Lung Ultrasound

UTSW POCUS Course

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Outline

- History of lung (pleural) ultrasound
- Lung ultrasound technique
- Lung ultrasound patterns (mostly of artifacts)
  - Lung sliding
  - A-lines
  - Interstitial pattern (B-lines)
  - Pleural effusions
- Lung ultrasound protocols

History of Lung Ultrasound

- Historically thought to be of low utility because ultrasound waves don’t propagate through air
- Use first widely described in 1993 (Lichtenstein *Intensive Care Med*)
  - Description of artifacts generated by pleural surface
- Currently gold standard for management of pleural disease, but other uses remain less well adopted

Lung Ultrasound Technique – Probes

- Typically start with phased array (cardiac) probe
- Low frequency = deeper field of view
- Small footprint fits between rib spaces better than curvilinear

Lung Ultrasound Technique – Probes

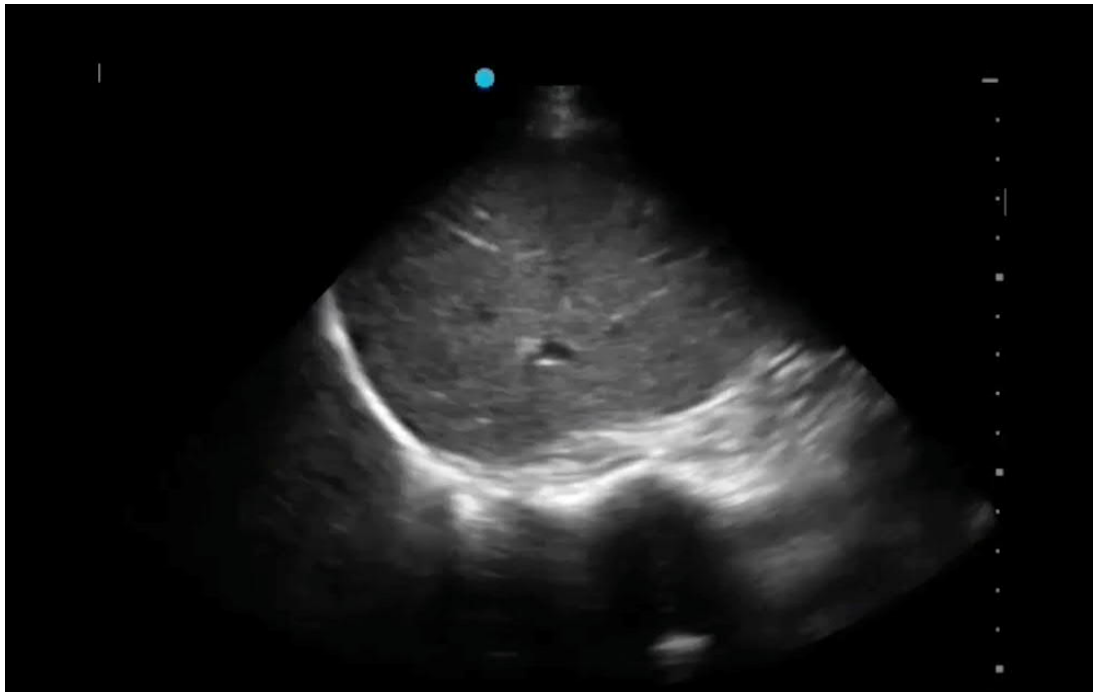
- Linear probe can also be useful
- Higher frequency = higher resolution image of shallower structures (e.g. pleural line)
- Wider linear probes allow visualization to include rib shadows for context

Lung Ultrasound Technique – Orientation

Soni *Point-of-Care Ultrasound* (2nd Edition)

- Radiology convention – dot at upper left of screen
- Image in long axis – dot towards patient's head
  - Left side of screen cephalad
- Abdominal or lung preset

Lung Ultrasound Technique – Orientation



Soni *Point-of-Care Ultrasound* (2nd Edition)

