WEBINAR

POCUS for COVID and Beyond: Diagnosing Lung, Cardiac and Thromboembolic Diseases

June 2021

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Your Host

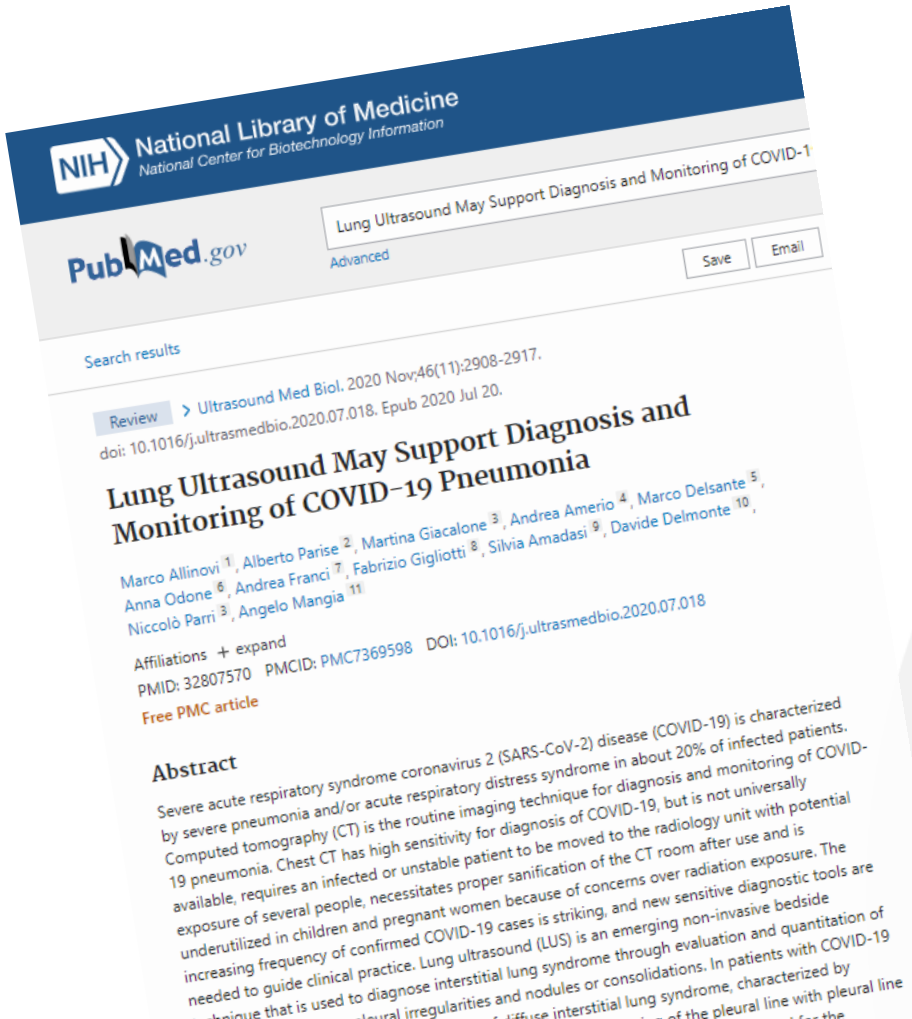
Dr. Oron Frenkel, MD, MS

Emergency Physician & POCUS Educator

Chairman, Clarius Medical Advisory Board

clarius Ultrasound Anywhere

COVID-19 – Chest CT or POCUS Scanning?



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Lung Ultrasound May Support Diagnosis and Monitoring of COVID-1

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doi: 10.1016/j.ultrasmedbio.2020.07.018. Epub 2020 Jul 20.

Lung Ultrasound May Support Diagnosis and Monitoring of COVID-19 Pneumonia

Marco Allinovi [1], Alberto Parise [2], Martina Giacalone [3], Andrea Amerio [4], Marco Delsante [5], Anna Odone [6], Andrea Franci [7], Fabrizio Gigliotti [8], Silvia Amadasi [9], Davide Delmonte [10], Niccolò Parri [3], Angelo Mangia [11]

Affiliations + expand
PMID: 32807570 PMCID: PMC7369598 DOI: 10.1016/j.ultrasmedbio.2020.07.018
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Abstract

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease (COVID-19) is characterized by severe pneumonia and/or acute respiratory distress syndrome in about 20% of infected patients. Computed tomography (CT) is the routine imaging technique for diagnosis and monitoring of COVID-19 pneumonia. Chest CT has high sensitivity for diagnosis of COVID-19, but is not universally available, requires an infected or unstable patient to be moved to the radiology unit with potential exposure of several people, necessitates proper sanification of the CT room after use and is underutilized in children and pregnant women because of concerns over radiation exposure. The increasing frequency of confirmed COVID-19 cases is striking, and new sensitive diagnostic tools are needed to guide clinical practice. Lung ultrasound (LUS) is an emerging non-invasive bedside technique that is used to diagnose interstitial lung syndrome through evaluation and quantitation of pleural irregularities and nodules or consolidations. In patients with COVID-19 diffuse interstitial lung syndrome, characterized by of the pleural line with pleural line

"Chest CT has high sensitivity for diagnosis of COVID-19, but is not universally available, requires an infected or unstable patient to be moved to the radiology unit with potential exposure of several people … radiation exposure."

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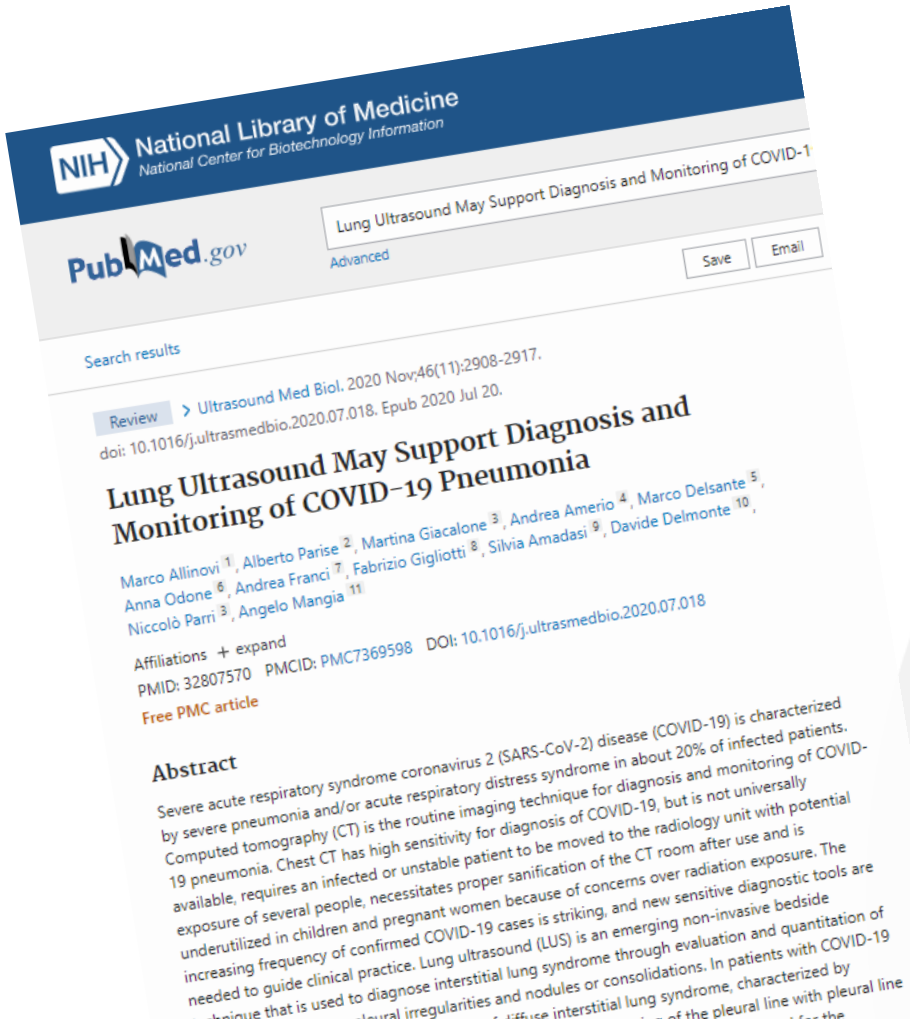

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"LUS findings correlate fairly with those of chest CT scan. Compared with CT, LUS has several other advantages, such as lack of exposure to radiation, bedside repeatability during follow-up, low cost and easier application in low-resource settings."

Allinovi M, Parise A, Giacalone M, Amerio A, Delsante M, Odone A, Franci A, Gigliotti F, Amadasi S, Delmonte D, Parri N, Mangia A. Lung Ultrasound May Support Diagnosis and Monitoring of COVID-19 Pneumonia. Ultrasound Med Biol. 2020 Nov;46(11):2908-2917. doi: 10.1016/j.ultrasmedbio.2020.07.018. Epub 2020 Jul 20. PMID: 32807570; PMCID: PMC7369598.
Source: https://pubmed.ncbi.nlm.nih.gov/32807570/

Lung Ultrasound Predicts Clinical Course and Outcomes in COVID-19 Patients

"Hospitalized patients with COVID-19 ... present with pathological LUS findings. Baseline LUS score strongly correlates with the eventual need for invasive mechanical ventilation and is a strong predictor of mortality."

Lichter Y, Topilsky Y, Taieb P, Banai A, Hochstadt A, Merdler I, Gal Oz A, Vine J, Goren O, Cohen B, Sapir O, Granot Y, Mann T, Friedman S, Angel Y, Adi N, Laufer-Perl M, Ingbir M, Arbel Y, Matot I, Szekely Y. Lung ultrasound predicts clinical course and outcomes in COVID-19 patients. Intensive Care Med. 2020 Oct;46(10):1873-1883. doi: 10.1007/s00134-020-06212-1. Epub 2020 Aug 28. Erratum in: Intensive Care Med. 2020 Sep 25;: PMID: 32860069; PMCID: PMC7454549.
Source: https://pubmed.ncbi.nlm.nih.gov/32860069/

ASE Statement on POCUS During the 2019 Novel Coronavirus Pandemic


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Review J Am Soc Echocardiogr. 2020 Jun;33(6):670-673.

doi: 10.1016/j.echo.2020.04.017. Epub 2020 Apr 15.

ASE Statement on Point-of-Care Ultrasound during the 2019 Novel Coronavirus Pandemic

Amer M Johri [1], Benjamin Galen [2], James N Kirkpatrick [3], Michael Lanspa [4], Sharon Mulvagh [5], Ritu Thamman [6]

Affiliations + expand

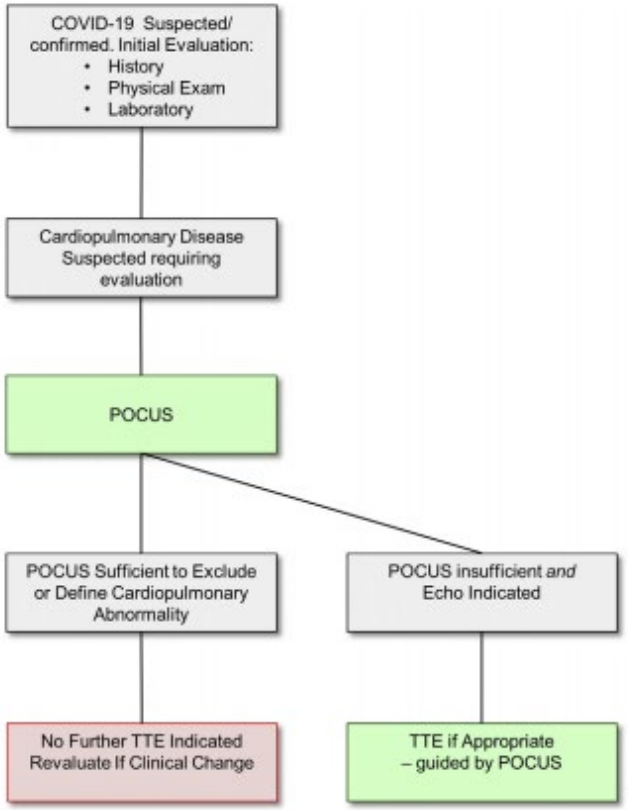
PMID: 32503704 PMCID: PMC7158805 DOI: 10.1016/j.echo.2020.04.017

Free PMC article

Abstract

- POCUS can assist in the evaluation of suspected/confirmed COVID-19 infection.
- A cardiopulmonary POCUS protocol is provided and implications discussed.
- A device-cleaning check-list is provided.

ultrasound; Point-of-care ultrasound.



Johri AM, Galen B, Kirkpatrick JN, Lanspa M, Mulvagh S, Thamman R. ASE Statement on Point-of-Care Ultrasound during the 2019 Novel Coronavirus Pandemic. J Am Soc Echocardiogr. 2020 Jun;33(6):670-673. doi: 10.1016/j.echo.2020.04.017. Epub 2020 Apr 15. PMID: 32503704; PMCID: PMC7158805. Source: https://pubmed.ncbi.nlm.nih.gov/32503704/

Should the Ultrasound Probe Replace Your Stethoscope?

"In critically ill patients, auscultation might be challenging as dorsal lung fields are difficult to reach in supine-positioned patients, and the environment is often noisy."

