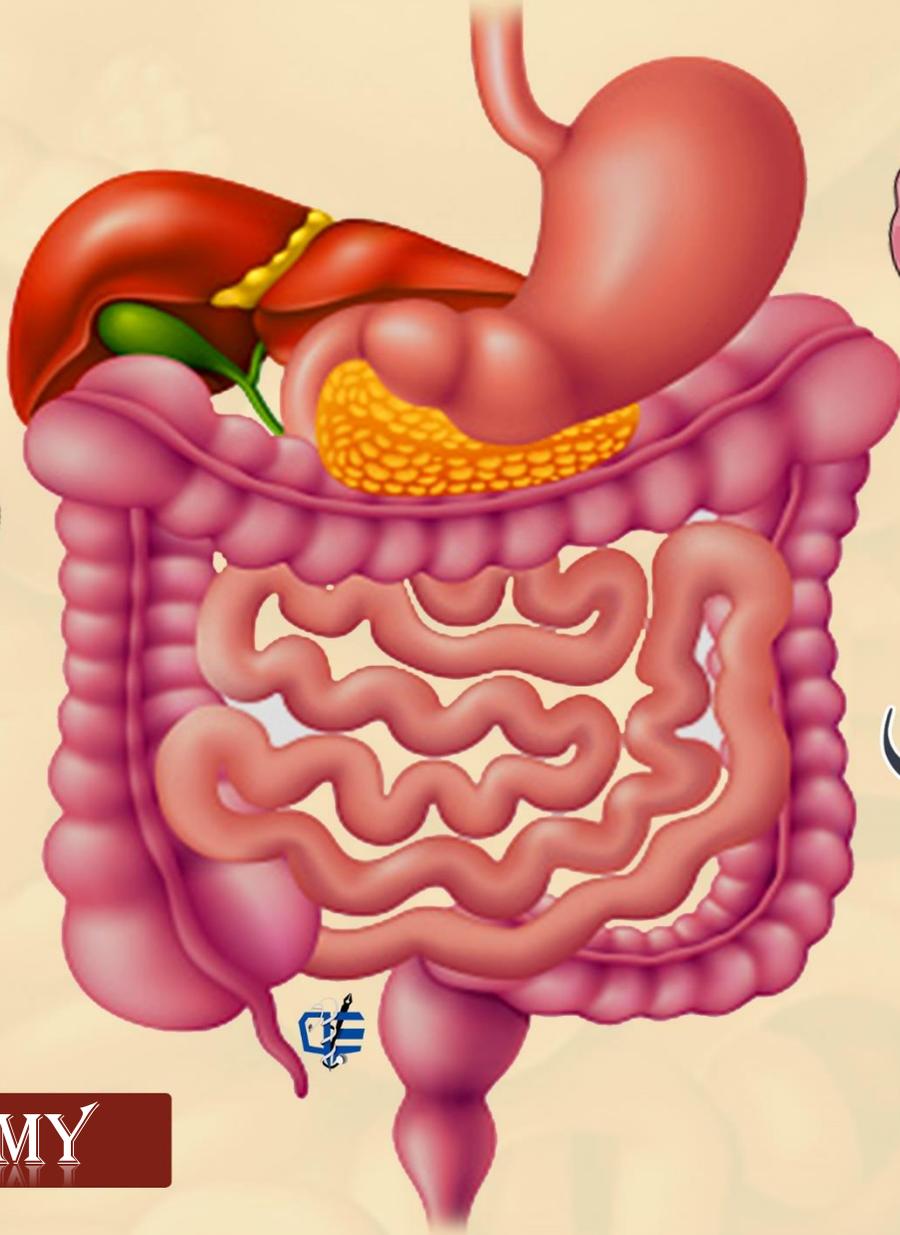


GastroIntestinal System



ANATOMY

Doctor:

Mohammad Almuhtaseb

Done by:

Majdoleen Hamed

Edited by:

Bayan Zaben

ESOPHAGUS

◆ The esophagus is a tubular structure (muscular, collapsible tube) about 10 in. (25 cm) long that is continuous above with the laryngeal part of the pharynx opposite the sixth cervical vertebra.

♣ In general, the esophagus starts at the lower border of cricoid cartilage and ends at the cardia of the stomach.

◆ The esophagus conducts food from the pharynx into the stomach. Wavelike contractions of the muscular coat, called **peristalsis**, propel the food onward.

◆ It passes through the diaphragm by an opening called **ESOPHAGEAL HIATUS (orifice)** at the level of the 10th thoracic vertebra to join the stomach.

◆ In the neck, the esophagus lies in front of the vertebral column; laterally, it is related to the lobes of the thyroid gland; and anteriorly, it is in contact with the trachea and the recurrent laryngeal nerve.

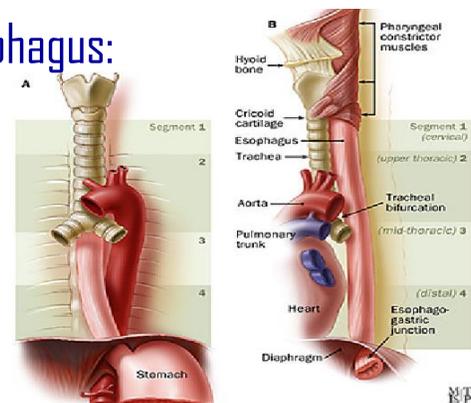
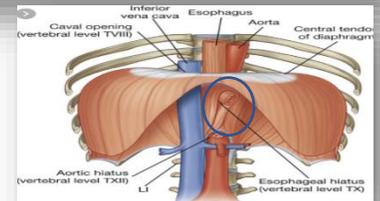
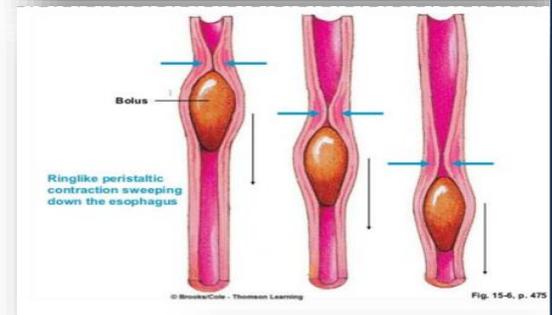
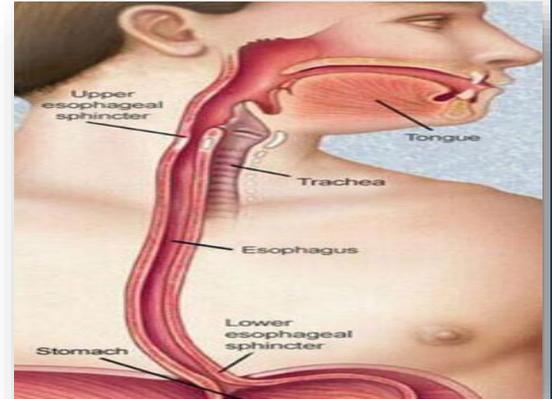
◆ In the thorax, it passes downward and to the left through the superior and then the posterior mediastinum.

◆ At the level of the sternal angle, the aortic arch pushes the esophagus over to the midline.

