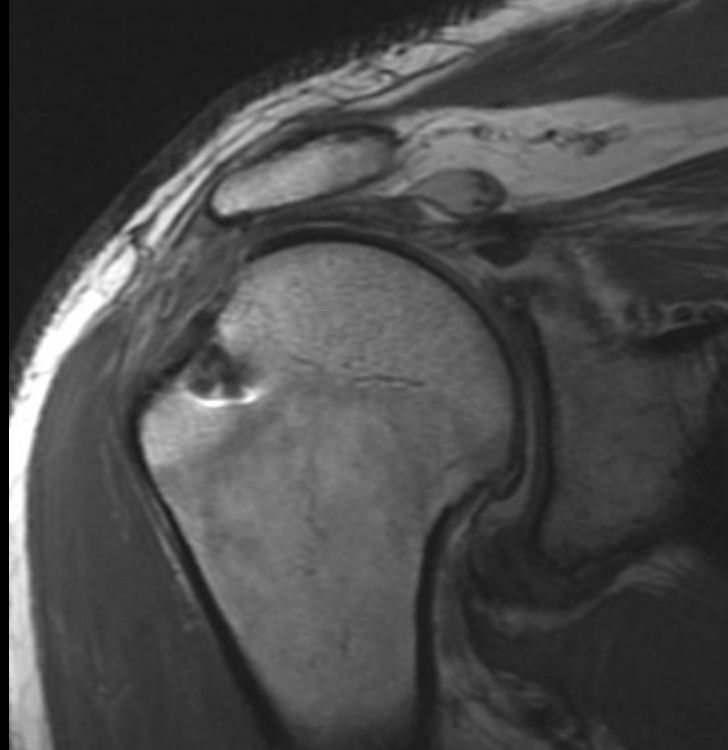


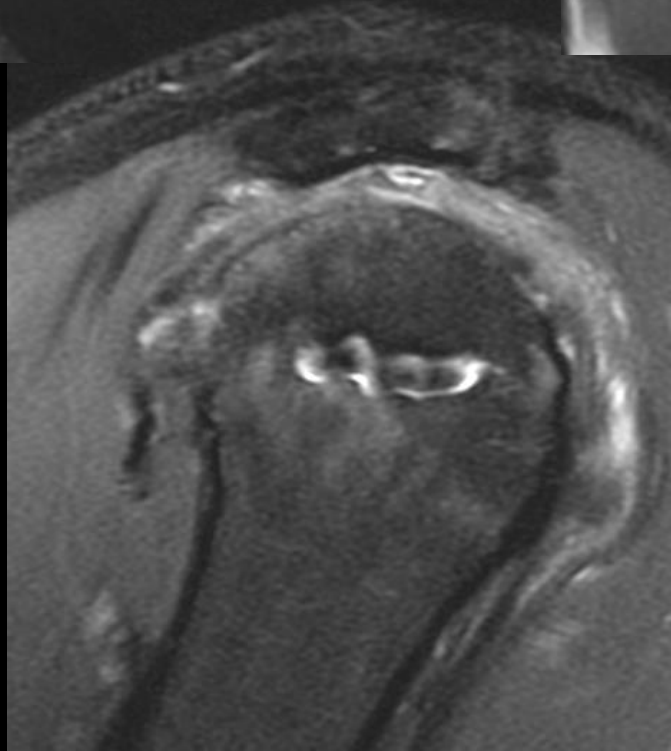
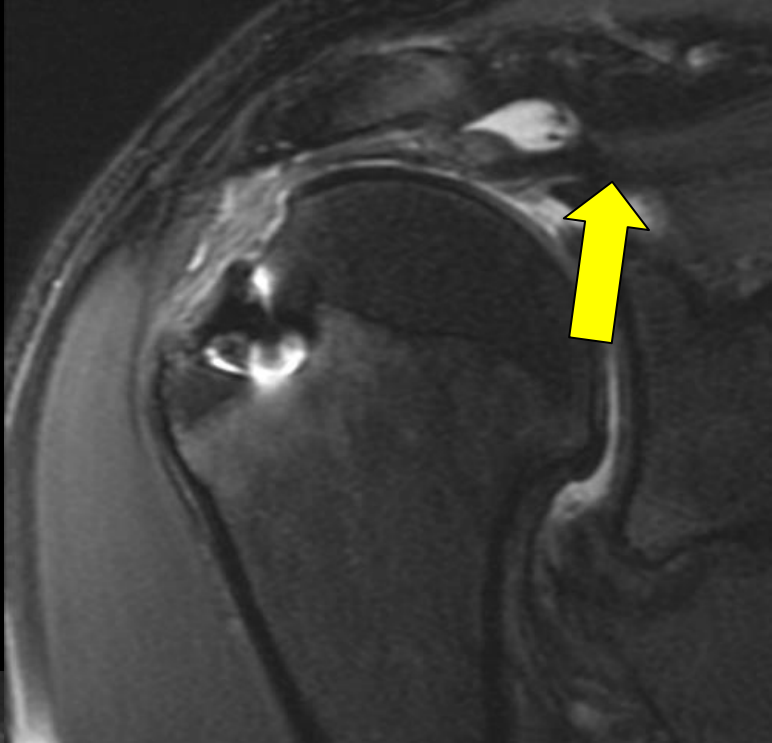
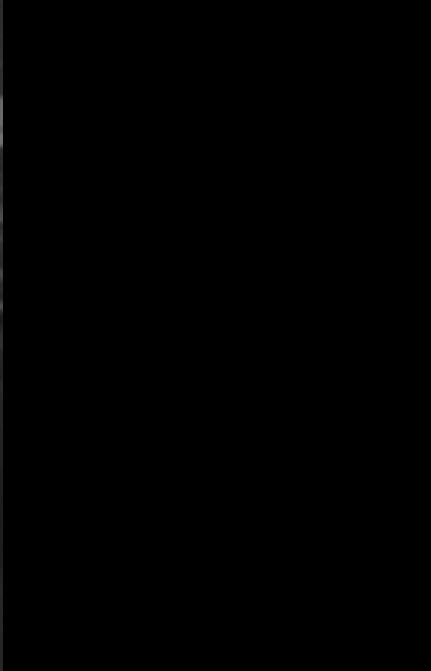
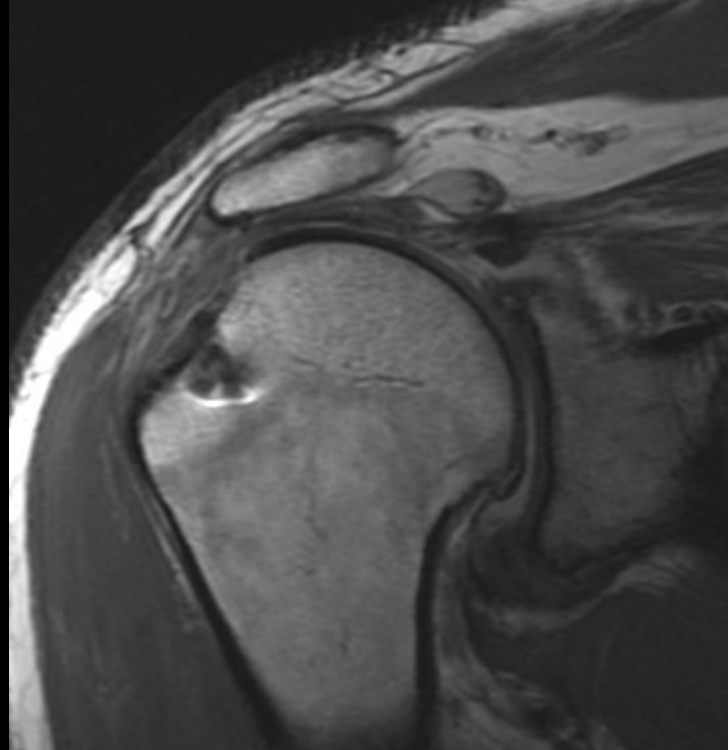


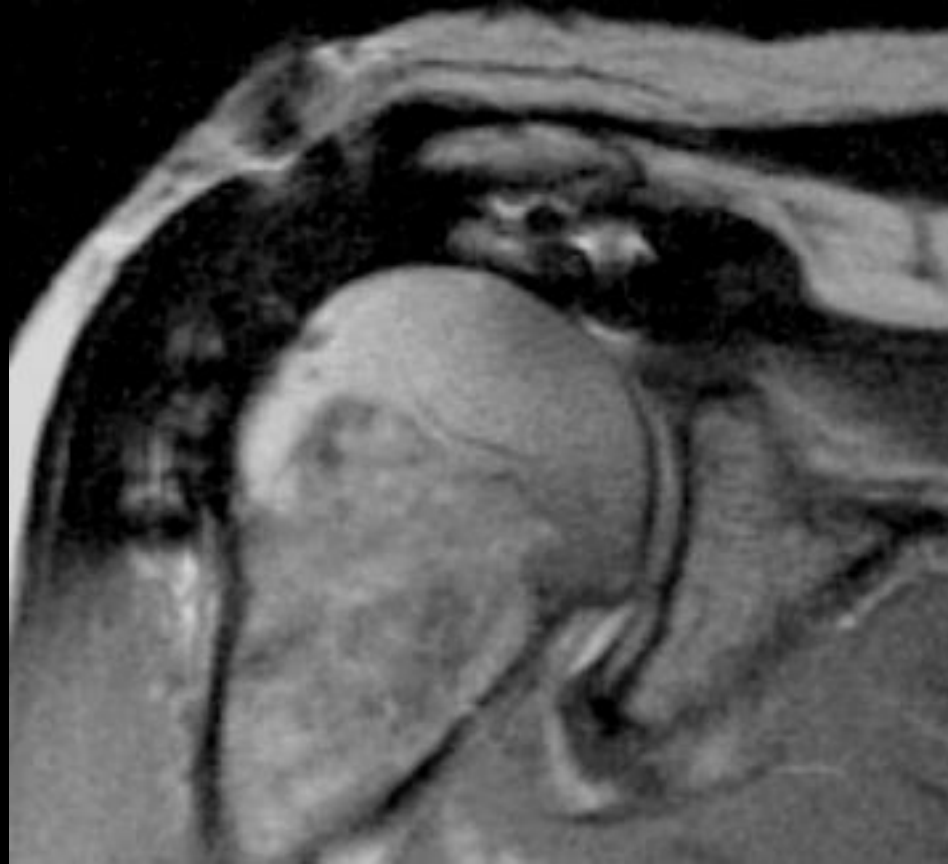


Post-operative  
rotator cuff retear







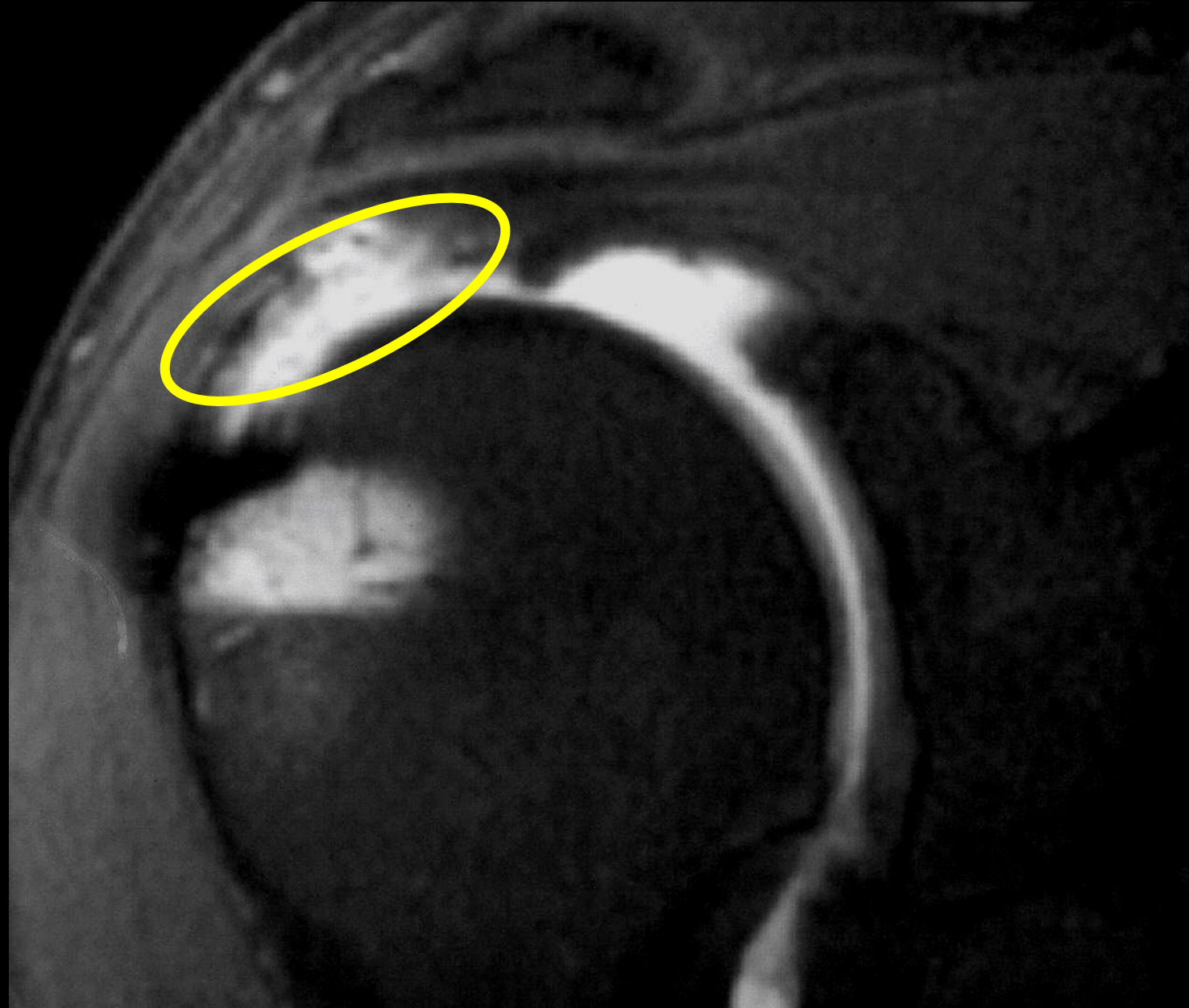


# Recurrent Partial RCT





# Recurrent Partial RCT



# Recurrent Partial RCT



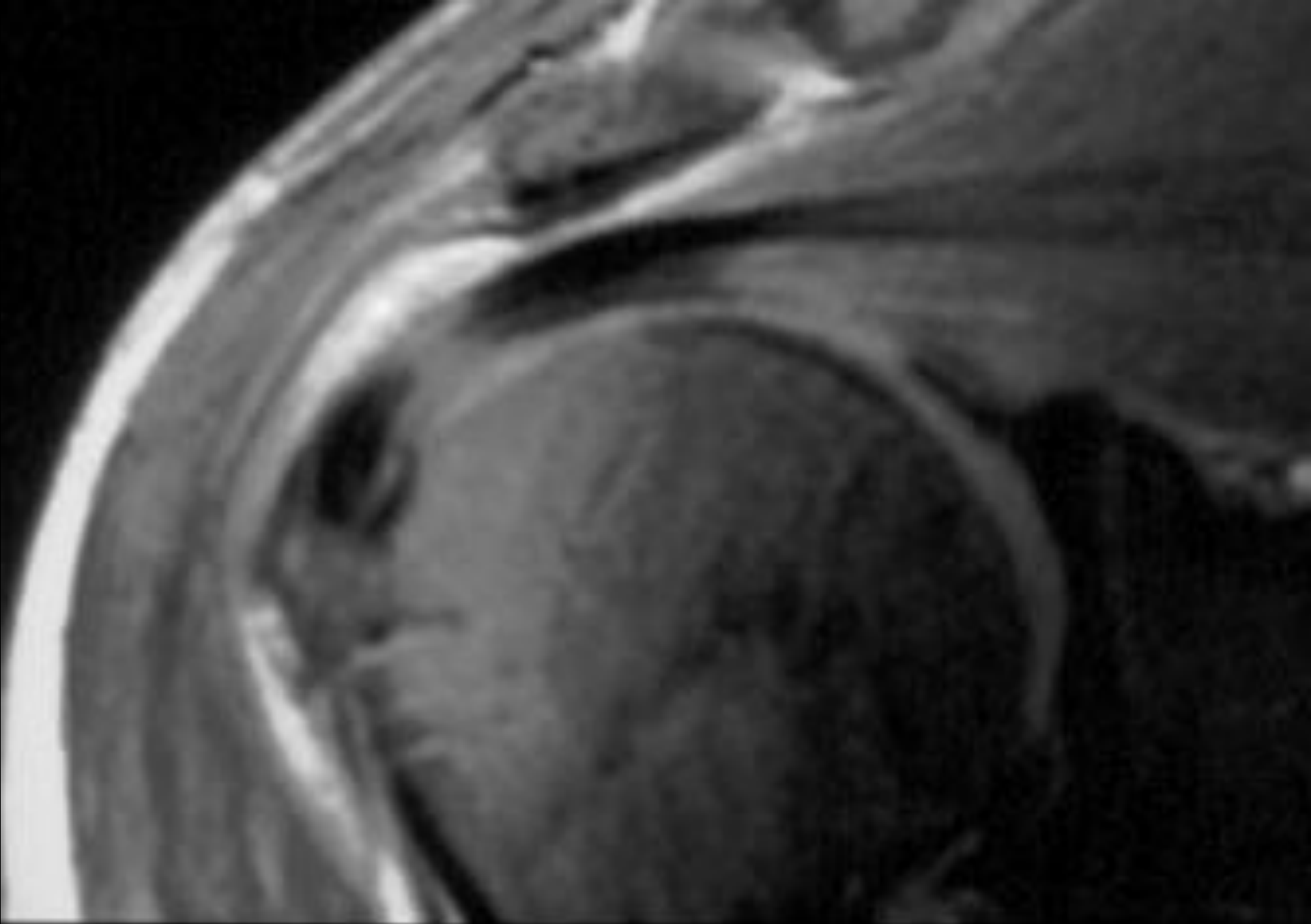
# ABNORMALITIES THAT CAN MIMIC ROTATOR CUFF TEAR

- Tendinosis/Magic angle
- Calcific tendonitis
- Adhesive capsulitis
- Subacromial bursitis

