JOHNS HOPKINS
SCHOOL of NURSING

Lights off. Gel. Scan. Repeat! POCUS Case Studies from the Head of the Bed

Alexander Halstead DNP, CRNA, FNP

DNP Nurse Anesthesia Program

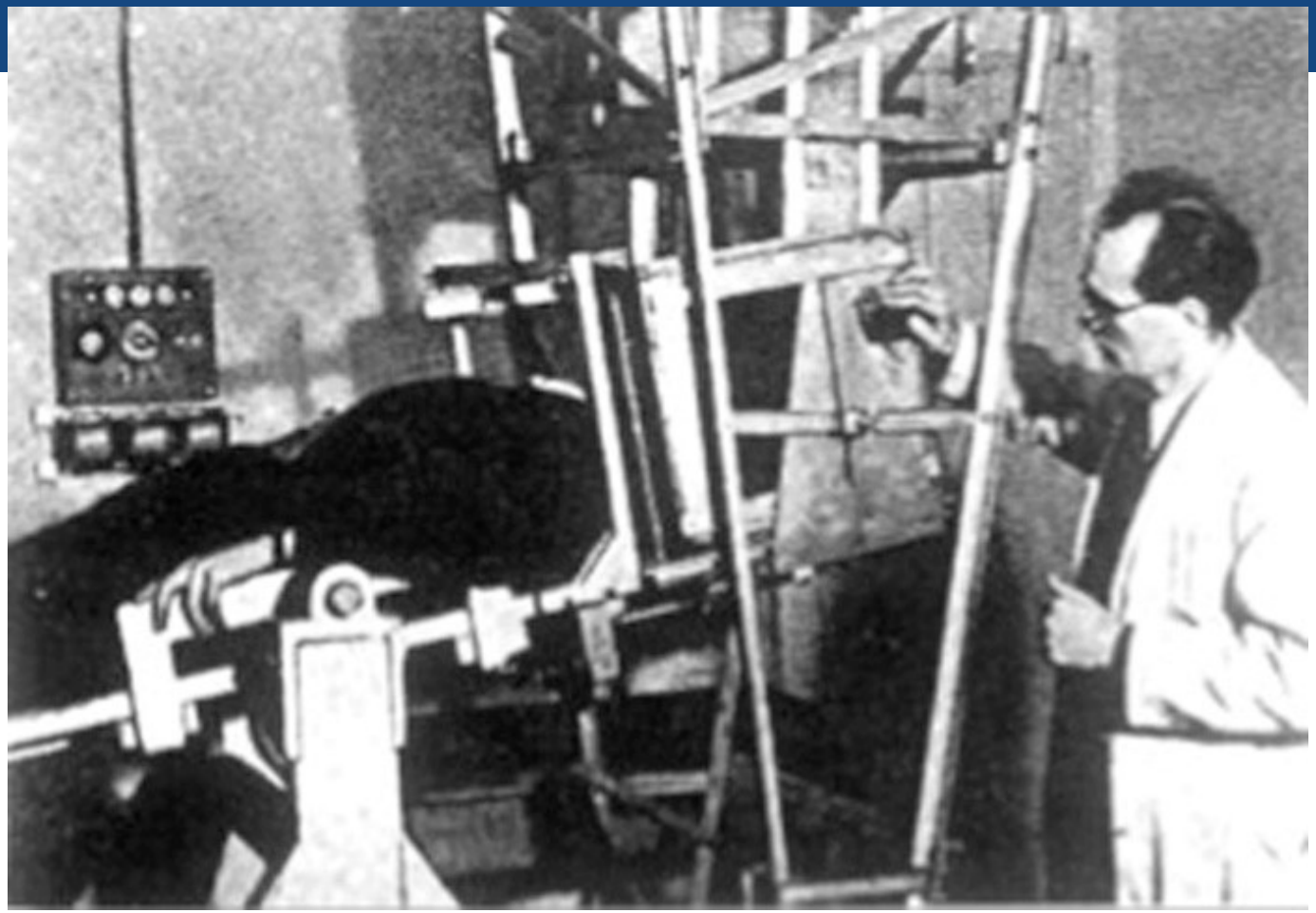
By the end of this module you will be able to:

- Review the basic principles of point-of-care ultrasound including image acquisition, ultrasound technology, and scanning techniques.
- Discuss perioperative case studies where POCUS was utilized to change the patient's clinical management.
- Review POCUS image acquisition and interpretation of cardiac, lung, gastric volume, IVC diameter, and abdominal examinations.
- Discuss future implications for the use of POCUS in the clinical setting and emerging technology.

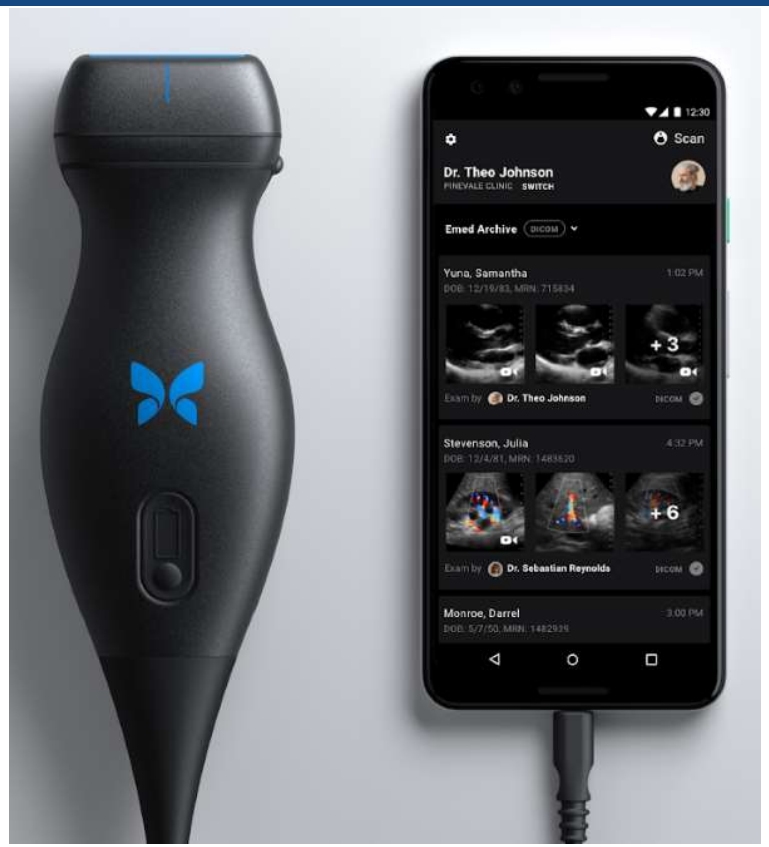
Financial Interests

- None

First Ultrasound



Now


12:30
Scan
Dr. Theo Johnson
PINEVALE CLINIC SWITCH
Emed Archive DICOM
Yuna, Samantha
1:02 PM
+ 3
Exam by Dr. Theo Johnson
DICOM
Stevenson, Julia
4:32 PM
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Exam by Dr. Sebastian Reynolds
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Monroe, Darrel
3:00 PM

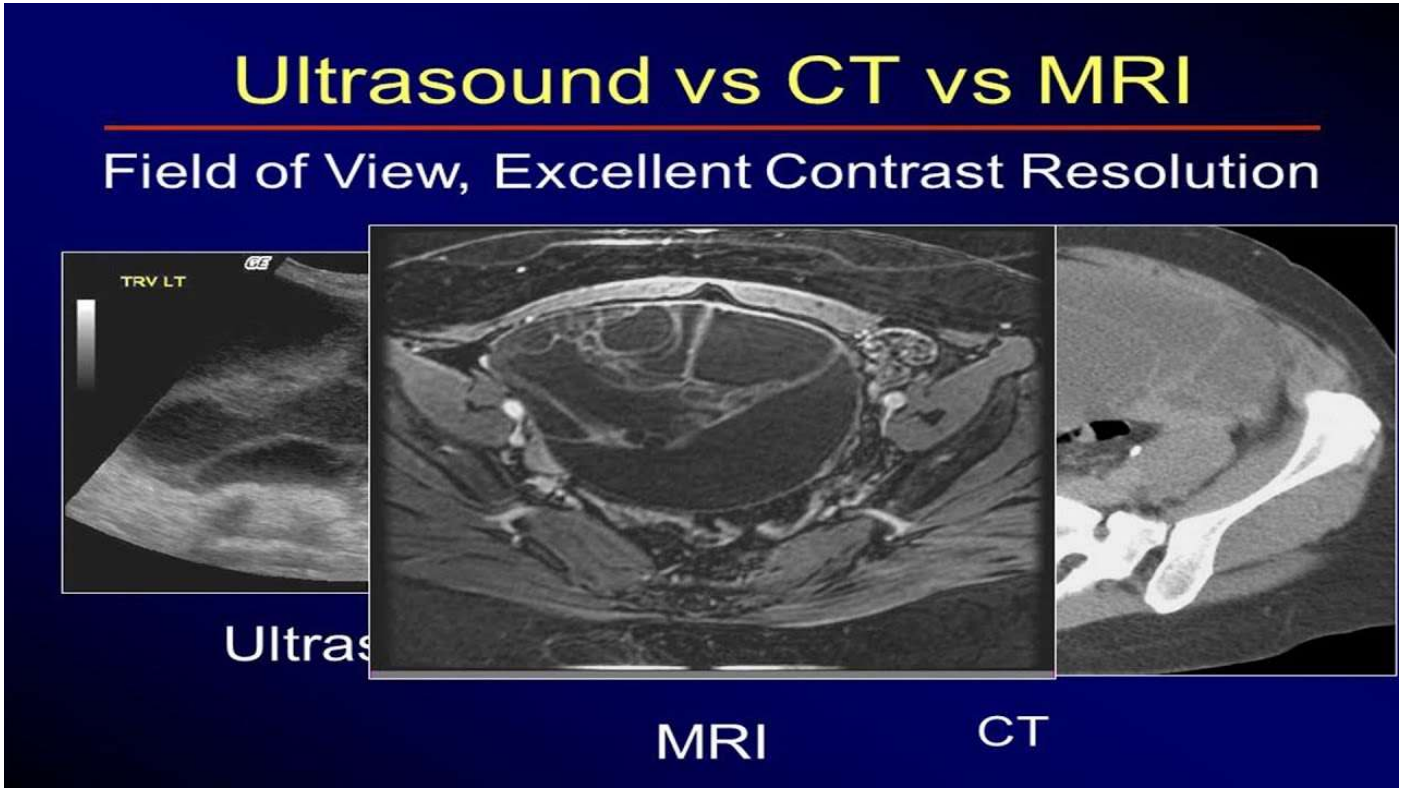
What is POCUS?

- Diagnostic vs therapeutic
- Specific clinical questions to change how you care for the patient
- FOCUS
- ED, medicine, anesthesia, critical care ect.

