

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

GROSS ANATOMY
of
THE OESOPHAGUS
THE OESOPHAGUS

By

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OBJECTIVES

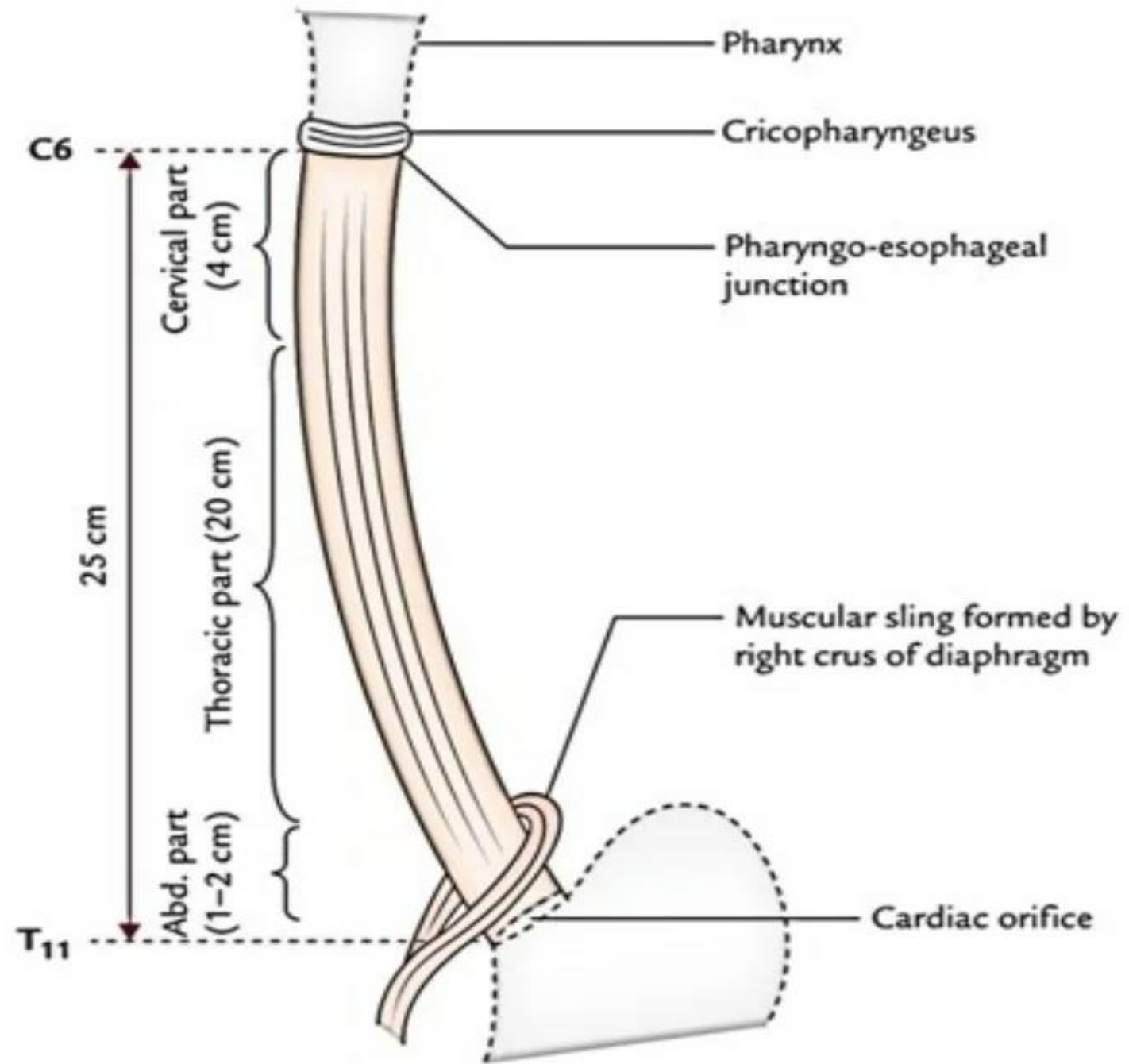
- By the end of this lecture the student should be able to
- Describe the anatomy of the **esophagus**: extent, length, parts, strictures, relations, blood supply, innervation and lymphatics.

Esophagus

- **Esophagus** is a narrow muscular tube extending from **pharynx** to the **stomach**. descends in front of the **vertebral column** goes through superior and posterior mediastinum.
- It begins with lower part of the neck at the inferior border of the **cricoid cartilage**(C6), extending to the cardiac orifice of the stomach(T11).
- It gives passage for chewed food (bolus) and liquids during the third stage of deglutition.

DIMENSIONS AND LUMEN

- **Length:**
 - 25 cm (10 inches).
- **Width:**
 - 2 cm.
- **Lumen:**
 - It's flattened anteroposteriorly.
 - Normally it's kept closed (collapsed) and opens (dilates) only during the passage of the food.



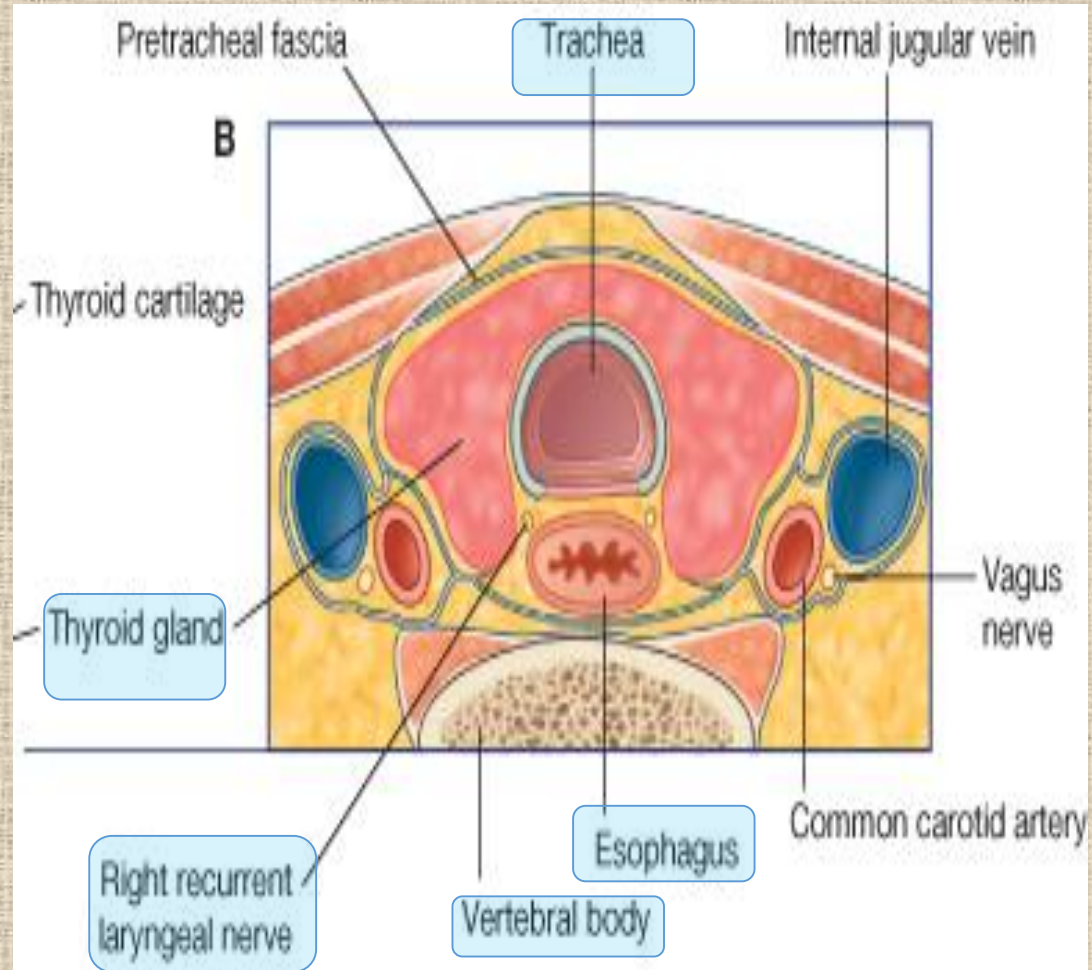
PARTS OF THE ESOPHAGUS

- The esophagus is split into the following 3 parts:
- **Cervical part (4 cm in length).**
- The cervical part extends from the lower border of cricoid cartilage to the superior border of manubrium sterni.

- **Thoracic part (20 cm in length).**
- The thoracic part extends from superior border of manubrium sterni to the esophageal opening in the diaphragm.

- **Abdominal part (1-2 cm in length).**
- The abdominal part extends create esophageal opening in the diaphragm to the cardiac end of the stomach.
 - *The narrowest part of esophagus is its commencement at the cricopharyngeal sphincter.*

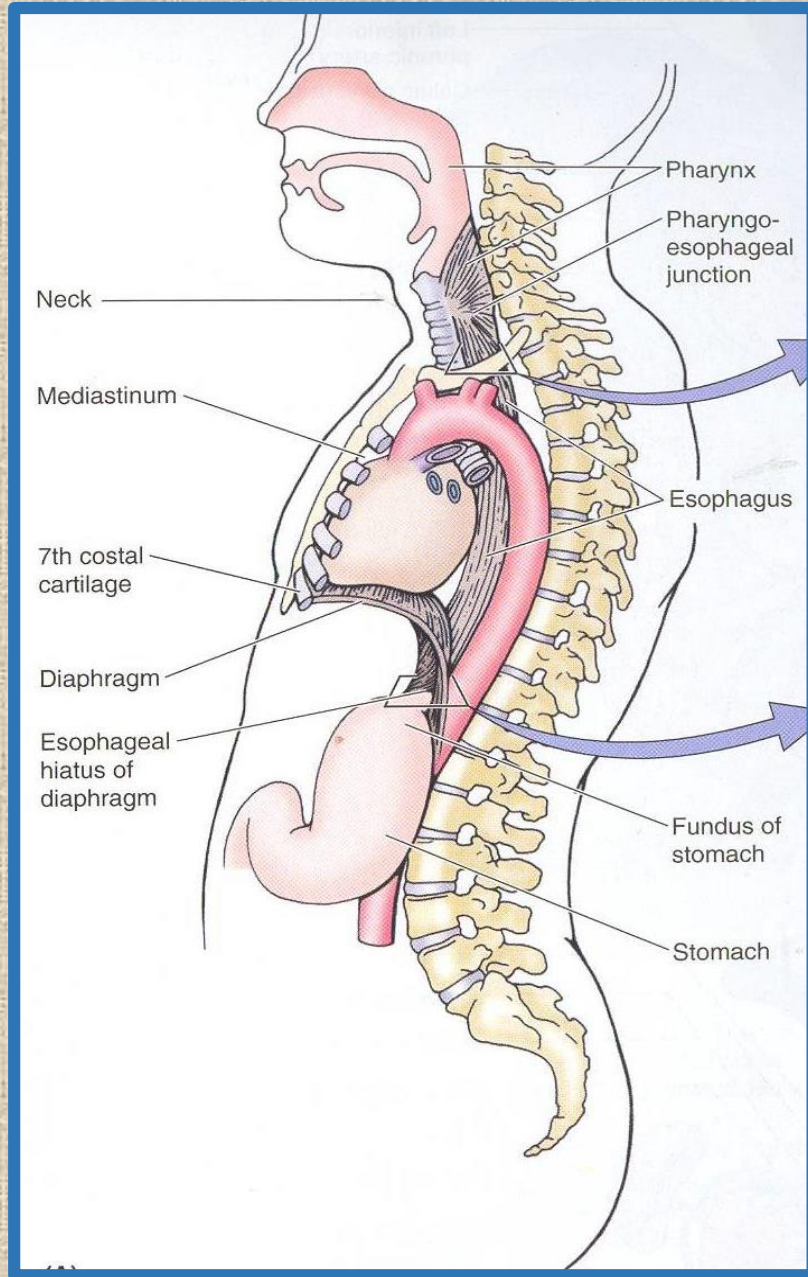
RELATIONS



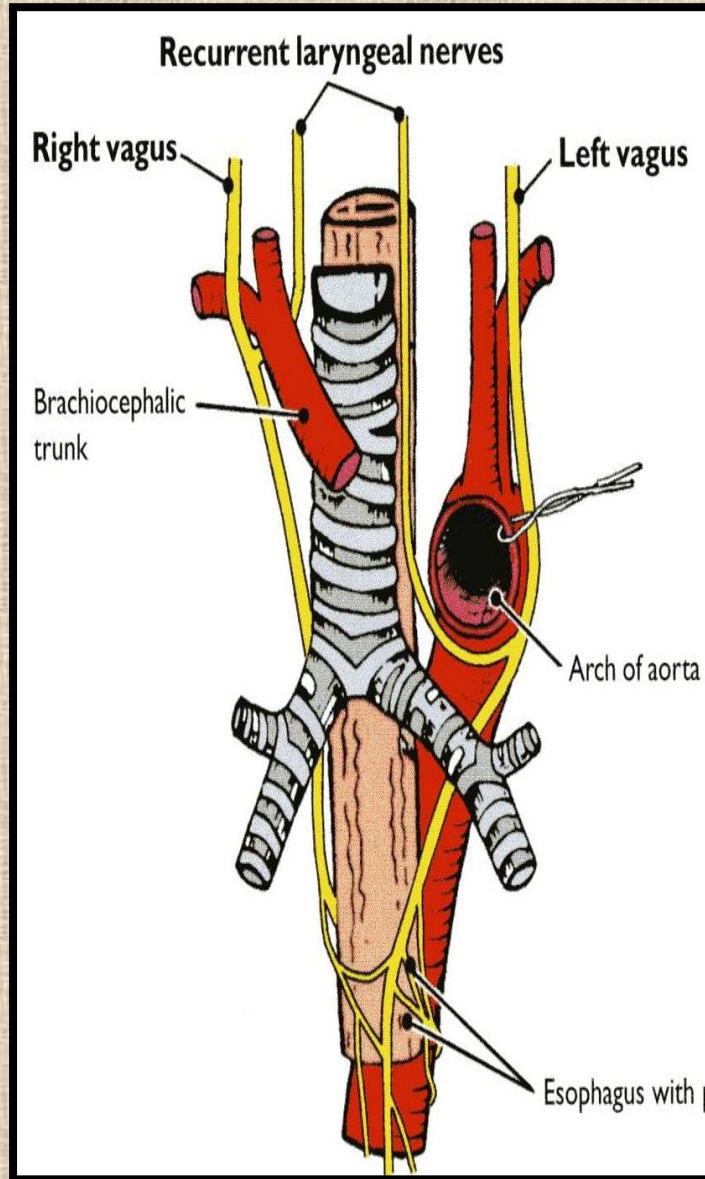
CERVICAL PART

- Posteriorly
- Post: Vertebral column.
- Laterally:
- Lat: Lobes of the thyroid gland.
- Anteriorly:
- Ant: Trachea and the recurrent laryngeal nerves.

