Transcontinental Ultrasound Conference

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Point of Care Ultrasound Enthusiast

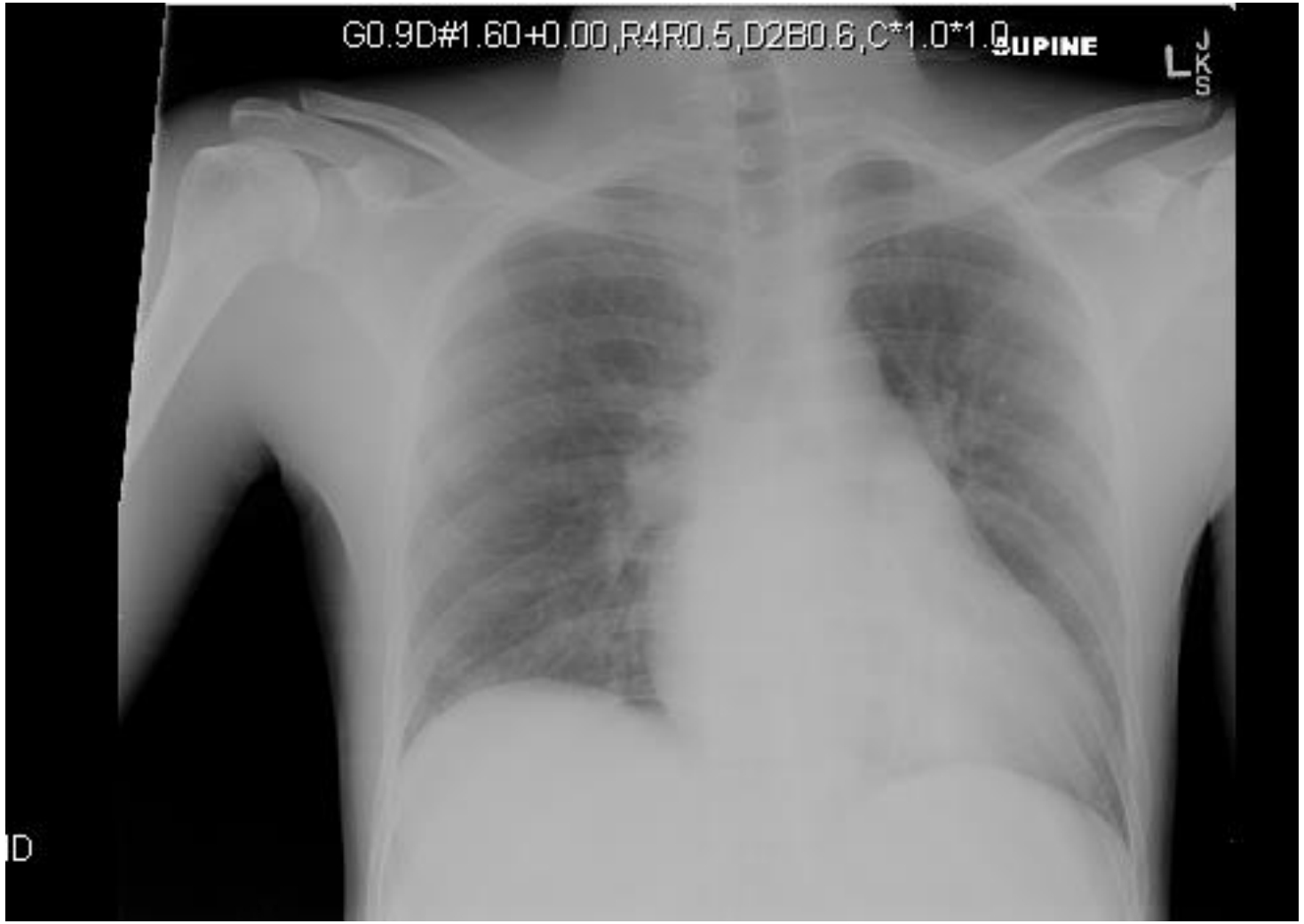
Learning Objectives

- Use POCUS to:
  - Accurately rule in and importantly rule OUT a diagnosis
    - Accurate “correct on all details, exact”
  - Efficiently make a diagnosis
    - Efficient “preventing the wasteful use of a particular resource”
  - Help answers already asked by the clinician
    - Why is the patient in acute respiratory failure? In shock?
  - Learn key basic ultrasound techniques
    - Lung ultrasound, basic cardiac, etc
  - Case examples for the above

Case: Young male with sickle cell disease and chest pain and hypoxemia.

- Chest pain Fever
- Acute chest syndrome history
- Question in chart about pulmonary hypertension
- Evidence of hemolysis
- Physical exam typical
  - Tachycardic, hypoxemia, shallow rapid breathes, some crackles
- DDx typical
  - ACS, pulmonary embolus, pneumonia, atelectasis, etc
- Patient had **6 CTPA** in 14 months, 3 DVT studies, and 2 echocardiograms
- Plan?

Chest radiograph obtained.



Now What?

ED ordered:

CTPA

Echocardiogram

Lower Ext US

Sickle Cell Patient

- What actually happened?
  - All above orders cancelled
  - Hospitalist and resident performed POCUS
  - Alveolar consolidation confirmed-ACS
  - Right ventricular dysfunction/failure documented
  - Diuretics given
  - No evidence of DVT
  - Red cell exchange ordered

  - 5 minutes went by

What IS Point of Care Ultrasound?

- Ultrasound performed by the treating clinician
- Image acquisition, interpretation, and clinical integration
- Exam intent on answering a specific question
  - Why is the patient hypoxemic? In shock, Not peeing?
- Exam may be limited in scope
- Repeated as necessary

Why Point of Care Ultrasound?

- Clinical dissociation when consultative services perform the exam
- Time dissociation
- No patient transport
- Virtually no radiation
- More time spent next to the patient
- Highly accurate in both ruling in and ruling out a diagnosis
  - RV not dilated-Not a massive PE
  - No B lines (lung ultrasound artifact) NO pulmonary edema
  - Alveolar consolidation in patient with fever and WBC count-Pneumonia

Point of Care Ultrasound. It is Time for a Paradigm Shift.

