ANATOMY

Major Topics

1	2	3	4	5	6	7	8	9
Basics	Head	Neck	Neuroanatomy	Upper limb	Thorax	Abdomen	Lower limb	Pelvis

ANATOMY

THORAX

THORAX

AREAS	BONES	MUSCLES	ORGANS	VASCULATURE
• Superior Mediastinum • Anterior Mediastinum • Middle Mediastinum • Posterior Mediastinum	• Ribs • Sternum • Thoracic Spine	• Thoracic Cage • Diaphragm	• Thymus Gland • Mammary Glands • Heart • Lungs • Tracheobronchial Tree • Pleurae	• Aorta • Superior Vena Cava

THORAX

Muscles of Thorax

Thoracic Cage

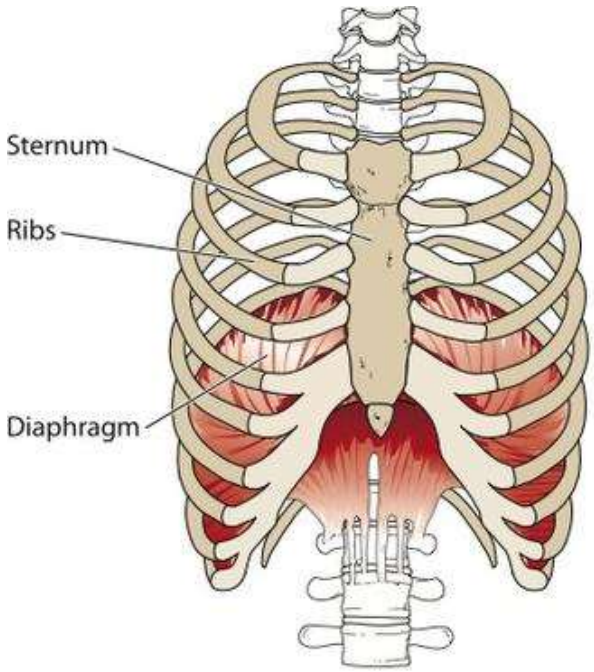
Diaphragm

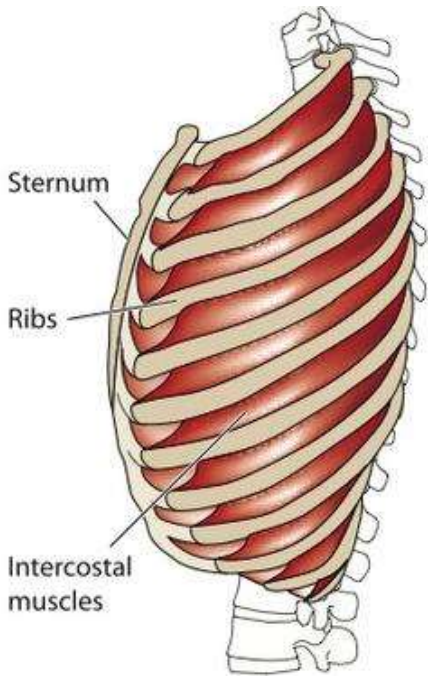
Muscle of the Thorax

Diaphragm

DIAPHRAGM

Overview





DIAPHRAGM

Contents

- Anatomical Position and Attachments
- Pathways through the Diaphragm
- Actions, Innervation and Vasculature
- Clinical Relevance: Paralysis of the Diaphragm

DIAPHRAGM

Introduction

- The diaphragm is a double-domed sheet of skeletal muscle, located at the inferior-most aspect of the rib cage. It serves two main functions:
- Separates the thoracic cavity from the abdominal cavity *(the word diaphragm is derived from the Greek 'diáphragma', meaning partition).*
- Undergoes contraction and relaxation, altering the volume of the thoracic cavity and the lungs, producing inspiration and expiration.