THORACIC PART



- In the thorax, it passes downward and to the **left** through superior then to posterior mediastinum
- At the level of the sternal angle, the **aortic arch** pushes the esophagus again to **the midline**.

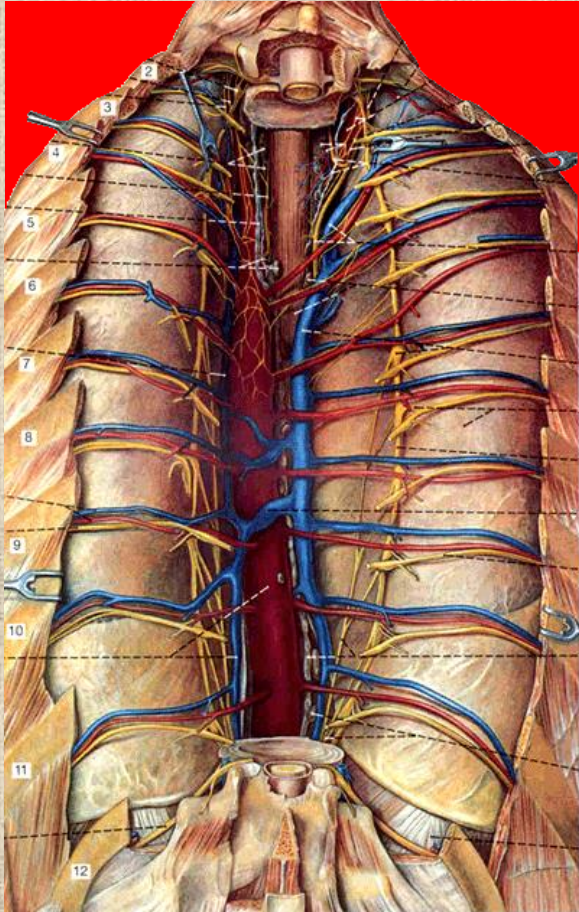


Thoracic part

ANTERIOR RELATIONS

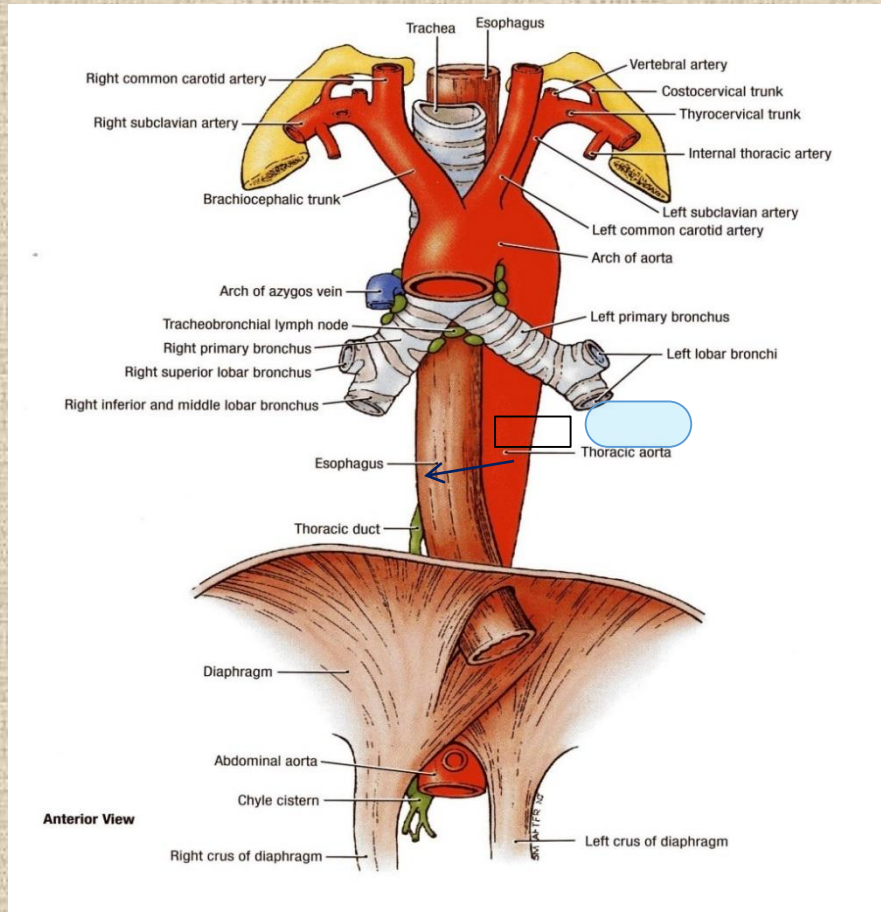
- Trachea
- Left recurrent laryngeal nerve
- Left principal bronchus
- Pericardium
- Left atrium

POSTERIOR RELATIONS – Thoracic duct



- **Bodies of the thoracic vertebrae**
- **Thoracic duct**
- **Azygos vein**
- **Right posterior intercostal arteries**
- **Descending thoracic aorta (at the lower end)**

LATERAL RELATION



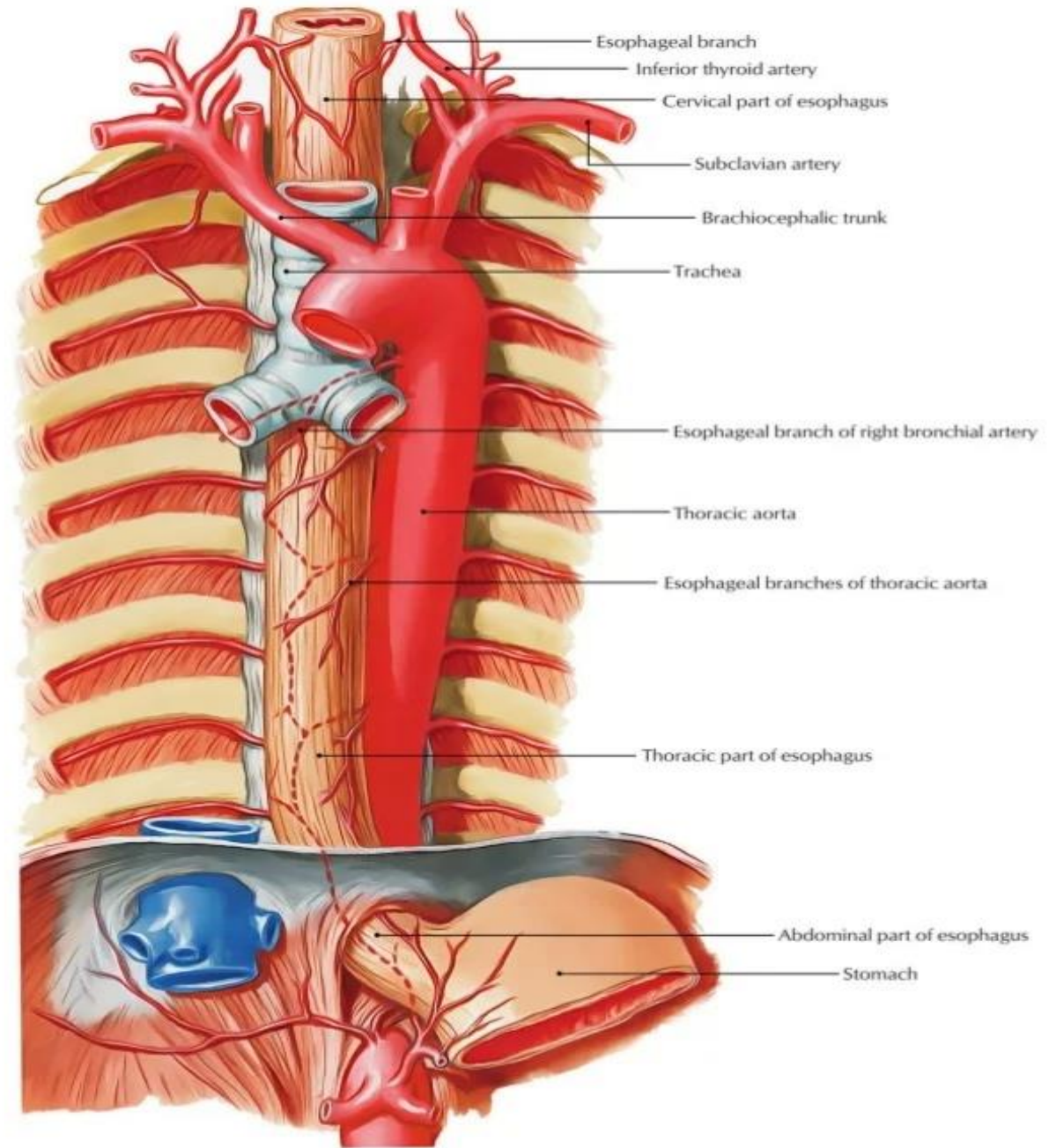
- **On the Right side:**
- Right mediastinal pleura
- Terminal part of the azygos vein.
- **On the Left side:**
- Left mediastinal pleura
- Left subclavian artery
- Aortic arch
- Thoracic duct

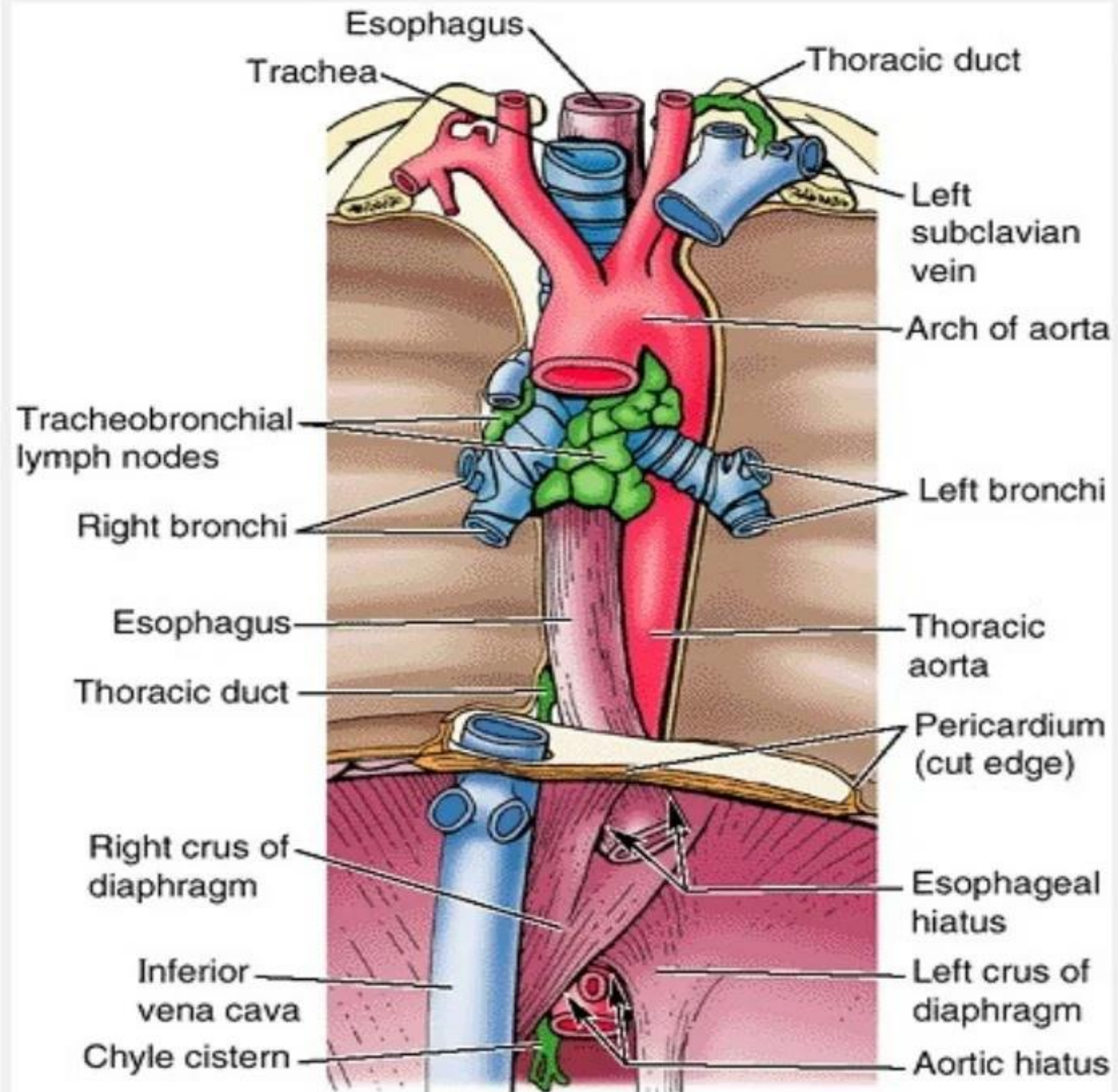
THE TABLE BELOW LISTS THE ANATOMICAL RELATIONS OF THE OESOPHAGUS

	ANTERIOR	POSTERIOR	RIGHT	LEFT
CERVICAL AND THORACIC	Trachea	Thoracic vertebral bodies	Pleura	Subclavian artery
	Left recurrent laryngeal nerve	Thoracic duct	Terminal part of azygous vein	Aortic arch
	Pericardium	Azygous veins		Thoracic duct
	LEFT MAIN BRONCHUS	Descending aorta		Pleura
ABDOMINAL	Left vagus nerve	Right vagus nerve		
	Posterior surface of the heart	Left crus of the diaphragm		

