

Ultrasound of Common Shoulder Pathology

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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:
 - Supraspinatus tear and tendinosis
 - Secondary signs of cuff tear
 - Other rotator cuff pathology
- Biceps brachii tendon abnormalities
- Subacromial-subdeltoid bursa

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Rotator Cuff Ultrasound:

- Accuracies:
 - Full-thickness tear: 96%¹
 - Partial-thickness tear: 94%²
 - Equal to MRI: accuracy, size of tear³
- Patients prefer ultrasound over MRI⁴

¹Teefey, JBJS Am 2000; 82:498.

²van Holsbeeck, Radiology 1995; 197:443.

³Teefey, JBJS Am 2004; 86:708.

⁴Middleton, AJR 2004; 183:1449.

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Rotator Cuff Tears:

- 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 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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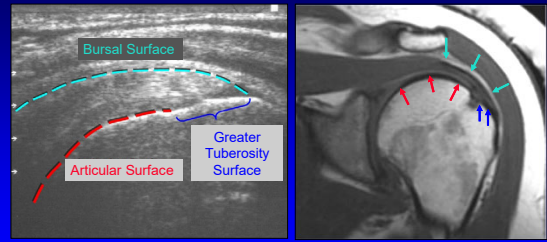
Rotator Cuff Abnormalities:

Categories:

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

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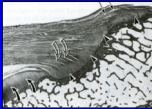
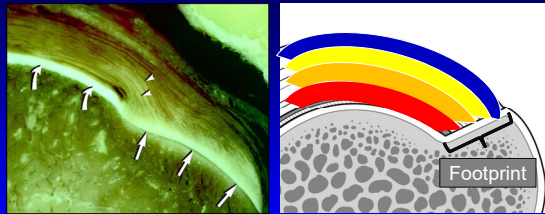
Supraspinatus: normal



Long Axis

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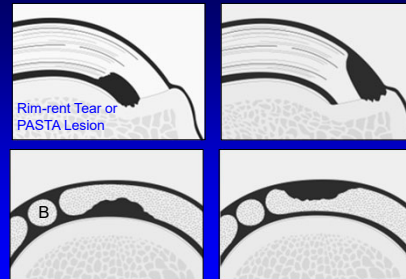
Supraspinatus Insertion



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

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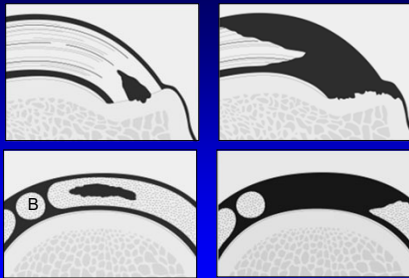
Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

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Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

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Partial-thickness Tear

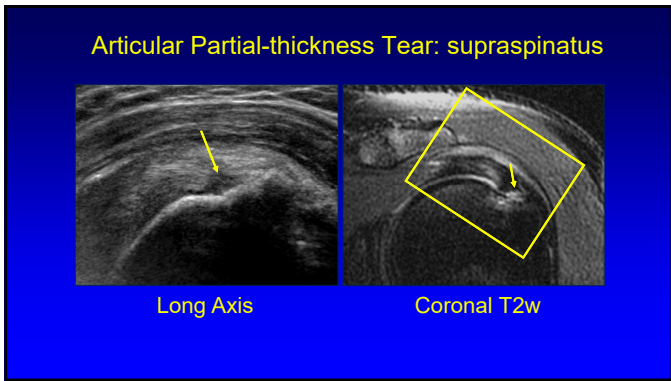
- Usually hypoechoic / anechoic
 - May see hyperechoic fiber stump*
- Articular, bursal, or intrasubstance
- Associated cortical irregularity
- Little if any tendon volume loss
 - Unless bursal location

