

# Ultrasound of Common Shoulder Pathology

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## Disclosures

- Consultant: Bioclinica
- Contractor: POCUS PRO
- Advisory Board: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

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Fundamentals of Musculoskeletal Ultrasound  
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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%<sup>1</sup>
  - Partial-thickness tear: 94%<sup>2</sup>
  - Equal to MRI: accuracy, size of tear<sup>3</sup>
- Patients prefer ultrasound over MRI<sup>4</sup>

<sup>1</sup>Teefey, JBJS Am 2000; 82:498.

<sup>2</sup>van Holsbeeck, Radiology 1995; 197:443.

<sup>3</sup>Teefey, JBJS Am 2004; 86:708.

<sup>4</sup>Middleton, 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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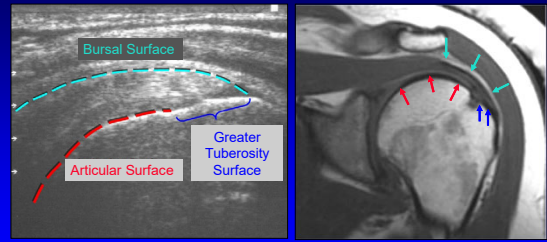
## Rotator Cuff Abnormalities:

### Categories:

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

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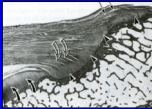
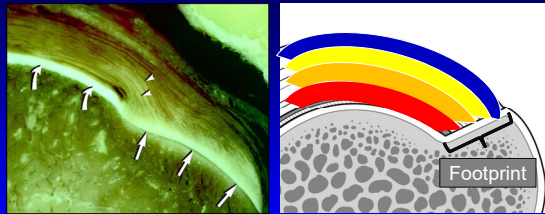
## Supraspinatus: normal



Long Axis

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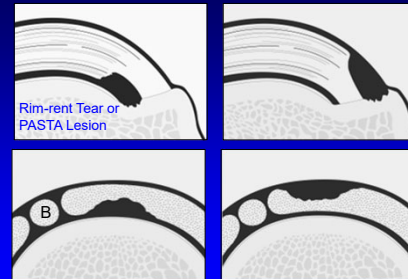
## Supraspinatus Insertion



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

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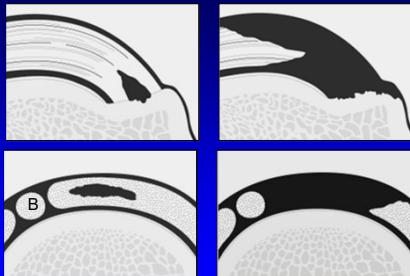
## Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

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## Supraspinatus Tears: extent



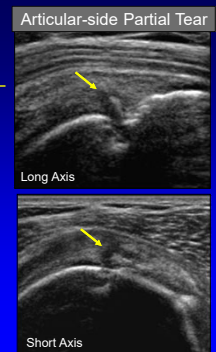
From: Fundamentals of Musculoskeletal Ultrasound

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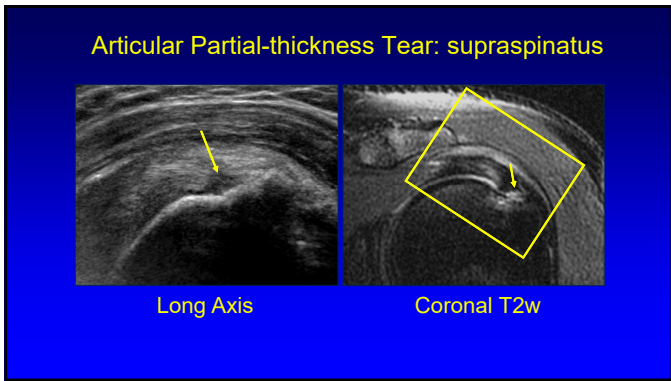
## Partial-thickness Tear

