



WEBINAR
EMERGENCY POCUS:
Techniques to Differentiate
Causes of Dyspnea

November 2023



Your Host



Shelley Guenther, CRGS, CRCS

Sonographer | Clinical Marketing Manager

Bedside lung ultrasound in the evaluation of acute decompensated heart failure

“

The integration of **LUS** to the clinical assessment allow to differentiate cardiogenic dyspnea with **sensitivity and specificity greater than 95%.**”

Leidi F, Casella F, Cogliati C. Bedside lung ultrasound in the evaluation of acute decompensated heart failure. Intern Emerg Med. 2016 Jun;11(4):597-601. doi: 10.1007/s11739-016-1403-0. Epub 2016 Feb 17. PMID: 26885846.

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Bedside lung ultrasound in the evaluation of acute decompensated heart failure

Federica Leidi ¹, Francesco Casella ¹, Chiara Cogliati ²

Affiliations + expand

PMID: 26885846 DOI: 10.1007/s11739-016-1403-0

Abstract

Dyspnea is a common presenting complaint in the emergency department (ED) and a leading cause of hospitalization in intensive care unit (ICU) and medical wards. Ultrasound (US) has traditionally been considered inadequate to explore the aerated lung. However, in the past 15 years LUS gained broader application, at least in part thanks to the interpretation of the artefacts generated by the interaction of US and lung structures/content. The total reflection of US beam occurring at the pleural level determines the artefactual image of the aerated lung: an homogenous 'foggy-like' picture under the pleural line. As the air content of the lungs decreases due to interstitial imbibition, deposition of collagen or presence of blood, vertical artefacts -arising from the pleural line and moving synchronously with the respiration- called B-lines appear. Multiple and bilateral B-lines identify the alveolar-interstitial syndrome (AIS). The most common cause of AIS is the wet lung: the more the congestion burden, the more the extent of the B-lines, which become confluent until the so-called white lung in case of pulmonary edema. Many studies showed a higher accuracy of LUS in diagnosing acute decompensated heart failure (ADHF) as compared to chest X-ray. As recently shown, the integration of LUS to clinical assessment allow to differentiate cardiogenic dyspnea with sensitivity and specificity greater than 95 %. Moreover, LUS can easily detect pleural effusion - frequently present in ADHF- appearing as an anechoic area in the recumbent area of the thorax, delimited inferiorly by the diaphragmatic dome and superiorly by the aerated lung.

Keywords: B-lines; Heart failure; Lung ultrasound.

[PubMed Disclaimer](#)

Similar articles

[Diagnostic accuracy and reproducibility of pleural and lung ultrasound in discriminating cardiogenic causes of acute dyspnea in the emergency department.](#)

Cibinel GA, Casoli G, Elia F, Padoan M, Pivetta E, Lupia E, Goffi A.

Intern Emerg Med. 2012 Feb;7(1):65-70. doi: 10.1007/s11739-011-0709-1. Epub 2011 Oct 28.

PMID: 22033792

[Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the ED: A SIMEU Multicenter Study.](#)

Pivetta E, Goffi A, Lupia E, Tizzani M, Porrino G, Ferreri E, Volpicelli G, Balzaretto P, Banderali A, Iacobucci A, Locatelli S, Casoli G, Stone MB, Maule MM, Baldi I, Merletti F, Cibinel GA, Baron P, Battista S, Buonafede G, Busso V, Conterno A, Del Rizzo P, Ferrera P, Pecetto PF, Moiraghi C, Morello F, Steri F, Ciccone G, Calasso C, Caserta MA, Civita M, Condo' C, D'Alessandro V, Del Colle S, Ferrero S, Griot G, Laurita E, Lazzero A, Lo Curto F, Michelazzo M, Nicosia V, Palmari N, Ricchiardi A, Rolfo A, Rostagno B, Bar F, Boero F, Francesco M, Micossi L.

Acute dyspnea in the emergency department: a clinical review

“ ... lung ultrasound, along with echocardiography, represents the first rapid and non-invasive line of assessment that accurately differentiates heart, lung or extra-pulmonary involvement in patients with dyspnea.”

Santus P, Radovanovic D, Saad M, Ziliani C, Coppola S, Chiumello DA, Pecchiari M. Acute dyspnea in the emergency department: a clinical review. Intern Emerg Med. 2023 Aug;18(5):1491-1507. doi: 10.1007/s11739-023-03322-8. Epub 2023 Jun 2. PMID: 37266791; PMCID: PMC10235852.

Review > Intern Emerg Med. 2023 Aug;18(5):1491-1507. doi: 10.1007/s11739-023-03322-8.

Epub 2023 Jun 2.

Acute dyspnea in the emergency department: a clinical review

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Affiliations + expand

PMID: 37266791 PMCID: PMC10235852 DOI: 10.1007/s11739-023-03322-8

[Free PMC article](#)

Abstract

Acute dyspnea represents one of the most frequent symptoms leading to emergency room evaluation. Its significant prognostic value warrants a careful evaluation. The differential diagnosis of dyspnea is complex due to the lack of specificity and the loose association between its intensity and the severity of the underlying pathological condition. The initial assessment of dyspnea calls for prompt diagnostic evaluation and identification of optimal monitoring strategy and provides information useful to allocate the patient to the most appropriate setting of care. In recent years, accumulating evidence indicated that lung ultrasound, along with echocardiography, represents the first rapid and non-invasive line of assessment that accurately differentiates heart, lung or extra-pulmonary involvement in patients with dyspnea. Moreover, non-invasive respiratory support modalities such as high-flow nasal oxygen and continuous positive airway pressure have aroused major clinical interest, in light of their efficacy and practicality to treat patients with dyspnea requiring ventilatory support, without using invasive mechanical ventilation. This clinical review is focused on the pathophysiology of acute dyspnea, on its clinical presentation and evaluation, including ultrasound-based diagnostic workup, and on available non-invasive modalities of respiratory support that may be required in patients with acute dyspnea secondary or associated with respiratory failure.

Keywords: Cardiogenic edema; Dyspnea; High flow oxygen; Non-invasive ventilation; Respiratory failure; Respiratory support.

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Conflict of interest statement

The authors declare that they have no conflict of interest in regard to the submitted work.

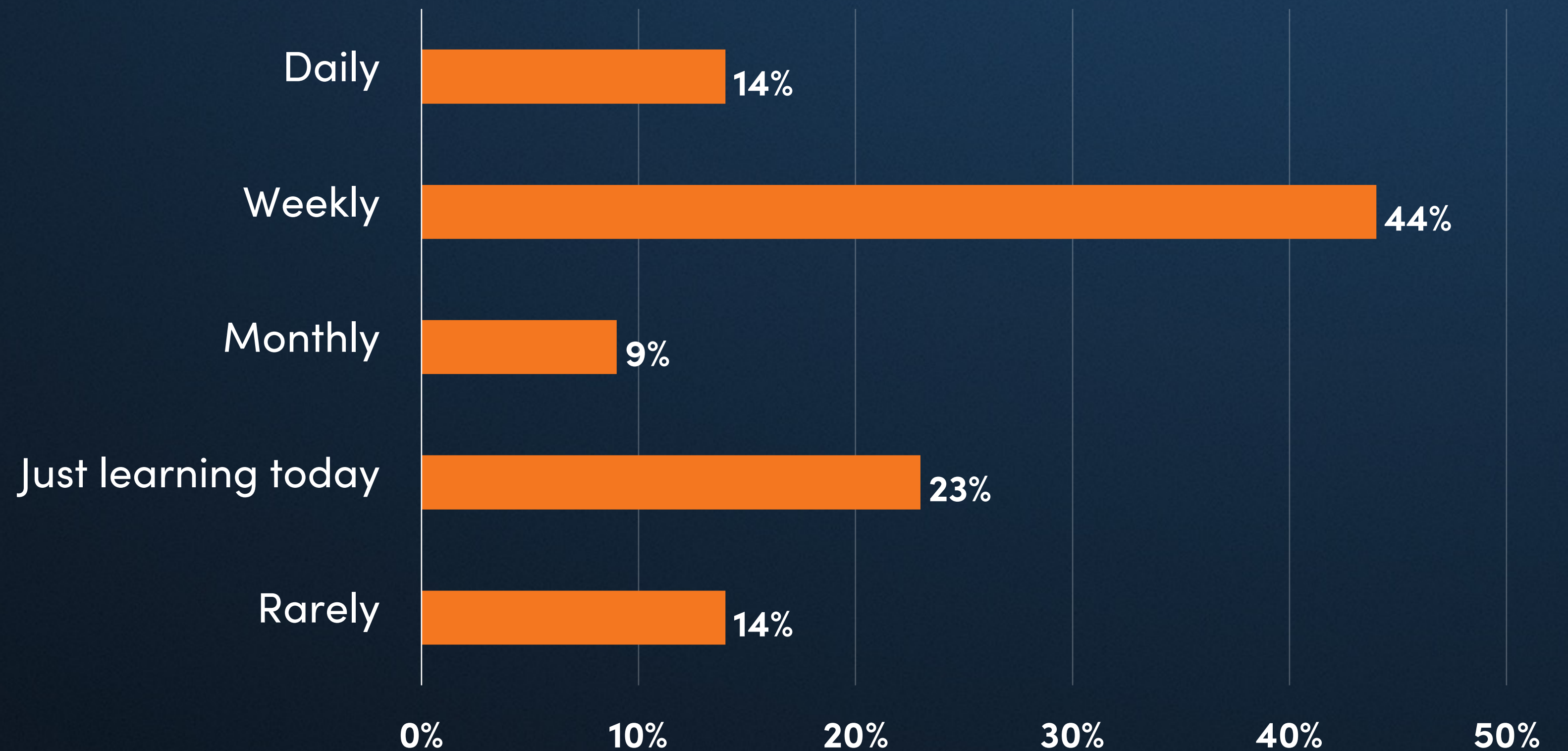
Figures





Interactive Poll

How frequently do you use ultrasound when examining patients with dyspnea?



Expert Speaker



Oron Frenkel, M.D., M.S.

