Cardiac and Pulmonary Ultrasound

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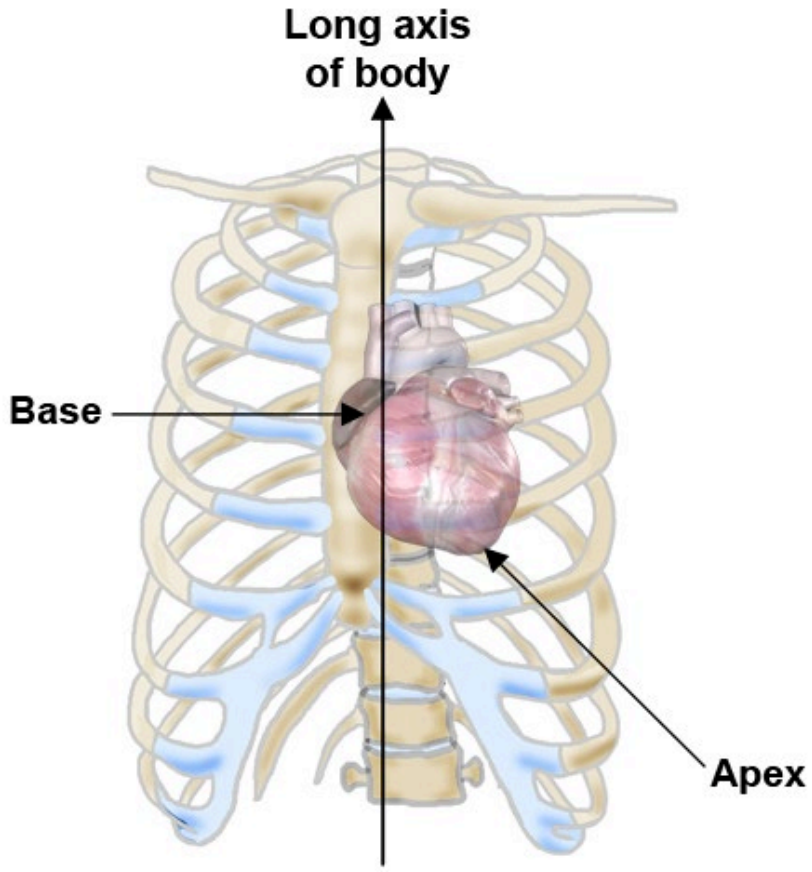
Getting Started

- What anatomic structure is being scanned?
- Which probe should be used?
- Where should the probe be placed?
- Does depth need to be adjusted?
- Does gain need to be adjusted?