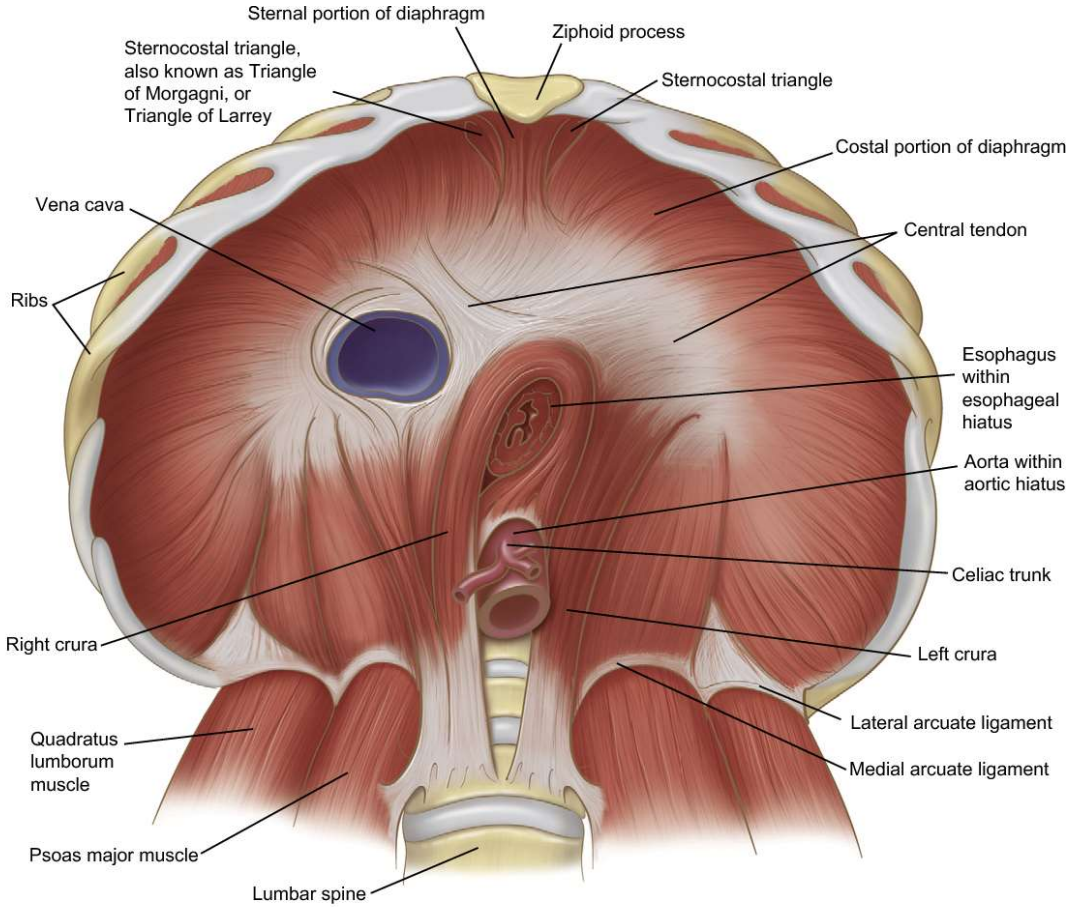
DIAPHRAGM

Anatomical position and attachment

- The diaphragm is located at the inferior-most aspect of the ribcage, filling the **inferior thoracic aperture**. It acts as the floor of the thoracic cavity and the roof of the abdominal cavity. The attachments of diaphragm can be divided into **peripheral** and **central attachments**. It has three peripheral attachments:
- Lumbar vertebrae and arcuate ligaments.
- Costal cartilages of ribs 7-10 (attach directly to ribs 11-12).
- Xiphoid process of the sternum

