Bones of the thorax :

A- *The sternum :*

The sternum (or breastbone) is a flat bone located at the anterior aspect of the thorax . It lies in the midline of the chest and has a 'T' shape. As part of the bony thoracic wall , the sternum helps protect the internal thoracic viscera – such as the heart , lungs and esophagus .

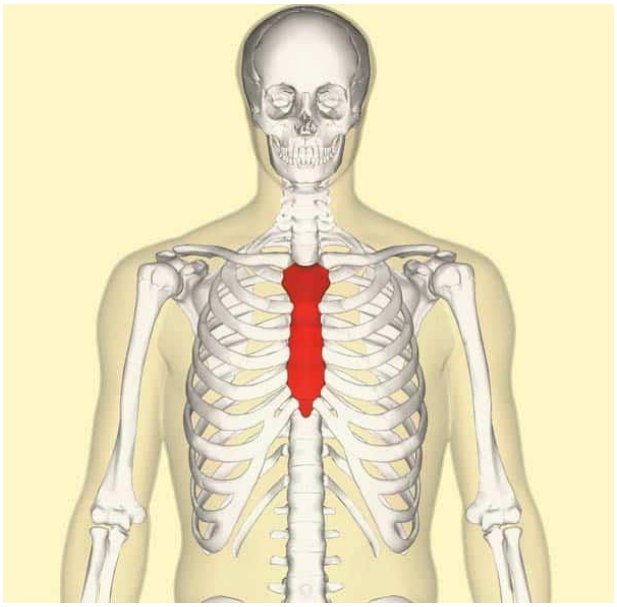


Fig 1 – Anatomical position of the sternum in the body thorax.

عظم القص

Parts of the Sternum :

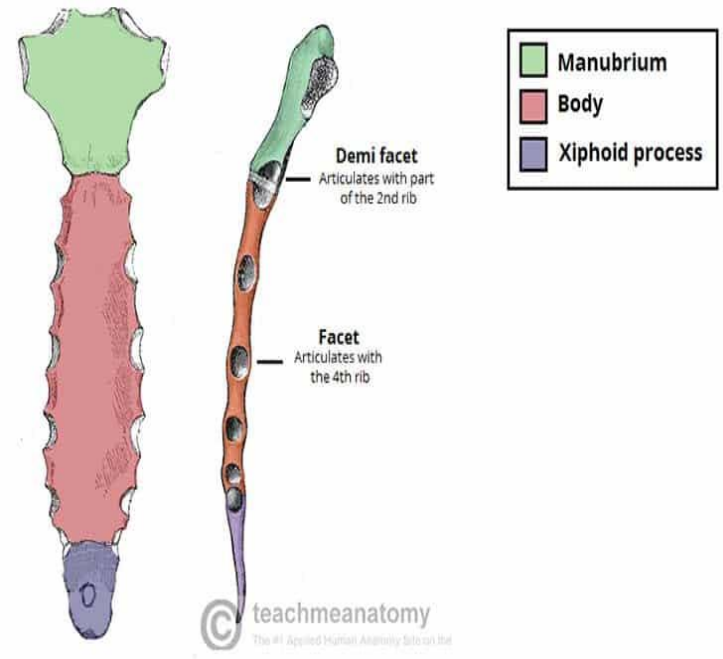
The sternum can be divided into three parts:

المقبض

1. **The manubrium.**
2. **Body .**
الجسم
3. **Xiphoid process.**

In children, these elements are joined by cartilage. The cartilage ossifies to bone during adulthood.

تتعظم — البلوغ



*1- **Manubrium :***

The manubrium is the most superior portion of the sternum. It is trapezoid in shape. The superior aspect of the manubrium is concave, producing a depression known as the jugular notch – this is visible underneath the skin. Either side of the jugular notch, there is a large fossa lined with cartilage. These fossae articulate with the medial ends of the clavicles, forming the sternoclavicular joints.

On the lateral edges of the manubrium, there is a facet (cartilage lined depression in the bone), for articulation with the costal cartilage of the 1st rib, and a demi facet (half - facet) for articulation with part of the costal cartilage of the 2nd rib.

*2- **Body :***

The body is flat and elongated – the largest part of the sternum. It articulates with the manubrium superiorly (manubriosternal joint) and the xiphoid process inferiorly (xiphisternal joint).