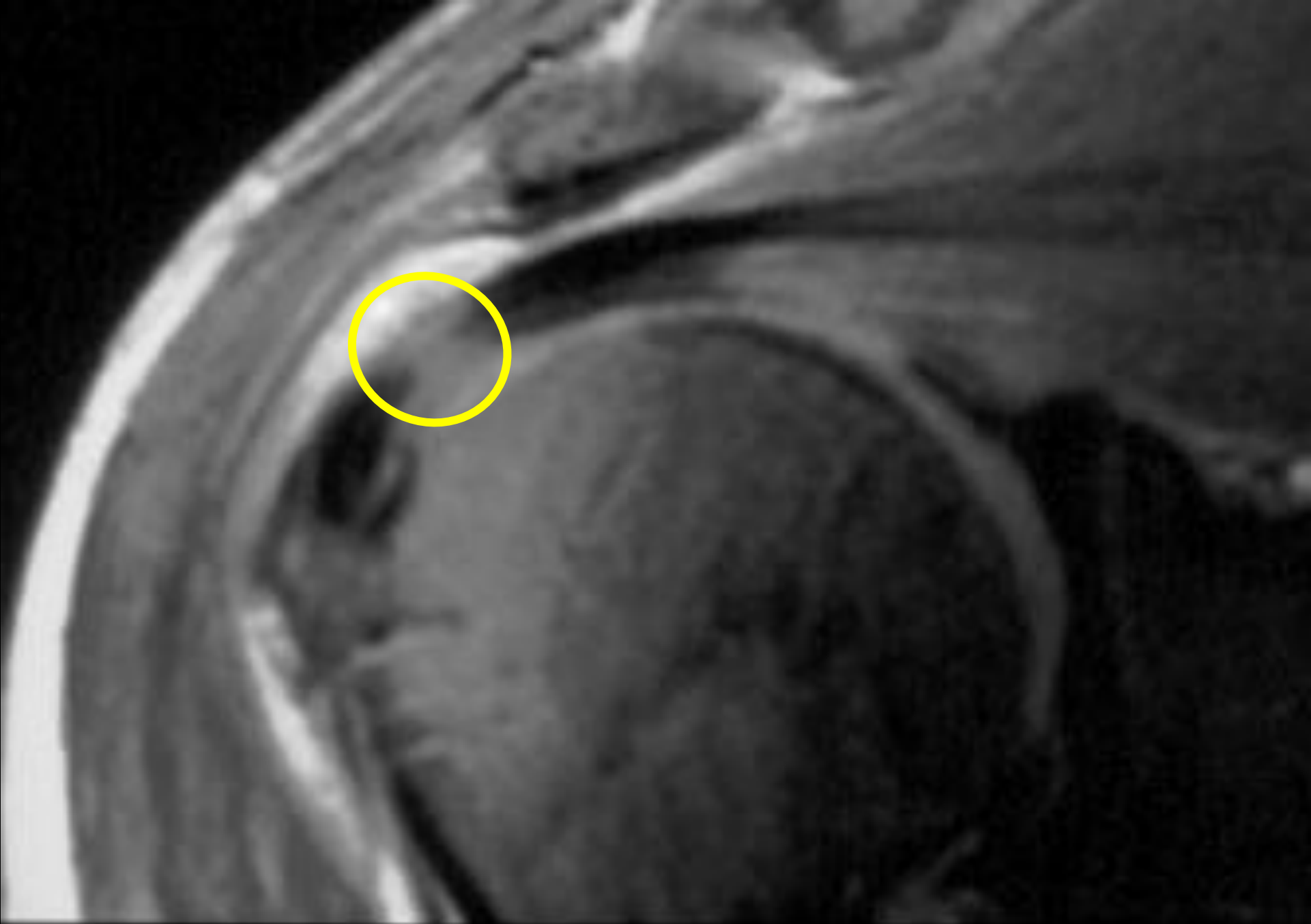
# INCREASED TENDON SIGNAL SHORT TE SEQUENCES

- Magic angle
- Connective tissue between fascicles
- Tendon overlap (internal rotation)
- Degeneration (tendinosis)
- Tear
- Partial volume
- Injection





PD CORONAL



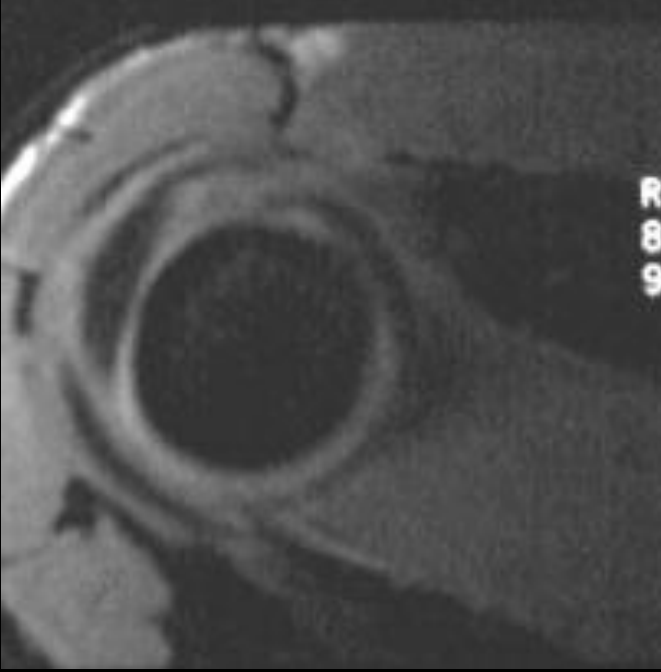
PD CORONAL



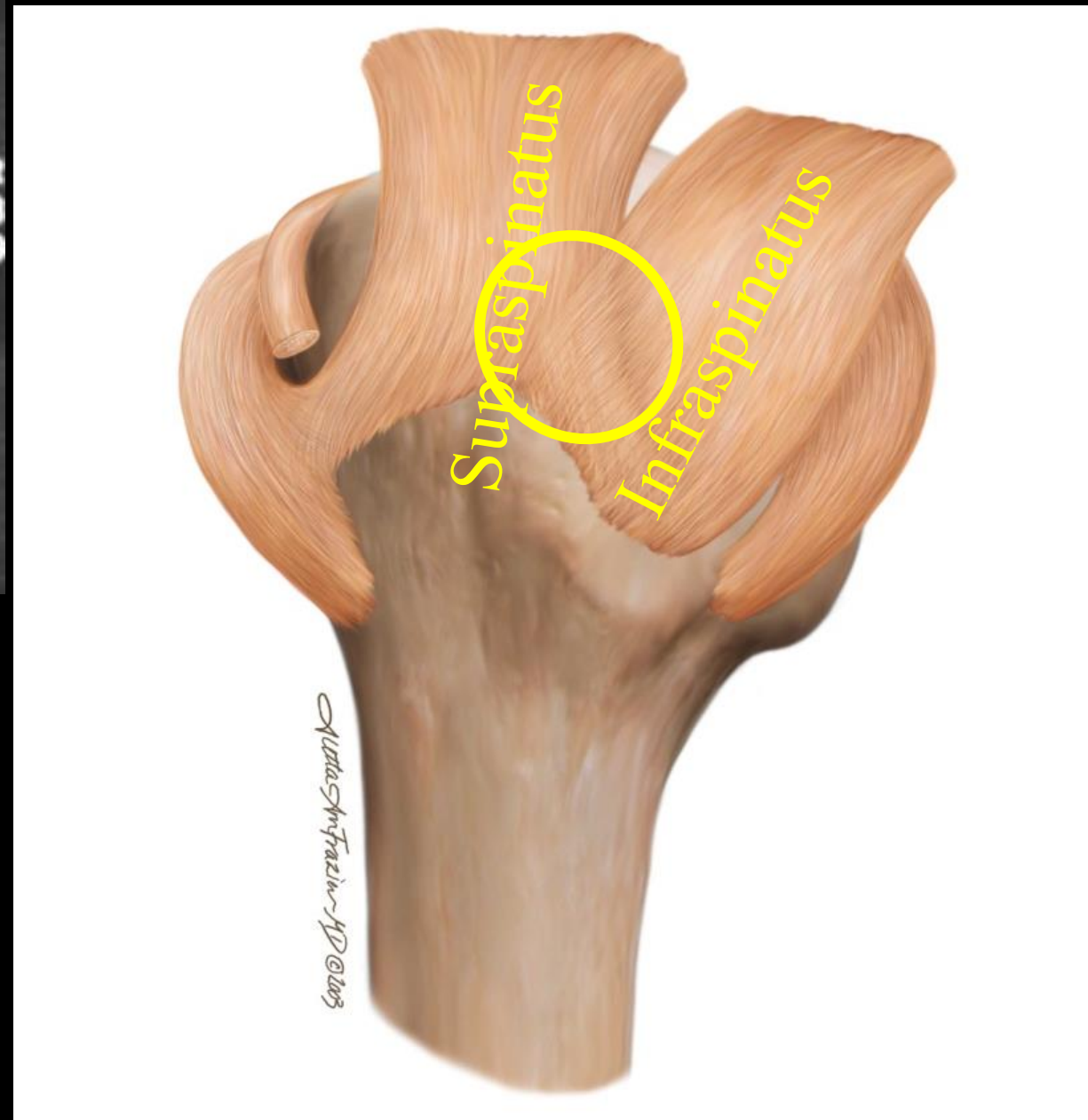
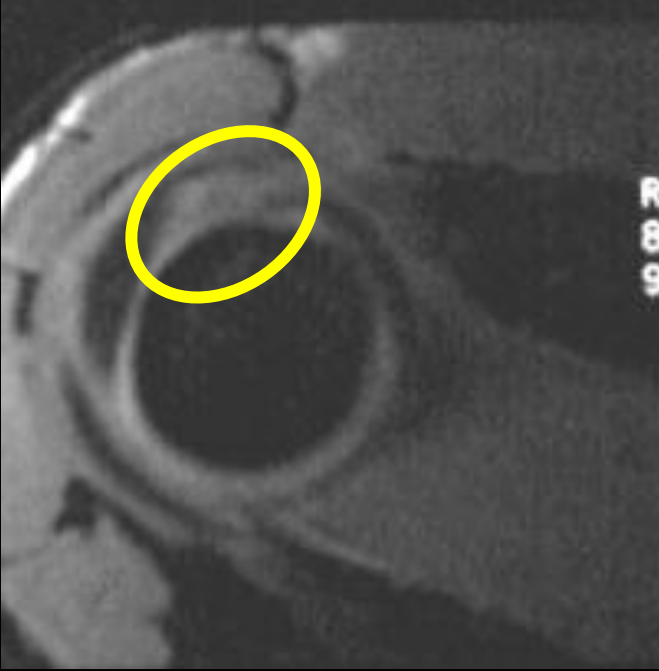


