Point of Care Ultrasound: Cutting edge care of the athlete

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SIU SCHOOL of MEDICINE

Conflict of Interest

There is no conflict of interest by the presenters of this workshop.

The views expressed in these slides and today's discussion / demonstration are supported by current medical practice and evidence based medicine but may differ in some areas from our colleagues.

Participants must use discretion when using the information contained in this presentation and should seek further education if preparing to use in their work setting.

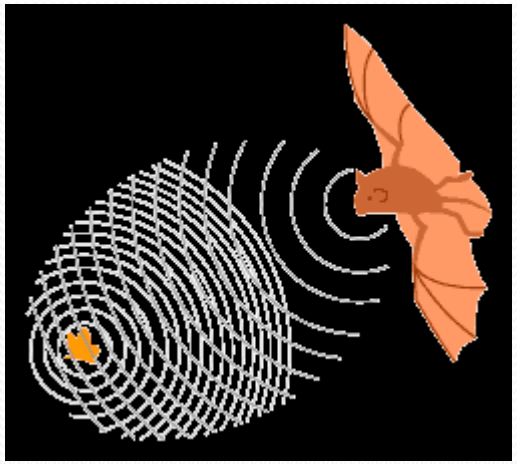
Objectives

- Identify how athletic trainers can use diagnostic ultrasound on and off the playing field
- Introduce types of ultrasound machines and basic knobology
- Learn how to obtain and analyze images
- Differentiate between muscle, tendon, nerve on images
- Differentiate between normal organ tissue and free fluid
- Differentiate between normal eye appearance on ultrasound and images indicating pathology

Evolution of POCUS

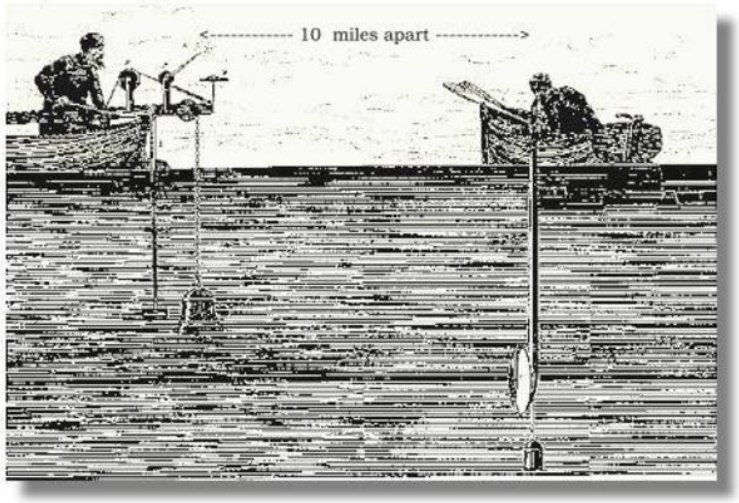
Soni, 2015

History of Ultrasound

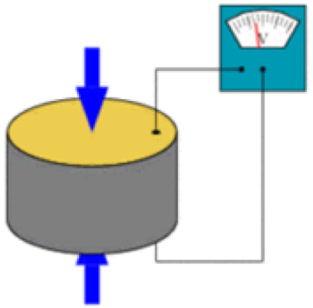


Sound waves studied by
Lazzaro Spallanzani, 1790s
Bat Echolocation

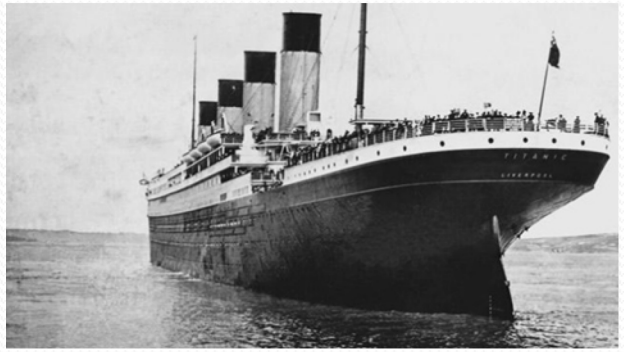
Jean Colladen & Charles Sturm
Lake Geneva Switzerland
Speed of sound in water faster than air



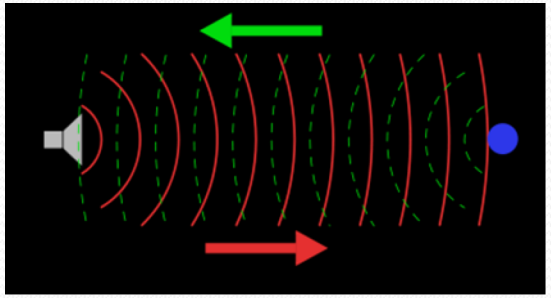
Soni, 2015

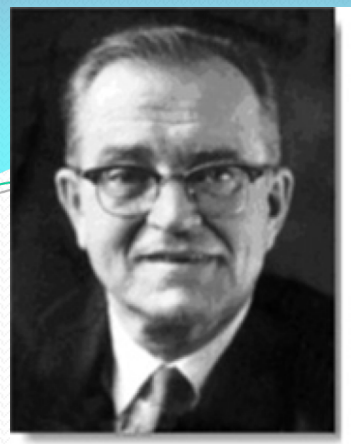


Curie brothers, Piezoelectric effect, 1880

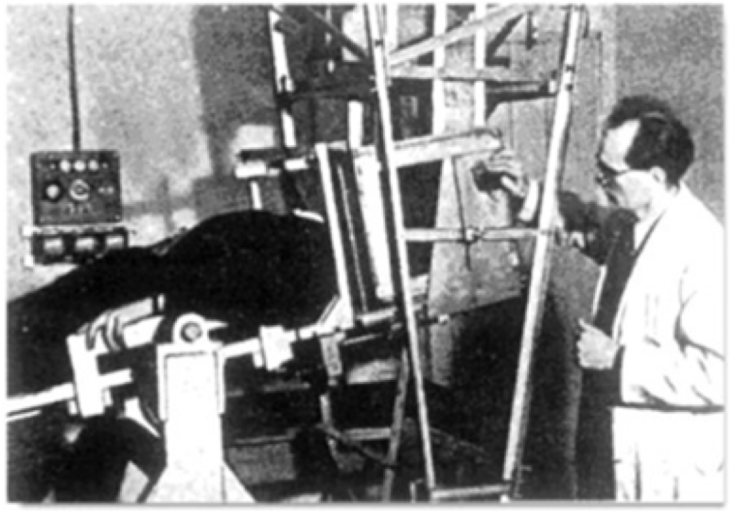


Sinking of Titanic and WWI – catalyst for sonar/sound wave technology





Karl Theo Dussik (9 January 1908 – 19 March 1968)



