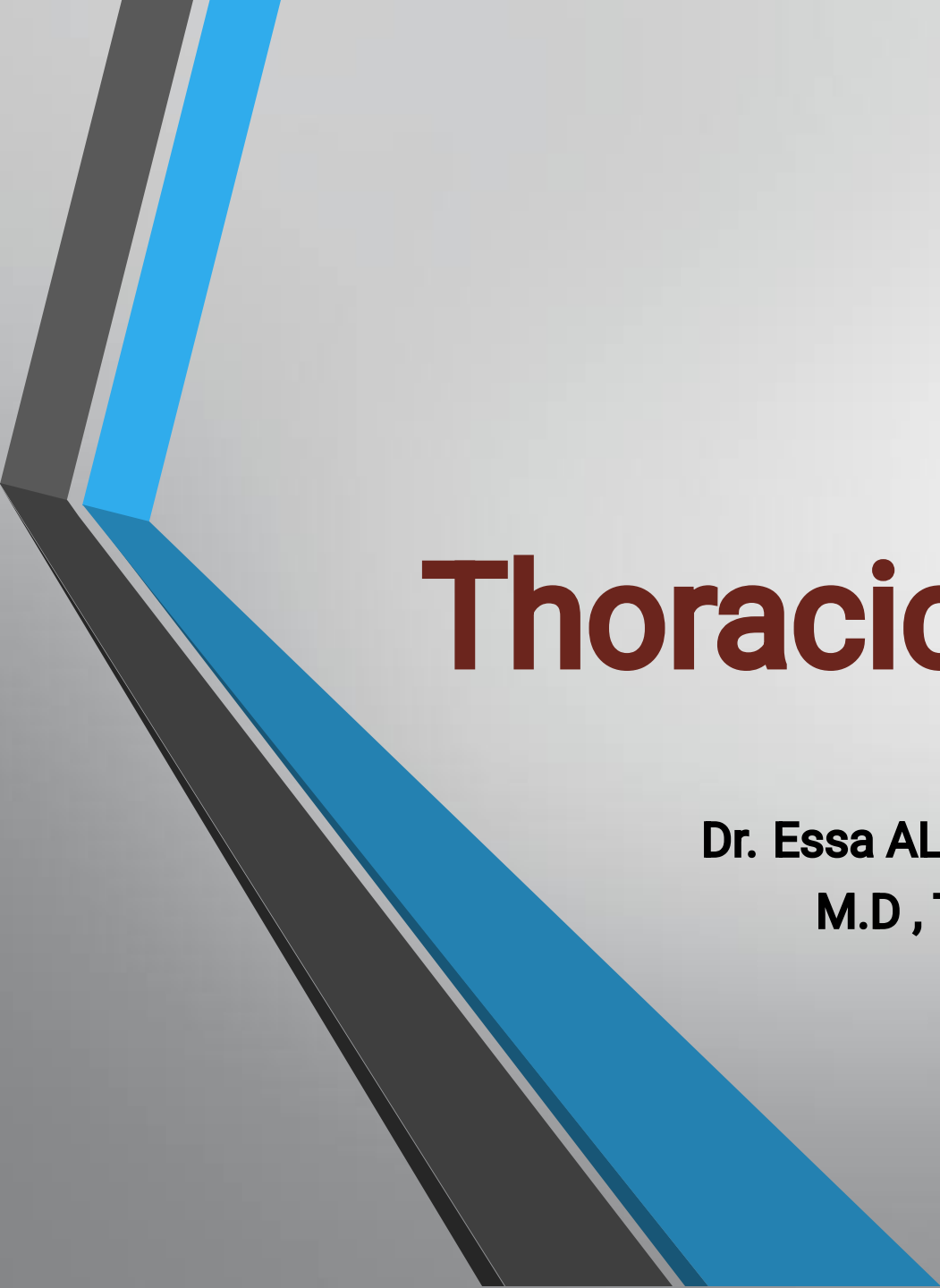




Thoracic Wall Anatomy

Dr. Essa AL-lahham
M.D , T.A

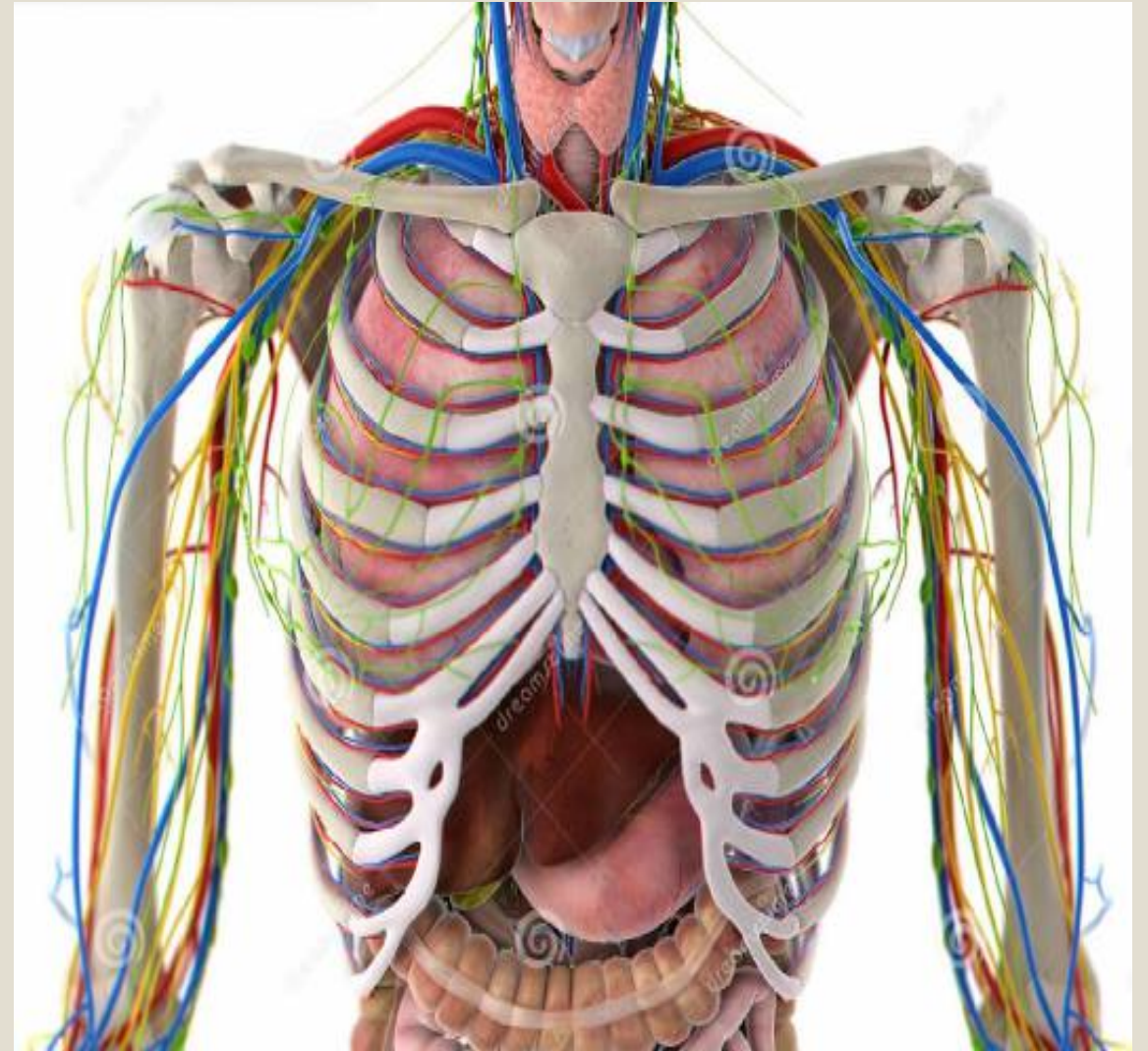
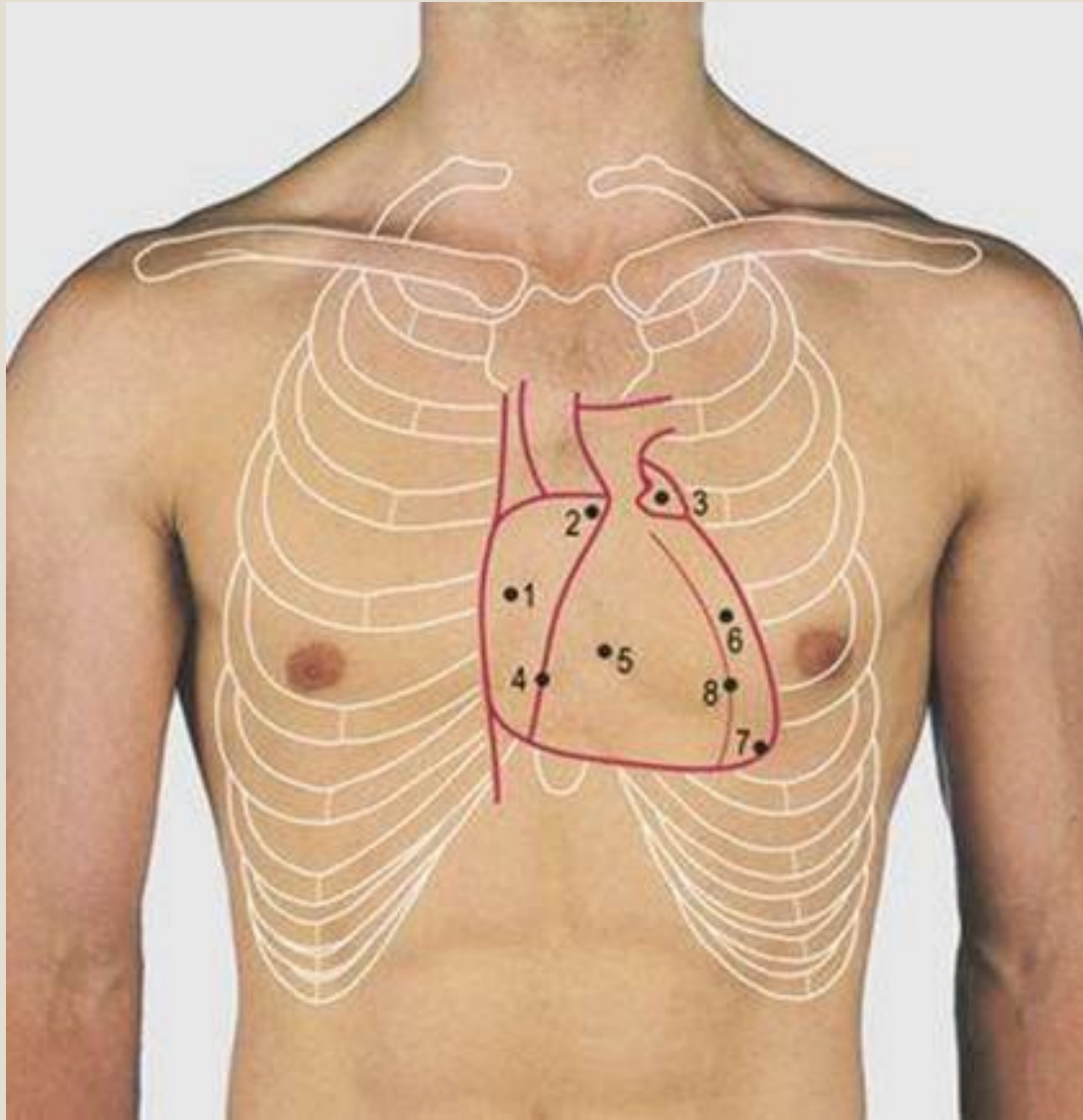
Basic Anatomy

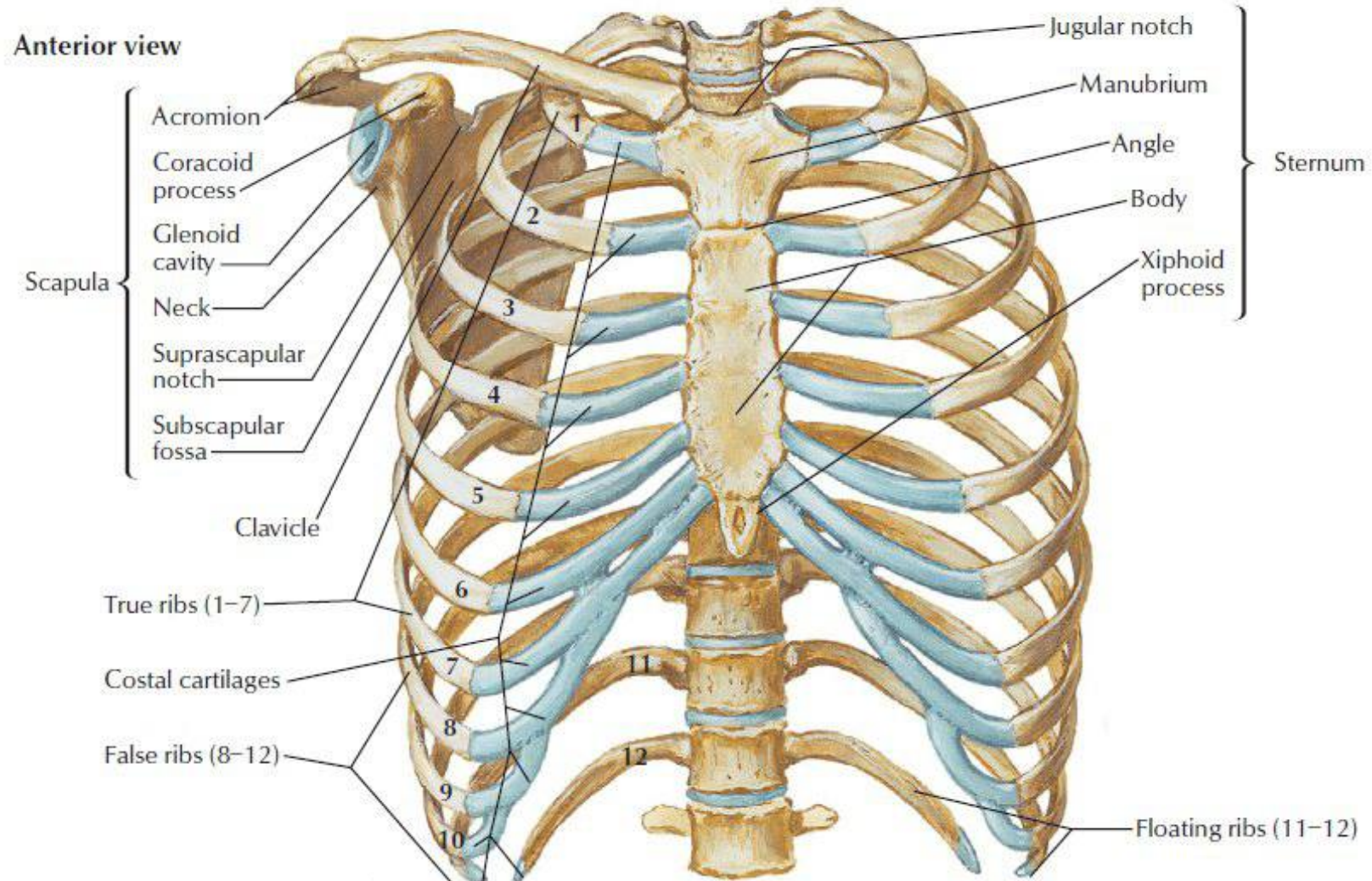
The thorax (or chest) is the region between the neck and the abdomen.

The framework of the walls of the thorax, which is referred to as the **thoracic cage**, is formed by:

- The vertebral column **behind** T1 – T12
the ribs and intercostal spaces **on either side**, and
the sternum and costal cartilages **in front**.

Superiorly, the thorax communicates with the neck,
and **inferiorly** it is separated from the abdomen by the diaphragm..



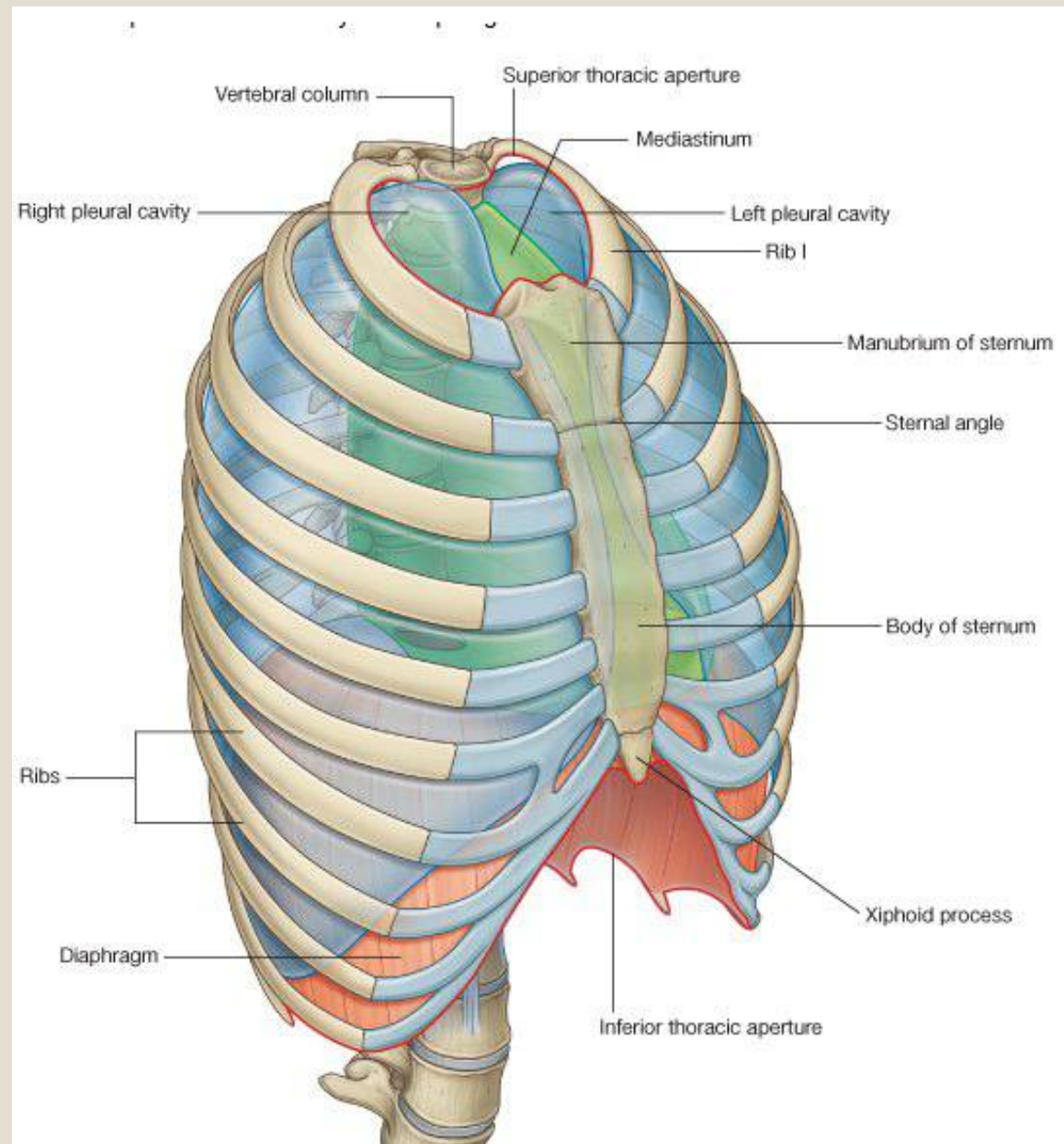


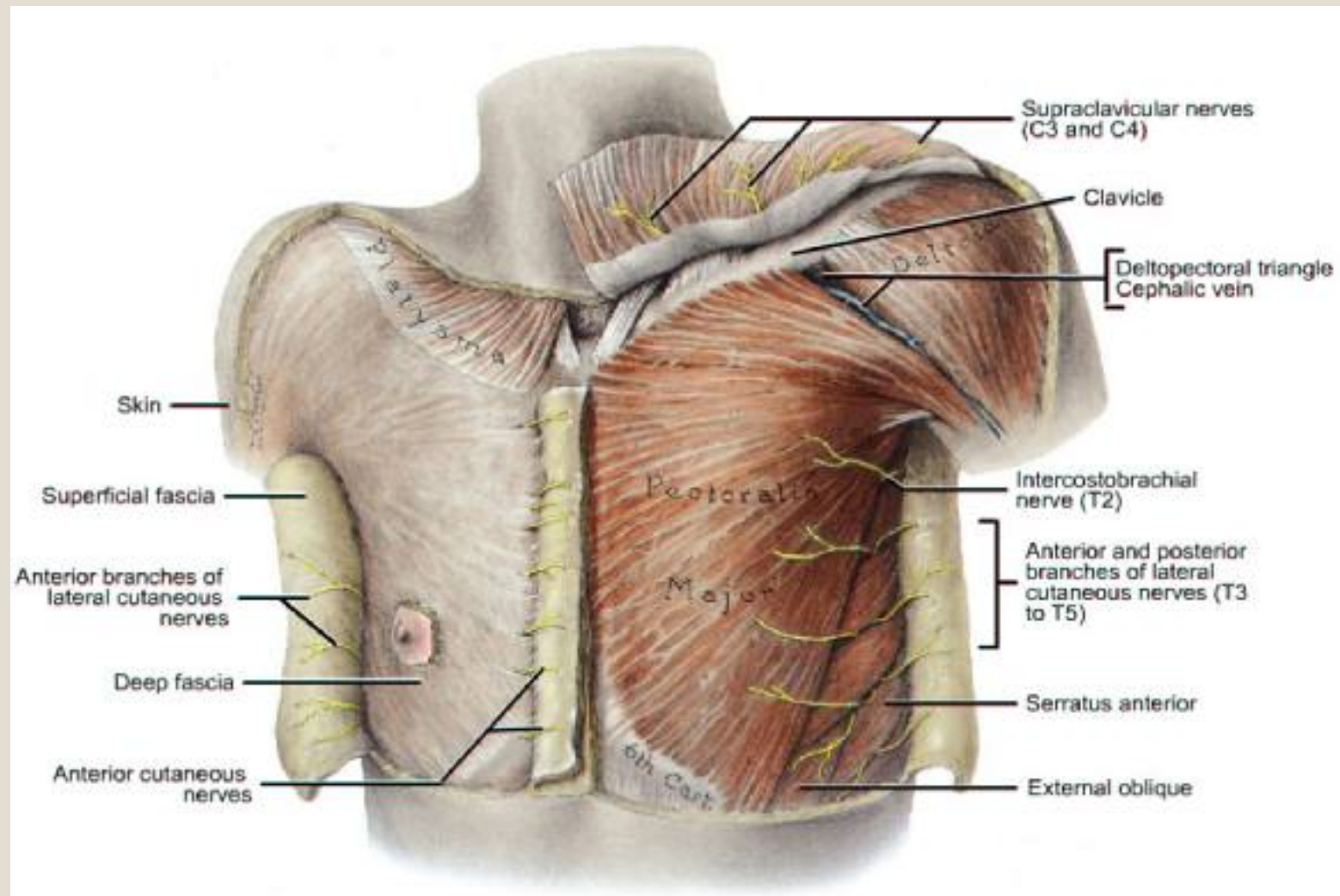
Basic Anatomy

The **thoracic cage** (bony structures) **protects the lungs and heart**, and provides an **attachment site** for the muscles of the thorax, upper limb, abdomen, and back.

The cavity of the thorax can be divided into a median partition, called the **mediastinum**, and the laterally placed **pleurae and lungs**.

The lungs are covered by a thin membrane called the **visceral pleura**, which passes from each lung at its root (lung hilum i.e., where the main air passages and blood vessels enter) to the inner surface of the chest wall, where it is called the **parietal pleura**.





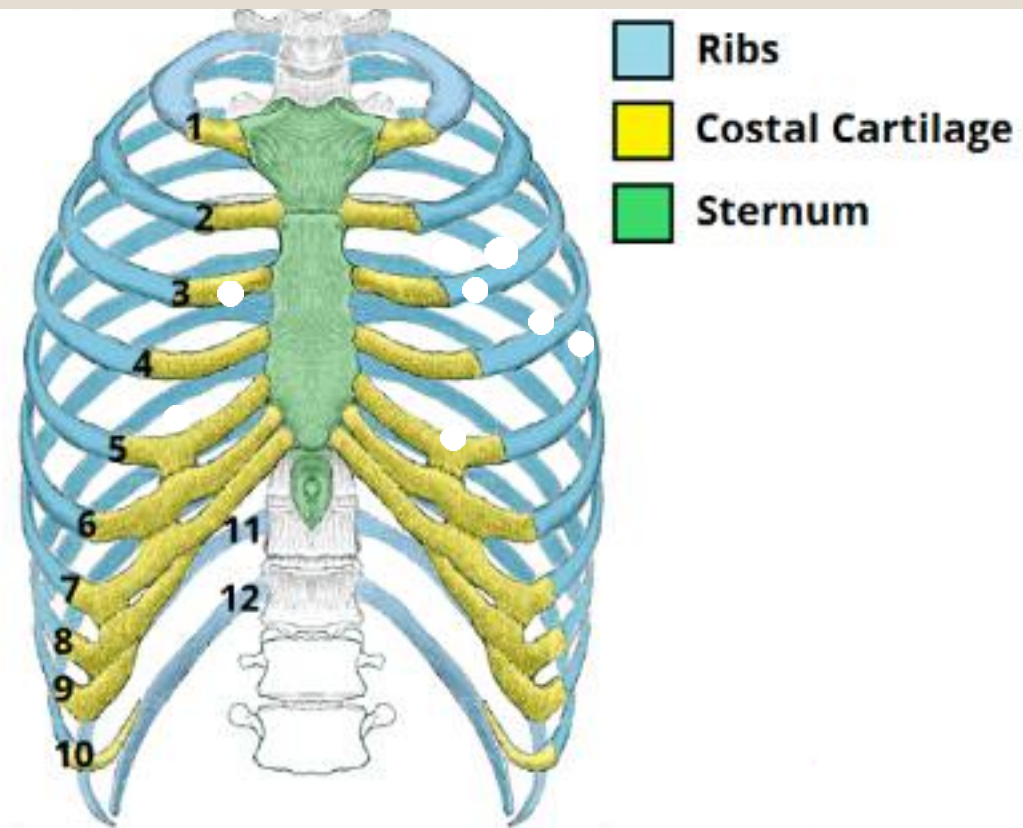
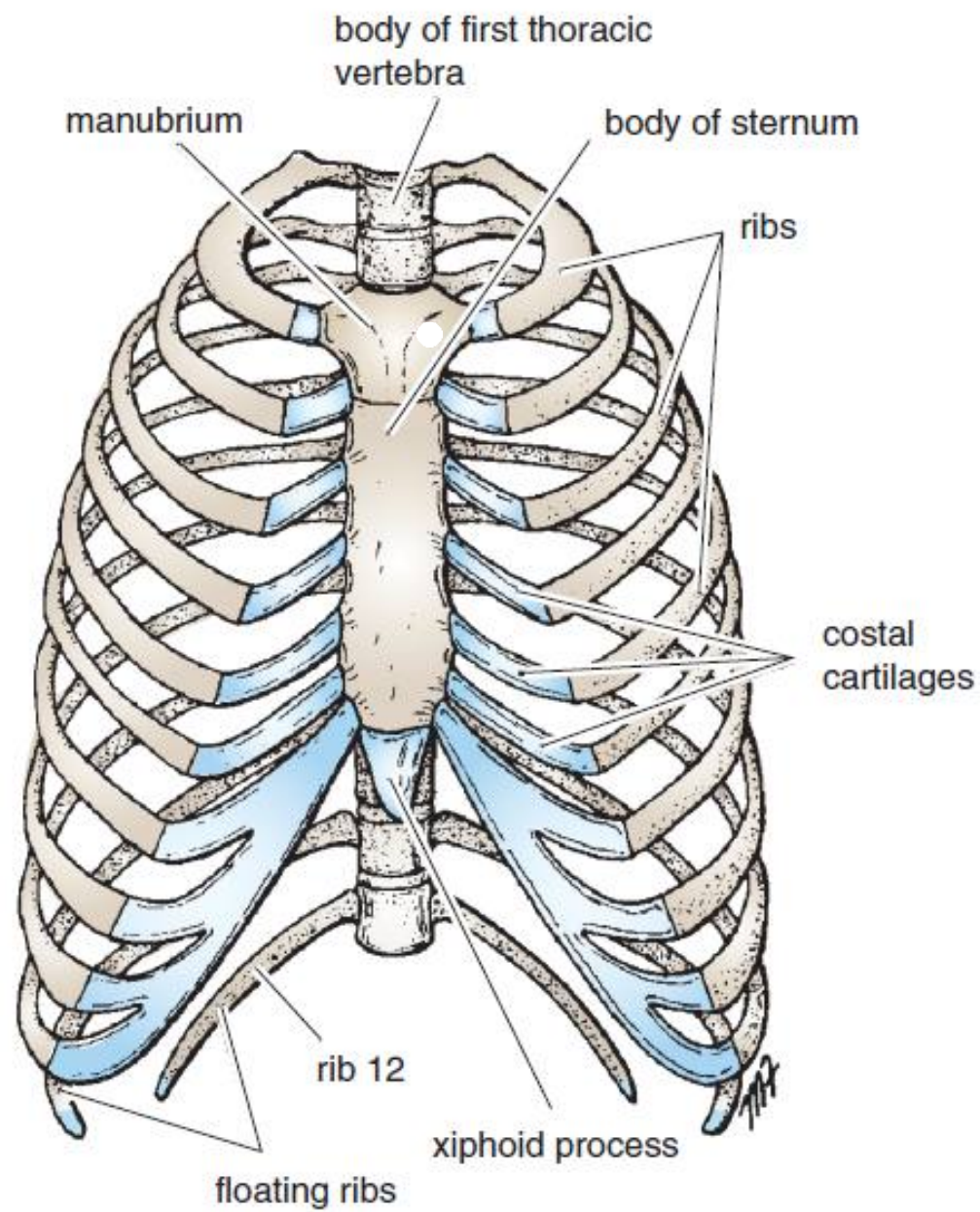


Fig 1 - Overview of the ribs and costal cartilage.

