

GI system

Anatomy

Sheet

Slide

Number:

E-Learning

Done by:

Omar Sami-2016

Corrected by:

Saif Yamin

Doctor:

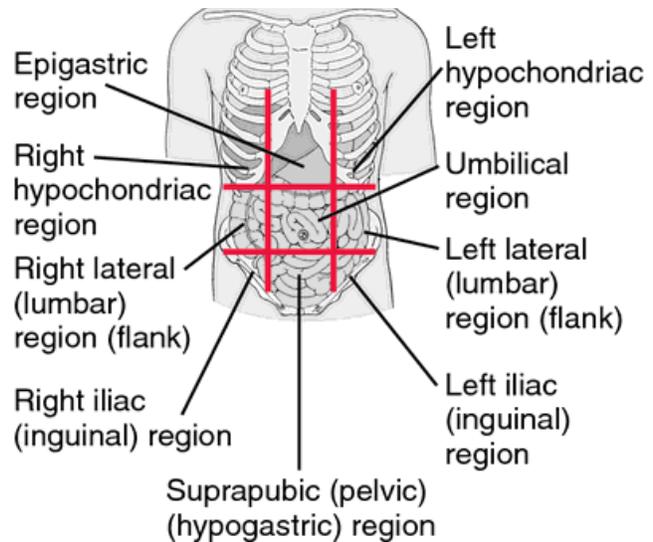
Muhammad Al-Muhatasib

The Stomach:

It is a dilated part in the alimentary canal. It lies between the esophagus and the duodenum (first part of the small intestine).

Location of the Stomach:

The stomach is located in the left upper quadrant mainly in the epigastric region.



Note: The small intestine is located umbilical region.

in the

The Shape of the Stomach:

It depends on the content, but it is J shaped (in normal people), or 'steer h or n' (in obese people).

It 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

To put it simply, the stomach has:

1. **2 orifices " openings "** : cardiac orifice and pyloric orifice.
2. **2 curvatures:** the lesser curvature on the right and the greater curvature on the left.
3. **2 surfaces:** anterior surface and posterior surface (where the stomach bed is located).

Function of the stomach: digestion mainly.

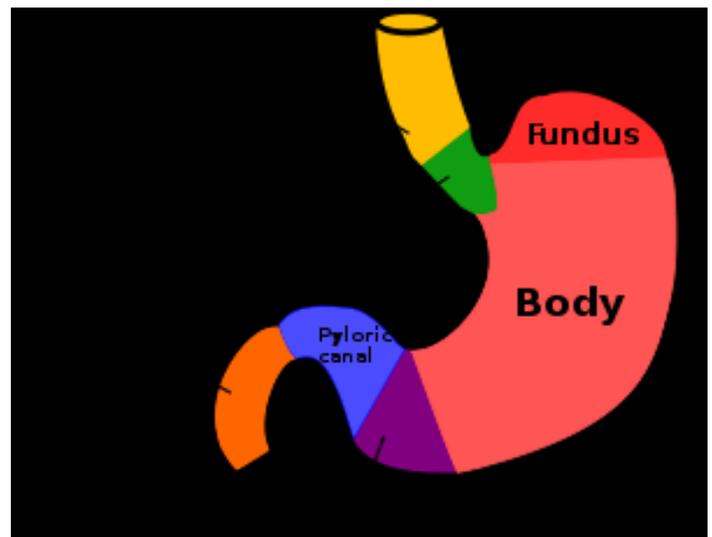
As we said earlier, the bolus is formed in the oral cavity, which moves to the pharynx after deglutition then to the esophagus until it reaches the stomach where it is mixed with gastric secretions to form a semi-fluid **chyme**, which is acidic (high amount of HCL), and stays in the stomach (capacity of 1500 ml) for 2-4 hours before it is evacuated to the duodenum by the pyloric sphincter which is an actual sphincter (anatomically and physiologically)

Detailed: formation of chyme mainly occurs in the body of the stomach in which it is acidic, after that it becomes neutralized in the pylorus which only have alkaline cells and mucous cells (**parietal cells and chief cells are absent in it**)

Parts of the Stomach:

