

# Shoulder Ultrasound

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## Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Not relevant to this lecture

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## Outline:

- Rotator cuff tears:
  - Primary and secondary signs
  - Pitfalls
- Miscellaneous pitfalls

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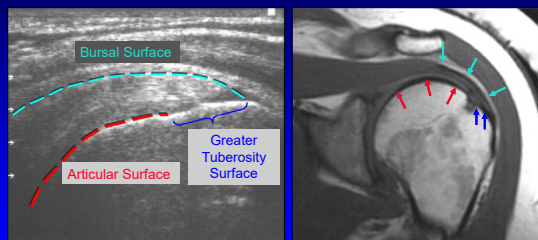
## Rotator Cuff Tears

- Tears are hypoechoic / anechoic
- Indirect signs at ultrasound:
  - Cortical irregularity: supraspinatus footprint
    - If present on radiographs, 75% have tear
  - Volume loss
- Massive tear: non-visualization

AJR 1998; 171:229  
Radiology 2004; 230:234

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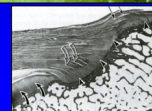
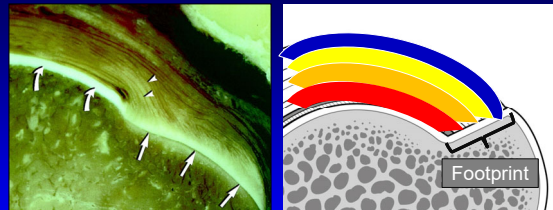
## Supraspinatus: normal



Long Axis

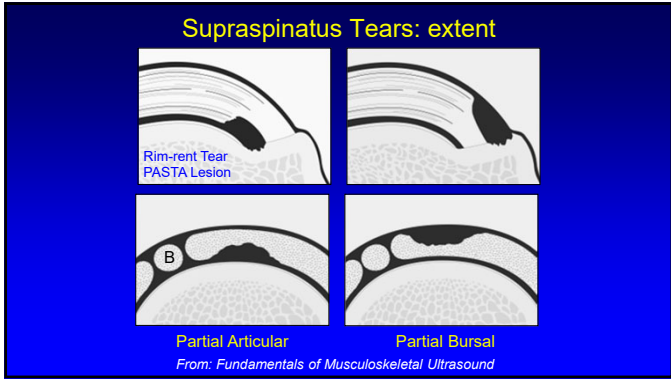
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## Supraspinatus Insertion

