1. **New York Physical Therapy Association**
   Greater New York District

   **Introduction to Diagnostic Musculoskeletal Ultrasound Imaging**

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2. **What is Musculoskeletal Ultrasound (MSK US)?**
   - Using high-frequency (3-17 MHz) sound waves to image soft tissues and bony structures in the body
   - Diagnosing pathology or guiding real-time interventional procedures

3. **MSK US units**

4. **MSK US Transducers**

5. **Why is Diagnostic MSK US Getting More Popular?**
   - Technology improved; resolution comparable to or higher than MRI
   - Portability
   - Fast scan time
   - Relatively inexpensive
   - Lacks radiation
   - Can interact with the patient while imaging
   - Real time
   - Dynamic examination
   - Enables rapid contralateral limb examination for comparison

6. **Capabilities**
   - Help diagnose musculoskeletal injuries/disorders
     - tendon, ligament, nerve, muscle, bursa, bone and joint, etc.
• An adjunct to physical examination
• Monitor injury progress
• Size of hematoma/effusion
• Stages of tendinopathy

7 Capabilities

8 Limitations
• Incomplete evaluation of bones and joints
• Operator dependent
  • Interobserver reliability depends on differences in years of experience among the practitioners
• Long learning curve

9 PTs or SPTs Learning Diagnostic MSK US
Advantages:
• Broad and deep musculoskeletal anatomy knowledge
• Surface palpation skills
• Used to learning motor skills

In 2013, faculty from 155 (75.2%) PT education programs responded to a survey.
• Faculty ratings of student competence in ultrasonography
  (1 = not competent; 5 = competent)
• Identify normal anatomy: 2.0
• Identify common MSK pathologies: 1.9
• Utilizing US imaging: 1.77

10 PTs Performing Diagnostic MSK US
Inter-professional agreement of US-based diagnoses in the Netherlands
• 65 patients with shoulder pain
• 13 PTs and 9 radiologists
• Agreement between PTs and radiologists
• Full thickness tears: substantial agreement (0.63 K)
• Bursitis: moderate agreement (0.54 K)
• Calcification: fair agreement (0.28 K)
• Partial thickness tears: slight agreement (0.10 K)
• All 4 diagnostic categories: fair agreement (0.36 K; 95%CI 0.29-0.43)
• Between more experienced and highly trained PTs and radiologists (0.43 K)
• Between less experienced and trained PTs and radiologists (0.17 and 0.09 K)

11 Basic Scanning Techniques
   Short axis (transverse plane; figures a & b)
   Long axis (longitudinal plane; figures c & d)

12 Image Orientation

13 Image Appearance

14 Normal Sonographic Appearance
   • Bone
     • Well-defined, linear, smooth, hyperechoic border
     • Posterior acoustic shadowing
   
   • Subcutaneous fat
     • Hypoechoic
     • Has thin septations of connective tissue

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16 Normal Sonographic Appearance
   • Muscle
• Hypoechoic
• Short axis: Starry night. See figure A.
• Long axis: Feather like. See figure B.

17 Normal Sonographic Appearance
• Tendon
  • Hyperechoic
  • Short axis: Broom end
  • Long axis: Narrow fibrillar parallel lines
• Nerve
  • Mixed echogenicity
  • Visible running along fascial planes
  • Paired with blood vessels, and sometimes with muscles
  • Short axis: Honeycomb
  • Long axis: Fascicular cord

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20 Normal Sonographic Appearance
• Ligament
  • Hyperechoic
  • Appears similar to tendon
  • Small in size; difficult to discern, especially in short axis
  • Short axis: Broom end
  • Long axis: Fibrillar parallel lines

21 Normal Sonographic Appearance
• Bursa
  • Not often visualized
  • If inflamed or infected: Visible and anechoic
Normal Sonographic Appearance

• Hyaline articular cartilage
  • Appears as a thin hypoechoic rim over a hyperechoic bony cortex

Sonographic Appearances of Common MSK Pathologies

Partial Thickness Tear

Full Thickness Tear

Calcification

Tendinosis

Ligament Tear

Joint Effusion

A List of Some Organizations that Provide MSK US courses

American Institute of Ultrasound in Medicine
http://www.aium.org

Biosound/Esaote MSK Ultrasound Courses
http://www.mskultrasound.com/education/msk-ultrasound-course/

The Burwin Institute

GE Healthcare
Musculoskeletal Sonography Credential

- The Registered Musculoskeletal Sonography (RMSK) Credential
- Offered by the American Registry for Diagnostic Medical Sonography (ARDMS)
- The Imaging Special Interest Group through the Orthopedic Section and in coordination with APTA
  - Physical therapists continue to qualify to sit for the examination
- RMSK prerequisite
  - Licensure
  - Required clinical musculoskeletal ultrasound experience
  - Recommended continuing medical education
  - Documentation required with application

Videotaped Demonstrations

References

5. Petscavage-Thomas J. Clinical applications of dynamic functional

35 References