Diaphragm

Overview



DIAPHRAGM

Anatomical Position and attachment

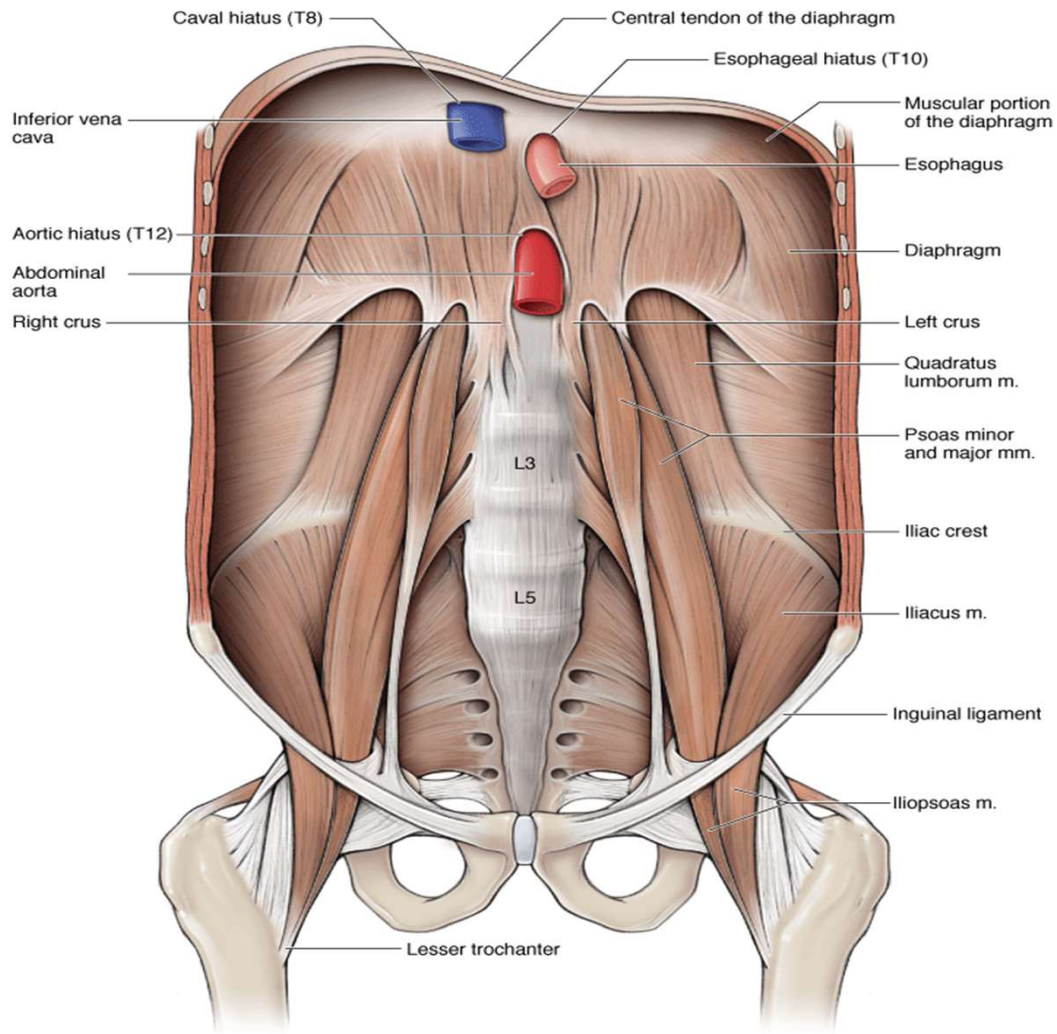
The parts of the diaphragm that arise from the vertebrae are tendinous in structure, and are known as the **Right and Left Crura:**

- **Right crus** – Arises from L1-L3 and their intervertebral discs. Some fibres from the right crus surround the oesophageal opening, acting as a physiological sphincter to prevent reflux of gastric contents into the oesophagus.
- **Left crus** – Arises from L1-L2 and their intervertebral discs.

The muscle fibres of the diaphragm combine to form a **central tendon**. This tendon ascends to fuse with the inferior surface of the fibrous pericardium. Either side of the pericardium, the diaphragm ascends to form left and right **domes.** At rest, the right dome lies slightly higher than the left – this is thought to be due to the presence of the liver.

DIAPHRAGM

Anatomical position and attachment



DIAPHRAGM

Openings In Diaphragm

Caval Hiatus (T8)	**Oesophageal Hiatus (T10)**	**Aortic Hiatus (T12)**
•Inferior vena cava •Terminal branches of right phrenic nerve	•Oesophagus •Right and left vagus nerves •Oesophageal branches of left gastric artery/vein	•Aorta •Thoracic duct •Azygous vein

DIAPHRAGM

Actions

- The diaphragm is the **primary muscle** of respiration. During inspiration, it contracts and **flattens**, increasing the vertical diameter of the thoracic cavity. This produces lung expansion, and air is drawn in. During expiration, the diaphragm passively relaxes and returns to its original dome shape. This reduces the volume of the thoracic cavity.

