

Shoulder Ultrasound: Pearls and Pitfalls

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Disclosures

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

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Fundamentals of Musculoskeletal Ultrasound are
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Outline

- Rotator cuff tears:
 - Primary and secondary signs
 - Pitfalls
- Calcific tendinosis
- Post-operative shoulder
- Non-cuff pitfalls

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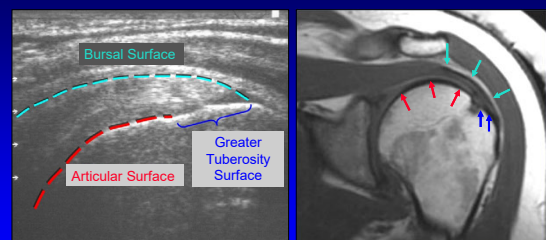
Rotator Cuff Tears

- 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

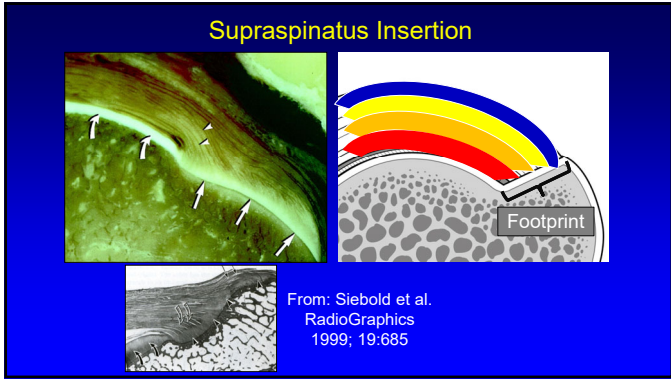
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Supraspinatus: normal

