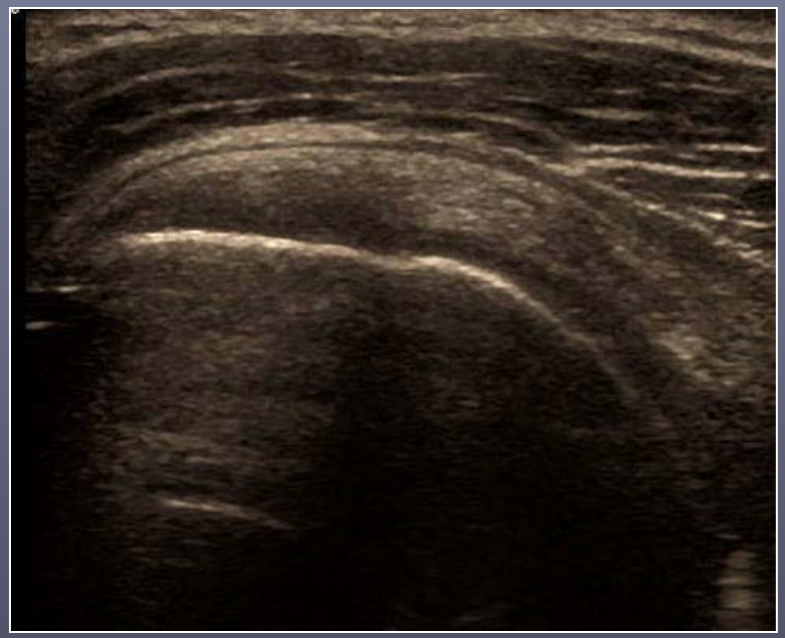
INTRODUCTION TO MSK ULTRASOUND



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www.shoulderultrasound.com

DISCLOSURE

- **EDUCATIONAL CONSULTANT FOR SONOSITE and GE HEALTHCARE**

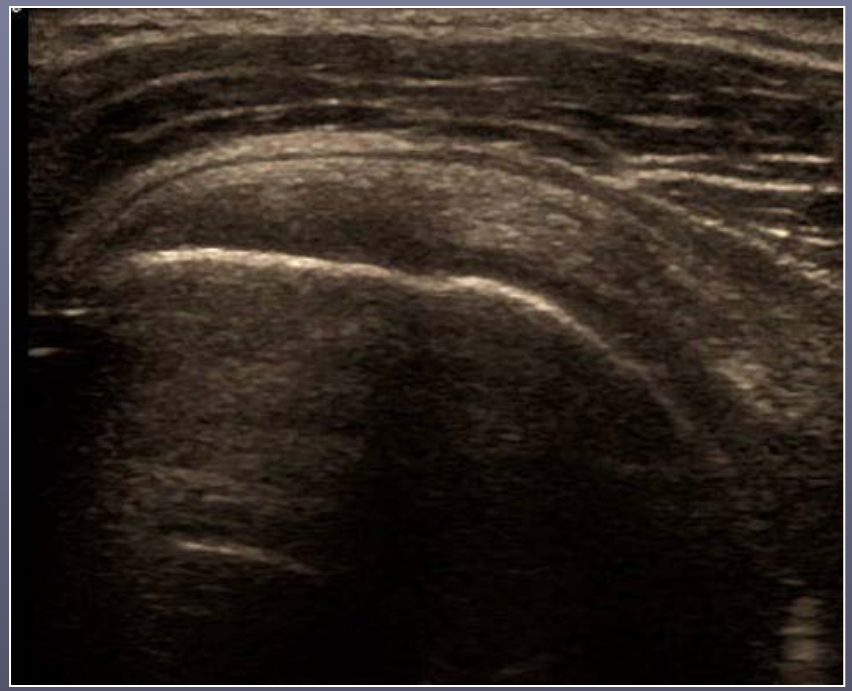
Ben DuBois, MD

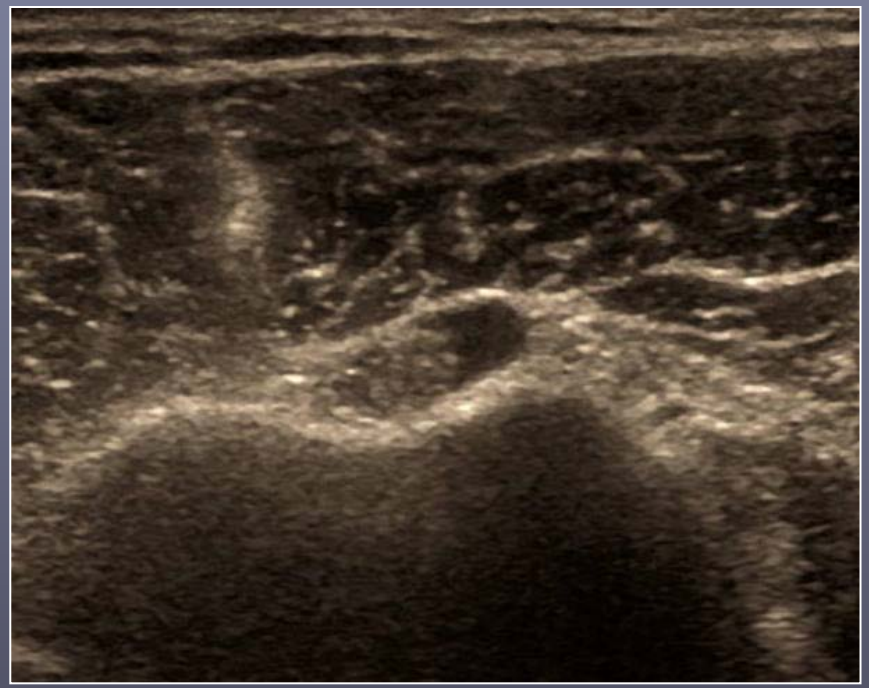
- Private Practice Orthopaedic Surgeon
- Fellowship Trained Shoulder Specialist
- 7 Years in Practice
- Over 1000 US Exams and Injections
- Train Other Physicians
- www.shoulderultrasound.com

COURSE OBJECTIVES

- Identify indications for US and how to integrate it into your practice
- Identify normal anatomy
- Identify abnormal anatomy
- Understand role of US in injections
- Understand cost, coding & reimbursement

ULTRASOUND BASICS





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What is Ultrasound?

- High frequency sound waves
  - frequencies higher than human hearing
- Audible Sound is 20Hz - 20,000Hz
- Diagnostic US is >1,000,000Hz (1MHz)
- Musculoskeletal US is 7MHz - 18MHz

What Can MSK Ultrasound Image?

- Skeletal bone
- Muscle
- Tendon
- Nerve
- Subcutaneous tissue
- Needles

What Can MSK Ultrasound Image?

- Foot/Ankle, Knee, Hip
- Fingers/Wrist, Elbow, Shoulder
- Shoulder is the most commonly imaged joint

What Can MSK Ultrasound Identify?

- Inflammation