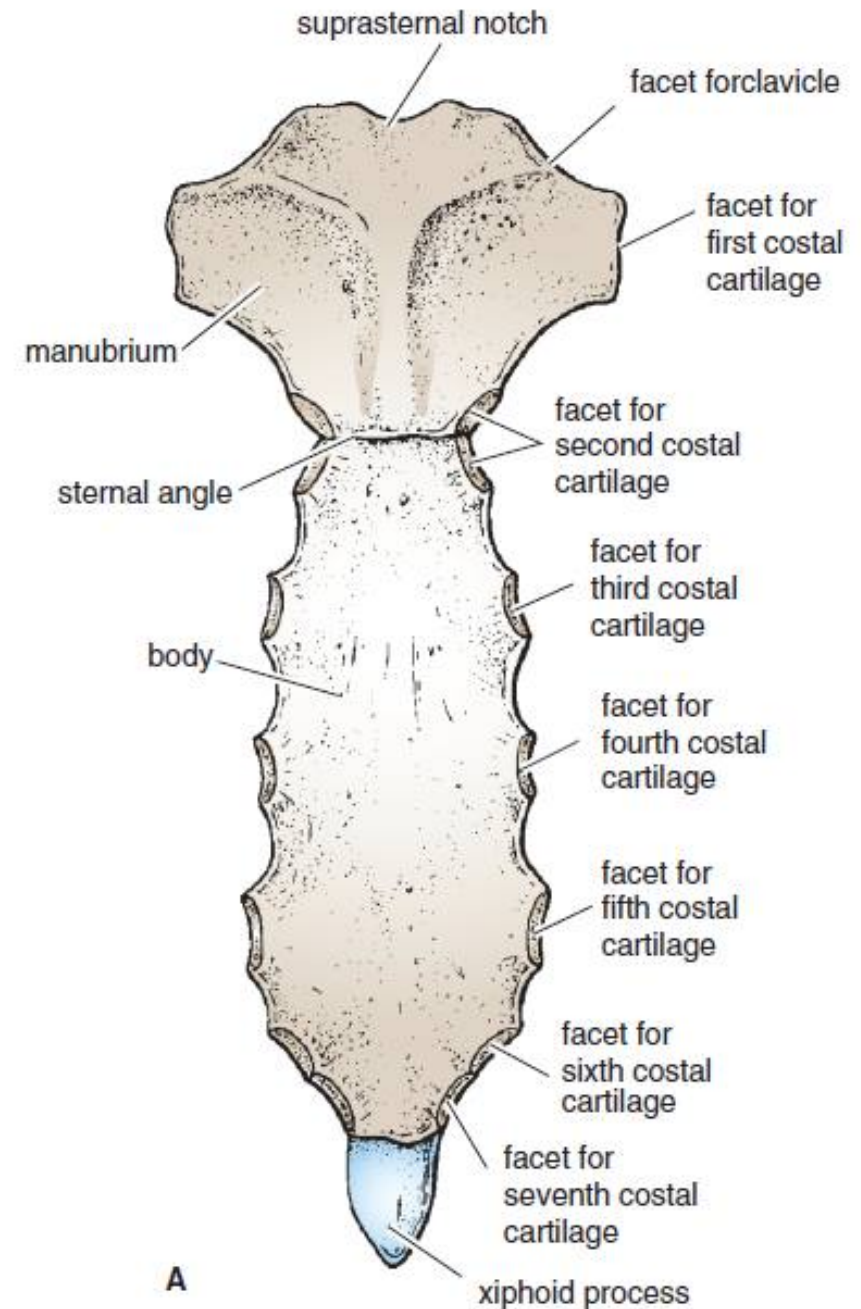
Sternum – Gross Anatomy

The sternum lies in the midline of the anterior chest wall.

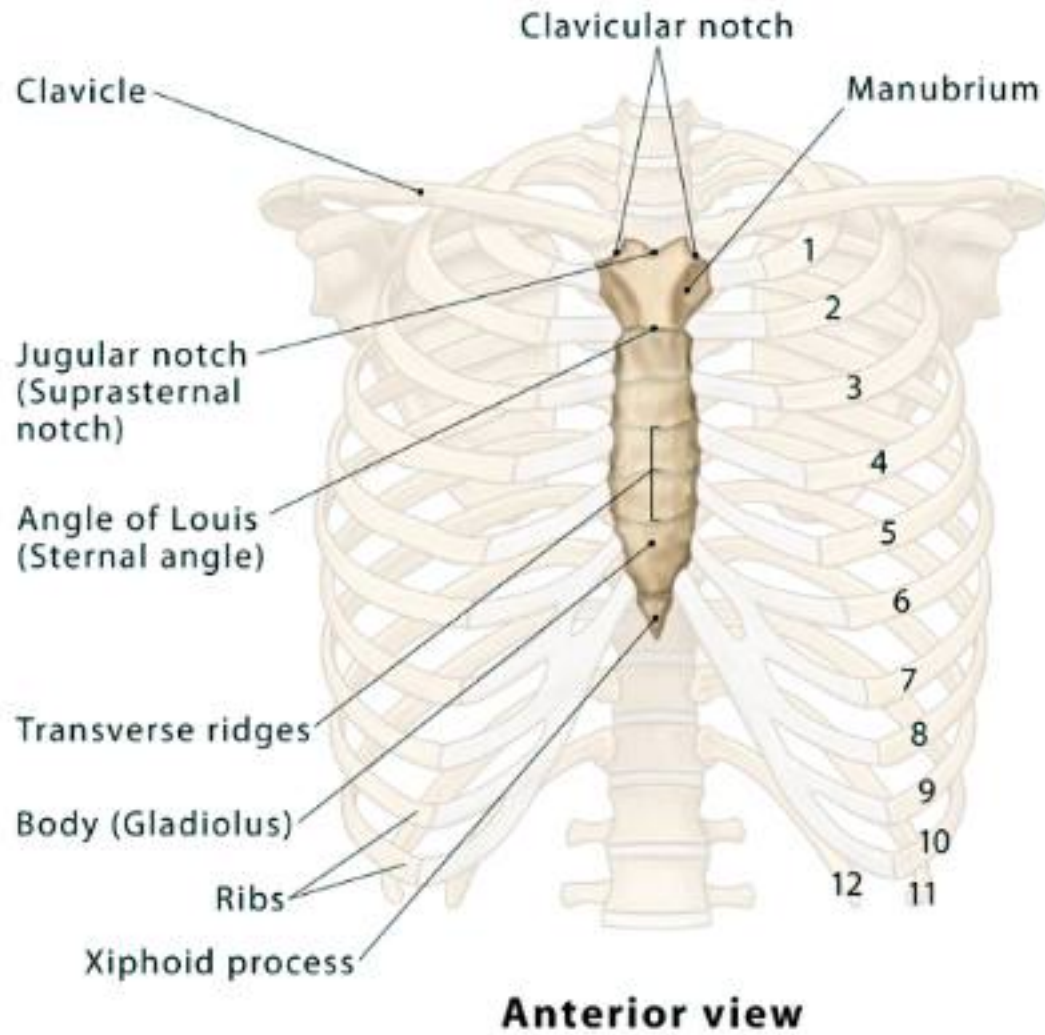
It is a flat bone that can be divided into three parts: **manubrium, body of the sternum, and xiphoid process.**

The **manubrium** articulates with the body of the sternum at the **manubriosternal joint**, and it also articulates with the clavicles and with the 1st costal cartilage and the upper part of the 2nd costal cartilages on each side.

The manubrium lies opposite to the 3rd and 4th thoracic vertebrae.



Sternum



TheSkeletalSystem.net

Sternum Parts Anatomy Labeled

The Angle of Louis (Sternal Angle)

The **sternal angle** (also known as the **angle of Louis**, **angle of Ludovic** or **manubriosternal junction**) is the joint formed by the articulation of the manubrium and the body of the sternum.

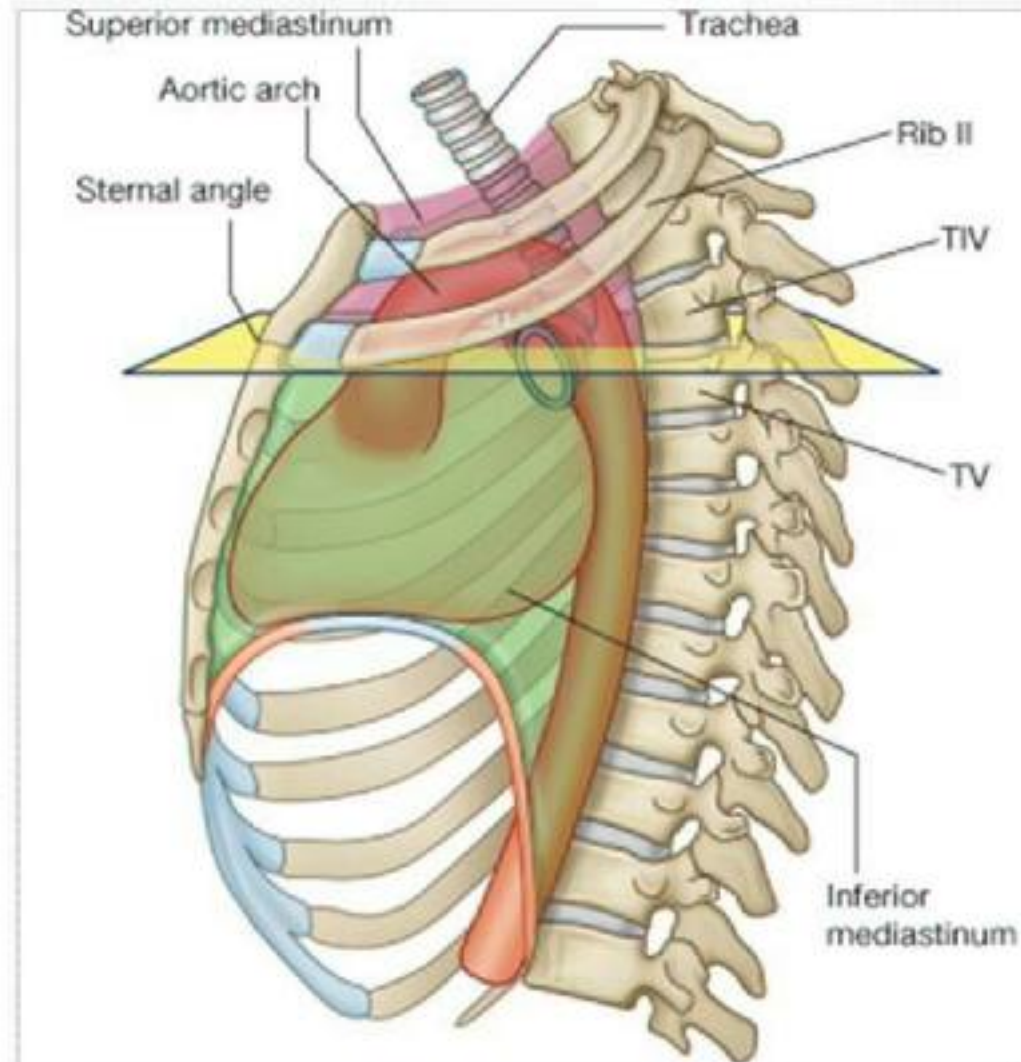
The sternal angle is a palpable clinical landmark in **surface anatomy**.

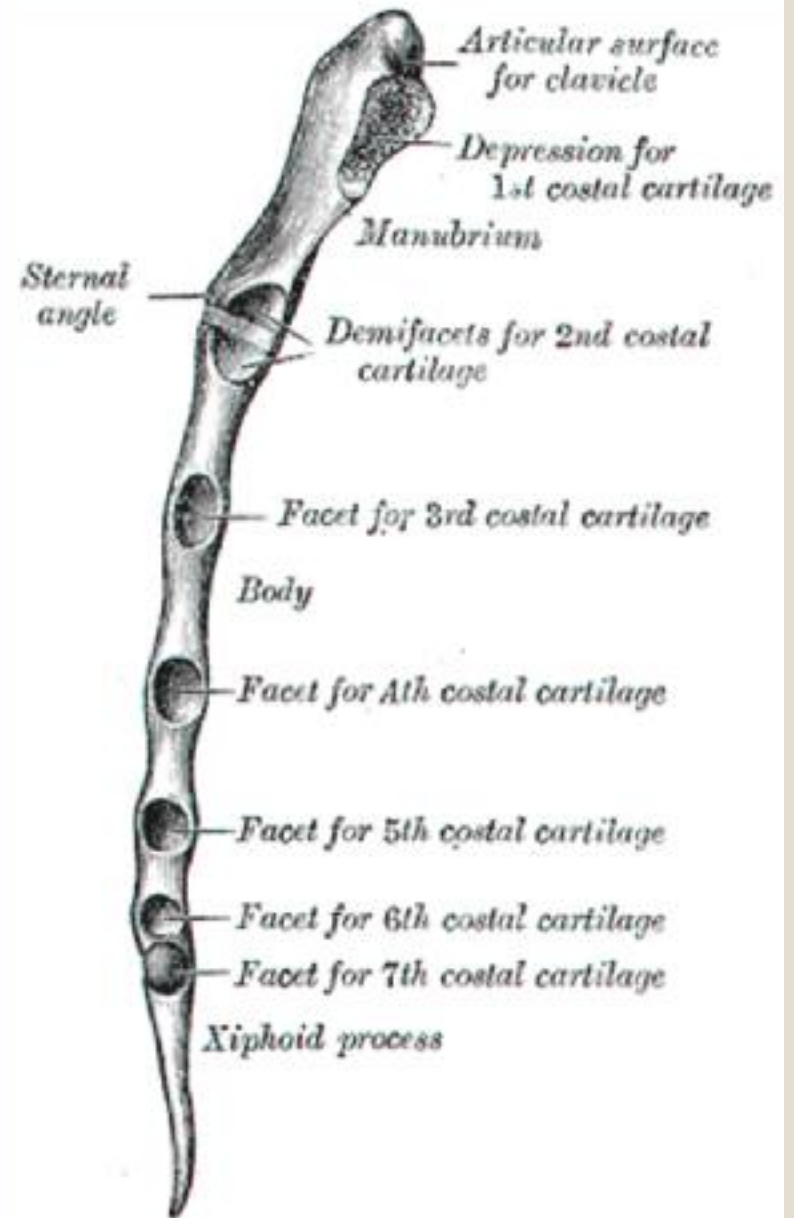
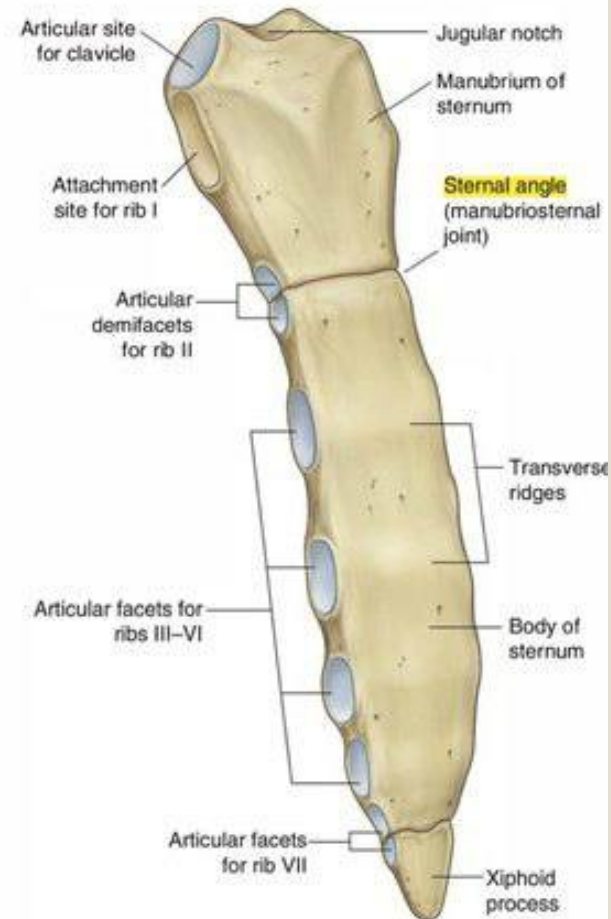
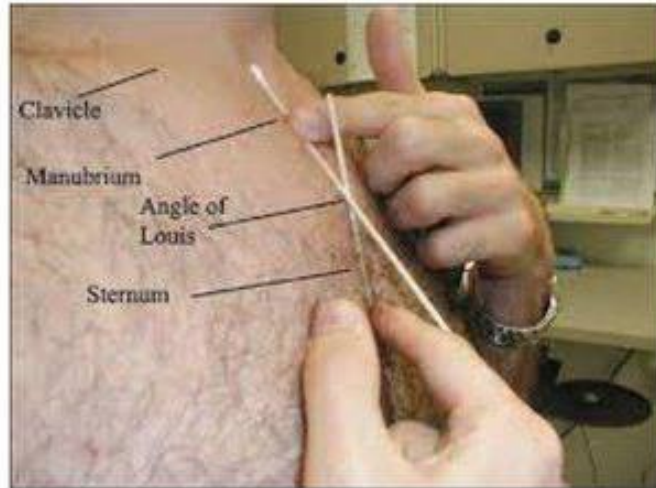
It marks the approximate level of the 2nd pair of costal cartilages, which attach to the second ribs, and the level of **lower border of T4** .

In clinical applications, the sternal angle can be palpated at the T4 vertebral level (**2nd Rib**).

The sternal angle (angle of Louis):

- Formed by articulation of **manubrium** with **body of sternum**.
- It lies at level of **2nd costal cartilage**,
- point from which all costal cartilages and **ribs are counted**.
- It lies opposite the intervertebral disc between **T4 & T5**.





The Angle of Louis (Sternal Angle)

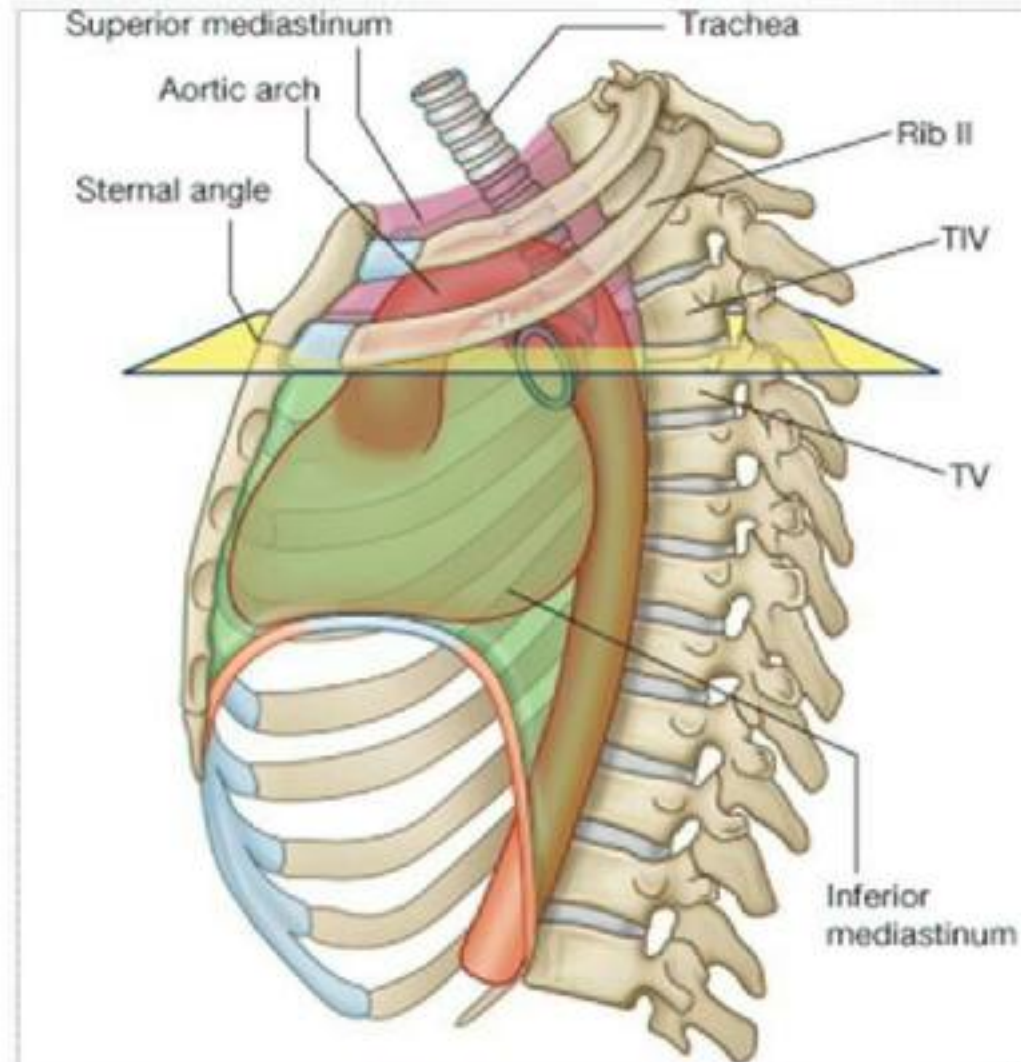
The sternal angle is an **important clinical landmark** for identifying many anatomical points:

It marks the point at which the costal cartilages of the second rib articulate with the sternum. This is particularly useful when **counting ribs** to identify landmarks as rib one is often impalpable. The counting of ribs is essential when one is attempting to make a thoracic incision. Additionally, **making an incision** at the first rib interspace can result in damage to large, important blood vessels and the brachial plexus. Identification of the second rib and thus the second intercostal space inferiorly is also useful when **auscultating heart sounds**.

It marks the level of the transverse thoracic plane which **divides the mediastinum** into the superior and inferior mediastinum.

The sternal angle (angle of Louis):

- Formed by articulation of **manubrium** with **body of sternum**.
- It lies at level of **2nd costal cartilage**,
- point from which all costal cartilages and **ribs are counted**.
- It lies opposite the intervertebral disc between **T4 & T5**.



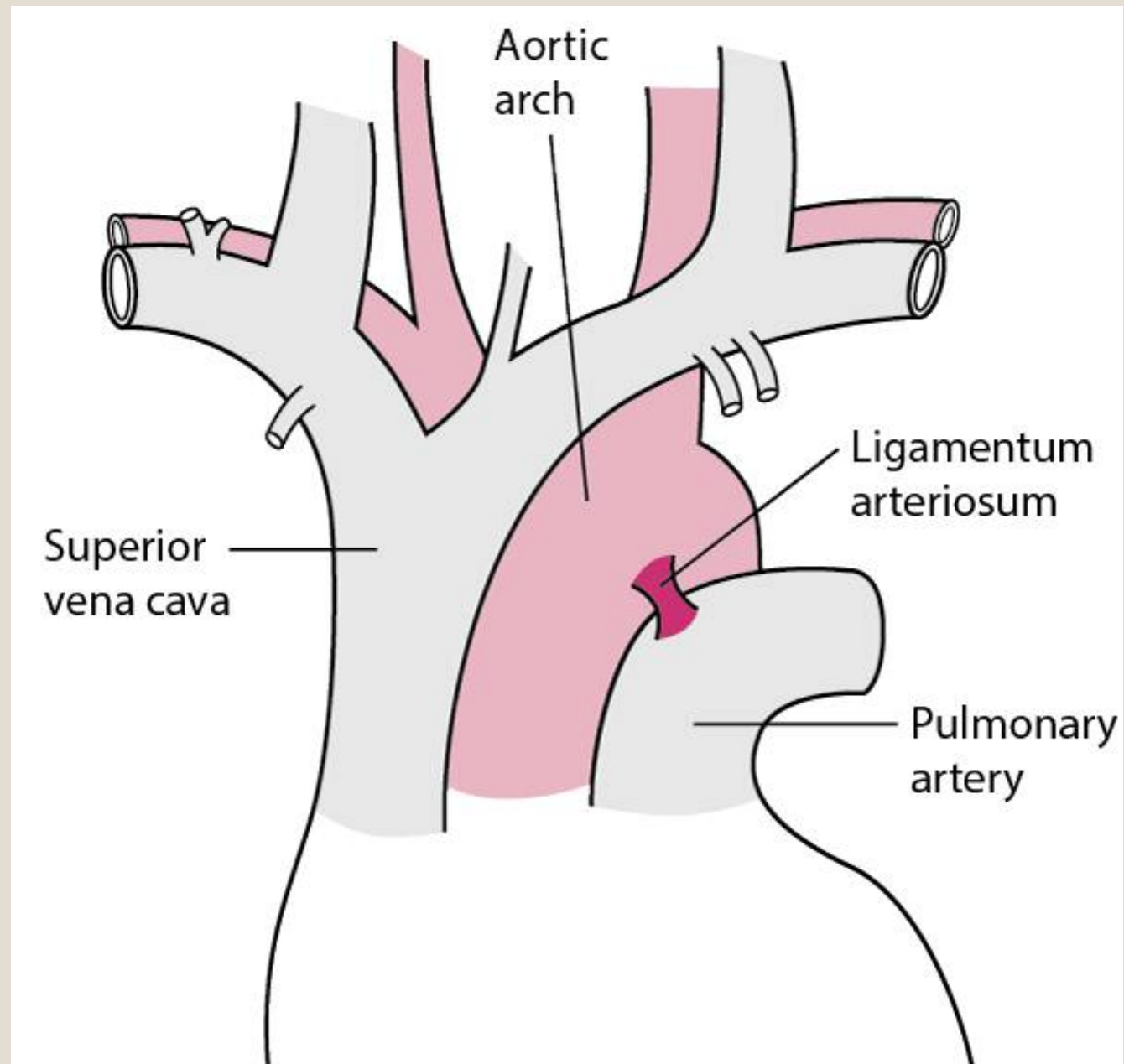
The Angle of Louis (Sternal Angle) – Cont.

It overlies the aortic arch on the left and the superior vena cava on the right.

It is roughly at the level of the bifurcation of the trachea.

The tracheal carina is deep to the sternal angle.

It is roughly at the level of the bifurcation of the pulmonary trunk.