Diaphragm

Innervation and Vasculature

- The halves of the diaphragm receives motor innervation from a **phrenic nerve**. The left half of the diaphragm (known as a **hemidiaphragm**) is innervated by the left phrenic nerve, and vice versa. The phrenic nerve originates mainly from the 4th cervical nerve, but also receives contributions from the 5th and 3rd cervical nerves (C3-C5) in humans. Thus, the phrenic nerve receives innervation from parts of both the cervical plexus and the brachial plexus of nerves. The majority of the arterial supply to the diaphragm is delivered via the **Inferior phrenic arteries**, which arise directly from the abdominal aorta. The remaining supply is from the superior phrenic, pericardiacophrenic, and musculophrenic arteries. The draining veins follow the aforementioned arteries.

Muscle of Thorax

Thoracic Cage

Thoracic Cage

Thoracic Cage

There are five muscles that make up the thoracic cage;

The intercostals

- External,
- Internal and
- Innermost,
- Subcostals, and
- Transversus Thoracis.

These muscles act to change the **volume** of the thoracic cavity during respiration.

There are some other muscles that do not comprise the thoracic wall, but do **attach** to it. These include the pectoralis major, minor, serratus anterior and the scalene muscles.

Thoracic Cage

Intercostals

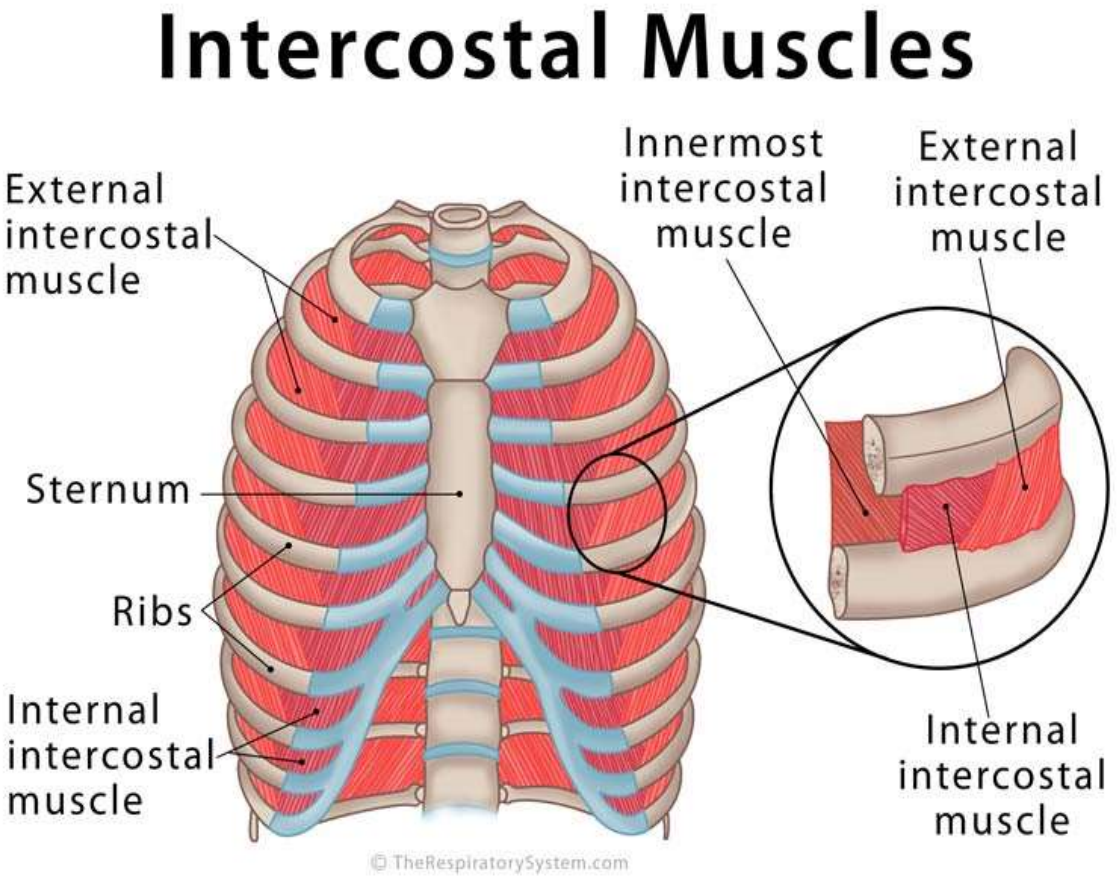
- The intercostal muscles lie in the intercostal spaces between ribs. They are organised into three layers.

