

# Intro to Ultrasound - MSK

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DMU-COM

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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

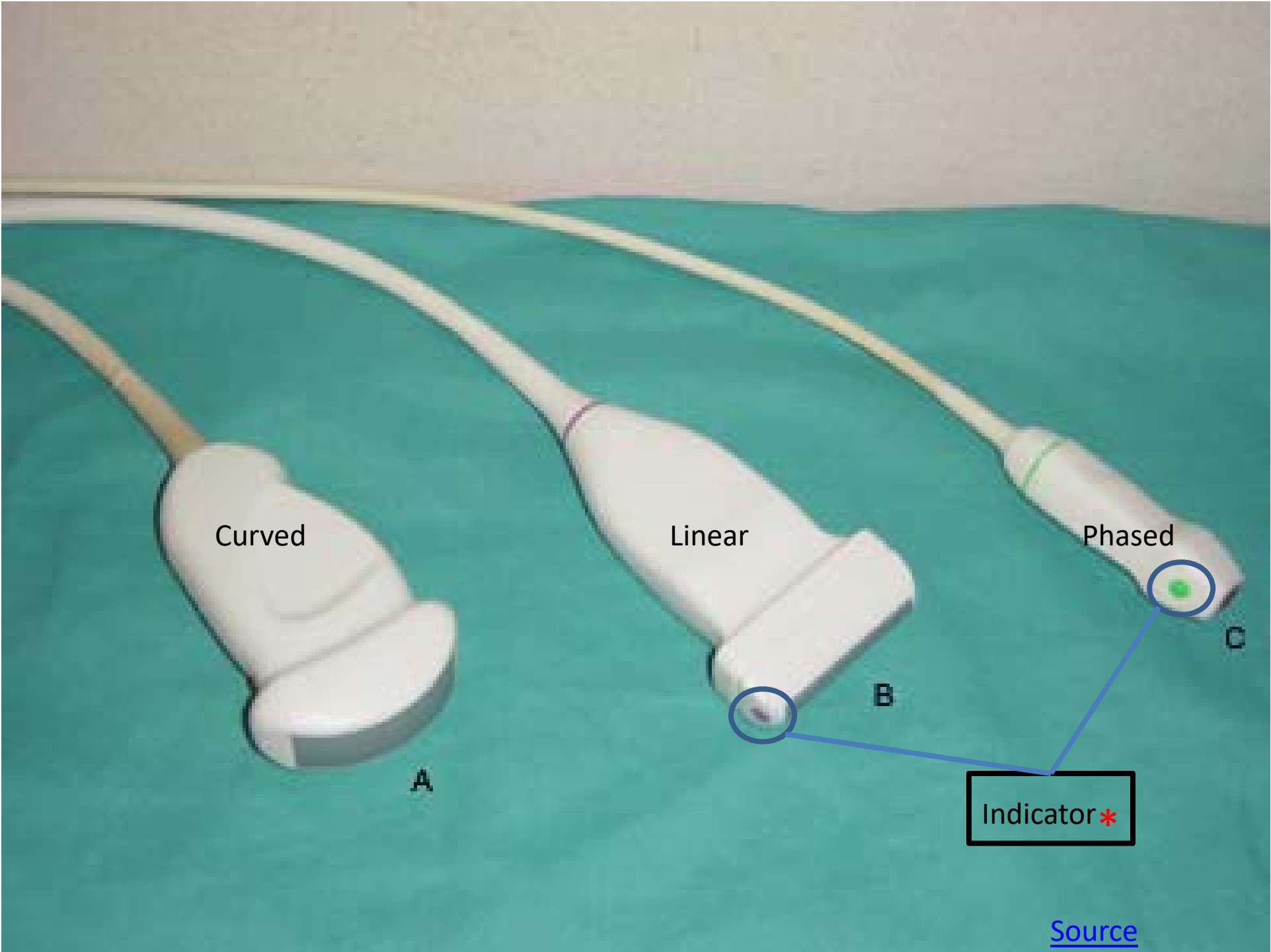
- Sound wave sent, received (*transducer*)
  - Transducer sends briefly, listens long
- Time received - time sent = distance
- $\angle$  of incidence =  $\angle$  of reflection\*
- Source of artifact (anisotropy)
- Reflection occurs at tissue-type interfaces
- Frequency:  $\alpha$  data density,  $1/\alpha$  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.....