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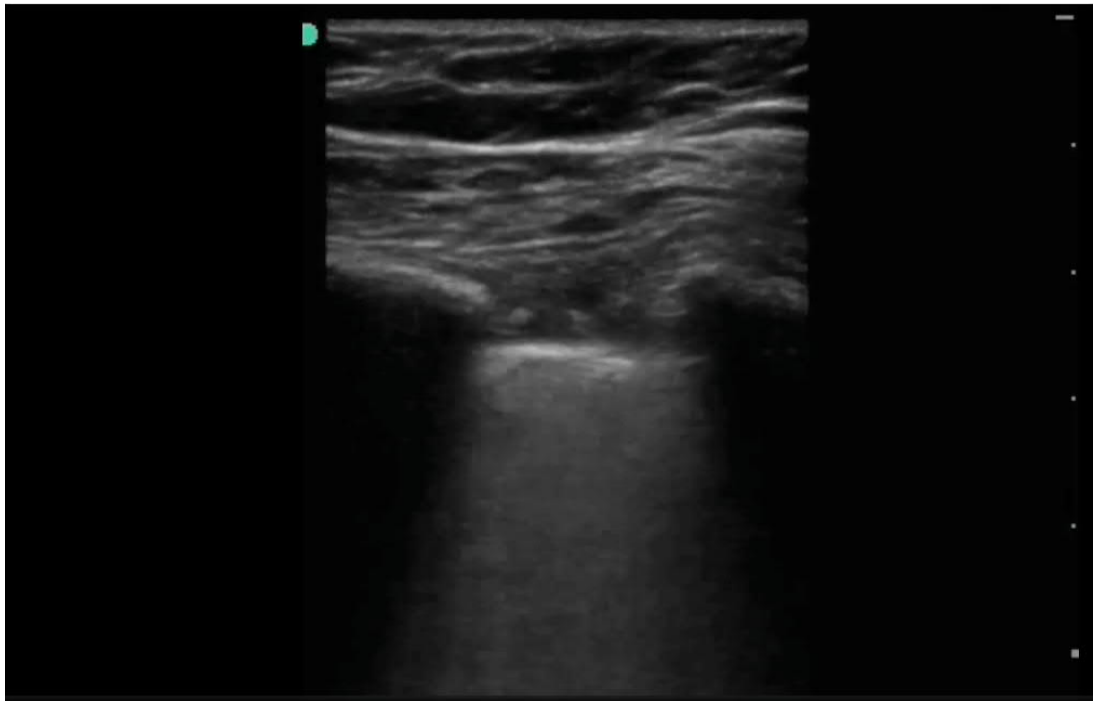
  - Left side of screen cephalad
- Abdominal or lung preset
- Start at diaphragm – characteristic

Lung Ultrasound Patterns of Artifacts

- Lung sliding – yes or no
- Distal pattern
  - A-lines
  - B-lines
  - Consolidation
- Pleural effusion

- Normal = A-lines and lung sliding
- Pneumothorax = A-lines and no lung sliding, maybe lung point
- Interstitial pattern = B-lines
- Consolidation +/- effusion
- Non-diagnostic pattern

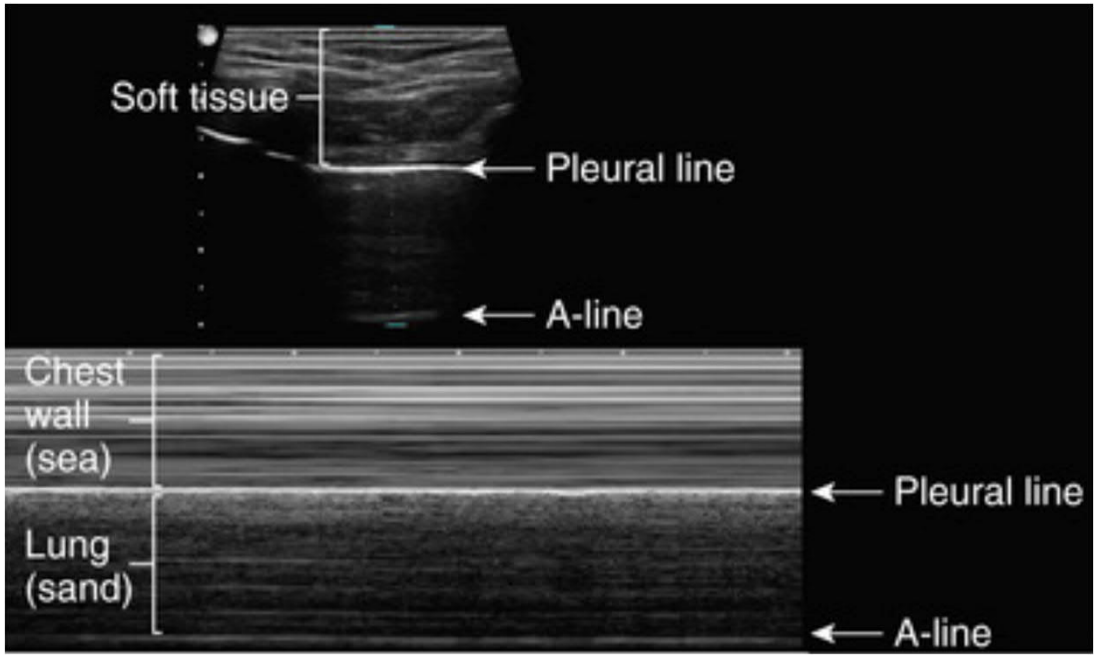
Lung Ultrasound Patterns – Lung Sliding



Soni *Point-of-Care Ultrasound* (2nd Edition)