van Holsbeeck et al. Radiology 1995; 197:443

Articular-side Partial Tear



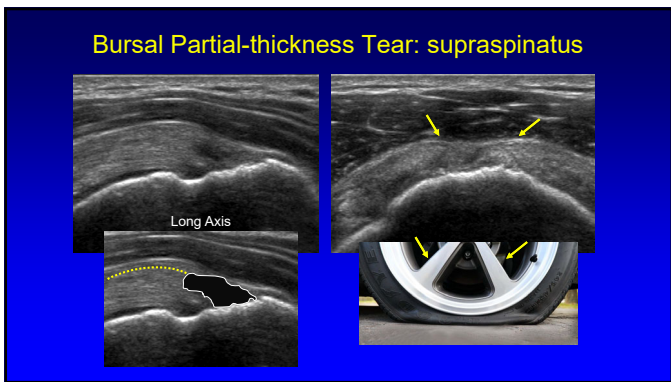
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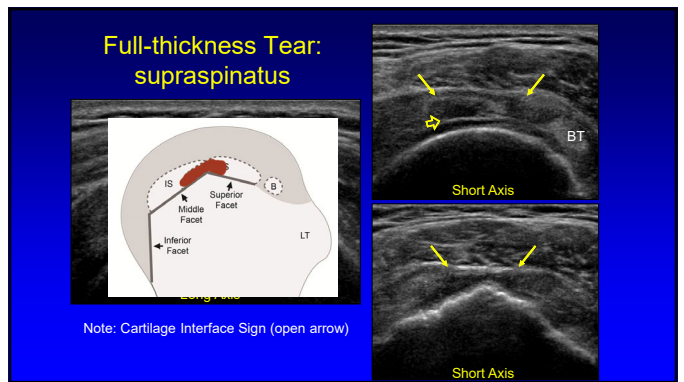
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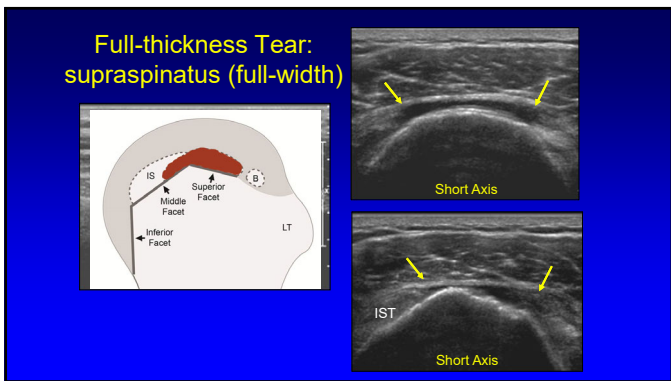
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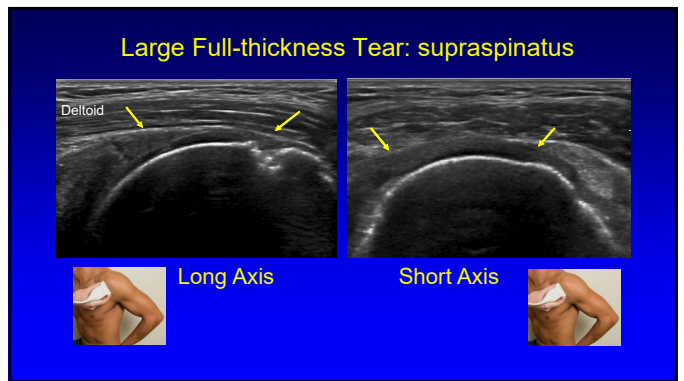
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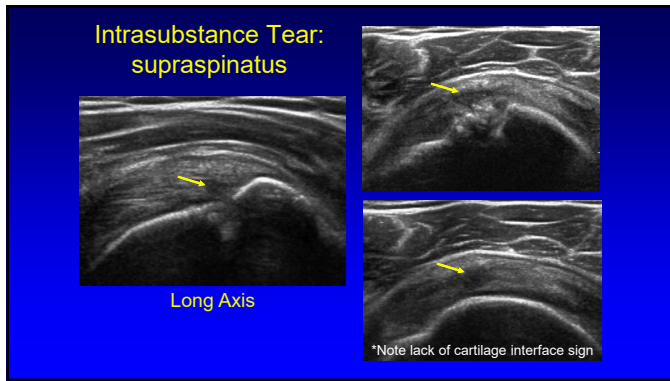
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Tendinosis