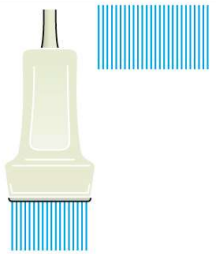
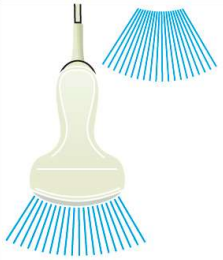
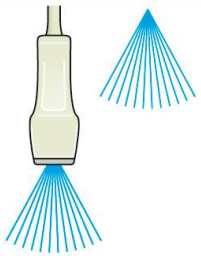
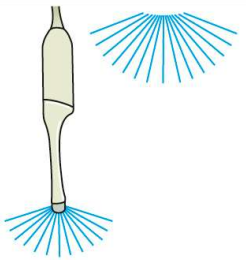
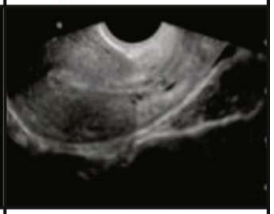
COA update (2021)

- Add the following glossary definition to Doctoral Standards: Point of Care Ultrasound (POCUS): Refers to the use of portable ultrasonography at a patient's bedside for diagnostic (e.g., symptom or sign-based examination) purposes. This is exclusive of using ultrasound for image-guidance purposes such as for regional anesthesia or vascular access. • Add the following In the Appendix (Clinical Experiences) of the Doctoral Standards: Add POCUS with no case number requirement but require students to track. • Implementation date: All students matriculating into an accredited program on or after January 1, 2022

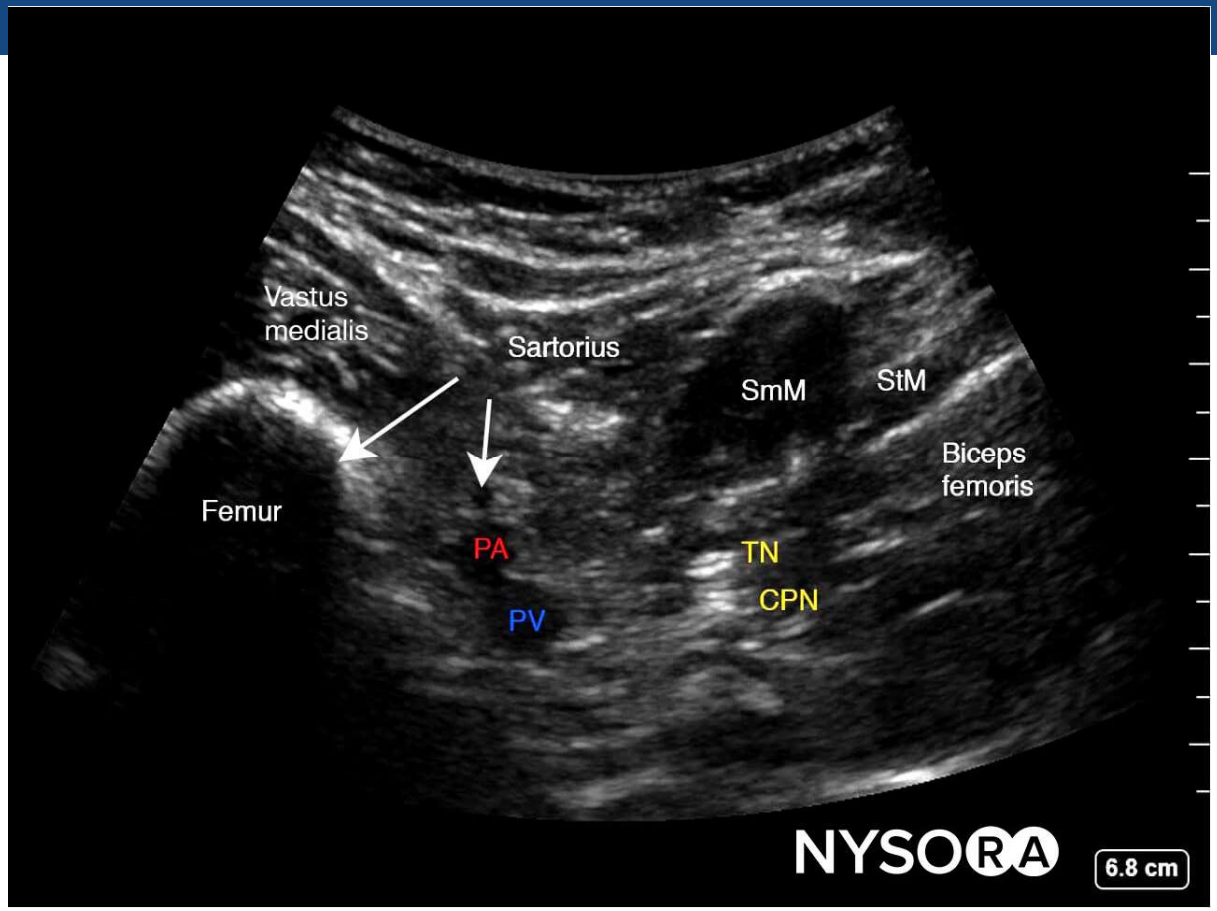
Imaging Modalities



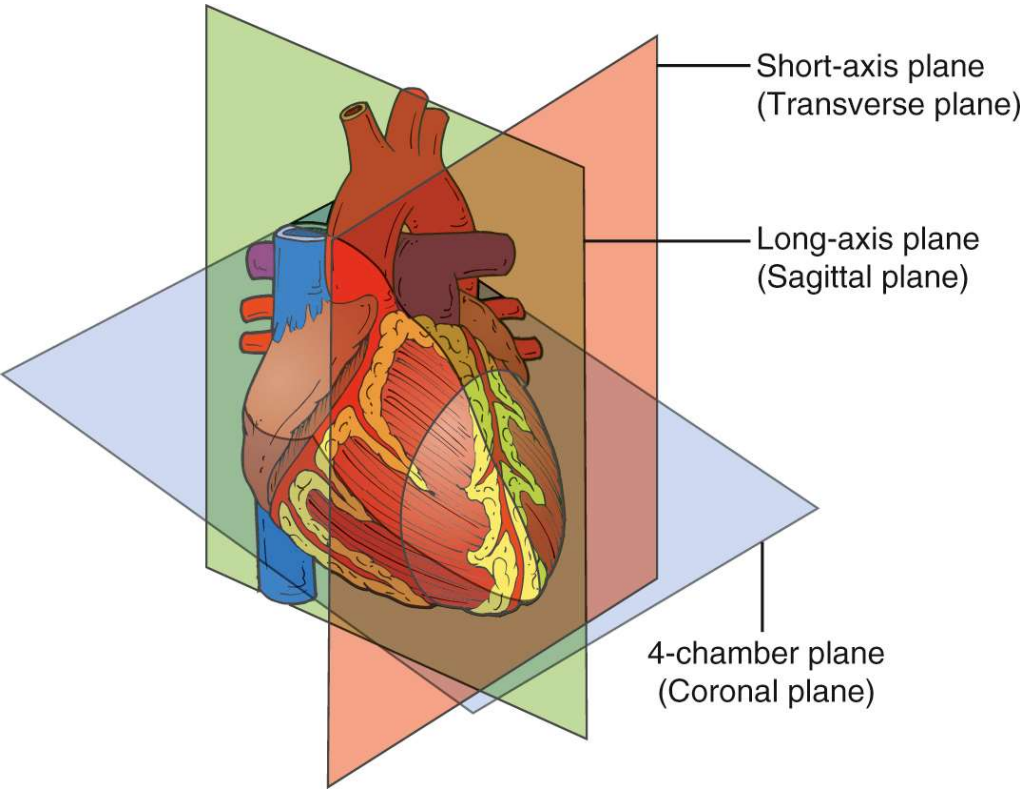
Probe selection

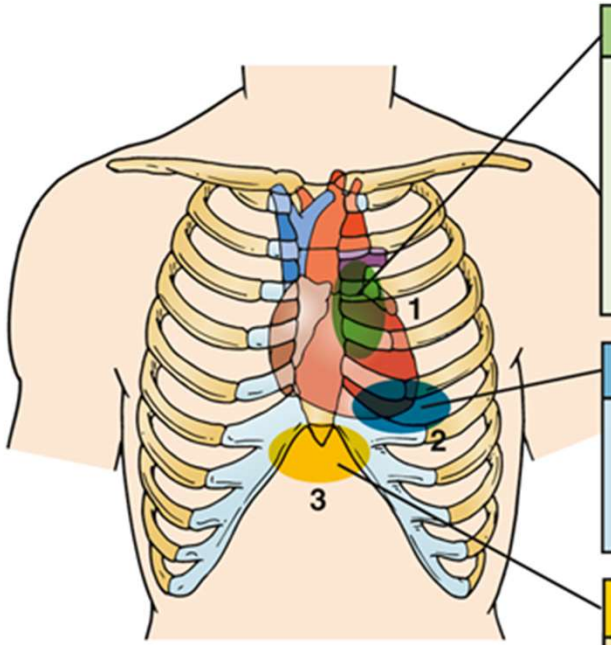
Transducer type	Linear	Curvilinear	Phased array	Intracavitary
				
Frequency range	5–15 MHz	2–5 MHz	1–5 MHz	5–8 MHz
Imaging depth	9 cm	30 cm	35 cm	13 cm
Footprint				
Image				
Applications	Arteries/veins Procedures Pleura Skin/soft tissues Musculoskeletal Testicles/hernia Eyes Thyroid Lymph Nodes Nerves	Gallbladder Liver Kidney Spleen Bladder Abdominal aorta Abdominal free fluid Uterus/ovaries Lumbar Puncture	Heart Inferior vena cava Lungs Pleura Abdomen Transcranial Doppler	Uterus/ovaries Pharynx

Hyperechoic vs Hypoechoic



Cardiac Scanning: Anatomy





Parasternal window

Parasternal long-axis
Parasternal short-axis, pulmonary
Parasternal short-axis, aortic valve
Parasternal short-axis, mitral valve
Parasternal short-axis, mid-vent
Parasternal short-axis, apical level
Right ventricular inflow view

Apical window

Apical 4-chamber
Apical 2-chamber
Apical 3-chamber
Apical 5-chamber

Subcostal window

Subcostal 4-chamber
Subcostal IVC view
Subcostal short-axis

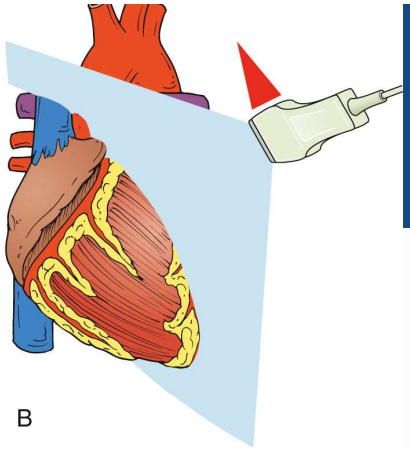
Clinical Questions during Cardiac Scanning

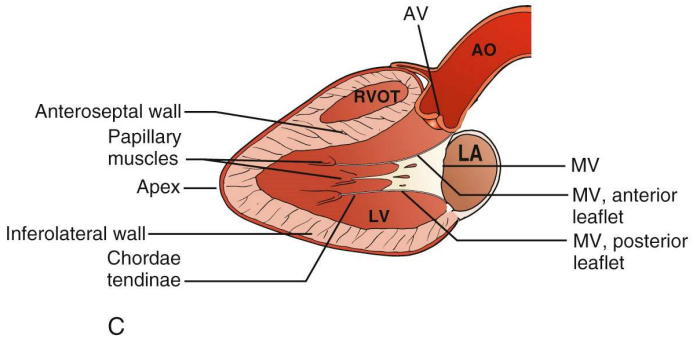
Is the cardiac image normal or abnormal?

