POCUS1 REVIEW

October 16, 2020

TAAAC-EM POCUS Committee

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This session will be recorded

- We are recording this Zoom session so that it can be watched again at your convenience, and so that we can share it with your colleagues who were not able to join us today.
- If you would prefer that this recording **not** be shared with your EM colleagues, please email amcknight@ghem.ca within 24 hours of the session.
- We will share the presentation slides and other materials (journal articles, etc.) by email; you will have access to all materials regardless of whether the recording is shared.

Please also note:

- The information in this presentation and the video recording is up to date as of the date it was recorded (October 16, 2020)
- It has not been updated in include any subsequent advances in practice, and the information presented in this video does not replace hospital, healthcare, or governmental guidelines

Learning Objectives

- My the end of this lecture, you will be able to
  - Locate the correct external and internal landmarks for the POCUS1 scans
  - Identify the area of interest for the POCUS1 scans
  - Interpret the patient’s scan as a true positive or negative
  - Identify common false positives and negatives
  - Troubleshoot indeterminate images
  - Correlate your POCUS findings with the patient’s clinical presentation

POCUS1 SCANS

- Abdominal (RUQ, LUQ, pelvic)
- Subxyphoid cardiac
- IVC
- Lung – pneumothorax
- Lung – pleural effusions
- Lung – interstitial edema

Pleural effusions & Interstitial edema

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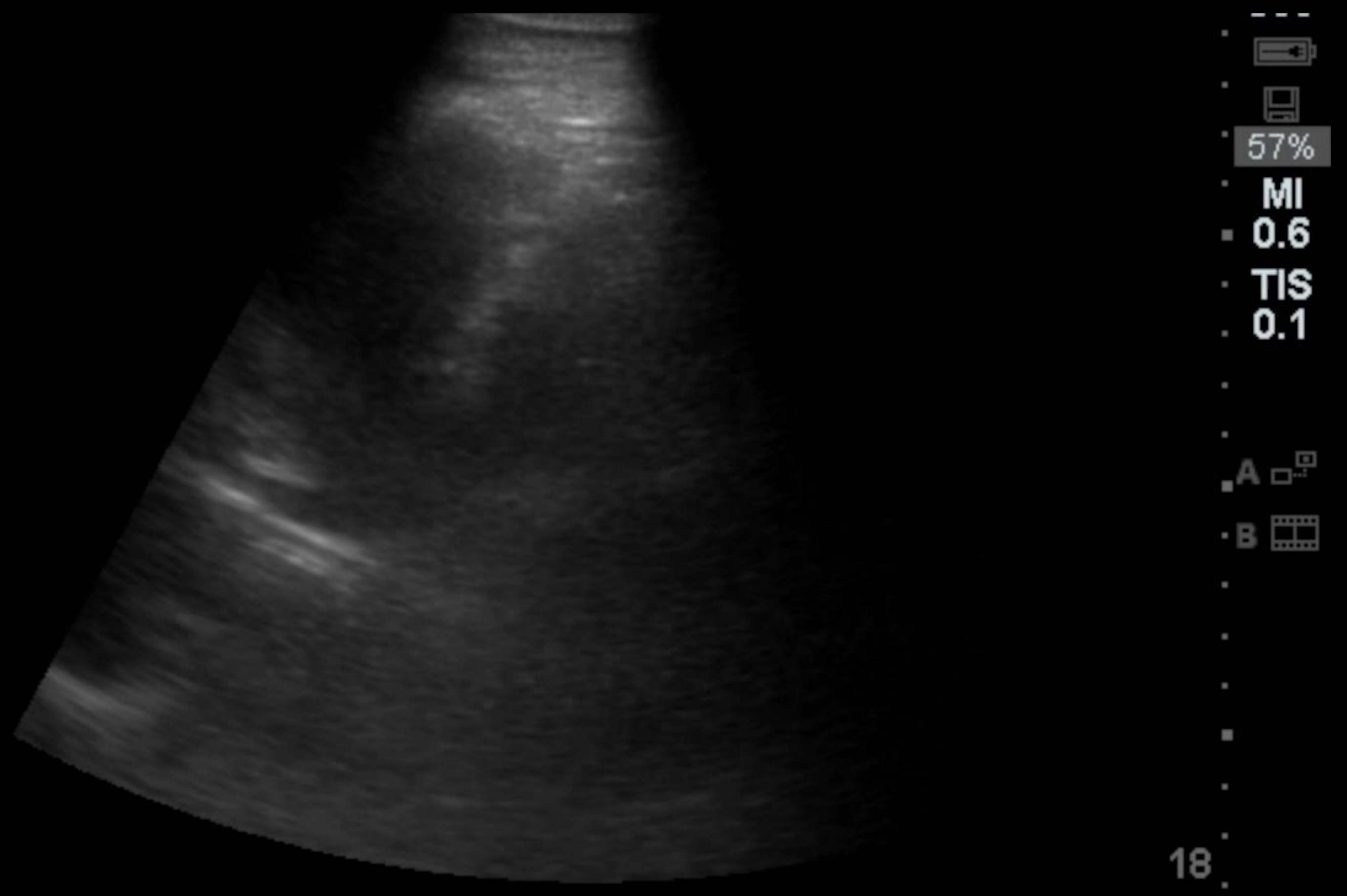
Emergency Medicine & Critical care

Graduate, Ultrasound Fellowship (Ultrasound Leadership Academy)

Pleural Effusion

- Detected by scanning the posterolateral thorax
- External landmarks (same as RUQ/LUQ in FAST exam)
  - Mid-axillary line
  - Xyphoid process
- Internal landmark: Diaphragm