- Visualization of visceral and parietal pleura sliding
- Excludes pneumothorax at site
  - Image most non-dependent area
  - Not specific for pneumothorax (unless lung point)
- Lung pulse similar significance
- Phased array or linear

Lung Ultrasound Patterns – Lung Sliding



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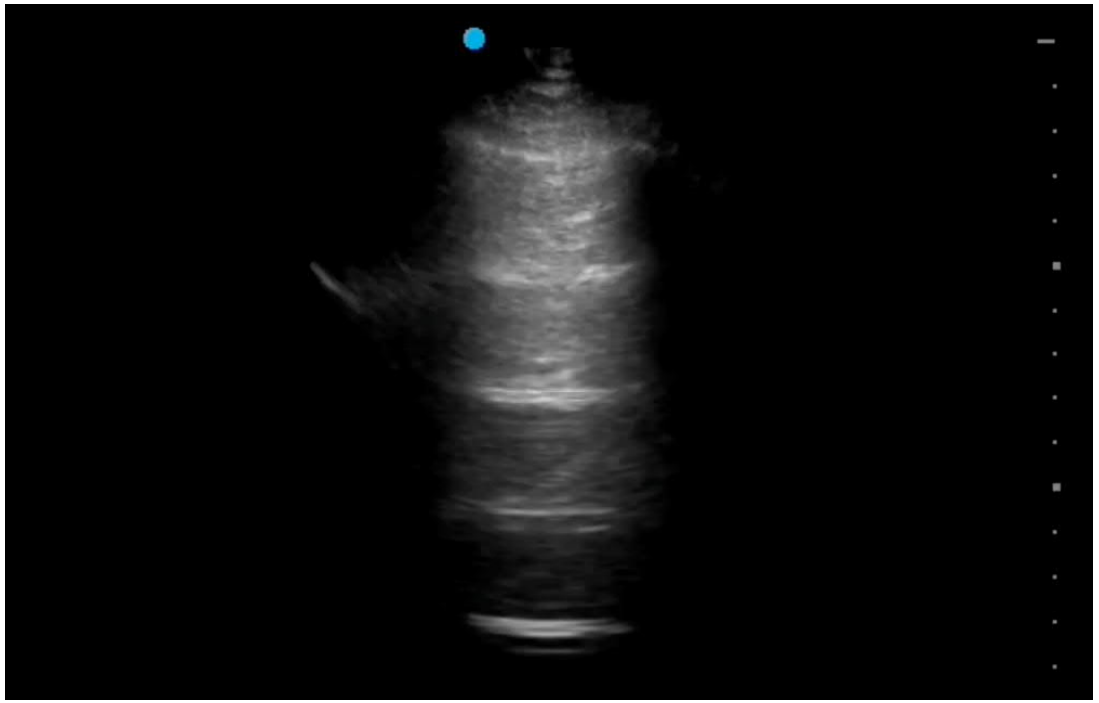
Lung Ultrasound Patterns – A-lines



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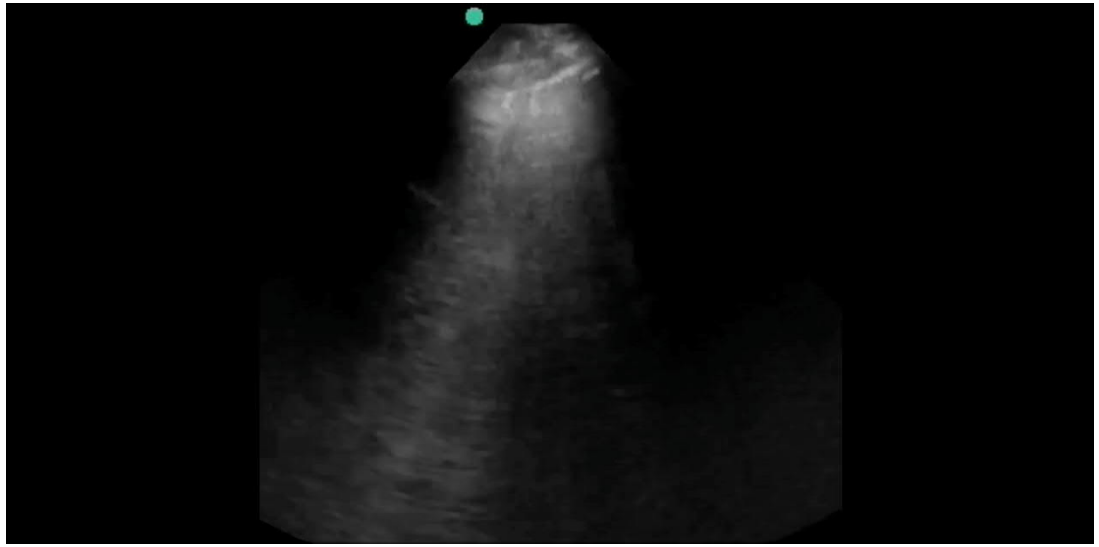
- Reverberation artifact
- Require probe to be perpendicular to pleural surface
- Occur at integral multiples of distance from probe to pleural line
- Become fainter with distance
- Occur in normal and abnormal