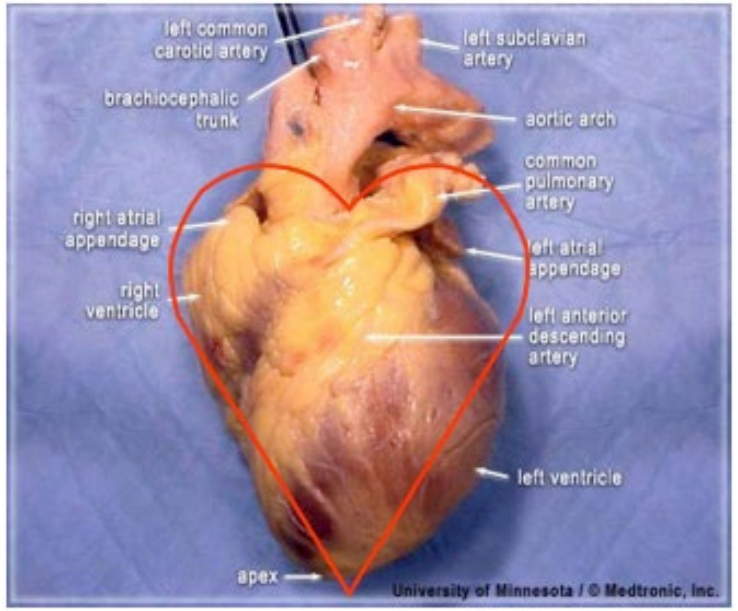
Cardiac Anatomy

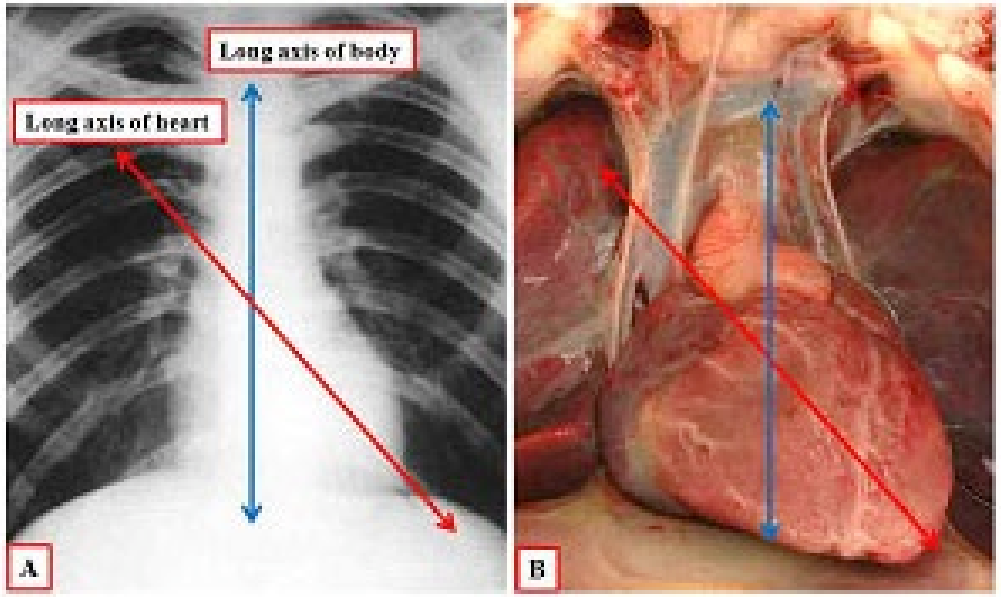
- The normal heart sits behind the sternum and within the left chest
- Base is anchored by the great vessels:
  - Aorta
  - Superior vena cava
  - Main pulmonary artery
- Apex consists mainly of the LV and some RV



Cardiac Plane

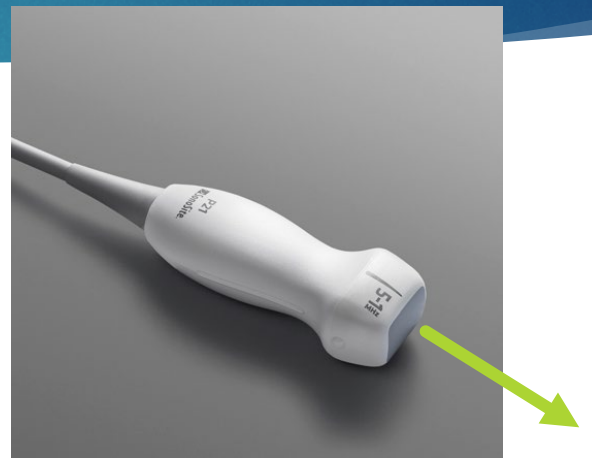
- Incorrect orientation is in the "valentine position" where the heart sits on its apex
- Apex of the heart points inferiorly and to the left with the long axis of the heart angulated off from the long axis of the body





Cardiac Scanning Technique

- Probe Selection
  - Phased array ("cardiac probe")
  - Curvilinear (option for subxiphoid and IVC)



- Patient positioning
  - Supine: Subxiphoid
  - Semi-recumbent or left lateral decubitus: Parasternal views
  - Left lateral decubitus: Apical