Emergency Physician & POCUS Educator
Chairman, Clarius Medical Advisory Board



Divert Death from Dyspnea

PoCUS for Shortness of Breath

Oron Frenkel, MD
Emergency Physician
Vancouver, BC

Clinical Assistant Professor, University of British Columbia

Dyspnea Scan Aka Triple Scan

1. Lungs

2. Focused cardiac/Echo

3. Adjunct (IVC/DVT/etc)

SCAN THE LUNGS

Lung ultrasound = artifact interpretation

SCAN THE LUNGS

DEEP

Wet vs Dry

Effusions

SHALLOW

Sliding

Contour

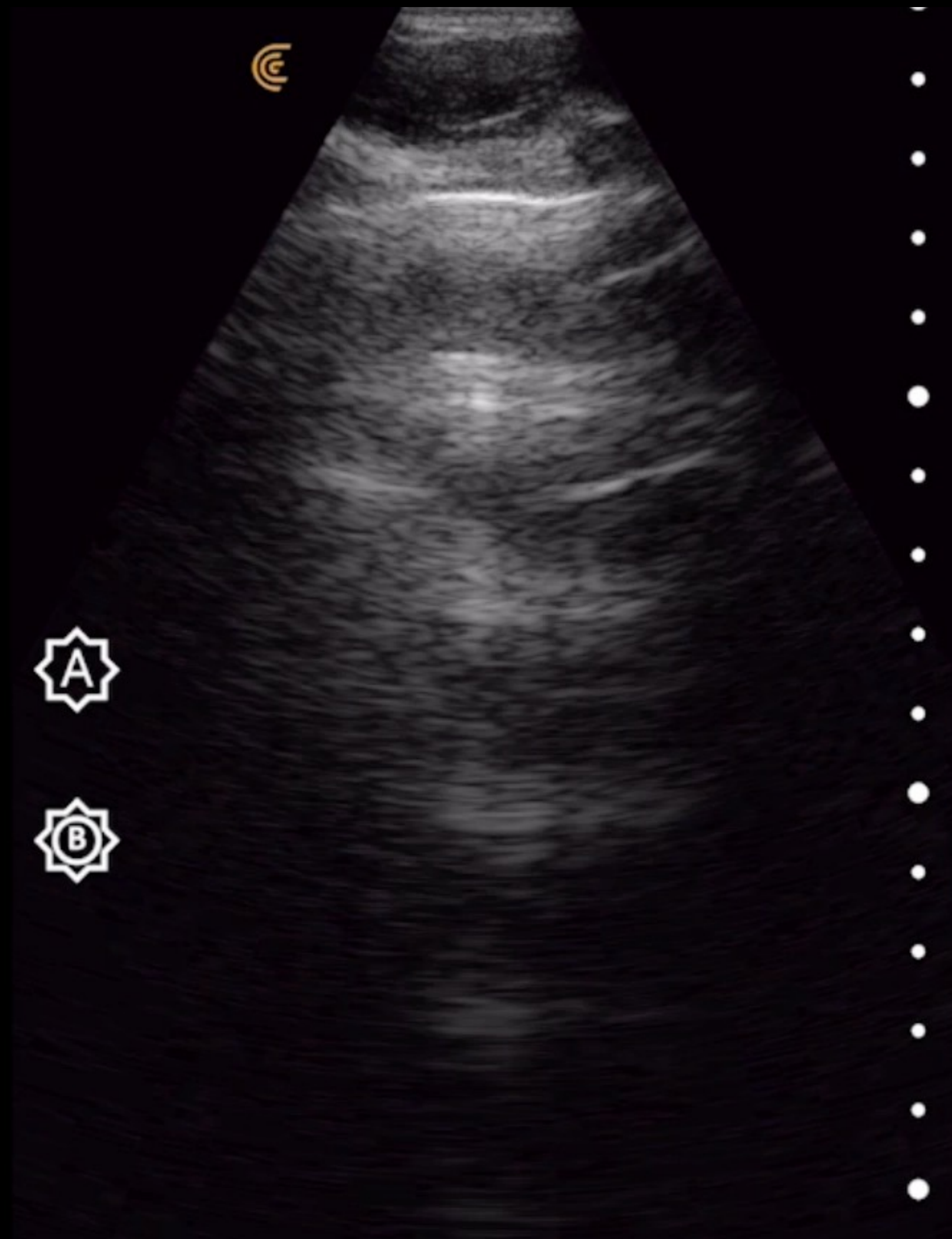
ANTERIOR



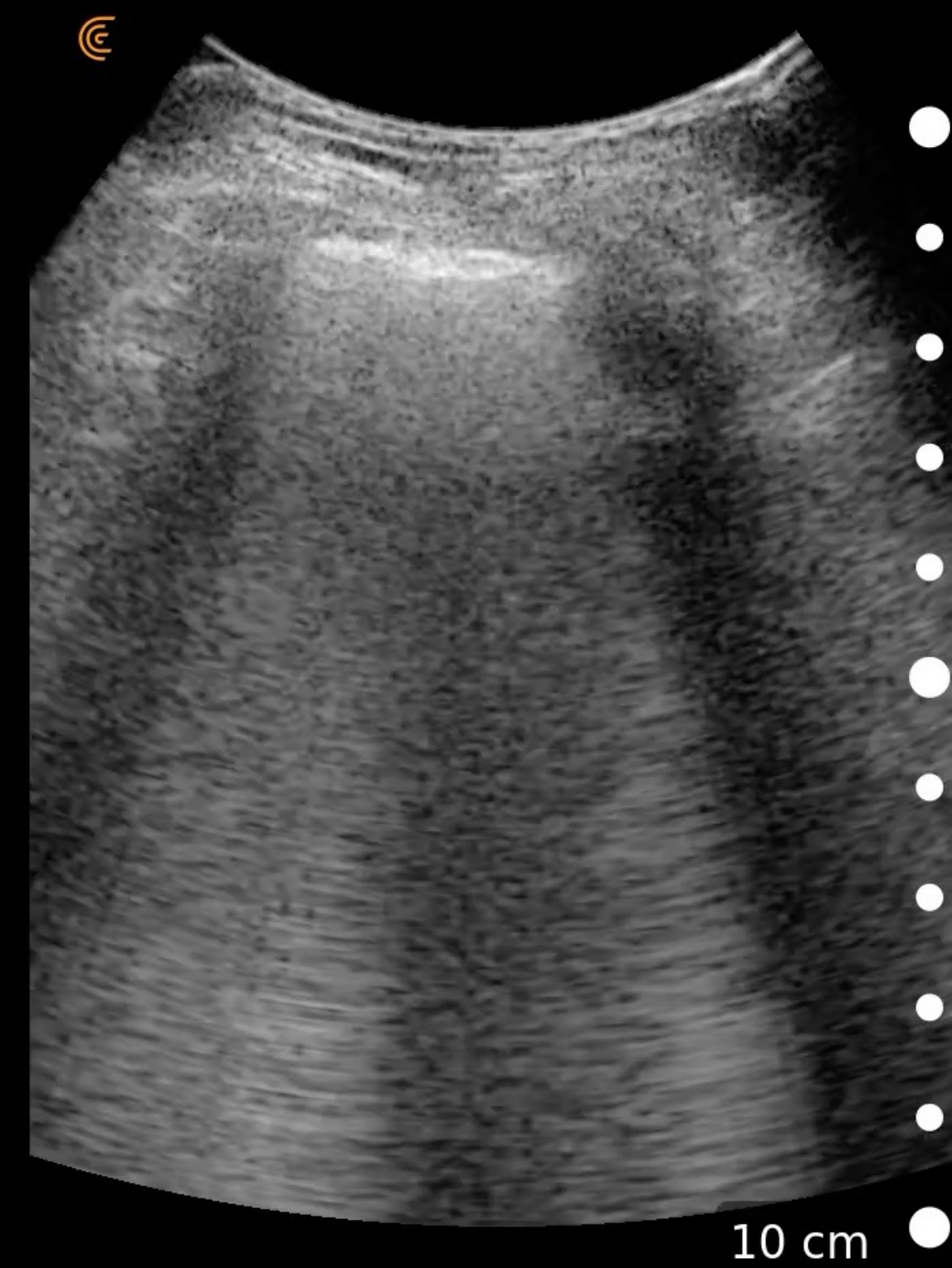
LATERAL



A lines
“Dry lungs”



