20

Disorders of the Pleura, Mediastinum, and Chest Wall

Eric J. Gartman and F. Dennis McCool

PLEURAL DISEASE

The pleura is a thin membrane that covers the entire surface of the lung, inner surface of the rib cage, diaphragm, and mediastinum. There are two pleural membranes: the visceral pleura, which covers the lung; and the parietal pleura, which lines the rib cage, diaphragm, and mediastinum. A layer of mesothelial cells lines both pleural surfaces. The closed space in between the surface of the lung and the chest cavity is called the *pleural space.* A small amount of fluid normally resides in this space and forms a thin layer between the pleural surfaces. Pleural fluid serves as a lubricant for the visceral and parietal pleurae as they move against each other during inspiration and expiration.

The blood vessels in the visceral pleura are supplied from the pulmonary circulation and have less hydrostatic pressure than the blood vessels in the parietal pleura, which are supplied by the systemic circulation. The pressure in the pleural space is subatmospheric during quiet breathing. Fluid is filtered from the higher-pressure vascular structures into the pleural space. The normal fluid turnover is about 10 to 20 mL per day, with 0.2 to 1 mL remaining in the pleural space. Pleural fluid usually contains a small amount of protein and a small number of cells that are mostly mononuclear cells. Although both parietal and visceral pleurae contribute to pleural fluid formation, most of the fluid results from filtration of the higher-pressure vessels supplying the parietal pleura.

After the fluid enters the pleural space, it is drained from the pleural space by a network of pleural lymphatics located beneath the mesothelial monolayer. The lymphatics originate in stomas on the parietal pleural surface. In abnormal circumstances of increased fluid production or impaired removal, fluid can accumulate in the pleural space. Factors that promote the entry of fluid into the pleural space include an increase in systemic venous pressure, an increase in pulmonary venous pressure, an increase in permeability of pleural vessels, and a reduction in pleural pressure. Conditions that increase hydrostatic pressure can be seen in congestive heart failure; changes in pleural membrane permeability can be seen in various inflammatory states or malignancy; and a reduction in pleural pressure can be seen with atelectasis. Occasionally, microvascular oncotic pressure may be sufficiently reduced to promote fluid entry into the pleural space in patients with hypoalbuminemia. Factors that block lymphatic drainage and interfere with the egress of fluid from the pleural space include central lymphatic obstruction and obstruction of lymphatic channels at the pleural surface by tumor.

Pleural Effusion

Pleural effusion is the accumulation of fluid in the pleural space. Pleural effusions usually are detected by chest radiography; however, the volume of fluid in the pleural space must exceed 250 mL to be visualized on a chest radiograph. When an effusion exists, there is blunting of the costophrenic angle on a posteroanterior chest film, which represents a fluid meniscus that can be detected posteriorly on the lateral chest radiograph, and fluid occasionally can be demonstrated in the minor or major fissures (E-Figs. 20-1 and 20-2). Apparent elevation or changes in the contour of the diaphragm on a posteroanterior chest film may signify a subpulmonic effusion, so called because it retains the general shape of the diaphragm without blunting the costophrenic angle; however, it is evident on the lateral film.

A decubitus chest radiograph can be obtained to determine whether the fluid is free flowing or loculated. Computed tomography (CT) of the chest provides better definition of the pleural space than plain radiography. Chest CT is particularly useful in defining loculated effusions and in differentiating pulmonary parenchymal abnormalities from pleural abnormalities, atelectasis from effusion, and loculated effusion from lung abscess or other parenchymal processes (E-Fig. 20-3). The edge of a parenchymal process usually touches the chest wall and forms an acute angle, whereas that of an empyema is usually an obtuse angle.

Thoracentesis is a procedure in which fluid is aspirated from the pleural space. To help minimize procedural complications and assist in needle placement, ultrasound or CT guidance should be used to direct the thoracentesis catheter into the pleural space.

Classifying pleural effusions as transudates or exudates greatly assists with the differential diagnosis. The approach to pleural effusions is outlined in E-Figure 20-4. Further analysis of pleural fluid may provide a definitive diagnosis (e.g., malignancy); however, even without a definitive diagnosis, pleural fluid analysis can be useful in excluding possible causes of disease such as infection.

Transudates

Effusions that accumulate due to changes in oncotic and hydrostatic forces usually have a low protein content and are called *transudates* (Table 20-1). Congestive heart failure is the most common cause of a transudate, and the effusions are typically bilateral. If the effusion is unilateral, it involves the right hemithorax in most instances. Effusions due to heart failure almost