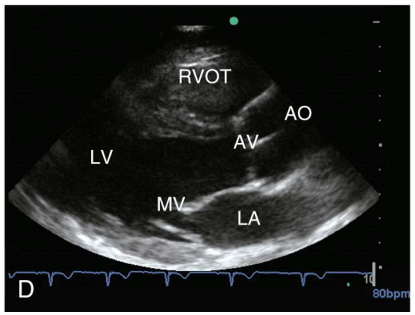
1. Is there a pericardial effusion? (Anechoic strip around the heart)
2. Are the ventricles squeezing well? (contraction / ejection fraction)
3. Are the valves opening and closing? (valvular stenosis / regurgitation)
4. Are the structures normal in size?
5. Is the myocardium thicker or thinner than normal? (hypertrophy / dilated cardiomyopathy)
6. Is the right ventricle bigger than the left ventricle? (pulmonary embolus / pulmonary HTN)
7. Is the whole LV squeezing? (regional wall motion abnormalities)

- Probe: Phased Array
- Rule: Any findings should be confirmed in more than one view, plus clinical correlation.

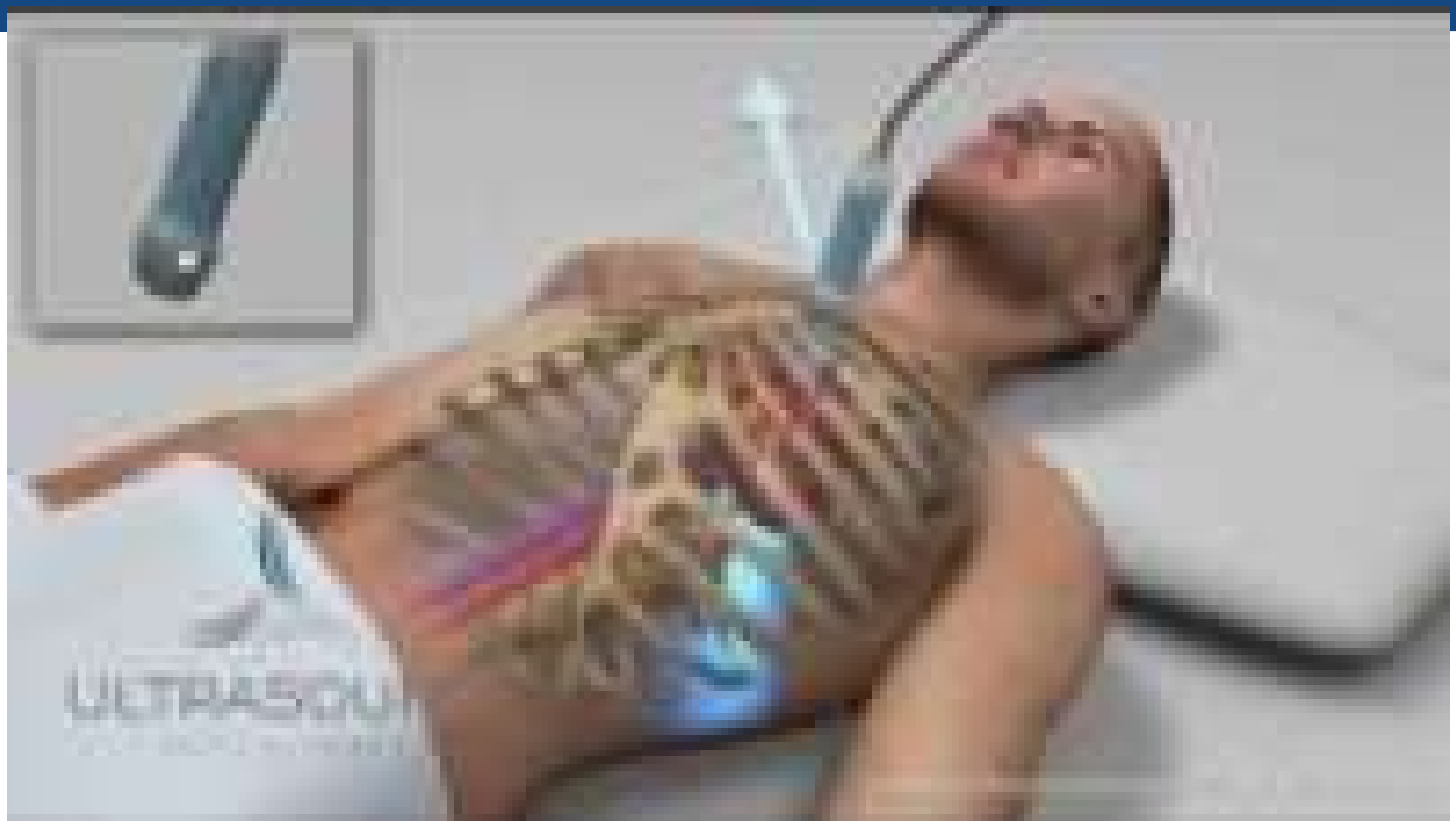
Parasternal Long Axis



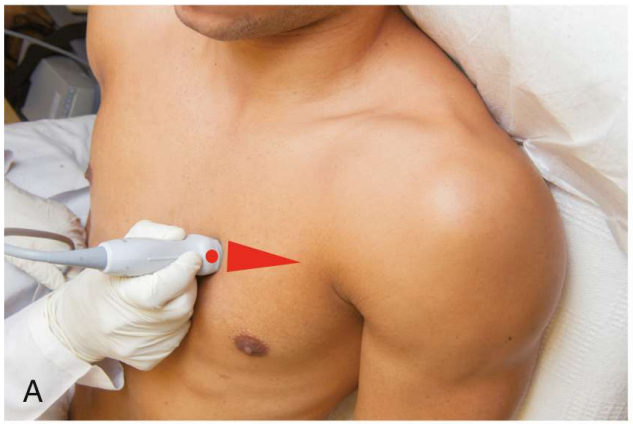


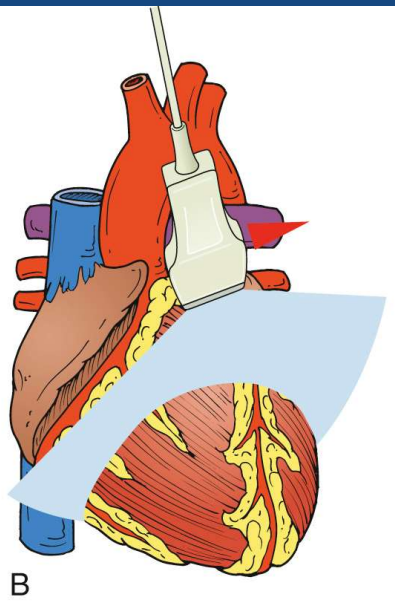


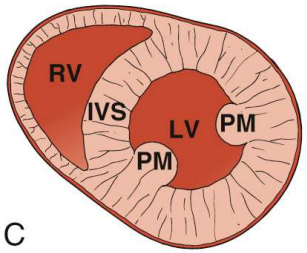
Parasternal Long Axis

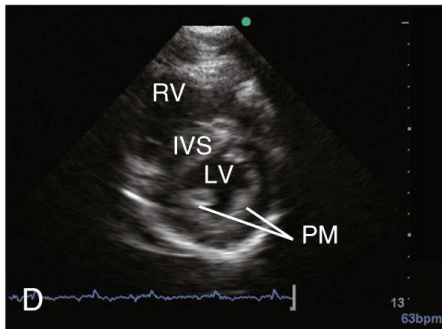


Parasternal Short Axis

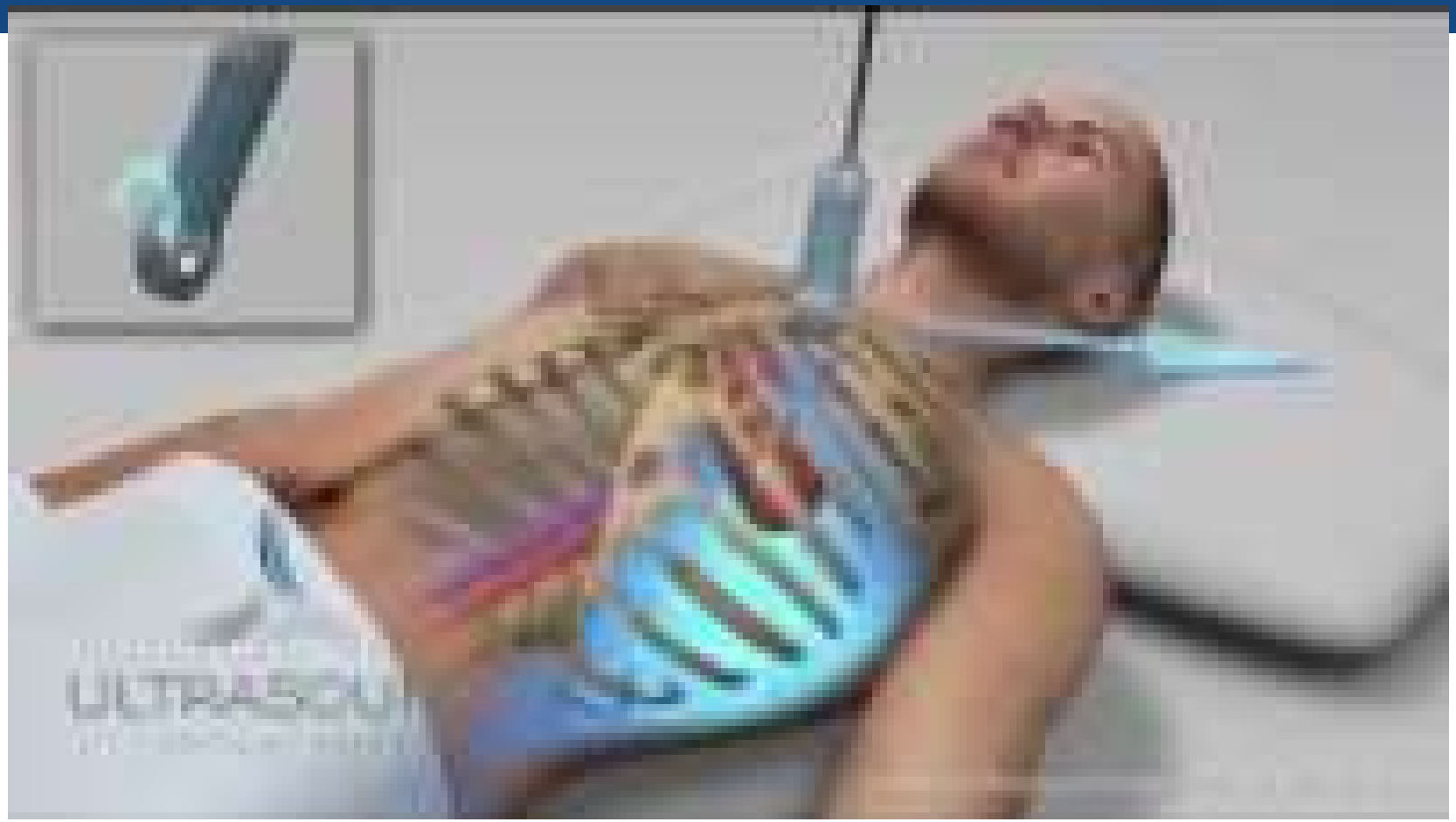




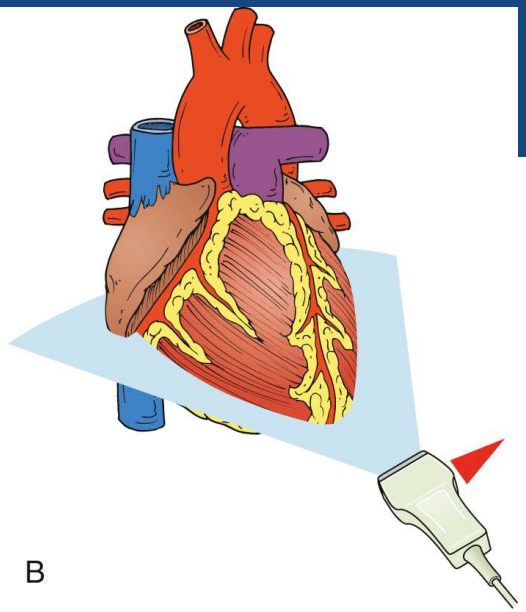


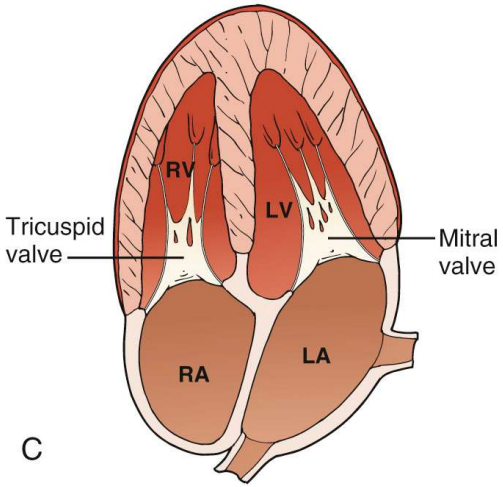


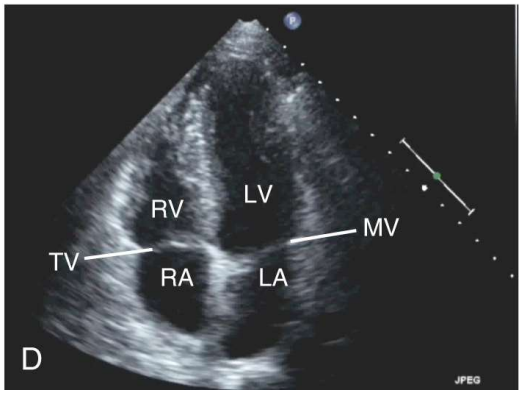
Parasternal Short Axis



