.DIAPHRAGM

DESCRIBE THE DIAPHRAGM UNDER FOLLOWING HEADINGS

A) ATTACHMENTS B) OPENINGS AND STRUCTURES PASSING THROUGH C) ACTIONS (LE)

a) Attachment of Diaphragm

Origin of diaphragm can be grouped into 3 groups Sternal, costal and vertebral (lumbar)

Sternal – Originates from back of xiphoid process

Costal –Originates from inner surface of lower 6 ribs and their cartilages.

Vertebral – 3 sources on either side.

A pair of crura – right and left

A pair of medial arcuate ligaments

A pair of lateral arcuate ligaments

Right crus

Longer & more muscular

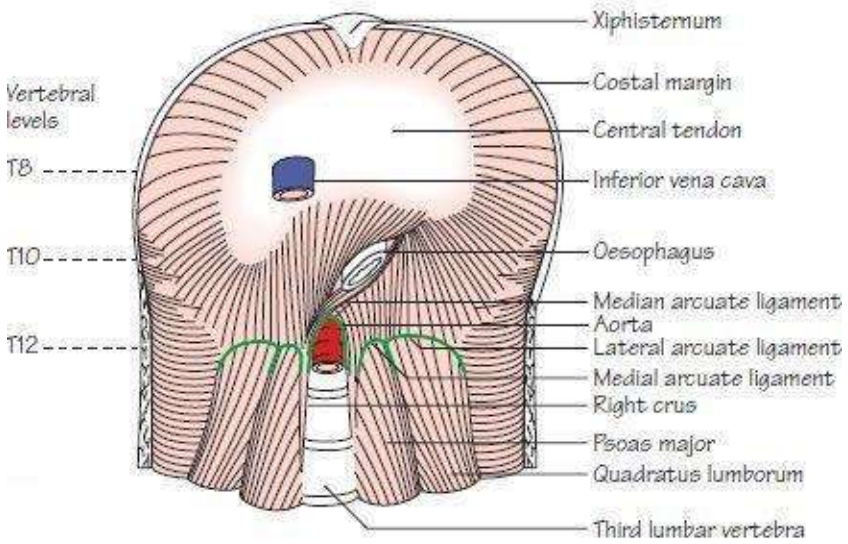
Attached to Upper 3 lumbar vertebrae

Left crus

Shorter

Attached to Upper 2 lumbar vertebrae

Right and left crus are connected across midline by median arcuate ligament.



Pair of Medial arcuate ligament (medial lumbo-costal arch)

Thickening of psoas fascia

Attachment:

Medial- body of L1

Lateral – Tip of transverse process of L1

Pair of lateral arcuate ligament (lateral lumbo-costal arch)

Thickening of anterior layer of thoracolumbar fascia

Attachment:

Medial- Tip of transverse process of L1

Lateral- Lower border of 12^{th} rib

Insertion:

All the fibers are inserted into central tendon

Central tendon is median depressed part of diaphragm

Situated close to the sternum

Trifoliate in shape with median, right and left leaflets

Openings and structures passing through

Major openings of Diaphragm

Vena caval opening – T8 vertebral level

Oesophagial opening- T10 vertebral level

Aortic opening – T12 vertebral level

Structures passing through Vena caval opening:

Inferior vena cava

Right phrenic nerve

Lymphatics

Structures passing through Oesophageal opening:

Oesophagus

Anterior and posterior vagal trunks

Oesophagial branch of Left gastric vessels

Lymphatics

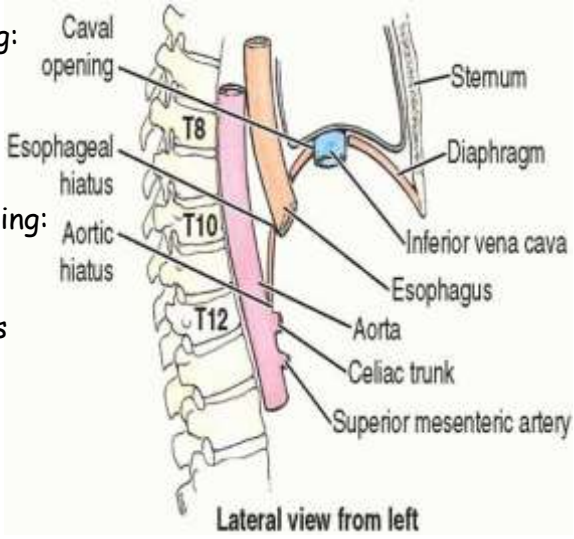
Phreno- oesophagial ligament

Structures passing through Aortic opening:

