Shoulder Ultrasound:
Beyond the Rotator Cuff

Jon A. Jacobson, M.D.
Professor of Radiology
Director, Division of Musculoskeletal Radiology
University of Michigan

Miscellaneous Pathology:
- Biceps brachii tendon
- Subacromial-subdeltoid bursa
- Acromioclavicular joint
- Labrum
- Greater tuberosity
- Pectoralis major

Biceps Brachii: pathology
- Tendinosis
- Tear: partial and full-thickness
- Subluxation and dislocation
- Association with:
  - SLAP and anterior rotator cuff tears
- Causes: acute injury, repetitive injury, degeneration

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

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

Shoulder Joint Recesses
- Long head biceps tendon sheath
- Posterior recess:
  - Image with shoulder in external rotation
- Axillary recess
- Subscapularis recess

1 Zubler et al. Eur Radiol 2011; 21:1858
Biceps Tendon:
- Tenosynovitis

*Unlike joint effusion:*
- Focal distention
- Hyperemia with color Doppler
- Pain with transducer pressure
- No effusion in posterior recess

---

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

---

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

Skendzel J, et al. AJR 2000; 197:942

---

Biceps Tendon:
- Full-thickness tear:
  - Non-visualization proximally
  - Bicipital groove filled with fluid / granulation tissue
  - Distal retracted tendon stump
  - Ultrasound: 88% sensitivity, 97% accuracy

Skendzel J, et al. AJR 2000; 197:942

---

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
Biceps Tendon: full-thickness tear
Long Axis

Biceps Tendon: full-thickness tear
Short Axis: proximal
Short Axis: distal

Biceps Tendon (long head): full-thickness tear
Bicipital Groove
Short Head

Biceps Tendon Subluxation
Lesser Tuberosity
Subluxation
Dislocation

Biceps Tendon: Dislocation into subscapularis tendon
Miscellaneous Pathology:

- Biceps brachii tendon
- Subacromial-subdeltoid bursa
- Acromioclavicular joint
- Labrum
- Greater tuberosity
- Pectoralis major

Subacromial-subdeltoid Bursa:

- Normal:
  - Thin hypoechoic layer: fluid, synovium
  - Hyperechoic: bursal walls and peribursal fat
- Abnormal: >1 mm thick*
  - Fluid: anechoic
  - Synovial tissue: hypoechoic to hyperechoic

*Invest Radiol 1985;20:311
Subacromial-subdeltoid Bursa and Biceps Tenosynovitis

Calcific Bursitis

Impingement Syndrome

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

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

Impingement Test

Impingement Syndrome
Impingement: supraspinatus

Miscellaneous Pathology:
- Biceps brachii tendon
- Subacromial-subdeltoid bursa
- Acromioclavicular joint
- Labrum
- Greater tuberosity
- Pectoralis major

Acromioclavicular Joint:
- Osteoarthritis: common by age 40
  - Thick capsule > 2 mm
  - Narrow, irregular, osteophytes
- Trauma:
  - Wide, possible subluxation
  - Thick capsule >2 mm
- Cyst versus geyser sign
  - Geyser: joint fluid tracking through ACJ via full-thickness rotator cuff tear
Post-traumatic Osteolysis of the Clavicle

Long Axis
Coronal T1w

Large Full-thickness Tear: geyser sign

Miscellaneous Pathology:
- Biceps brachii tendon
- Subacromial-subdeltoid bursa
- Acromioclavicular joint
- Labrum
- Greater tuberosity
- Pectoralis major

Glenoid Labrum:
- Hyperechoic
- Some areas difficult to visualize
- Hypoechoic cleft: tear
- Diffuse hypoechoic: degeneration
- Consider MRI to confirm

Labrum: normal

Axial

Posterior Labral Tear

Axial
Axial T1w post-gado
Paralabral Cysts:
• Periarticular shoulder cyst
• May cause pain simulating rotator cuff tear
• Associated with labral tears

Tung et al. AJR 2000; 174:1707

Pitfall: suprascapular vein dilation

Miscellaneous Pathology:
• Biceps brachii tendon
• Subacromial-subdeltoid bursa
• Acromioclavicular joint
• Labrum
• Greater tuberosity
• Pectoralis major

Greater Tuberosity Fracture:
• Cortical step-off
• Point tenderness
• Differentiate from osteophyte
• Correlate with radiographs

Patten et al. Radiology 1992; 182:201
Fracture: greater tuberosity

Long Axis

Short Axis

Miscellaneous Pathology:
- Biceps brachii tendon
- Subacromial-subdeltoid bursa
- Acromioclavicular joint
- Labrum
- Greater tuberosity
- Pectoralis major

Pectoralis Major
- Clavicular head:
  - Forms anterior layer
- Sternal head:
  - Forms posterior layer and inferior aspect of anterior layer
- Each layer: 2 mm thick
- "U" shaped
- Fuses 11 mm proximal to insertion

Pectoralis Major: ultrasound
- Begin short axis over bicipital groove
- Identify bicep brachii long head
- Scan inferior to identify pectoralis major tendon superficial to biceps tendon

Pectoralis Major: short axis (sagittal plane)
**Pectoralis Major: ultrasound**

- Distal tendon: short axis (sagittal)
- Fused anterior and posterior layers
- Identified over biceps brachii tendon

**Case 1: full-thickness, full-width tear**

Long Axis

Arrowheads: fused anterior and posterior layers

*B* = biceps brachii long head

**Case 3: partial-thickness, full-width sternal head tear (surgically created)**

Curved arrow = torn sternal head (S); Arrow = posterior layer

* = short head biceps brachii + coracobrachialis

**Case 5: partial-thickness, full-width sternal head tear (arrow)**

Clavicular Head

Coracobrachialis + short head biceps brachii

**Take-home Points**

- Biceps brachii:
  - Don’t overcall tenosynovitis
  - Dynamic evaluation
- Subacromial-subdeltoid bursa:
  - Covers SST, IST, subscapularis, BT
- ACJ: cyst versus geyser
- Labrum: suprascapular vein pitfall
- Greater tuberosity: fracture
- Pectoralis: anatomy
Syllabus on line and other educational material:
www.jacobsonmuskus.com

Twitter handle: @jacobsm