- However
  - POCUS must never be performed in a vacuum
  - Clinical history, surface physical exam AND POCUS very powerful tool

A Quick Primer in POCUS

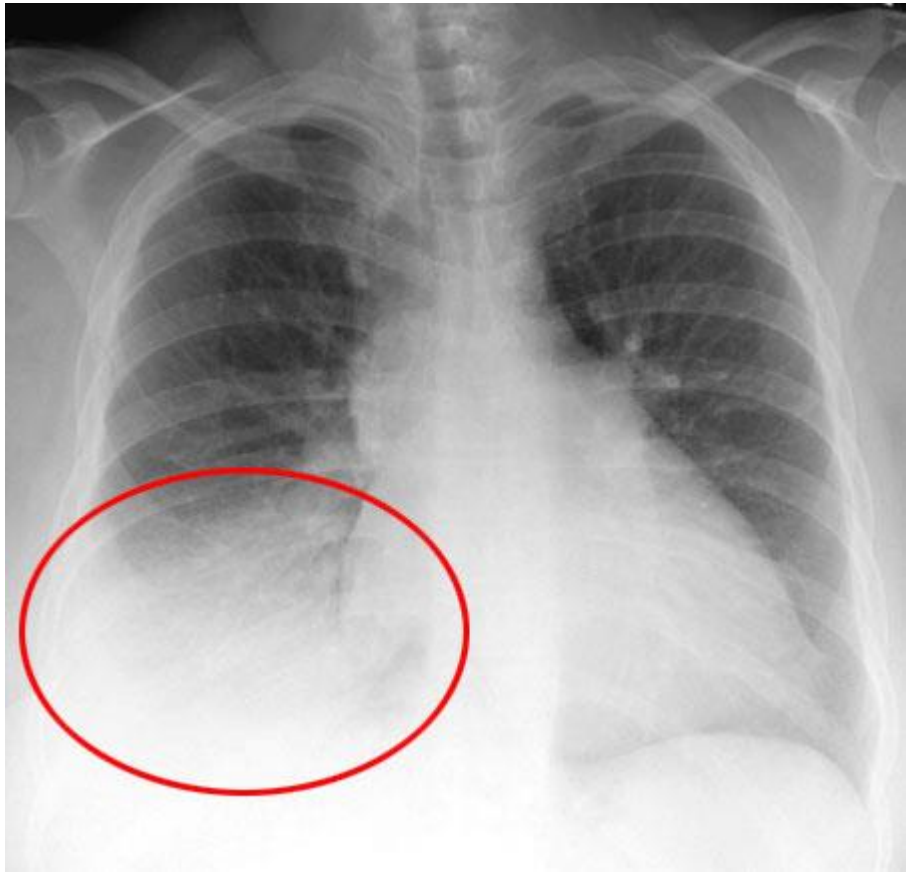
- A tour of what typical POCUS exams look like and how to integrate them into the clinical picture

Point of Care Ultrasound. What Does it Encompass?

- Thoracic ultrasound
  - Lungs and pleura
- Cardiac ultrasound
  - Basic 5 view exam
- Abdominal ultrasound
  - FAST exam, bladder, kidney, gross anatomic abnormalities
- Vascular diagnostic and access
  - DVT

Thoracic Ultrasound

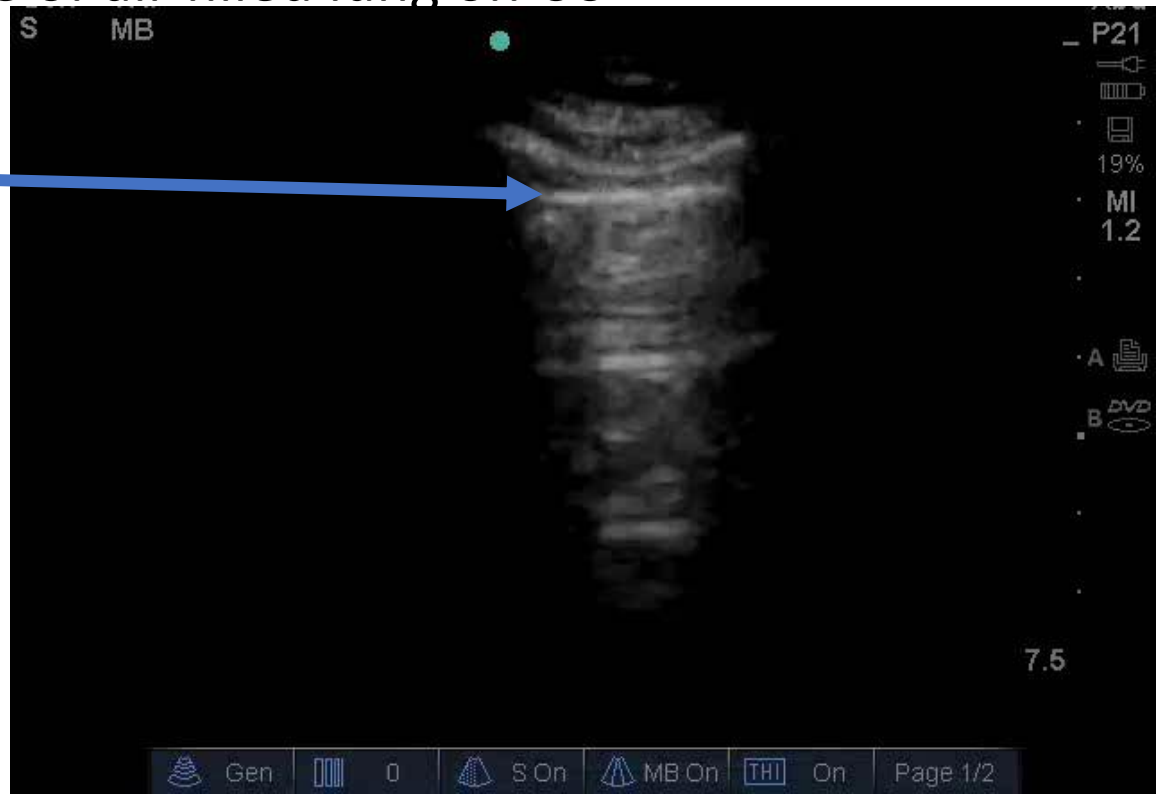
- Why does the patient have hypoxemia? Chest pain? Dyspnea?
- Categorize the problem
  - Wet or dry lungs
  - Unilateral or bilateral disease
  - Alveolar consolidation
    - Pneumonia
    - Atelectasis
  - Pleural effusion
    - Simple? Complex? Septated? Drainable?
  - Mass
    - Can we biopsy it?



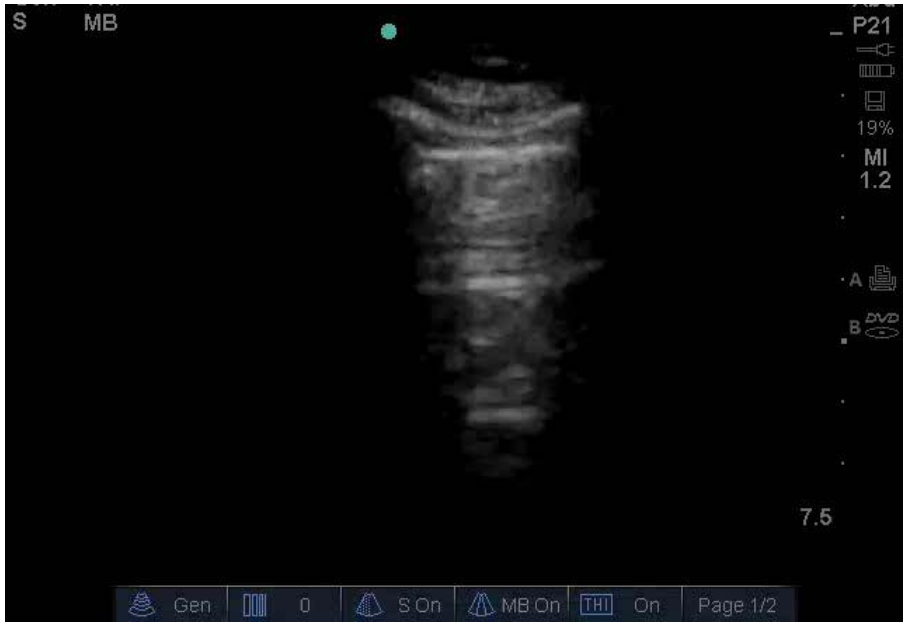
The Pleural Surface

Air was Thought to be the Enemy of the Sonographer

- Large difference in acoustic impedance between air and tissue
- Reflection of most of ultrasound at interface air/tissue
  - Reason for amorphous gray appearance of air filled lung on US
- To the naive clinician
  - Completely Absurd
- To the learned
  - Nirvana



