Intro to Ultrasound - MSK

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Declarations

- COI
  - None
- Agency
  - none
- FDA indication deviation
  - None; these are *"radiation emitting devices"*
- Rules of engagement
  - Adult conversation

Uses, now and future

- "Stethoscope of the future"
  - Maybe…
- Answer a specific question
  - All good answers start with a good question.
    - Shock? Which type (tank, pump, pipes)?
    - Dead? Cardiac motion?
    - Pregnant? Where/wellbeing?
    - Access? Seeing is believing…and cannulating.
    - Fluid? Can I put a needle in there?
    - Inflated? Better than X-ray!

Objectives

- Basic physics
- Machine operation
- Probe (transducer) types
- Probe manipulation
- Obtaining an image
- Artifacts
- Reporting/exporting/admin (at session end)

Physics

- Sound wave sent, received (*trans*ducer)
  - Transducer sends briefly, listens long
- Time received - time sent = distance
- ∡ of incidence = ∡ of reflection*
  - Source of artifact (anisotropy)
- Reflection occurs at tissue-type interfaces
- Frequency: α data density, 1/α penetration*
  - Impacts probe selection

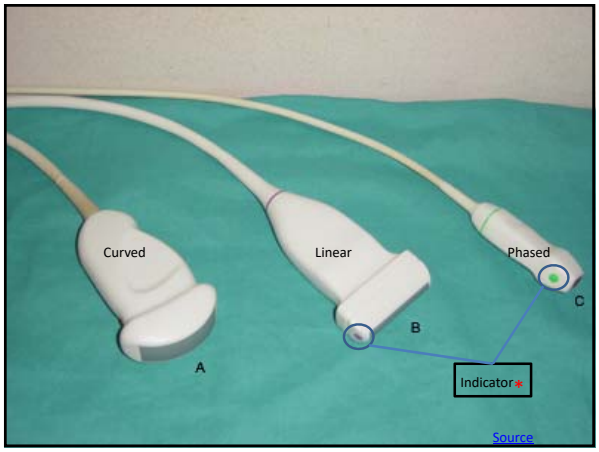
Machine operation

- Knobs ("knobology")
  - Gain
    - Does NOT change probe; adds "volume" to signal
  - Depth
    - Does NOT change probe
      - Instructs software to ignore signals after certain time interval
  - Doppler
    - Signal approaching = red, receding = blue (convention)
  - M-Mode, etc.

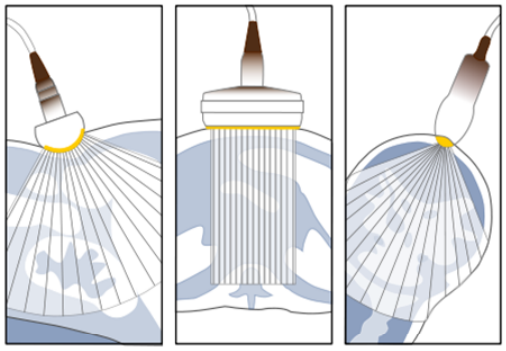
Probe types

- Curved array
  - Curved line source, higher frequency; abd. studies
- Linear array
  - Straight line, highest frequency; vascular, MSK
- Phased array
  - Point source, lower frequency, greater penetration
  - Trauma workhorse, cardio (fast response)

- Etc……..



Beam/inquiry patterns



Curved Linear Phased Source

Probe manipulation

- Probe marker orientation
  - Indicates location of specific beam
- Probe indicator positioning
  - Radiology convention: "Right hand generator rule"
  - Cardiology convention: "Left hand motor rule"
- Plane terminology:
  - Near field, far field
  - Leading edge, receding edge

You must think in 2D/plane terms!!

Probe manipulation

- This is important!
- **Fan** = tilt at same contact point
- **Sweep** = move into new plane
- **Slide** = move to extend same plane to side
- **Rock** = tilt to extend plane side to side
- **Rotate** = precise turn about central axis
- PRACTICE!

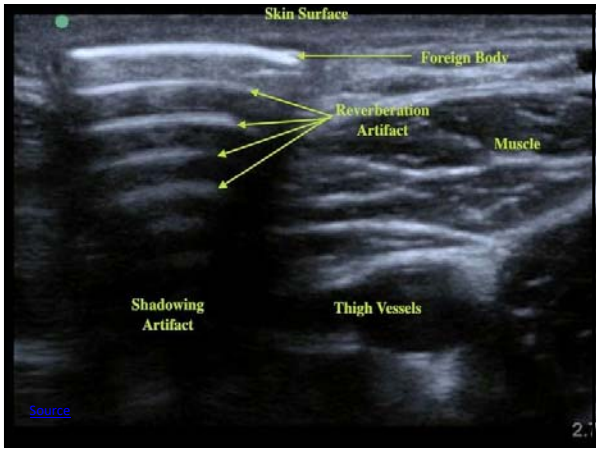
Obtaining an image

"Chance favors the prepared mind." -Pasteur

- Mental preparation
  - What's your question? What is relevant anatomy?
- Select most appropriate probe
- Apply gel (Benzoni's rule: more gel)
- Manipulate probe
- Freeze or cine?

Artifacts

- Origins: timing, scatter, energy
- Timing creates reverb
  - Look for frequency/repetition effects
- Anisotropy
  - Beam scatter; look from several angles
- Energy absorption
  - Augmentation
  - Shadowing



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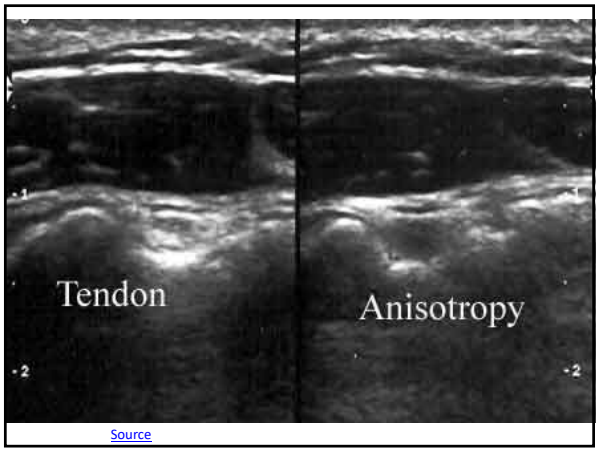

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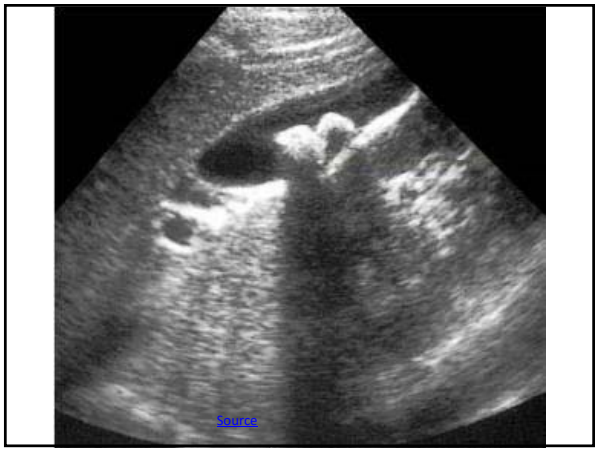

Resources

- Ohio State University – everything you need.
- U Virginia Medical U/S curriculum
- M-Turbo user manual
- Vascular access
  (Yes, nurses are doing this.)
- Dawson/Mallen
  – Special ACEP offering; superb iBook.
- Who can order a test? (CMS)
- AFP: POCUS in Family Medicine