Cox EGM, Koster G, Baron A, Kaufmann T, Eck RJ, Veenstra TC, Hiemstra B, Wong A, Kwee TC, Tulleken JE, Keus F, Wiersema R, van der Horst ICC; SICS Study Group. Should the ultrasound probe replace your stethoscope? A SICS-I sub-study comparing lung ultrasound and pulmonary auscultation in the critically ill. Crit Care. 2020 Jan 13;24(1):14. doi: 10.1186/s13054-019-2719-8. PMID: 31931844; PMCID: PMC6958607. Source: https://pubmed.ncbi.nlm.nih.gov/31931844/

Your Expert Guest Speaker

Dr. Shane Arishenkoff, MD, FRCPC

Internist and Clinical Assistant Professor

clarius Ultrasound Anywhere

PoCUS for COVID and Beyond: Diagnosing Lung, Cardiac and Thromboembolic Diseases

Shane Arishenkoff MD FRCPC
UBC Division of General Internal Medicine
Ultrasound Lead
Vancouver General Hospital

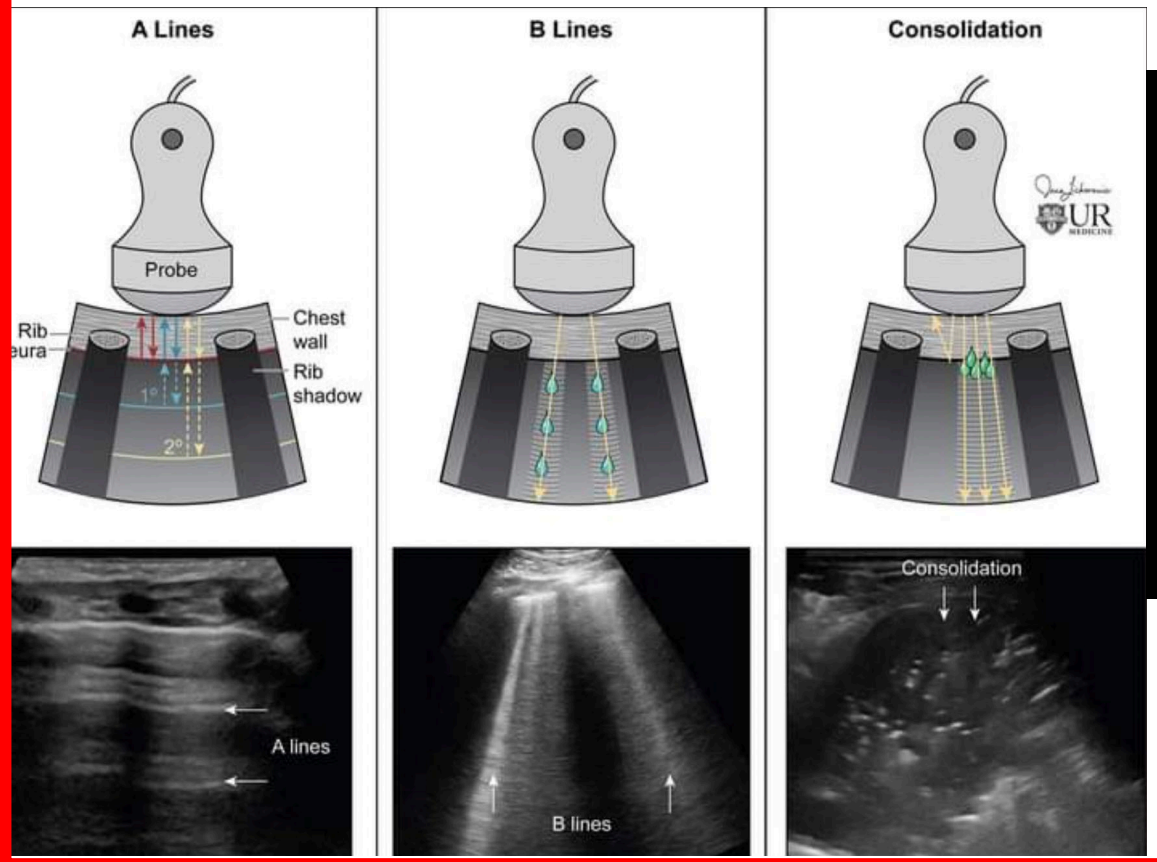
Objectives

- Lung scanning tips
- The interstitial syndromes: B-lines
- Cardiogenic vs non-cardiogenic causes of B-lines
- COVID pneumonia
- Cardiac case
- DVT scanning

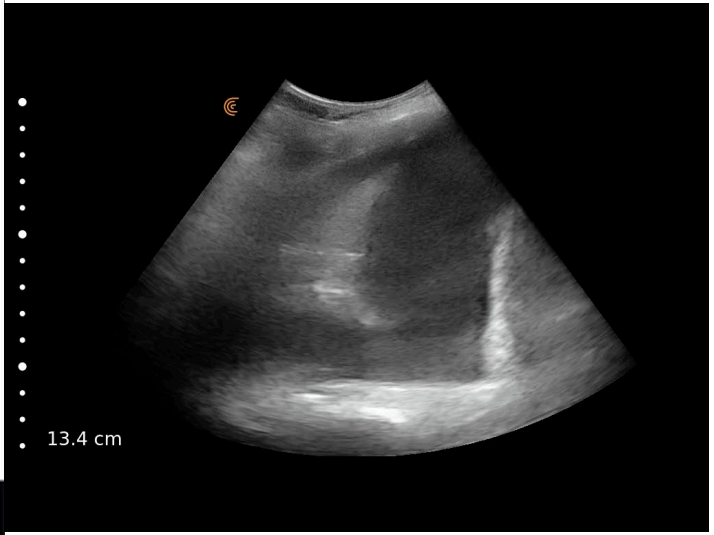
Lung scanning: what to look for

Pleura

Deep to pleural line



Effusion



https://pubs.rsna.org/doi/10.1148/ryct.2021200564

Lung scanning: what to look for

- Pleural line
  - sliding
  - contour
  - subpleural consolidation
- Deep to the pleural line
  - Artifacts
    - A-line(s)
    - B-lines
  - Hepatization
  - Effusions/intra pleural collections

Lung scanning: what to look for

- Pleural line
- Deep to the pleural line
  - Artifacts
    - A-line(s)
    - B-lines
      - number
      - symmetry
      - gradient
      - skip areas
      - movement
  - Hepatization
  - Effusions/intra pleural collections

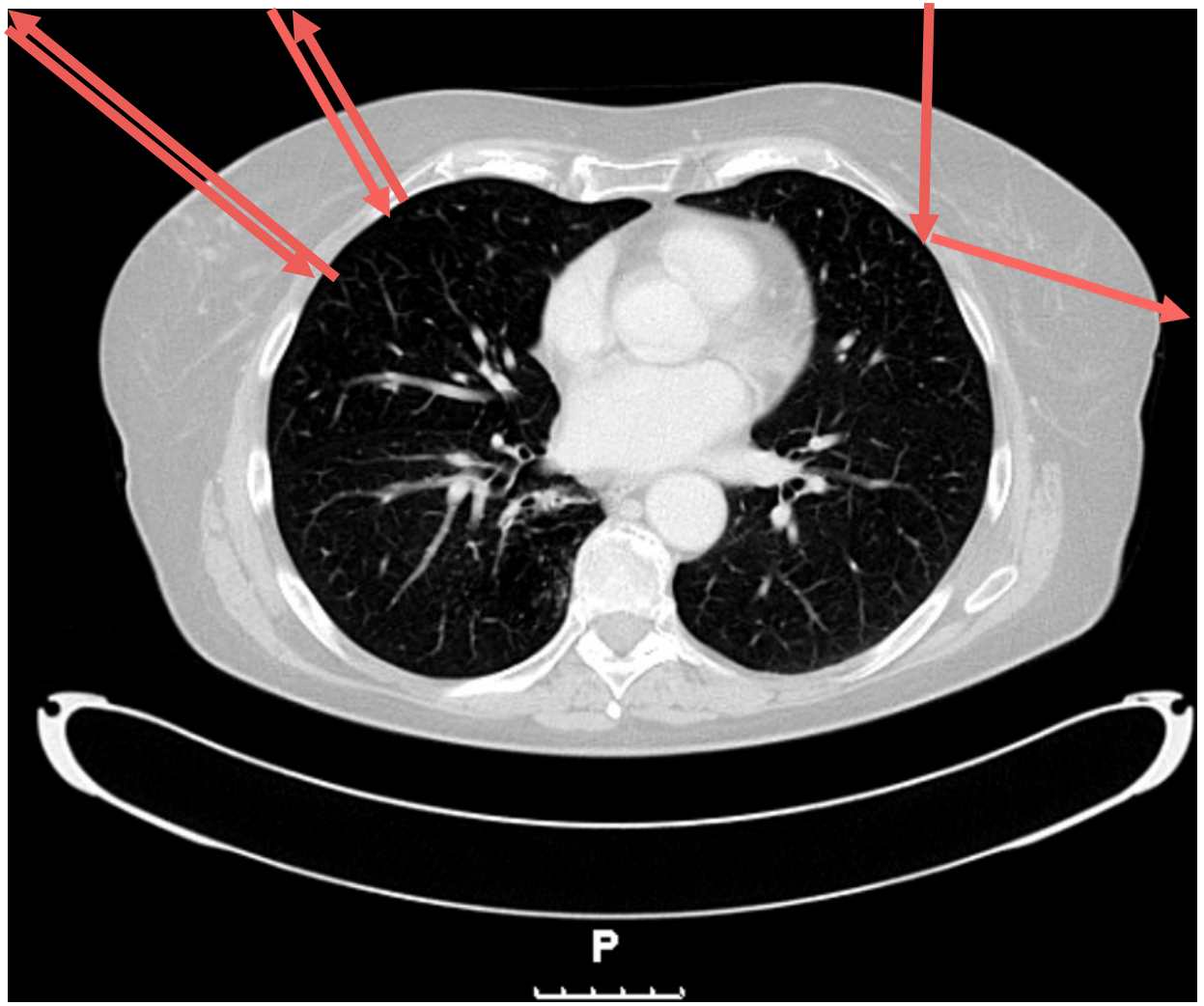
Lung scanning: Technical considerations

1. Plan your scan: start with a clear sense of what you're looking for
2. Probe Choice
3. Preset
4. Protocol (zones)
5. Probe placement and external landmarks
6. Identify internal landmarks
7. Optimize angle of insonation (wrt pleura)
8. Interrogate the pleural line
9. Interrogate the subpleural region

Technical considerations: Optimize angle of insonation

- **Pleural line**
- **Deep to the pleural line**
  - **Artifacts**
    - **A-lines**
    - **B-lines**
  - Hepatization
  - Effusions/intra pleural collections

Lung scanning: pleural interface



Case 1: patient info

- 80M independent
- PMHx includes mild asthma, NSTEMI, no recent echo
- Presents with SOB, fevers, cough during period of high COVID prevalence
- URTI symptoms ~2 weeks ago, with mild SOB and myalgias, no anosmia/ageusia
- Tested negative for COVID early in the illness X 1
- Subsequently started to feel a bit better, but now worse over past couple days

Case 1: physical exam

- 79% R/A, BP 115/60, HR 105 reg, RR 22, temp 38.8
- Mild WOB at rest, not in distress, Scattered crackles
- No additional contributory findings

Case 1: investigations

- WBC 6.8, lymph 1.0, Hgb 122
- Tn not elevated
- COVID test pending
- Inflammatory markers pending
- ECG: sinus tach, no ischemic changes

Case 1: CXR

DDX

- COVID

DDX

- COVID
- COVID

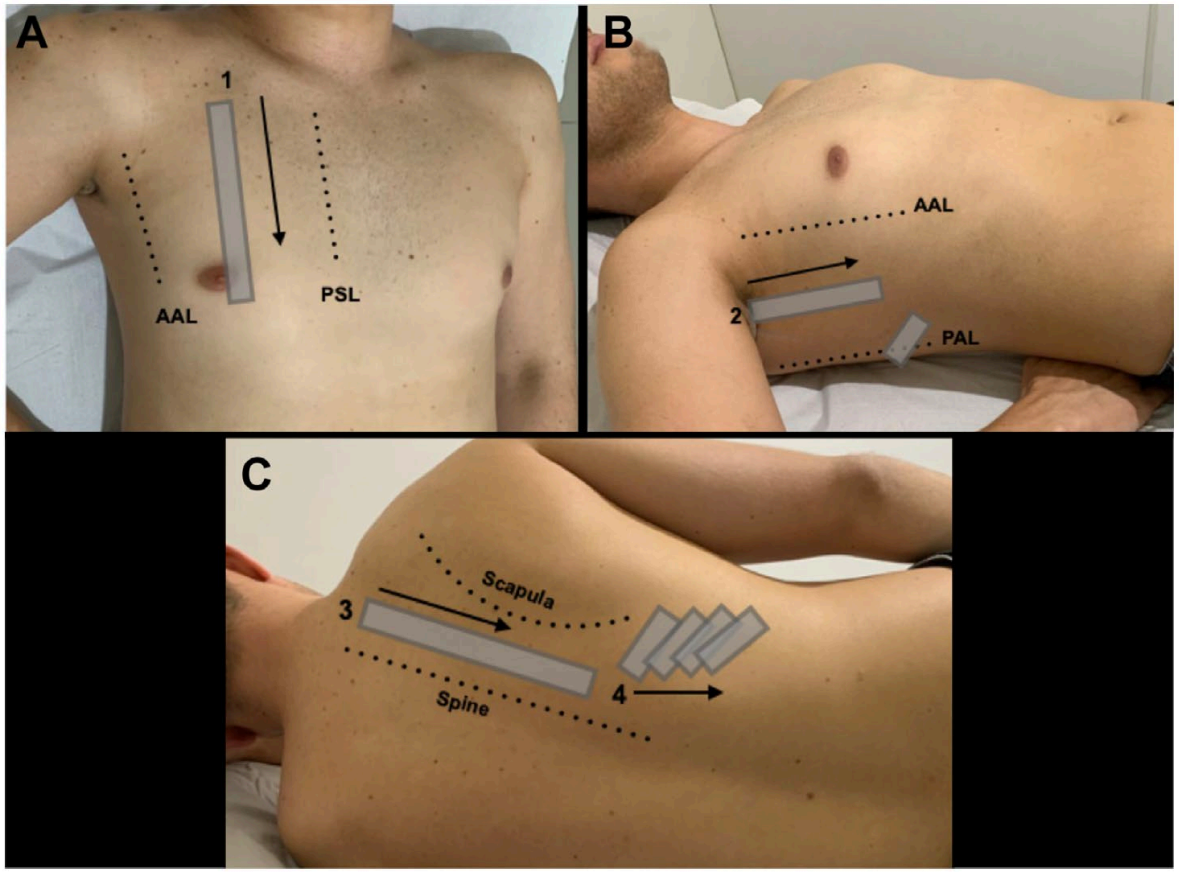
DDX

- COVID
- COVID
- Other respiratory infections/illness

CHEST

Lung Ultrasound for Patients With Coronavirus Disease 2019 Pulmonary Disease

Scott J. Millington, MD; Seth Koenig, MD; Paul Mayo, MD; and Giovanni Volpicelli, MD