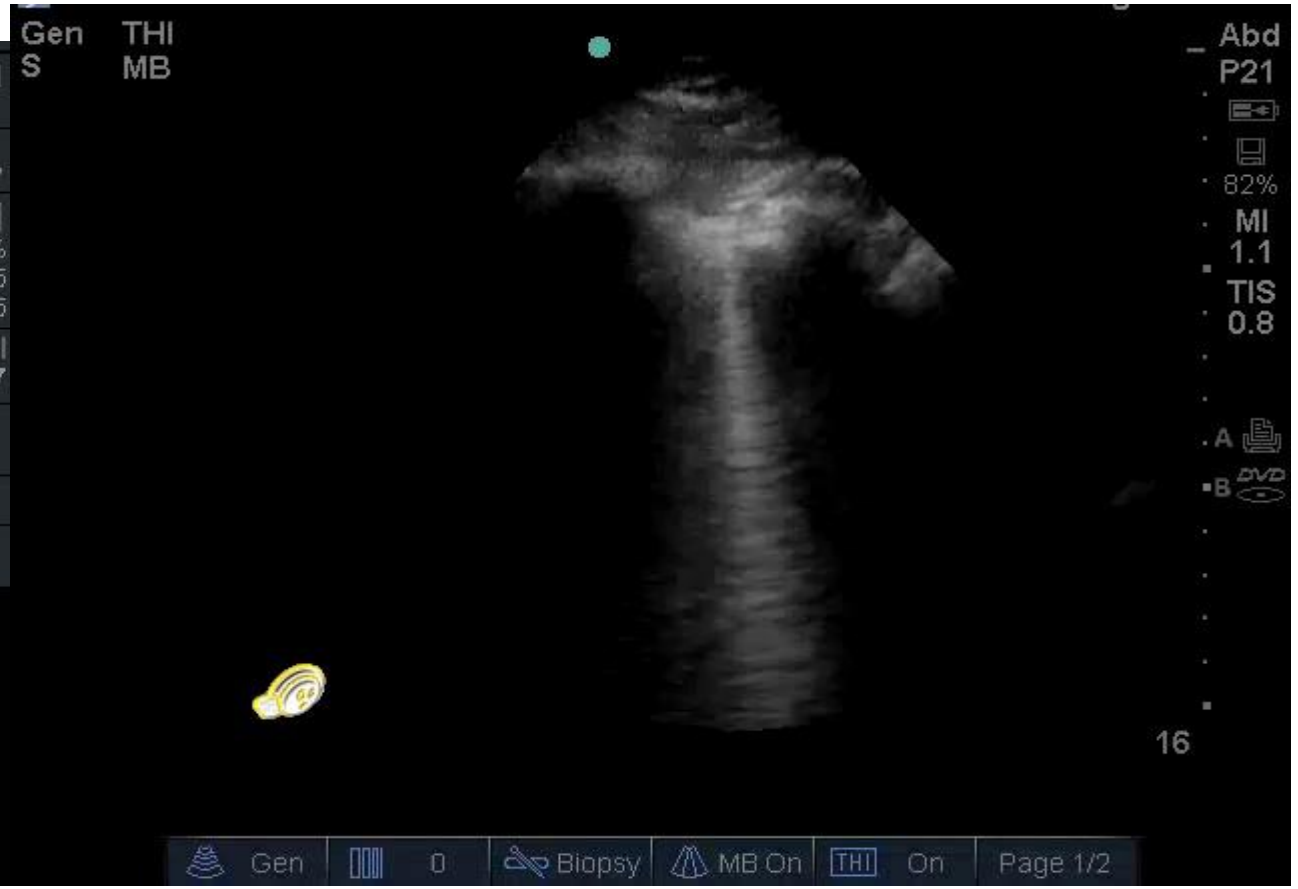
What Does the Lung Ultrasound Tell Us?



Normal Aeration Pattern
No evidence of alveolar consolidation
No evidence of pulmonary edema (PAOP <18mmHg)
No pneumothorax
No pleural effusion

Reference: Blue Protocol Lichtenstein, MANY OTHERS

What do the Other Lung Ultrasound Findings Look Like?



What About This B-line?

