Anatomy of the Pleura

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KEYWORDS

• Pleural anatomy • Stomata • Visceral • Parietal
• Lymphatics

During development, to protect vital organs, the thoracic cavity is formed to house the lungs, heart, and mediastinal structures. This rigid encasement shields these organs from injury, but inhibits their ability to move freely. The pleura allows the lung to expand and contract within this space, and also transmits the mechanical forces of the diaphragm and chest wall with minimal friction and damage to the lung parenchyma and protects the lung from infection. The anatomy of the pleural space provides insight into how this complex layer performs all of these functions.

GROSS ANATOMY

The pleural space is defined by the visceral and parietal pleura, and contains a small amount of liquid to help facilitate the expansion and contraction of the lung and chest wall.[1] The visceral pleura covers the lung from the pulmonary hilum outward and lines all of the major and minor fissures, including two opposing layers that form the inferior pulmonary ligament (triangular ligament) (**Fig. 1**). The inferior pulmonary ligament is created through invagination of the lung as it grows into the thoracic cavity, pulling along the ventral and dorsal aspects of the visceral pleura (**Fig. 2**).[2] Because no defined plane exists between the lung and the visceral pleura, which is densely adherent to the elastic layer of the lung, its removal can cause tearing of the underlying lung parenchyma.[3]

The extension of the pleura into the interlobar spaces allow for each individual lobe to expand and contract separately.[2] If one lobe has an abnormality, such as occlusion of a segmental bronchus by tumor or secretions, the other ipsilateral lobes are often not restricted by its collapse. In many people these separations of the lobes, or fissures, by the visceral pleura are incomplete or septated, reducing the ability of the lung to tolerate these insults to one lobe.

The inner surface of the chest wall, mediastinum, and diaphragm are covered by the parietal pleura, and the transition between the parietal and visceral pleura is at the level of the pulmonary hilum.[4] A fat plane between the parietal pleura and the endothoracic fascia is present along most of the chest wall, allowing the pleura to be removed easily from the basilar structures. This plane is often lost through fusion of the parietal pleura to the underlying structures, especially along the pericardium and diaphragm, making the parietal pleura over these areas difficult to remove.

Within the thoracic cavity, the pleura extends 2 to 3 cm superiorly above the first rib, rising up beneath the sternocleidomastoid muscle, forming the cupola, or dome of the lung (**Fig. 3**). The inferior aspect of the pleural space varies from anterior to lateral to posterior, following the line of attachment between the diaphragm and the chest wall. Anteriorly, the pleura ends at the level of the sixth or seventh rib and, coursing at an oblique angle, it can reach below the twelfth rib posteriorly (**Fig. 4**).[5] Because the pleura stretches beyond the confines of the rib cage, injury in these areas is more common during procedures, increasing risk of pneumothorax.