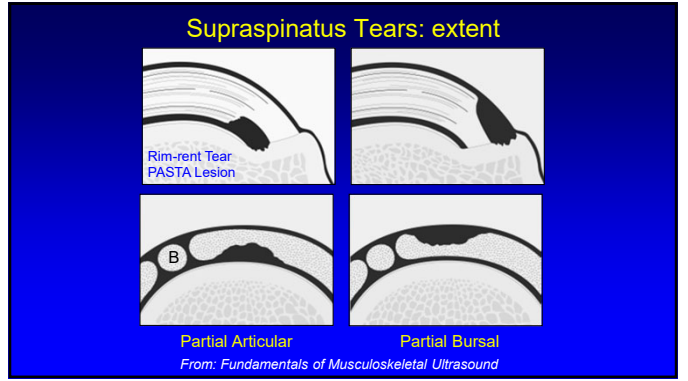


Long Axis

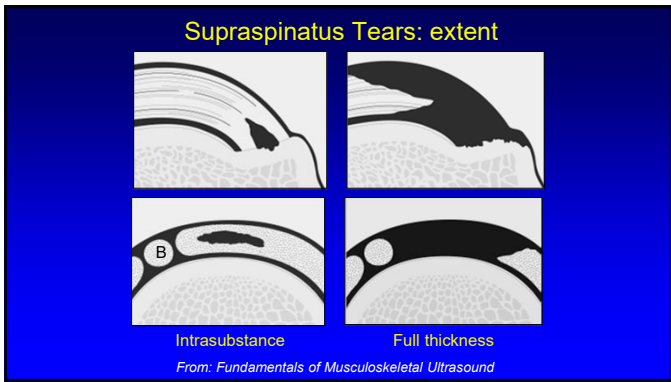
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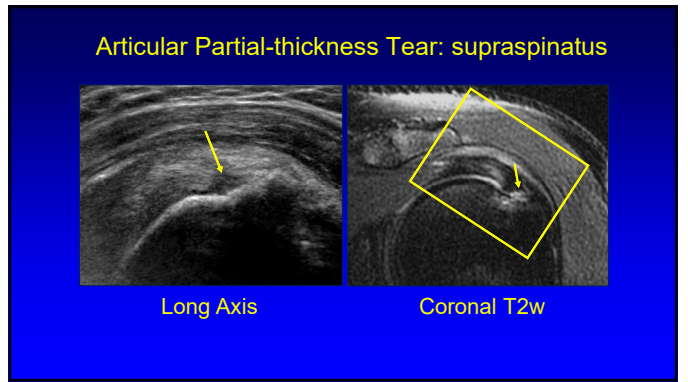
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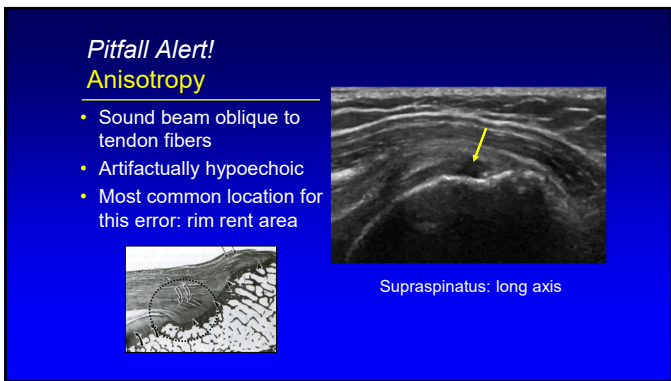
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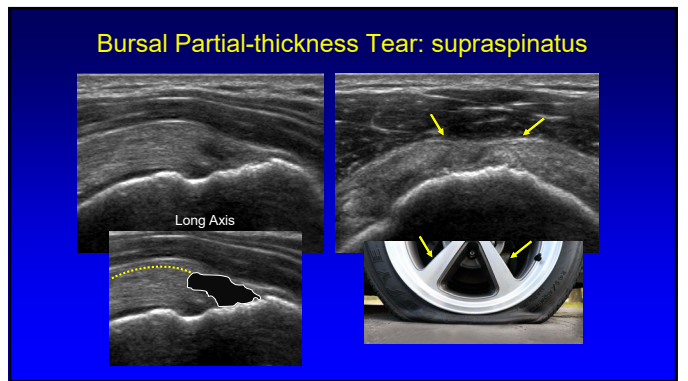
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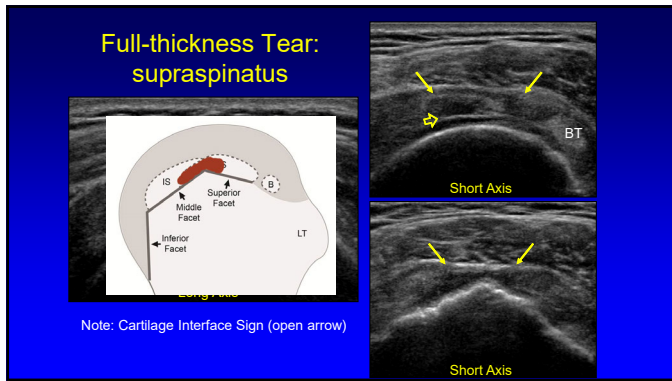
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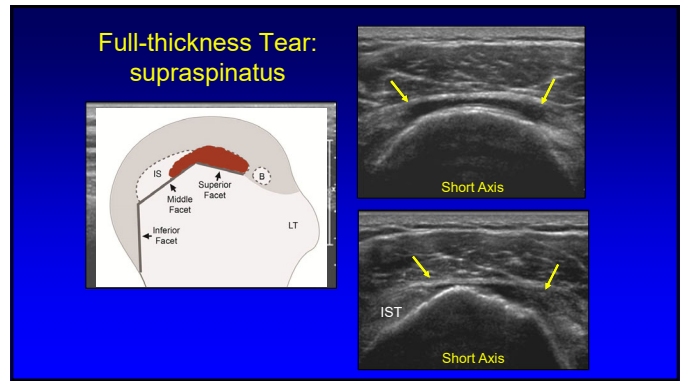
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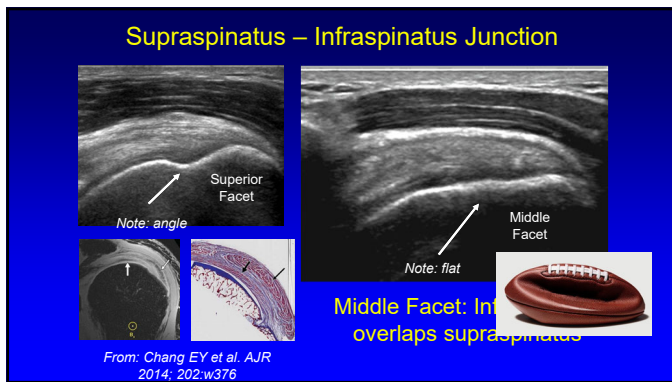
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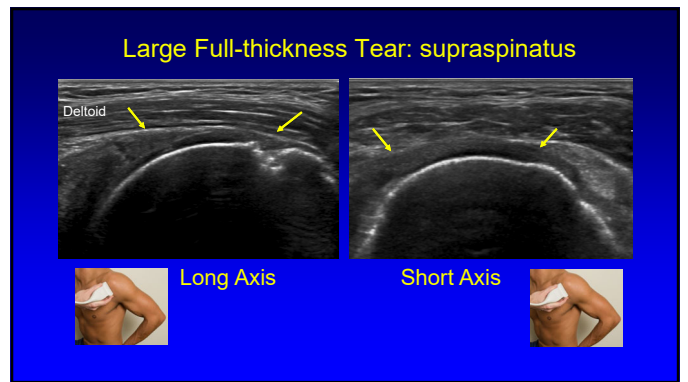
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Tendinosis