Curved

Linear

Phased

A

B

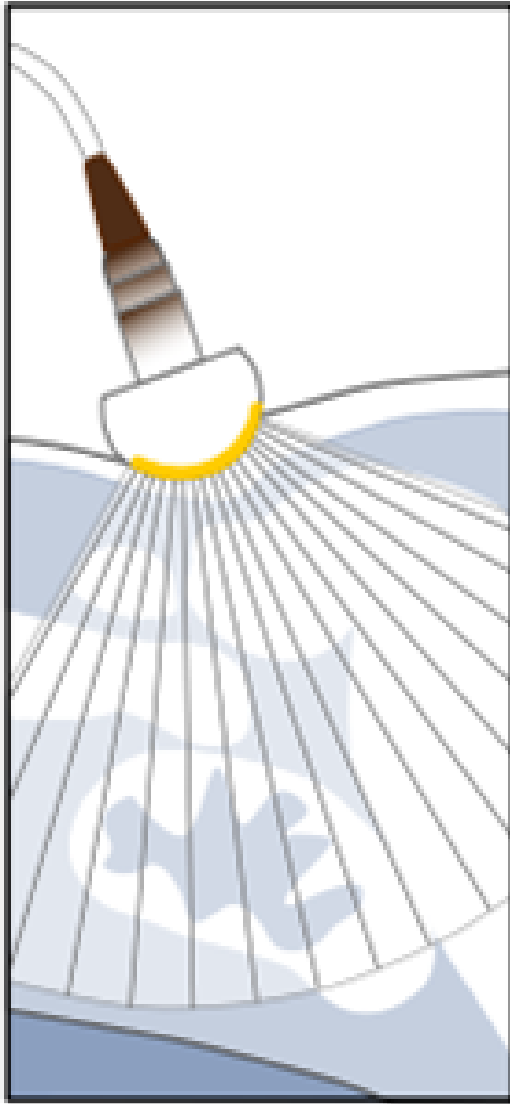
C

Indicator\*

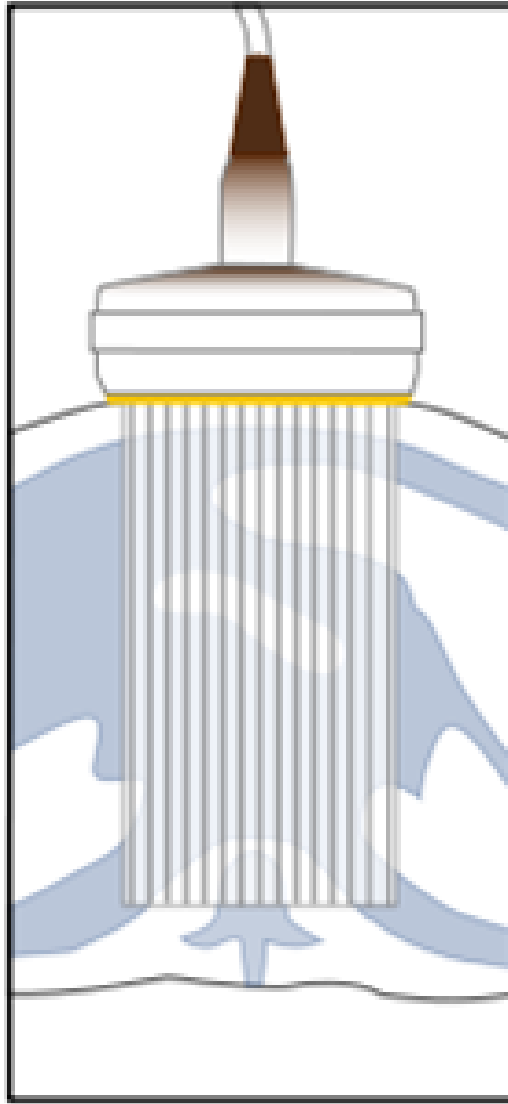
Source



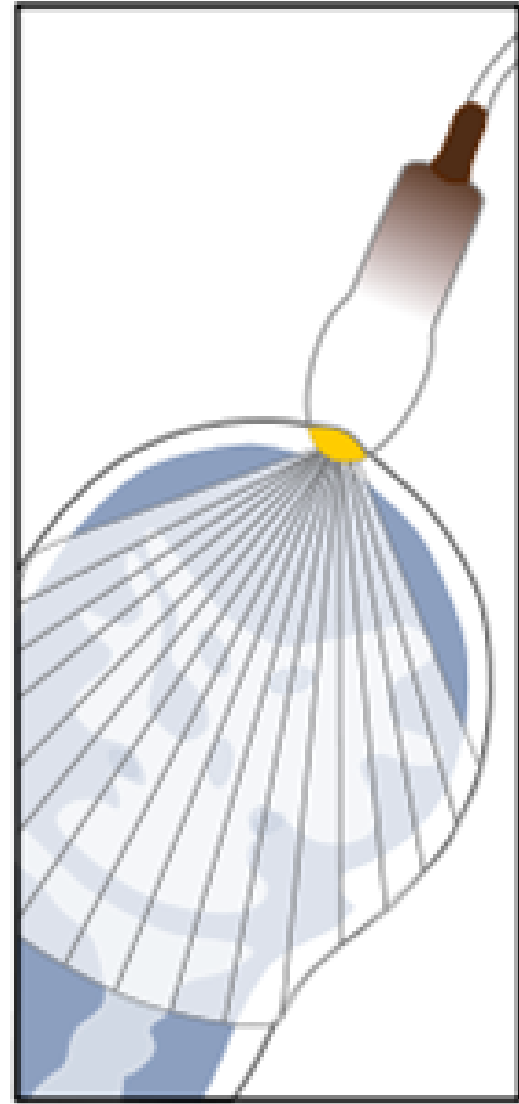
# Beam/inquiry patterns



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!

