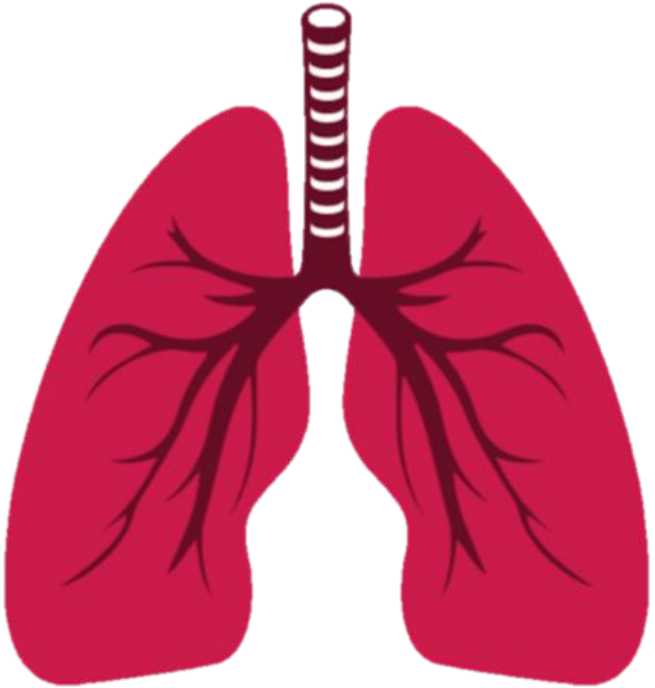
Anatomy team
med 438

MED438
KING SAUD UNIVERSITY

Reviewed by Razan AlRabah & Ibrahim AlDakhil

Muscles involved in respiration



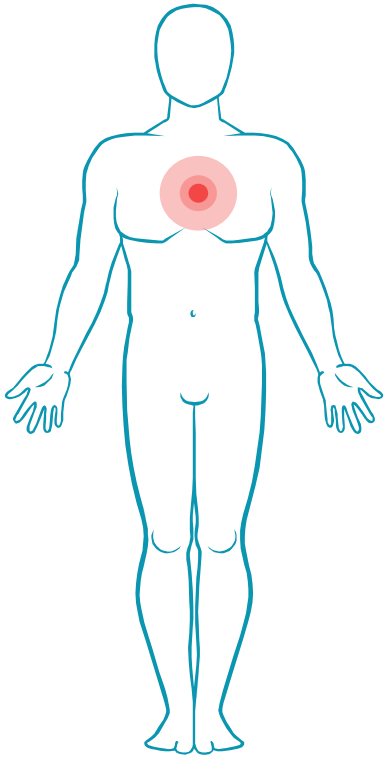
Respiratory block-Anatomy-Lecture 1

Editing file

Objectives

- Describe the components of the thoracic cage and their articulations.
- Describe in brief the respiratory movements.
- List the muscles involved in inspiration and in expiration.
- Describe the attachments of each muscle to the thoracic cage and its nerve supply.
- Describe the origin, insertion, nerve supply of diaphragm.

Color guide :
Only in boys slides in **Blue**
Only in girls slides in **Purple**
important in **Red**
Doctor note in **Green**
Extra information in **Grey**



Thoracic cage :

- Conical in shape
- Has 2 apertures (openings):

1. Superior (thoracic outlet): narrow, open, continuous with neck obliquely placed facing upward and forward

Bounded by:

- Superior border of the manubrium anteriorly
- Medial borders of first rib laterally
- First thoracic vertebrae posteriorly

2. Inferior: wide, closed by diaphragm

Bounded by:

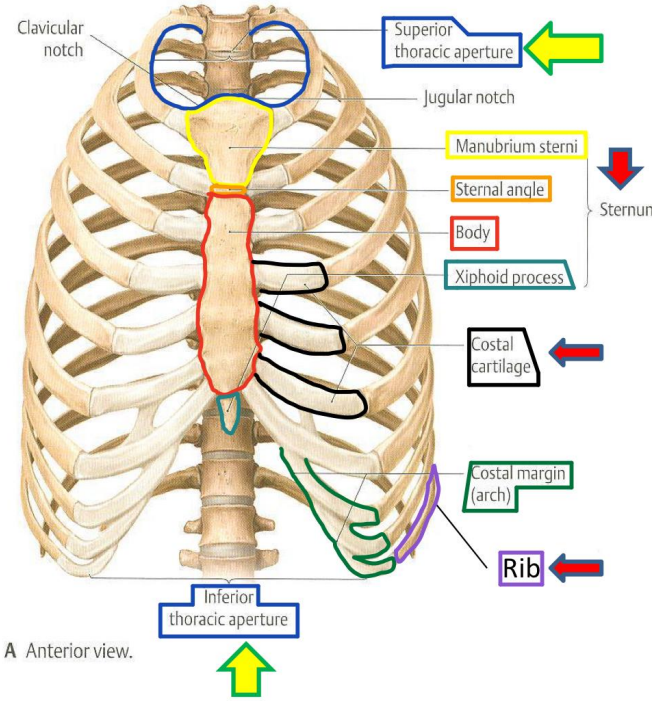
- Xiphisternal joint: anteriorly
- Curving costal margin laterally
- Twelve thoracic vertebrae: posteriorly

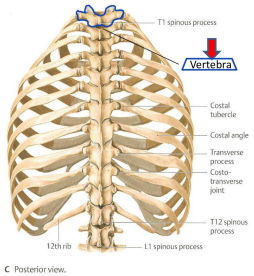
- Formed by:

1- Sternum & costal cartilages: anteriorly

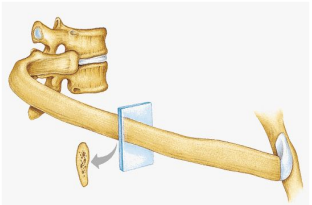
2- Twelve pairs of ribs: laterally

3- Twelve thoracic vertebrae: posteriorly

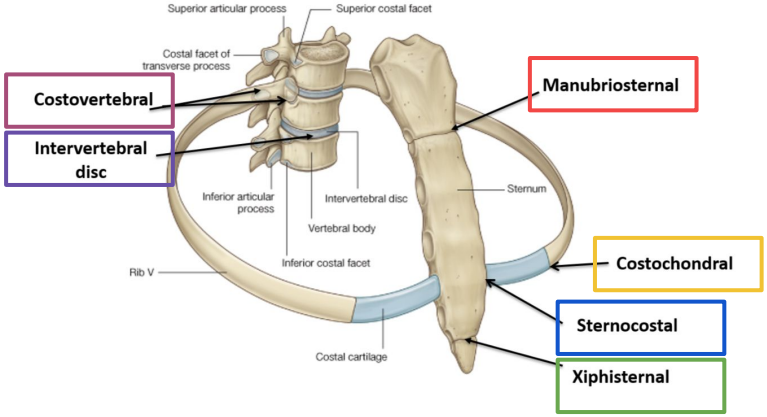


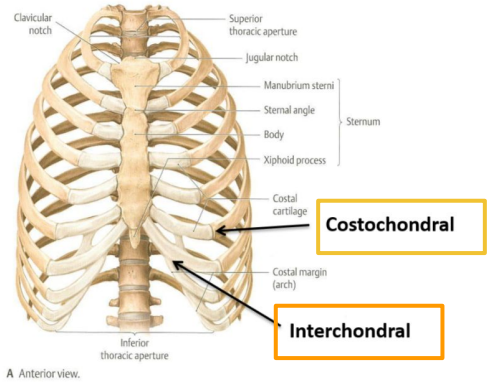


Note : the lower border of the rib is sharp.



