

Diseases of the pulmonary pleura

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1 Introduction: Basic anatomy of the pleura

The pulmonary pleurae (from singular pleura) are the two opposing layers of serous membrane overlying the lungs, mediastinum and the inside surfaces of the surrounding chest walls.

The pleura that covers the surface of each lung, called the visceral pleura. The outer layer that covers the chest wall, called the parietal pleura, lines the inner surfaces of the thoracic cavity, also covering the upper surface of the diaphragm, covering the inside of rib cage.

Between two pleurae is a potential space called the pleural cavity (also pleural space), which is normally collapsed and filled with only a tiny amount of serous fluid (pleural fluid) secreted by the pleurae, and is clinically considered vacuumous under healthy conditions.

2 Pleural effusion

A pleural effusion results when fluid collects between the parietal and visceral pleural surfaces of the thorax. A thin layer of fluid is always present in this space for lubrication and ease of movement of the lung during inspiration and expiration. If the normal flow of fluid is disrupted, with either too much fluid produced or not enough removed, then fluid accumulates, resulting in a pleural effusion.

The primary cause of a pleural effusion is simply an imbalance between the fluid production and fluid removal in the pleural space. The pleural space must, under normal circumstances, have a small amount of lubricating fluid present to allow the lung surface to glide within the thorax during the respiratory cycle. Normally approximately 15 mL/day of fluid enters this potential space, primarily from the capillaries of the parietal pleura. This fluid is removed by the lymphatics in the parietal pleura. At any one time there is about 20 mL of fluid in each hemithorax and the layer of fluid is 2 to 10 micrometres thick.

This regulated fluid balance is disrupted when local or systemic derangements occur. An effusion can be exudative or transudative.

1. An **exudative effusion** occurs when local factors are altered, such as inflammation of the lung or the pleura leading to capillary leakage of fluid into the pleural space. When local factors are altered, the fluid is protein- and lactate dehydrogenase (LDH)-rich and is called an **exudate**. Local factors include leaky capillaries from inflammation secondary to infection, infarction, or tumour.
2. A **transudative effusion**, by contrast, is mediated by systemic factors. These include an elevated portal pressure from cirrhosis, elevated visceral pulmonary capillary pressure from left-sided heart failure, elevated parietal pleural capillary pressure from right-sided heart failure, or low oncotic pressure due to hypoalbuminaemia (with or without fluid overload). When systemic factors are altered, producing a pleural effusion, the fluid tends to have low protein and LDH levels and is called a **transudate**. This can be caused by an elevated pulmonary capillary pressure with heart failure, excess ascites with cirrhosis, or low oncotic pressure due to hypoalbuminaemia (e.g., with nephrotic syndrome).

As a rule of thumb, exudate has a great amount of proteins, LDH or even cholesterol. So, we have Light's criteria for transudate/exudate differentiation, that is, these criteria are used to differentiate between a transudative and exudative effusion. An exudate is defined as the presence of any of the following:

- Pleural protein to serum protein ratio >0.5
- Pleural lactate dehydrogenase (LDH) to serum LDH ratio >0.6
- Pleural LDH greater than two-thirds of upper limit of normal for serum.

Transudate is seen in heart failure, hypoalbuminemia, and nephrotic syndrome. **Exudate** is seen in infections, malignancies, trauma, and inflammatory disorders.

3 Pneumothorax

Pneumothorax refers to gas within the pleural space. Therefore, pneumothorax occurs when air gains access to, and accumulates in, the pleural space. A primary spontaneous pneumothorax occurs in young people without known respiratory illnesses. A secondary spontaneous pneumothorax occurs in patients with pre-existing pulmonary diseases, such as emphysema.

Traumatic pneumothorax results from either penetrating or blunt injury to the chest. These may be the result of accidental or non-accidental injury.

Iatrogenic pneumothorax is a form of accidental traumatic pneumothorax, and occurs as a result of complications related to medical interventions, such as thoracentesis, endoscopic transbronchial biopsy, and central venous catheter placement, as well as barotrauma as a result of mechanical ventilation.

A tension pneumothorax is a medical emergency that requires immediate decompression.

Patients with a pneumothorax typically report dyspnoea and chest pain. In tension pneumothorax, patients are distressed with rapid laboured respirations, cyanosis, profuse diaphoresis, and tachycardia.

First-line treatment of pneumothorax depends on the size/type of pneumothorax. It may include observation with supplemental oxygen therapy, percutaneous aspiration of the air in the pleural space, insertion of a chest tube.