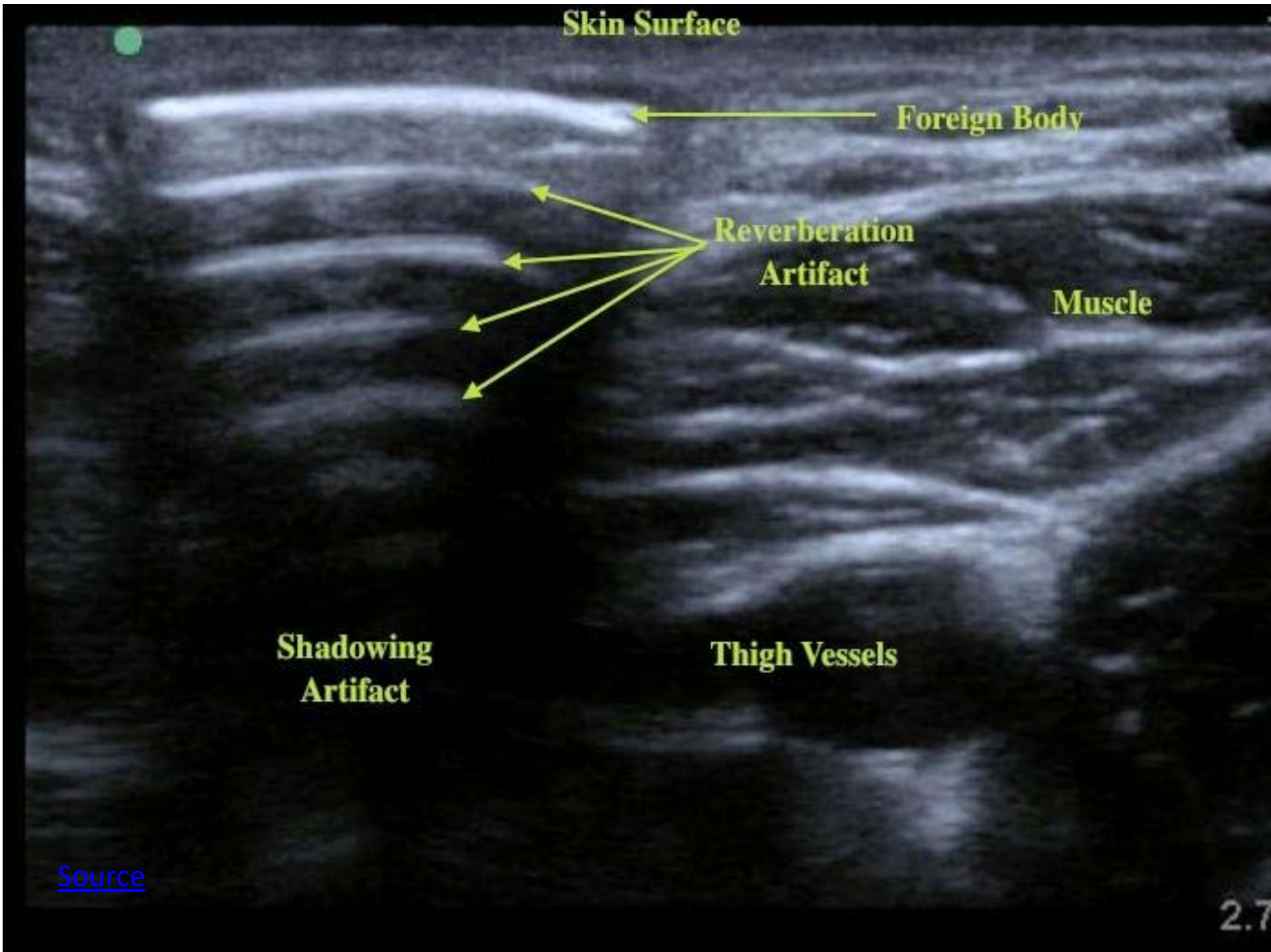
# Obtaining an image

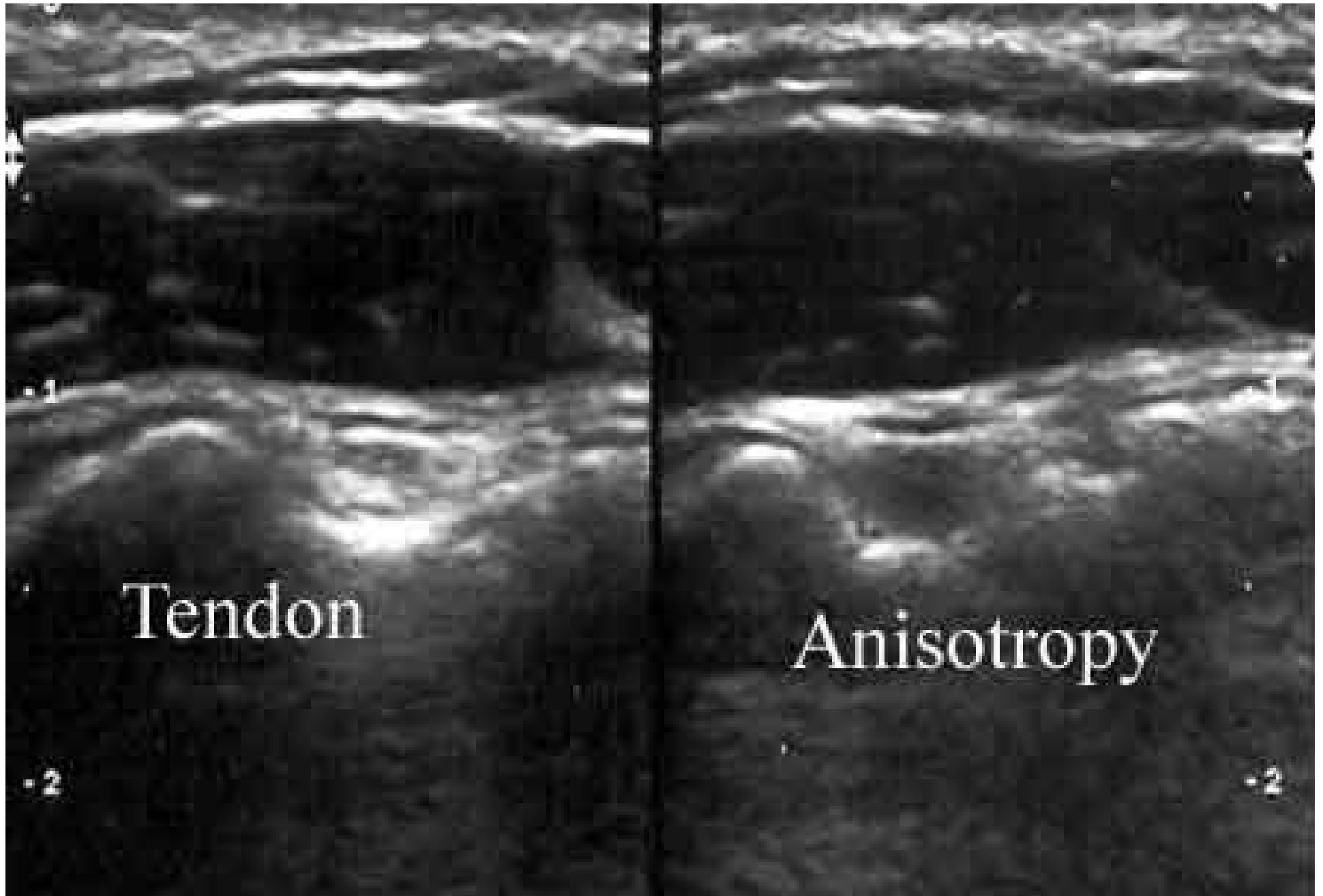
“Chance favors the prepared mind.” -Pasteur

- 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





[Source](#)