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- Th
- Th
- Th
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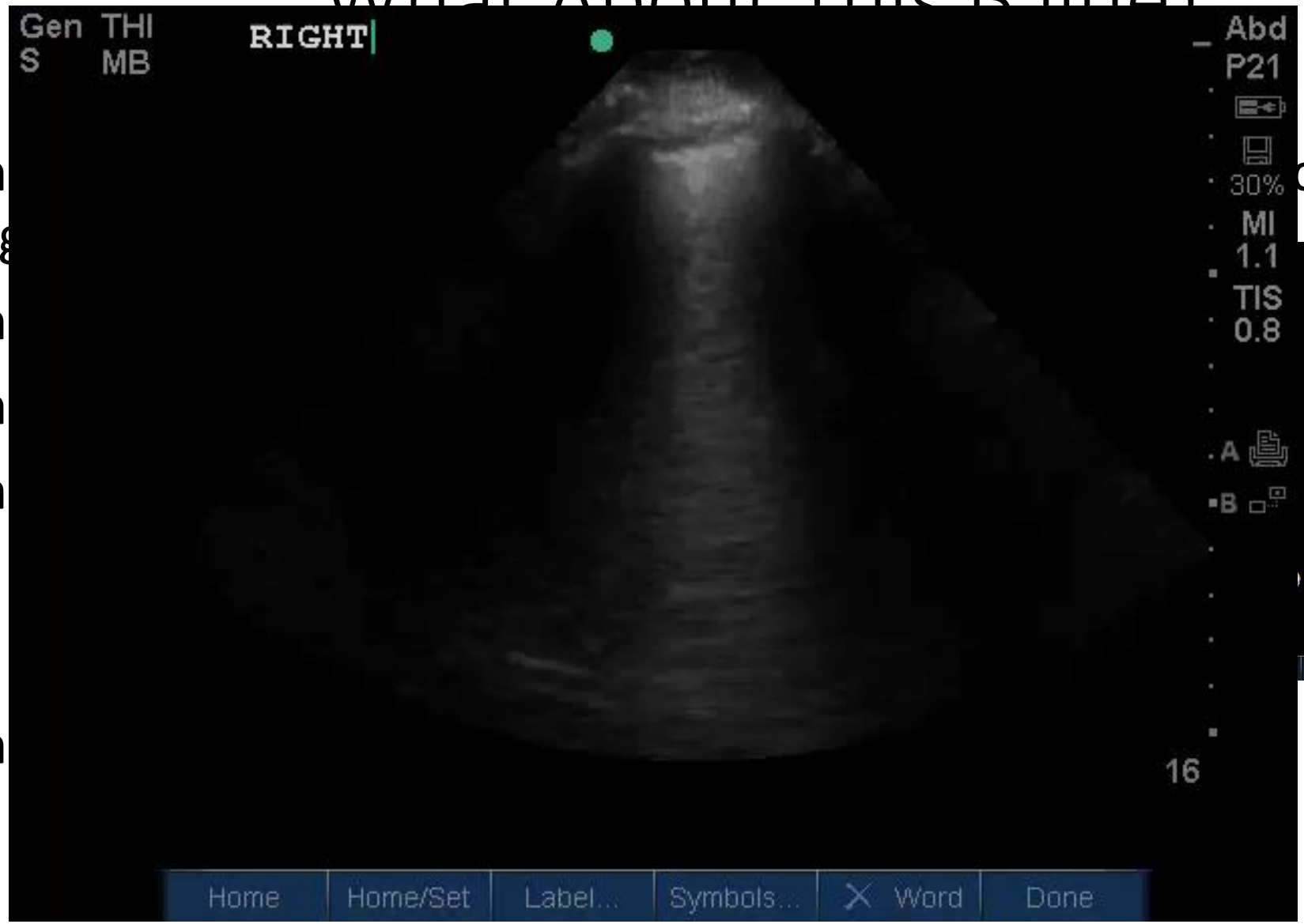
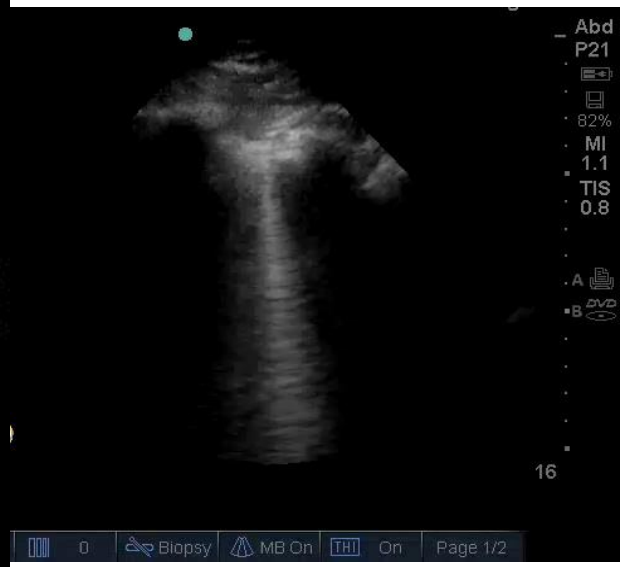




Why is the patient Hypoxemic? Normal Chest Radiograph
Will the stethoscope answer it? Maybe

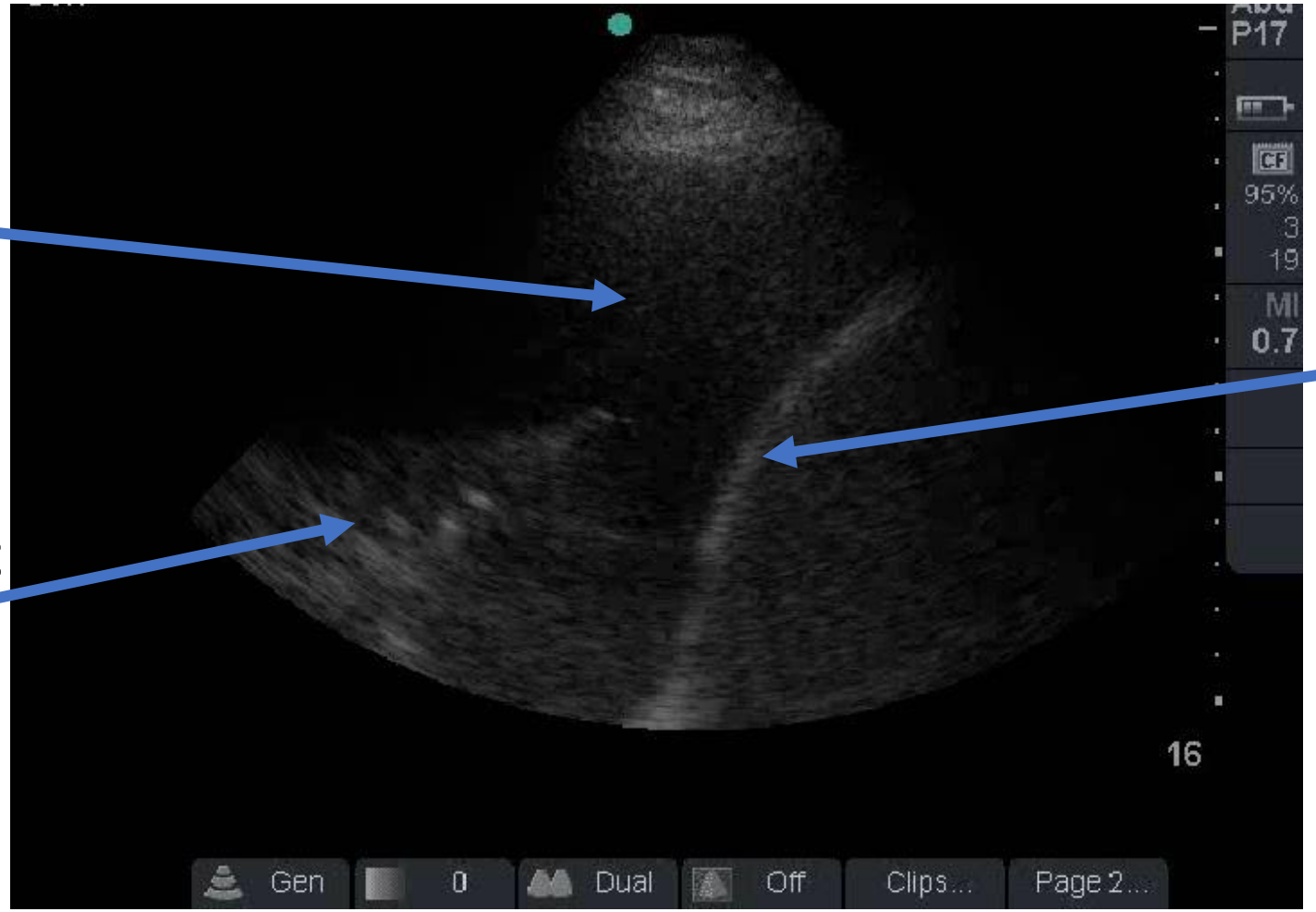
- Are the lungs wet?
- Alveolar consolidation?
- Pleural effusion

Etiology of the hypoxemia?
Pneumonia with small parapneumonic process
Do we need the CT?

Does the Patient have a Consolidation? A Parapneumonic Effusion? Both?

- Do you need a chest CT to characterize a pleural effusion?
  - CT less specific to characterize an effusion
  - Many chest CTs read as empyema, are not when tapped
  - Many read as loculated are not on ultrasound
- Why would ever send a patient for a chest CT BEFORE a thoracic ultrasound?
  - If an effusion-tap it first
  - The lung may expand, then do a CT chest if needed
- Uni-lateral white out?
  - Thoracic ultrasound first

Large Pleural Effusion?



