VOL- X | ISSUE- VIII | AUGUST | 2023 | PEER REVIEW e-JOURNAL | IMPACT FACTOR 7.367 | ISSN 2349-638x

Structural and Functional Review of Stomach

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Introduction

The digestive system's most dilated and significant organ is the stomach. It is preceded by the esophagus and is followed by the small intestine. It is a sizable, muscular, hollow organ with the ability to store food. It is made up of the cardia, fundus, body, and pylorus, which are its four primary regions. The cardia, which connects to the esophagus, is where food enters the stomach for the first time. The superior, bulbous, and domed-shaped section of the stomach known as the fundus follows the cardia. The body, or the largest and most important part of the stomach, comes next to the fundus. The pylorus, which guides food into the duodenum, or top part of the small intestine, follows the body. The stomach is situated centrally and to the left of the midline in the upper region of the abdomen. Following mastication, or chewing, the stomach is where the next phase of digestion starts.

Structure and Function

The temporary storage of food and the partial chemical and mechanical digestion of food are the main purposes of the stomach. As food enters, the cardia, body, and fundus of the stomach relax, enabling the stomach to hold progressively more food. In order to aid in the breakdown of the food, the lower part of the stomach contracts rhythmically (mechanical digestion). This mixture of stomach juices and food is then called chyme at this stage of digestion and is ready for further digestion. Mixing waves are created at intervals of around 20 seconds, and as they approach the lower stomach, their intensity rises.

The pyloric sphincter releases little amounts of suitably liquefied or broken down chyme into the small intestine with each wave, as much as the duodenum can manage and control. Hydrochloric acid (HCl) is a naturally occurring liquid that is secreted by the fundus region of the stomach for the chemical processes of digestion. The stomach's parietal cells also create intrinsic factor in addition to HCl. Vitamin B12 (cobalamin) can be absorbed later in the small intestine because to the intrinsic factor created at this stage of digestion. Since vitamin B12 is essential for the development of red blood cells and brain processes, its creation is crucial.

Food can be processed in the stomach and sent to the duodenum in 2 to 4 hours on average. However, the type of food consumed greatly affects how quickly this happens because proteins and carbs both break down quickly in the stomach, unlike fats like triglycerides, which take longer. Despite not being the stomach's principal job, some chemicals can be absorbed by the stomach. Water in cases of dehydration, specific drugs like aspirin, amino acids, ethanol, caffeine, and various water-soluble vitamins are a few of these substances. Additionally, many types of bacteria and other microbes that enter the body through food may be killed by the acidic environment of the stomach, thereby defending the body from infection and sickness.

Embryology

The most distended part of the foregut, the stomach, starts to take shape during the fourth week of development. Due to fast esophageal elongation, the stomach declines during development from the level of the C2 vertebrae to the level of the T11 vertebrae by week twelve. By the fifth week of development, the stomach's dorsal wall, which grows more quickly than its ventral wall, causes the stomach to bulge more noticeably on one side, giving it its distinctive shape. The stomach rotates 90 degrees clockwise around its longitudinal axis during week seven of development, and then clockwise around its anteroposterior axis during week eight, bringing the pyloric area upward to its final position.

Blood Supply

An area that is highly mobile and distensible, composed of five different cell types that function at

high metabolic rates, and with multiple muscle layers to facilitate the stomach waves of brisk peristalsis for the second phase of digestion, the stomach is an organ that requires a rich supply of blood. The primary arterial blood supply is provided by the celiac trunk, which branches anteriorly from the aorta. The left gastric artery (LGA), splenic artery, and common hepatic artery (CHA) are all supplied by the trunk. An ascending branch of the LGA supplies parts of the esophagus, whereas a descending branch of the LGA supplies the less curved side of the stomach.

The gastroduodenal artery (GDA), which branches out from the common hepatic artery (CHA), is located on the right side of the common hepatic artery, which runs above the pancreas. The appropriate hepatic artery subsequently divides into the right gastric artery (RGA). The RGA then crosses the less curved part of the stomach from right to left and continues to branch into smaller vessels throughout the stomach's body to connect to the network of smaller arteries that supply the stomach and were diverted from the LGA. The GDA divides into the anterior superior pancreaticoduodenal artery (ASPDA), the right gastro-omental (gastroepiploic) artery (RGEA), and the posterior superior pancreaticoduodenal artery (PSPDA).