- 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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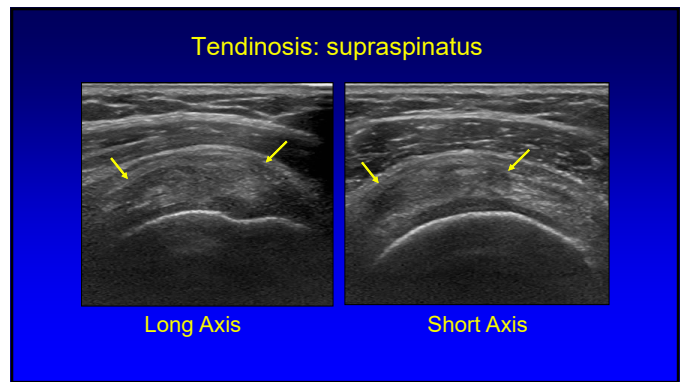
Tendon Tear versus Tendinosis

**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

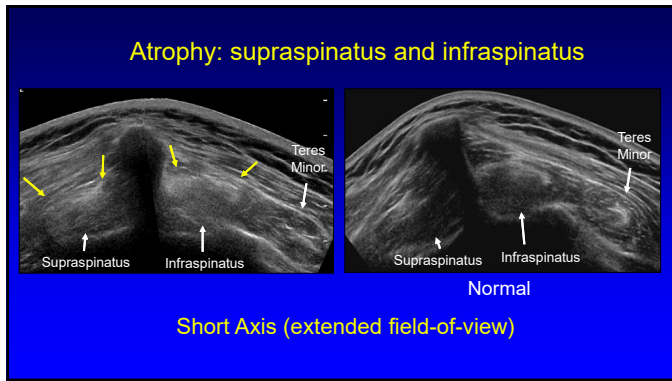
- Indistinct tendon-muscle border
- Increased muscle echogenicity
 - Compare to teres minor
- Decreased muscle bulk
 - Compared to teres minor
 - Bone landmark: ridge in scapula
 - Short axis: infraspinatus 2x size

Short Axis

Long Axis

Teres Minor

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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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Cortical Irregularity: no significance

Humerus

Long Axis Short Axis

Subscapularis Tendon

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Tendon Volume Loss

- Flat or concave outer margin of supraspinatus*
 - Deltoid muscle dips into tendon gap
- Full-thickness tears
- Bursal sided partial-thickness tears
- Not seen in tendinosis