The lateral edges of the body are marked by numerous articular facets (cartilage lined depressions in the bone). These articular facets articulate with the costal cartilages of ribs 3 – 6 . There are smaller facets for articulation with parts of the second and seventh ribs – known as demi facets.

3- *Xiphoid Process :*

The xiphoid process is the most inferior and smallest part of the sternum . It is variable in shape and size, with its tip located at the level of the T10 vertebrae. The xiphoid process is largely cartilaginous in structure, and completely ossifies late in life – around the age of 40. In some individuals , the xiphoid process articulates with part of the costal cartilage of the seventh rib.

B- *The thoracic Spine :*

The thoracic spine is the second segment of the vertebral column, located between the cervical and lumbar vertebral segments. It consists of (12) vertebrae, which are separated by intervertebral discs. Along with the sternum and ribs, the thoracic spine forms part of the thoracic cage. This bony structure helps protect the internal viscera – such as the heart, lungs and esophagus .

Fig - Overview of the thoracic spine.

C- *The ribs :*

The ribs are a set of twelve paired bones which form the protective 'cage' of the thorax. They articulate with the vertebral column posteriorly, and terminate anteriorly as cartilage (known as costal cartilage). As part of the bony thorax, the ribs protect the internal thoracic organs. They also have a role in ventilation; moving during chest expansion to enable lung inflation.

Classification of the ribs : كلش مهمة

The ribs are classified into three groups based on their relationship to the sternum as :

1- **Ribs 1–7 are classified as: (true ribs OR vertebra sternal ribs). The costal cartilage from each of these ribs attaches directly to the sternum.**

2- **Ribs 8–12 are called false ribs (vertebrachondral ribs). The costal cartilages from these ribs do not attach directly to the sternum as the following :**

- **For ribs (8–10) are called (false non floating ribs) : The costal cartilages are attached to the cartilage of the next higher rib. Thus, the cartilage of rib 10 attaches to the cartilage of rib 9, rib 9 then attaches to rib 8, and rib 8 is attached to rib 7.**

- **The last two false ribs (11 & 12) are also called(false floating ribs OR vertebral ribs). These are short ribs that do not attach to the sternum at all . Instead, their small costal cartilages terminate within the musculature of the lateral abdominal wall.**

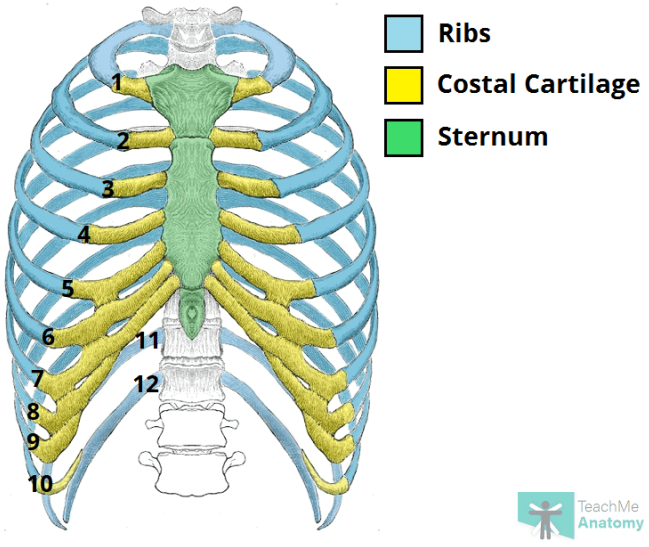


Fig 1 – Overview of the ribs and costal cartilage.

The structure of the rib :

There are two classifications of ribs:

1. **Typical**
2. **Atypical**

The typical ribs have a generalized structure, while the atypical ribs have variations on this structure.

