

Ultrasound of the Rotator Cuff with MRI Correlation

Jon A. Jacobson, MD, FACR

Professor of Radiology
Section Chief of Musculoskeletal Imaging



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Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Advisory Board: Philips
- Medical Board: POCUSPRO
- I no longer eat Skittles

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

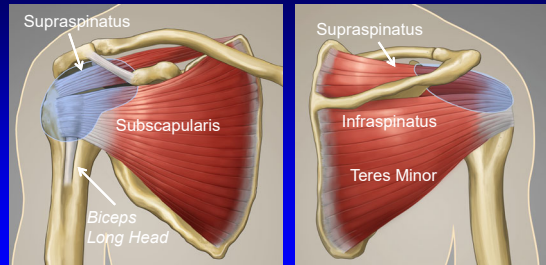
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Rotator Cuff

- General comments
- Supraspinatus pathology
- Secondary signs of rotator cuff tear
- Infraspinatus and subscapularis
- Calcific tendinitis

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Rotator Cuff

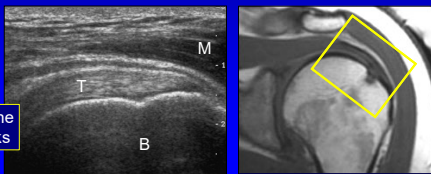


Note: Subacromial-subdeltoid Bursa (light blue)

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Ultrasound Appearance:

- Tendon: *hyperechoic*, fibrillar
- Muscle: relatively *hypoechoic*
- Bone cortex: *hyperechoic*, shadowing

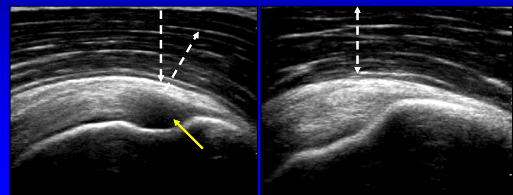


*Note: Bone Landmarks

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Anisotropic Effect

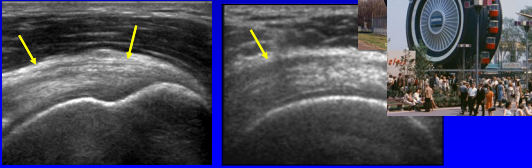
- Tendon is artifactually hypoechoic
- Sound beam is not perpendicular to fibers
- Tendon, ligament > muscle



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Supraspinatus Tendon: normal

- Hyperechoic and fibrillar echotexture
- Convex superior surface
- Uniform thickness: transverse



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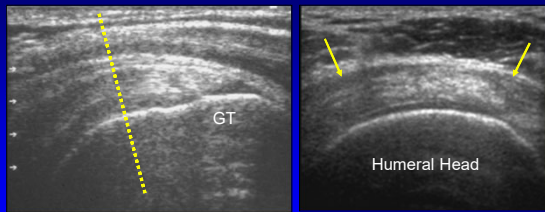
Technical Considerations

- > 10 Mhz (prefer at least 12 Mhz)
- Supraspinatus: long axis most important plane
 - Less pitfalls, easy recognition of anatomy
 - >90% accuracy long axis alone¹
- Biceps tendon (intra-articular)
 - Important landmark: complete evaluation

¹Arend CF et al. J Ultrasound Med 2010; 29:1725

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Supraspinatus Tendon: proximal

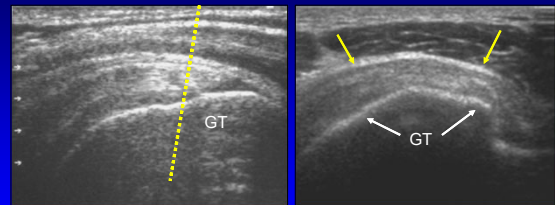


Long Axis

Short Axis
(Intra-articular)

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Supraspinatus Tendon: distal

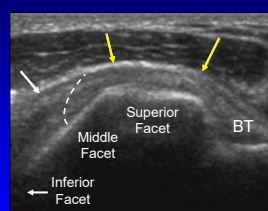
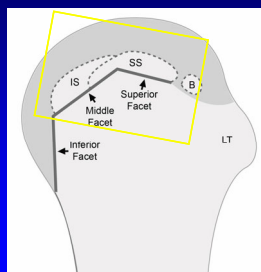


Long Axis

Short Axis
(Greater Tuberosity)