Hypoechoic Space

Hemidiaphragm

Typical Dynamic Changes

What do the Other Pleural Effusions Look Like?

Point of Care Echocardiography

- Uses a limited number of echo views
- For rapid evaluation of hemodynamic failure
- For Identification of life threatening process
- For categorization of shock state
- To guide management of shock state
- To follow evolution of disease and response to therapy

Keeping it Simple

- The 5 Standard views
- Parasternal long axis view (PSL)
- Parasternal short axis midventricular (PSS)
- Apical four chamber view (AP4)
- Subcostal long axis view (SC long)
- Inferior vena cave long axis view (IVC long)
- (screening color Doppler optional)

Immediate Identification of Life Threatening Conditions

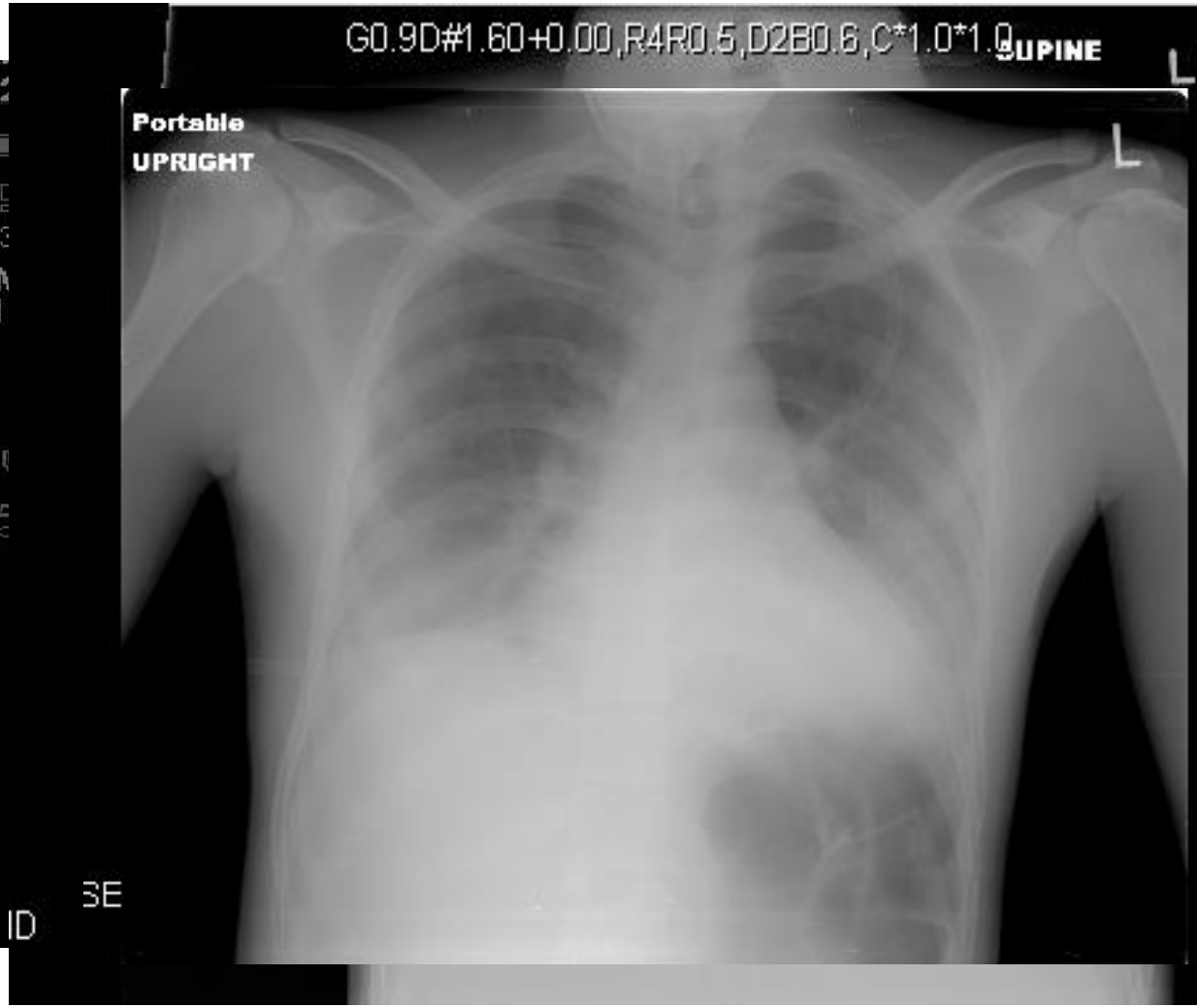
- Hemodynamic failure has many causes
- Some may be imminently life threatening
- Goal directed echo allow immediate identification of this subgroup
- Delay in performance of echo places the patient’s life at risk
- All patients with shock should have an immediate goal directed echo

TPA or OR?

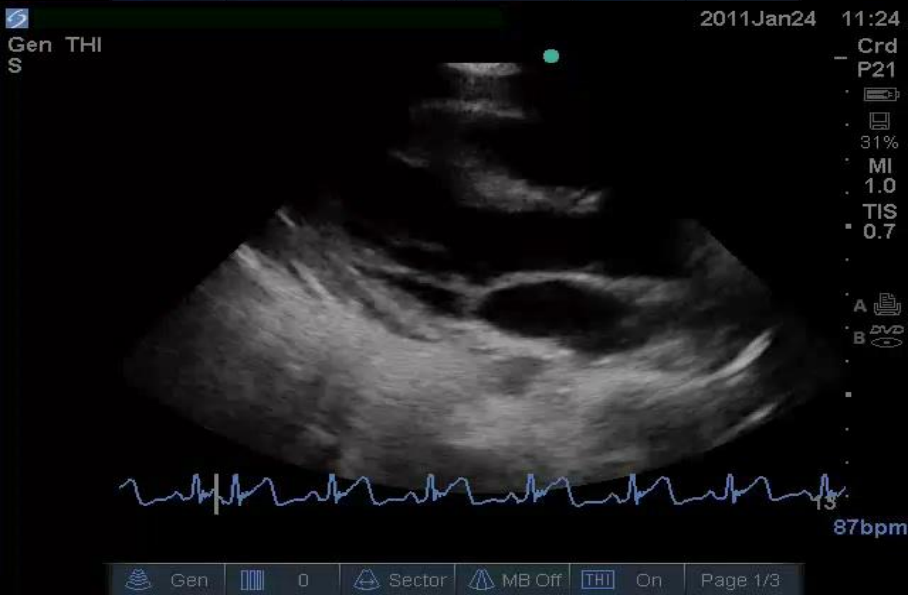
AP4

CFV DVT

Back to the Sickle Cell Patient



Back to the Sickle Cell Patient



Back to the Sickle Cell Patient

What Else Might You Encounter at a RRT?