Dussik's elaborate apparatus for scanning the head

1940s Karl Dussik, credited with modern medical ultrasound

Howry and Holmes
Late 1940s
Immersion Tank
Published first 2D images

1950: Douglas Howry & Joseph Holmes
Pioneros en el uso del ultrasonido en 2D y modo B
en la Univ. de Colorado

Douglass Howry, late 1960s

Joseph H Holmes
1902 - 1982

SOUND-WAVE PORTRAIT IN THE FLESH

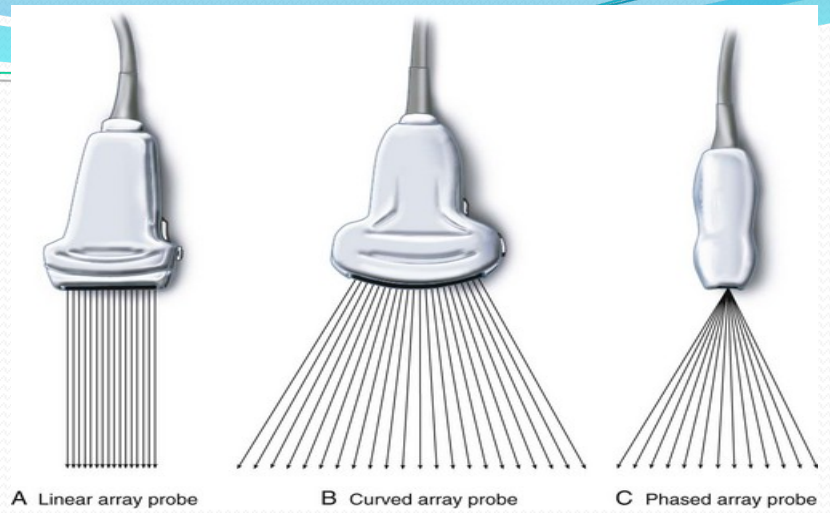
Soni, 2015

Ultrasound Machines

Knobology

- Gain: changes the brightness of the screen
- Depth: change to evaluate superficial or deep structures; used to magnify area of interest
- Modes:
  - M mode – motion; ie motion at the pleura
  - B mode – brightness (basic)
  - Color doppler (blood flow); inflammation, blood vessels

Probes



<u>Frequency</u> is determined by the probe

- Inversely related to penetration

lower number = increased depth

low # good for deep structures, high # good for superficial structures

- Direct relation to resolution (clarity of picture)

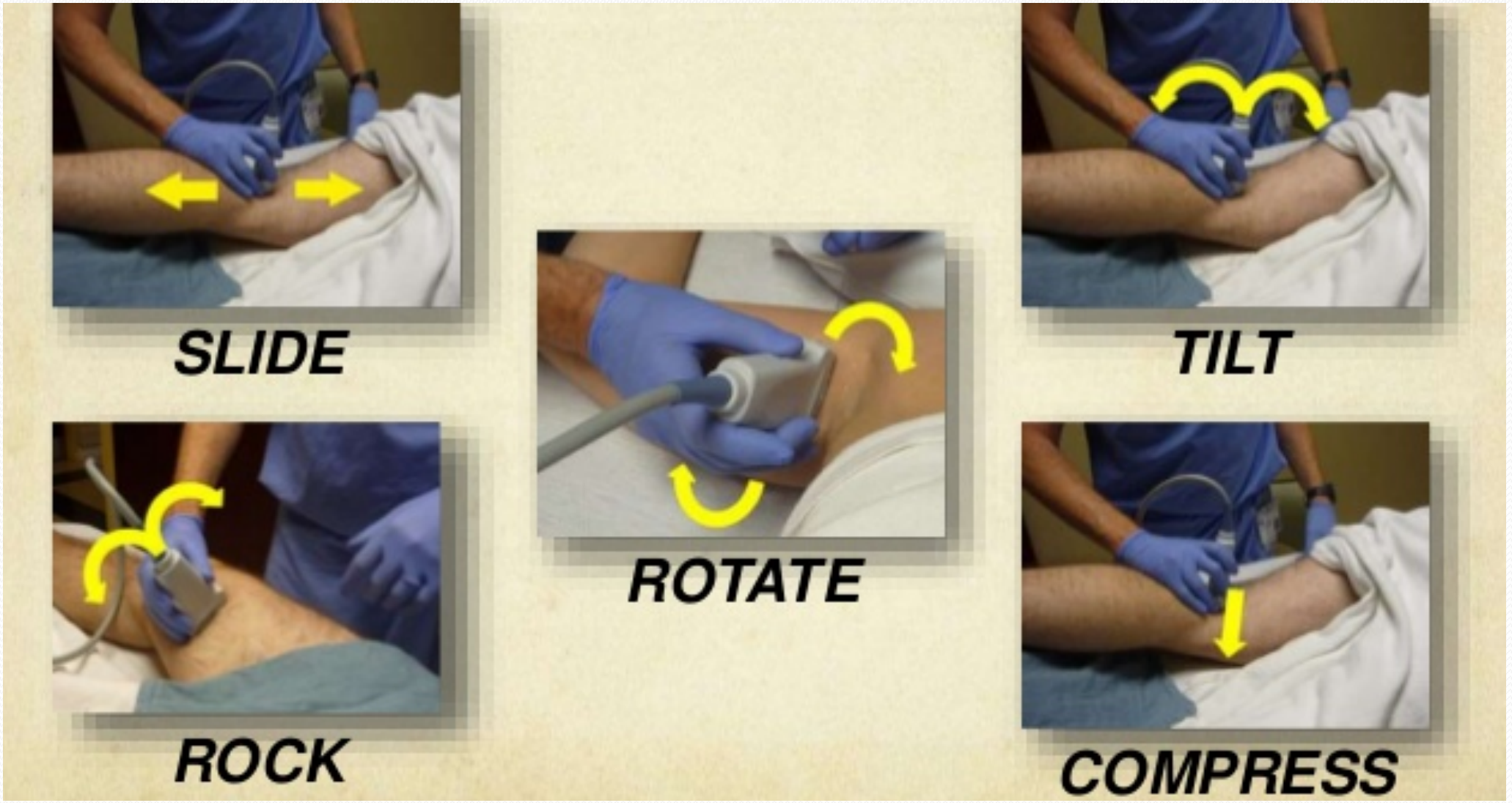
higher number = better picture for superficial structures