♠ The relations of the thoracic part of the esophagus:

I-Anteriorly:

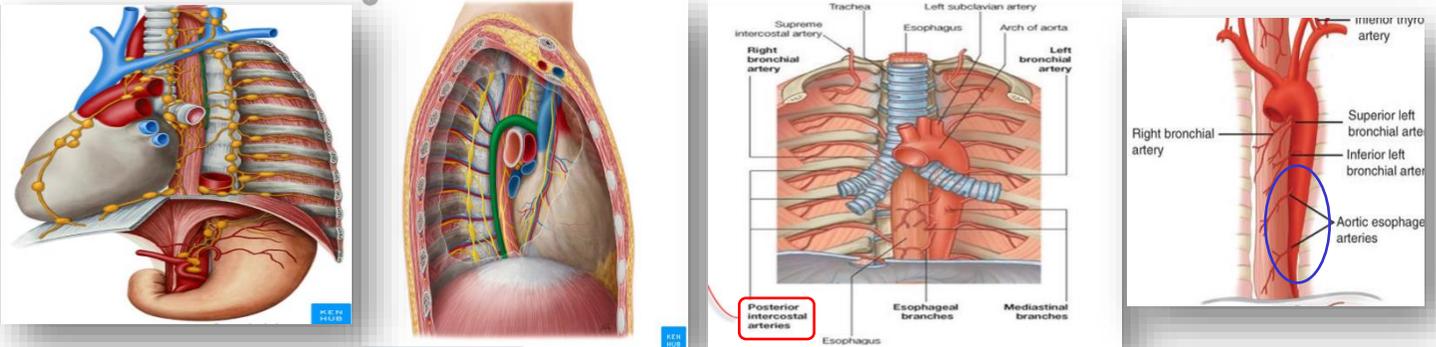
The trachea and the left recurrent laryngeal nerve; the left principal bronchus, which constricts it (that's



mean any foreign body enters the esophagus will lodge in one of the 4 sites → At the beginning, left main bronchus, arch of the aorta, piercing of diaphragm) ; and the pericardium, which separates the esophagus from the left atrium.

2-Posteriorly:

The bodies of the thoracic vertebrae; the **thoracic duct**; the **azygos veins**; the **right posterior intercostal arteries**; and, at its lower end, the **descending thoracic aorta**.

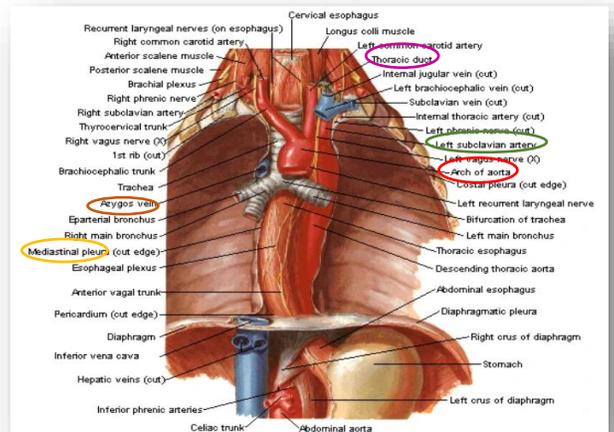


3- Right side:

The right **mediastinal pleura** & lung and the terminal part of the **azygos vein**.

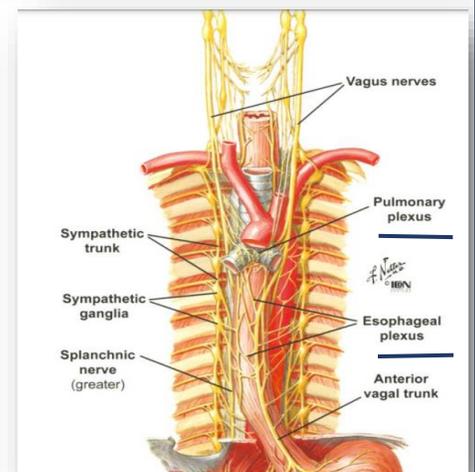
4-Left side:

The **left subclavian artery**, the **aortic arch**, the **thoracic duct**, and the left **mediastinal pleura** & lung.



♠ Abdominal Esophagus:

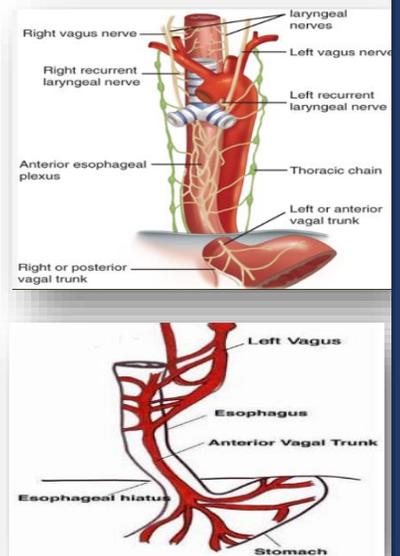
◆ Inferiorly to the level of the roots of the lungs, the vagus nerves (pass behind hilum of the lung) leave the pulmonary plexus and join with sympathetic nerves to form the esophageal plexus.



◆ Around the esophagus we had left and right vagus nerves. After passing through the opening, the left vagus nerve became anterior, and the right vagus nerve became posterior.

◆ At the opening in the diaphragm at the level of T10, the esophagus is accompanied by the two vagi, branches of the left gastric blood vessels; which supply the lower third of the esophagus and lymphatic vessels. Fibers from the right crus of the diaphragm pass around the esophagus in the form of a sling (connective tissue fiber).

◆ In the abdomen, the esophagus descends for about 0.5 in. (1.3 cm) and then enters the stomach, where it forms a physiological sphincter, which is innervated by the vagus nerve and prevents regurgitation of food from the stomach to the esophagus.



♠ The relations of the abdominal part of the esophagus:

1-Anteriorly: left lobe of the liver & left vagus nerve

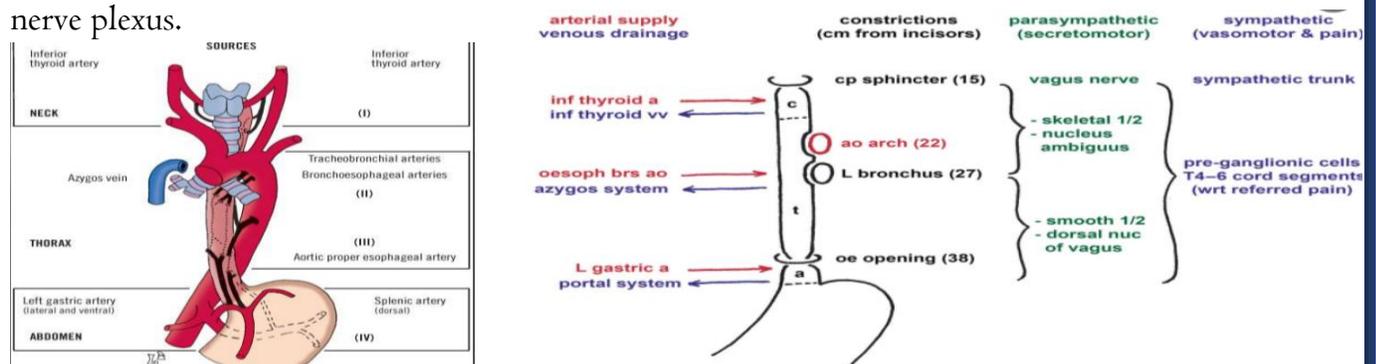
2-Posteriorly: left crus of the diaphragm & right vagus nerve

♠ Innervation & Blood Supply of the Esophagus:

SECTION	Artery	Vein	Lymph Nodes
Upper third	Inferior thyroid artery	Drain into the inferior thyroid veins	Drain into the deep cervical nodes
Middle third	Descending thoracic aorta	Drain into the azygos veins	Drain into the superior and posterior mediastinal nodes
Lower third	Branches from the left gastric artery	Drain into the left gastric vein, a tributary of the portal vein	Drain into nodes along the left gastric blood vessels and the celiac nodes

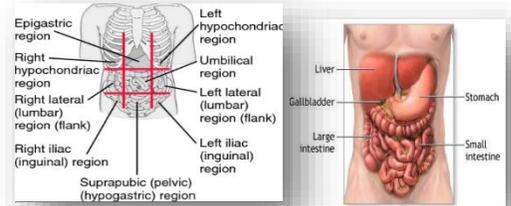
◆ **Nerve Supply:** by parasympathetic (secreto-motor) and sympathetic (vasomotor to the blood supply) efferent and afferent fibers via the vagi and sympathetic trunks respectively.