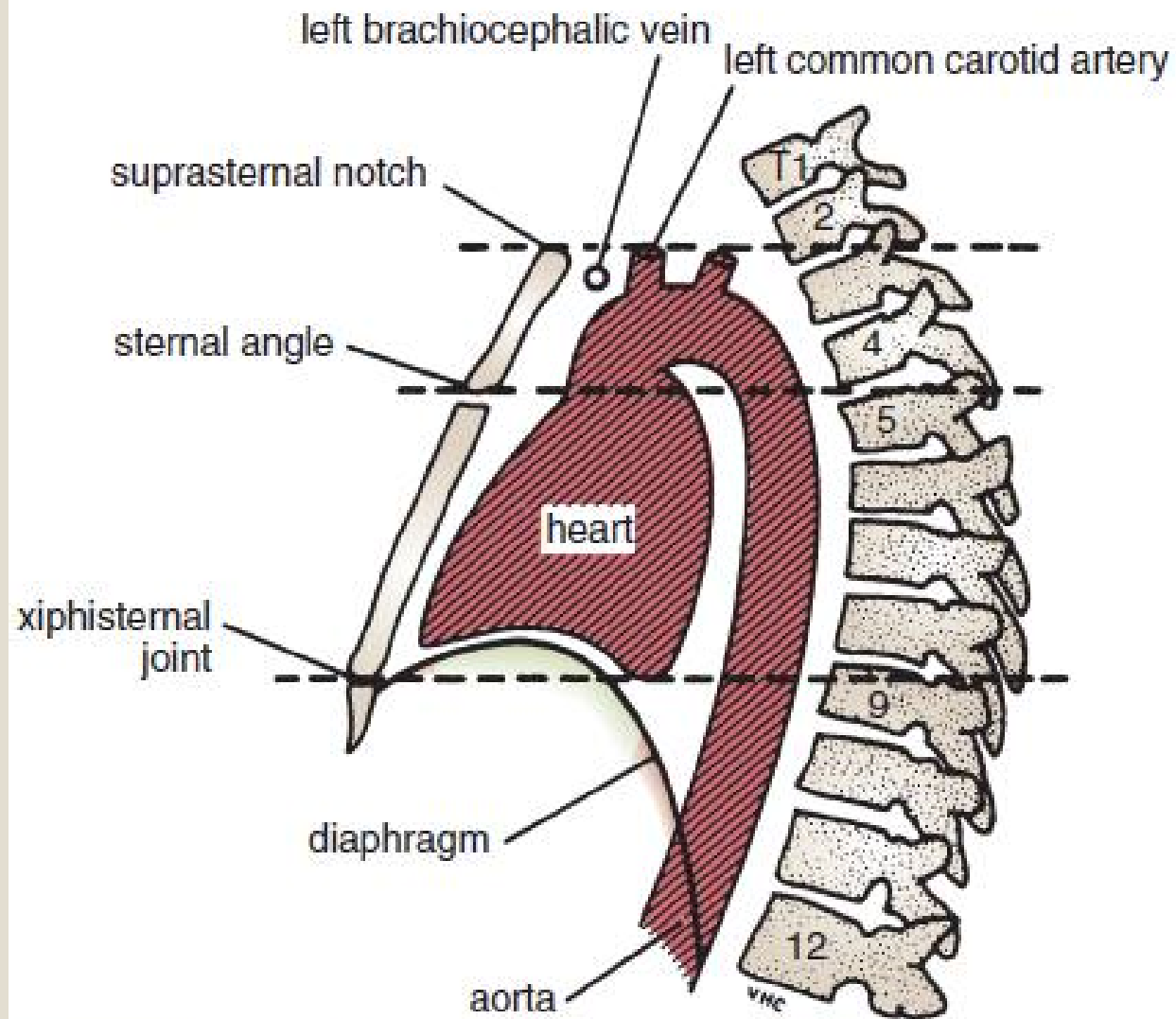


FIGURE 2.2 Lateral view of the thorax showing the relationship of the surface markings to the vertebral levels.

Sternum Anatomy – Cont.

The **body of the sternum** articulates with:

above with the manubrium at the **manubriosternal joint**, and
below with the xiphoid process at the **xiphisternal joint**.

On each side, it articulates with **the 2nd to the 7th costal** cartilages.

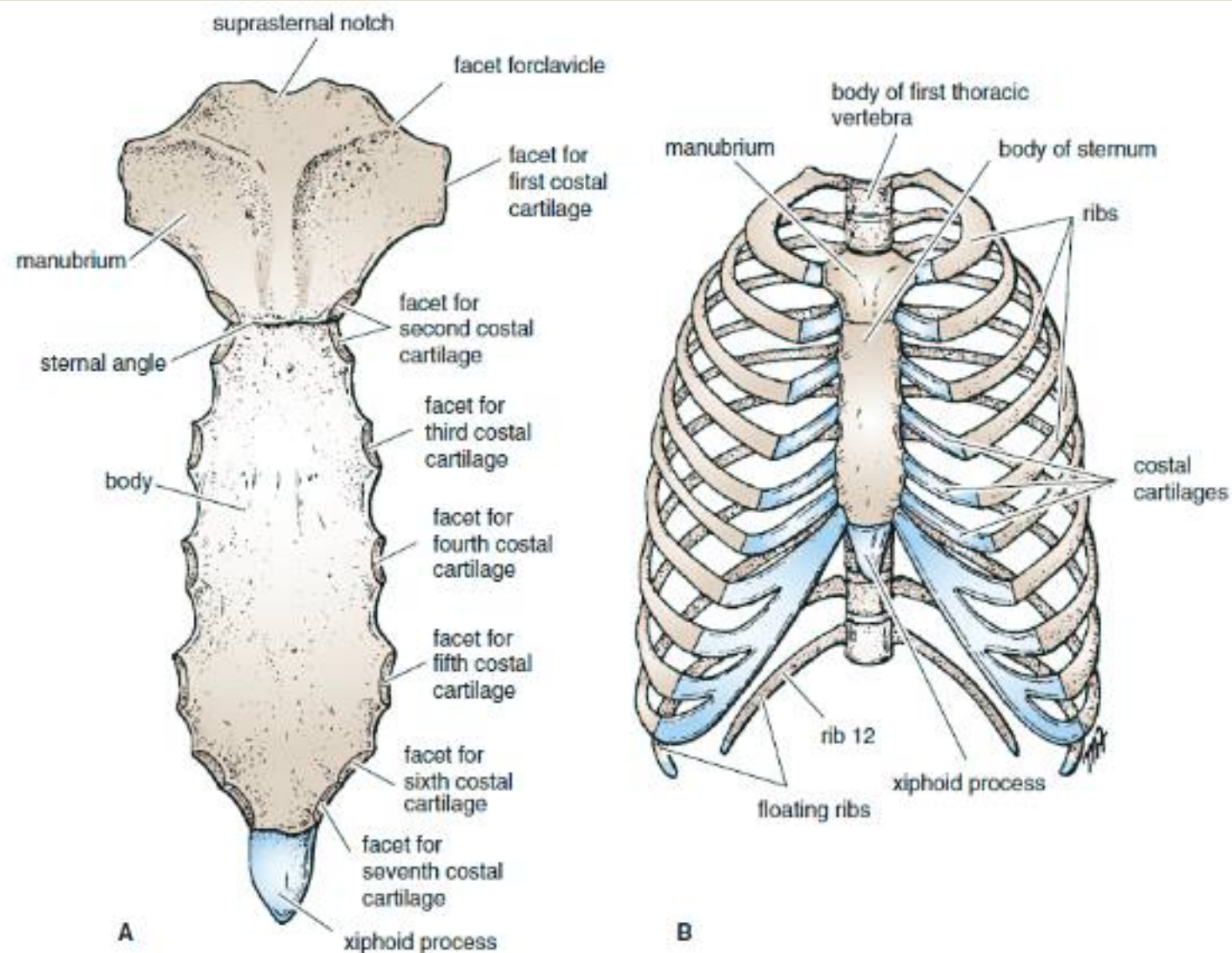
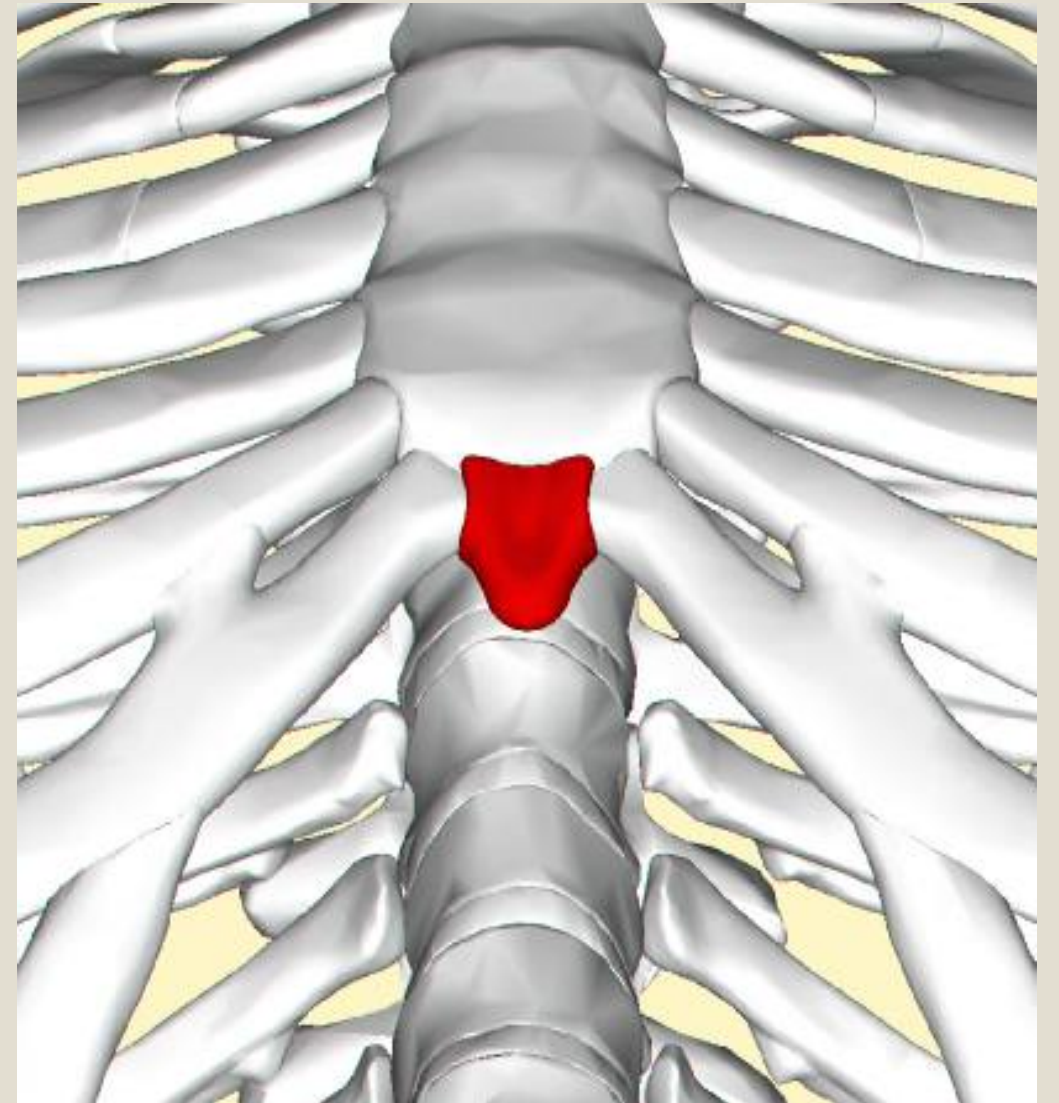


FIGURE 2.1 A. Anterior view of the sternum. B. Sternum, ribs, and costal cartilages forming the thoracic skeleton.

Xiphoid process

The **xiphoid process** is a thin plate of **cartilage** that becomes ossified at its proximal end during adult life. (Ossification occurs around **age 40**)

The **xiphisternal joint** lies opposite the body of the **9th thoracic vertebra**



Ribs - Anatomy

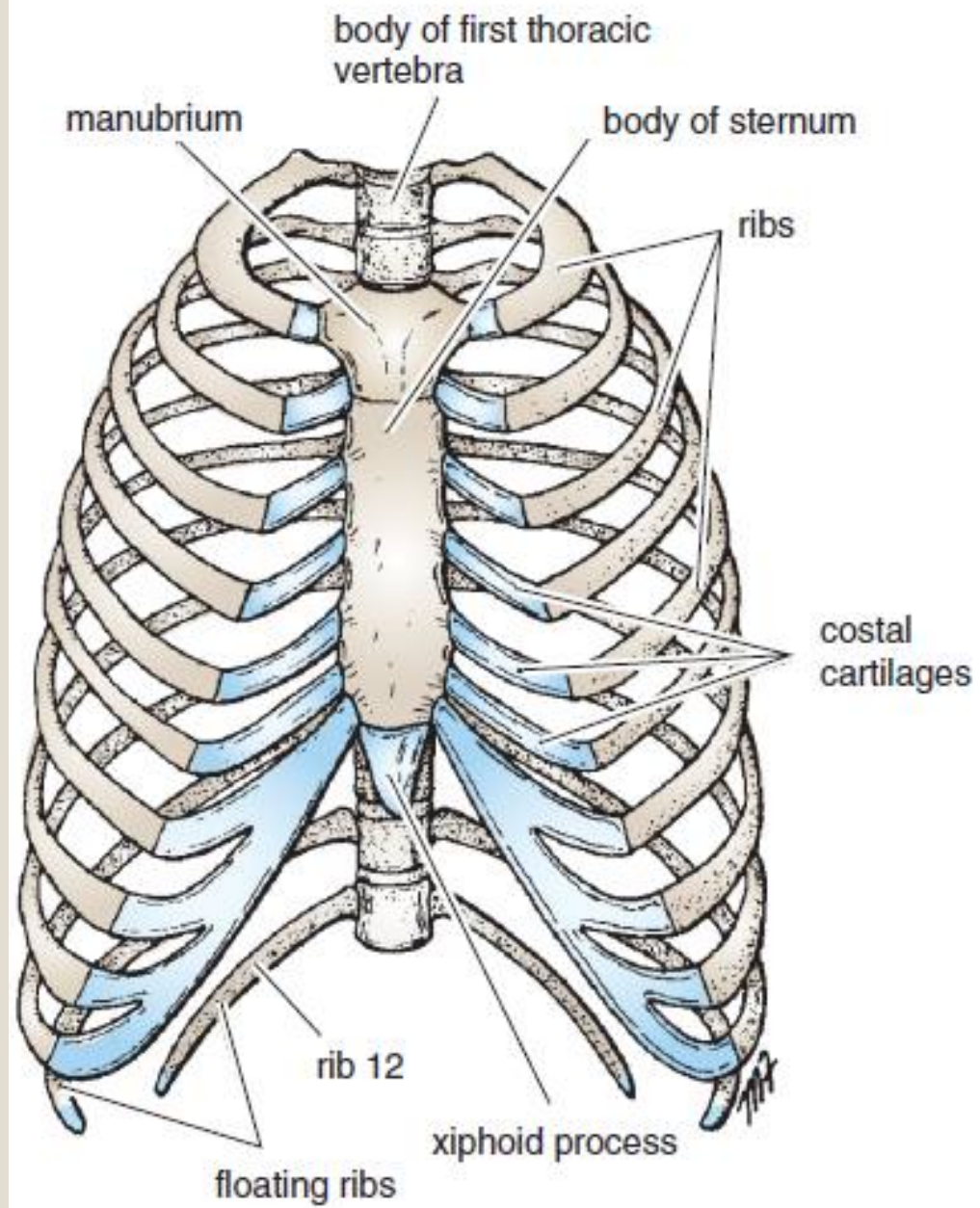
There are **12 pairs** of ribs, all of which are attached posteriorly to the thoracic vertebrae.

The ribs are divided into three categories:

True ribs: The **upper seven** pairs are attached anteriorly to the **sternum** by their costal cartilages.

False ribs: The **8th, 9th, and 10th** pairs of ribs are attached anteriorly to each other and to the 7th rib by means of their costal cartilages and small synovial joints.

Floating ribs: The 11th and 12th pairs have no anterior attachment.



Typical vs. Atypical Ribs

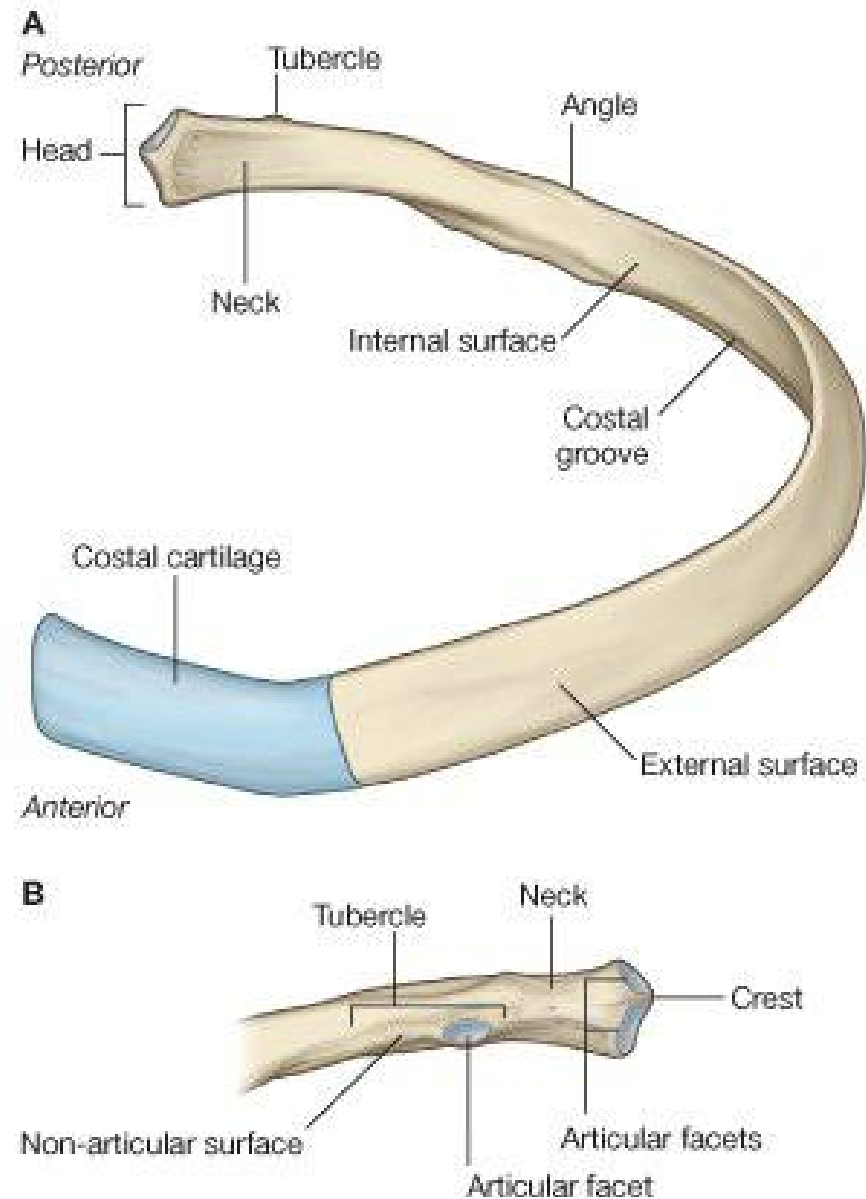
3rd – 9th ribs are considered typical

A typical rib has a **head, neck, tubercle, shaft,** and **angle.**

A typical rib is a long, twisted, bone having a rounded, smooth **superior border** and a **sharp thin inferior border.**

The anterior end of each rib is attached to the corresponding **costal cartilage.**

Typical Rib - Anatomy



Typical Rib - Anatomy

The **head** has two facets for articulation with the numerically corresponding vertebral body and that of the vertebra immediately above.

The **neck** is a constricted portion situated between the head and the tubercle.

The **tubercle** is a prominence on the outer surface of the rib at the junction of the neck with the shaft. It has a facet for articulation with the transverse process of the numerically corresponding vertebra.

The **shaft** is thin and flattened and twisted on its long axis. Its inferior border has the costal groove. The angle is where the shaft of the rib bends sharply forward.

Costal groove: lower aspect of inner surface

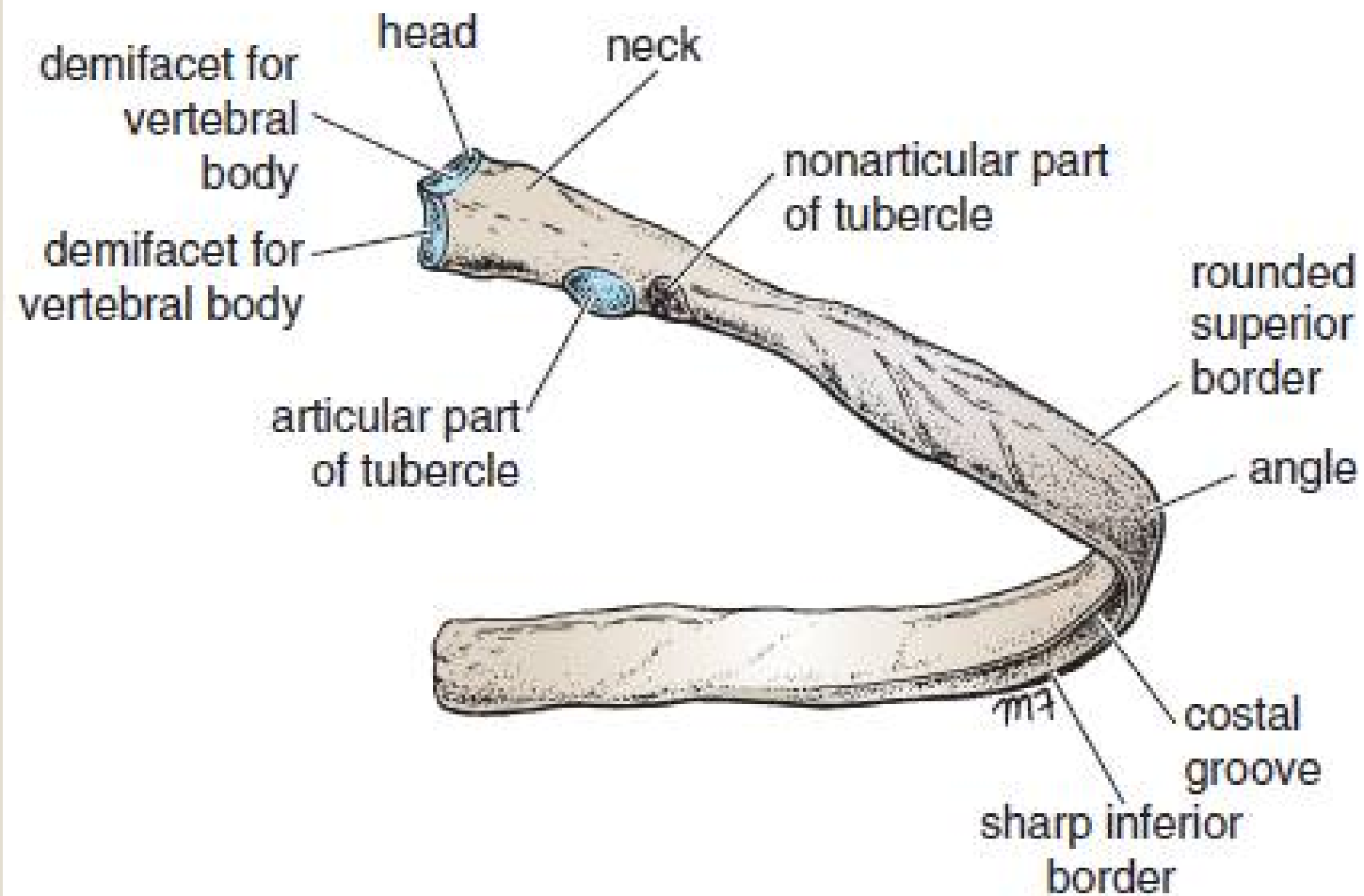
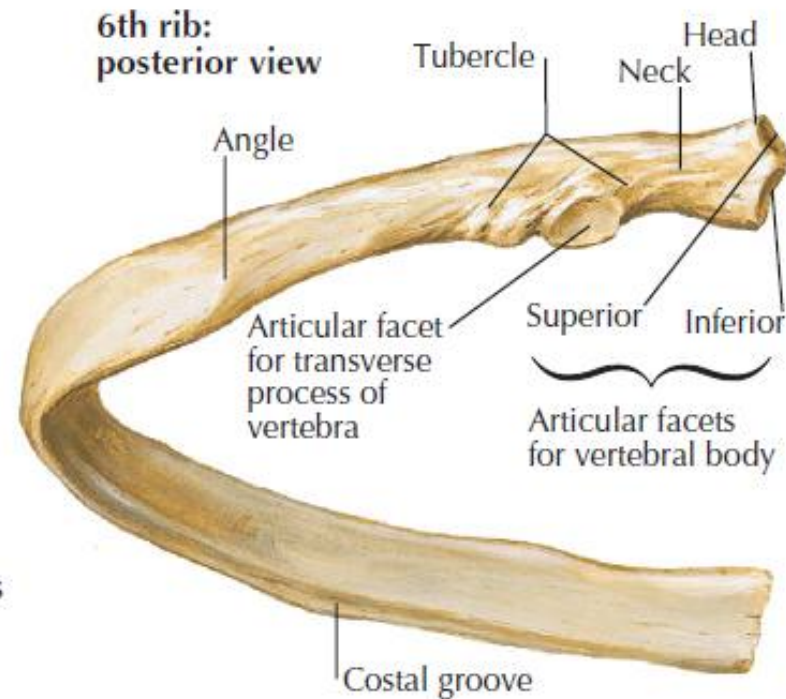
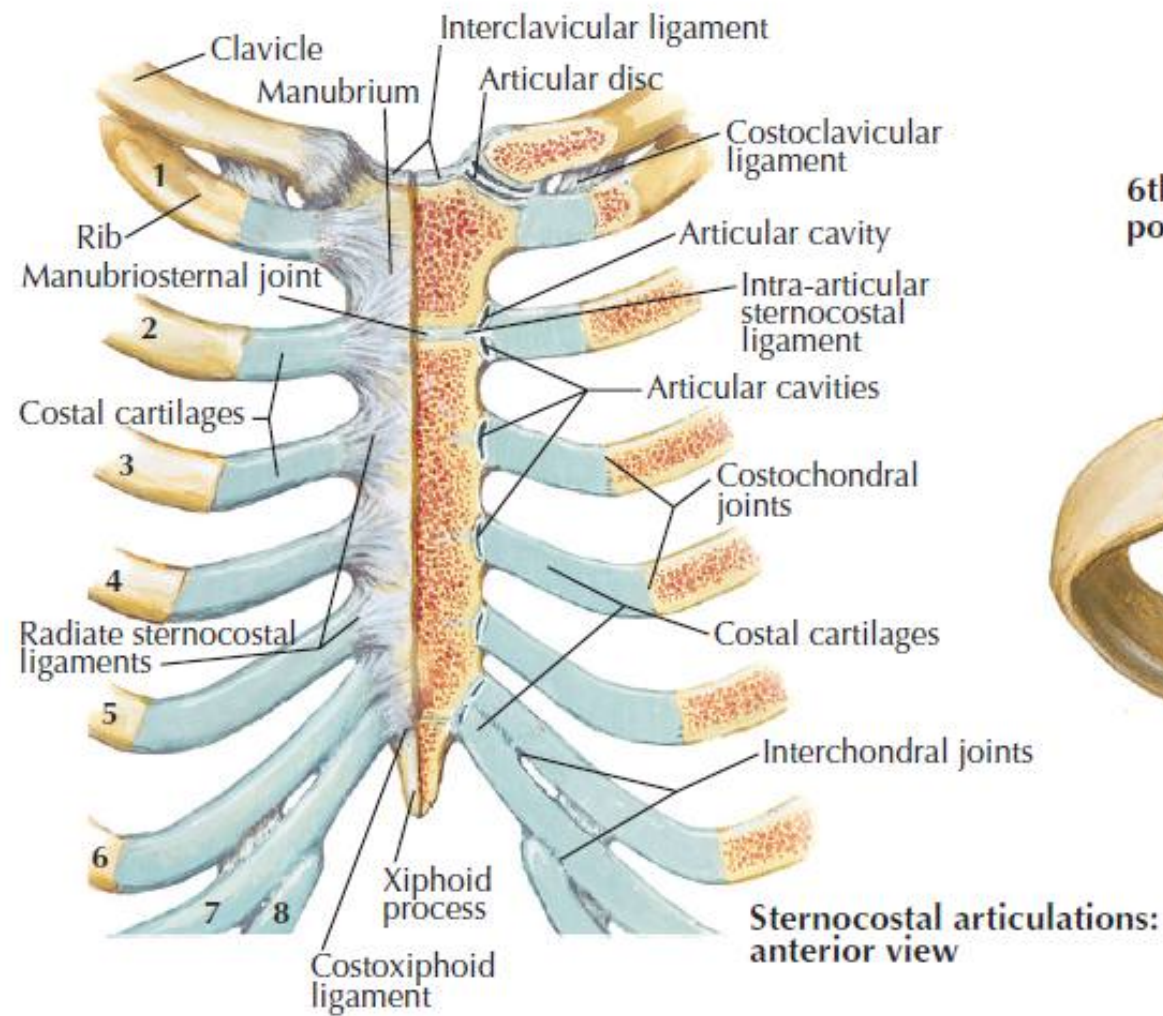


FIGURE 2.5 Fifth right rib, as seen from the posterior aspect.



Note: The head of a typical rib articulates with the superior costal facet of the thoracic vertebra of the same number (by its inferior articular facet), the inferior costal facet of the vertebra above (by its superior articular facet), and the intervertebral disc between the two vertebrae. The costal tubercle articulates with the transverse process of the vertebra of the same number.