Articulations

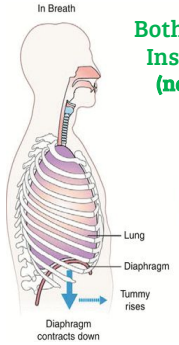
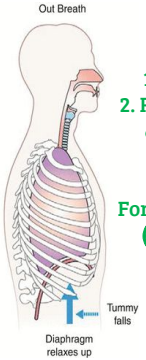
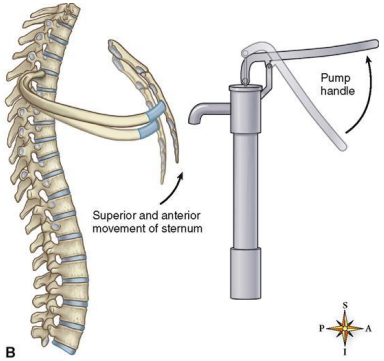
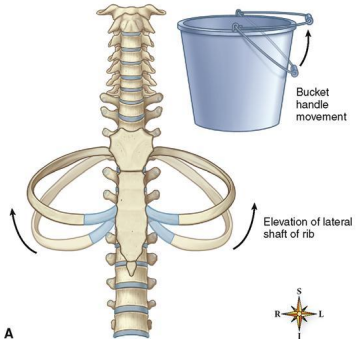




- Intervertebral discs*= Between two vertebrae (Secondary cartilaginous)
- Costovertebral joints= Between ribs and thoracic vertebrae (Plane synovial)
  - → Note : each Rib articulates with two vertebrae.
- Costochondral joints= Between ribs and their costal cartilages (Primary cartilaginous)
- Interchondral joints*= Between costal cartilages of 6th -10th ribs (Primary cartilaginous)
- Sternocostal joints= Between costal cartilages and sternum
  - → 1st costal cartilage (Primary cartilaginous)
  - → From 2nd to 7th (Plane synovial)
- Manubriosternal joint*= Between manubrium and body of sternum (Secondary cartilaginous)
- Xiphisternal joint*= Between body of the sternum and xiphoid process (Secondary cartilaginous)

* found only in boys slide

Respiratory Movements :Movements of DIAPHRAGM and RIBS

DIAPHRAGM		RIBS	
Inspiration (in breath)	**Expiration (out breath)**	**Pump handle movement**	**Bucket handle movement**
Contraction, descent (down) Of diaphragm ↓ Increase of vertical diameter of thoracic cavity	Relaxation, ascent (up) ↓ Decrease of vertical diameter of thoracic cavity	Elevation of ribs ↓ Increase in antero-posterior diameter of thoracic cavity	Elevation of ribs ↓ Increase in lateral diameter of thoracic cavity
 Both Normal and forced Inspiration are active **(needs muscles action)**	 Normal Expiration is **Passive** 1. Elastic recoil of lung 2. Relaxation of diaphragm & external intercostal **(No muscles action)** Forced Expiration is **active** **(needs muscles action)**		

Inspiratory Muscles

1. Active in both normal and forced inspiration = Diaphragm and External intercostal muscles
2. Active Only in forced inspiration (Accessory muscles) such as : Scalene muscles and Pectoralis major

DIAPHRAGM:

A musculotendinous partition between thoracic & abdominal cavity.
It is Convex toward thoracic & concave toward abdominal cavity.
(most important muscle)

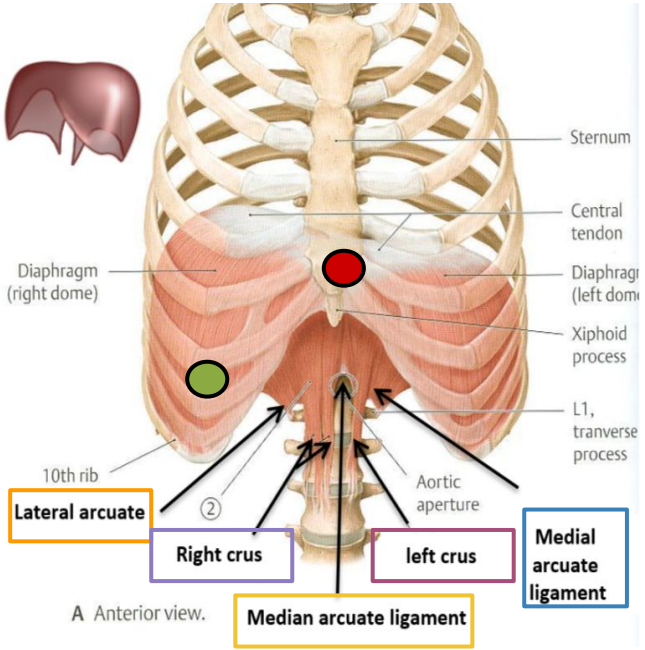
Origin :

