Ultrasound of Common Shoulder Pathology

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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

Rotator Cuff Abnormalities:

Categories:

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

Disclosures

- Consultant: Bioclinica
- Advisory Board: Philips
- Book Royalties: Elsevier
- Not relevant to this talk

Note: all images from the textbook
Fundamentals of Musculoskeletal Ultrasound are copyrighted by Elsevier Inc.

Outline:

- Rotator cuff:
  - Cuff tear and tendinosis
  - Secondary signs of cuff tear
  - Calcific tendinosis
- Biceps brachii tendon abnormalities
- Subacromial-subdeltoid bursa

Supraspinatus: normal

Long Axis
**Supraspinatus Insertion**

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

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**Articular Partial-thickness Tear: supraspinatus**

Long Axis  
Short Axis

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**Supraspinatus Tears: extent**

- Rim-rent Tear or PASTA lesion
- Partial Articular
- Partial Bursal

From: Fundamentals of Musculoskeletal Ultrasound

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**Pitfall Alert! Anisotropy**

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

**Supraspinatus: long axis**

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**Supraspinatus Tears: extent**

- Intrasubstance
- Full thickness

From: Fundamentals of Musculoskeletal Ultrasound

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**Bursal Partial-thickness Tear: supraspinatus**

Long Axis  
Coronal T2w
**Bursal Partial-thickness Tear: supraspinatus**

**Long Axis**

**Short Axis**

**Full-thickness Tear: supraspinatus**

**Long Axis**

**Short Axis**

Note: Cartilage Interface Sign (open arrow)

**Intrasubstance Tear: supraspinatus**

**Long Axis**

*Note lack of cartilage interface sign*

**Full-thickness Tear: supraspinatus**

**Long Axis**

**Short Axis**

**Tendinosis**

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

Radiology 2004; 230:234*
**Tendon Tear versus Tendinosis**

*both may appear hypoechoic*

<table>
<thead>
<tr>
<th>Tear</th>
<th>Tendinosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anechoic</td>
<td>Hypoechoic</td>
</tr>
<tr>
<td>Well-defined</td>
<td>Ill-defined</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Heterogeneous</td>
</tr>
<tr>
<td>Thinned</td>
<td>Swollen</td>
</tr>
<tr>
<td>Bone irregularity*</td>
<td>Smooth cortex</td>
</tr>
</tbody>
</table>

*Hodler et al. Radiology 1988; 169:791

**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

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**Secondary Findings of Rotator Cuff Tears:**

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

**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
Cortical Irregularity: no significance

Cartilage Interface Sign:
- Reflective interface between hypoechoic hyaline cartilage and adjacent fluid
- Indicates articular extension of tear
- Limited value

Joint & Bursal Effusions:
- Joint effusion (biceps tendon)
- Subacromial-subdeltoid bursal fluid: >1 mm distention
- If both: 95% positive predictive value for rotator cuff tear*  
  *Hollister et al. AJR 1995; 165:605

Small Full-thickness Tear: supraspinatus

Fatty Infiltration and Muscle Atrophy
- Supraspinatus and infraspinatus
  - Infraspinatus: only variable to predict cuff healing
- Associations:
  - Chronic, large, anterior supraspinatus tears
- Ultrasound:
  - Moderate to good correlation with MRI
  - Improved reliability with extended field-of-view

3 Khoury et al. AJR 2008; 190:1105.
4 Nazarian et al. 2008; 190:27.
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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Tendon Calcification:

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

Degenerative Calcification

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

Calcific Tendinosis

Biceps Tendon:
- Glenohumeral joint effusion:
  - Collects around biceps tendon
  - Tendon sheath communication
  - Seen in 97% with joint effusion
  - Abnormal: > 1 mm²

Calcific Tendinosis

Biceps Tendon Sheath
- Intra-articular body
  - Echogenic
  - Possible shadowing
  - Single or multiple
  - Associated with glenohumeral joint osteoarthritis
Biceps Tendon:
- Tendinosis:
  - Hypoechoic
  - Swollen
  - No inflammatory cells (not tendinitis)
  - Possible tenosynovitis

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

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

Moser et al. Skeletal Rad 2015; 44:223

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

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

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

Moser et al. Skeletal Rad 2015; 44:223

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Biceps Tendon Subluxation

Sublaxation

Dislocation

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Bursal Thickening Simulating Intact Cuff

Long Axis
Short Axis

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
- At coracoid¹:
  - Axial plane, active elevation internal rotation

¹Farin et al. Radiology 1990; 176:845
²Stallenberg et al. AJR 2006; 187:894

Impingement: supraspinatus

Impingement Test

Take-home Points
- Must follow a protocol
- Cuff tears: avoid anisotropy
- Cortical irregularity: important indirect sign
  - Supraspinatus tears
- Dynamic: impingement
- Joint effusion: biceps

See www.jacobsonmskus.com for this syllabus other educational material