◆ In the lower part of its thoracic course, the esophagus is surrounded by the esophageal nerve plexus.



STOMACH

- The stomach is a dilated part of the alimentary canal.
- Between the esophagus and the small intestine.
- It occupies the left upper quadrant mainly in the epigastric region.



♠ Shape of the stomach:

- It is roughly J-shaped especially in thin person BUT Steer horn in obese person, and it has:

1-Two openings, the cardiac(6) and pyloric orifices(11)

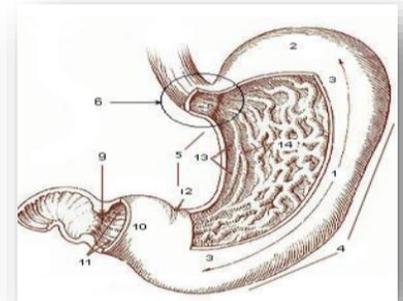
2-Two curvatures, the greater(4) and lesser curvatures(5)

3-Two surfaces, an anterior and a posterior surface

- (14) folds of mucosa-RUGAE-

- Its shape undergoes considerable variation in the same person and depends on

1- The volume of its contents 2- The position of the body 3- The phase of respiration.



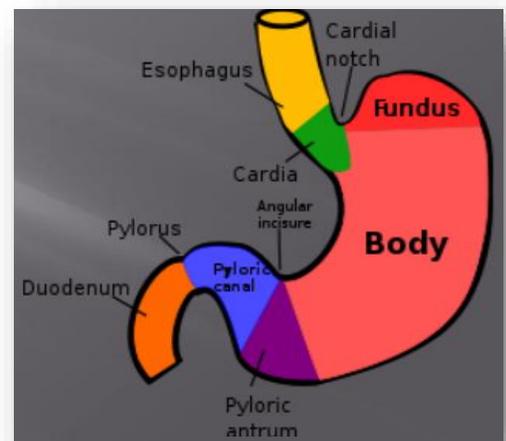
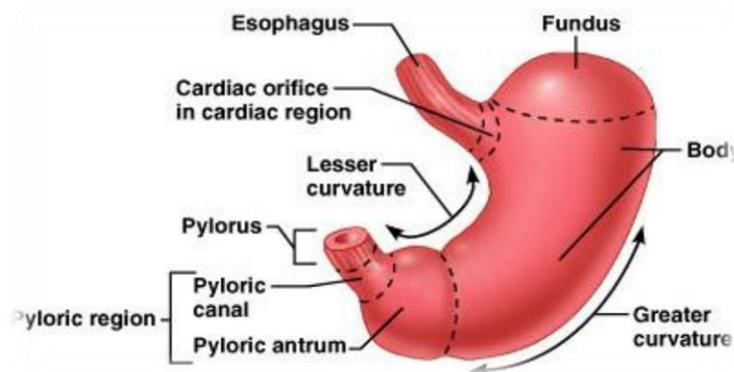
♠ Function of the Stomach:

1-It stores food (in the adult it has a capacity of about 1500 mL).

2-It mixes the food with gastric secretions to form a semifluid chyme.

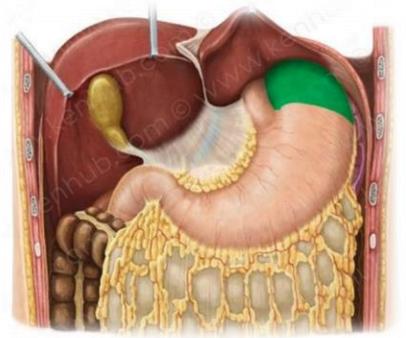
3-It controls the rate of delivery of the chyme to the small intestine by hormones, vagus and sympathetic fibers so that efficient digestion and absorption can take place.

♠ Parts of the stomach:



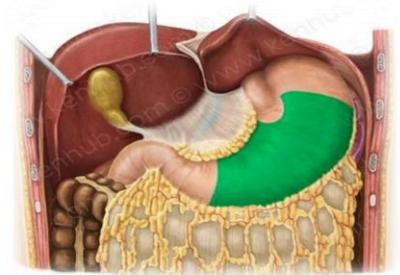
I- Fundus:

- ◆ Dome-shaped.
- ◆ Projects upward and to the left of the cardiac orifice.
- ◆ It is usually full of gas so appears in X-ray as dark spot.



2- Body:

- ◆ Extends from the level of the cardiac orifice to the level of the incisura angularis (a constant notch in the lower part of the lesser curvature which separates the body and pyloric region).



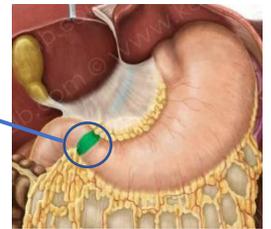
3- Pyloric region:



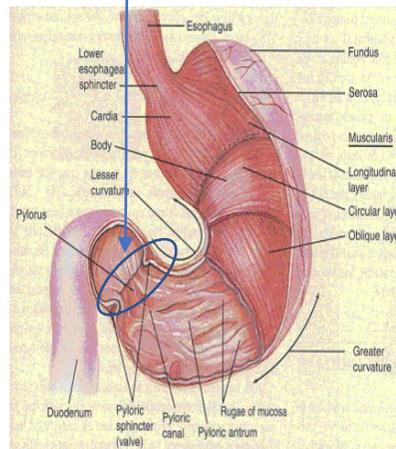
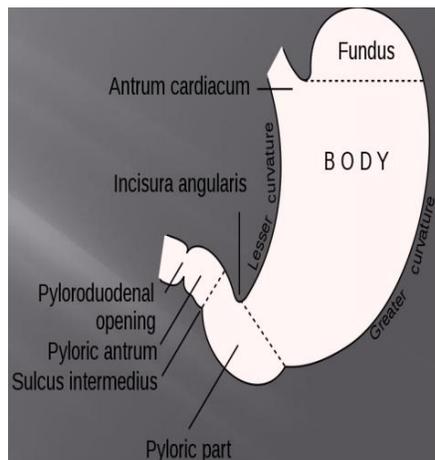
- ◆ Divided into:

A- Pyloric antrum: This extends from the incisura angularis to the pylorus.

B- Pylorus: The most tubular part of the stomach.



- The thick muscular wall is called the pyloric sphincter.