CHEST

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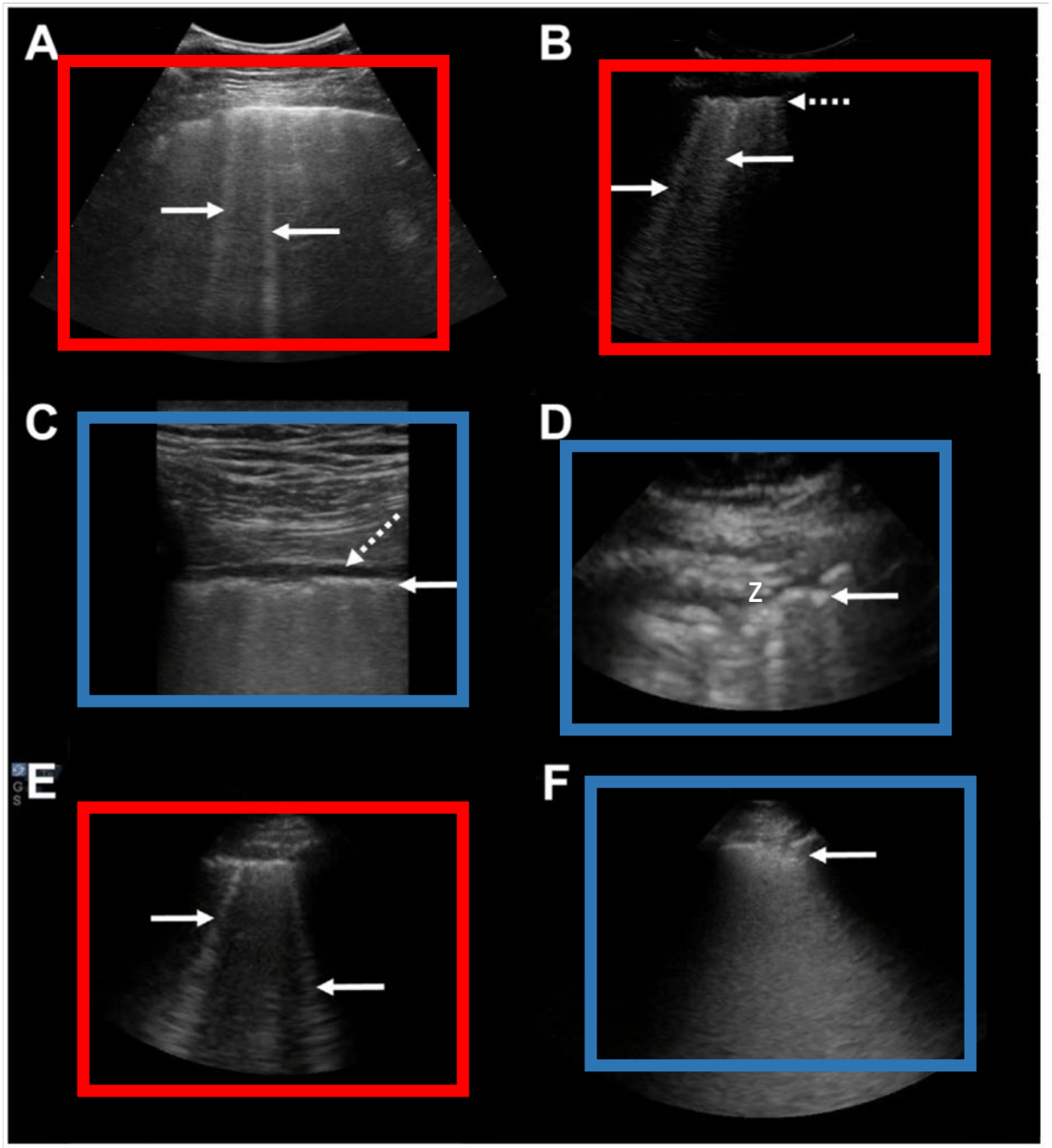
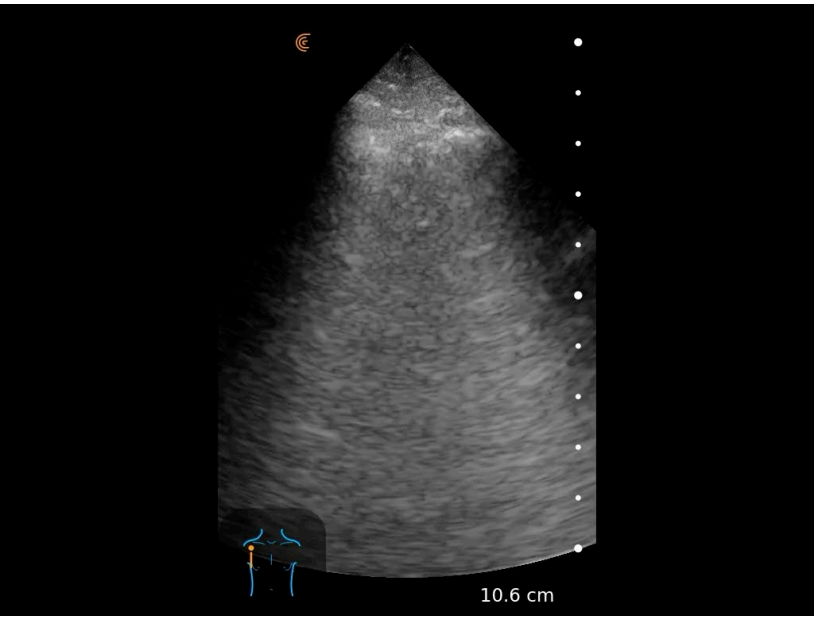
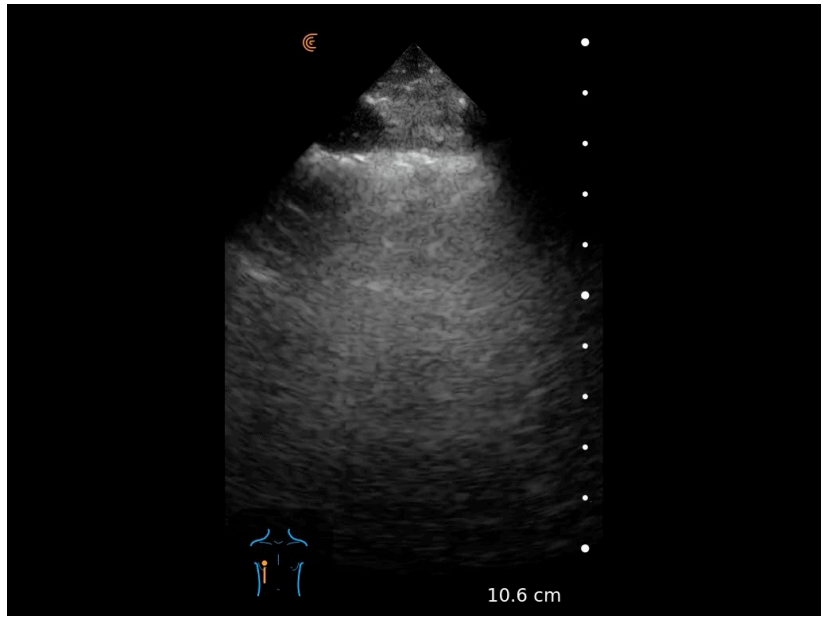
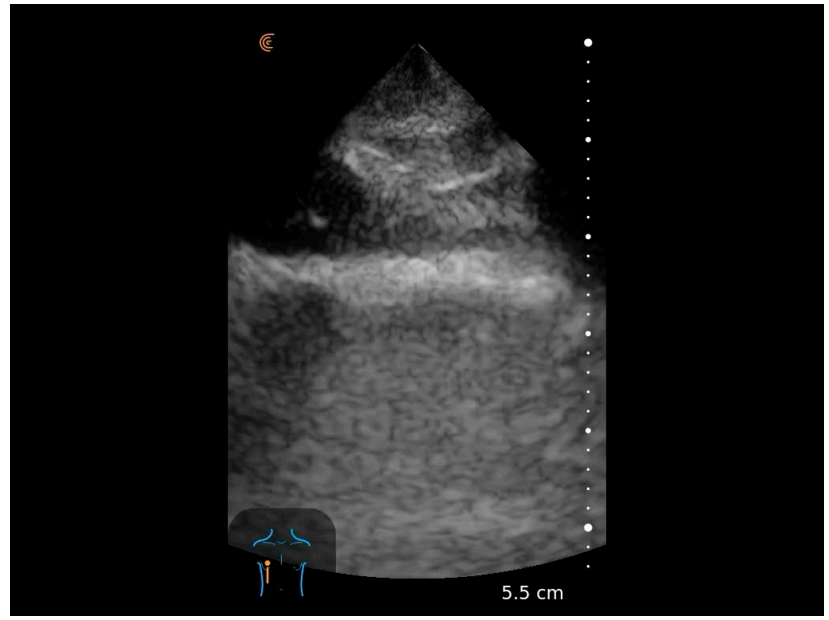


