



# POCUS FOR A CASE OF SOB IN CHF

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# Outline

- Patient case
- Patient images
- Data supporting POCUS for volume status
- Conclusions



# Patient case



# CC: Weakness

- HPI:**
- 86 yo man with h/o Afib on amiodarone, CAD c/b ICM, chronic systolic HF (EF 22% in 2016), severe MR and CKD presenting on 11/2016 with weakness and decreased PO intake x1 week.
  - Recent prolonged admission for CHF exacerbation in setting of PNA requiring ionotrope-assisted diuresis and intubation, discharged to cardiac rehab.
  - Feeling well until one week ago after working out on the elliptical machine, went home and slept the whole day. Family also reported increased confusion and decreased PO intake.
  - No SOB, orthopnea, PND, chest pain, fever, cough, nausea/vomiting, abd pain, dysuria, diarrhea or constipation.
  - Pt's cardiologist decreased his bumetanide dose as he appeared dehydrated, stopped bumetanide completely on 10/29.

# Physical exam

**Tc: 36.4**

**HR: 83**

**BP: 95/61**

**RR: 18 SpO2: 96%**

**Weight: 72.4kg (dry weight 72.4 kg on prior discharge)**

**Pertinent findings:**

**Dry MM**

**No JVD**

**Holosystolic murmur loudest at right upper sternal border**

**No JVD**

**Lungs CTAB posteriorly, anterior wheeze**

**No LE edema**



# Labs

**BNP- 4084**

**Troponin: 0.06**

**WBC: 9.0 / Hb: 10.9 (MCV: 96.5) / Hct: 32.2 / Plt: 196**

**138 | 102 | 112**

**-----< 131 Ca: 9.0 Mg: 2.2 Anion Gap: 17.0 [11/02 @ 11:56]**

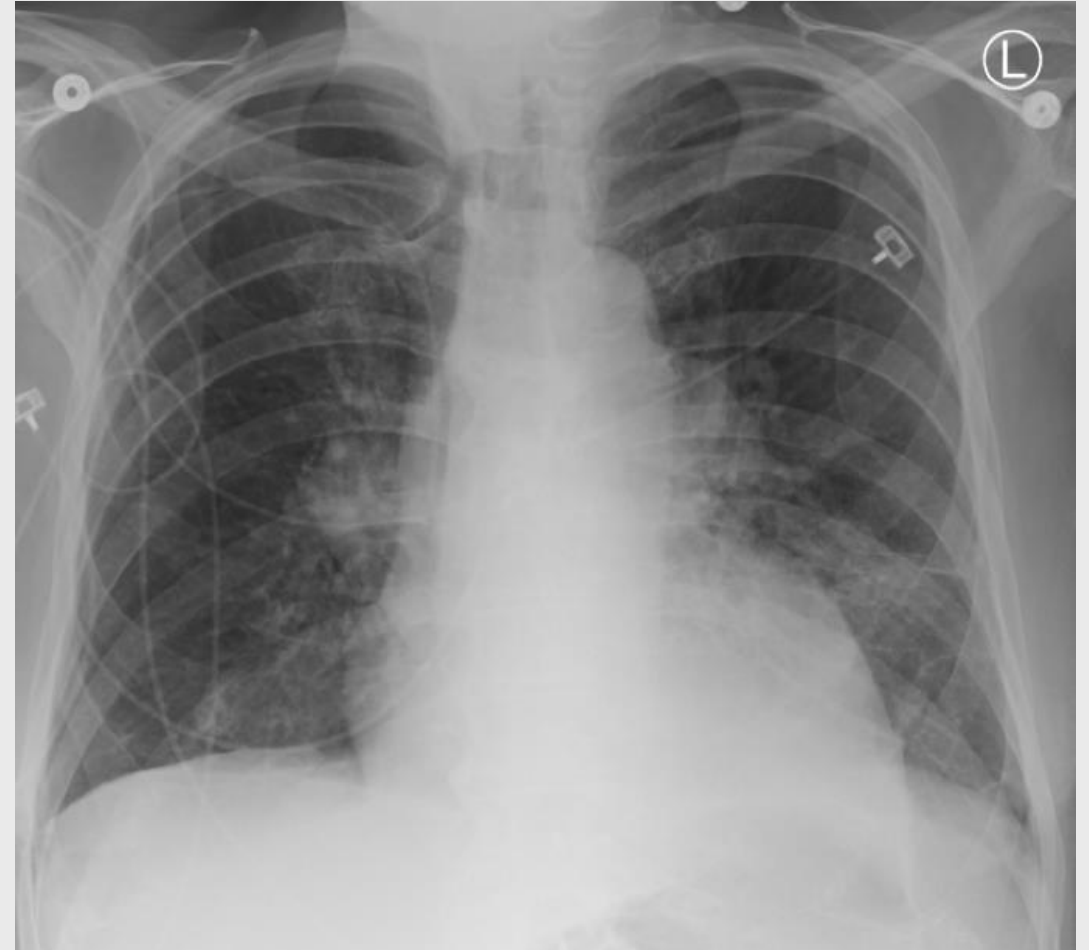
**3.8 | 19 | 4.24**

# CXR

Current



2 mos prior



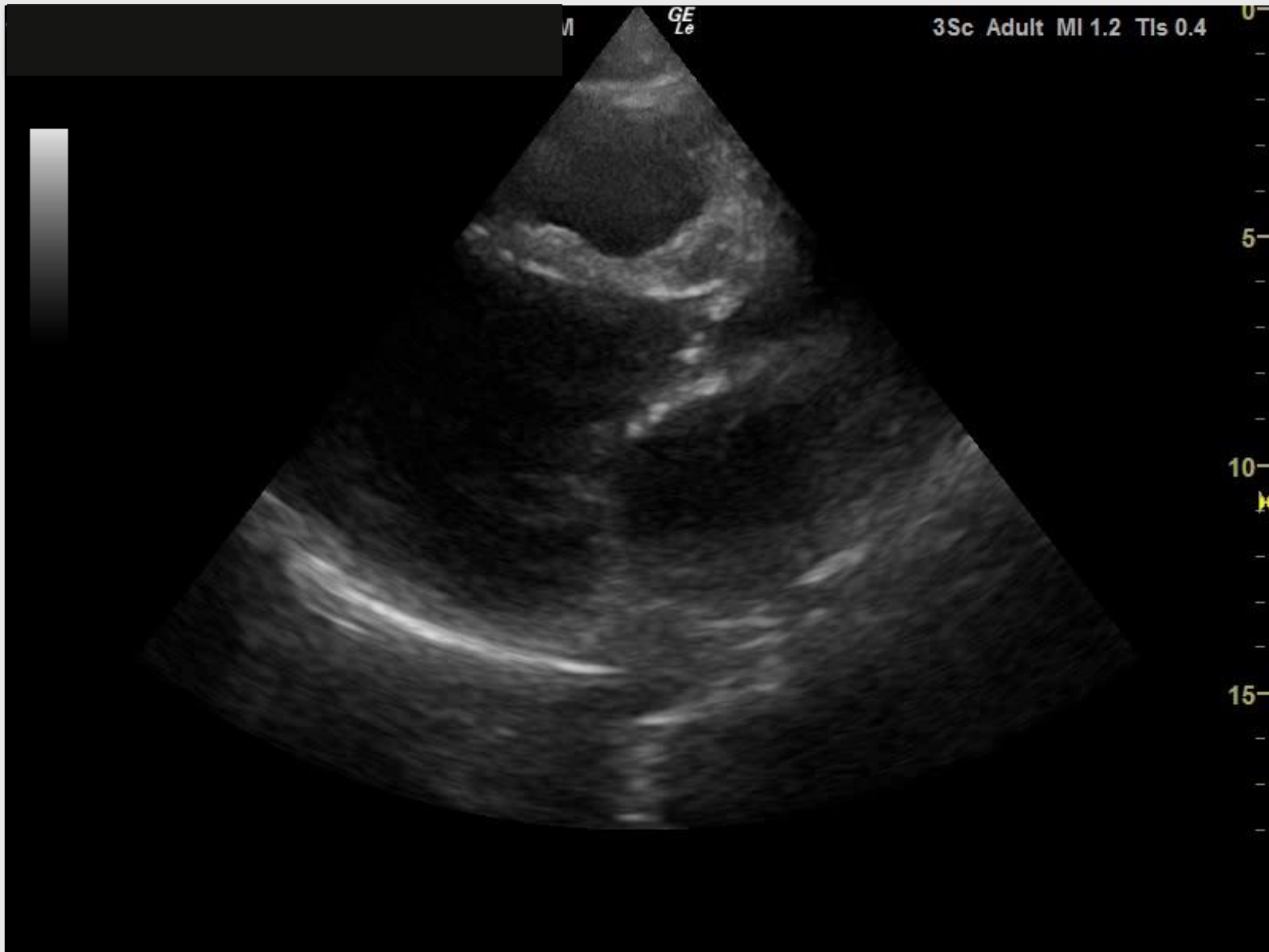
# POCUS CLINICAL QUESTION: Is this patient volume overloaded?