Lung Ultrasound Patterns – B-lines



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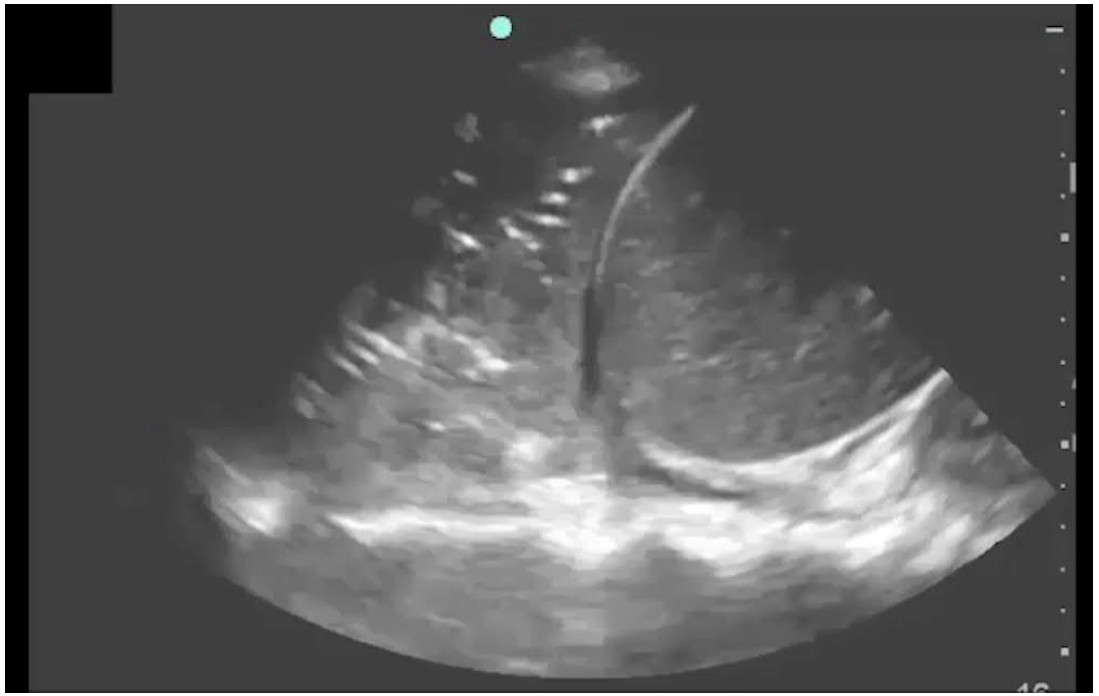
- Increase in thickness of interlobular septa (fluid, ILD)
- Must meet criteria:
  - Hyperechoic ray-like
  - Arise at pleural line
  - Obliterate A-lines
  - Extend to edge of field
  - Move with lung sliding
- Occasional B-lines not pathologic (fissures or bases)