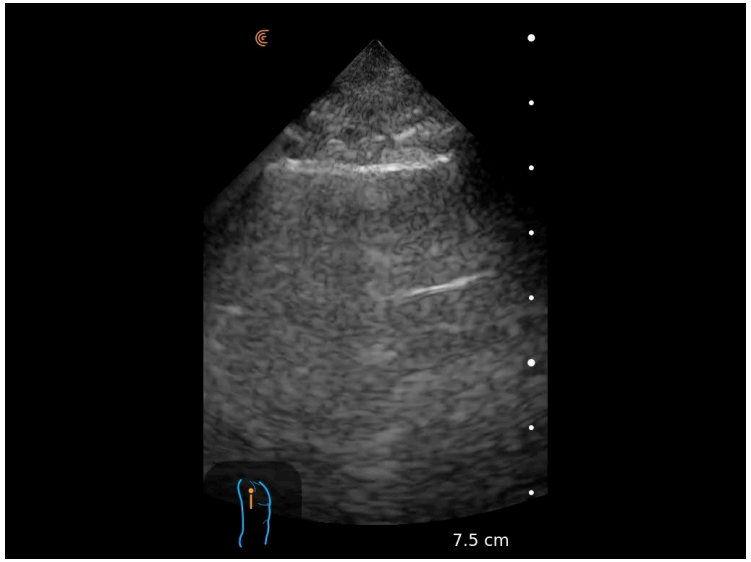
Back to the case… R anterior lung

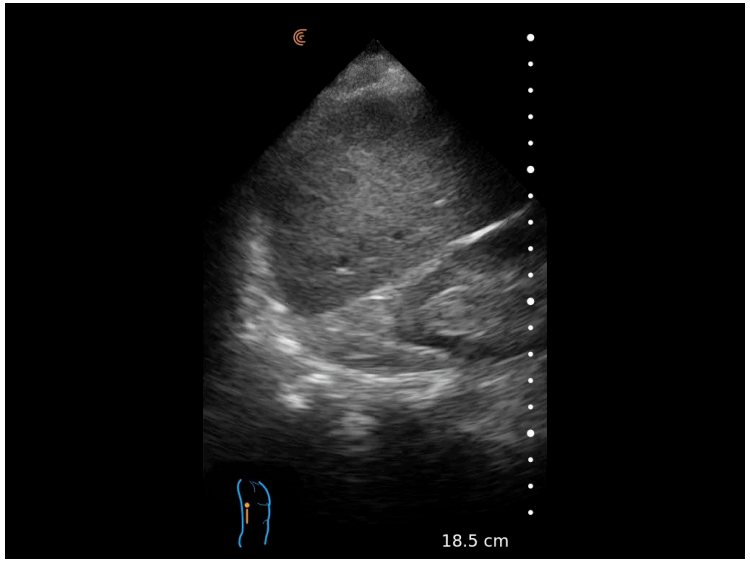


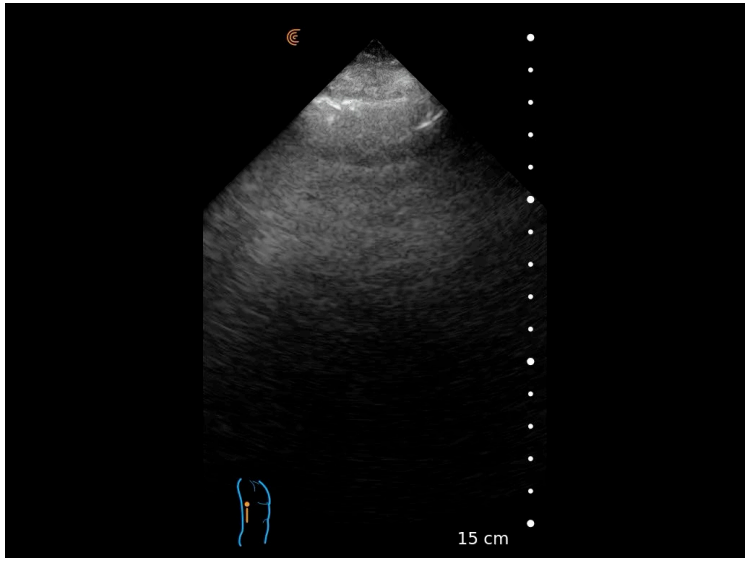


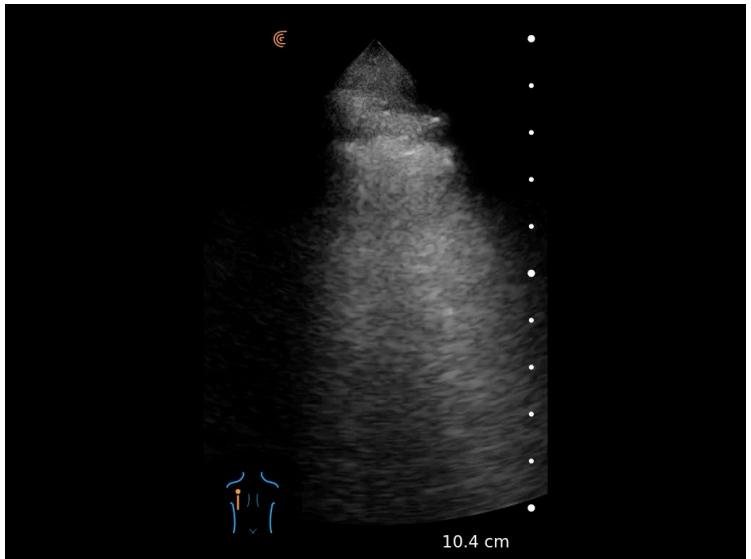


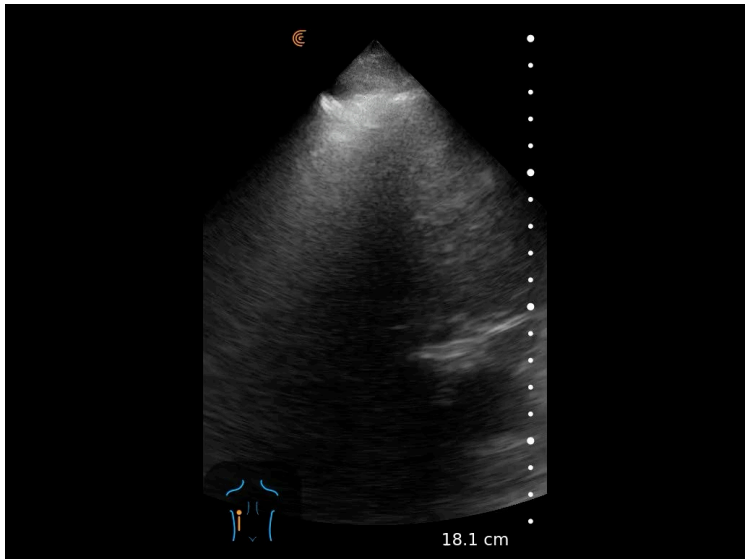
R lateral and posterior lung

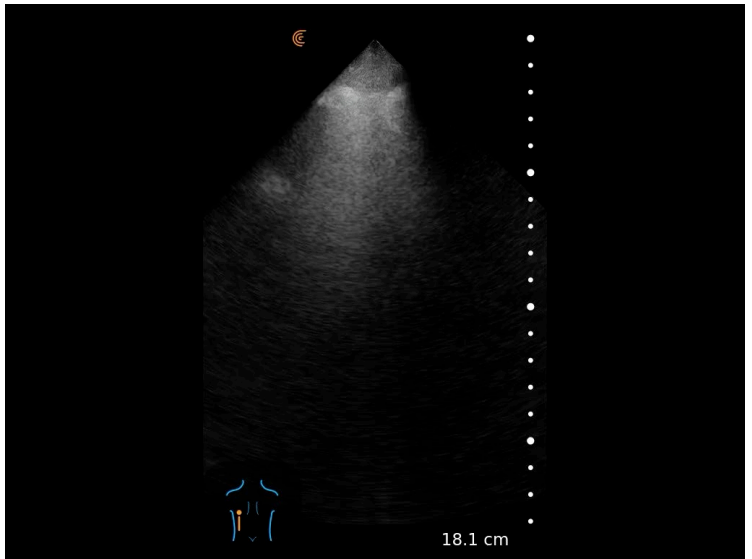




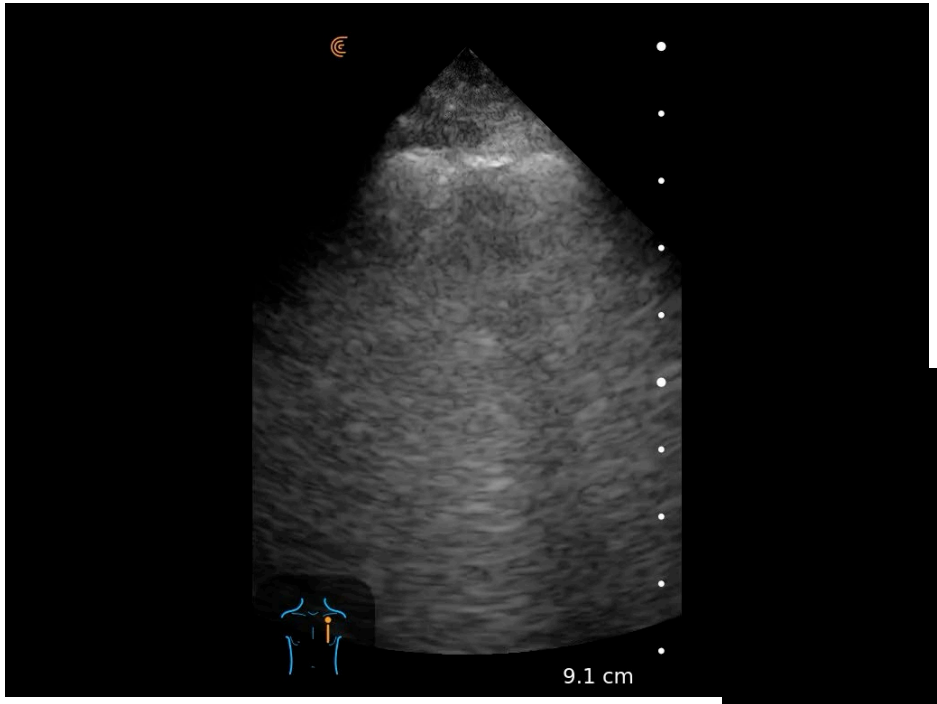


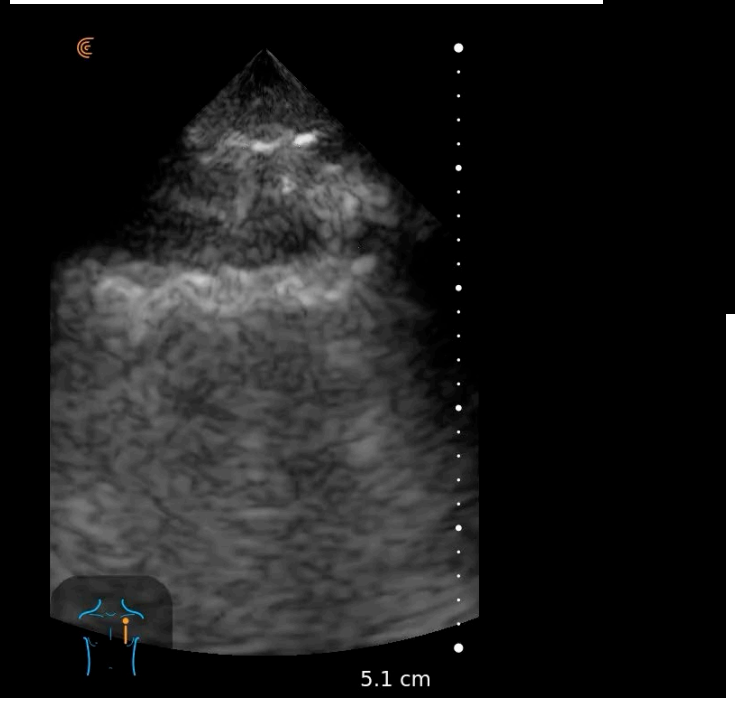


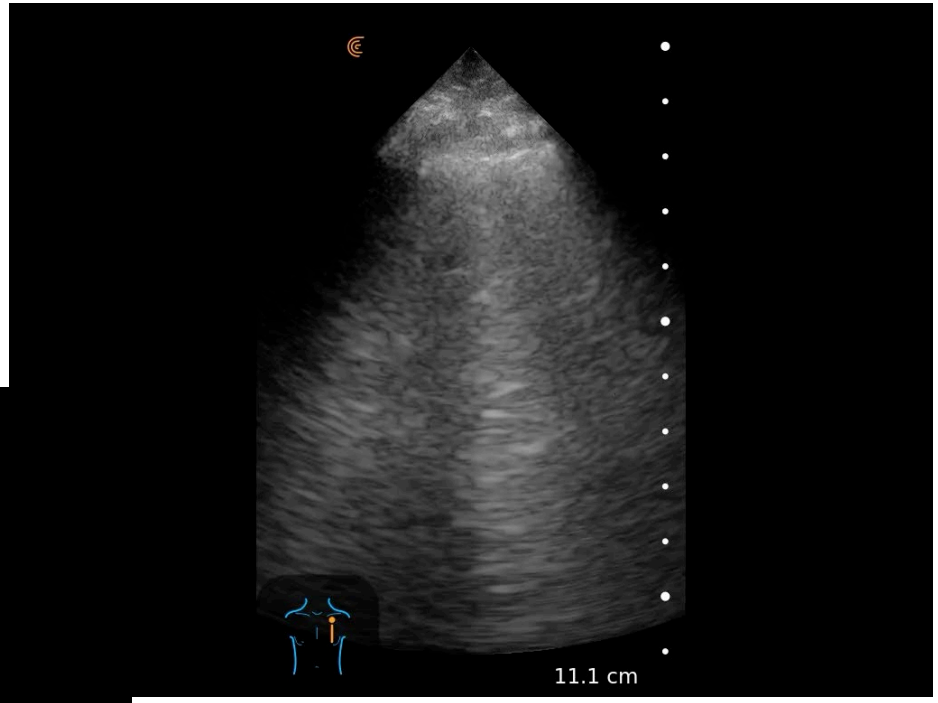




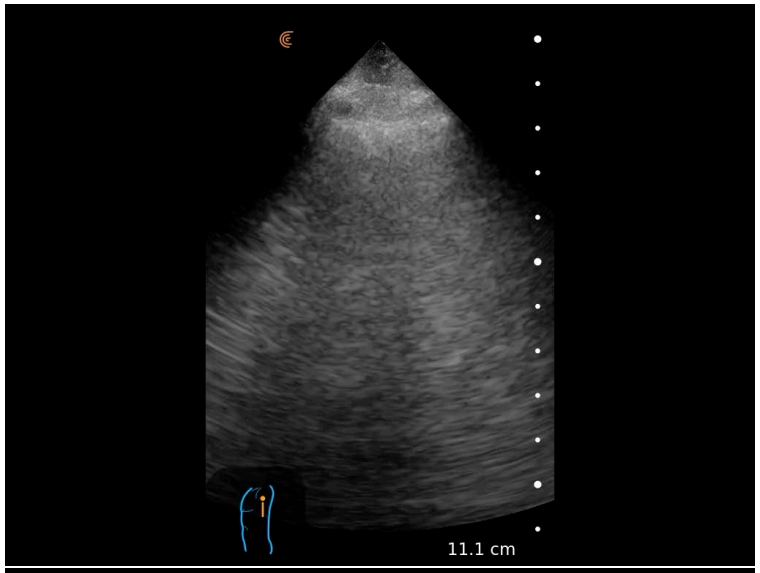
L anterior lung

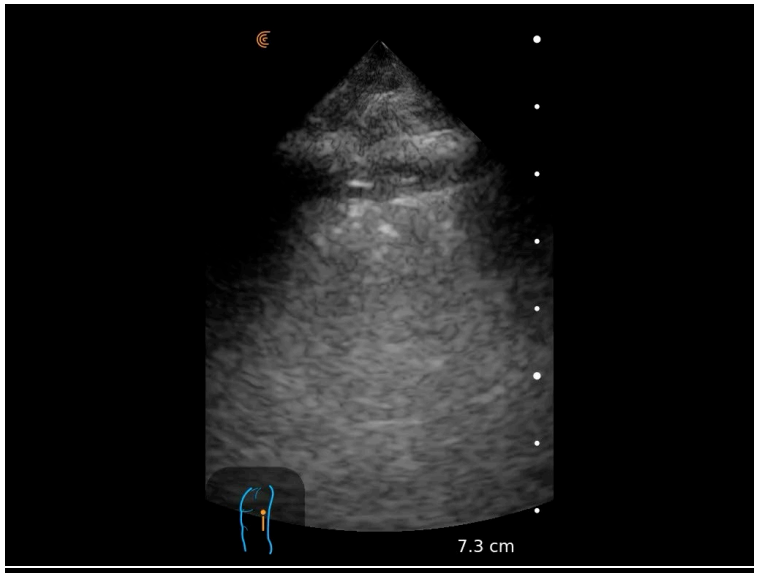


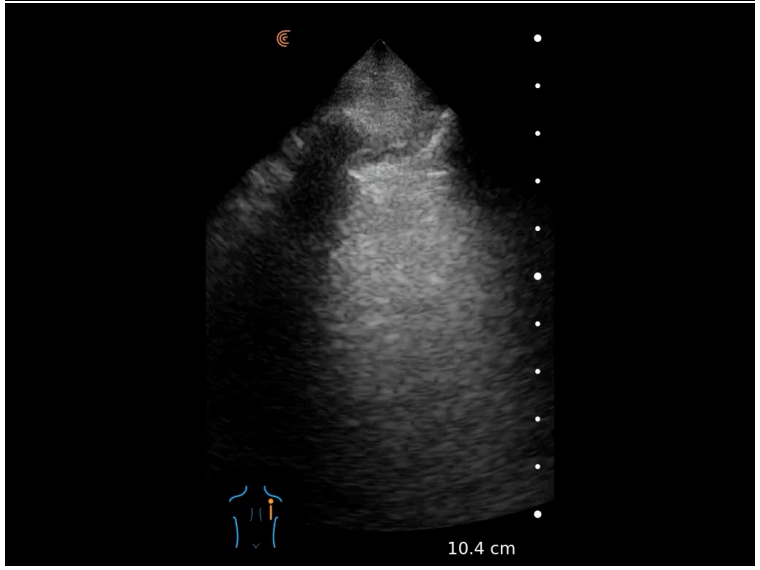


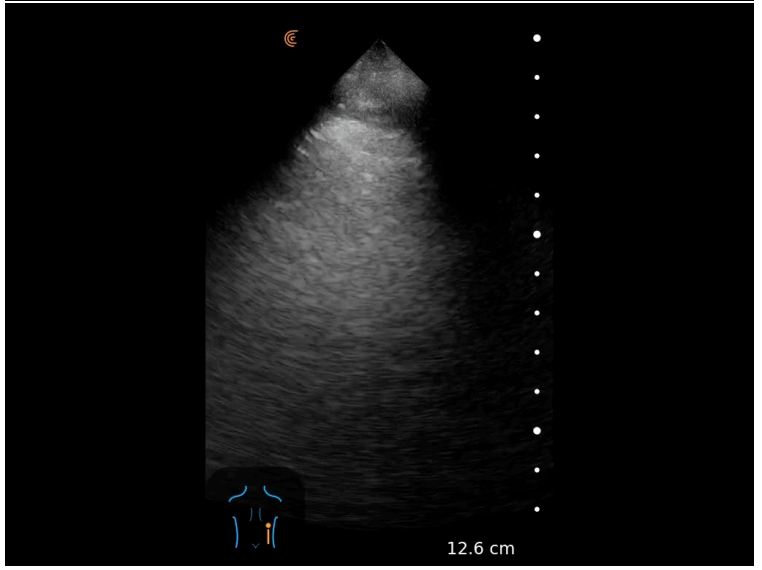


L lateral and posterior lung









Case 1: Interpretation

- Pleural line
  - Areas of reduced lung sliding
  - Irregular, thickened pleural contour
  - Subpleural consolidations most prominent in basal and posterior regions of the lungs
- B-lines present
  - >/=3 in multiple lung zones bilaterally
  - Heterogenous pattern with no clear dependent gradient
  - spared area in R3
- No pleural effusions