External Intercostals

- There are 11 pairs of external intercostal muscles. They run inferoanteriorly from the rib above to the rib below, and are continuous with the external oblique of the abdomen.
- **Attachments:** Originate at the lower border of the rib, inserting into the superior border of the rib below.
- **Actions:** Elevates the ribs, increasing the thoracic volume.
- **Innervation:** Intercostal nerves (T1-T11).

Thoracic Cage

Intercostals



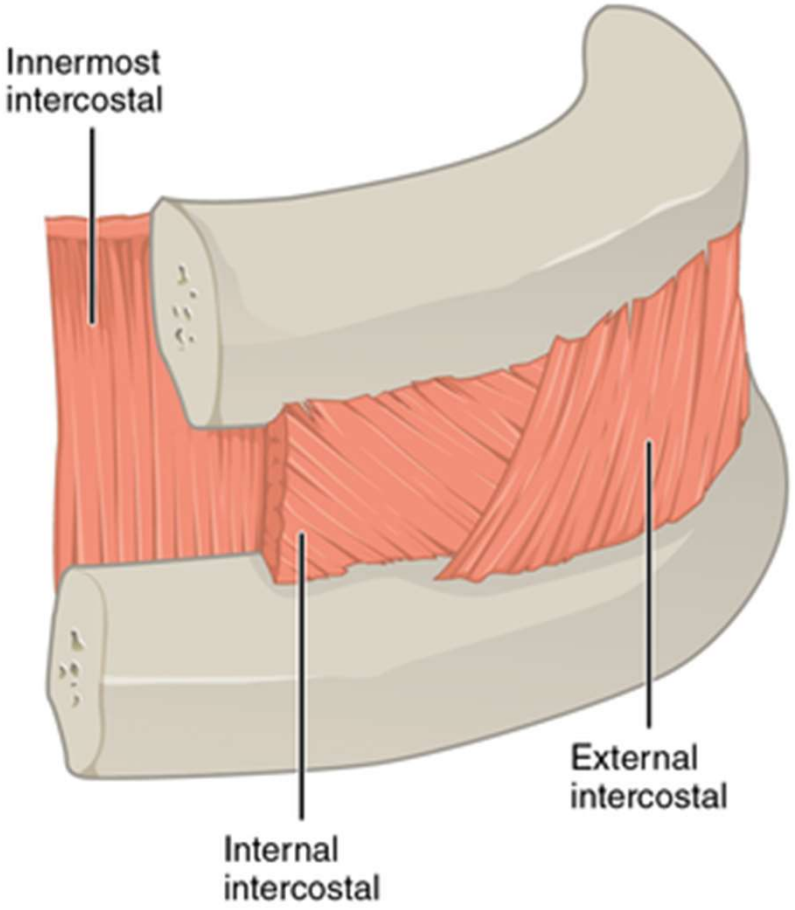
Thoracic Cage

Internal Intercostals

- These flat muscles lie deep to the external intercostals. Like the external intercostals, they run from the rib above to the one below, but in an opposite direction (inferoposteriorly). They are continuous with the internal oblique muscle of the abdominal wall.
- **Attachments:** Originates from the lateral edge of the costal groove and inserts into the superior surface of the rib below.
- **Actions:** The interosseous part reduces the thoracic volume by depressing the ribcage, and the interchondral part elevates the ribs.
- **Innervation:** Intercostal nerves (T1-T11).