1. The Fundus:

Dome shaped. Projects upward and to the left of the cardiac orifice. It is located above the level of cardiac orifice. Usually **filled with gas** (since it is the highest part in the stomach) which appears on x-ray as black spots.. Clinically: a peptic ulcer patient with perforation in the fundus, **gas leaves the fundus goes to the abdomen** to also enter the highest part which is the right cupula of the diaphragm. So as a doctor if a patient showed up with severe pain in the abdomen and a history of peptic ulcer and the x-ray showed black spots (gas) under the right cupula of the diaphragm you should know that he has a perforating fundus



2- The Body (Corpus):

Extends from the level of the cardiac orifice (below the fundus) to the level of the incisura angularis (a constant notch in the lower part of the lesser curvature that separates the body from the pylorus).

3. Pyloric Region:

Divided into:

- Pyloric antrum: extends from the incisura angularis to the pylorus
- Pyloric canal: the most tubular part of the stomach (1 inch)
- Pyloric sphincter: anatomical sphincter, which contains a thickening of the inner circular muscles, controlled by sympathetic and parasympathetic.

Remember: the cardiac and pyloric orifices:

- The cardiac orifice** where the esophagus enters the stomach, it is a physiological sphincter (no thickening of smooth muscles).

Surface anatomy: at the 7th costal cartilage, 1 inch to the left from midline at the level of T10, 10 cm from the anterior abdominal wall. 45 cm from incisors.

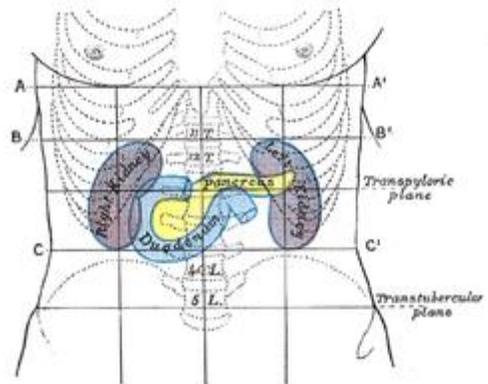
- The pyloric orifice** is an anatomical sphincter because it contains thickening of smooth muscles. Surface anatomy: 1 inch to the right from the midline at the level of L1 [medically known: transpyloric line passes through the pylorus].

Transpyloric line: located halfway between the jugular notch and the upper border of the pubic symphysis.

Structures that passes through it: fundus of gallbladder, pylorus, 9th costal cartilage, lower hilum of left kidney, and upper hilum of right kidney.

Structures above: transverse colon (sometimes, depends on mesocolon length), celiac trunk.

Structures below: Duodenum, superior mesenteric.



Clinical note:

We said that the cardiac orifice is 45 cm away from the incisors. Nowadays, all GIT specialists have gastrosopes in their clinics, which they use for gastroscopy in relation to problems in the upper GIT. The gastroscope is a fibro-optic flexible tube which is inserted through the mouth with light at its tip. The gastroscope has a scale that reads 5 cm, 10 cm, 20 cm... etc. When it reaches 45 cm, the physician will know that they have reached the cardiac orifice and, subsequently, the stomach. It can also be used to inject medicine. Therefore, it is a diagnostic and therapeutic tool.

The function of the pyloric sphincter is controlled by:

Nerve fibers:

- a) **Sympathetic fibers** which are motor for the sphincter.
- b) The inhibition happens by the **vagus nerve** for drainage (**parasympathetic**)

Hormonal influence: which helps in the secretion of cholecystokinin (CCK) from the duodenum. **CCK**→ ***inhibits gastric emptying & causes pyloric contraction.***

Curvatures of the stomach:

- 1) **The Lesser Curvature:** Forms the right border of the stomach - Extends from the cardiac orifice to the pylorus. Also has longitudinal folds for the passage of fluids which goes directly to the duodenum. Attached to it is the lesser omentum.

- 2) **The Greater Curvature:** forms the *left border of the stomach*- longer, attached to it is the greater omentum, and in the upper part, the *gastrosplenic ligament* (between the stomach{ fundus and part of greater curvature} and spleen). From greater curvature there is the *gastrocolic ligament* (attached to the transverse colon). We also have the *gastrophrenic ligament* (extends to the underside of the left dome of the diaphragm). All of which help in the fixation of the stomach in its place, and delivers the blood supply and nerve supply to it.