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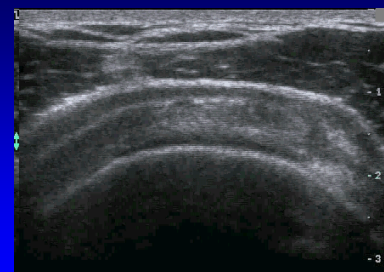
Supraspinatus and Infrapinatus Tendons



Short Axis
(Greater Tuberosity)

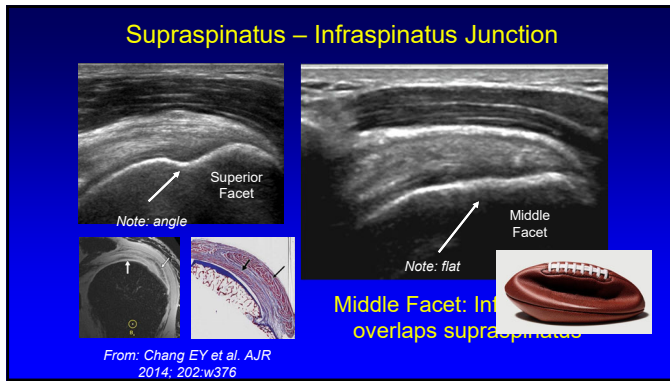
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Supraspinatus and Infrapinatus Tendons



Short Axis


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Rotator Cuff Tear:

- Meta-analysis: 65 articles
- Full-thickness tears:
 - MRA, MRI, US = in sensitivity (92 – 95%)
 - MRA more specific
- Partial-thickness tears:
 - MRA most sensitive (86%) and specific
 - MRI (64%), US (67%)



de Jesus, 2009; 192:1701

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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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Rotator Cuff Tears

- Supraspinatus: most common
- Patients < 40 years old
 - Not common
 - Partial, articular, anterior
 - Associated labral pathology
- Degenerative tears
 - Posterior aspect of supraspinatus
 - May extend anterior or posterior

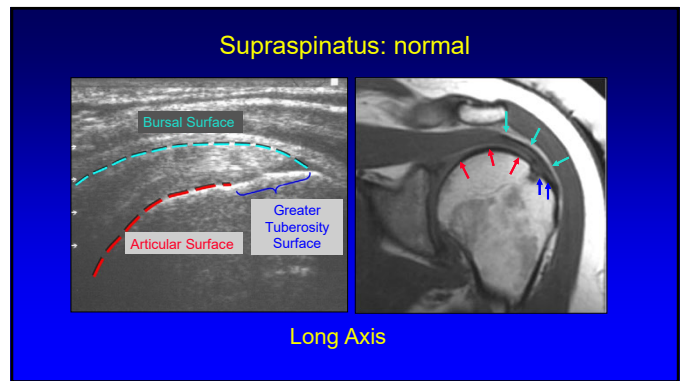
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Rotator Cuff Abnormalities:

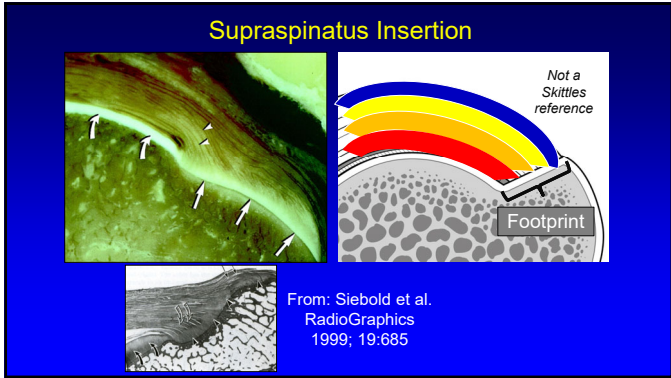
Categories:

- Partial-thickness tear
 - Articular-sided
 - Bursal-sided
 - Intrasubstance (or interstitial)
- Full-thickness tear
- Tendinosis