*Hodler et al. Radiology 1988; 169:791

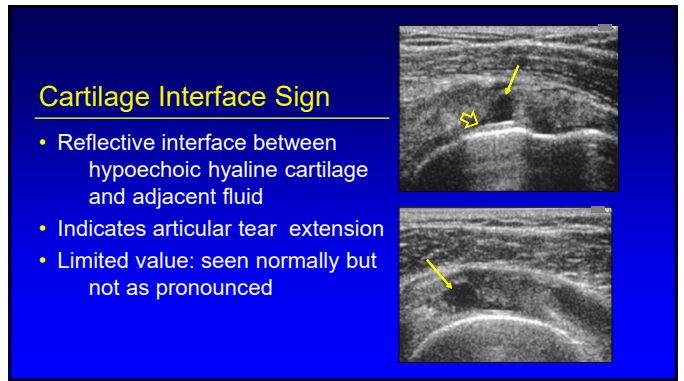
Full-thickness Tear

Partial Bursal Tear

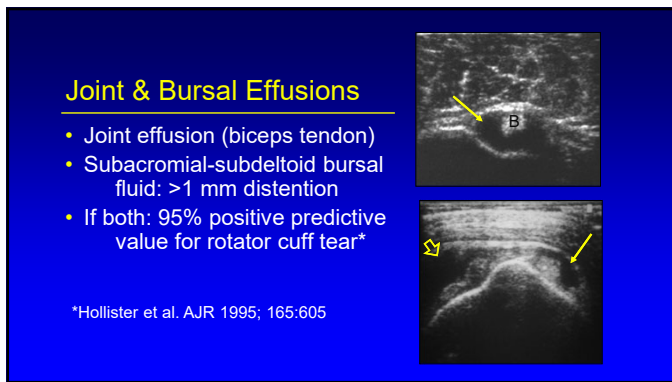
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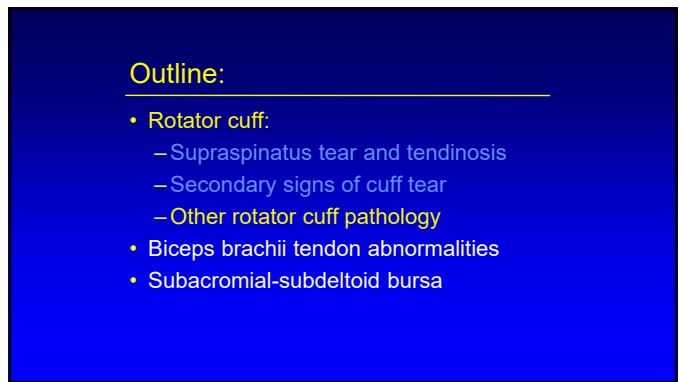
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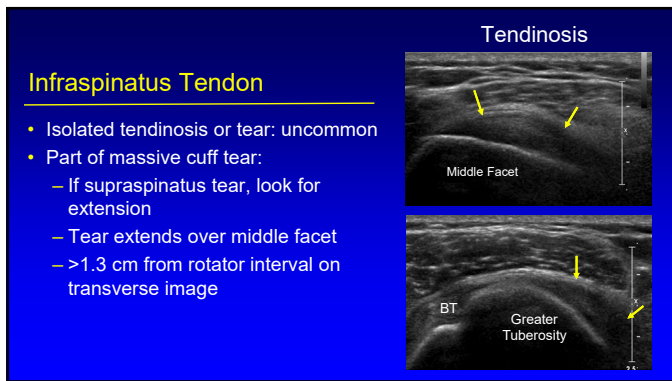
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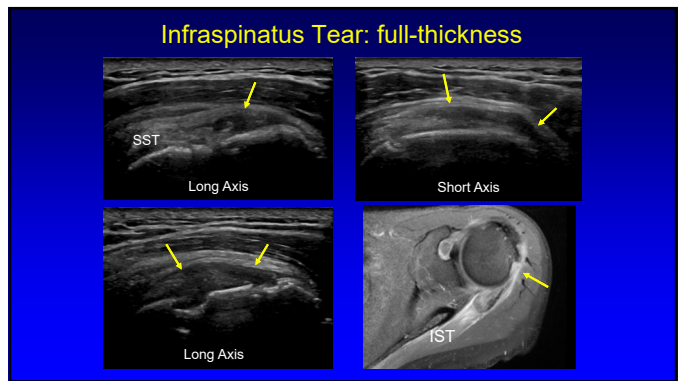
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Subscapularis Tear

- Isolated tear: rare, trauma
- Part of massive cuff tear
- Anterosuperior cuff tear:
 - Supraspinatus and subscapularis borders of the rotator interval

Pfirschmann et al. Radiology 1999; 213:709

Partial-thickness Articular

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Focal Full-thickness Tear: subscapularis

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Subscapularis Tear: full-thickness

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Subscapularis Tear: full-thickness

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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: usually large with nonvisualization
- Focal hypoechoogenicity: equivocal

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Post-operative cuff: recurrent tear

Note: echogenic sutures not in tendon

Open arrow = bioabsorbable suture anchor

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Arthroplasty: Intact Cuff

Arthroplasty

Arthroplasty

Long Axis

Short Axis

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Arthroplasty: Cuff Tear

Arthroplasty

Arthroplasty

Long Axis

GT

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Tendon Calcification:

- Degenerative: thin, linear deposit
- Calcific tendinosis:
 - Formative: well-defined, dense shadow
 - Resorptive:
 - Globular, amorphous
 - Variable shadow
 - Best success with aspiration

