Pleural Disease in the Emergency Department

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KEYWORDS

• Pleura • Pleural effusion • Spontaneous pneumothorax
• Primary pneumothorax • Secondary pneumothorax

PLEURAL DISEASES

Introduction

The pleural cavity is traditionally considered a potential space. When disease processes cause this potential space to become a true space (filled with fluid, air, or tumor) the vital role of the pleura in lung mechanics becomes evident. Complaints related to pleural disease are common in the emergency department, with severity ranging from mild to life threatening.

Pleural Anatomy

The normal pleural anatomy consists of 2 thin layers of mesothelium that envelop a space containing a small amount of fluid on the order of 7 to 16 mL.[1,2] The pleura have 2 membranous components: the visceral and parietal pleura. The visceral pleura envelops the lung surface and invaginates between the lobes, creating the interlobar fissures. The parietal pleura lines the chest wall, diaphragm, and mediastinum and spares the hila. The superior aspect of the pleura extends 2 to 3 cm above the first rib, and the inferior aspect of the pleura ends at the sixth or seventh rib anteriorly but may extend beyond the twelfth rib posteriorly. The fact that the pleural space exists beyond the ribcage has important implications for injury during emergency procedures.[2–4] The main function of the pleural fluid and space is to allow movement of the lungs in relation to the chest wall. The pleural fluid provides a means of mechanical coupling, ensuring effective respiratory mechanics. For effective coupling to occur the volume of pleural liquid must be minimal.[5–7]

The blood supply of the parietal pleura originates from the systemic arteries that anatomically cover it. The visceral pleura is supplied by the pulmonary and bronchial

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arterial systems.[3] Sensory innervation of the parietal pleura is provided mostly by somatic intercostal nerves, with the exception of the central diaphragm, which is innervated, by the phrenic nerve. The visceral pleura has no specific nociceptors, therefore the presence of pleuritic chest pain indicates parietal pleural involvement. Pleural inflammation in the region of the central diaphragm is often referred to the ipsilateral shoulder.[8]

The lymphatic anatomy of the pleura consists of parietal pores that transfer fluid and particulate matter directly to the lymphatic system.[4,9] These lymphatic channels are a major route of drainage from the pleural space because the visceral pleura lymphatics do not connect directly to the pleural space.[3]

Pleural Effusion

Physiology and pathophysiology

Pleural fluid originates from systemic pleural vessels as well as the interstitium; homeostasis within the pleural space follows Starling's law. Intrapleural pressure is lower than the interstitial pressure of pleural tissues, favoring flow of pleural fluid into the pleural space.[7] Because pleural fluid is effectively a filtrate, the protein and cellular concentration in the fluid is typically low.[4] Normally, the influx of fluid into the pleural space is balanced by its removal via the lymphatic system. Any pathologic process that results in a loss of this homeostasis ultimately causes fluid accumulation (**Box 1**). In disease states the normal composition of pleural fluid is altered, which allows for diagnosis via pleural fluid analysis.

Cause of pleural effusion

The most common disease processes resulting in pleural effusion include congestive heart failure, malignancy, and infection.[10] The differential diagnosis of pleural effusion is extensive (**Box 2**).

Clinical features

The clinical presentation along with radiographic assessment guides diagnostic workup as well as treatment. Symptoms related to pleural effusion are dependent on the underlying disease process and the overall health of the patient's respiratory system, as well as the volume, type, and rate of accumulation of liquid occupying the pleural space. When excess volume enters the pleural space, the lungs respond by recoiling inward and the chest wall recoils outward. If the compensatory response is minimal and the lung and chest wall are of normal compliance, symptoms may be minimal. Larger effusions result in restrictive respiratory impairment with low total lung capacity, functional residual capacity, and forced vital capacity (FVC). As a result hypoxemia and ventilation-perfusion mismatch may occur.[11] Dyspnea typically occurs in the presence of large amounts of excess volume in the pleural space or if the respiratory system has abnormal underlying mechanics. Chest pain is resultant

Box 1
Mechanisms of fluid accumulation in the pleura

1. Increase in hydrostatic pressure
2. Decrease in oncotic pressure
3. Decrease in pleural space pressure
4. Increased permeability of vascular microcirculation
5. Blocked lymphatic drainage
6. Fluid movement from peritoneum