Abdominal aorta

Thoracic duct

Azygos vein



Actions of Diaphragm

On the thoracic cavity

It is the **principal muscle of inspiration**

When the diaphragm contracts vertical diameter of the thorax increases

Average range of movement of the diaphragm in quiet breathing is about 1.5cm And during deep breathing it will be between 6 – 10 cm

On the Abdominal cavity:

It is the compressor of abdominal viscera

Helps in increasing intra-abdominal pressure

THORACIC DIAPHRAGM(SE)

Thoracic diaphragm is a musculo-aponeurotic partition between thorax and abdomen

It is dome shaped

Peripheral part is muscular and central part is tendinous

Attachments of Diaphragm

Origin of diaphragm can be grouped into 3 groups
Sternal, costal and vertebral (lumbar)

Sternal

Originates from back of xiphoid process

Costal

Originates from inner surface of lower 6 ribs and their cartilages.

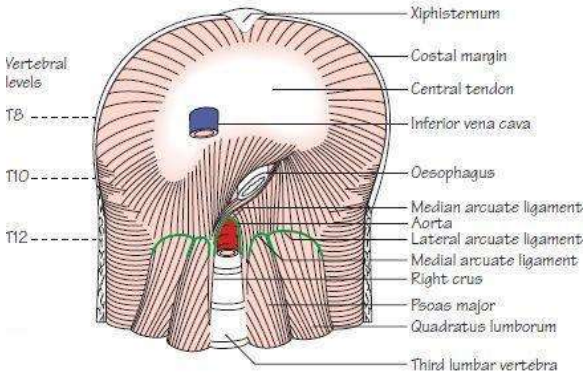
Vertebral

3 sources on either side.

A pair of crura – right and left

A pair of medial arcuate ligaments

A pair of lateral arcuate ligaments



Right crus

Longer & more muscular

Attached to Upper 3 lumbar vertebrae & disc

Left crus

Shorter

Attached to Upper 2 lumbar vertebrae

Pair of Medial arcuate ligament (medial lumbo-costal arch)-

Thickening of psoas fascia

Pair of lateral arcuate ligament (lateral lumbo-costal arch)

Thickening of anterior layer of thoracolumbar fascia

Insertion:

All the fibers are inserted into central tendon

Central tendon is median depressed part of diaphragm

Situated close to the sternum

Trifoliate in shape with median, right and left leaflets

Nerve Supply:

Motor Nerve Supply – **Phrenic nerve (C3,4,5)**

Sensory Nerve Supply –

central part- phrenic nerve

peripheral part – lower 6-7 intercostal nerves

Actions of Diaphragm

On the thoracic cavity:

It is the **principal muscle of inspiration**

On the Abdominal cavity:

Helps in increasing intra-abdominal pressure

Major openings of Diaphragm

Vena caval opening – T8 vertebral level
Oesophagial opening- T10 vertebral level
Aortic opening – T12 vertebral level

ATTACHMENTS OF RESPIRATORY DIAPHRAGM(SE)

Attachment of Diaphragm

Origin of diaphragm can be grouped into 3 groups
Sternal, costal and vertebral (lumbar)

Sternal – Originates from back of xiphoid process

Costal –Originates from inner surface of lower 6 ribs and their cartilages.

Vertebral – 3 sources on either side.

