STOMACH

I. INTRODUCTION

The stomach is the most dilated part of the alimentary tract. It is interposed between the oesophagus and duodenum. The stomach transforms the food bowl into chyme and progressively evacuate it into the small intestine. Thus, it acts as a food bowl container with a highly secreting mucosa and much developed muscle.

II. DESCRIPTIVE ANATOMY

A- SITUATION

The stomach is situated in the supracolic compartment of the abdominal cavity lying mainly in the left hypochondrial, epigastric and umbilical regions to the left of the midline. Much of it is under cover of the lower ribs and diaphragm.

Thus, it occupies a limited space between, on top, the diaphragm, at the bottom, the transverse colon, to the right, the liver and, to the left, the spleen.

Its upper orifice, the cardiac orifice, projects towards the T10 vertebra and its lower orifice, the pyloric orifice projects towards the L1 vertebra.

B- DIMENSIONS

The dimensions of the stomach are subject to great variations in size depending on the volume of its contents. In the newborn, it has the size of a hen’s egg with a capacity of thirty millilitres. In the adult it has a capacity of one thousand five hundred millilitres.

The stomach is twenty-five to thirty centimetres long, ten to twelve centimetres wide and eight to ten centimetres thick.

C- SHAPE

The stomach has a J-like shape and is flattened anteroposteriorly when empty.

Four different portions are distinguished from the top to the bottom, the fundus, the body, the pyloric antrum and the pyloric canal, two orifices, cardiac and pyloric, two curvatures, upper lesser and lower greater and two surfaces. (Figure 1)

The fundus is the upper pole of the stomach limited downwards by the upper border of the cardiac orifice.

The body of stomach is the middle vertical portion.

The pyloric portion comprises the pyloric antrum, lowest point of the stomach, and the pyloric canal sloping upwards, backwards and to the left.

The cardiac orifice of stomach constitutes the junction with the oesophagus and represents the most fixed part of the organ. It is continuous with the lesser curvature at the right border of the stomach with the greater curvature at the left border of the stomach forming the cardiac notch. The latter, thus, separates the fundus from the cardiac orifice. The cardiac notch is a major element of the anti-reflux gastro-oesophageal barrier.

The pyloric orifice is the junction with the duodenum. It is preceded by a palpably thickened zone, the pyloric sphincter, whose position is indicated on the anterior surface by the prepyloric vein. Its narrow lumen is the pylorus.

The curvatures of the stomach join the anterior and posterior surfaces and extend from the cardiac to the pyloric orifice.

The lesser constitutes the upper right border of the stomach. At the lesser curvature, the pyloric part is separated from the body by the angular notch. The lesser curvature of the stomach ends at the upper lip of the pyloric sphincter.

The greater is four times as long as the lesser and constitutes the lower left border. Its upper portion belongs to the fundus forming with the cardiac orifice the cardiac notch. It ends at the lower lip of the pyloric sphincter.

The anterior surface of the stomach faces forwards and upwards when its posterior surface faces backwards and downwards.