Thoracic Cage

Internal Intercostal



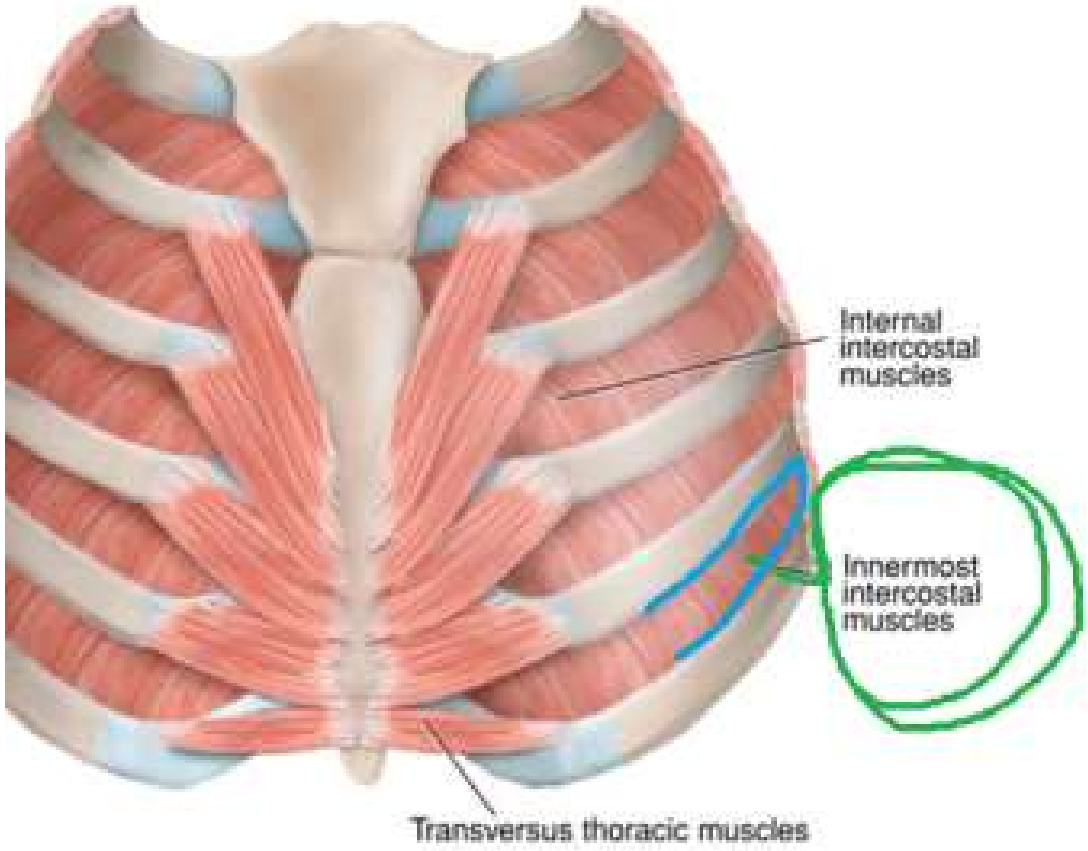
Thoracic Cage

Transversus Thoracis

- These muscles of the thoracic cage are continuous with transversus abdominis inferiorly.
- **Attachments:** From the posterior surface of the inferior sternum to the internal surface of costal cartilages 2-6.
- **Actions:** Weakly depress the ribs.
- **Innervation:** Intercostal nerves (T2-T6).