B lines
Interstitial edema



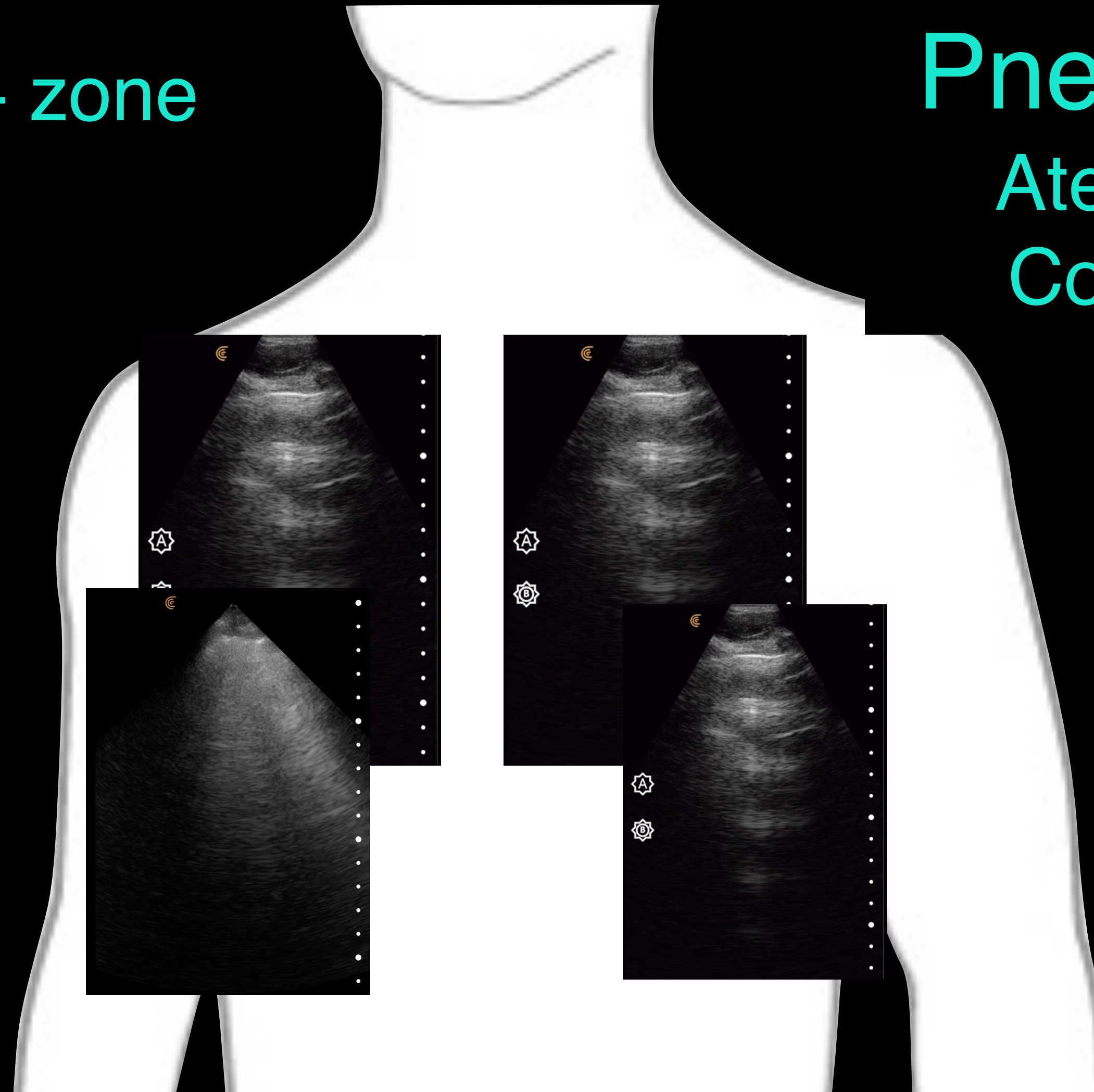
3 lines = + zone



Localized B lines

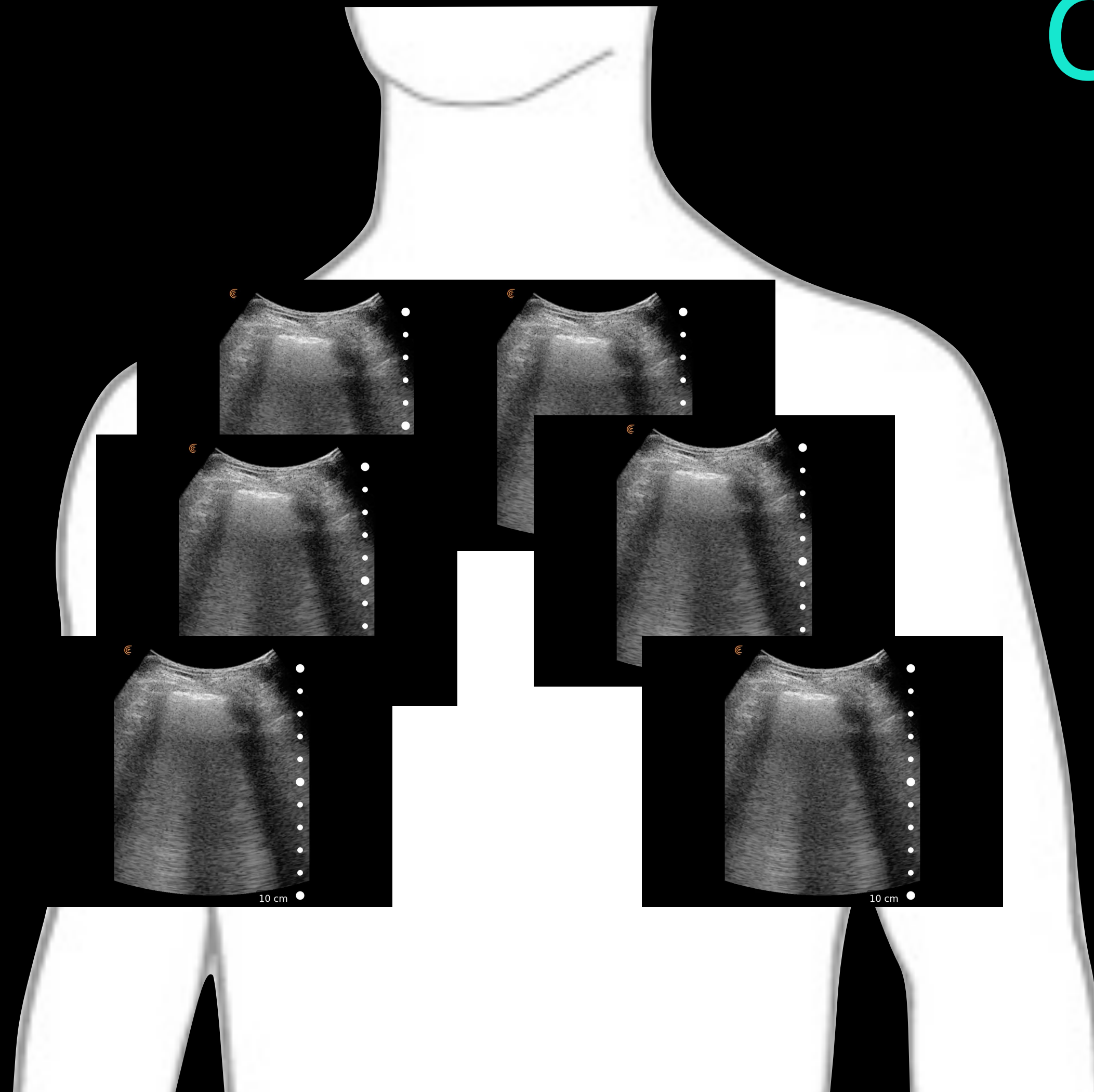
3 lines = + zone

Pneumonia
Atelactasis
Contusion



Diffuse B lines

Cardiogenic
ILF
ARDS
Multifocal PNA



Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the ED

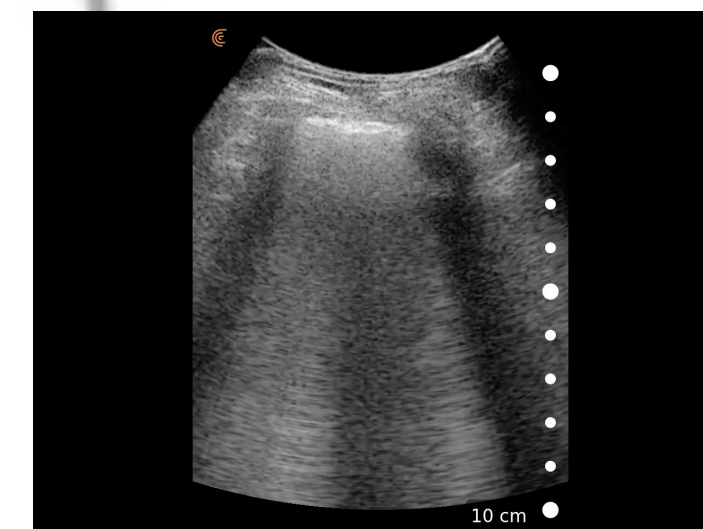
A SIMEU Multicenter Study

Undifferentiated Dyspnea

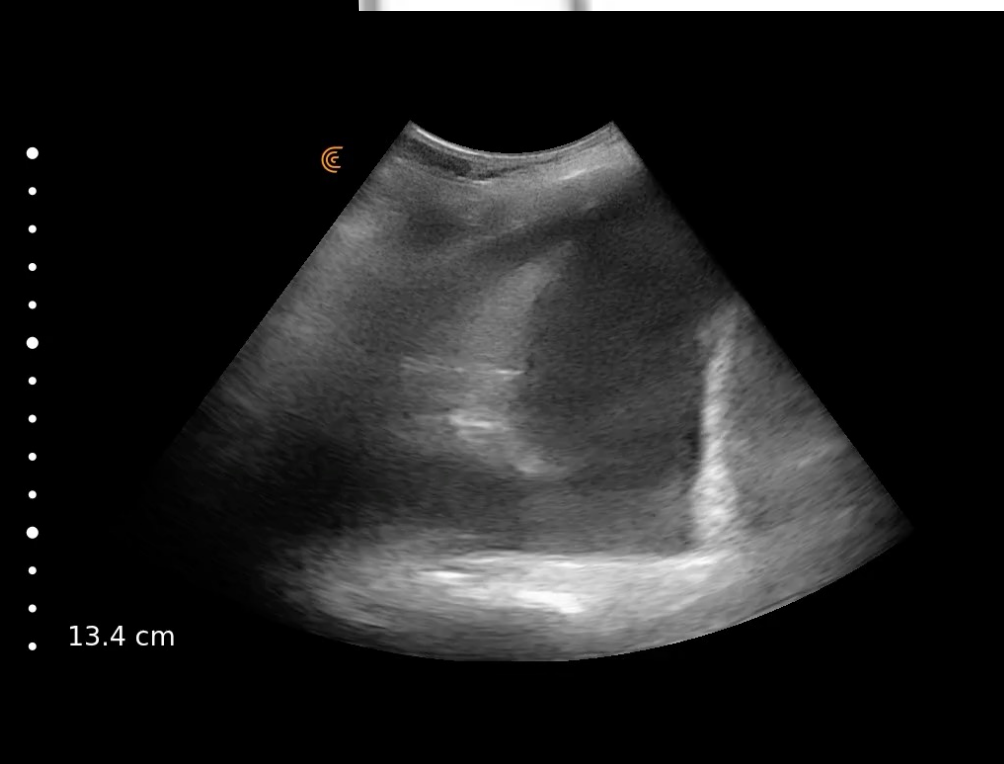
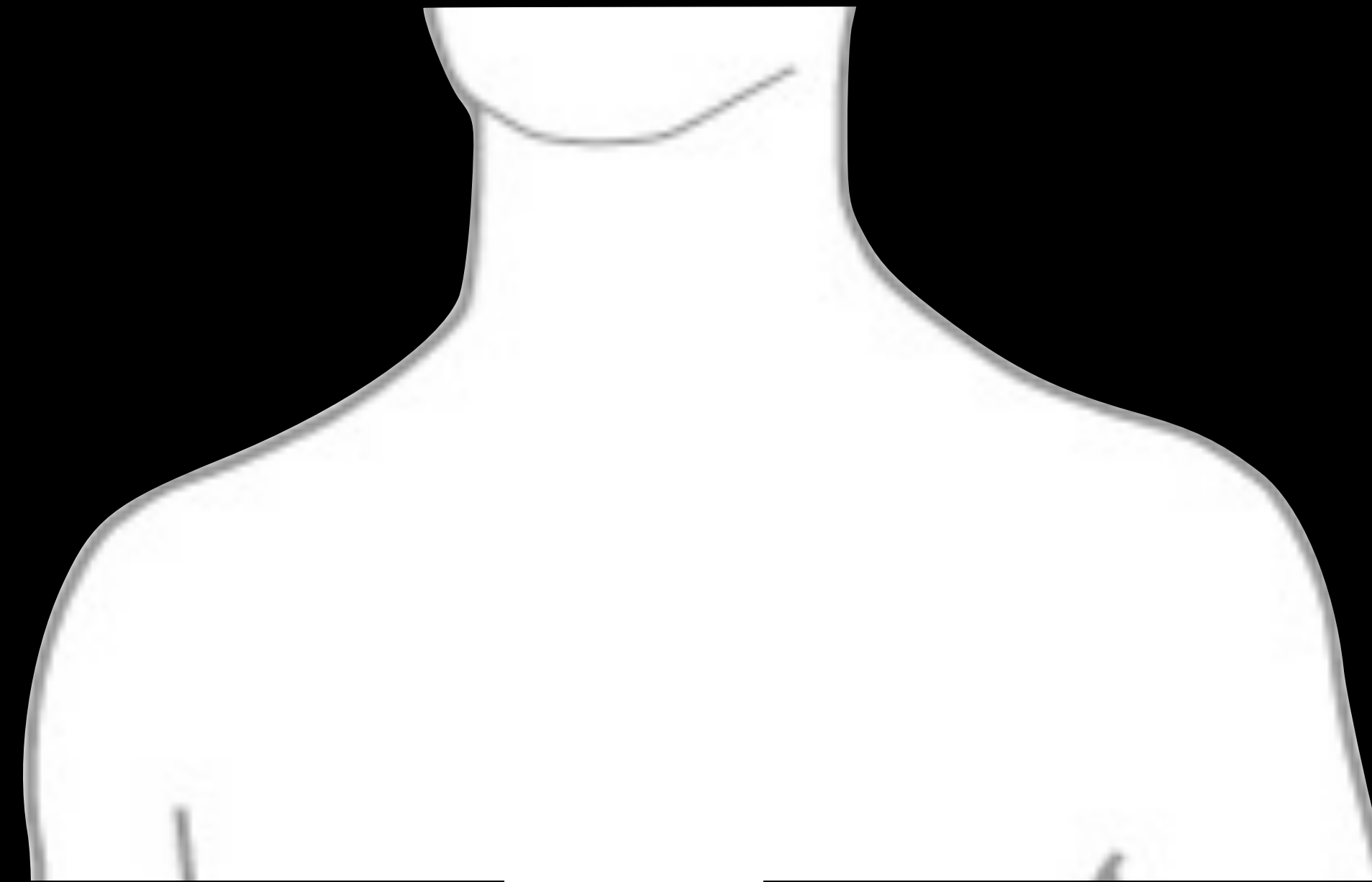
	LR+	LR-
Clinical	8.6	0.2
CXR	3.9	0.4
US	14	0.1
Clinical + US	37.5	0.03

Lung ultrasound for the diagnosis of pneumonia in adults: a systematic review and meta-analysis

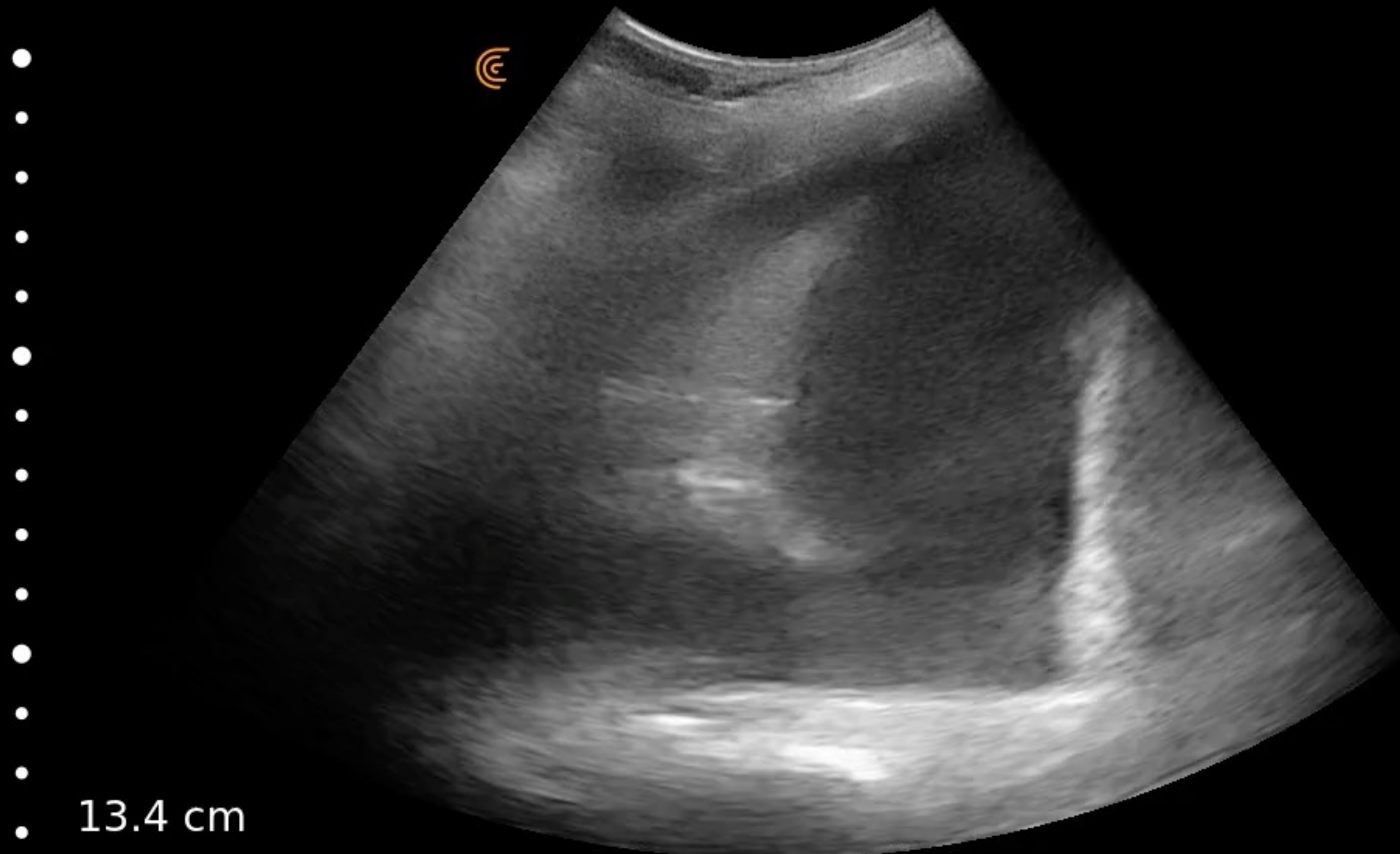
LR+ 16.8.
LR- 0.07



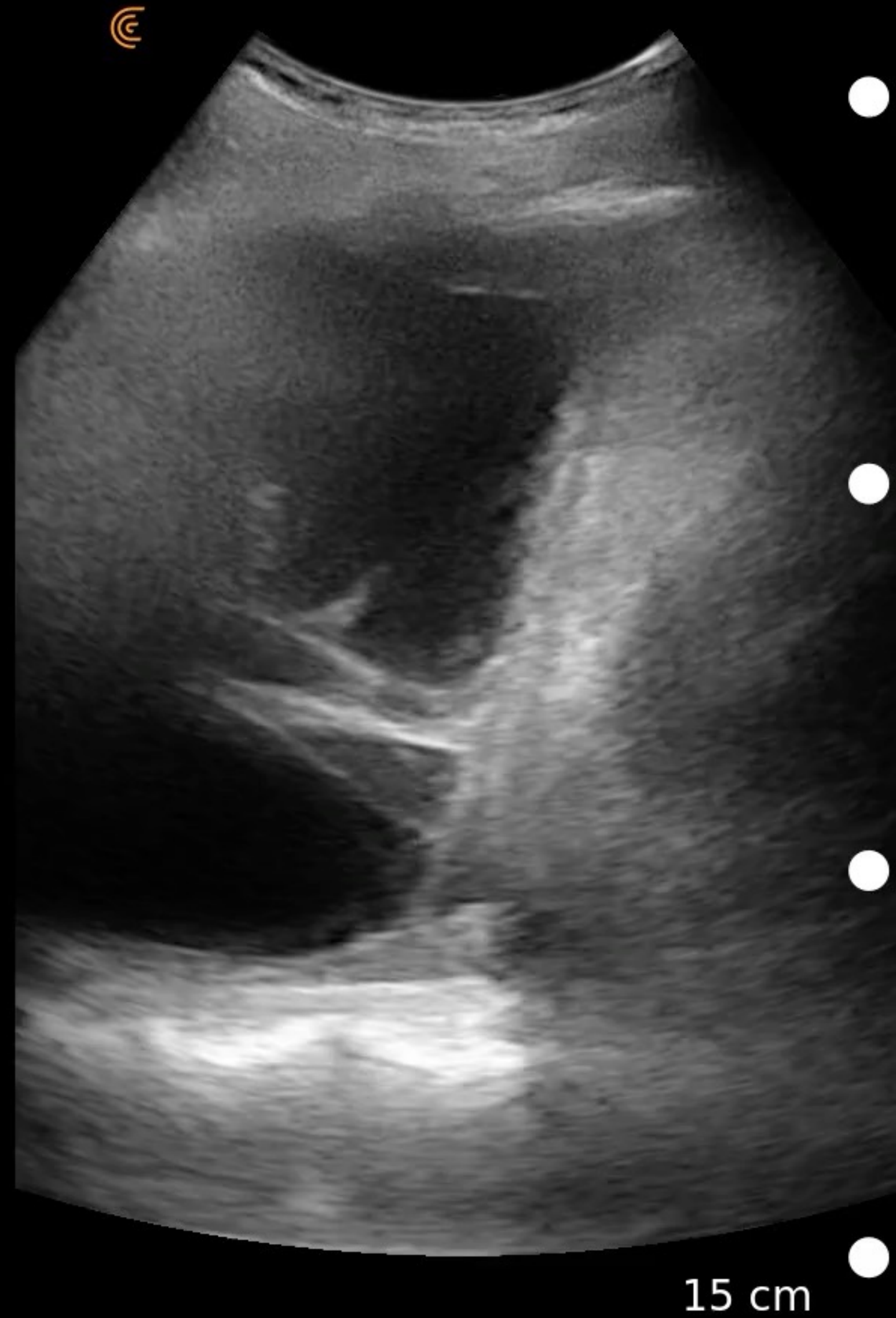
Pleural Effusions



Pleural Effusions



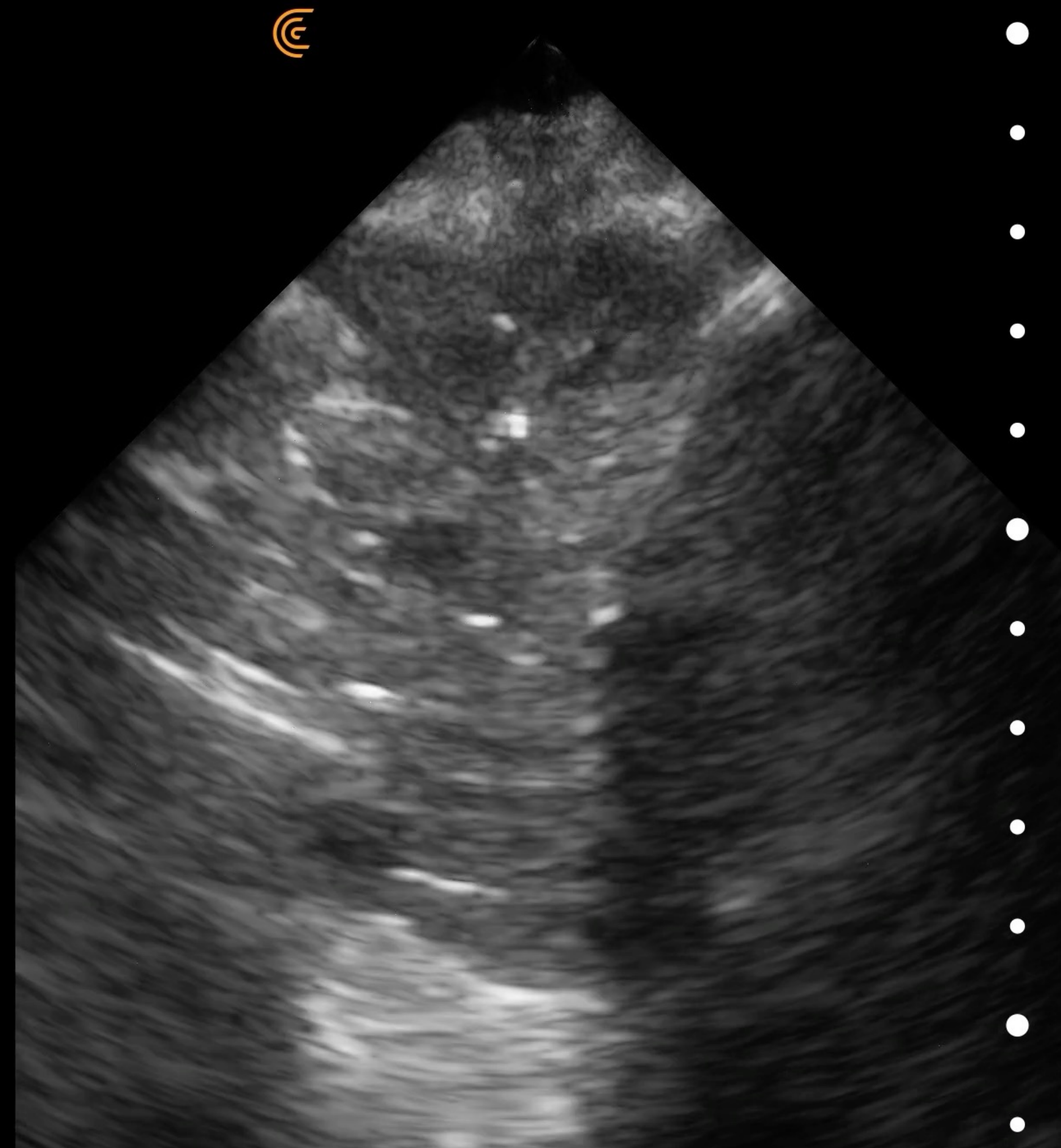
Pleural Effusions



Dense consolidation “Hepatization”

