

Lung

Case 1:

A 53 year old male with a history of non-ischemic cardiomyopathy and a reported LVEF of 35% is admitted to the ICU following a sigmoid bowel resection for perforated diverticulitis. When he arrives, he is tachycardic and hypotensive. After volume resuscitation and pressors, the patient has an ABG of 7.32/30/53 on a non-rebreather. The decision is made to intubate the patient. A lung ultrasound is performed. What is seen on this ultrasound image?

Answer: The image acquired demonstrates a large pleural effusion. This pleural effusion is likely the consequence of large volume resuscitation in the setting of sepsis, in a patient with poor systolic function, causing a significant amount of fluid to accumulate in the lungs, and subsequently, the pleural space. If it is thought that the effusion is contributing significantly to poor oxygenation, a chest tube can be placed and the effusion drained. The lung tissue, in this case, is highly consolidated in some areas, can be compared to the density of the liver, a finding termed "hepatization of the lung".

Case 2:

A 75 year old female is admitted to the MICU with a history of shortness of breath. Upon presentation, she appears tachypnic and is febrile. A chest x-ray is performed and right lower lobe white-out is seen. A lung ultrasound is performed to ascertain whether this is an effusion or consolidation. What phenomenon is seen on this ultrasound image of the lung?

Answer. The finding is called an air bronchogram. An air bronchogram is seen when inflamed, consolidated lung tissue collapses around rigid bronchi. The hyperechoic lines and dots that move upon inspiration represent air trapped in small areas of consolidation. This finding is specific for pneumonia. There are two types of air bronchograms, static and dynamic. As the description implies, dynamic air bronchograms, as imaged here, move with the patient respiratory cycle. Dynamic air bronchograms are pathognomonic for pneumonia.

Case 3:

A 45 year old male has been resuscitated after a motor vehicle accident with bilateral femoral fractures and significant blood loss during the reductions. The patient has been extubated, is hemodynamically stable after 3 units of packed red cells and 4 liters of crystalloid. He is now complaining of shortness of breath and is moderately tachypnic. A lung ultrasound is performed. What phenomenon is seen here?

Answer: The patient is displaying B-lines. B-lines are typically visualized as white lines extending from the pleura to the bottom of the ultrasound image. They are highly sensitive for pulmonary edema. The edema, in this case, was most likely secondary to large volume resuscitation after the trauma.

Case 4:

A 25 year old male presents having fallen 15 feet from the roof of his motor home. He is complaining of shortness of breath and is visibly splinting on the right side with each breath. Chest x-ray in the emergency department revealed multiple rib fractures. The patient begins to desaturate and is becoming progressively more tachycardic and hypotensive. You decide to perform a bedside lung ultrasound. What is concerning about the following ultrasound image?

Answer: The concern with this image is that lung sliding is absent. Lung sliding is identified as a shimmering or sliding white line at the lung / pleura interface. Lung sliding implies that both the visceral and parietal pleura are in contact with one another. When this phenomenon is not visualized, one must consider the possibility of a pneumothorax. Given the mechanism of this patient's injury, combined with his shortness of breath, you should have a low threshold for placing a chest tube in this patient who is likely developing a tension pneumothorax.

Case 5:

A 45 year old male with a long-standing history of alcohol abuse is admitted to the ICU for a workup for orthotopic liver transplantation. When he arrives, he complains of difficulty breathing. He is febrile and his blood pressure is 100/65. The following ultrasound image is obtained. What is the next step in management?

Answer: The ultrasound image demonstrates both fluid in the pleural space as well as the abdomen. The patient should be evaluated for the presence of bilateral pleural fluid in the setting of liver failure, an entity called hepatic hydrothorax. He should also be assessed for ascites. Patients with hepatic hydrothorax do not benefit long-term from drainage of pleural fluid, as this only reaccumulates. However, if the patient is experiencing respiratory distress, tapping of the ascitic and pleural fluid can be considered. Patients with liver failure do not metabolize intrinsic vasodilators. As a result, they are often tachycardic with hyperdynamic cardiac function, and somewhat hypotensive.

Case 6:

A 78 year old female is admitted to the ICU and intubated for respiratory distress. According to her daughter, she has a history of CVA and complains that the staff at her nursing home have been continuing to feed her despite frequent coughing and occasional choking on her food. Over the next 48 hours she develops copious respiratory secretions and is unable to be weaned from the ventilator. A bronchoscopy is performed and reveals thick, tenacious secretions from the right lower lobe bronchus.

An ultrasound image is obtained. What is the next step in the management of this patient?

Answer: The ultrasound image shows the formation of a lung abscess. A lung abscess forms when liquefactive necrosis results in a collection of necrotic debris caused by a microbial infection. In order to be considered an abscess, it must be more than two centimeters across. An abscess is usually the result of aspiration of oropharyngeal contents. It may be very difficult to penetrate with antibiotics. The patient should be evaluated for her abscess.

Case 7:

A 25 year old male has been intubated and sedated for 6 days after arriving status post motor vehicle accident. He sustained a large liver laceration and underwent massive transfusion protocol in the operating room just after arrival. He continues to require volume for hypotension. Today, his PaO₂ is 62 on an FiO₂ of 0.7. This prompts an ultrasound. What is visualized on the ultrasound and what is the next step in management?

Answer: The patient has a large pleural effusion. The aerated lung is seen moving in and out of the ultrasound image, through the pleural fluid. This creates a sign known as the curtain sign. Given the fact that the effusion is likely creating a large shunt, a chest tube should be placed for drainage.

Case 8:

You are the provider in the intensive care unit and you are caring for a 68 year old intubated patient who is status post right nephrectomy for a large renal mass. The surgery was complicated by a large estimated blood loss and large volume of fluid given intra-operatively. This led to the patient requiring mechanical ventilation post-operatively and the patient had a prolonged course on the mechanical ventilator. You obtain a chest x-ray on him to evaluate his endotracheal tube, and you note his xray to have blunted costophrenic angles and concern for a large pleural effusion. As a prudent intensivist, you decide to ultrasound the lung to evaluate the effusion.

The image that you obtain is as follows: [Lung22-Large-Pleural-Effusion](#).

How would you interpret this ultrasound and what would be your next step? **This image reveals a very large pleural effusion that would require a chest tube placement for drainage.**

After reviewing the above image, you decide to place a **Thal Quick** chest tube into the pleural space to drain the effusion utilizing ultrasound guidance. After placing the guidewire you obtain the following image: [Lung21-Ultrasound-Guided-Thoracostomy](#)

How would you interpret the above ultrasound? The ultrasound reveals a large pleural effusion with a guidewire in the pleural space.

What would you do next? Insert the chest tube over the guidewire.

How could you further evaluate this patient after placing the chest tube? A chest x-ray could be repeated to fully evaluate the positioning of the chest tube. An ultrasound could also be repeated to evaluate the effusion for appropriate drainage.