Lecture 4 Thoracic cavity

Learning objectives

By the end of the lecture the student will be able to:
- Describe the mediastinum, and its divisions
- Describe the normal anatomy of the diaphragm
- Describe the normal anatomy of pleura
- Interpret the typical appearance of chest X-ray and CT scan.
- Interpret anatomical facts with its major clinical applications

The thoracic cavity is enclosed by the thoracic wall and the diaphragm.

It is subdivided into three major compartments (**Fig.4-1**):

- ♣ Median partition, the mediastinum.
- ♣ Laterally placed pleurae and lungs.

Mediastinum

It is a movable central partition that separates the two laterally placed pleural cavities and lungs.

Boundaries:

- Sternum anteriorly
- Thoracic vertebrae posteriorly
- Lungs and pleura laterally

Divisions (**Fig.4-2**):

By a transverse plane extending from the sternal angle (the junction between the manubrium and the body of the sternum) to the lower border of T4

1. Superior mediastinum

2. Inferior mediastinum

The inferior mediastinum is further subdivided into the ***anterior***, ***middle***, and ***posterior*** mediastinum by the **pericardial sac**.

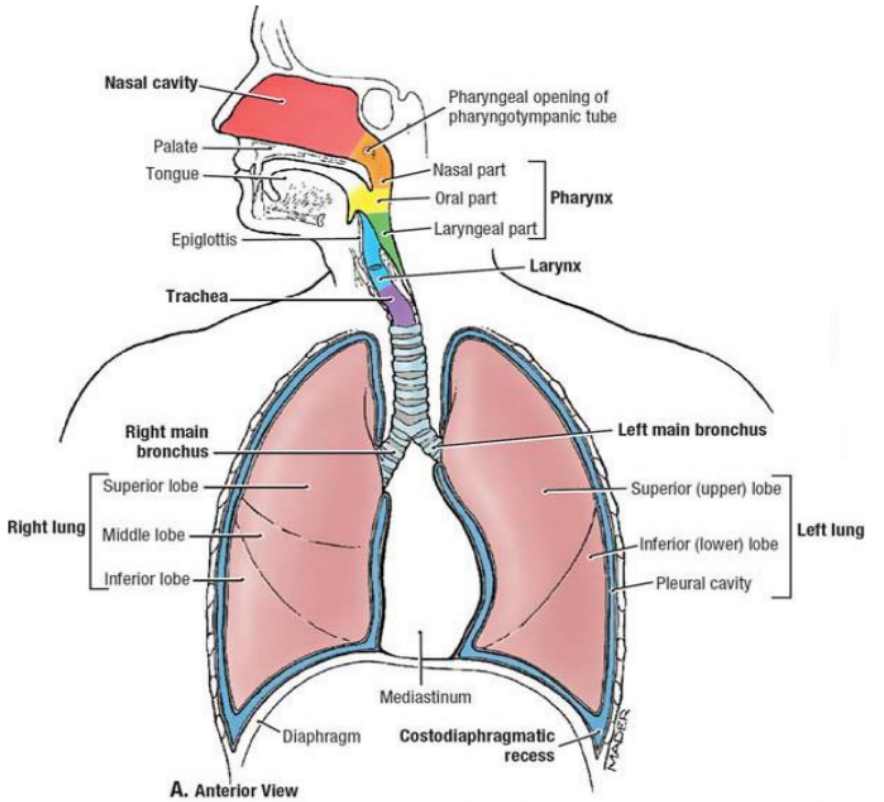

Fig. 4-1: Thoracic cavity

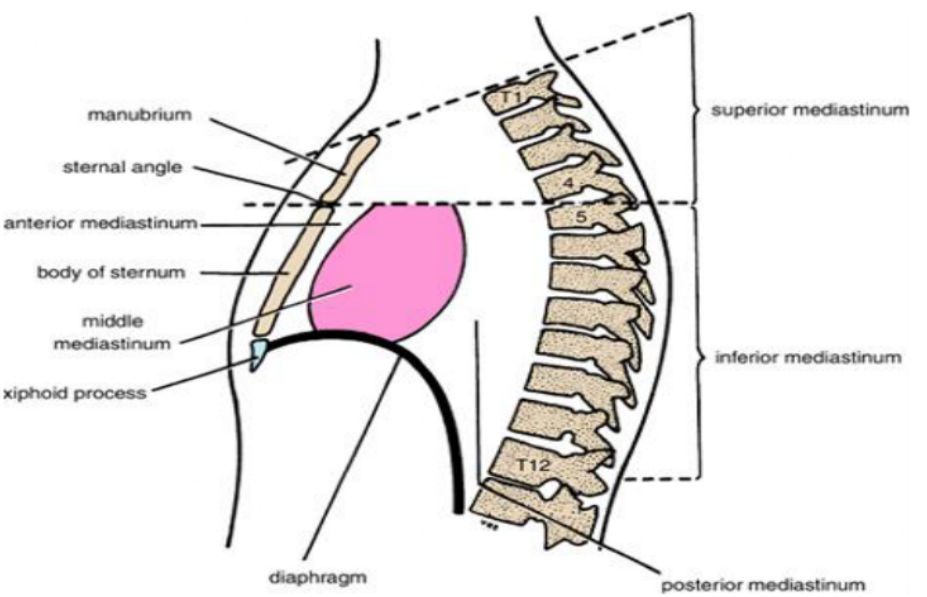

Fig. 4-2: Subdivisions of the mediastinum

Diaphragm

The diaphragm is a thin muscular and tendinous septum that separates the chest cavity above from the abdominal cavity below.

- **Origin:** Origin of the diaphragm can be divided into three parts:

1- **A sternal part** arising from the posterior surface of the xiphoid process.
2- **A costal part** arising from the deep surfaces of the lower six ribs and their costal cartilages.
3- **A vertebral part** arising by vertical columns or crura and from the arcuate ligaments.

- **Insertion**

From these peripheral attachments, muscle fibers converge to join the central tendon.

- **Shape of the Diaphragm(Fig.4-3)**

As seen from in front, the diaphragm curves up into right and left domes

- **Nerve Supply of the Diaphragm**

Phrenic nerve (C3, 4,5).

- **Functions of the Diaphragm**

* Muscle of inspiration: On contraction, the diaphragm pulls its central tendon down and increases the vertical diameter of the thorax. The diaphragm is the most important muscle used in inspiration.
* Muscle of abdominal straining: The contraction of the diaphragm assists the contraction of the muscles of the anterior abdominal wall in raising the intra-abdominal pressure for micturition, defecation, and parturition.

- **Openings in the Diaphragm:** The diaphragm has three main openings:

1- **The aortic opening:**
   - lies anterior to the body of the 12^{th} thoracic vertebra.
   - It transmits the aorta, the thoracic duct, and the azygos vein.
2- **The esophageal opening**

- lies at the level of the 10th thoracic vertebra
- It transmits the esophagus, the right and left vagus nerves,

3- The caval opening

- lies at the level of the 8th thoracic vertebra in the central tendon.
- It transmits the inferior vena cava and terminal branches of the right phrenic nerve.