- Tendon tears (complete and partial)
- Soft tissue lesions and masses
- Fluid collections
- Fractures

What Are Ultrasound Advantages?

- Efficient and cost effective
- Provides dynamic, “live” images
- No known long term side effects
- Portable, relatively inexpensive
- High spatial resolution (1mm) with high frequency transducers
- Effective visualization of the postsurgical rotator cuff - not affected by implants like MRI

What Are Ultrasound Disadvantages?

- Can’t see “thru” bone or gas
- Relatively limited depth of penetration (Can’t Dx SLAP, labral pathology)
- Operator dependent/Learning Curve
- Hardware/Software dependent imaging modality

Basic US Concept

- Higher frequency transducers
  - Better resolution, less penetration
- Lower frequency transducers
  - Worse resolution, better penetration

How Does Diagnostic Ultrasound Work?

Three Basic Steps

- Step 1 - Making the US wave
- Step 2 - Receiving US reflections/echoes
- Step 3 - Interpreting the US reflections

How Does It Work?

Step 1 - Making The Sound Wave

- The US machine sends electrical pulses to piezoelectric elements within the transducer
  - Transducer generates a US waves at the desired frequency
- Modern musculoskeletal transducers are typically linear phased array transducers
  - US machines can change direction **and** depth of focus

How Does It Work?

