



## **1-STERNUM**

- ≻Lies in the midline of the anterior chest wall
- $\succ$  It is a flat bone
- Divides into three parts:
- 1-Manubrium sterni2-Body of the sternum3- Xiphoid process

The body of the sternum articulates 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 <u>second to</u> <u>the seventh costal cartilages</u>

The xiphoid process is a thin plate of cartilage that becomes *ossified* at its proximal end during adult life

No ribs or costal cartilages are attached to it







formed by the articulation of the manubrium with the body of the sternum

Can be recognized by the presence of a transverse ridge on the anterior aspect of the sternum

# The transverse ridge lies at the level of the second costal cartilage

The point from which all costal cartilages and ribs are counted

The sternal angle lies opposite the intervertebral disc between *the fourth and fifth thoracic vertebrae* 



# 2-Ribs

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

The ribs are divided into *three categories according to their attachment to the sternum*:

**<u>1-True ribs:</u>** The upper seven pairs (<u>1-7</u>) are attached anteriorly to the sternum by their costal cartilages (*vertebrosternal*)

### <u>2-False ribs:</u>

<u>The 8th, 9th, and 10th</u> pairs of ribs are attached anteriorly to each other and to the 7th rib by means of their costal cartilages and small synovial joints. <u>(vertebrocostal)</u>

### <u>3-Floating ribs:</u>

The 11th and 12th pairs have no anterior attachment (*vertebral*)



According to the anatomical features presented on each rib they are classified into<u>: typical and</u> <u>a typical ribs</u>

# **Typical Rib**

A typical rib has

**1- A head :**The head has <u>**two facets**</u> for articulation <u>*with the numerically corresponding*</u> vertebral body and that of <u>*the vertebra immediately above*</u>

**2- Neck:** is a constricted portion situated between the head and the tubercle

**3-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** 

**4-Shaft:** a long, twisted, flat bone having a rounded, smooth superior border and a sharp, thin inferior border .The inferior border overhangs and forms **the costal groove**, which accommodates <u>*the intercostal*</u> <u>*vessels and nerve*</u>.

5-Angle



A typical ribs

For example, <u>*Rib I*</u> \*It is flat in the horizontal plane \*Has broad superior and inferior surfaces \*The head articulates <u>only with the body of</u> <u>vertebra TI and therefore has only one articular</u> <u>surface.</u> \*The superior surface of the rib is characterized by a distinct tubercle, <u>THE SCALENE TUBERCLE</u>, which separates two smooth grooves The anterior groove is caused by THE SUID CLAVIA NUVELN

### THE SUBCLAVIAN VEIN

and the posterior groove is caused by the

**SUBCLAVIAN ARTERY** 





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

➢ The diaphragm is the most important muscle of respiration.

➢ It is dome shaped and consists of a peripheral muscular part and a *centrally placed tendon* 

The origin of the diaphragm can be divided into three parts:

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



➤<u>The right crus</u> arises from the sides of the bodies of the first three lumbar vertebrae and the intervertebral discs

Some of the muscle fibers of the right crus pass up to the left and surround <u>the esophageal orifice in a</u> <u>slinglike loop</u>. These fibers appear to act as a sphincter and possibly assist in the prevention of regurgitation of the stomach contents into the thoracic part of the esophagus

The left crus arises from the sides of the bodies of the first two lumbar vertebrae and the intervertebral disc

✤Lateral to the crura the diaphragm arises from the medial and lateral arcuate ligaments

The medial arcuate ligament extends from the side of the body of the second lumbar vertebra to the tip of the transverse process of the first lumbar vertebra.

> <u>The lateral arcuate ligament</u> extends from the tip of the transverse process of the first lumbar vertebra to the lower border of the 12th rib.

The medial borders of the two crura are connected by *a median arcuate ligament*, which crosses over the anterior surface of the aorta





### Nerve supply of the diaphragm

The phrenic nerves pass vertically through the neck, the superior thoracic aperture, and the mediastinum to supply <u>motor</u> <u>innervation to the entire</u> <u>diaphragm</u>



Intercostal Spaces 1-SKIN 2-SUPERFISCIAL FASCIA 3- THREE MUSCLES OF RESPIRATION: THE EXTERNAL INTERCOSTAL THE INTERNAL INTERCOSTAL THE INNERMOST INTERCOSTAL MUSCLE 4-THE ENDOTHORACIC FASCIA 5-THE PARIETAL PLEURA.