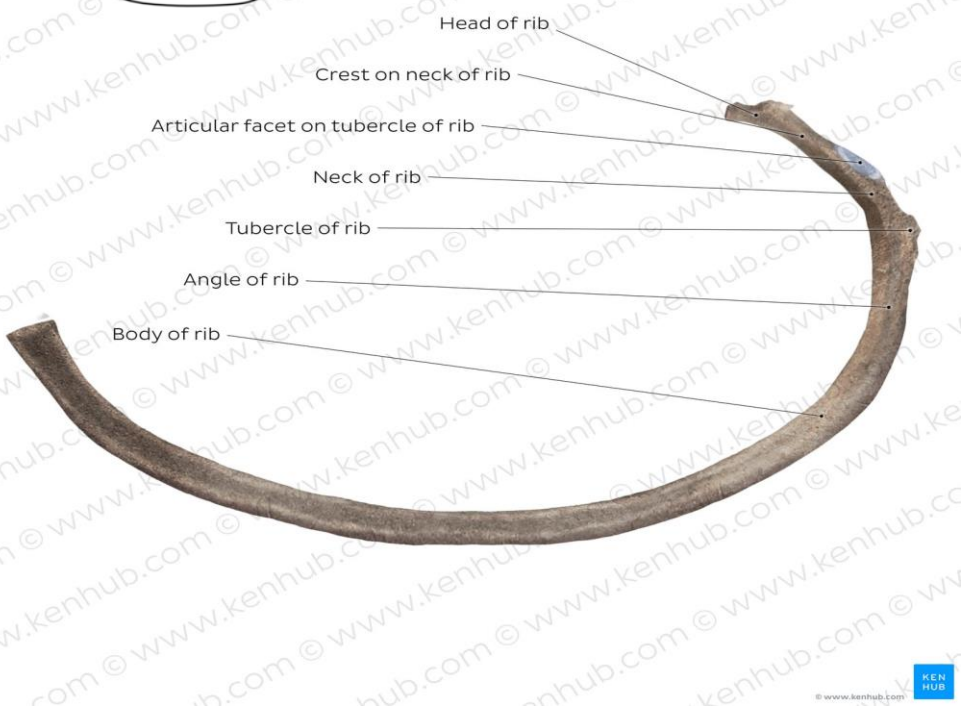
1- Typical Ribs :

The typical rib consists of a head, neck and body:

- **The head is wedge shaped, and has two articular facets separated by a wedge of bone . One facet articulates with the numerically corresponding vertebra , and the other articulates with the vertebra above.**

- **The neck contains no bony prominences, but simply connects the head with the body. Where the neck meets the body there is a roughed tubercle, with a facet for articulation with the transverse process of the corresponding vertebra.**

- **The body, or shaft of the rib is flat and curved. The internal surface of the shaft has a groove for the neurovascular supply of the thorax, protecting the vessels and nerves from damage.**



2- ***A typical Ribs :***

Ribs ((1, 2, 10 , 11 and 12)) can be described as 'atypical' – they have features that are not common to all the ribs.

- ***Rib (1) :*** **is shorter and wider than the other ribs. It only has one facet on its head for articulation with its corresponding vertebra (there isn't a thoracic vertebra above it). The superior surface is marked by two grooves, which make way for the subclavian vessels.**

- ***Rib (2) :*** **is thinner and longer than rib 1, and has two articular facets on the head as normal . It has a roughened area on its upper surface, from which the serratus anterior muscle originates.**

- ***Rib (10) :*** **only has one facet – for articulation with its numerically corresponding vertebra.**

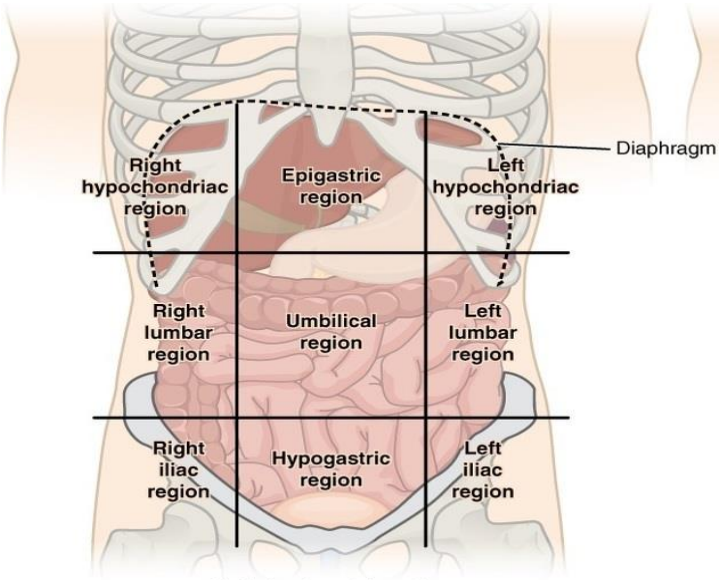
- ***Ribs (11 and 12) :*** **have no neck, and only contain one facet, which is for articulation**

Abdominal surface anatomy :

