PLEURAL EFFUSION

Pleural effusion is the most common sign of pleural pathology, caused by a mismatch in the rate of inflow and outflow within the pleural space.

GENERAL CONSIDERATIONS:

The pleura envelopes the lung with a serous membrane and contains a small amount of fluid which lubricates the pleural space, allowing the lungs to alter their shape and providing a cushion between the lungs and the chest wall. The parietal pleura is the portion of the pleura that lines the walls of the thoracic cavity including the ribs, diaphragm, and mediastinum. The visceral pleura is the portion of the pleura that lines the lungs and interlobar fissures, completely separating the different lobes. The visceral pleura lacks pain fibers and is relatively insensitive. The two pleural layers join together at the pulmonary hila and at the inferior pulmonary ligament. The anterior and posterior junction lines are formed where the two lungs contact each other and represents the interface of the right and left pleural surfaces of the thorax.

FORMATION AND CAUSES OF PLEURAL EFFUSIONS:

Pleural effusions are caused by:
- Increased capillary hydrostatic osmotic pressure
- Decreased colloid osmotic pressure
- Increased microvascular permeability
- Decreased lymphatic pleural drainage
- Decreased pleural surface pressure
- Transdiaphragmatic passage of peritoneal fluid

Causes of pleural effusion include congestive heart failure, metastatic disease to the pleura, infections, pulmonary infarcts, tuberculous pruritus, pleural mesothelioma, systemic lupus erythematosus, nephrotic syndrome, pleural trauma, and Meigs syndrome.

TRANSUDATES VERSUS EXUDATES:

TRANSUDATES:
Pleural fluid can be either a transudate or an exudate. Transudates result from decrease in colloid osmotic pressure and are caused by disease states that cause hyponatremia. Transudates can also result from increased microvascular hydrostatic osmotic pressure. With transudative fluid, the pleura is normal. Congestive heart failure is the most common cause, with other less common causes including cirrhosis, nephrotic syndrome, nephrogenic effusion, hypoalbuminemia, constrictive pericarditis, atelectasis, pulmonary embolus, and myxedema. Transudates are often bilateral.

EXUDATES:
Pleural effusions which are exudates result from an alteration in the pleural surface from increased permeability or decrease in lymphatic flow, usually secondary to pleural malignancy or inflammatory conditions. When the ratio of pleural fluid to serum protein is greater than 0.5, or when the ratio of pleural fluid to serum LDH is greater than 0.6, exudative fluid can be established.
**RADIOGRAPHIC APPEARANCE:**

The earliest finding of a small effusion on the chest x-ray is blunting of the costophrenic angle (CPA). The fluid first collects here because this is the most dependent portion of the lung when the patient is upright. The CPA, which usually has a sharp angle, becomes blunted with an upward, concave border. At least 200 cc of fluid is needed to blunt the CPA on an upright PA chest, and at times up to 500 cc may not be apparent. The most sensitive radiographic projection to detect small amounts of fluid is the lateral decubitus view. The appearance of the fluid will depend on the position of the patient and on the mobility of the fluid.

1) LARGE PLEURAL EFFUSIONS:

These effusions are of homogeneous density, and are located in the dependent portion of the chest. Their lateral border forms a meniscus, which is a crescentic, curvilinear upper lateral border. Effusions located at the lung bases obscure the diaphragm (silhouette sign), and if the fluid is adjacent to the heart border that will also be obscured (silhouette sign). In massive effusions, there can be widening of the interspaces of the ribs and contralateral displacement of the heart and mediastinum. The fluid may also extend into the fissures of the lung, resulting in enlargement and distention.

2) PLEURAL EFFUSIONS IN SUPINE PATIENTS:

With the patient supine, the effusions layer posteriorly, creating a hazy density over the entire hemithorax affected. It is possible to miss large effusions in supine patients because of the posterior layering of the effusions. Generally, the volume of fluid is underestimated when the patient is supine. As the fluid flows into the apices of the lung, there can be "capping" of the lung apices. This can be used as an early sign of pleural fluid in a supine patient because the apex of the lung is the most dependent portion of the thorax when the patient is in a supine position. The paraspinal soft tissues will be widened when the effusions are large and there can also be thickening of the interlobar fissures.

3) SUBPULMONIC EFFUSIONS:

Subpulmonic effusions occur when fluid collects between the diaphragm and the inferior surface of a lower lobe. This may simulate an elevated hemidiaphragm. When unilateral, subpulmonic effusions are more common on the right side. Bilateral, subpulmonic effusions may be overlooked, giving the appearance of apparently bilaterally elevated diaphragms. The superior margin of the fluid collection mimics the contour of the diaphragm, resulting in the appearance of an elevated ipsilateral diaphragm, however, there is flattening of the medial portion of the diaphragm, and the dome of the diaphragm appears shifted laterally. These are signs which can be used to differentiate a subpulmonic effusion from a truly elevated diaphragm. Also, blunting of the CPAs is a valuable clue for detection of subpulmonic effusions. When the subpulmonic effusion is on the left side, an increased distance between the gastric fundus and the leaf of the "diaphragm" can be another clue to the diagnosis. When a subpulmonic effusion is suspected, a lateral decubitus view can be very helpful in demonstrating the presence and amount of fluid and will also help to show the true position of the diaphragms. This can be helpful if volume loss is a consideration as the reason as to why the diaphragm is elevated.

4) LOCULATED PLEURAL EFFUSIONS:

Loculated pleural effusions are accumulations of pleural fluid within the fissures or between the visceral and parietal pleura when the pleural layers are adherent due to scarring, fibrosis, adhesions, or other factors which.
restrict movement, preventing the fluid from freely shifting in the pleural space.

**Location of loculated effusions:**

Loculated fluid occurs between the lung and chest wall or in interlobar fissures. They are often posterior, commonly forming adjacent to the chest wall, but can be anywhere.

**Appearance of loculated effusions:**

Loculated effusions usually appear as a circumscribed, homogeneous peripheral density, which, at times, if within an interlobular fissure, may simulate a tumor mass in the frontal view, but on the lateral view the density conforms to the location and direction of the fissure. Air fluid levels can appear, and often occur after thoracentesis has been performed, or can be seen if there is a broncho-pleural fistula or if a gas producing organism is present. To differentiate free fluid from loculated fluid, films with the patient in different positions should be obtained.