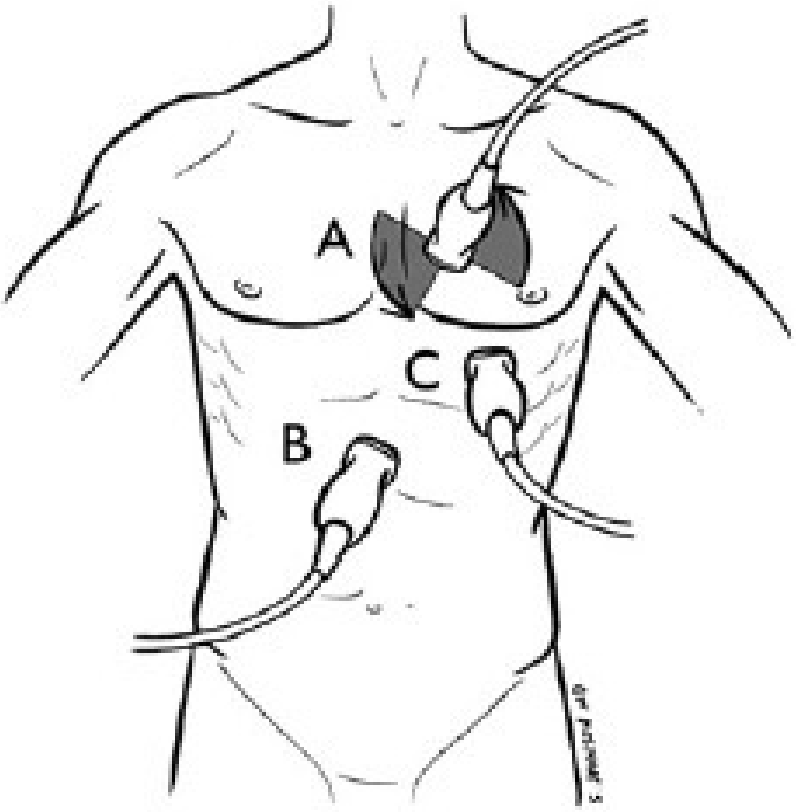
Cardiac Views

- 1. Subxiphoid
- 2. Parasternal Long
- 3. Parasternal Short
- 4. Apical 4-Chamber

