DISCLOSURE

No conflict of interest
OUTLINE

• Background of MSK US
• Shoulder Anatomy Review
• US Shoulder Protocol
• Normal Shoulder US
• Basics of Common Shoulder Pathology
MSK US

- Use of MSK US has significantly increased over the past two decades
- Especially US evaluation of shoulder for pain & rotator cuff pathology

BENEFITS OF US OVER MRI

- Dynamic assessment while interacting directly with patient
- Higher spatial resolution than MRI & excellent in imaging superficial structures
- Real time Doppler analysis & allows comparing with contralateral side
- Ease of accessibility & lower cost of US when compared to MRI
- Ability to perform US in patients with contraindications to MRI

US ROTATOR CUFF RESEARCH

• “Ultrasonography and magnetic resonance imaging had comparable accuracy for identifying and measuring the size of full-thickness and partial-thickness rotator cuff tears”¹

• Up to 95% sensitivity & specificity in the hands of experienced practitioners¹

• Overall accuracy in detecting full-thickness rotator cuff tears equal to 96%²

### US ROTATOR CUFF RESEARCH

<table>
<thead>
<tr>
<th>Rotator Cuff Tears</th>
<th>Ultrasound</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-thickness tear</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>94.3%</td>
<td>91.2%</td>
</tr>
<tr>
<td>Specificity</td>
<td>95.3%</td>
<td>94.2%</td>
</tr>
<tr>
<td><strong>Partial-thickness tear</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>79.1%</td>
<td>63.1%</td>
</tr>
<tr>
<td>Specificity</td>
<td>94.6%</td>
<td>93.7%</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
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</tbody>
</table>

Data from Diagnostic Imaging of Rotator Cuff Tears: A Meta-Analysis of the Accuracy of US and MR. Department of Radiology, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.
NORMAL SHOULDER ANATOMY
S.I.T.S.

Rotator cuff muscles

Supraspinatous muscle

Subscapularis muscle

Infraspinatous muscle

Teres minor muscle

Anterior shoulder

Posterior shoulder
US SHOULDER PROTOCOL

• Long head of biceps tendon
  • Rotator Interval

• Subscapularis tendon
  • Subcoracoid impingement

• AC joint
  • Subacromial impingement
US SHOULDER PROTOCOL

- Supraspinatus tendon
- Infraspinatus tendon (Teres minor tendon)
- GH jt, Posterior glenoid labrum
- Spinoglenoid notch
- Rotator cuff muscle bellies
Overview of Shoulder Evaluation

**An:** Anterior Shoulder
- Tendon of the long head of the biceps brachii
- Dynamic Manoeuvre: Medial subluxation of the tendon of the long head of the biceps brachii
- Subscapularis tendon

**Po:** Posterior Shoulder
- Glenohumeral joint and glenoid labrum
- Infraspinatus tendon and teres minor
- Suprascapular nerve

**Su:** Superior Shoulder
- Acromioclavicular joint

**AI:** Anterolateral Shoulder
- Supraspinatus tendon
- Dynamic Manoeuvre: Subacromial impingement
LONG HEAD OF BICEPS TENDON SAX

http://www.med.umich.edu/radiology/mskus/index.html
LONG HEAD OF BICEPS TENDON SAX
LONG HEAD OF BICEPS TENDON SAX

Pectoralis Major Tendon
LONG HEAD OF BICEPS TENDON SAX
LONG HEAD OF BICEPS 
TENDON LAX
LONG HEAD OF BICEPS TENDON LAX
LONG HEAD OF BICEPS TENDON LAX

RIGHT BICEPS
ROTATOR INTERVAL
Adhesive Capsulitis
• Decreased ROM on dynamic US\textsuperscript{1}
• Thickened CHL (>3mm)\textsuperscript{2}

\textsuperscript{2}Homsi C, et al. Skel Rad 2006; 35(9):673-8
SUBSCAPULARIS LAX (TO TENDON)
SUBSCAPULARIS LAX (TO TENDON)
SUBSCAPULARIS SAX (TO TENDON)

In SAX multiple tendon slips appear as multi-pennate pattern w/ multiple hyperechoic bundles

Seibold, JC. Radiographics 1999; 19(3):685-705
Vivek K. Am J Roentgenol 2018; 211(3):538-547
SUBCORACOID IMPINGEMENT & LHBT SUBLUXATION
SUBCORACOID IMPINGEMENT & LHBT
SUBLUXATION