20/10/2023

Fren



SCAN THE LUNGS

DEEP

Wet vs Dry

Effusions

SHALLOW

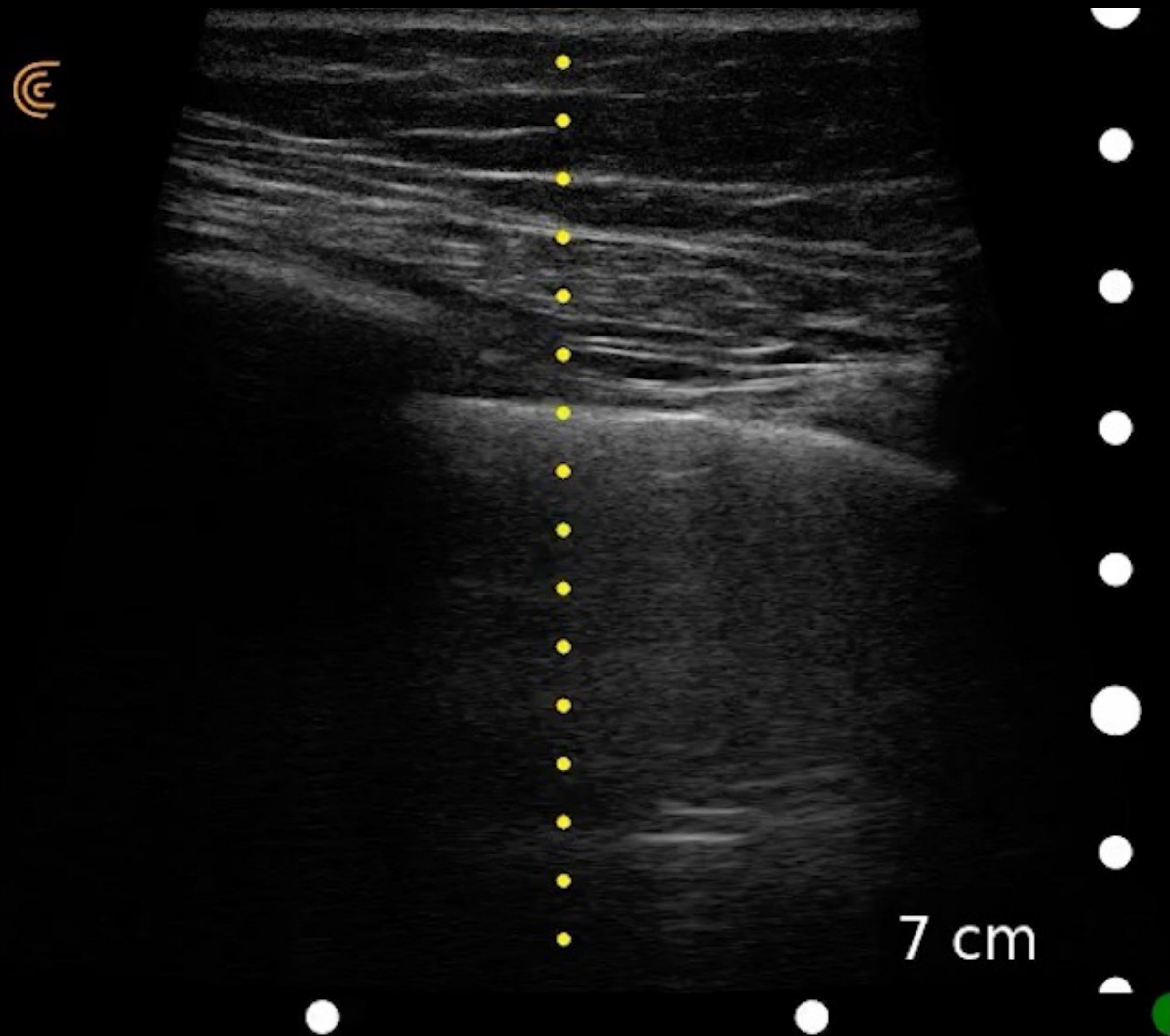
Sliding

Contour

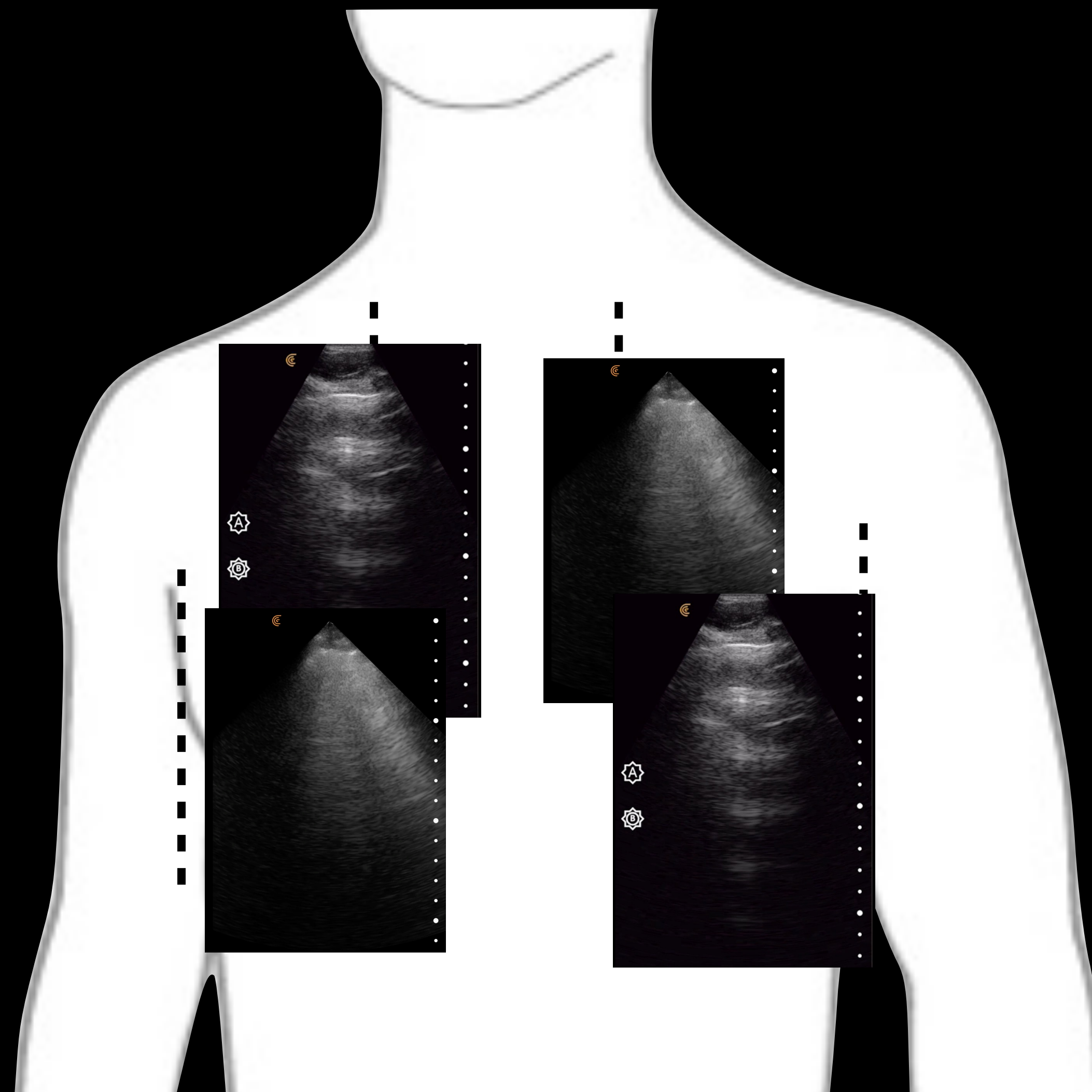
Pleural Line



Pneumothorax



Patchy B lines?



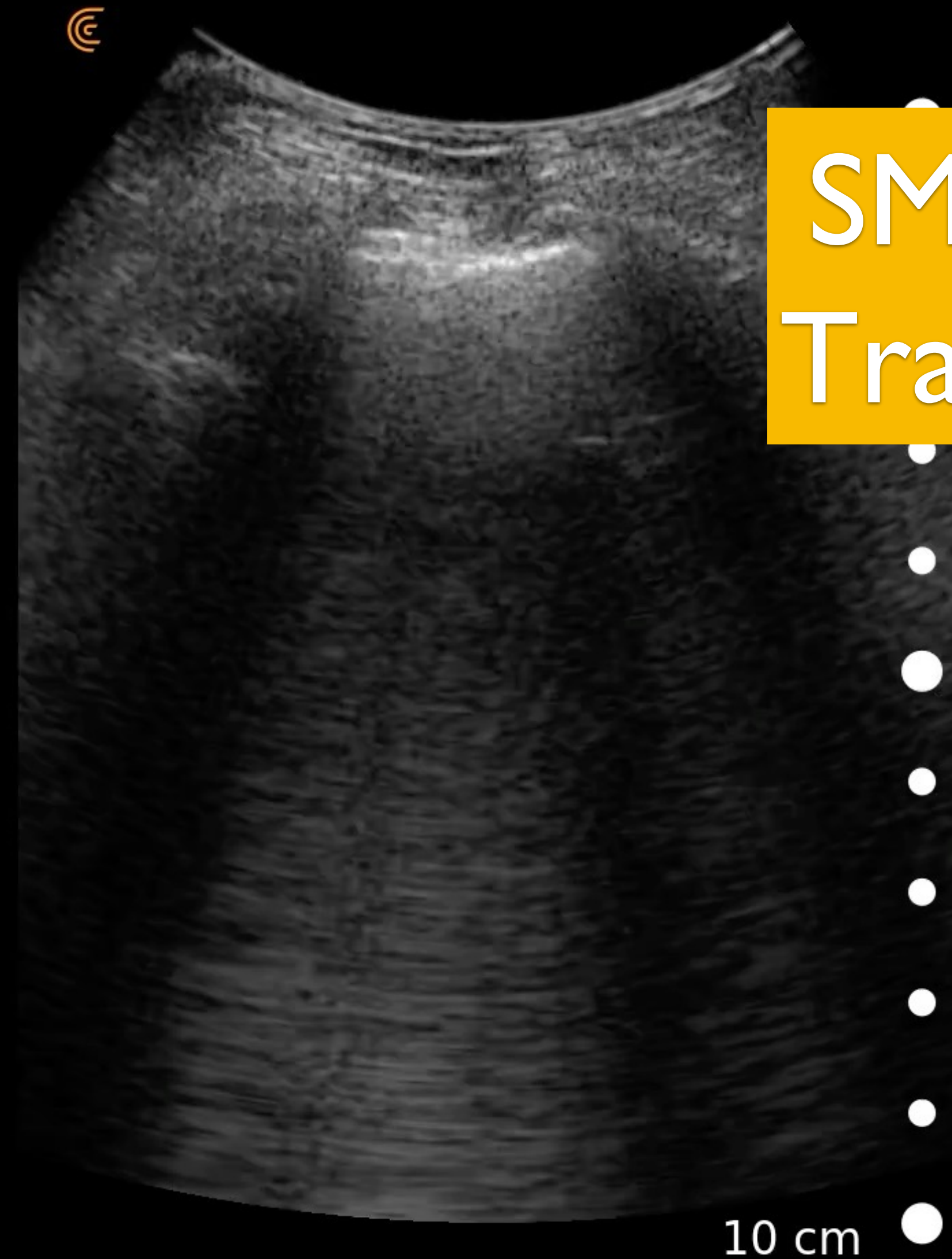
Pleural contour



ROUGH ~
Infectious

9.1 cm

Pleural contour



SMOOTH ~
Transudative

Scan the Heart

PLAX

PSAX / A4CH



EVIDENCE-BASED DIAGNOSTICS

Diagnosing Acute Heart Failure in the Emergency Department: A Systematic Review and Meta-analysis

Reduced EF LR₊ 4.1 / LR₋ 0.24

Martindale JL, Wakai A, Collins SP, Levy PD, Diercks D, Hiestand BC, Fermann GJ, Desouza I, Sinert R. Diagnosing acute heart failure in the emergency department: a systematic review and meta-analysis. *Academic emergency medicine*. 2016 Mar;23(3):223-42.

PLAX

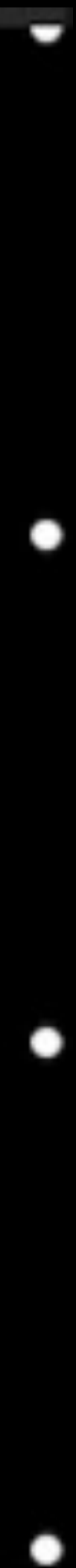
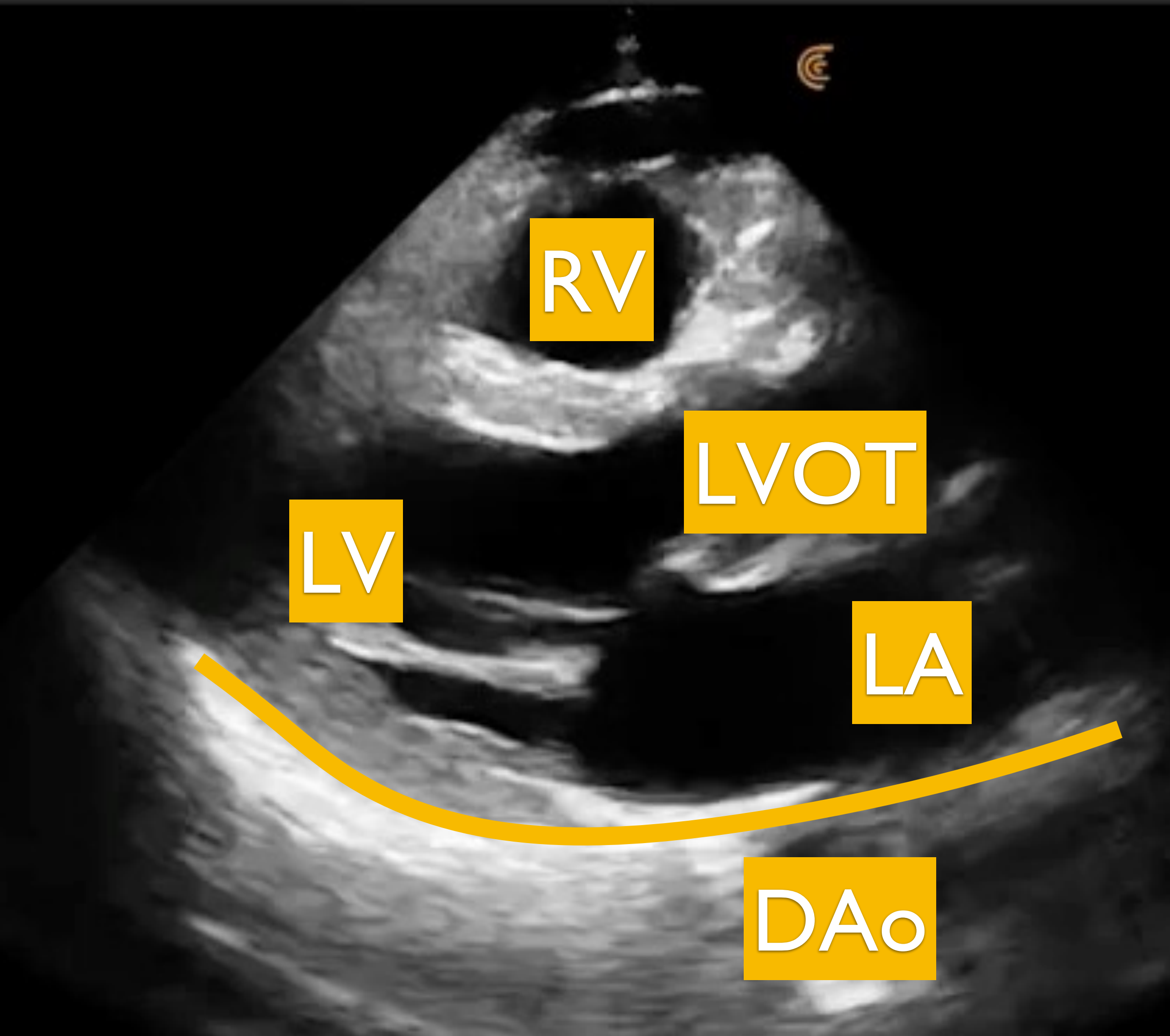


1. Easiest focused echo view
2. Quick to generate & optimize
3. Rapidly interpretable

PLAX: How to generate



PLAX orientation



PSAX: Bonus view!