- 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



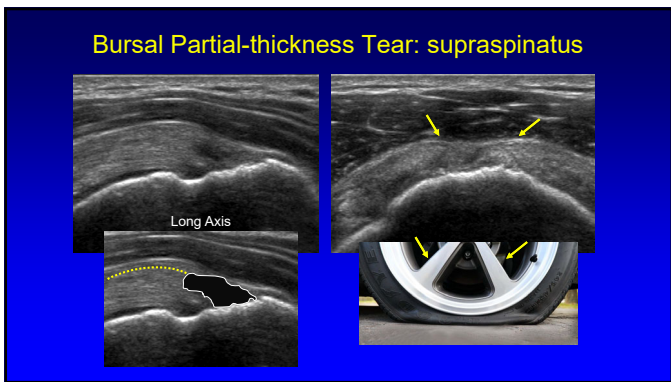
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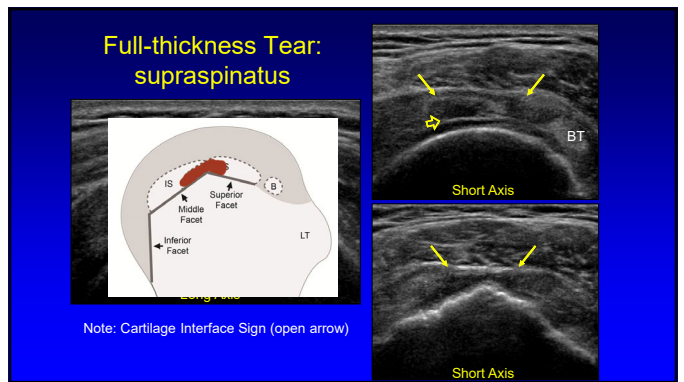
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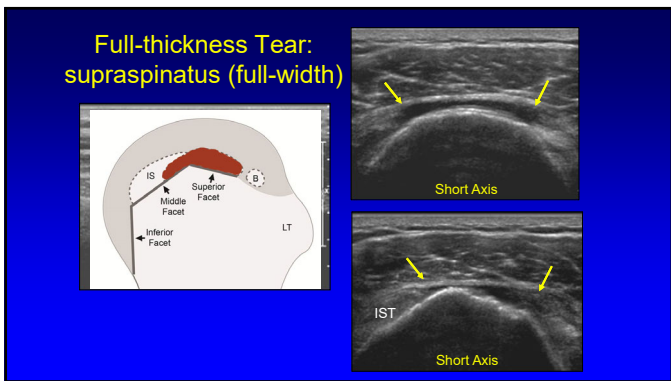
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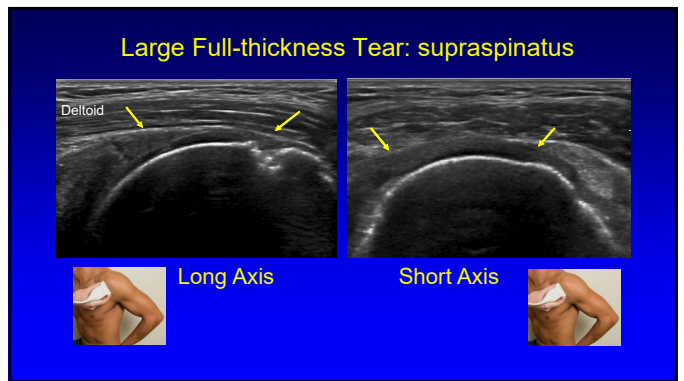
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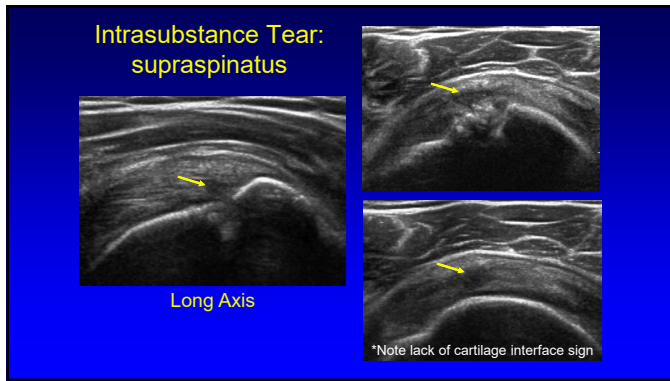
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### Tendinosis