Histology of the Stomach

The stomach contains 4 layers: mucosa, submucosa(CT), muscularis externa and serosa

The layer of serosa is completely covered by peritoneum (simple squamous epithelium)

The *muscular layer* contains 3 layers:

- 1) Outer longitudinal.
- 2) Inner circular(Forms the sphincter).
- 3) The most inner, which is Oblique; absent in the pylorus.

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

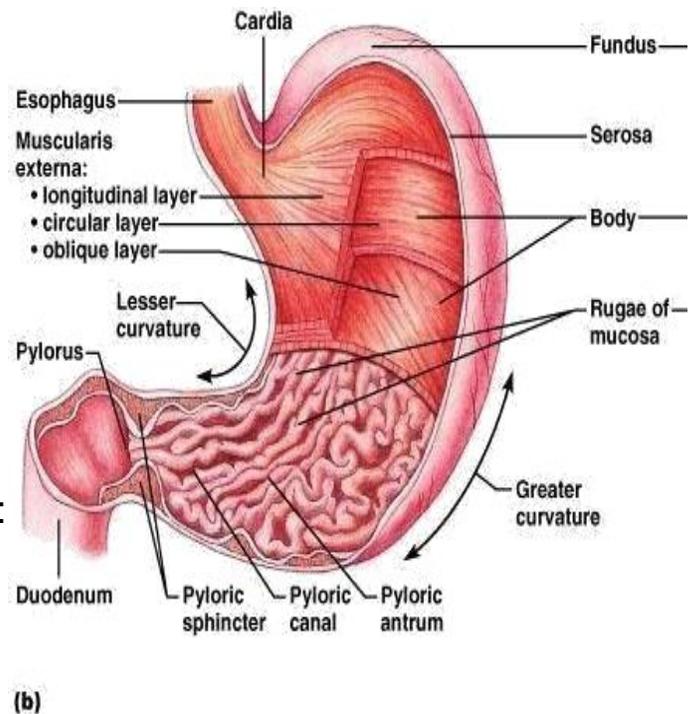
On the inside, the stomach contains **rugae**, which are foldings of the

Mucosa that submucosa made as it invaginated through the mucosa.

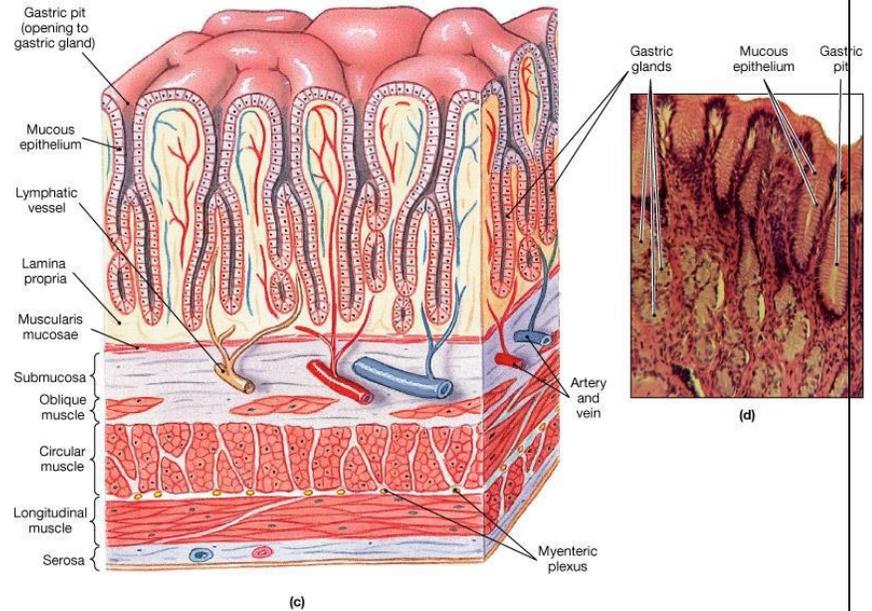
Rugae's function is to increase the surface area of mucosa for digestion.