Diagnostic Vascular Ultrasound-Remember the Sickle Cell Patient

- Compression ultrasound only
- Different protocols
- Accuracy similar to radiology performed examinations

Young Male, Fever 103F, Tooth Pain, Sore Throat

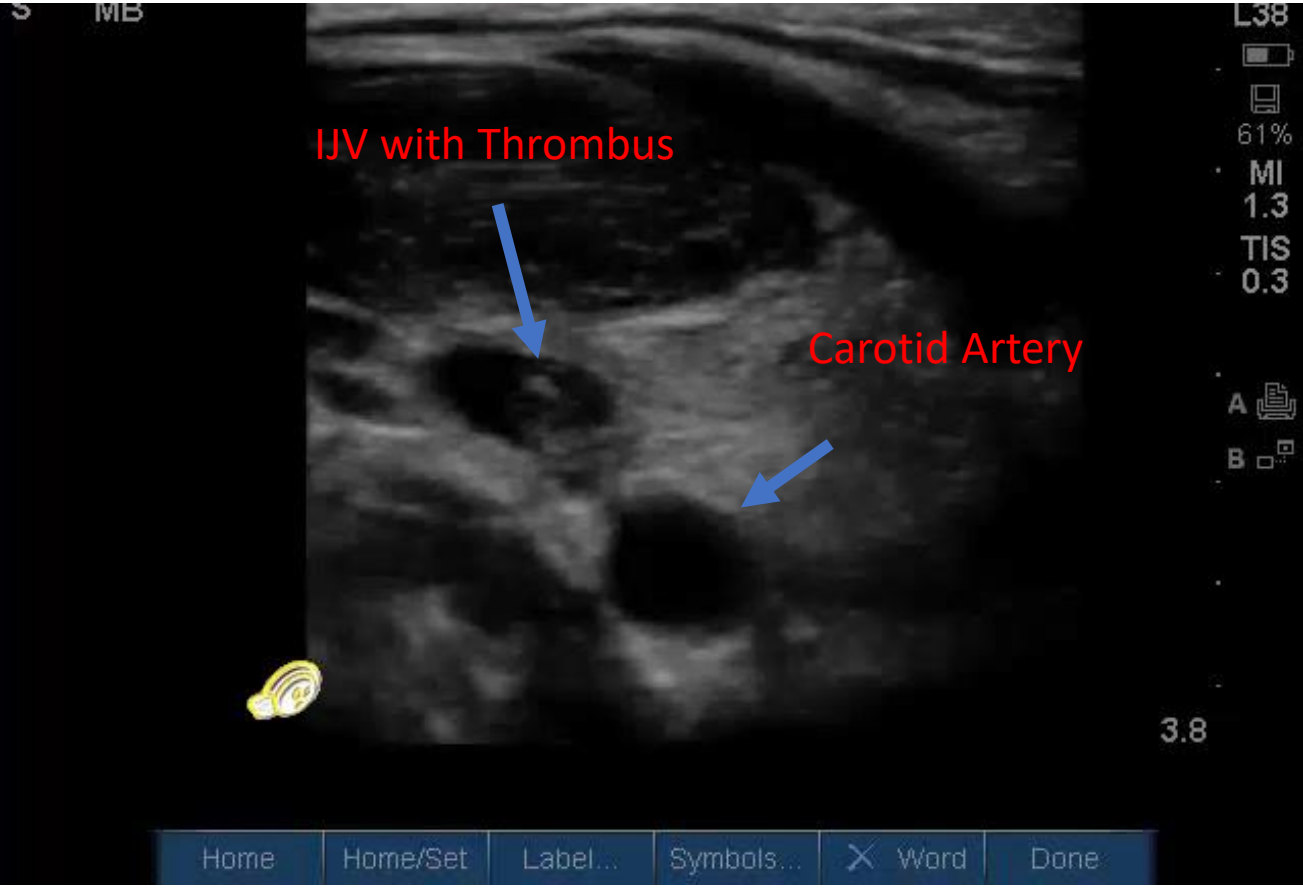
hypotension, dyspnea, hypoxemia with severe cervical neck pain.

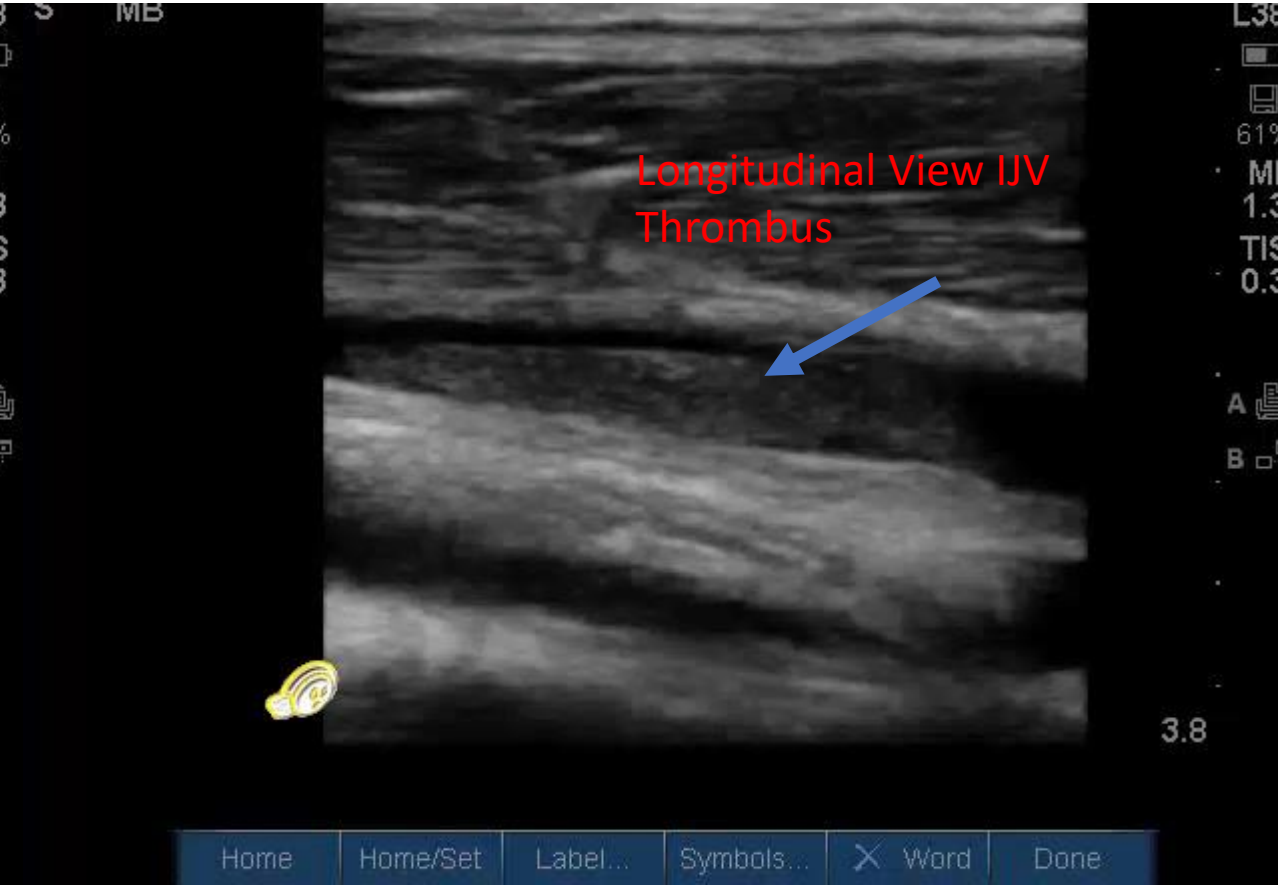
What to do?