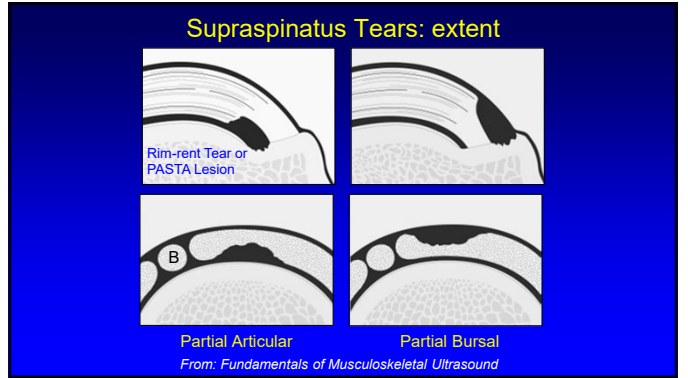
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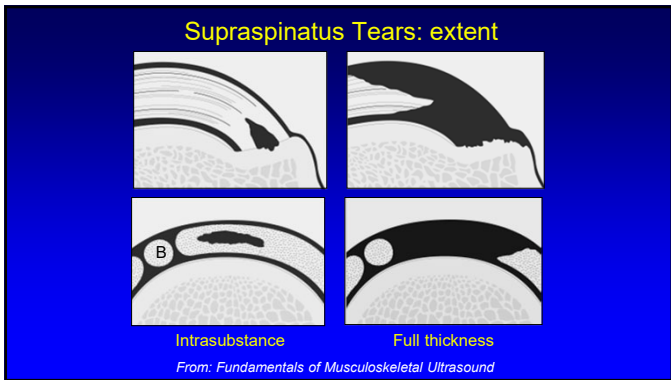
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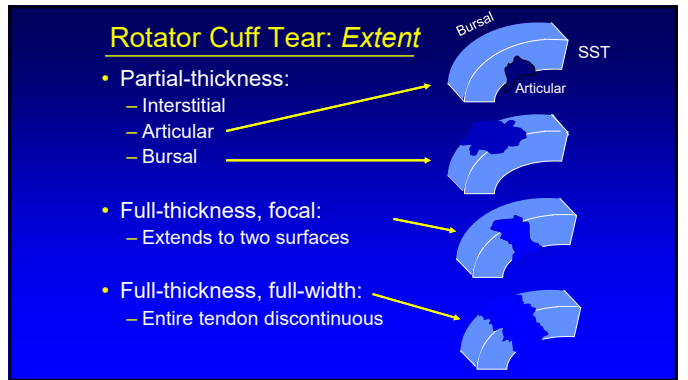
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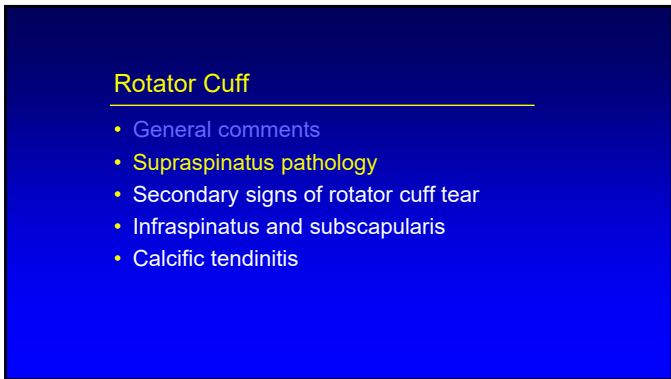
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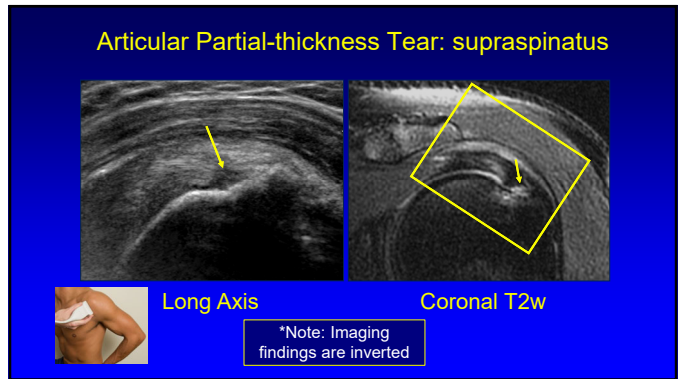
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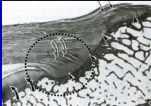
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Pitfall Alert!
Anisotropy

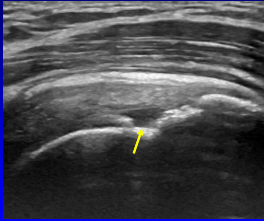
- Sound beam oblique to tendon fibers
- Artificially hypoechoic
- Most common location for this error: rim rent area