COVID 19 Pneumonia

Intensive Care Medicine (2021) 47:444-454

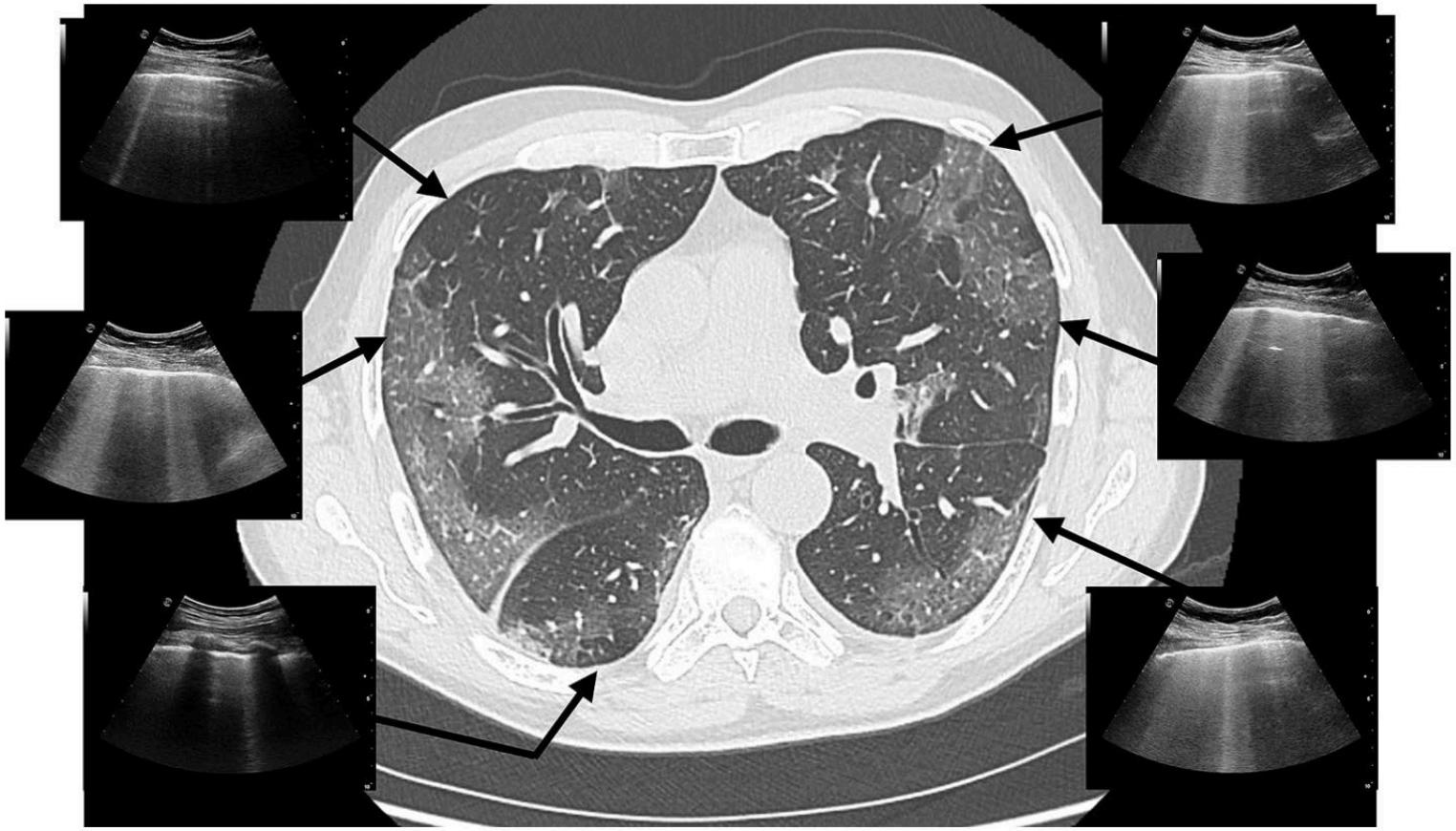


Fig. 4 The case of a 65-year-old patient complaining of fever, cough, and fatigue for 4 days, without signs of respiratory failure and showing normal saturation in room air. The CT scan shows bilateral early smooth GGO affecting main part of the lung periphery. The correspondent LUS exam shows the typical interstitial signs with patchy distribution well characterized by the "light beam" in abrupt alternance with "spared areas". *CT* computed tomography, *LUS* lung ultrasound, *GGO* ground-glass opacity

Case 1: Integration

- COVID?
  - Prevalence of COVID during time of scan was high (4 – 5 admissions per day)
  - Consistent clinical story for COVID
  - High probability lung US for COVID
- Other infectious or inflammatory condition?
- Patient was kept isolated on the “Patient Under Investigation” unit for presumed COVID and initiated on Dexamethasone and Abx
  - 3 X nasal swabs: all –ve
  - CT scan done
  - Bronchoscopy: microbiology –ve (including COVID)
- Respirology weighed in and suggested that in addition to viral/bacterial pneumonia, the CT pattern also raised the possibility of organizing pneumonia
  - Recommended an extended steroid taper

Beyond COVID: the interstitial syndromes

TABLE 3

Characteristics of B lines based on etiology[a]

	Cardiogenic pulmonary edema	Noncardiogenic diffuse pulmonary interstitial edema	Interstitial pneumonia or pneumonitis (bacterial, viral, or inflammatory)	Interstitial fibrosis
Distribution	Diffuse Usually bilateral and symmetric Predominant in dependent regions	Diffuse or patchy Often asymmetric	Focal or patchy Usually asymmetric	Diffuse or patchy Variable symmetry
Spared areas	Absent	Often present	Present	Often present
Number of B lines	Variable	Variable	Variable	Variable
Pleura	Smooth	Irregular	Irregular	Irregular
Subpleural consolidations	Absent	Present	Present	Typically absent
Reduced lung sliding	Absent	May be present	May be present	May be present
Pleural effusion	Often present	Typically absent	May be present	Typically absent

[a] Defining the terminology: diffuse = present throughout; patchy = present in many areas throughout, absent in other areas throughout; focal = present in one region but not in others; spared areas = regions of lung with A-line pattern (amid a background of B-line pattern).

CCJM 2021 Jun; 88(6): 345-359

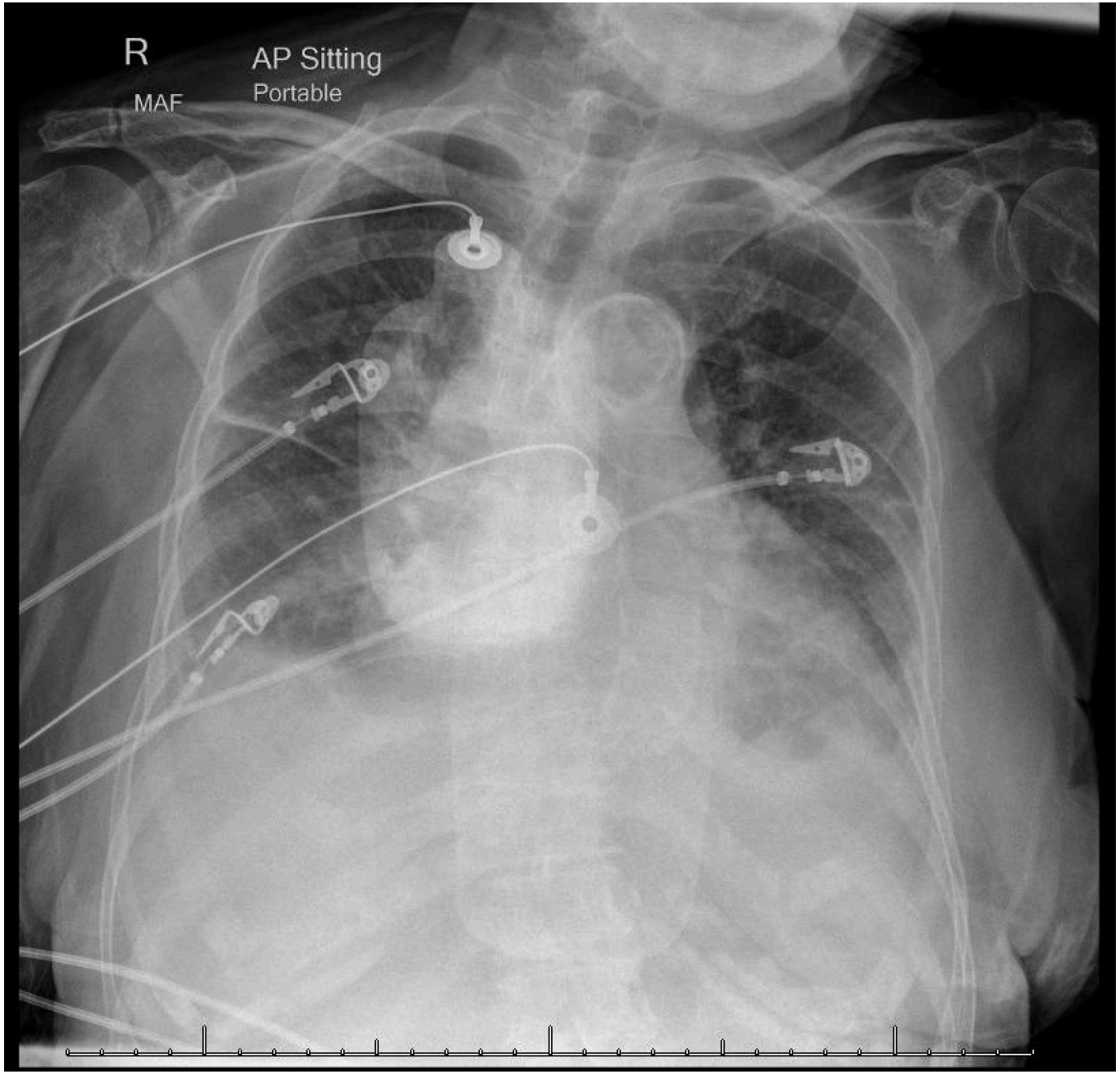
Case 2: patient info

- 99F, infrequent healthcare contact
- PMHx: CKD (BL Cr 180), no h/o heart disease
- Medication: ASA
- 1 week progressive generalized weakness, functional decline, mild confusion and decrease PO intake, has spent last couple days almost exclusively in bed
- No distress, no WOB at rest
- Cardio-resp exam revealed an irregular tachycardia, otherwise documented as normal for initial encounter
- Extremities cool-ish, no mottling
- No additional contributory findings

Case 2: patient info

- Vitals remarkable for Afib with rates into 160's, BP 160 – 180/100 – 110, 94% R/A, afebrile
- CBC normal
- Cr initially 200, lactate 4.8, HS Tn I 319, LE's moderately elevated