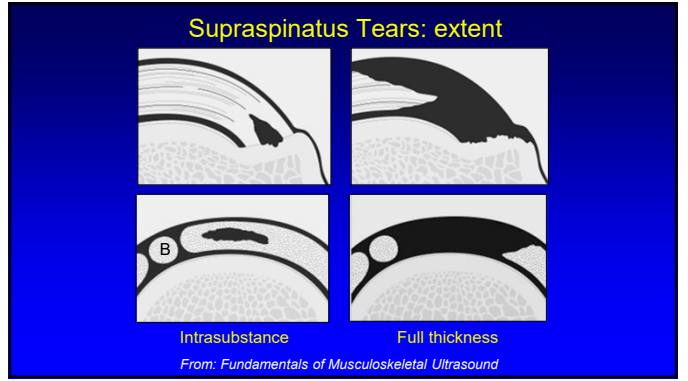


From: Siebold et al.  
RadioGraphics  
1999; 19:685

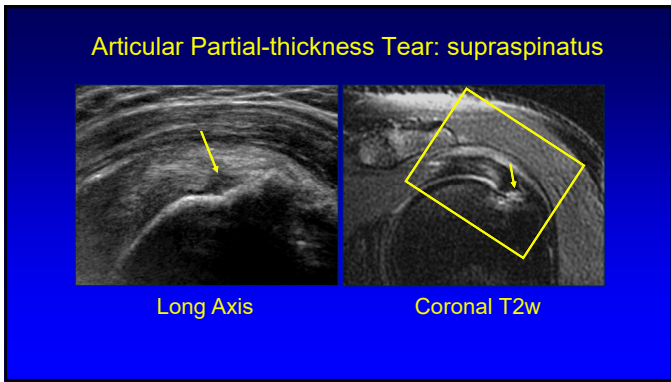
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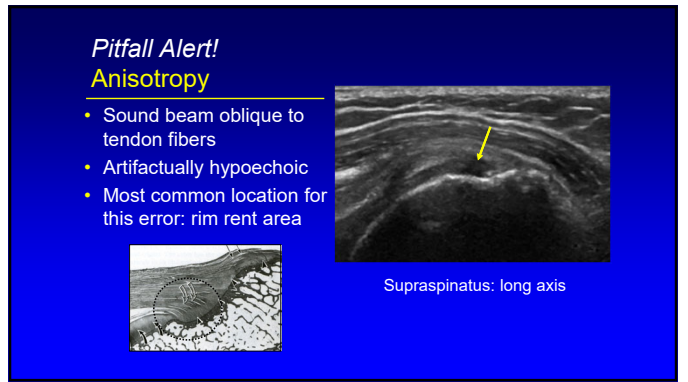
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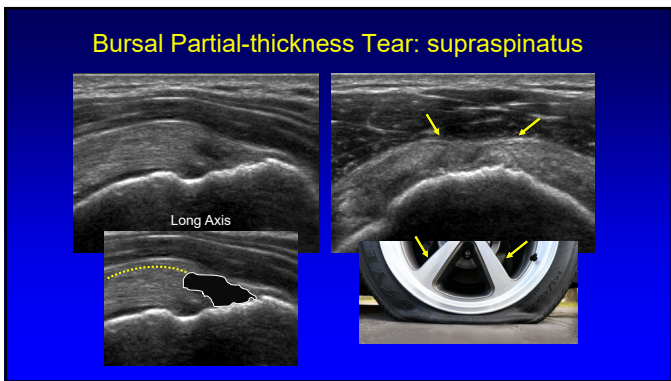
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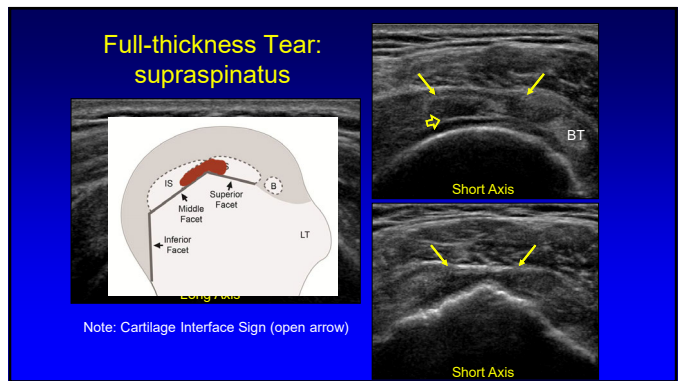
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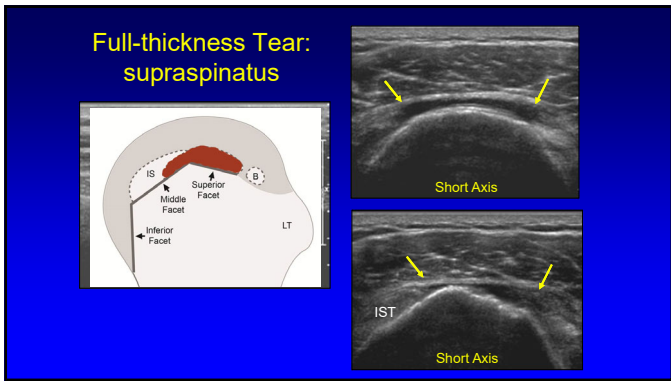
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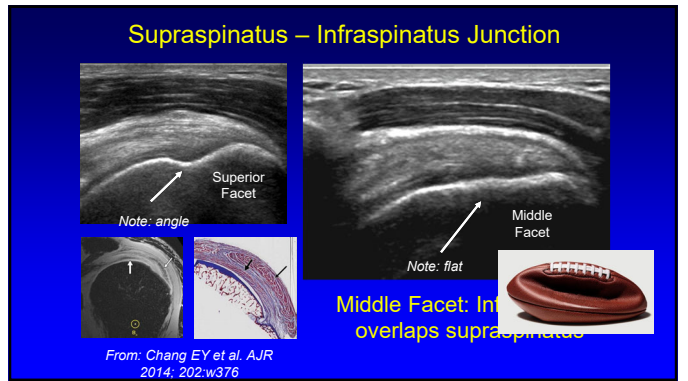
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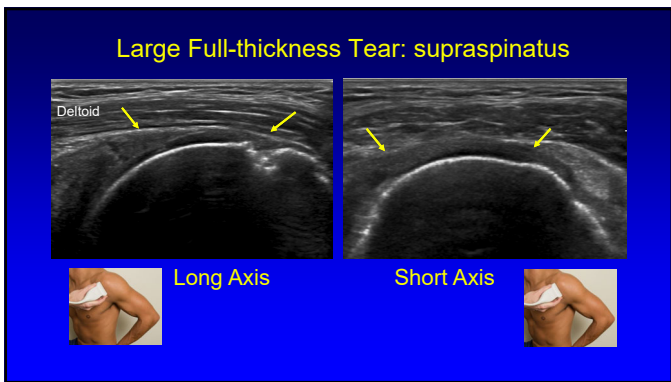
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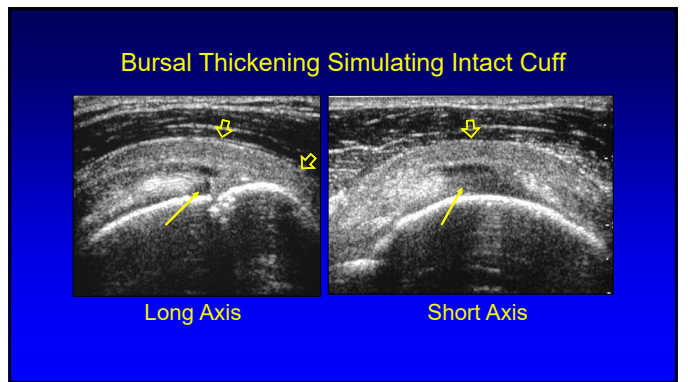
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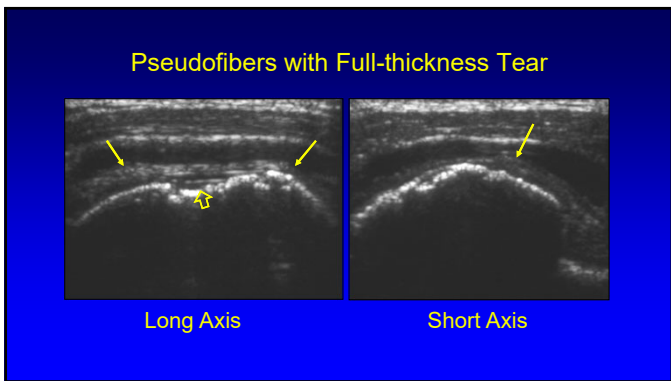
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### Tendinosis