Apical 4-Chamber

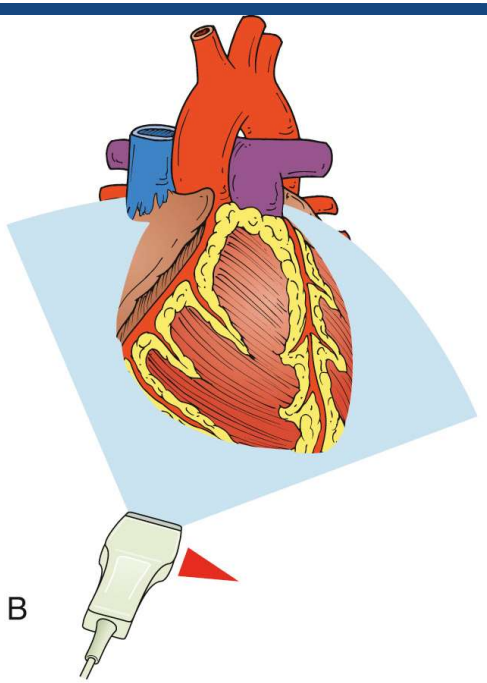


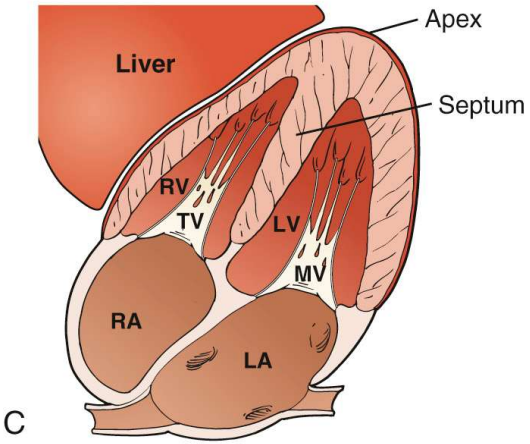


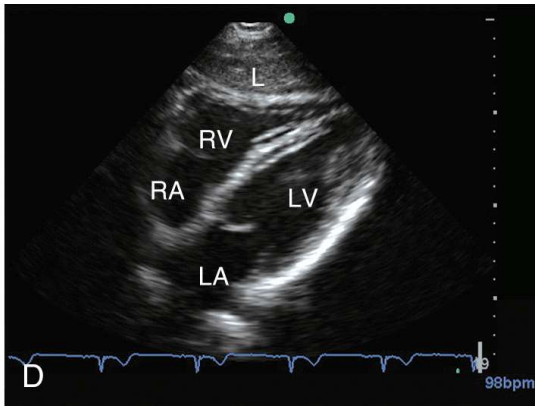


Apical 4-Chamber

Subcostal 4-Chamber

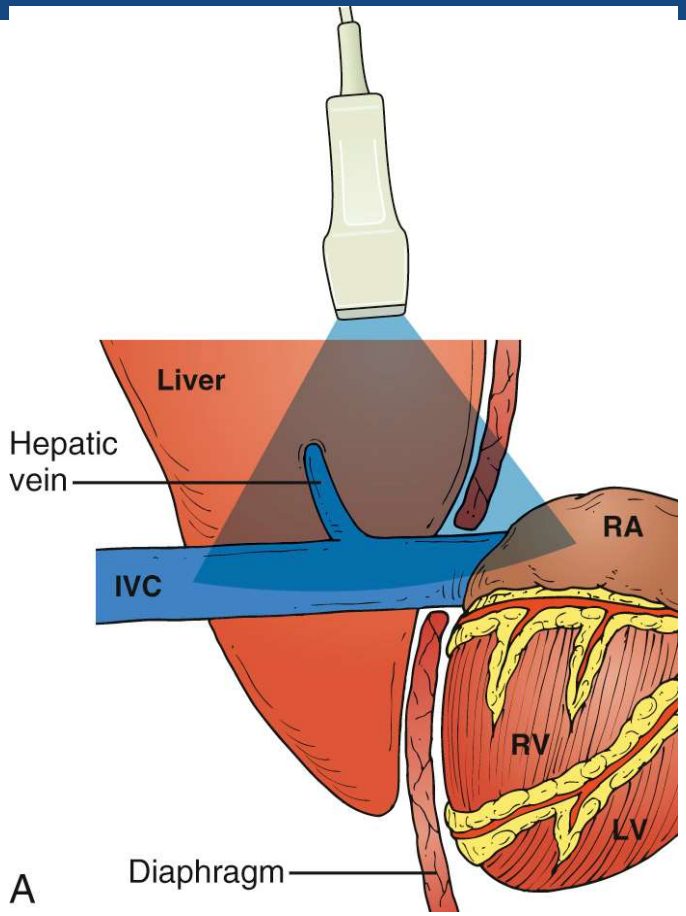


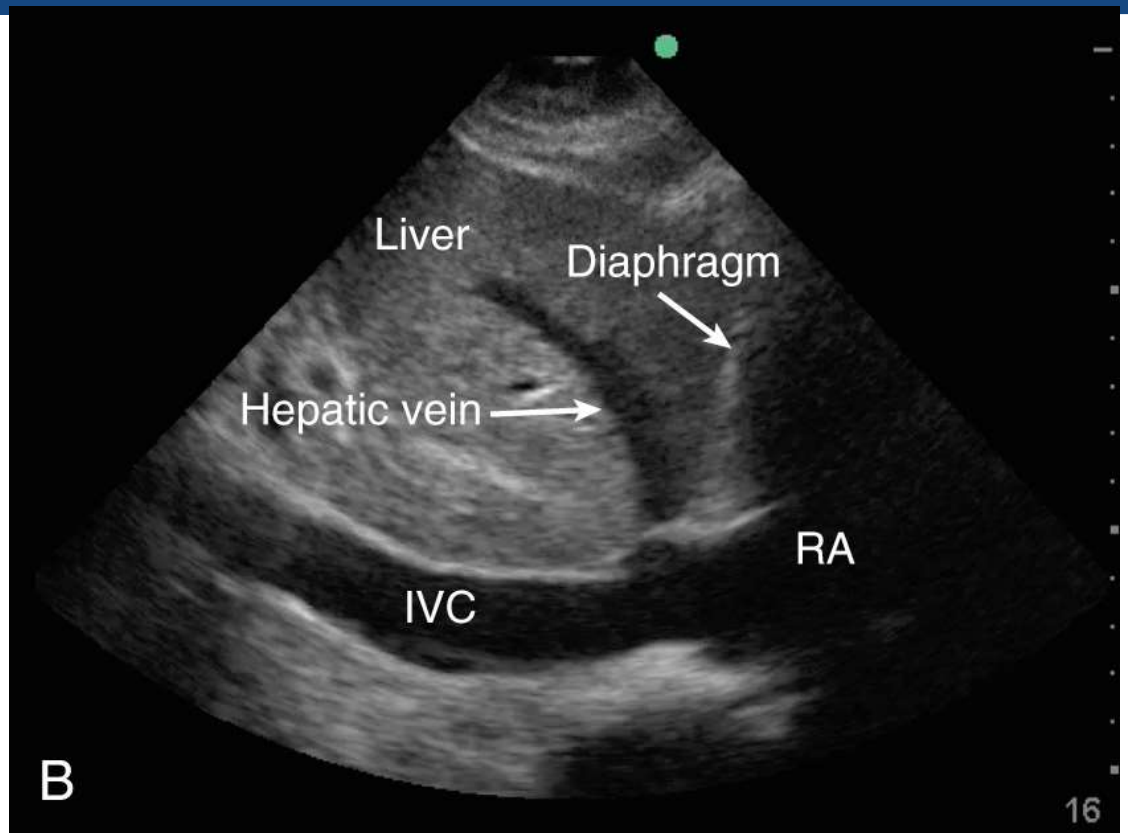




Subcostal 4-Chamber

IVC Assessment



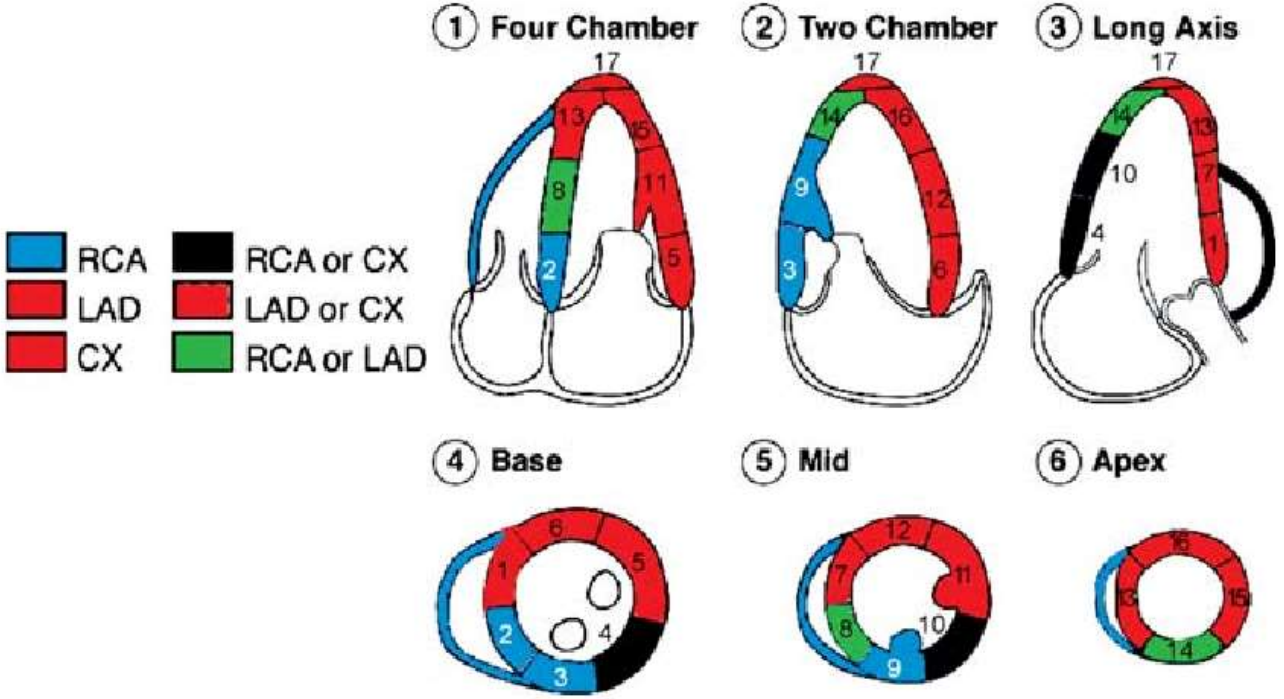


IVC Assessment

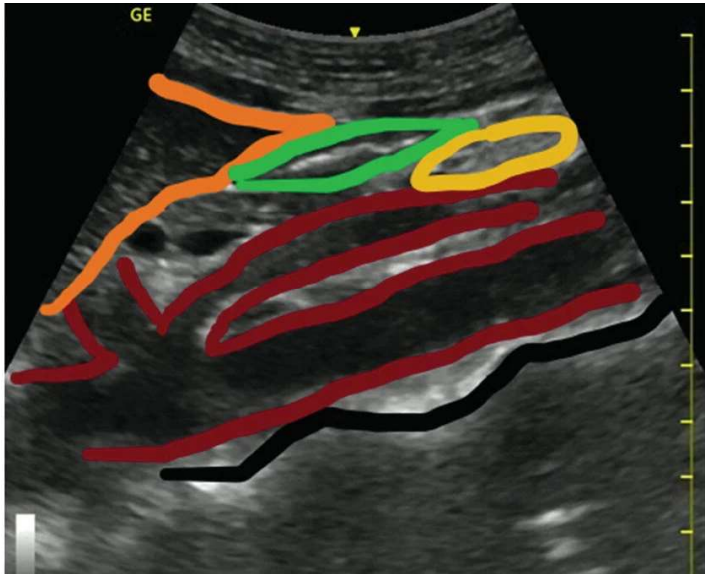
Cardiac/IVC Interpretation

- Findings: pericardial effusion with small ventricles
- Possible Etiology: Traumatic pericardial effusion, or possible cardiac tamponade
-
- Findings: RV Size larger than LV Size
- Possible Etiology: Pulmonary Embolus, Severe Pulmonary HTN, Cor Pulmonale
-
- Findings: IVC overly collapsible and small, with underfilled LV/RV, and clear lung sounds
- Possible Etiology: Hypovolemia, Sepsis, Hemorrhagic Shock
-
- Findings: LV/RV larger than normal, decreased contractility, and B-lines on lung POCUS exam
- Possible Etiology: LV/RV failure with or without volume overload and pulmonary congestion
-
- Finding: No cardiac motion on POCUS during cardiac arrest
- Possible Etiology: Prognostic indicator of poor outcome