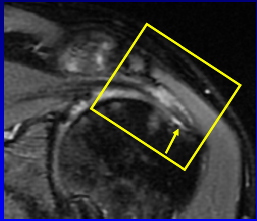

Supraspinatus: long axis

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Articular Partial-thickness Tear: supraspinatus



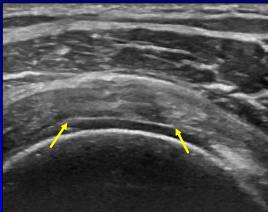
Long Axis



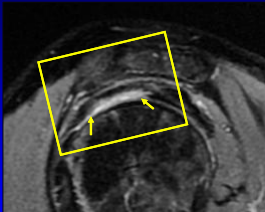
Coronal T2w

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Articular Partial-thickness Tear: supraspinatus




Long Axis



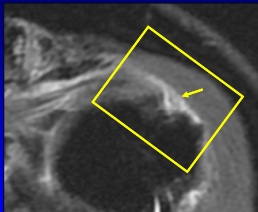
Sagittal T2w

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Bursal Partial-thickness Tear: supraspinatus



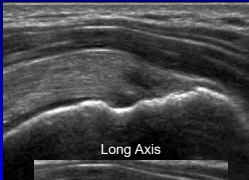
Long Axis



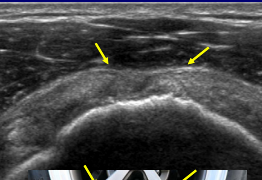

Coronal T2w

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Bursal Partial-thickness Tear: supraspinatus

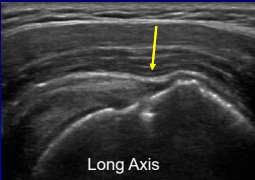


Long Axis

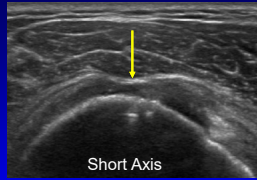



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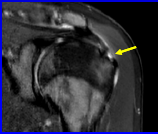
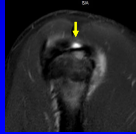
Bursal Partial-thickness Tear: supraspinatus