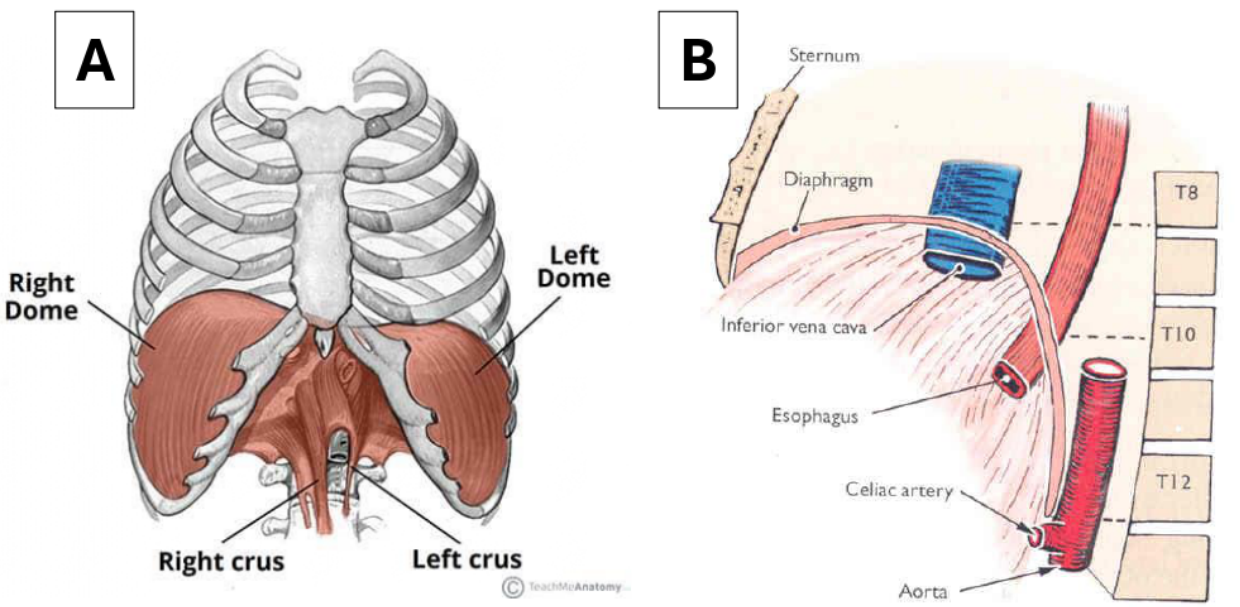

Fig.4-3: A-Position of the diaphragm B-major openings of the diaphragm

Pleura

The **pleura** is a double-layered serous membrane that surrounds each lung and lines the thoracic cavity. It consists of two continuous layers:

The parietal pleura –The visceral pleura

Parietal pleura:

⇒Lines the thoracic wall.

⇒Covers the diaphragm, and the lateral side of the mediastinum extends into the root of the neck. It is subdivided into four parts **(Fig. 4-4):**

1- **Costal pleura**: lines the inner surfaces of the ribs, the costal cartilages, the intercostal spaces, the sides of the vertebral bodies, and the back of the sternum.
2- **Diaphragmatic pleura**: covers the thoracic surface of the diaphragm.,
3- **Mediastinal pleura** covers and forms the lateral boundary of the mediastinum. At the hilum of the lung, it is reflected as a cuff around the vessels and bronchi and here becomes continuous with the visceral pleura.
4- **Cervical pleura** extends up into the neck, lining the undersurface of the suprapleural membrane. It reaches a level 1 inch above the medial third of clavicle.

Visceral pleura: completely covers the outer surfaces of the lungs and extends into the depths of the interlobar fissures.

The parietal and visceral layers of pleura are separated from one another by a slit-like space called the **pleural cavity** that contains a small amount of **pleural fluid**, which covers the surfaces of the pleura as a thin film and permits the two layers to move on each other with the minimum of friction.