- No inflammatory cells
 - Mucoid degeneration, chondroid metaplasia
- Hypoechoic, 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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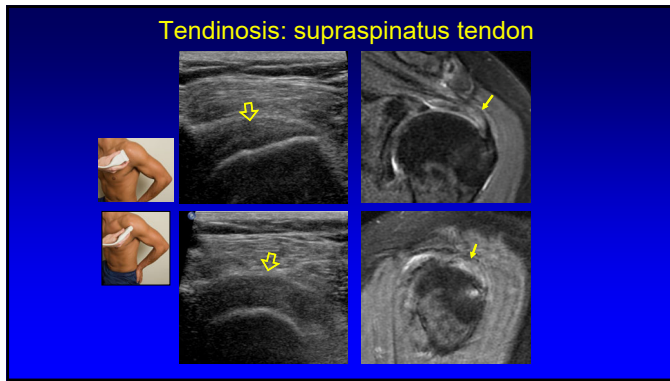
Tendon Tear versus Tendinosis

**both may appear hypoechoic*

Tear	Tendinosis
• Anechoic	• Hypoechoic
• Well-defined	• Ill-defined
• Homogeneous	• Heterogeneous
• Thinned	• Swollen
• Bone irregularity*	• Smooth cortex

*At supraspinatus tendon footprint in patients over 40 years old

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Fatty Infiltration and Muscle Atrophy

- Supraspinatus and infraspinatus
 - Infraspinatus: only variable to predict cuff healing¹
- Associations:
 - Chronic, large, anterior supraspinatus tears²
- Ultrasound:
 - Comparable to MRI³
 - Improved reliability with extended field-of-view⁴

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

Short Axis (extended field-of-view)

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Secondary Findings of Rotator Cuff Tears:

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

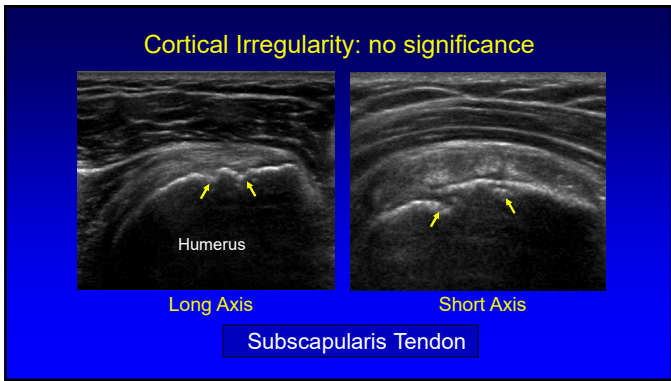
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Cortical Irregularity:

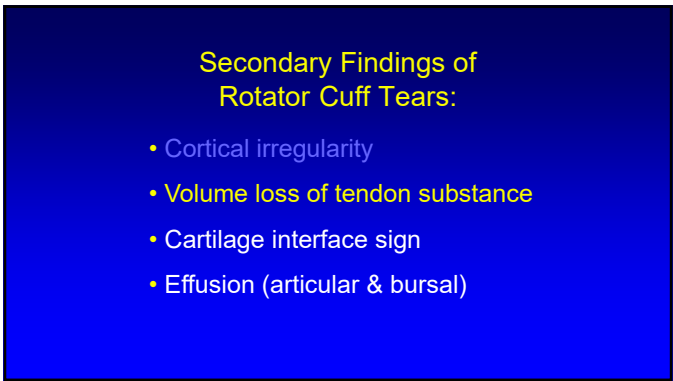
- Greater tuberosity: at supraspinatus insertion
- When present: 75% have rotator cuff tears
 - Patient over 40 years old
- When absent: 96% normal cuffs by sonography