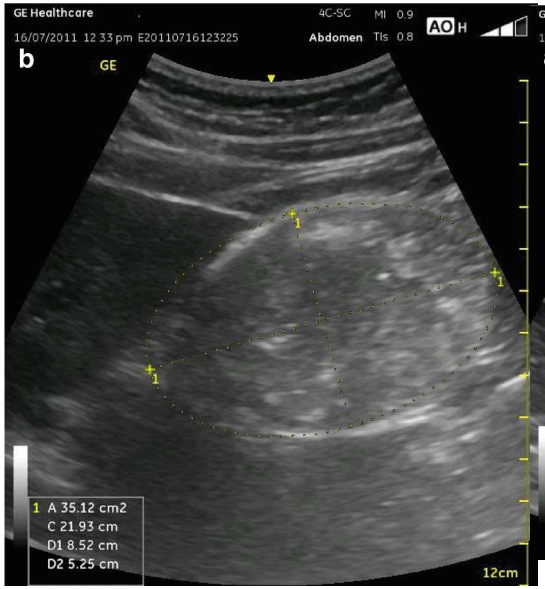
Regional Wall Motion Abnormalities

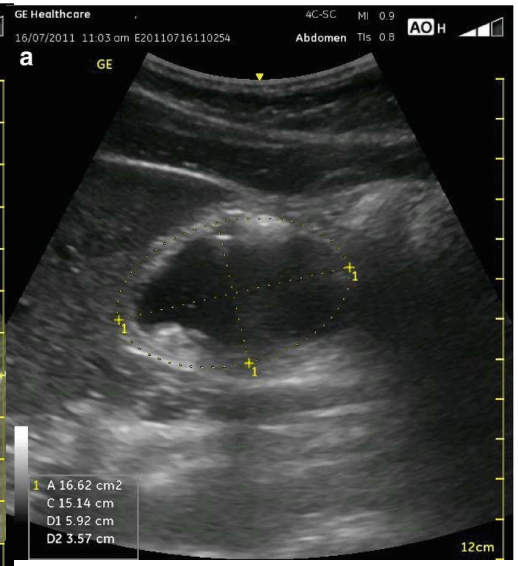


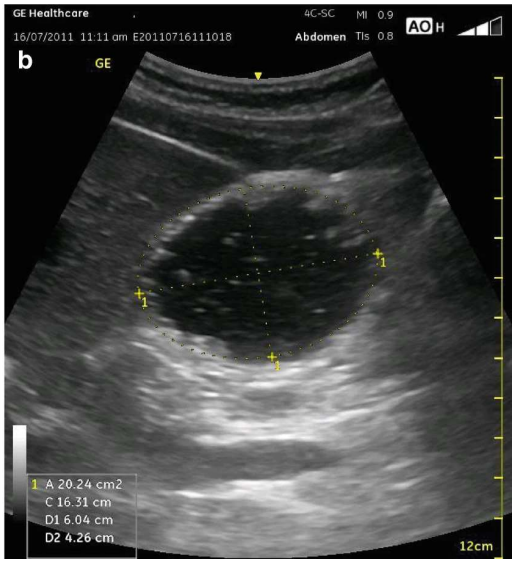
Gastric Volume Assessment



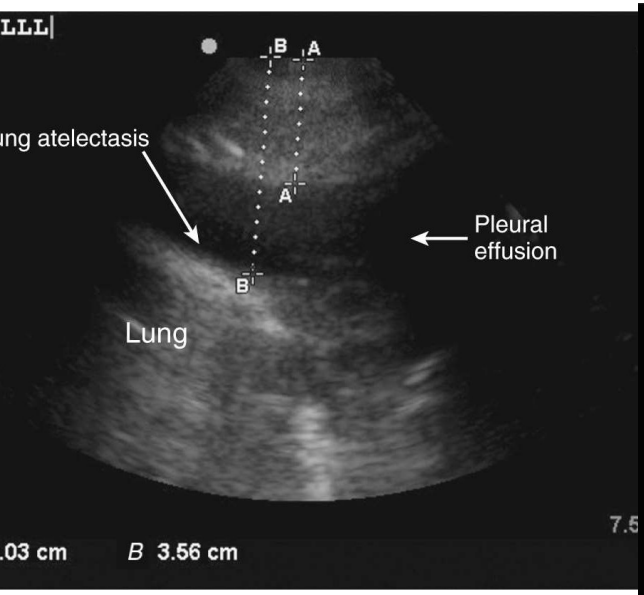
Gastric Volume Assessment

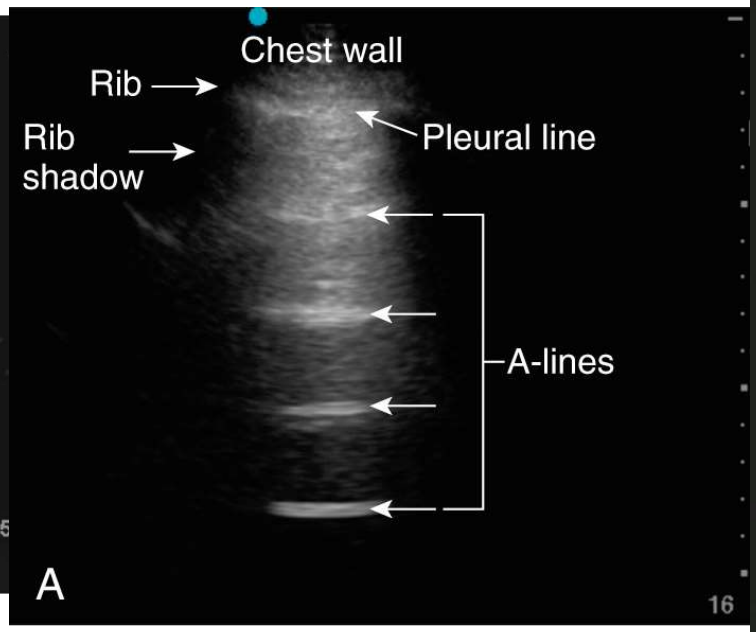


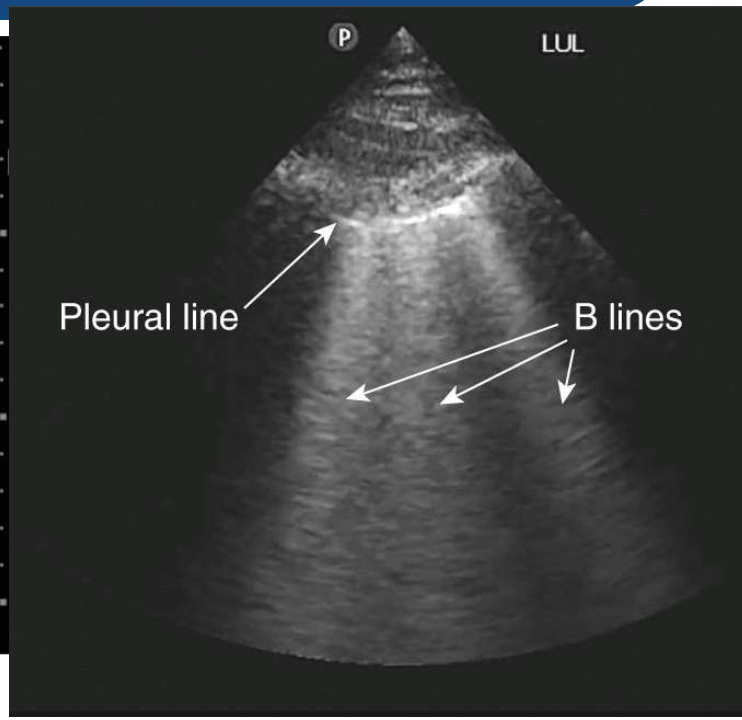




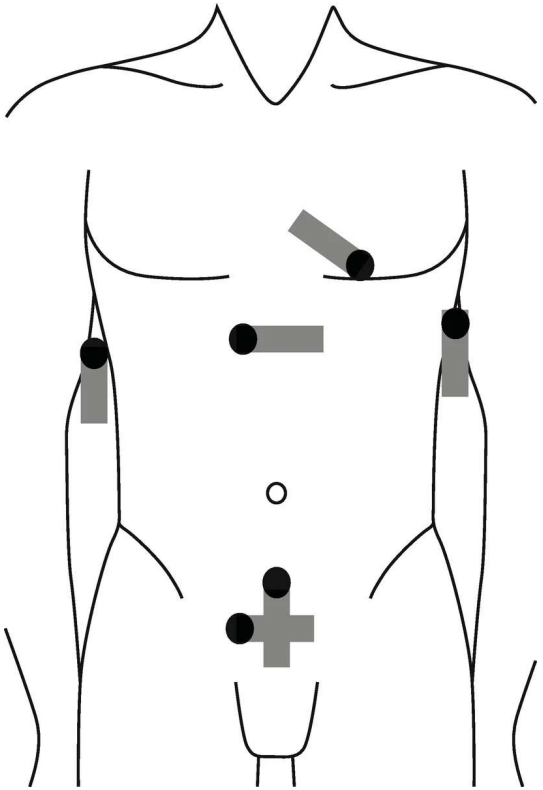
Lung Scanning







eFAST Exam