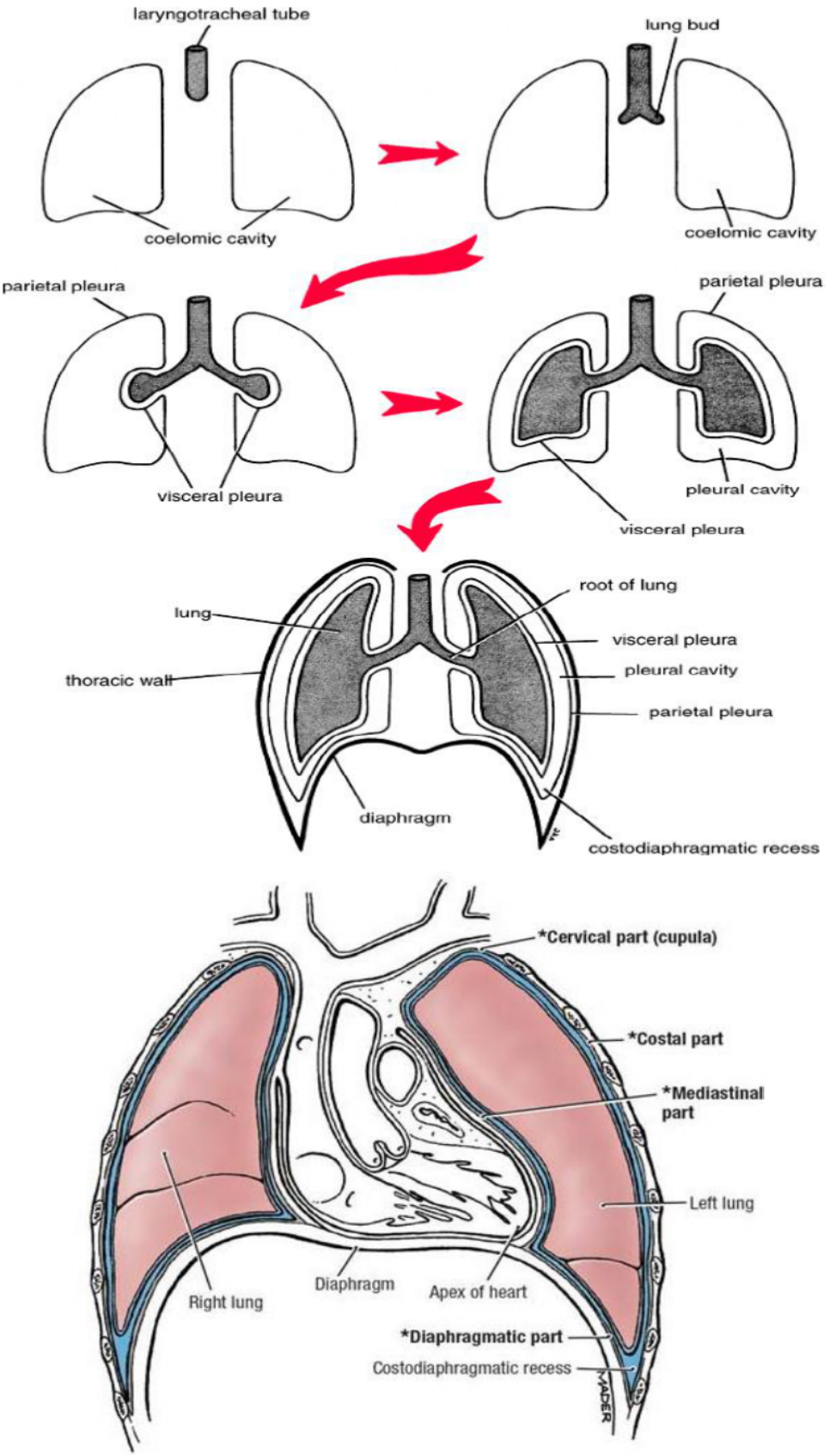

Fig.4-4: Divisions of the parietal pleura

Clinical Note: Accumulation of air (pneumothorax), fluid (pleural effusion), or blood (hemothorax) in the pleural cavity can impair lung expansion.

Pleural recesses

The lungs do not completely occupy the pleural cavities during expiration. This results in recesses in which two layers of parietal pleura become opposed. These recesses are:

1. **The costodiaphragmatic recesses** are slitlike spaces between the costal and diaphragmatic parietal pleurae**(Fig.4-4)**.
2. **The costomediastinal recesses** are situated along the anterior margins of the pleura. They are slitlike spaces between the costal and the mediastinal parietal pleurae**(Fig.4-5)**.

Nerve supply of the pleura

1-The parietal pleura: is sensitive to pain, temperature, touch, and pressure and is supplied as follows: **(Fig. 4-6)**

- The costal pleura is segmentally supplied by the intercostal nerves.
- The mediastinal pleura is supplied by the phrenic nerve.
- The diaphragmatic pleura is supplied over the domes by the phrenic nerve and around the periphery by the lower six intercostal nerves.