A pair of crura – right and left
A pair of medial arcuate ligaments
A pair of lateral arcuate ligaments

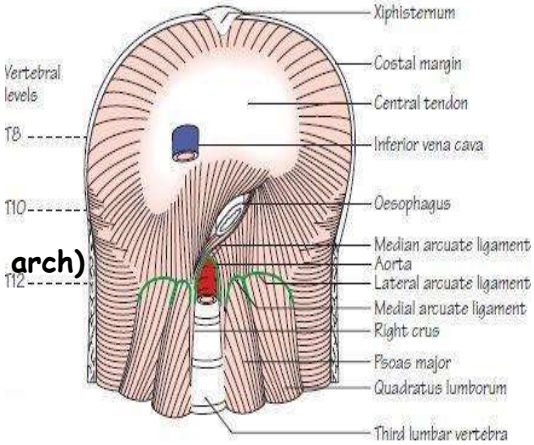
Right crus	**Left crus**
Longer & more muscular	Shorter
Attached to Upper 3 lumbar vertebrae	Attached to Upper 2 lumbar vertebrae

Right and left crus are connected across midline by median arcuate ligament

Pair of Medial arcuate ligament (medial lumbo-costal arch)-

Thickening of psoas fascia

Attachment:
Medial- body of L1
Lateral – Tip of transverse process of L1



Pair of lateral arcuate ligament (lateral lumbo-costal arch)

Thickening of anterior layer of thoracolumbar fascia

Attachment:
Medial- Tip of transverse process of L1
Lateral- Lower border of 12th rib

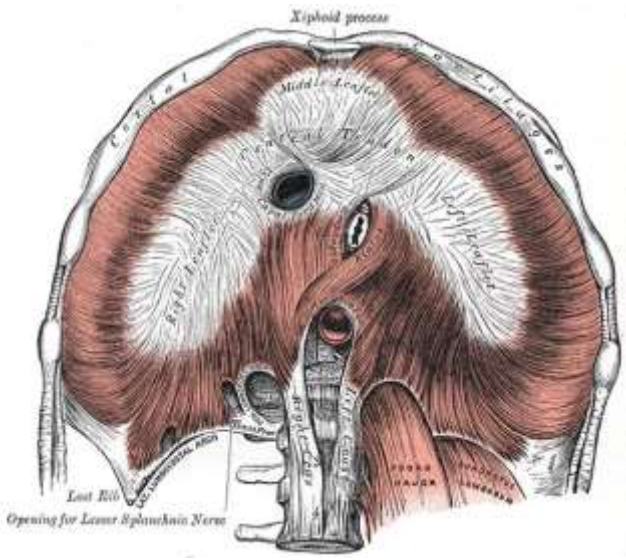
Insertion:

All the fibers are inserted into central tendon

Central tendon is median depressed part of diaphragm Situated close to the sternum

Trifoliate in shape with median, right and left leaflets

CENTRAL TENDON OF DIAPHRAGM(SE)

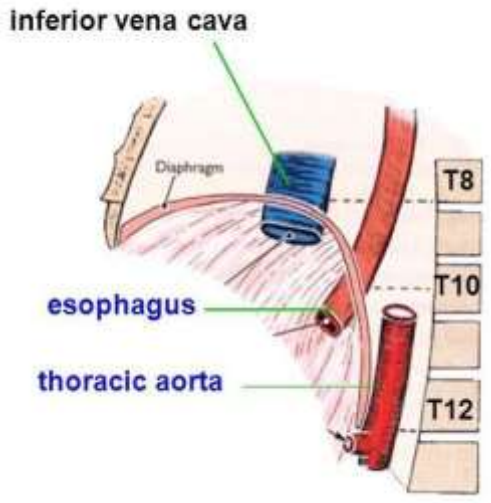


All the fibers of the diaphragm are inserted into central tendon
Central tendon is median depressed part of diaphragm
Situated close to the sternum
It is Trifoliate in shape with median, right and left leaflets
It is related above to the pericardium containing heart.
At the junction between anterior and median leaflet there is opening for Inferior vena cava.
To the left of this opening it presents a central point of decussation

MAJOR OPENINGS OF THORACIC DIAPHRAGM(SE)

Major openings of Diaphragm

- **Vena caval opening – T8 vertebral level**
- **Oesophagial opening- T10 vertebral level**
- **Aortic opening – T12 vertebral level**



Structures passing through Vena caval opening:

- **Inferior vena cava**
- Right phrenic nerve
- Lymphatics

Structures passing through Oesophageal opening:

- **Oesophagus**
- Anterior and posterior vagal trunks
- Oesophagial branch of Left gastric vessels
- Lymphatics
- Phreno- oesophagial ligament

Structures passing through Aortic opening:

- Abdominal aorta
- Thoracic duct
- Azygos vein

DIAPHRAGMATIC HERNIAS(SE)

Diaphragmatic hernias can be congenital (due to partial failure of origin of diaphragm) or acquired.

