

Basic Lung POCUS

Educational Quick Guide

Any patient. Anywhere. Anytime.

Information contained in this document is meant for quick reference and a supplement to formal ultrasound experience, education or training.



Basic Lung POCUS

Objective

Evaluating Pleura and Lung Parenchyma for patients with Respiratory Failure and Shock

Procedure Description:

The use of lung POCUS has rapidly demonstrated utility for patients with respiratory failure and shock. There are many protocols, including the original BLUE protocol introduced by Lichtenstein et al, with multiple recommendations for number of zones and specific scoring systems. Intuitively, the transducer will only image the portions of the lung directly underneath it. Therefore, the more zones that are scanned, the higher the sensitivity of the test for pathology. The International Consensus protocol from Volpicelli et al provides a reasonable balance of convenience and diagnostic accuracy with 12 zones and is described in this quick guide.

This quick guide will demonstrate transducer placement, views, and tips on how to perform this potentially life-saving diagnostic examination.

Recommended Transducers:

Any of the following transducers can be used, as each will provide slightly different information. The linear transducer will provide the most information about the pleura, but depending on patient habitus may not allow for meaningful imaging of the parenchyma.

- Phased Array
- Linear Array
- Curvilinear Array

Clinical Indications:

- Unexplained Dyspnea
- Respiratory Failure
- Shock

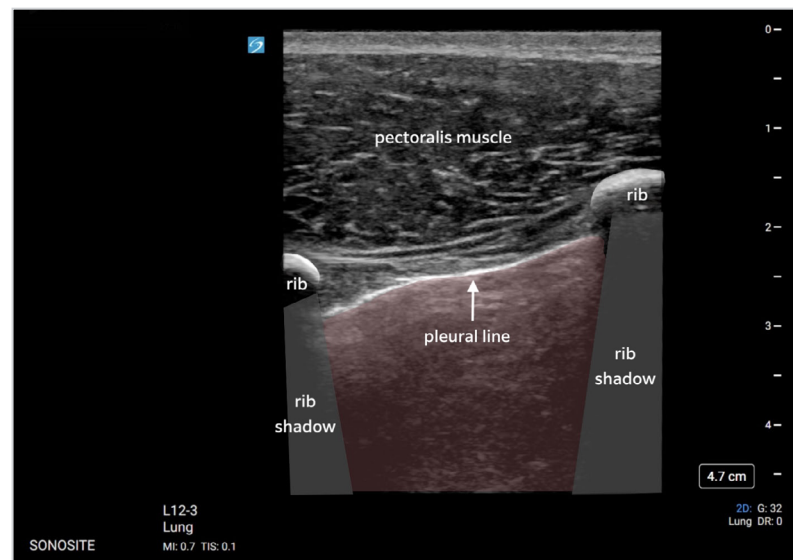
Clinical Applications:

- Volume Overload
- Pneumonia
- Acute Respiratory Distress Syndrome (ARDS)
- Pneumothorax
- Pleural Effusion

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Apical Pleural view:

- Place the transducer perpendicular to the pleura with the indicator toward the patient's head. Smaller pneumothorax may be only found above the clavicle. Set the depth such that the pleura is in the middle third of the screen. This view is essential for evaluating lung sliding to rule out Pneumothorax. It also allows visualization of pleural abnormalities in inflammatory and infectious etiologies of respiratory failure. Both Lung Sliding and Lung Pulse can be seen in this view.
- This example shows skin, pectoralis muscles, ribs with the underlying shadow, and the hyperechoic pleural line.