1- **Costal**: Lower 6 ribs and their costal cartilages

2- **Vertebral**: upper 3 lumbar vertebrae by

- ➔ **Right crus** (attached to the upper three lumbar vertebrae)
  Right crus is stronger and bigger because liver is immediately below it
- ➔ **left crus** (attached to the upper two lumbar vertebrae)
- ➔ **And 5 ligaments :**
  2x Medial arcuate: connects each crus to 1st lumbar vertebra
  2x Lateral arcuate:connects 1st lumbar vertebra to last rib
  Median arcuate: connects right & left crus

3- **Sternal**: Posterior surface of xiphoid process



Inspiratory Muscles

DIAPHRAGM: cont

Insertion :

Fibers converge to join the **central tendon**
(lies at the level of xiphisternal joint, at 9th thoracic Vertebra)

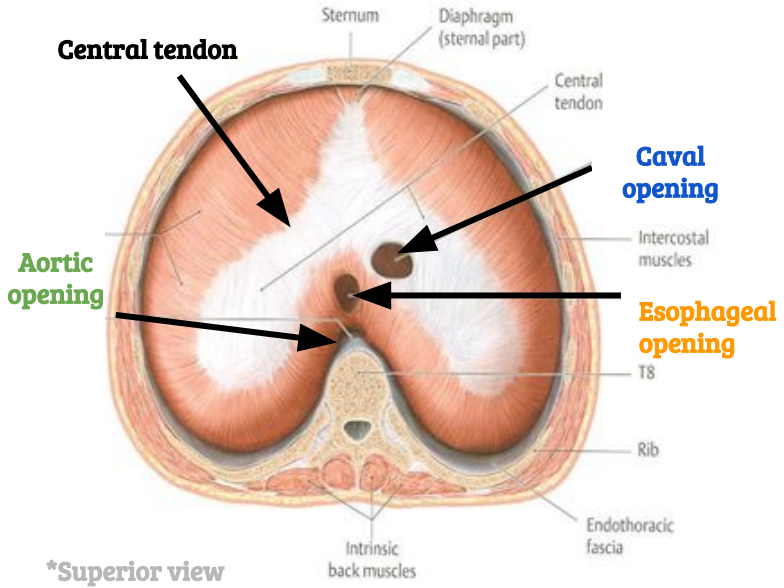
Nerve supply:

phrenic nerve (C3,4,5), penetrates diaphragm & innervates it from abdominal surface

Why the cervical spines?
Because first it forms near the neck then it goes down as the embryo develops (folding of embryo)

Action :

contraction of the diaphragm
Lead to increase of vertical diameter of thoracic cavity
(this action is essential for normal breathing)



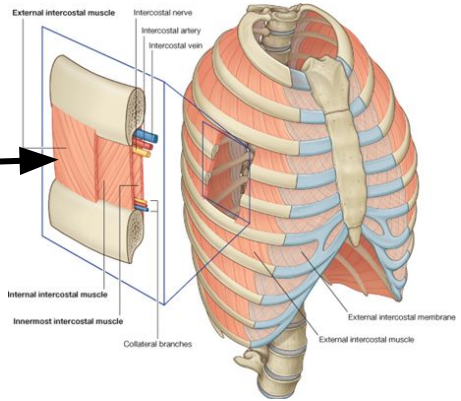
Openings of diaphragm (apertures) :