A) Parasternal Views
Long / Short Axis

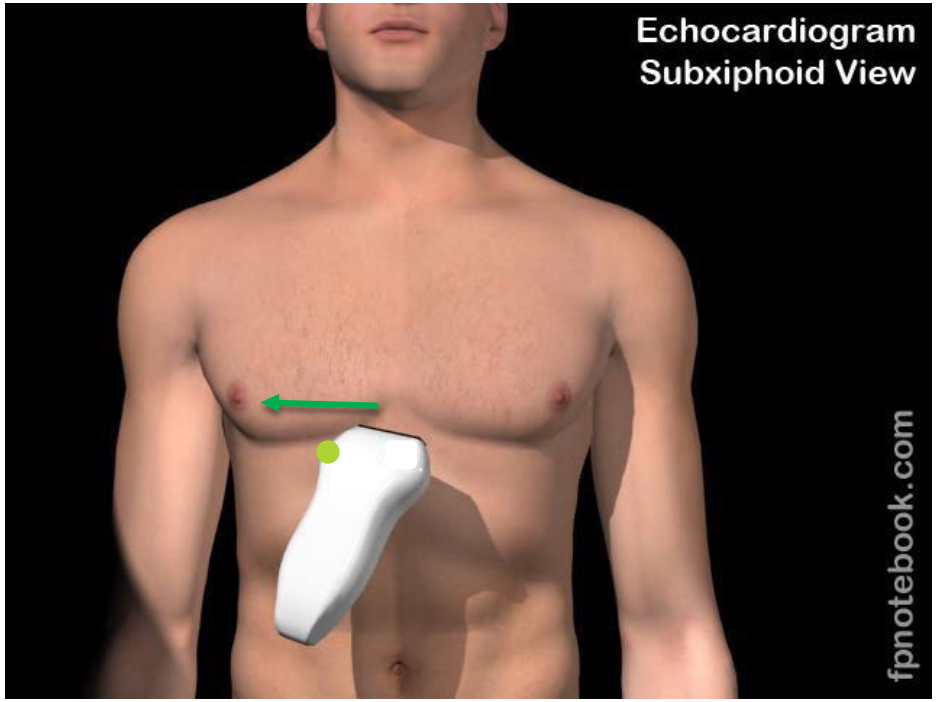
B) Subxiphoid View

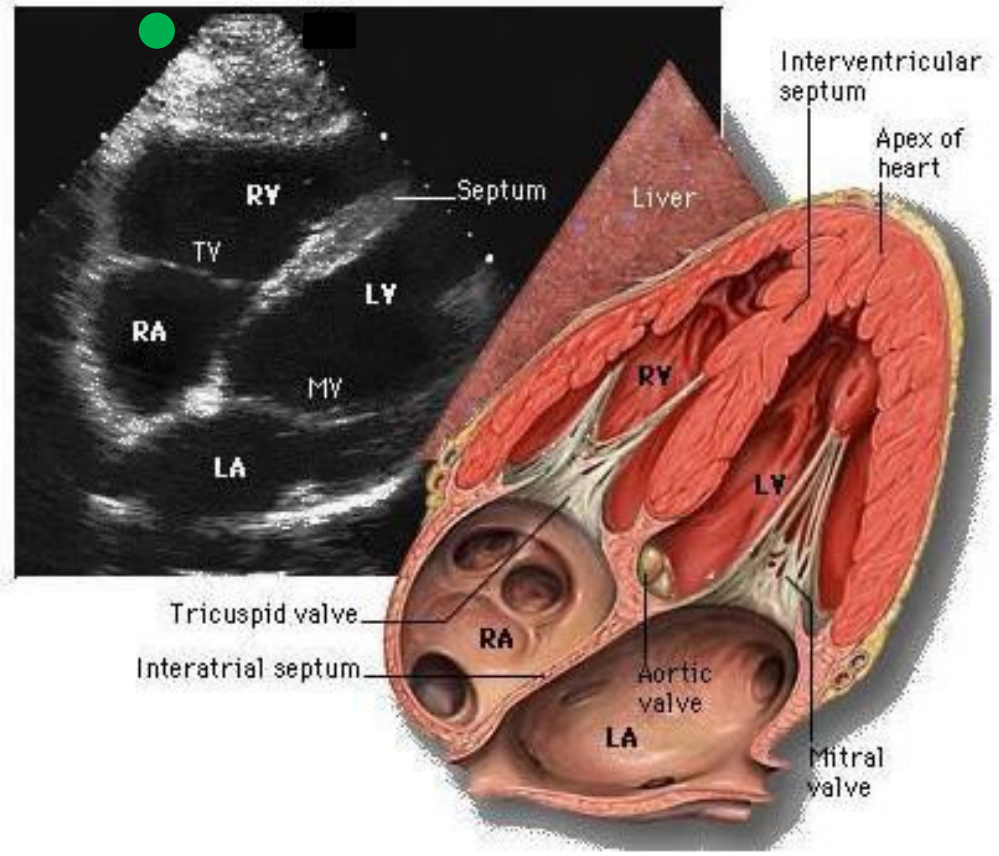
C) Apical View



Subxiphoid Window

- Inferior to xiphoid process, angle towards head
- Transducer marker to patient's right