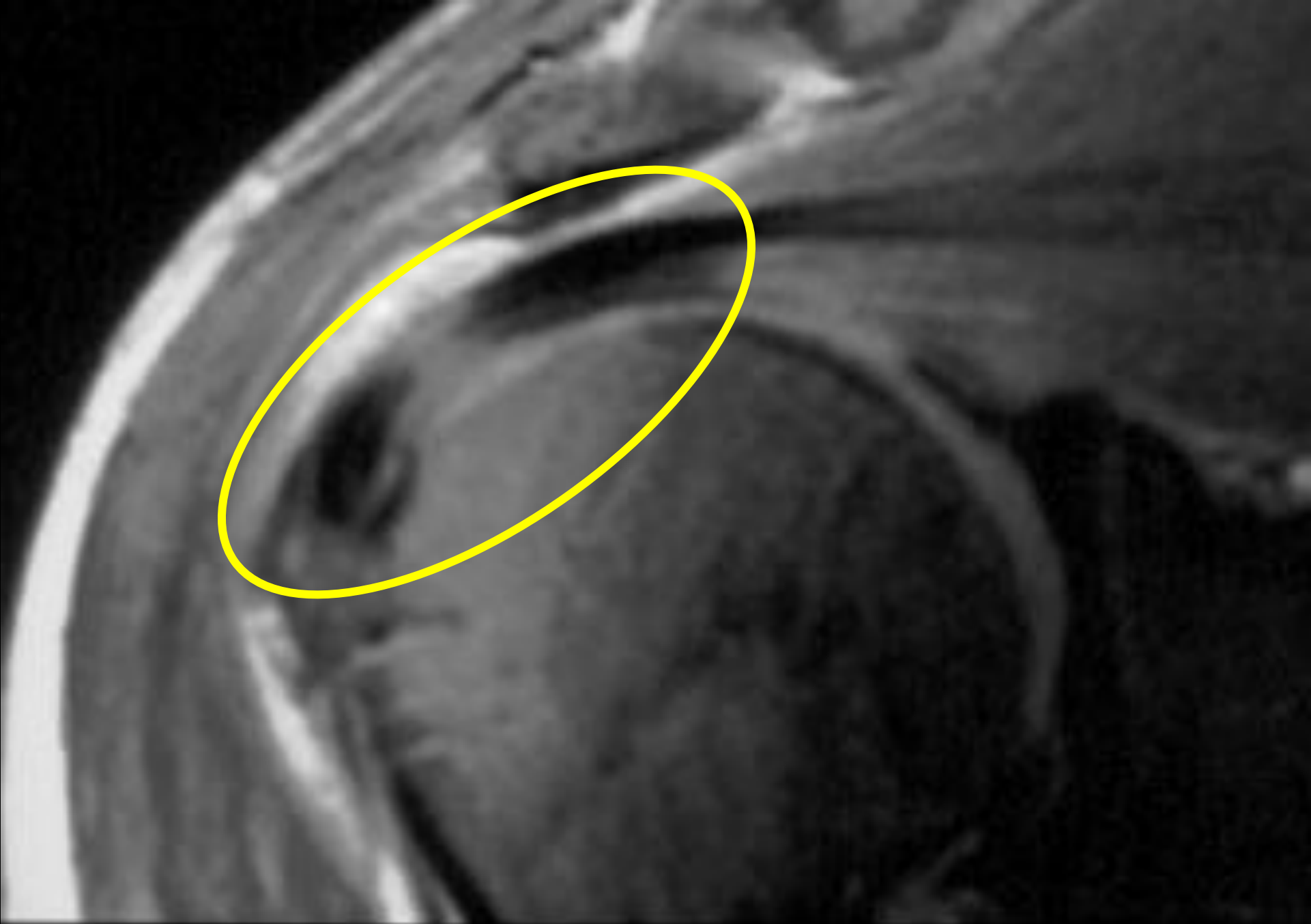


# TENDON OVERLAP



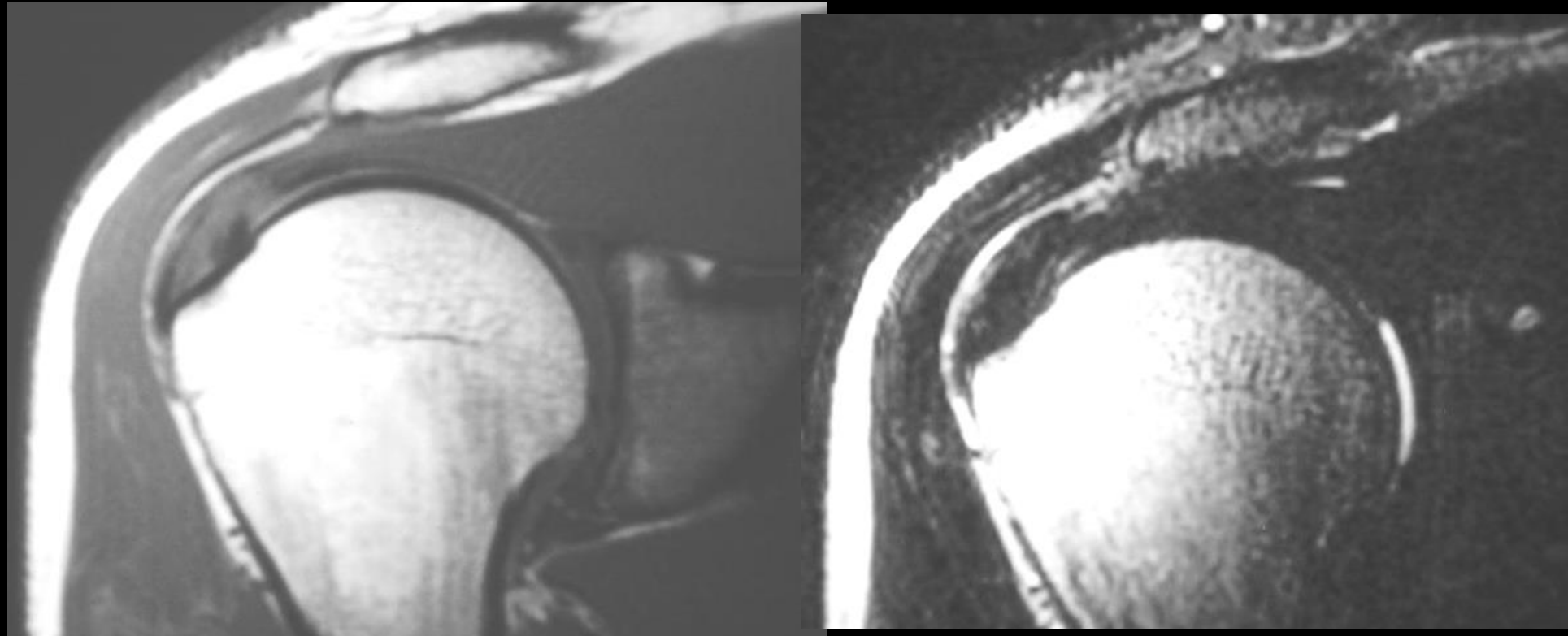
# TENDON OVERLAP





PD CORONAL

# TENDINOSIS



PD CORONAL

T2 CORONAL



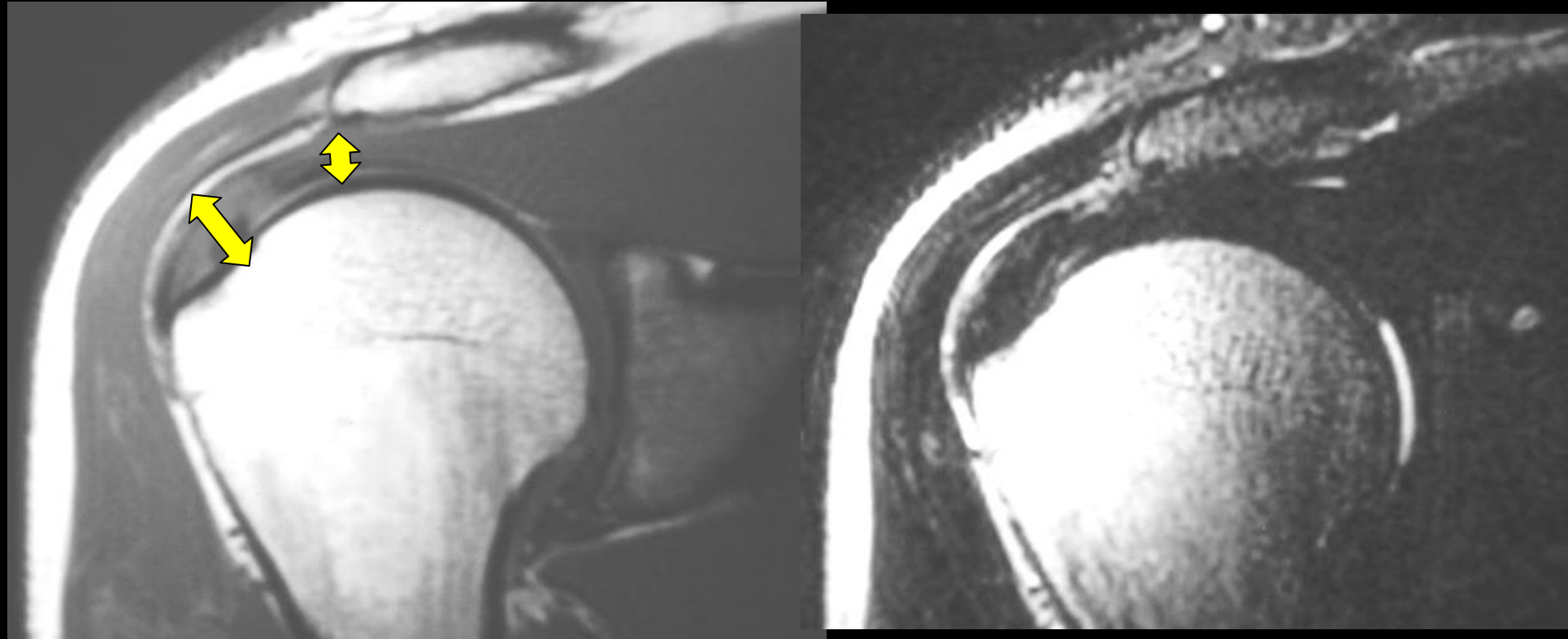
# TENDINOSIS



PD CORONAL

T2 CORONAL

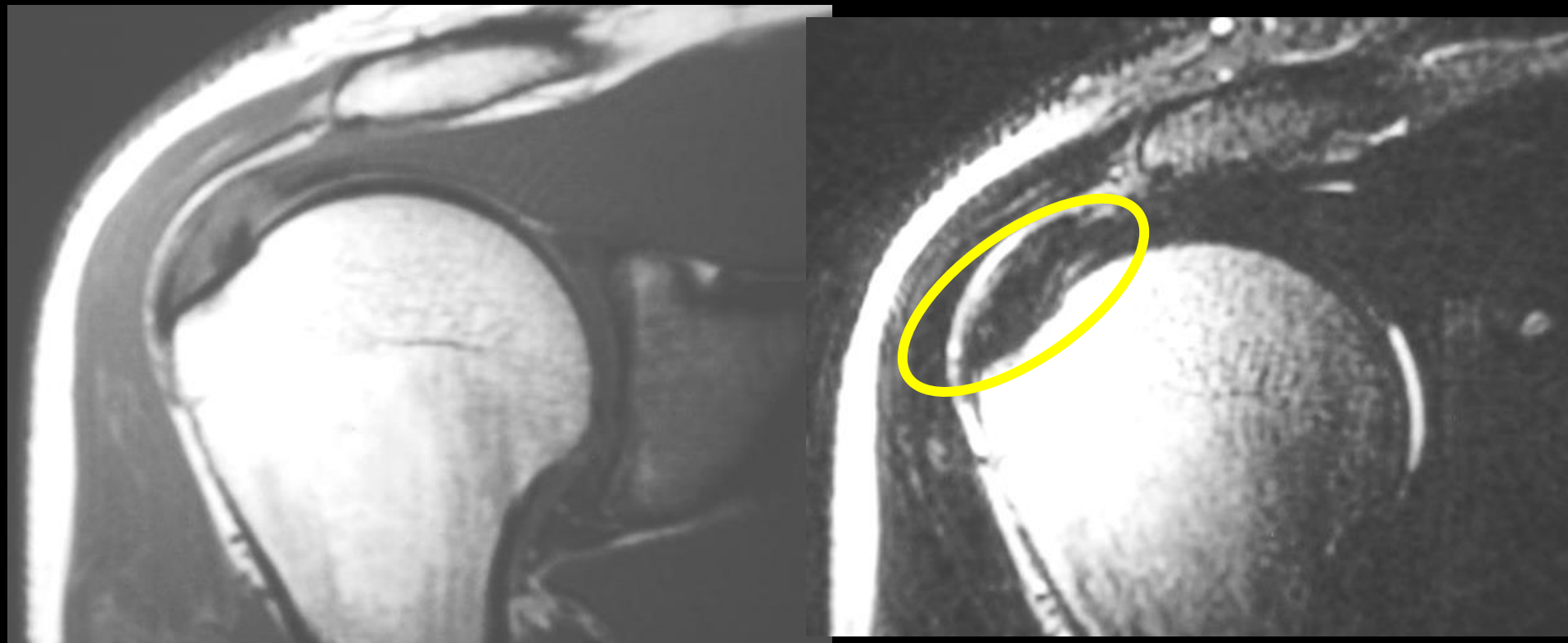
# TENDINOSIS



PD CORONAL

T2 CORONAL

# TENDINOSIS



PD CORONAL

T2 CORONAL

Short TE	Long TE	Pathology
Grey	Black	Tendon Overlap Magic Angle No Morphologic Abnormality
Grey	Grey	Tendinopathy Morphologic Abnormality Partial tear
Grey	White	Tear



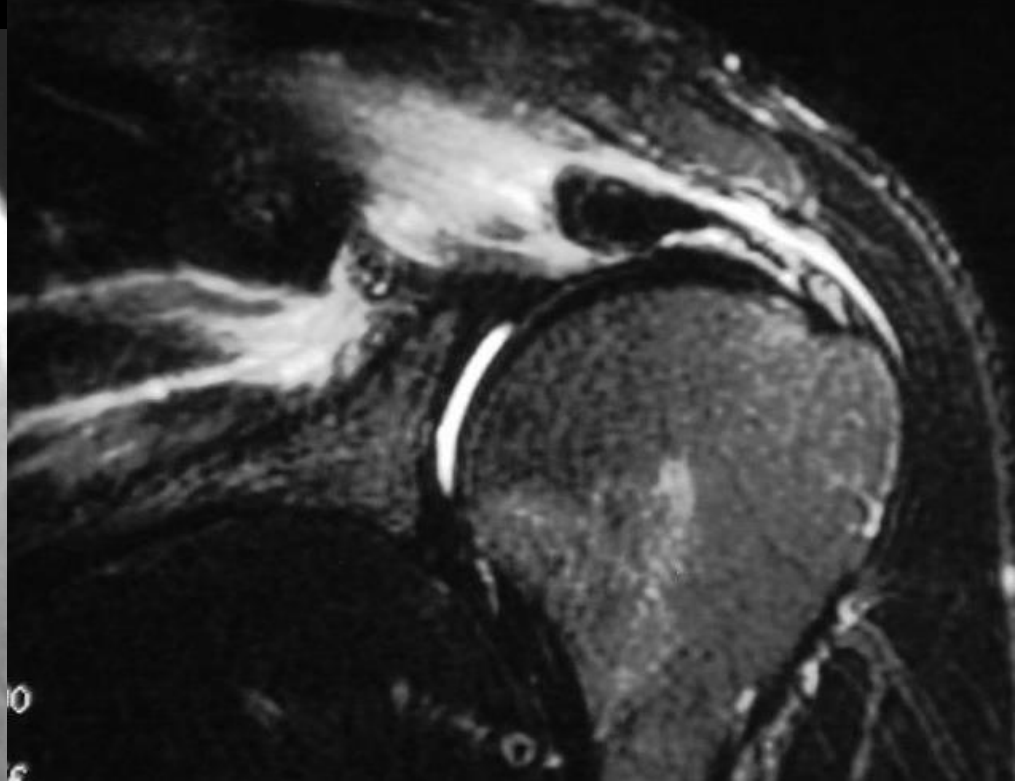
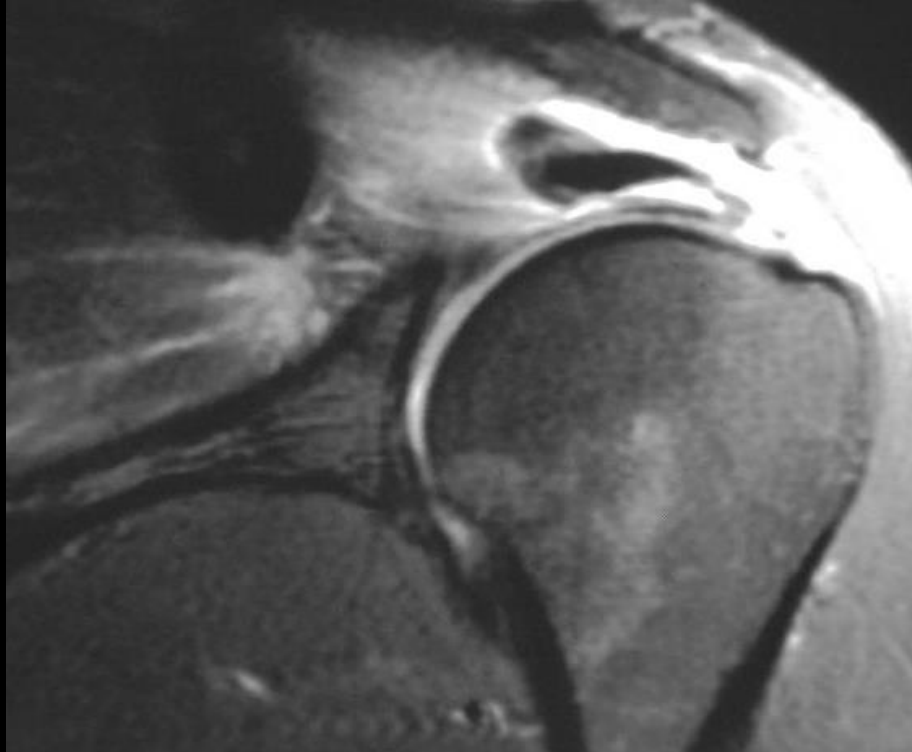
# ABNORMALITIES THAT CAN MIMIC ROTATOR CUFF TEAR

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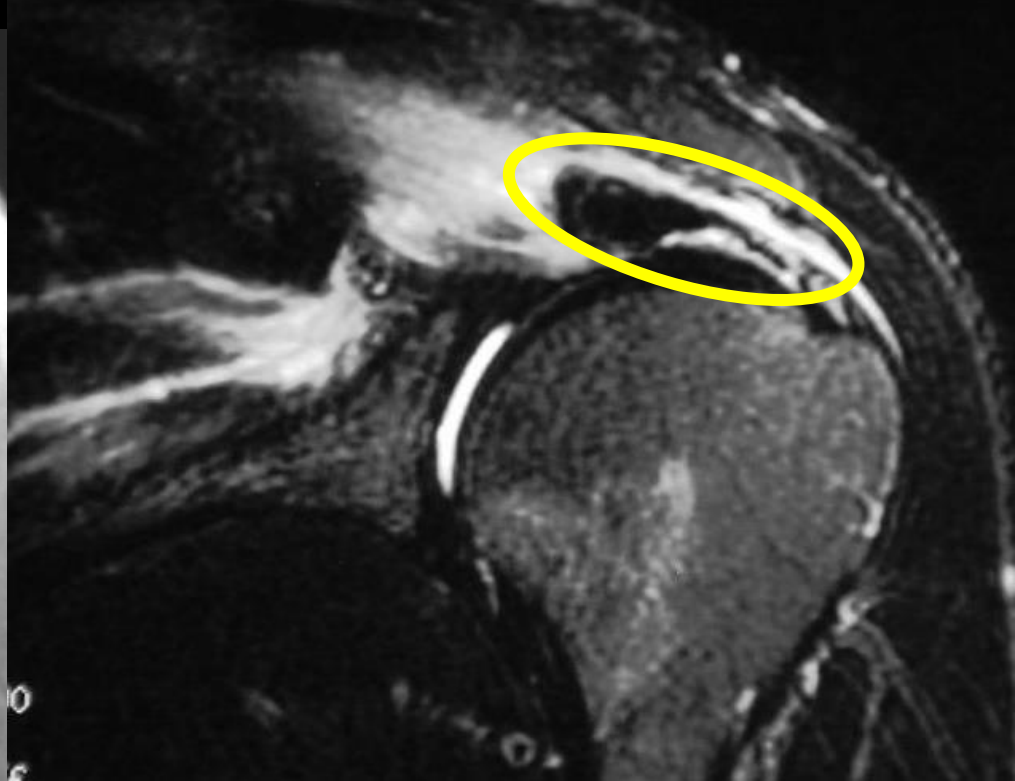
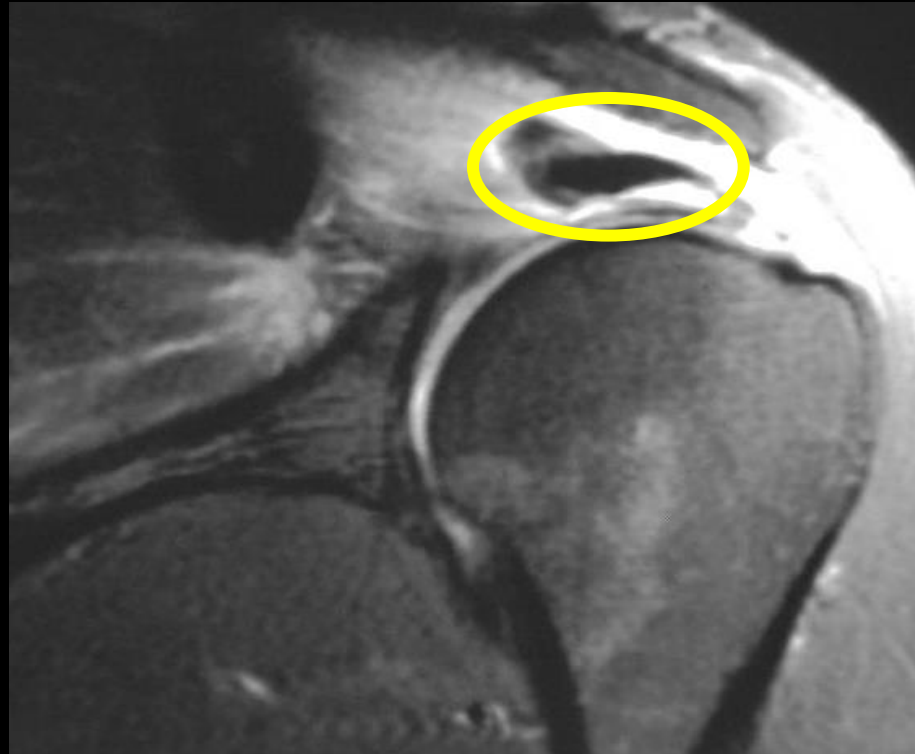
# CALCIFIC TENDINITIS