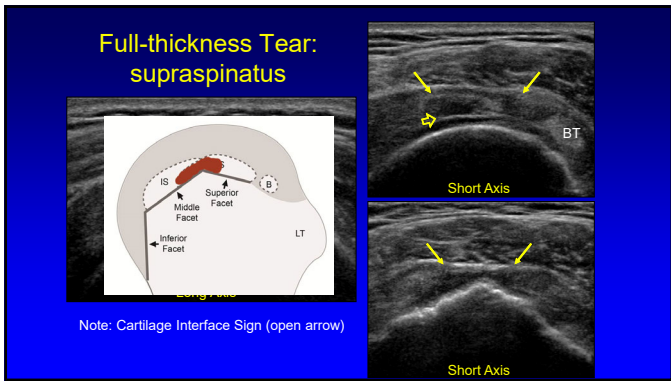
Long Axis



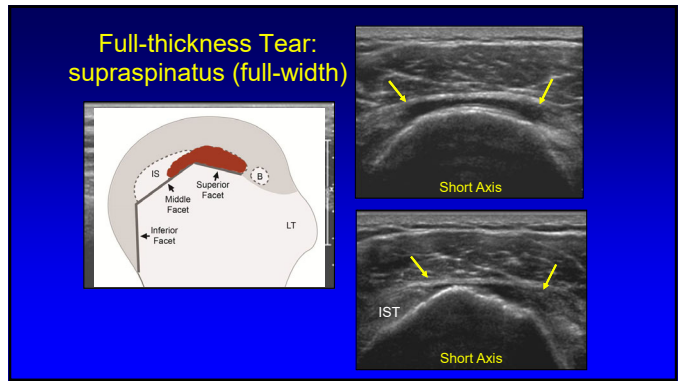
Short Axis

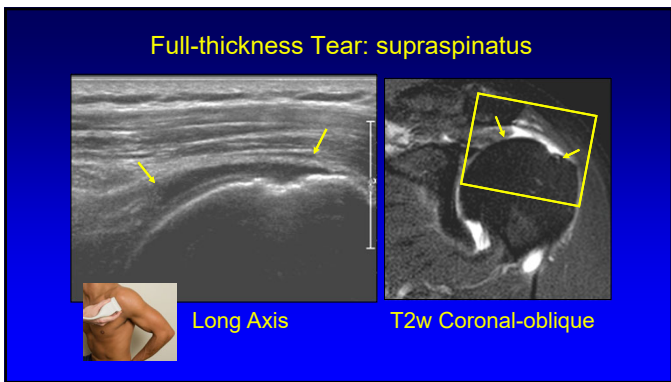
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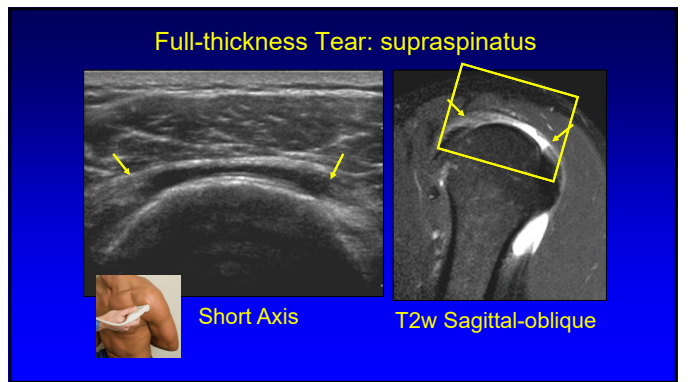
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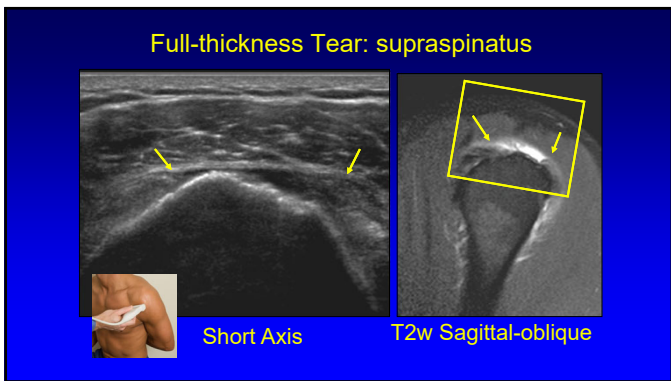
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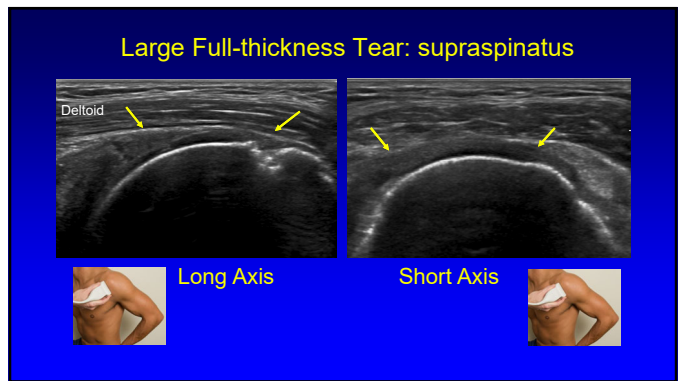
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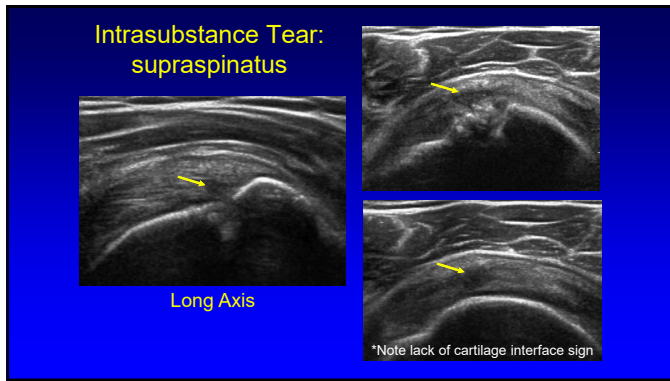
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Tendinosis

- No inflammatory cells
 - Mucoïd 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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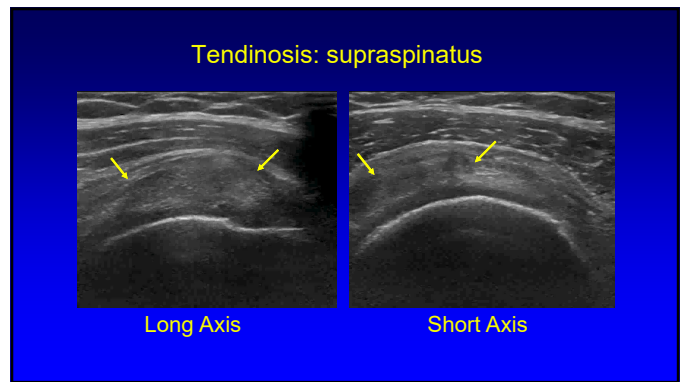
Tendon Tear versus Tendinosis