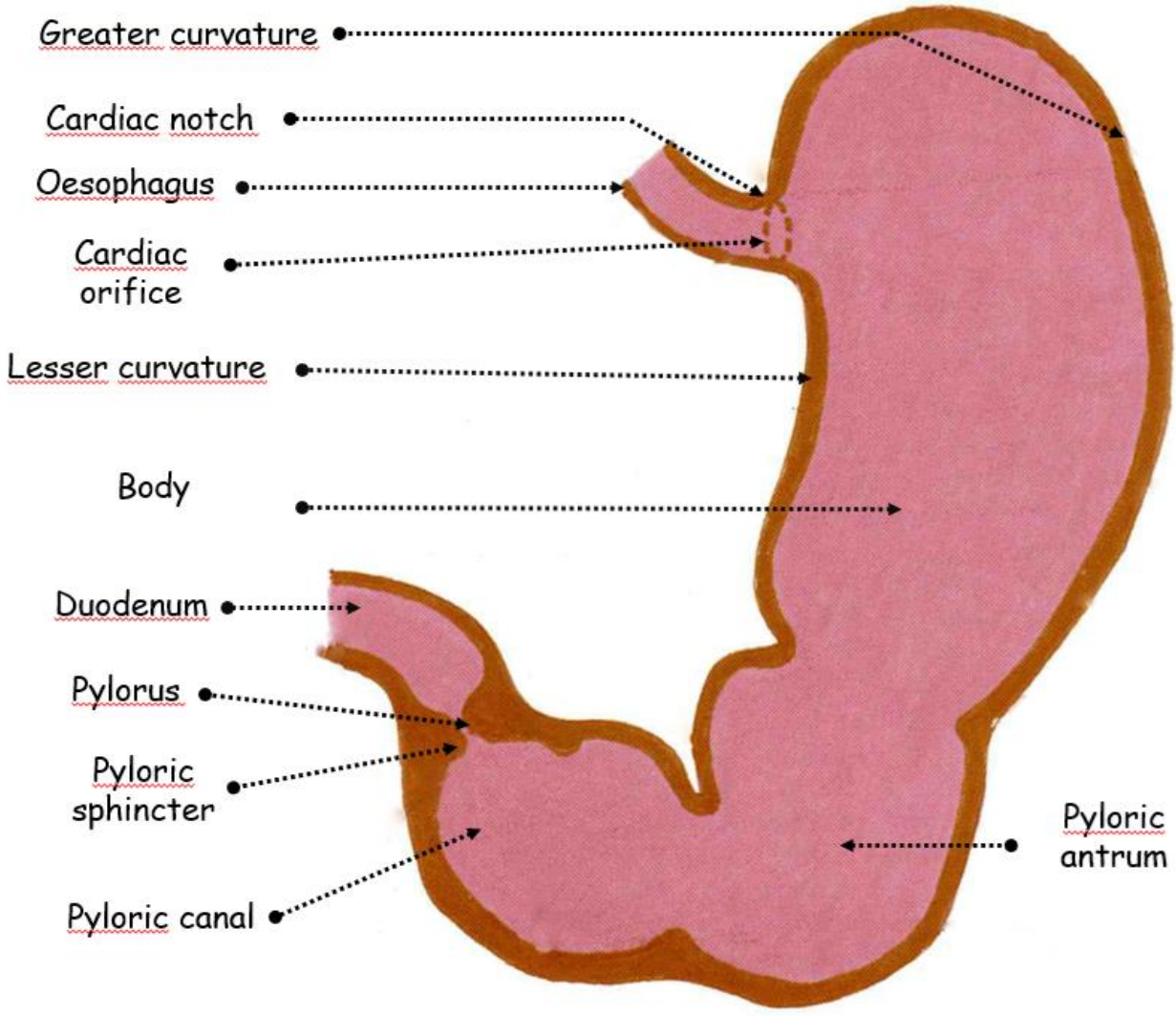

Figure 1: Anterior view of the stomach

III. STRUCTURE

The stomach is a muscular bag of four layers. (Figure 2)

From the outer to the inner, the serous coat corresponds to the gastric peritoneum.

The gastric muscle is made of two layers, outer longitudinal and inner circular and is reinforced by

an incomplete innermost oblique layer; its fibres loop over the fundus and are thickest at the cardiac notch and oblique to the long axis of the organ. The pyloric sphincter is made of the thickening of this layer forming two lips, upper and lower. The gastric muscle ensures the process of stirring and mixing the food bowl.

The submucosa contains tubular glands reunited by lax connective tissue containing vessels and nerves.

The mucous membrane of stomach is thick and resistant. It changes abruptly from stratified to single-layered columnar epithelium at the cardio-oesophageal junction. Its body part contains parietal cells secreting acid, intrinsic factor and pepsin. Its pyloric part contains G cells producing gastrin. There is no landmark on the external surface to signal the change.

The gastric mucosa is pink-red and consists of longitudinal folds, a mucous fold towards the cardiac notch acting as the inferior sphincter of oesophagus and, thus, participating in the anti-reflux barrier, and annular fold at the end of the pyloric canal resulting from the elevation of the mucosa by the pyloric sphincter. The degree of plication of the gastric folds depends on the distention of the gastric lumen. It is low when distended.