- Rotator cuff most common site
- Tendinopathy
- Primary or secondary disorder?
- Calcium hydroxyapatite deposition in tendon
- Concretion - low T1 and T2 but best seen on GRE sequences
- Most common supraspinatus (95%)
- Variable surrounding edema
- May erode cortex/ invade marrow

# CALCIFIC TENDINITIS

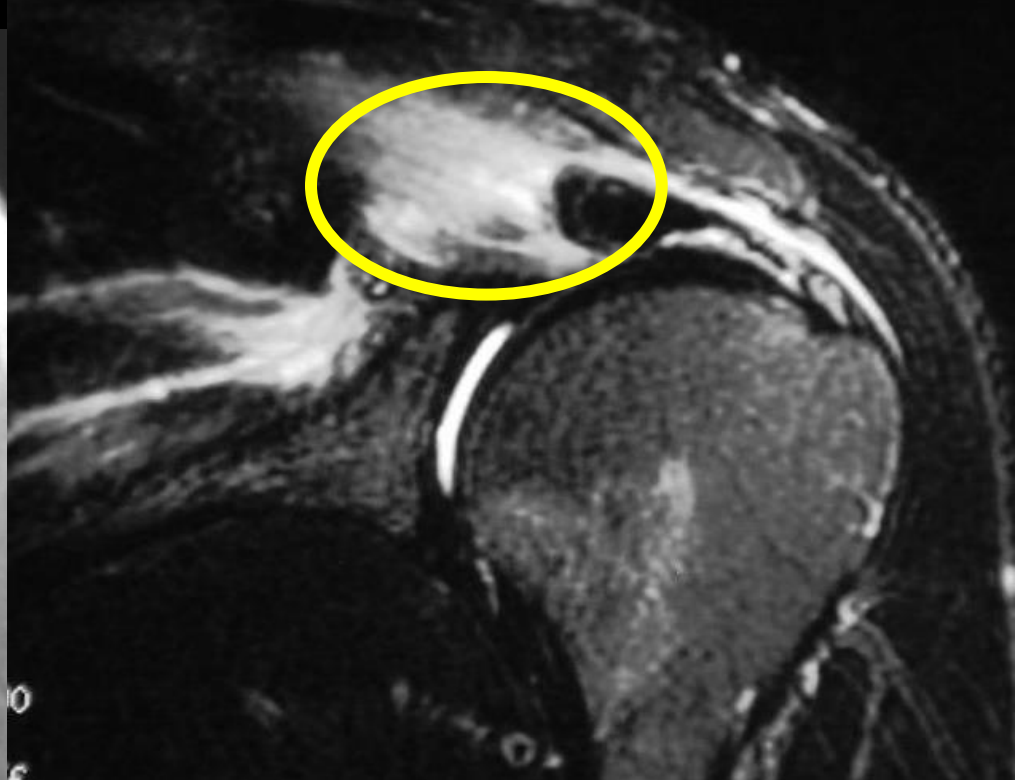
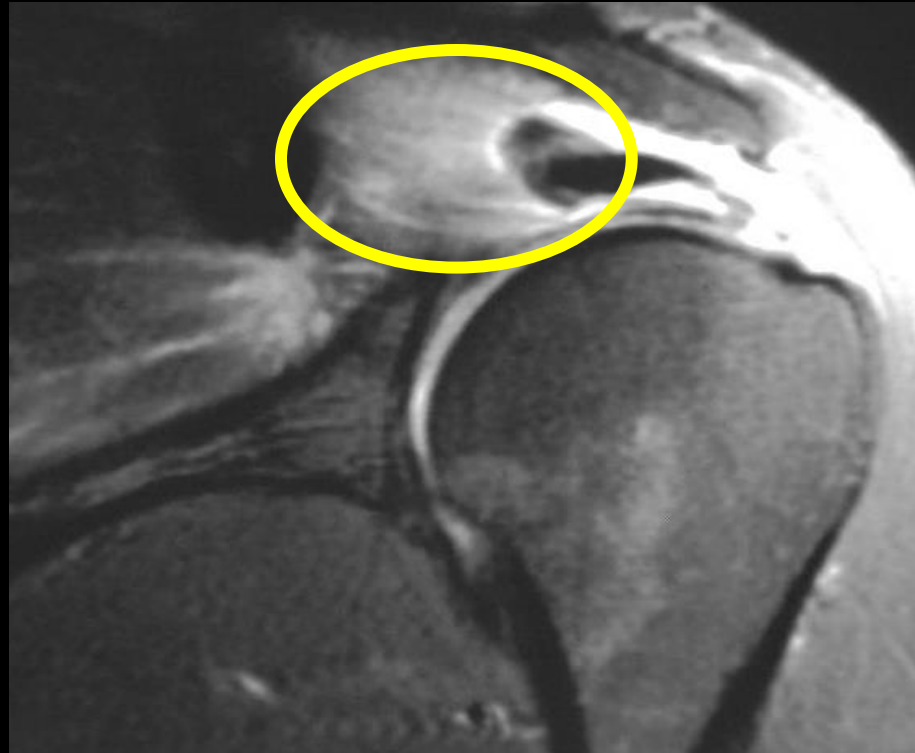


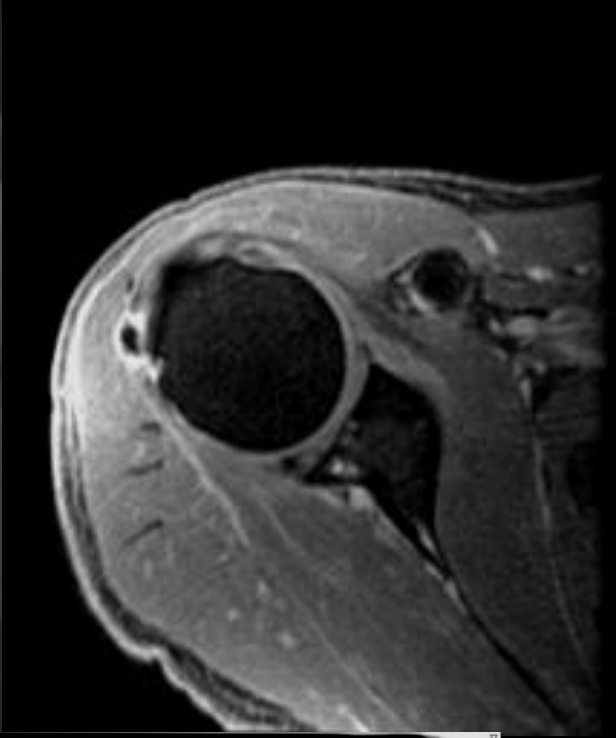
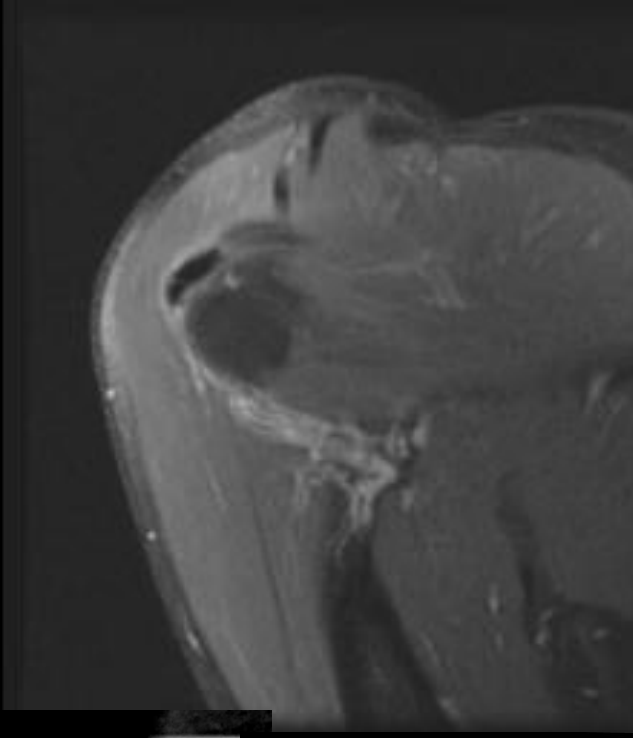
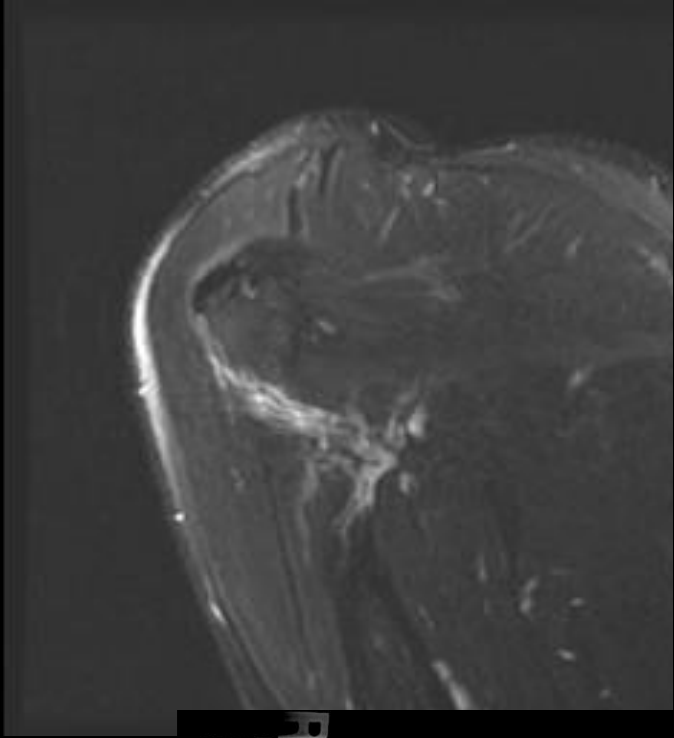
# CALCIFIC TENDINITIS

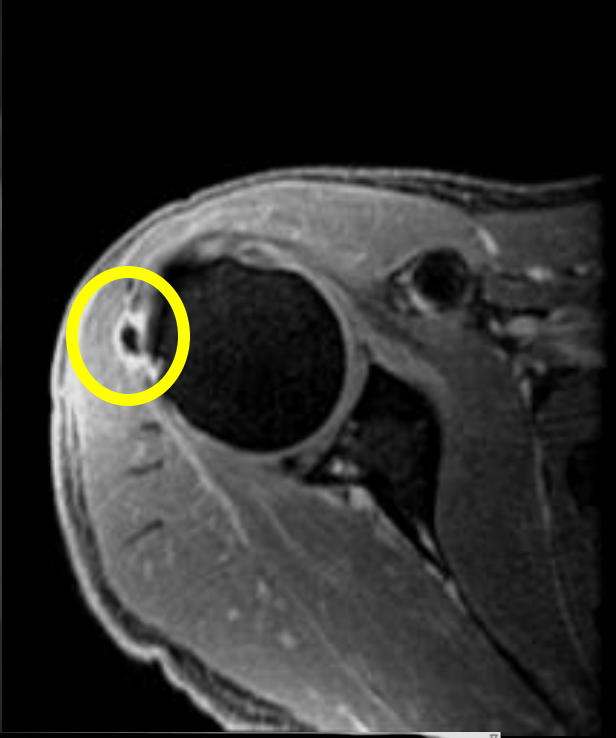
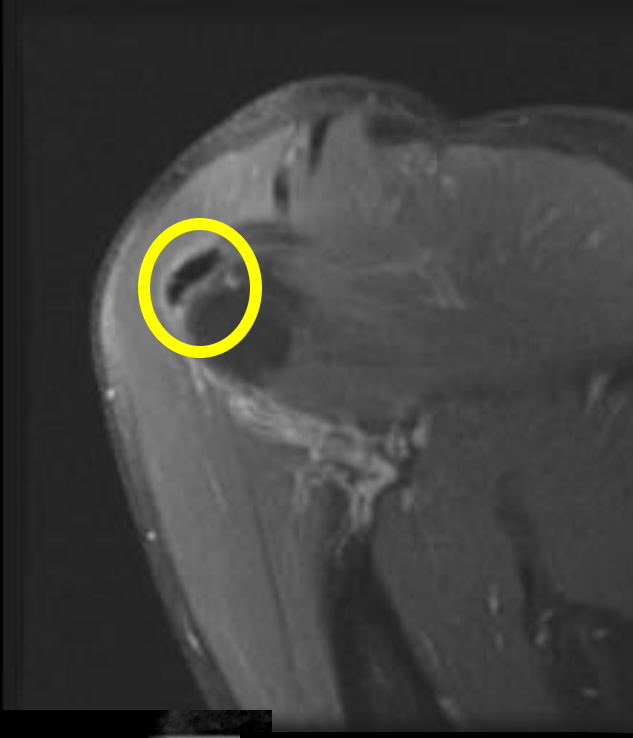
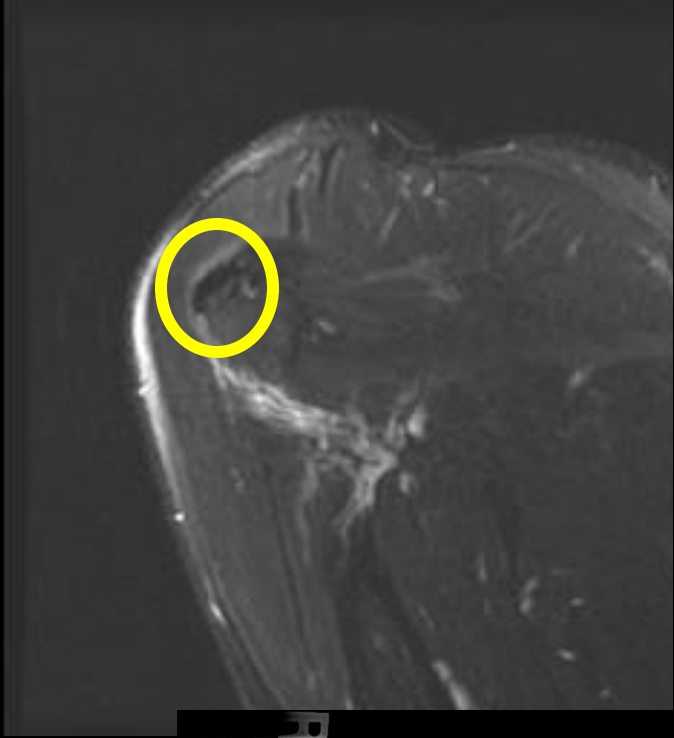


