Ultrasound for the Evaluation of Muscles & Tendons
Disclosures

- I’m admittedly a “newbie”

- I’m missing my kid’s soccer game for this

- No incentive/gain for today’s presentation aside from good karma
What will be discussed:

- Advantages & Disadvantages of Ultrasound as compared to MRI
- Indications for MSK Ultrasound
- The importance of anatomical landmarks
- Anisotropy
- Basic overview of a shoulder ultrasound
- The future of MSK ultrasound
MSK Ultrasound: Brief History


• 1972 = First published U/S scan of a human joint by MacDonald & Leopold (Br J Radiology. 1972; 45:729-32)

• 1978 = First demo of synovitis in Rheumatoid Arthritis (Radiology 1978; 126:759-63)

MSK Ultrasound: What are we Looking at?

• Bone
• Tendon
• Muscle
• Ligament
• Cartilage
  • Articular
  • Fibrocartilage
• Nerve
• Bursa
Ultrasound versus MRI: Ultrasound Advantages

- Cost $$$
- Dynamic scanning
- Doppler
- Portability
- Great for claustrophobic patients in the right situation
- Possible option for patients who may not be able to enter the MRI due to medical devices/implants

Images From:
Necklace: http://rlv.zcache.com/medical_alert_no_mri_medical_implant_necklace-r311a51d797a04d0aa5f0460876f9100a_fkoez_8byvr_512.jpg
Achilles Tendonitis: www.AuntMinnieEurope.com, Ollympics experience reinforces ultrasound's value
Ultrasound versus MRI: Ultrasound Disadvantages

- More helpful in targeted pain/site situations versus generalized area
- Can’t effectively scan inside joint spaces
- Extremely operator dependent
Clinical Indications for Hand & Wrist Ultrasounds

**Recommended**
- Tendons & Soft Tissue
  - Mass
  - Tenosynovitis
  - Pulley Injuries
  - Trigger Finger
  - Ganglion
  - De Quervain’s
  - FCU/FCR
  - ECU/UCL
- Nerves
  - Median Nerve
  - Guyon’s Canal
  - Warternberg Syndrome

**Not Recommended**
- Hamate Fractures
- TFCC
- Capitate Fractures
- Kienbock’s Disease (hamate-lunate impinge)
- Scaphoid Fractures


Image From: [http://radiographics.rsna.org](http://radiographics.rsna.org)
# Clinical Indications for Elbow Ultrasound

<table>
<thead>
<tr>
<th><strong>Recommended</strong></th>
<th><strong>Not Recommended</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendons &amp; Soft Tissue</td>
<td>Lateral collateral ligaments</td>
</tr>
<tr>
<td>Mass</td>
<td>Lateral condyle fracture in children</td>
</tr>
<tr>
<td>Lateral epicondylitis</td>
<td>Radial head fracture &amp; subluxation</td>
</tr>
<tr>
<td>Medial epicondylitis</td>
<td>Supracondylar elbow fracture/Post-Op positioning</td>
</tr>
<tr>
<td>Synovitis</td>
<td>Septic Artifacts</td>
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<tr>
<td>Ulnar Collateral Ligament</td>
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<tr>
<td>Triceps injury</td>
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<tr>
<td>Snapping triceps syndrome</td>
<td></td>
</tr>
<tr>
<td>Olecranon bursitis</td>
<td></td>
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<tr>
<td>Nerves</td>
<td></td>
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<tr>
<td>Median nerve entrapment</td>
<td></td>
</tr>
<tr>
<td>Radial nerve compression</td>
<td></td>
</tr>
<tr>
<td>Ulnar nerve neuropathy &amp; subluxation</td>
<td></td>
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</tbody>
</table>

## Clinical Indications for Shoulder Ultrasound

<table>
<thead>
<tr>
<th>Recommended</th>
<th>Not Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendons &amp; Soft Tissue</td>
<td>Adhesive capsulitis</td>
</tr>
<tr>
<td>Bursitis</td>
<td>Glenohumeral joint trauma &amp; dynamic instability</td>
</tr>
<tr>
<td>Full/partial thickness tears</td>
<td>Parsonage-Turner Syndrome</td>
</tr>
<tr>
<td>Calcific tendonitis</td>
<td>Rotator cuff muscle atrophy</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>Quadrilateral space syndrome</td>
</tr>
<tr>
<td>Long head of biceps tendon</td>
<td>Thoracic outlet syndrome</td>
</tr>
<tr>
<td>* Dislocation</td>
<td>Glenoid Labrum</td>
</tr>
<tr>
<td>* Tendinopathy</td>
<td></td>
</tr>
<tr>
<td>* Rupture</td>
<td></td>
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</tbody>
</table>