Anatomical Relations

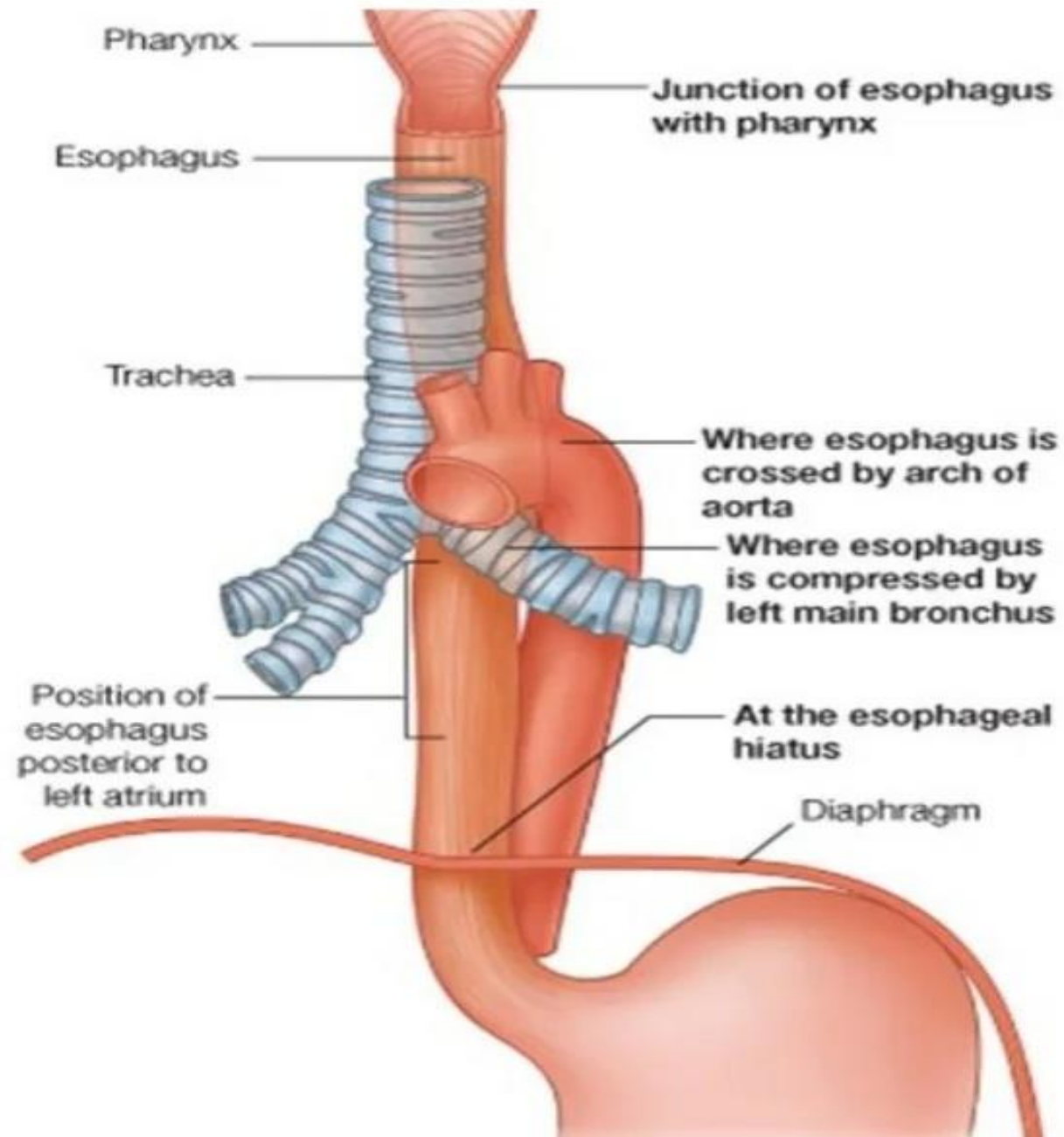
	Anterior	Posterior	Right	Left
Cervical part	*Trachea	*Cervical vertebrae	*The recurrent laryngeal nerve <i>lies in the Tracheo-esophageal Groove.</i> *The thyroid gland. *The right carotid sheath and its contents.	*The recurrent laryngeal nerve <i>lies in the Tracheo-esophageal groove</i> *The thyroid gland. *The left carotid sheath. *The thoracic Duct
Thoracic part	*Trachea *Left recurrent laryngeal nerve *Pericardium	*Thoracic Vertebral bodies *Thoracic duct *Azygous veins *Descending aorta	*Pleura *Terminal part of azygous vein	*Subclavian artery *Aortic arch *Thoracic duct *Pleura
Abdominal part shortest (1 to 2 cm long)	*Left vagus nerve *Posterior Surface of the heart	*Right vagus nerve *Left crus of the Diaphragm		





Anatomical Position

- The oesophagus begins **in the midline** at the level of the **lower cricoid border (C6)**.
- It then **deviates to the left at the root of the neck** and returns to the midline at **T5**.
- When it reaches **T7**, it once again deviates to the left to reach the **gastric cardia**.
- It passes through the **oesophageal hiatus** of the diaphragm at **T10**.
- The short abdominal part of the oesophagus (about 1 cm) **forms a groove in the left lobe in the liver**.
- It ends at the level of **T11** in the gastric cardiac orifice.

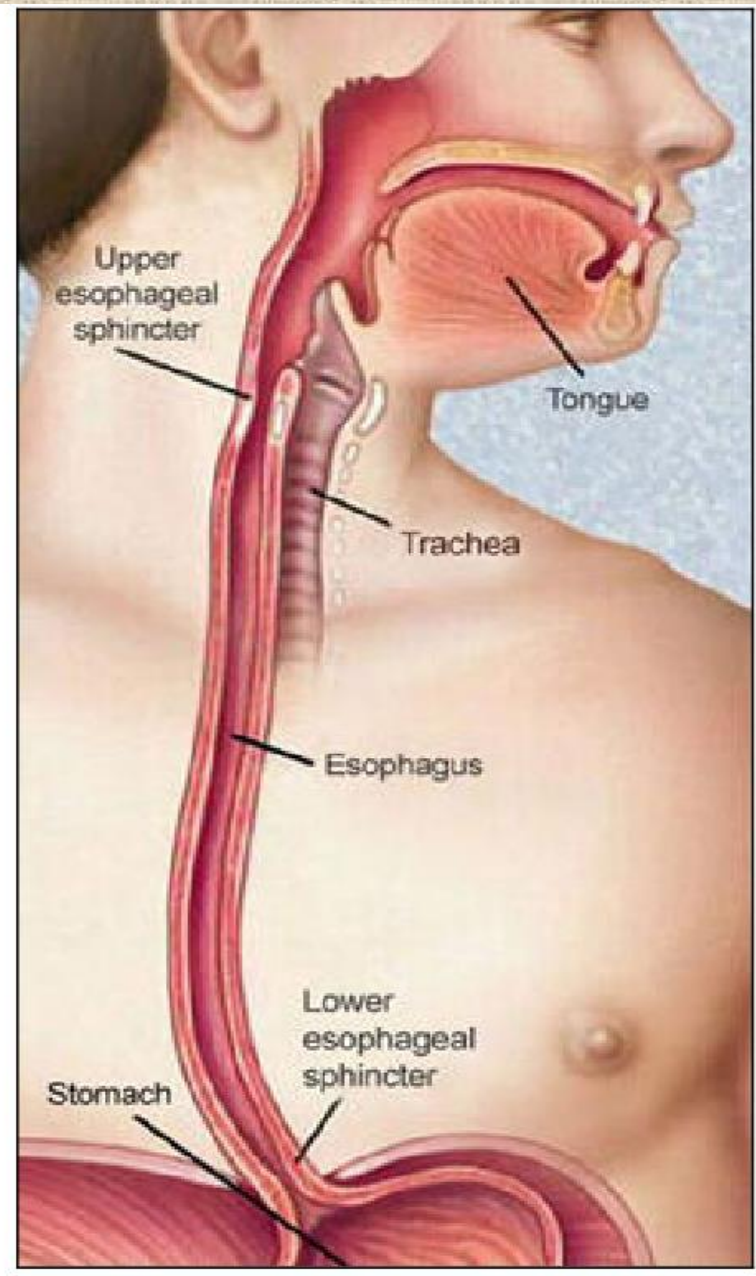
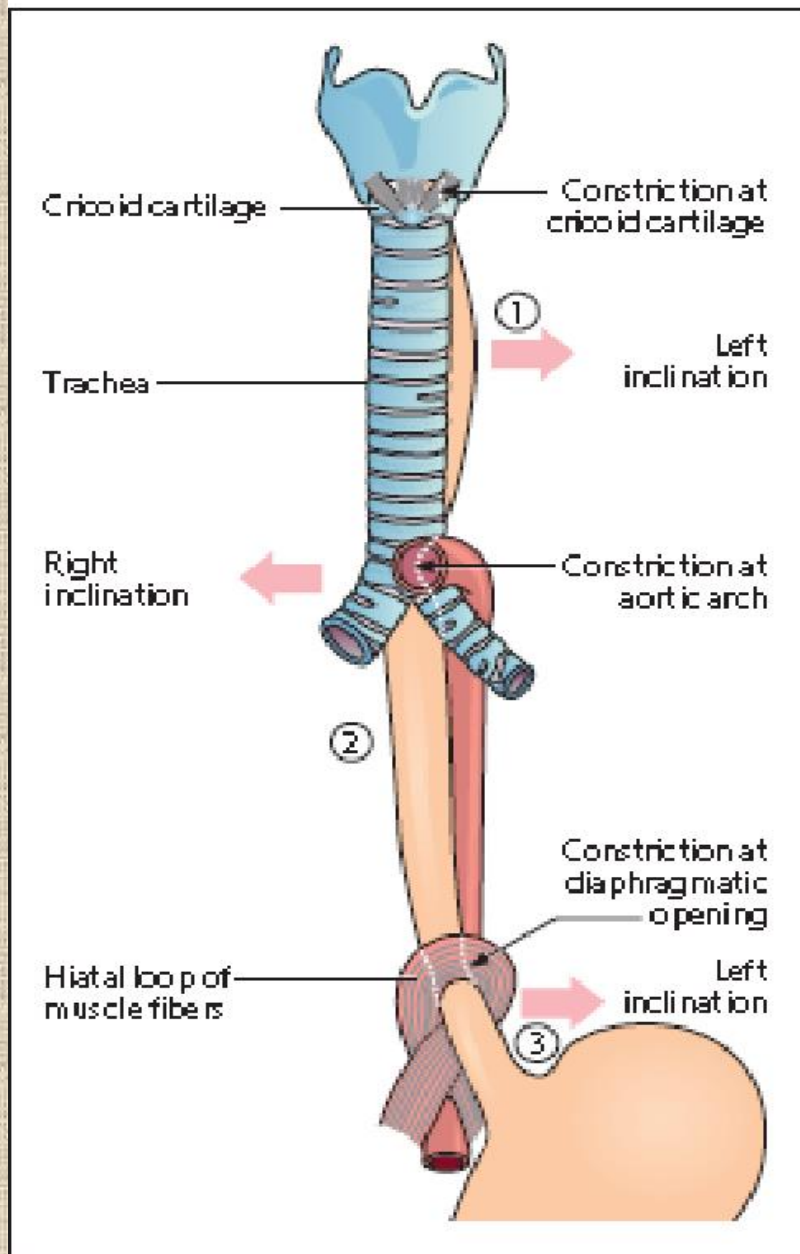