IMPINGE TEST
RIGHT SUBSCAP
AC JOINT
SUBACROMIAL IMPINGEMENT
SUBACROMIAL IMPINGEMENT
SUBACROMIAL IMPINGEMENT

IMPINGE TEST
RIGHT SUPRA
SUPRASPINATUS TENDON

Crass

Modified Crass
SUPRASPINATUS TENDON
SUPRASPINATUS TENDON LAX
SUPRASPINATUS LAX

LAX
RIGHT SUPRA MOD
SUPRASPINATUS SAX
SUPRASPINATUS SAX
Infraspinatus

Teres Minor
INFRASPINATUS & TERES MINOR LAX
INFRASPINATUS LAX

RIGHT POST INFRA
SPINOGLENOID NOTCH
SUPRASPINATUS MUSCLE
ROTATOR CUFF MUSCLES
COMMON SHOULDER PATHOLOGIES

- LHBT
- Impingement
- Subacromial-Subdeltoid Bursitis
- Rotator Cuff Tendinopathy
  - RTC Calcific Tendinosis
- RTC Muscle Atrophy
MSK US BASICS

• TENDINOSIS
  • Thickened, enlarged, & focally or diffusely hypoechoic
  • Decreased normal defined fibrillar architecture
  • +/- Hyperemia

• TENOSYNOVITIS
  • Hypoechoic rind surrounding the tendon within sheath, resulting from complex fluid w/ associated echogenic debris or synovium
  • Often incompletely compressible & painful
  • +/- Hyperemia

MSK US BASICS

• PARTIAL THICKNESS TEAR
  • Hypoechoic to anechoic w/ volume loss
  • Bursal, intrasubstance, articular sided

• FULL THICKNESS TEAR
  • Bursal to articular surface regardless of size or shape
  • Non-displaced or retracted
FULL THICKNESS TEAR
INDIRECT SIGNS OF RTC TEARS

- Indirect signs of rotator cuff tears:
  - Cortical irregularity of subjacent greater tuberosity footprint
    - If present, 75% have RTC tears/ absent 96% nml
  - Glenohumeral joint effusion
    - Cortical irregularity & effusion highest sensitivity, specificity, & PPV & NPV for FT supra tears by US

INDIRECT SIGNS OF RTC TEARS

• “Cartilage interface” sign
  • Through transmission w/ curvilinear hyperechoic line along humeral head articular cartilage result of articular extension

• Loss of convexity w/ Deltoid m. or SASD bursa sagging

• SASD bursal fluid
  • If both bursal fluid & effusion, 95% PPV for RTC tear

LONG HEAD OF BICEPS TENDINOSIS

NORMAL

TENDINOSIS
LONG HEAD OF BICEPS TENOSYNOVITIS

SAX

SAX W/ COMPRESSION & COLOR

Biceps Tendon  Left

Biceps Tendon  Left  COMP
LONG HEAD OF BICEPS TENOSYNOVITIS

Biceps Tendon  Left
LONG HEAD OF BICEPS TENDON FT TEAR

SAX

LAX

LEFT BICEPS

LEFT BICEPS
LONG HEAD OF BICEPS TENDON FT TEAR
LONG HEAD OF BICEPS TENDON FT TEAR

SAX

LAX

MID HUMERUS LEFT BICEPS

MYOTENDINOUS LEFT BICEPS
LONG HEAD OF BICEPS TENDON FT TEAR

MYOTENDINOUS
LEFT BICEPS
BICEPS TENDON SUBLUXATION
BICEPS TENDON DISLOCATION

LEFT BICEPS

GROOVE
SUBSCAPULARIS CALCIFIC TENDINOSIS
SUBCORACOID IMPINGEMENT

RIGHT SUBSCAP
SUBACROMIAL-SUBDELTOID BURSITIS
SUBACROMIAL-SUBDELTOID BURSITIS

RTC Calcific Tendinosis – Resorptive Phase
SUBACROMIAL IMPINGEMENT

LEFT SUPRASPINATUS TENDON CORONAL
SUPRASPINATUS TENDINOSIS

Normal

Tendinosis
“CARTILAGE INTERFACE” SIGN

- 100% specific for PT articular or FT tears

FULL THICKNESS SUPRA TEAR

LEFT SUPRA MOD LAX COMPRESSION
FULL THICKNESS SUPRA TEAR

LEFT SUPRA MOD SAX  COMPRESSION

0 Gn48 S/A:3/1 Map:A/0 D2.3 DR69 AO%100
RETRACTED FULL THICKNESS SUPRASPINATUS TEAR
MASSIVE RETRACTED FTT

LEFT SUPRA SAX

LEFT SUPRA LAX
MASSIVE RETRACTED FTT WITH LOSS OF SUBACROMIAL SPACE
INTRASUBSTANCE PTT SUPRA
ARTICULAR SIDED PTT SUPRA
ARTICULAR PT TEAR SUPRA
BURSAL PT TEAR SUPRA
BURSAL PT TEAR SUPRA
SUPRA MUSCLE ATROPHY & FATTY INFILTRATION
TAKE HOME POINTS

• Ultrasound is excellent for rotator cuff evaluation

• Understanding anatomy & MSK US basics is critical

• Follow protocol

• Benefits of MSK US
  • Dynamic imaging for impingement & biceps subluxation
THANK YOU