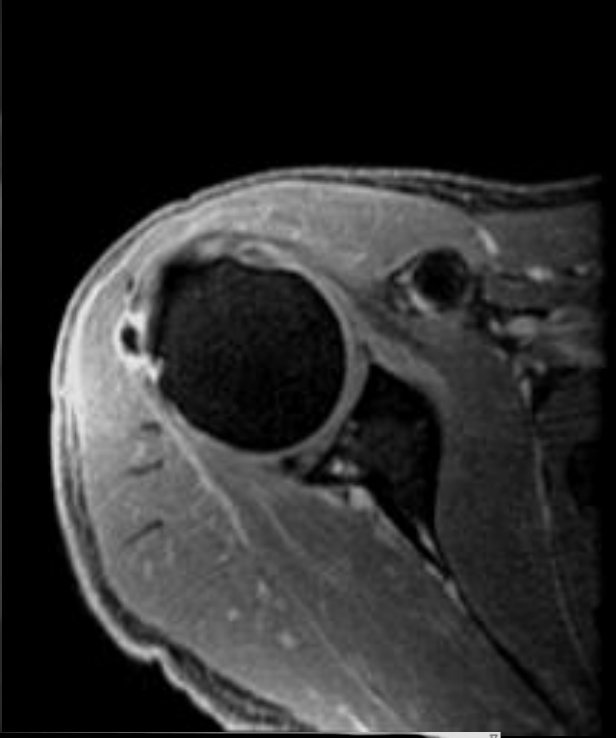
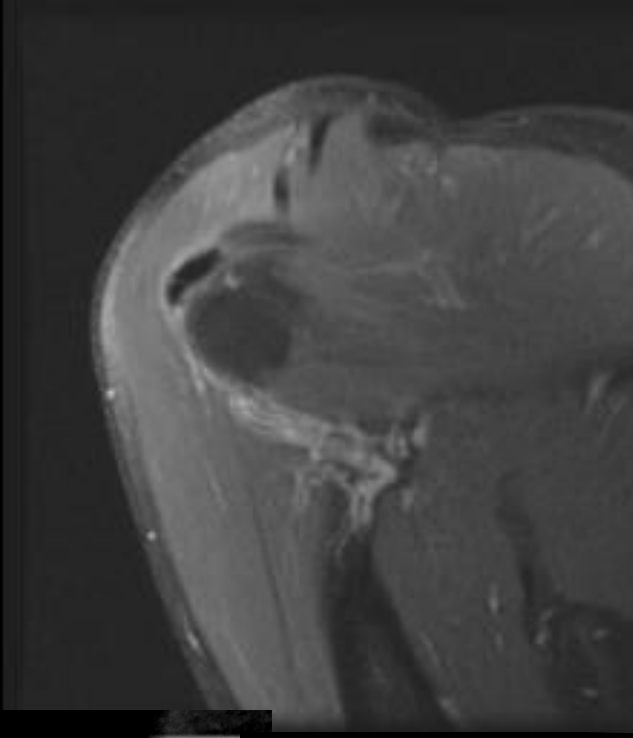
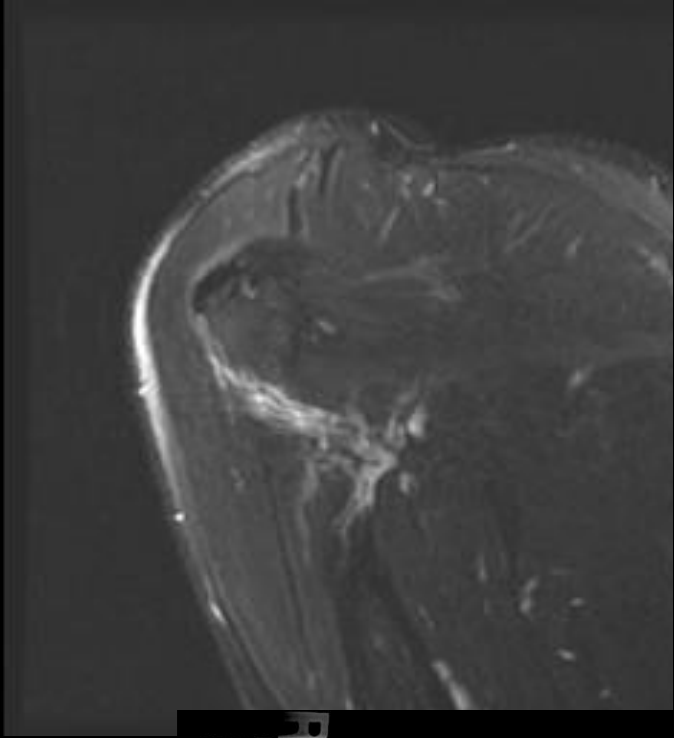


# CALCIFIC TENDINITIS





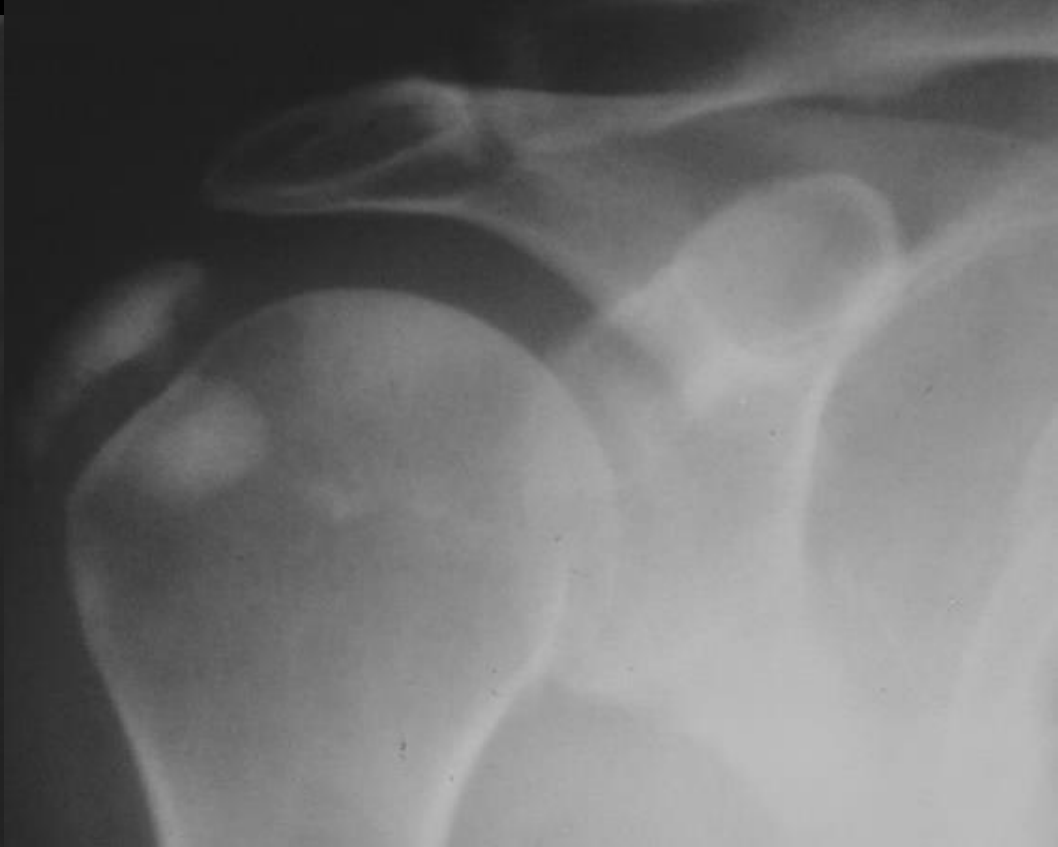
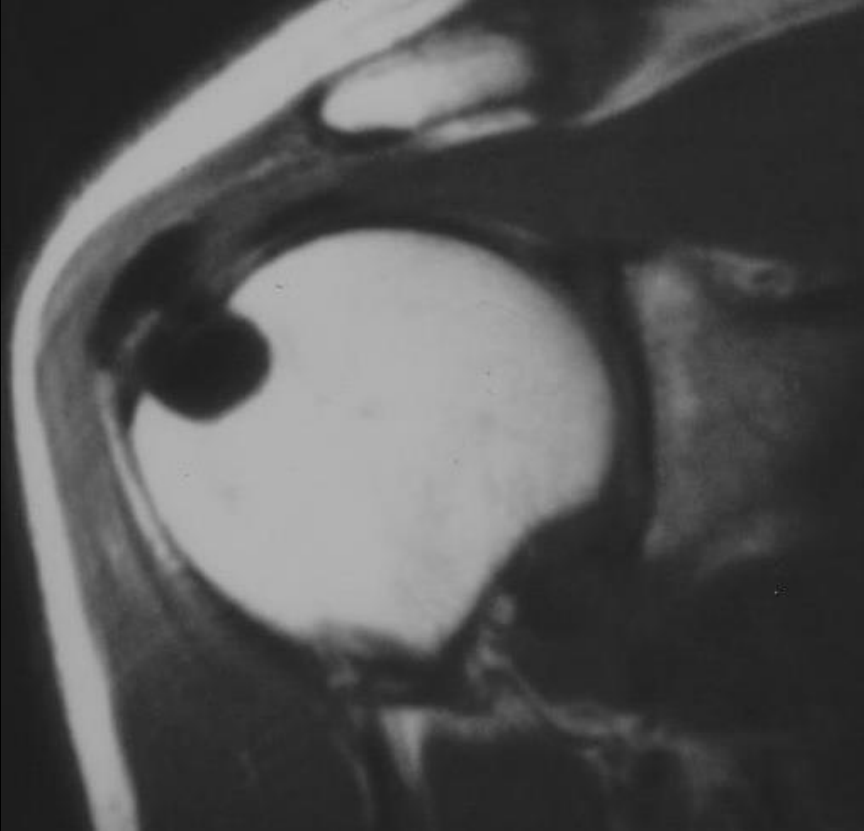