F. Netter M.D.

Atypical rib -the First rib

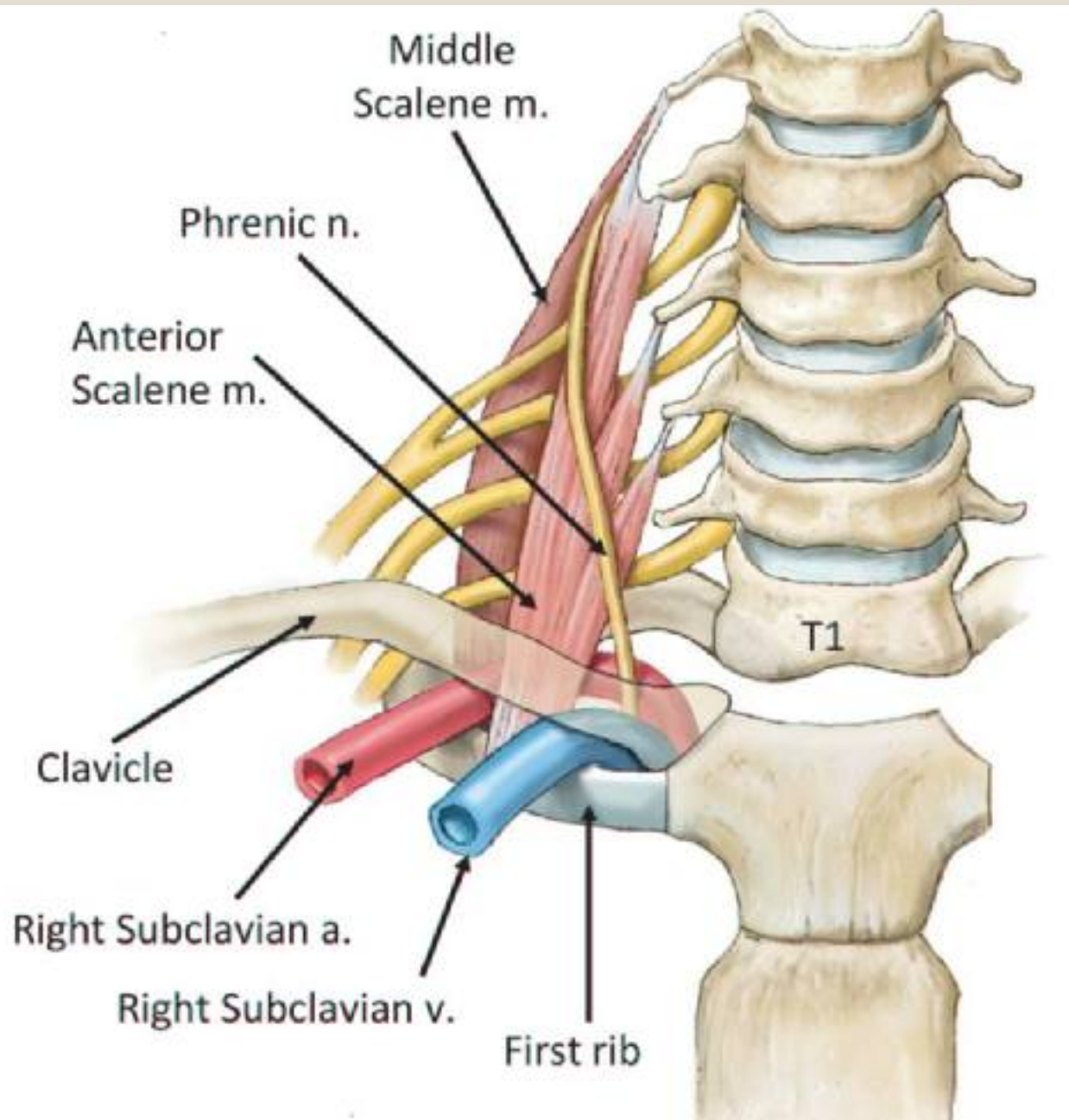
This rib is **small** and **flattened** from above downward.

The **scalenus anterior muscle** is attached to its upper surface and inner border.

Anterior to the scalenus anterior, the **subclavian vein** crosses the rib; posterior to the muscle attachment, the **subclavian artery** and **the lower trunk of the brachial plexus** cross the rib and lie in contact with the rib.

The 1st rib is important clinically because of its close relationship to the lower nerves of the brachial plexus, and the main vessels to the arm, namely, the subclavian artery and vein.

(At the outer edge of the first rib, the subclavian artery becomes the axillary artery)



The subclavian vein is anterior to the anterior scalene muscle and the artery is posterior. Notice the phrenic nerve on the anterior surface of the anterior scalene muscle. The brachial plexus is between the anterior and middle scalene muscles.

Notice that many plexuses of nerves are in close relationship to first rib.

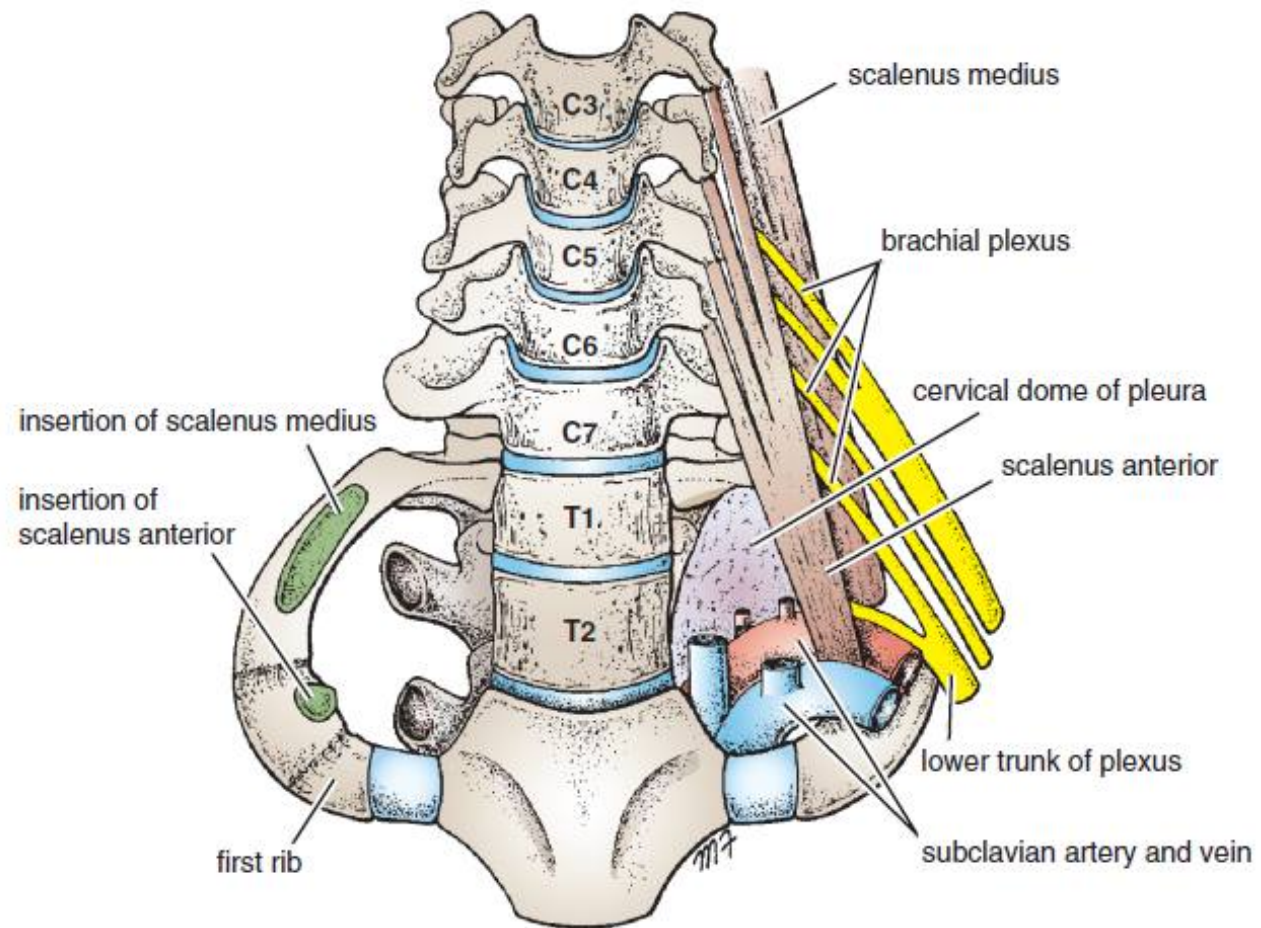


FIGURE 2.6 Thoracic outlet showing the cervical dome of pleura on the left side of the body and its relationship to the inner border of the 1st rib. Note also the presence of brachial plexus and subclavian vessels. (Anatomists often refer to the thoracic outlet as the thoracic inlet.)

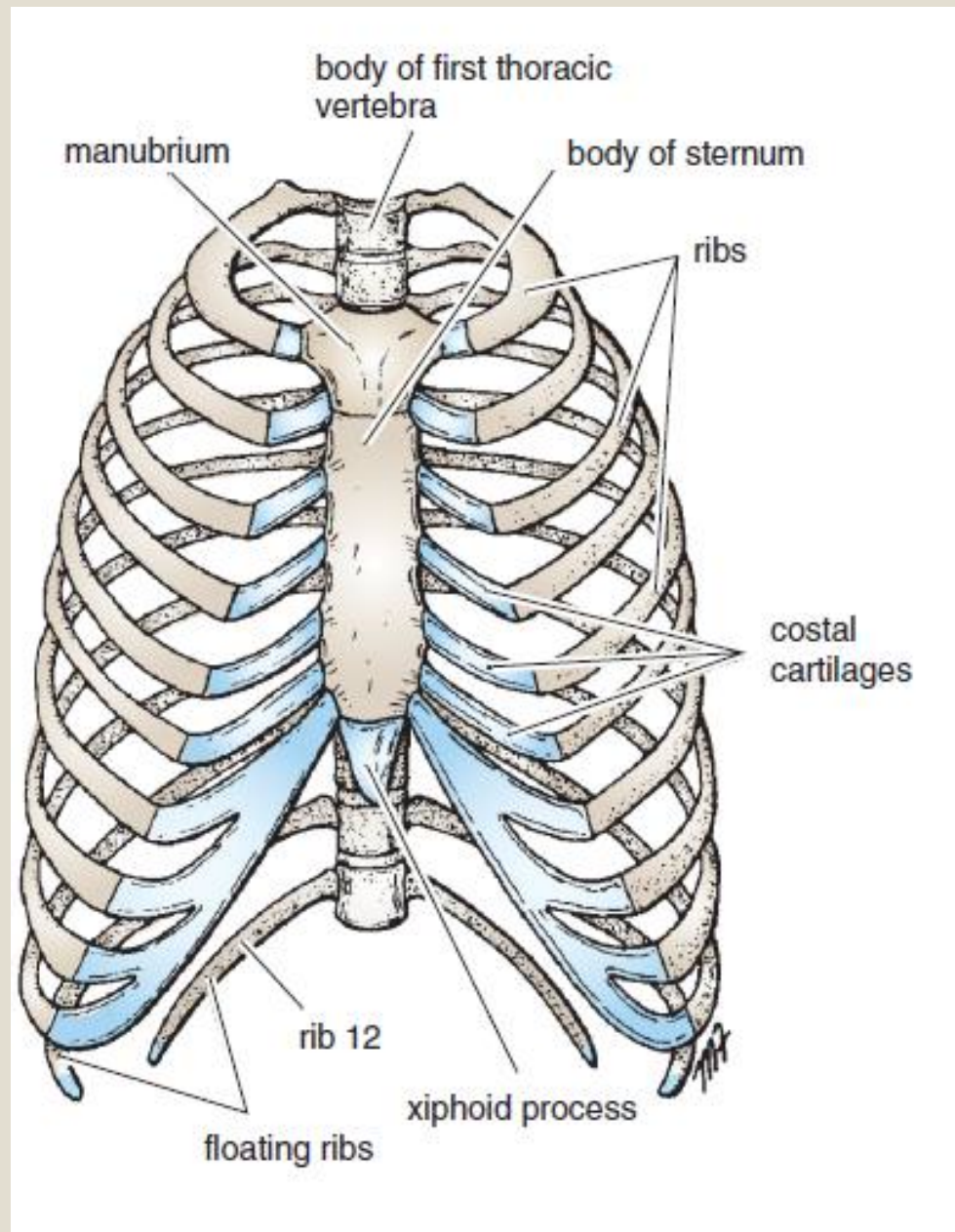
Costal Cartilages - Anatomy

Costal cartilages are bars of cartilage connecting the upper seven ribs to the lateral edge of the sternum and

- the 8th, 9th, and 10th ribs to the 7th costal cartilage immediately above.

The costal cartilages contribute significantly to the elasticity and mobility of the thoracic walls.

In old age, the costal cartilages tend to lose some of their flexibility as the result of superficial calcification.



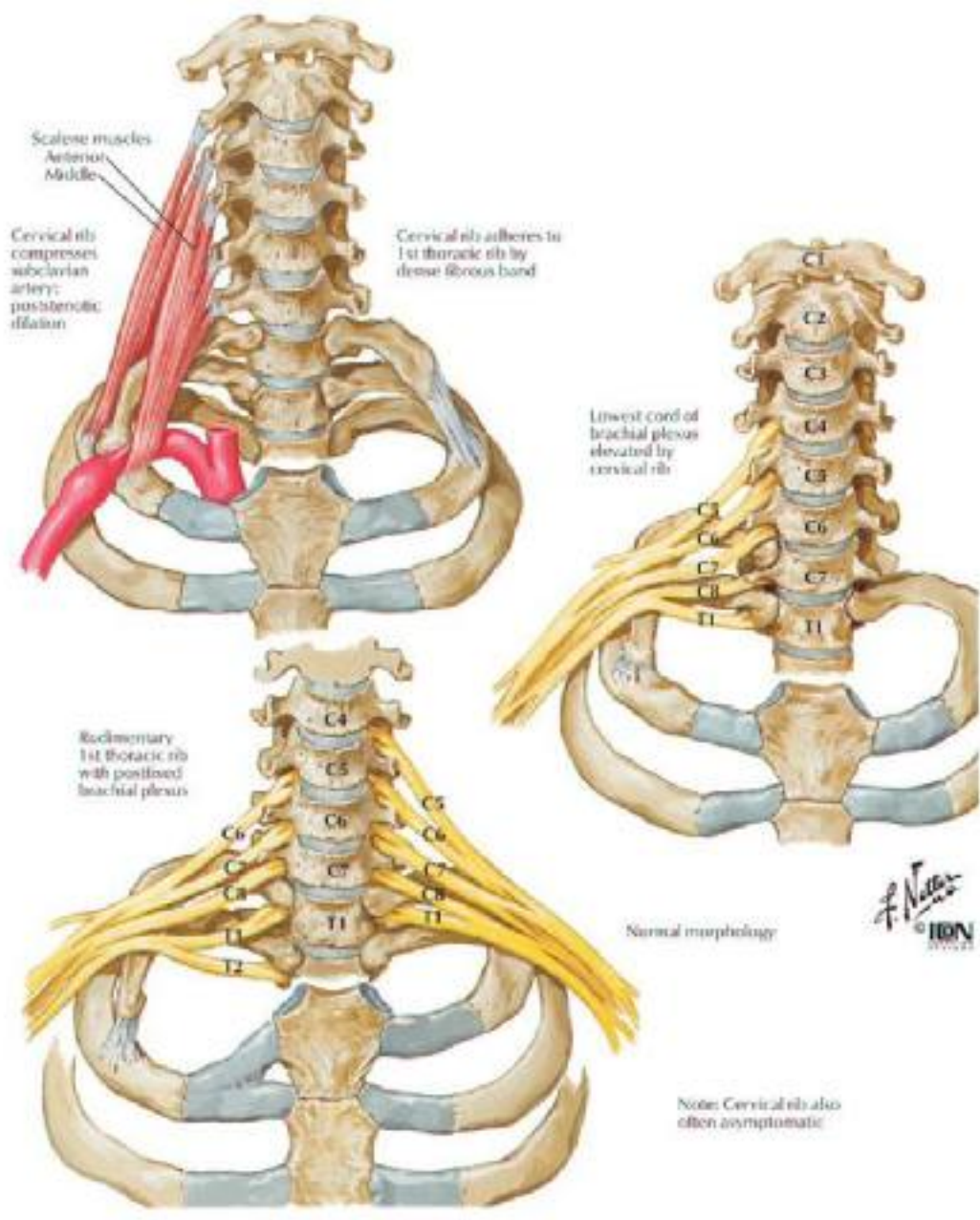
Clinical Relevance - Cervical Rib

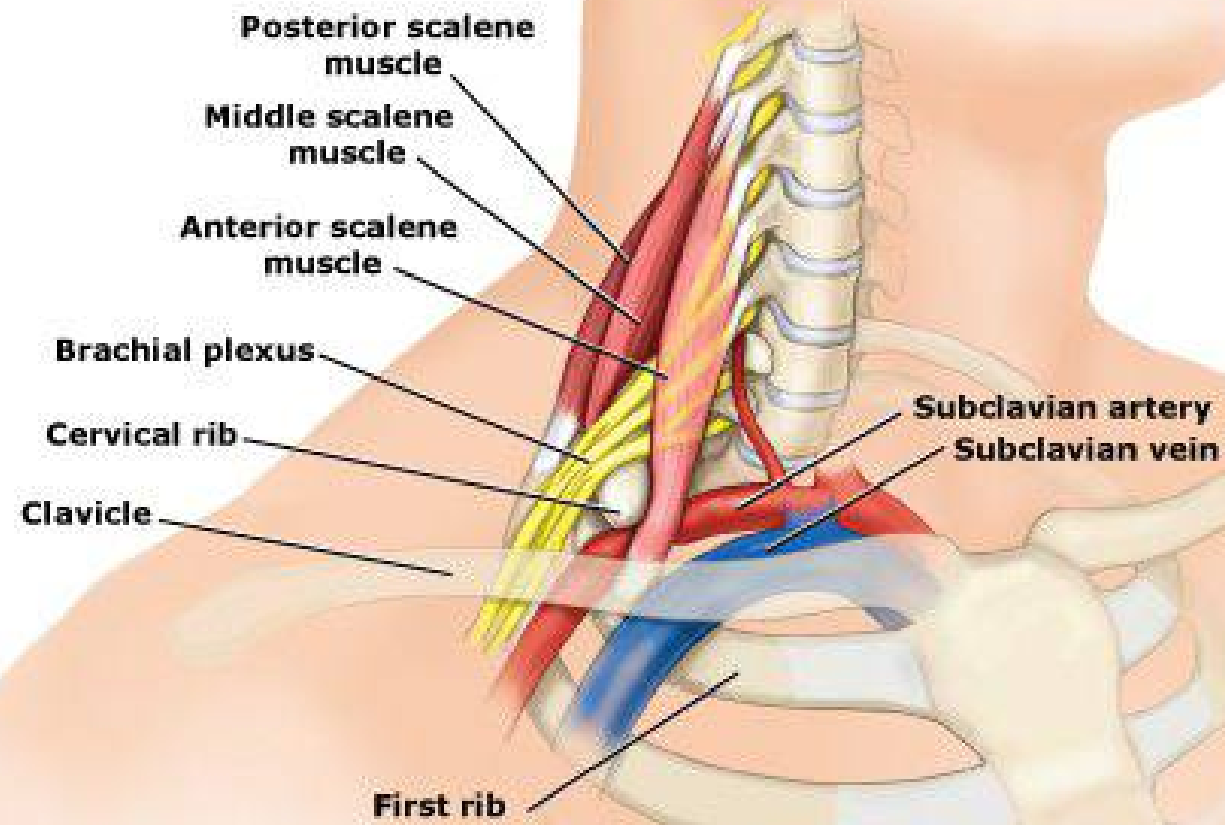
A cervical rib arising from the 7th cervical vertebra) .

It may have a free anterior end, may be connected to the 1st rib by a fibrous band, or may articulate with the 1st rib.

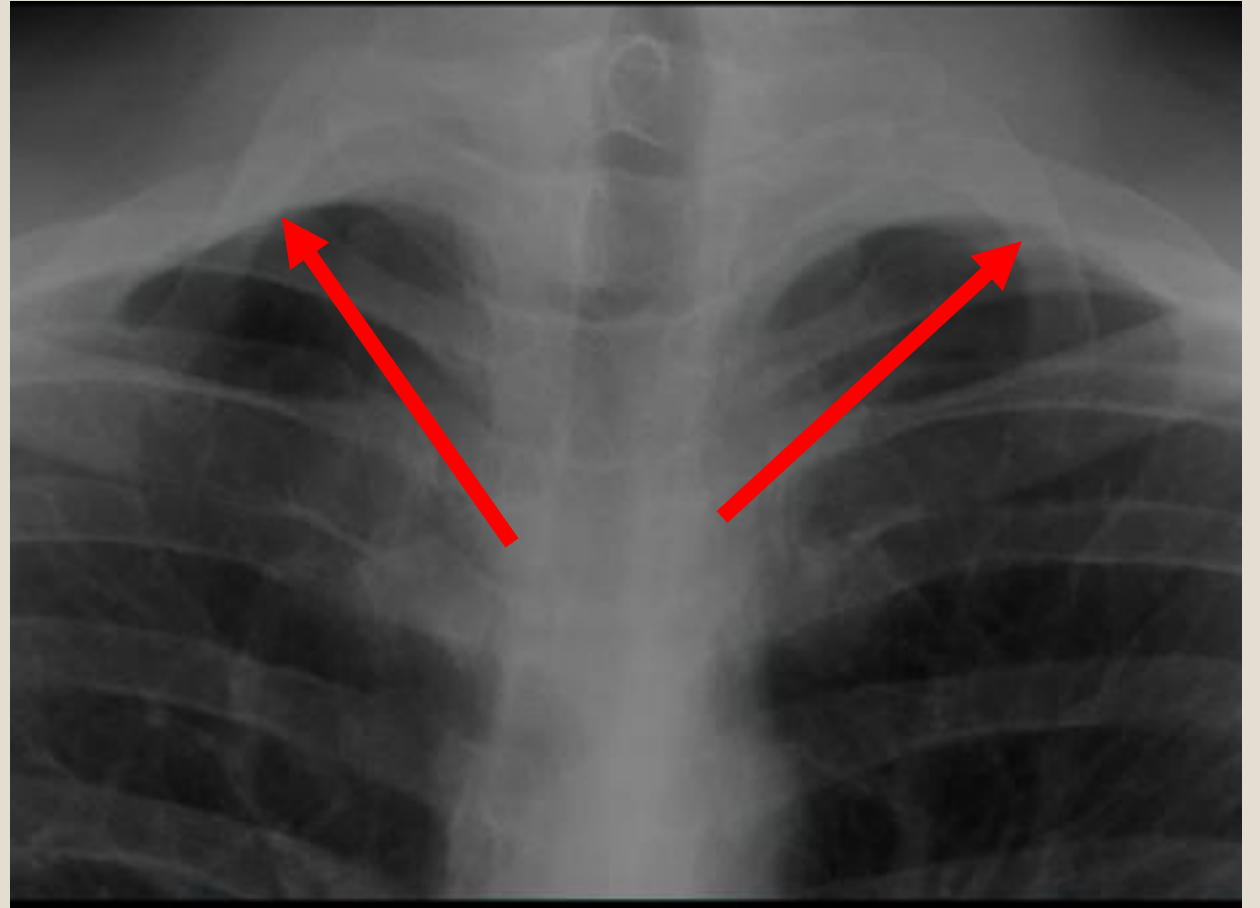
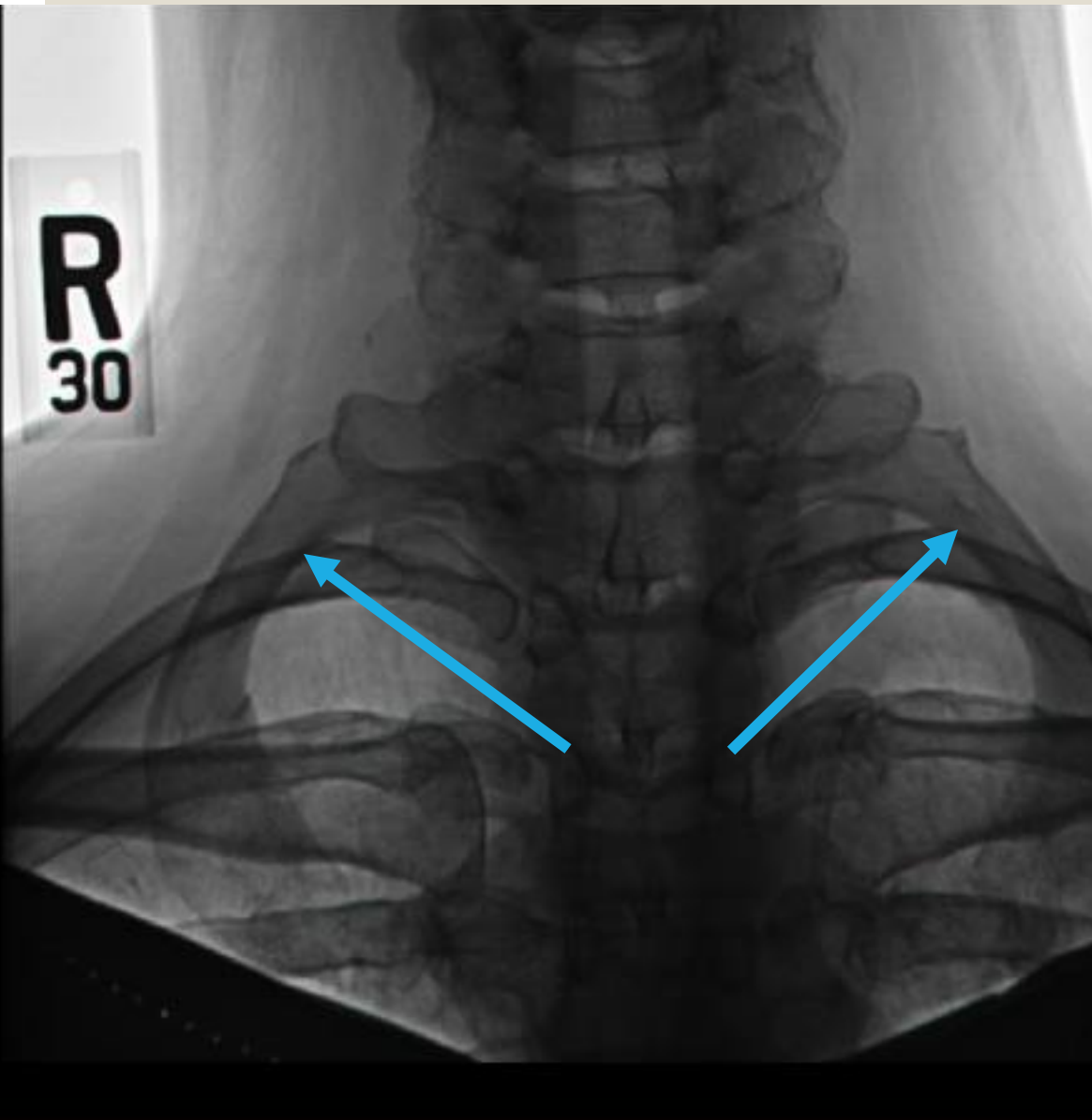
The clinical importance of a cervical rib is that it can cause pressure on the lower trunk of the brachial plexus, in some patients, producing pain down the medial side of the forearm and hand and wasting of the small muscles of the hand.

It can also exert pressure on the overlying subclavian artery and vein to interfere with the circulation of the upper limb.