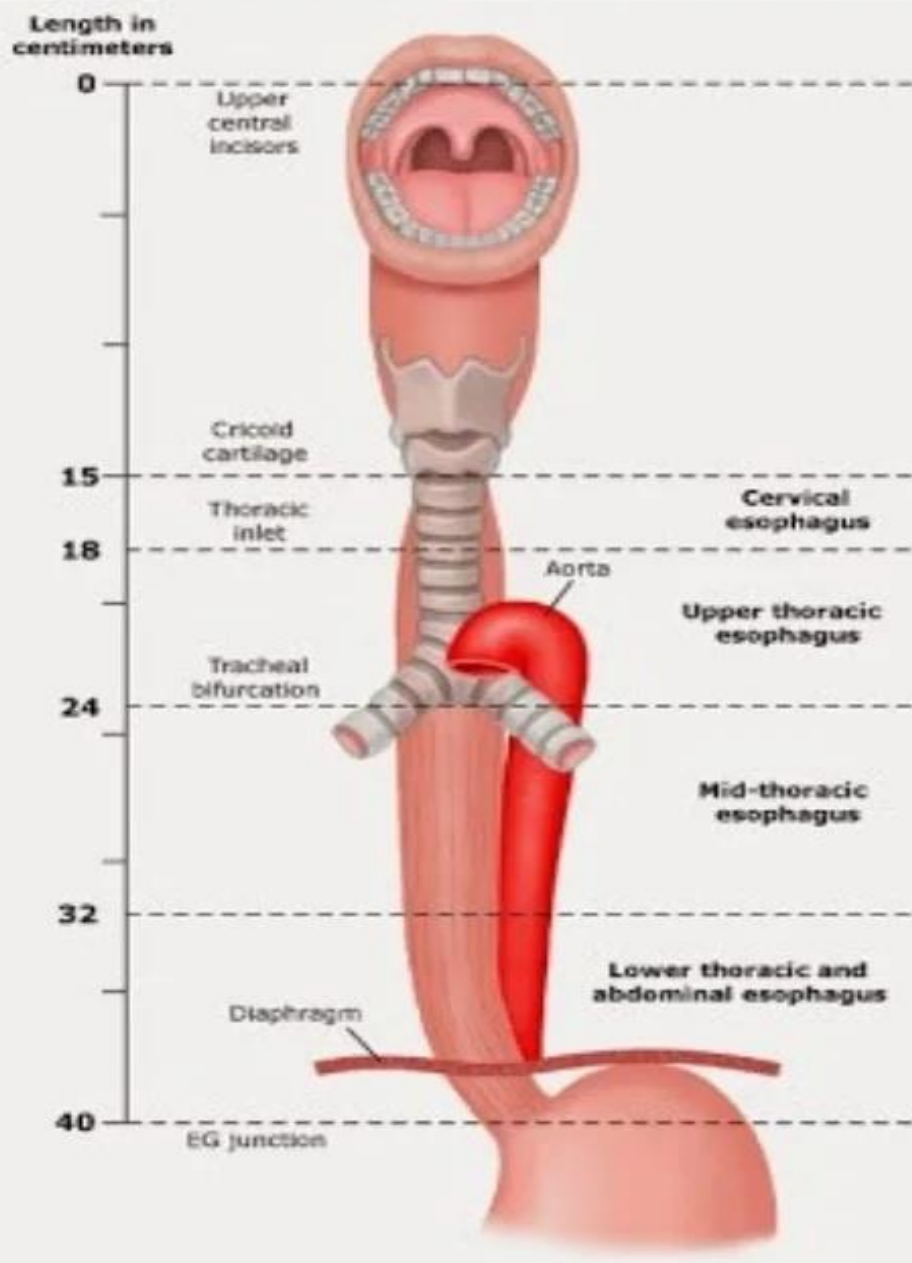
Constrictions

The distance of each constriction is measured from the upper incisor **teeth**.

First constriction (cervical)	at the pharyngo-esophageal junction (at C6)	9 cm (6 inches) from the incisor teeth.
Second constriction (thoracic)	where it's crossed by the arch of aorta (at T4)	22.5 cm (9 inches) from the incisor teeth.
Third constriction (thoracic)	where it's crossed by the left principal bronchus (at T5-T6)	27.5 cm (11 inches) from the incisor teeth
Fourth constriction (diaphragmatic)	where it pierces the diaphragm (at T10)	40 cm (15 inches) from the incisor teeth.

These constrictions are important as they are the likely sites of obstruction in the event of oesophageal scarring due to the swallowing of caustic or acidic material.





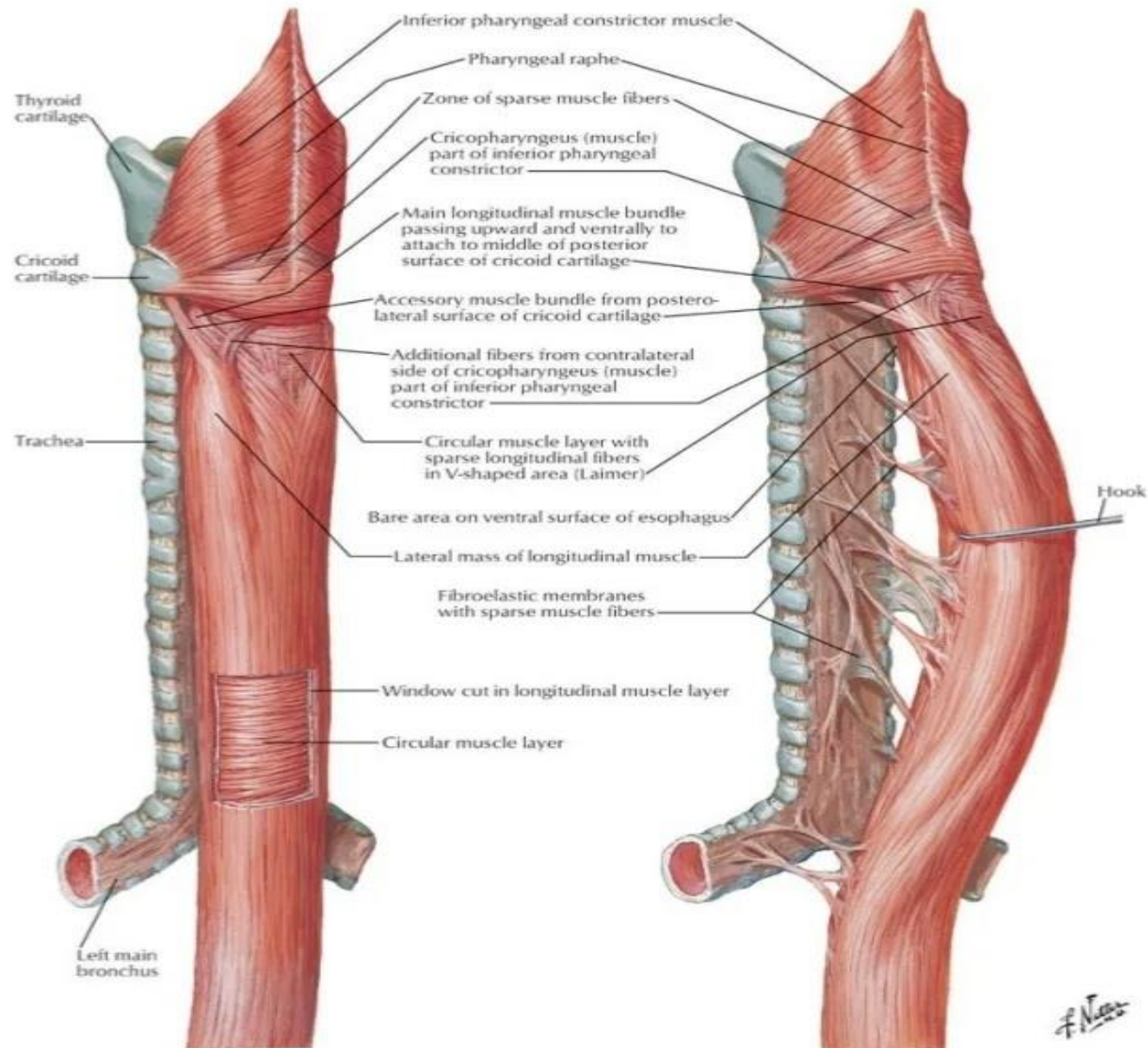
CLINICAL IMPORTANCE OF ESOPHAGEAL CONSTRICTIONS

- The anatomical constrictions of esophagus are of considerable clinical importance because of the following reasons:
- These are the sites where swallowed foreign bodies may stuck in the esophagus.
- These are the sites where strictures develop after ingestion of caustic substances.
- These sites have predilection for the carcinoma of the esophagus.
- These are sites via which it might be difficult to pass esophagoscope/gastric tube.

The esophagus musculature

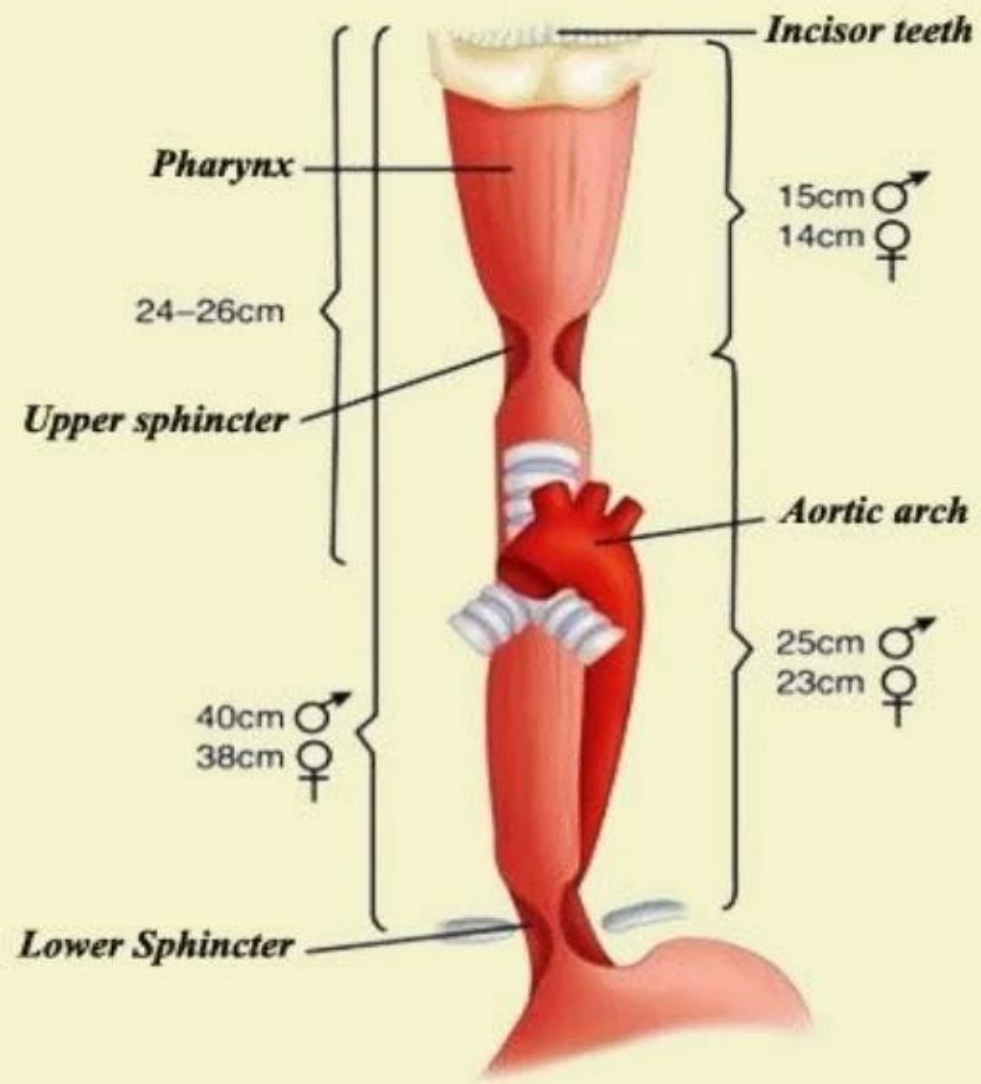
- The esophagus consists of
 - Striated (voluntary) muscle in its upper third,
 - Smooth (involuntary) muscle in its lower third,
 - Mixture of striated and smooth muscle in between.
- Externally, the pharyngoesophageal junction appears as a constriction produced by the cricopharyngeal part of the inferior constrictor muscle (the superior esophageal sphincter) and is *the narrowest part of the esophagus*.

Musculature of Esophagus



Oesophageal Sphincters

- There are two sphincters present in the oesophagus, known as
 - The upper and
 - The lower oesophageal sphincters.
- They act to prevent the entry of air and the reflux of gastric contents respectively.