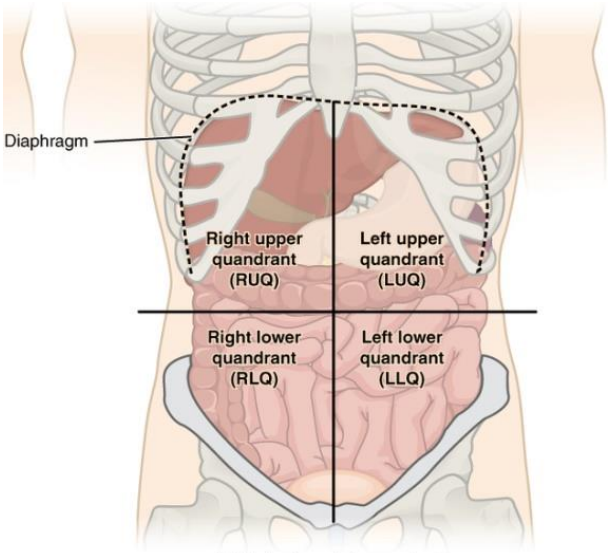
Abdominal surface anatomy can be described when viewed from in front of the abdomen in 2 ways:

1. **divided into 9 regions by two vertical and two horizontal imaginary planes**
2. **divided into 4 quadrants by single vertical and horizontal imaginary planes**

These regions and quadrants are of clinical importance when examining and describing pathologies related to the abdomen .



(a) Abdominopelvic regions

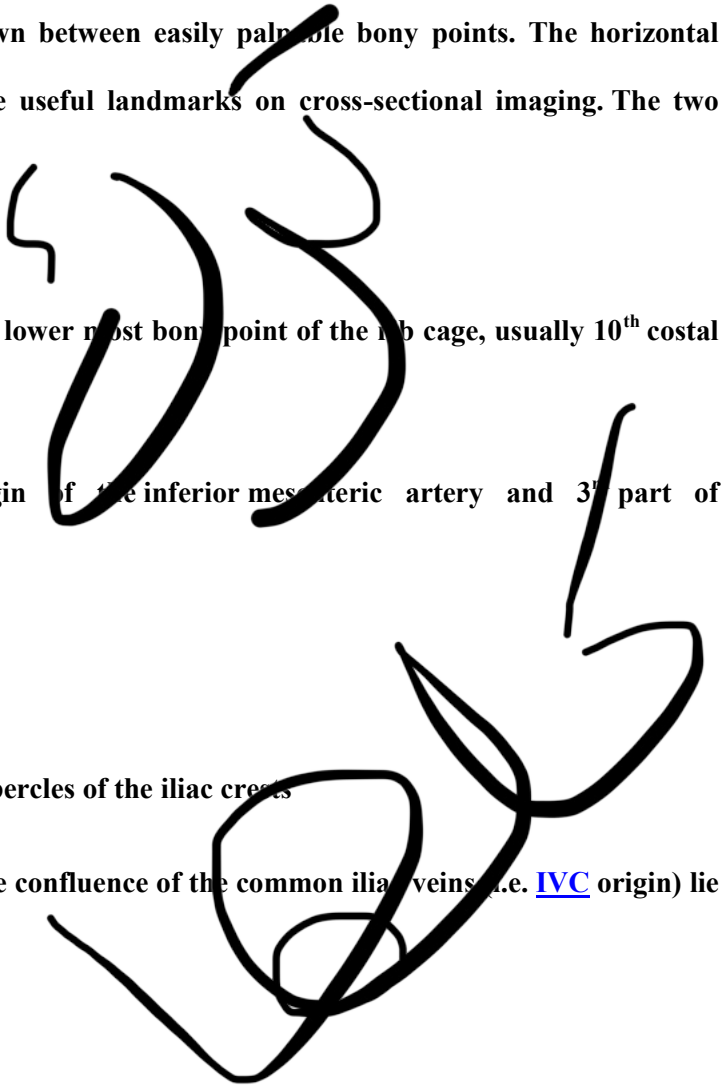


(b) Abdominopelvic quandrants

Nine abdominal regions :

Horizontal planes :

The dividing planes are based on lines drawn between easily palpable bony points. The horizontal planes are also of importance as they provide useful landmarks on cross-sectional imaging. The two horizontal lines are :



- **Subcostal plane :**
  - **corresponds to a line drawn joining the lower most bony point of the rib cage, usually 10th costal cartilage**
  - **body of the L3 vertebra; the origin of the inferior mesenteric artery and 3rd part of the duodenum lie on this plane .**