Clinical Relevance – Cervical Rib



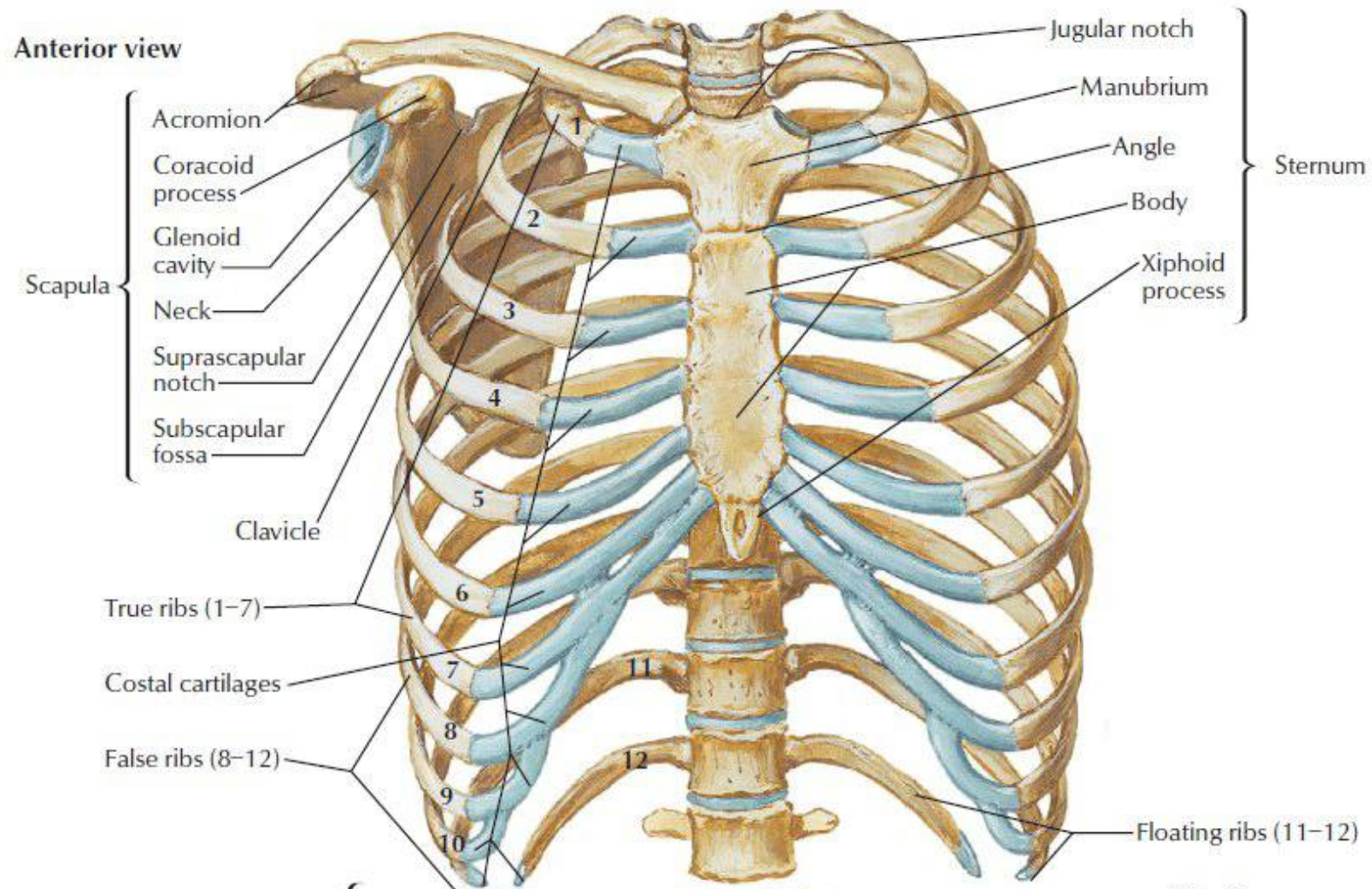
Movements of the Ribs and Costal Cartilages

The 1st costal cartilages articulate with the manubrium, by **cartilaginous joints** that permit **no movement**.

The **2nd to 7th costal cartilages** articulate with the lateral border of the sternum by **synovial joints**.

In addition, **the 7th, 8th, 9th, and 10th costal cartilages** articulate with one another along their borders by small synovial joints.

The cartilages of **the 11th and 12th (floating) ribs** are embedded in the abdominal musculature.



Openings of the Thorax- Anatomy

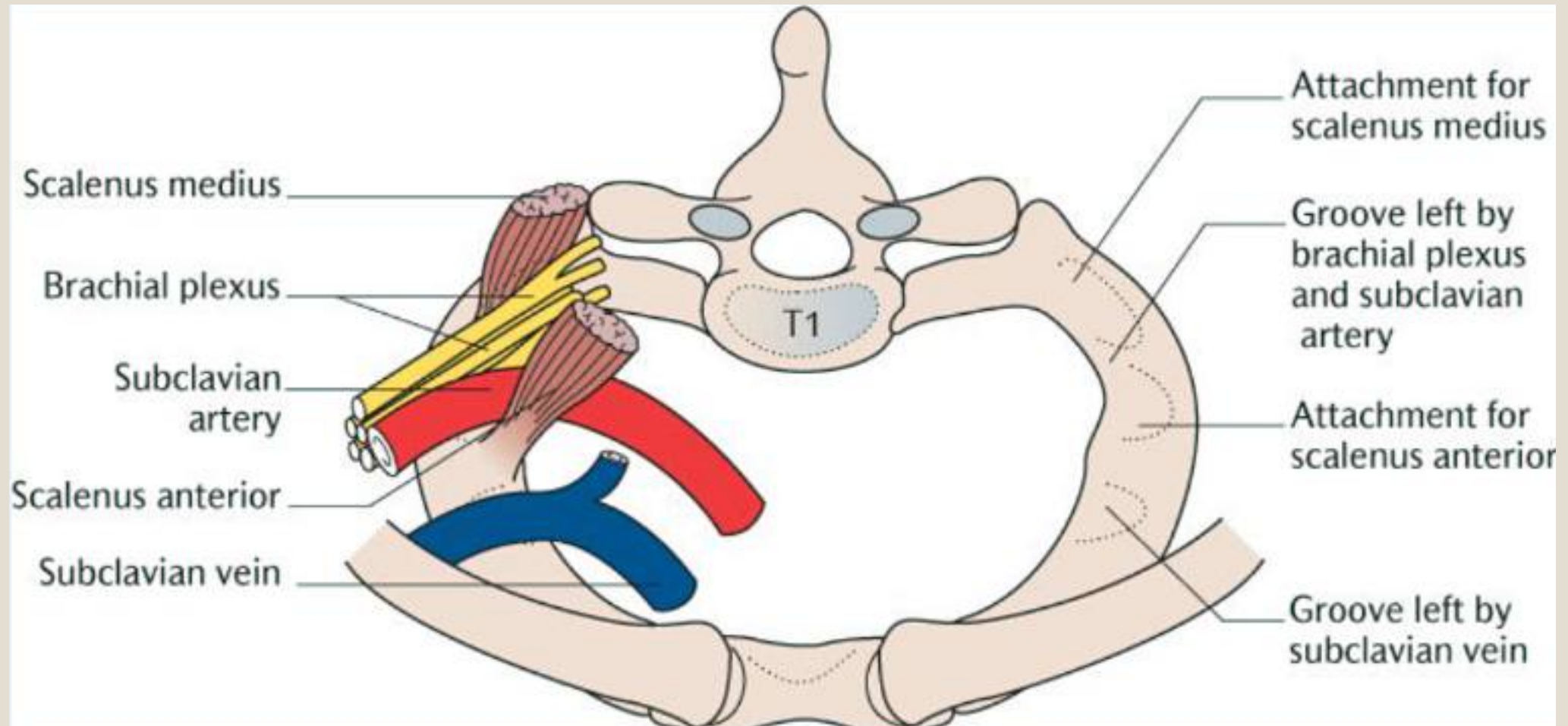
The chest cavity communicates with the root of the neck through an opening called the **thoracic outlet**.

The opening is bounded

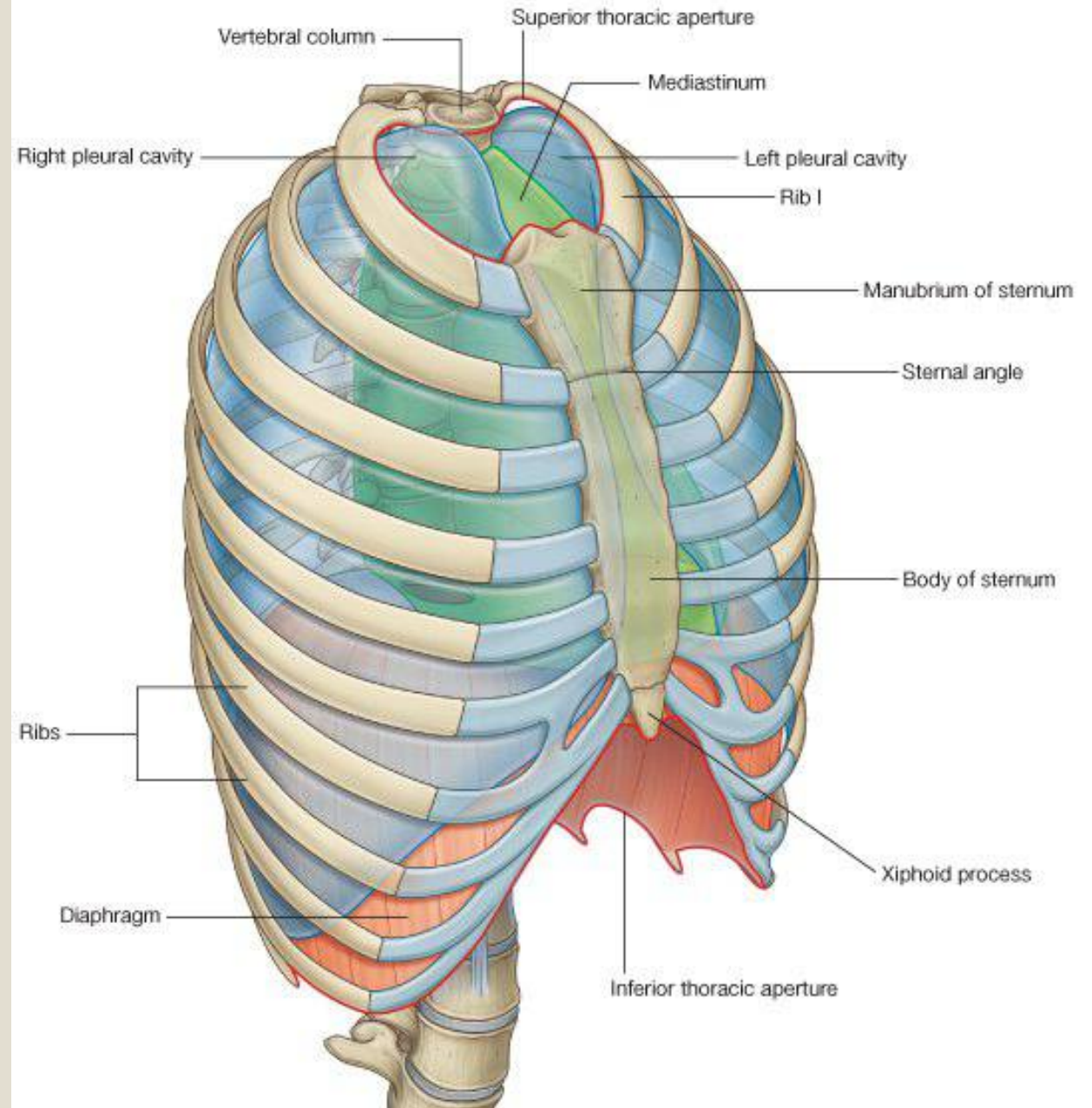
posteriorly by the 1st thoracic vertebra

laterally by the **medial borders of the 1st ribs** and their costal cartilages, **anteriorly** by the **superior border of the manubrium**.

Thoracic Outlet - Anatomy



The opening is **obliquely** placed facing downward and forward. Through this small opening pass the esophagus and trachea and many vessels and nerves. Because of the obliquity of the opening, **the apices of the lung and pleurae project upward into the neck.**



Clinical Relevance – Thoracic Outlet Syndrome

It is here that the **nerves or blood vessels may be compressed** between the bones (*clavicle and 1st rib*) .

The brachial plexus of nerves (C5, 6, 7, and 8 and T1) and the subclavian artery and vein are closely related to the upper surface of the 1st rib and the clavicle as they enter the upper limb.

Most of the symptoms are caused by pressure on the lower trunk of the plexus producing pain down the medial side of the forearm and hand and wasting of the small muscles of the hand. Pressure on the blood vessels may compromise the circulation of the upper limb.

Thoracic Outlet Syndrome

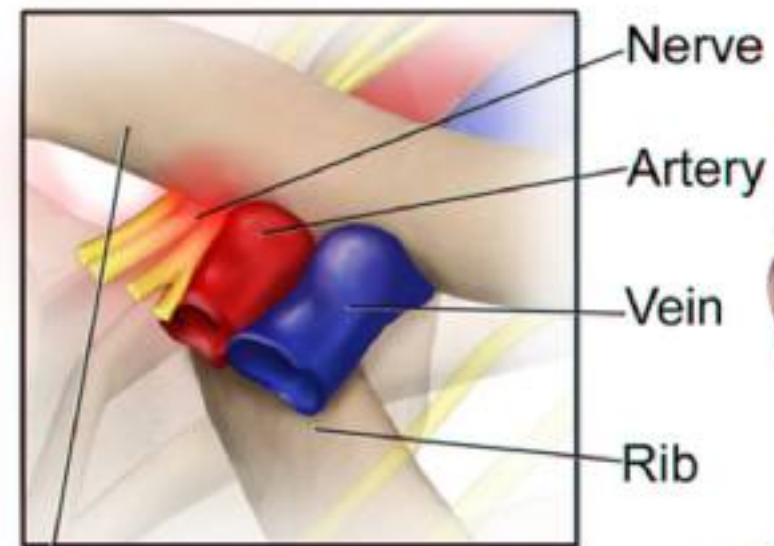
Thoracic outlet syndrome (TOS) is a condition in which there is compression of the nerves, arteries, or veins in the passageway from the lower neck to the armpit.

There are three main types : neurogenic, venous, and arterial.

1. **The neurogenic type is the most common** and presents with pain, weakness, and occasionally loss of muscle at the base of the thumb.
2. **The venous type** results in swelling, pain, and possibly a bluish coloration of the arm.
3. **The arterial type** results in pain, coldness, and pallor of the arm.

TOS may result from trauma , tumours or anatomical variations such as a **cervical rib**.

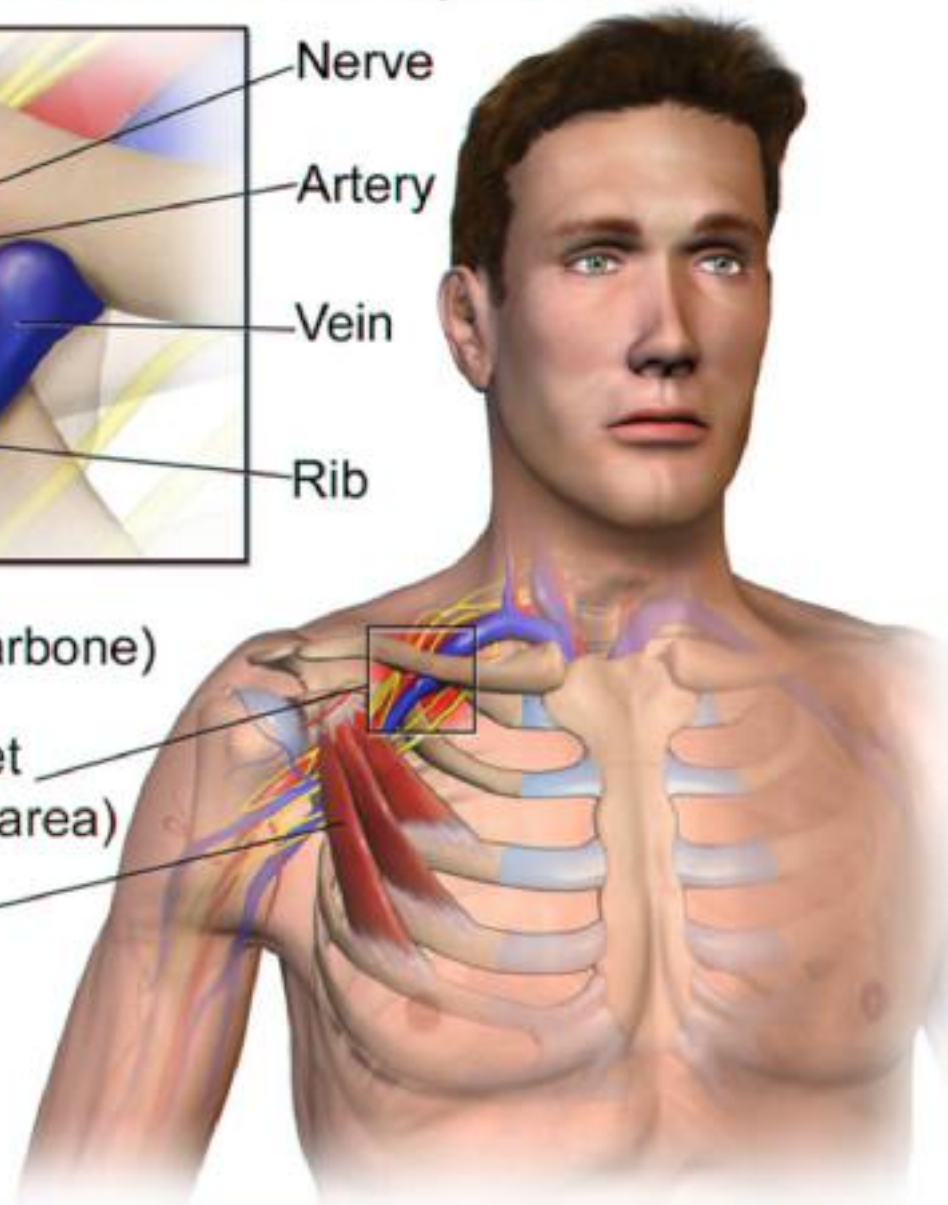
Thoracic Outlet Syndrome



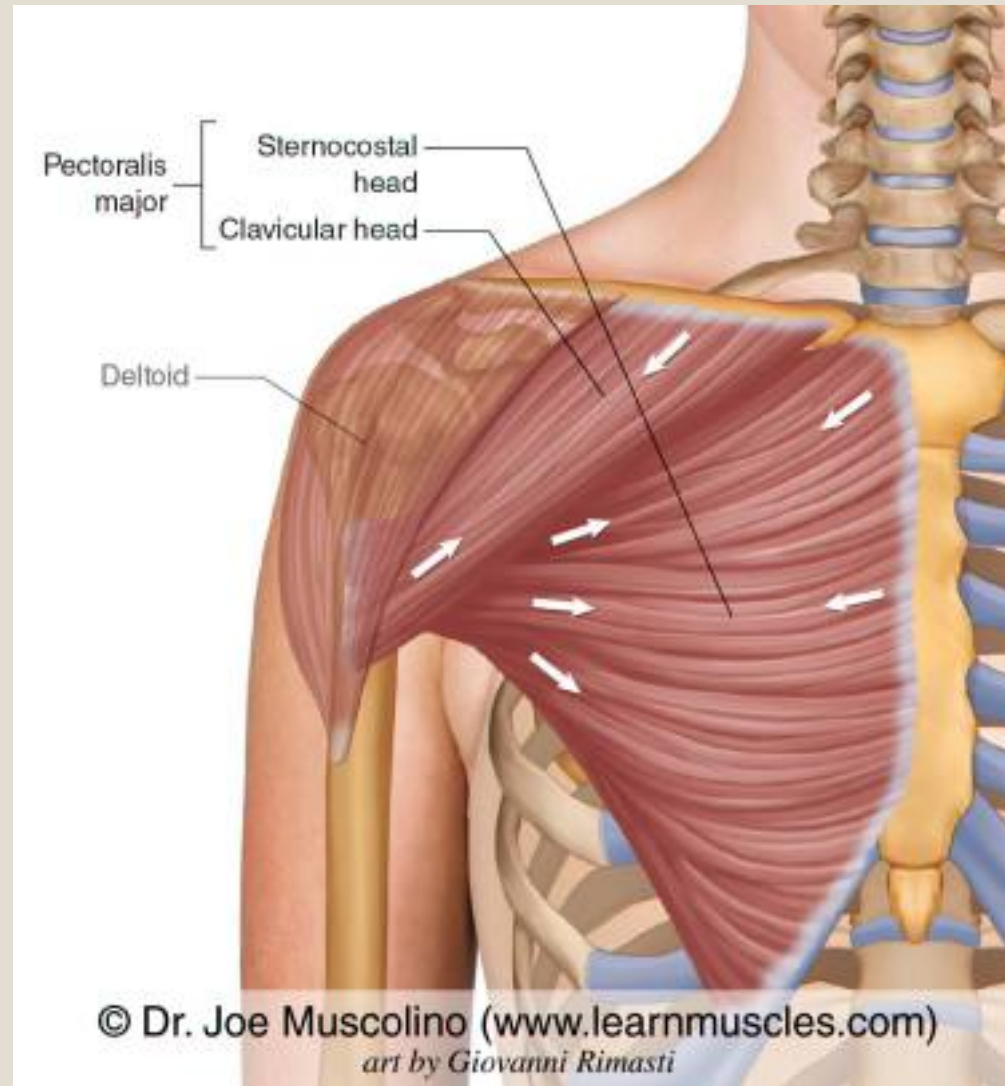
Clavicle (collarbone)

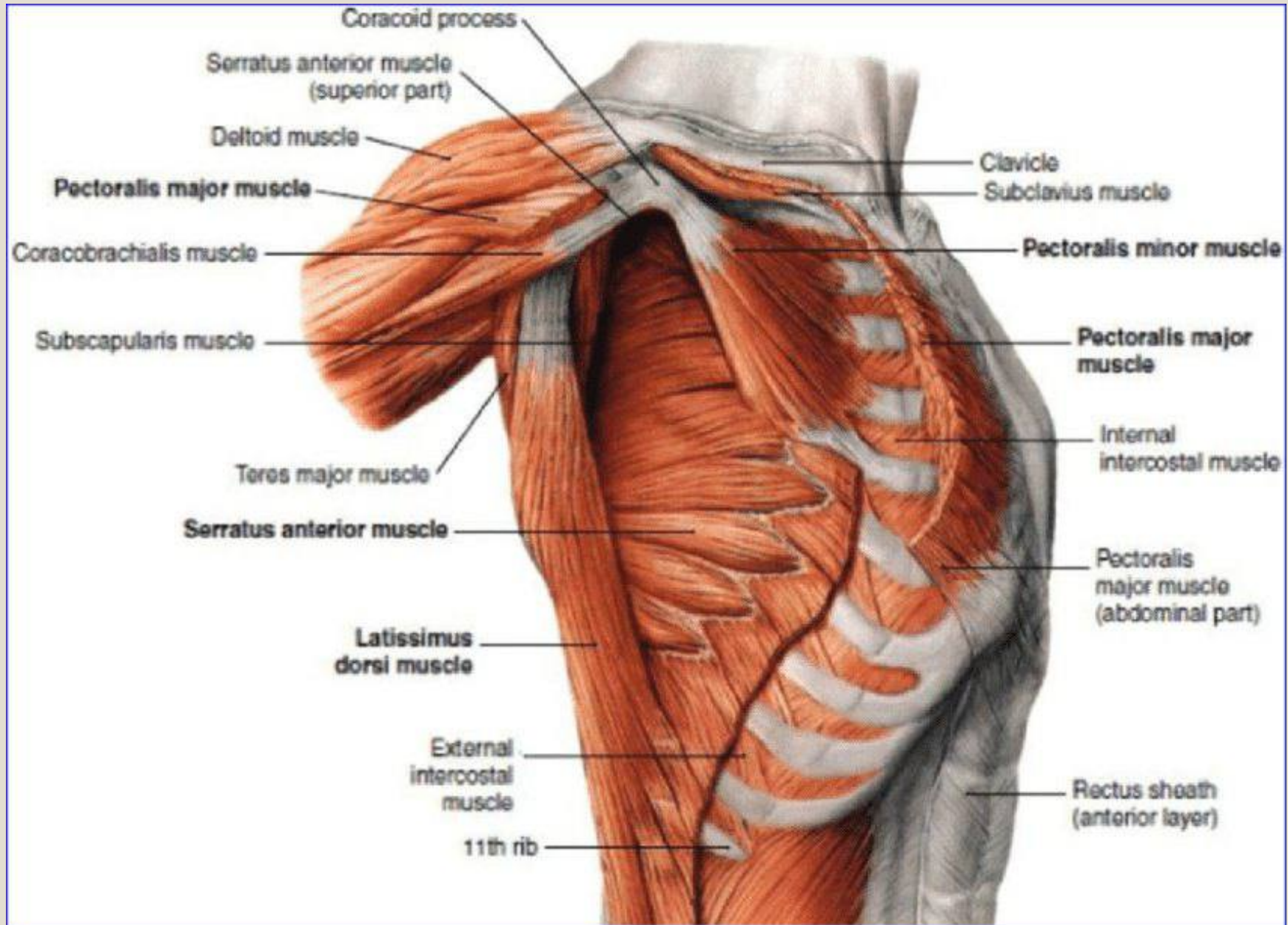
Thoracic outlet
(compressed area)

Muscle



Muscles of the thoracic wall





Intercostal Muscles

The spaces between the ribs contain 3 muscles :

- the **external** intercostal muscles.
- the **internal** intercostal muscles.
- the **innermost** intercostal muscle.

The innermost intercostal muscle is lined internally by the parietal pleura.

The intercostal nerves and blood vessels run between the internal and innermost layers of muscle.

They are arranged in the following order **from above downward:**

(intercostal vein, intercostal artery, and intercostal nerve (i.e., VAN).

Intercostal Spaces - Anatomy

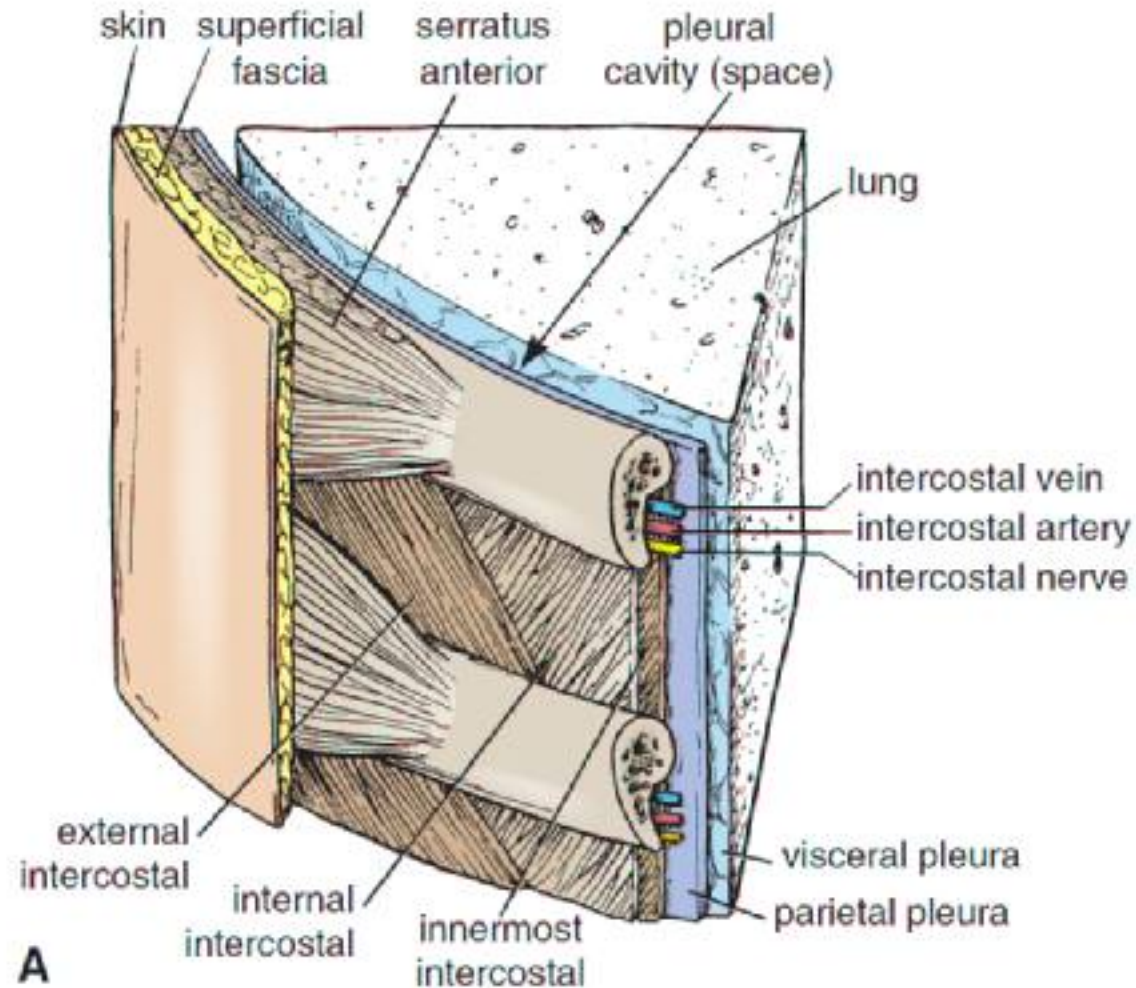
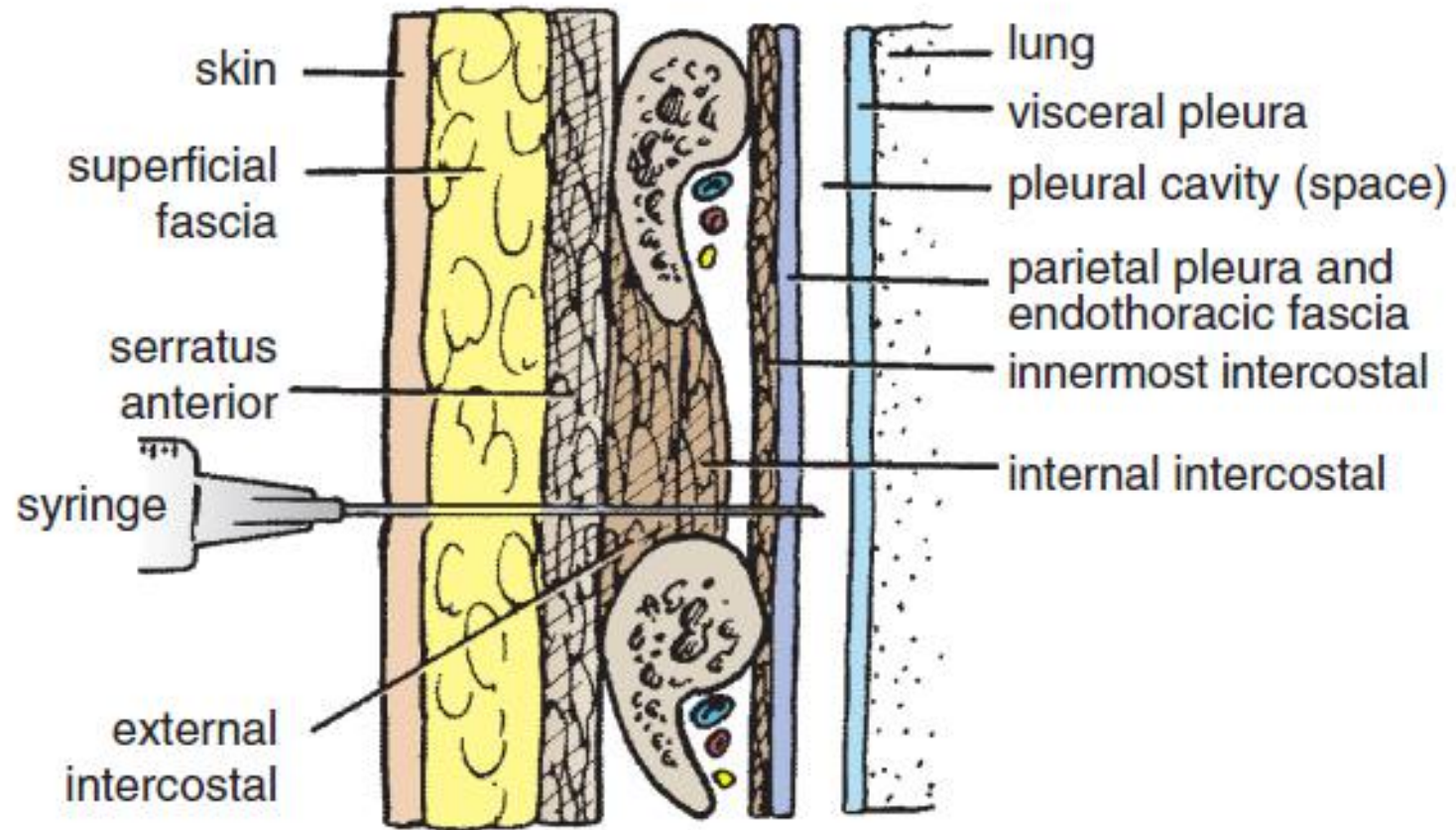


FIGURE 2.8 A. Section through an intercostal space. B. Struc

A very important note to know -

- A thoracostomy tube (Chest Tube) is usually placed **ABOVE THE RIB**, in order not to injure the intercostal bundle (artery, vein, nerve).