♠ Orifices of the stomach:

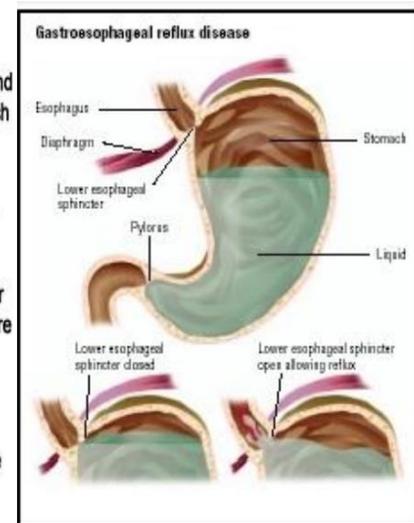
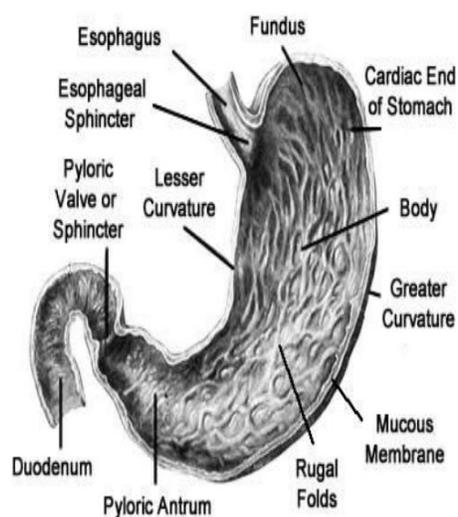
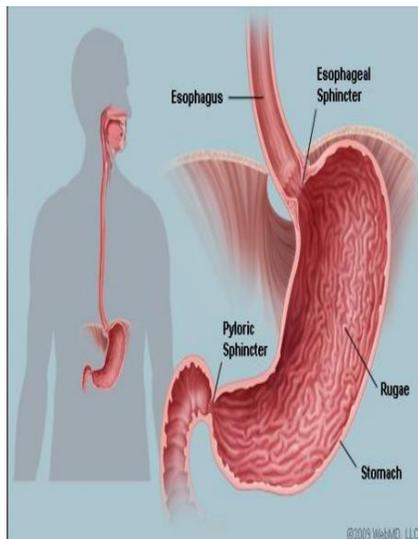
1. Cardiac orifice (Gastroesophageal Sphincter)

- ◆ It's located at the level of 7th Left costal cartilage, 1 inch to Left of midline, 45 cm from incisors in the oral cavity and 10 cm from anterior abdominal wall.

- ◆ It is where the esophagus enters the stomach.

***Anatomical sphincters** have a thickening inner circular smooth muscle which gives them a sphincter action BUT **Physiological sphincters** don't have thickening in muscles and achieve their sphincter action through muscle contraction

- ◆ No anatomic sphincter can be demonstrated here (at the lower end of the esophagus).
- ◆ A physiological sphincter physiological mechanism exists that prevents regurgitation of stomach contents into the esophagus. However, the circular layer of smooth muscle in this region serves as a physiologic sphincter.
- ◆ As the food descends through the esophagus, relaxation of the muscle at the lower end occurs ahead of the peristaltic wave so that the food enters the stomach. The tonic contraction of this sphincter prevents the stomach contents from regurgitating into the esophagus. The closure of the sphincter is under vagal control, and this can be augmented by the hormone gastrin and reduced in response to secretin, cholecystokinin, and glucagon.

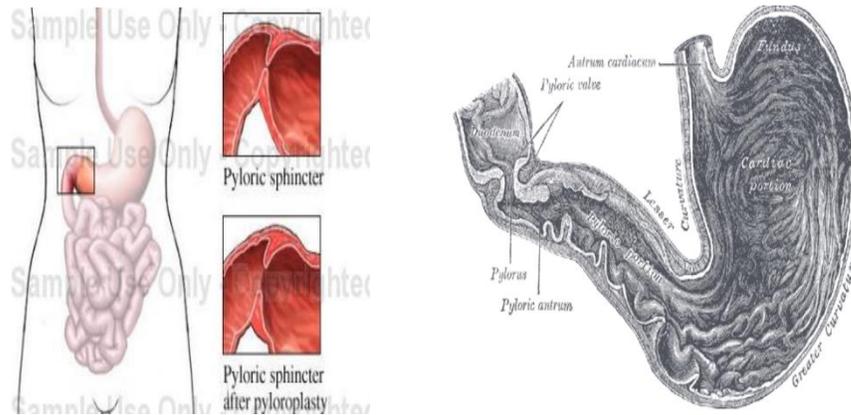


2-Pyloric Orifice

- ◆ Present at end of the pyloric canal, at the level of L1, 1in. to the right of the midline.
- ◆ The circular muscle coat of the stomach is much thicker here and forms the anatomic and physiologic pyloric sphincter.
- ◆ Its position can be recognized by a slight constriction on the surface of the stomach (The pylorus lies on the transpyloric plane) and by vein of mayo which cross the anterior surface.
- ◆ The sphincter receives motor fibers from the sympathetic system which contracts the sphincter and parasympathetic (inhibitory fibers) from the vagus nerve which relaxes the sphincter so it will drainage of stomach contents to the duodenum.

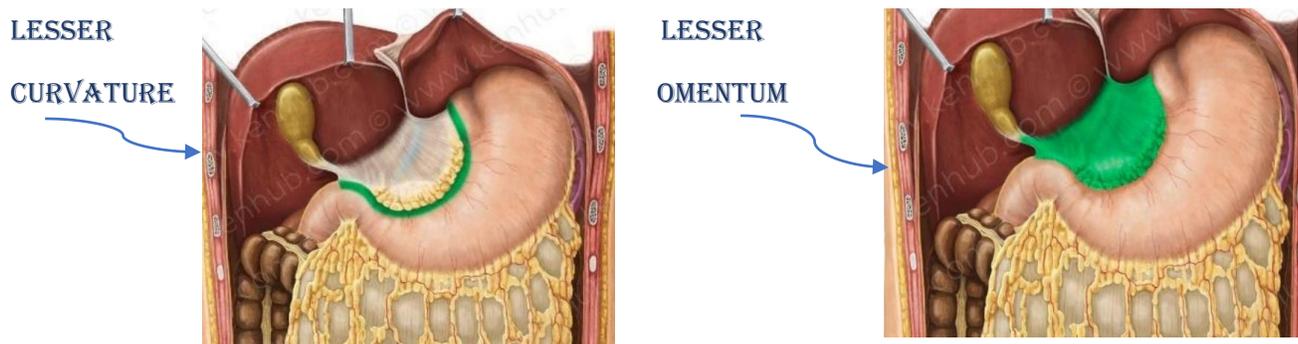
◆ The pyloric sphincter controls the outflow of gastric contents into the duodenum and this controls by:

1. Hormonal influences from stomach & duodenum such as gastrin hormone.
2. Nerve fibers: the stretching of the stomach (due to **filling**) will stimulate the **myenteric** nerve plexus which leads to the **relaxation** of the sphincter.

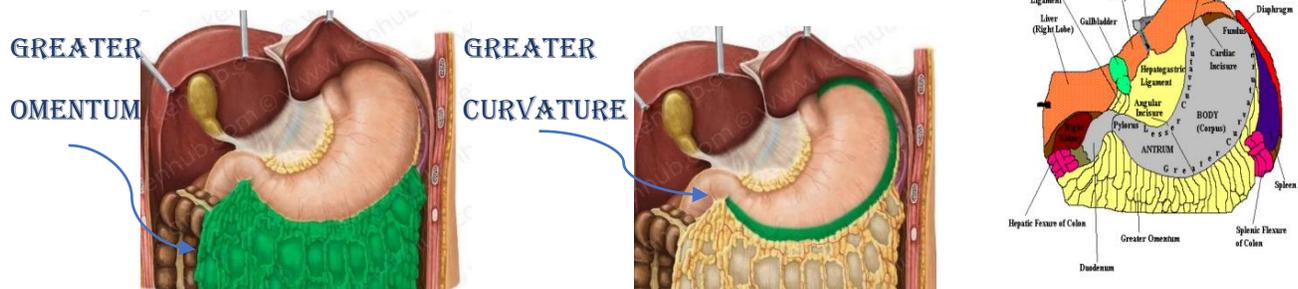


♠ Curvatures of the stomach:

1- **lesser curvature**: is short and concave, it forms the right border of the stomach and extends from the cardiac orifice (opening) to the pylorus and it is suspended from the liver by the lesser omentum, it contains a small notch called the angular incisure which marks the line of intersection between the body and pyloric part of the stomach.



2- **Greater curvature**: is convex and much longer than the lesser curvature, it extends from the left of the cardiac orifice, over the dome of the fundus, and along the left border of the stomach to the pylorus. The greater omentum extends from the lower part of the greater curvature to the transverse colon.