They are usually transverse and oblique, but at the **lesser curvature** they are **longitudinal folds** for the fast passage of **fluids** which goes directly to the **duodenum**. This is why the **mixing of food and fluid is minimal**; therefor don't listen to people that tell you to not drink water with food.

The **mucosa** contains glands and ducts called pits in order for the secretion to reach the surface, it is composed of three layers: **lining epithelium** (simple columnar without goblet cells), **lamina propria** (filled with gastric glands); contains parietal cells(secrete HCL), chief cells(secrete pepsinogen) , mucous cells, and endocrine cells (secrete gasrin hormone) and **muscularis mucosae**



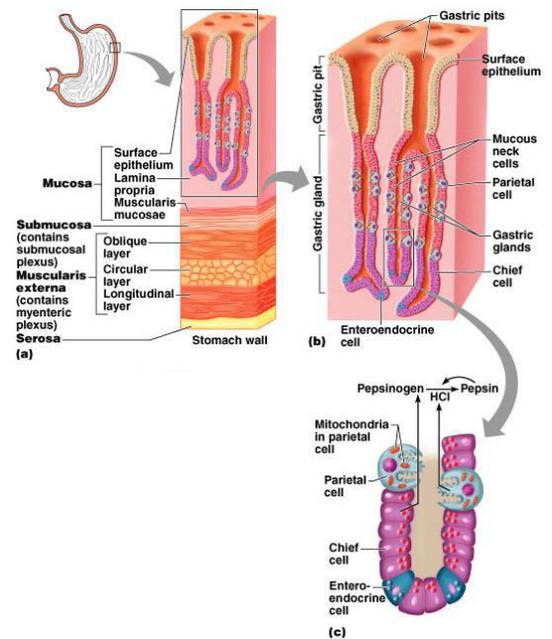
The stomach also contains mucous cells, parietal cells in the neck, chief cells at the base, and enteroendocrine cells.



Peritoneum of the Stomach: The stomach is completely covered by peritoneum.

The Lesser Omentum:

The lesser omentum is composed of 2 layers of peritoneum which extend from the lesser curvature of the stomach to the porta hepatis of the liver, and they extend upwards until they reach the diaphragm. Since there are two layers between them we are going to have blood vessels, nerves (branches from vagi-sympathetic), lymph nodes and lymphatic drainage and small amount of fat. It is divided to two parts the part attached to the stomach hepatogastric and the part attached to the duodenum hepatoduodenum



Note: space behind stomach: lesser sac//space in front of stomach: greater sac. Lesser omentum has a free edge, which contains an opening that lies deep to it, called the **epiploic foramen**, or **foramen of Winslow**: passage of communication between lesser and greater sac.

The importance of this foramen is that it reaches the **lesser sac of peritoneum, posterior to the stomach**. You can insert your fingers through it.

The free edge of lesser omentum contains:

- 1) Common bile duct
- 2) Hepatic artery
- 3) And deep to it, the portal vein.

When you insert your fingers in the epiploic foramen, these structures would be anterior to your fingers. Posterior to your fingers would be the inferior vena cava.

The Greater Omentum: It is composed of 2 layers of peritoneum, descending from the greater curvature of the stomach downwards in the abdominal cavity, and ascends upwards until they reach the transverse colon (intraperitoneal), surrounding it. The layers of greater omentum contain the lesser sac. Contains gastroepiploic blood vessels, veins, nerves, lymph nodes, lymph drainage and the gastrosplenic ligament, gastrophrenic ligament

Gastrosplenic Ligament: the word 'ligament' means 2 layers of peritoneum which are thickened. So, the gastrosplenic ligament is located between the fundus of the stomach and a part of the greater curvature, and goes to the spleen. It contains blood vessels, nerves, lymph nodes and lymphatics.

Anterior Relations of the Stomach:

- The anterior abdominal wall.
- The left costal margin.
- The left pleura and lung.
- The diaphragm (separates left pleura and lung from the stomach)
- The left lobe of the liver.