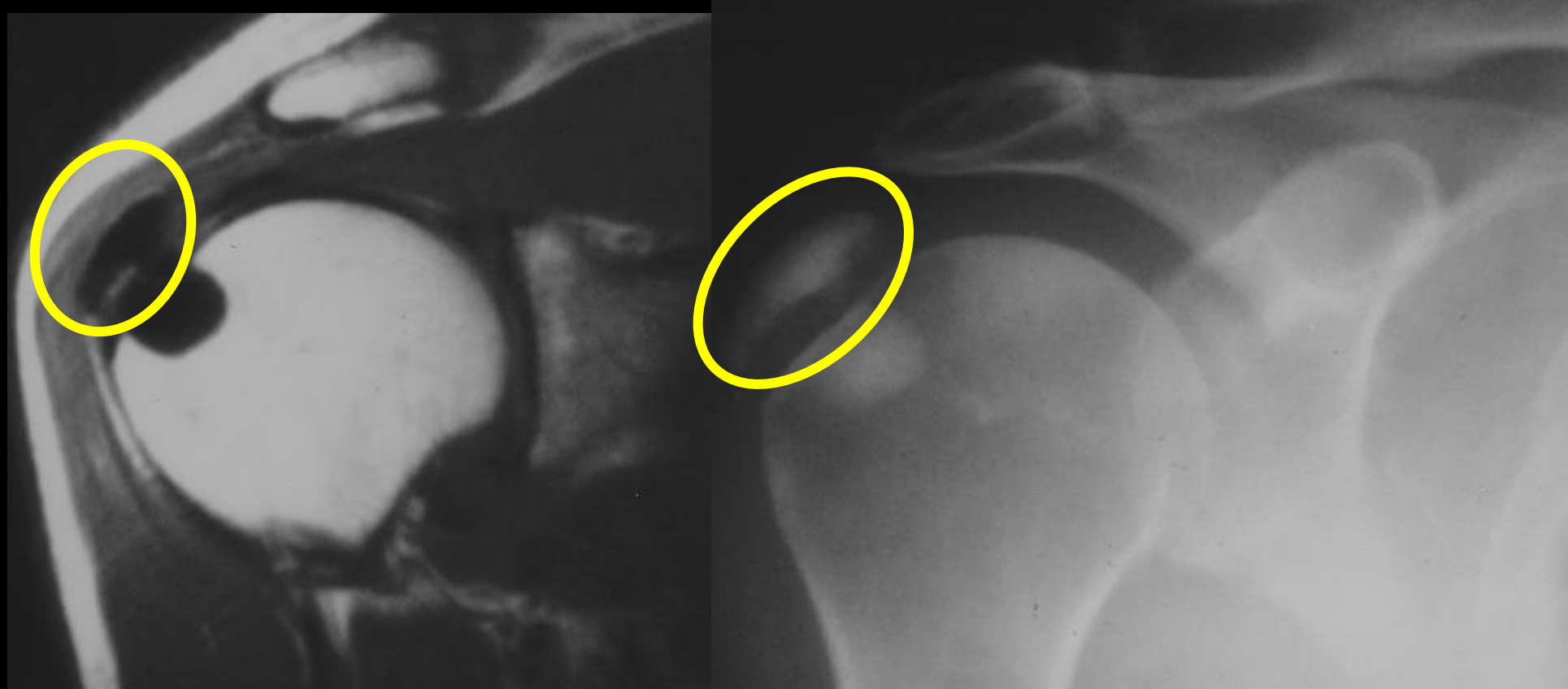
B  
BAL



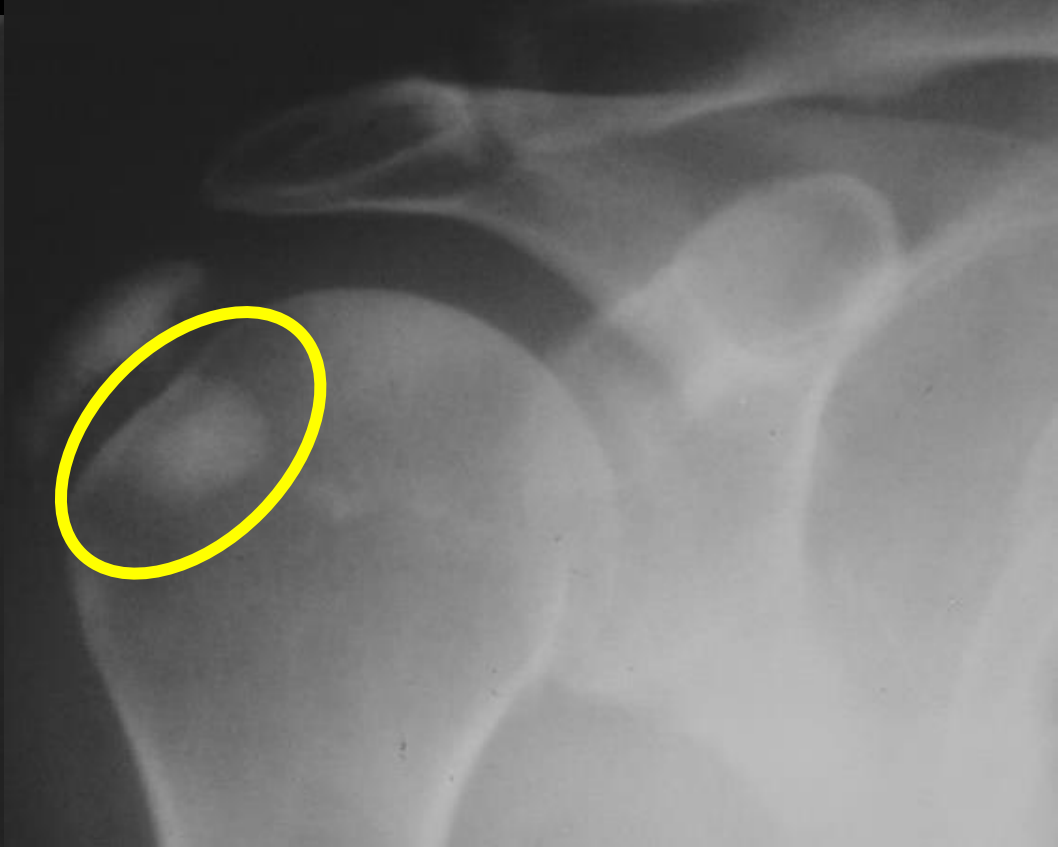
# CALCIFIC TENDINITIS



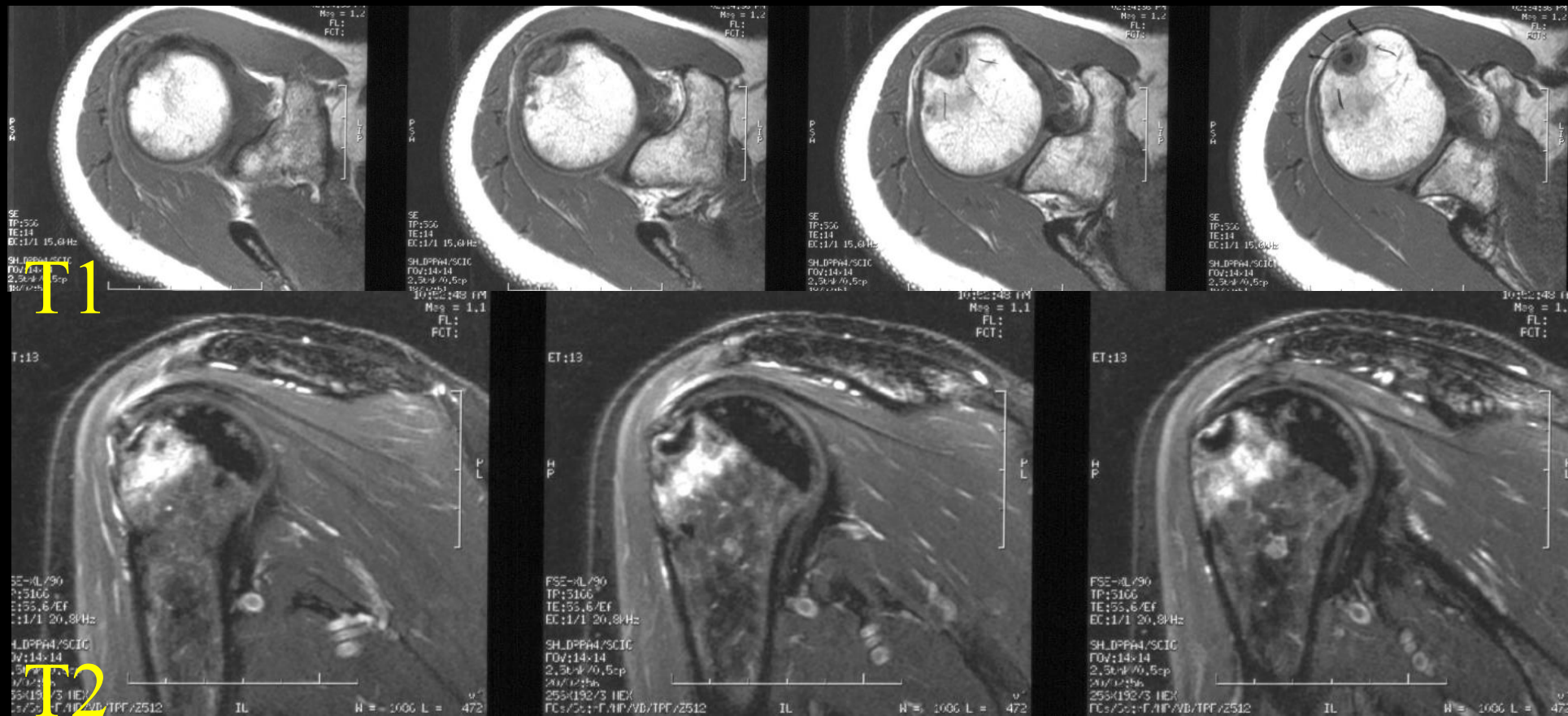
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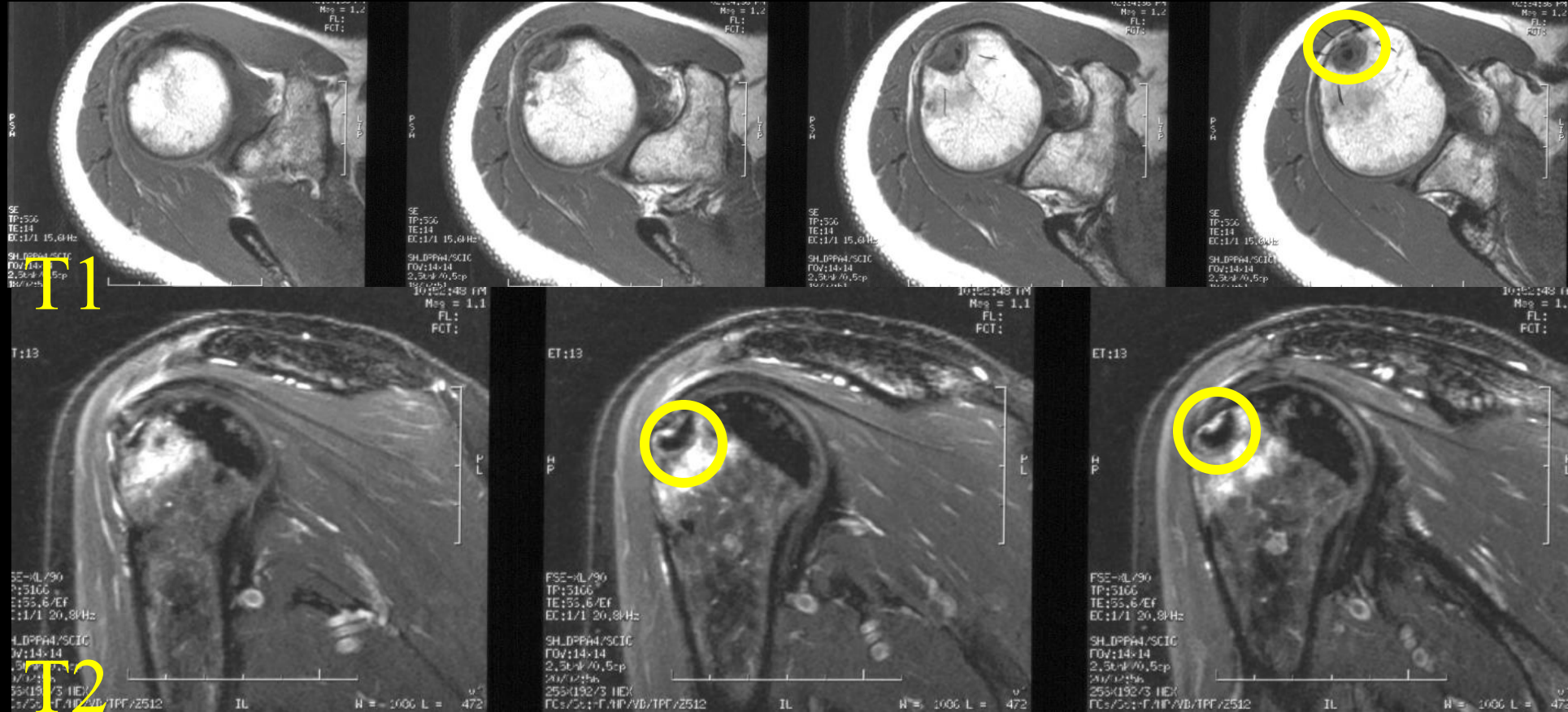


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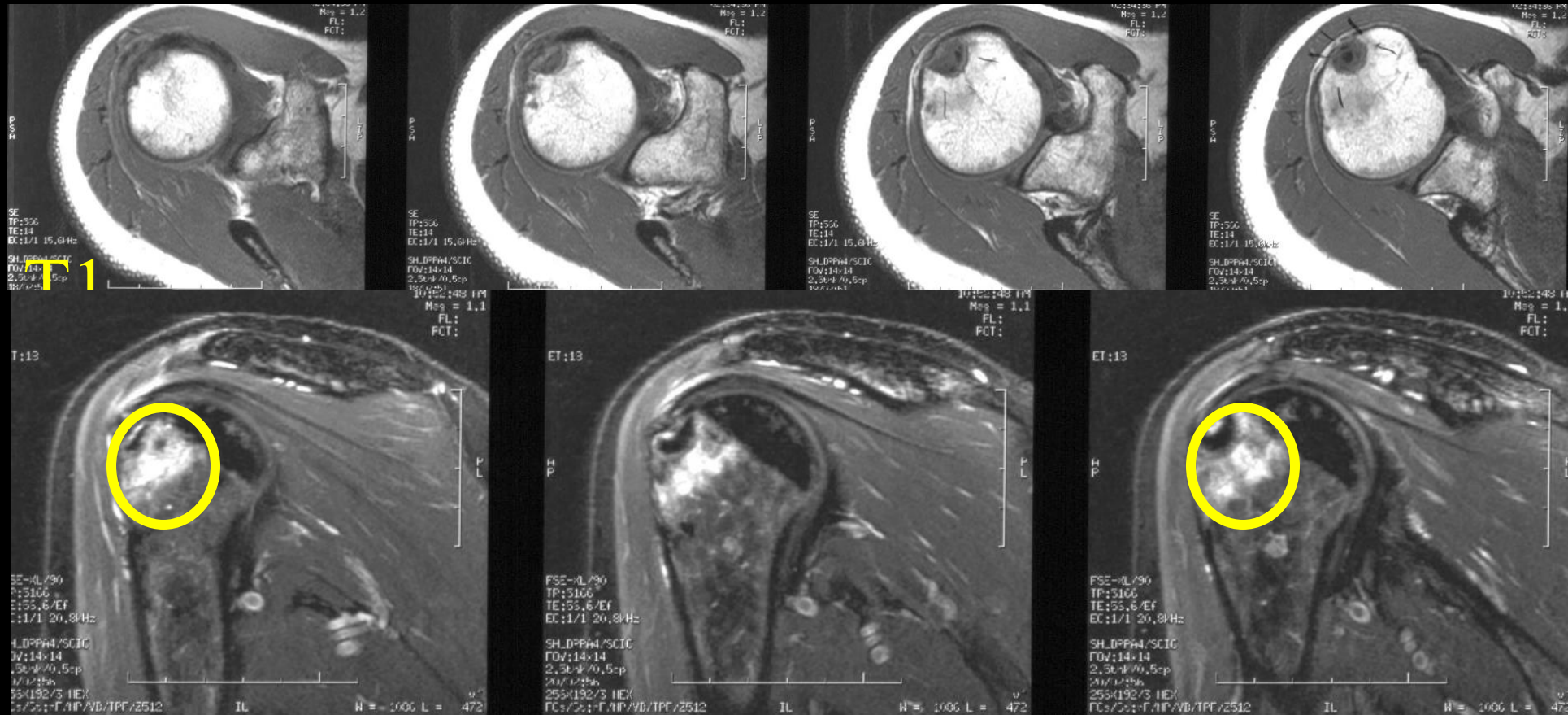




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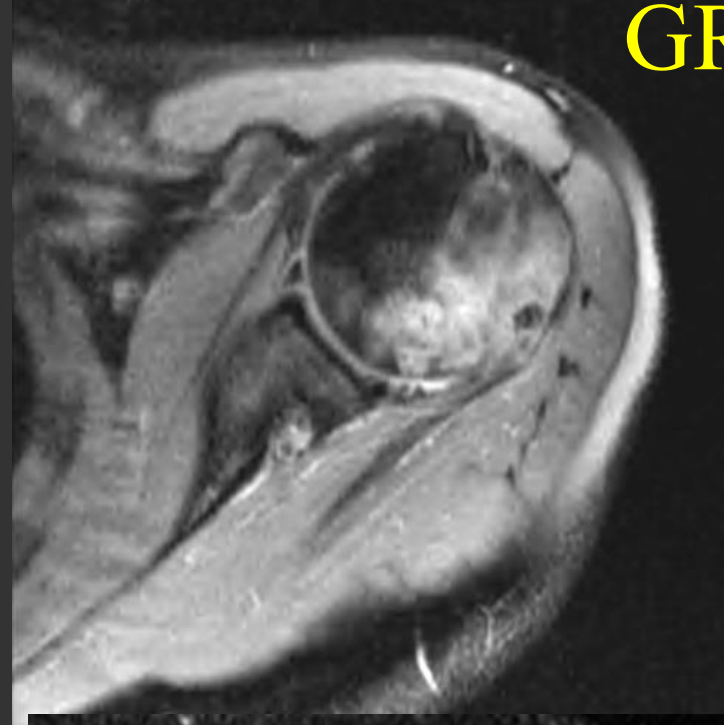
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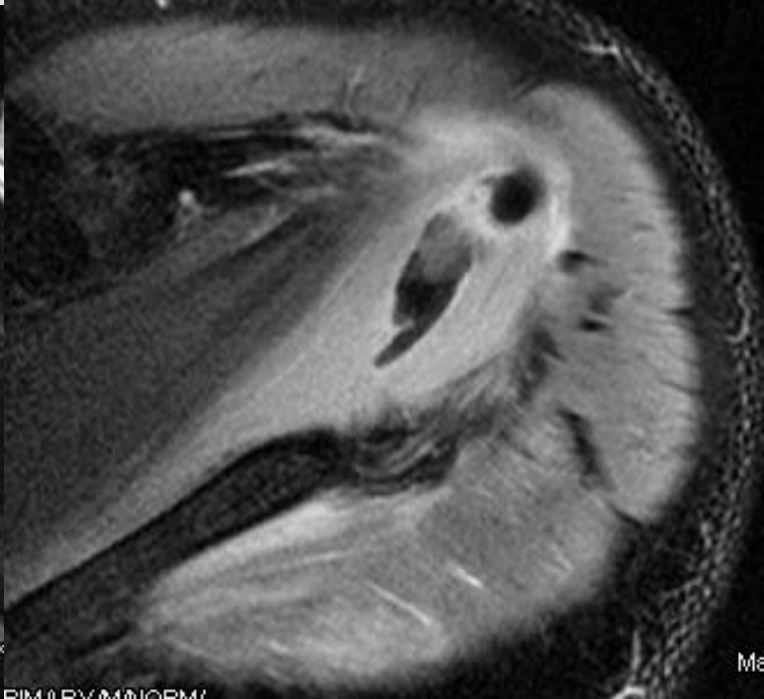
T2



GRE



v1/NORM/DIS2D



Matrix

RIM (BY MNORM)

Me



T2



GRE



v/NORMDIS2D

Matrix

P1M1BYMNORM/

Me



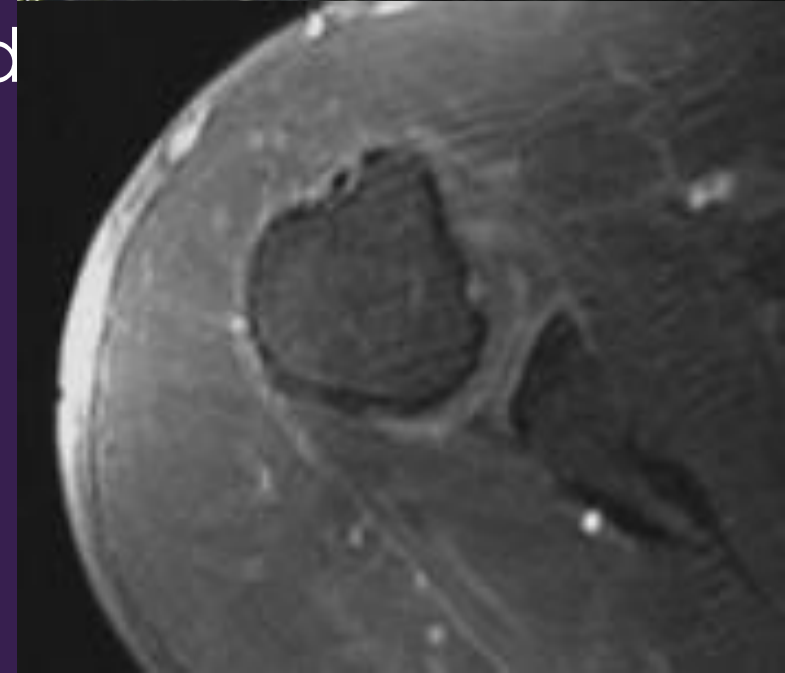
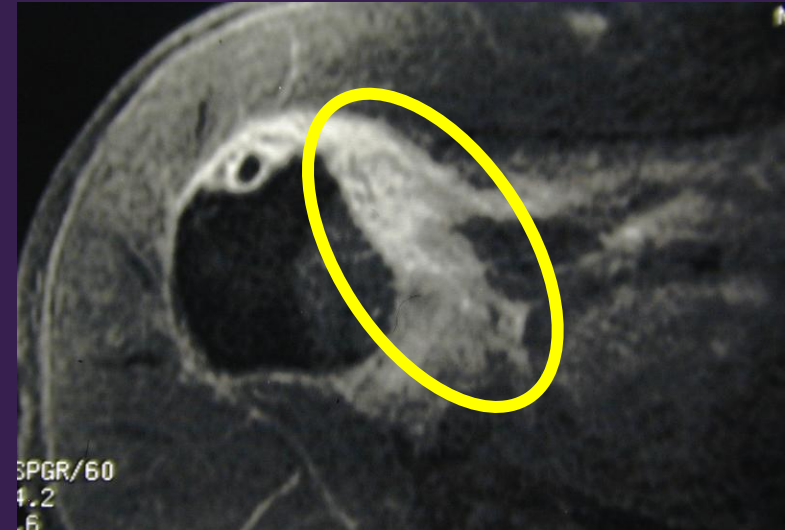
# ABNORMALITIES THAT CAN MIMIC ROTATOR CUFF TEAR

- Tendinosis/Magic angle
- Calcific tendonitis
- Adhesive capsulitis
- Subacromial bursitis

# ADHESIVE CAPSULITIS

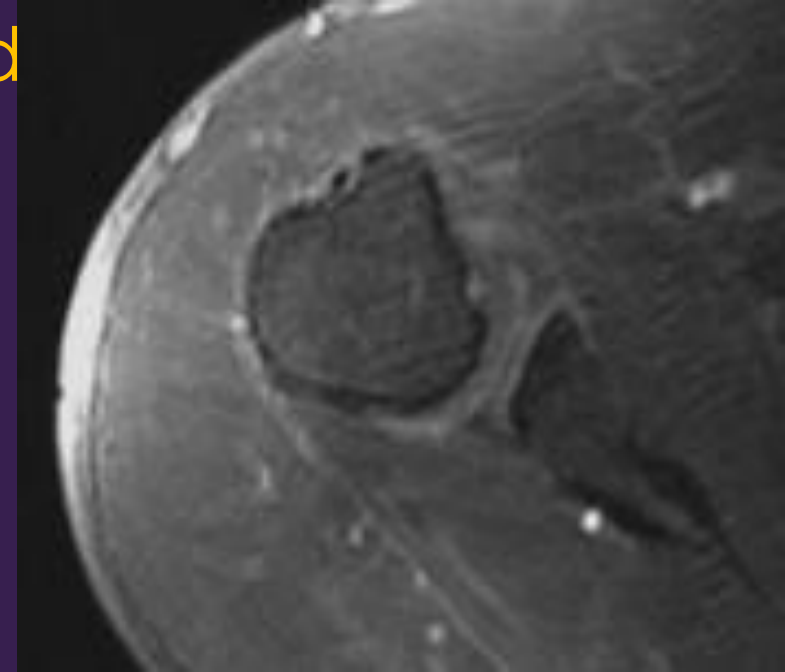
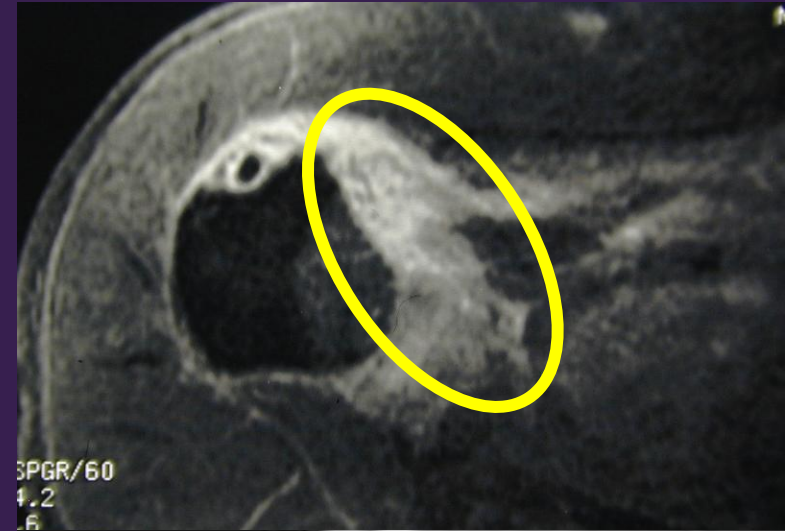
AIRP