Ordered CT chest, Neck, with contrast, Ultrasound of Neck, and an Echocardiogram

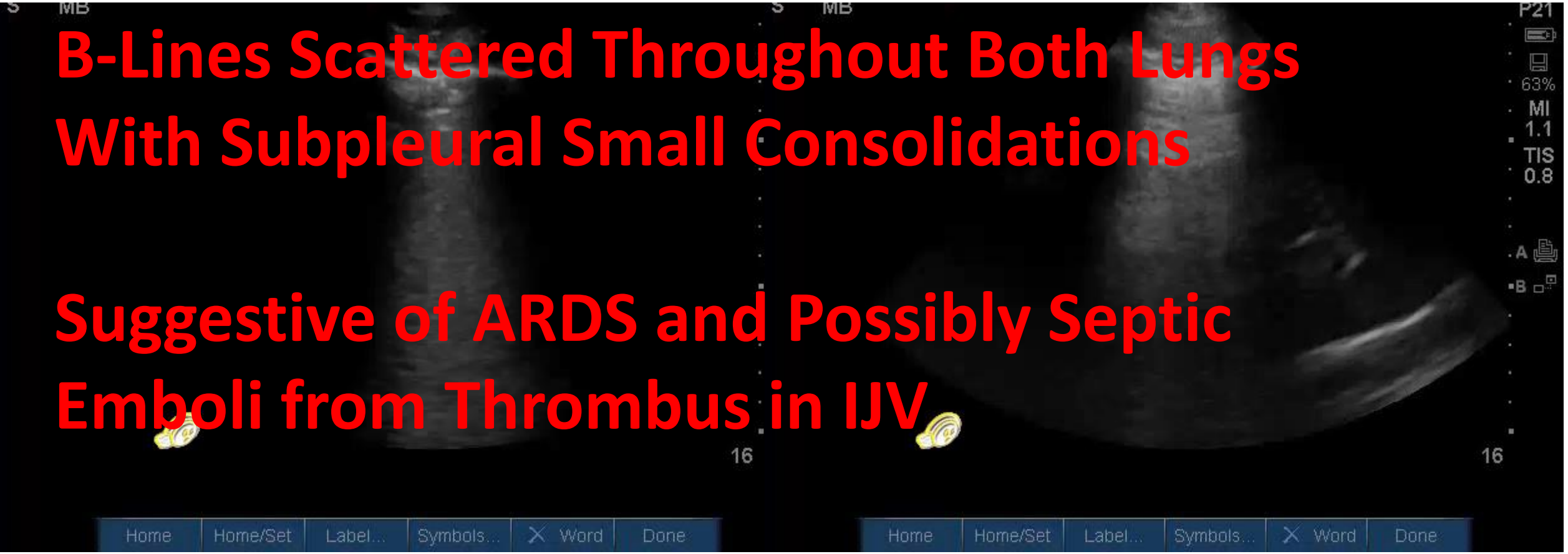
HOCUS POCUS

- Why the painful cervical area?
- Why the hypotension?
- Why the hypoxemia?


IJV with Thrombus
Carotid Artery
L38
61%
MI
1.3
TIS
0.3
3.8
Home
Home/Set
Label...
Symbols...
Word
Done


Longitudinal View IJV
Thrombus
3.8
Home
Home/Set
Label...
Symbols...
Word
Done

Hypoxemia?


B-Lines Scattered Throughout Both Lungs
With Subpleural Small Consolidations
Suggestive of ARDS and Possibly Septic
Emboli from Thrombus in IJV
MB
P21
63%
MI
1.1
TIS
0.8
16
Home
Home/Set
Label...
Symbols...
Word
Done

He Grew *Fusobacterium necrophorum*

- ***Lemierre's syndrome***

POCUS-the Abdomen

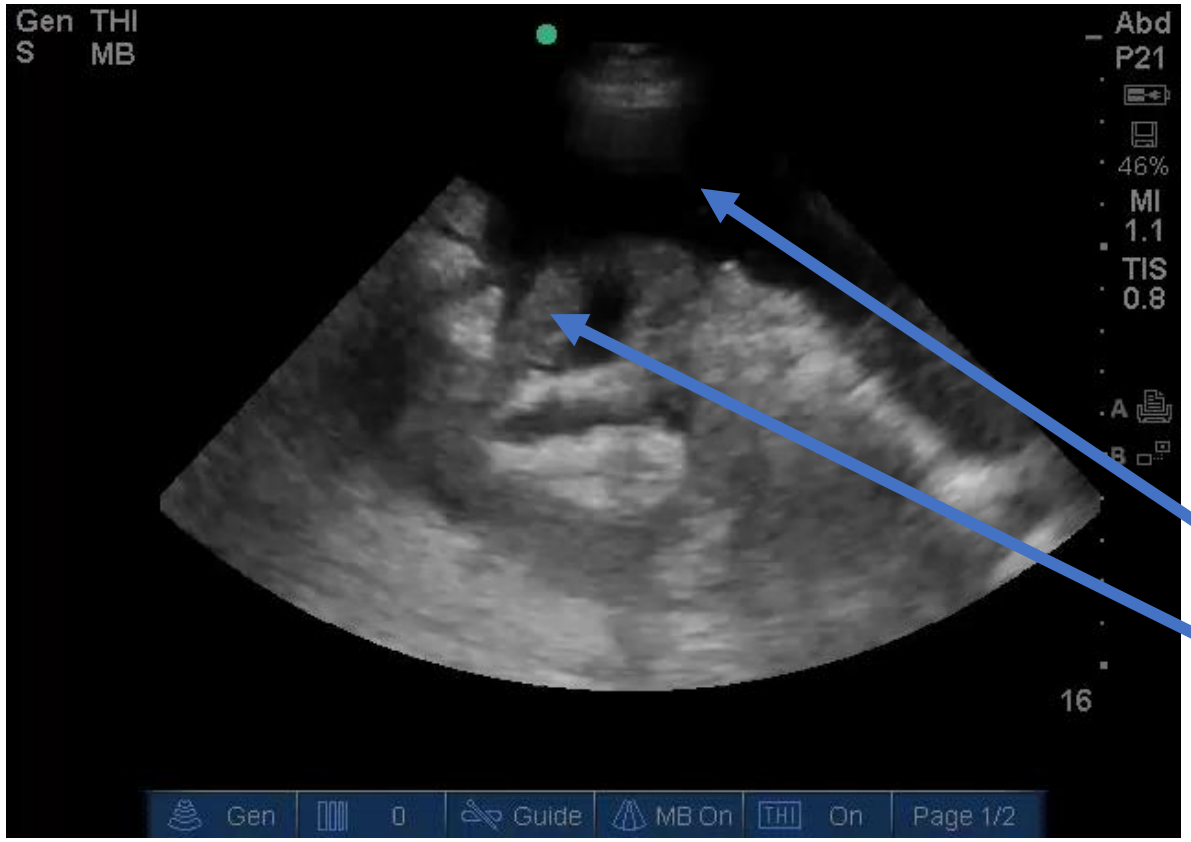
- Free fluid?
  - Ascites
- Hydronephrosis?
  - Bilateral?
    - Look at the bladder
  - Unilateral?
    - Stone?
    - Other obstruction?
- Free air?
- Infection?
- Mass?
- The list is endless

Follow the Clues.