Posterior Relations of the Stomach (Stomach Bed)

- The lesser sac [space behind the stomach]
- The **left** crus of diaphragm
- The spleen (only a small part) most lateral
- The body of pancreas
- The transverse mesocolon and transverse colon
 - The **left** suprarenal gland
- The upper part of the **left** kidney
- The splenic artery [which is tortuous also for elongation of stomach after food on upper border of pancreas; the same applies for uterine artery and pregnancy].

Note: the position of the transverse colon depends on the length of the mesocolon. Long mesocolon → transverse colon below the stomach / short mesocolon → transverse colon behind the stomach

The Blood Supply and Venous Drainage of 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 upper half of the duodenum.
- 2) **Midgut** -> takes blood supply from the superior mesenteric artery It extends from the lower half of the duodenum and ends at the lateral third of the transverse colon.
- 3) **Hindgut** -> takes blood supply from the inferior mesenteric artery It includes the lateral third of transverse colon, descending colon, rectum, and anal canal.

The Celiac Trunk

It is called a trunk because it is very short (about **1 cm in length**). It originates from the abdominal aorta at the level of T12 (between T12 and L1). On each side, it contains the celiac ganglia (contain sympathetic and parasympathetic fibers) and lymph nodes, which are named after it. Behind it, we have the crus of the diaphragm.

It gives off 3 main arteries:

- 1) **Left gastric**, which goes to the lesser curvature and gives blood supply to the stomach and the lower third of the esophagus.
- 2) **Splenic**, which moves behind the stomach, then on the upper border of the pancreas and gives blood supply to the stomach.
- 3) **Common Hepatic**, which moves towards the liver. It gives small branches such as:
 - a) Right gastric artery
 - b) Hepatic Artery Proper**
 - c) Gastro-duodenal artery {passes behind the first part of the duodenum}

So, in short, the blood supply of the stomach contains:

2 gastric arteries

- 1) The left gastric branches from the celiac trunk.
- 2) The right gastric branches from the common hepatic artery, goes towards the lesser curvature of the stomach. Supplies the lower part of the body and pylorus.

2 gastro-epiploic arteries

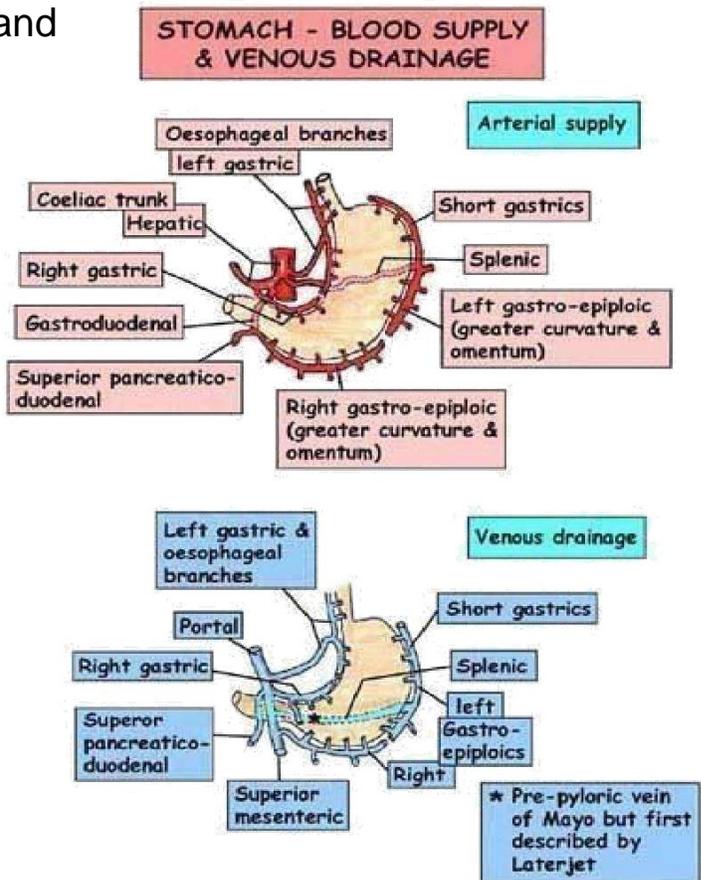
- 1) The right gastro-epiploic branches from the gastro-duodenal artery (from the common hepatic) which continues towards the duodenum [superior pancreaticoduodenal artery]
- 2) The left gastro-epiploic branches from the splenic artery.