Lung Ultrasound Patterns – Consolidation



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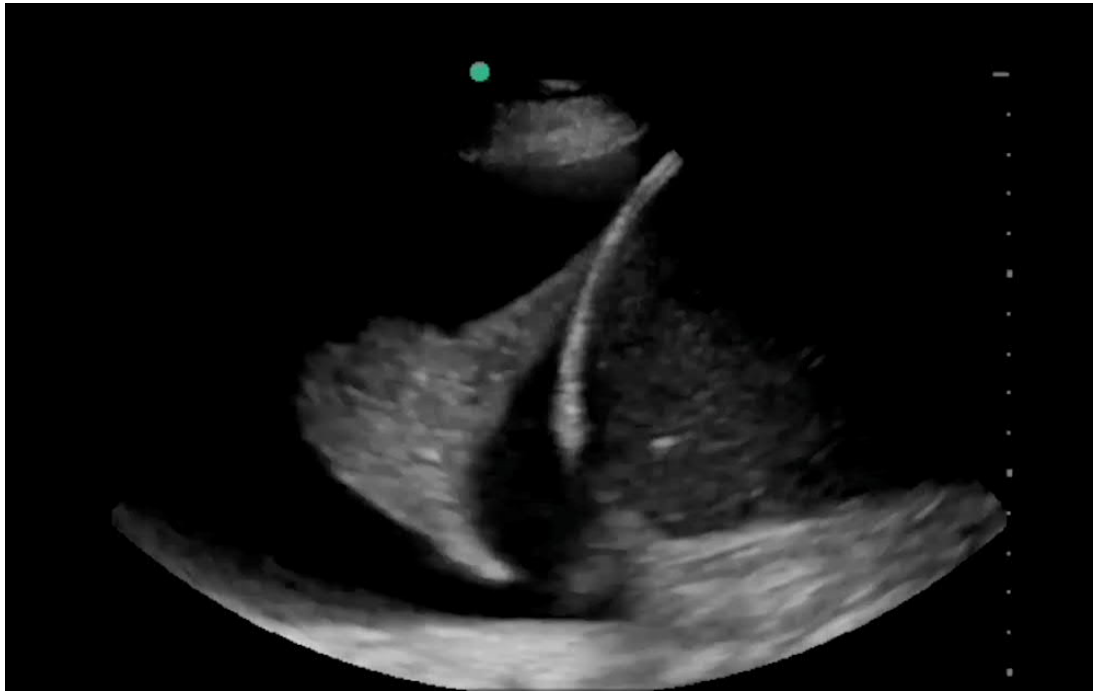
- Pneumonia or atelectasis
- Loss of air leads to ability to visualize
- Echogenicity similar to liver (hepatization)
- Dynamic air bronchograms suggest pneumonia

Lung Ultrasound Patterns – Pleural Effusion



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- Anechoic space, confirm boundaries:
  - Chest wall
  - Diaphragm
  - Lung
  - Pericardium (if on left)
- Ultrasound detects smaller effusions (>100 mL) than CXR
- Ultrasound better than CT at detecting septations

Lung Ultrasound Protocols

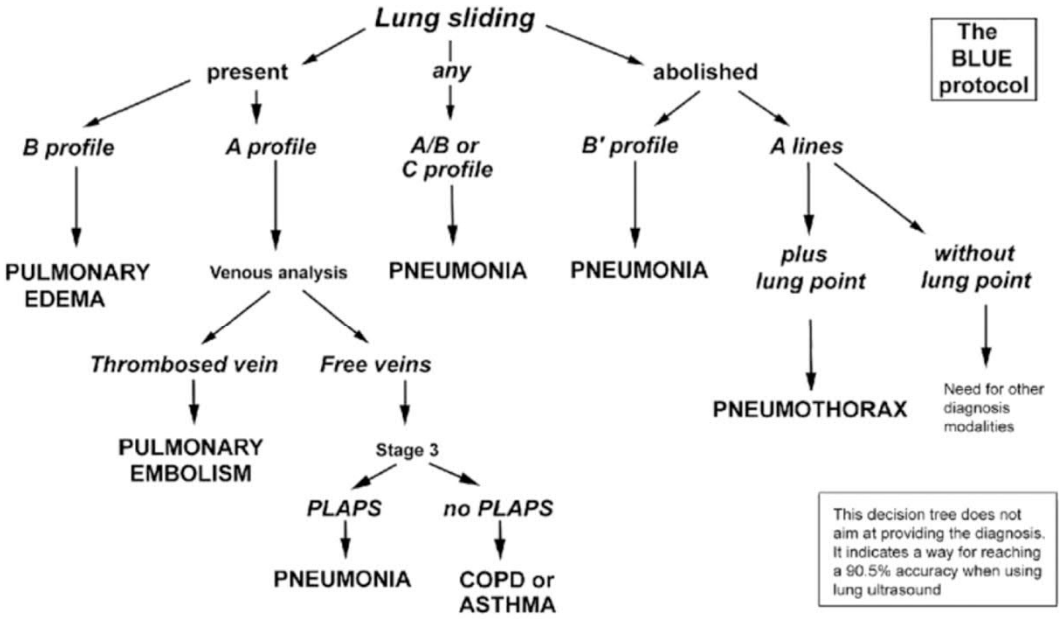
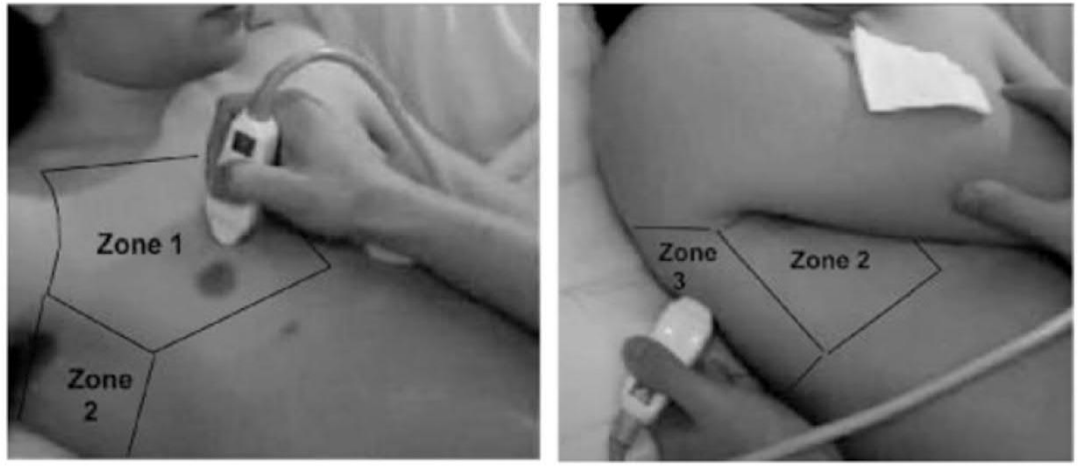