- Negative exam:
  - No fluid (black) visible when lung is swept until diaphragm disappears in both directions
  - Diaphragm is seen from 6 to 9 o’clock only
  - Curtain sign
- Positive exam:
  - Fluid seen (black)
  - +/- diaphragm visualized to 12 o’clock
  - +/- spine sign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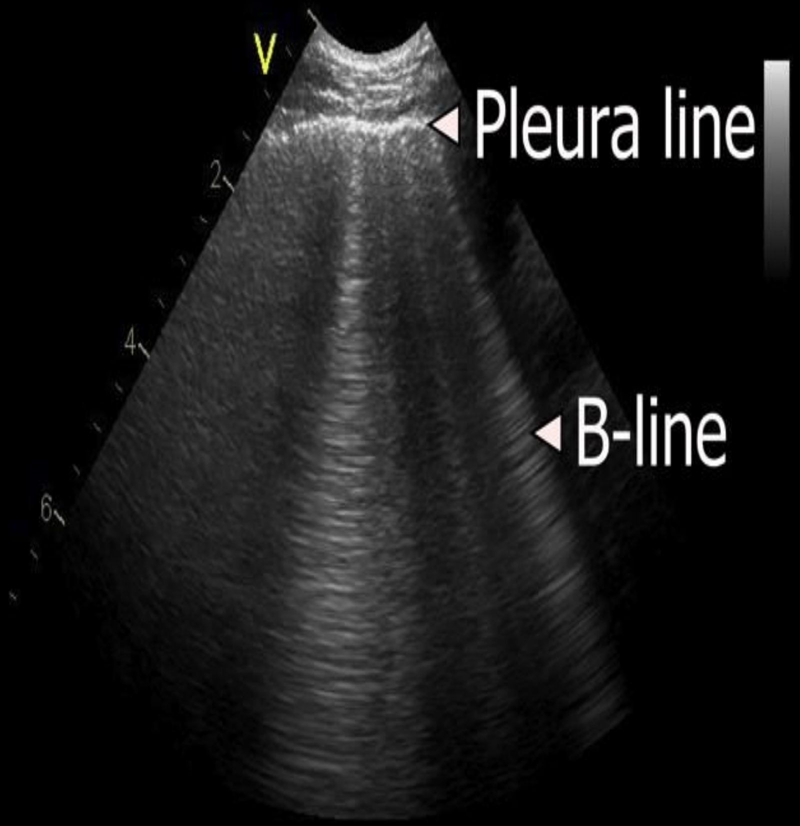
Interstitial Syndrome

- Interstitial syndrome: characteristic and reproducible artifact called B-lines
  - They represent abnormal extravascular lung water
- An interstitial syndrome is defined by the presence of at least three B-lines in the width of an intercostal space (the “B-profile”)

B-lines

“B-lines are defined as discrete laser-like vertical hyperechoic reverberation artifacts that arise from the pleural line, extend to the bottom of the screen without fading, and move synchronously with lung sliding”



B-profile

- A B-profile can represent cardiogenic pulmonary edema, but is not specific
  - Bilateral/diffuse ddx: pulmonary fibrosis, ARDS
  - Focal: pulmonary contusions, consolidation
- The presence of a B-line also excludes a pneumothorax (originates from the pleura)

*Insert vi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Clinical pearl

Pure cardiogenic shock is unlikely to be the primary cause of hemodynamic instability in the presence of a normal lung pattern on ultrasound, suggesting that fluid administration is probably safe.

References

- Jean-Franc¸ois Lancto^t • Maxime Valois ,Yanick Beaulieu, An algorithmic approach to undifferentiated shock, EGLS: Echo-guided life support.
- Point of Care Ultrasound (PoCUS):Introduction George A. Fox MD, MSc, FRCPC, FCCP
- **Assessment of lung parenchymal abnormalities Christian B. Laursen, MD, PhD, Clin Ass Prof Department of Respiratory Medicine, Odense University Hospital, Denmark**

Focused Assessment with Sonography in Trauma (FAST)

Berhanu Tesfaye (MD, Emergency physician)

ULA Fellow

Objectives

- Discuss the accuracy and utility of FAST in clinical decision making.
- To rapidly screen for injury at the bedside of patients, especially those patients who are hemodynamically unstable.
- Identification of free fluid in potential spaces

Introduction

- The FAST exam was first used in trauma in the 1970s.
- “Focused Abdominal Sonography for Trauma” (Focused Assessment with Sonography for Trauma)
- Included in the Advanced Trauma Life Support program for evaluation of the hypotensive trauma patient.

FAST has replaced DPL as the diagnostic modality of choice in evaluating for abdominal hemorrhage.

Ultrasound

- Bedside
- Noninvasive
- Repeatable
- Rapid
- No contraindications

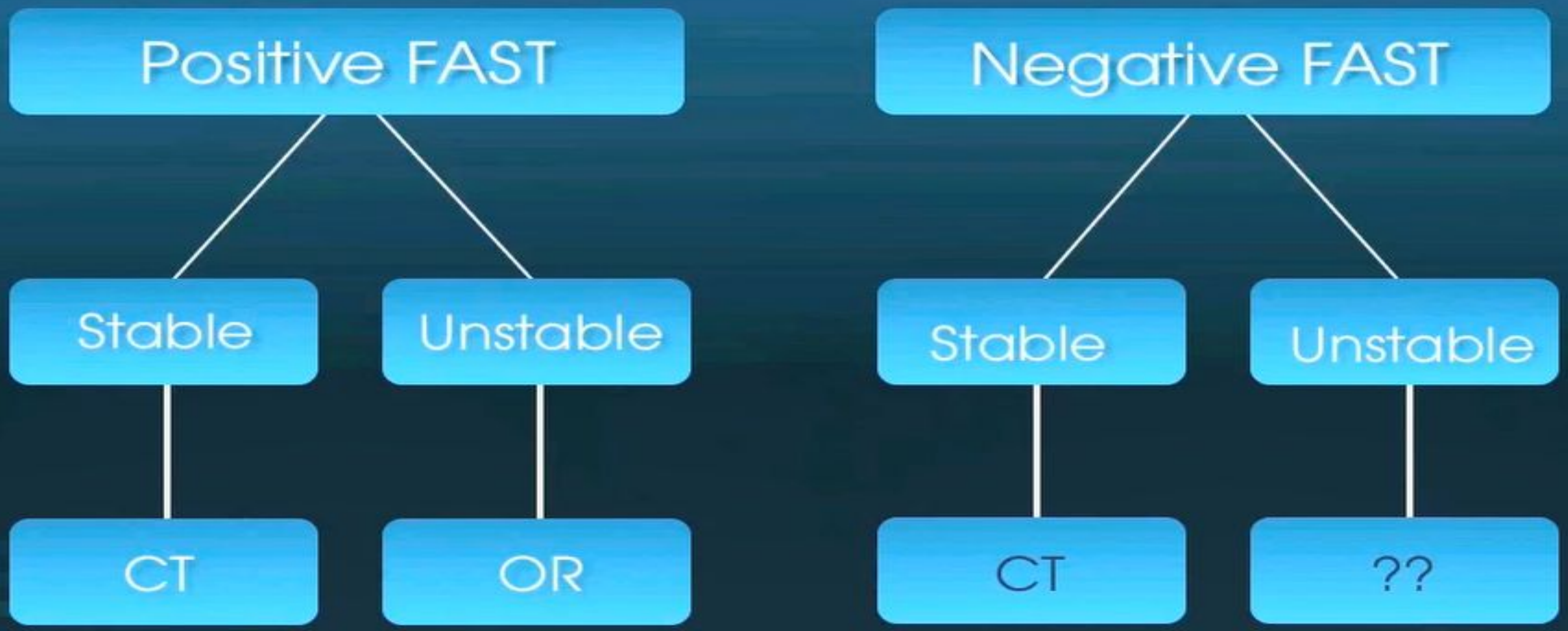
Indications

- Blunt or penetrating trauma to the abdomen or the chest.