5-7 short gastric arteries from the splenic artery, located in the gastrosplenic ligament and going towards the fundus.

The Venous Drainage of the Stomach

The portal circulation contains the portal vein which carries the venous drainage to the liver. The most important function of the portal circulation is to take the absorptive material to the liver.

The 2 gastric veins (left and right) drain into the portal vein.



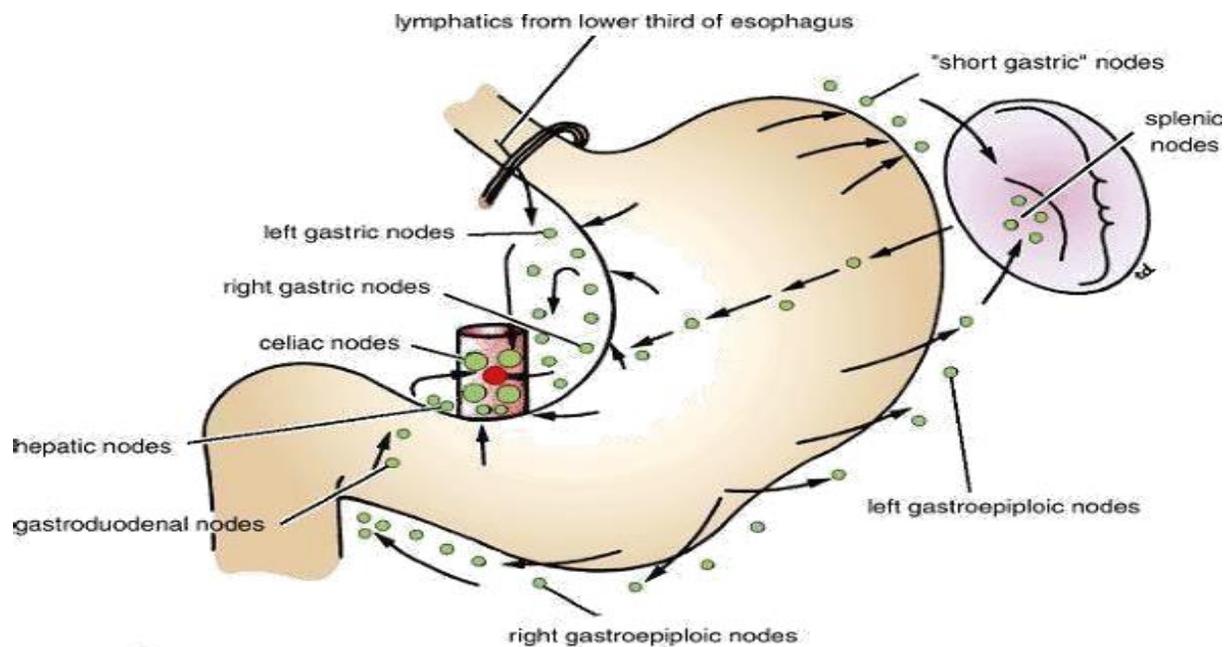
- The right gastro-epiploic vein drains into the superior mesenteric vein, and the left gastro-epiploic vein drains into the splenic vein.
- The short gastric veins also drain into the splenic vein.
- The superior mesenteric and the splenic behind the neck of the pancreas form the portal vein.

The Lymphatic Drainage of the Stomach

It is very similar to the venous drainage:

- Gastric lymph nodes [with the left and right gastric veins]
- Gastro-epiploic lymph nodes at the greater curvature [with the right and left gastro-epiploic veins]
- Pancreatico-duodenal lymph nodes [around the splenic vein]

In the end, all lymphatic drainage will gather around the celiac trunk in the celiac lymph nodes.



The Nerve Supply of the Stomach:

We have **sympathetic** fibers that go towards the *celiac plexus* of nerves around the celiac trunk. The sympathetic fibers mainly go towards the sphincters for contraction (such as the pyloric sphincter), and they also carry pain sensation.