Case 2: CXR



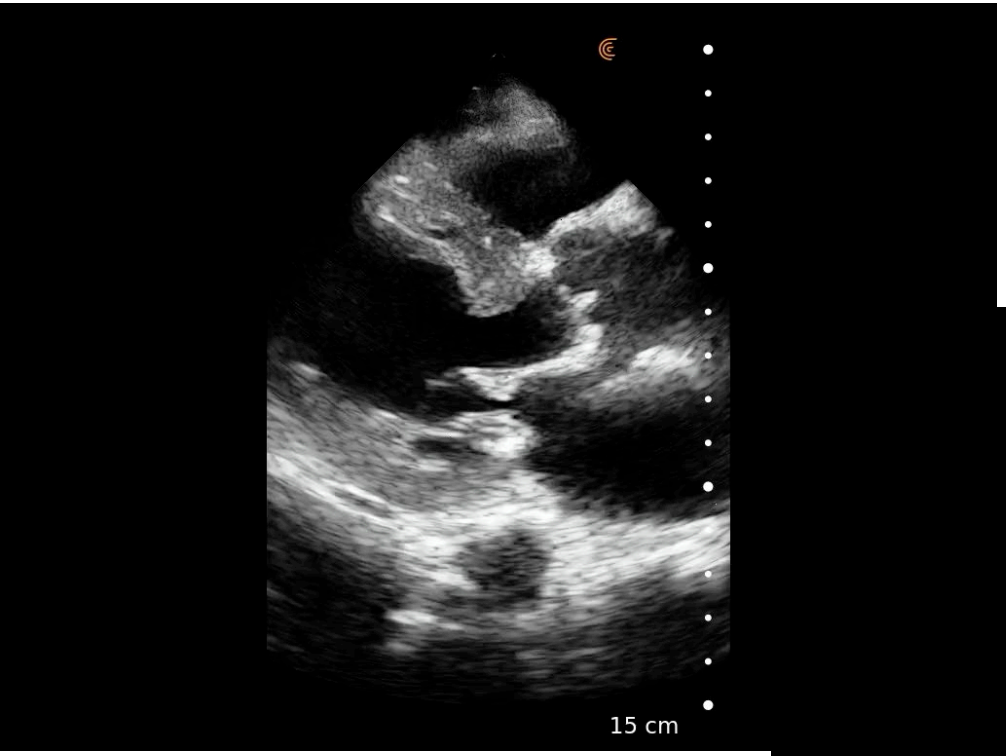
Case 2: patient info

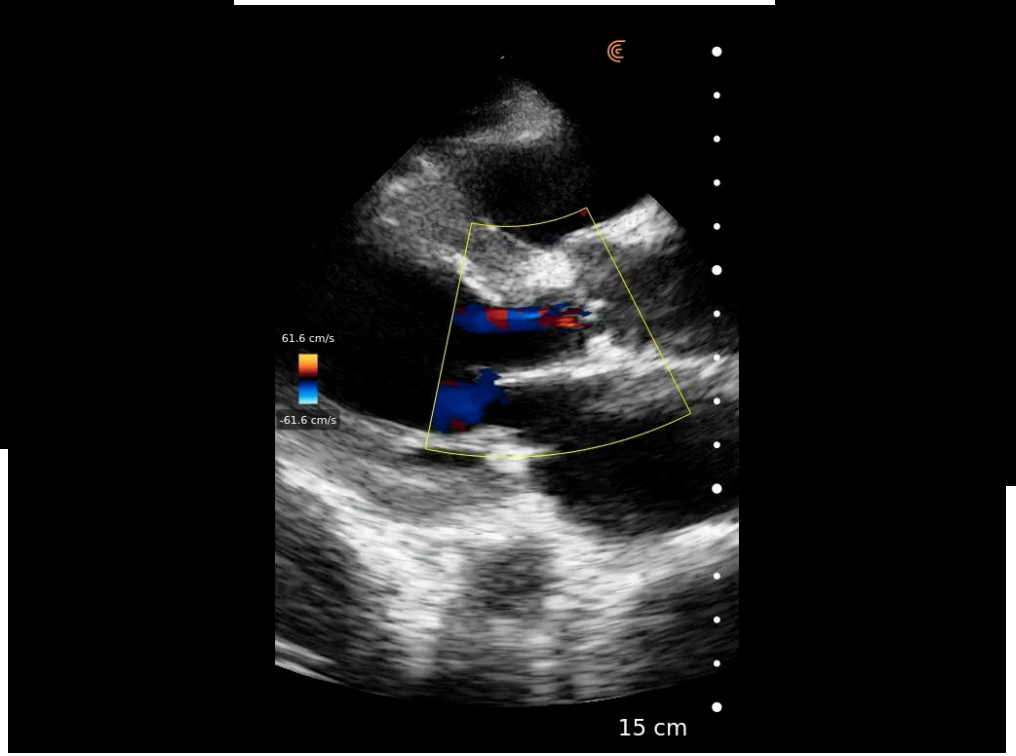
- Initially felt to be in decompensated heart failure precipitated by uncontrolled tachycardia and given IV lasix and IV metoprolol
- F/U BW a few hours later revealed increase in both Cr and lactate
- Patient reflexively given 500mL crystalloid
- Over next 48hrs the patient received PO metoprolol, further Lasix and small IV fluid boluses with fluctuating, but persistently elevated lactate and climbing Cr
- PoCUS service asked to help
  - At this time her BP remained elevated and her HR mildly tachycardic

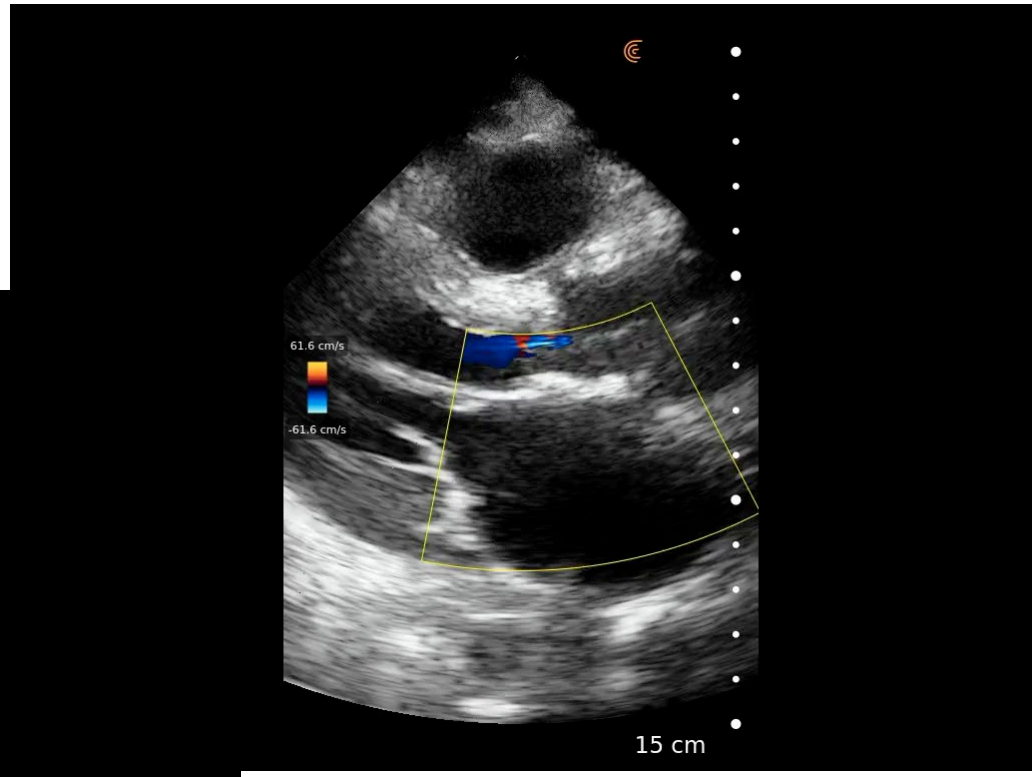
Lung and IVC

- Lung
  - Bilateral mod – large simple pleural effusions in dependent regions
  - Dominant A line pattern with normal pleura elsewhere
- IVC
  - Maximum diameter ~ 1.7cm
  - Collapsibility index < 30%
  - Ovoid form in short axis