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

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Degenerative Calcification

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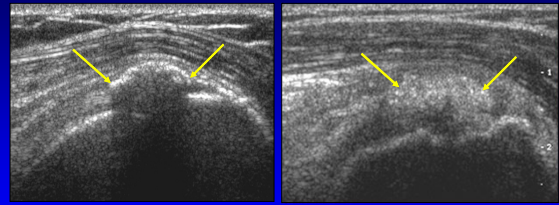
Calcific Tendinosis

- 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 Tendinosis



Formative
Defined, shadow

Resorptive
Amorphous, little shadow

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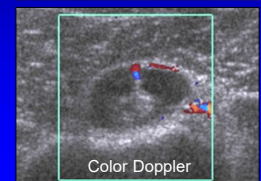
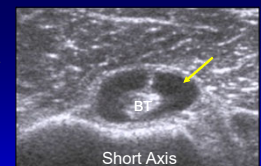
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- **Biceps brachii tendon abnormalities**
- Subacromial-subdeltoid bursa

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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

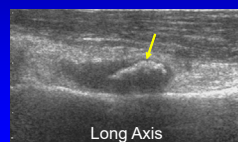


¹Zubler et al. Eur Radiol 2011; 21:1858

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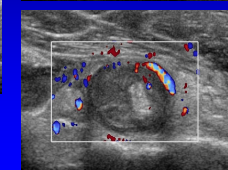
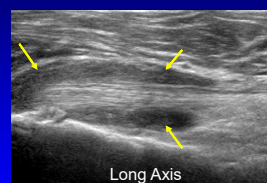
Biceps Tendon Sheath

- Intra-articular body
 - Echogenic
 - Possible shadowing
 - Single or multiple
 - Associated with glenohumeral joint osteoarthritis



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Biceps Tendon: tenosynovitis



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Biceps Tendon

- Tendinosis:
 - Hypoechoic
 - Swollen
 - No inflammatory cells (not tendinitis)
 - Possible tenosynovitis

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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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Biceps Tendon: full-thickness tear

Short Axis Long Axis Short Axis: distal

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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

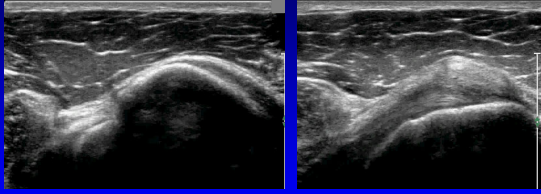
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Biceps Tendon

Subluxation Dislocation

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Biceps Tendon Subluxation



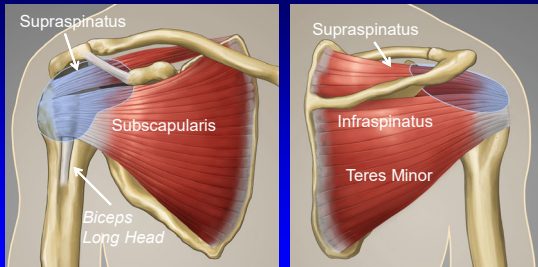
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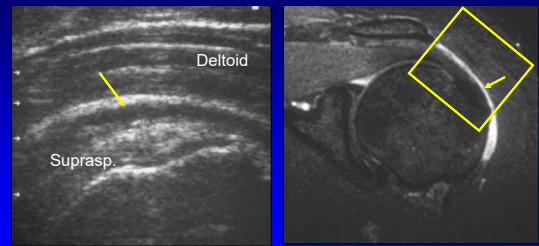
Subacromial-subdeltoid Bursa



Note: Subacromial-subdeltoid Bursa (light blue)

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Subacromial-subdeltoid Bursa: fluid