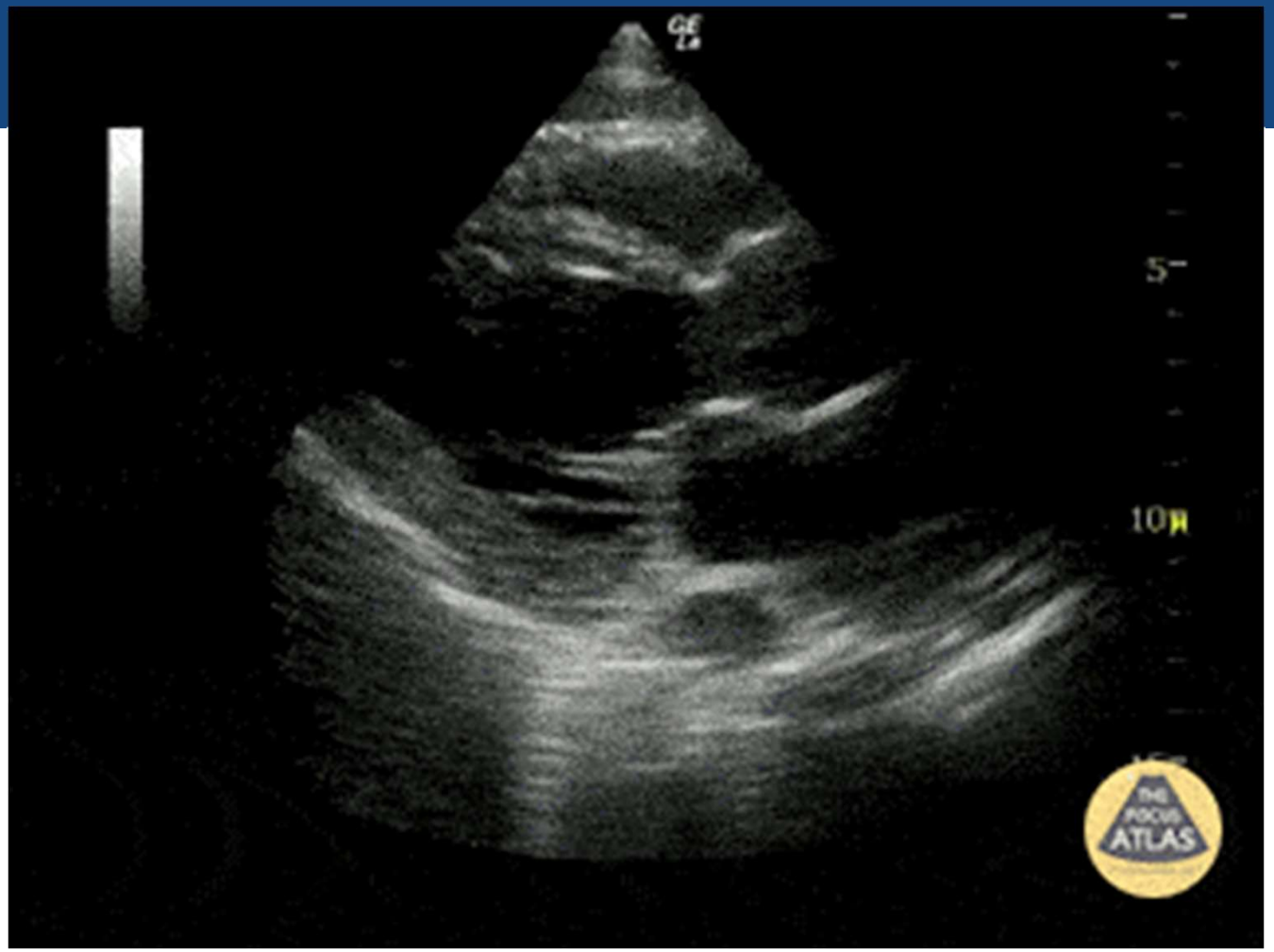


Normal Echo

Patient #1

- 89 yo male coming in for hernia repair at your ASC. Pmhx is HTN, renal insufficiency and DMII. He complains of a new onset nonproductive cough over the past couple of months. He also reports that he used to enjoy gardening outside, but now he gets fatigued easily.

PLax



PSax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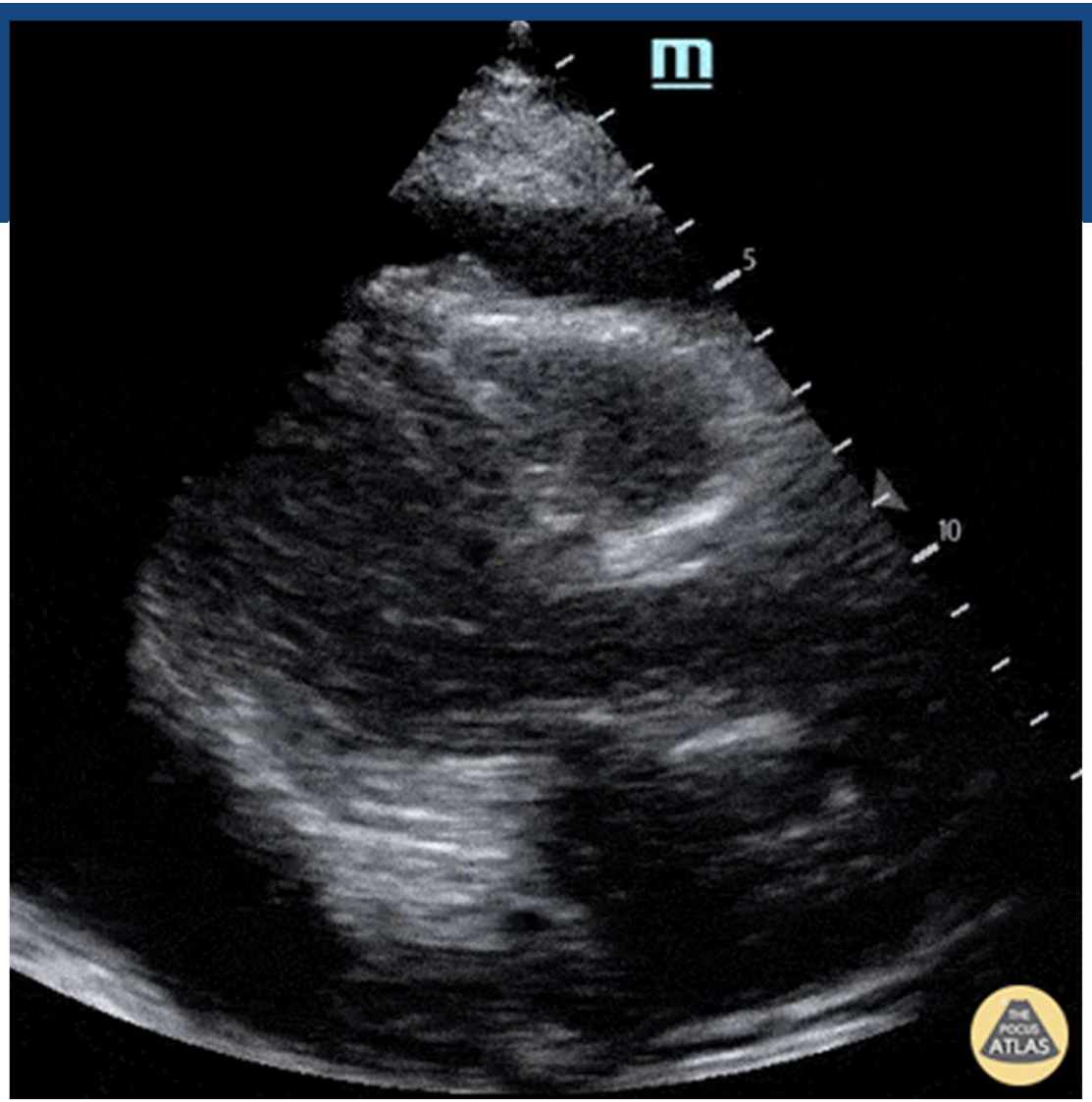
Page 1/3