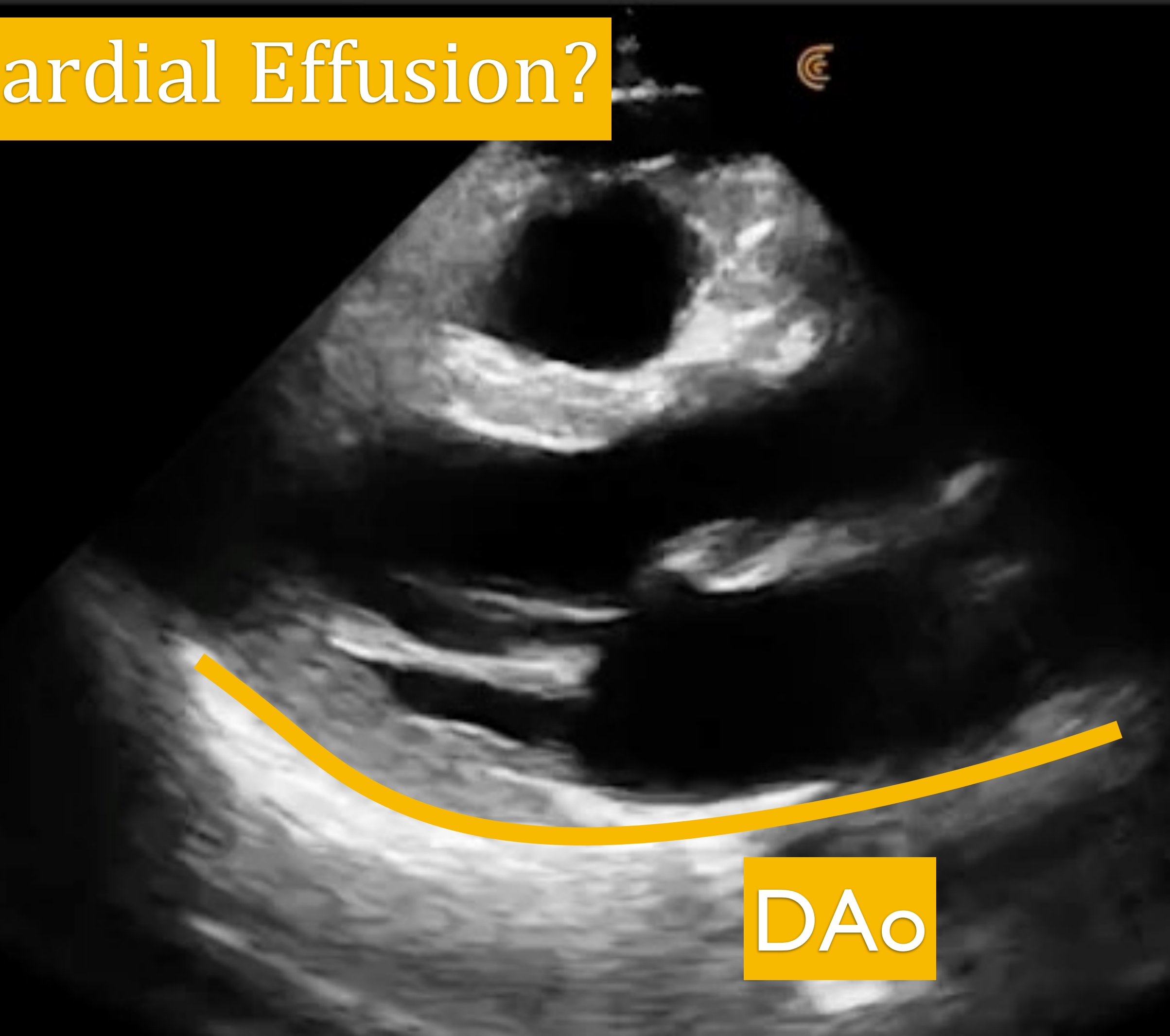
PLAX: How to interpret

3 RAPID QUESTIONS:

1. Pericardial effusion?
2. Significant decrease in LV function?
3. Rule of 3's aka 1:1:1

PLAX orientation

1. Pericardial Effusion?



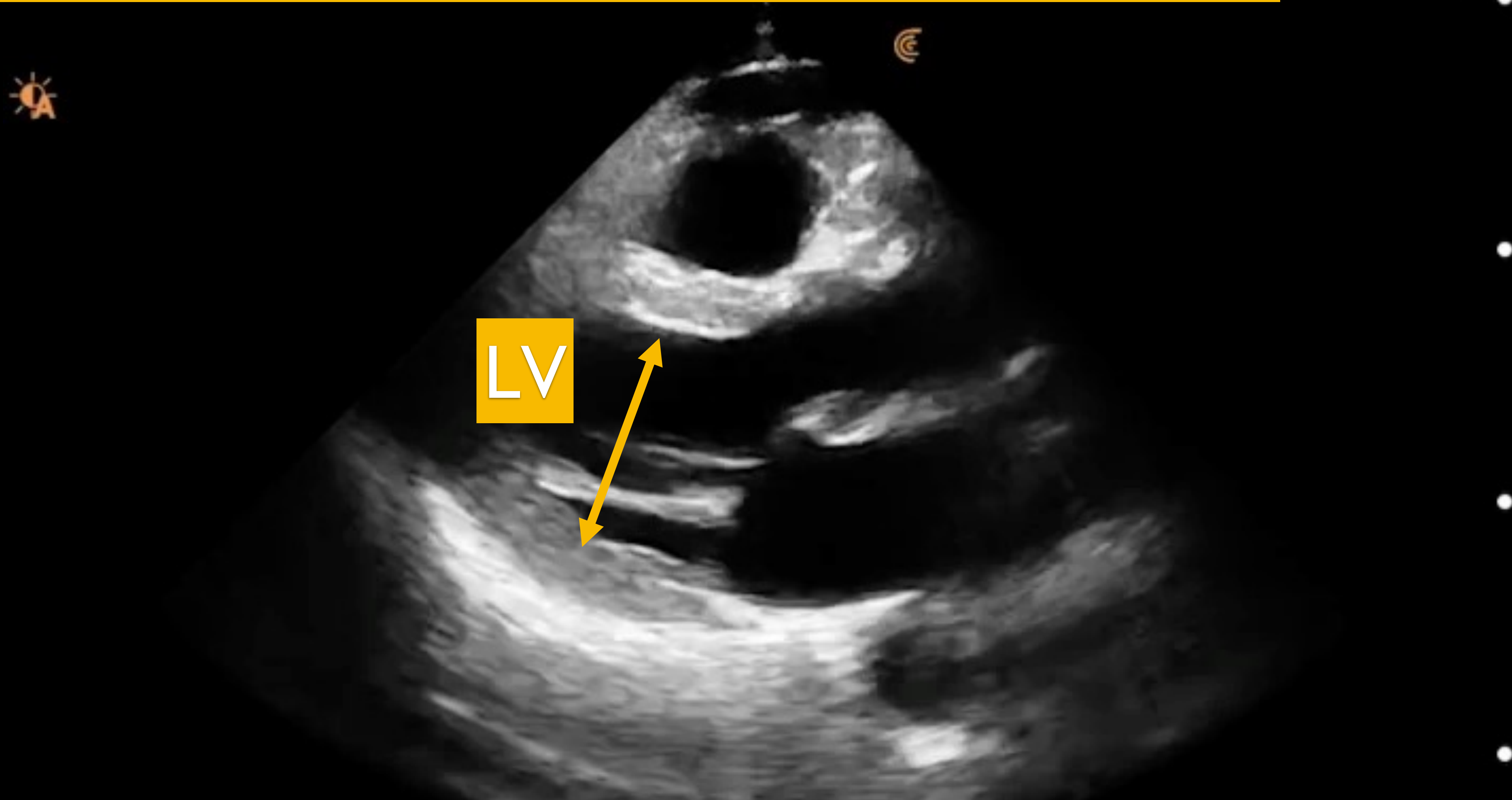
DAo

PLAX: effusion(s)