FIGURE 7. A decision tree utilizing lung ultrasonography to guide diagnosis of severe dyspnea.

- BLUE protocol (Lichtenstein *Chest* 2008)
  - Lung sliding
  - A-lines/B-lines/consolidation
  - DVT study
- Reported accuracy of 90.5% for diagnosis of: pulmonary edema, COPD/asthma, PE, pneumothorax, pneumonia

Lung Ultrasound Protocols

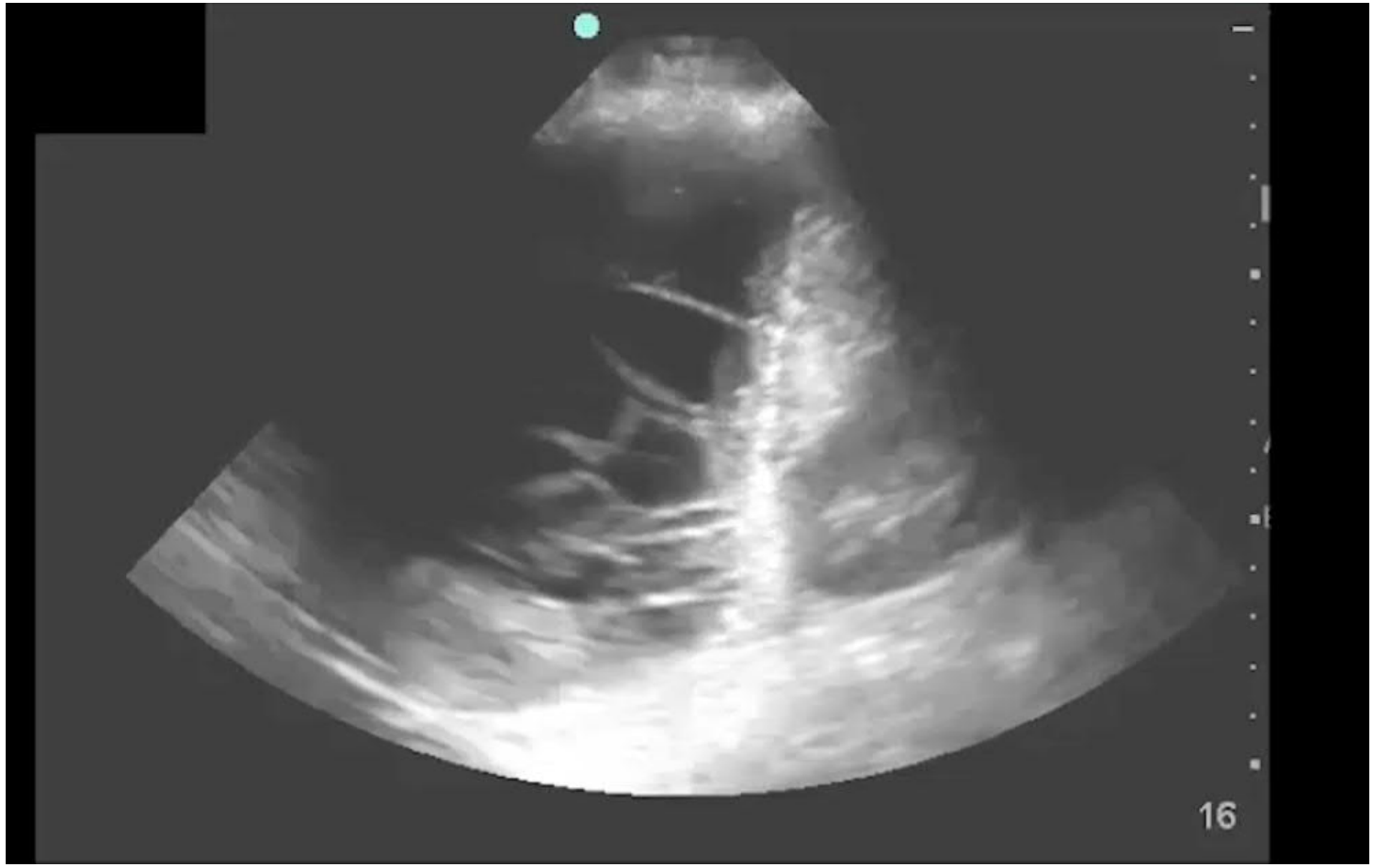


Lichtenstein *Chest* 2008

- Number of spaces to image?