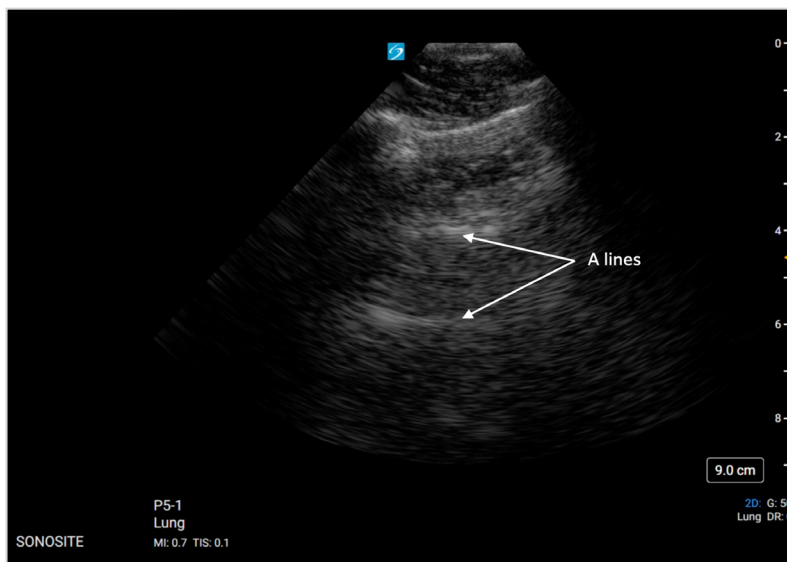


Tip: Ensure the anchoring anatomy of the ribs can be seen, otherwise fascial plane or subcutaneous air can be mistaken for pleura. A linear transducer is the best for visualizing pleura.

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Anterior Apical View:

- Place the transducer perpendicular to the pleura with the indicator toward the patient's head in the rib spaces just inferior to the clavicle. Note that the pleura and chest wall are not always parallel, especially as you get more apical. Set the depth to at least 3x that of the pleura to ensure visualization of A and B line artifacts.
- This example demonstrates **A lines**, as seen in normal lung parenchyma. Also note that this is seen in airways diseases such as Asthma, COPD, and vascular pathology such as PE.



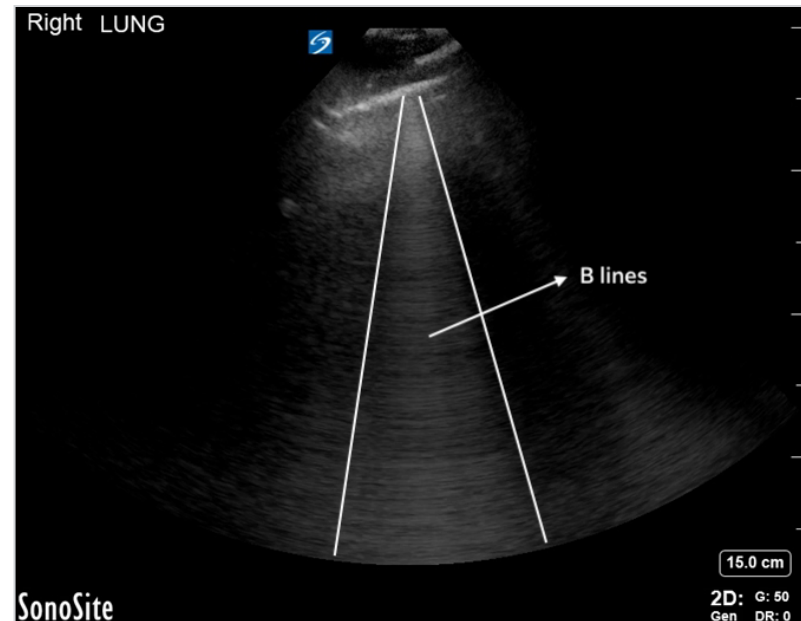
Tip: Use fanning and rocking to achieve visualization of A lines. If neither A nor B lines are seen, the problem is most often angle of insonation or presence of consolidation.

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Anterior Lower View:

- Place the transducer perpendicular to the pleura with the indicator toward the patient's head in the 4th to 7th rib spaces.
- This example demonstrates **B lines**, as seen in pulmonary edema. Also note that this is seen in alveolar and interstitial diseases such as Pneumonia, Pulmonary Contusion, Pulmonary Infarction, Diffuse Alveolar Hemorrhage, ARDS, and Interstitial Lung Disease.