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

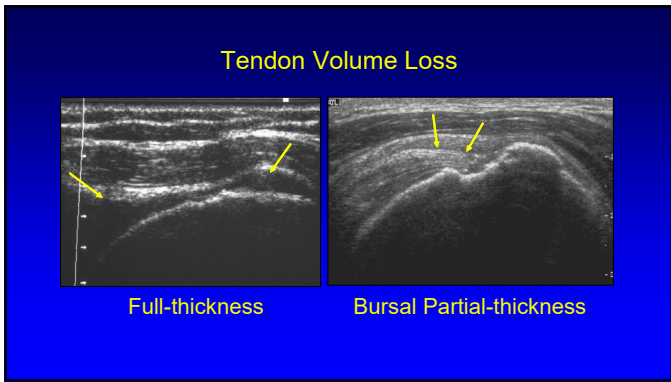
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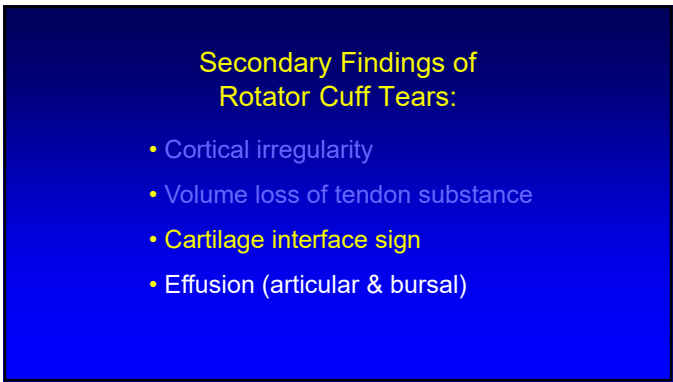
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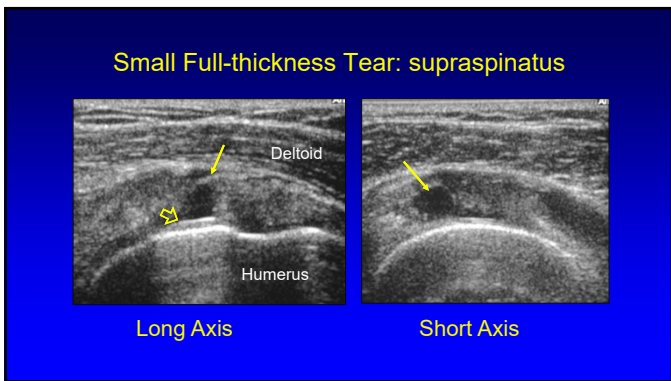
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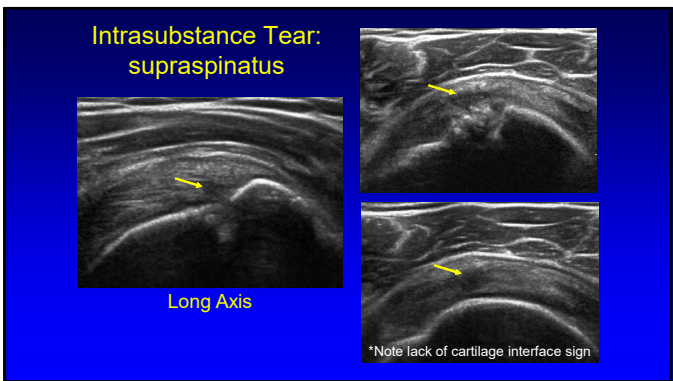
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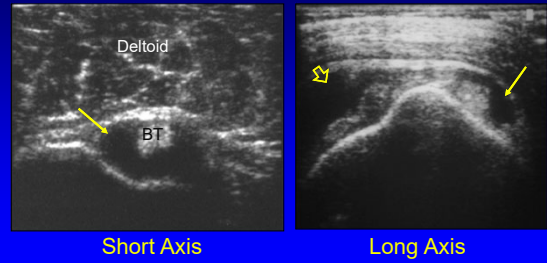
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Secondary Findings of Rotator Cuff Tears:

- Cortical irregularity
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Joint Effusion and Bursal Fluid



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Improper Arm Position

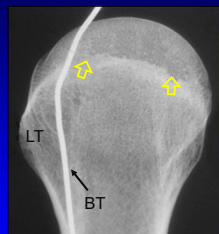
- Inadequate internal rotation/extension
- Supraspinatus is hidden beneath acromion
- Proximal tears not visualized



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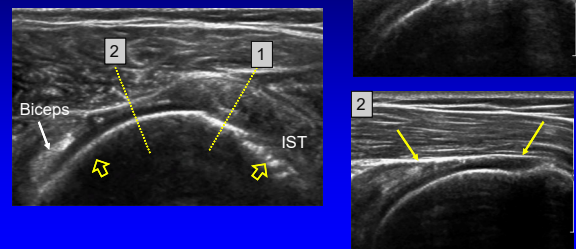
Incomplete Evaluation of Supraspinatus:

- Scan entire width of greater tuberosity
- Many tears occur anteriorly over superior facet
- Include biceps on transverse image as landmark



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Incomplete Evaluation of Supraspinatus



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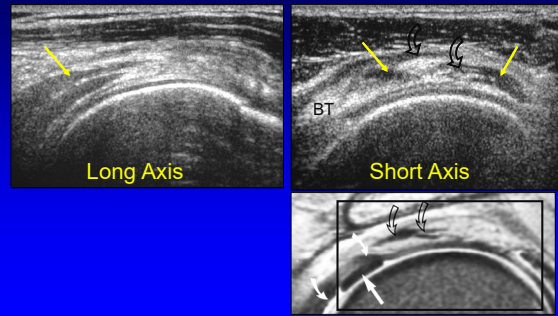
Musculotendinous Junction:

- **Supraspinatus:** several distinct tendons
- Appears as hypoechoic area extending into tendon
- Usually terminates by mid-tendon
- Characteristic tapering from proximal to distal

Turrin et al. Skeletal Radiology 1997; 26:89

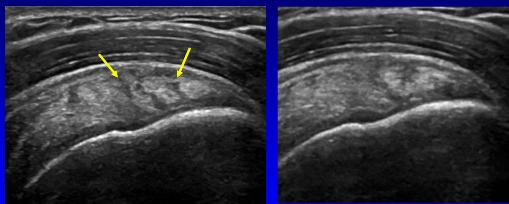
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Musculotendinous Junction: supraspinatus



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Supraspinatus – Infraspinatus Junction

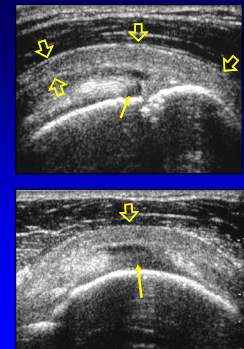


Long Axis to Supraspinatus over Middle Facet

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Subacromial-subdeltoid Bursa

- Hyperechoic synovium may appear similar to tendon fibers
- Hyperechoic thickness that extends beyond greater tuberosity is synovium and not cuff fibers



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Bursal Partial-thickness Tear: supraspinatus

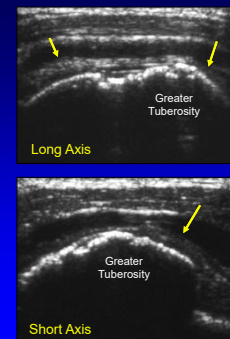


Long Axis

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Pseudofibers with full-thickness tear

- Hyperechoic and fibrillar
- Typically thinner than normal cuff
- Extends beyond greater tuberosity



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- **Calcific tendinosis**
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Degenerative Calcification

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Calcific Tendinosis/Tendinitis

- Tendon metaplasia: calcium hydroxyapatite deposition
- Two phases:
 - Formative: well-defined, dense shadow
 - Resorptive: amorphous
- Percutaneous US-guided lavage/aspiration

Uthoff. J Am Acad Ortho Surg 1997; 5:183

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Calcific Tendinosis/Tendinitis