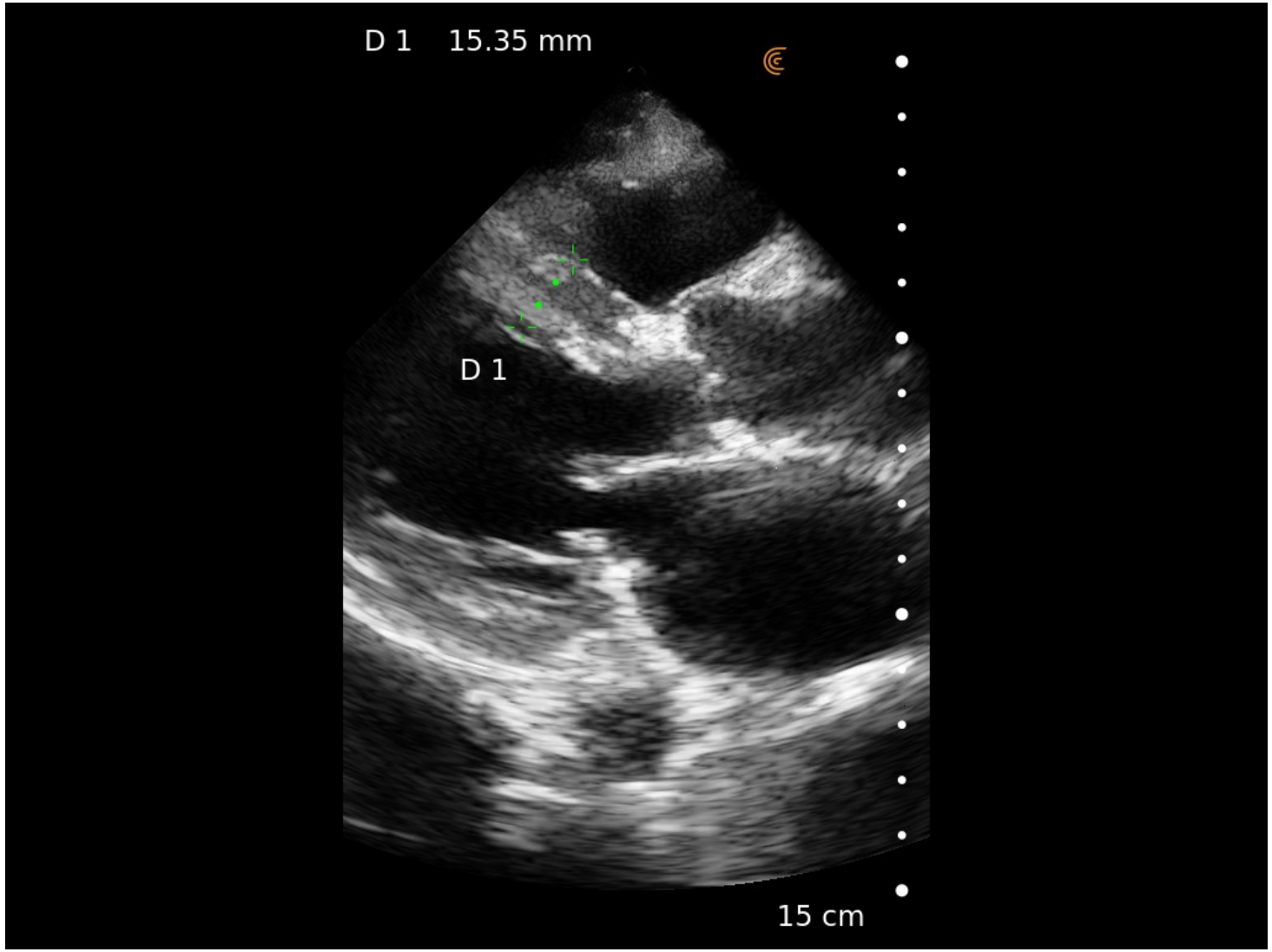
PSLA







PSLA IVSdD



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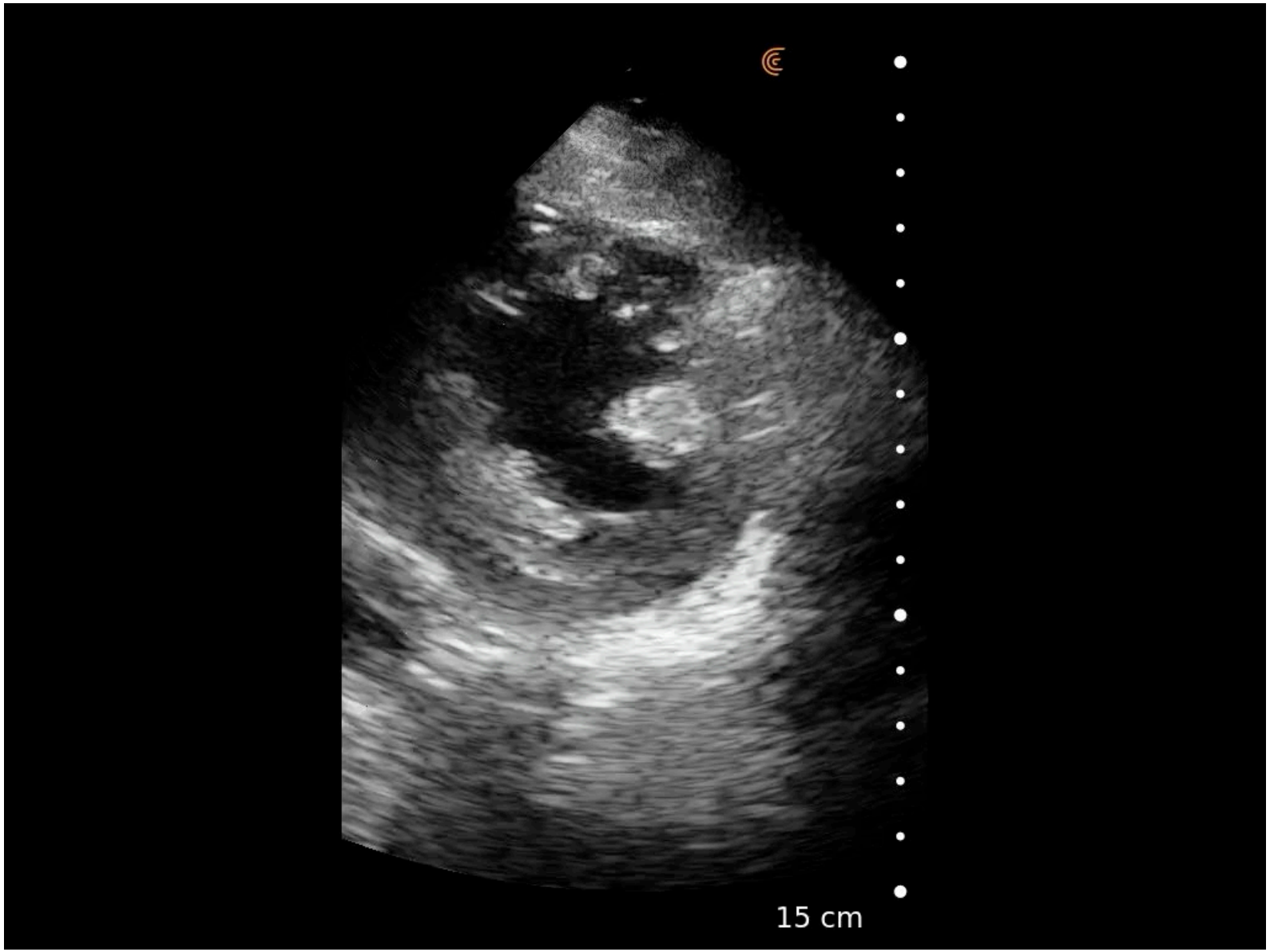
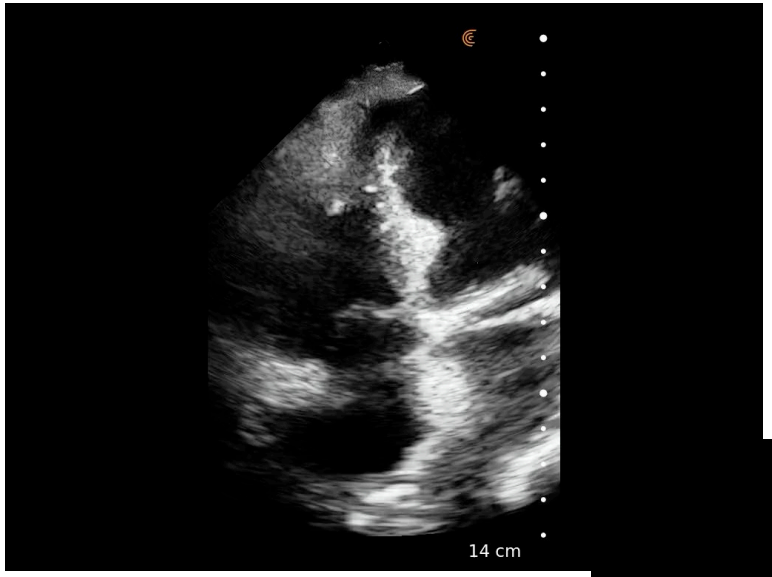
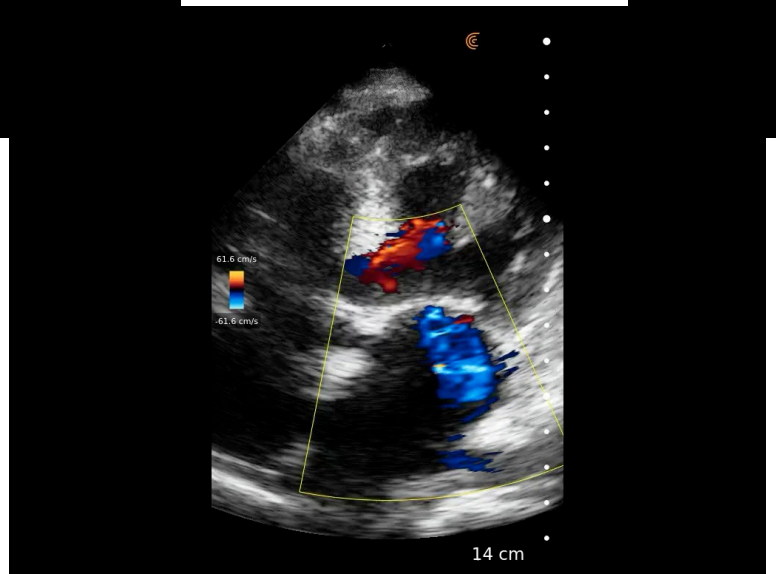
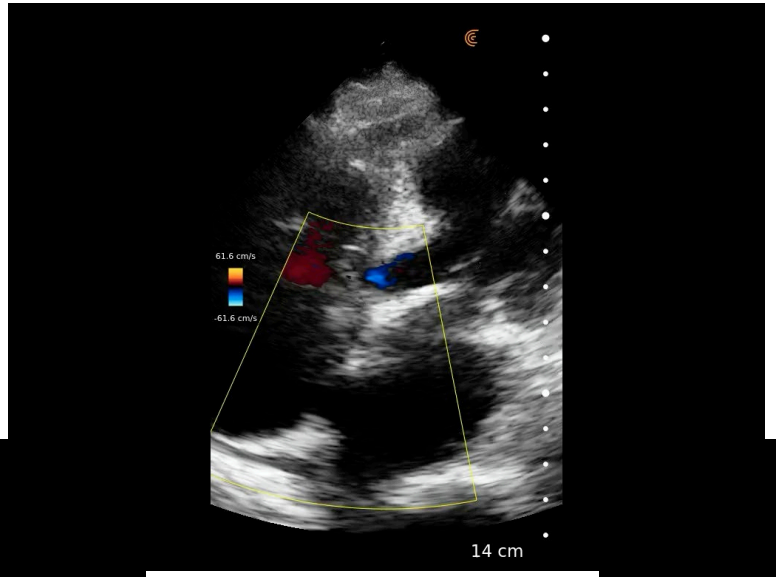
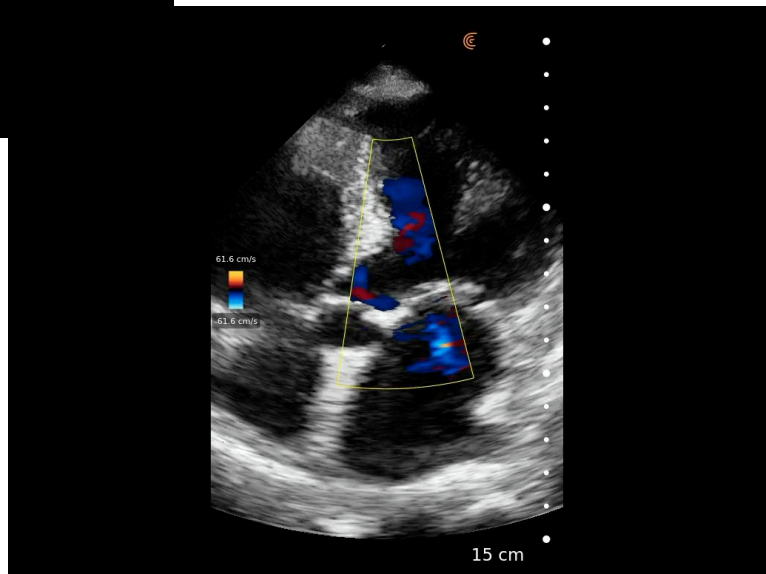


Apical views









Interpretation and integration

- Increased lactate, elevated Cr and mental status changes suggest hypoperfusion/shock… etiology?
- Lung
  - **Bilateral** pleural effusions
  - Dominant **A-line** pattern
  - Suggests decompensated heart failure without significant left sided congestion
  - Increased intra-thoracic pressure

Interpretation and integration

- Increased lactate, elevated Cr and mental status changes suggest hypoperfusion/shock… etiology?
- IVC
  - In keeping with elevated right sided pressures but…
    - moderate TR and pleural effusions needs to be taken into account
  - No evidence of edema elsewhere
  - Not convinced that congestion was enough to explain degree of end organ compromise

Interpretation and integration

- Increased lactate, elevated Cr and mental status changes suggest hypoperfusion/shock… etiology?
- Cardiac
  - LV concentric hypertrophy (in context of atrial fibrillation)
    - Consider impact of LV filling time
  - Regurgitant flow at Aortic and Mitral valve (in context of elevated BP)
    - Consider impact of afterload
  - Increased intrathoracic pressure (pleural effusions)
    - Effects on diastolic and systolic function
  - Decreased LV systolic function
    - Consider impact of regurgitation

Interpretation and integration

- Increased lactate, elevated Cr and mental status changes suggest hypoperfusion/shock… etiology?
  - Ultrasound findings support a cardiogenic cause
  - Clinically, no clear alternative etiology
- Forward failure
  - Compromised LV filling
  - Regurgitant fraction
  - Decreased ejection

Treatment plan

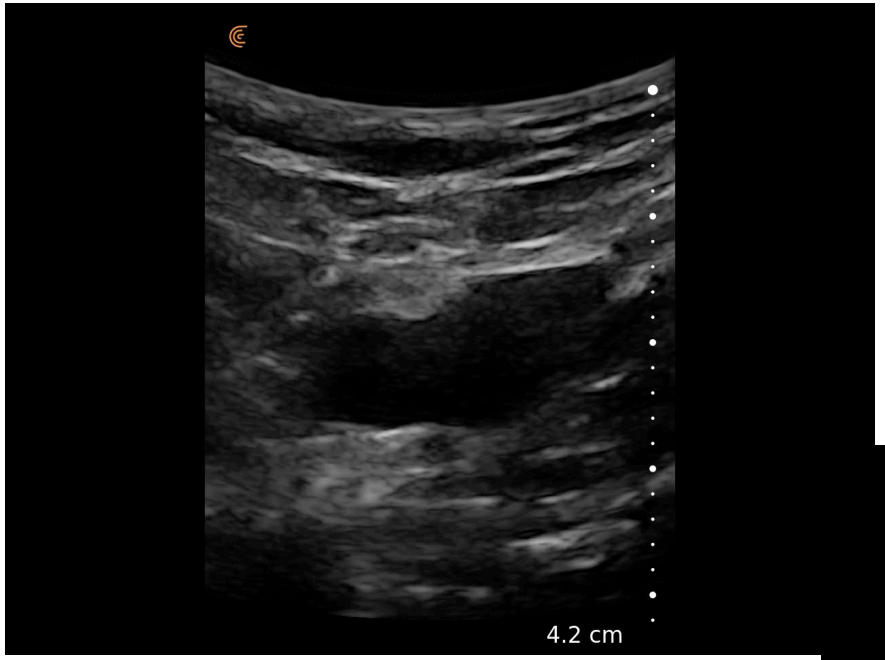
- Afterload reduction:
  - addition of Amlodipine to antihypertensive regimen
- Control of heart rate: not too fast, not too slow
  - continue titrating Metoprolol that had been initiated in the ED
- Consider drainage of pleural effusion
  - reducing intrathoracic pressure may improve both diastolic and systolic function
- Avoid Lasix – fluid infusion yo-yo
  - congestion (backward failure) not felt to be the route of the problem
  - requisite increase in filling pressure?
  - stable resp status (lack of compelling reason to trial diuretics)

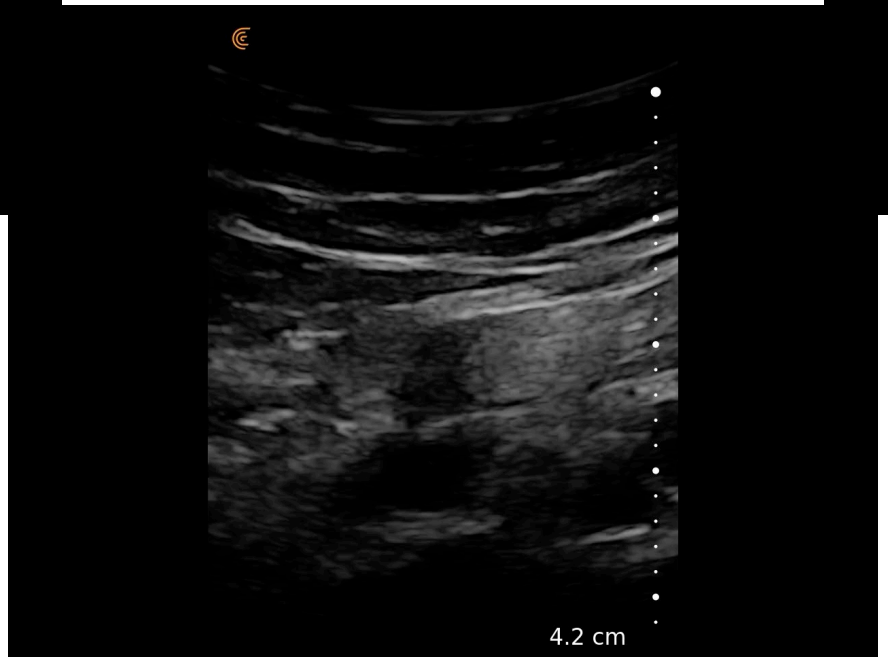
VTE and COVID

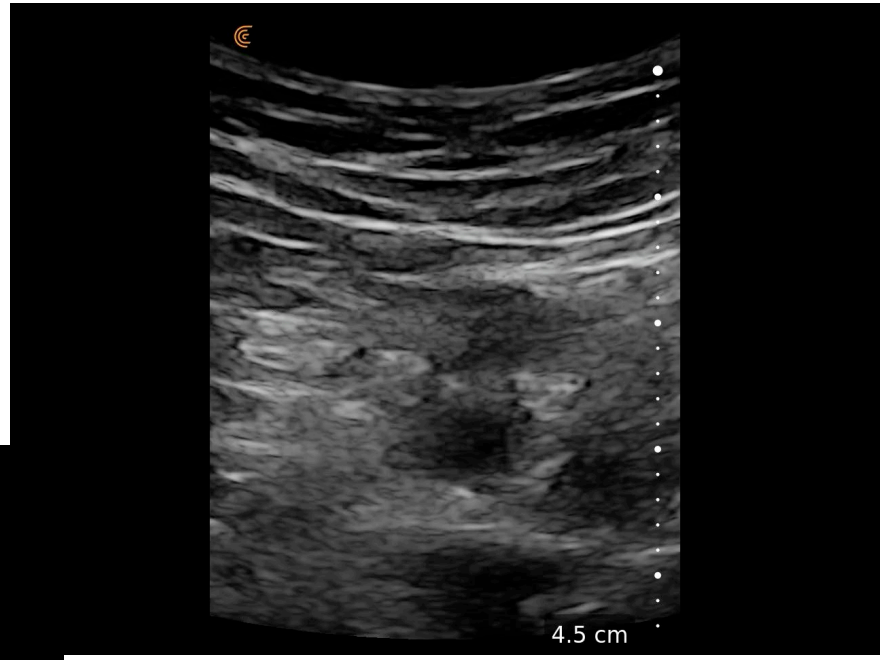
- VTE in COVID positive patients
  - Increased incidence: ICU > ward
  - Clots may form directly in lung
  - Therapeutic dose LMWH for hospitalized COVID patients requiring low flow O2 w/o high risk bleeding and NOT requiring organ support
- VITT
  - Rare complication following adenovirus vector COVID 19 vaccines (AZ and J+J)
  - Immune thrombosis similar to HIT
  - Patients may present with CSVT or other venous and arterial clots