- **Transtubercular plane :**
  - **corresponds to a line uniting the two tubercles of the iliac crests**
  - **upper border of the L5 vertebra and the confluence of the common iliac veins (i.e. IVC origin) lie on this plane .**

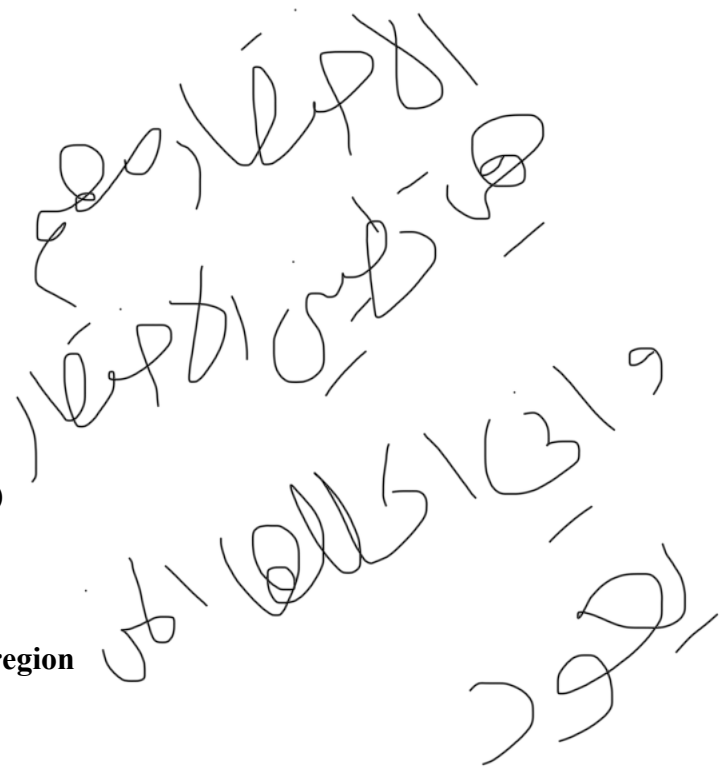
Vertical planes :

The two vertical planes are similar on each side and follow a line joining the mid clavicular point to the mid inguinal point. It passes just lateral to the tip of the ninth costal cartilage, which is palpable as a distinct step along the costal margin. It roughly corresponds to the lateral border of the rectus abdominis muscle .

Surface anatomy :

The above lines intersect and divide the abdomen into nine regions (clockwise from the top) :

- **epigastric region (epigastrium)**
- **left hypochondrium (LHC)**
- **left lumbar region (left flank)**
- **left iliac fossa (LIF)**
- **suprapubic (hypogastric) region**
- **right iliac fossa (RIF)**
- **right lumbar region (right flank)**
- **right hypochondrium (RHC)**
- **and in the center, the umbilical region**



Four abdominal quadrants :

Horizontal plane :

The dividing plane is a horizontal line drawn through the umbilicus .

Vertical plane:

The vertical line is down the midline of the body, overlying the linea alba from the xiphoid to the pubic symphysis .

Surface anatomy :

The above lines intersect and divide the abdomen into four quadrants (clockwise from the top):

- **right upper quadrant fossa (RUQ)**
- **right lower quadrant fossa (RLQ)**
- **left lower quadrant fossa (LLQ)**
- **left upper quadrant fossa (LUQ**

The abdomen (commonly called the belly) is the body space between the thorax (chest) and pelvis. The diaphragm forms the upper surface of the abdomen. At the level of the pelvic bones, the abdomen ends and the pelvis begins.

The abdomen contains all the digestive organs, including the stomach, small and large intestines, pancreas, liver, and gallbladder. These organs are held together loosely by connecting tissues (mesentery) that allow them to expand and to slide against each other. The abdomen also contains the kidneys and spleen.

Many important blood vessels travel through the abdomen, including the aorta, inferior vena cava, and dozens of their smaller branches. In the front, the abdomen is protected by a thin, tough layer of tissue called fascia. In front of the fascia are the abdominal muscles and skin. In the rear of the abdomen are the back muscles and spine.

The muscles of the abdomen protect vital organs underneath and provide structure for the spine. These muscles help the body bend at the waist .

The major muscles of the abdomen include:

- **The rectus abdominis in front .**
- **The external obliques at the sides .**
- **The latissimus dorsi muscles in the back .**