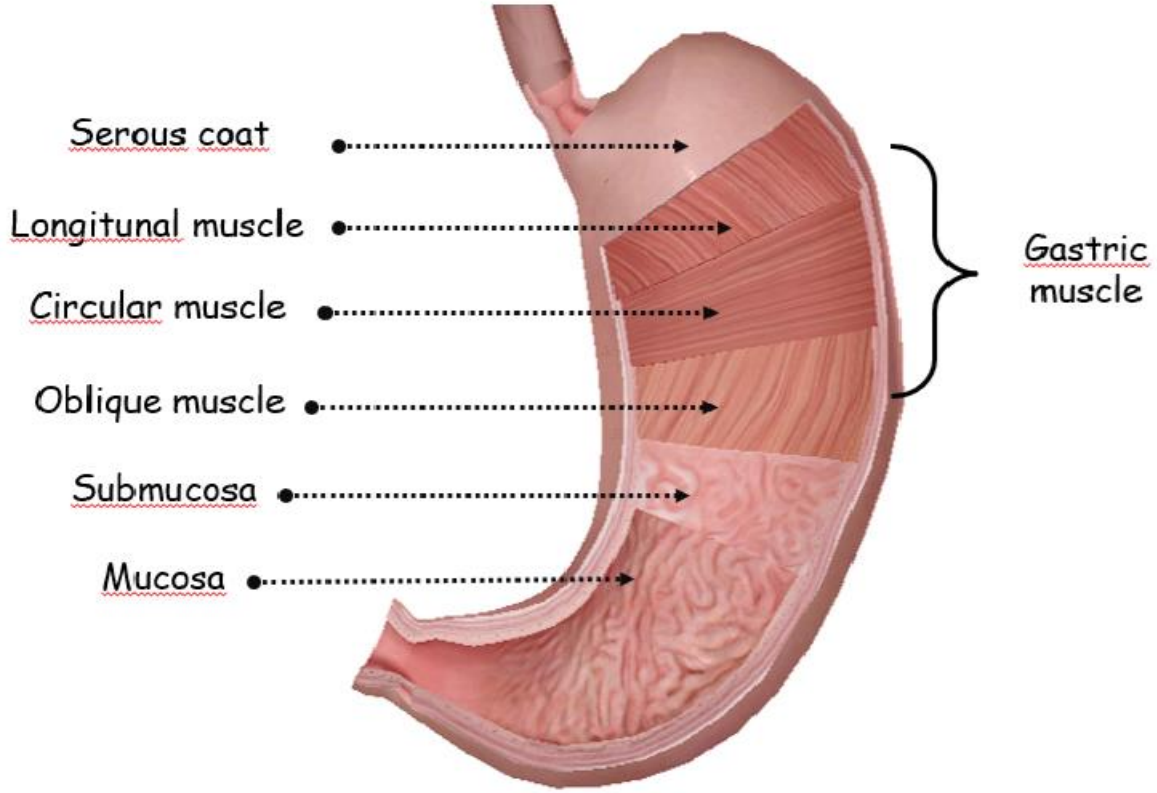

Figure 2: Coronal section of the stomach

IV. SUPPORTS

The stomach is relatively fixed at both ends, the gastro-oesophageal junction being the most fixed, and is completely invested by peritoneum. The lesser omentum is a double layer from the lesser curvature to the liver when the greater omentum is a double layer hanging down from the fundus and greater curvature and fusing with transverse colon and mesocolon. The gastrophrenic ligament fixes the fundus to the left dome of diaphragm. The gastrosplenic ligament represents the portion of the greater omentum between the greater curvature of stomach and the spleen. Ultimately, the stomach remains a mobile organ.

V. ANATOMICAL RELATIONS

A- ANTERIOR SURFACE

The fundus is overlied by the diaphragm. Through the diaphragm, it is in contact with the left costodiaphragmatic recess of pleura and left lung upwards and the thoracic wall laterally.