Thoracic Cage

Transverse Thoracic



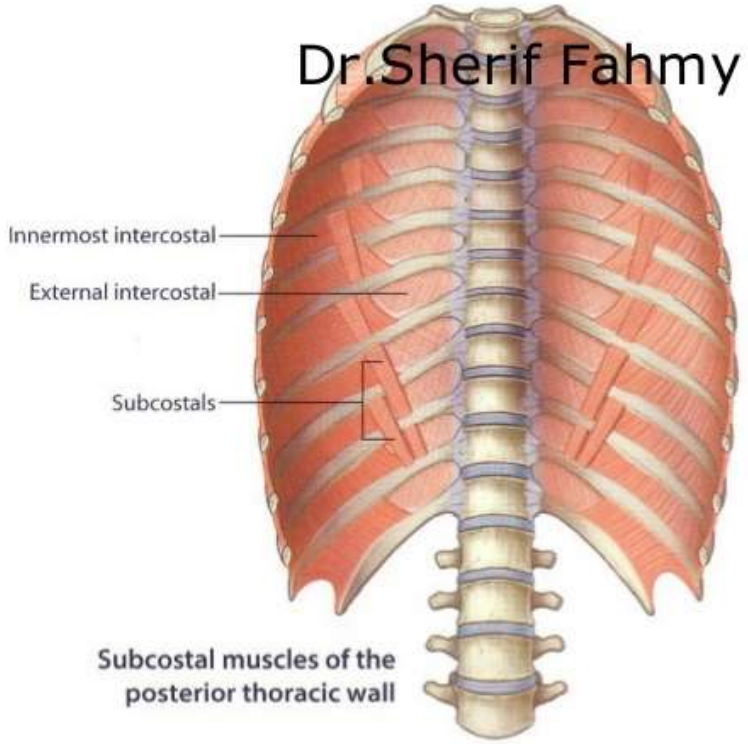
Thoracic Cage

Subcostals

- The subcostal muscles are found in the inferior portion of the thoracic wall. They comprise of thin slips of muscle, which run from the internal surface of one rib, to second and third ribs below. The direction of the fibres parallels that of the innermost intercostal.
- **Attachments:** These originate from the inferior surface of the lower ribs, near the angle of the rib. They then attach to the superior border of the rib 2 or 3 below.
- **Actions:** Share the action of the internal intercostals
- **Innervation:** Intercostal nerves

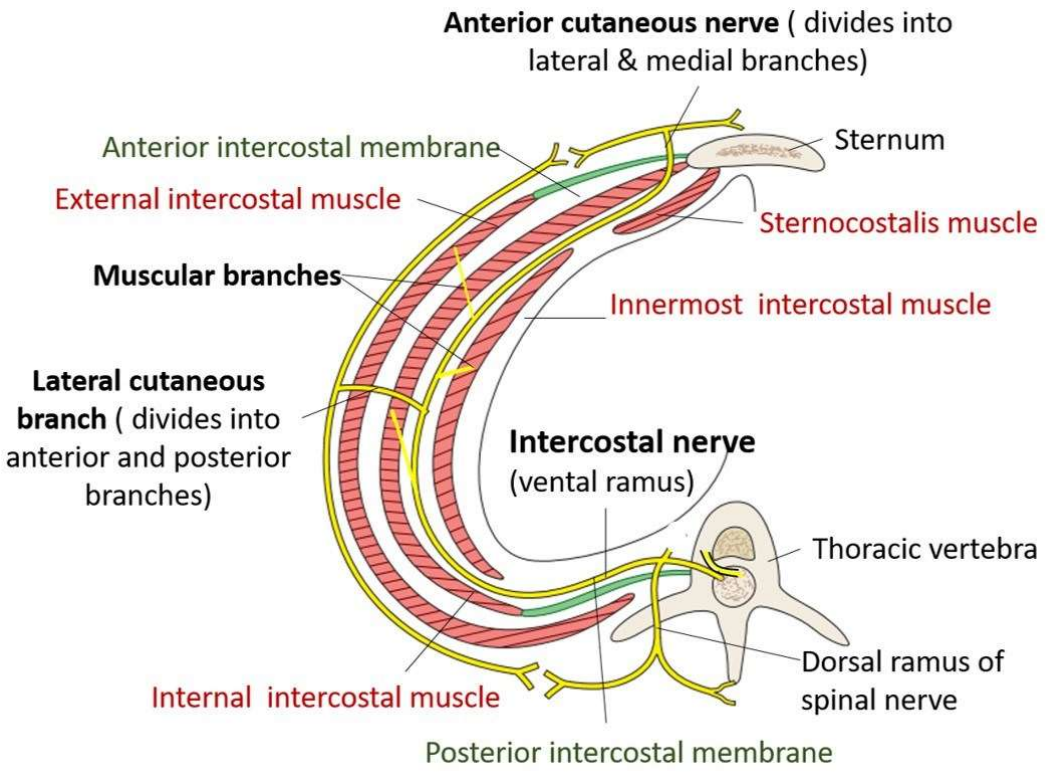
Thoracic Cage

Subcostal Muscle



Thoracic Cage

Nerve supply



Thoracic Cage

Vasculature