- Most common used 2.0-5.0 MHz for Abdomen

9-18 MHz for MSK

Obtaining an Image

- Pencil Hold versus Platform Hold



Slide curtesy of: VCU Ultrasound file share

Anisotropy

Artifact created when the angle of ultrasound waves hitting the tissues is not perpendicular

Can cause false readings or incorrect diagnosis of tears

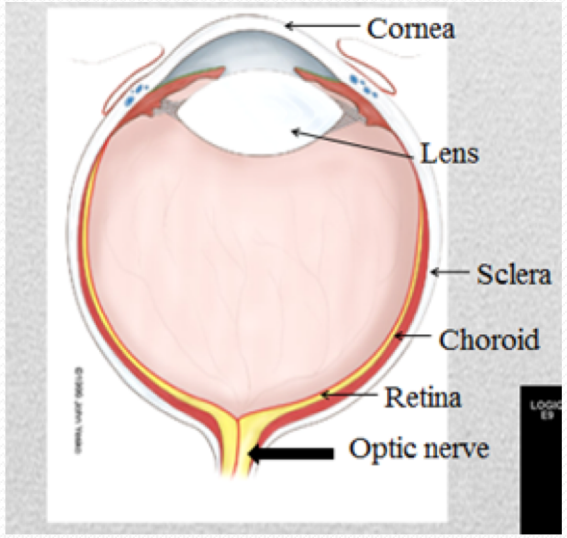
Scanning

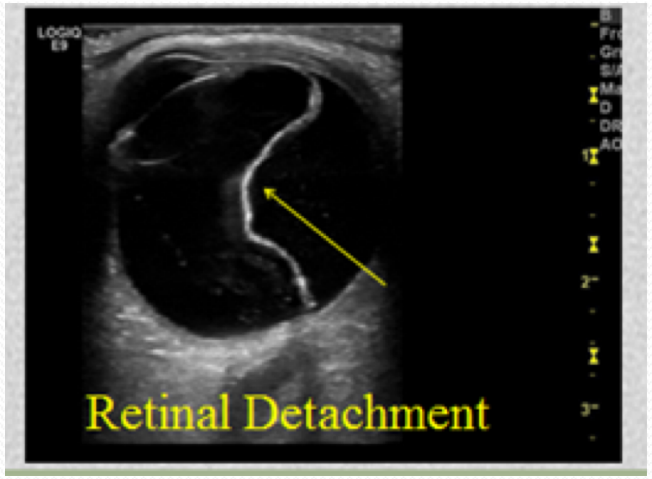
- Eye
- Right upper quadrant
- Soft tissue (abscess vs cellulitis)
- Muscle / Tendon

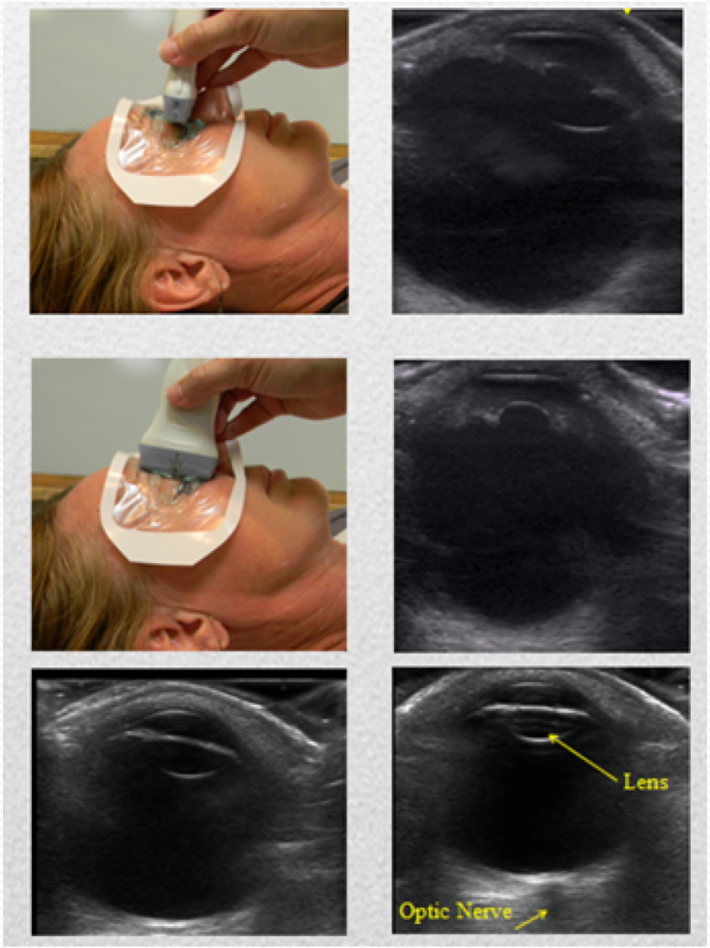
CASE #1

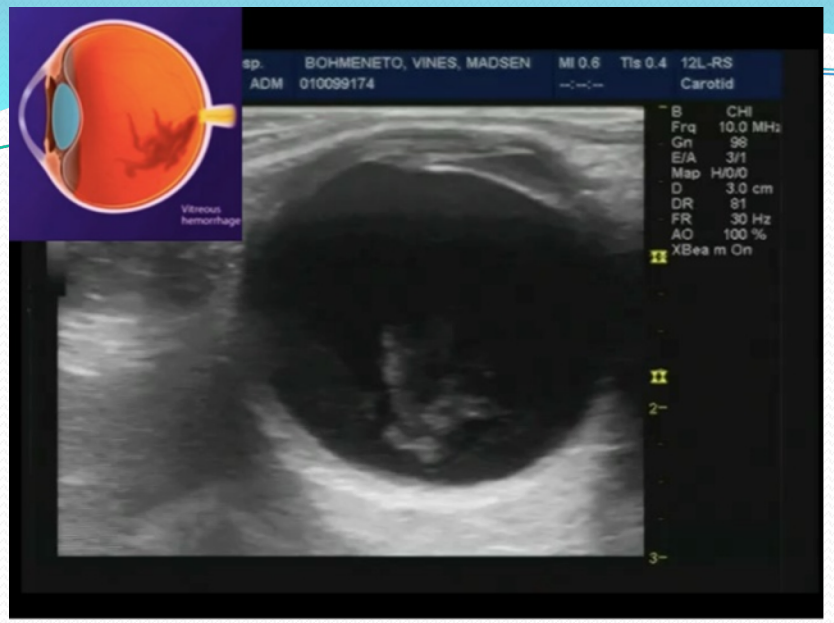
Ocular Ultrasound

- **Contraindications**
  - Globe rupture; known or highly suspected
  - Peri-orbital trauma
  - Suspected retrobulbar hematoma