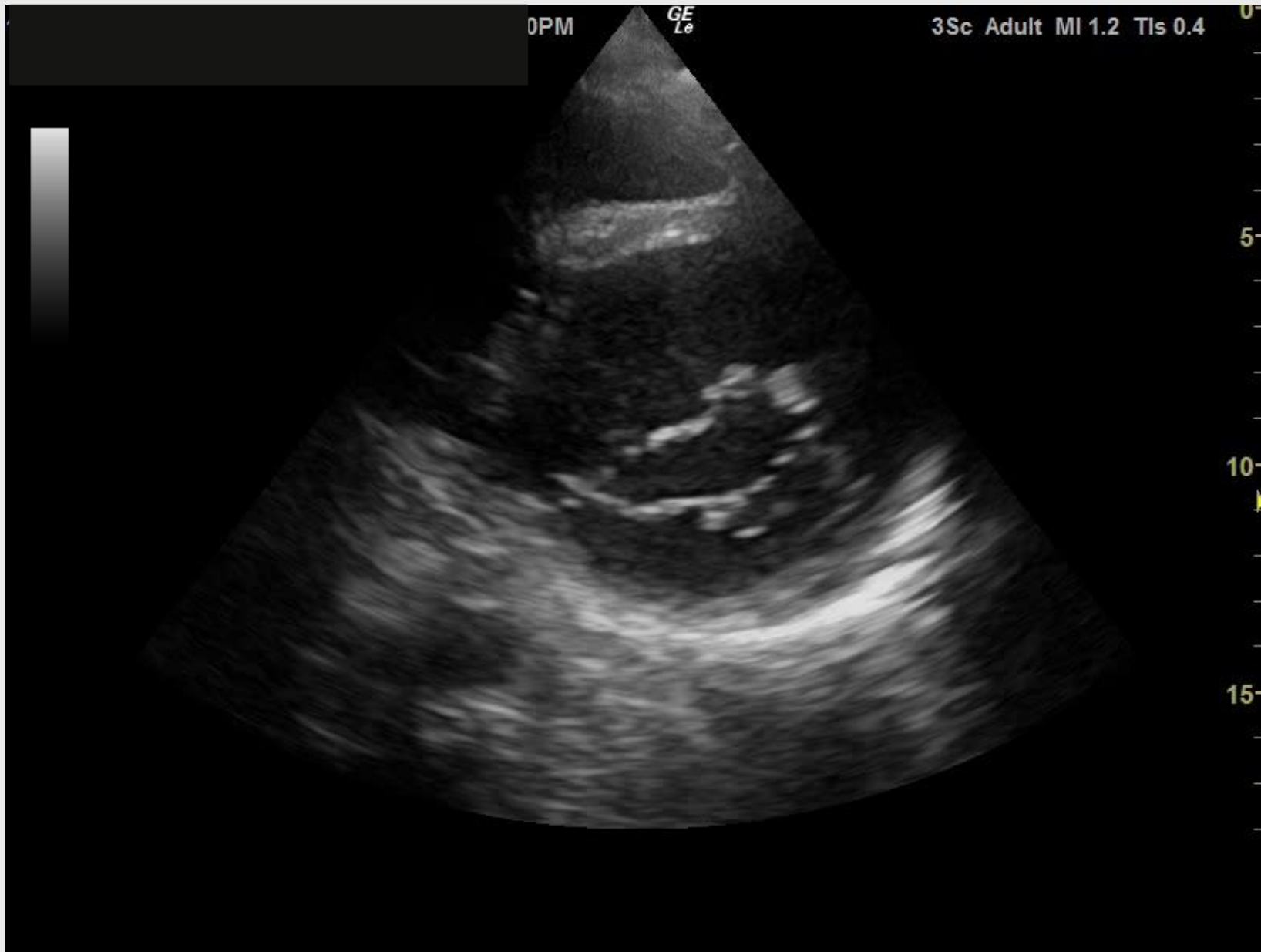
Lung windows

Cardiac exam



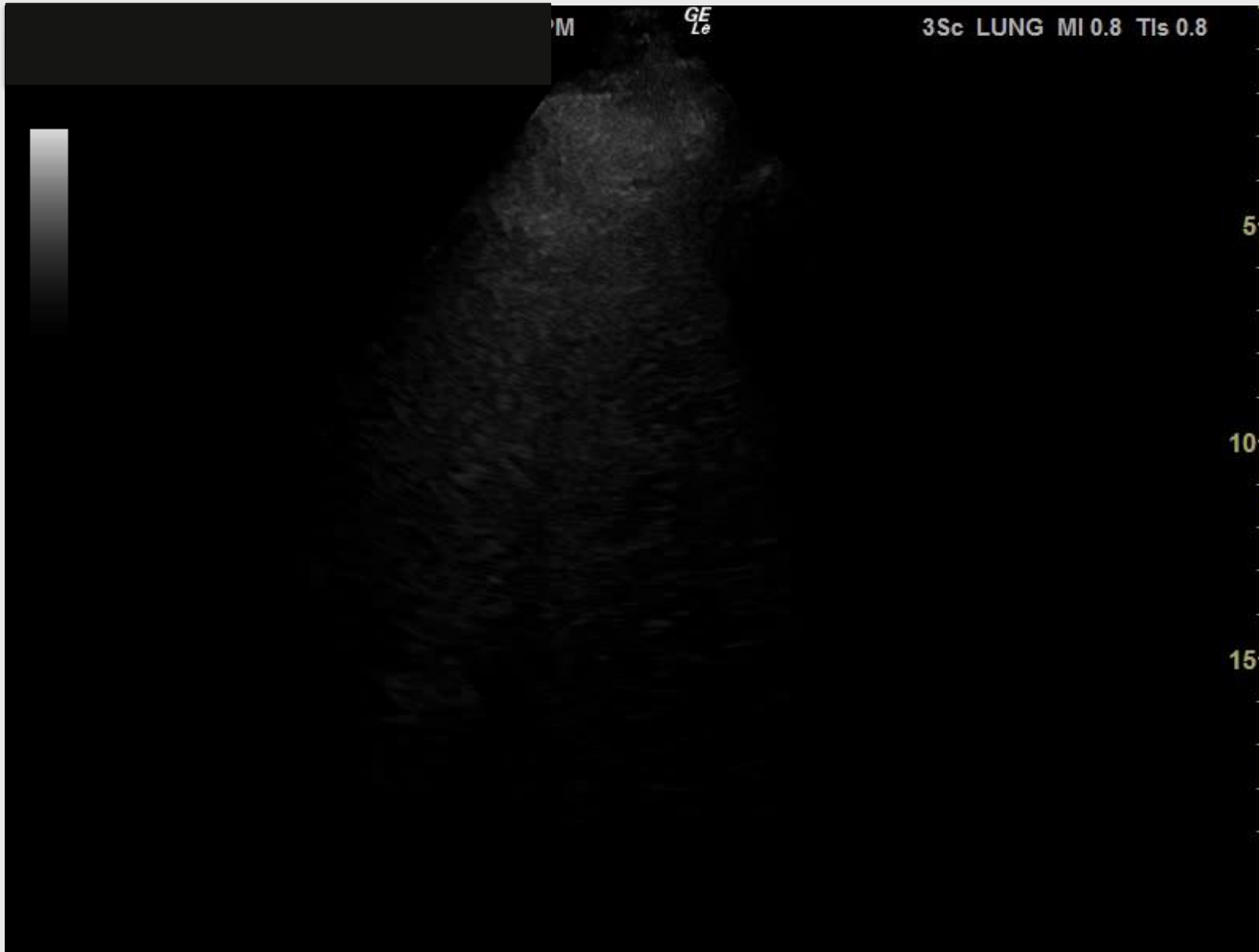


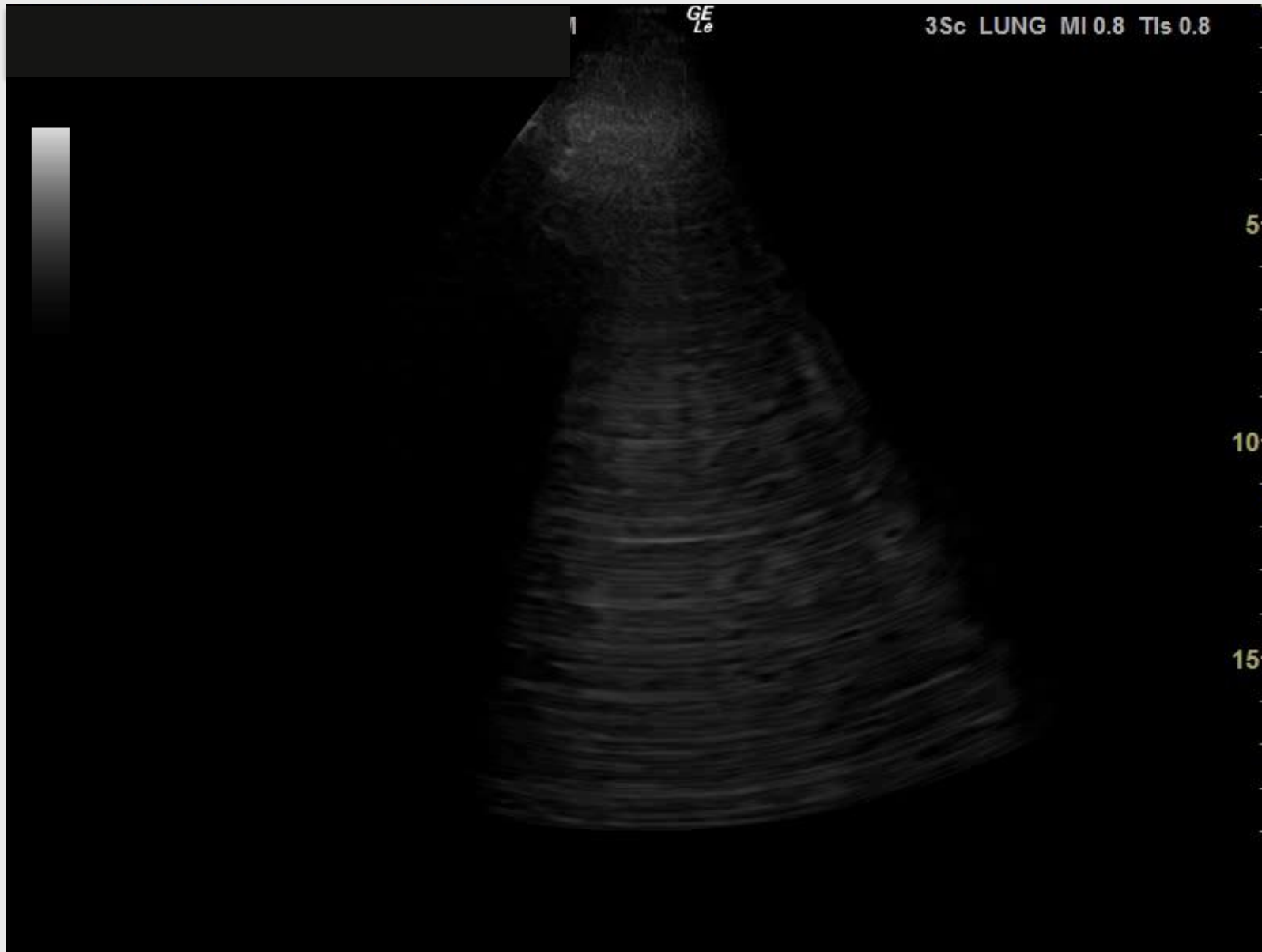


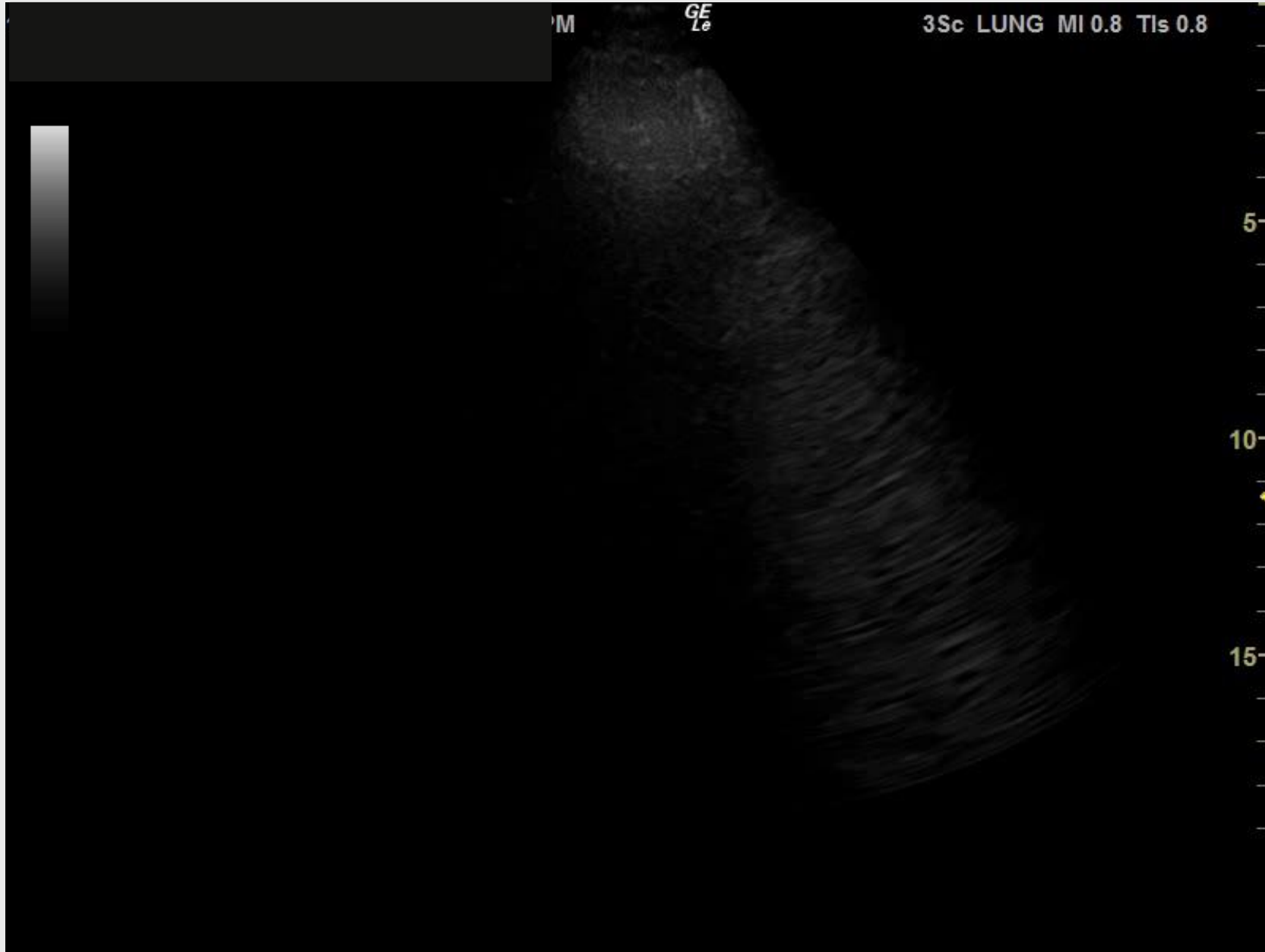


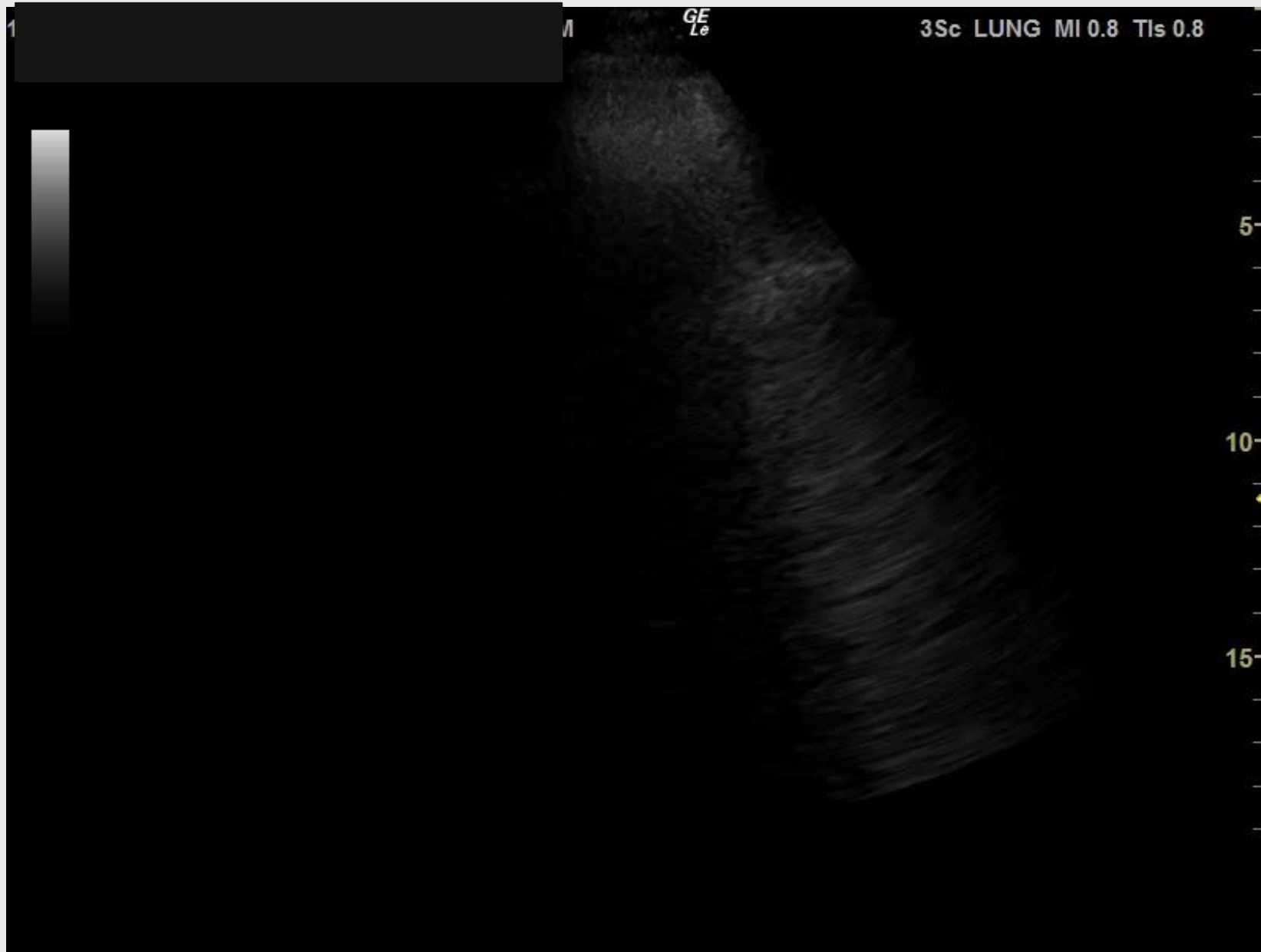










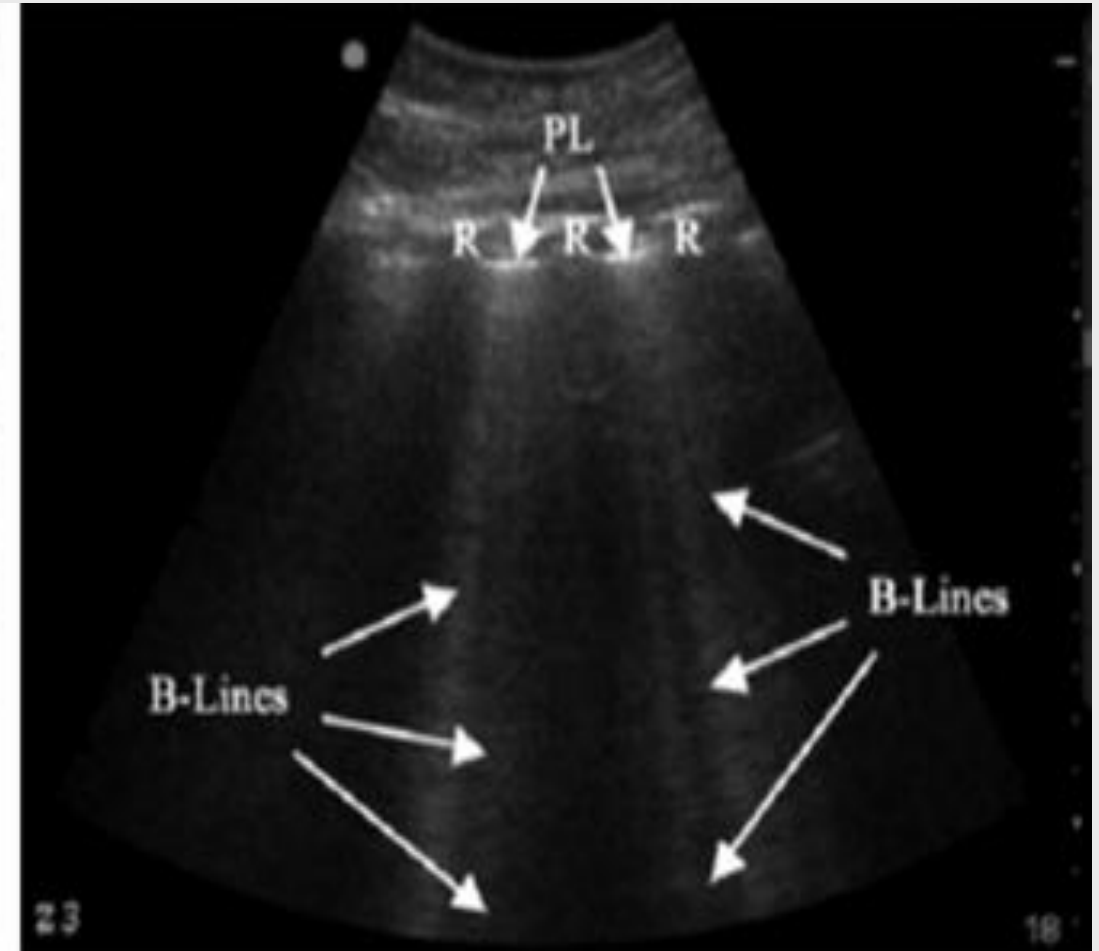
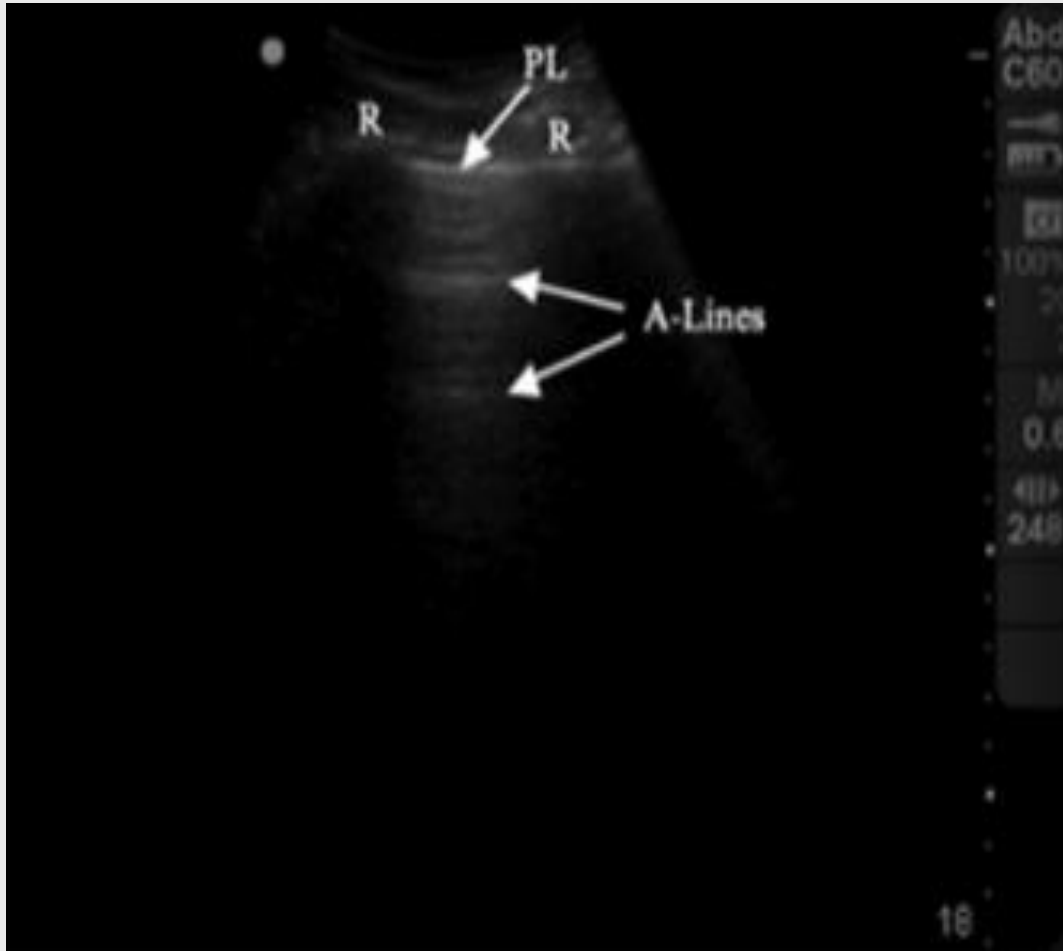




# Evidence for POCUS : B- Lines as a marker of volume status



# B-lines



# B-lines: Study 1

- Prospective, blinded observational study of adult patients in ED
- 100 patients enrolled, 6 excluded for incomplete data
- Each patient had an eight-zone thoracic US performed by one of five sonographers and serum NT-ProBNP levels were measured
- Chart review by two physicians blinded to the US results served as the criterion standard
- Studies were performed within the first 12 hours of presentation
- A positive 8-zone US was defined as **at least two** positive zones on **each side**

Liteplo AS, Marill KA, Villen T, Miller RM, Murray AF, Croft PE, Capp R, Noble VE. Emergency Thoracic Ultrasound in the Differentiation of the Etiology of Shortness of Breath (ETUDES): Sonographic B-Lines and N-Terminal Pro-Brain-Type Natriuretic Peptide in Diagnosing congestive Heart Failure. Acad Emerg Med. 2009; 16:201-10.