Upper Oesophageal Sphincter

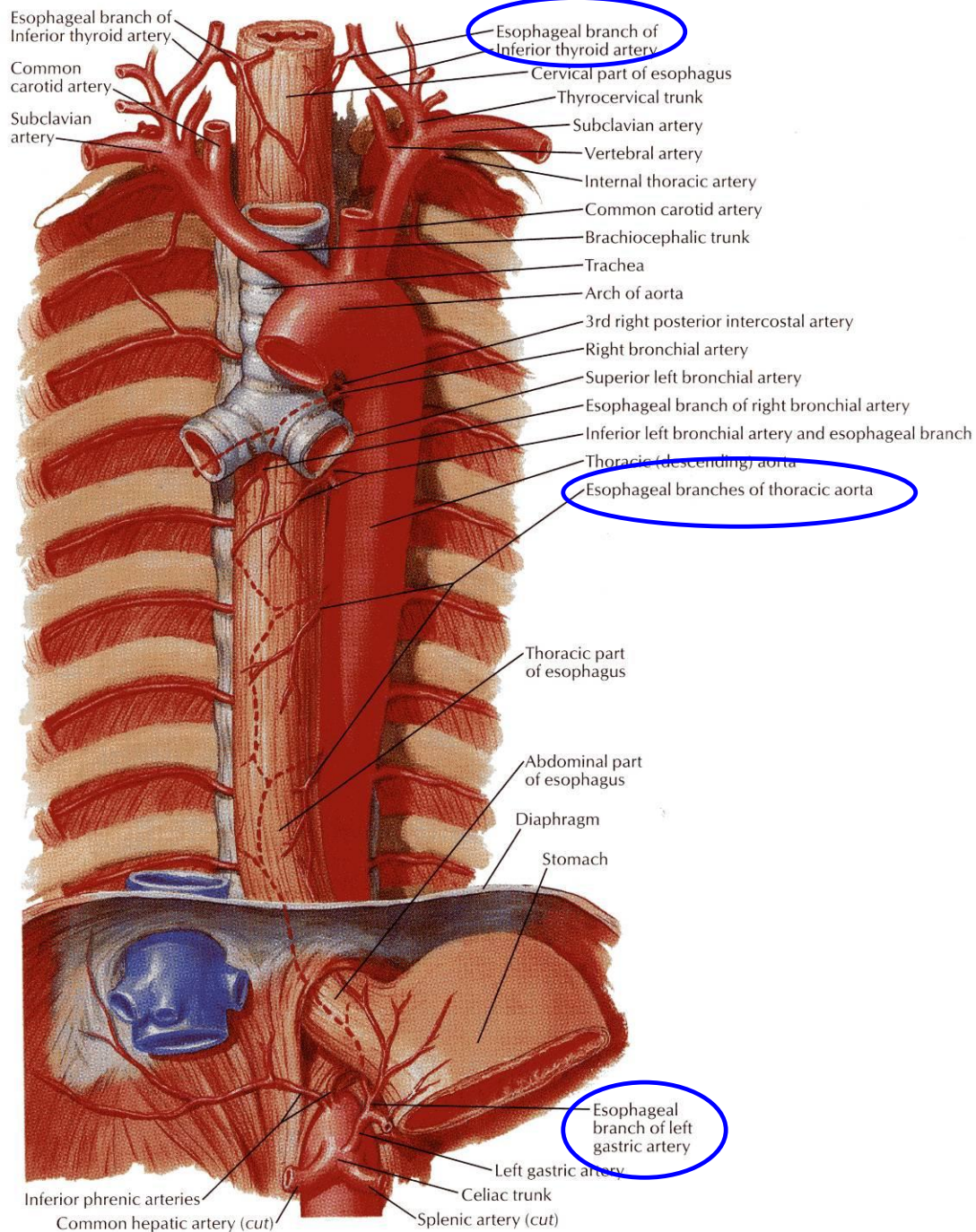
- The upper sphincter is an *anatomical*, striated muscle sphincter at the junction between the pharynx and oesophagus.
- It is produced by the cricopharyngeus muscle.
- Normally, it is constricted to prevent the entrance of air into the oesophagus.

Lower Oesophageal Sphincter

- The lower oesophageal sphincter is a *physiological sphincter* located in the **gastro-oesophageal junction** (junction between the stomach and oesophagus). *The gastro-oesophageal junction is situated to the left of the **T11 vertebra**, and is marked by the change from oesophageal to gastric mucosa.*
- The sphincter is classified as a *physiological* (or functional) sphincter, as it does not have any specific sphincteric muscle. Instead, the sphincter is formed from four phenomena:
 1. The oesophagus enters the stomach at an **acute angle**.
 2. The walls of the intra-abdominal section of the oesophagus are **compressed** when there is a positive intra-abdominal pressure.
 3. The **folds of mucosa** present aid in occluding the lumen at the gastro-oesophageal junction.
 4. The right crus of the diaphragm has a “**pinch-cock**” effect.

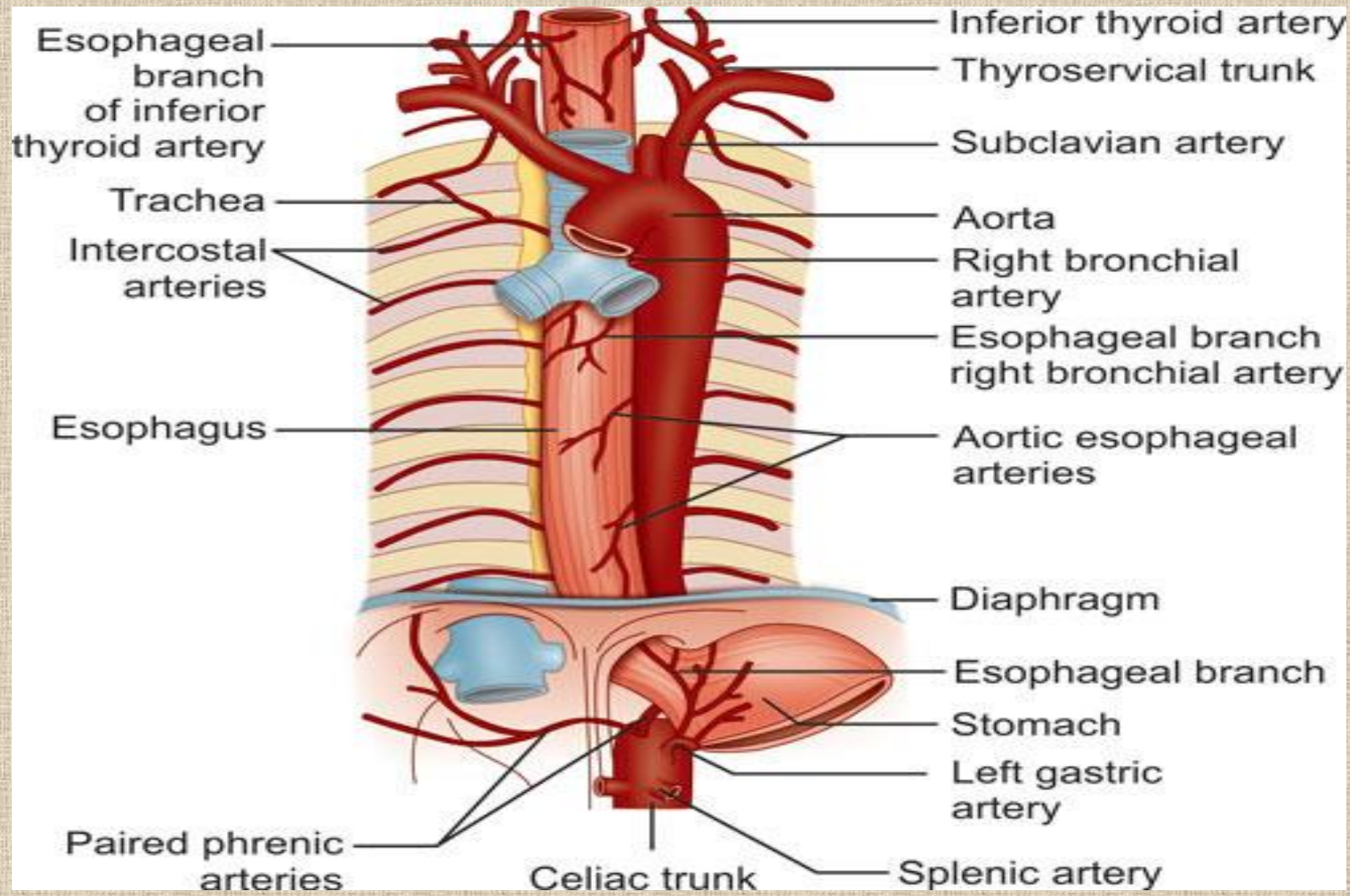
ARTERIAL SUPPLY

- **A.** The cervical part is by
 - Inferior thyroid arteries.
- **B.** The thoracic part is by
 - Esophageal branches of
 - Descending thoracic aorta, and
 - Bronchial arteries.
- **C.** The abdominal part is by
 - Esophageal branches of
 - Left gastric artery, and
 - Left inferior phrenic artery.