- Clinical mimic of cuff tear
- Associated with diabetes
- Capsule thickened
- Thickened coracohumeral ligament
- Replacement anterior interval fat and thickened coracohumeral ligament
- Thickened axillary region
- Abnormal enhancement

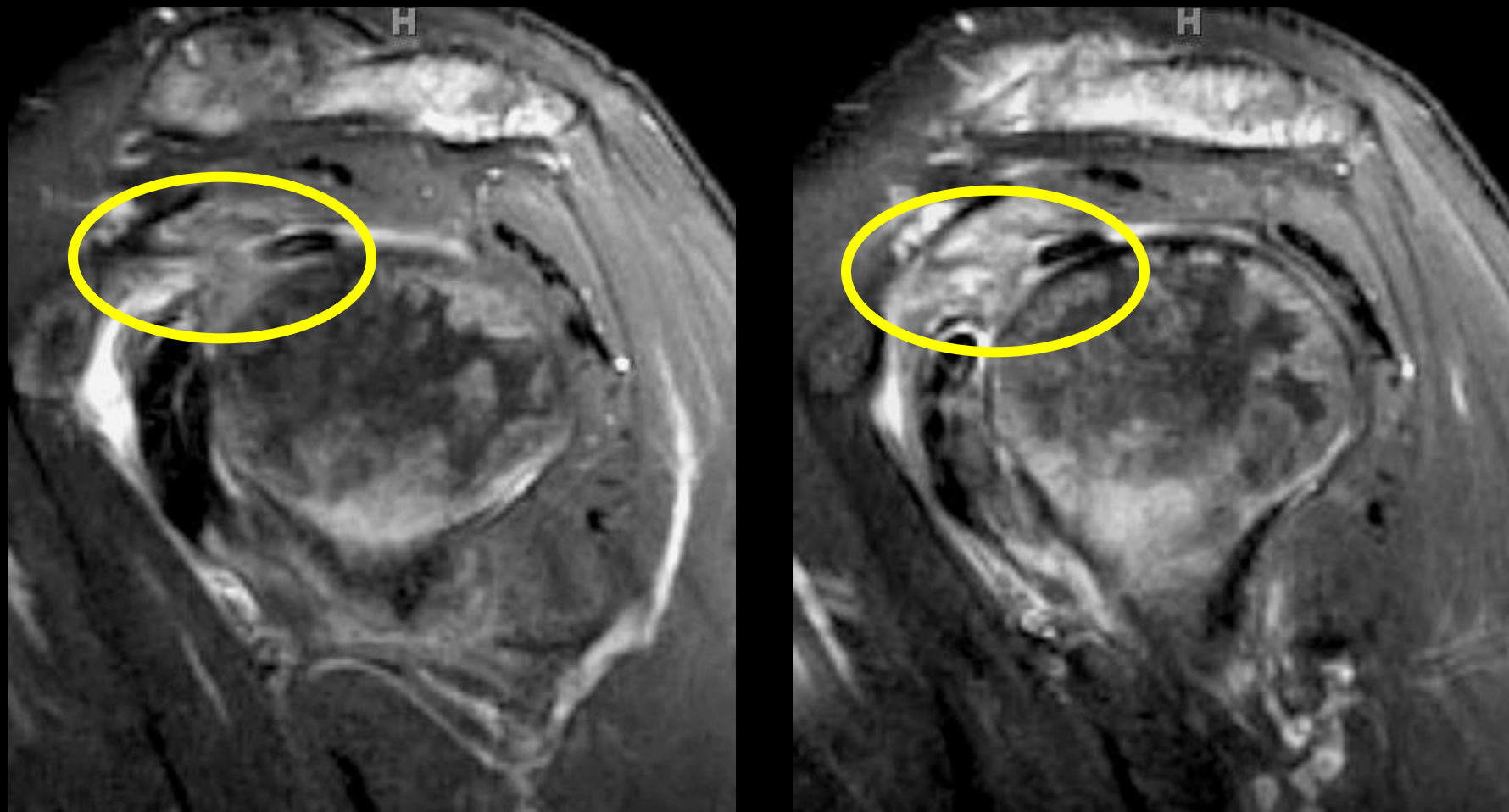


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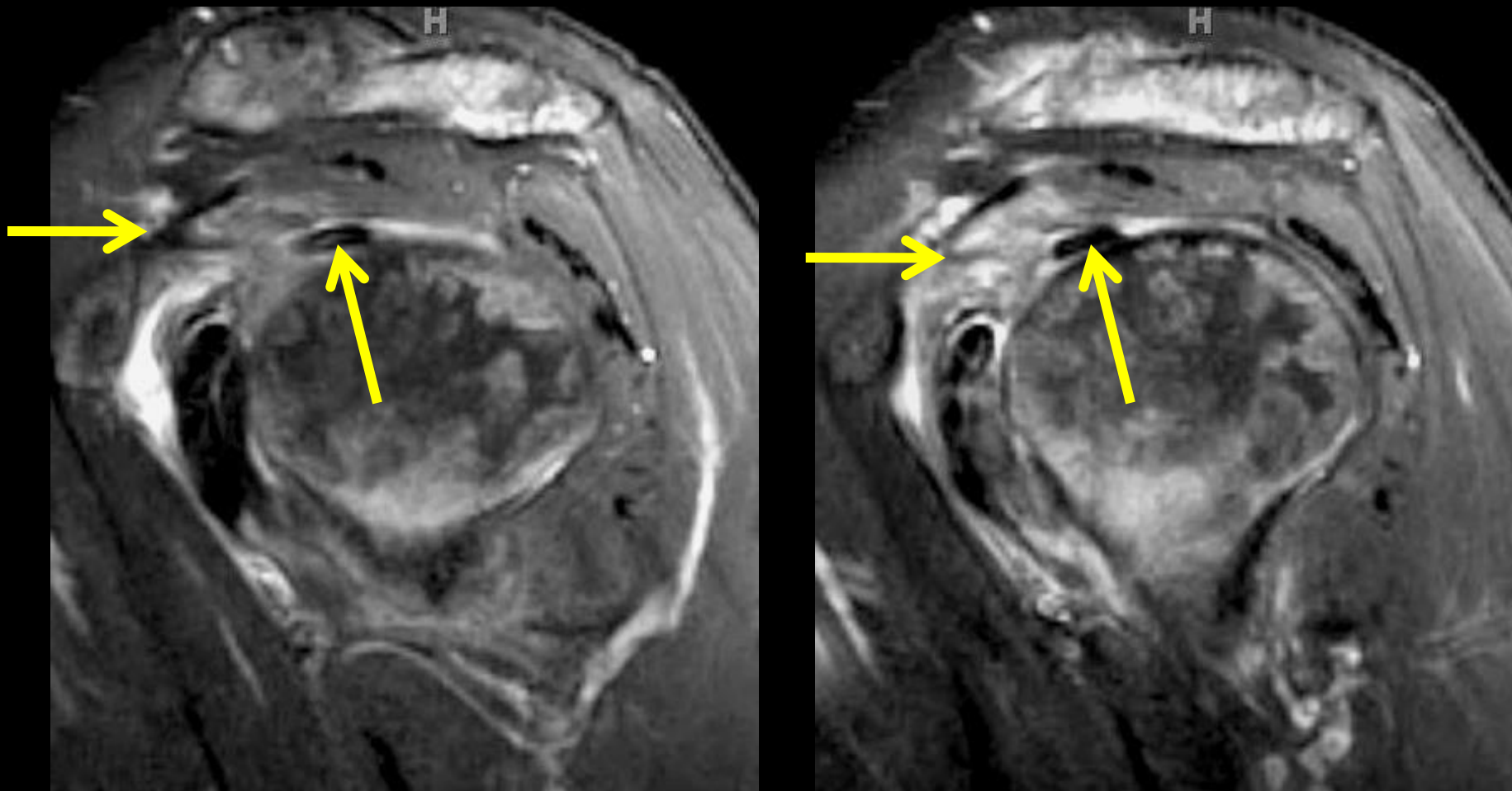
# ADHESIVE CAPSULITIS