♠ Histology of the stomach:

*The stomach consists of four histological layers called, from interior to exterior, mucosa, submucosa, muscularis externa, and serosa.

*In this figure, we can see the muscular layers of the wall of stomach from outside to inside which contains **longitudinal fibers** (outer surface), **circular fibers** (inner surface), and **oblique fibers** (most inner layer, absent in pyloric region so the circular fibers form the sphincter).

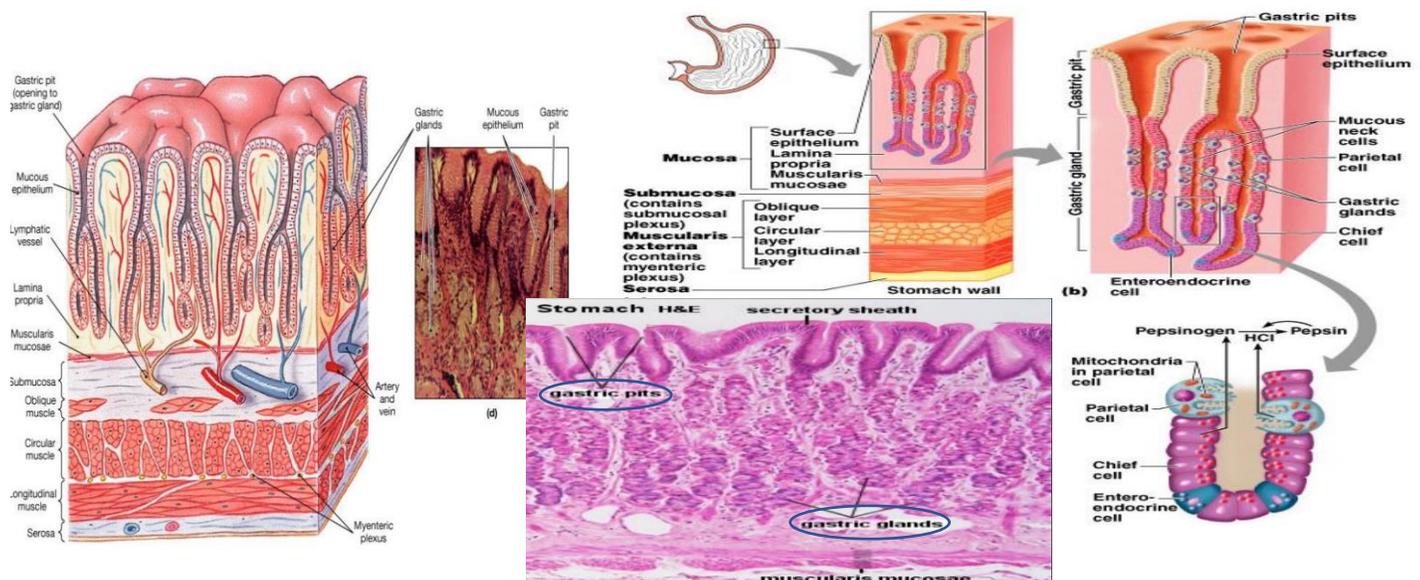
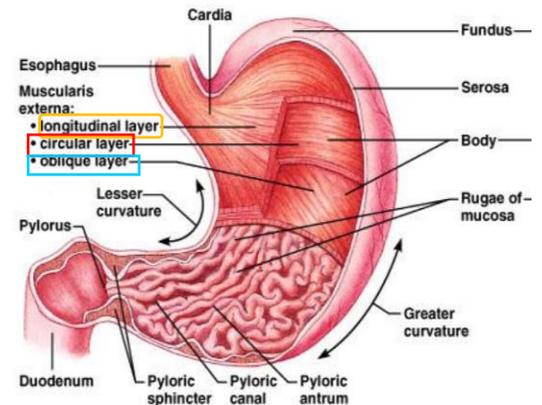
With myenteric (enteric) plexus in between the outer and inner which is mainly parasympathetic.

*Stomach is lined by simple columnar epithelium without goblet cell and form a **gastric pits** (opening to gastric glands in order for the secretion to reach the surface).

***Gastric glands** are simple or branched tubular gland in lamina propria and also lined by simple columnar epithelium without goblet cell and have different type of cells according to its location; the **mucous neck cells & parietal cells(acidophilic)** found in the **Neck** but the **chief cells(basophilic) & neuroendocrine cells** found in the **Base**.

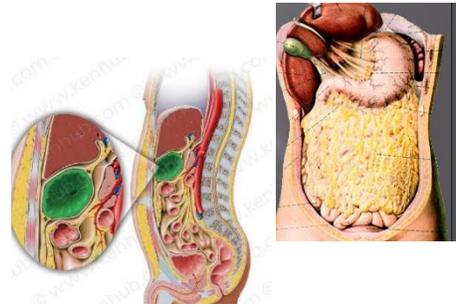
*The mucous membrane of the stomach is thick and vascular and has a wrinkled aspect, consisting of ridges called gastric folds, or **rugae** (It's an invagination of submucosa to mucosa that increase the surface area of mucosa for digestion) mainly longitudinal in direction. During distension of the organ, the gastric folds disappear (flatten out).

*Submucosa has a blood vessels and lymphatics.



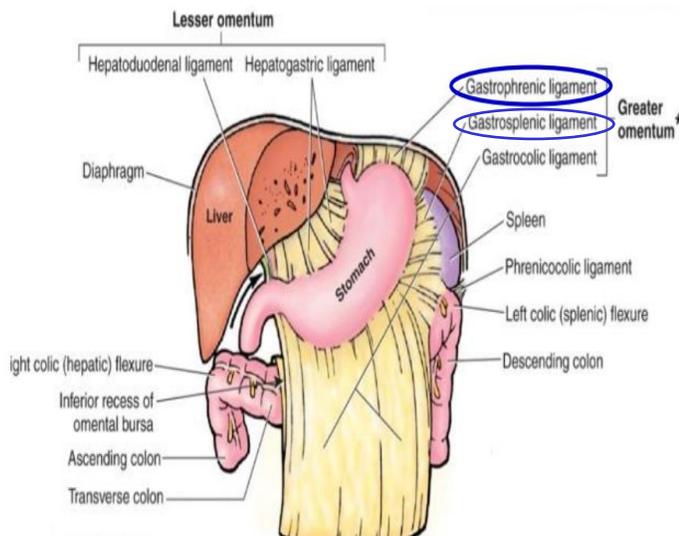
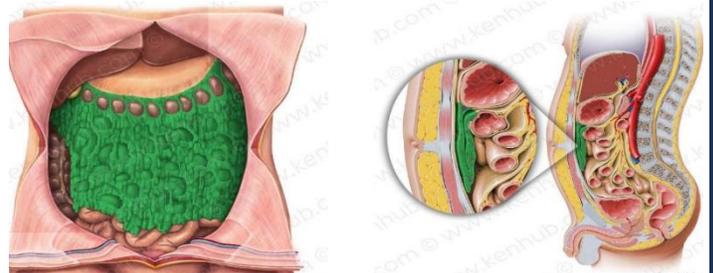
♠ Peritoneum of the stomach:

◆ The peritoneum (visceral peritoneum) completely surrounds the stomach.



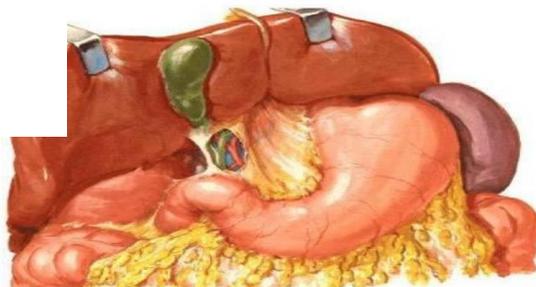
◆ It leaves the lesser curvature as the lesser omentum.

