UC San Diego
SCHOOL OF MEDICINE
Department of Anesthesiology

POINT OF CARE ULTRASOUND

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AGENDA:

- Background
- Equipment
- Cardiac Ultrasound
- Lung Ultrasound
- Abdominal Ultrasound

BACKGROUND

What is Point of Care Ultrasound?

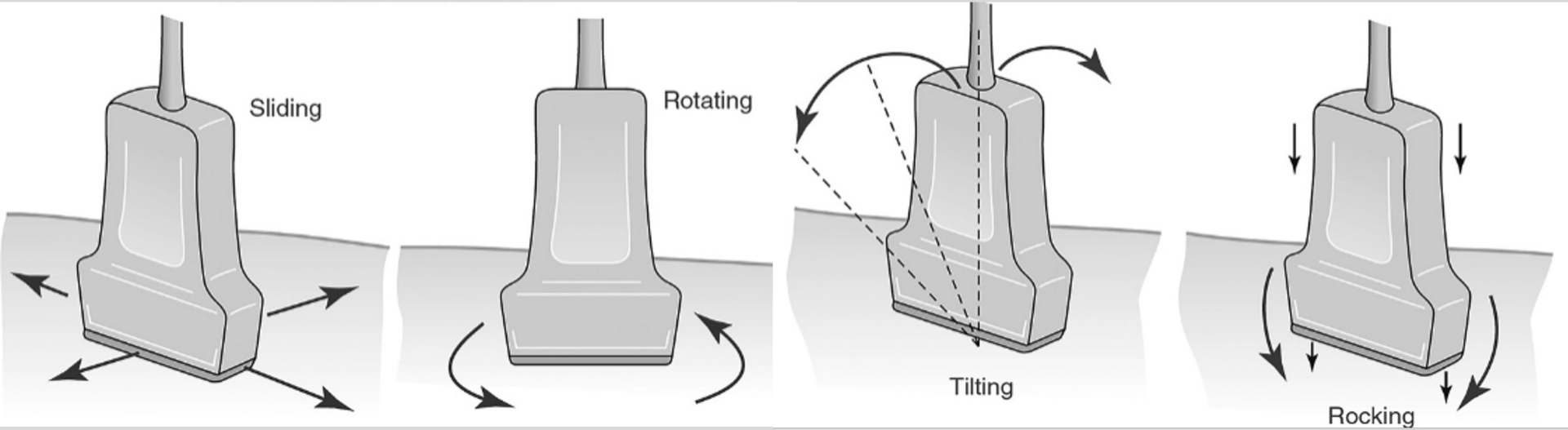
PoCUS is the use of ultrasound as an adjunct for in-the-moment diagnosis, monitoring, and management - particularly for critically ill patients

- performed by clinicians at bedside, not generally by trained sonographers
- ideally, helps to expedite diagnoses and avoid delay from obtaining formal imaging
- neither comprehensive nor quantitative

PROBE OPTIONS

Linear	5-15 MHz	Vascular, Thoracic
Curvilinear	2-5 MHz	Abdominal, FAST
Phased Array	1-5 MHz	Cardiac, Thoracic, FAST

MANIPULATION OF THE ULTRASOUND PROBE



Ransingh. Teaching Point-of-Care Ultrasound (POCUS) to the Perioperative Physician. 2018.

FOCUSED CARDIAC ULTRASOUND

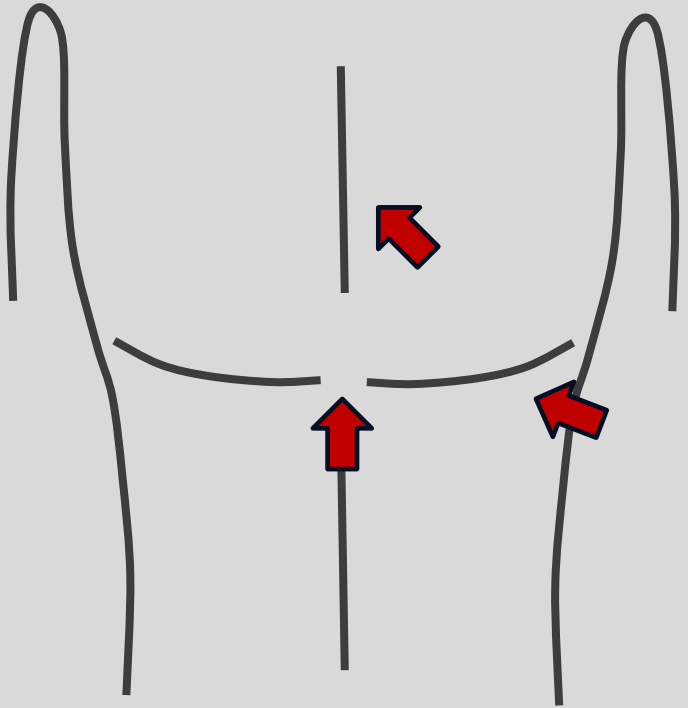
JASE 2014 - International Evidence-Based Recommendations for Focused Cardiac Ultrasound (FCU)

- Recognizes need for standardized guidelines for point of care ultrasound of the heart
- What is the difference between FCU and limited TTE?
- Established expectation that patients will typically have subsequent referral for formal echocardiography

FOCUSED CARDIAC ULTRASOUND

FCU exam is a qualitative exam to assess overall cardiac structure and function, typically performed by non-experts for rescue purposes

- 3 primary windows
- 5 primary views



FOCUSED CARDIAC ULTRASOUND

What are we looking for?

- Remember: often in setting of undifferentiated shock
- Gross ventricular function
- Pericardial effusion/tamponade
- Cardiac preload

More advanced:

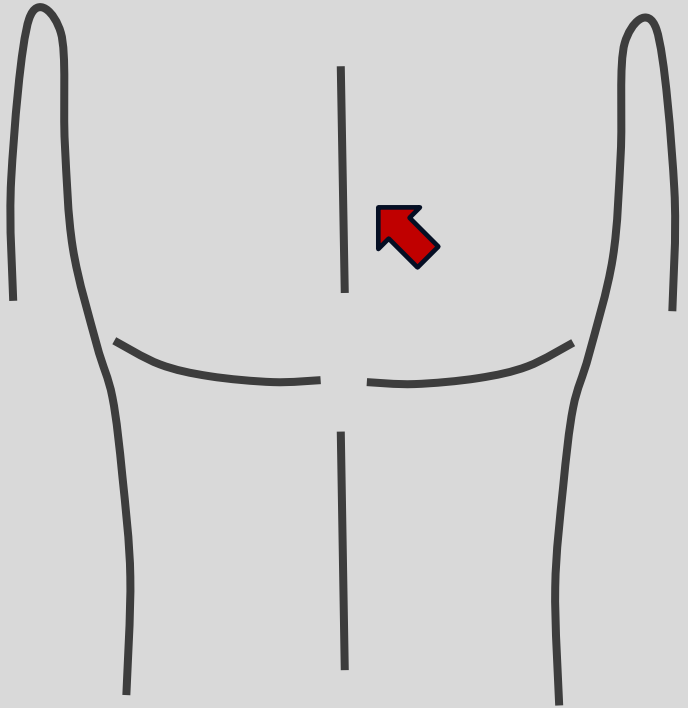
- Valvulopathies
- Obstructive pathologies
- Quantitative assessments

PARASTERNAL WINDOW

Location: left 3rd-4th intercostal space

Patient Position: left lateral decubitus

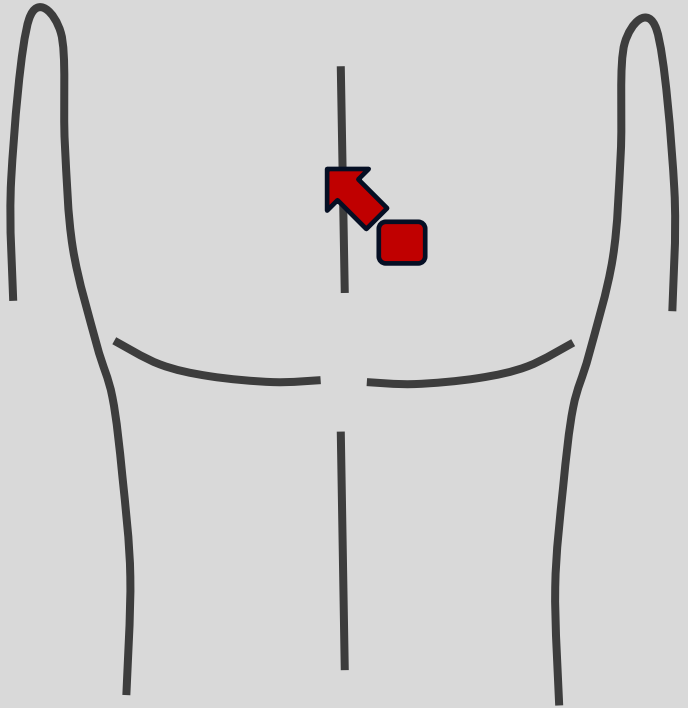
Optimization: small tidal volumes, end expiration



PARASTERNAL LONG AXIS VIEW

Probe position: marker to right shoulder

- Tilt caudal for RV inflow view
- Tilt cephalad for RV outflow



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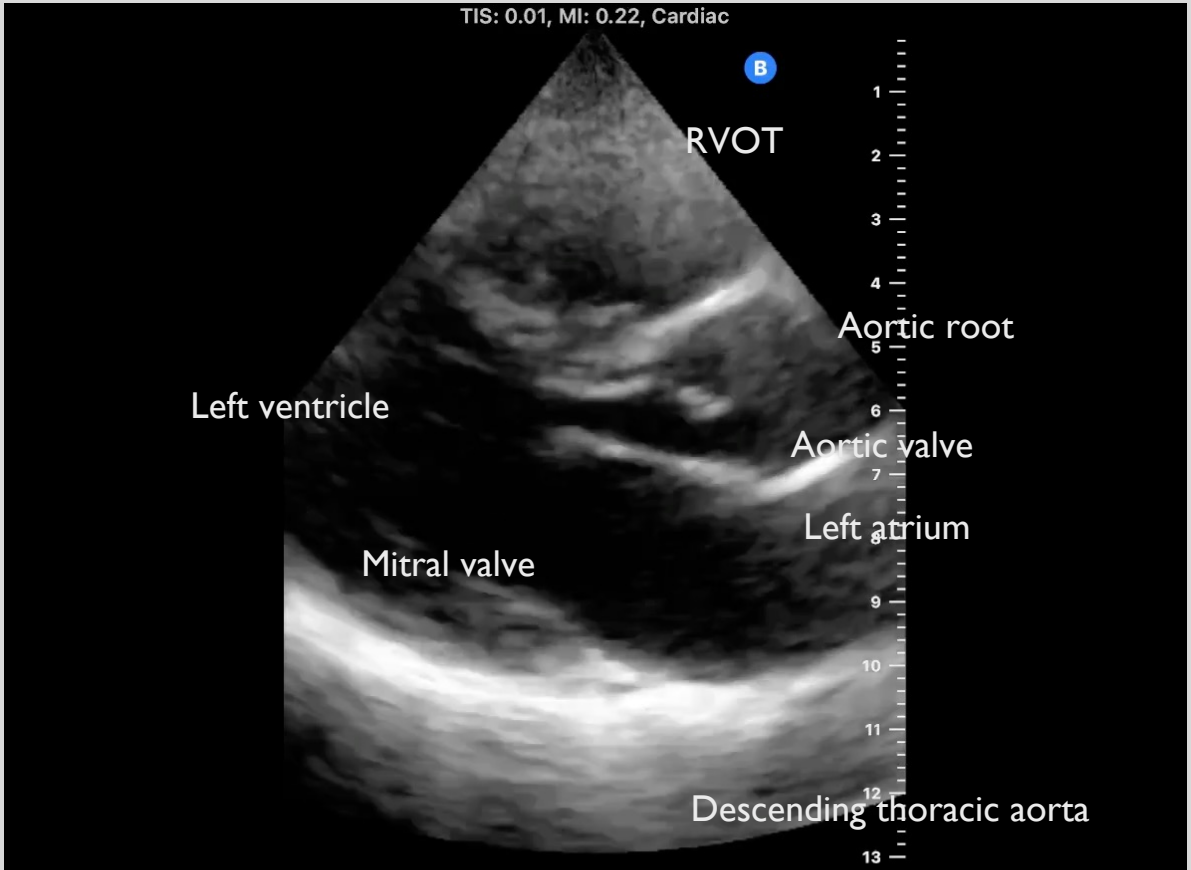