**both may appear hypoechoic*

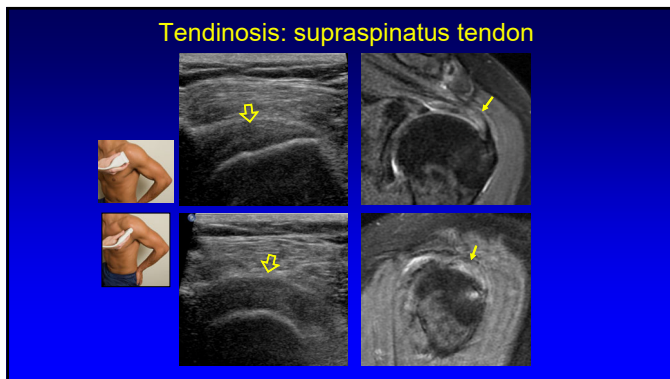
<u>Tear</u>	<u>Tendinosis</u>
• Anechoic	• Hypoechoic
• Well-defined	• Ill-defined
• Homogeneous	• Heterogeneous
• Thinned	• Swollen
• Bone irregularity*	• Smooth cortex

*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

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No Atrophy

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Rotator Cuff Tears

- General comments
- Supraspinatus pathology
- Secondary signs of rotator cuff tear
- Infraspinatus and subscapularis
- Calcific tendinitis

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Secondary Findings of Rotator Cuff Tears:

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

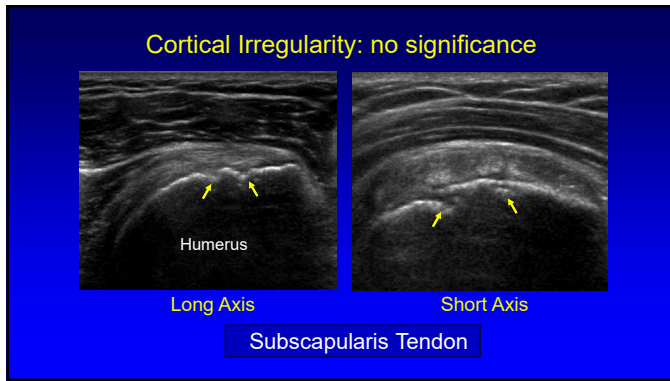
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Cortical Irregularity:

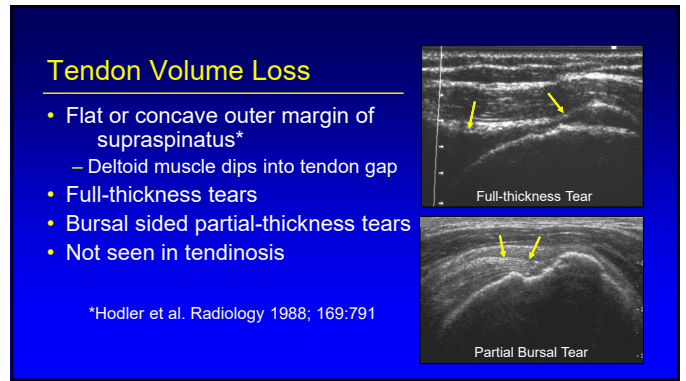
- Greater tuberosity: at supraspinatus insertion
- When present: 75% have rotator cuff tears
 - Patient over 40 years old
- When absent: 96% normal cuffs by sonography