Patient with Severe Abdominal Pain After 2 Weeks Fever, ICU Figured Out Diagnosis

- 60s female with shock, fever, diffuse abdominal tenderness develops hypoxemic respiratory failure
- Severe metabolic acidosis
- Acute kidney injury
- Elevated WBC with bands
- Presumptive diagnosis-Severe sepsis, maybe abdominal source

She had Abdominal Pain



What does this ultrasound show?

1. Free colonic air
2. Ascites
3. Peristalsis
4. Distended bladder

Ascites

Bowel

No Peristalsis, Think of ischemic bowel disease

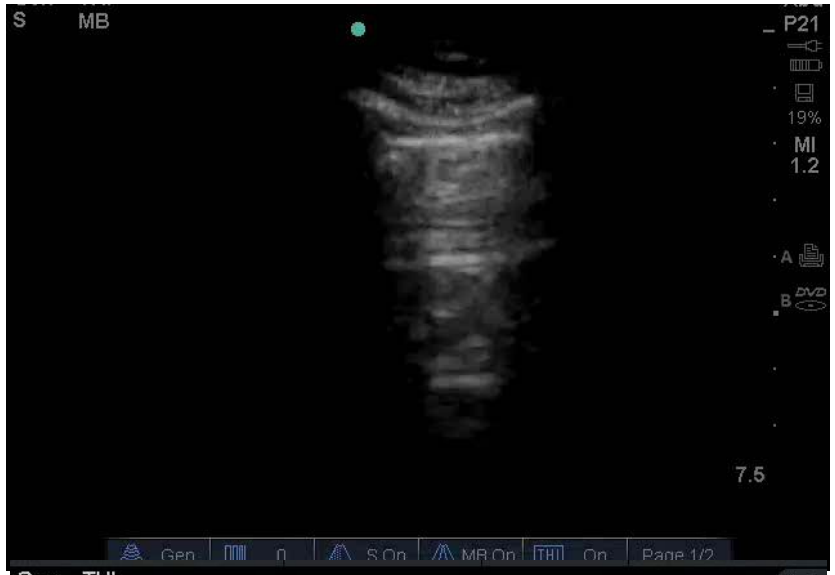
Patient Still in Shock and in Respiratory Failure

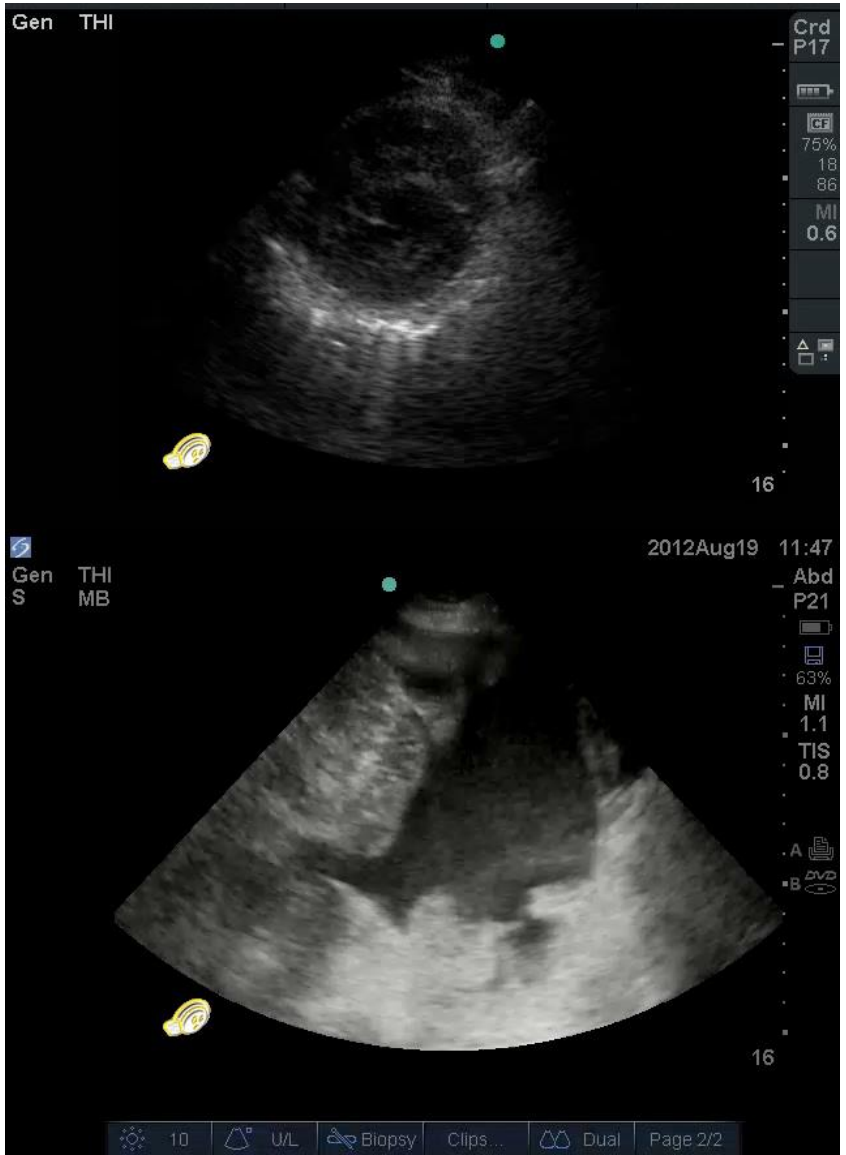
How do you know what is normal and abnormal?

What is Point of Care Ultrasound?

- 70’s Female, watching reruns of Mickey Mouse at home, “passed out” EMS to Emergency Department
- She is in shock and severe hypoxemic respiratory failure, intubated, without diagnosis, too sick to move
- Abdomen very distended, legs swollen
- What to do?

Point of Care Ultrasound.





WBU
Whole Body Ultrasonography

A Whole-Body Approach to Point of Care Ultrasound

Mangala Narasimhan, DO, FCCP; Seth J. Koenig, MD, FCCP; and Paul H. Mayo, MD, FCCP

VIDEO

Ultrasonography is an essential imaging modality in the ICU used to diagnose and guide the treatment of cardiopulmonary failure. Critical care ultrasonography requires that all image acquisition, image interpretation, and clinical applications of ultrasonography are personally performed by the critical care clinician at the point of care and that the information obtained is combined with the history, physical, and laboratory information. Point-of-care ultrasonography is often compartmentalized such that the clinician will focus on one body system while performing the critical care ultrasonography examination. We suggest a change from this compartmentalized approach to a systematic whole-body ultrasonography approach. The standard whole-body ultrasonography examination includes thoracic, cardiac, limited abdominal, and an evaluation for DVT. Other elements of ultrasonography are used when clinically indicated. Each of these elements is reviewed in this article and are accompanied by a link to pertinent cases from the Ultrasound Corner section of *CHEST*.

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I will end here

- Time to chat and debrief