◆ It leaves the greater curvature as the gastrosplenic ligament and the greater omentum.

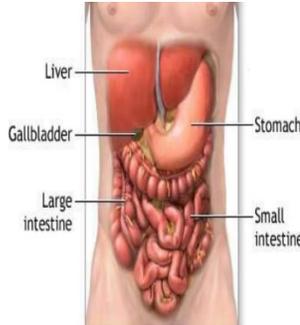
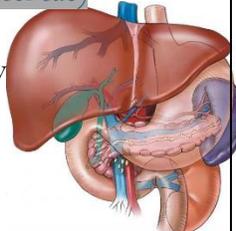


◆ The gastrosplenic ligament extends from the upper part of the greater curvature to the spleen, and the greater omentum extends from the lower part of the greater curvature to the transverse colon.

◆ Gastrophrenic ligament between the fundus and the diaphragm.



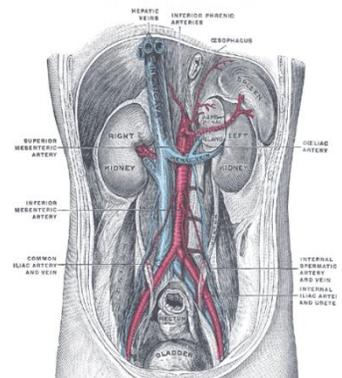
♠ Relations of stomach:

ANTERIOR- SUPERIOR	POSTERIORLY = STOMACH BED
<ul style="list-style-type: none"> -The anterior abdominal wall - the left costal margin - the left pleura and lung - the diaphragm - the left lobe of the liver 	<ul style="list-style-type: none"> -The lesser sac -the left crus of diaphragm - the spleen (as angle, part ant. and part post. and form the left boundary of the lesser sac) - the left suprarenal gland -the upper part of the left kidney - the splenic artery - the body of pancreas - the transverse mesocolon - the transverse colon 

♠ Blood supply for the stomach:

The GI tract (according to embryology) is divided into 3 parts:

- 1) Foregut: takes blood supply from the celiac trunk, it extends from the lower third of the esophagus, the stomach, until the middle half of the second part of the duodenum.
- 2) Midgut
- 3) Hindgut

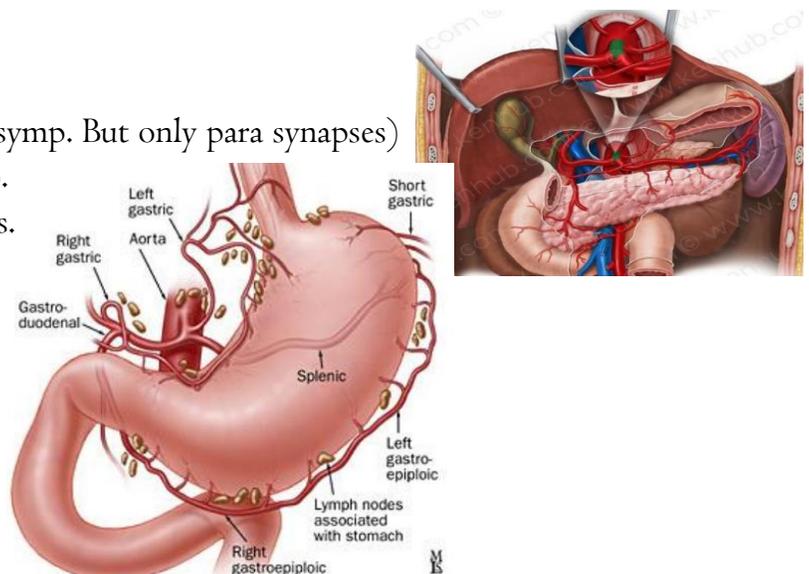


CELIAC TRUNK

◆ It arises from the front of the abdominal aorta and is located at the level of T12 to L1 above the pancreas, its 1 cm long, all arteries are derived from the branches of it.

◆ Relations of celiac artery:

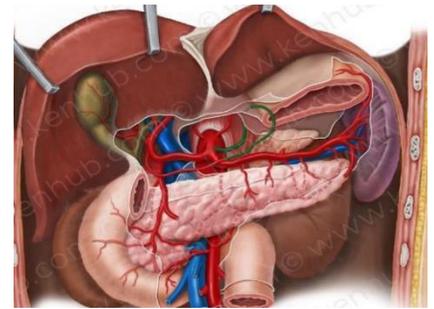
- 1-On each side: celiac ganglia (para. & symp. But only para synapses)
+ lymphatic nodes (celiac lymph node).
- 2-Crus of diaphragm and lumbar nerves.
- 3-Its Branches for foregut.



◆ It gives off 3 main arteries:

1-Left Gastric Artery:

- *Arises from the celiac artery
- *It passes upward and to the left to reach the esophagus, then descends along the lesser curvature of the stomach
- *It supplies the lower third of the esophagus and the anterior & posterior of the upper right part of the stomach



2-Splenic Artery (Tortuous Artery):

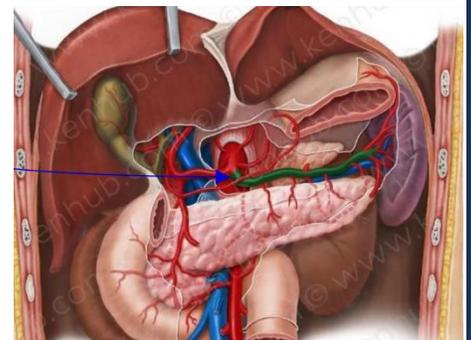
- *Tortuous behind the stomach.
- *It moves behind the stomach, then on the upper border of the pancreas and gives blood supply to the stomach.
- *It gives 2 branches:

A-The short gastric arteries:

Arise from the splenic artery (5-7 arteries) in the gastrosplenic ligament, pass upward in the gastrosplenic to supply the fundus.

B-The left gastroepiploic artery:

Arises from the splenic artery before the hilum of the spleen, passes forward in the gastrosplenic (ligament) and supply the stomach along the upper part of the greater curvature in the greater omentum.

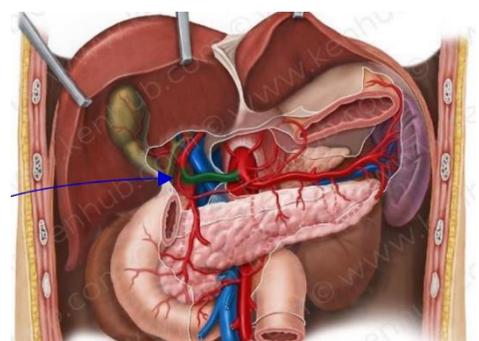


3-Hepatic Artery:

- *It moves towards the liver*
- *It gives 3 branches:

A-Right gastric artery:

Arises from the hepatic artery at the upper border of the pylorus, runs to the left along the lesser curvature. It supplies the lower right part of the stomach.