Formative
Defined, shadow

Resorptive
Amorphous, little shadow

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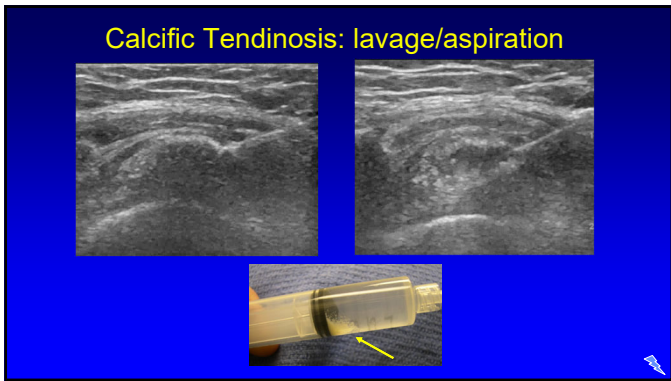
Subscapularis: calcific tendinosis

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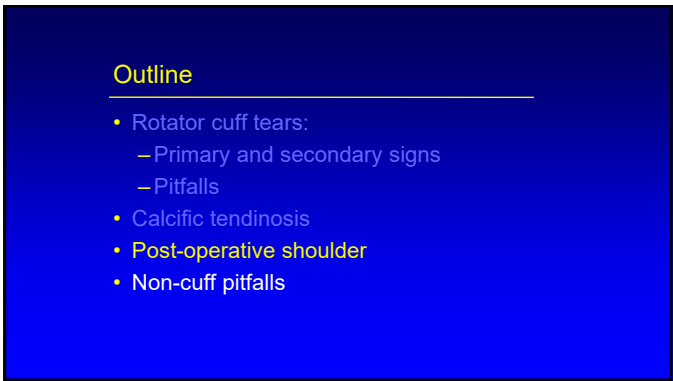
Calcific Tendinosis: supraspinatus
Use of Tendon Anisotropy