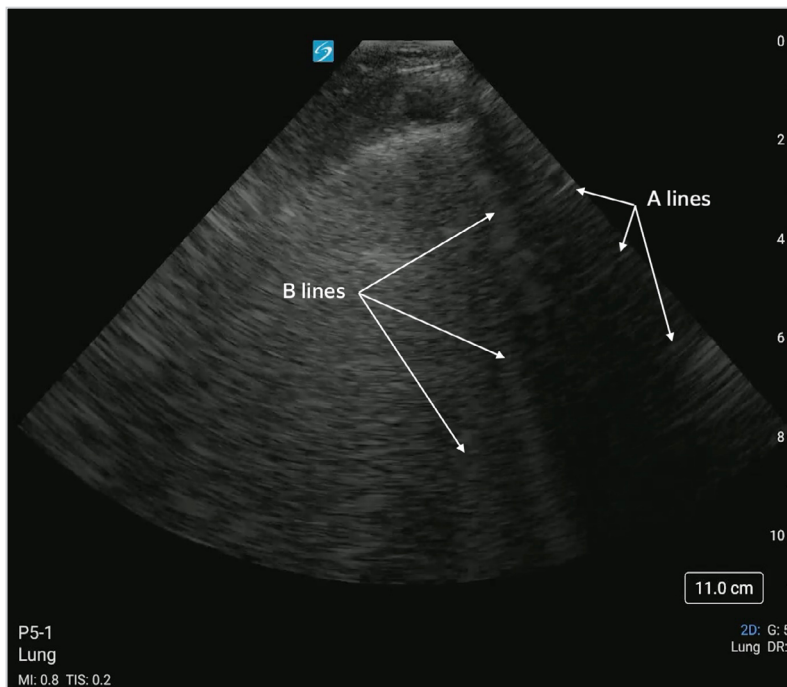
Tip: The lower anterior field may require lateral sliding to avoid cardiac interference. The number of B lines is important, as 3 or more are known to be pathological. If the B lines begin to coalesce, the percentage of the rib space occupied by B lines can be used instead, with 100% being 10 B lines.



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Lateral View:

- Place the transducer posterior to the lateral pectoralis and as high as possible on the thorax. Ensure that the transducer remains perpendicular to the pleura, which can be challenging given soft tissue.
- This example shows many **B lines** in a patient with ARDS, which can be seen intermittently obliterating **A lines**.

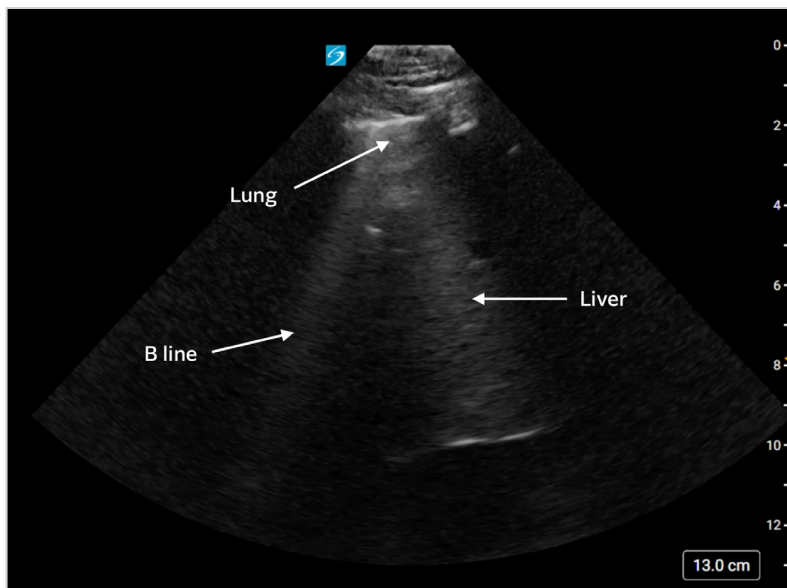


Tip: Commonly the transducer is held too caudal on the thorax, losing visualization of much of this field. Remember to fan the transducer to adjust the angle of insonation in this view. It may require abducting the arm to make space.