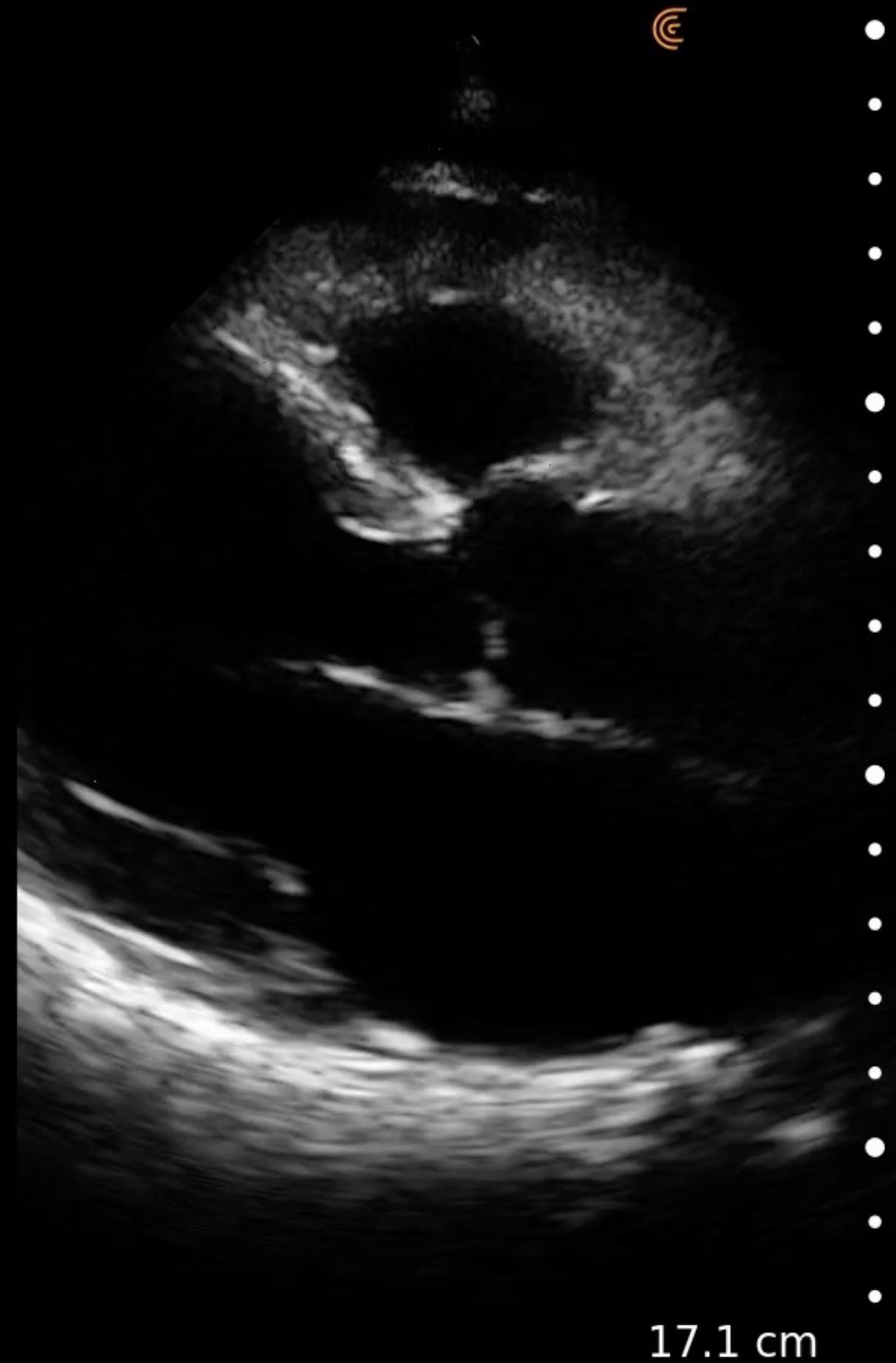


PLAX orientation

2. Is LV function severely diminished?

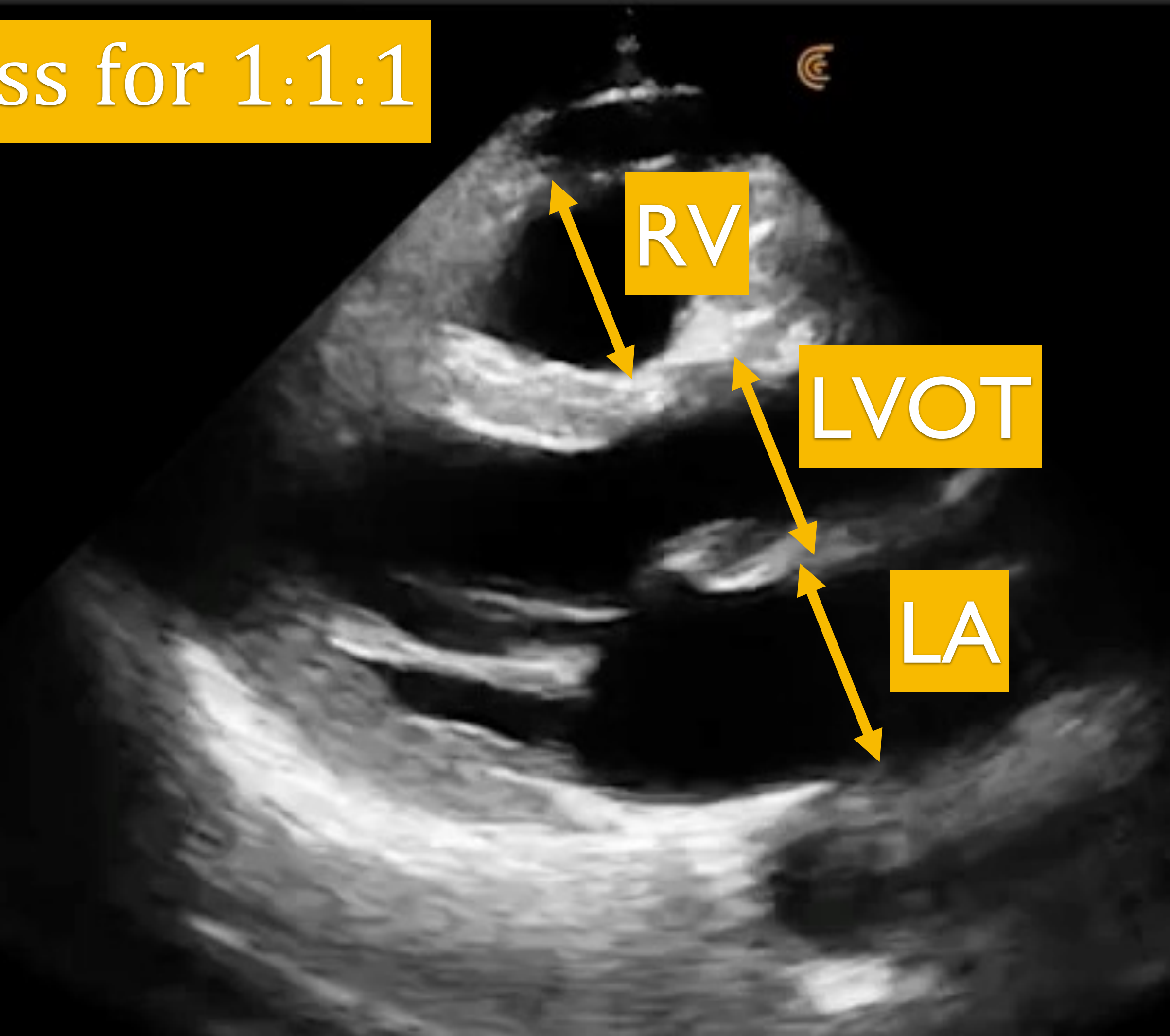


PLAX: LV systolic failure

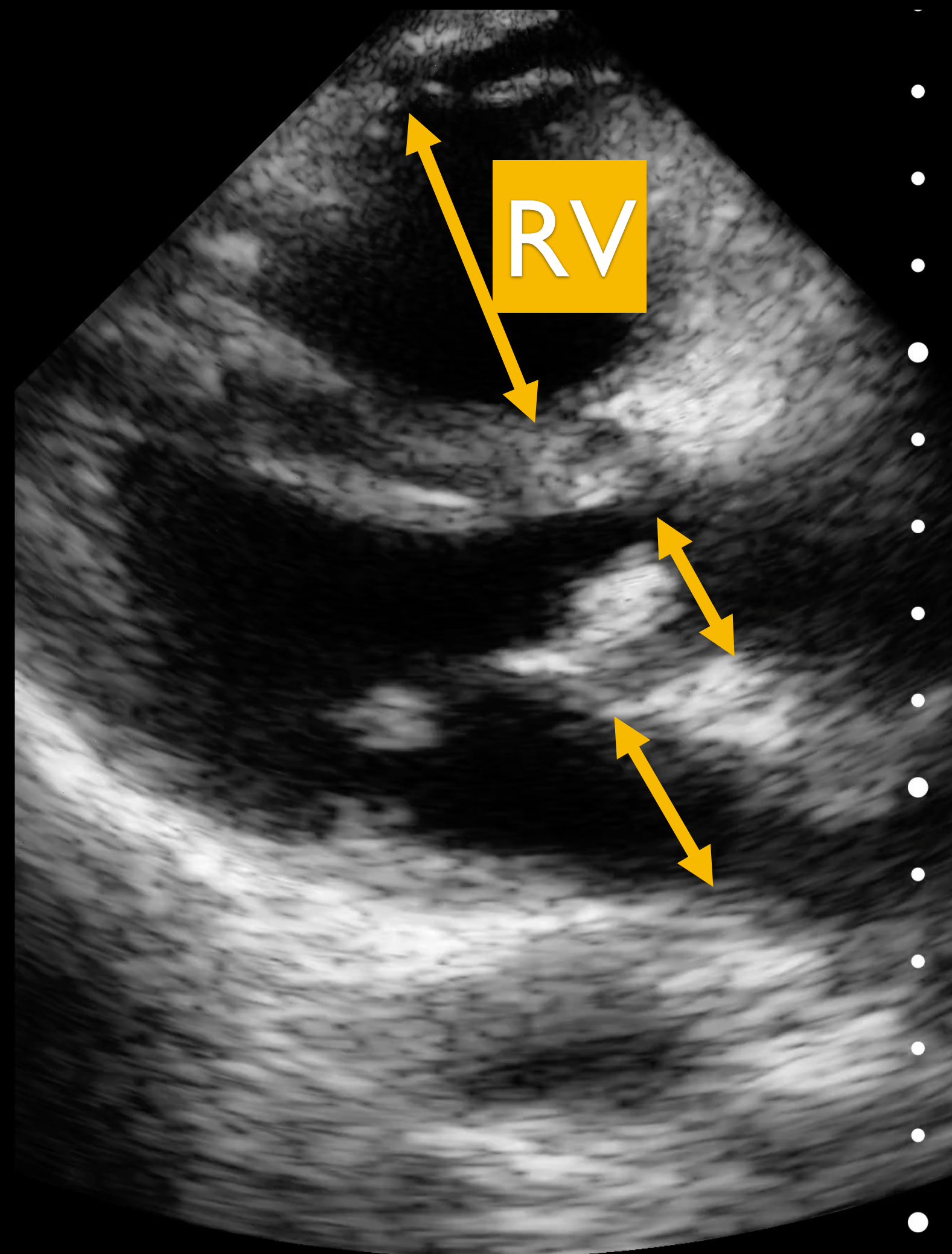


PLAX orientation

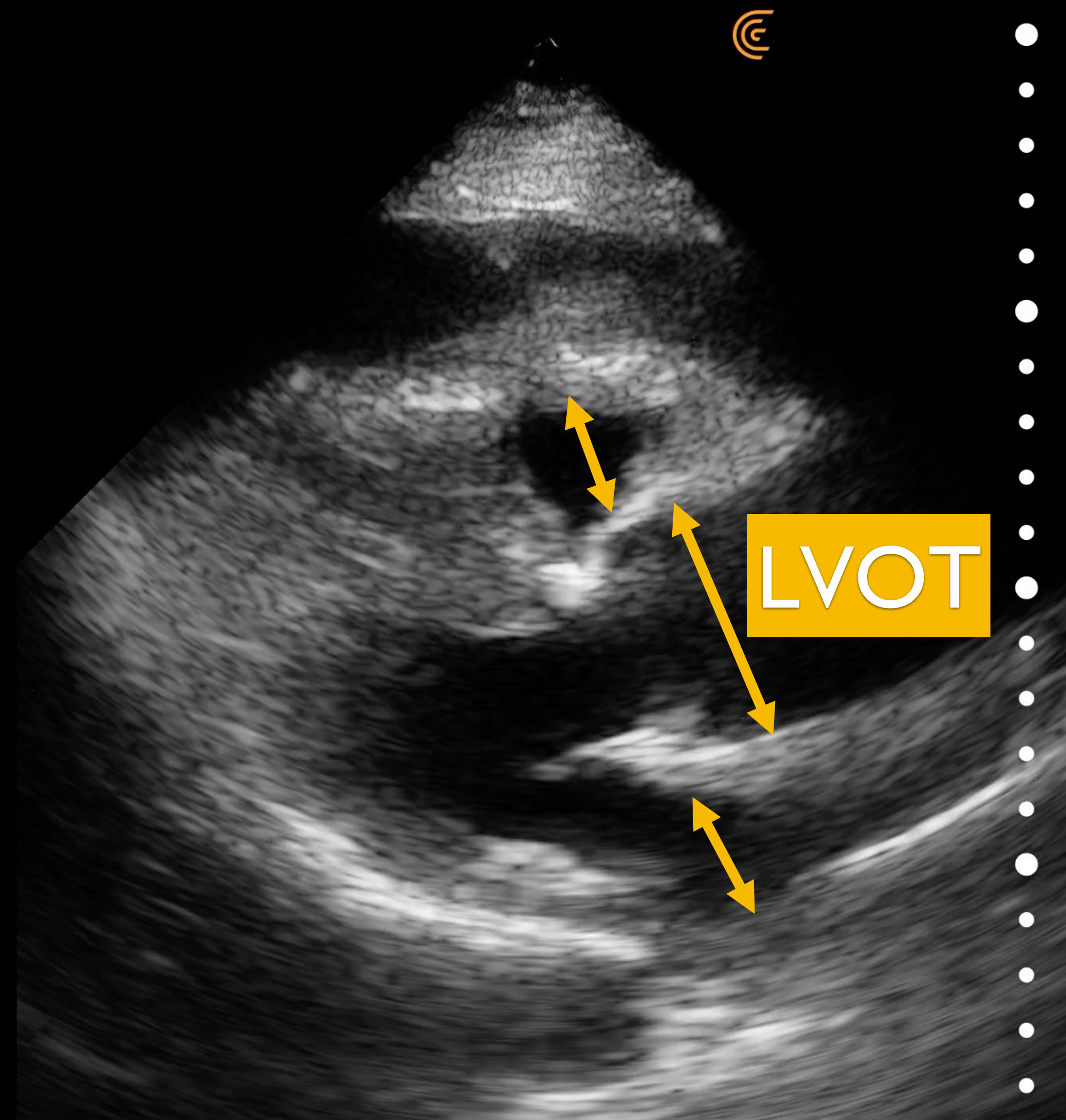
3. Assess for 1:1:1



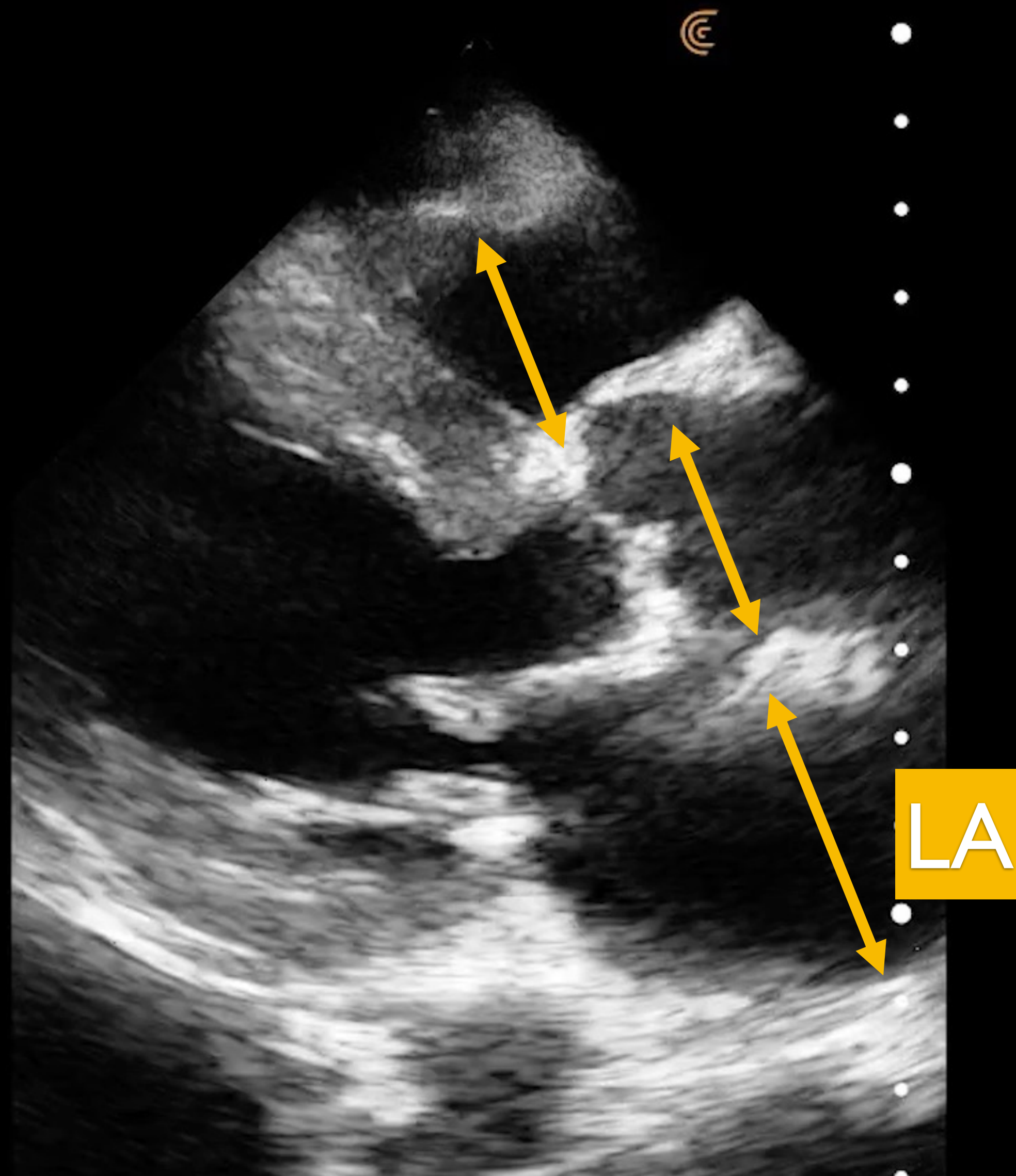
PLAX: RV dilation



PLAX: LVOT dilation



PLAX: LAE



Hypothesis checking

IVC

DVT

IVC





FAT

High R heart pressure

SENSITIVE!

But not specific...

CHF

COPD (pulm HTN)

Any cause of sig TR

....



FLAT

Low R heart pressure

SPECIFIC!