Structures penetrated by a needle when it passes from skin surface to pleural cavity. Depending on the site of penetration, the pectoral muscles will be pierced in addition to the serratus anterior muscle.

Intercostal Muscles - Anatomy

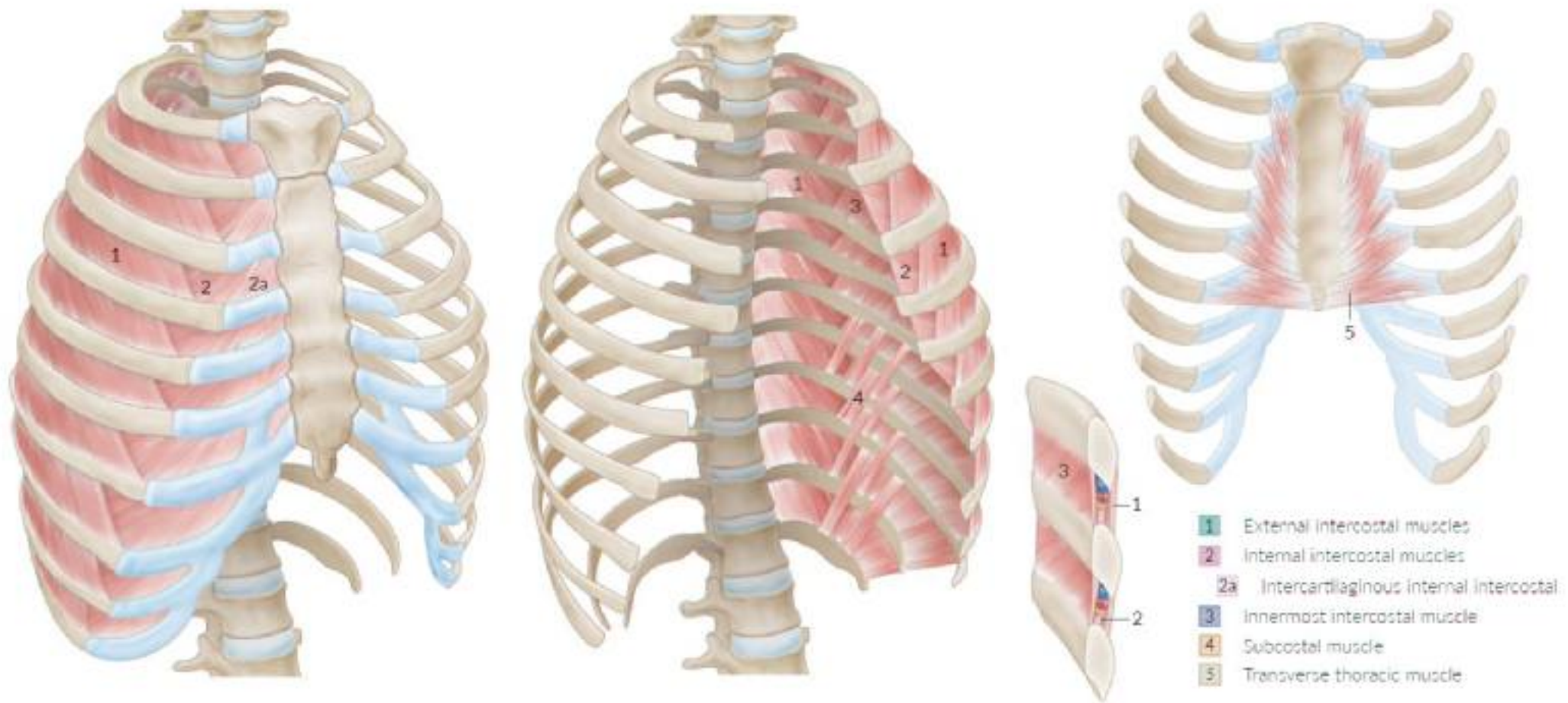
The **external intercostal muscle** forms the most superficial layer.

Its fibers are directed **downward and forward** from the inferior border of the rib above to the superior border of the rib below.

The **internal intercostal muscle** forms the intermediate layer. Its fibers are directed **downward and backward** from the subcostal groove of the rib above to the upper border of the rib below.

The **innermost intercostal muscle** forms the deepest layer and corresponds to the transversus abdominis muscle in the anterior abdominal wall.

It is related internally to fascia (endothoracic fascia) and parietal pleura.



The **external intercostal muscle** fibers run **downward forward**, while those of the **internal and innermost intercostal muscles** fibers run **downward backward**.

The **neurovascular bundle** lies between the internal and innermost intercostal muscles just below the **inferior border of the rib**.

Intercostal Muscles- Function

External intercostal muscles - Elevate the ribs during **inspiration**.
(Widening of intercostal spaces – increasing thoracic volume).

Internal intercostal muscles - Lower the ribs during **expiration**.
(Narrowing of intercostal spaces – decreasing thoracic volume).

Intercostal Arteries

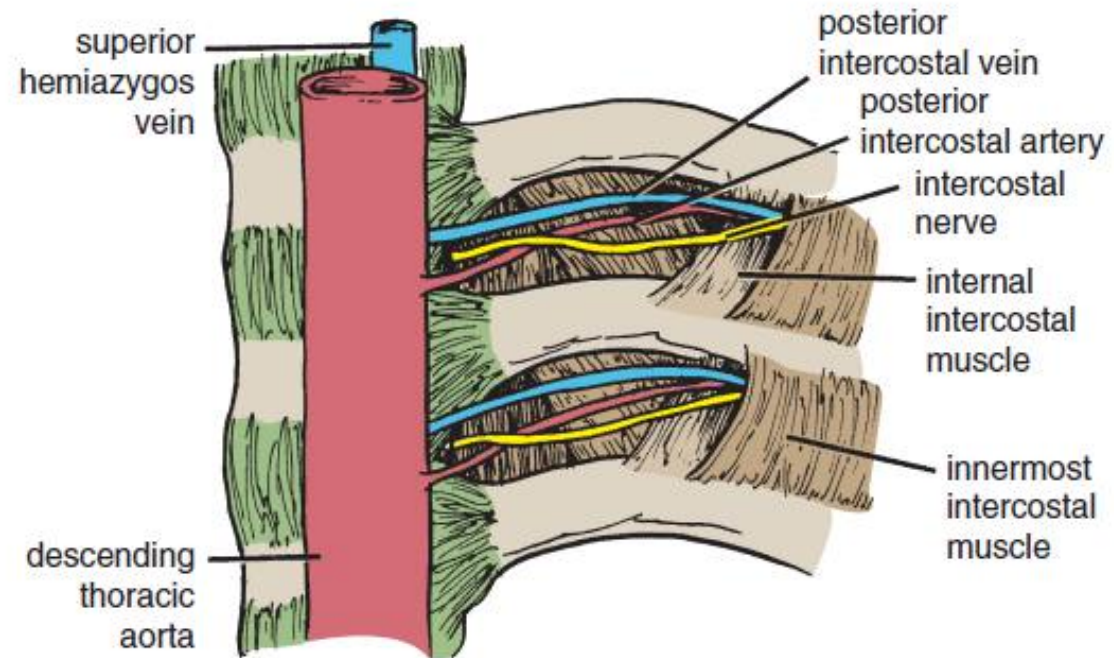
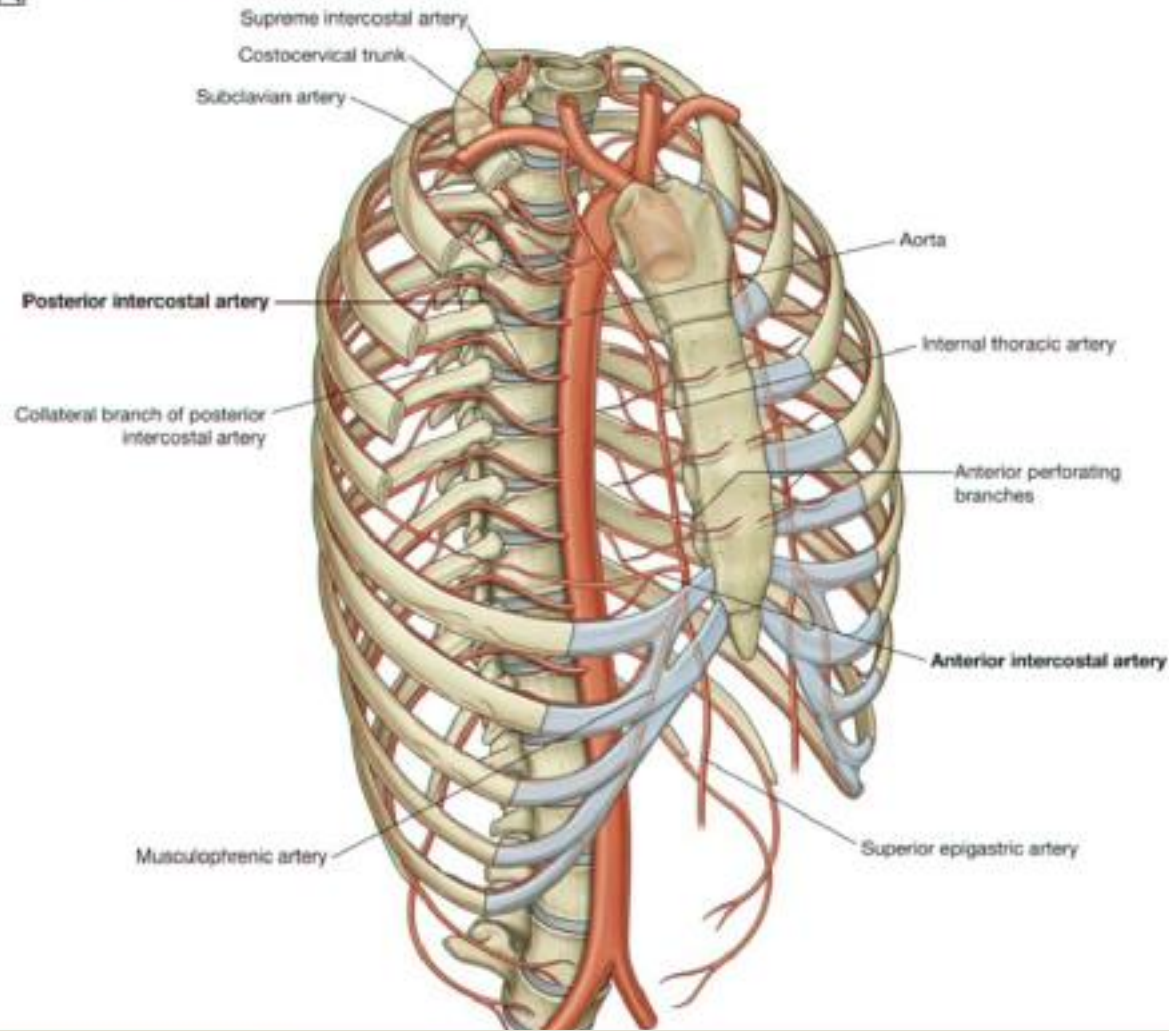
- In each intercostal space:

(One Posterior + Two Anterior) intercostal arteries.

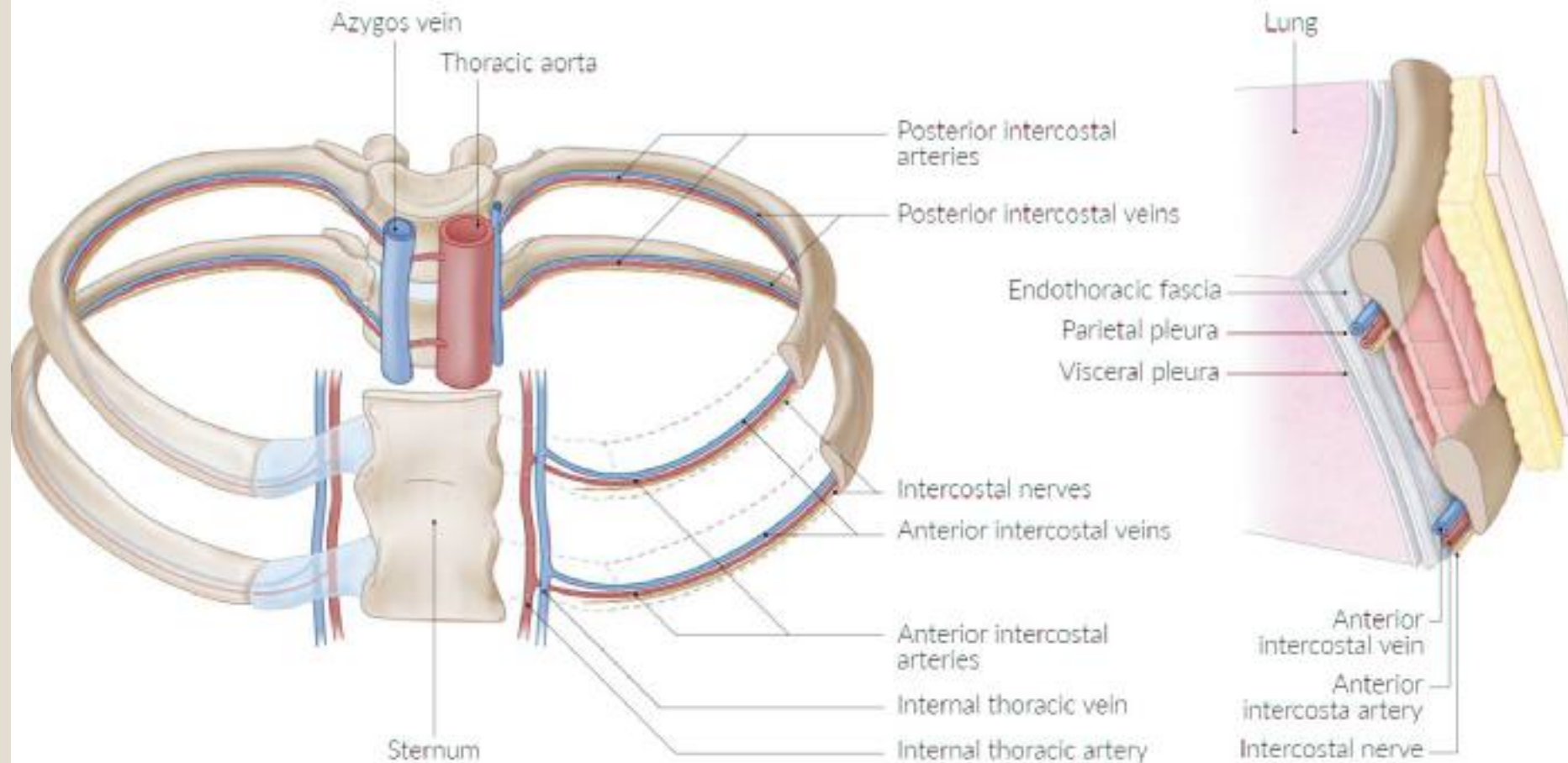
Each intercostal space contains a large single posterior intercostal artery and two small anterior intercostal arteries.

The **posterior intercostal arteries** are as follows:

- the first two spaces are branches from the superior intercostal artery, a branch of the costocervical trunk of the subclavian artery.
- The posterior intercostal arteries of the lower nine spaces are branches of the descending thoracic aorta.



The lower nine posterior intercostal arteries arise from the descending thoracic aorta. While the first two posterior intercostal arteries arise from subclavian artery.



- Illustration of the intercostal artery, vein and nerve within the costal sulcus. As the pathway of these structures follows the inferior edge of the rib, **medical interventions, such as chest drain insertion, is always performed on the superior edge of the rib**

Intercostal Arteries Anatomy

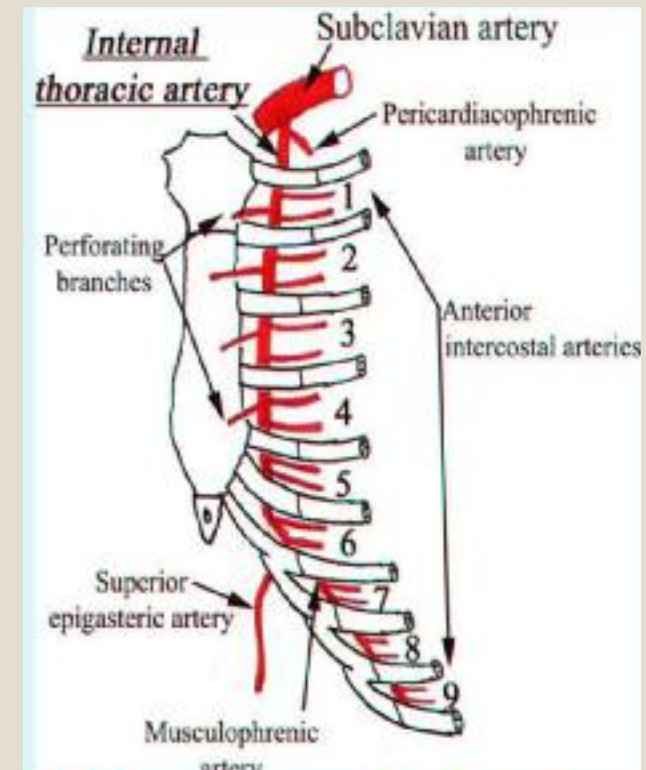
The **anterior intercostal arteries** of the **first six** spaces are branches of the **internal thoracic artery**, which arises from the first part of the subclavian artery.

The anterior intercostal arteries of the lower spaces are branches of the **musculophrenic artery**, one of the terminal branches of the internal thoracic artery.

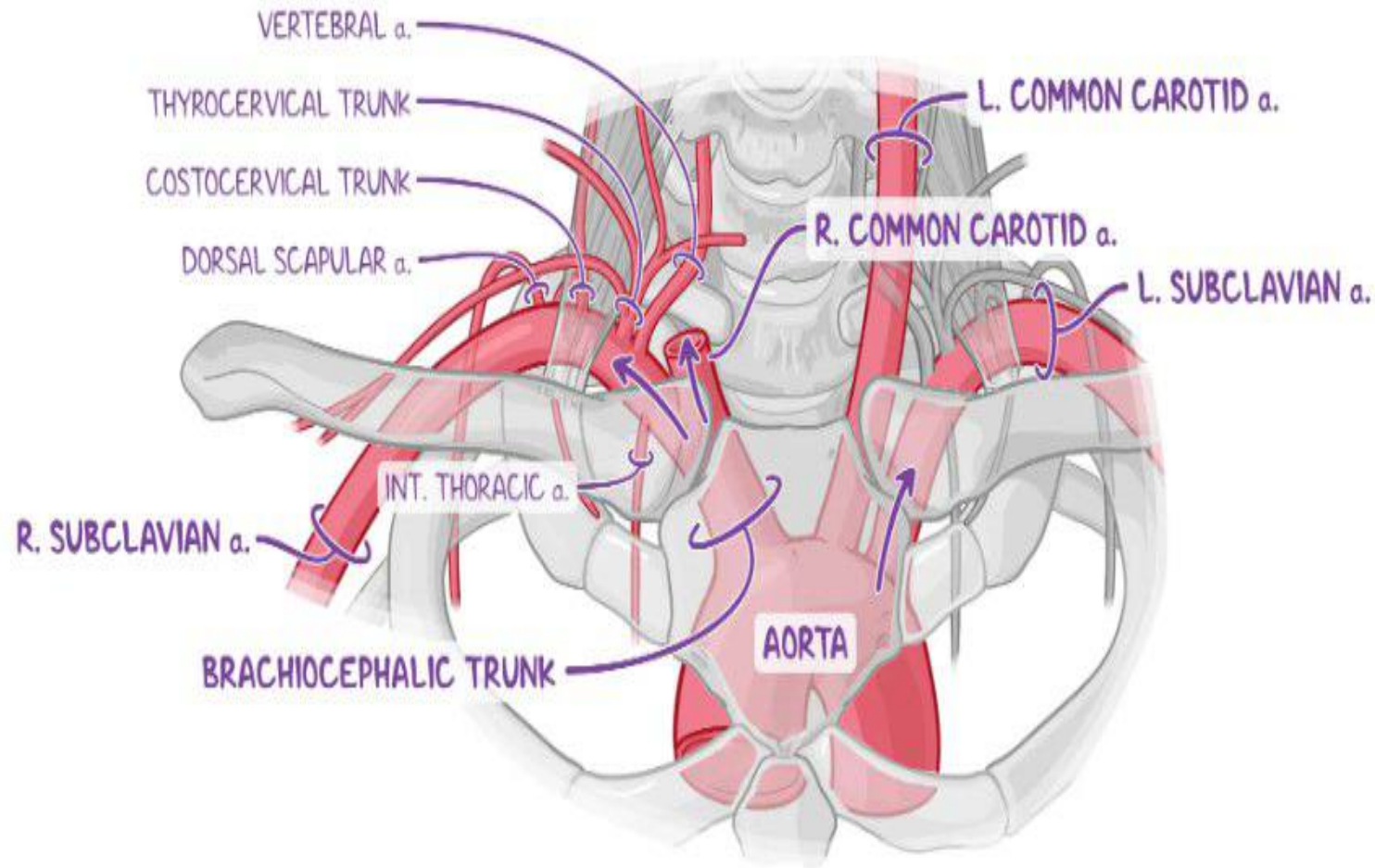
Intercostal Arteries Anatomy

The internal mammary (thoracic) artery is a branch of (first part of subclavian artery).
(What are other branches of subclavian artery?)

The internal thoracic artery terminates opposite to the sixth intercostal space by dividing into: **musculophrenic artery** and **superior epigastric artery**.



Branches of subclavian artery



vertebral artery

internal thoracic artery

thyrocervical trunk

costocervical trunk

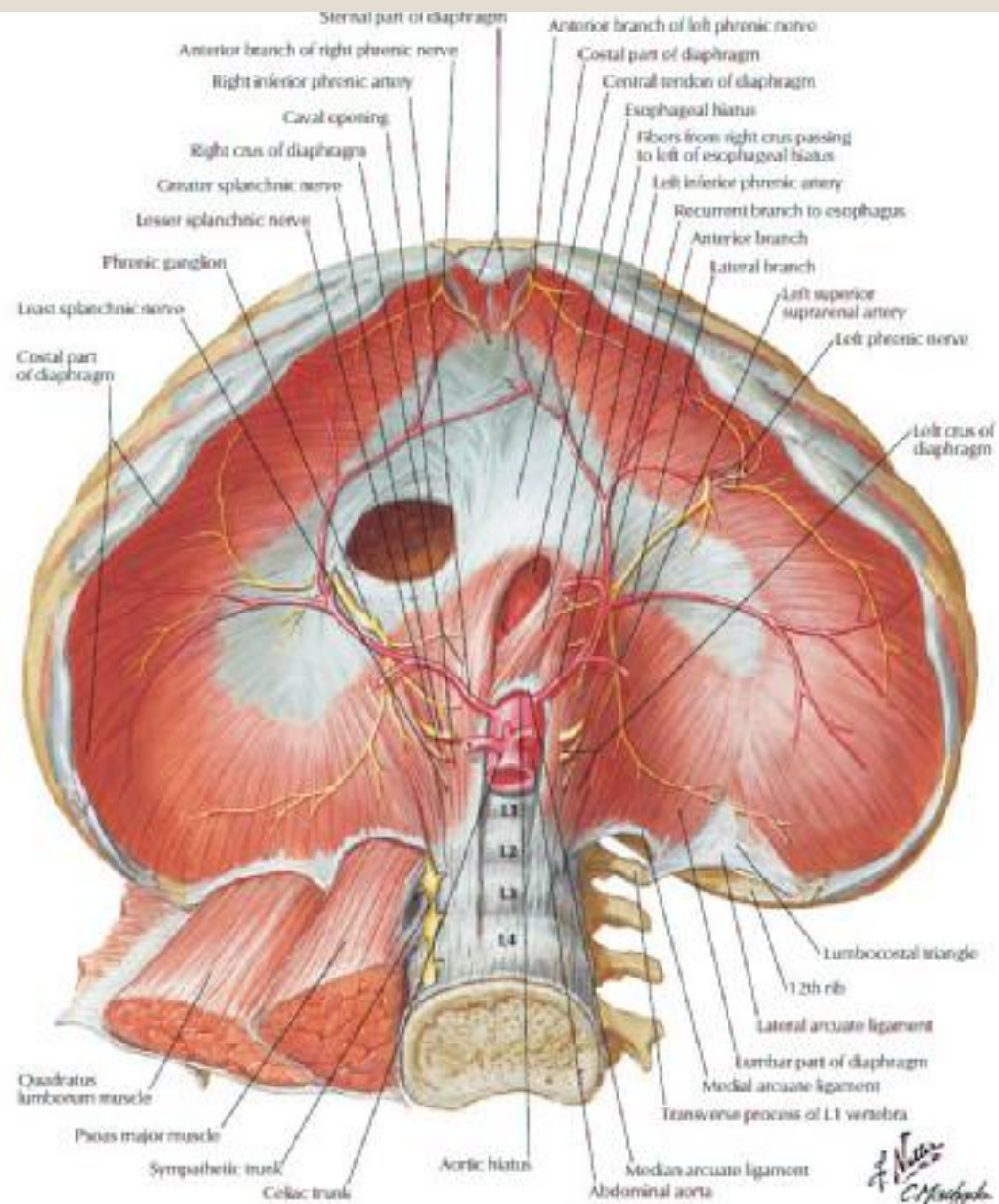
dorsal scapular artery

Diaphragm - Anatomy

The diaphragm is a thin muscular and tendinous septum that separates the chest cavity above from the abdominal cavity below. It is pierced by the structures that pass between the chest and the abdomen.

The diaphragm is the most important muscle of respiration.

It is dome shaped and consists of a **peripheral muscular part**, which arises from the margins of the thoracic opening, and **a centrally placed tendon**.