clarius
L7HD042001A0118
Venous
MI 0.43
TIS 0.04
TIB 0.05
5.2 cm
B

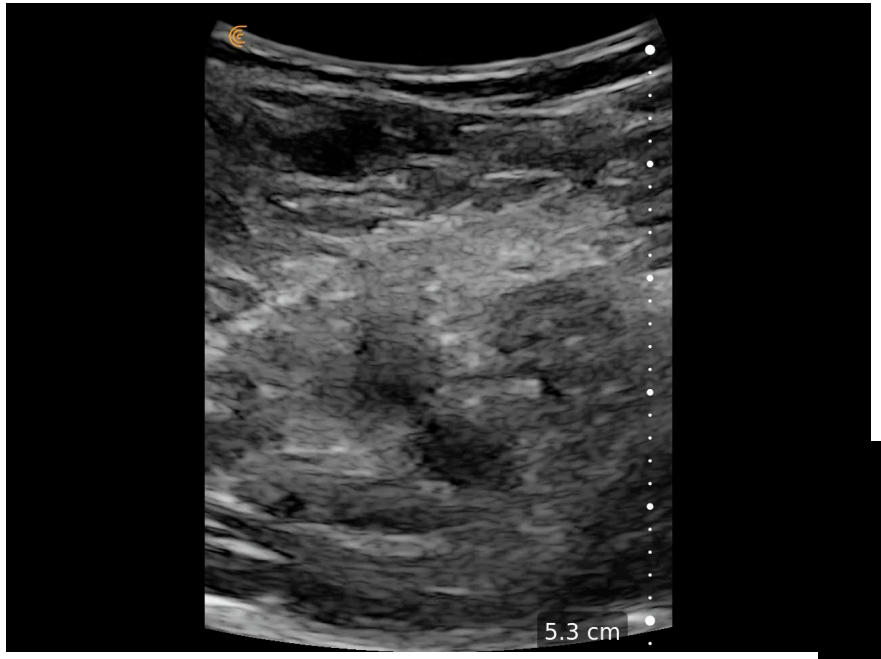
Femoral

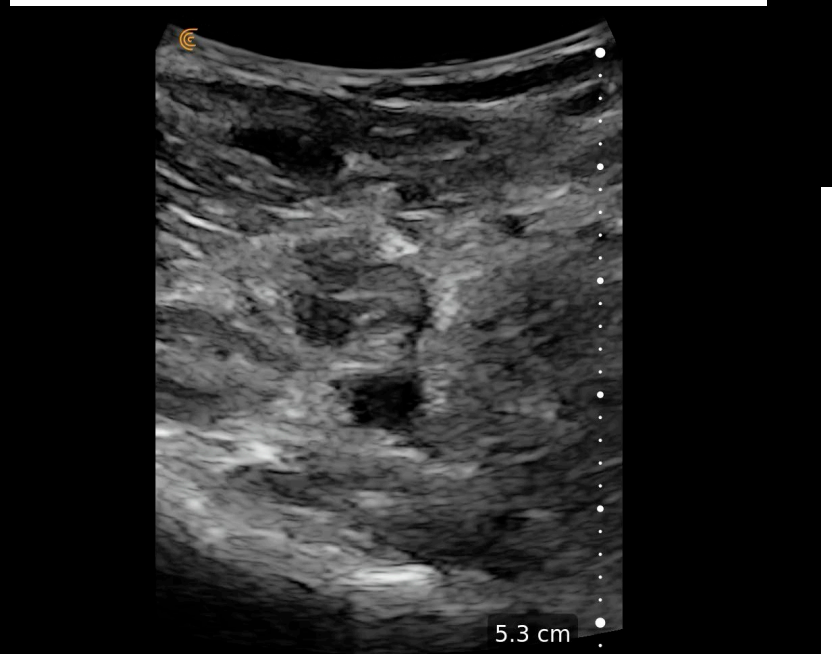


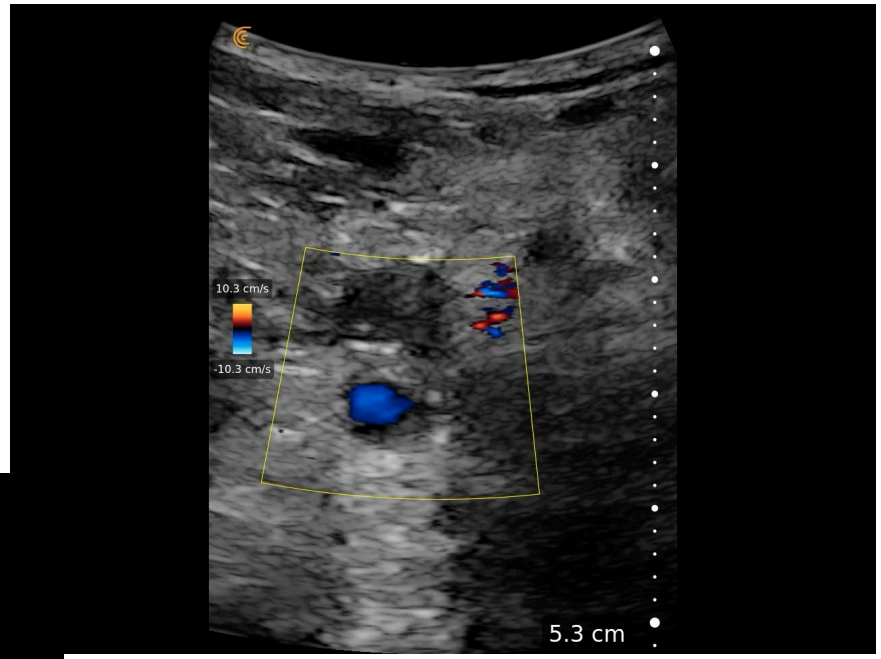




Popliteal







Summary

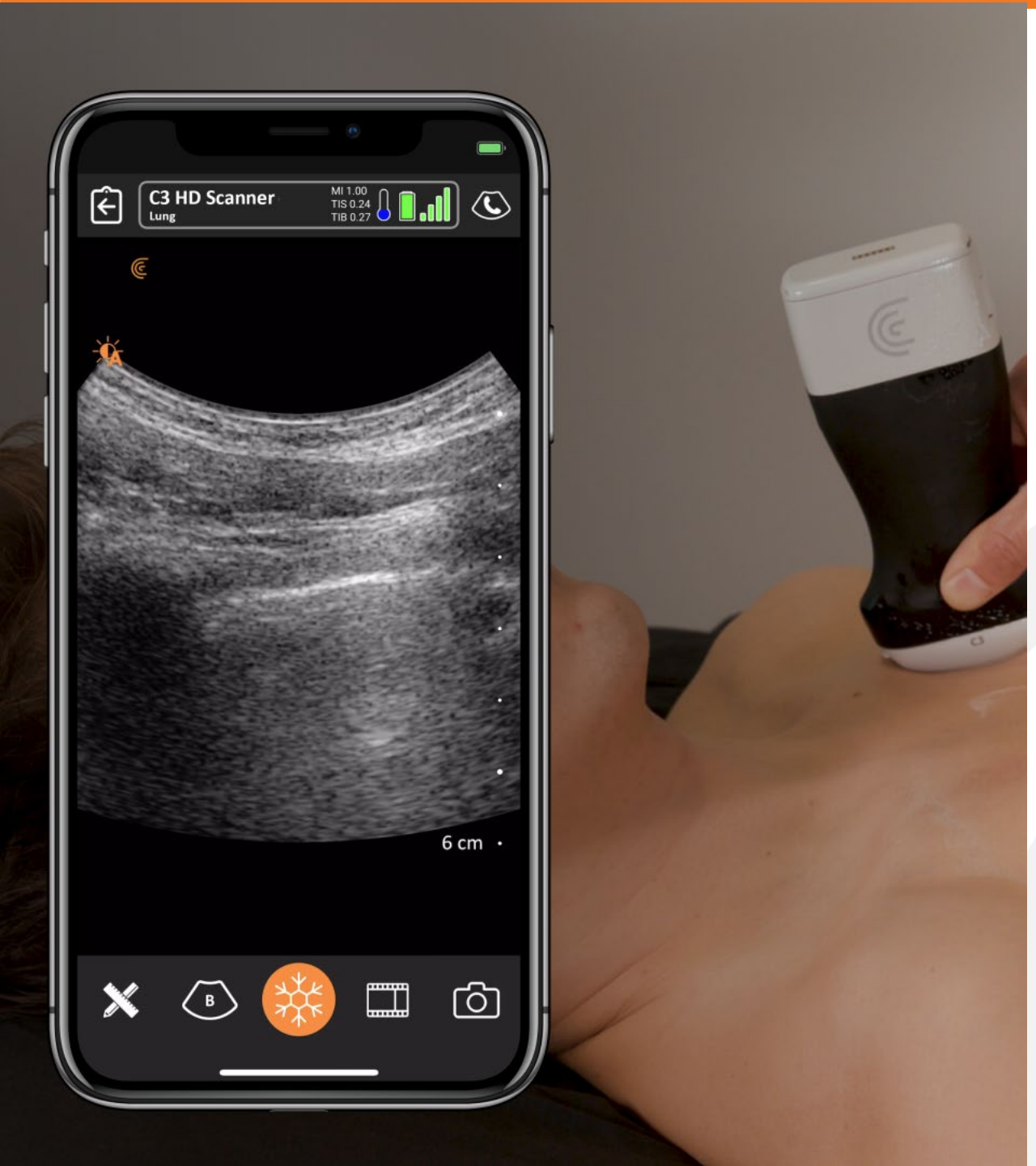
- B-lines are not specific to cardiogenic pulmonary edema
- A pleural line assessment can help discriminate between a cardiogenic and non-cardiogenic (eg. viral pneumonia) interstitial syndrome
- Absence of B-lines does not rule out decompensated heart failure
- In suspected heart failure there is more to cardiac scanning than assessing systolic function
  - Diastolic dysfunction: LA, LV wall thickness
  - Valvular lesions
  - …
- VTE can be diagnosed with B mode compression exam

“Portable bedside imaging has become an incredibly important part of my Cardiology and Cardiac Electrophysiology practice. I have increasingly relied on my wireless Clarius scanner both in my office practice, on the hospital wards and in the peri-operative unit.”

Dr. Zachary Laksman, MD, MSc
Cardiologist

Live Demo
Clarius C3 HD Multipurpose

clarius Ultrasound Anywhere



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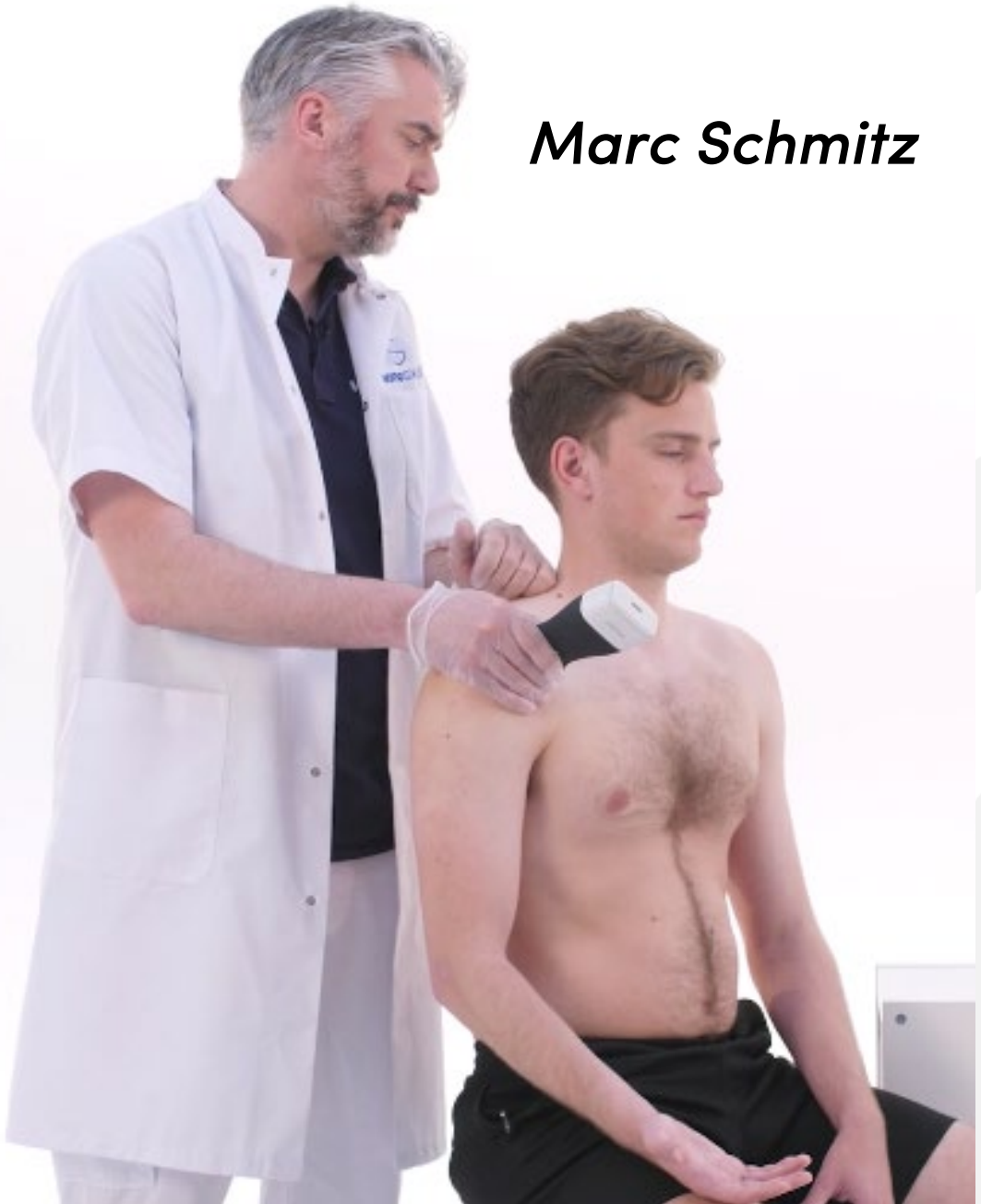

Marc Schmitz

Poll: Pre-Register

NEXT FREE WEBINAR

Pragmatic MSK Ultrasound: Scanning the Rotator Interval, Common Extensor Tendon and Patellar Tendon

Tuesday, June 29th

11 AM Pacific | 2 PM Eastern
18:00 GMT | 19:00 CET

Questions?

Dr. Arishenkoff

Dr. Frenkel

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Thank you!