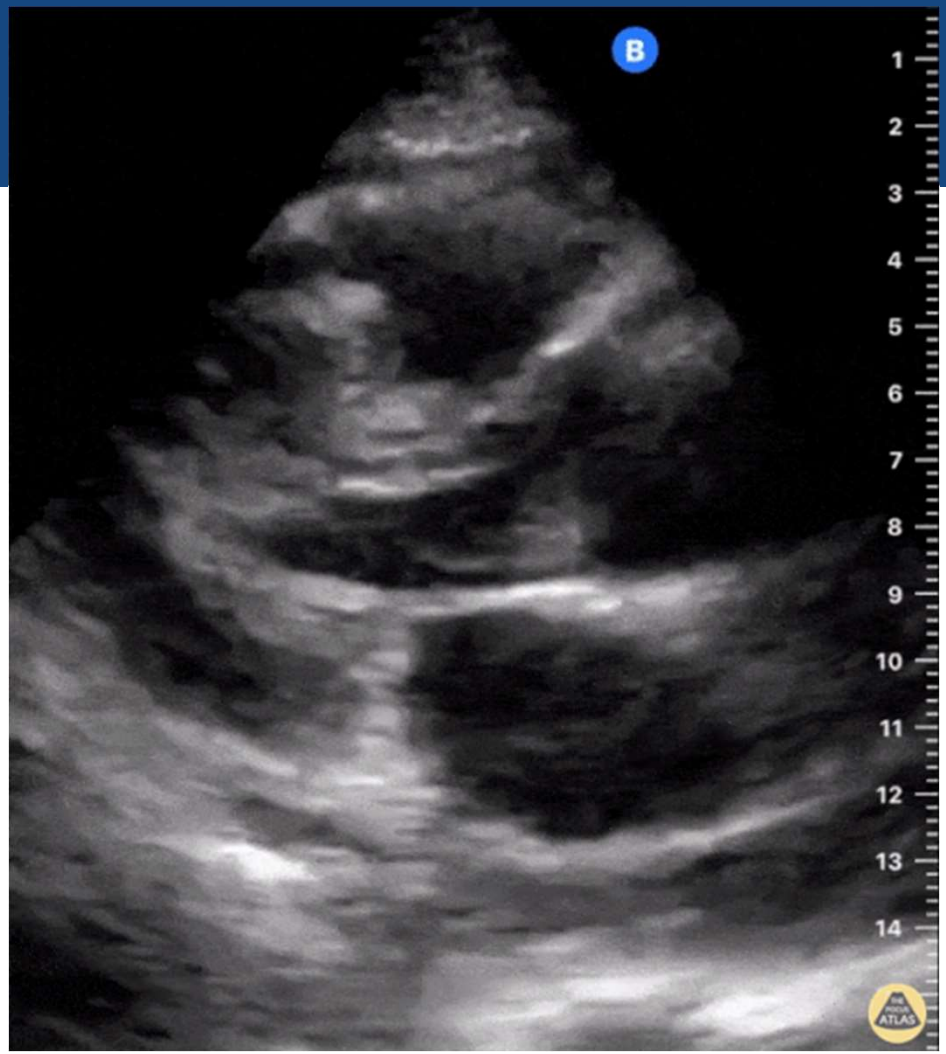
Patient #2

- 17 yo female trauma activation. Airway intact. Multiple gunshots wounds noted to chest and abdomen. P-127 BP-72/45 O2Sat- 85% on 15L NRB mask. GCS-14.
- Surgeon is demanding that pt be intubated now.

Plax



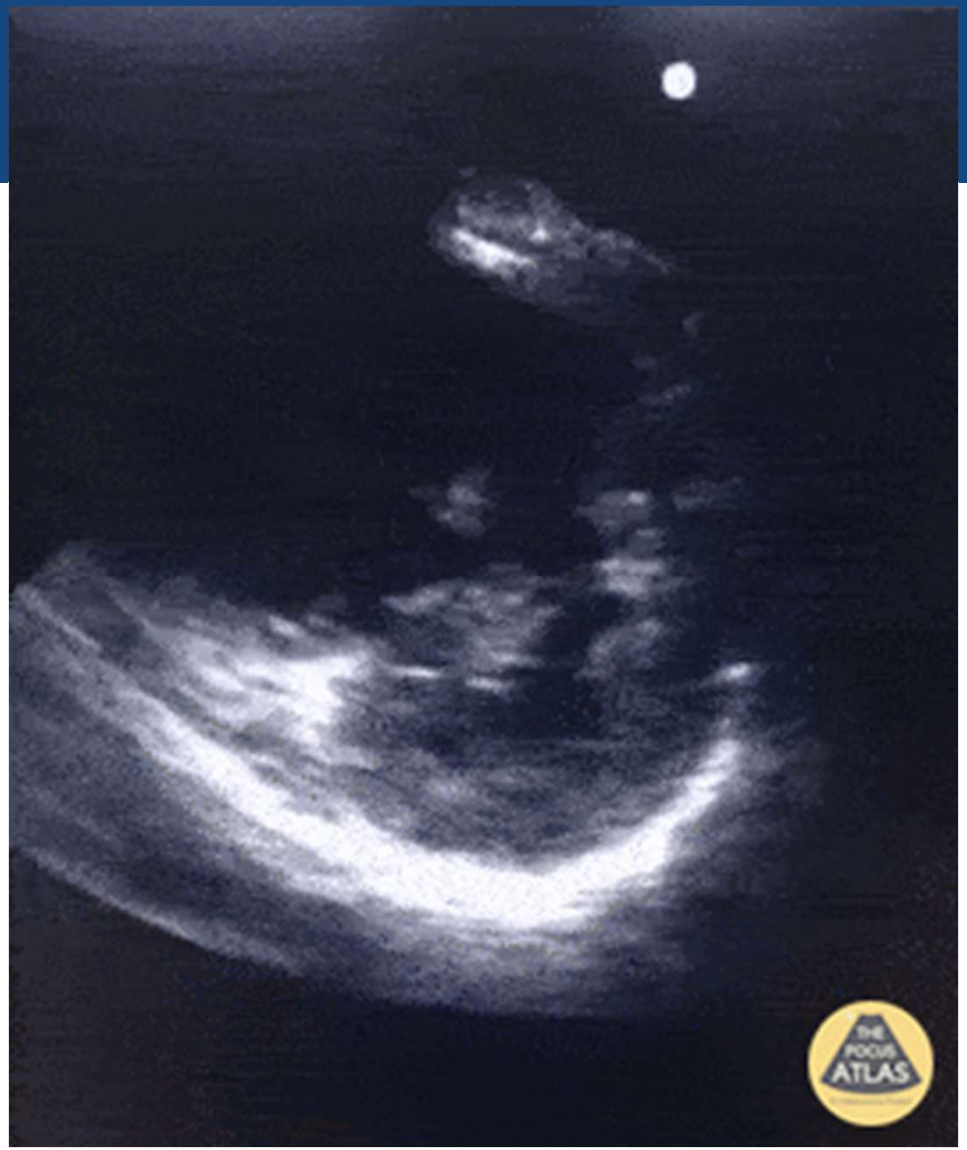
PSax



Patient #3

- Pt is a 28 yo pregnant female 38w5d, presents to OB for induction of labor for PEC. Pmhx, 1 ppd smoker, although she states that she “tried” to stop during the pregnancy.
- IV Pitocin is started, and pt suddenly gets SOB followed by a brief period of unconsciousness. She is given fluids and her mentation improves. Her O2Sat is 88% on 6L NC and remains tachypnic. BP 84/46. Baby is currently stable FHR- 160