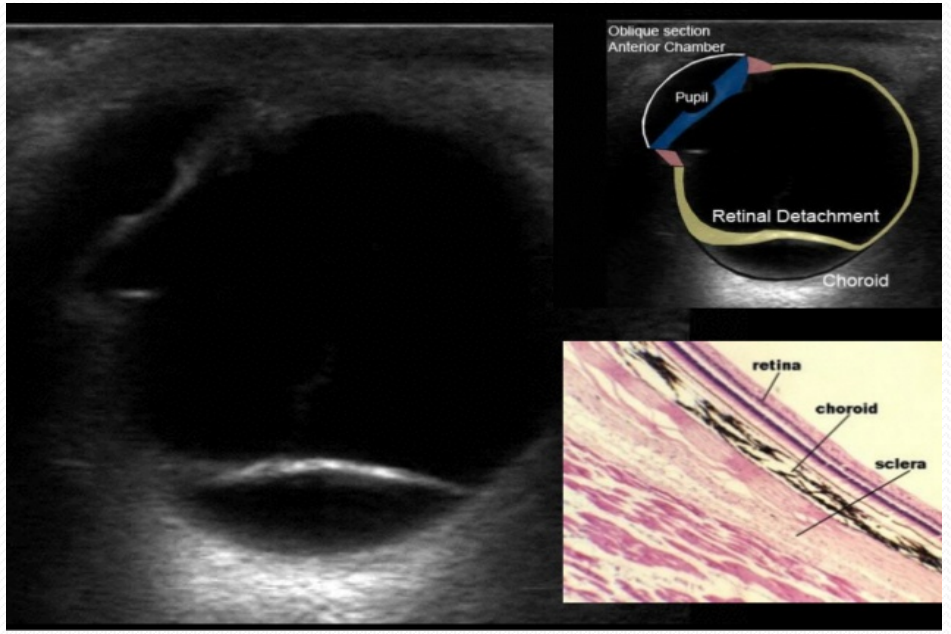


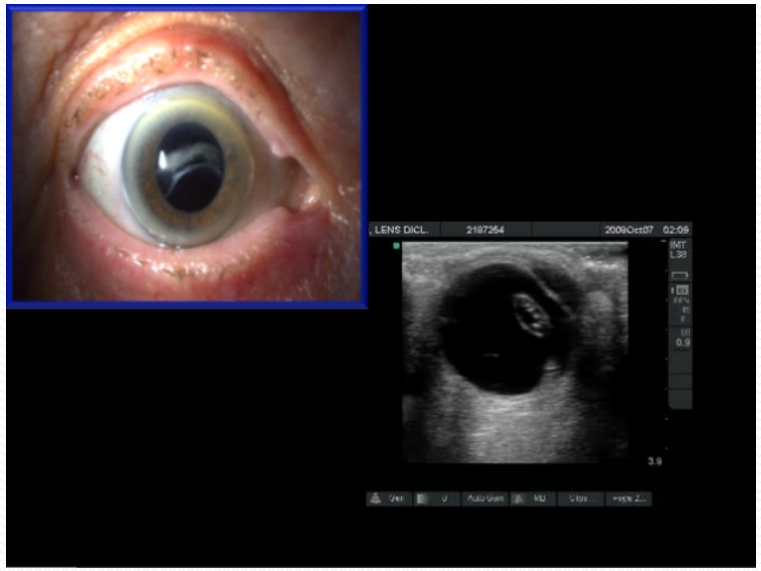




Vitreous Hemorrhage

Retinal Detachment





Lens Dislocation

Case #2

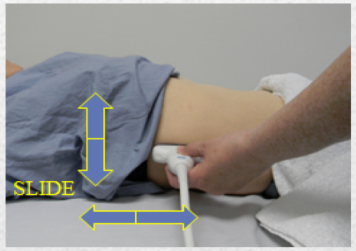
Abdominal Ultrasound

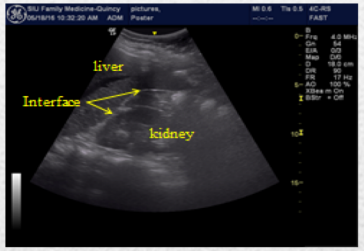
- Used to evaluate for small amounts of free fluid in the abdomen
  - 10 ml of free fluid can be found with abdominal POCUS
- Right upper quadrant is most likely the area to find free fluid
  - Anatomy allows direct route to “Morrison’s Pouch”, potential space for free fluid between liver and kidney

Abdominal ultrasound

Step 1: Start at external landmark: Find kidney
Use anterior / posterior slide

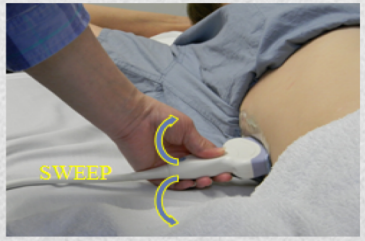
Step 2: Find interface "Area of interest"
Use longitudinal slide
RUQ - kidney / liver
LUQ - kidney / spleen

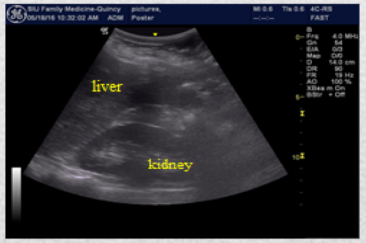




Step 3: Magnify image, limited wasted space beyond kidney

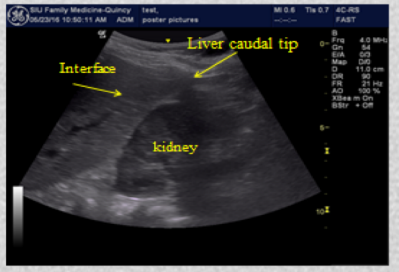
Step 4: Sweep entire interface until kidney disappears