- No inflammatory cells
  - Mucoid degeneration, chondroid metaplasia
- Hypochoic, ill-defined
- Possible increased thickness
- No cortical irregularity\*

From: Wilson JJ, et al. Am Fam Physician; 2005. 32:165

From: Hodler J, et al. J MRI; 2010. 72:811

\*Radiology 2004; 230:234

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### Tendon Tear versus Tendinosis

*\*both may appear hypoechoic*

<u>Tear</u>	<u>Tendinosis</u>
• Anechoic	• Hypoechoic
• Well-defined	• Ill-defined
• Homogeneous	• Heterogeneous
• Thinned	• Swollen
• <b>Bone irregularity*</b>	• Smooth cortex

\*At supraspinatus tendon footprint in patients over 40 years old

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### Tendinosis: supraspinatus tendon

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### Fatty Infiltration and Muscle Atrophy

- Supraspinatus and infraspinatus
  - Infraspinatus: only variable to predict cuff healing<sup>1</sup>
- Associations:
  - Chronic, large, anterior supraspinatus tears<sup>2</sup>
- Ultrasound:
  - Comparable to MRI<sup>3</sup>
  - Improved reliability with extended field-of-view<sup>4</sup>

<sup>1</sup>Chung et al. Am J Sports Med 2013; 41:16764  
<sup>2</sup>Hodler et al. Radiology 2005; 237:584.  
<sup>3</sup>Wall LB et al. JBJS 2012; 94:e83.  
<sup>4</sup>Nazarian et al. 2008; 190:27.

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### Fatty Infiltration and Muscle Atrophy

- Indistinct tendon-muscle border
- Increased muscle echogenicity
  - Compare to teres minor
- Decreased muscle bulk
  - Compared to teres minor
  - Bone landmark: ridge in scapula
  - Short axis: infraspinatus 2x size

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### Atrophy: supraspinatus and infraspinatus

Normal

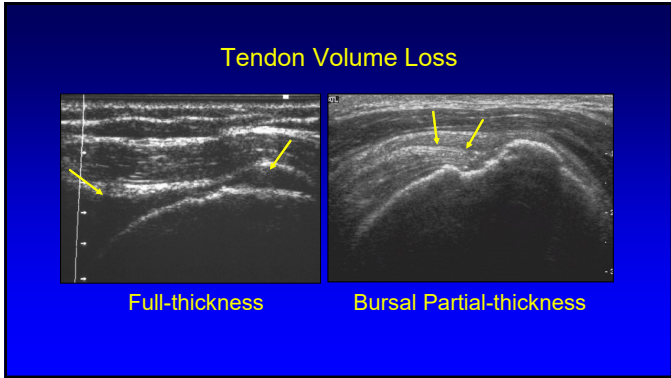
Short Axis (extended field-of-view)

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### Secondary Findings of Rotator Cuff Tears:

- Volume loss of tendon substance
- Cortical irregularity
- Effusion (articular & bursal)
- Cartilage interface sign

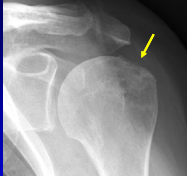

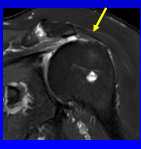
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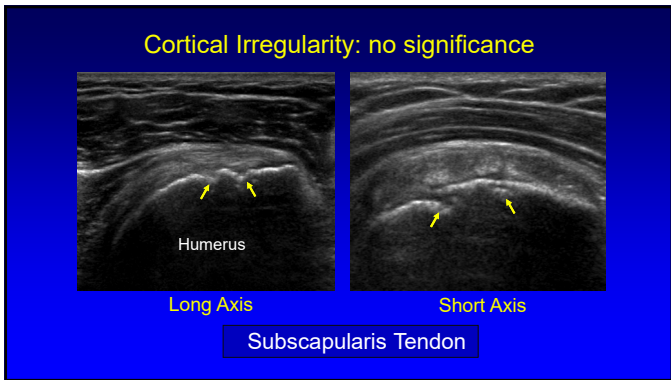
### Cortical Irregularity:

- Greater tuberosity: at **supraspinatus** insertion
- When present: 75% have rotator cuff tears
  - Patient over 40 years old
- When absent: 96% normal cuffs by sonography

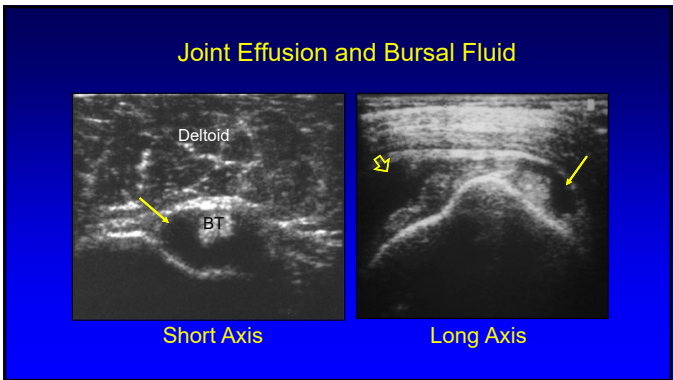




AJR 1998; 171:229  
Radiology 2004; 230:234

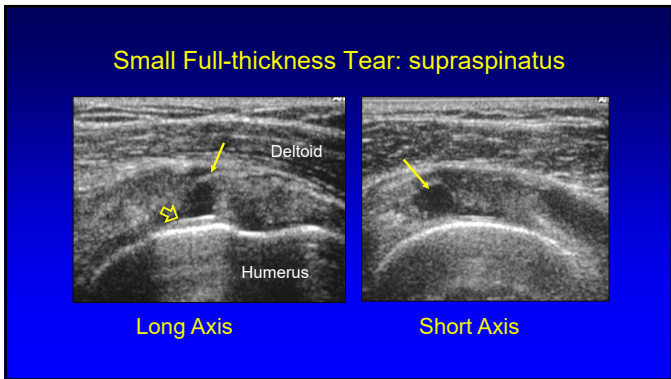
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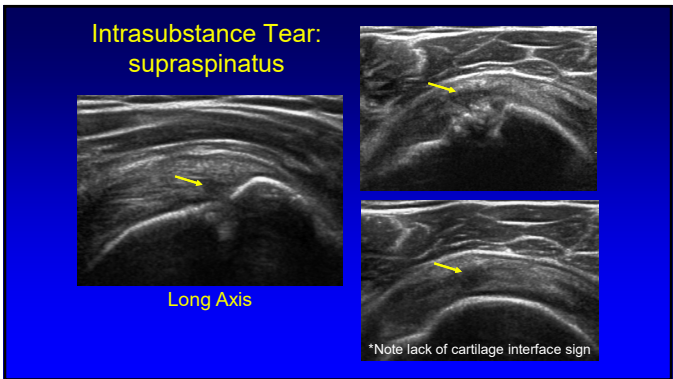
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### Miscellaneous Pathology

- Post-operative shoulder
- Non-cuff pitfalls
- Pectoralis major tear

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### Repaired Cuff: ultrasound

- Post-op intact tendon:
  - Variable and heterogeneous echogenicity
  - Variable thickness
- Reimplantation trough
- Echogenic sutures & anchors

Jacobson et al. Sem Musculo Radiol 2011; 15:320

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### Intact Post-operative Cuff

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### Post-operative Rotator Cuff

- Recurrent tear:
  - Defined tendon defect
    - Anechoic or hypoechoic
  - Tendon non-visualization
  - Tendon retraction