  - 3-16 per hemithorax studied
  - May depend on degree of suspicion
  - At least three per side
    - Anterior upper chest (upper lobe)
    - Lateral lower chest (middle lobe)
    - Posterior lower chest (lower lobe) or posterolateral alveolar and/or pleural syndrome

Questions?

Complex Pleural Effusion



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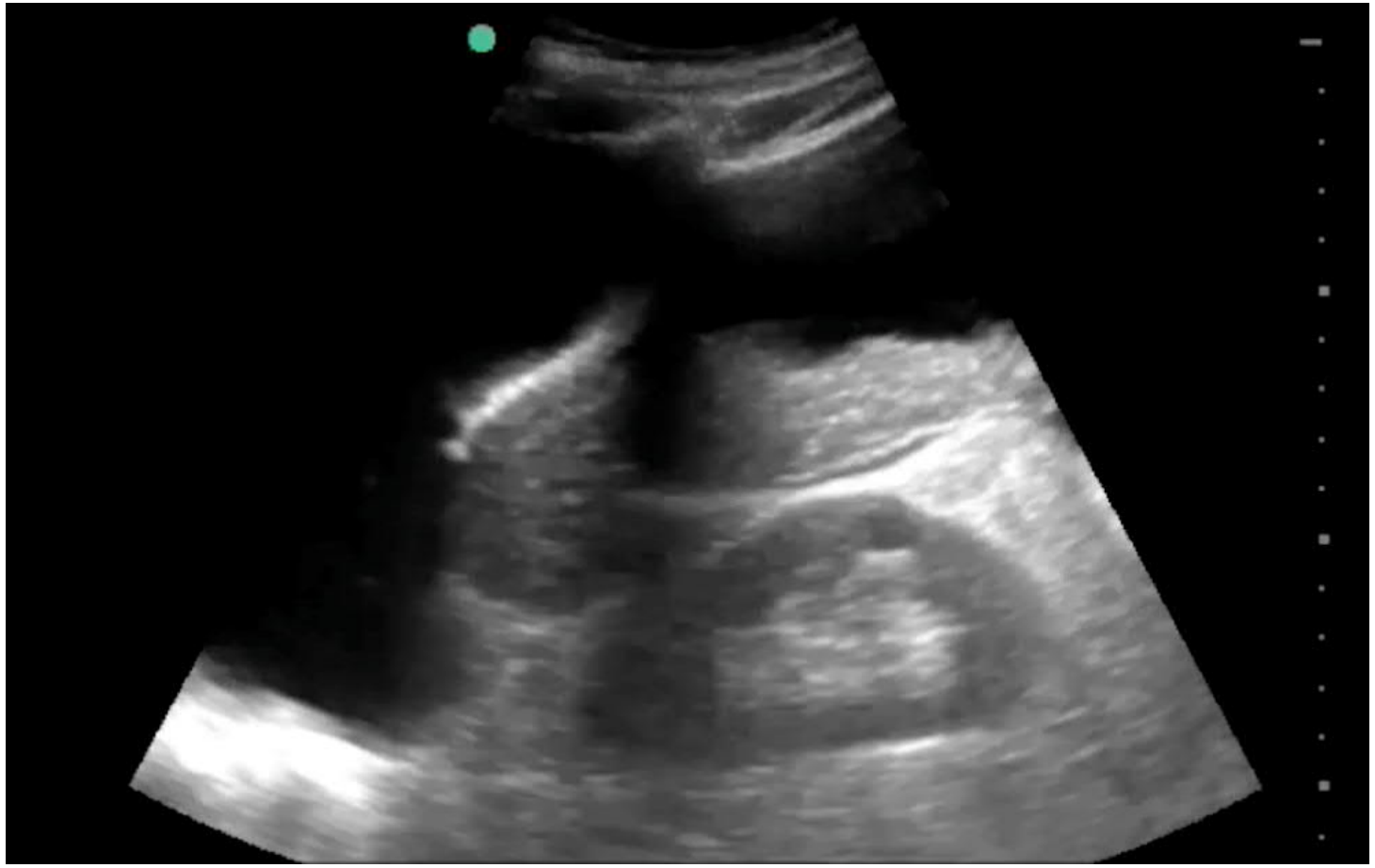
Ascites and Pleural Effusion