T2

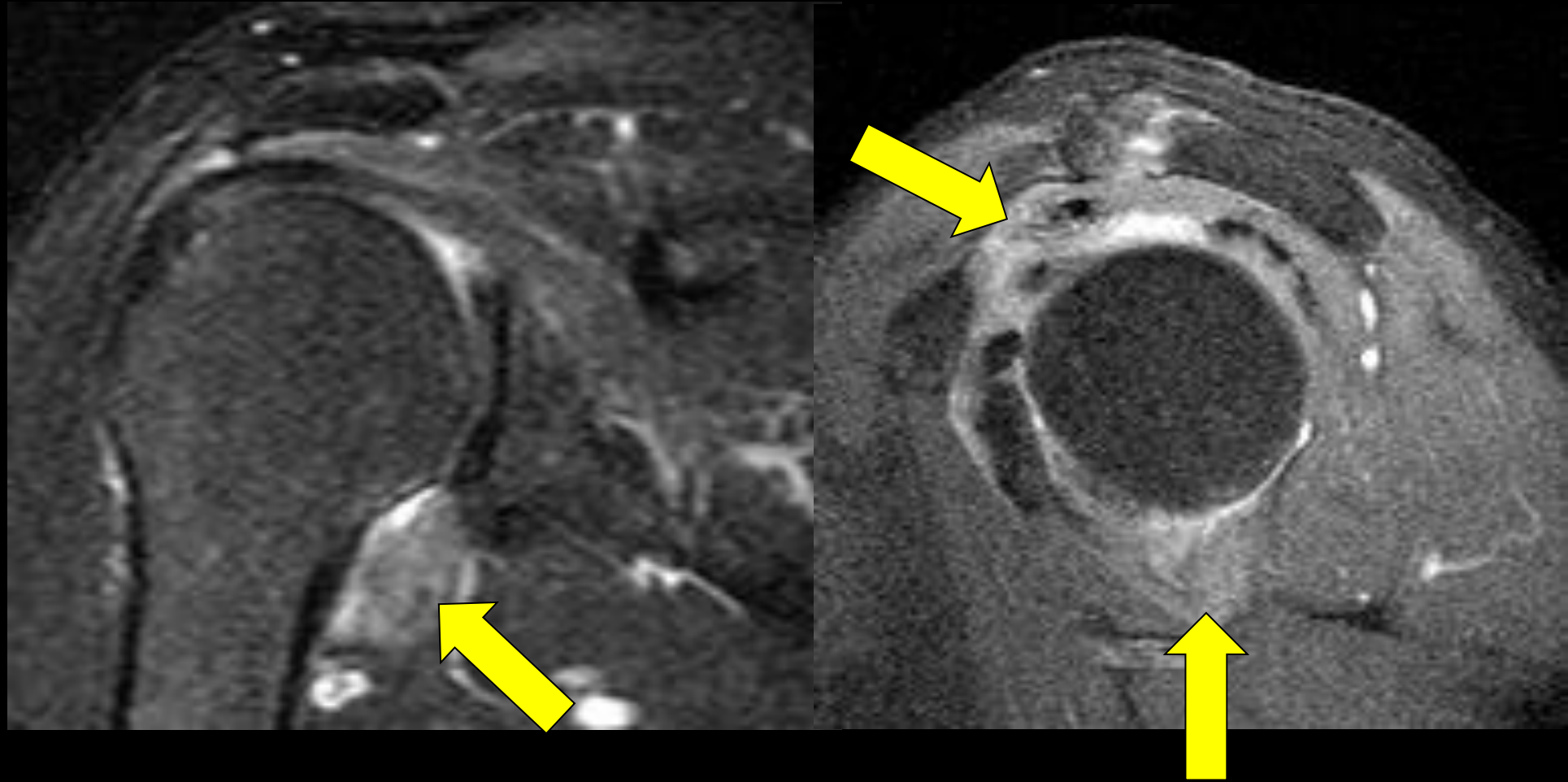


# ADHESIVE CAPSULITIS



T2

# ADHESIVE CAPSULITIS

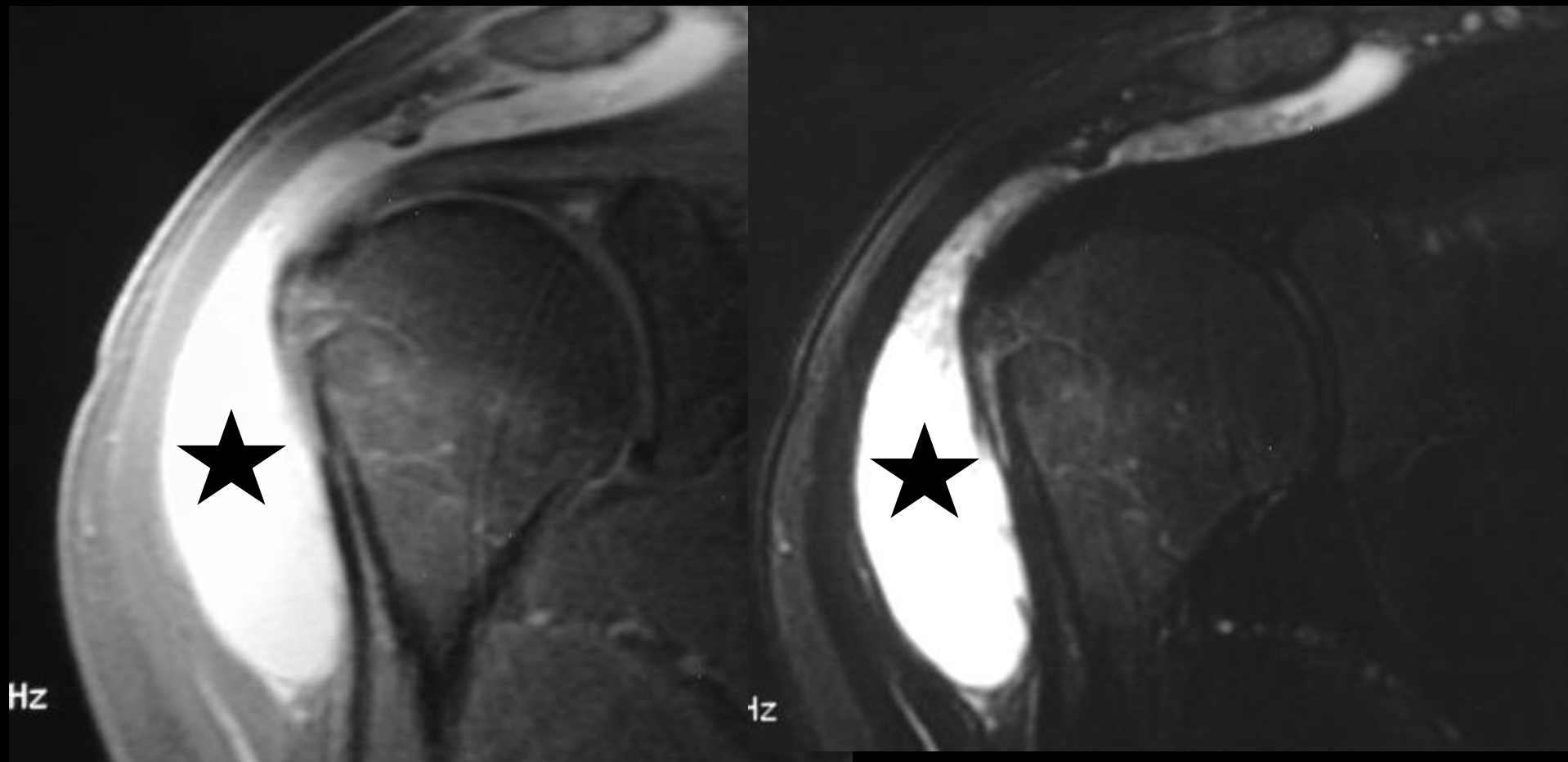


T1GD

# ABNORMALITIES THAT CAN MIMIC ROTATOR CUFF TEAR

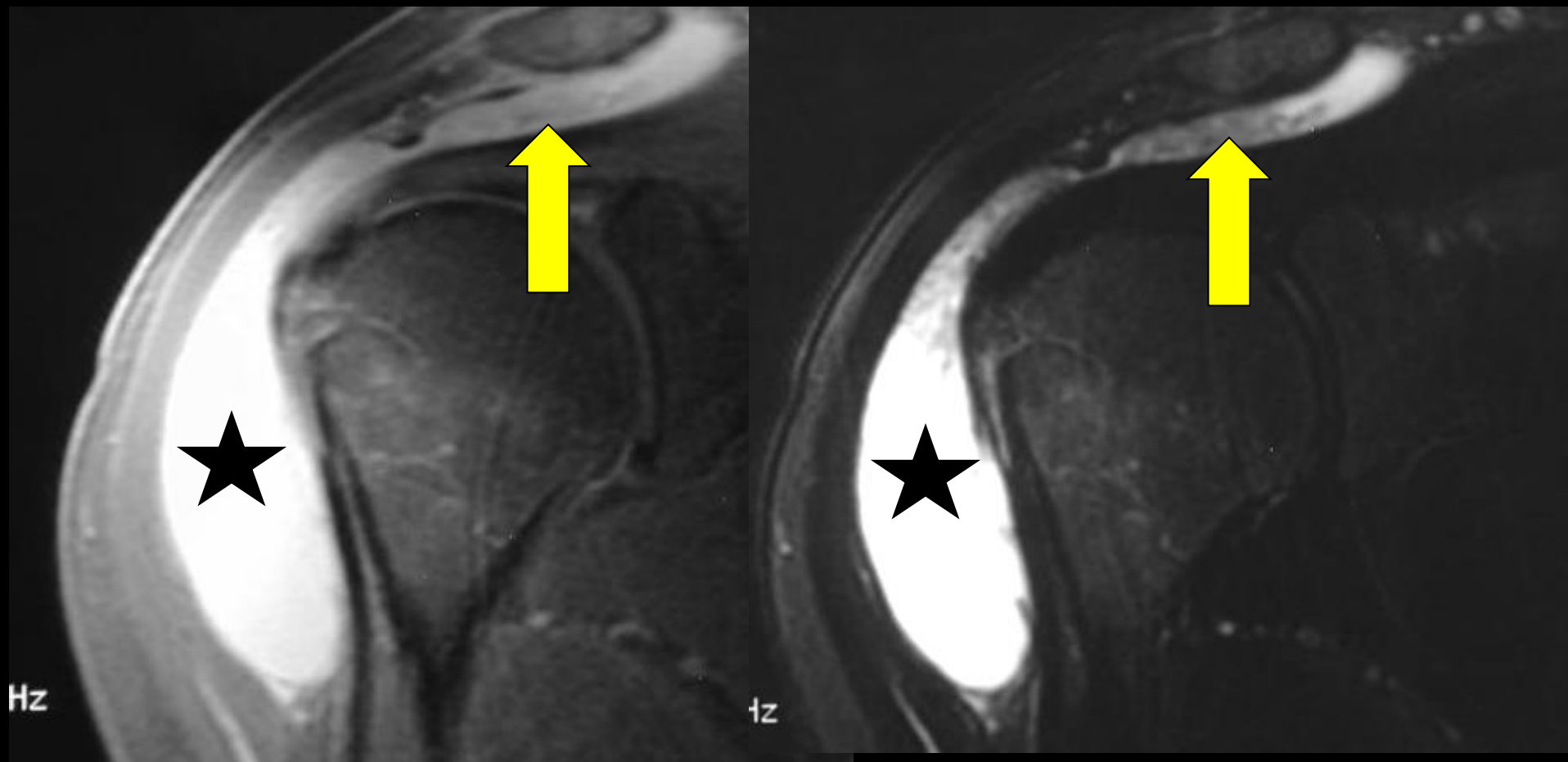
- Tendinosis/Magic angle
- Calcific tendonitis
- Adhesive capsulitis
- Subacromial bursitis

# SUBACROMIAL/SUBDELTOID BURSITIS





# SUBACROMIAL/SUBDELTOID BURSITIS



# WHAT THE SURGEON WANTS TO KNOW: RADIOLOGY REPORT

- Rotator cuff tear full thickness
  - Location/size (**Superior Cuff**) (0-2cm mild; 2-3cm moderate; 3-4cm; large; >4cm massive); **Subscapularis tears easy to miss**
  - Retraction musculotendinous junction (overcalled and NOT the defect)
  - Quality of the remainder of the cuff
  - Muscle atrophy and how severe
- Partial thickness tear
  - Location and size (> or < 50% thickness of tendon)

# WHAT THE SURGEON WANTS TO KNOW: RADIOLOGY REPORT

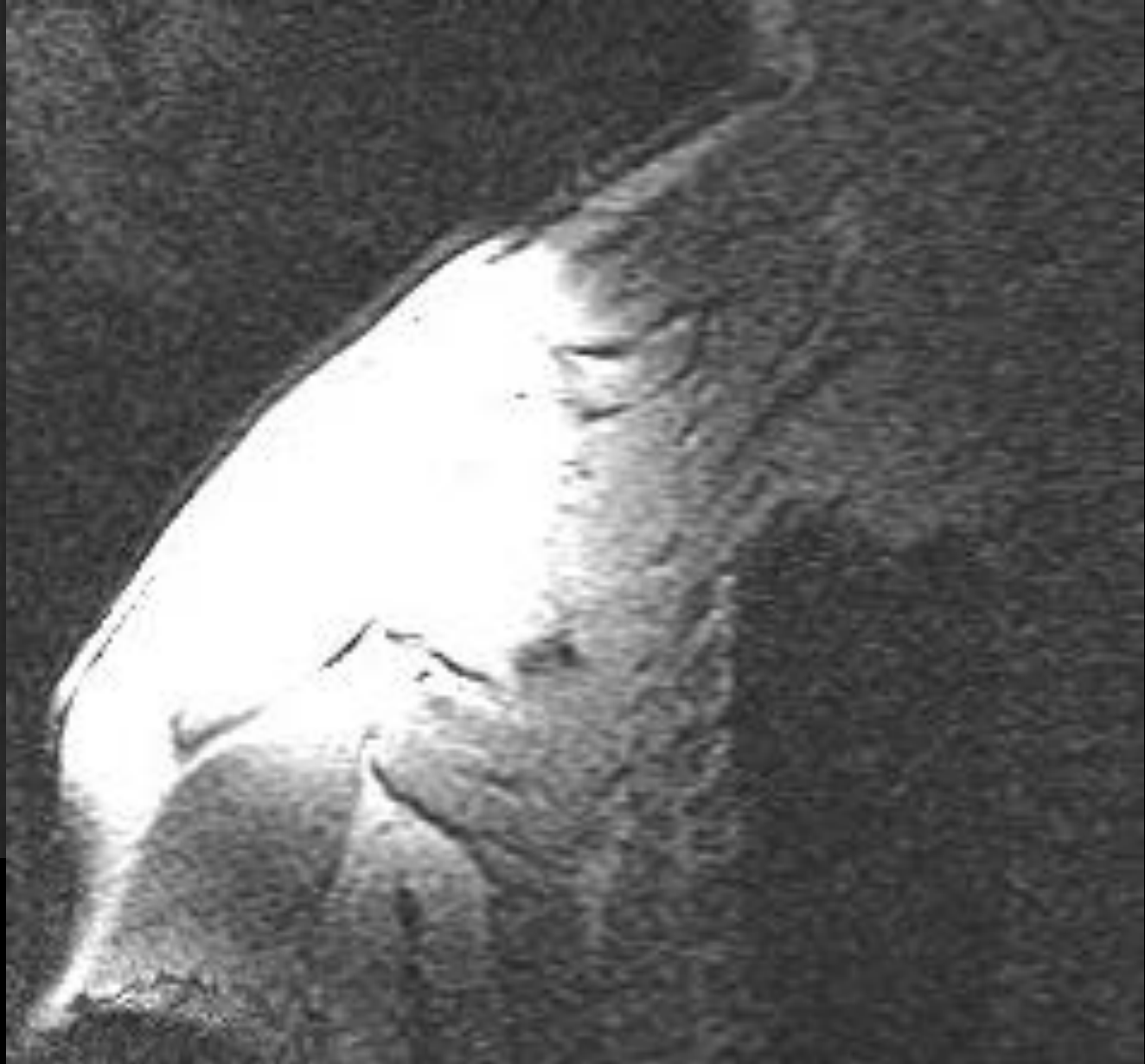
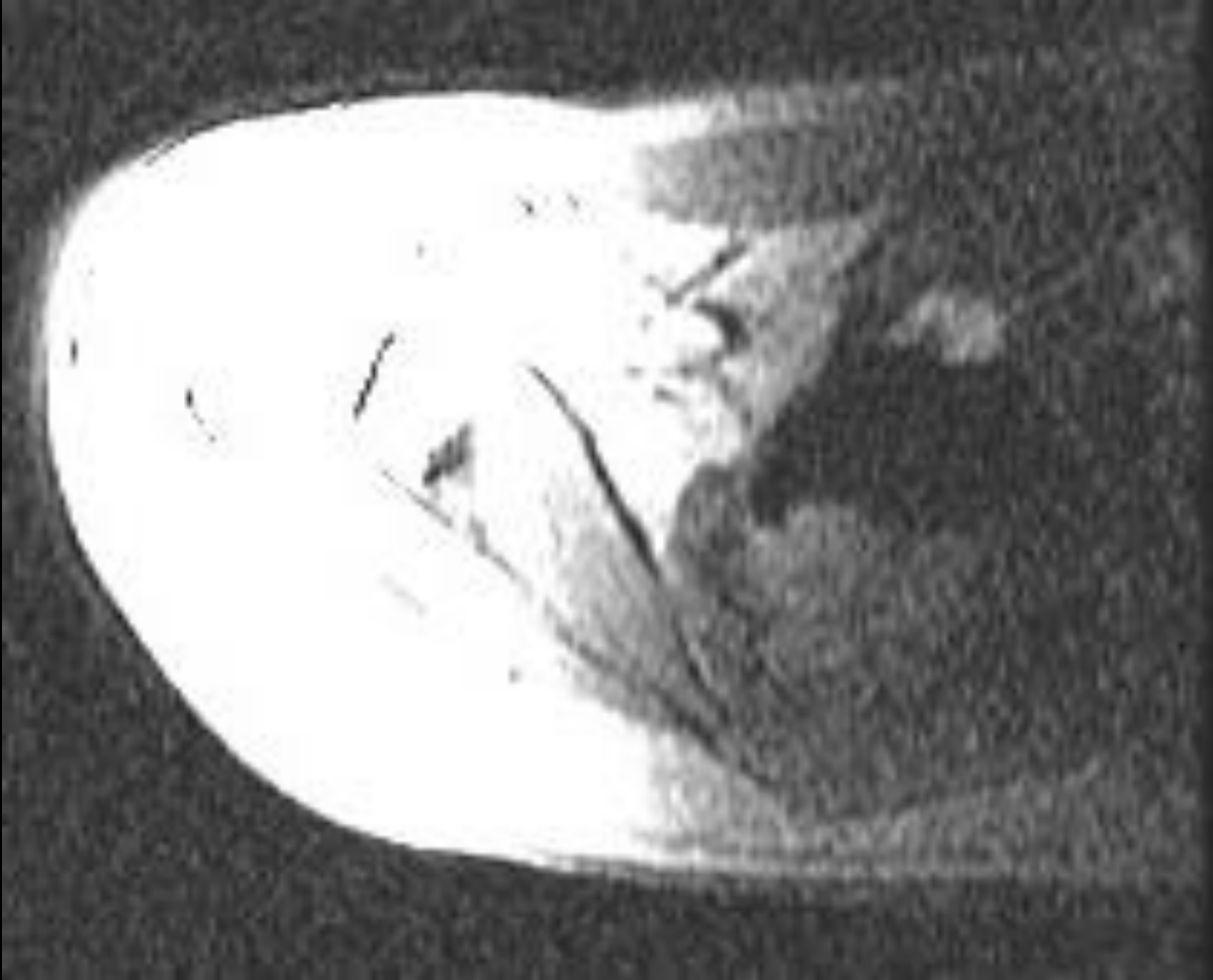
- Associated abnormalities/causes of similar symptoms
  - Os acromiale
  - Tendinopathy
  - Calcific tendinosis
  - Adhesive capsulitis
  - Subacromial/subdeltoid bursitis

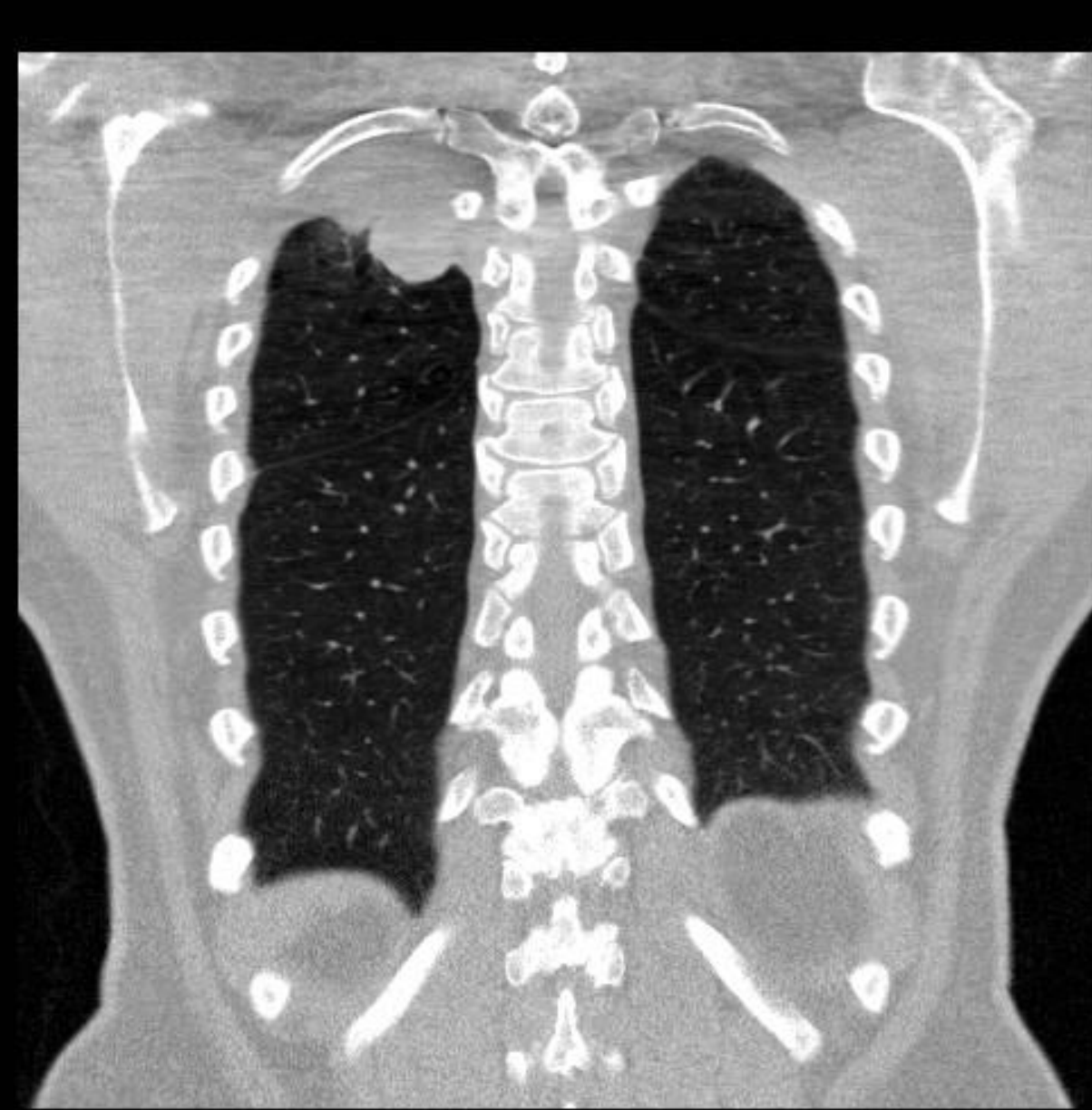
# MR IMAGING OF THE ROTATOR CUFF

Mark D. Murphey MD, FACR

Physician-in-Chief, Chief, Musculoskeletal Imaging AIRP  
Professor of Radiology Uniformed Services University of the Health Sciences  
Staff Radiologist Musculoskeletal Section,  
Walter Reed National Military Medical Center, Bethesda, Maryland







# SPECIAL THANK YOU

- Mark Anderson MD
- Donald Flemming MD
- Mark Kransdorf MD











# MR IMAGING OF THE ROTATOR CUFF

**MARK D. MURPHEY, MD, FACR**

**PHYSICIAN-IN-CHIEF, AIRP**

**CHIEF, MUSCULOSKELETAL RADIOLOGY**