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### Post-operative cuff: recurrent tear

Open arrow = bioabsorbable suture anchor

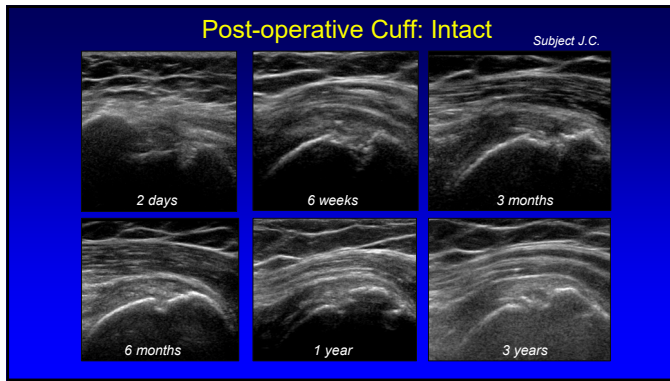
Note: echogenic sutures not in tendon

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### Post-operative Cuff: Intact

Subject B.A.

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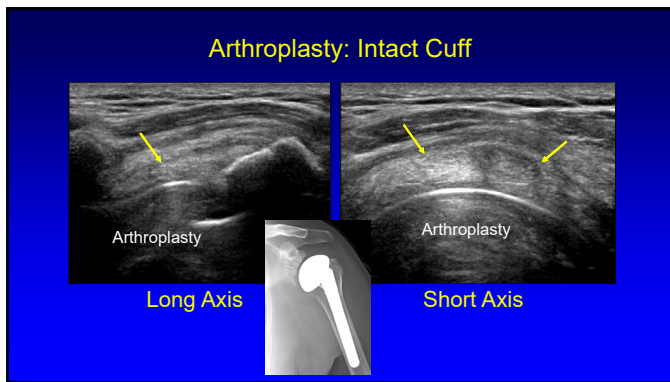


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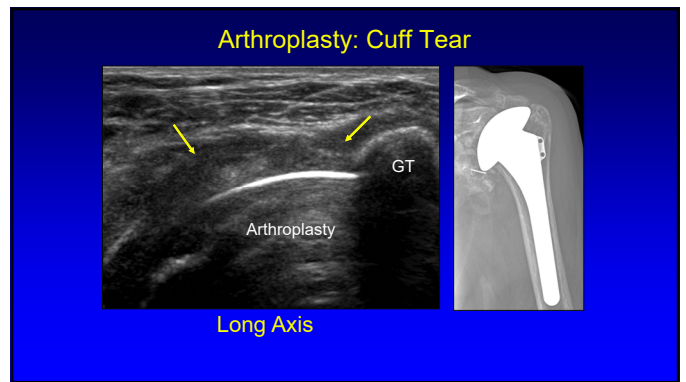
**Rotator Cuff Repair:**

- Most recurrent tears: within 3 months
- Tendons start to look "normal" by 6 to 9 months
- Focal defects are equivocal, may be post-surgical, may disappear
- Recurrent tears tend to be larger or get larger
- If unsure, get follow-up scan

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**Miscellaneous Pathology**

- Post-operative shoulder
- Non-cuff pitfalls
- Pectoralis major tear

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**Biceps Tendon:**

- Glenohumeral joint effusion:
  - Collects around biceps tendon
  - Tendon sheath communication
  - Seen in 97% with joint effusion
  - Abnormal: > 1 mm<sup>1</sup>

BT      Short Axis


Color Doppler

<sup>1</sup>Zubler et al. Eur Radiol 2011; 21:1858

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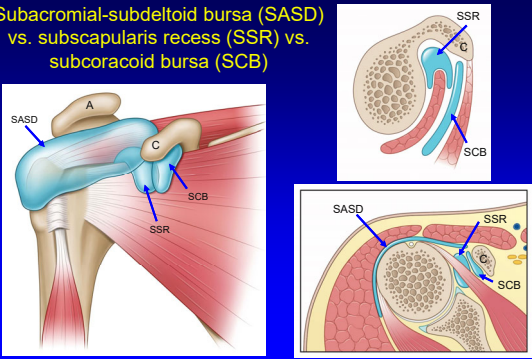
### Shoulder Joint Recesses

- Long head biceps tendon sheath
- Posterior recess:
  - Image with shoulder in external rotation
- Axillary recess
- Subscapularis recess