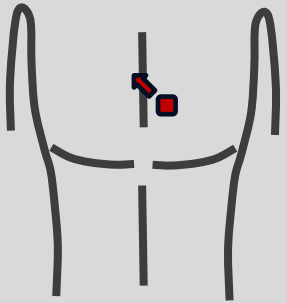

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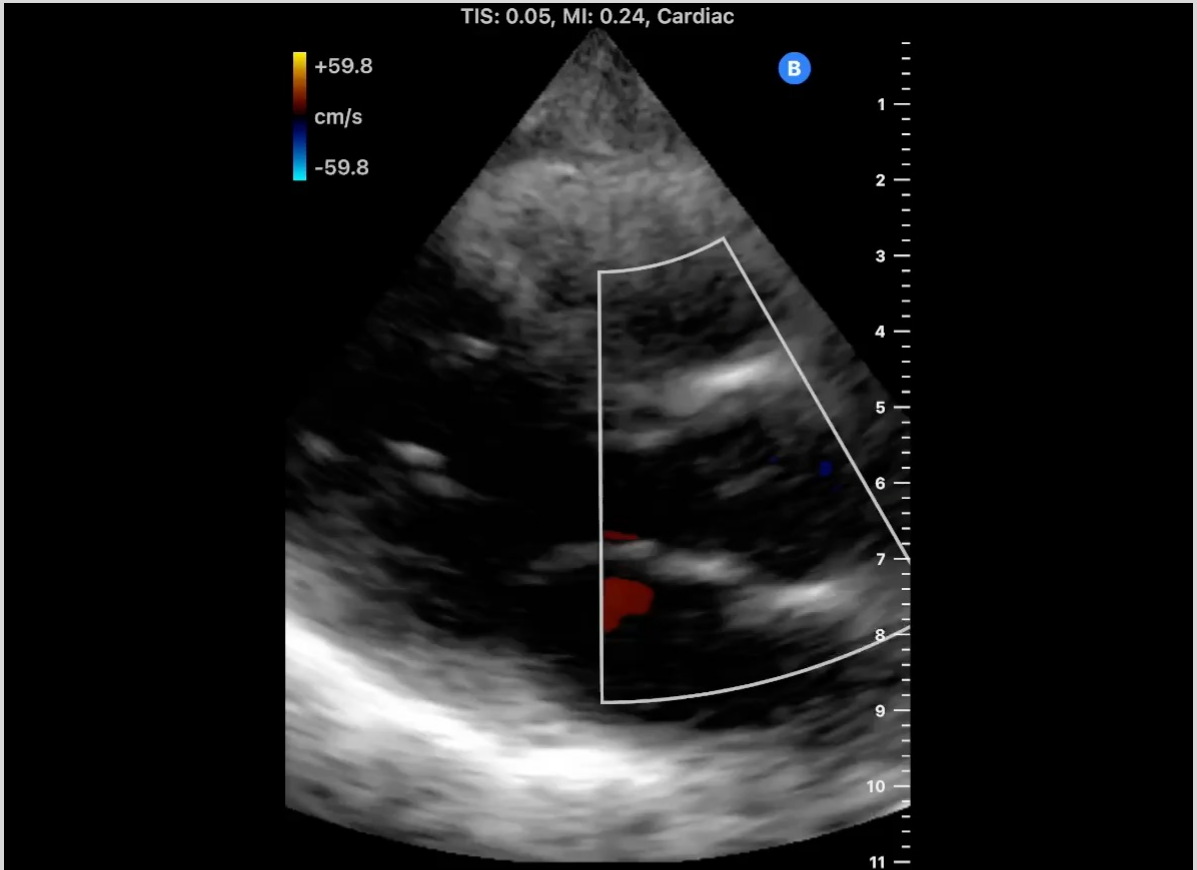

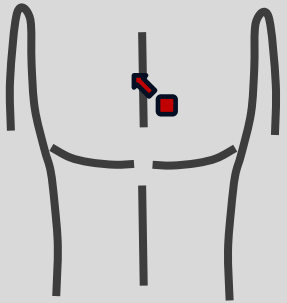

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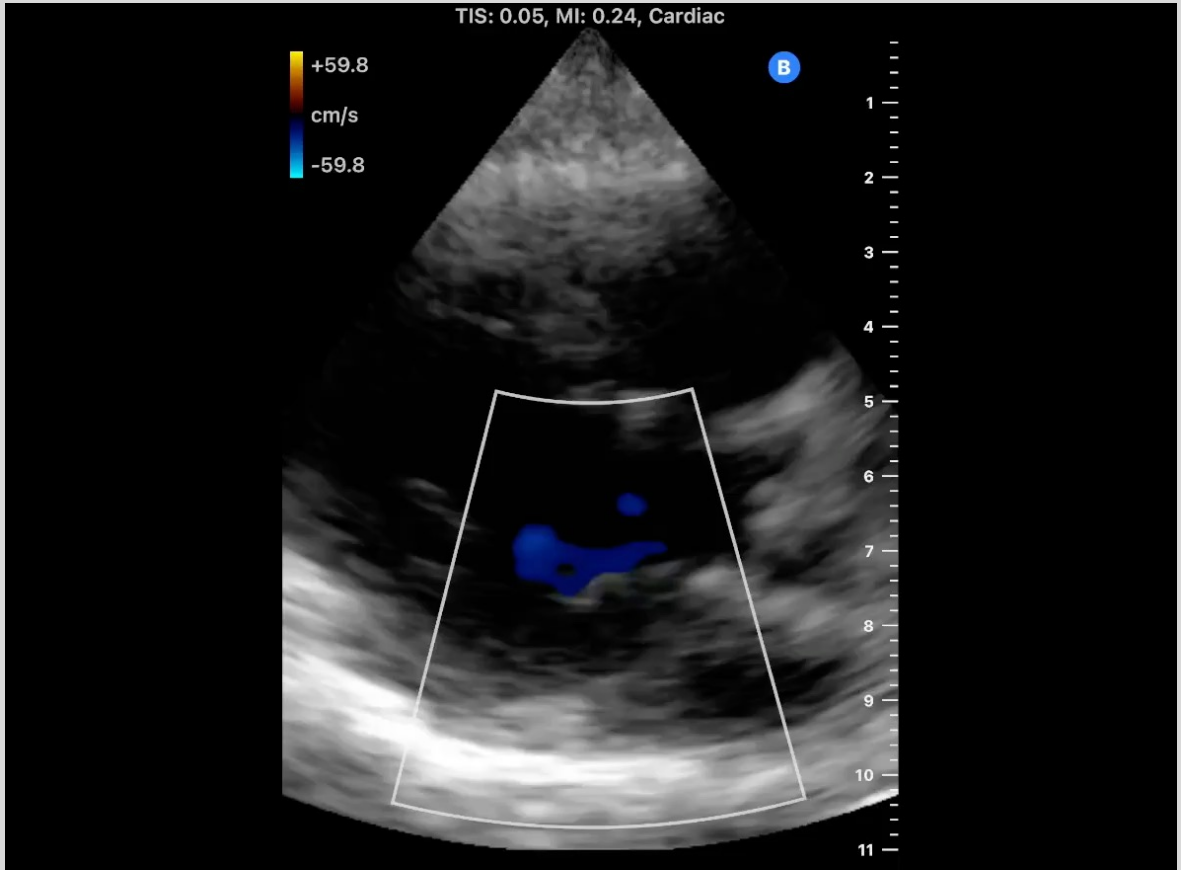
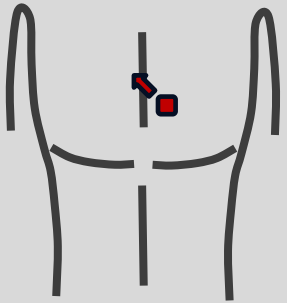
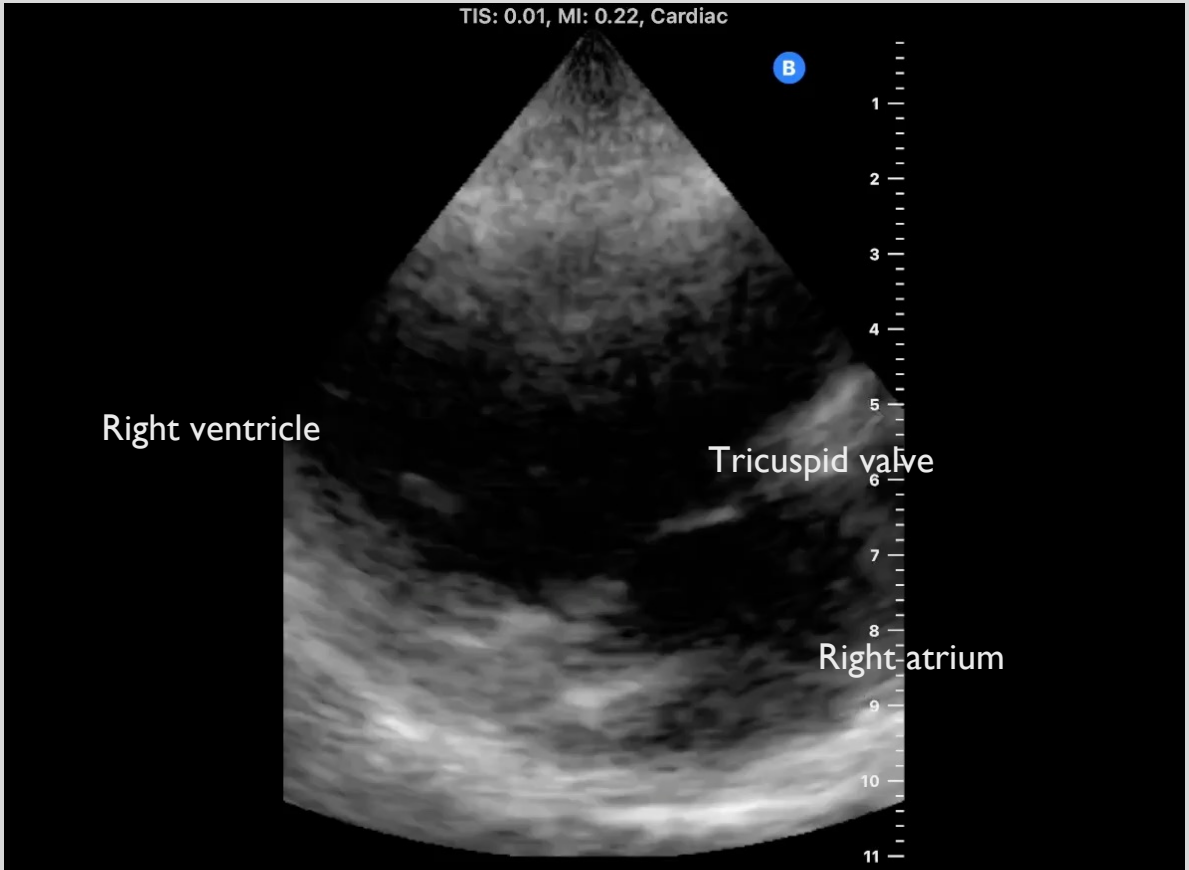
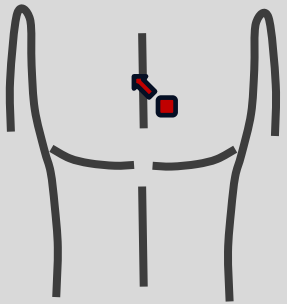




PARASTERNAL LONG AXIS RV INFLOW VIEW





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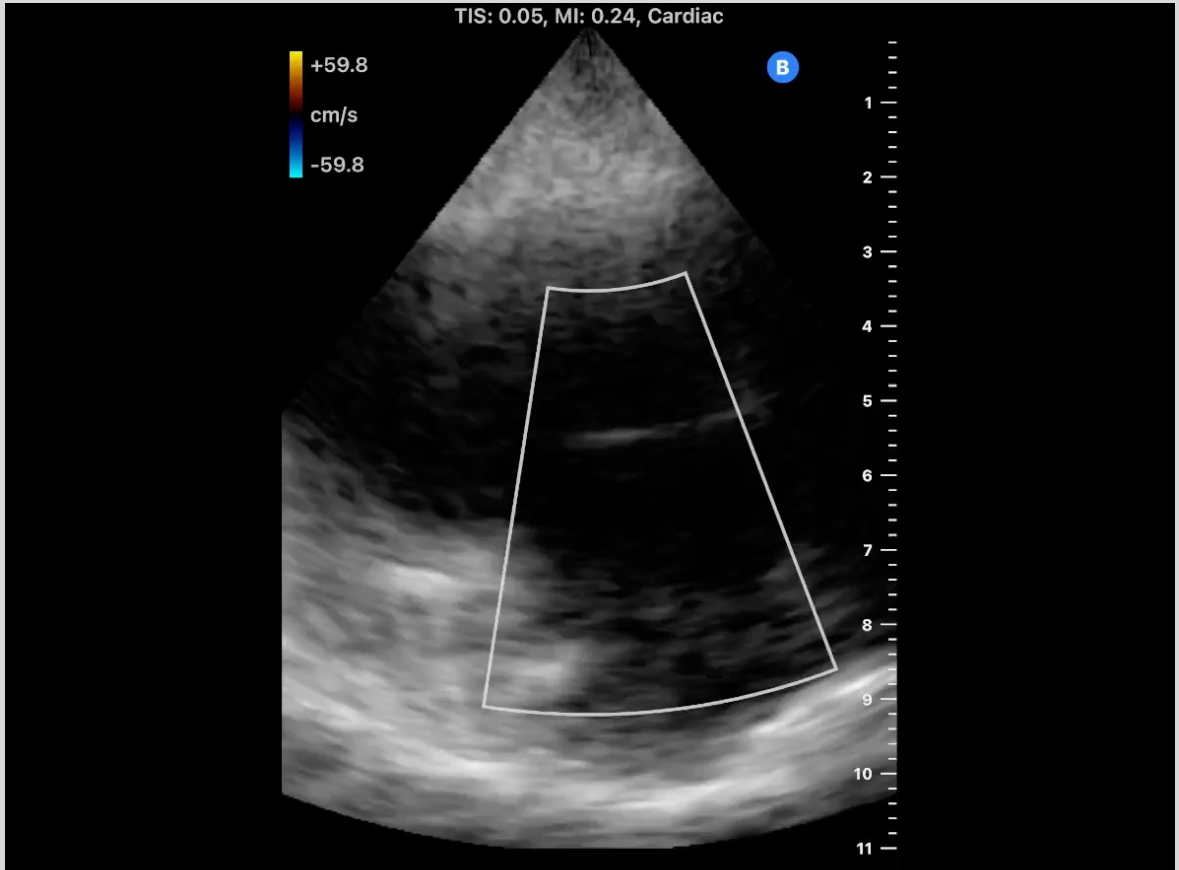