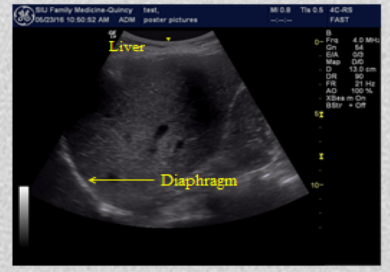




Step 5: Sweep caudal tip of liver

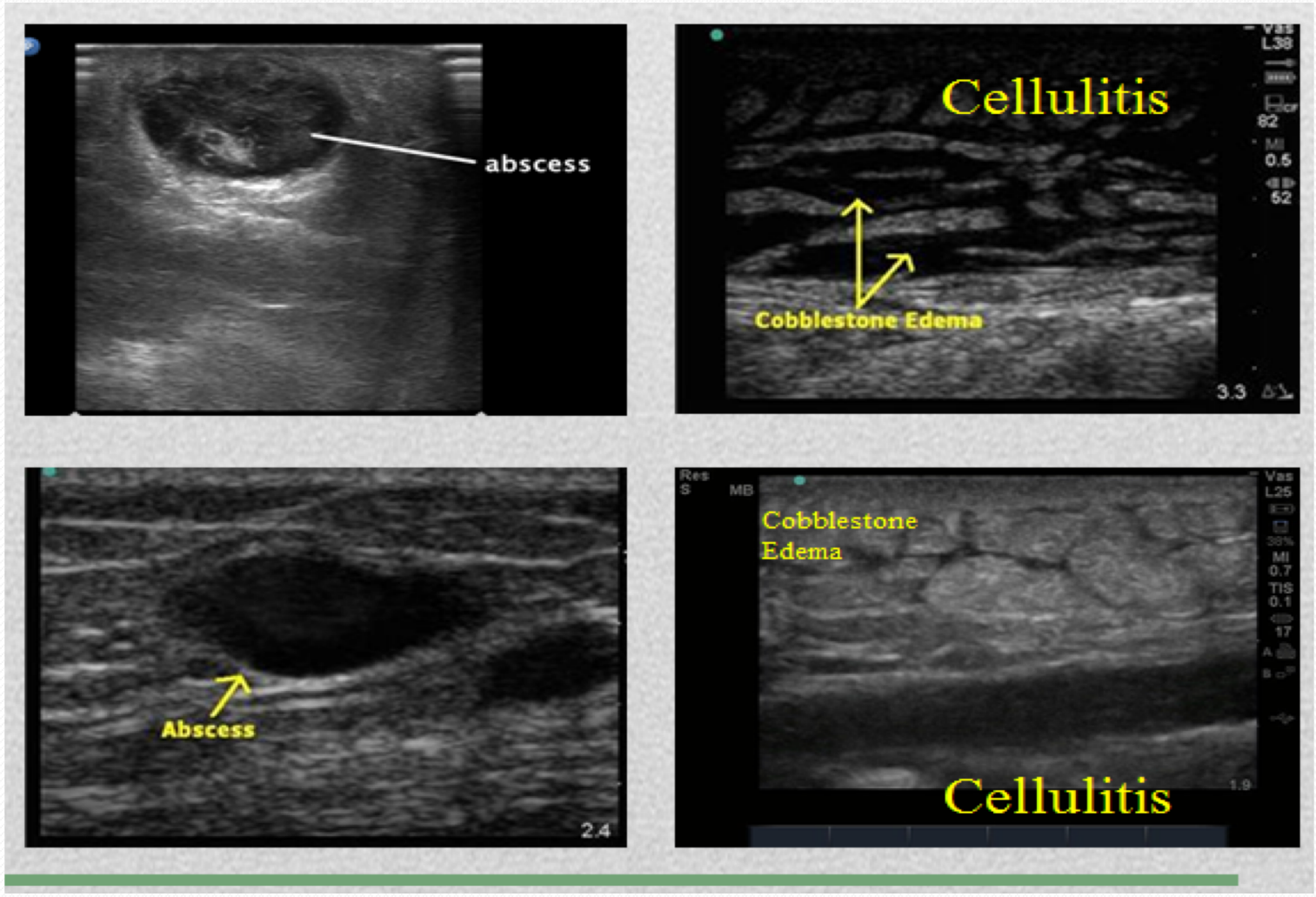
Step 6: Sweep diaphragm (6-9 o'clock)





Case #3

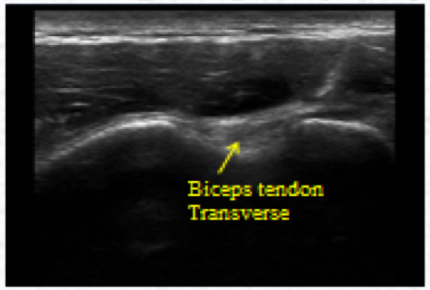
Skin Ultrasound



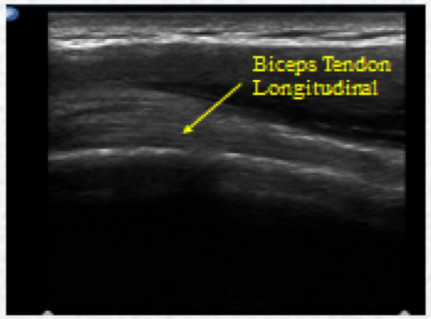
Case #4

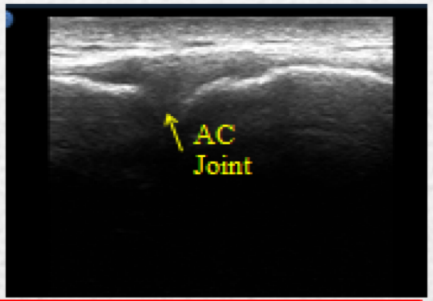
Shoulder

- Linear probe 12 mHz
- Patient positioned with forearm resting on thigh and palm up



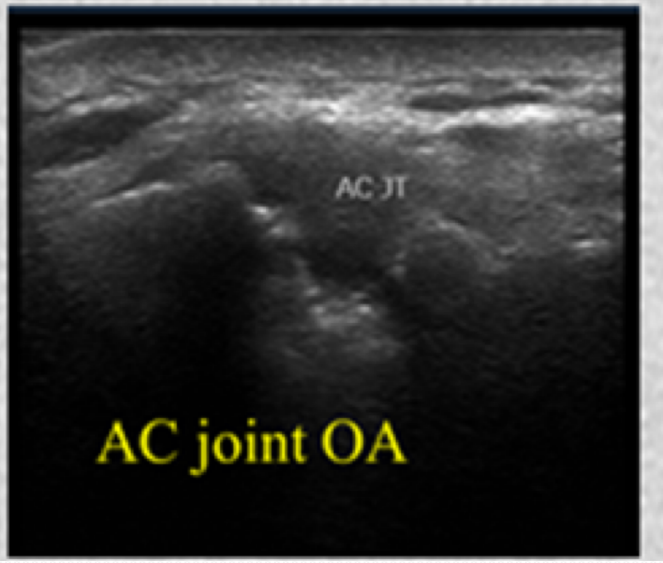
- Examiner can also perform dynamic testing of the biceps with patient internally and externally rotating in this position; check for biceps subluxation out of groove