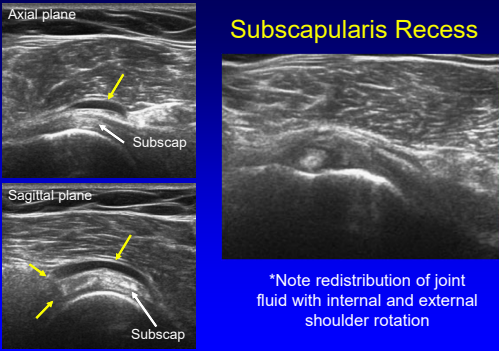
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### Subacromial-subdeltoid bursa (SASD) vs. subscapularis recess (SSR) vs. subcoracoid bursa (SCB)



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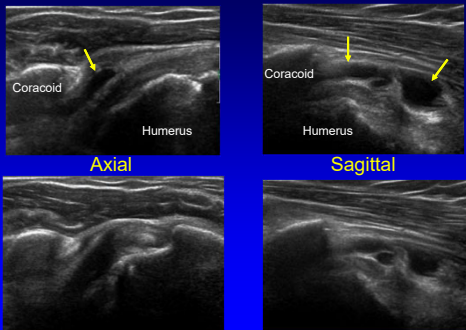
### Subscapularis Recess



\*Note redistribution of joint fluid with internal and external shoulder rotation

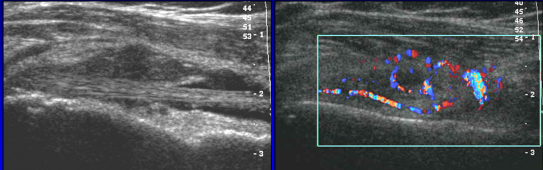
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### Subcoracoid Bursa



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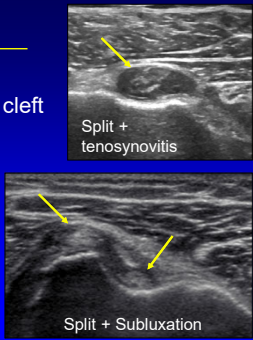
### Inflammatory Tenosynovitis: biceps tendon



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### Biceps Tendon:

- Partial-thickness tear:
  - Hypoechoic / anechoic cleft
  - Tenosynovitis
  - Sensitivity: 27%
  - Accuracy: 88%
  - Subluxation / spur
    - Important secondary signs



Skendzel J, et al. AJR 2011; 197:942

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### Aponeurotic Expansion of Supraspinatus Tendon

- Up to 49% of shoulders
- Cleft: coronal plane
- Origin: supraspinatus
- Distal: pectoralis or bicipital groove

Moser et al. Skeletal Rad 2015; 44:223

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### Pitfall Alert! Pseudo Biceps Tendon

- Biceps brachii long head
- Complete retracted tear
- Visible "fibers" in groove
  - Collapsed tendon sheath
  - Aponeurotic expansion of supraspinatus
- Look for distal retracted tendon and absent tendon in rotator interval

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### Biceps Tendon Dislocation

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### Large Full-thickness Tear: geyser sign

Long Axis      Coronal T1w

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### Post-traumatic Osteolysis of the Clavicle

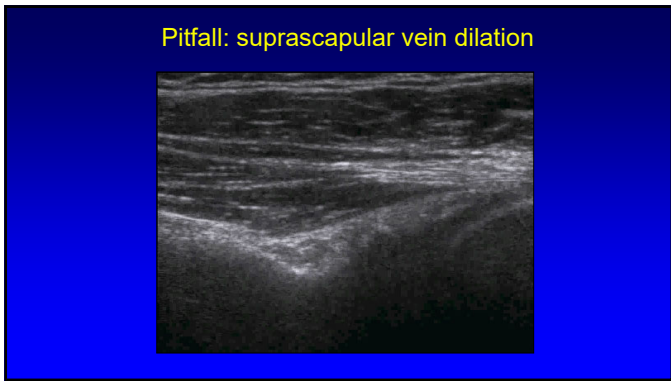
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### Labral Tear and Labral Cyst

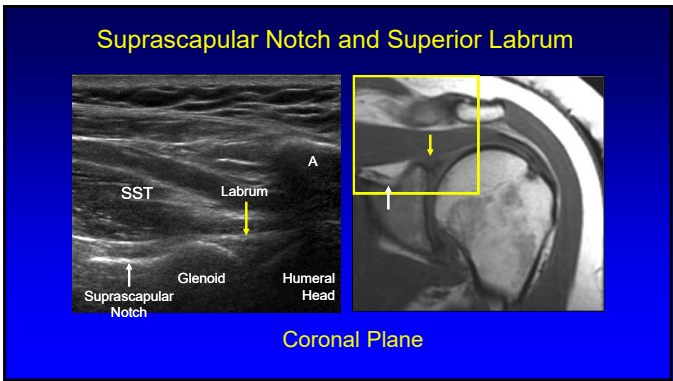
Long Axis: infraspinatus      Short Axis: infraspinatus