- Trauma in pregnancy.

- Unexplained hypotension

Blunt Trauma Algorithm



Accuracy of FAST and Clinical Decision Making

- sensitivity (69%–98%) for detection of free fluid and lower sensitivity (63%) for detection of solid organ injury.

- underestimation of injuries and severity, especially in stable trauma patients without detectable free fluid.

- high specificity (94%– 100%) for detection of free fluid and/or solid organ injury

- Probe selection
- (3–5 MHz) is best utilized as a multipurpose probe.
- examining solid organs and determining presence of free fluid in the abdomen or pelvis.
- examine the heart for a pericardial effusion or hemorrhage.
- useful to scan between the ribs for pneumothorax.

Probe selection

- Phased array probe

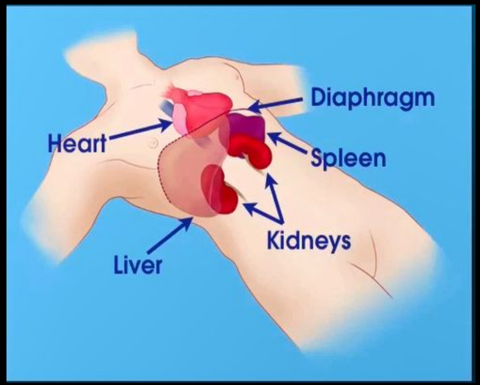
- Curvilinear Probe

- Linear Probe

BASIC FAST EXAM

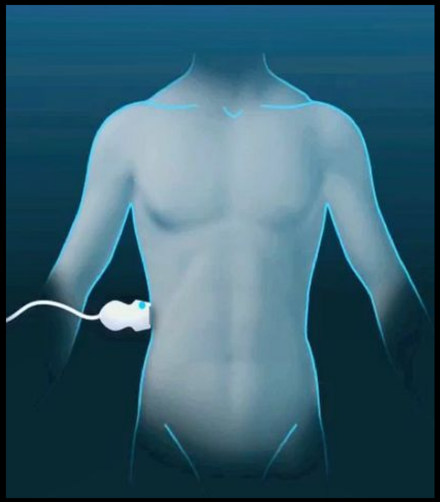
- The basic FAST exam includes 4 views.

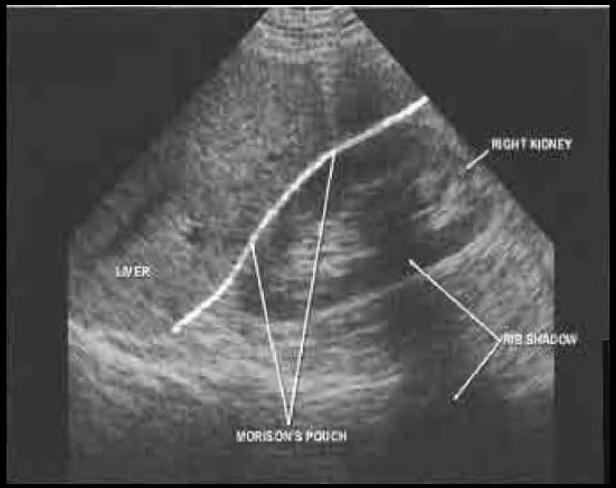
1. Perihepatic (right. upper quadrant)
2. Perisplenic (left upper qua drant)
3. Pelvic(Pouch of Douglas or retrovesicular)
4. Pericardial] (cardiac)



1 **Perihepatic**(RUQ)

- The preferred initial site - free fluid with FAST - right upper quadrant view, scanned by using a lower frequency (3.5–5 MHz).



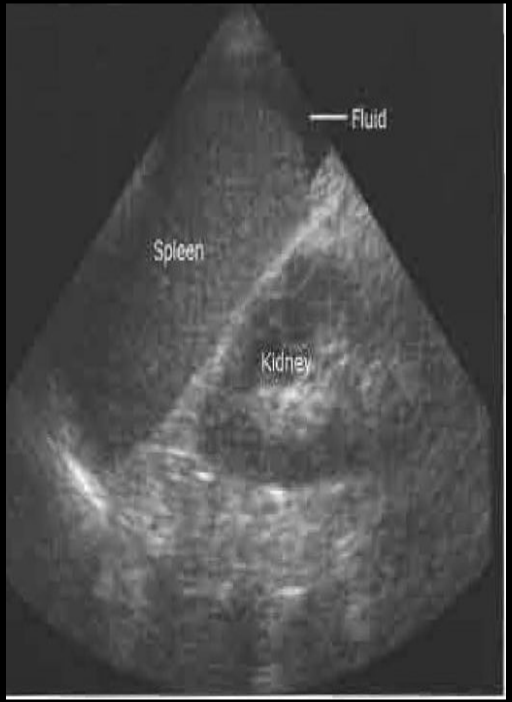


2 Perispleenic(LUQ)

- Unlike RUQ most commonly fluid is collected in subdiaphramatic space in the LUQ.
- Phrenic colic ligament restricts fluid collection in the spleenorenal space.
- Alternatively fluid may also be seen at the tip of the spleen.
- In case of large collection fluid can be seen between the kidney and the spleen