2-**The visceral pleura**: covering the lungs is sensitive to stretch but is insensitive to common sensations such as pain and touch. It receives an autonomic nerve supply from the pulmonary plexus.

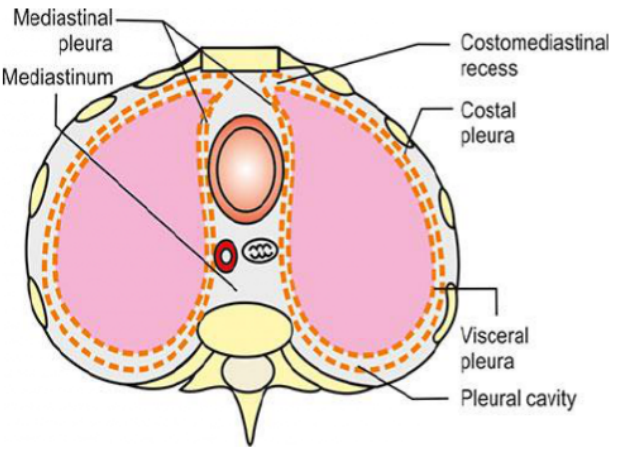

Fig.4-5: Transverse section in the thorax

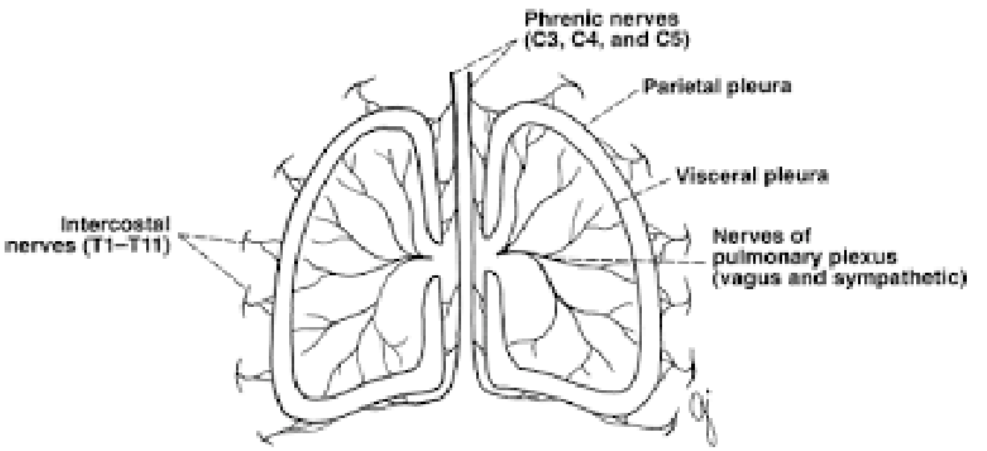

Fig. 4-6: Nerve supply of the parietal pleura

Surface markings of the pleura(Fig.4-7)

- **The apex of the pleura** is a point 1 in. (2.5 cm) above the junction of the medial and intermediate thirds of the clavicle.
- **The anterior border of the right pleura** represented as a curved line from the apex of the pleura **to the level of the sternoclavicular joint** and continue downwards reaching the **midline** at the **sternal angle**. It then descends vertically downwards until it reaches the **xiphisternal joint**.
- **The anterior border of the left pleura** has a similar course, but at the level of **the fourth costal cartilage** it deviates laterally and extends to the lateral

margin of the sternum to form **the cardiac notch**. It then turns sharply downward to the **xiphisternal joint**.

- **The lower border of the pleura** on both sides follows a curved line,
  - ⇒ which crosses **the 8th rib** in the midclavicular line and
  - ⇒ the **10th rib** in the midaxillary line, and
  - ⇒ reaches the **12th rib** adjacent to the vertebral column.
- **The posterior border** extends downward from the spinous process of the 7th cervical vertebra to the level of the 12th thoracic vertebra and lies about 1.5 in. (4 cm) from the midline.