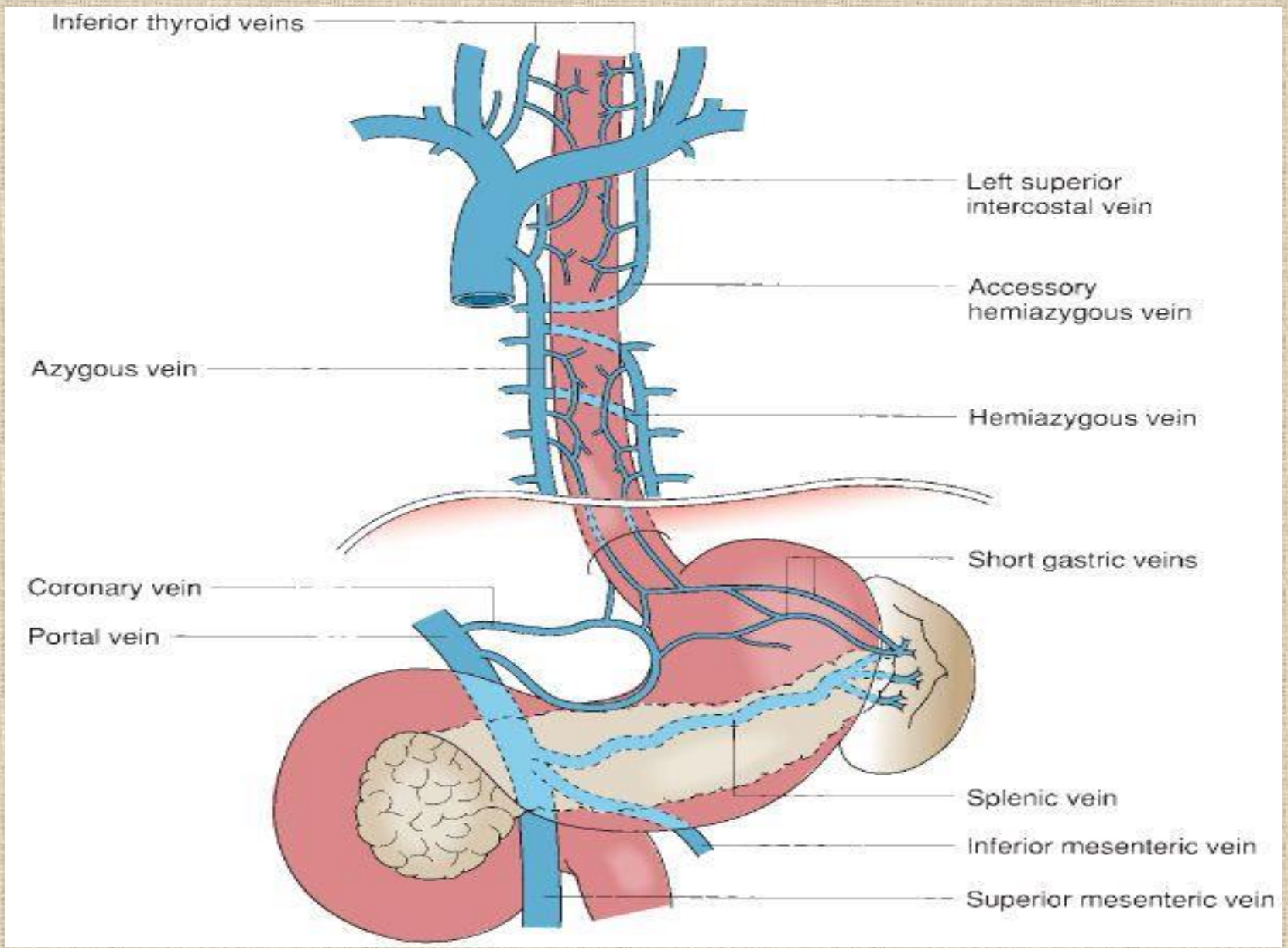
ARTERIAL SUPPLY

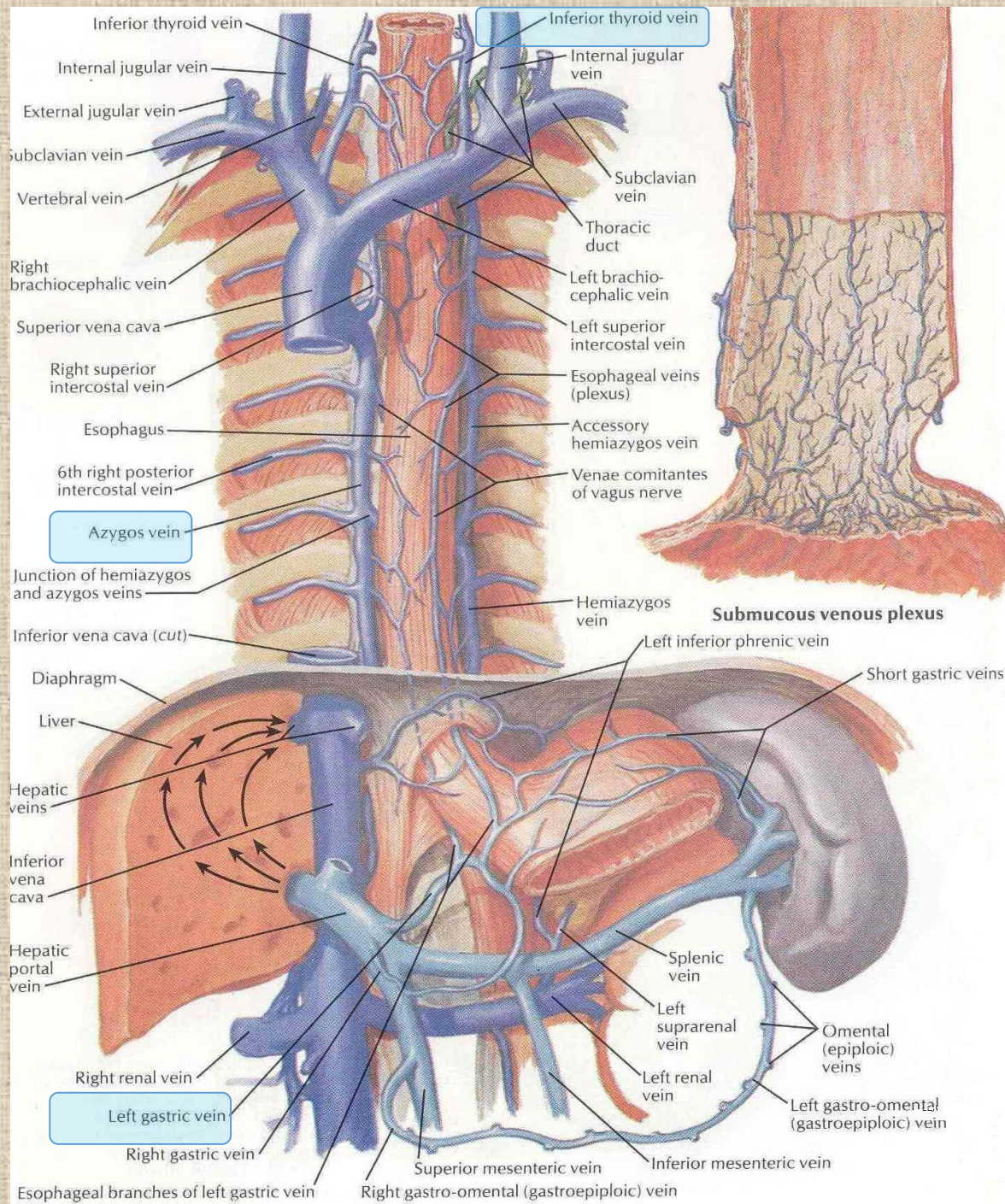
- Upper third by the **inferior thyroid artery**.
- The middle third by the **thoracic aorta**.
- The lower third by the **left gastric artery**.



VENOUS DRAINAGE

- **A.** Cervical part is drained by inferior thyroid veins.
- **B.** Thoracic part is drained by **azygos and hemiazygos veins.**
- **C.** Abdominal part is drained by 2 venous channels, viz,
 - **Hemiazygos vein**, a tributary of **inferior vena cava**, and
 - left gastric vein, a tributary of **portal vein.**
 - Thus abdominal part of esophagus is the site of portocaval(**porto-systemic**) anastomosis.



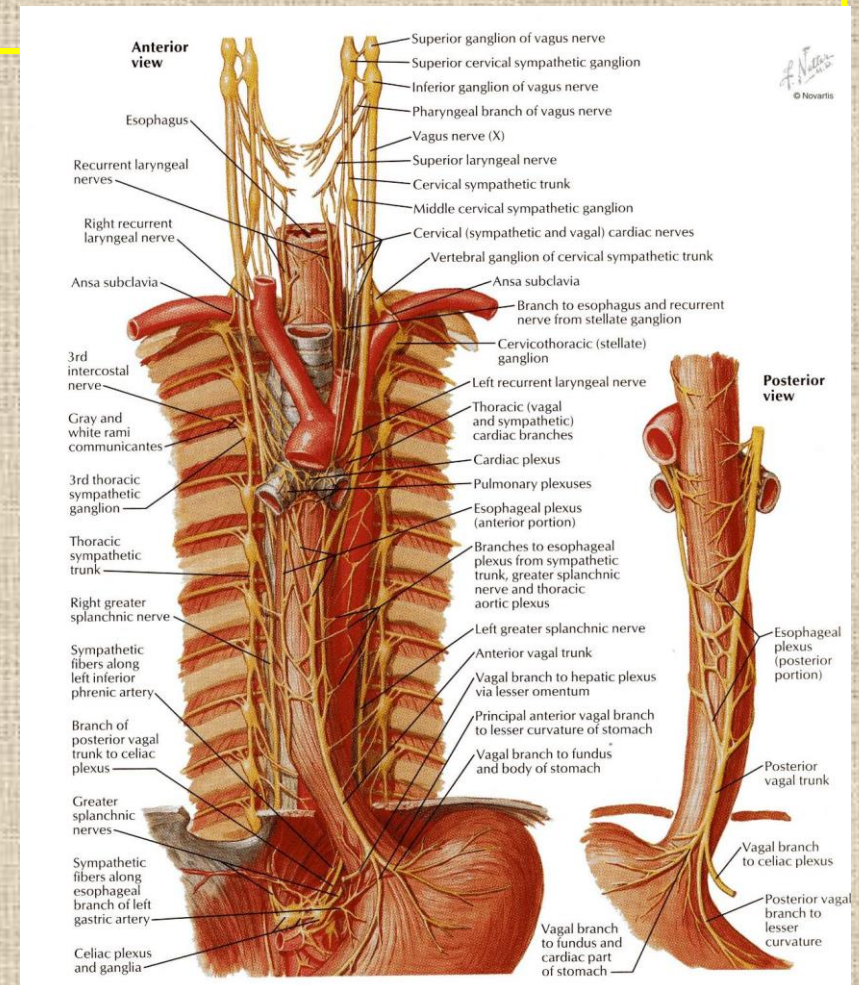


VENOUS DRAINAGE

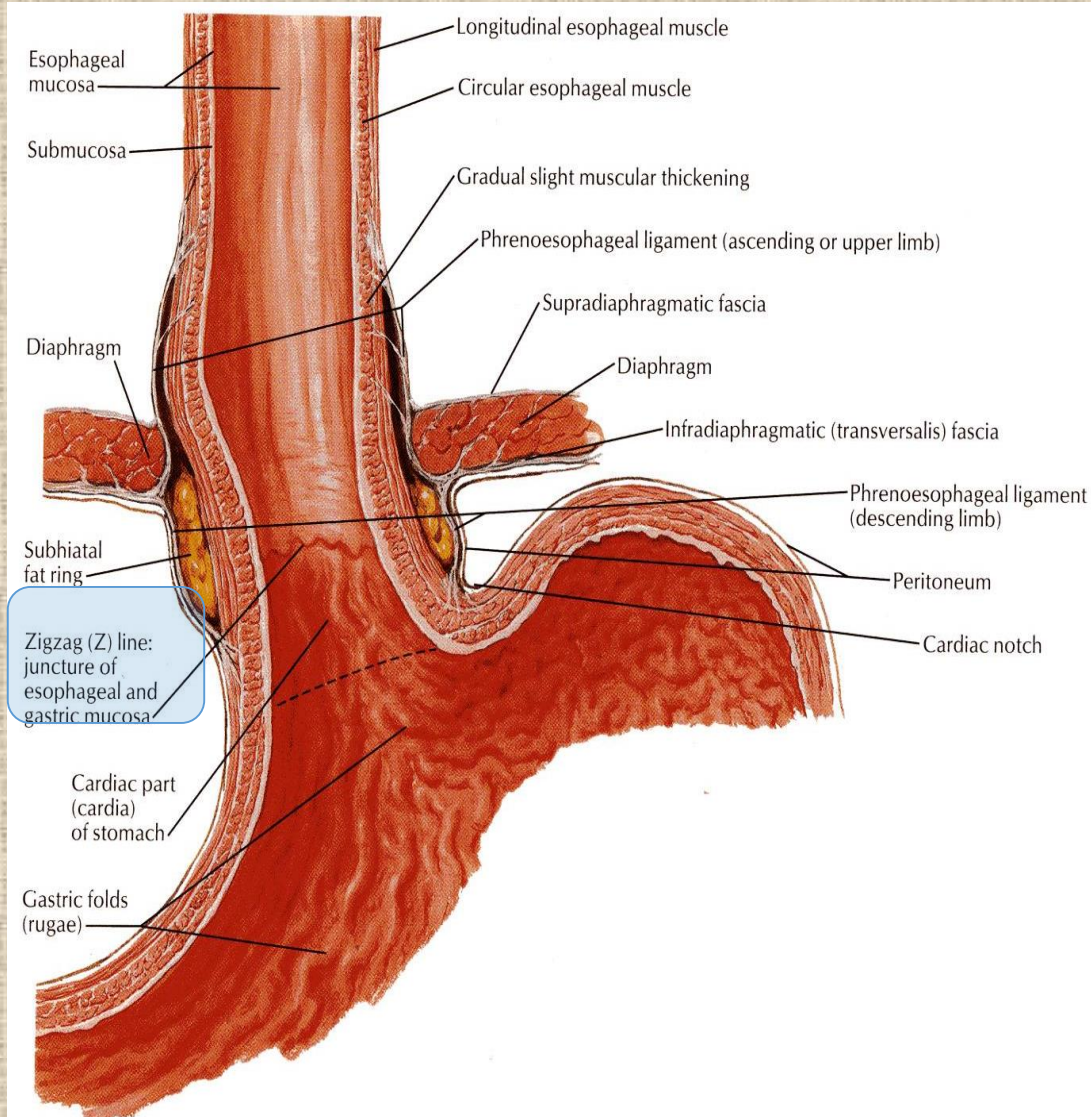
- The upper third drains into the **inferior thyroid veins**.
- The middle third into the **azygos veins**.
- The lower third into the **left gastric vein, which is a tributary of the portal vein**.
- *NB. Esophageal varices.*

NERVE SUPPLY

- It is supplied by sympathetic fibers from the **sympathetic trunks**.
- The parasympathetic supply comes from the **vagus nerves**.
- Inferior to the roots of the lungs, the vagus nerves join the sympathetic nerves to form the **esophageal plexus**.
- The **left** vagus lies **anterior** to the esophagus.
- The **right** vagus lies **posterior** to it.



CARDIAC ORIFICE



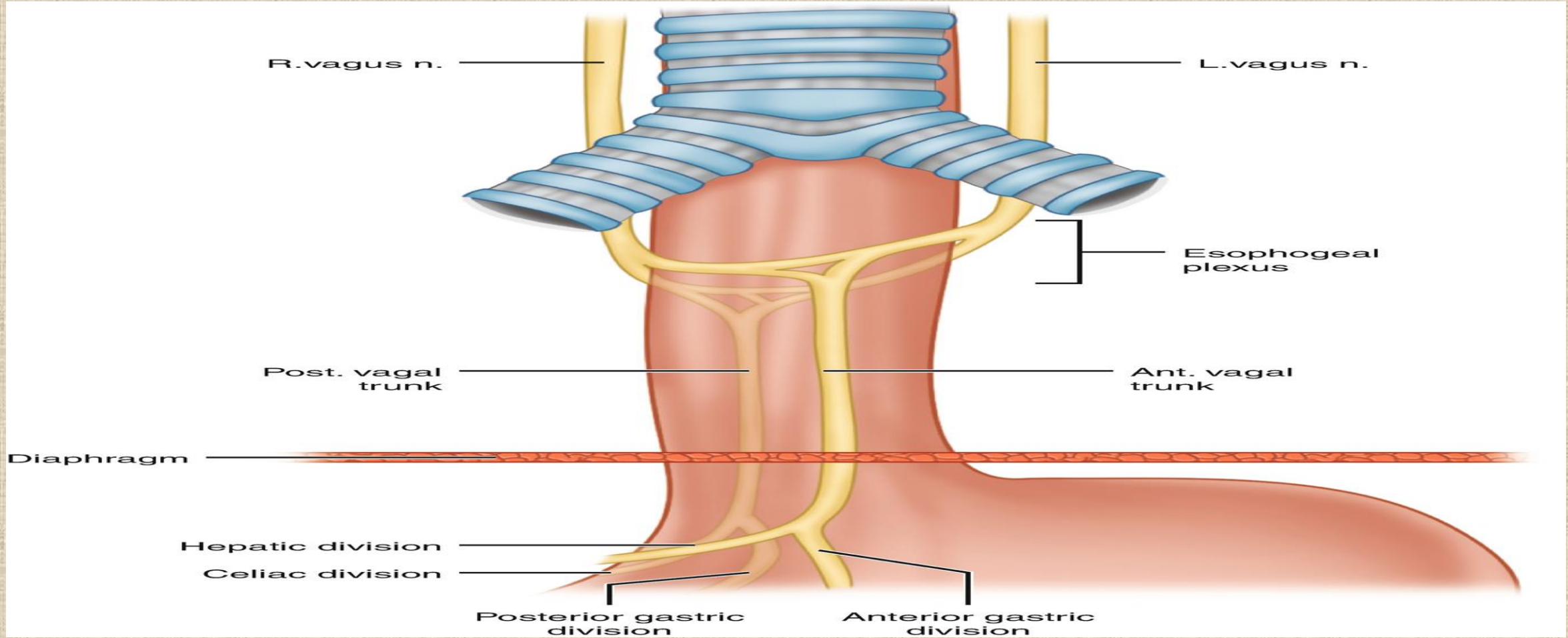
- It is the site of the **gastro-esophageal sphincter**.
- It is a physiological rather than an anatomical, sphincter.
- Consists of a **circular layer** of smooth muscle (**under vagal and hormonal control**).
- **Function:**
- Prevents **(GER)** regurgitation (reflux)
- **NB.** Notice the abrupt mucosal transition from esophagus to stomach (Z-line)

Lymphatics

- The **lymphatic drainage** of the oesophagus is divided into thirds:
- **Superior third :**
 - Deep cervical lymph nodes.
- **Middle third:**
 - Superior and posterior mediastinal nodes.
- **Lower third:**
 - Left gastric and celiac nodes.