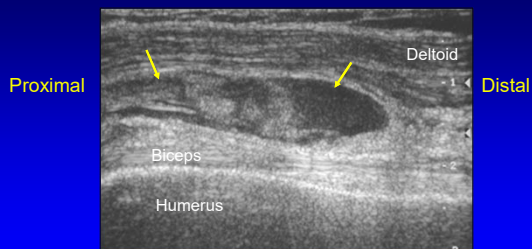


Coronal

Coronal T2w

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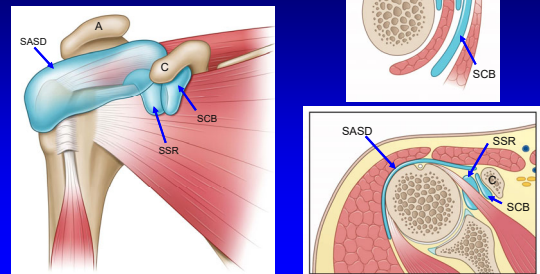
Subacromial-subdeltoid bursa: anterior



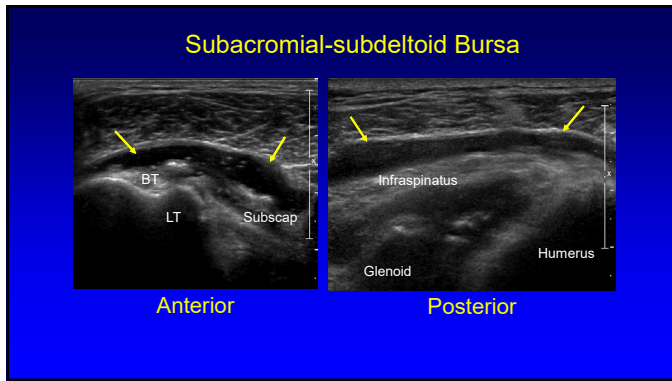
Sagittal

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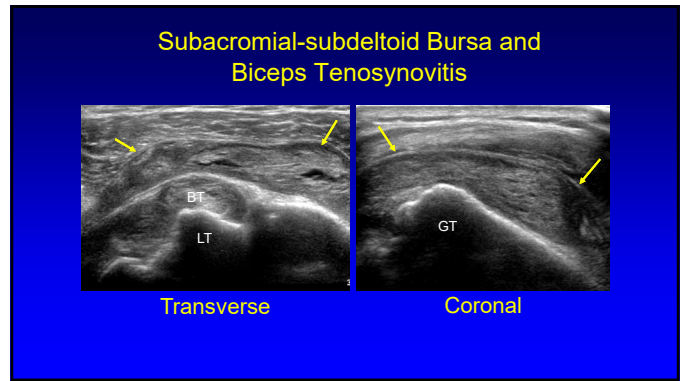
Subacromial-subdeltoid bursa (SASD) vs. subscapularis recess (SSR) vs. subcoracoid bursa (SCB)



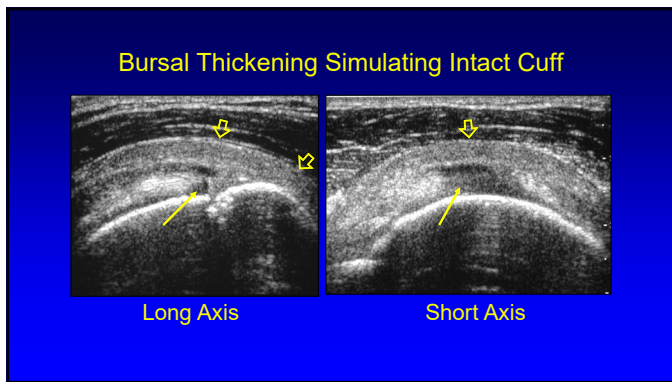
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Impingement Syndrome

- Cuff impingement
- Subacromial enthesophyte or acromioclavicular joint osteophyte
- Associated tendon degeneration and tear