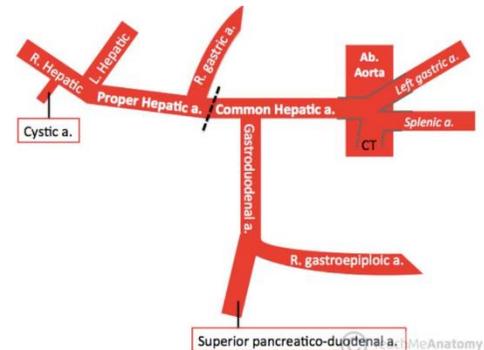
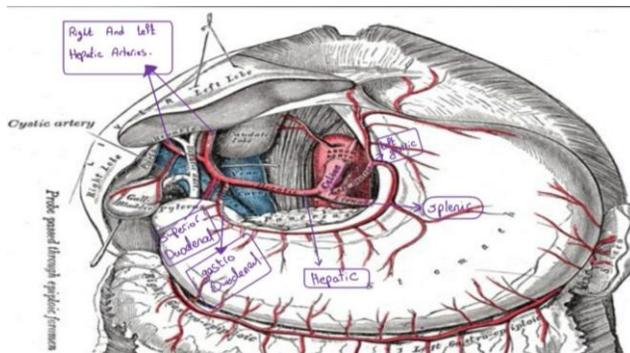
B-Gastro-duodenal artery:

Passes behind the first part of the duodenum and between the layers of greater omentum gives a branch called **the right gastroepiploic artery**, it passes to the left and supplies the stomach along the lower part of the greater curvature in the greater omentum. Also, it gives **the superior pancreaticoduodenal artery** that supplies the duodenum and pancreas.

C- Hepatic Artery Proper:

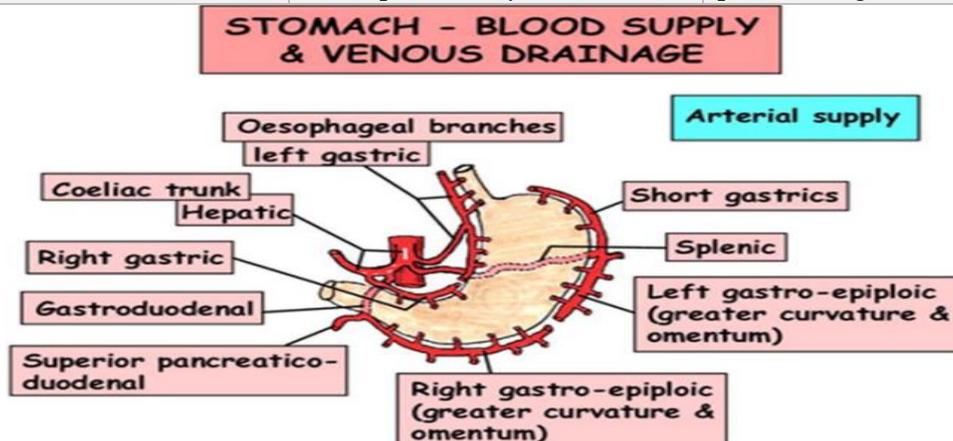
*It branches into the right and left **hepatic arteries**, which supply the corresponding lobes of the **liver**.

*The cystic artery originates from the right hepatic artery.



SUMMARY OF THE BLOOD SUPPLY FOR THE STOMACH

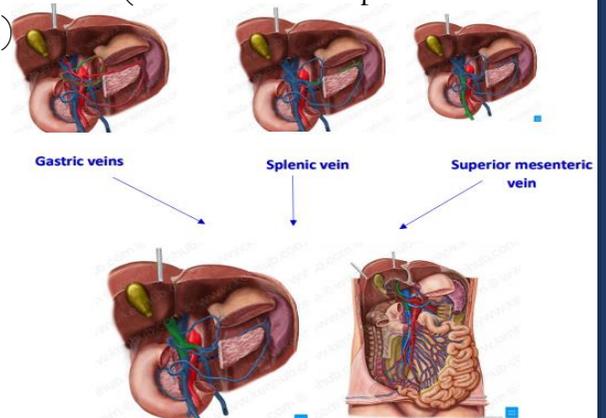
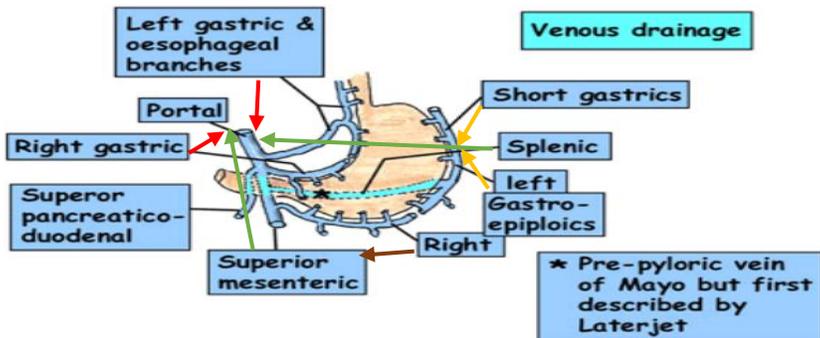
ARTERY	BRANCH FROM	SUPPLIED PARTS
Left gastric artery	Celiac artery	lower third part of the esophagus and the upper right part of the stomach.
Right gastric artery	Hepatic artery	lower right part of the stomach
short gastric artery	Splenic artery	Fundus of the stomach
left gastroepiploic artery	Splenic artery	The stomach along the upper part of the greater curvature
The right gastroepiploic artery	The gastroduodenal branch of the hepatic artery	The stomach along the lower part of the greater curvature



♠ Venous Drainage for the stomach:

◆ The stomach veins drain either directly or indirectly into the portal circulation as follows:

- 1-The left and right gastric veins drain directly into the portal vein
- 2-The short gastric veins and the left gastroepiploic veins join the splenic vein
- 3-The right gastroepiploic vein joins the superior mesenteric vein (which meet the splenic vein behind the neck of pancreas to form the portal vein)



Hepatic portal vein

♠ Lymphatic drainage for the stomach:

Follow the arteries of stomach;

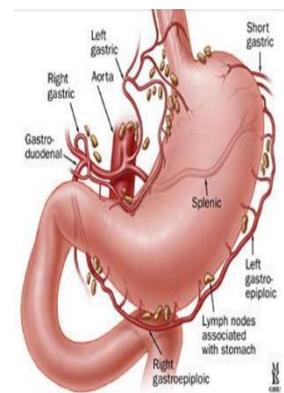
↔ The left and right gastric nodes

↔ The left and right gastroepiploic nodes

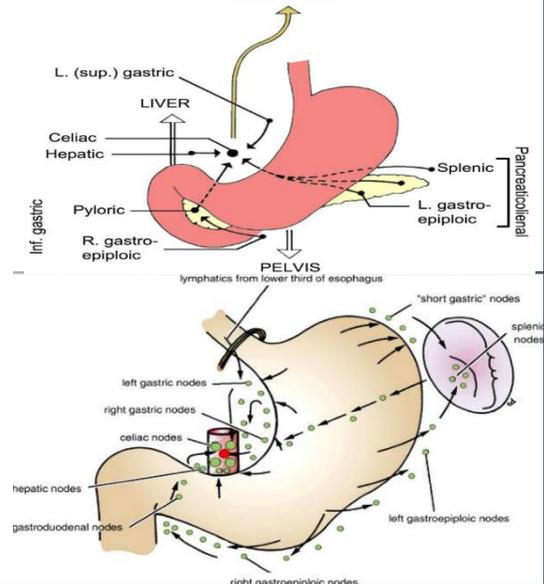
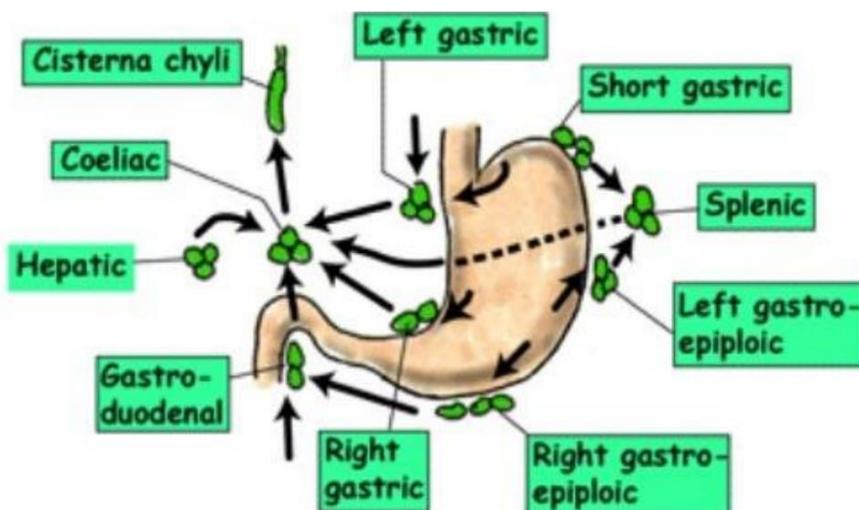
↔ The short gastric nodes

◆ All lymph from the stomach eventually passes to the celiac nodes, located around the root of the celiac artery on the posterior abdominal wall.