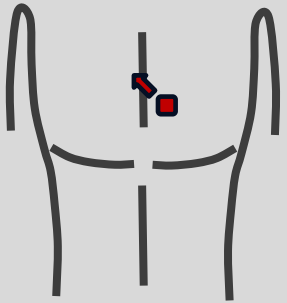

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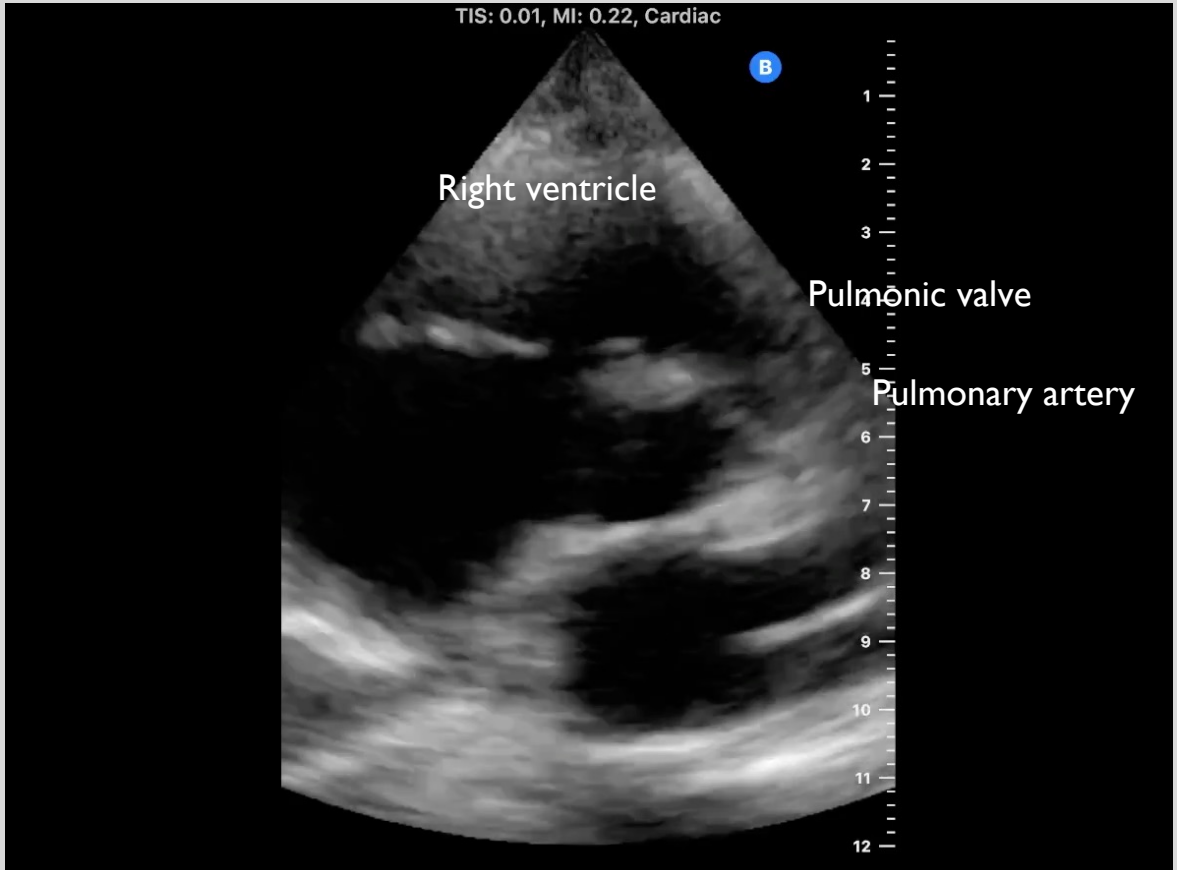
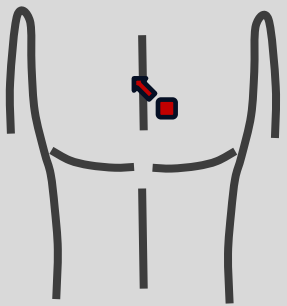
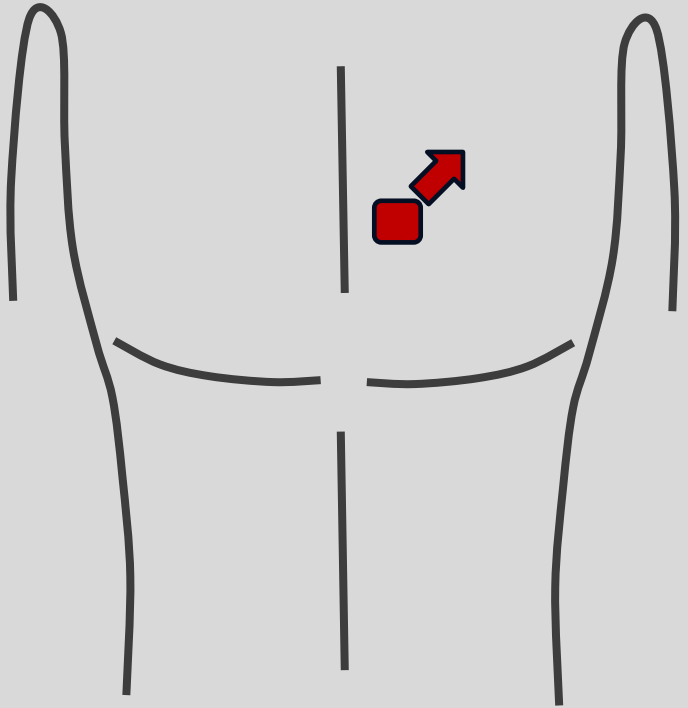




PARASTERNAL SHORT AXIS VIEW

Probe position: marker to left shoulder

- Tilt probe up and down to visualize all segments



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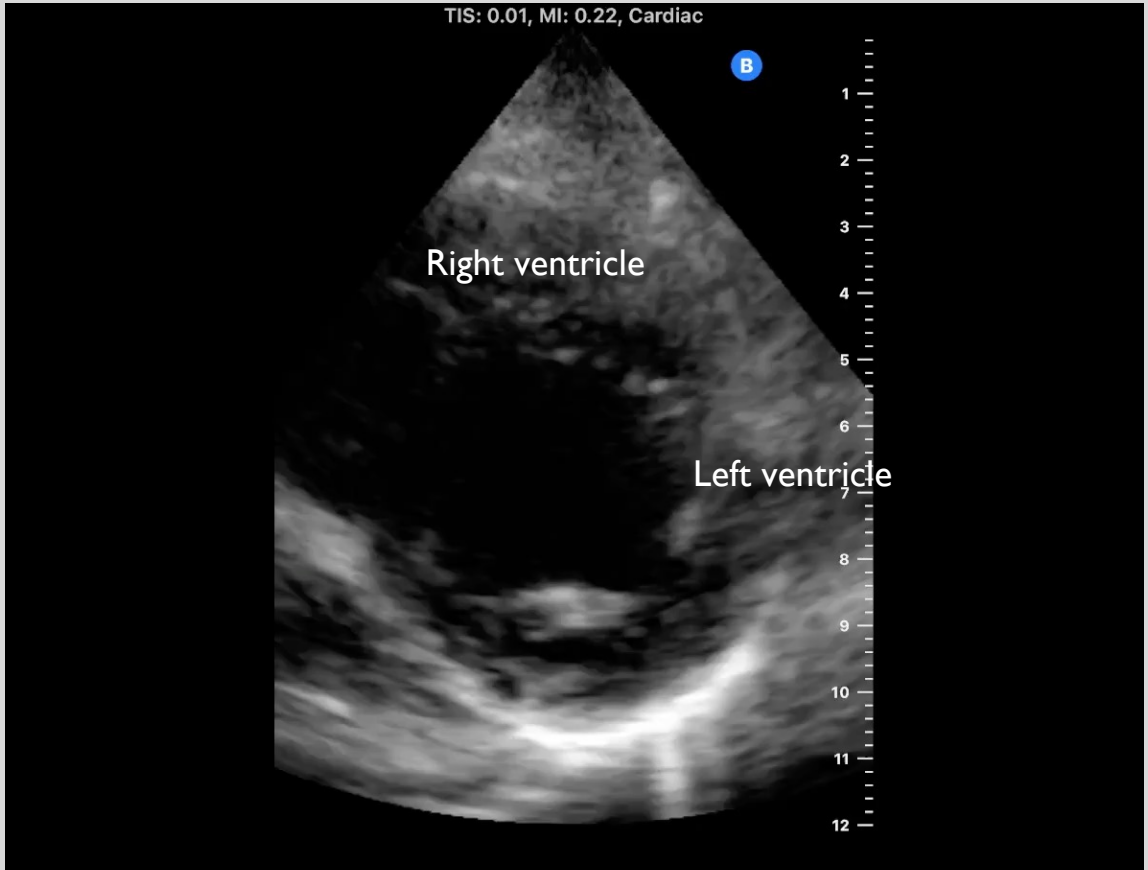
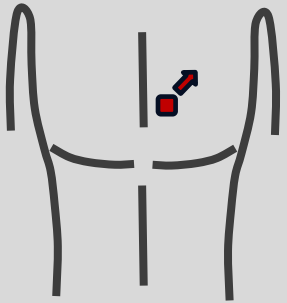


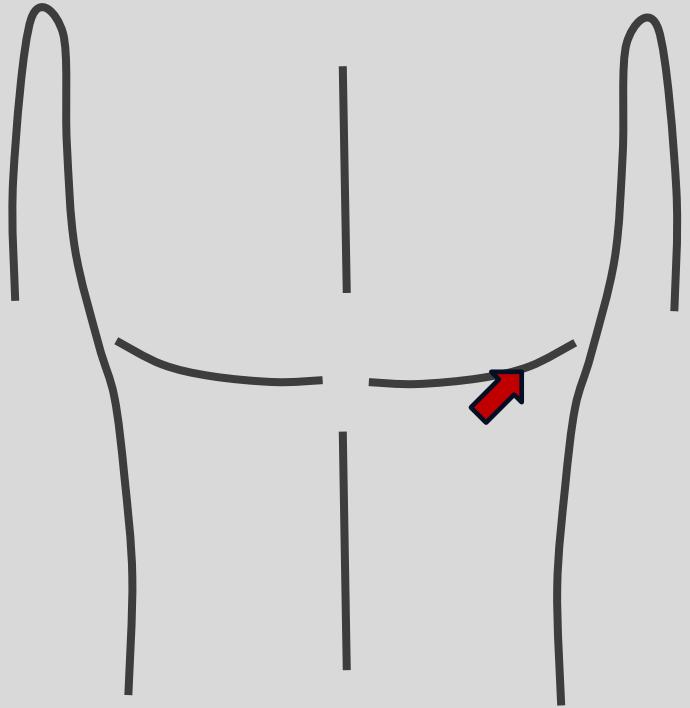


APICAL WINDOW

Location: left mid-axillary line (look for the point of maximal impulse

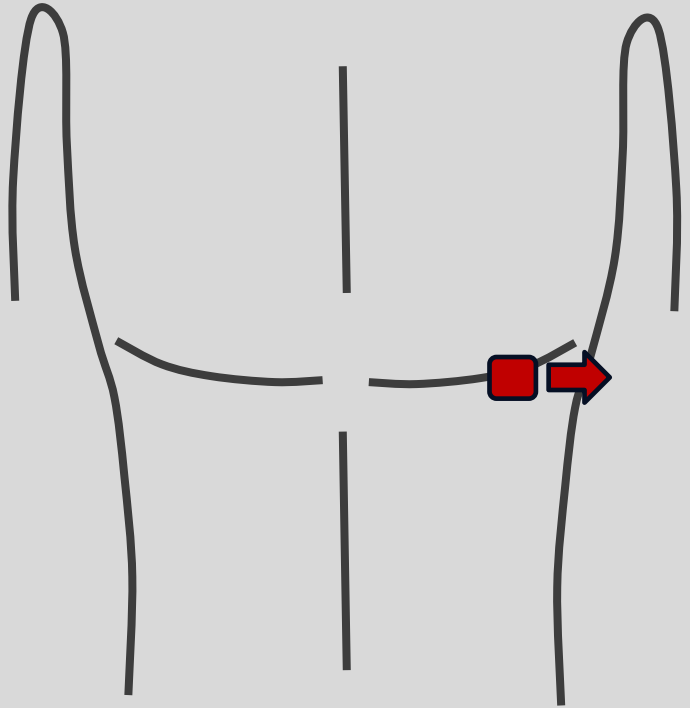
Patient position: left lateral decubitus