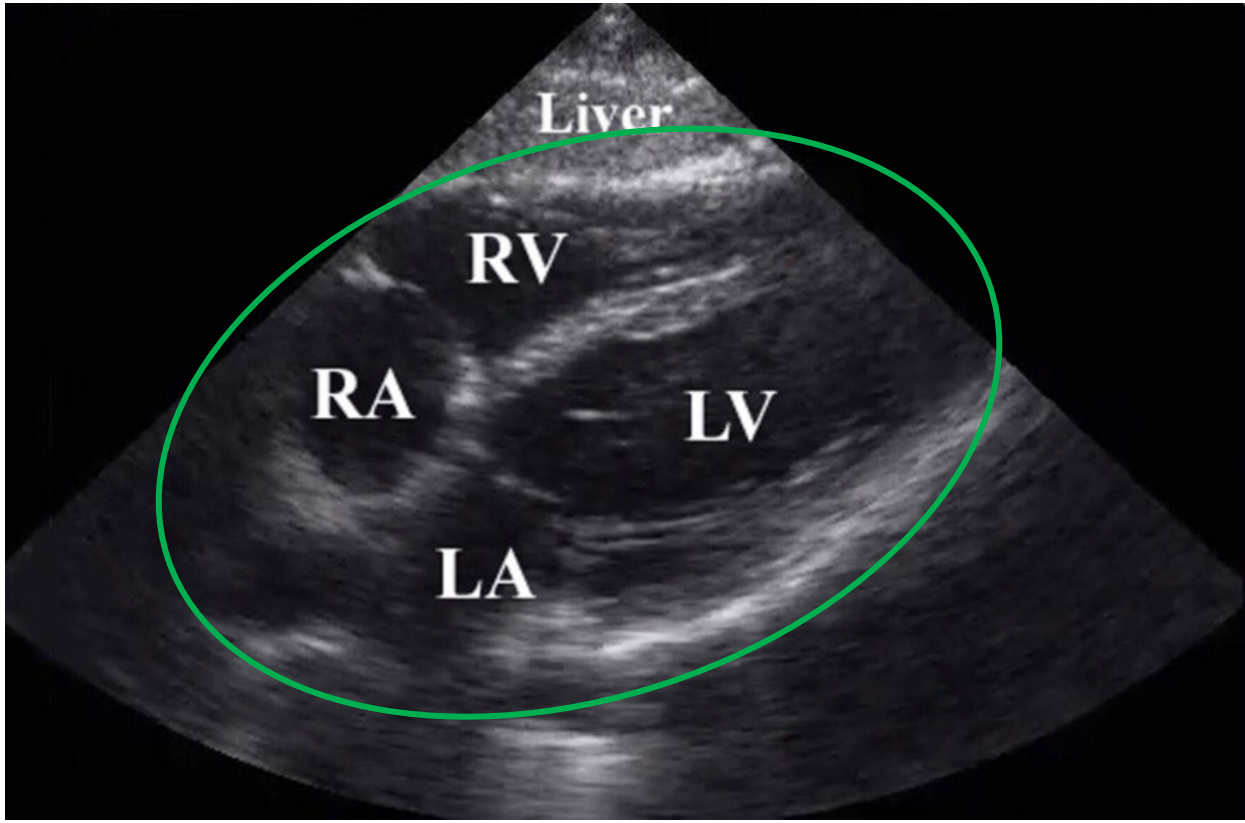




Subxiphoid View Scanning Tips

- Hold the probe like a computer mouse, allowing downward pressure with index and middle fingers
- Use the liver (a solid organ) as an "acoustic window" to avoid the stomach and poor visualization from air/gas
- Having the patient take and hold a deep breath in lowers the heart towards the probe, improving visualization