SONOACE  
X4

OB | FPS 25D | 10.0cm | MI 0.8  
C3-7ED | HGen. | TIs 0.3

**CINE**

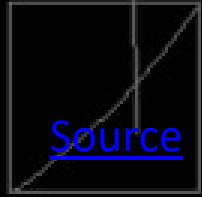
#255

M

[2D] G48 / P100  
86dB / FA6  
FSI2 / PGC0



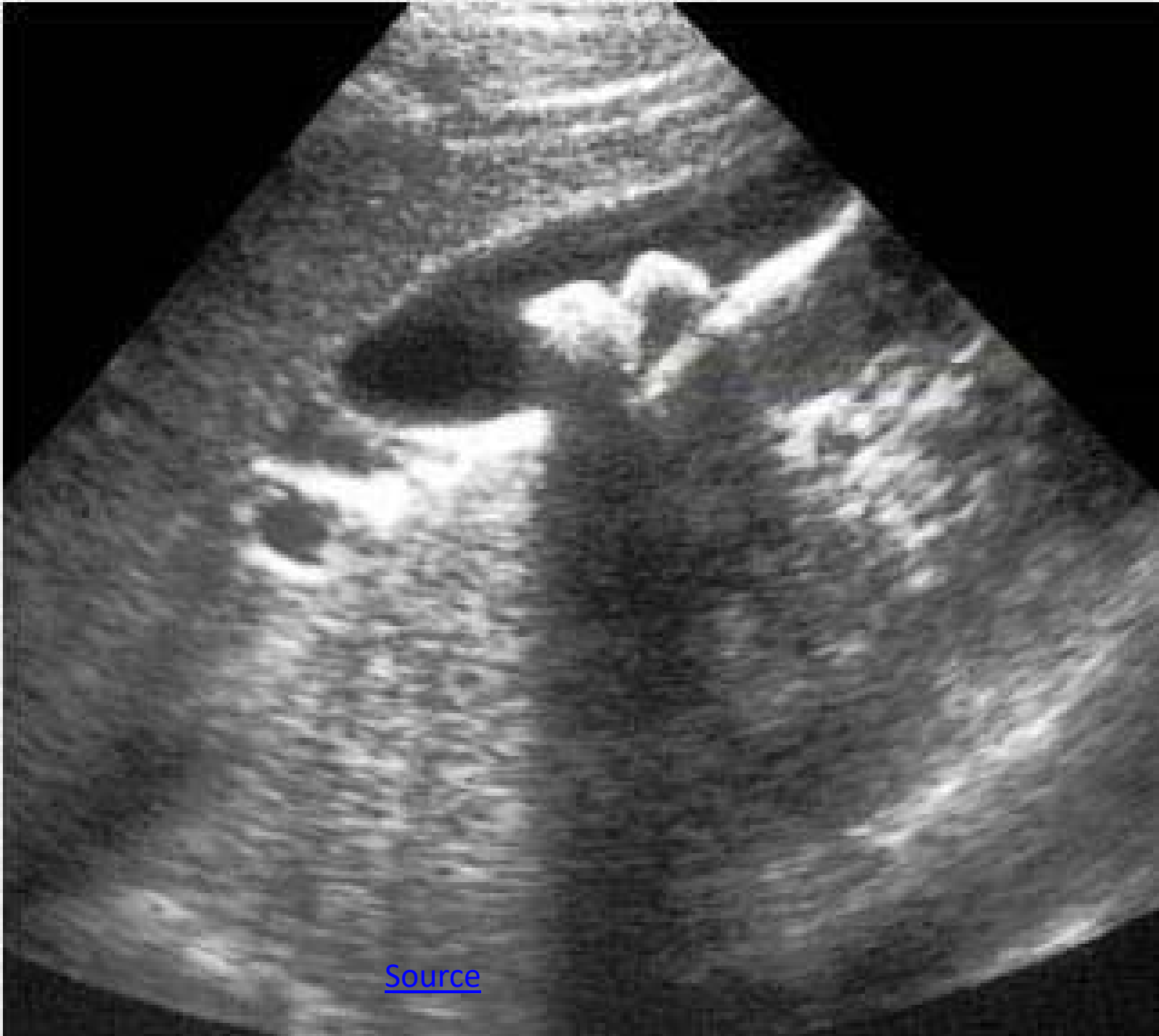
0—  
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5—  
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—  
10—



2D

|   |          |   |          |   |            |   |          |   |  |
|---|----------|---|----------|---|------------|---|----------|---|--|
| 1 | Auto Run | 2 | One/Loop | 3 | Start Cine | 4 | End Cine | 5 |  |
|---|----------|---|----------|---|------------|---|----------|---|--|





[Source](#)

# 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](#)