LUQ View


LUQ View with Free Fluid
Free
Fluid
Kidney

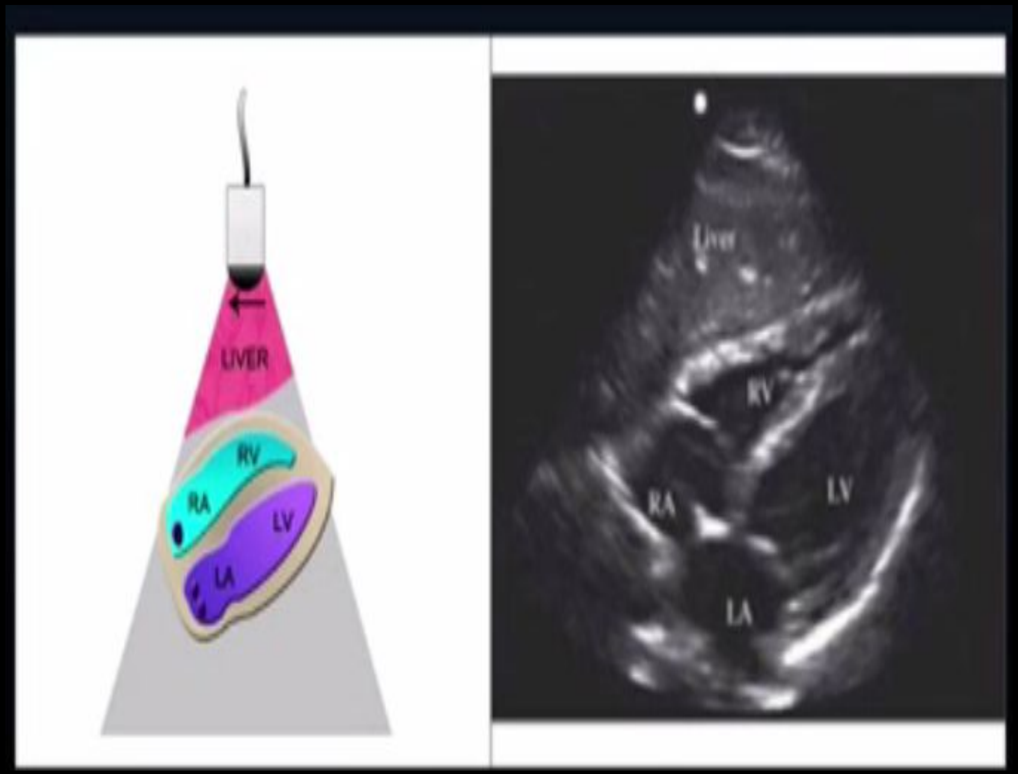

Fluid
Spleen
Kidney

3 Subxiphoid(Cardiac) view

- Allows to see fluid collection between the visceral and parietal space of the pericardium.

- Most commonly using subxiphoid window.

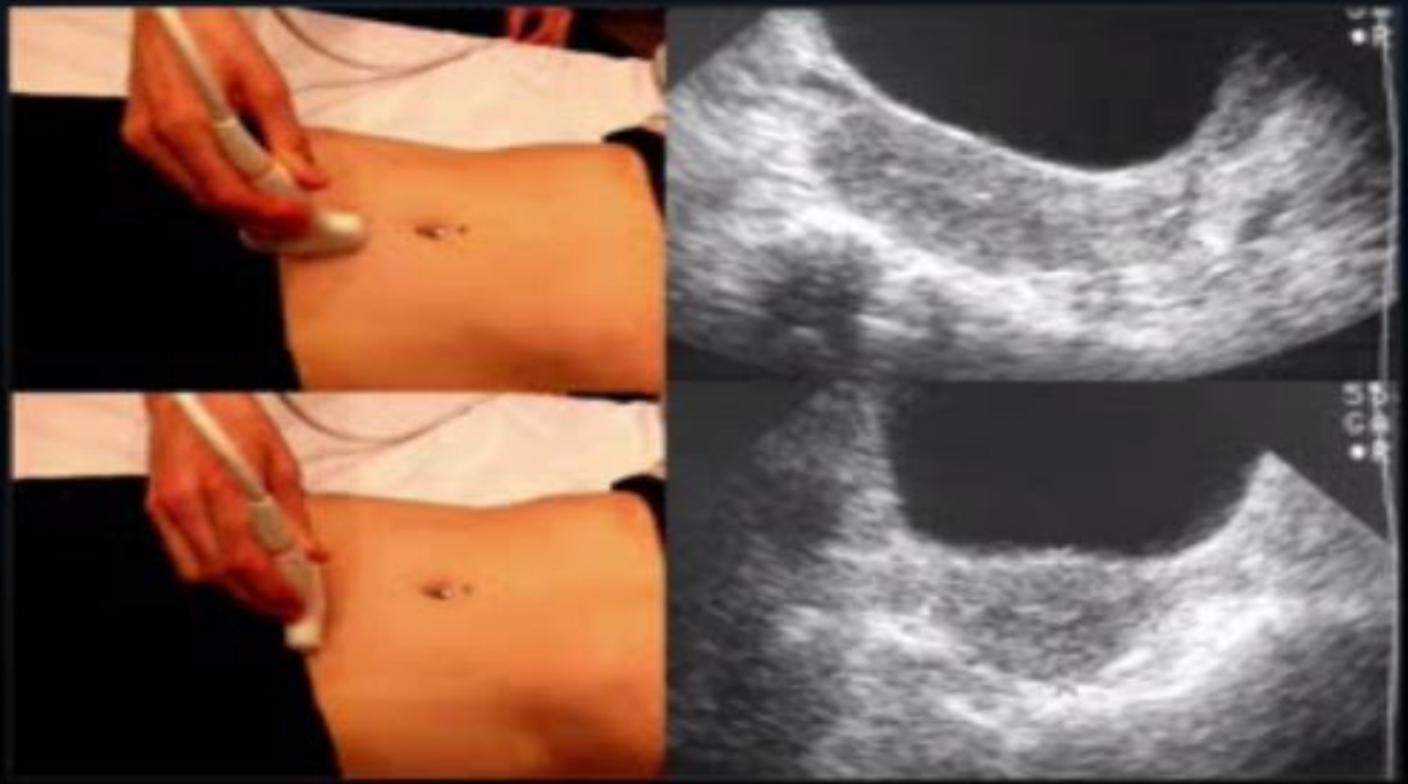
Subxiphoid view



4 **Suprapubic view(Pelvic)**

- An important and potentially under appreciated window for detecting free peritoneal fluid.
- fluid collections may be seen here before being detected in other areas.
- pelvic view is done through a moderately full bladder to facilitate visualization.
- The transducer is paced transversely and sagittal and fan to see per vesicular and retrovesicular areas

Pelvic view



Transverse and Longitudinal view

- References
  - Cosby ultrasound
  - Introduction to bedside us(M.DAWSON,M.MALLIN)

THANK YOU

IVC and Pneumothorax

Tigist Zewdu , MD,
Consultant emergency physician
Asst. Professor of emergency medicine
Addis Ababa University

IVC Ultrasound

- Describe indications for using ultrasound at the bedside to image the inferior vena cava.
- Describe how to performing bedside ultrasound of the inferior vena cava.
- Use the findings on ultrasound to guide assessment of intravascular volume status.
- Pearls