The body and pyloric part are covered by the left lobe of the liver to the right and the anterior abdominal wall forwards directly towards the palpable zone of the stomach between the costal margin to the left, the inferior border of the liver to the right and the horizontal line passing by the 9th costal cartilage downwards.

B- POSTERIOR SURFACE

The posterior surface of the stomach rests on the lesser sac. A set of retroperitoneal organs constitute the stomach bed. The fundus lies on the left crus of diaphragm, the left suprarenal gland, the pancreas, the splenic vessels and the spleen and the left kidney. The body lies on the pancreas and the transverse mesocolon. The pyloric part lies on the fourth portion of duodenum, the duodenojejunal junction and intestinal coils.

C- UPPER END

The upper end of the stomach, towards the cardiac orifice, projects at the level of T10 vertebra with the left crus of the diaphragm behind it and the medial end of the 7th costal cartilage forwards with the left lobe of the liver in front of it two centimetres to the left of the midline.

Towards the fundus, it is overlied by the diaphragm and, through the latter, the left costodiaphragmatic recess of pleura and pericardium and, more deeply, left lung and heart.

D- LOWER END

The lower end, towards the pyloric orifice, projects at the level of the umbilicus forwards and the L1 vertebra backwards. It is limited forwards and upwards by the liver, downwards by the head of pancreas, backwards by the pancreas and portal vein.

E- LESSER CURVATURE

The lesser curvature is bordered by the gastric arteries in the lesser sac.

F- GREATER CURVATURE

The greater curvature of stomach is bordered by gastroepiploic arteries in the greater omentum and is in contact with transverse colon through the continuity of the greater omentum with the transverse mesocolon. The short gastric arteries flank the greater curvature at the level of the gastrosplenic ligament.

VI. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A- ARTERIES

The stomach is supplied by the branches of the coeliac trunk.

The coeliac trunk arises from the front of the abdominal aorta at the level of T12 vertebra, it enters the abdomen between the crura of the diaphragm, behind and below the median arcuate ligament. It is a short wide trunk and divides into three branches behind the peritoneum of the posterior wall of the lesser sac at the upper border of pancreas.

The left gastric artery runs upwards across the left crus towards the oesophageal opening in the diaphragm and enters the lesser omentum to run to the right along the lesser curvature of the stomach. It gives oesophageal branches for the abdominal portion of the oesophagus.

The splenic artery passes to the left and is very tortuous with crests and troughs, it runs across the left crus and left psoas to the hilum of the left kidney. It, then, turns forward in the lienorenal ligament to the hilum of the spleen. Before breaking up into its terminal splenic branches it gives off the short gastric arteries which run in the gastrosplenic ligament, and the left gastroepiploic artery which runs in the greater omentum.

The common hepatic artery passes over the upper border of the pancreas downwards and to the right behind the peritoneum of the posterior abdominal wall as far as the first part of the duodenum. It turns forward at the epiploic foramen and curves upwards inside the lesser omentum to become the hepatic artery. It, usually, gives off the right gastric and gastroduodenal arteries.

The right gastric artery turns into the lesser omentum to reach the stomach.

The gastroduodenal artery passes down behind the first part of the duodenum, to the left of the portal vein, and divides into two.

The right gastroepiploic artery passes forward between the first part of the duodenum and the pancreas and turns to the left inside the greater omentum.

Thus, the arterial circle of the lesser curvature is an end-on anastomosis between the left gastric and the right gastric arteries. It runs along the lesser curvature between the two layers of the lesser omentum. It may be double.

The arterial circle of the greater curvature is an end-on anastomosis between the left gastroepiploic and the right gastroepiploic arteries. It runs along the greater curvature between the two layers of the lesser omentum. It is rarely double.

The short gastric arteries are five or six vessels which run from the splenic artery in the gastrosplenic ligament.

All these vessels give off their gastric branches at right angles in contrast to branches from the vagal nerve trunks which come off obliquely. They enter the anterior and posterior walls of the stomach. The epiploic branches of the gastroepiploics pass downwards between the leaves of the greater omentum and constitute the largest supply of peritoneum. The short gastric vessels supply the fundus and upper left part of the greater curvature.