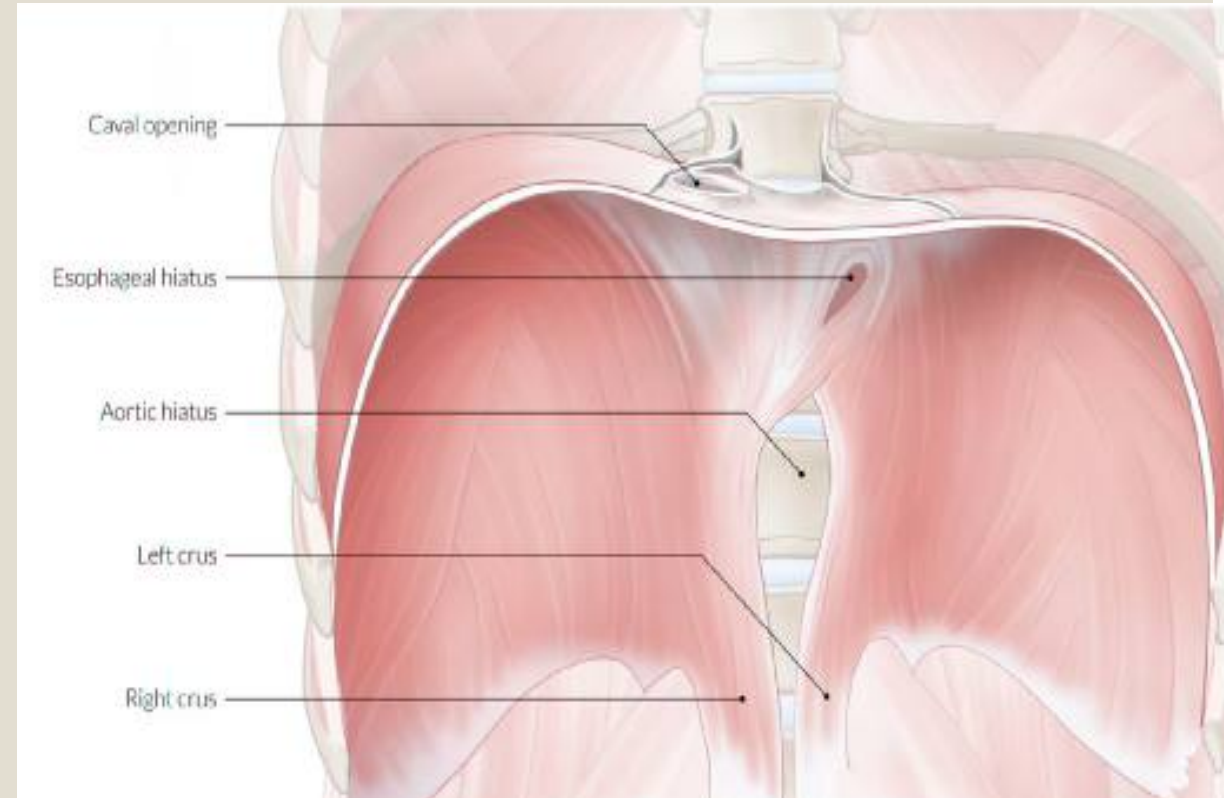
Diaphragm - Anatomy

- The diaphragm curves up into **right and left domes**.
- The right dome reaches as high as the upper border of the **5th rib**, and the left dome may reach the lower border of the 5th rib.

(The right dome lies at a higher level, because of the large size of the right lobe of the liver.)

The central tendon lies at the level of the xiphisternal joint.

The domes support the right and left lungs, whereas the central tendon supports the heart.



(The **right** dome lies at a **higher** level, because of the large size of the right lobe of the **liver**)

Diaphragm :

- Peripheral muscular region has the following parts:

– **Sternal part**: originates from the posterior surface of the sternum

– **Costal part**: originates from the inner surface of the lower 6 ribs (7th–12th ribs)

– **Lumbar part**: originates from L1–L3 vertebrae include :

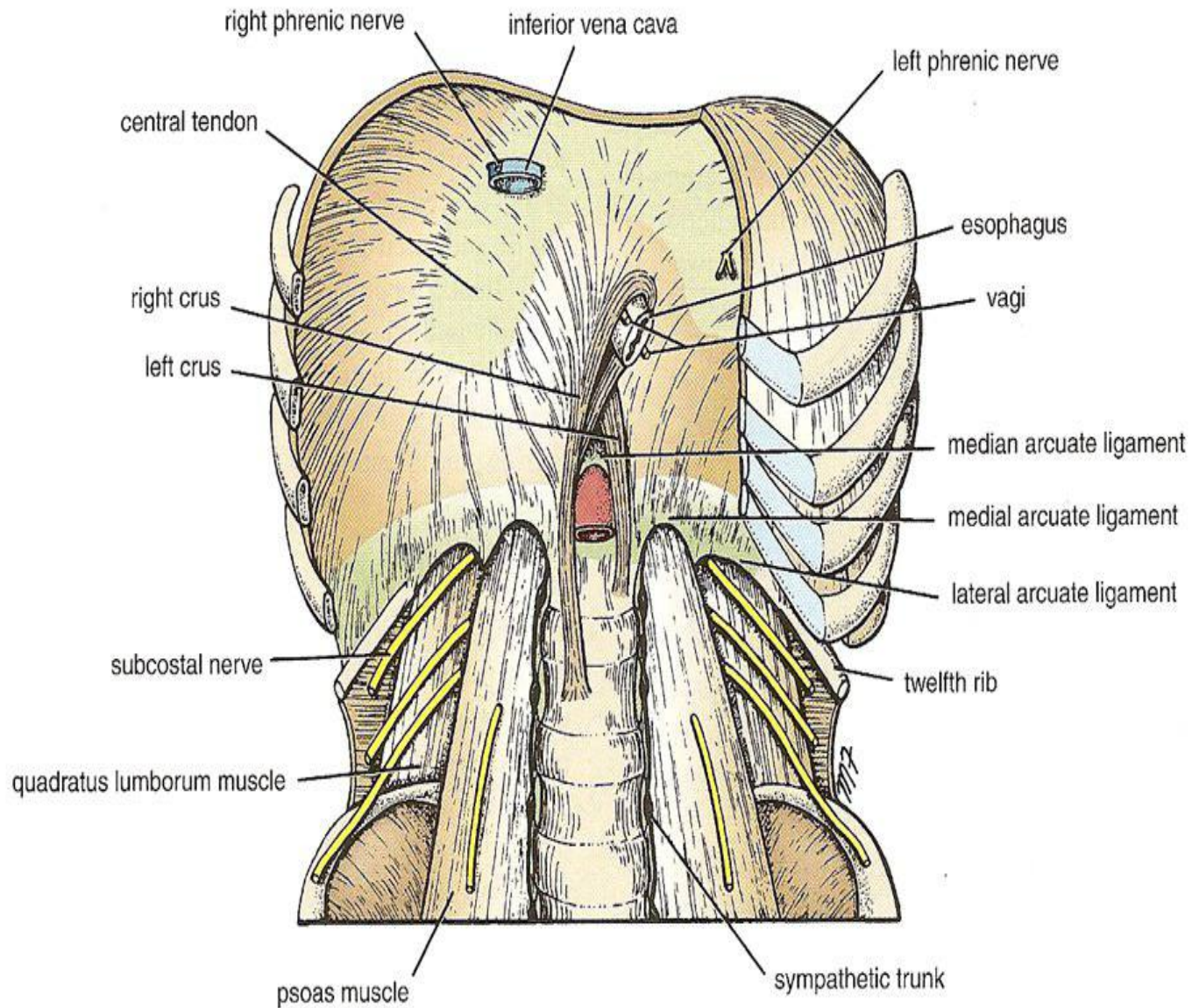
1. **Crura** muscle bundles Rt crus L1-L3 and Lt crus L1-L2

2. **Arcuate Ligaments**:

Median: medial borders of crura

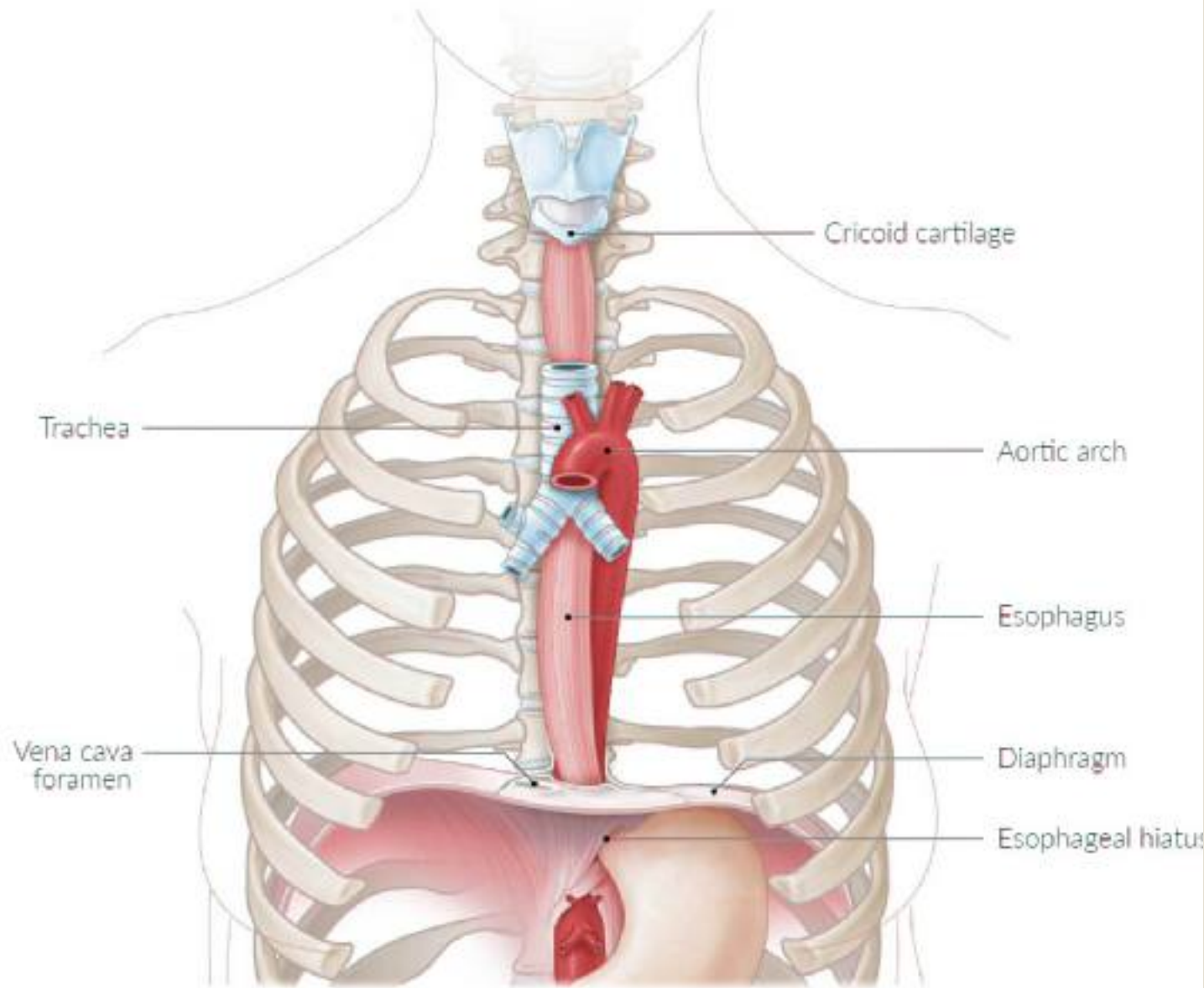
Medial: L2 body L1 Transverse Process

Lateral: L1 Transverse Process 12th rib



The diaphragm has the following openings:

- **Caval hiatus (right)**: at **T8** serves the inferior vena cava and the **right** phrenic nerve
- **Esophageal hiatus (left)**: at **T10** serves the esophagus and the vagus nerve
- **Aortic hiatus (midline)**: at **T12** serves the aorta, azygos vein, and the thoracic duct



- The esophagus begins at the lower border of the cricoid cartilage.

It first descends posterior to the trachea, and then posterior to the heart.

At the level of the 4th thoracic vertebra, the aorta runs adjacent to the esophagus, pushing it slightly to the right.

The esophagus passes through the esophageal hiatus of the diaphragm at the level of the **10th thoracic vertebra** and ends at the stomach after a brief stretch within the peritoneum.

Nerve Supply of Diaphragm

- **Motor nerve supply:** The right and left phrenic nerves

(Phrenic Nerve = (C3, C4, C5))

- **Sensory :**

Central: phrenic nerve

Lateral: intercostal nerves



C3, C4, C5 keeps the diaphragm alive.

Structures passing through the diaphragm – Diaphragm Openings

Openings of the diaphragm		
Opening	Level	Structure
<u>Caval hiatus</u>	• <u>T8</u>	• <u>IVC</u> • <u>Right phrenic nerve</u>
Esophageal hiatus 	• <u>T10</u>	• <u>Esophagus</u> • <u>Vagus nerve</u> (anterior and posterior trunk)
Aortic hiatus 	• <u>T12</u>	• <u>Aorta</u> • <u>Thoracic duct</u> • <u>Azygos vein</u>

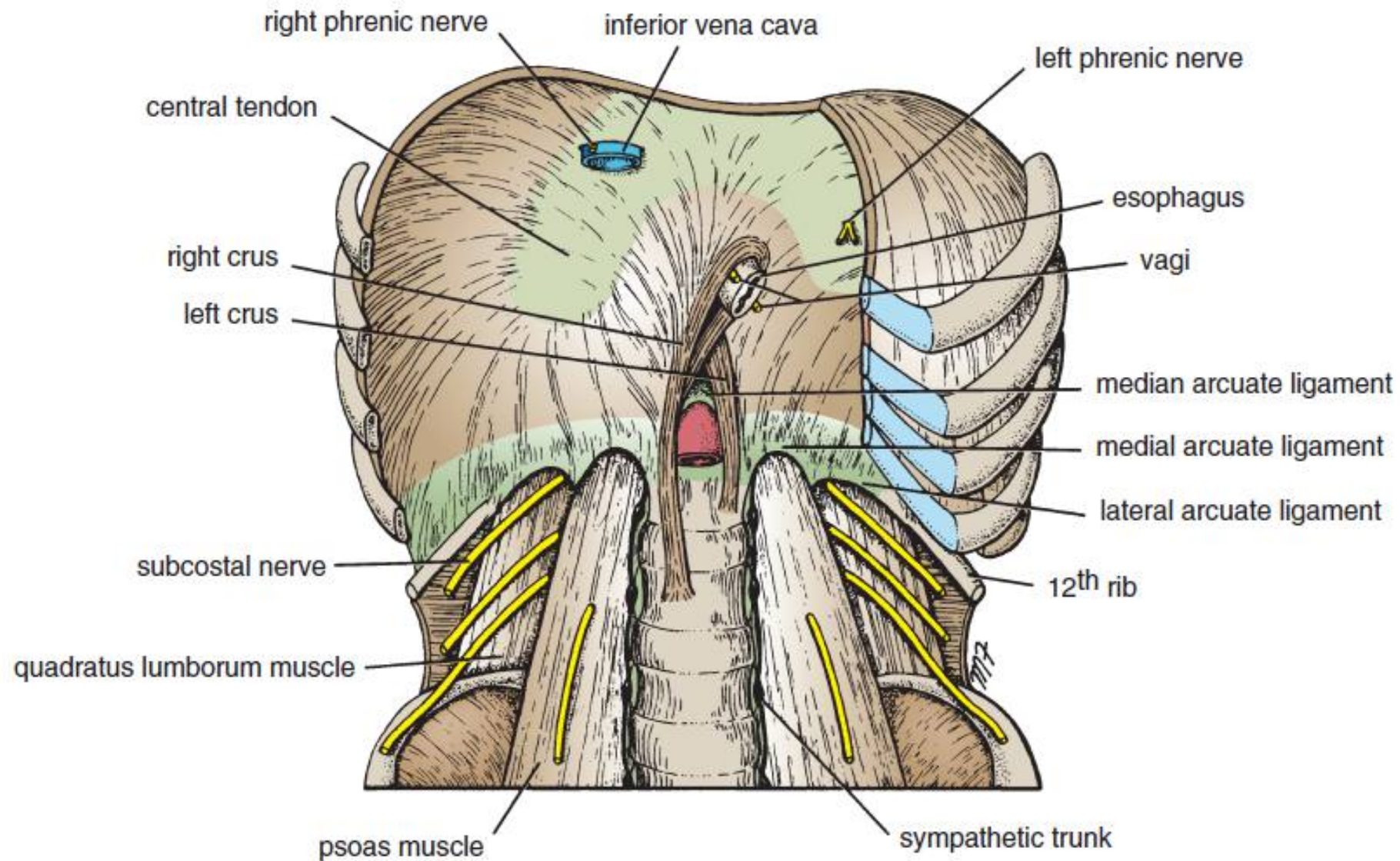
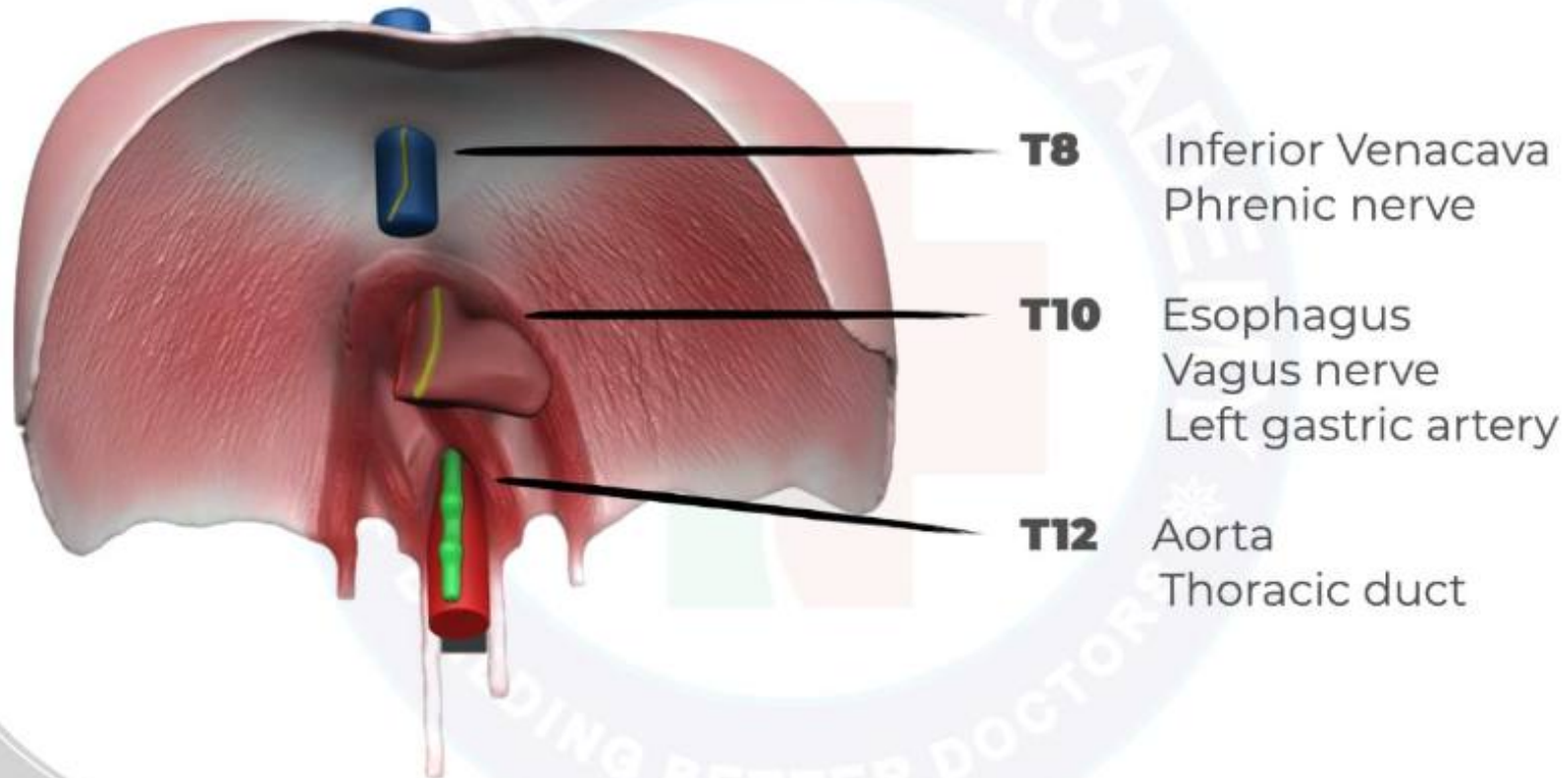


FIGURE 2.16 Diaphragm as seen from below. The anterior portion of the right side has been removed. Note the sternal, costal, and vertebral origins of the muscle and the important structures that pass through it.

OPENINGS IN THE DIAPHRAGM



Diaphragm - Action

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 respiration, particularly inspiration.

(With inspiration, the diaphragm goes **DOWNWARD**)

- With inspiration, the diaphragm pushes the abdominal organs downwards, this is important in clinical examination, in order to palpate organs such as liver, gallbladder, and spleen.

TABLE 2.1 Muscles of the Thorax

Name of Muscle	Origin	Insertion	Nerve Supply	Action
External intercostal muscle (11) (fibers pass downward and forward)	Inferior border of rib	Superior border of rib below	Intercostal nerves	With 1st rib fixed, they raise ribs during inspiration and thus increase anteroposterior and transverse diameters of thorax
Internal intercostal muscle (11) (fibers pass downward and backward)	Inferior border of rib	Superior border of rib below	Intercostal nerves	With last rib fixed by abdominal muscles, they lower ribs during expiration
Innermost intercostal muscle (incomplete layer)	Adjacent ribs	Adjacent ribs	Intercostal nerves	Assists external and internal intercostal muscles
Diaphragm (most important muscle of respiration)	Xiphoid process; lower six costal cartilages, first three lumbar vertebrae	Central tendon	Phrenic nerve	Very important muscle of inspiration; increases vertical diameter of thorax by pulling central tendon downward; assists in raising lower ribs Also used in abdominal straining and weight lifting



CLINICAL NOTES

Needle Thoracostomy

A needle thoracostomy is necessary in patients with tension pneumothorax (air in the pleural cavity under pressure) or to drain fluid (blood or pus) away from the pleural cavity to allow the lung to reexpand. It may also be necessary to withdraw a sample of pleural fluid for microbiologic examination.

Anterior Approach

For the anterior approach, the patient is in the supine position. The sternal angle is identified, and then the 2nd costal cartilage, the 2nd rib, and the second intercostal space are found in the midclavicular line.

Lateral Approach

For the lateral approach, the patient is lying on the lateral side. The 2nd intercostal space is identified as above, but the anterior axillary line is used.

The skin is prepared in the usual way, and a local anesthetic is introduced along the course of the needle above the upper border of the 3rd rib. The thoracostomy needle will pierce the following structures as it passes through the chest wall (see Fig. 2.8): (a) skin, (b) superficial fascia (in the anterior approach the pectoral muscles are then penetrated), (c) serratus anterior muscle,

(d) external intercostal muscle, (e) internal intercostal muscle, (f) innermost intercostal muscle, (g) endothoracic fascia, and (h) parietal pleura.

The needle should be kept close to the upper border of the 3rd rib to avoid injuring the intercostal vessels and nerve in the subcostal groove.

Tube Thoracostomy

The preferred insertion site for a tube thoracostomy is the fourth or fifth intercostal space at the anterior axillary line (Fig. 2.14). The tube is introduced through a small incision. The neurovascular bundle changes its relationship to the ribs as it passes forward in the intercostal space. In the most posterior part of the space, the bundle lies in the middle of the intercostal space. As the bundle passes forward to the rib angle, it becomes closely related to the lower border of the rib above and maintains that position as it courses forward.

The introduction of a thoracostomy tube or needle through the lower intercostal spaces is possible provided that the presence of the domes of the diaphragm is remembered as they curve upward into the rib cage as far as the 5th rib (higher on the right). Avoid damaging the diaphragm and entering the peritoneal cavity and injuring the liver, spleen, or stomach.

(continued)

Thoracotomy

In patients with penetrating chest wounds with uncontrolled intrathoracic hemorrhage, thoracotomy may be a life-saving procedure. After preparing the skin in the usual way, the physician makes an incision over the fourth or fifth intercostal space, extending from the lateral margin of the sternum to the anterior axillary line (Fig. 2.15). Whether to make a right or left incision depends on the site of the injury. For access to the heart and the aorta, the chest should be entered from the left side. The following tissues will be incised (see Fig. 2.14): (a) skin, (b) subcutaneous tissue, (c) serratus anterior and pectoral muscles, (d) external intercostal muscle and anterior intercostal membrane, (e) internal intercostal muscle, (f) innermost intercostal muscle, (g) endothoracic fascia, and (h) parietal pleura.

Avoid the **internal thoracic artery**, which runs vertically downward behind the costal cartilages about a fingerbreadth lateral to the margin of the sternum, and the **intercostal vessels and nerve**, which extend forward in the subcostal groove in the upper part of the intercostal space (see Fig. 2.14).

Hiccup

Hiccup is the involuntary spasmodic contraction of the diaphragm accompanied by the approximation of the vocal folds and closure of the glottis of the larynx. It is a common condition

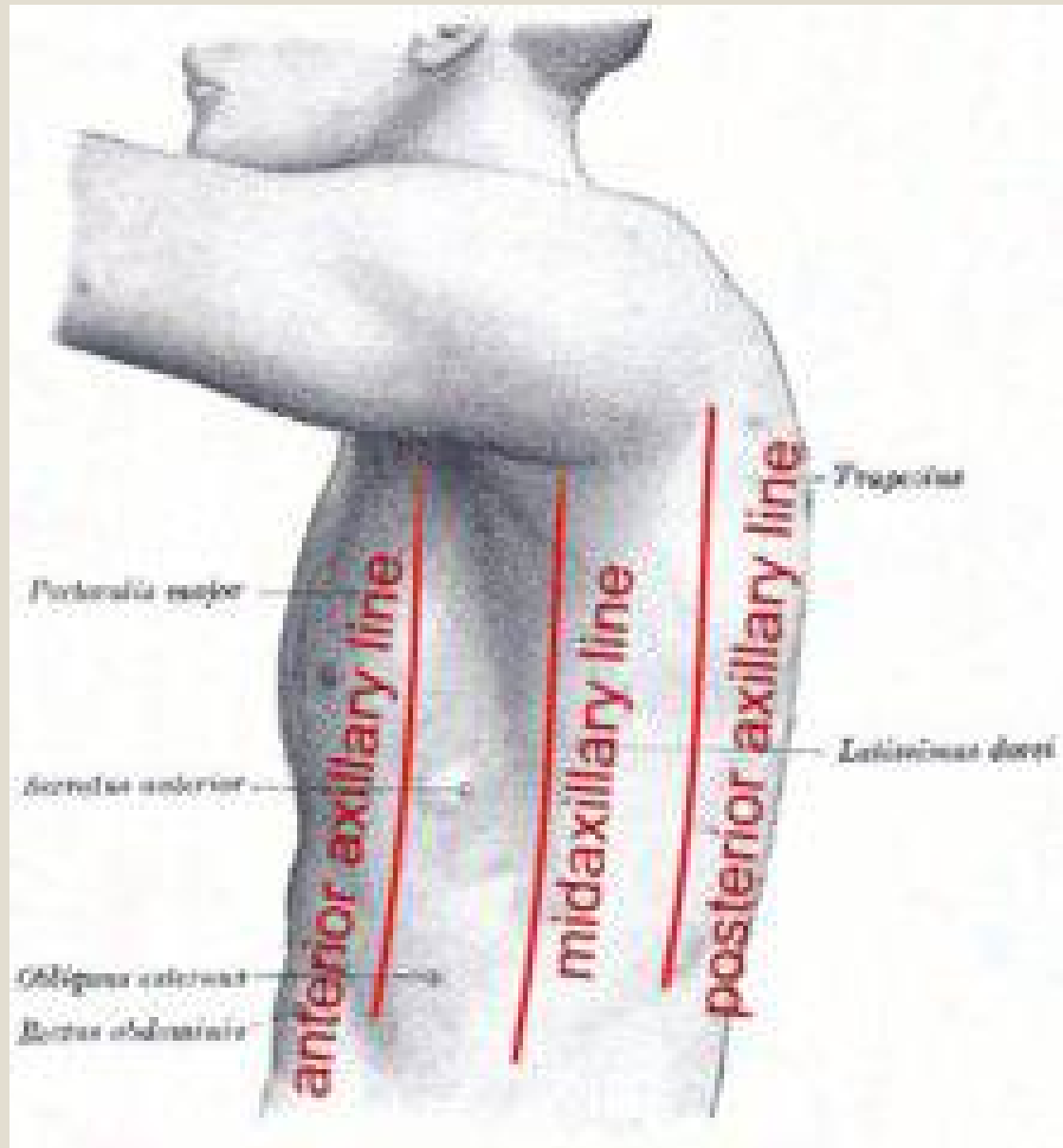
in normal individuals and occurs after eating or drinking as a result of gastric irritation of the vagus nerve endings. It may, however, be a symptom of disease such as pleurisy, peritonitis, pericarditis, or uremia.