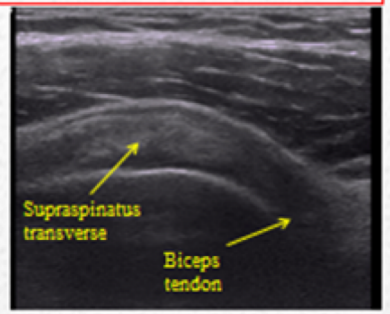


- Examiner can perform dynamic testing of AC joint with patient actively reaching toward opposite shoulder, abducting arm at same time and checking for movement of the clavicle upward

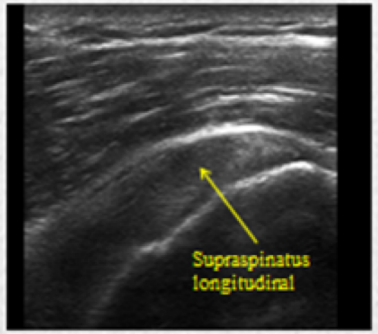
Musculoskeletal

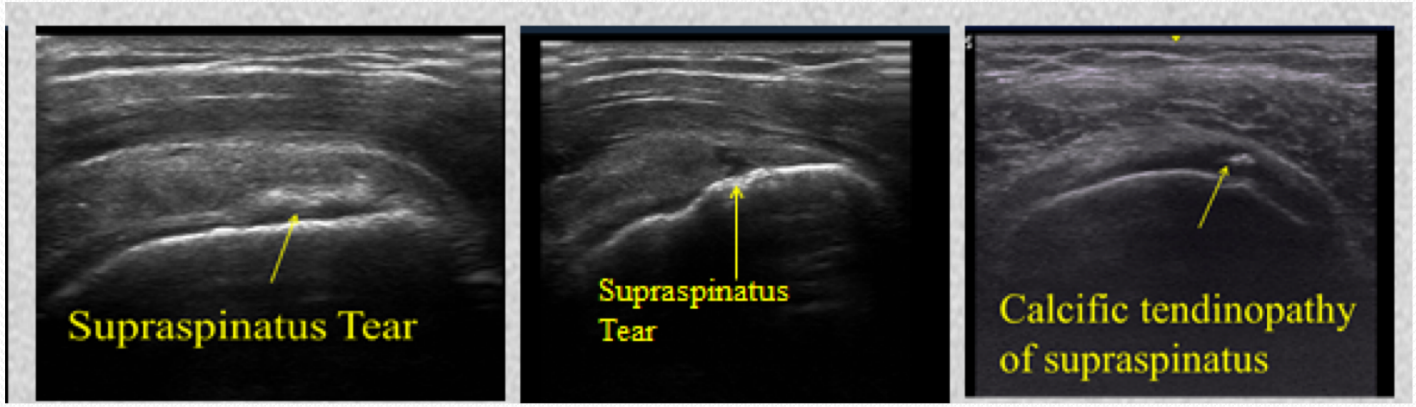


- Examiner can perform dynamic testing for impingement with the patient actively abducting arm and checking for decreased subacromial space

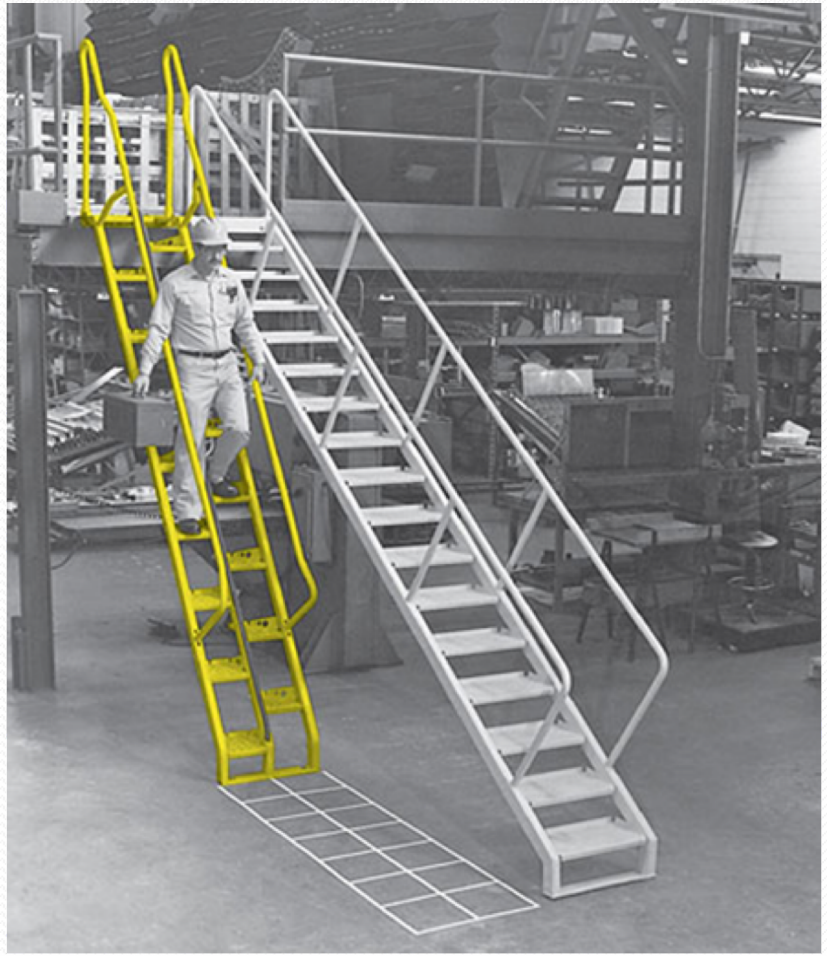


- For *above and below views*, patient will place hand on back pocket and elbow back; examiner can perform dynamic test of supraspinatus by placing pressure against elbow and patient pushing outward