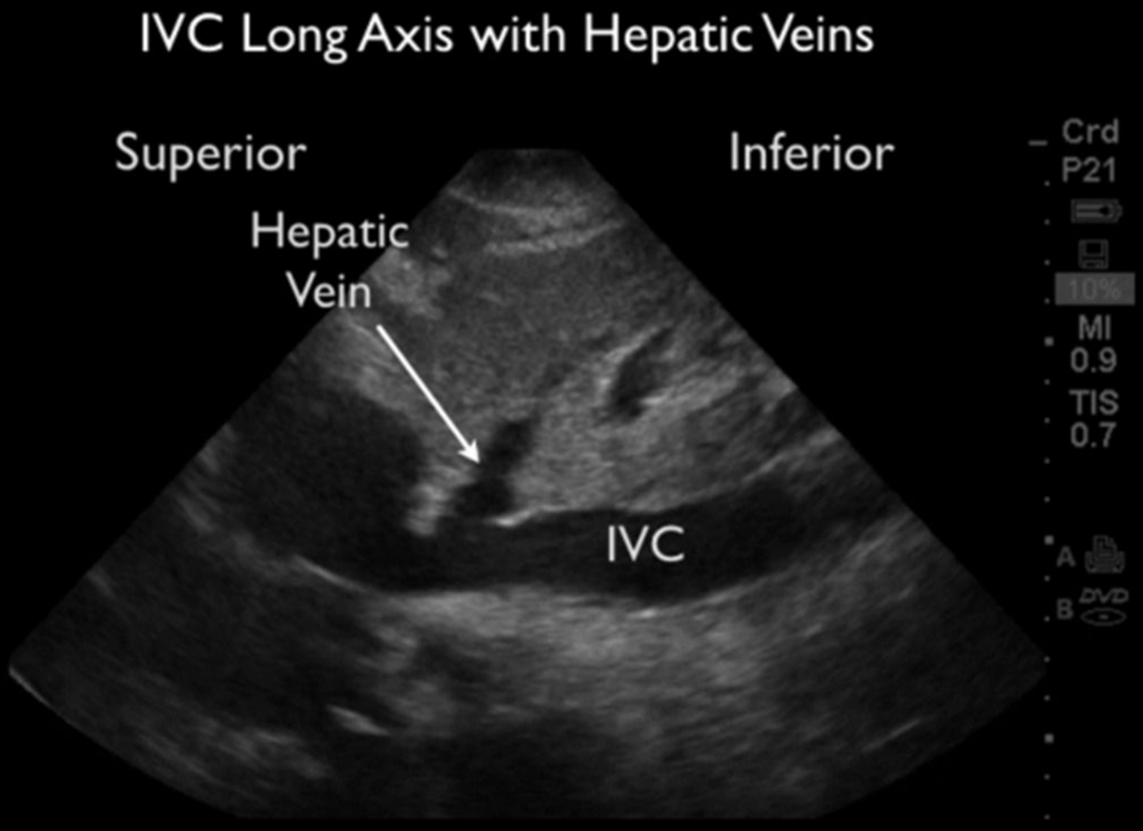
Indication

- Assessing intravascular volume status/CVP.
- Assessing fluid responsiveness in shock

Anatomy

- The inferior vena cava returns blood from body to the right atrium.
- Formed by the convergences of the iliac veins.
- Retroperitoneal
- Right of the aorta.
- Normal size <2.5cm
- Varies with respiration.

IVC long axis view



Normal IVC

Procedure

- Positioning
- Supine
- Degree of head elevation has not been shown to make a significant difference in measurments.

Probe selection

- Low frequency 2-5 MHZ
- Curvalinear probe

Subxyphoid view

- Most common approach
- Place the probe longitudinally just below the xiphoid process with the probe markers towards patient's head
- Look for IVC going into right atrium-may need to move probe 1-2cm to the patient's right and then tilt it slightly towards the heart.
- To obtain longitudinal view of the IVC, center IVC in the center of the screen and rotate 90 degree.

Subxyphoid view

Figure 1. Abdominal transducer in transverse orientation with the index (•)marker to the patient's right