NERVE SUPPLY

- The esophagus is supplied by both parasympathetic and sympathetic fibres.
- The parasympathetic fibres are originated from recurrent laryngeal nerves and esophageal plexuses created by vagus nerves. They supply sensory, motor, and secretomotor supply to the esophagus.
- The sympathetic fibres are originated from T5-T9 spinal segments are sensory and vasomotor.

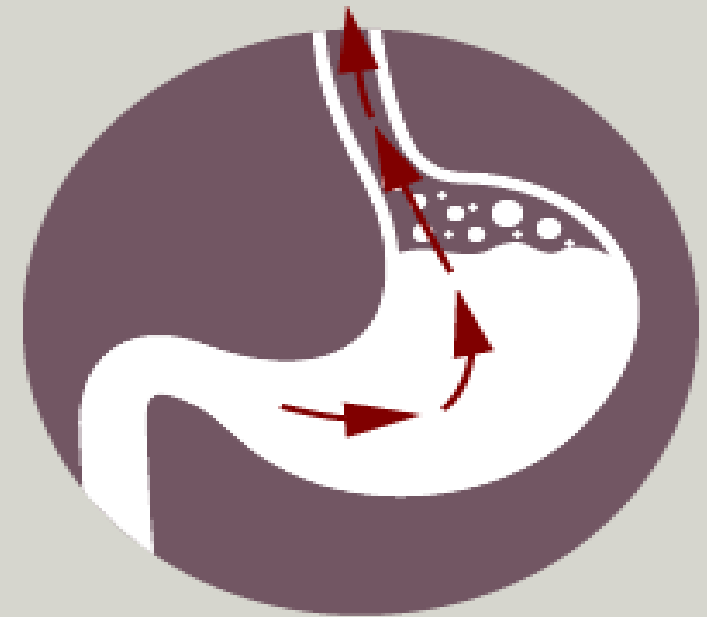


CLINICAL SIGNIFICANCE

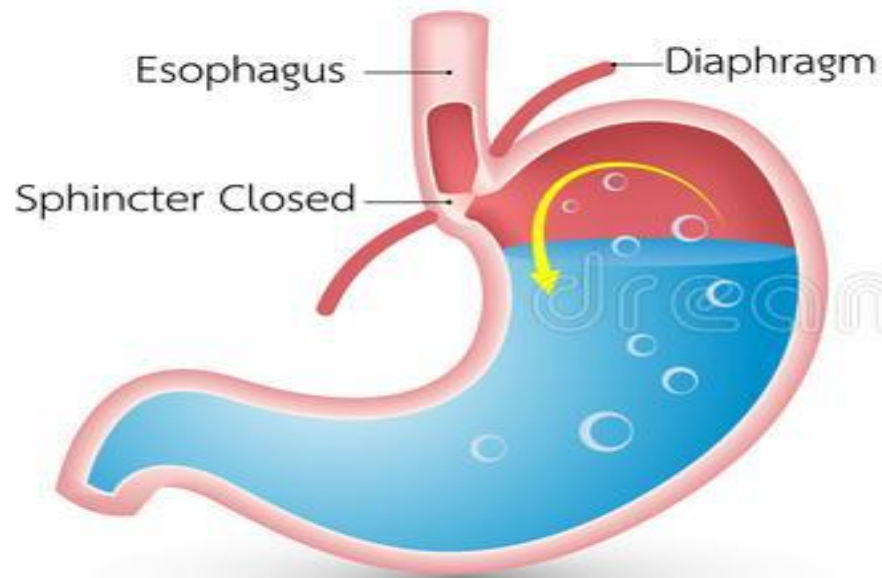
- **ESOPHAGEAL VARICES**
- The lower end of esophagus is one of the significant sites of portocaval anastomosis.
- In portal hypertension, example, because of the **cirrhosis** of **liver** there's back pressure in portal circulation. Because of this, collateral channels of portocaval anastomosis not only open up but become dilated and tortuous to create esophageal varices.
- The ruptured esophageal varices cause hematemesis (vomiting of blood).

What is Gastroesophageal Reflux Disease (GERD)?

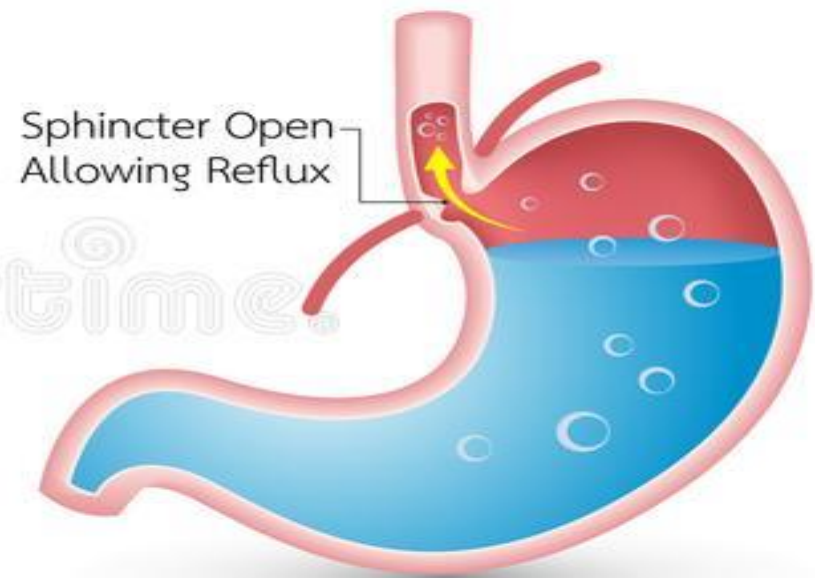
- When the one-way valve between your esophagus and stomach is weakened
- Allows food, acid and bile to reflux into your esophagus
- Reflux causes inflammation and irritation



GASTROESOPHAGEAL REFLUX DISEASE



HEALTHY



GERD

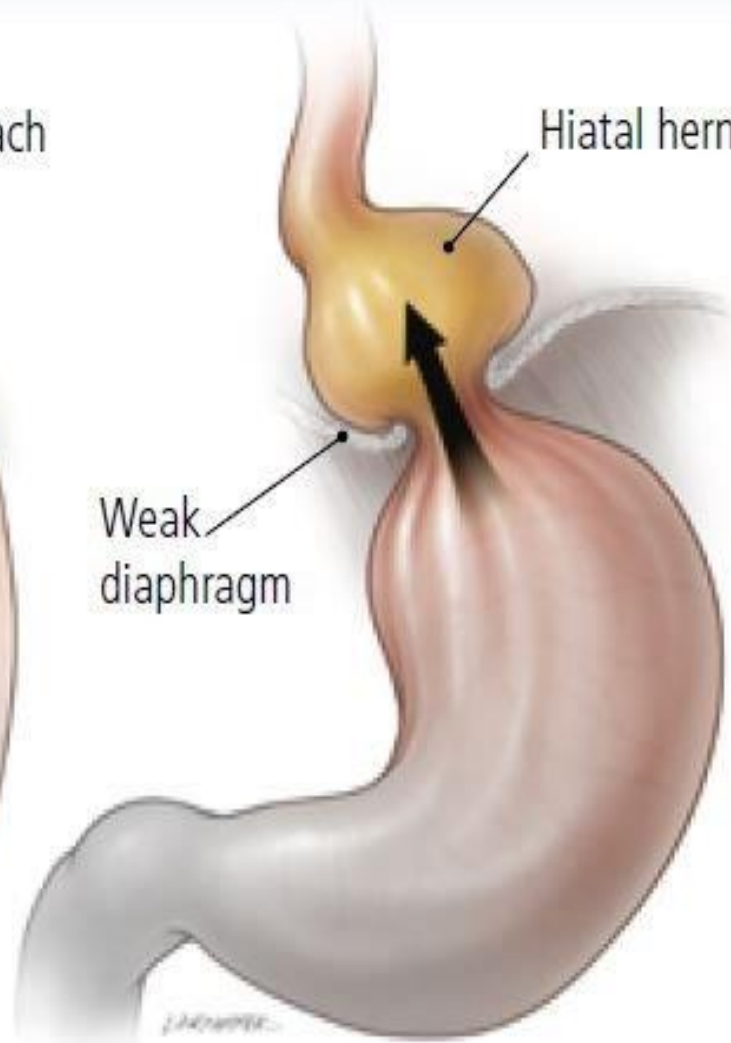
Normal stomach

Normal diaphragm



Hiatal hernia

Weak diaphragm



REFERRED PAIN OF ESOPHAGUS

- The pain sensations mostly originates from the lower part of the esophagus as it's susceptible to acid-peptic esophagitis. Pain sensations are carried by sympathetic fibre to the T4 and T5 spinal segments.
- For that reason, esophageal pain is referred to the lower thoracic region and epigastric region of the abdomen, and at times it becomes difficult to differentiate esophageal pain from the anginal pain.

RADIOLOGICAL EVALUATION OF THE ESOPHAGUS BY BARIUM SWALLOW

- It's performed to detect
 - (a) Enlargement of the **left atrium** because of mitral stenosis,
 - (b) Esophageal strictures, and
 - (c) Carcinoma and achalasia cardia.
- In normal case, the barium swallow examination presents indentations in its outline caused by constrictions.

ACHALASIA CARDIA

- It's a clinical condition where sphincter at the lower end of esophagus fails to relax when the food is swallowed.
- Consequently food accumulates in the esophagus and its regurgitation takes place.
- This condition takes place because of neuromuscular incoordination, probably because of congenital absence of ganglion cells in the myenteric plexus of nerves in the esophageal wall.

A radiographic barium swallow evaluation of the esophagus reveals a characteristic birds beak/rat tail appearance.

ACHALASIA CARDIA

- Primary oesophageal motility disorder
- Also called as cardiospasm –because of severe spasm of circular muscles of lower end of oesophagus.
- The contracted segment doesn't relax during swallowing as a result there is dilatation of, tortuosity and hypertrophy of the oesophagus above

**Dilation
(widening)
of the
oesophagus**

**Sphincter
not working
properly**



Clinical presentation

- Severe pain in the chest or upper abdomen following a meal or a bout of drinking
- SOB
- Sometimes misdiagnosed as MI, perforated peptic ulcer or pancreatitis
- Rigidity of the upper abdomen
- Dec. breath sounds
- Dullness on percussion, subcutaneous emphysema
- In late cases sepsis is present

ESOPHAGOSCOPY

- It's performed to visualize the interior of the esophagus while passing esophagoscope, the sites of normal constrictions ought to be kept in mind

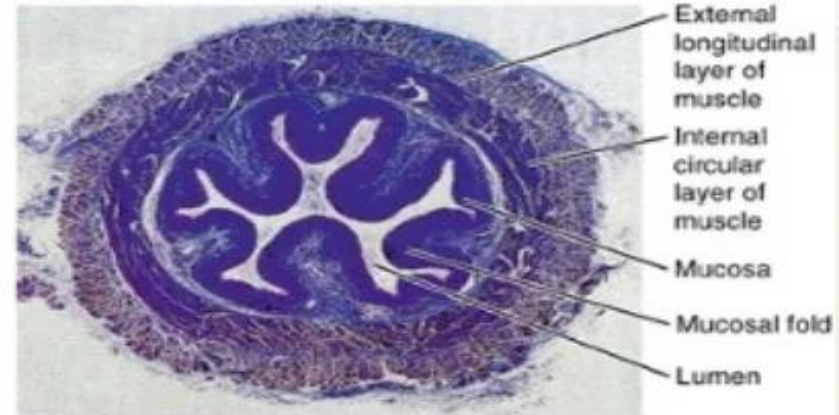
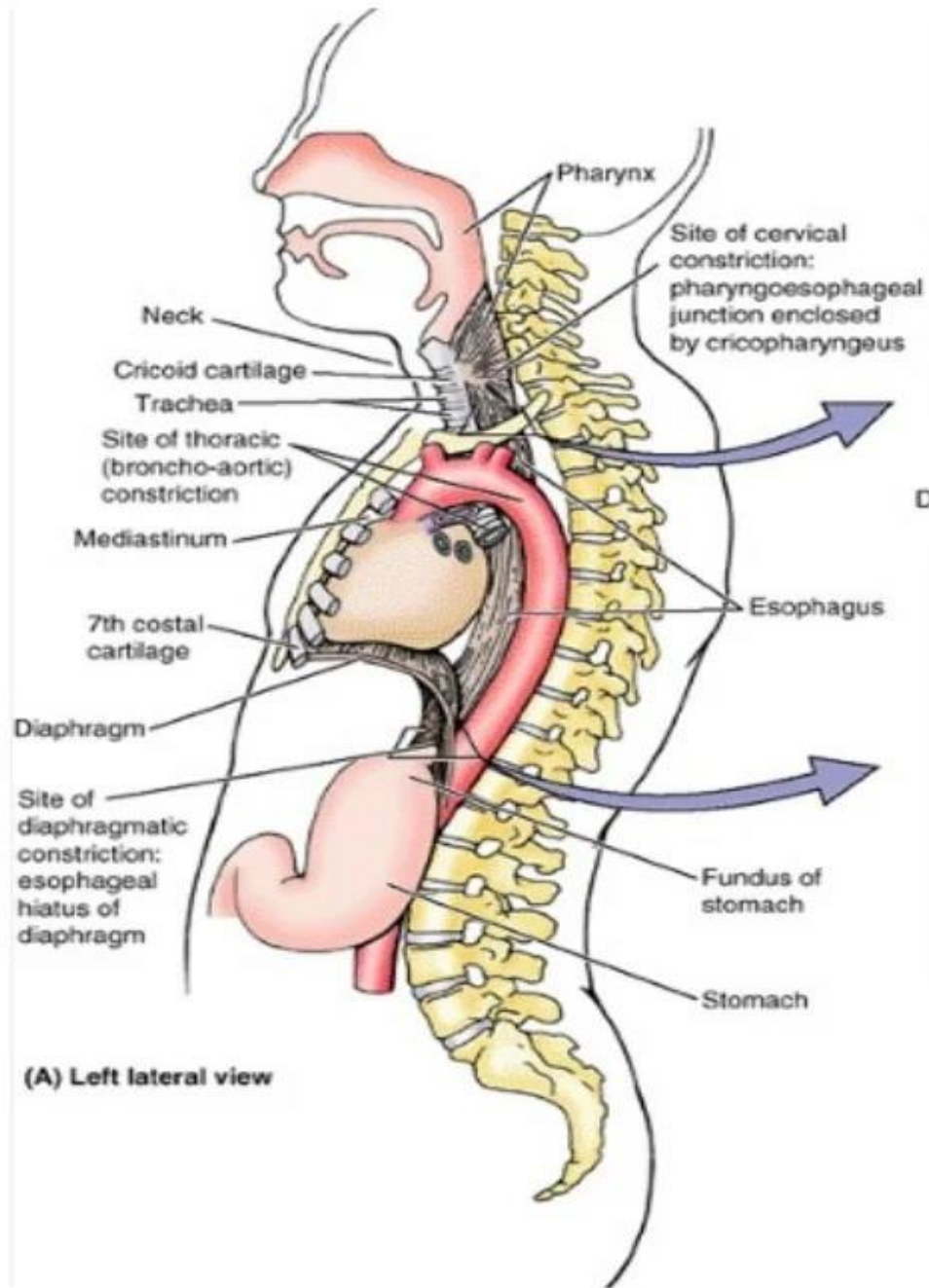
DYSPHAGIA