- 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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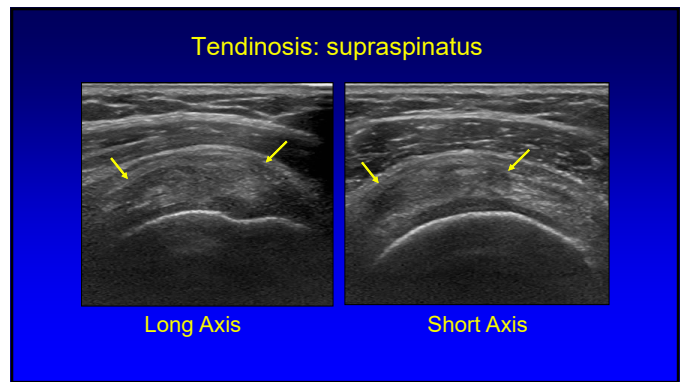
### Tendon Tear versus Tendinosis

*\*both may appear hypoechoic*

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

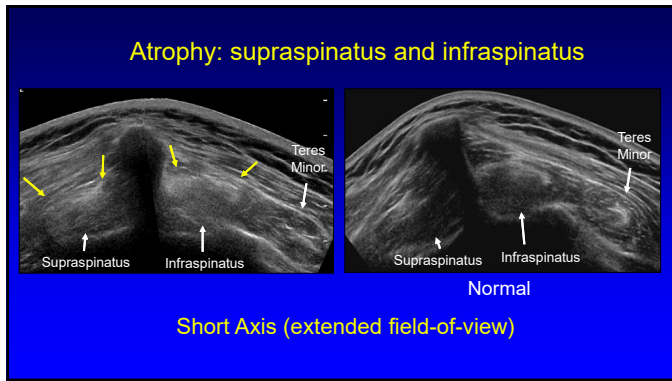
- Indistinct tendon-muscle border
- Increased muscle echogenicity
  - Compare to teres minor
- Decreased muscle bulk
  - Compared to teres minor
  - Bone landmark: ridge in scapula
  - Short axis: infraspinatus 2x size

Short Axis

Long Axis

Teres Minor

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### Outline:

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

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### Secondary Findings of Rotator Cuff Tears:

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

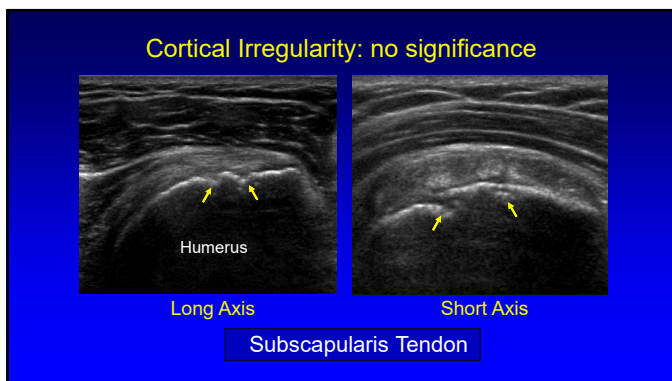
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### Cortical Irregularity:

- 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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### 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

