- Increased hydrostatic pressure, as in congestive heart failure
- Increased vascular permeability, as in pneumonia
- Decreased osmotic pressure, as in nephrotic syndrome
- Increased intrapleural negative pressure, as in atelectasis
- Decreased lymphatic drainage, as in mediastinal carcinomatosis

Inflammatory Pleural Effusions

Serous, serofibrinous, and fibrinous pleuritis all have an inflammatory basis, differing only in the intensity and duration of the process. The most common causes of pleuritis are disorders associated with inflammation of the underlying lung, such as tuberculosis, pneumonia, lung infarcts, lung abscess, and bronchiectasis. Rheumatoid arthritis, systemic lupus erythematosus, uremia, diffuse systemic infections, other systemic disorders, and metastatic involvement of the pleura can also cause serous or serofibrinous pleuritis. Radiation used in therapy for tumors in the lung or mediastinum often causes a serofibrinous pleuritis. In most of these disorders, the serofibrinous reaction is only minimal, and the fluid exudate is resorbed with either resolution or organization of the fibrinous component. However, large amounts of fluid sometimes accumulate and compress the lung, causing respiratory distress.

A purulent pleural exudate *(empyema)* usually results from bacterial or mycotic seeding of the pleural space. Most commonly, this seeding occurs by contiguous spread of organisms from intrapulmonary infection, but occasionally, it occurs through lymphatic or hematogenous dissemination from a more distant source. Rarely, infections below the diaphragm, such as the subdiaphragmatic or liver abscess, may extend by continuity through the diaphragm into the pleural spaces, more often on the right side.

Empyema is characterized by loculated, yellow-green, creamy pus composed of masses of neutrophils admixed with other leukocytes. Although empyema may accumulate in large volumes (up to 500 to 1000 mL), usually the volume is small, and the pus becomes localized. Empyema may resolve, but more often the exudate organizes into dense, tough fibrous adhesions that frequently obliterate the pleural space or envelop the lungs; either can seriously restrict pulmonary expansion.

Hemorrhagic pleuritis manifested by sanguineous inflammatory exudates is infrequent and is found in hemorrhagic diatheses, rickettsial diseases, and neoplastic involvement of the pleural cavity. The sanguineous exudate must be differentiated from hemothorax (discussed later). When hemorrhagic pleuritis is encountered, careful search should be made for the presence of exfoliated tumor cells.

Noninflammatory Pleural Effusions

Noninflammatory collections of serous fluid within the pleural cavities are called *hydrothorax*. The fluid is clear and straw colored. Hydrothorax may be unilateral or bilateral, depending on the underlying cause. The most common cause of hydrothorax is cardiac failure, and for this reason it is usually accompanied by pulmonary congestion and edema. Transudates may also collect in any other systemic disease associated with generalized edema and are therefore found in renal failure and cirrhosis of the liver.

The escape of blood into the pleural cavity is known as *hemothorax*. It is almost invariably a fatal complication of a ruptured aortic aneurysm or vascular trauma or it may occur postoperatively.

Chylothorax is an accumulation of milky fluid, usually of lymphatic origin, in the pleural cavity. Chyle is milky white because it contains finely emulsified fats. Chylothorax is most often caused by thoracic duct trauma or obstruction that secondarily causes rupture of major lymphatic ducts. This disorder is typically caused by malignancies that obstruct the major lymphatic ducts. Usually such cancers arise within the thoracic cavity and invade the lymphatics locally, but occasionally more distant cancers metastasize via the lymphatics and grow within the right lymphatic or thoracic duct, producing obstruction.

Pneumothorax

Pneumothorax refers to air or gas in the pleural cavities and is most commonly associated with emphysema, asthma, and tuberculosis. It may be spontaneous, traumatic, or therapeutic. Spontaneous pneumothorax may complicate any form of pulmonary disease that causes rupture of an alveolus. An abscess cavity that communicates either directly with the pleural space or with the lung interstitial tissue may also lead to the escape of air. In the latter circumstance the air may dissect through the lung substance or back through the mediastinum (interstitial emphysema), eventually entering the pleural cavity. Traumatic pneumothorax is usually caused by some perforating injury to the chest wall, but sometimes the trauma pierces the lung and thus provides two avenues for the accumulation of air within the pleural spaces. Resorption of the air in the pleural space occurs in spontaneous and traumatic pneumothorax, provided that the original communication seals itself.

Of the various forms of pneumothorax, the one that attracts greatest clinical attention is so-called *spontaneous idiopathic pneumothorax*. This entity is encountered in relatively young people, seems to be due to rupture of small, peripheral, usually apical subpleural blebs, and usually subsides spontaneously as the air is resorbed. Recurrent attacks are common and can be quite disabling.

Pneumothorax may have as much clinical significance as a fluid collection in the lungs because it also causes compression, collapse, and atelectasis of the lung and may be responsible for marked respiratory distress. When the defect acts as a flap valve and permits the entrance of air during inspiration but fails to permit its escape during expiration, it effectively acts as a pump that creates the progressively increasing pressures of *tension pneumothorax*, which may be sufficient to compress vital mediastinal structures and the contralateral lung.

Pleural Tumors

The pleura may be involved by primary or secondary tumors. Secondary metastatic involvement is far more common than are primary tumors. The most frequent metastatic malignancies arise from primary neoplasms of the lung and breast. In addition to these cancers, malignancy