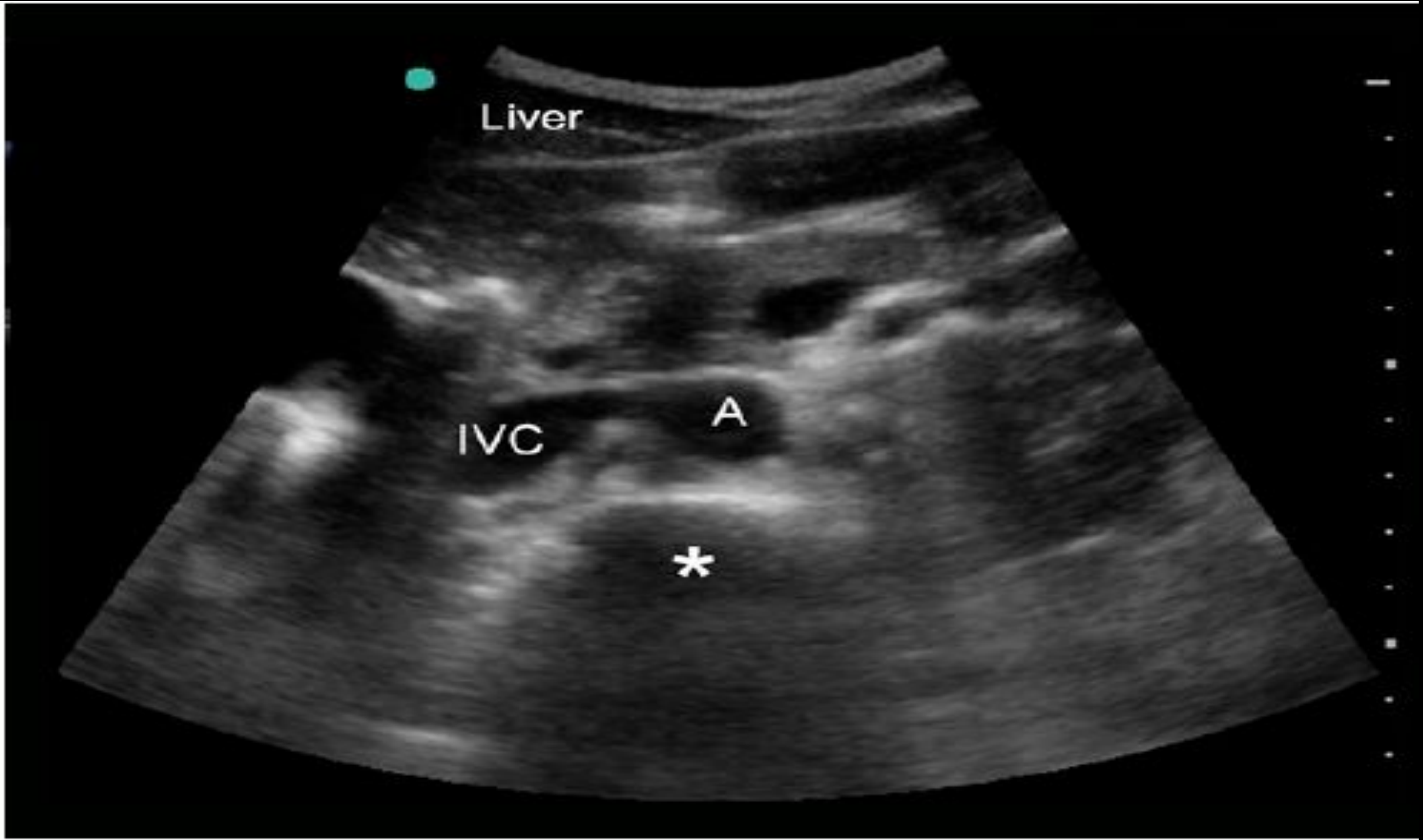


Figure 2. Transverse view of the upper abdomen showing the IVC and aorta (A) overlying a vertebral body (*) with the liver in the near field.

Figure 3. Longitudinal view of the IVC emptying into the right atrium (RA)

Measuring IVC Diameter

- you can measure 2 cm distal to the right atrium or just to distal to hepatic vein.

A rough estimates of CVP based on IVC size and CI

IVC size (cm)	Respiratory Change	CVP (cm)
< 1.5	Total collapse	0-5
1.5-2.5	> 50% collapse	5-10
1.5-2.5	< 50% collapse	11-15
> 2.5	< 50% collapse	16-20
> 2.5	No change	> 20

PEARLS

<u>Bowel gases</u>

- May impede visualization in the xiphoid view.
- Gentle graded pressure may help move bowel out of the way.
- Don't press too hard or will collapse IVC causing false measurement.
- Consider anterior mid- axillary view.

PEARLS

Plethoric (dilated) IVC

- Volume overload
- Cardiac tamponade
- Mitral regurgitation
- Aortic stenosis

PEARLS

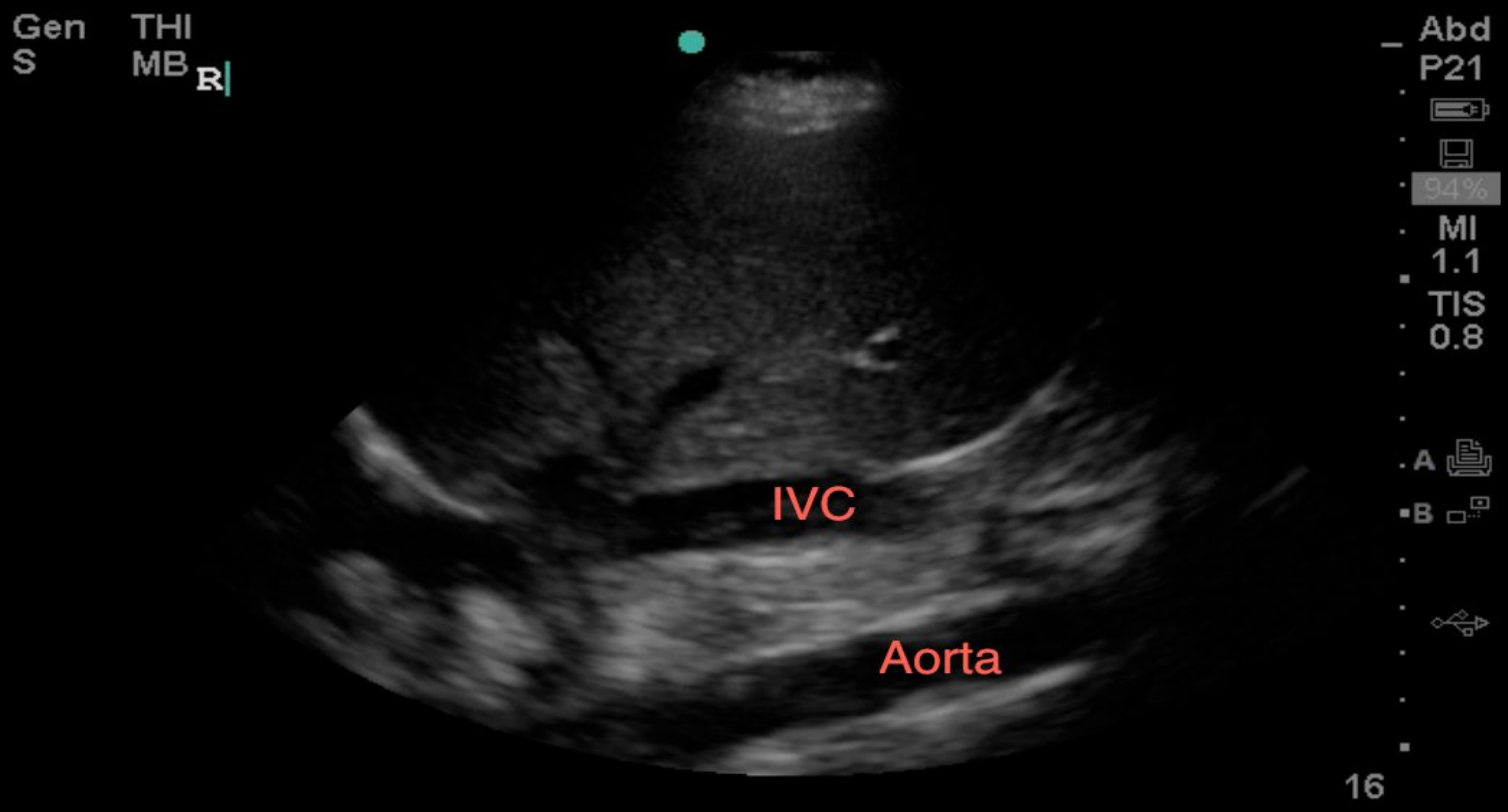
Mechanical ventilation

- Causes the reversal of IVC changes with respiration.
- Maximum diameter with inspiration
- Minimum diameter with expiration

PEARLS
IVC versus Aorta

IVC	Aorta
• Thin walls	• Thick echogenic walls
• Usually Not pulsatile	• Pulsatile
• Low flow velocity	• High flow velocity
• Compressible	• Not compressible
• Respiratory variation	• No respiratory variation
• Right of vertebral bodies	• Above vertebral bodies