Hypovolemia

Sepsis (vasodilation)

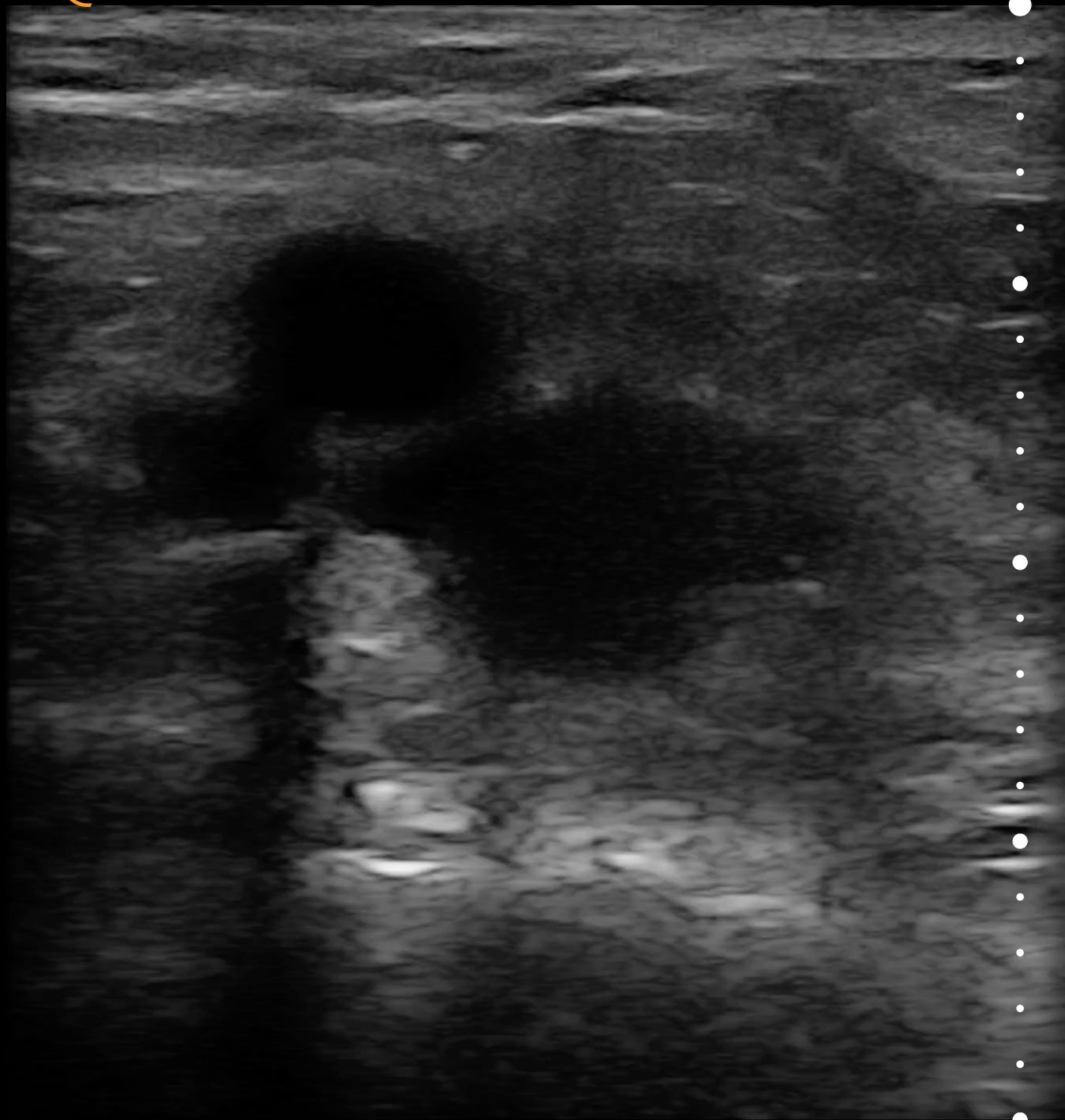
DVT



DVT



DVT



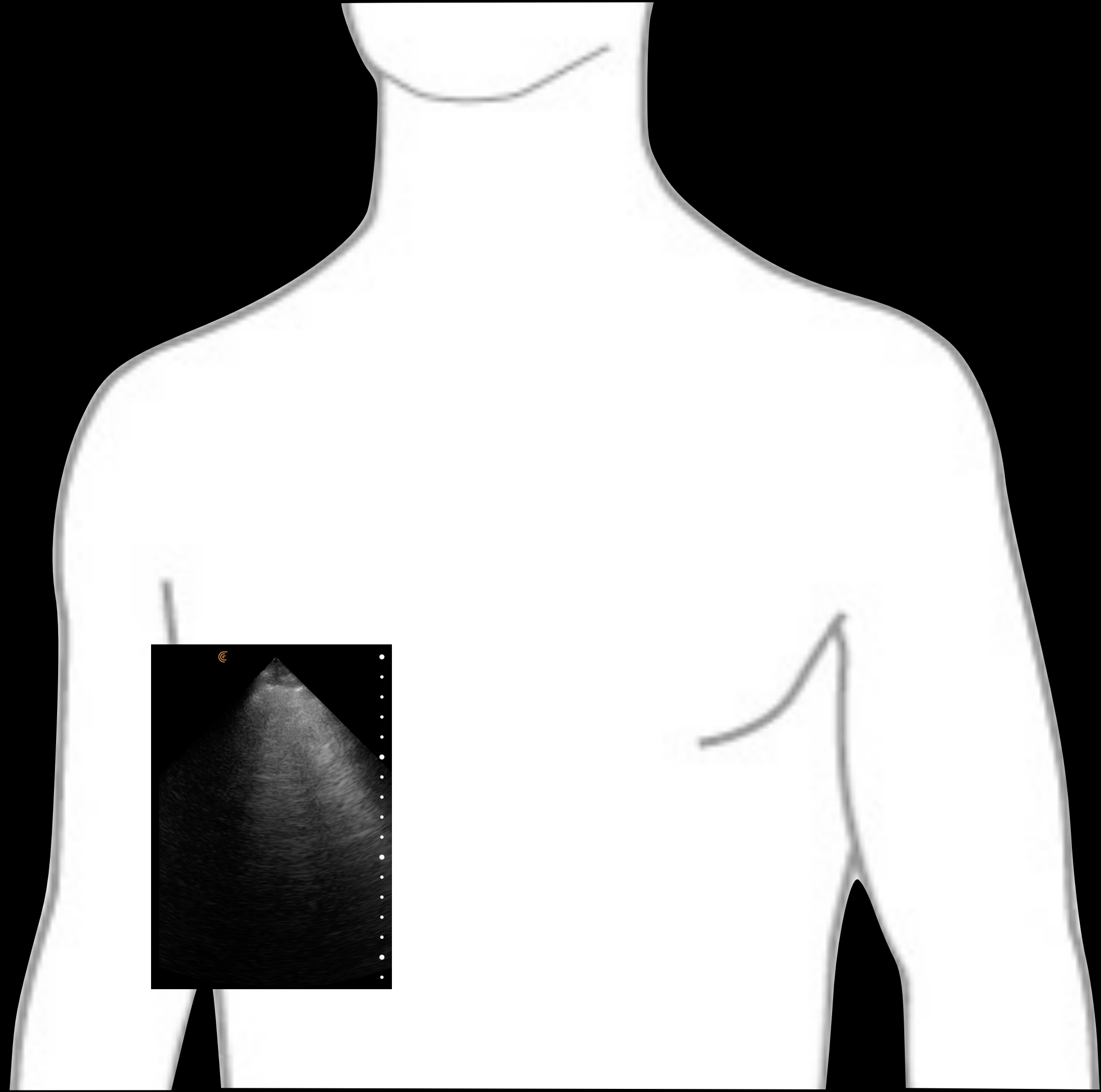
4 cm

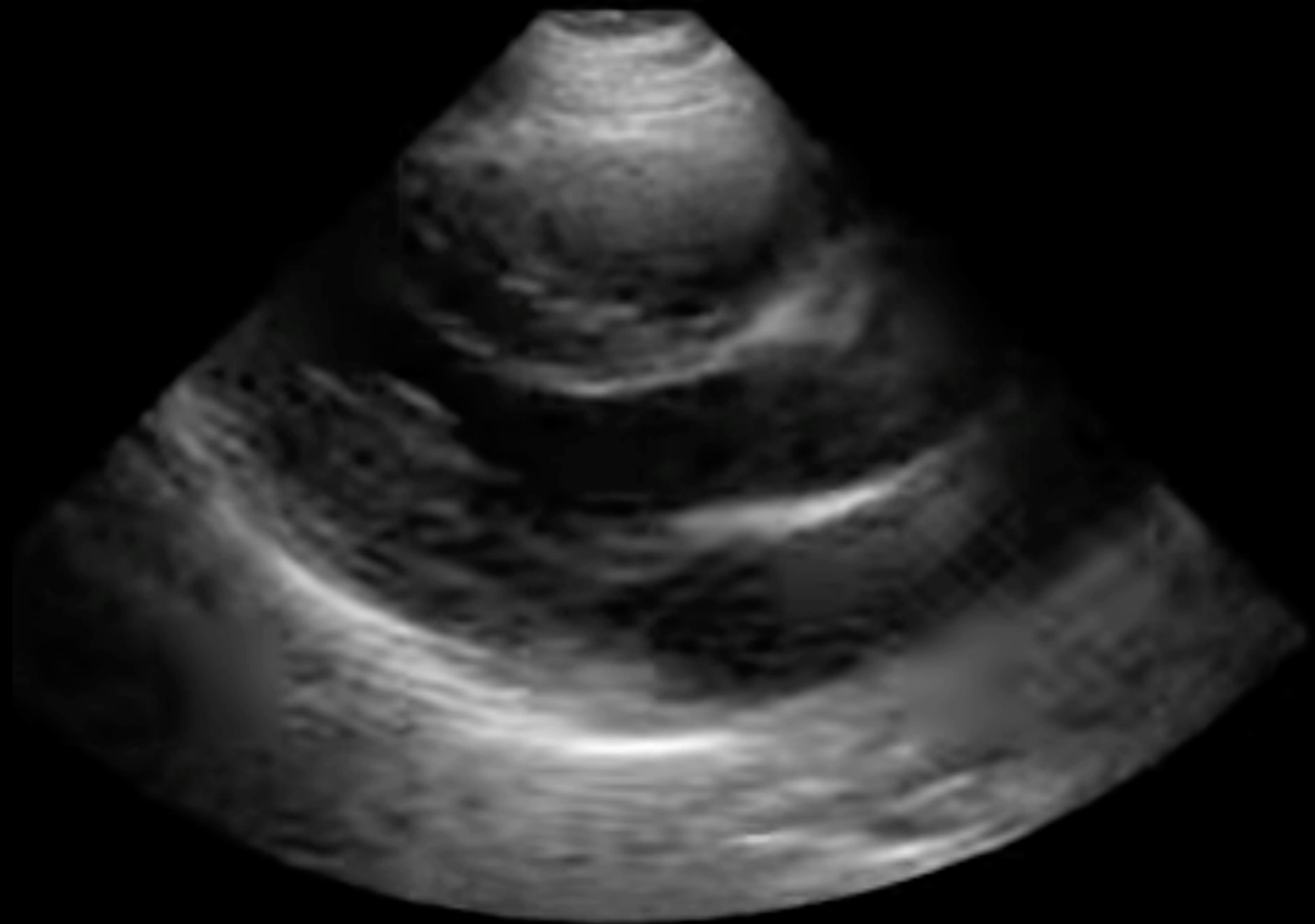
Putting it all together

65M Hx CHF + COPD
“Can’t breathe”