\*Note: non-compressible

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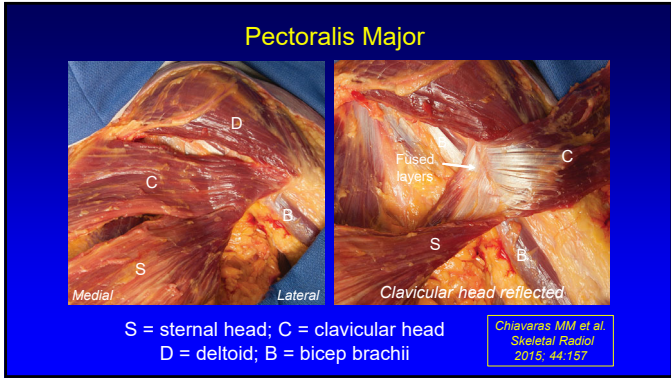
- ### Miscellaneous Pathology
- Post-operative shoulder
  - Non-cuff pitfalls
  - Pectoralis major tear

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### Pectoralis Major

- Clavicular head:
  - Forms anterior layer
- Sternal head:
  - Forms posterior layer and inferior aspect of anterior layer
- Each layer: 2 mm thick
- “U” shaped
- Fuses 11 mm proximal to insertion

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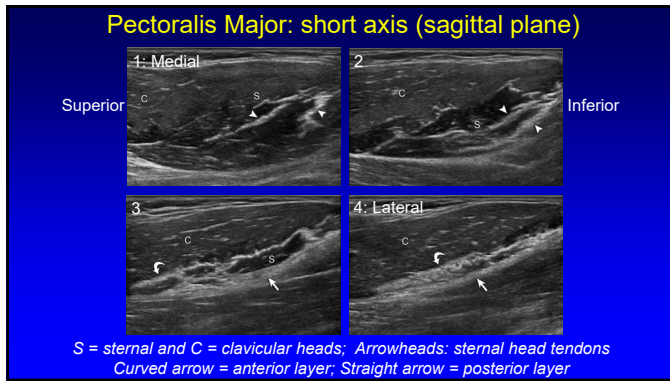
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### Pectoralis Major: ultrasound

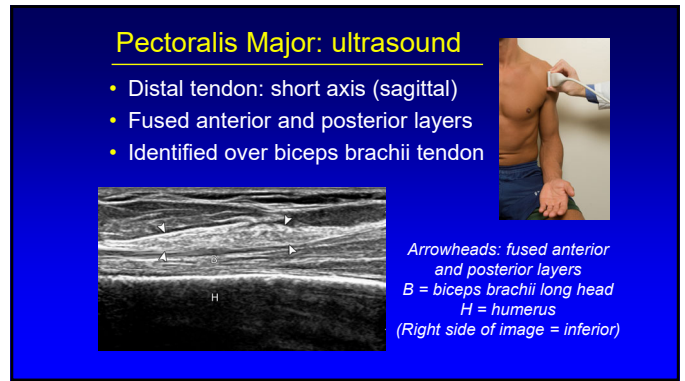
- Begin short axis over bicipital groove
- Identify biceps brachii long head
- Scan inferior to identify pectoralis major tendon superficial to biceps tendon

Curved arrow = anterior layer  
Straight arrow = posterior layer  
S = sternal head  
C = clavicular head  
B = biceps brachii long head  
H = humerus  
(Right side of image = lateral)