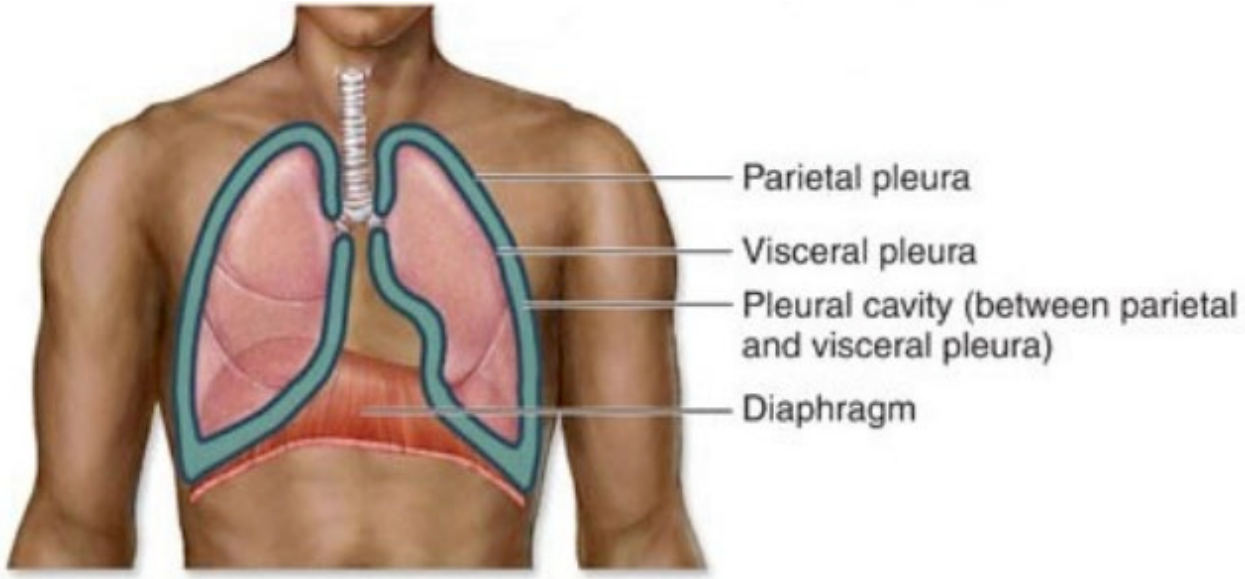
Subxiphoid Standard Image



Subxiphoid View in Motion

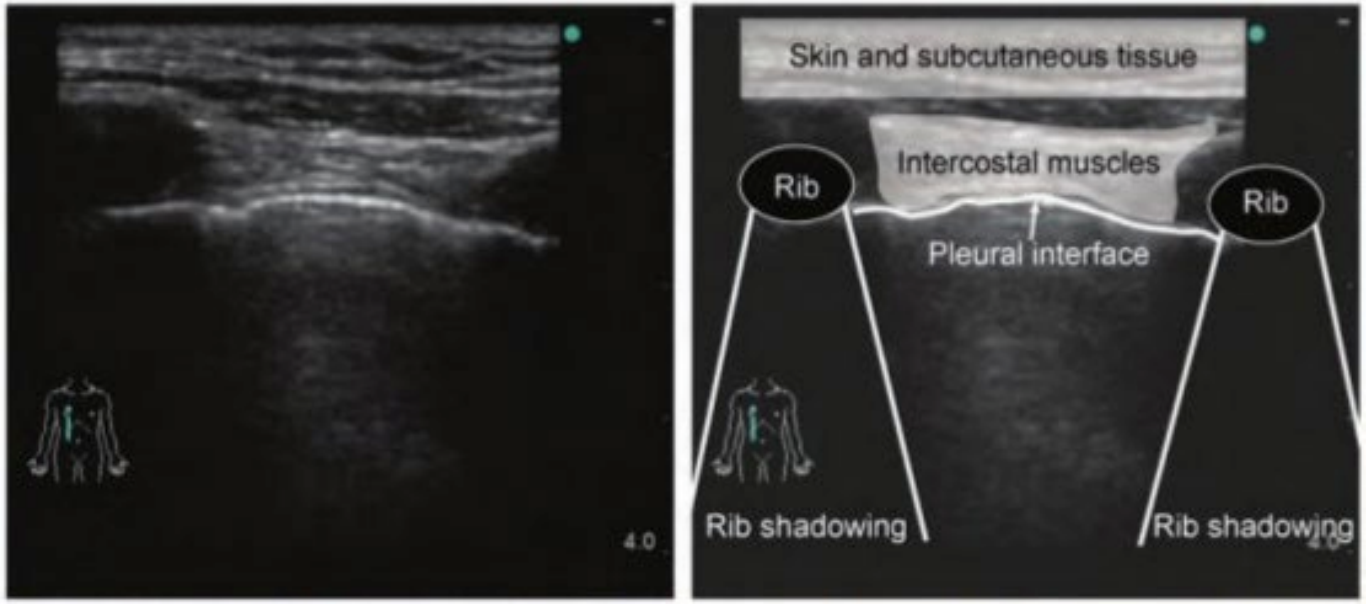
Lung Anatomy

- Lung is surrounded a double-layered membrane – "Pleural membrane"
  - Parietal pleura: outer layer lining the thoracic cavity and upper surface of the diaphragm
  - Visceral pleura: inner layer towards the lung surface



Lungs on Ultrasound

- As normal lungs are air-filled, the acquired image will not be of the lung itself
- Everything seen on lung ultrasound will be an artifact
- Evidence of "lung slide" is cause by the movement of the parietal and visceral pleura across each other during respiration