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Impingement: bursal fluid

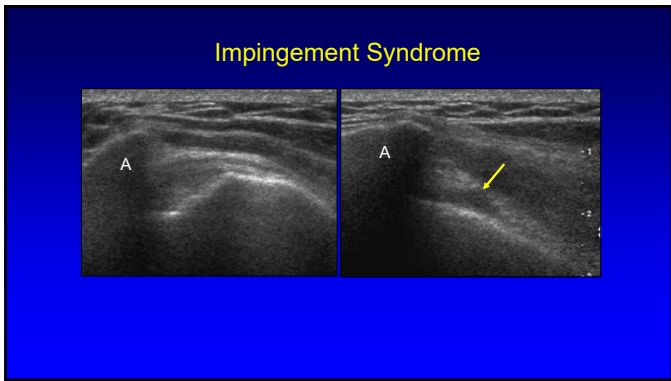
- Abnormal pooling of subacromial-subdeltoid bursal fluid
- Lateral acromion¹:
 - Coronal plane, active arm elevation
 - Not visible in neutral position, no cuff tear
- Thickened tendon or bursa
 - Possible snapping of thickened bursa
 - “Gathering” of bursa: may be asymptomatic²

¹Farin et al. Radiology 1990; 176:845
²Daghir A et al. Skeletal Radiol 2012; 41:1047

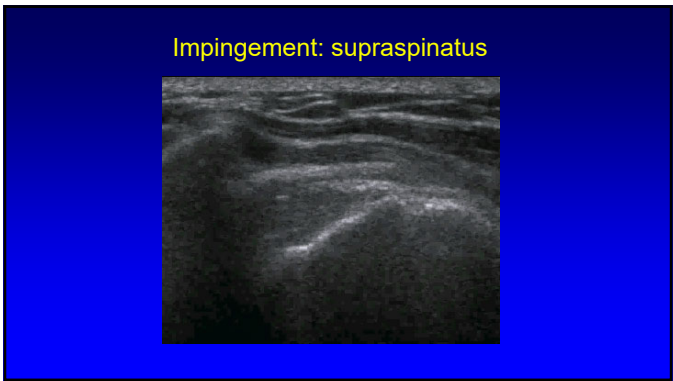
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Impingement Test

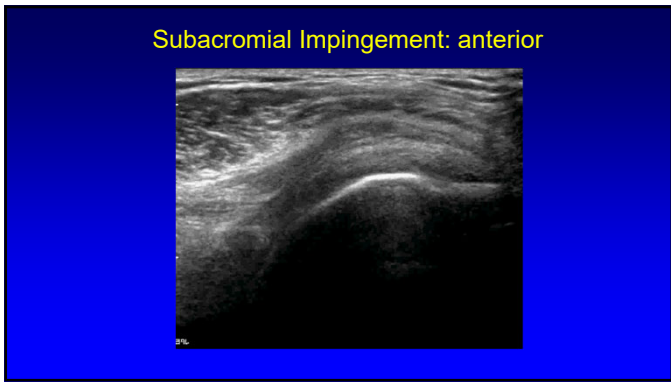
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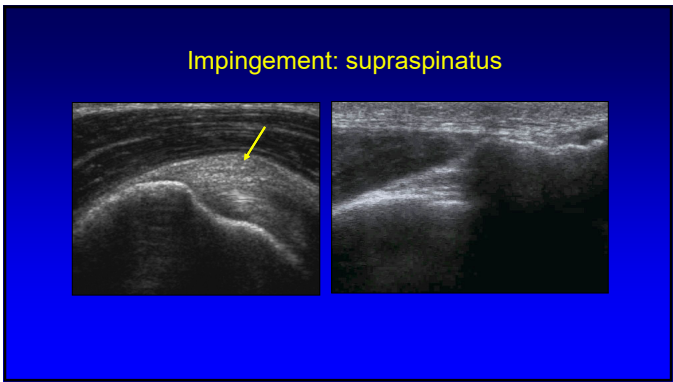
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Take-home Points

- Rotator cuff tears: follow an scanning protocol
- Indirect signs of tendon tear:
 - Cortical irregularity at supraspinatus footprint
 - Volume loss or thinning
 - Cartilage interface sign
- Biceps:
 - Do not overcall tenosynovitis
- Subacromial-subdeltoid bursa
 - Varies from anechoic to hyperechoic

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Thank you!





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



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