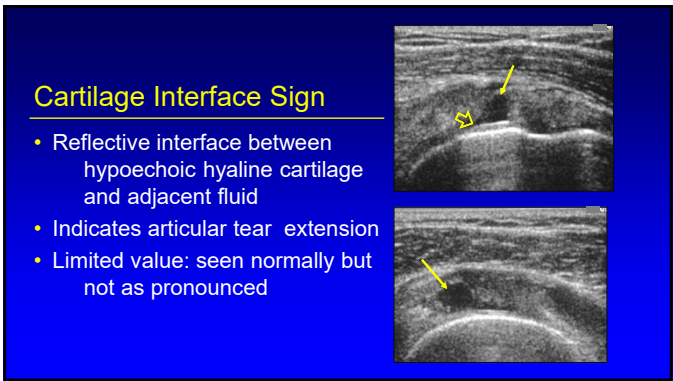
Full-thickness Tear

Partial Bursal Tear

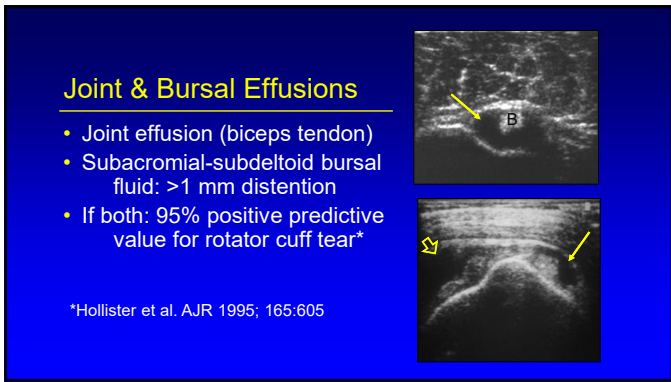
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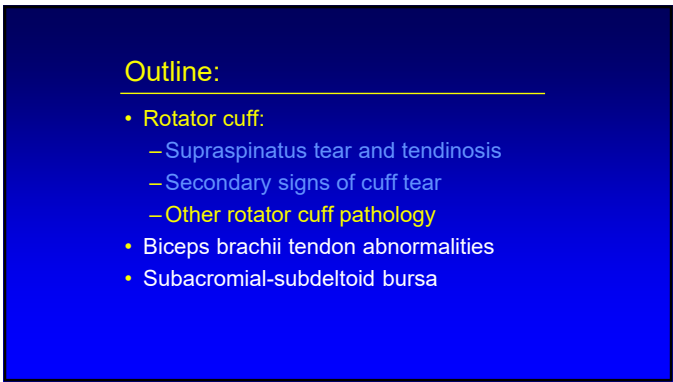
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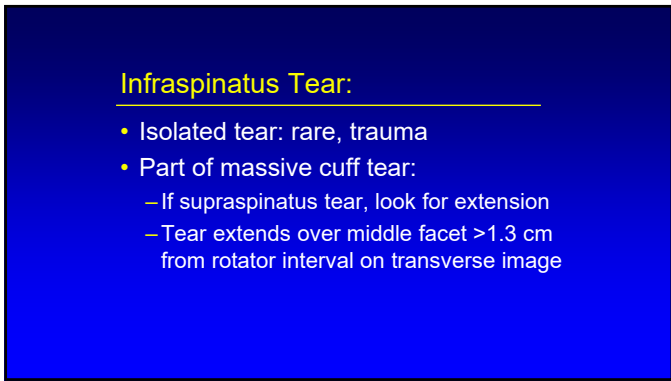
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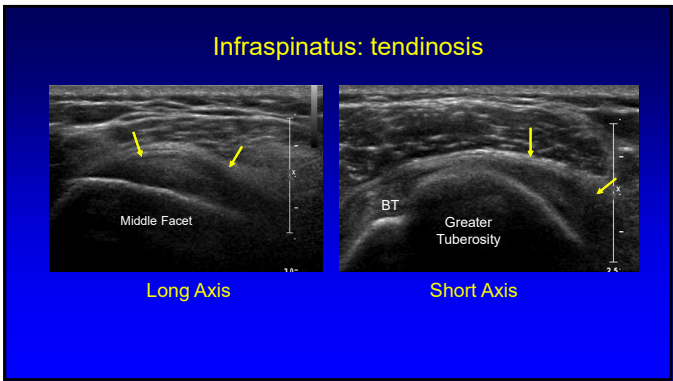
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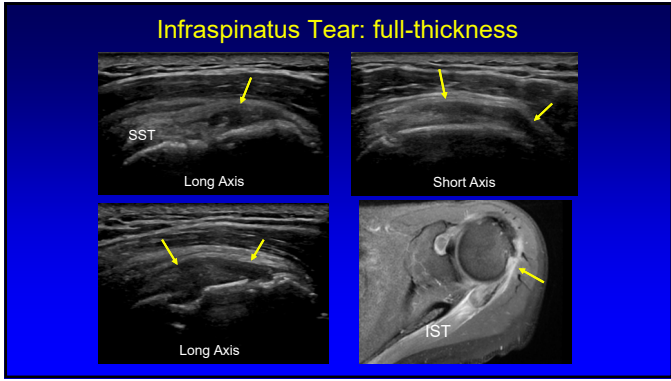
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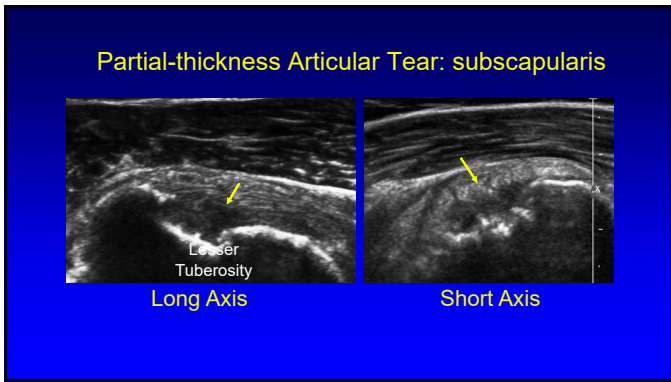
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### Subscapularis Tear:

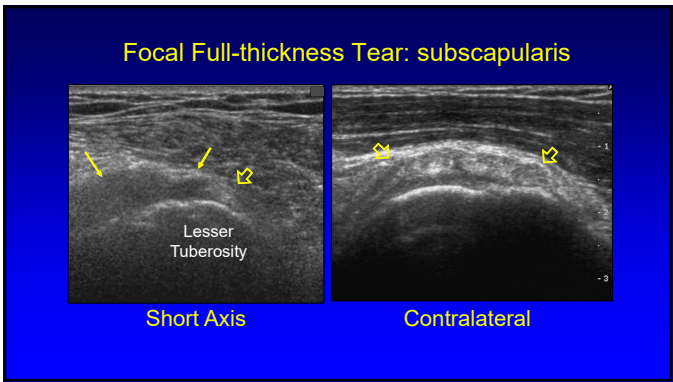
- Isolated tear: rare, trauma
- Part of massive cuff tear
- Anterosuperior cuff tear:
  - Supraspinatus and subscapularis borders of the rotator interval

Pfirrmann et al. Radiology 1999; 213:709

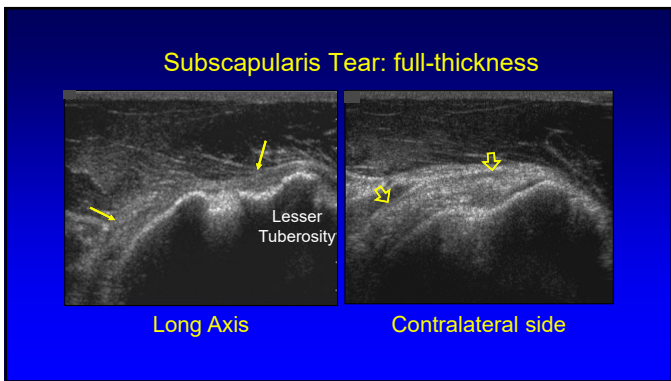
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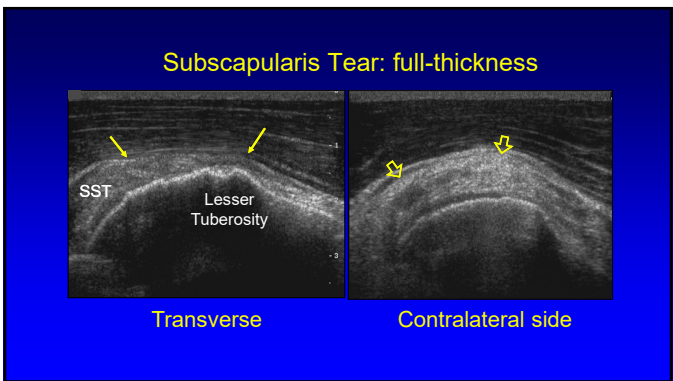
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### Repaired Cuff: ultrasound

- 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

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### Arthroplasty: Cuff Tear

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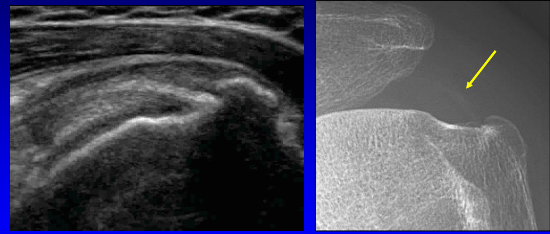
### Tendon Calcification:

- 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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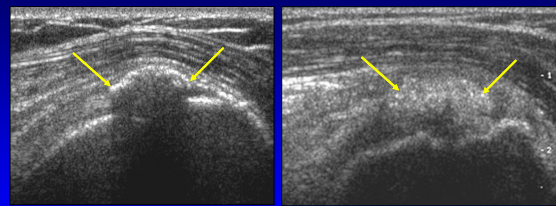
### Calcific Tendinosis

- 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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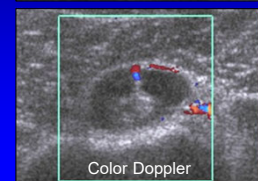
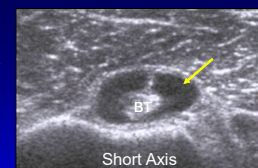
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### Biceps Tendon:

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



<sup>1</sup>Zubler 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

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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**

Subluxation      Dislocation

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**Biceps Tendon Subluxation**

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**Outline:**

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- **Subacromial-subdeltoid bursa**

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**Subacromial-subdeltoid Bursa**

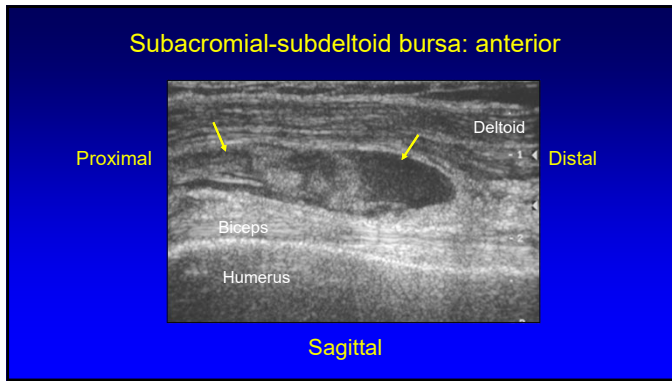
Note: Subacromial-subdeltoid Bursa (light blue)

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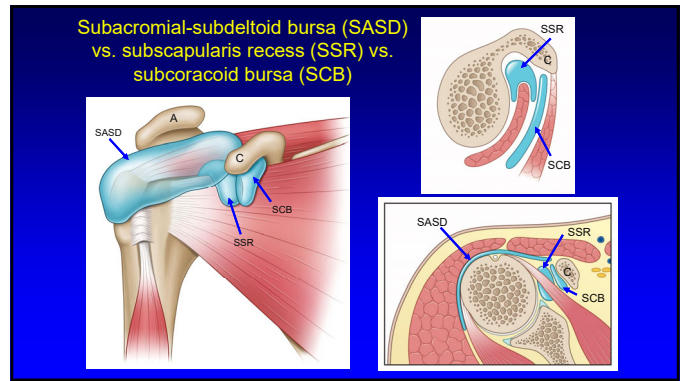
**Subacromial-subdeltoid Bursa: fluid**