HR bpm	110
ST +0.019 mV	X1
NIBP mmHg	10:12
	120/70
PR	
ADUL	MANU
PR	SpO2
61	88%
RR	
30	
X2	
TEMP1/2 °C	TD
	38.1
MONITOR	



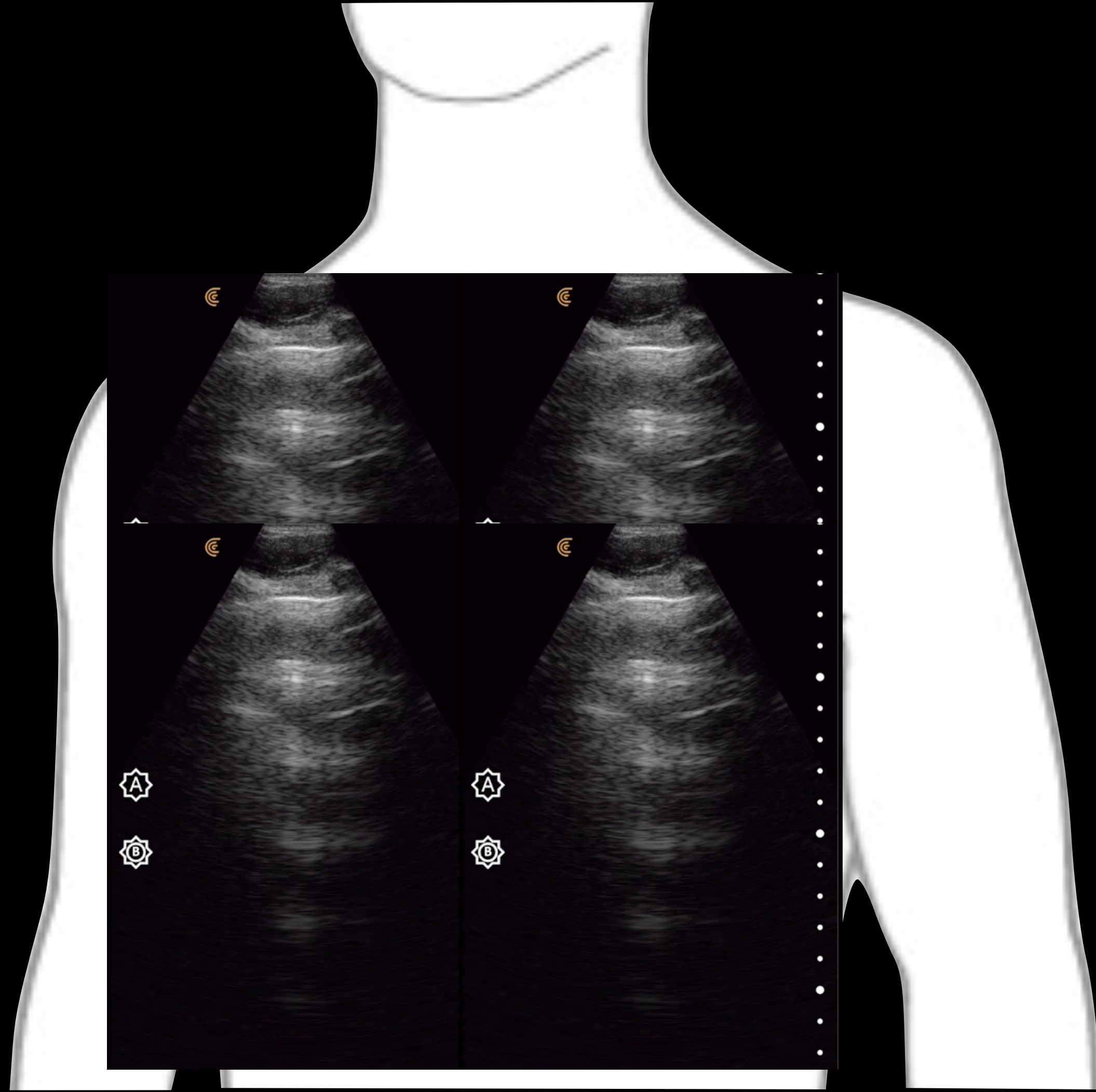


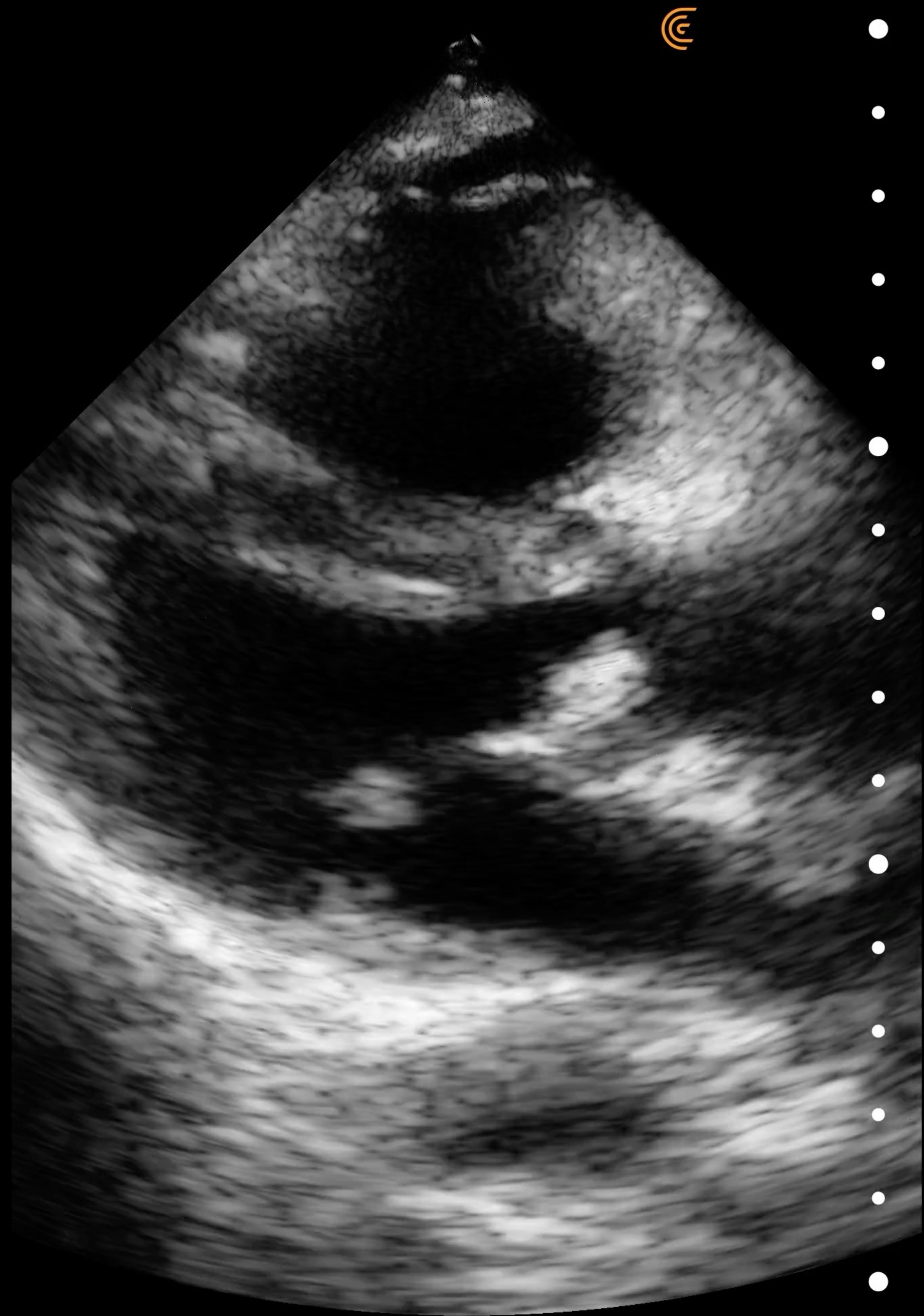


Putting it all together

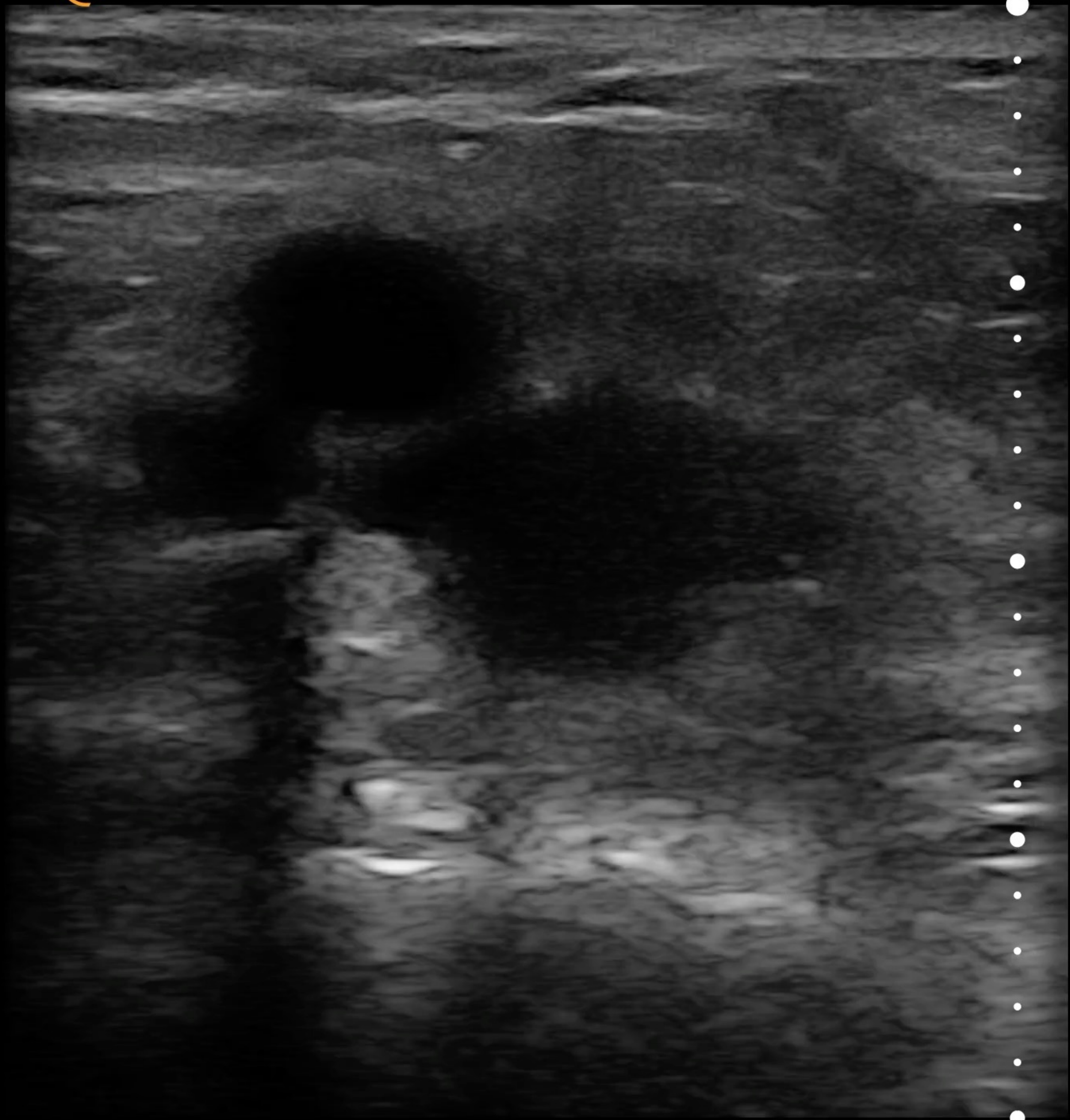


HR bpm	110
♥	
ST +0.019 mV	X1
NIBP mmHg	10:12
	100/60
PR	
ADUL	MANU
PR	SpO2
☰	61
	88%
RR	
👃	30
X2	
TEMP1/2 °C	TD
	37.0
MONITOR	









4 cm

Putting it all together

Young M found in
respiratory distress with
cough



HR bpm



120

ST +0.019 mV

X1

NIBP mmHg

10:12

90/60

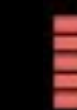
PR

ADUL

MANU

PR

SpO2



61

85%

RR



30

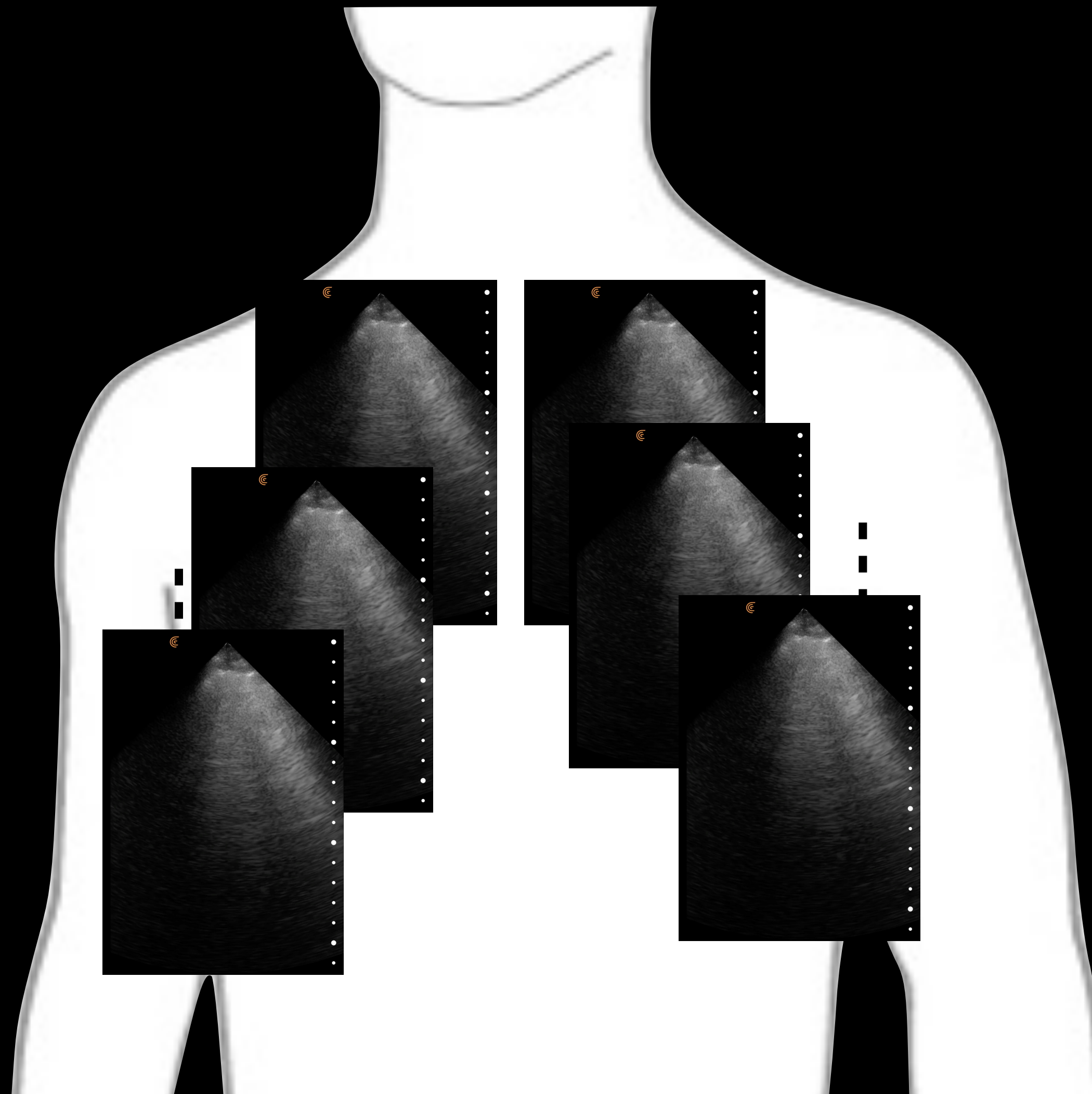
X2

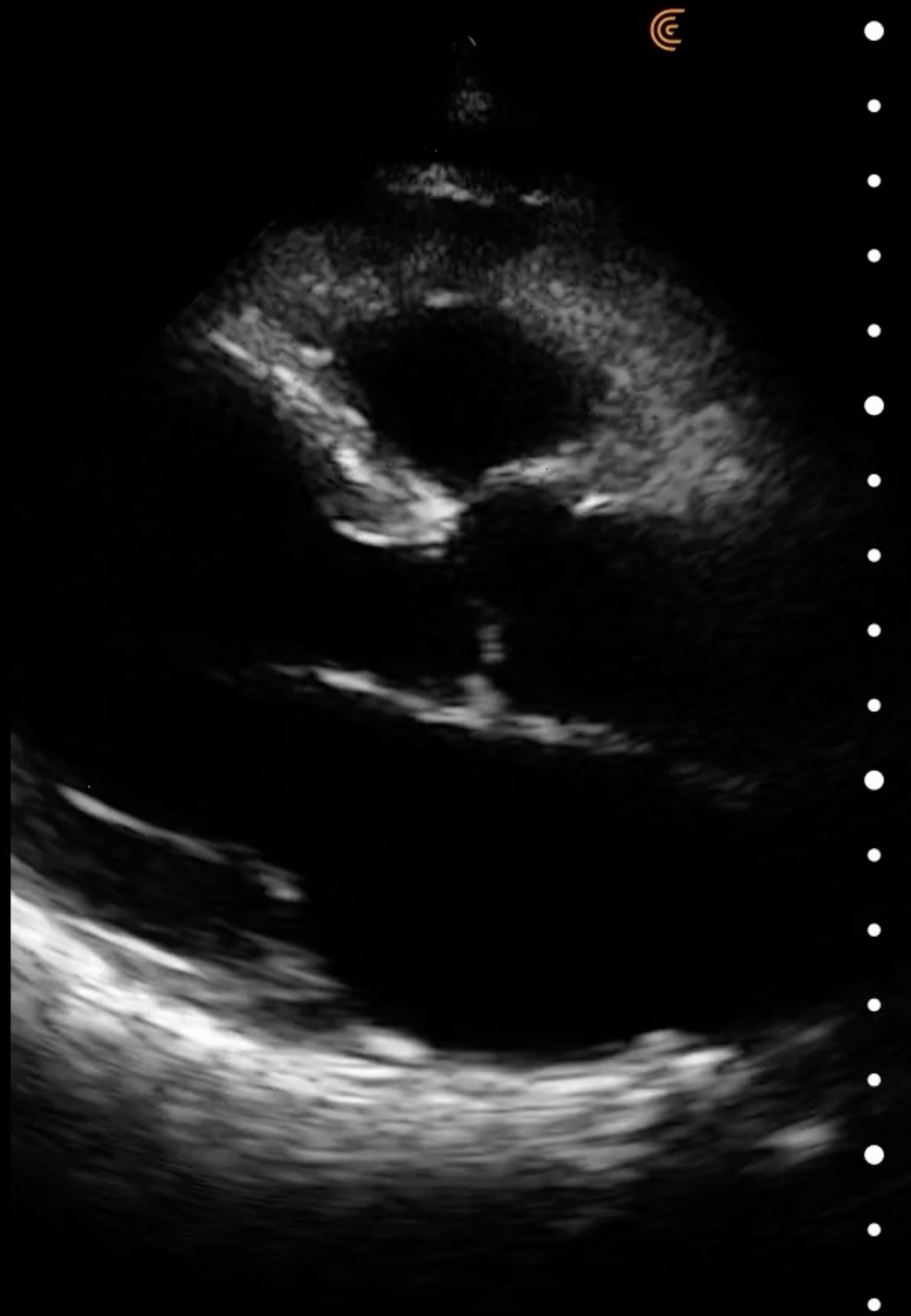
TEMP1/2 °C

TD

37.8

MONITOR





17.1 cm



Dyspnea Scan

1. Scan lungs
2. Check heart: PLAX +
3. Check your hypothesis
4. Save a life!

4 Ways PoCUS Can Elevate Your Practice

1. Improve patient outcomes
2. Reduce costs
3. Feel empowered
4. Improve patient satisfaction

Live Demonstration



Shelley Guenther, CRGS, CRCS

Sonographer | Clinical Marketing Manager



What additional information would you like?

Interactive Poll

NEW Whole-Body Scanner



Unsurpassed **versatility** in a high-resolution handheld that streamlines your **workflow!**

- Multi-purpose dual-array
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- Broadest frequency range
- Greatest imaging depth to 40cm
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- Available today only in the USA!





Pre-Register

Poll

POCUS Skills for Your Next ED Shift: 5 Ways to Elevate Patient Care

Thursday, February 29th, 2024
2PM Pacific | 5PM Eastern

www.clarius.com/ultrasound-webinars

Questions



Dr. Oron Frenkel

Emergency Physician



Shelley Guenther

Sonographer



Thank you!