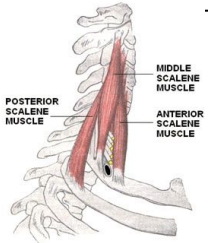
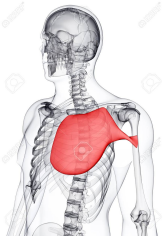
- Caval apertures , at level of T8
- Esophageal apertures , at level of T10
- Aortic apertures , at level of T12

Inspiratory Muscles

External intercostal muscles (Rib elevators)	
Attachments	from lower border of rib **above** to upper border of rib **below**
Direction of fibers	downward & medially(forward)
Action	rib elevators
Nerve supply	intercostal nerves

EXTERNAL INTERCOSTAL

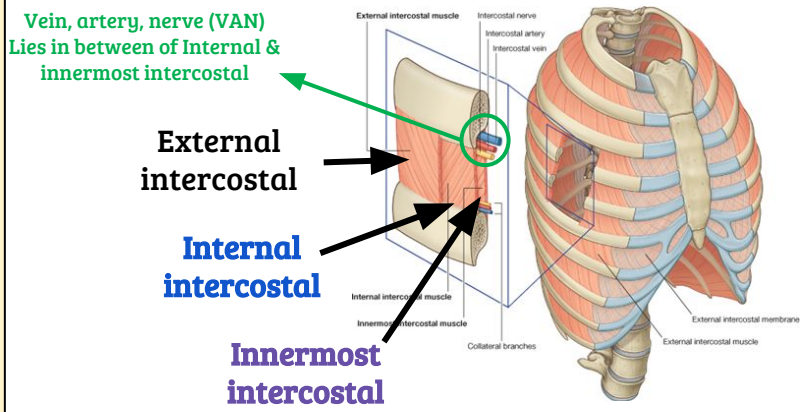
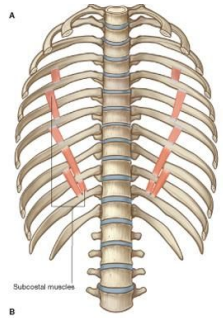
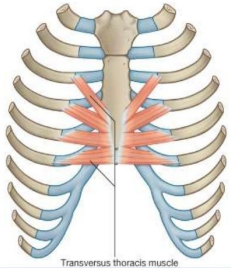


Muscle	Scalene muscles	Pectoralis major
Origin	Cervical vertebrae	clavicle + sternum + costal cartilages
Insertion	1st rib (scalenus anterior and medius) 2nd rib (scalenus posterior)	Bicipital groove of humerus
Action	Elevate 1st & 2nd ribs	increases antero-posterior diameter of thoracic cavity, when arm is fixed
Picture		

Expiratory muscles

Two groups: A- Ribs depressors B- Anterior abdominal wall muscles

➔ All expiratory muscles act only during forced expiration

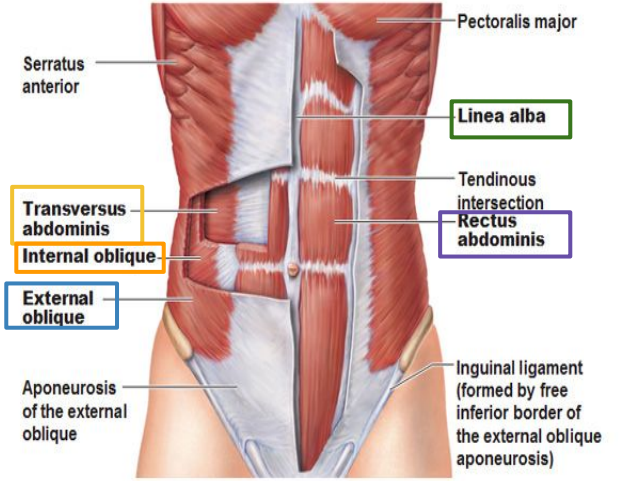
First : Ribs depressors				
Muscle	**Internal intercostal**	**Innermost intercostal**	**Subcostal**	**Transversus thoracis**
Direction	backward & laterally		-	-
Nerve	Intercostal nerves (ventral rami of T1-T11)			
Action	depression of the ribs			
Picture				