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

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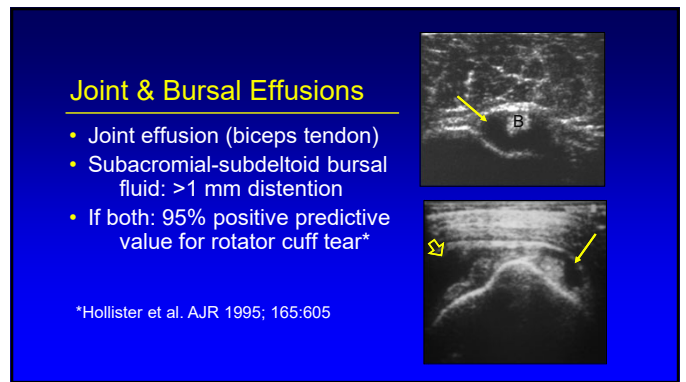
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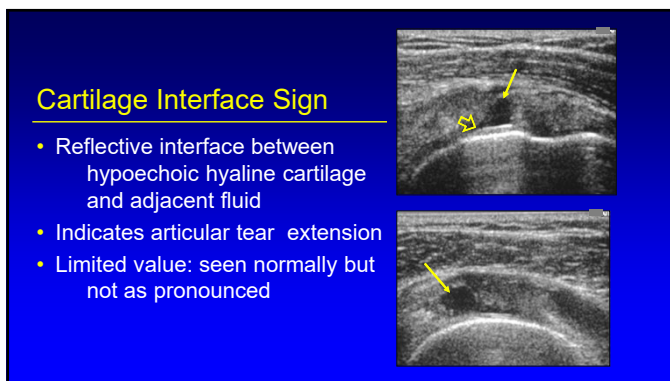
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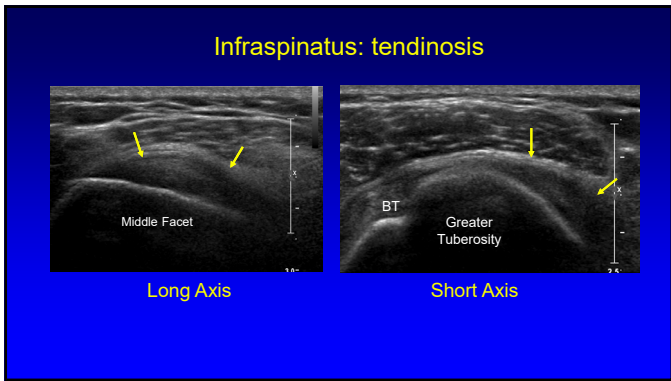
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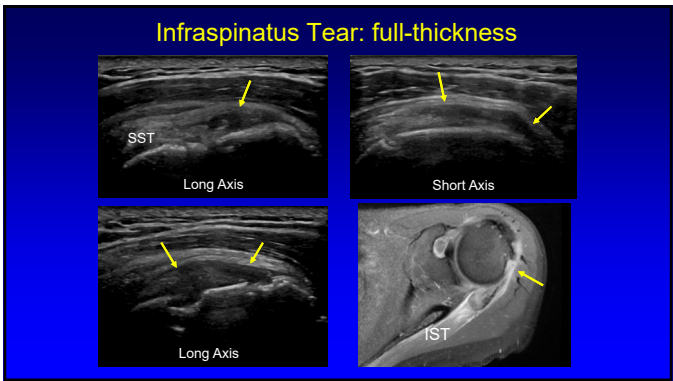
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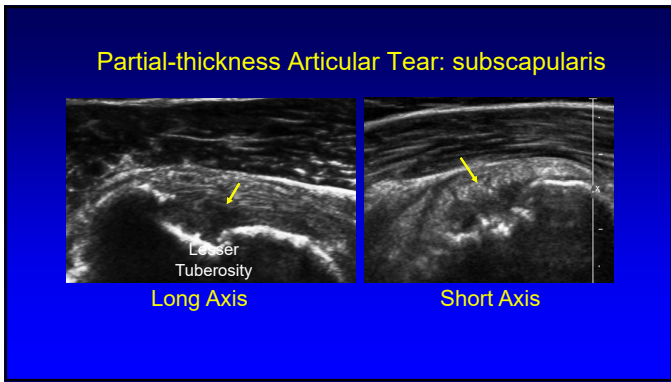
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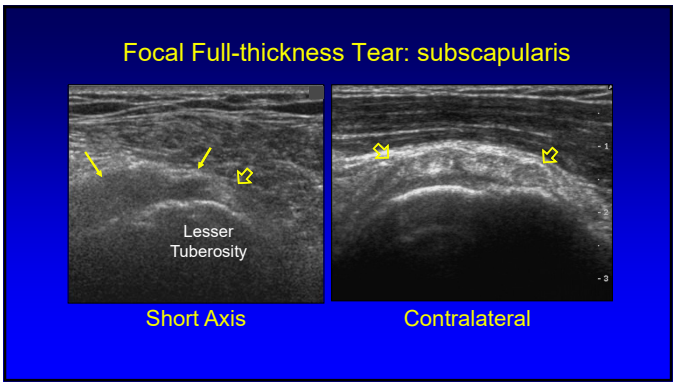
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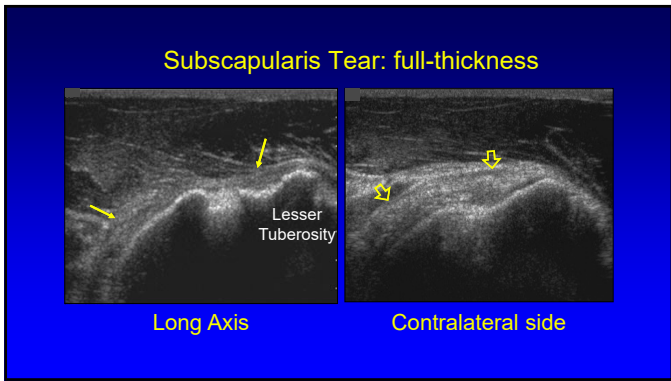
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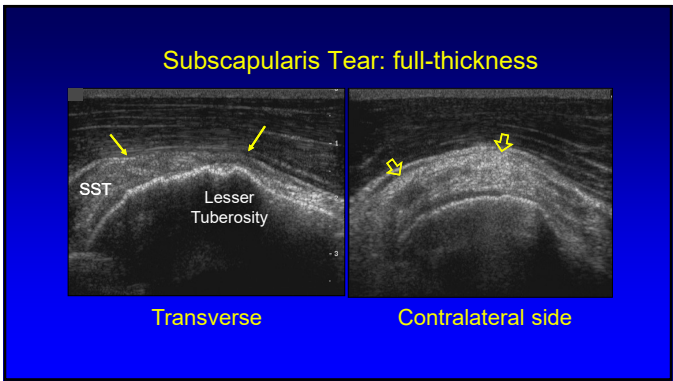
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Rotator Cuff Tears