Optimization: slide more lateral and more caudal to avoid foreshortening the apex of the LV

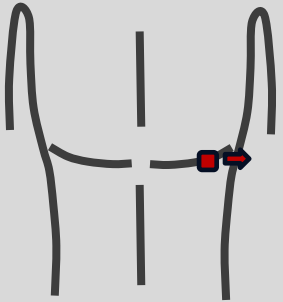


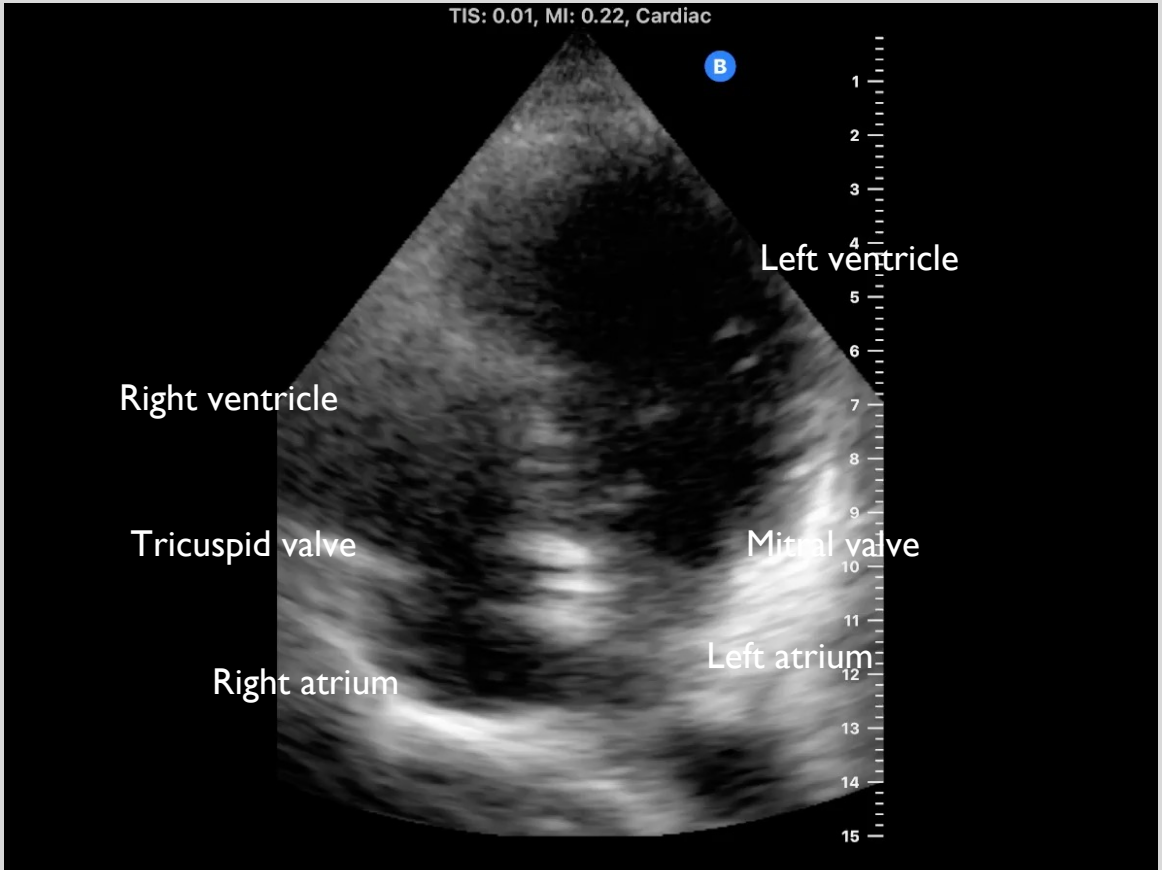
APICAL 4 CHAMBER VIEW

Probe position: marker to left side

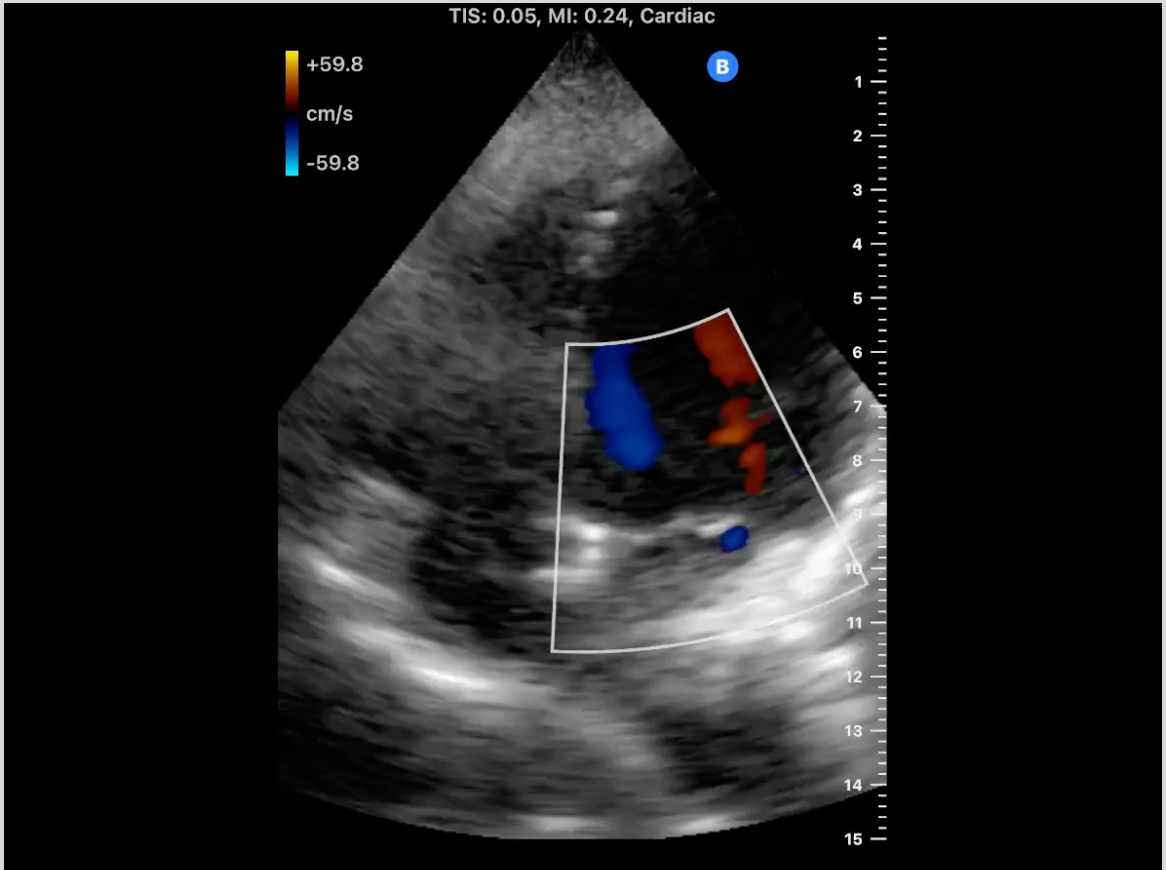


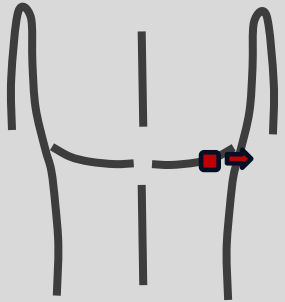
APICAL 4 CHAMBER VIEW





APICAL 4 CHAMBER VIEW





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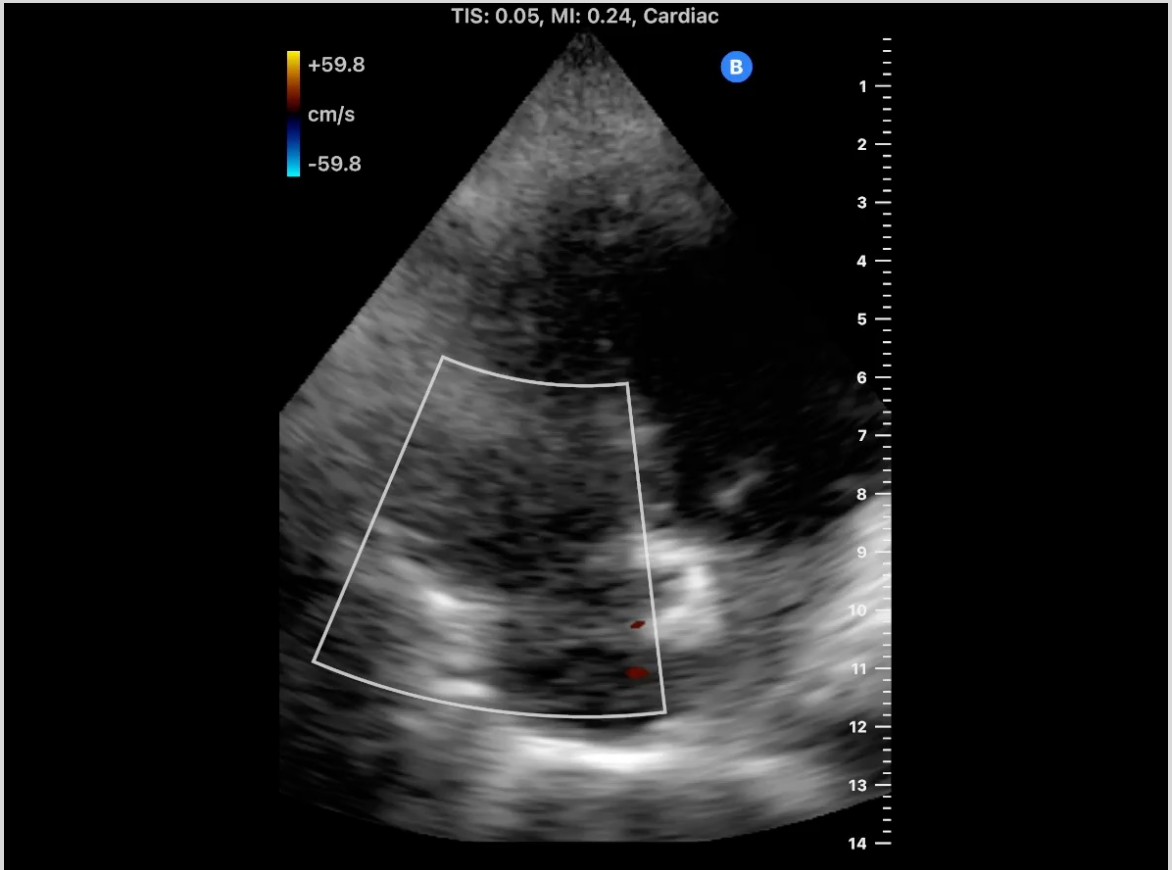
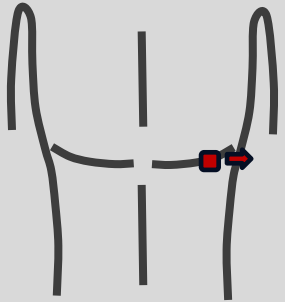
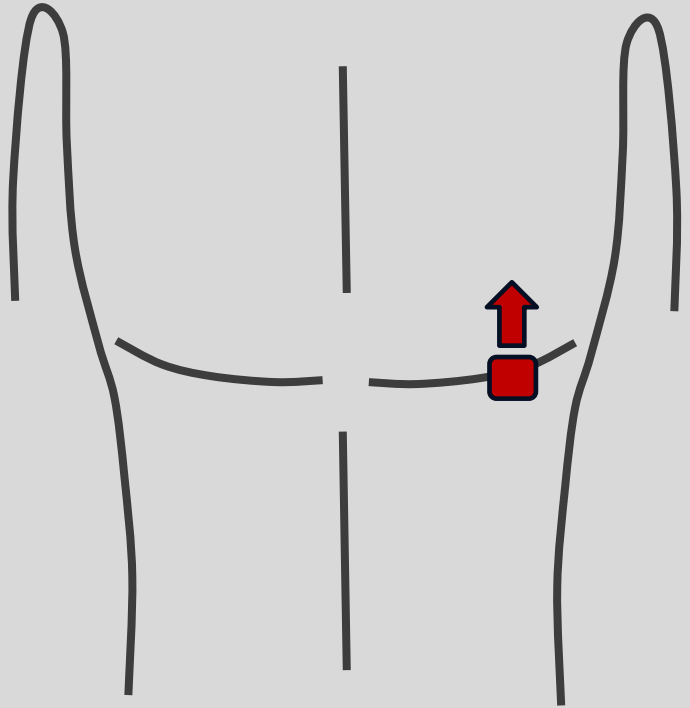