Long axis

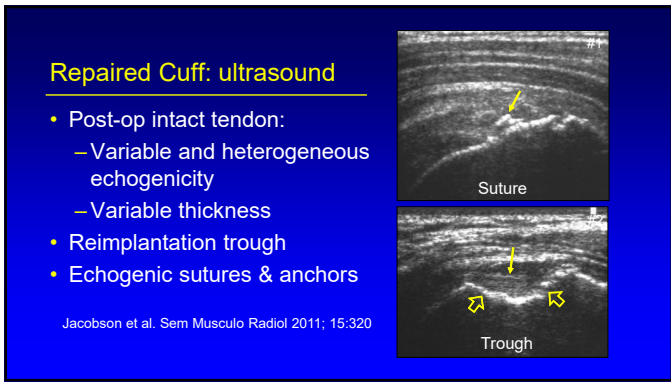
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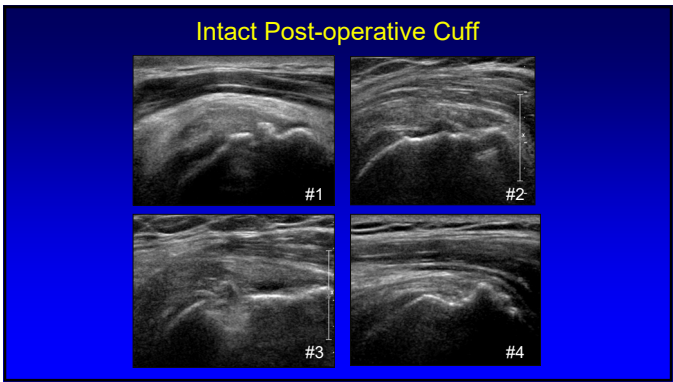
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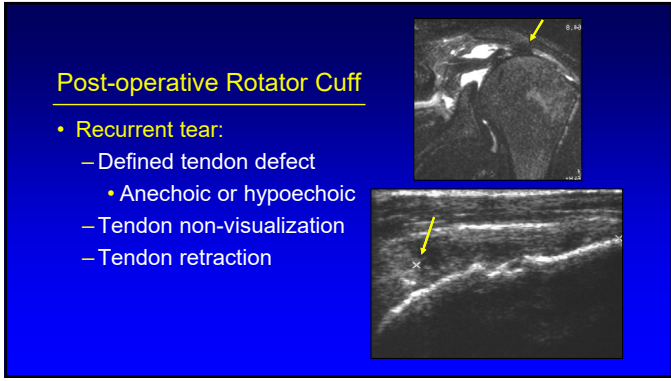
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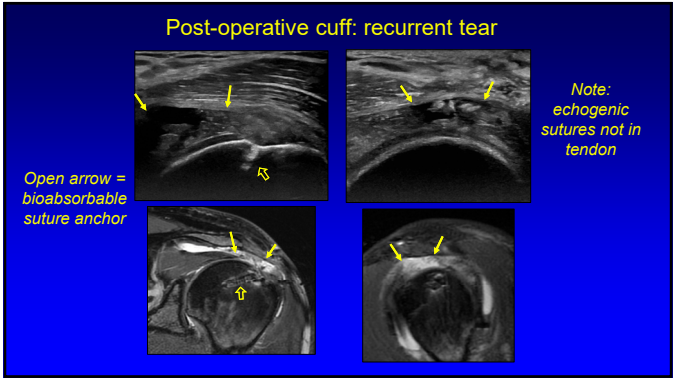
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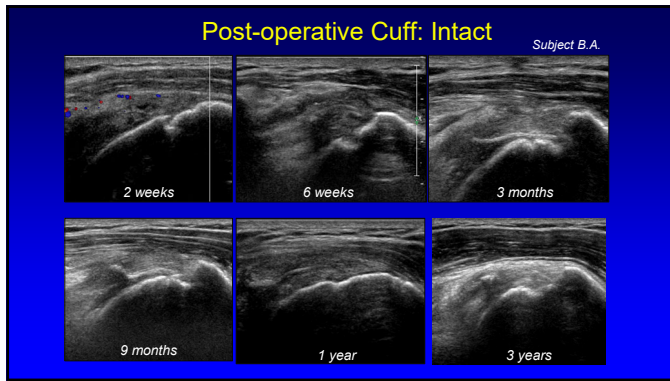
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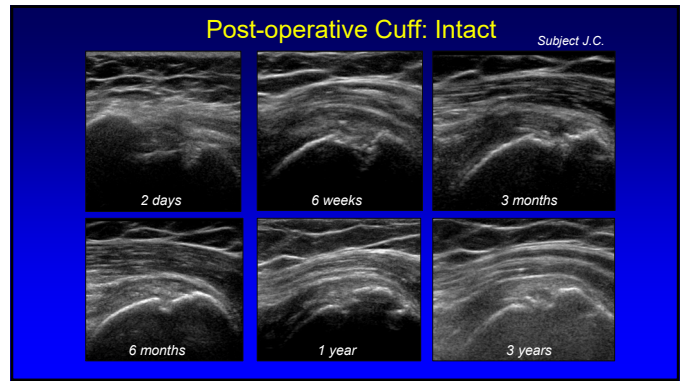
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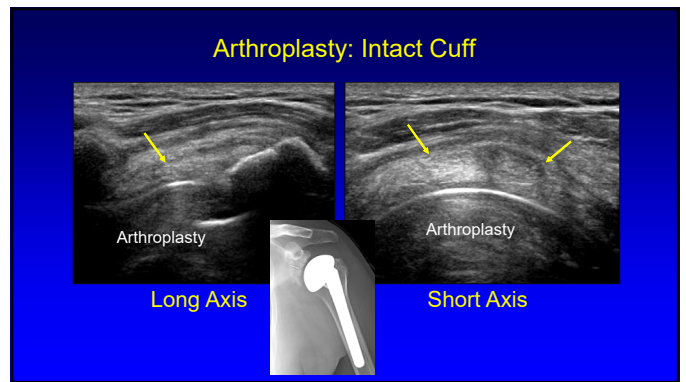
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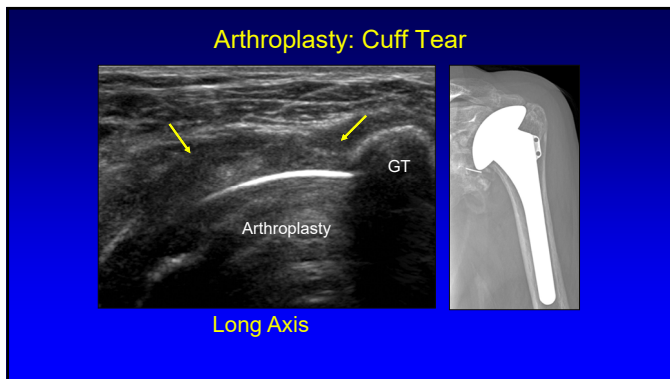
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- Rotator Cuff Repair:**
- Most recurrent tears: within 3 months
 - Tendons start to look "normal" by 6 to 9 months
 - Focal defects are equivocal, may be post-surgical, may disappear
 - Recurrent tears tend to be larger or get larger
 - If unsure,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