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# B-lines: Study 1

- NT-ProBNP → LR(+) = 2.3 [1.4-3.8]
  - POCUS → LR(+) = 3.9 [1.6-9.7]
  - POCUS → LR (all 8 zones (+)) =  $\infty$
  - POCUS → LR (-) = 0.22 [0.06-0.8]
- 
- **CONCLUSION: POCUS for B-lines may be a useful diagnostic test for diagnosing CHF. Predictive accuracy is improved when studies are totally positive or totally negative**
  - **Studies took less than 5 minutes to perform!**

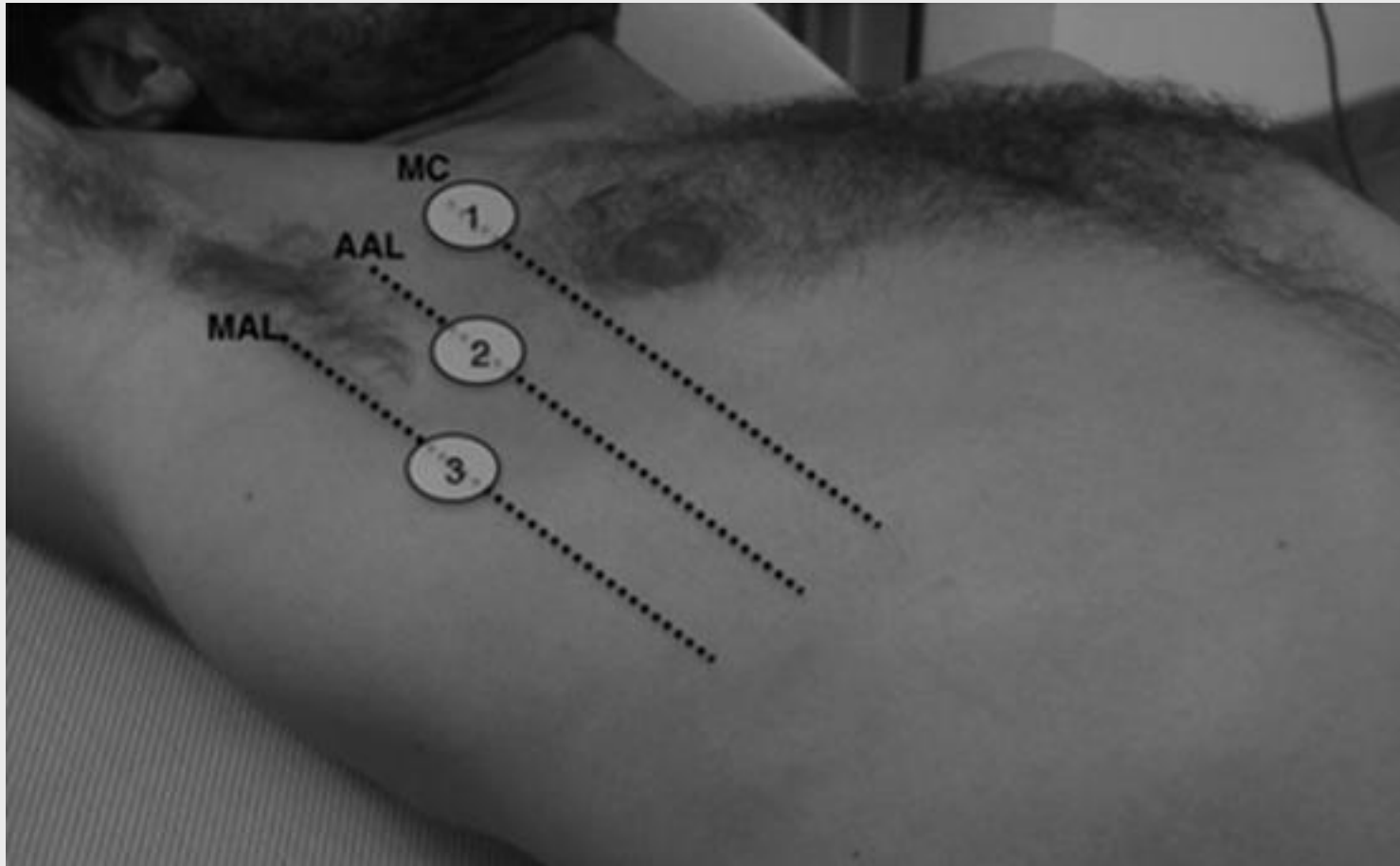
Liteplo AS, Marill KA, Villen T, Miller RM, Murray AF, Croft PE, Capp R, Noble VE. Emergency Thoracic Ultrasound in the Differentiation of the Etiology of Shortness of Breath (ETUDES): Sonographic B-Lines and N-Terminal Pro-Brain-Type Natriuretic Peptide in Diagnosing congestive Heart Failure. Acad Emerg Med. 2009; 16:201-10.

# B-lines: Study 2

- **Multicenter prospective cohort study in seven Italian Eds**
- **1,007 patients screened, 1,005 consented to enrollment**
- **Underwent POCUS and clinical workup (history, physical, EKG, ABG)**
- **Two expert physicians reviewed final diagnosis**
- **All patients also got a CXR**
- **A subgroup of patients also had BNP measured, this was not protocolled by study**

Pivetta E, Goffi A, Lupia E, et.al. Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the ED: A SIMEU Multicenter Study. Chest. 2015; 148(3):e96-98

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# B Lines: Study 2

24

- Found that POCUS of lung windows had a significantly higher accuracy (sensitivity 97%, specificity 97.4%) in differentiating CHF from noncardiac causes of acute dyspnea than:
  - initial clinical workup (history, physical, EKG, ABG) (sensitivity 85.3%, specificity 90%),
  - chest x-ray (sensitivity 69.5%, specificity 82.1%)
  - BNP (sensitivity 85%, specificity 61.7%)

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# B-lines: Study 2

	LR(+)	LR(-)
BNP	2.2	0.24
initial clinical workup (Hx, PE, EKG, ABG)	8.5	0.16
chest x-ray	3.9	0.37
POCUS	37	0.03

Pivetta E, Goffi A, Lupia E, et.al. Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the ED: A SIMEU Multicenter Study. Chest. 2015; 148(3):e96-98