◆ In the end, celiac lymph nodes drain into the cisterna chyli (sac of lymph in the opening of abdomen).



Thoracic duct



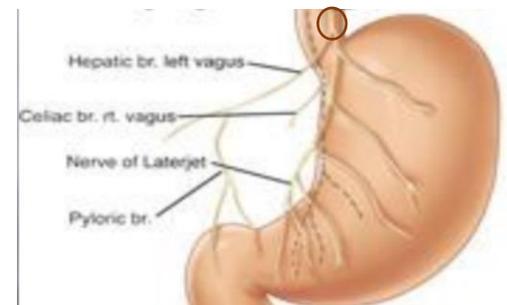
♠ Nerve Supply for the Stomach:

- We have **sympathetic fibers** derived from celiac plexus around the celiac trunk (branch of abdominal aorta). The sympathetic fibers mainly go towards the sphincters for contraction (such as the pyloric sphincter), and they also carry pain sensation.
- We also have **parasympathetic fibers** derived from the right and left vagus nerves. The parasympathetic fibers are mainly secretomotor for the gastric glands, and motor to the muscular wall of the stomach (smooth muscles), so they are responsible for peristaltic movement as well as relaxation of the pyloric sphincter by inhibitory fibers so the passing of chyme from stomach to duodenum will take place.

• The anterior vagal trunk

- Mainly from the left vagus nerve, innervates:

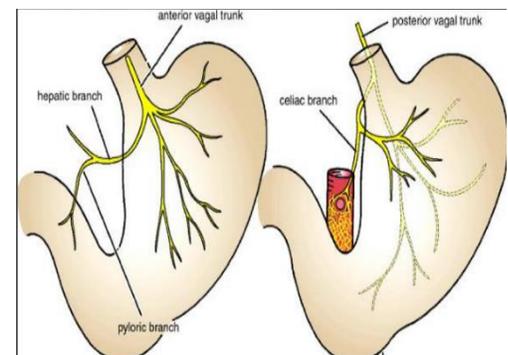
- 1) The anterior wall of the stomach.
- 2) Gives a hepatic branch that goes to the liver and gallbladder.
- 3) Gives another branch called anterior nerve of Latarjet that goes towards the pylorus.



• The posterior vagal trunk

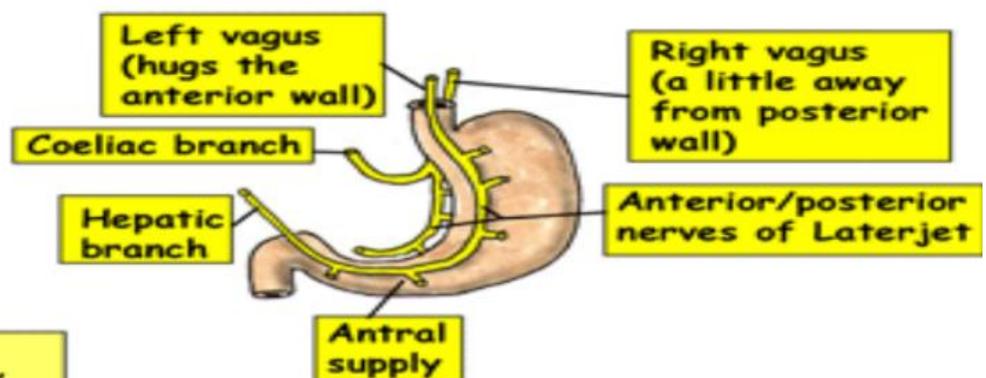
- Mainly from the right vagus nerve, innervates:

- 1) Mainly the posterior wall of the stomach.
- 2) Anterior wall of body of stomach.
- 3) Posterior nerve of Latarjet to the pylorus.
- 4) Celiac branch which innervates the small intestines and the proximal two thirds of the transverse colon but the lateral third supplied by S2-4 Sacral nerves.



Sympathetics
Greater splanchnic nerves (T5-9) for decreasing motility, vasoconstriction, closing pylorus & sensation

Vagus nerves are 80% sensory, 20% motor for increasing motility, opening pylorus & initiating secretions



Note: Highly selective vagotomy destroys vagus to fundus & body but preserves nerve to antral pump

♠ Clinical Notes:

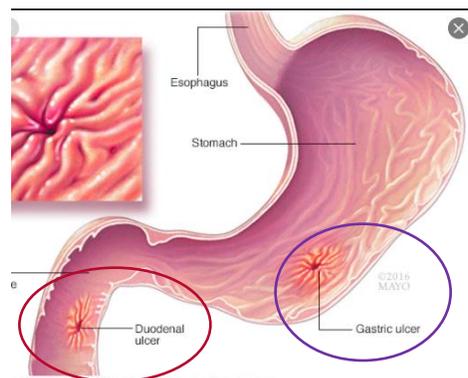
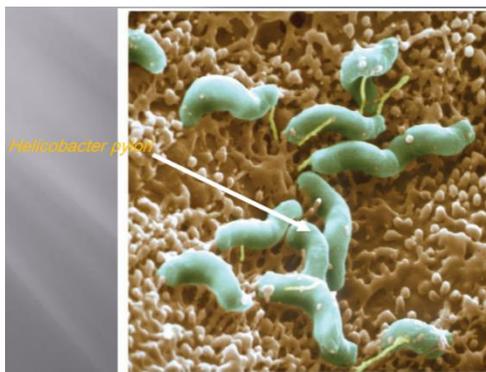
Gastric Ulcer: the most common site in stomach: anterior and posterior walls of lesser curvature. The gastric ulcer is considered malignant until proven that it is not malignant. So, a biopsy needs to be taken to prove malignancy.

Peptic Ulcer (duodenal ulcer): the most common site for peptic ulcer is the first part of the duodenum especially in the first inch, since it receives gastric acidity from stomach which may result in irritation ulcer especially in post. Surface.

Trunkal Vagotomy the rule said that hyperacidity meant peptic ulcer, and its treatment was surgery to the vagus nerve. We used to cut the vagus nerve below the diaphragm, so the stomach stopped receiving parasympathetic innervations, which resulted in bad drainage. Now, we perform a **highly selective vagotomy** where we cut all branches of vagi except the nerve of Latarjet (pylorus) so no secretion in body of stomach but we have evacuation of stomach contents to duodenum. Now, it has changed completely. The real cause of peptic ulcer is a bacterium known as Helicobacter pylori. Its treatment by antibiotics and antiacidity.

Gastroscopy: where we enter an endoscope into the oral cavity until the second part of the duodenum to take biopsy and sometimes treatment.

We can drainage of the stomach contents through the pyloric sphincter by **gastro-jejunosomy** which is a surgical procedure in which an anastomosis is created between the stomach and the jejunum or by **pyloroplasty** which is surgery to dilate the sphincter.



Everything's gonna be "OK"