(DIFFICULTY IN SWALLOWING)

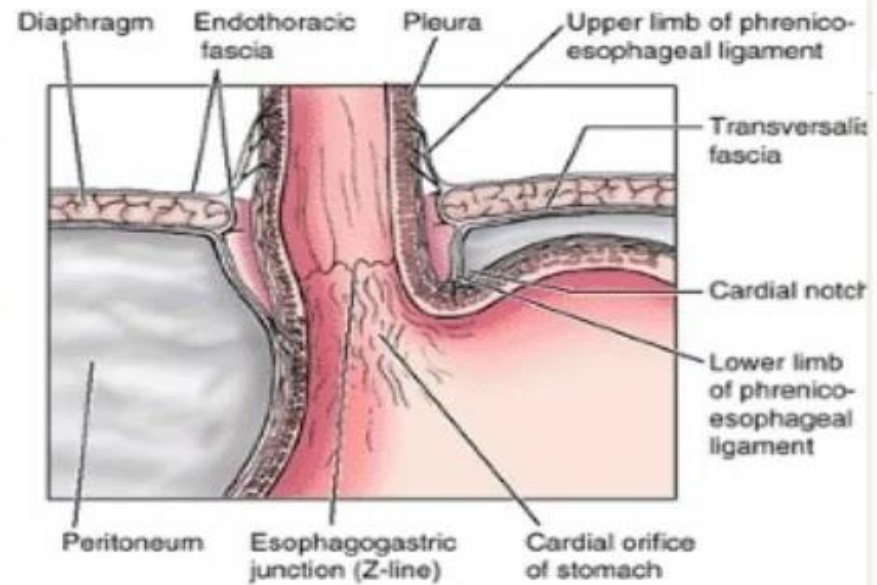
- It takes place because of:
 - Compression of esophagus from outside by aortic arch aneurysm, enlargement of lymph nodes, abnormal right subclavian artery (passing posterior to esophagus),
 - Narrowing of lumen because of stricture or carcinoma.

TRACHEOESOPHAGEAL FISTULA

- It's a commonest congenital anomaly of esophagus which takes place because of failure of separation of the lumen of tracheal tube from that of esophagus by a laryngotracheal septum.
- In the most commonest type of tracheoesophageal fistula, the upper esophagus ends blindly and lower esophagus interacts with trachea in the level of T4 vertebra.
- Medically it presents as:
 - (a) Hydramnios because fetus is unable to swallow amniotic fluid,
 - (b) Stomach is distended with air, and
 - (c) Infant vomit every feed given or may cough up bile. The fistula must be closed surgically to avoid passage of swallowed liquids into the **lungs**.



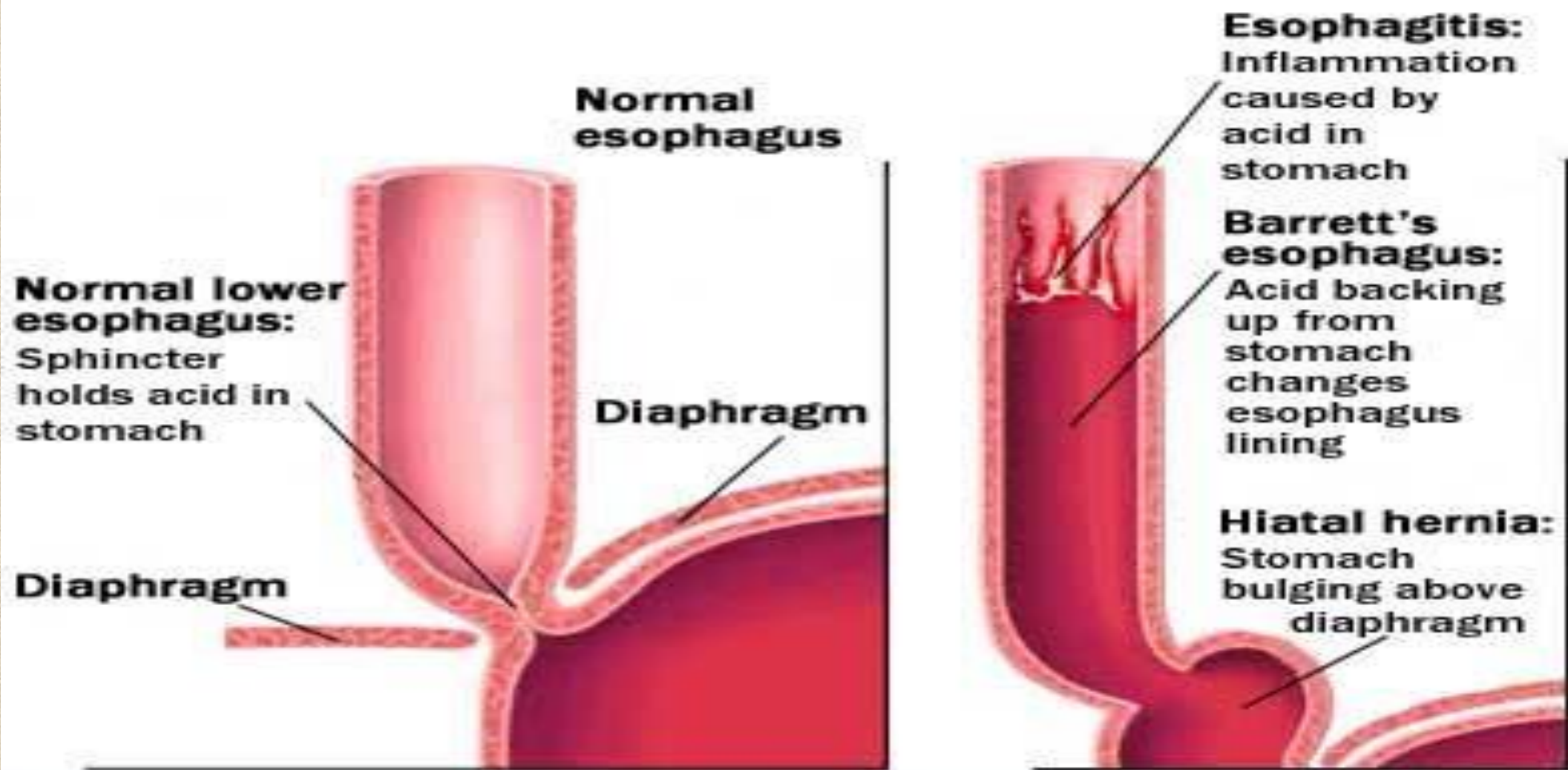
(B) Interior microscopic view



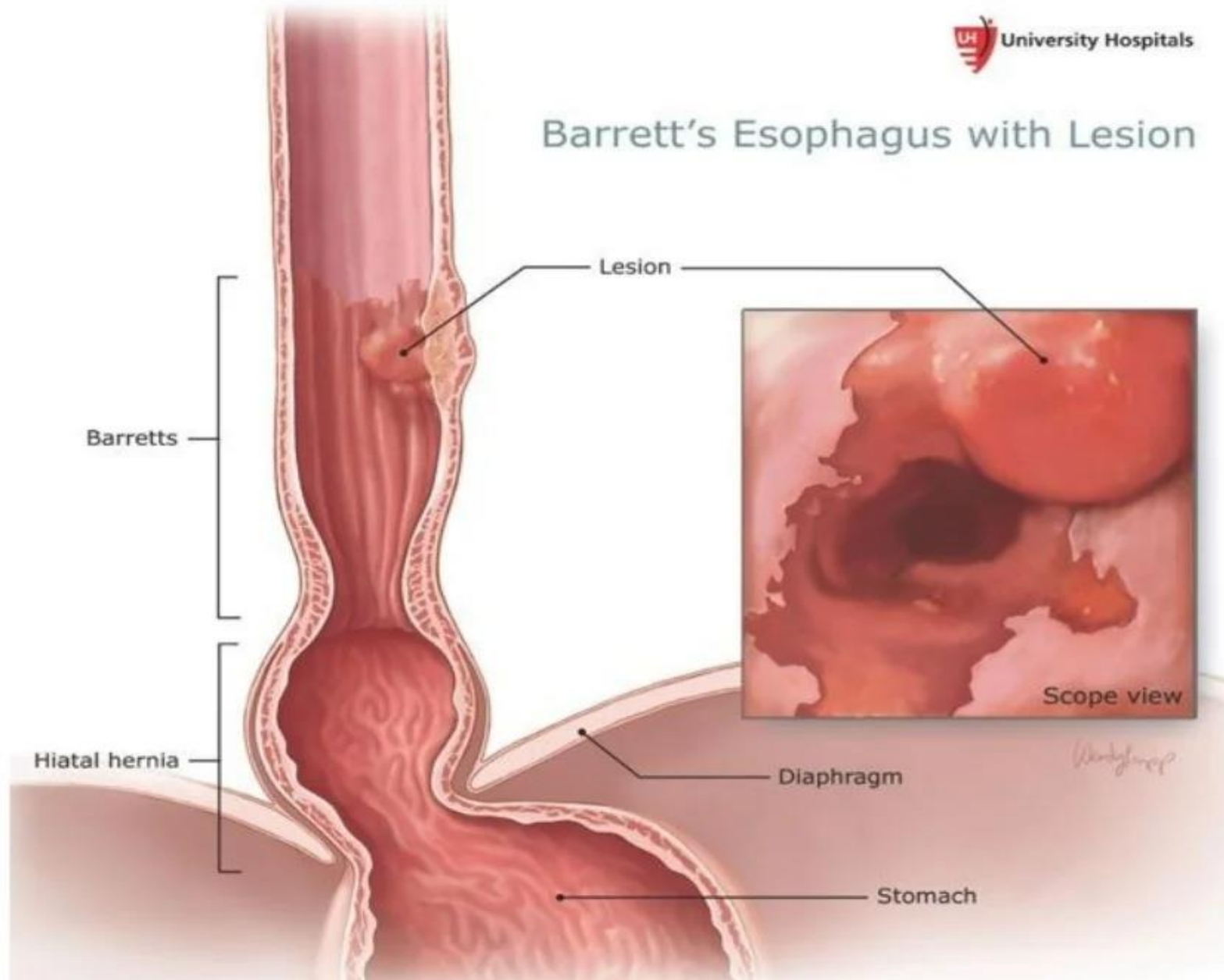
(C) Anterior view

Barrett's Oesophagus

- Barrett's oesophagus refers to the **metaplasia** (reversible change from one differentiated cell type to another) of lower oesophageal squamous epithelium to gastric columnar epithelium.
 - It is usually caused by chronic acid exposure as a result of a malfunctioning lower oesophageal sphincter.
 - The acid irritates the oesophageal epithelium, leading to a metaplastic change.
- The most common symptom is a long-term burning sensation of indigestion.
- It can be detected **via endoscopy** of the oesophagus. Patients who are found to have it will be monitored for any cancerous changes.



Barrett's Esophagus with Lesion



Oesophageal Carcinoma

- Around 2% of malignancies in the UK are oesophageal carcinomas. The clinical features of this carcinoma are:
- Dysphagia – difficulty swallowing. It becomes progressively worse over time as the tumour increases in size, restricting the passage of food.
- Weight loss
- There are two major types of oesophageal carcinomas: squamous cell carcinoma and adenocarcinoma.
- **Squamous Cell Carcinoma** – the most common subtype of oesophagus cancer. It can occur at any level of the oesophagus.
- **Adenocarcinoma** – **only occurs in the inferior third of the oesophagus** and is associated with Barrett's oesophagus. It usually originates in the metaplastic epithelium of Barrett's oesophagus.

Esophageal Carcinoma