Coronal      Coronal T2w

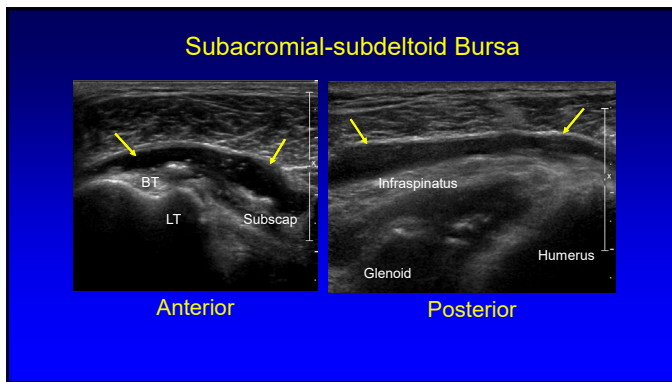
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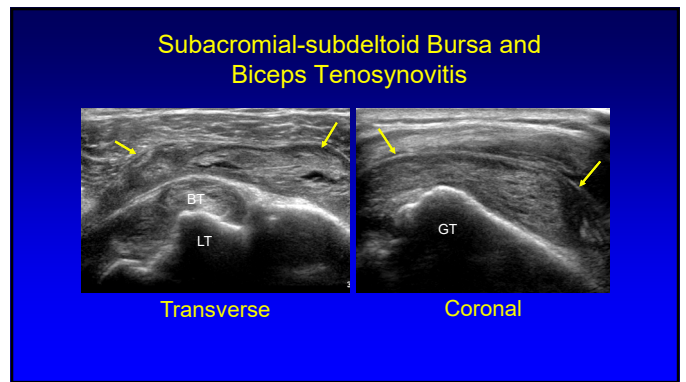
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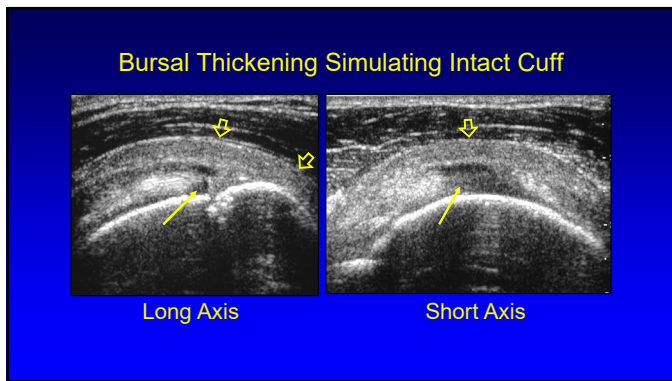
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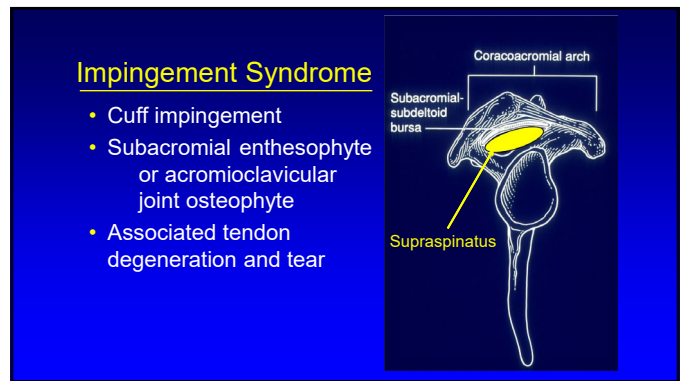
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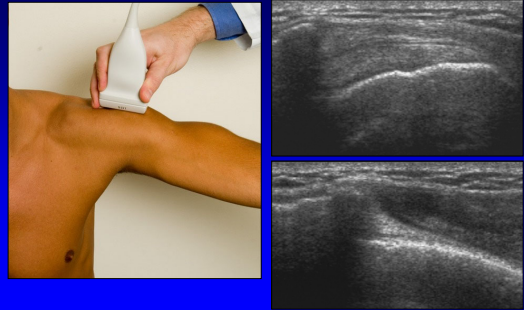
### Impingement: bursal fluid

- Abnormal pooling of subacromial-subdeltoid bursal fluid
- Lateral acromion<sup>1</sup>:
  - 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 asymptomatic<sup>2</sup>

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

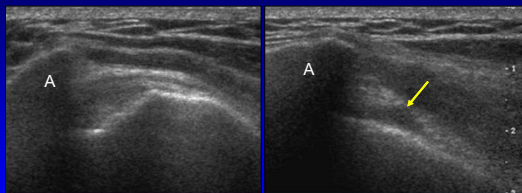
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### Impingement Test



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### Impingement Syndrome



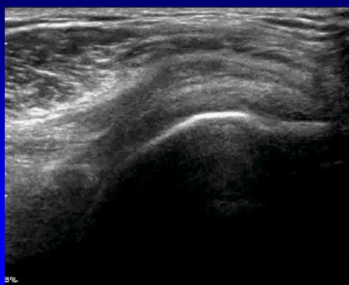
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### Impingement: supraspinatus



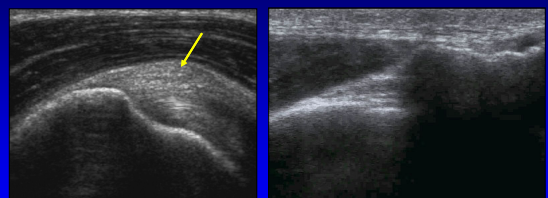
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### Subacromial Impingement: anterior



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### Impingement: supraspinatus



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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!

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[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

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