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Posterior Lateral View (Also referred to as PLAPS View):

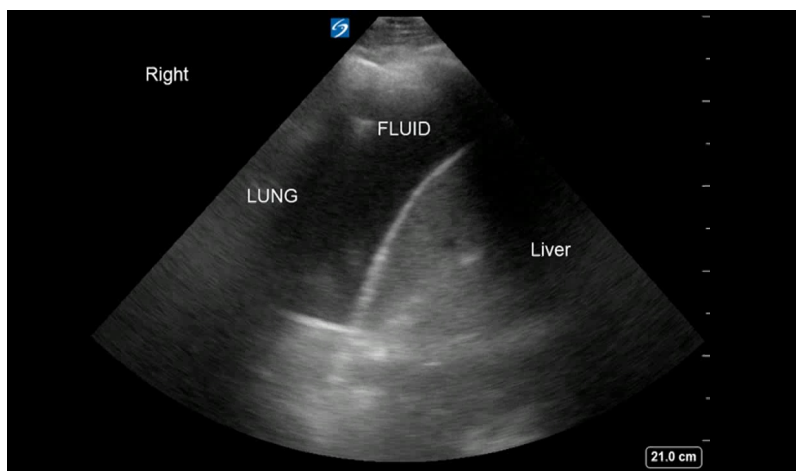
- Place the transducer at the level where the diaphragm is visualized during at least a portion of the respiratory cycle.
- This example to the right shows one **B line**, the liver, and the adjacent lung, which forms a curtain obscuring the other anatomy with **A lines**. Sometimes the diaphragm can be visualized as a hyperechoic line overlying the liver or spleen, but frequently it cannot, as seen in this example.



Tip: Sometimes the diaphragm cannot be visualized, this is acceptable if there is no pathology seen between the lung curtain and the liver or spleen.

Pleural Effusion:

Seen here below in the PLAPS view. Note the anchoring anatomy and the anechoic fluid demonstrating posterior acoustic enhancement.

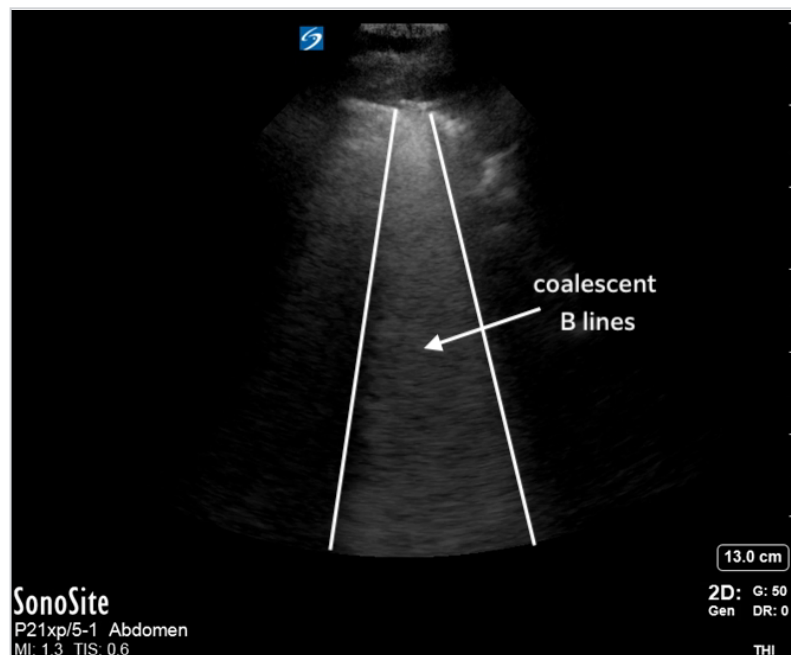


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Superior Posterior View:

- Place the transducer medial and superior of the scapula.
- This example shows **coalescent B lines** occupying about half the rib space, worth 5 if counting.