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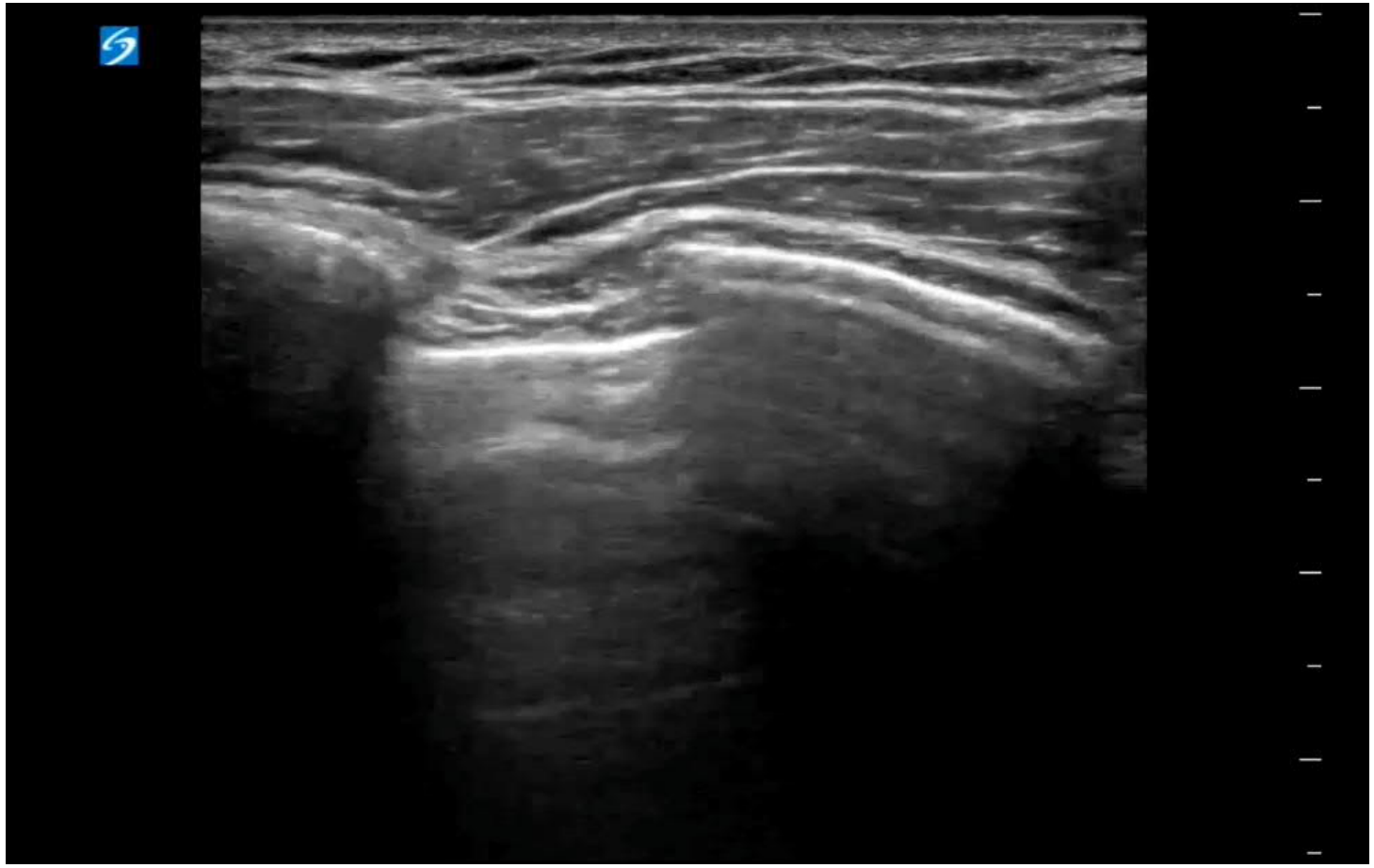
Lung Point



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