Lung Scanning Technique

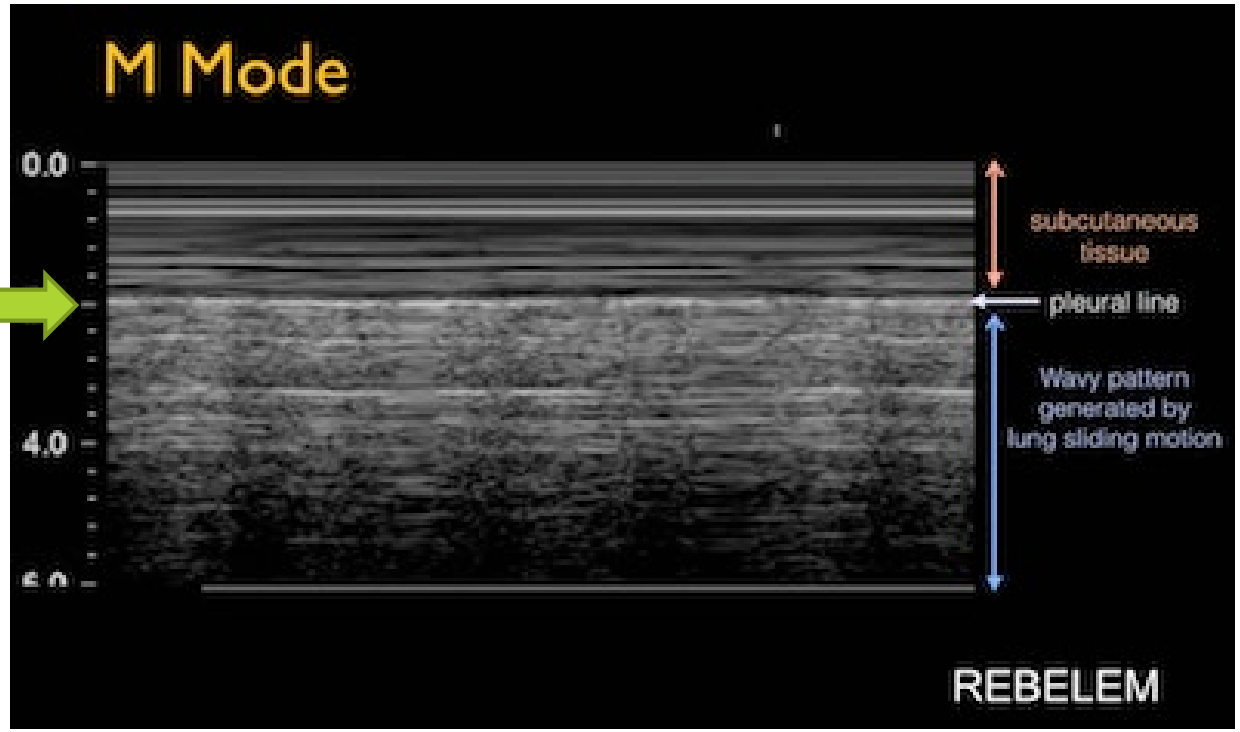
- Probe selection
  - Linear: allows for closer assessment of the pleural line
  - Curvilinear: allows broader assessment of the lung parenchyma
- Patient position
  - Semi-recumbent
- Probe placement
  - Longitudinal orientation
  - Mid-clavicular line in 2nd to 3rd intercostal space
  - Slide the probe caudally several rib spaces to the diaphragm

Pulmonary Ultrasound Image

- Subcutaneous tissue and intercostal muscles
- Ribs:
  - Hyperechoic rim with posterior shadowing
- Pleural line:
  - Hyperechoic line connecting between the ribs
  - The “lung slide” appears as ”ants marching” or shimmering along the pleural line

M-Mode

- Motion mode
  - Detects motion at a specific line across time
- Normal lung will create a “sea-shore sign”
- The transition between the “sea” and “shore” is where sliding is detected at the pleural line in M-mode (Green Arrow)



Quiz

Questions?

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