B- VEINS

The veins of stomach correspond to the arteries.

The gastric veins flow into the portal vein.

The short gastric and left gastroepiploic veins drain into the splenic vein.

The right gastroepiploic vein drains into the superior mesenteric vein.

The prepyloric vein of Mayo drains into the right gastric artery.

There is no gastroduodenal vein.

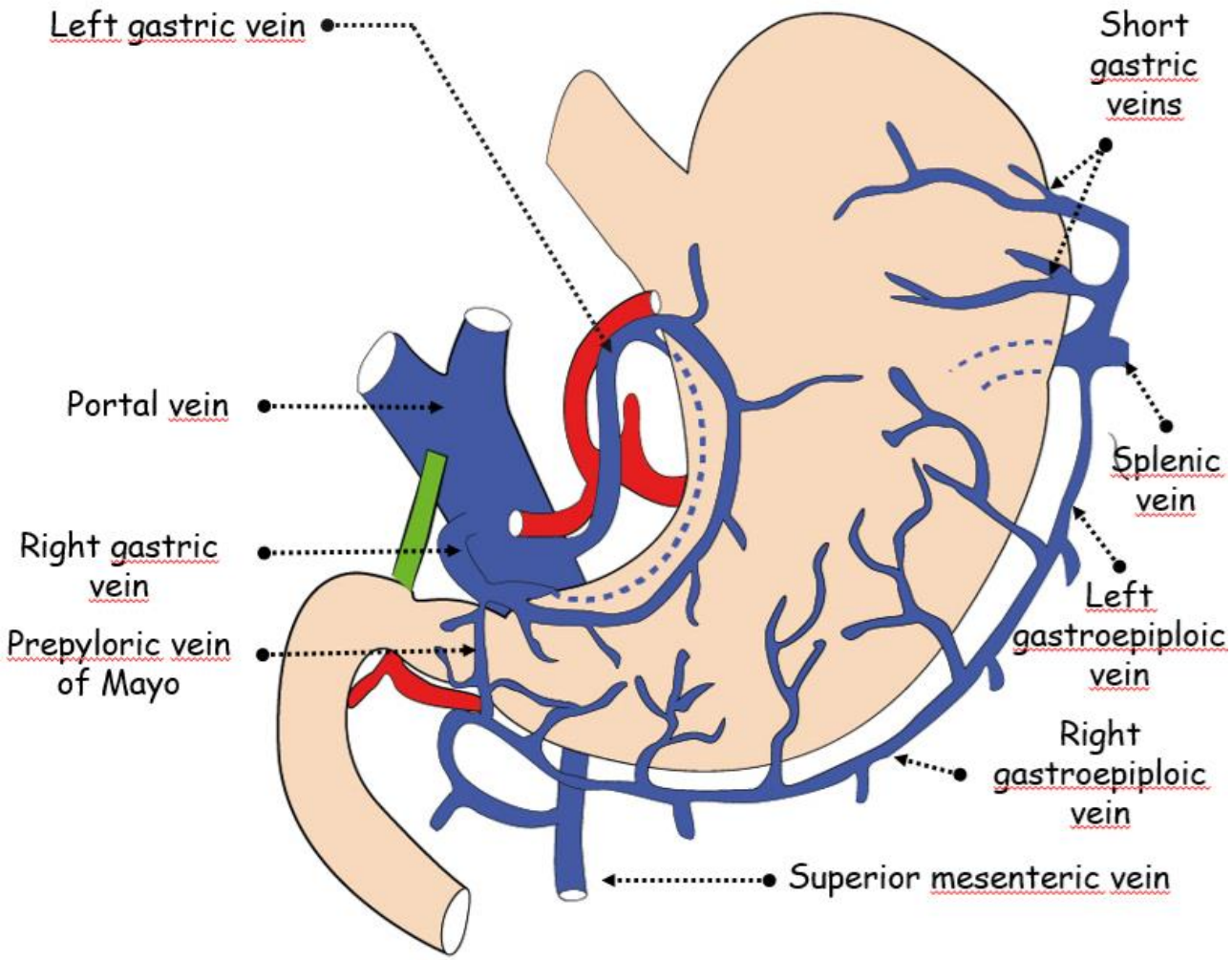

Figure 3: Anterior view of the stomach showing its veins

C- LYMPH DRAINAGE

All the lymph eventually reaches coeliac nodes after passing through various outlying groups. There are valves in the vessels that direct lymph in such a way that a line drawn parallel to the greater curvature and two-thirds of the way down the anterior surface indicates a watershed.