Congenital diaphragmatic hernia:

Failure of sternal origin of diaphragm – **Foramen of Morgagni**

Through this gap abdominal viscera may herniated into thorax

Bochdalek's Hernia (Costovertebral trigone)

Sometimes diaphragm fails to arise from lateral arcuate ligament (more often on left side) Abdominal viscera can herniated into thorax

These herniated viscera will prevent the lung expansion in new born child.

Hiatal Hernia:

Most often it is **acquired hernia.**

There are two types of Hiatal hernia:

sliding hernnia – more common, Cardio-oesophageal junction enters thorax

Rolling hernia- Cardio-oesophageal junction remains in abdomen, fundus of stomach herniated into thorax

Origin of diaphragm(SA)

Origin of diaphragm can be grouped into 3 groups Sternal, costal and vertebral (lumbar)

Sternal – Originates from back of xiphoid process

Costal –Originates from inner surface of lower 6 ribs and their cartilages.

Vertebral – 3 sources on either side.

A pair of crura – right and left
A pair of medial arcuate ligaments
A pair of lateral arcuate ligaments

CENTRAL TENDON OF DIAPHRAGM(SA)

All the fibers of Diaphragm are inserted into central tendon

Central tendon is median depressed part of diaphragm

Situated close to the sternum

Trifoliate in shape

Has got – median, right and left leaflets

At the junction of median and right leaflets – vena caval opening

- central point of decussation

OPENINGS OF DIAPHRAGM AND STRUCTURES PASSING THROUGH THEM(SA)

Major openings of Diaphragm
- Vena caval opening – T8 vertebral level
- Oesophagial opening- T10 vertebral level
- Aortic opening – T12 vertebral level

Structures passing through Vena caval opening:
- Inferior vena cava
- Right phrenic nerve
- Lymphatics

Structures passing through Oesophageal opening:
- Oesophagus
- Anterior and posterior vagal trunks
- Oesophagial branch of Left gastric vessels
- Lymphatics
- Phreno- oesophagial ligament

Structures passing through Aortic opening:
- Abdominal aorta
  - Thoracic duct
  - Azygos vein

STRUCTURES PASSING THROUGH THE AORTIC OPENING OF DIAPHRAGM(SA)

Structures passing through Aortic opening:
- Abdominal aorta
- Thoracic duct
- Azygos vein

STRUCTURES PASSING THROUGH VENA CAVAL HIATUS OF THE DIAPHRAGM(SA)

Structures passing through Vena caval opening:
- Inferior vena cava
- Right phrenic nerve
- Lymphatics

STRUCTURES PASSING THROUGH OESOPHAGEAL OPENING OF THE DIAPHRAGM (SA)

Structures passing through Oesophageal opening:
- Oesophagus
- Anterior and posterior vagal trunks
- Oesophagial branch of Left gastric vessels
- Lymphatics
- Phreno- oesophagial ligament

NERVE SUPPLY OF DIAPHRAGM(SA)

Motor Nerve Supply – **Phrenic nerve (C3,4,5)**

Sensory Nerve Supply –

central part- phrenic nerve

peripheral part – lower 6-7 intercostal nerves

ROOT VALUE AND DISTRIBUTION OF PHRENIC NERVE(SA)

Root value of phrenic nerve – C3,C4&C5

Distribution: The phrenic nerve contain motor and sensory components.

Motor supply to diaphragm

Sensory Supply to central part of diaphragm, mediastinal pleura and pericardium.

DIAPHRAGMATIC HERNIAS(SA)

Diaphragmatic hernias can be congenital (due to partial failure of origin of diaphragm) or acquired. Abdominal viscera can herniated into thoracic cavity compressing the thoracic structures.

CONGENITAL DIAPHRAGMATIC HERNIA(SA)

Failure of sternal origin of diaphragm – **Foramen of Morgagni**

Bochdalek's Hernia (Costovertebral trigone)

Sometimes diaphragm fails to arise from lateral arcuate ligament (more often on left side)

Hiatal Hernia:

Most often it is **acquired hernia.**

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