APICAL 2 CHAMBER VIEW

Probe position: rotate 90° so marker is directed cephalad



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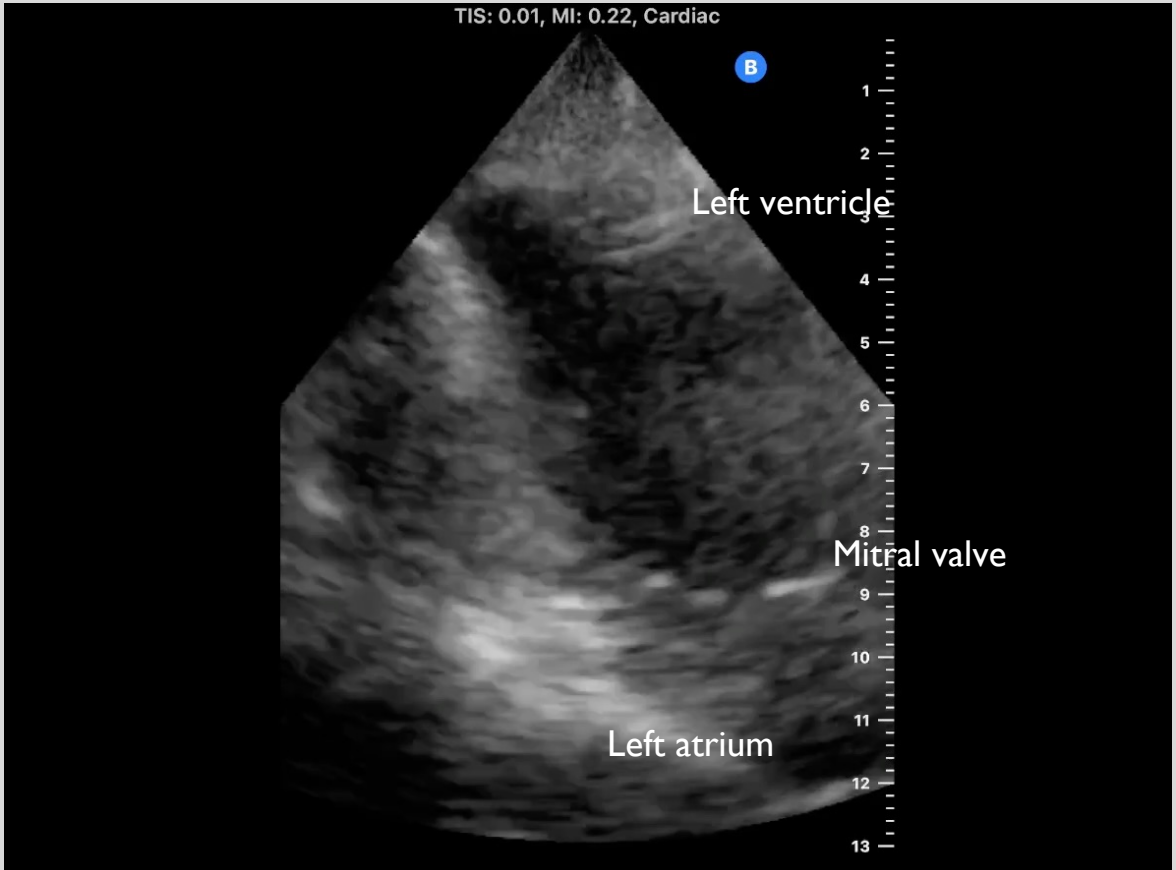
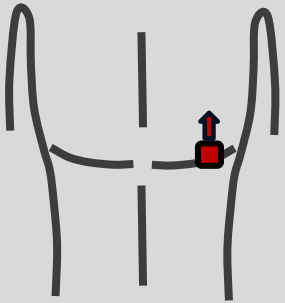
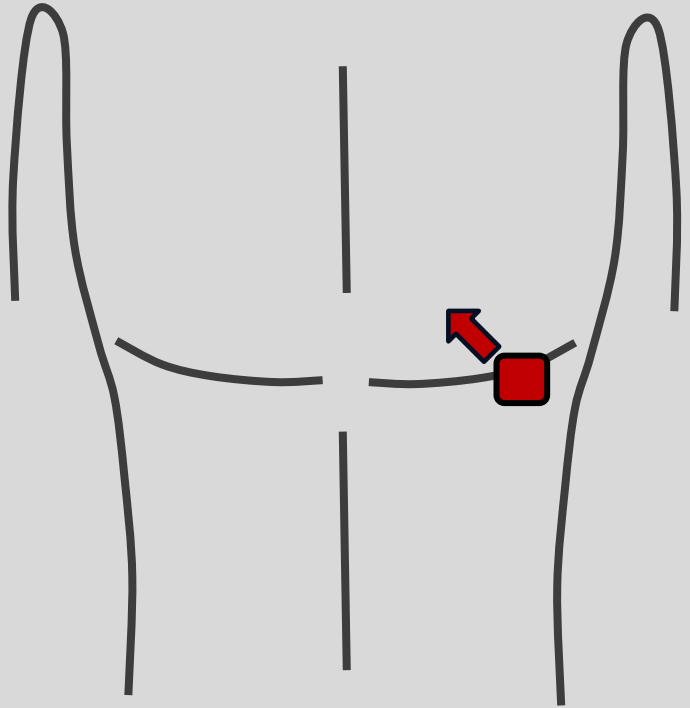


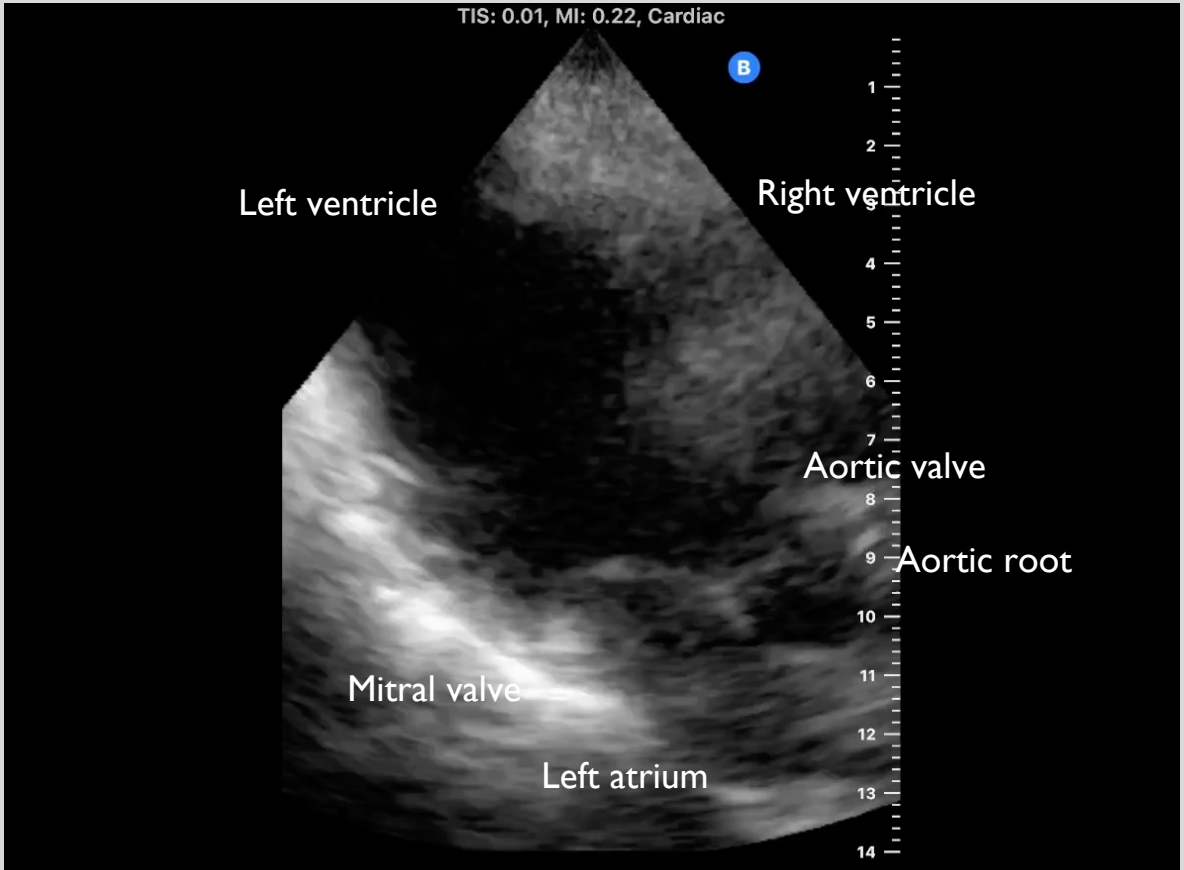


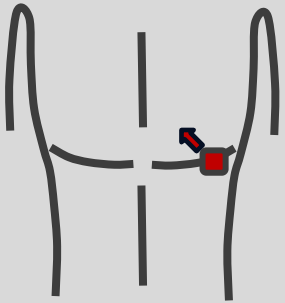
APICAL 3 CHAMBER (APICAL LONG AXIS) VIEW

Probe position: rotate an additional 45° so marker is directed toward right shoulder