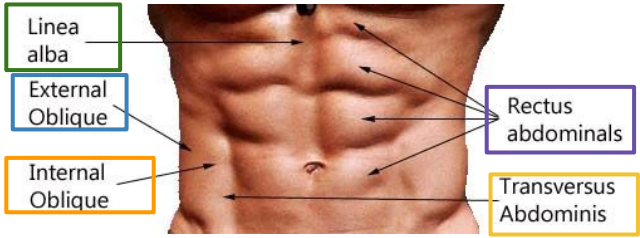
Expiratory muscles

Second : Anterior abdominal wall muscles

- It Is formed of 3 layers of muscles of fibers running in different directions (to increase strength of anterior abdominal wall)
- The 3 muscles form a sheath in which a fourth muscles lies (rectus abdominis)
- Muscles are attached to: sternum, costal cartilages and ribs + hip bones
- The aponeurosis of the 3 muscles on both sides fuse in the midline to form **linea alba** (it is meeting of 3 aponeurosis in both sides, extending from the xiphoid process to symphysis pips)

Muscle	External oblique	Internal oblique	Rectus abdominis	Transversus abdominis
Direction	Downward & medially	Upward & medially	Vertical	Transverse
Nerve	lower 5 intercostal nerves (T7-T11), subcostal nerve (T12) and first lumbar nerve.			
Action	(during forced expiration): Compression of abdominal viscera to help in ascent of diaphragm			





MCQs

Question 1: What happens in bucket handle movement of the ribs ?

A. Increase in antero-posterior diameter of thoracic cavity.

B. Increase in lateral diameter of thoracic cavity.

C. decrease in antero-posterior diameter of thoracic cavity.

D. decrease in lateral diameter of thoracic cavity.

Question 2: Inspiratory Muscles that are involved in elevation of all ribs ?

A. Diaphragm.

B. Scalene muscles.

C. External intercostal muscles.

D. Internal intercostal muscles.

Question 3: What is the origin of scalene muscles ?

A. 1st rib.

B. Sternum.

C. Thoracic vertebrae.

D. Cervical vertebrae.

Question 4: intercostal nerves arise from ?

A. ventral plexuses of T1-T11

B. ventral rami of T1-T12

C. ventral horn of T1-T12

D. ventral rami of T1-T11

Question 5: What is the action of pectoralis major in inspiratory ?

A. Increase in antero-posterior diameter of thoracic cavity.

B. Decrease in antero-posterior diameter of thoracic cavity.

C. Increase lateral diameter of of thoracic cavity.

D. Decrease lateral diameter of of thoracic cavity.

Question 6: Which one of the following is correct about normal inspiration ?

A. Does not need muscle action.

B. Passive.

C. Active

D. can be both active or passive

SAQs

Question 1: Name all muscles that are involved in normal inspiration ?

Diaphragm and External intercostal muscles

Question 2: Name 3 joints found in the thoracic cage that is considered primary cartilaginous joints :

Costochondral joints

Interchondral joints

Sternocostal joints for 1st costal cartilage

Answers: Q1.B- Q2.C -Q3.D -Q4.D- Q5.A- Q6.C

Best wishes

Don't forget to leave your feedback:

Team members

Boys team:

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- Ziyad Al-jofan
- ★ Suhail Basuhail
- Ali Aldawood
- Khalid Nagshabandi
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- Amirah Al-Zahrani
- Alhanouf Al-haluli
- Sara Al-Abdulkarem
- Rawan Al Zayed
- Renad Al Haqbani
- Nouf Al Humaidhi
- Jude Al Khalifah
- Nouf Al Hussaini
- Alwateen Al Balawi
- Rahaf Al Shabri
- Danah Al Halees
- Rema Al Mutawa
- Amirah Al Dakhilallah
- Maha Al Nahdi
- Ghaida Al Braithen

Team leaders

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- Ateen Almutairi