

C. ULTRASOUND FOR EVALUATION OF PLEURAL EFFUSION

Ultrasound examination of the normal pleura is easy to perform. When the probe is applied to an interspace such that the probe is between adjacent ribs, the normal pleura appears as a bright, highly echogenic line interposed between the chest wall and the air artifact of the lung. With small movements of the transducer, the examiner may orient the rib shadows such that the pleural line is centrally located on the screen. The marker on the probe should be pointed toward the head of the patient so that the cephalad direction is projected to the left of the screen. Approximately 70% of the pleural surface is accessible to ultrasound examination via techniques discussed in the prior lung exam tutorials. The normal pleura is 0.2 to 0.4 mm thick. Using the curved linear (best) or phased array probe to scan the dependent areas of lungs is the best method to assess for pleural effusion (see below).

There are four main considerations when performing a chest needle or chest tube insertion: 1) symptoms and size of the effusion or air, 2) site integrity, 3) coagulation status, and 4) presence of positive pressure mechanical ventilation. *If the distance between the lung and posterior chest wall at the lung base is greater than 5 cm, one can predict that at least 500 ml of pleural fluid can be drained safely.* Therefore, 5 cm is a good cutoff point for when patients may have significant pulmonary improvement after thoracentesis. Also, a good equation to estimate **effusion volume** is:

$$\text{Vol (ml)} = 16 \times \text{Diameter (mm)}$$

The diameter is measured from the pleura to the lung tissue (see picture).

Patient Position: There are two potential positions for pleural effusion evaluation: 1) recumbent, which will usually allow for the majority of lung tissue examination. The full lung parenchyma exam can be very involved (see picture below), but a basic six-point exam that is used to assess the lung pleura for PTX can provide the majority of the information. 2) upright sitting position, this will allow one to easily quan-

tify the severity of the fluid space by evaluating the distance from the diaphragm and lung parenchyma.

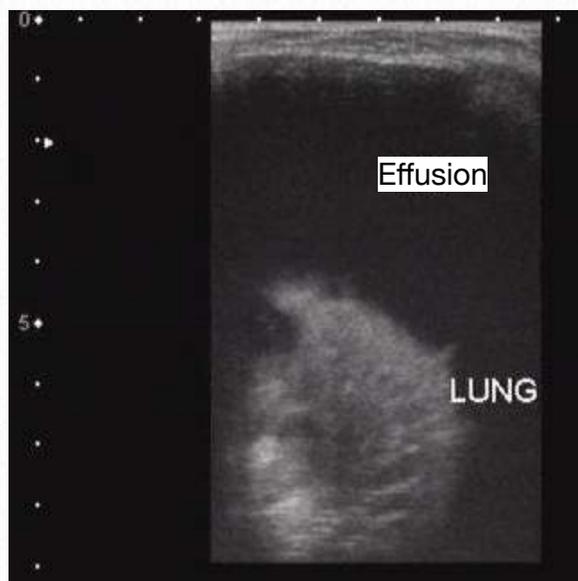
Probe Position: Either the curved linear or phased array probe can be used. Both probes offer a lower frequency that will allow adequate depth of penetration. The curved linear, being of a higher frequency, will provide an improved image quality while still providing enough deep penetration; the phased array probe may also be used. The indicator should be at the 12 o'clock position, perpendicular to the ribs (similar to the lung pleura exam). The transducer is oriented to scan between the ribs, as ribs block the transmission of ultrasound. In the supine position, one should place the ultrasound probe in the posterior axillary line at the 9th rib space to identify the diaphragm and scan the base of the lung fields for effusion. Please see the pictures for further information on the lung parenchyma exam.



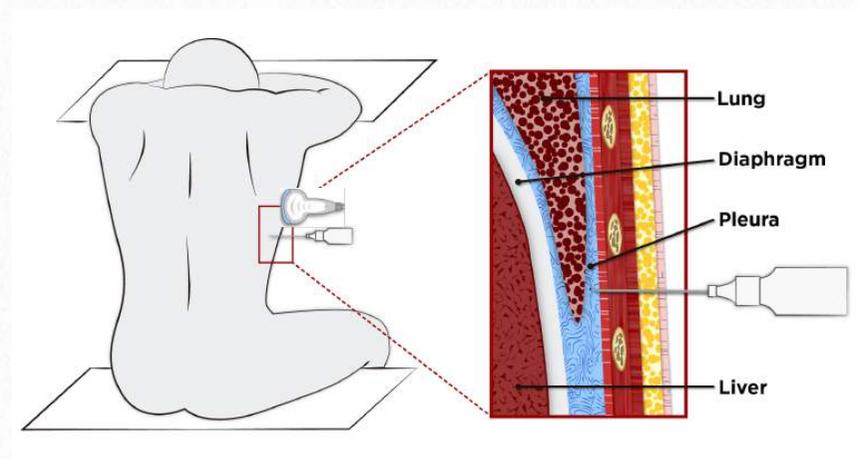
Probes to Use



Ultrasound image of Pleural Effusion



Thoracentesis Procedure



Placement of the needle: above the rib at the level of the pleural fluid.