Longitudinal view of IVC & Aorta



Pneumothorax on ED ultrasound

- Sensitivity of ED ultrasound 86-98%
- Sensitivity of supine CXR 36-75%

Pneumothorax on ED ultrasound

- High frequency probe
- Start at 5-8 cm depth
- Longitudinal plane, mid-clavicular line
- Most anterior aspect of hemithorax

Scanning protocol

RIGHT AND LEFT LUNG

Quadrant 1: mid-clavicle, upper lung
Quadrant 2: mid-clavicle, lower lung
Quadrant 3: mid-axilla, upper lung
Quadrant 4: mid-axilla, lower lung

American Journal of Emergency Medicine (2006) 24, 689–696

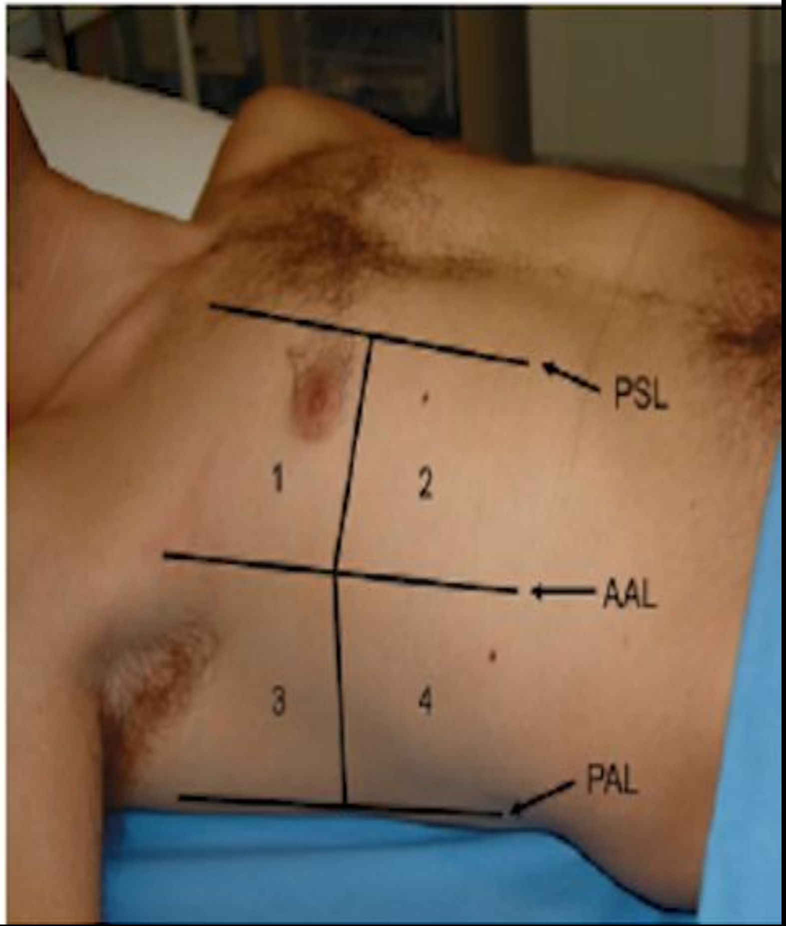
ELSEVIER

The American Journal of Emergency Medicine

www.elsevier.com/locate/ajem

Original Contribution

Bedside lung ultrasound in the assessment of alveolar-interstitial syndrome

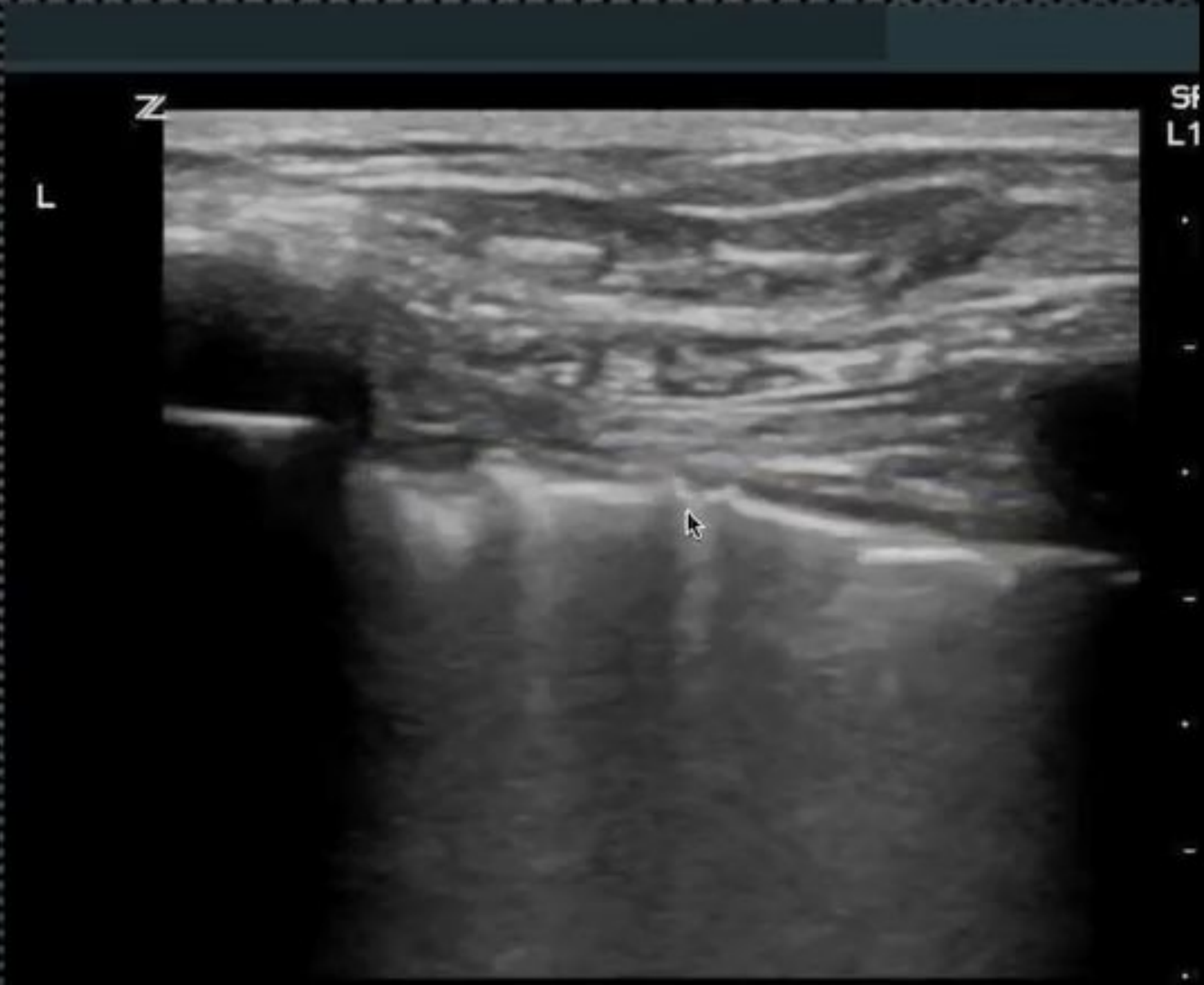


Pneumothorax on ED ultrasound

- Ribs are the landmark
- Pleural line is the area of interest
- Scan over 3-4 rib spaces (bilaterally if indicated)
- Observe for three respiratory cycles