- General comments
- Supraspinatus pathology
- Secondary signs of rotator cuff tear
- Infraspinatus and subscapularis
- **Calcific tendinitis**

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Tendon Calcification

- Degenerative:
 - Thin, linear
 - Background of tendinosis
- Calcific tendinitis / tendinitis:
 - Globular
 - Tendon metaplasia
 - Lavage and aspiration

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

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Degenerative Calcification

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Calcific Tendinitis

- Hydroxyapatite deposition: metaplasia
 - Usually do not have cuff tear
- Appearance:
 - 79% hyperechoic & shadowing
 - No shadow: 7%
- Two phases:
 - Formative
 - Resorptive: painful

Farin et al. Skeletal Radiol 1996; 25:551

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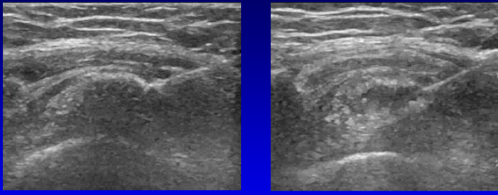
Calcific Tendinitis: resorptive phase

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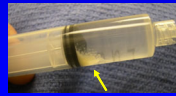
Subscapularis: calcific tendinitis

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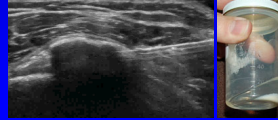
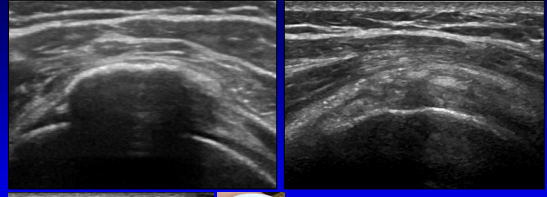
Calcific Tendinosis: lavage/aspiration



- Single puncture: 20 gauge needle
- Lavage: three 10ml syringes: lidocaine
- Shoulder: inject steroids in bursa
- Amorphous type: easier



Calcific Tendinosis



3 weeks after lavage
and aspiration

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Take-home Points

- Must follow a protocol
- Most cuff tears: supraspinatus
 - Use rotator interval as landmark
 - Understand greater tuberosity facets
- Cortical irregularity: important indirect sign
 - Supraspinatus tears
- Calcific tendinitis
 - Lavage and aspiration

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

Twitter handle: @jjacobsn

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