Use of the Musculoskeletal Ultrasound in the Sports Medicine Clinic

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Introduction

• Initially, diagnostic ultrasound applications were limited due to poor resolution and lack of real-time imaging capability.
• Last decade, with the use of real-time U/S imaging and detailed anatomic imaging, diagnostic MSK ultrasound became capable of fully evaluating the MSK system.
Ultrasound Equipment

- Linear array transducer: high-frequency 17-5 MHz - used for superficial imaging studies (inverse relationship between frequency and penetration depth).
- Curvilinear array transducer: low-to medium-frequency (5-2 MHz)
  - For examination of deeper tissues (e.g., hip/gluteal region)

Transducer (probe) attached to the main body of the machine via a cord.
Image

- U/S machine generates an electric current to crystals inside the transducer.
- The vibrating crystals generate a sinusoidal sound wave.
- Sound waves travel through the gel into the body until they encounter tissue which reflects the wave.
- The reflected sound wave is detected by the transducer which transforms the mechanical sound energy wave to electrical signals.
- U/S machine computer software transforms the electrical signals to a black and white image,
- Generate a two-dimensional image of a 3-dimensional structure.
- All U/S images are not based on the absolute material properties of a tissue but rather on the relative material properties of that tissue compared with adjacent regions.
Ultrasound Scanning Skills

- Requires dedication, training and many hours of practice to master
- The ability to skillfully manipulate the transducer using specific movements (sliding, tilting, rotating, and heel-toeing) ensures accurate image
- The transducer must be moved fully through the entire range of the structure to avoid errors of omission.
Normal MSK U/S anatomy

High resolution U/S produce detailed anatomic images of:
- Tendons
- Nerves
- Ligaments
- Joint capsules
- Muscles

Basic normal MSK U/S anatomy provide in-depth knowledge to identify abnormal MSK anatomy.
Normal MSK U/S anatomy
Diagnostic MSK U/S

- Diagnostic ultrasound can diagnose pathology in
- Tendons: tendinosis, partial- or full-thickness tendon tears, tenosynovitis
- Nerves: nerve entrapments (swelling proximal to the entrapment site and focal narrowing), neuroma
- Ligaments: sprains grade I, II, III, stress testing
- Joint capsules: joint effusion, erosions
- Muscles: strains
- Bone: fractures, periostitis
- Other soft tissue: hematomas, cysts, Bursa,
- Foreign body
MSK U/S Guided Injections

- Ultrasound is used primarily to guide needle placement for injections (cortisone, HA), aspirations (joint, bursa) and biopsies.
- A complete sonographic examination (including Doppler exam) of the proposed area should be conducted to determine critical structures such as nerve and vessels to be avoided.
- Patient’s skin and transducer is sterilized.
- The needle is directed toward the intended target with the long axis of the needle in line with the long axis of the transducer face.

- [Video Link](http://www.youtube.com/watch?v=boXIamA kWoQ)
Procedures in clinic

- Shoulder: GH and AC joint, biceps tendon, SA bursa (Repeat)
- Elbow: joint, bursa
- Wrist and fingers: joint, tendons, Carpal Tunnel (early)
- Hip: joint, Iliopsoas bursa
- Knee: bursa (some), cyst
- Ankle and toes: joints
- Back: SI joint injections, Piriformis
Procedures in my clinic

Knee suprapatellar bursa
- USGI knee.MOV

GH Joint
- USGI GH joint.MOV

Biceps Tendon Sheath
- biceps tendon.MOV

Hip Joint
- USGI hip 1.MOV

SI Joint
- USGI SI joint.MOV
Ultrasound Advantages

- Lack of radiation risk
- No known contraindications
- Relatively low cost
- Can be used in certain patients that are contraindicated for MRI imaging (e.g., claustrophobic or obese patients, metal artifacts)
- Dynamic, and interactive examination: real-time soft tissue imaging.

Ultrasound Disadvantages

- Limited by the variable quality and resolution of images
- Limited by the examiner’s skill level