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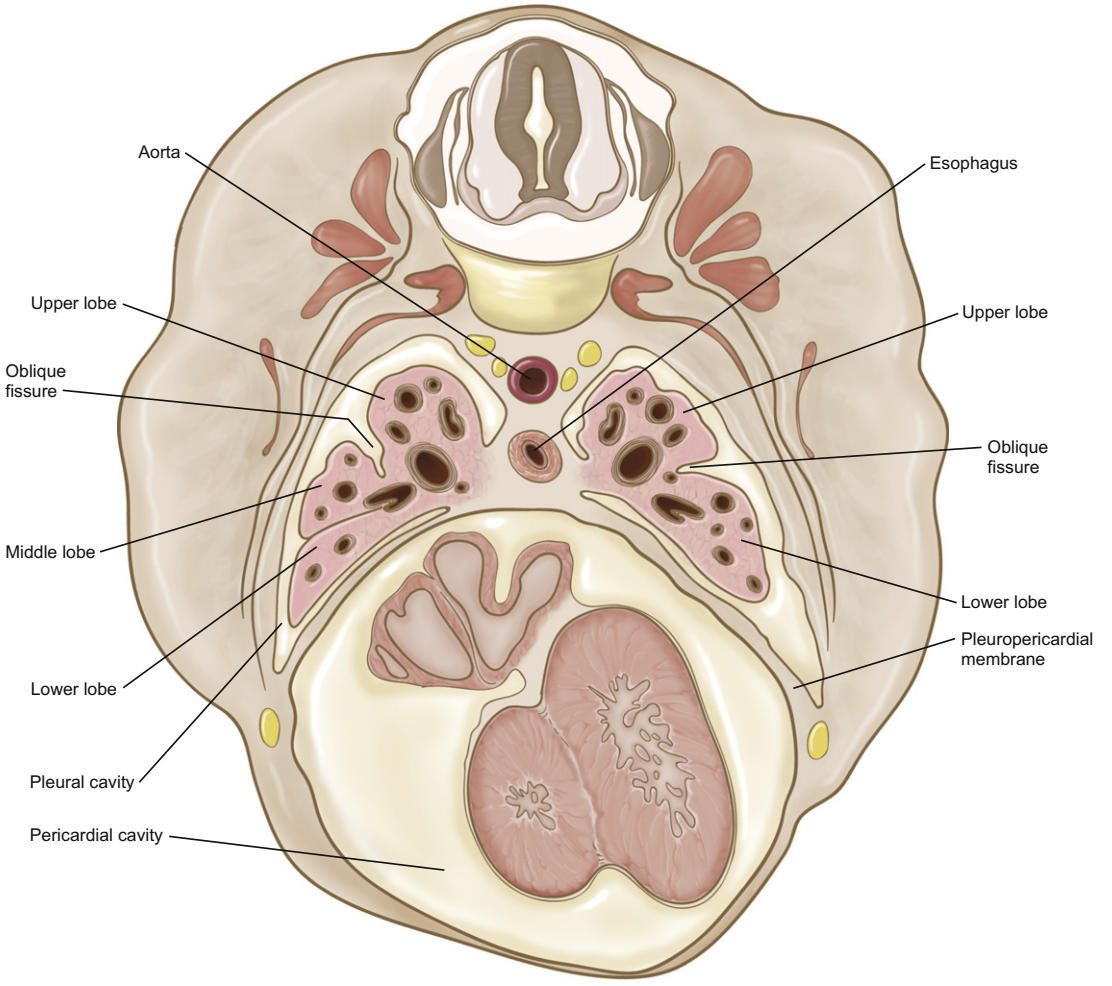

Fig. 1. As the primitive lungs grow into the pleural cavity, they are covered by the visceral pleura, which invaginates with the lung buds.

The visceral and parietal pleura are serosal membranes, but only the parietal pleura is believed to contain stomata.[6,7] The parietal pleura becomes thick and strong at the level of the diaphragm. It also is attached to the multiple suspensory ligaments at the level of the diaphragmatic hiatus. The pleural sinuses are where the parietal pleura is in contact at the end of expiration and filled with lung during inspiration. They include the anterior and posterior costomediastinal sinuses, costophrenic sinus, and mediastinophrenic sinus.

EMBRYOLOGY

During the third week of gestation, the mesoderm differentiates to create the lateral mesoderm as one of the early precursors of the pleural sac. The lateral mesoderm forms the somatic and splanchnic mesoderms, which will become the parietal and visceral pleura, respectively.[4] The diaphragm then splits the somatic and splanchnic mesoderms to form the peritoneal and pleural sacs during the seventh week of gestation. The pleural cavity is complete within the third month, with the formation of lung buds that invaginate the visceral pleura over its surface (**Fig. 5**).

BLOOD SUPPLY

Some disagreement still exists on the blood supply to the visceral pleura. Originally, McLaughlin and colleagues[8,9] found that the visceral pleura was supplied by either the pulmonary artery or the bronchial artery. Evaluation of sheep visceral pleura showed exclusive supply