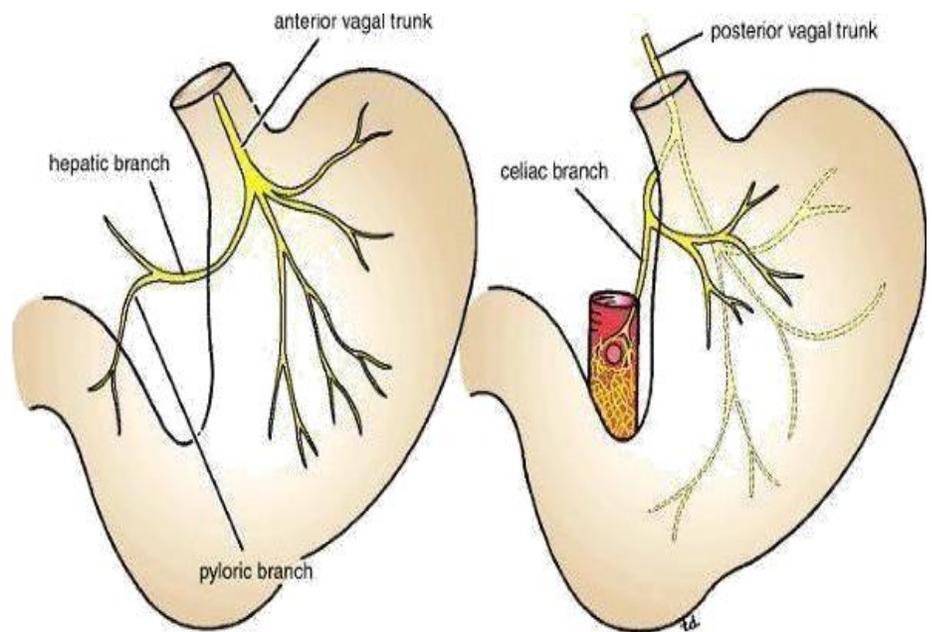
We also have **parasympathetic** fibers from the *vagus*.

The parasympathetic fibers are mainly secretomotor for the gastric glands, and motor for smooth muscles, so they are responsible for peristaltic movement.

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. They are part of the contents of the lesser omentum.

The anterior vagal 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, it is extremely important in its role in drainage.



The posterior vagal nerve innervates:

- 1-The posterior wall of the stomach.
- 2-Posterior nerve of Latarjet to the pylorus.
- 3-Celiac branch which innervates the small intestines and the medial two thirds of the transverse colon.

Clinical Points:

1) Gastric Ulcer

15 years ago, the rule said that hyperacidity meant peptic ulcer, and its treatment was surgery to the vagus nerve.

Now, it has changed completely. The real cause of peptic ulcer is a bacteria known as **Helicobacter pylori**. It is present inside the human body and is usually non-pathogenic. Under certain conditions, when there is resistance in the body, it may lead to peptic ulcer. Its treatment consists of a combination of 4 drugs for 21 days. 95% of the cases are completely cured with this method. Peptic ulcer has two forms: gastric and duodenal. The gastric ulcer is considered malignant until proven that it is not malignant. The duodenal ulcer is a peptic ulcer until proven otherwise (they are the opposite of each other). It is very common, especially in the first inch, since it receives acidic chyme which may result in irritation. Ulcer. So, a biopsy needs to be taken to prove malignancy.

Note: common site in stomach: anterior and posterior walls of lesser curvature

Remember that: the most common site for peptic ulcer is the first part of the duodenum, and if progressed it can perforate the gastro-duodenal artery, and cause severe bleeding, the individual may be prone to death due to shock.

2) Trunkal Vagotomy

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.

4) **Gastroscopy** (where we enter an endoscope into the oral cavity to check the stomach, esophagus, and duodenum, (to be more specific, until the second part of the duodenum)).

5) **Pyloroplasty**, means drainage, where the pyloric sphincter has a thickening and continuous contraction that results in no drainage. So they cut it and add stitches which will lead to the dilatation of the sphincter