Sonographic Findings

- Identify ribs and posterior shadowing
- Lung sliding
- Comet tail artifact
  - Hyperechoic
  - Arise from pleural interface



- The presence of lung sliding excludes a pneumothorax under the probe with certainty and requires a minimal training to recognize

- While not specific, its absence in the appropriate context can be highly suggestive of a pneumothorax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[redacted]
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D 8.0
G 48
FR 35
DR 115
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Sonographic Findings - ***PTX***

- Identify ribs and posterior shadowing
- Absent lung sliding
- No comet tail artifact


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Lung Point

- The ‘‘lung point’’, which is pathognomonic for a pneumothorax, is observed when lung sliding is intermittently absent from the ultrasound field at expiration .
- A lung point might not be observed in the case of tension pneumothorax because the lung is expected to be completely collapsed


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Lung PTX
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mindray
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F 7.6~16.2
D 3.5
G 69
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Other causes of absent lung sliding

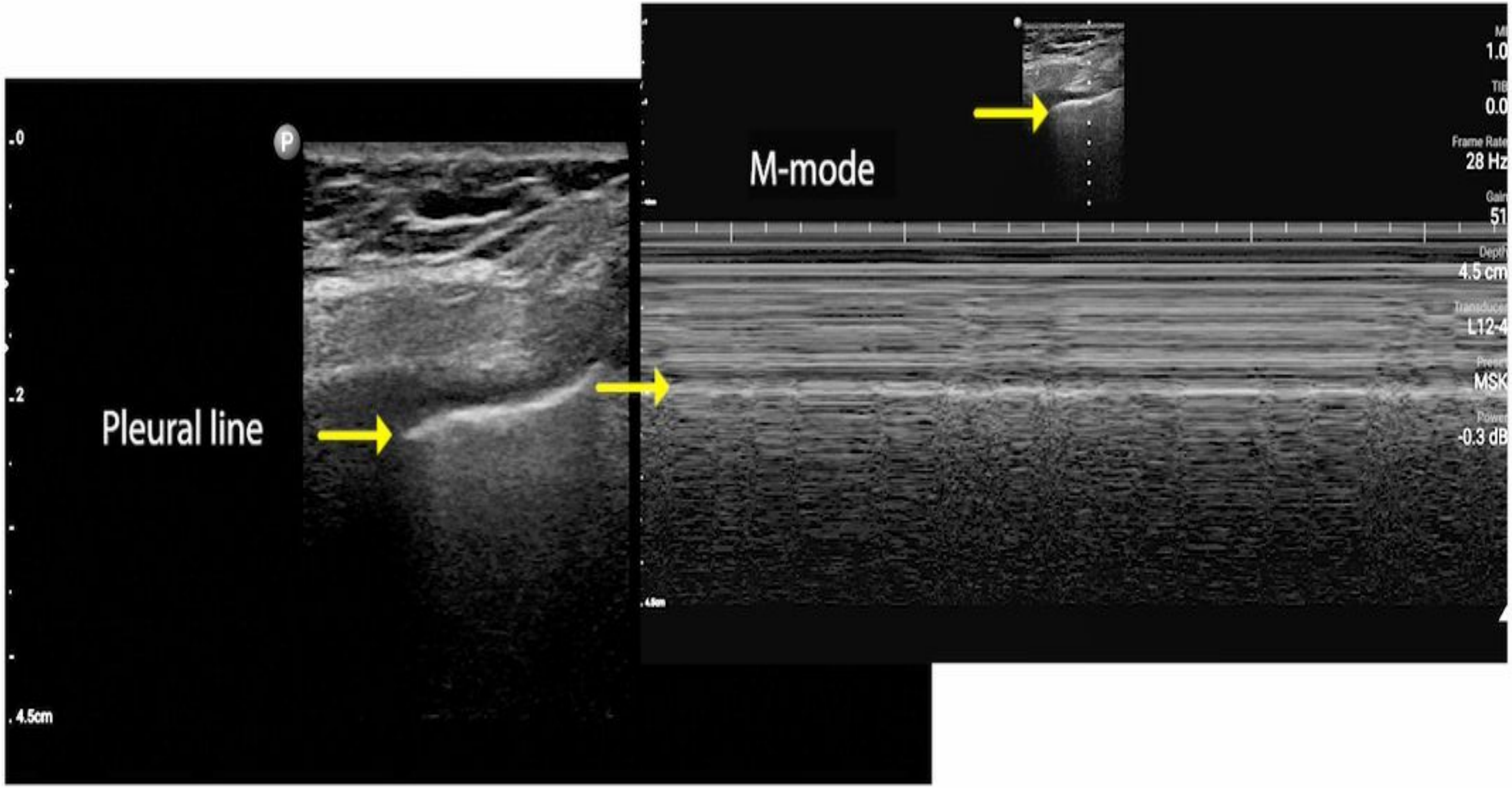
- Pleural adhesions
- Atelectasis
- Lobectomy/Pneumonectomy
- Main-stem intubation
- Pneumonia
- Acute respiratory distress syndrome (ARDS)
- Severe emphysema
- Bronchial obstruction
- Apnea

Pneumothorax on ED ultrasound

- M-mode
  - Movement along a vertical line
  - X axis represents time
  - Y axis represents depth

  - Adjust depth so that pleural line is halfway down y axis

M-mode: normal lung



M-mode is a representation of tissue motion over time

M-mode can depict the presence or absence of lung sliding

Pneumothorax on ED ultrasound

- M-mode
  - No movement= straight, parallel lines (“barcode sign”)
  - Movement= blurred lines (“sandy shore sign”)


Thank you!!! ...