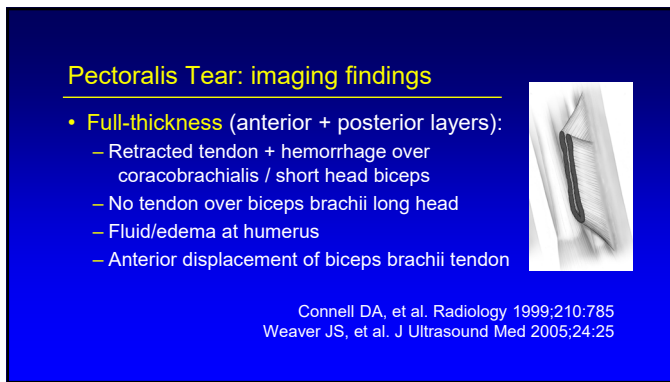
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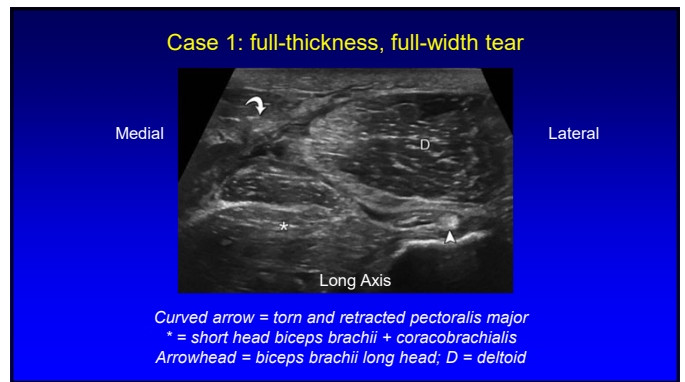
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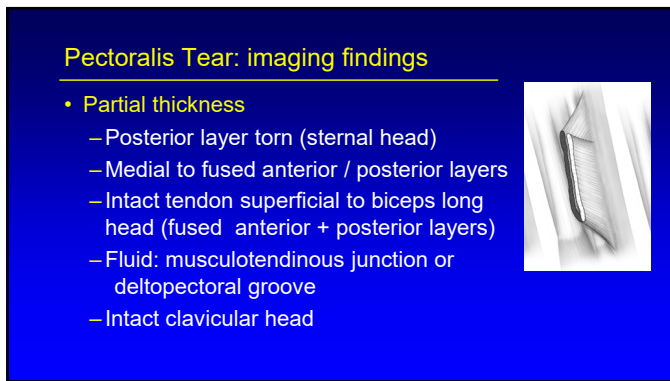
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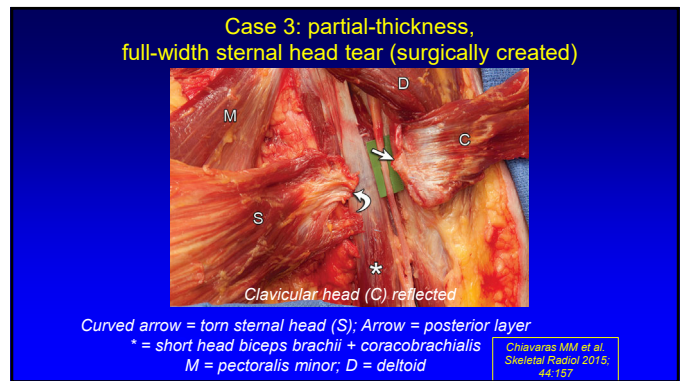
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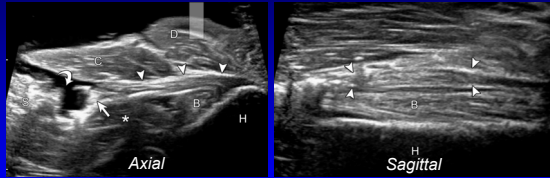


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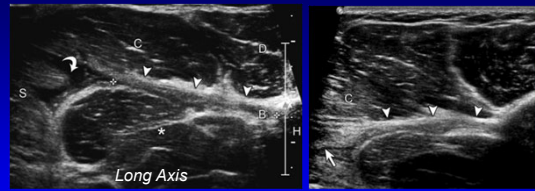
Case 3: partial-thickness, full-width sternal head tear (surgically created)



Curved arrow = torn sternal head (S); Arrow = posterior layer  
 Note: intact fused anterior and posterior layers (arrowheads) over biceps brachii long head tendon (B)  
 \* = short head biceps brachii + coracobrachialis  
 D = deltoid; H = humerus

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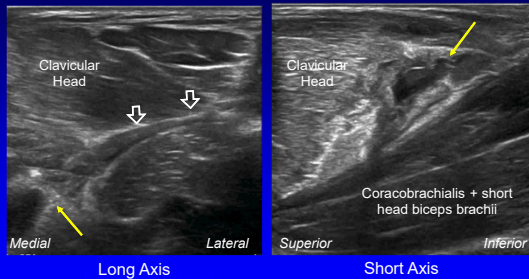
Case 4: partial-thickness, full-width sternal head tear



Curved arrow = torn sternal head (S)  
 Note: intact fused anterior and posterior layers (arrowheads) over biceps brachii long head tendon (B)  
 \* = short head biceps brachii + coracobrachialis  
 C = clavicular head; D = deltoid; H = humerus

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Case 5: partial-thickness, full-width sternal head tear (arrow)



Note: intact fused anterior and posterior layers (open arrows)

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Take-home Points

- Rotator cuff pitfalls:
  - Partial articular: focal anisotropy
  - Partial bursal: SA-SD bursal thickening
  - Full-thickness: extent, chronic tear
- Secondary signs of cuff tear:
  - Cortical irregularity (SST), thinning, cartilage interface
- Post-op cuff: 6 – 9 months
- Pectoralis major: partial, sternal, musculotendinous

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Thank you!



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Syllabus on line and other educational material:  
[www.jacobsonmskus.com](http://www.jacobsonmskus.com)



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