*Clinical indications for musculoskeletal ultrasound: A Delphi-based consensus paper of the European Society of Musculoskeletal Radiology; A Klauser; A Tagliafico et al/RaEur Radiology (2012)*
Clinical Indications for Ankle & Foot Ultrasound

**Recommended**
- Tendons & Soft Tissue
  - Tendinopathy
  - Sheath effusions
  - ATFL, CFL & AITF ligaments
  - Peroneal tendon dislocation
  - Calcific tendonitis
  - Retrocalcaneal bursitis
  - Joint effusions
  - Synovitis
  - Plantar fascia pathology
  - Ganglion
- Nerves
  - Entrapment
  - Morton Neuroma

**Not Recommended**
- Posterior talofibular ligaments
- Intraarticular disease
- Distal tibial or talus coalition
- Cartilage lesions

*Clinical indications for musculoskeletal ultrasound: A Delphi-based consensus paper of the European Society of Musculoskeletal Radiology; A Klauser; A Tagliafico et.al/RaEur Radiology (2012)*
# Clinical Indications for Knee Ultrasounds

<table>
<thead>
<tr>
<th>Recommended</th>
<th>Not Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendons &amp; Soft Tissue</td>
<td>ACL/PCL</td>
</tr>
<tr>
<td>Patellar tendinopathy/tear</td>
<td>Posterior Lateral Corner lesions</td>
</tr>
<tr>
<td>Quadriceps tendinosis/tear</td>
<td>Hoffa’s fat pad syndrome</td>
</tr>
<tr>
<td>Pes Anserine tendinobursitis</td>
<td>Loose bodies</td>
</tr>
<tr>
<td>Baker’s cyst</td>
<td>Meniscus</td>
</tr>
<tr>
<td>Osgood-Schlatter, Sinding-Larsen</td>
<td>Cartilage</td>
</tr>
<tr>
<td>Periarticular ganglion</td>
<td></td>
</tr>
<tr>
<td>Nerves</td>
<td></td>
</tr>
</tbody>
</table>

*Clinical indications for musculoskeletal ultrasound: A Delphi-based consensus paper of the European Society of Musculoskeletal Radiology; A Klauser; A Tagliafico et.al/RaEur Radiology (2012)*
Know your anatomical landmarks!

- Muscles and tendons must be imaged in relation to bony landmarks and other structures for positive identification

Image From: [http://radiographics.rsna.org](http://radiographics.rsna.org)
Anisotropy

Not having properties that are the same in all directions.

Medical Dictionary for the Health Professions and Nursing © Farlex 2012
Anisotropy

Image From: http://radiographics.rsna.org
Shoulder Ultrasound Demonstration
Shoulder Case Study

- 36 Y.O. weight-lifter c/o dull/achy Rt Shoulder with no known injury

- Apley’s scratch test difference of 6cm

- Other clinical exams were unremarkable

Images & Case from: [www.diagnosticimaging.com/case-studies](http://www.diagnosticimaging.com/case-studies)  Credit: Dr. Gregg Mallett
Partial Tear of the Supraspinatus
Full Thickness Supraspinatus Tear

Images From: www.ultrasound-images.com
Rib Fracture

Images From: www.ultrasound-images.com
Olecranon Bursitis

Image From: http://www.ultrasound-images.com
Medial Cruciate Ligament Rupture
Biceps Tendonitis

Images From: www.ultrasound-images.com
Hematoma over a Fracture

Images From: www.ultrasound-images.com
The Future of MSK Ultrasound

- ARDMS has added a certification exam RMSK

- SDMS recognizes the need for more training & exposure to MSK

- Radiology groups are beginning to establish MSK ultrasound practices

- Educational programs are limited but expected to expand in the future

Image From: http://t0.gstatic.com/
Helpful References

• Textbooks
  • Fundamentals of Musculoskeletal Ultrasound by Dr. Jon Jacobson
  • Normal Ultrasound Anatomy of the Musculoskeletal System: A Practical Guide by Enzo Silvestri, Alessandro Muda, & Luca Maria Sconfienza

• Guidelines/Protocols
  • essr.org
  • aiium.org
  • ardms.org
  • University of Michigan - Musculoskeletal Website
Special Thanks

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• Mike McKinney, RT(R), RDMS

• Linda Scott, Amazing Boss Lady among other credentials