The intercostal nerves and blood vessels run between the intermediate <u>(internal intercostal)</u> and deepest layers <u>(innermost intercostal)</u> of muscles They are arranged in the following order from above downward: INTERCOSTAL VEIN INTERCOSTAL ARTERY INTERCOSTAL NERVE (VAN)



# **Intercostal Muscles**

#### The external intercostal muscle

 the most superficial layer.
 Its fibers are directed downward and forward ORIGIN: FROM THE INFERIOR BORDER OF THE RIB ABOVE TO INSERTION: THE SUPERIOR BORDER OF THE RIB BELOW

The muscle extends forward to the costal cartilage where it is replaced by an aponeurosis, <u>THE ANTERIOR (EXTERNAL)</u> <u>INTERCOSTAL MEMBRANE</u>



#### 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 muscle extends backward from the sternum in front to the angles of the ribs behind, where the muscle is replaced by an aponeurosis, the posterior (internal) intercostal membrane



The innermost intercostal muscle

➢Forms the deepest layer and corresponds to the transversus abdominis muscle in the anterior abdominal wall

It is an incomplete muscle layer and crosses more than one intercostal space within the ribs.

It is related internally to fascia (endothoracic fascia) and parietal pleura and externally to the intercostal nerves and vessels



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

The posterior intercostal arteries of the first two spaces are branches from *the superior intercostal artery*, a branch of the <u>costocervical trunk</u> of the <u>subclavian artery</u>

The posterior intercostal arteries of the lower nine spaces are branches <u>Of</u>

THE DESCENDING THORACIC AORTA

*The anterior intercostal* arteries of <u>the first six</u> spaces are branches of <u>THE INTERNAL THORACIC ARTERY</u> which arises from the first part of the

which arises from the first part of the subclavian artery.



The anterior intercostal arteries of the lower spaces are branches of <u>THE MUSCULOPHRENIC ARTERY</u>, one of the terminal branches of the internal thoracic artery. The corresponding posterior intercostal veins drain backward into the azygos or hemiazygos veins , and the anterior intercostal veins drain forward into the internal thoracic and musculophrenic veins



Intercostal Nerves The intercostal nerves are the anterior rami of the first 11 thoracic spinal nerves

The anterior ramus of the 12th thoracic nerve lies in the abdomen and runs forward in the abdominal wall as the subcostal nerve



Each intercostal nerve enters an intercostal space between the parietal pleura and the posterior intercostal membrane It then runs forward inferiorly to the intercostal vessels in the subcostal groove of the corresponding rib, between the innermost intercostal and internal intercostal muscle.

![](_page_19_Figure_1.jpeg)

The first six nerves are distributed within their intercostal spaces.

The seventh to ninth intercostal nerves leave the anterior ends of their intercostal spaces by passing deep to the costal cartilages, to enter the anterior abdominal wall.

The 10th and 11th nerves, since the corresponding ribs are floating, pass directly into the abdominal wall

![](_page_20_Picture_3.jpeg)

# **6- Joints of the Chest Wall**

### **A-Joints of the Sternum**

*<u>1-The manubriosternal joint:</u>* is a *cartilaginous joint* between the **manubrium** and the **body of the sternum**.

A small amount of movement is possible during respiration.
<u>2-The xiphisternal joint:</u> is a cartilaginous joint between the xiphoid process (cartilage) and the body of the sternum.
The xiphoid process usually fuses with the body of the sternum

during middle age.

![](_page_21_Figure_5.jpeg)

![](_page_22_Figure_0.jpeg)

#### 1-Joints of the Heads of the Ribs

The first rib and the three lowest ribs have a single synovial joint with their corresponding vertebral body.
For the second to the ninth ribs, the head articulates by means of <u>a synovial joint</u> with the <u>corresponding</u> vertebral body and that of the vertebra above it 2-Joints of the Tubercles of the Ribs

The tubercle of a rib articulates by means of a synovial joint with the transverse process of the corresponding vertebra

This joint is absent on the 11th and 12th ribs

**3-Joints of the Ribs and Costal Cartilages** 

These joints *are cartilaginous joints*. No movement is possible.

![](_page_22_Figure_7.jpeg)

#### 4-Joints of the Costal Cartilages with the Sternum

The first costal cartilages articulate with the manubrium, by cartilaginous joints that permit no movement

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

✤In addition, the 6th, 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 ribs are embedded in the abdominal musculature.