Paralysis of the Diaphragm

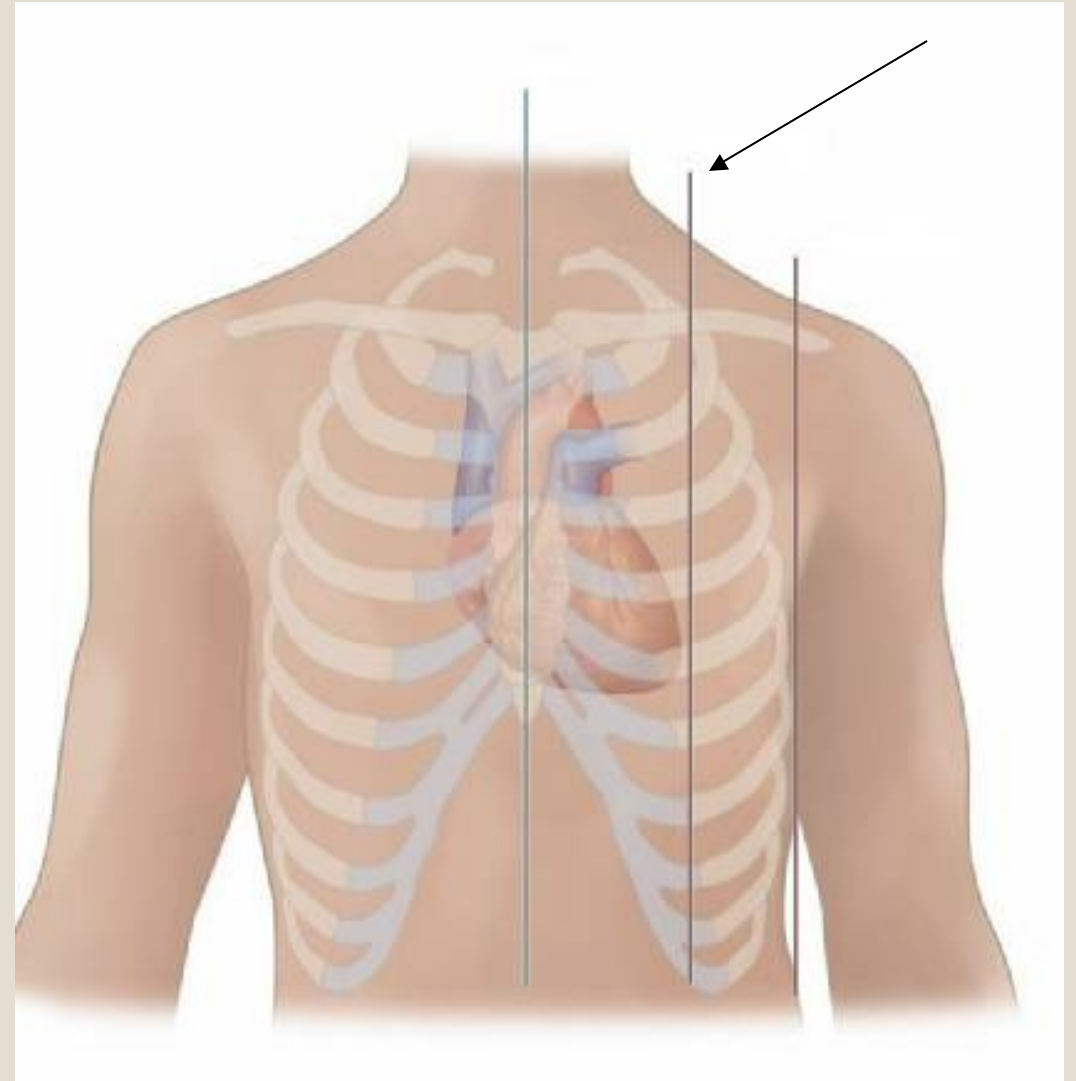
A single dome of the diaphragm may be paralyzed by crushing or sectioning of the phrenic nerve in the neck. This may be necessary in the treatment of certain forms of lung tuberculosis, when the physician wishes to rest the lower lobe of the lung on one side. Occasionally, the contribution from the fifth cervical spinal nerve joins the phrenic nerve late as a branch from the nerve to the subclavius muscle. This is known as the **accessory phrenic nerve**. To obtain complete paralysis under these circumstances, the nerve to the subclavius muscle must also be sectioned.

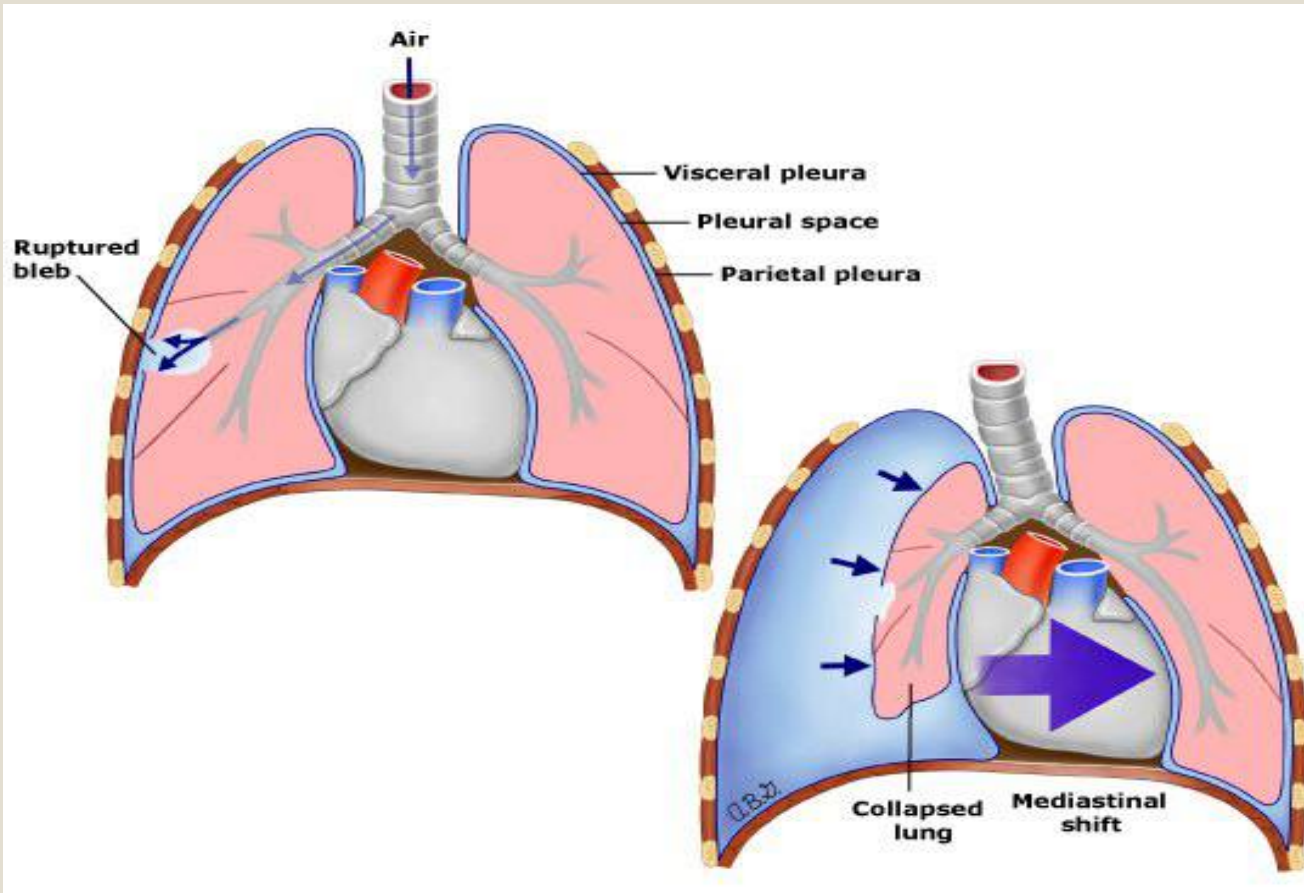
Penetrating Injuries of the Diaphragm

Penetrating injuries can result from stab or bullet wounds to the chest or abdomen. Any penetrating wound to the chest below the level of the nipples should be suspected of causing damage to the diaphragm until proved otherwise. The arching domes of the diaphragm can reach the level of the 5th rib (the right dome can reach a higher level).



Midclavicular line





- Needle thoracostomy is insertion of a needle into the pleural space to decompress a **tension pneumothorax**. Needle thoracostomy is an emergency, potentially life-saving, procedure.

Most common site for insertion is:
2nd Intercostal space,
mid-clavicular line.

How do you suspect tension pneumothorax?

- Diagnosis of tension pneumothorax should be suspected in individuals with **respiratory distress, tracheal deviation, distended neck veins, low blood pressure**



Chest Tube – Site of Insertion



Figure 72-2 Preferred site for intercostal drain placement: at a point along the mid-to-anterior axillary line, in the fourth or fifth interspace.

For pneumothorax or hemothorax, the tube is usually inserted in between **4th-5th intercostal space, between the mid-axillary and anterior axillary line.**

Chest tube – Safety Triangle

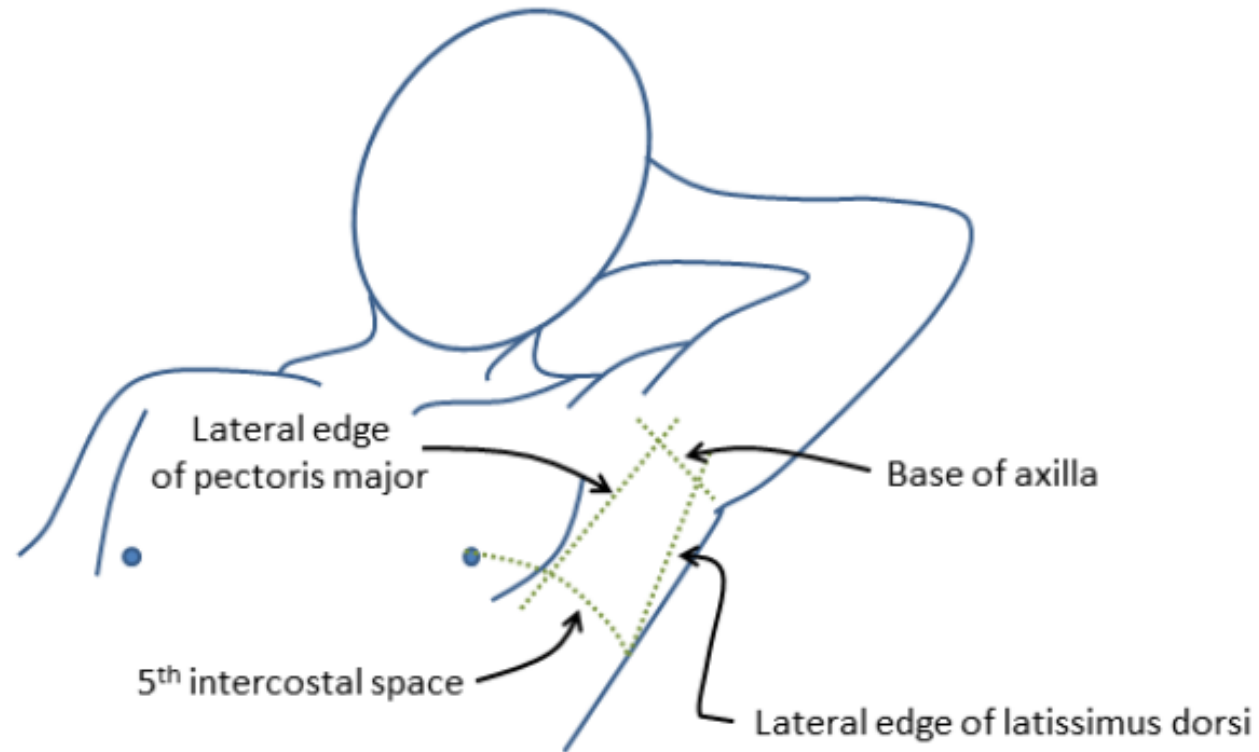


Figure 1: The safe triangle for inserting a chest drain. Redrawn and adapted from the [BTS pleural diseases guidelines](#).

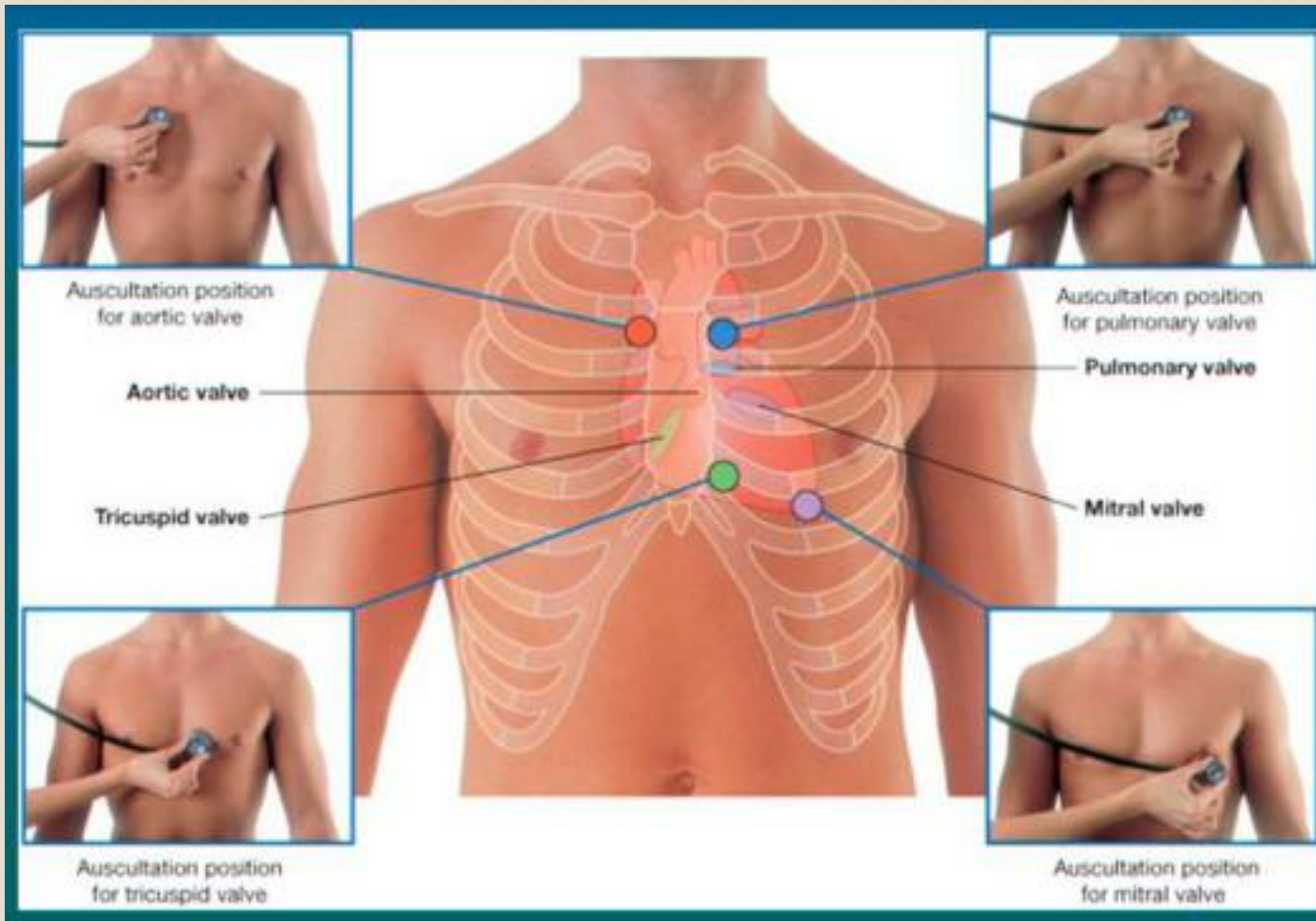
Surface Anatomy – Clinical Points

The apex beat of the heart is normally found in **the fifth left intercostal space in the mid-clavicular line.**

Nipple: is at the level of 4th intercostal space



Heart Valves – Surface Locations



Aortic Valve:

Right second intercostal space.

Pulmonary valve:

Left second intercostal space.

Tricuspid Valve:

Left fourth intercostal space.

Mitral valve:

The fifth left intercostal space in mid-axillary line.

Anterolateral dissection

Pectoralis major muscle (deep to pectoral fascia)

Serratus anterior muscle

External oblique muscle

Clavicle

Subclavius muscle

2nd rib

Pectoralis major muscle

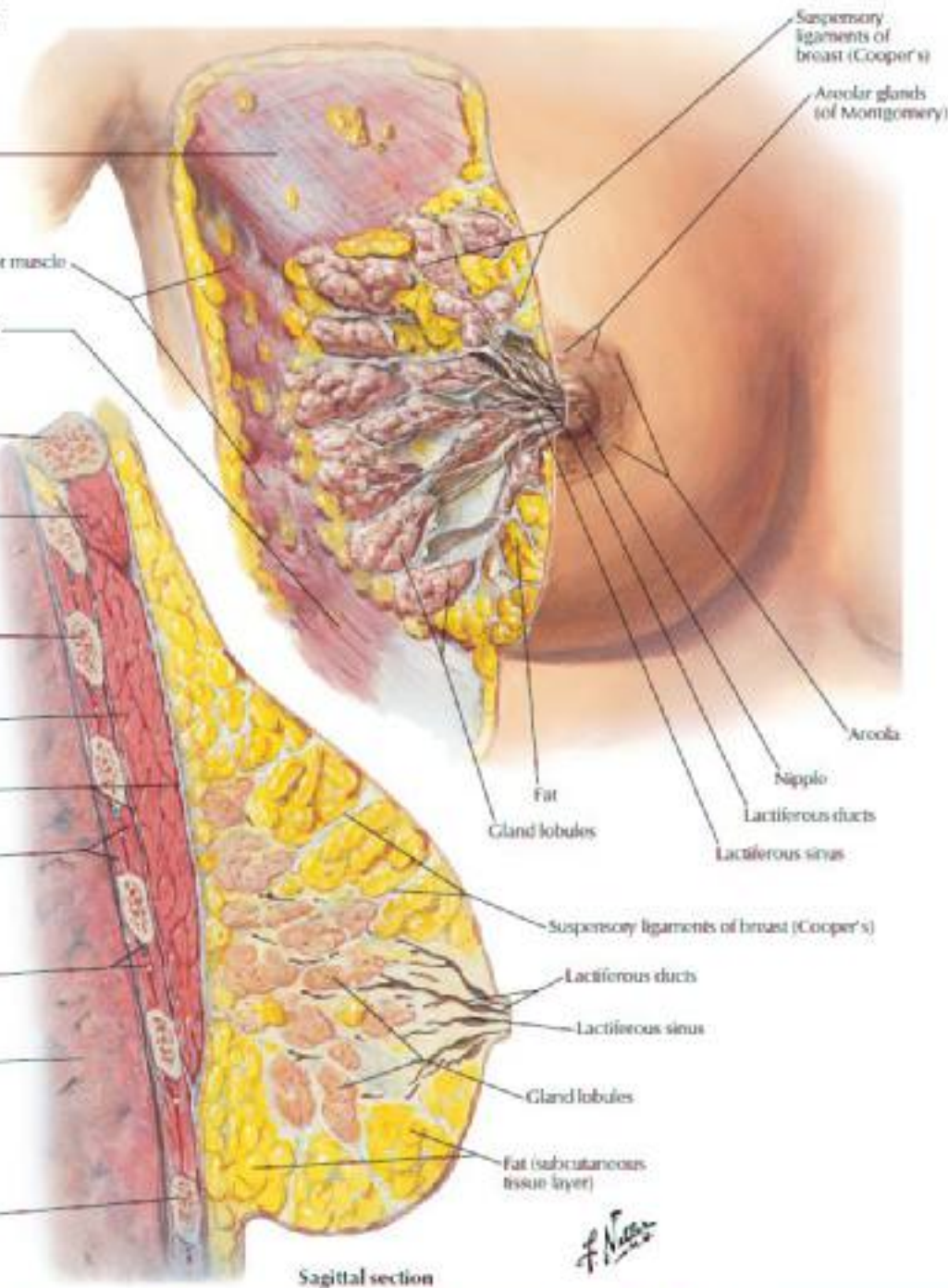
Pectoral fascia

Intercostal muscles

Intercostal vessels and nerve

Lung

6th rib



- **The mammary gland** overlies the 2nd to 6th ribs and their costal cartilages and extends from the lateral margin of the sternum to the midaxillary line.

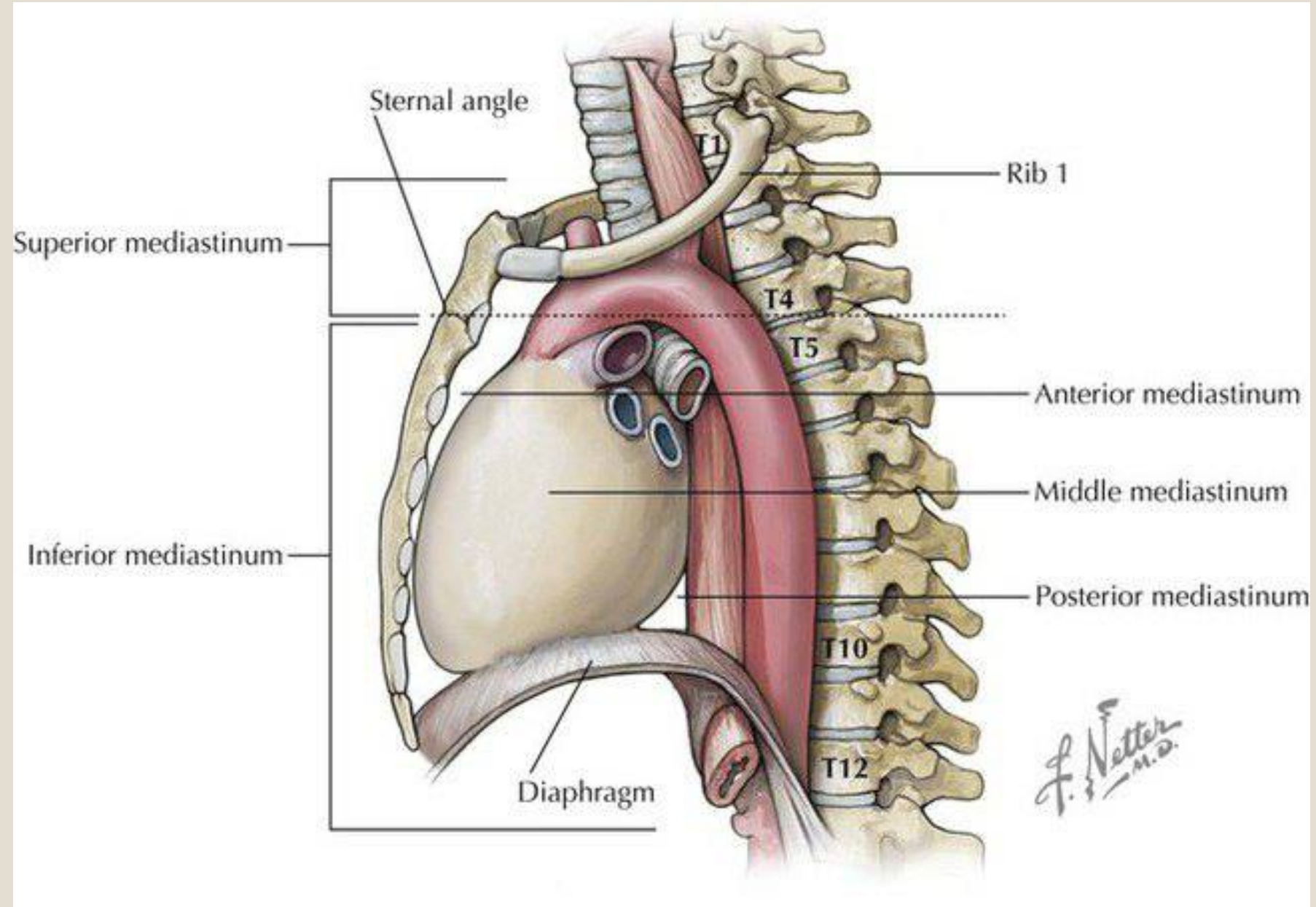
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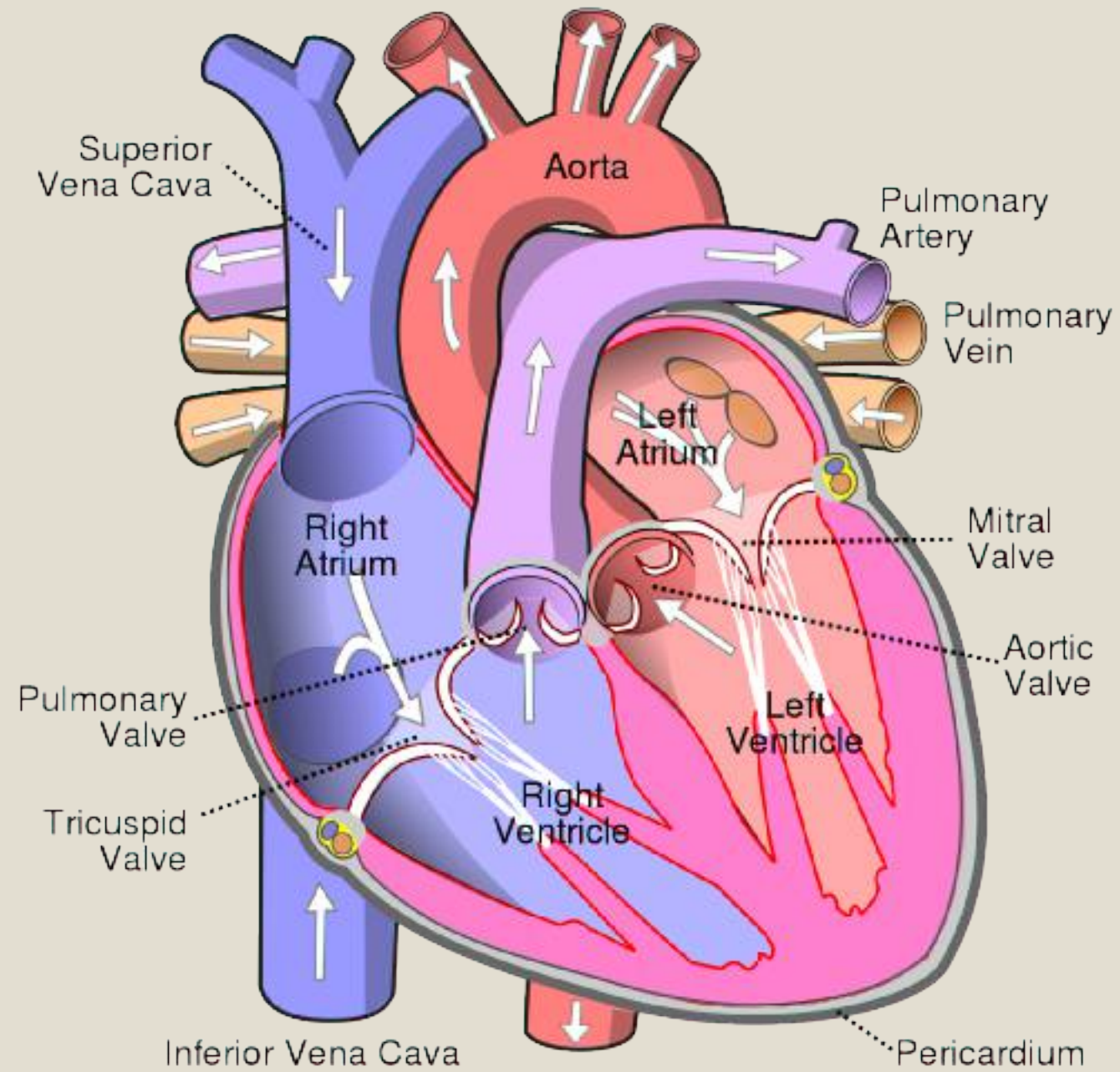
Thoracic Blood Vessels – Surface Anatomy

The **arch of the aorta** and the roots of the **brachiocephalic** and **left common carotid arteries** lie behind the manubrium of sternum.

The **superior vena cava** and the terminal **parts of the right and left brachiocephalic veins** also lie behind the manubrium sterni.

The **internal thoracic vessels** run vertically downward, posterior to the costal cartilages, lateral to the edge of the sternum, as far as the sixth intercostal space.





Thank You