Tip: If the transducer is held too lateral or caudal, this view can easily overlap with the Posterior-Lateral view. If the diaphragm is visible, slide cranial and anteriorly.

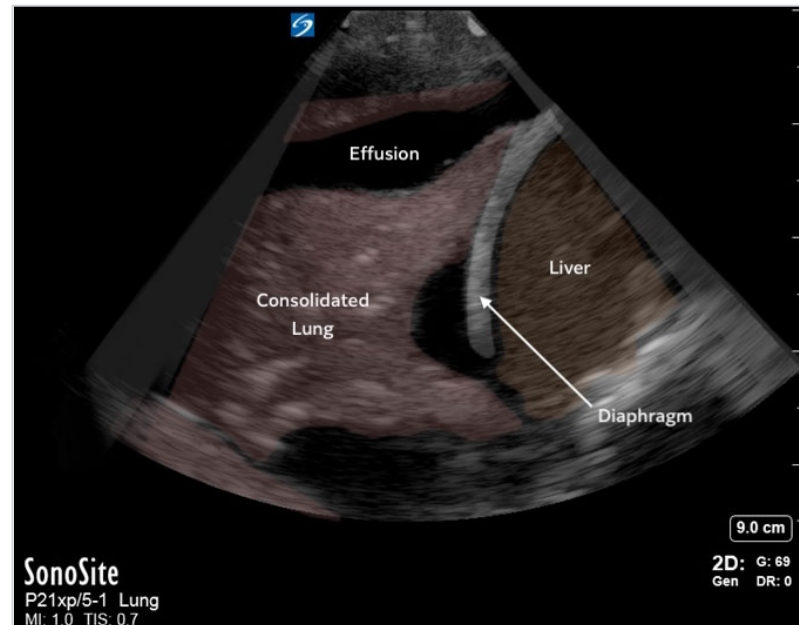


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Inferior Posterior View:

- Lay the transducer at the level of the diaphragm in the posterior mid clavicular line.
- This example shows consolidated lung as is seen in atelectasis, pneumonia, contusion, and infarction. Note the effusion surrounding the consolidated lung.

Tip: This view requires the patient to be able to sit or be rolled onto the contralateral side. The scapula will resemble pleura, but without the anchoring anatomy of the ribs.



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Interpretation:

- POCUS lung only shows what is happening directly under the transducer
- The pattern of sonographic findings correlates tightly with what a CT scan would show in that location
- Different pathological states have different patterns, with the understanding that patients can have more than one simultaneous cause of respiratory failure

Pathological state	Lung Ultrasound Findings
Pneumothorax	A-lines with absent lung sliding
Right Mainstem Intubation	Lung sliding on right, but not left; Lung pulse present bilaterally
Cardiogenic Pulmonary Edema	Diffuse B-lines with lung sliding and smooth pleura
Acute Respiratory Distress Syndrome	Lung sliding may be absent in severe cases.
Diffuse Alveolar Hemorrhage	Heterogeneously diffuse B lines with or without subpleural consolidations
Massive Aspiration / Drowning	
Pulmonary Embolus	A-lines early, focal B-lines later, with subpleural consolidation in area of infarcted lung
Pneumonia	Focal B-lines, sometimes with subpleural consolidations, or consolidated lung, with or without pleural effusion
Chronic Obstructive Pulmonary Disease (COPD)/Asthma	A-lines with lung sliding unless severe bullae are present
Pleural Effusion	Hypoechoic collection in pleural space with or without compression atelectasis of lung
Interstitial Lung Disease	B-lines in affected areas

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