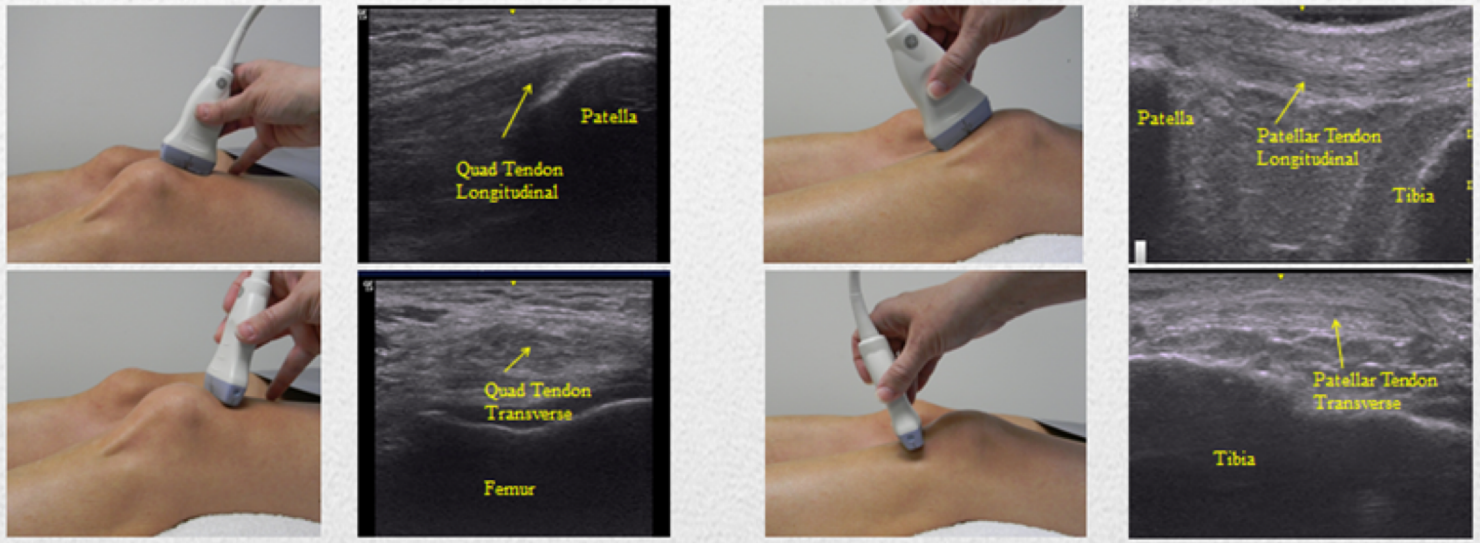


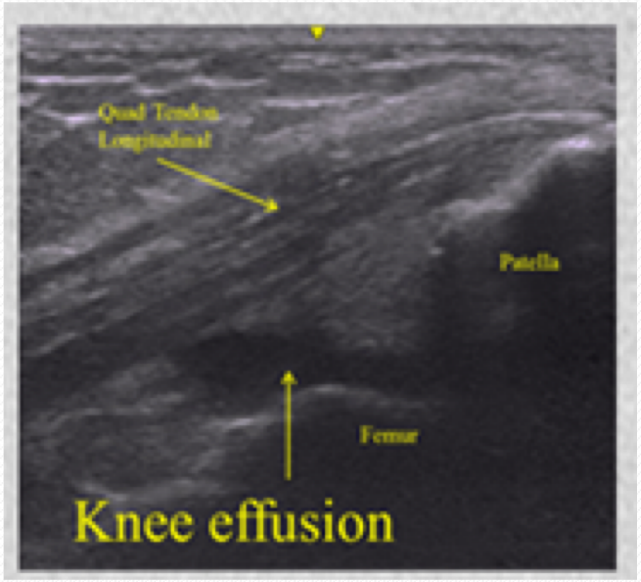
Case #5



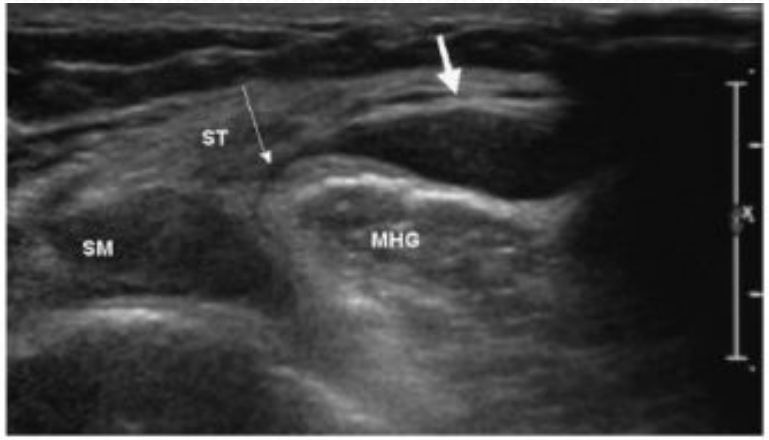
Knee

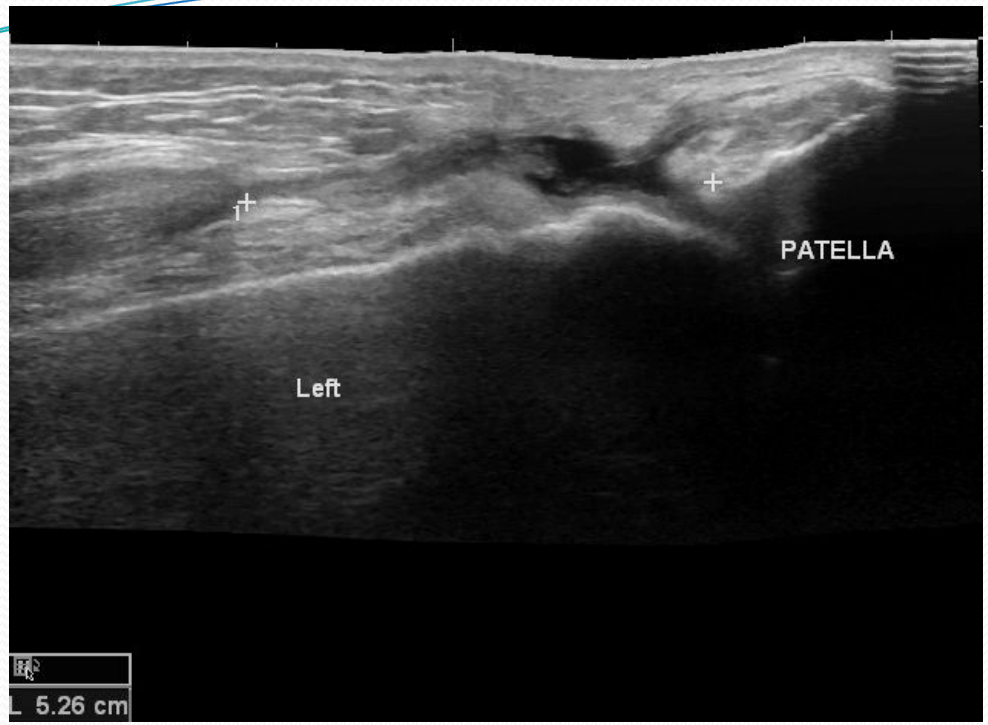
- Linear Probe 12 mHz
- Patient positioned with knee extended, can place pillow under knee if needed.