From the largest zone above and to the right of this line, lymph passes to left and right gastric nodes along the lesser curvature adjacent to the blood vessel.

From the upper left quadrant, the lymph flows to splenic nodes at the hilum which flow into pancreatic nodes.

From the rest of the stomach lymph reaches nodes along the gastroepiploic vessels of the greater curvature and in the pyloric region above, below and behind the pylorus. In rare cases of gastric carcinoma the left supraclavicular nodes may become palpably involved, Troisier's sign, presumably by spread through the posterior mediastinum.

D- NERVES

Sympathetic fibres, vasomotor, accompanied by afferent pain fibres run with the various arterial branches to the stomach, but of greater importance is the parasympathetic supply from the vagi which control motility and secretion, although ninety percent of vagal fibres below the diaphragm are afferent for reflex activities, not pain. The anterior vagal trunk from the oesophageal plexuses at the oesophageal opening in the diaphragm lies in contact with the anterior oesophageal wall, usually nearer its right margin than in the centre; in twenty percent it is

double. It runs down in the lesser omentum near the lesser curvature with the left gastric artery where it is often called by clinicians the anterior nerve of Latarget, giving branches to the anterior surface of the stomach and a large hepatic branch which in turn gives a branch to the pyloric antrum. If the nerve is double, each gives a hepatic branch. The posterior vagal trunk lies in loose tissue a little behind and to the right of the right oesophageal margin, not in contact with the posterior surface of the oesophagus. It runs in the lesser omentum behind the anterior trunk as the posterior nerve of Latarget, giving off a large coeliac branch that runs backwards along the left gastric artery to the coeliac ganglion, and numerous branches to the posterior surface of the stomach. The posterior trunk is rarely double.

VII. SURGICAL APPROACH

The truncal vagotomy involves cutting the trunks at the level of the abdominal oesophagus. In selective vagotomy the branches to the stomach that run on or near the lesser curvature vessels are cut. Ligating vessels will inevitably sever some nerve branches but not all, since not all nerves accompany vessels closely, and any individual nerves that can be identified must be cut also. Arterial branches run into the lesser curvature transversely, but nerve branches approach it obliquely. Although effective in diminishing gastric secretion, truncal and selective vagotomy are often accompanied by gastric stasis, so that an antral drainage procedure is required. Highly selective vagotomy, also known as parietal cell vagotomy, attempts to avoid stasis by cutting only the branches to the fundus and body, leaving the antral nerves intact.

The partial gastrectomy for peptic ulcer and tumour involves removal of the distal two-thirds of the stomach, with the line of transection of the duodenum just beyond the pylorus. Among the anatomical hazards during mobilization of the stomach are the middle colic vessels, which must not be damaged when freeing the greater omentum from the adherent transverse colon and mesocolon. A gastroenterostomy to restore continuity can be made by bringing a loop of proximal jejunum through the transverse mesocolon to the left of the middle colic artery; the loop must lie isoperistaltically. The bile duct should be to the right of the line of transection of the duodenum. The left gastric artery is a larger vessel than the right gastric and should be doubly ligated. An accessory hepatic artery arising from the left gastric should be left intact; it may be the sole supply for the left lobe.

VIII. CONCLUSION

The stomach is the most dilated part of the alimentary tube. It is highly peritonised and mobile. Functionally, it secretes different digestive substances. The stomach has several retroperitoneal and intraperitoneal relations as well as a rich blood supply. Nerves of the stomach mainly provide from the vagi and its lymph drainage is ensured by the celiac nodes.