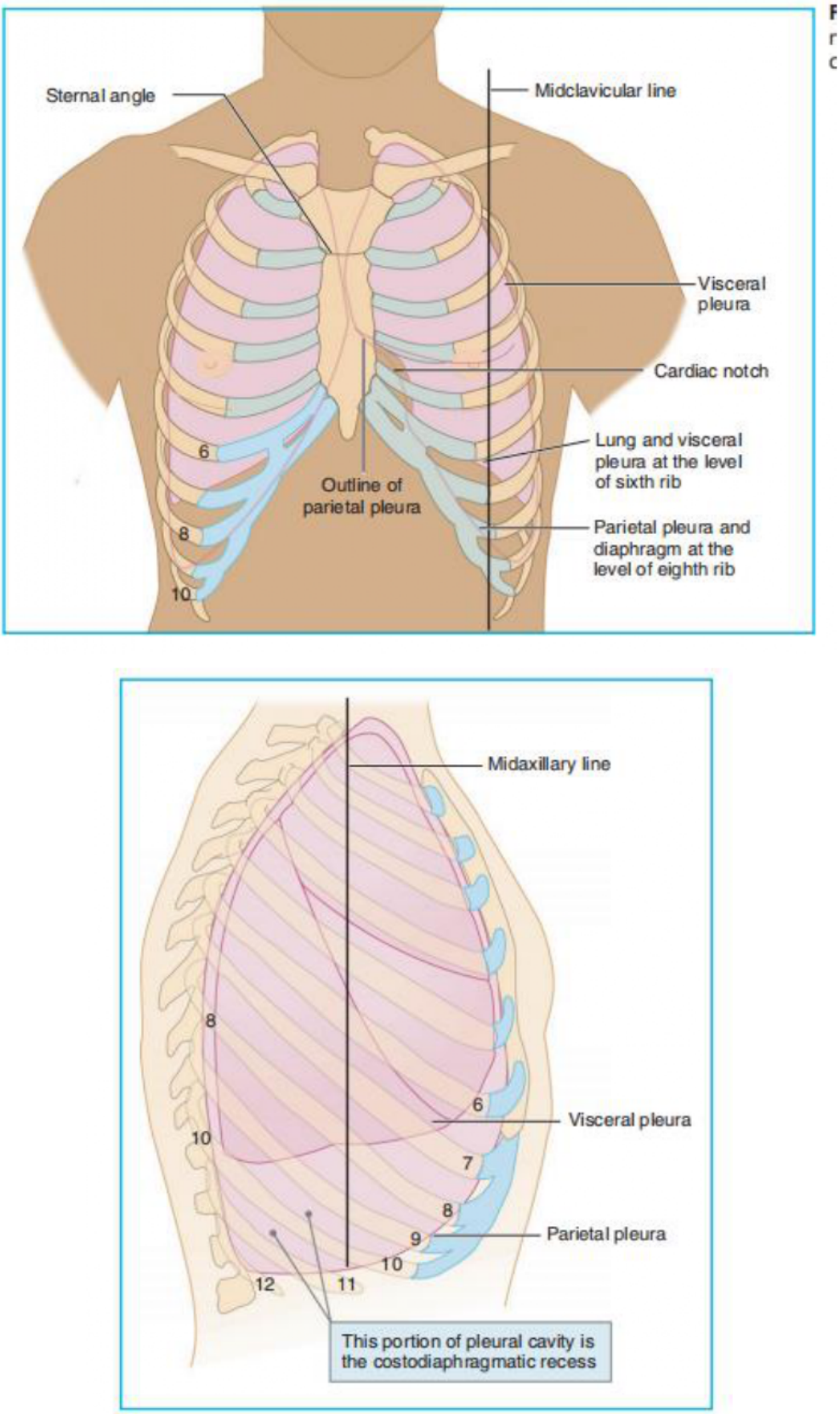

Fig.4-7: Surface markings of the pleura and lung.