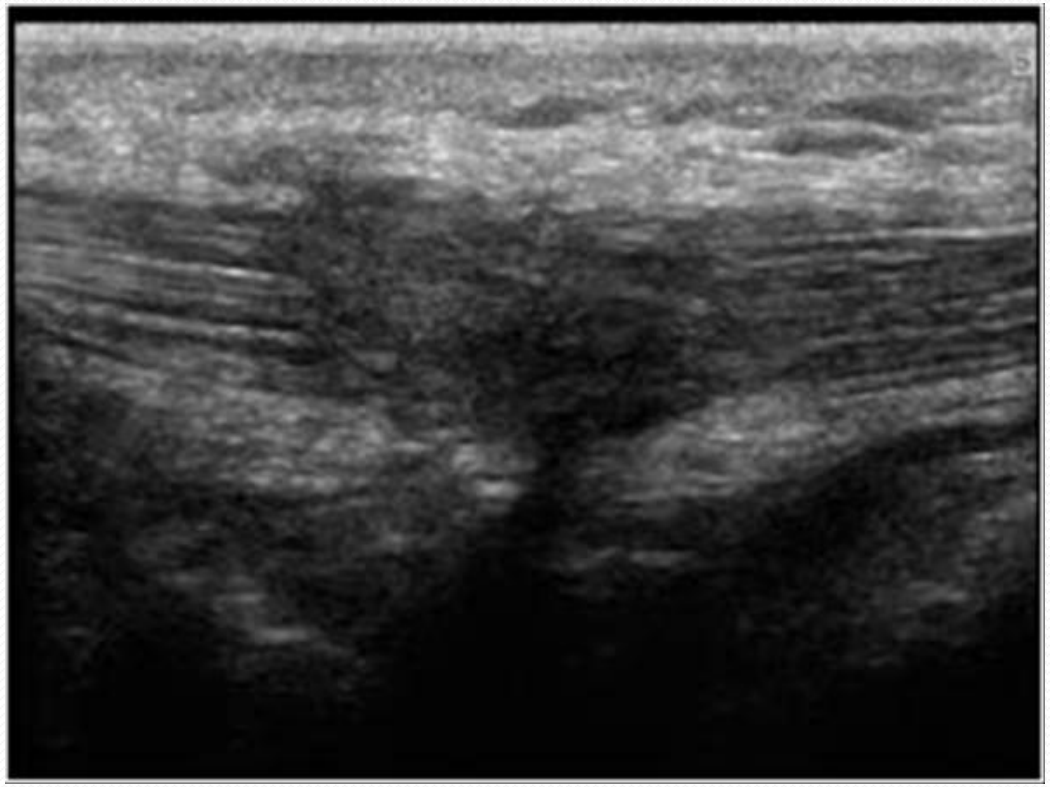


Bakers cyst posterior





Quad
tendon tear

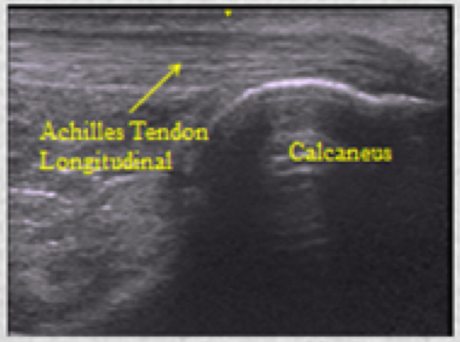


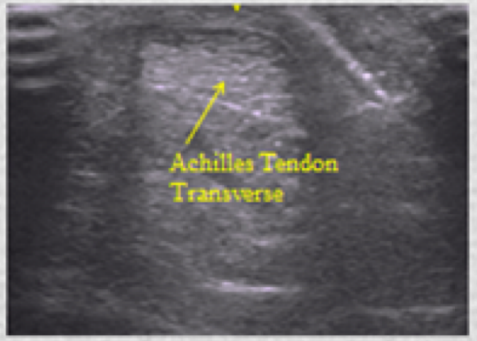
Patellar
tendon tear

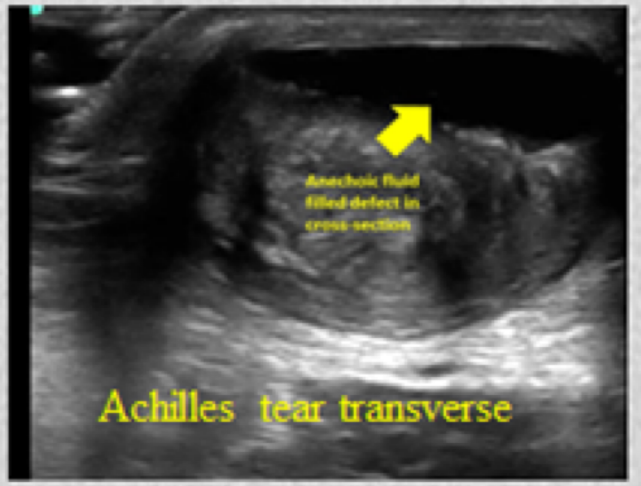
Case #6

Ankle/Achilles Tendon

- Linear probe 12mHz
- Patient positioned prone, ankle/foot propped up on pillow or hanging off end of exam table







Resources / Credits

- Daniels, Hoppmann. Practical Point of Care Medical Ultrasound
- Jacobson. Fundamentals of Musculoskeletal Ultrasound
- McNally. Practical Musculoskeletal Ultrasound
- Soni, Arntfield, Kory. Point of Care Ultrasound 2015
- AIUM guidelines, www.aium.org
- EDE 2 Course