Step 2 - Receiving The US Reflections/Echoes

- The US wave is partially reflected when it hits a density change in the body
- The amount of the reflection depends on the density difference (impedance difference)
  - Large density difference - large reflection, “bright echo”
  - Small density difference - small reflection, “grayer”

How Does It Work?

Step 2 - Receiving The US Reflections/Echoes

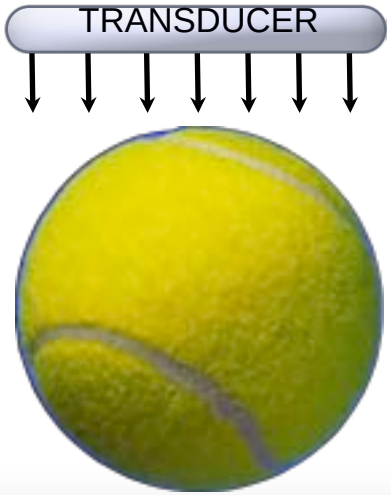
- US reflections are received by the transducer which vibrates the transducer
- Transducer turns vibrations back into electrical pulses that are then interpreted by the machine to create an image

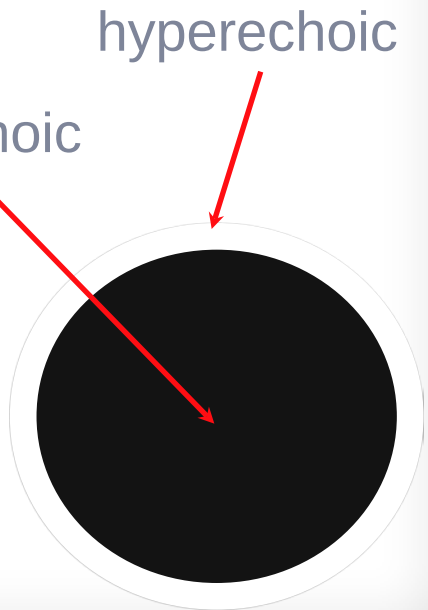
How Does It Work?

Step 3 - Interpreting The US Reflections

Echogenicity

Hyperechoic - Brighter (bone surfaces)
Hypoechoic - Darker (muscle, cartilage)
Isoechoic - Equal
Anechoic - Black (fluid)





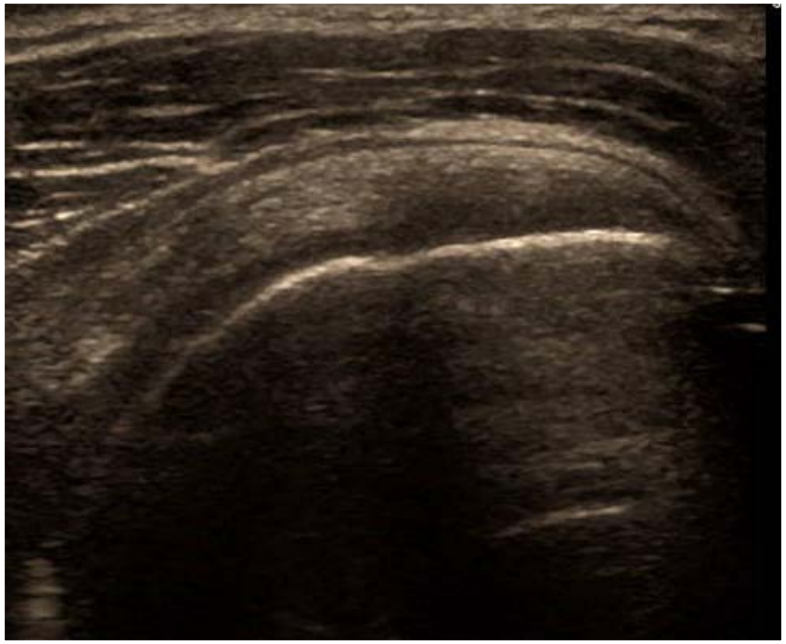
Tissue Appearances

Tendon - parallel collagen bundles, brightly echogenic structure with fine fibrillar pattern. Nerve is similar to tendon

Muscle - hypoechoic bundles interspresed with echogenic connective tissue

Bone - bright hyperechoic surface with significant posterior shadowing or signal loss below the cortical surface

Articular cartilage - anechoic (black), thin layer above bright cortical bone



THANK YOU

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