# Evidence for POCUS: IVC as a marker of volume status

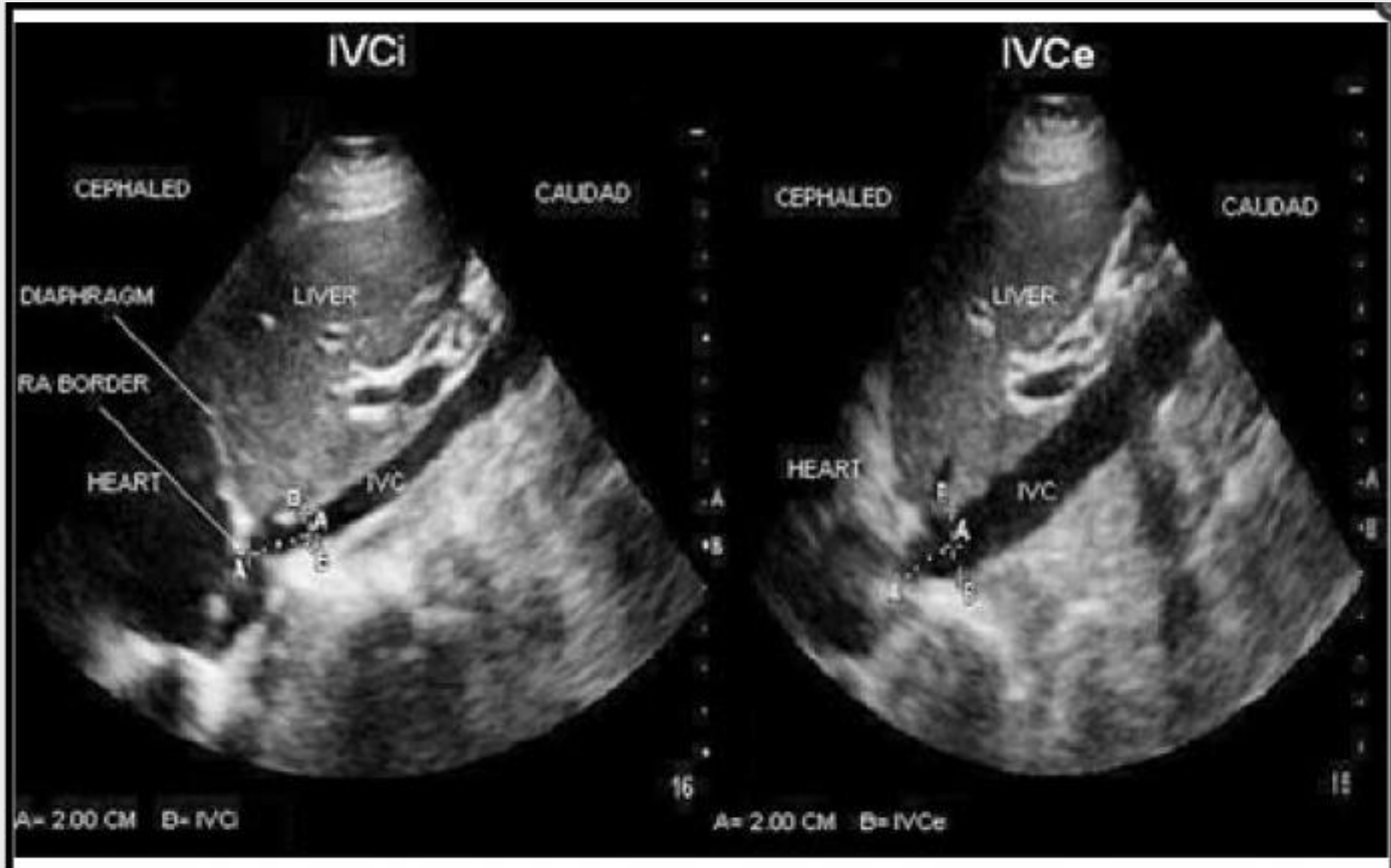


# IVC

- **Multiple studies compared IVC measurements on ultrasound with CVP measured by central line in critically ill patients**
- **Increased IVC diameter and decreased collapsibility measured by bedside ultrasound was significantly associated with elevated central venous pressure**

1. Citilcioglu S, Sebe A, Ay MO, Icme F, Avci A, Gulen M, et al. The relationship between inferior vena cava diameter measured by bedside ultrasonography and central venous pressure value. *Pak J Med Sci.* 2014;30(2):310–315.
2. Karacabey S, Sanri E, and Guneyssel O. A Non-invasive Method for Assessment of Intravascular Fluid Status: Inferior Vena Cava Diameters and Collapsibility Index. *Pak J Med Sci.* 2016;32(4):836-40.
3. Thanakitcharu P, Charoenwut M, Siriwiwatanakul N. Inferior vena cava diameter and collapsibility index: a practical non-invasive evaluation of intravascular fluid volume in critically ill patients. *J Med Assoc Thai.* 2013;96 Suppl 3: S14-22.

# IVC: subxiphoid view



# Conclusions



# Conclusions based on POCUS

**For this patient...**

- **Poor cardiac function**
- **Volume overloaded- IVC dilation, B lines everywhere**
- **Patient was evaluated by heart failure and transferred to the CCU for inotrope-assisted diuresis**

**In conclusion, POCUS can be used to help determine volume status!**

# References

1. Liteplo AS, Marill KA, Villen T, Miller RM, Murray AF, Croft PE, Capp R, Noble VE. Emergency Thoracic Ultrasound in the Differentiation of the Etiology of Shortness of Breath (ETUDES): Sonographic B-Lines and N-Terminal Pro-Brain-Type Natriuretic Peptide in Diagnosing congestive Heart Failure. *Acad Emerg Med*. 2009; 16:201-10.
2. Pivetta E, Goffi A, Lupia E, et.al. Lung Ultrasound-Implemented Diagnosis of Acute Decompensated Heart Failure in the ED: A SIMEU Multicenter Study. *Chest*. 2015; 148(3):e96-98
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