The RGEA then travels through and supplies the larger curvature of the stomach from right to left. The greater curvature body section of the stomach is supplied by the left gastroepiploic (gastroomental) artery (LGEA), which originates on the left side and branches in a rightward manner. The splenic artery divides into three to five additional minor arteries that serve the stomach. The right gastric, right gastro-omental, and left gastric (coronary) veins all drain into various parts of the portal vein. The splenic vein serves as the drainage pathway for the left gastro-omental vein and short stomach veins (also known as the vasa brevia).

Nerves

Parasympathetic and sympathetic nerves of the autonomic nervous system innervate the stomach. The right posterior and left vagal trunks receive parasympathetic innervation from the vagus nerve. The left vagus nerve is anterior and the right vagus nerve is posterior as a result of the rotation of the stomach during development. The criminal nerve of Grassi, which innervates the cardia and fundus, receives a branch from the right vagus nerve. The posterior and anterior gastric nerves of Latarjet, which innervate the body, antrum, and pylorus, are likewise formed by the trunks, which follow the region of the stomach's smaller curvature. From spinal cord segments T6 through T9, sympathetic nerves, including some fibers that transmit pain, are given to the celiac plexus.

Muscles

The stomach wall is largely made up of three layers of muscular tissue that run longitudinally, obliquely, and cirratically. Understanding the many layers of the stomach wall is crucial before understanding the muscular structure of the stomach. The muscularis externa, serosa, submucosa, and mucosa are the stomach wall's four principal layers. The mucosa, the innermost layer, is mostly made up of gastric glands that secrete stomach juices and is covered in epithelial tissue. The cardia region secretes protective mucus that coats the inner mucosal wall of the stomach via mucus cells, preventing the stomach muscles from being digested by the gastric juices generated by the pepsin. In particular, the fundus region produces gastric juices.

Blood and lymphatic vessels, nerves, and dense connective tissue can all be found in the submucosa. The rugae, or many folds like an accordion, found in the submucosa, which supports the mucosal layer, allow for the distension of these layers as food enters the stomach. The following layer, the muscularis externa, is made up of the three aforementioned sublayers. Unique to the stomach, the inner oblique layer is principally in charge of the mechanical, churning digestion of food. The pyloric sphincter, which controls the stomach's discharge into the duodenum, is formed by a thickening of the middle circular layer, which is concentric with the stomach's longitudinal axis.

The outer longitudinal layer is the next layer; however, there is a zone of innervation for the two subsequent muscular layers called the Auerbach's (myenteric) plexus between this layer and the middle circular layer. By shrinking its muscles, the outer longitudinal layer makes it easier for food to travel toward the pylorus. The serosa, the last layer, is

composed of numerous layers of connective tissue that are connected to the peritoneum continually.

Applied anatomy

Some gastrointestinal conditions may call for surgery. Stomach cancer, gastric ulcers, ripping, and other issues are a few of these. Bariatric procedures like gastric bypass surgery and gastric banding that involve the stomach are another medical option to take into account. Where appropriate and practical, laparoscopic surgery is advised to encourage least invasive access to the stomach and to speed up the patient's recovery. The assessment of the stomach can be done using a variety of radiographic methods. Additionally, endoscopes can be used to examine stomachs and determine whether surgery is necessary or how best to prepare for it.

Clinically, understanding and treating stomach disorders are extremely important. Most stomach problems can be addressed if they are found early enough to prevent further damage to the organ or to the patient as a whole. The stomach serves as both a primary digestive organ and a crucial stop on the food delivery pathway to the duodenum. Therefore, problems with this organ may have an impact on a patient's nutritional health by preventing them from receiving these vital nutrients through this digestive pathway. There are many problems that can affect the stomach.

These problems have clinical importance. The condition known as gastroesophageal reflux disease (GERD) is characterized by persistent stomach acid reflux into the esophagus. Patients with GERD frequently experience heartburn, regurgitation, dysphagia, a persistent cough, and hoarseness. Because GERD is a significant risk factor for esophageal adenocarcinoma, it is crucial to treat it. When someone has dyspepsia, they commonly feel queasy in the stomach and have indigestion. When stomach acid erodes the stomach's inner lining, gastric ulcers develop. In addition, the stomach can develop tumors, bleeding, and potentially stomach cancer.

Different drugs are utilized to treat the causes of many of these problems when surgery is not necessary. Histamines, proton pump inhibitors, and antacids for lowering stomach acid are a few of these medicines. Antibiotics may also be used to treat stomach infections like those brought on by Helicobacter pylori. Motility medicines may also be given to help the stomach's muscles contract.

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