APICAL 3 CHAMBER VIEW



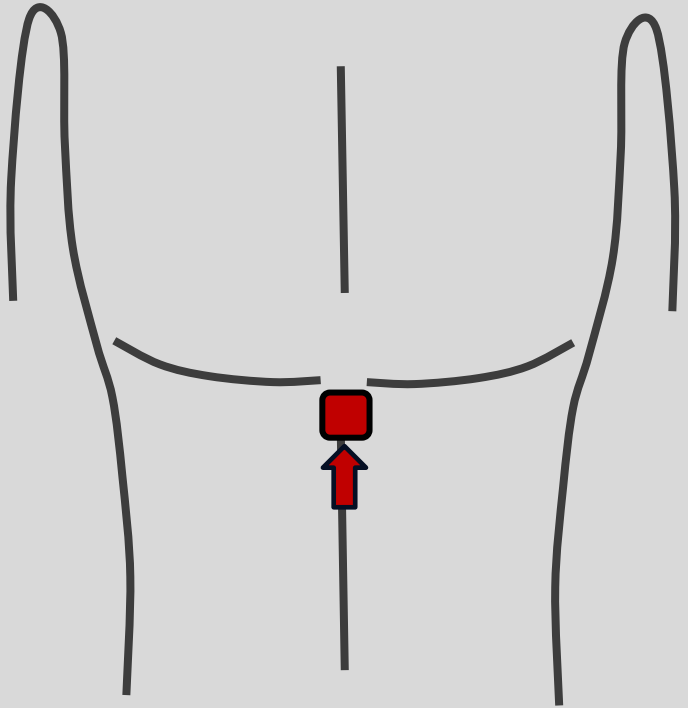


SUBXYPHOID (SUBCOSTAL) WINDOW

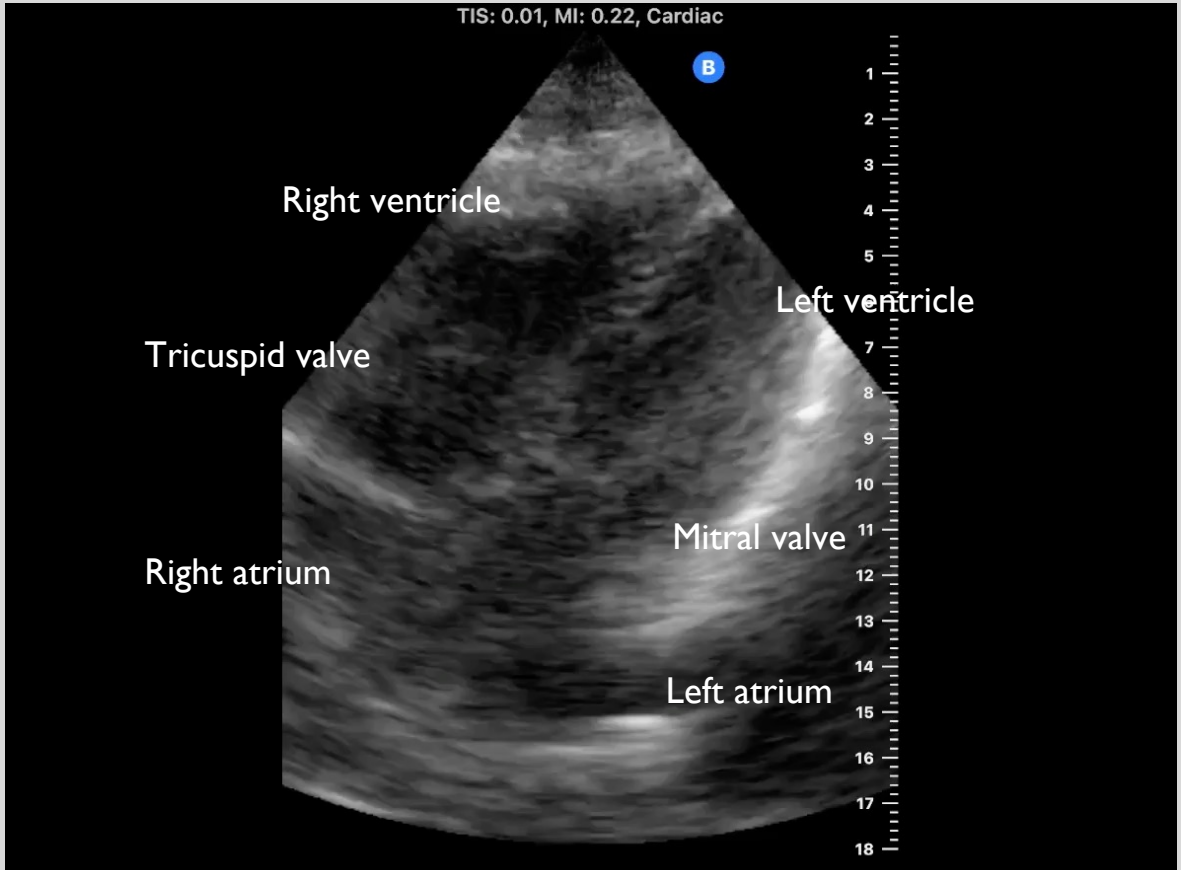
Location: inferior to the xyphoid process and just right of midline

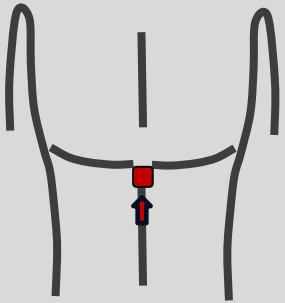
Positioning: supine with the knees flexed

Probe position: directed cephalad with probe marker to the patient's left

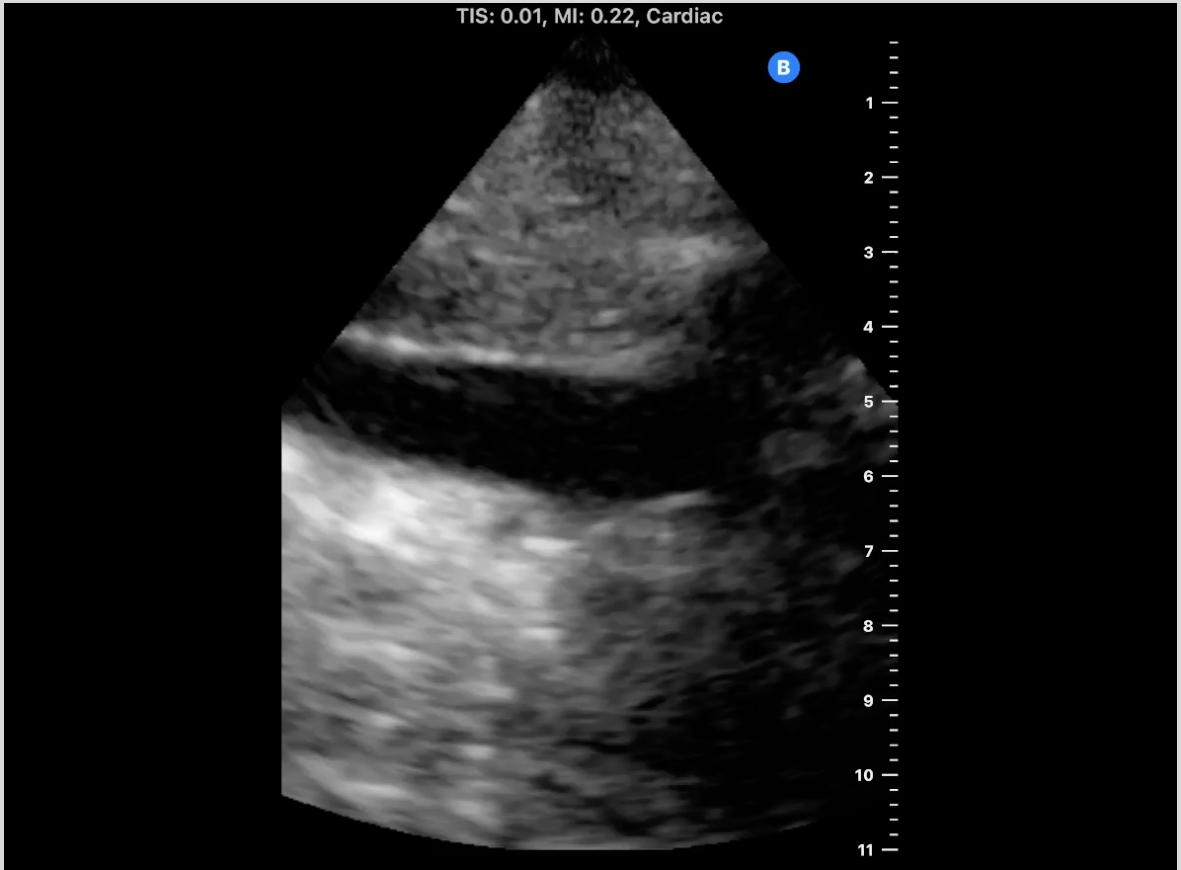


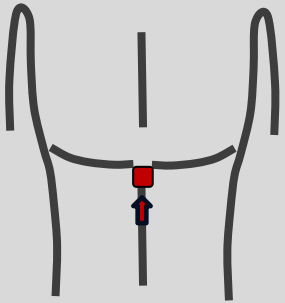
SUBCOSTAL FOUR CHAMBER VIEW



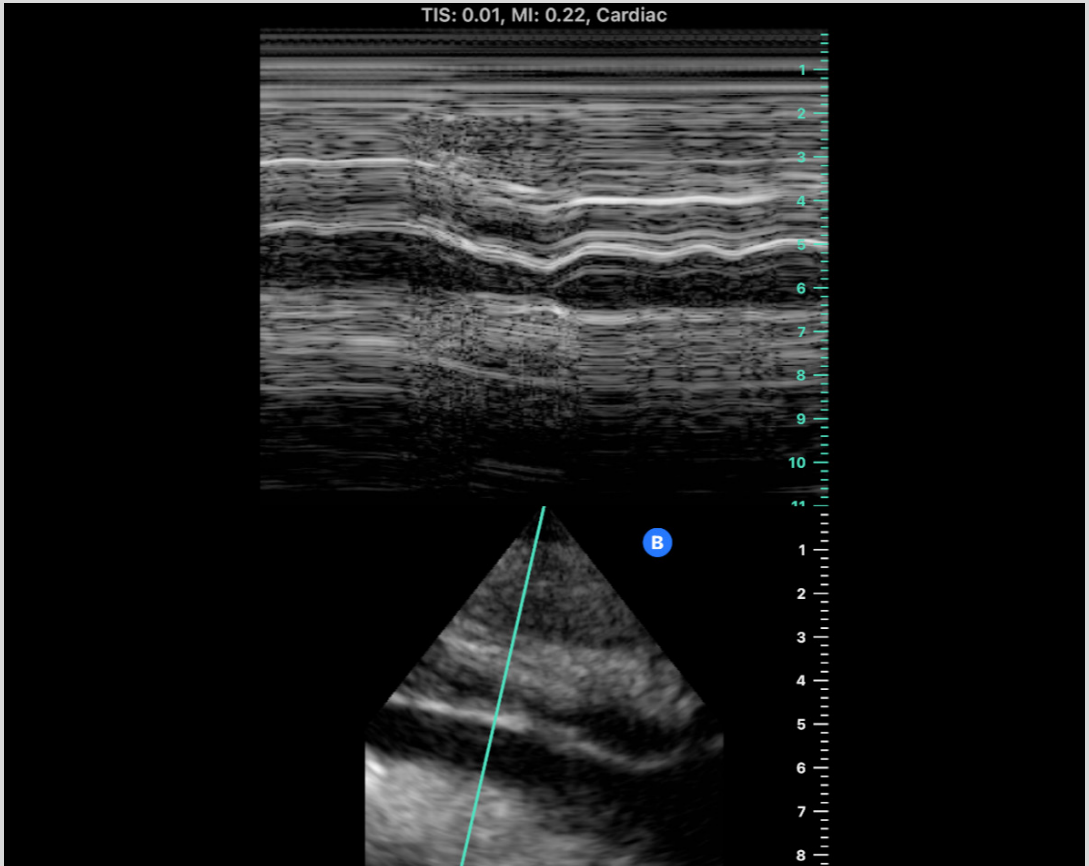


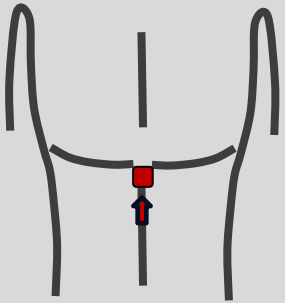
IVC ASSESSMENT





IVC ASSESSMENT – SNIFF TEST



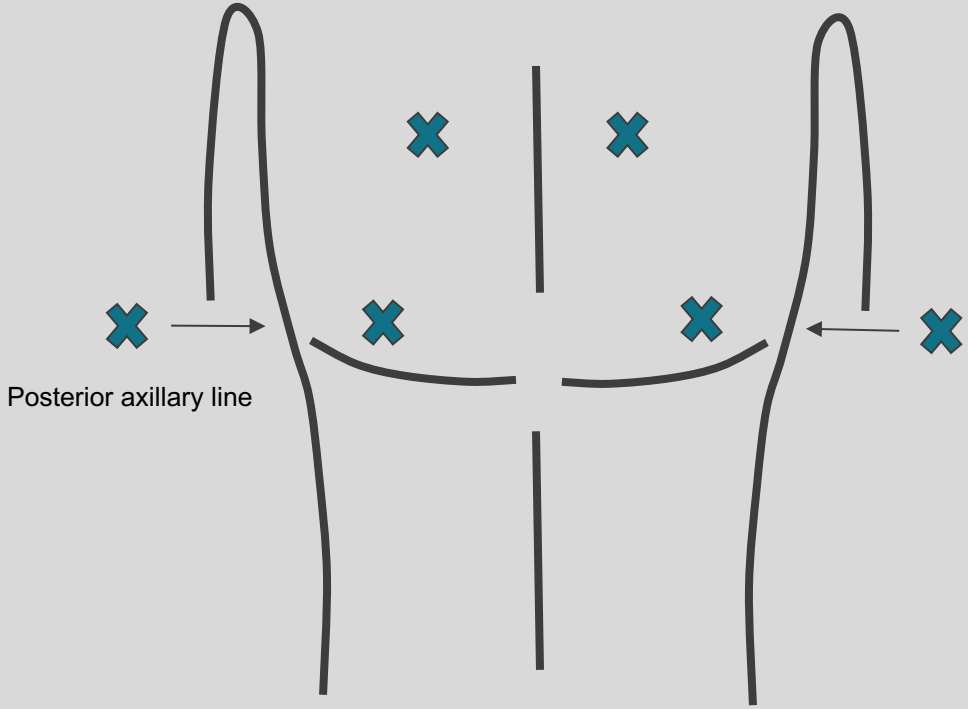


LUNG ULTRASOUND

Lung Ultrasound in the Critically Ill (Lichtenstein 2014, *Annals of Intensive Care*)