Psax



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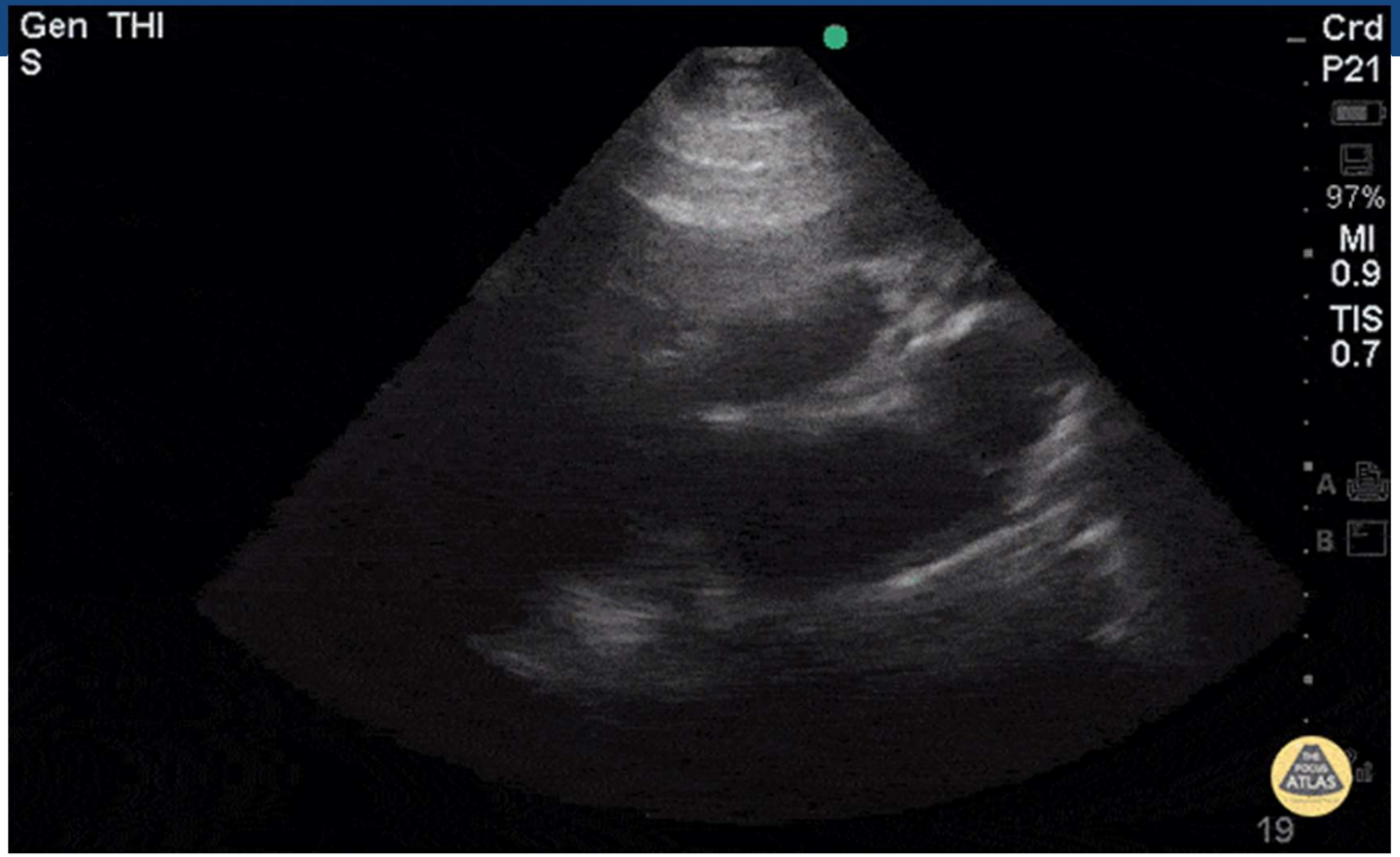
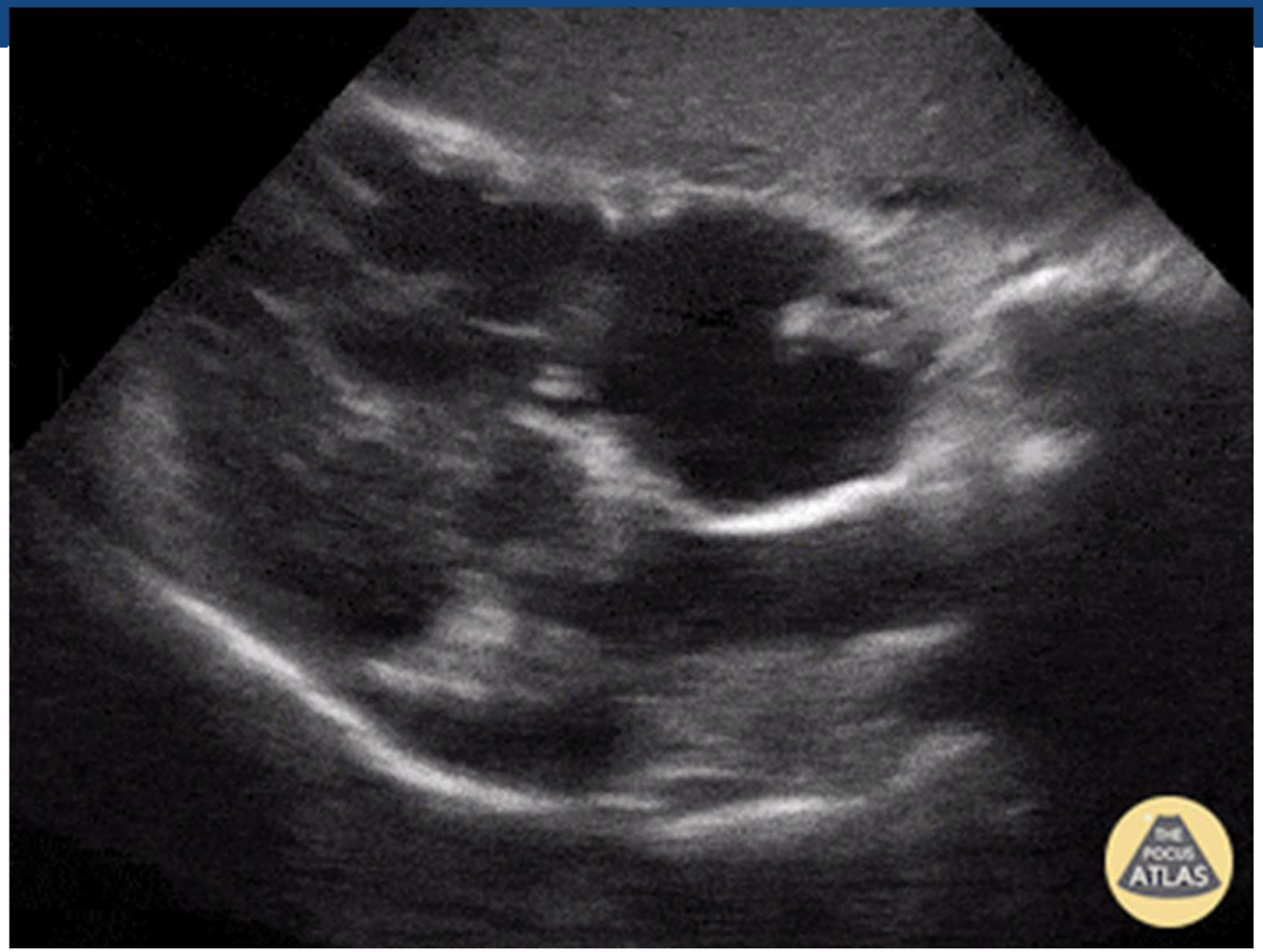
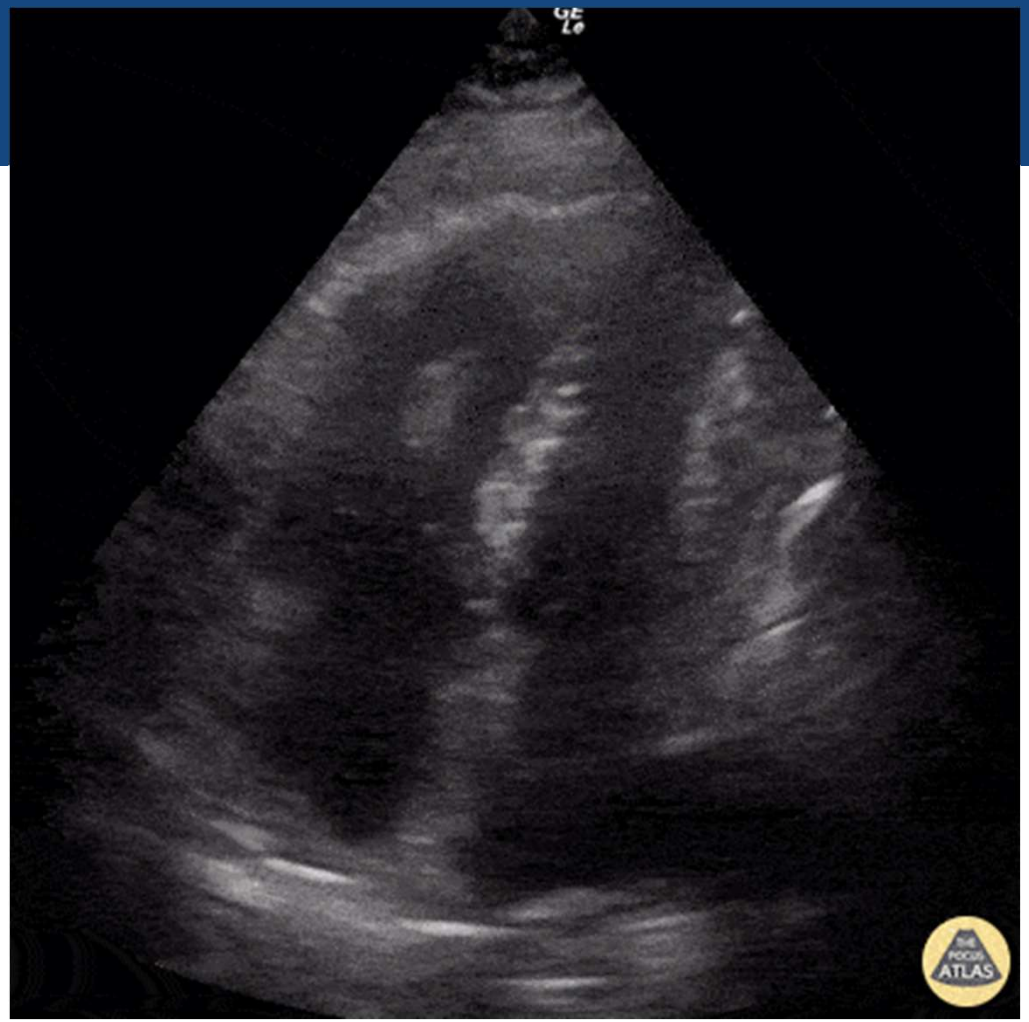


Subcostal 4



A4C



PE Grading

PE subtypes	Massive PE	Submassive PE	Simple PE
% of PE patients	≈ 5%	≈ 40%	≈ 55%
Clinical definition	Sustained hypotension (systolic < 90 mmHg for at least 15 min), need for inotropic support, persistent profound bradycardia (HR < 40 bpm with signs or symptoms of shock)	Systemically normotensive (systolic BP > 90 mmHg), myocardial ischemia (elevated troponins, ECG changes), and/or RV dysfunction (dysmotility on Echo, Increased RV/LV ratio > 0.9, elevated BNP/pro BNP), ECG changes)	Systemically normotensive (systolic BP > 90 mmHg), no RV dysfunction, no myocardial ischemia
Mortality	18–65%	5–25%	Up to 1%

References

- Chakraborty, A., & Ashokka, B. (2022). *A Practical Guide to Point of Care Ultrasound (POCUS).* 1st ed. 2022. Singapore: Springer Nature Singapore .
- Soni, N. J., Arntfield, R., & Kory, P. (2020). *Point-of-care ultrasound.* Second edition. Philadelphia, PA: Elsevier.
- Echocardiography — TPA (thepocusatlas.com)