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Biceps Tendon:

- Glenohumeral joint effusion:
 - Collects around biceps tendon
 - Tendon sheath communication
 - Seen in 97% with joint effusion
 - Abnormal: > 1 mm¹

¹Zubler 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

Long Axis

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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
 - SST

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Biceps Tendon Dislocation

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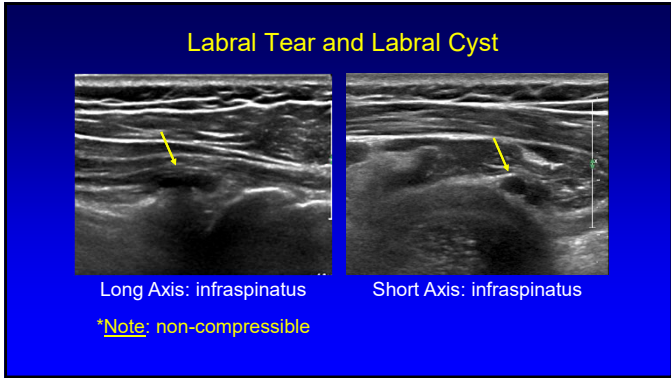
Large Full-thickness Tear: geyser sign

Long Axis Coronal T1w

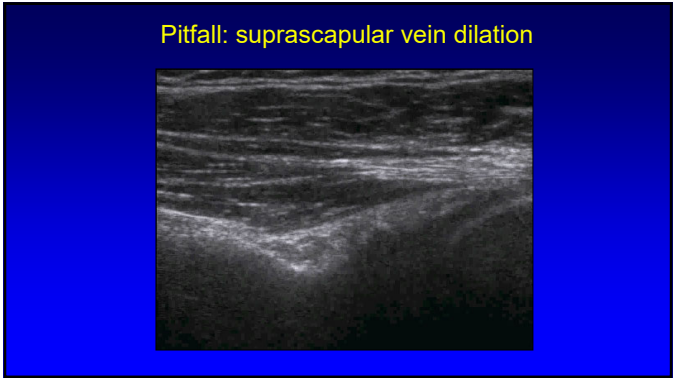
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Post-traumatic Osteolysis of the Clavicle

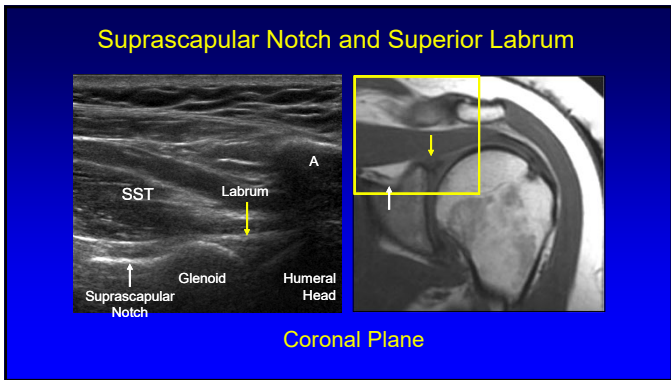
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- ### Take-home Points
-
- Rotator cuff pitfalls:
 - Partial articular: focal anisotropy
 - Partial bursal: SA-SD bursal thickening
 - Full-thickness: extent, chronic tear
 - Secondary signs of cuff tear:
 - Cortical irregularity (SST), thinning, cartilage interface
 - Post-op cuff: 6 – 9 months
 - Don't overcall biceps tenosynovitis

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Thank you!





Syllabus on line and other educational material:
www.jacobsonmskus.com



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