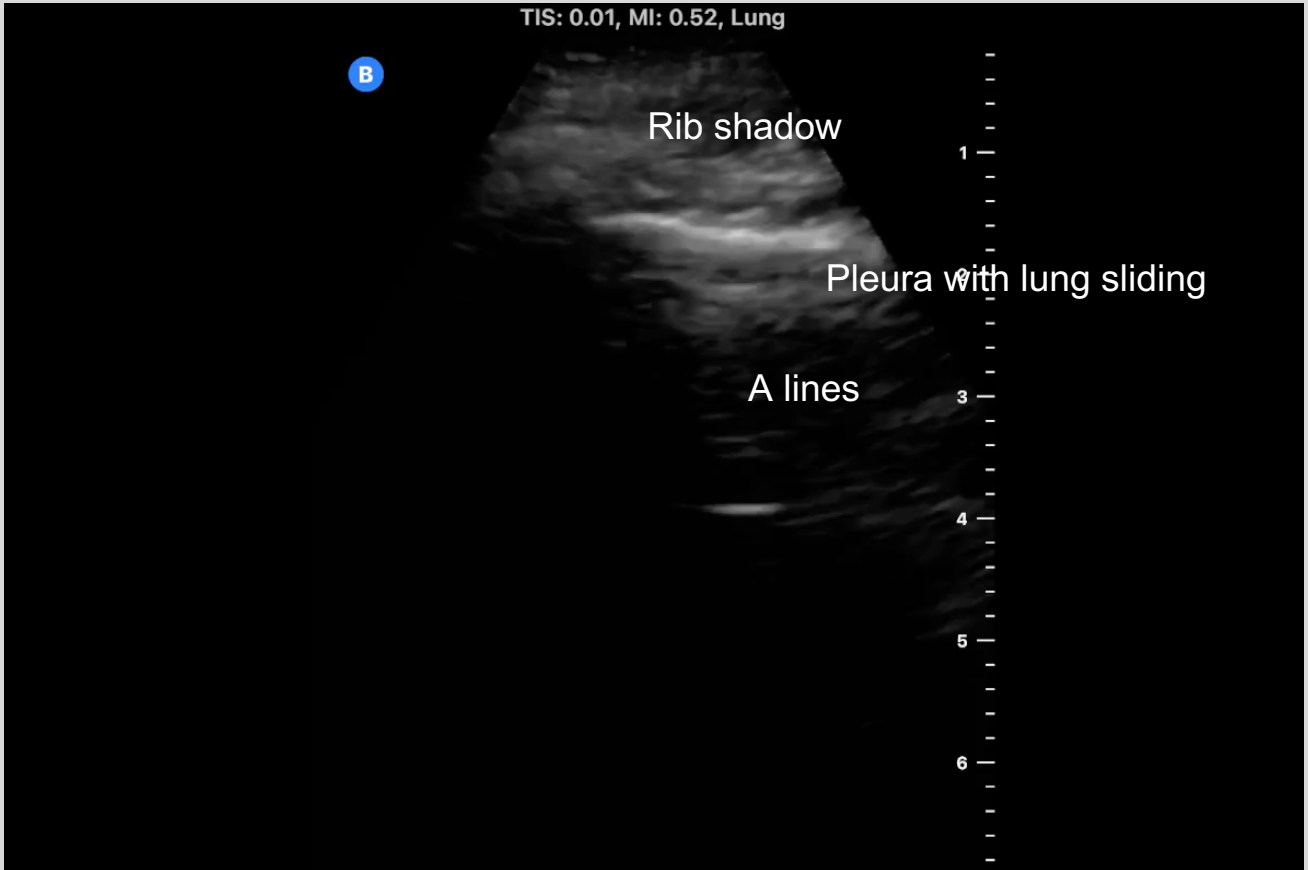
- Comprehensive discussion of ultrasound of the lung
- BLUE-protocol
- Concepts central to lung ultrasound:
  - All ultrasound signs arise from the pleural line
  - Most acute disorders are adjacent to the pleural line
- Looking for: effusions, edema, consolidation, pneumothoraces

LUNG ULTRASOUND

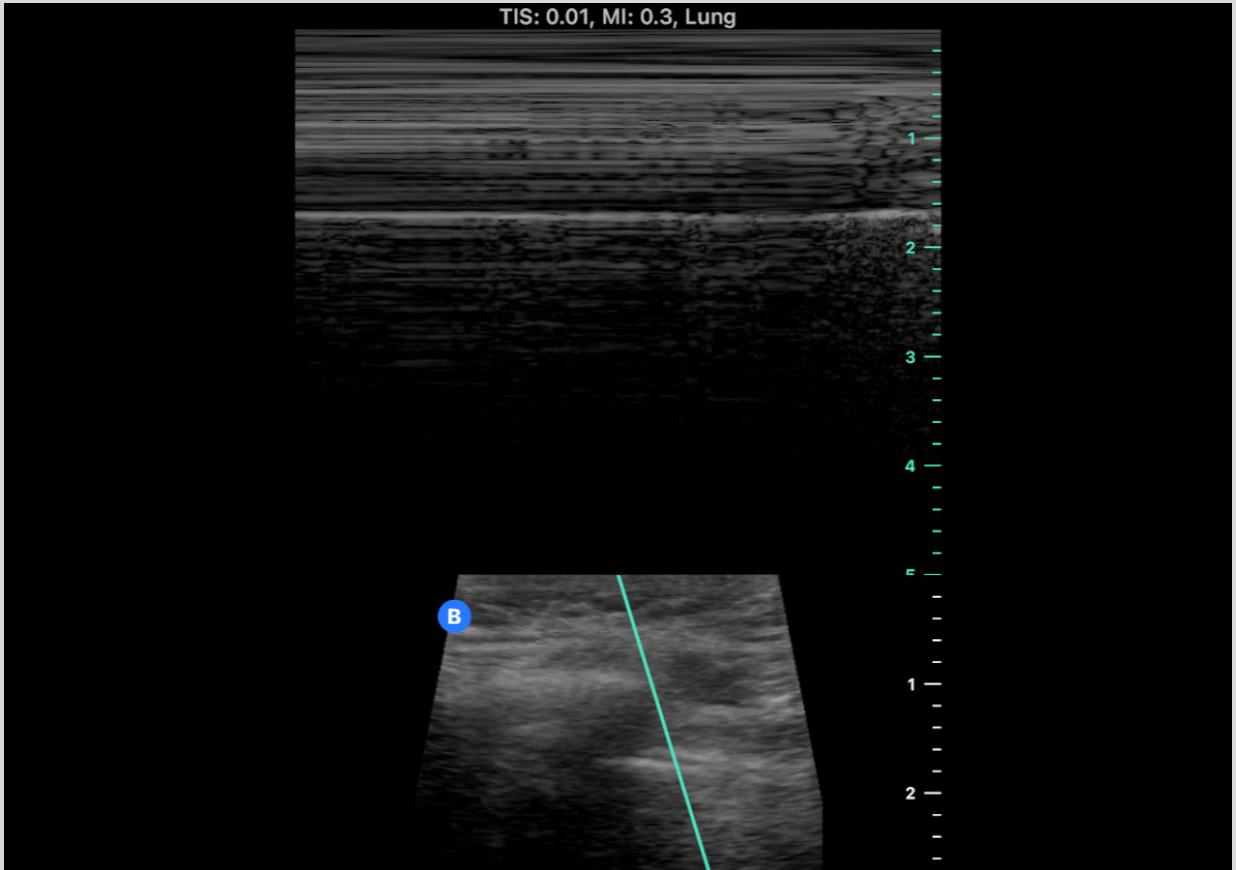


BLUE-protocol

LUNG ULTRASOUND



LUNG ULTRASOUND



ABDOMINAL ULTRASOUND

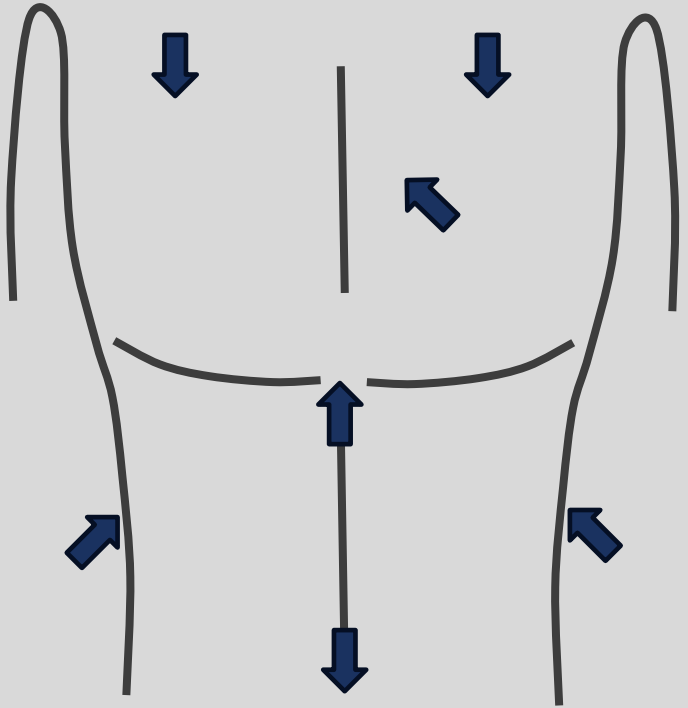
Focused Assessment with Sonography in Trauma (FAST) Exam

- Simple rescue exam searching for free fluid in abdomen and pericardium, typically in setting of suspected hemorrhage or trauma
- E-FAST (extended FAST) includes lung windows to assess pleural spaces
- Not a detailed assessment of the structures of the abdomen
- Cannot reliably assess retroperitoneal space

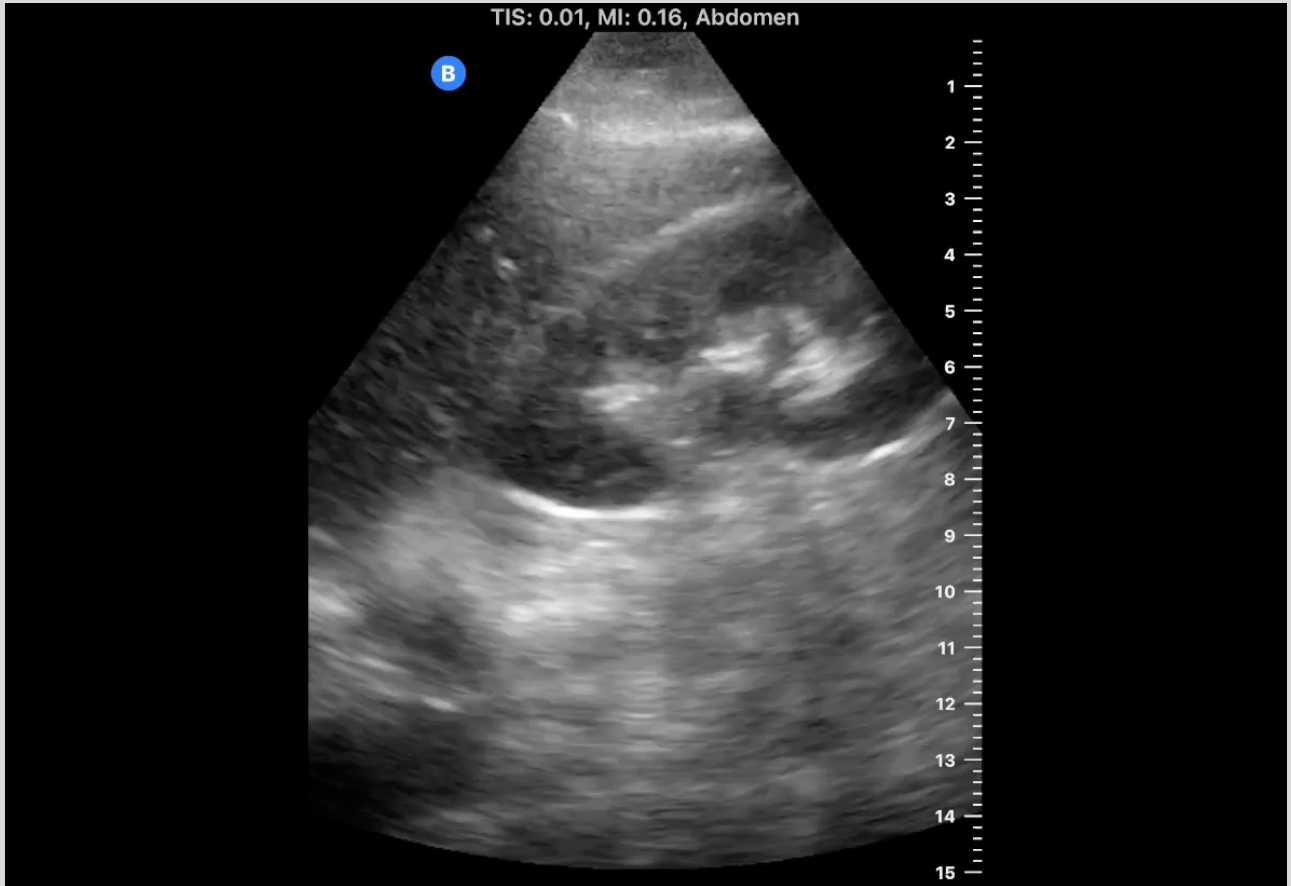
E-FAST EXAM

Windows:

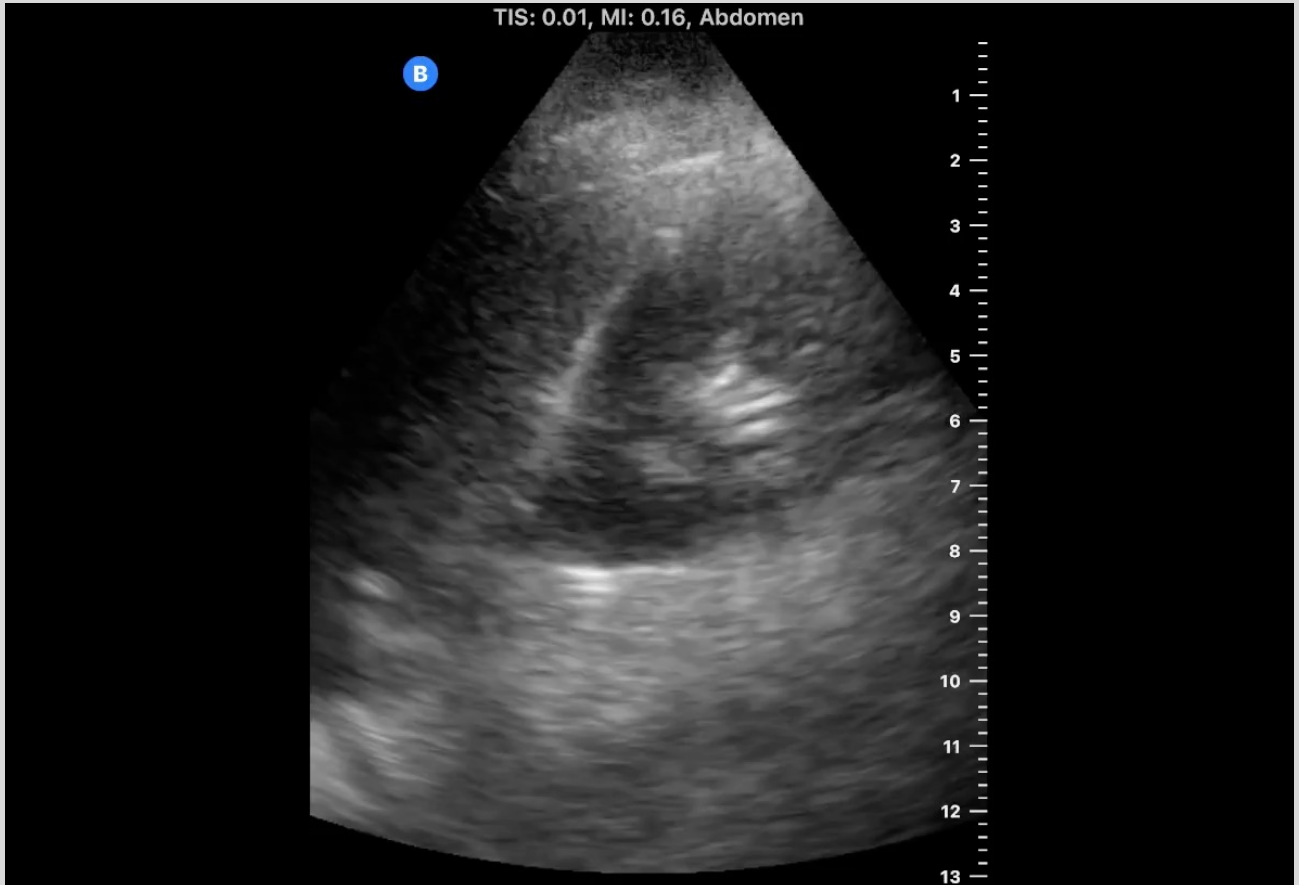
- -Subxyphoid (pericardial)
- -Parasternal (pericardial)
- -Bilateral Pleura (lungs)
- -Morrison's pouch (perihepatic)
- -Perisplenic
- -Pelvic



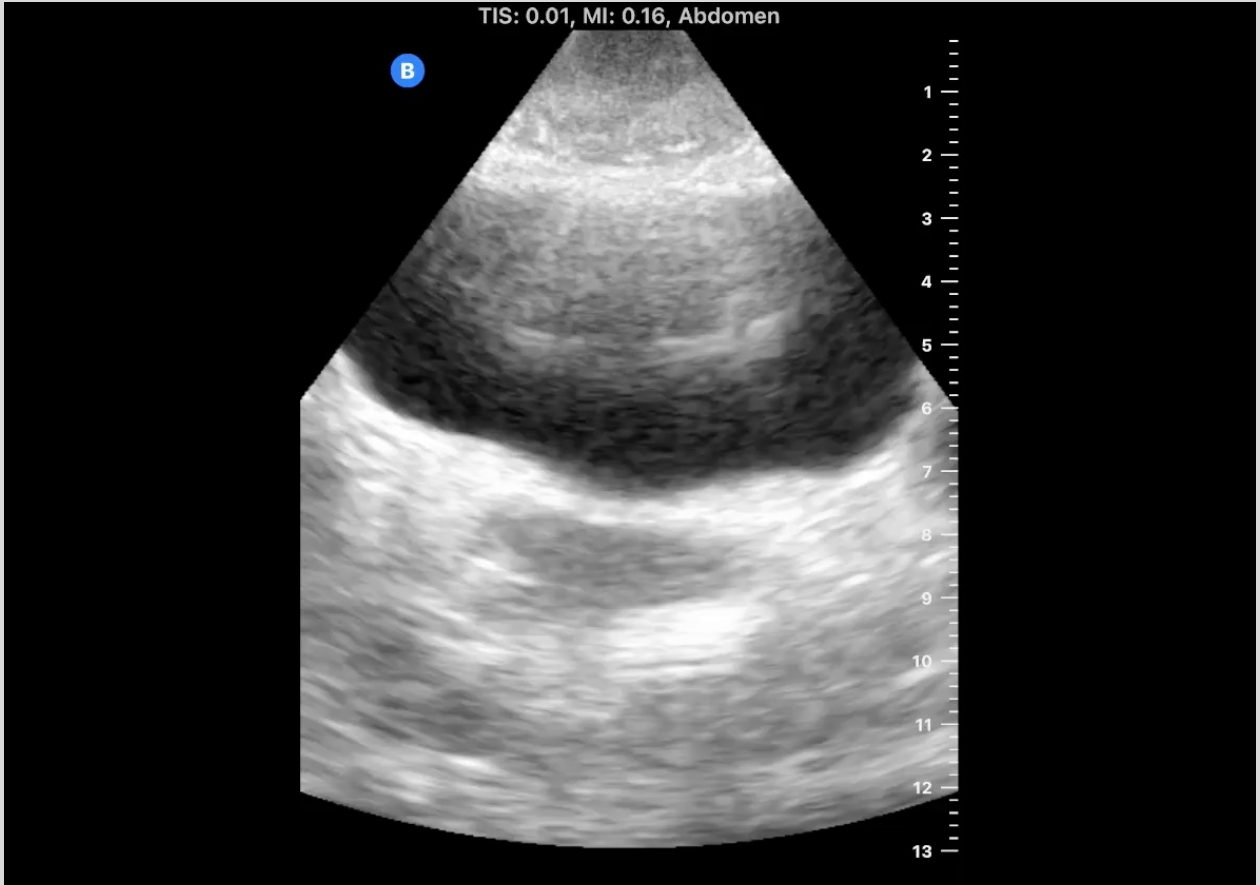
RIGHT UPPER QUADRANT



LEFT UPPER QUADRANT

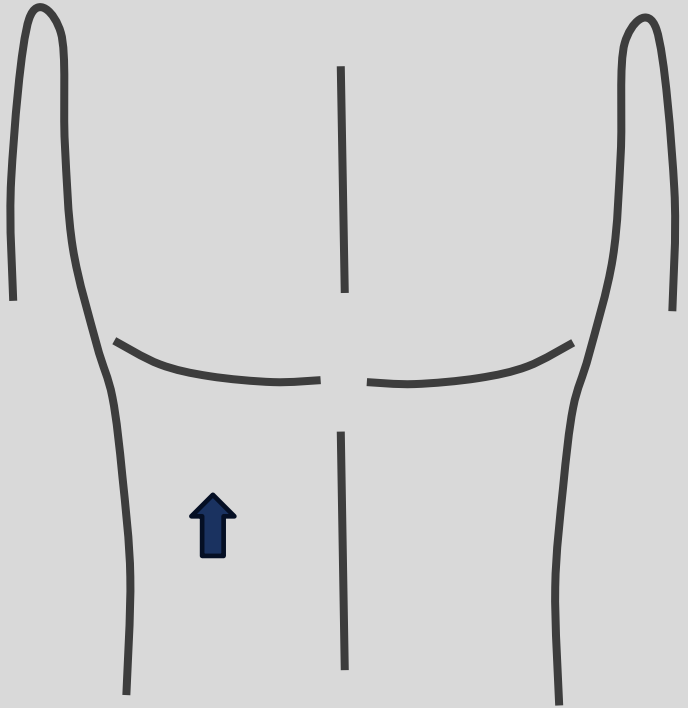


PELVIS

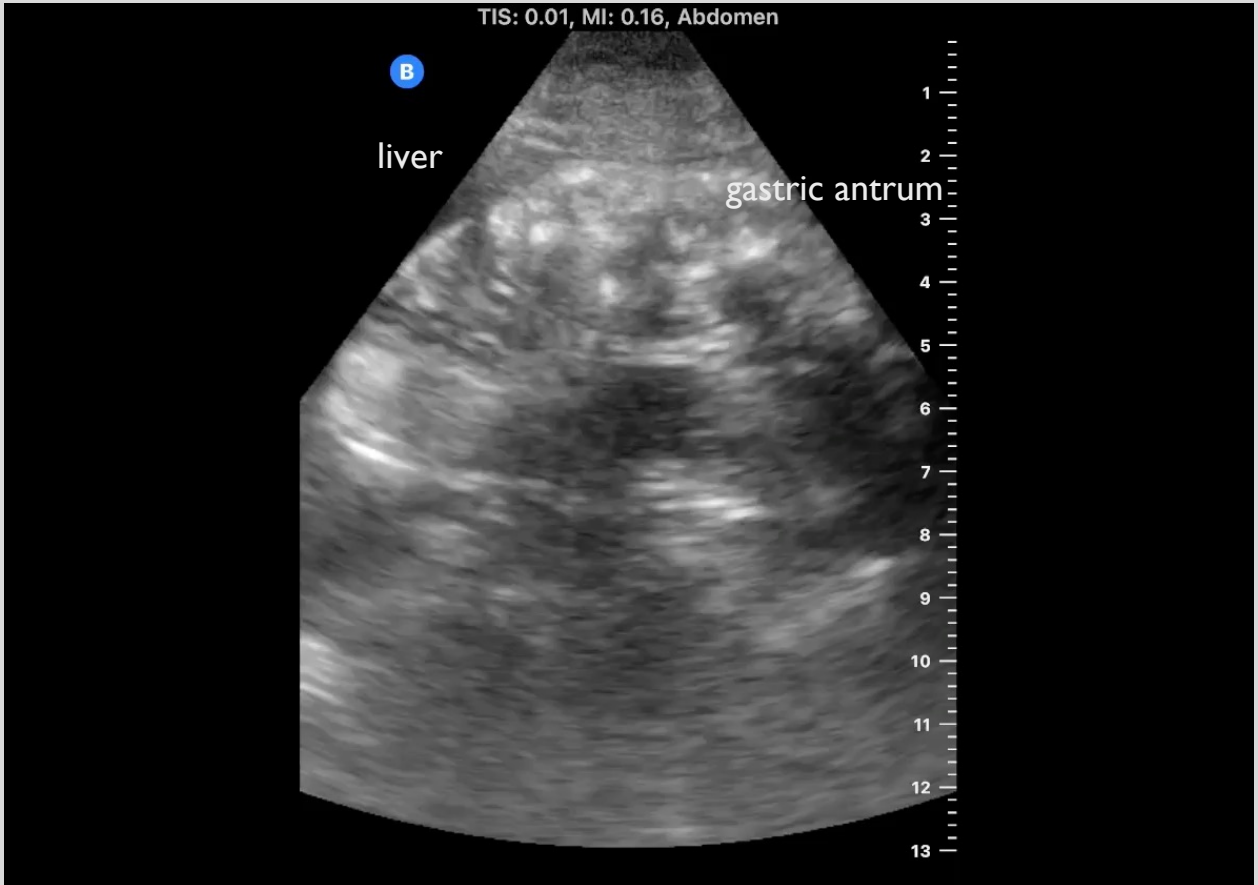


GASTRIC ULTRASOUND

- Low frequency probe (suggest curvilinear) in sagittal plane at the epigastrum can visualize gastric antrum
- ASRA recommends scan in supine and right lateral decubitus positions
- Goal: visualization of gastric antrum adjacent to liver



GASTRIC ULTRASOUND



LIMITS OF POCUS

- Most useful as an adjunct to bedside diagnosis in setting of clinical suspicion
- Utility will be limited by skill and experience of clinician
- Always consider later formal echocardiography or ultrasound if warranted

QUESTIONS?