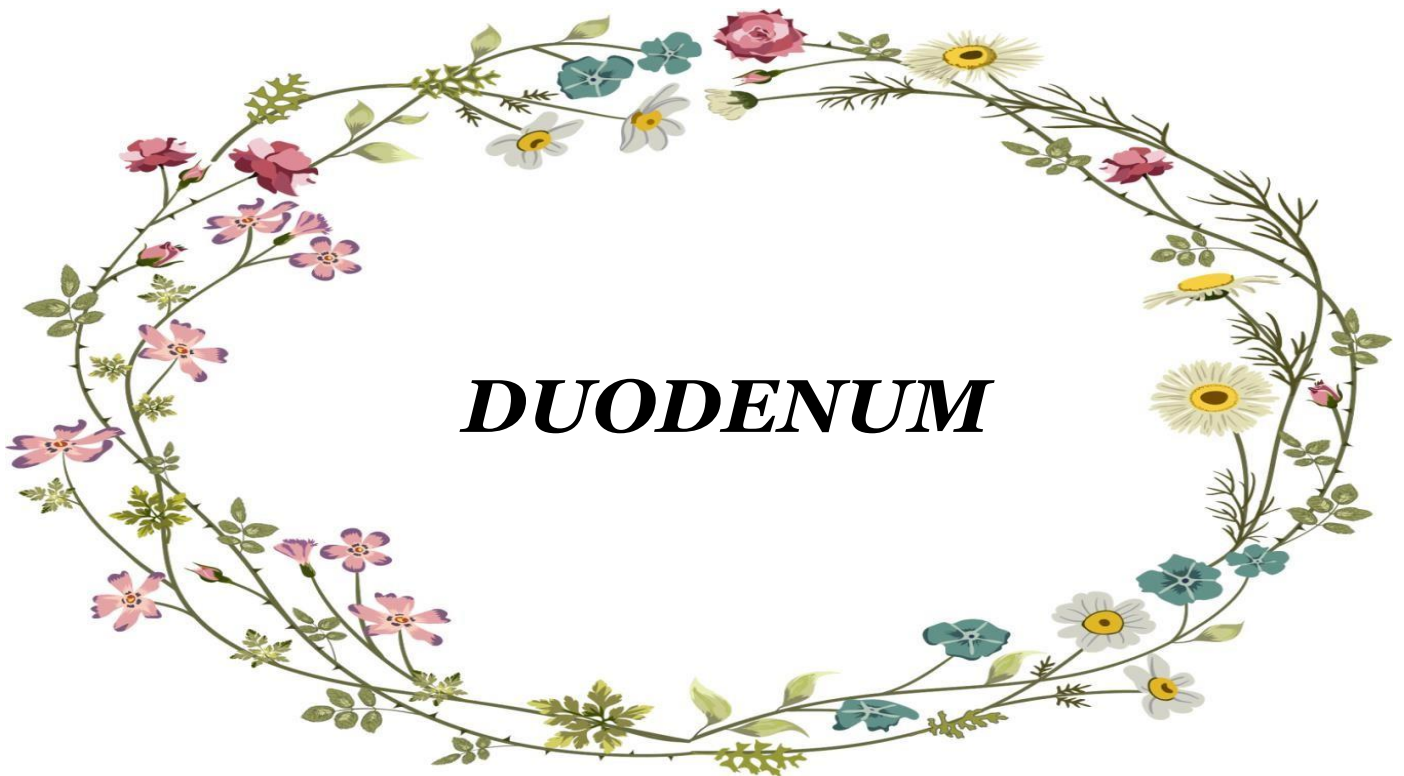


L'enseignement de l'anatomie des appareils digestif, urinaire et génital par l'utilisation de vidéos d'anatomie 3D en anglais, intérêts pédagogiques par rapport aux méthodes classiques d'enseignement



I. INTRODUCTION

The duodenum is the initial portion of the small intestine interposed between the stomach at its pyloric part and the jejunum at the duodenojejunal flexure. Clinically the term small intestine often excludes the duodenum. The duodenum has the shape of a frame opened upwards, slightly backwards and to the left surrounding the head of pancreas. It constitutes the portion of the small intestine where the pancreatic and bile ducts communicate with the alimentary tube.

II. DESCRIPTIVE ANATOMY

A- SITUATION

The duodenum is almost entirely retroperitoneal. Fixed and deep in the epigastric region, it lies against the lumbar spine towards L1 to L4 vertebrae. The duodenum is crossed forwards by the root of the transverse mesocolon. Thus, it lies in both supracolic and infracolic compartments. Forwards, it projects above the umbilicus.

B- SHAPE

The duodenum is a C-shaped tube round the head of pancreas; sometimes, pancreatic lobules may penetrate the duodenal wall and extend to the mucous membrane. It curves over the convexity of the forwardly projecting aorta and inferior vena cava. The first two centimetres are contained between the peritoneum of the lesser and greater omenta.

The duodenum is divided into four parts, superior, descending, horizontal and ascending. (Figure 1)

The first portion of the duodenum is the superior right portion, mobile and free at the level of L1 vertebra. It runs to the right, upwards and backwards from the pylorus. The first two centimetres are pear-shaped and constitute the duodenal cap. It represents the lowermost boundary of the epiploic foramen, the opening into the lesser sac upon the liver pedicle. The last three centimetres pass backwards and upwards behind the peritoneum.

The second portion curves downwards over the hilum of the right kidney at an acute angle, the genu superius. It lies vertical behind the posterior parietal peritoneum crossed by the attachment of the transverse mesocolon and in front of the right side of L2 to L4 vertebrae alongside the head of pancreas medially. Thus, its upperhalf stands towards the supracolic compartment and lower towards the infracolic. Its posteromedial wall receives the common opening of the bile duct and main pancreatic duct at the hepatopancreatic ampulla of Vater constituting the connexion site between the alimentary tube and its annexed glands.

The third portion of the duodenum curves forwards from the right paravertebral gutter over the slope of the right psoas muscle and passes over the forwardly projecting inferior vena cava and aorta to reach the left psoas muscle. It prolonges the second portion at a right angle, the genu inferius, and runs horizontally. It is covered by the peritoneum of the posterior abdominal wall just below the transverse mesocolon towards L4 vertebra.

The fourth portion of the duodenum ascends to the left of the aorta lying on the left psoas to reach the lower border of the pancreas, almost as high as the root of the transverse mesocolon towards L2 vertebra. It is covered in front by the peritoneal floor of the left infracolic compartment. It breaks free from the peritoneum curving forwards and to the right as the duodenojejunal flexure.

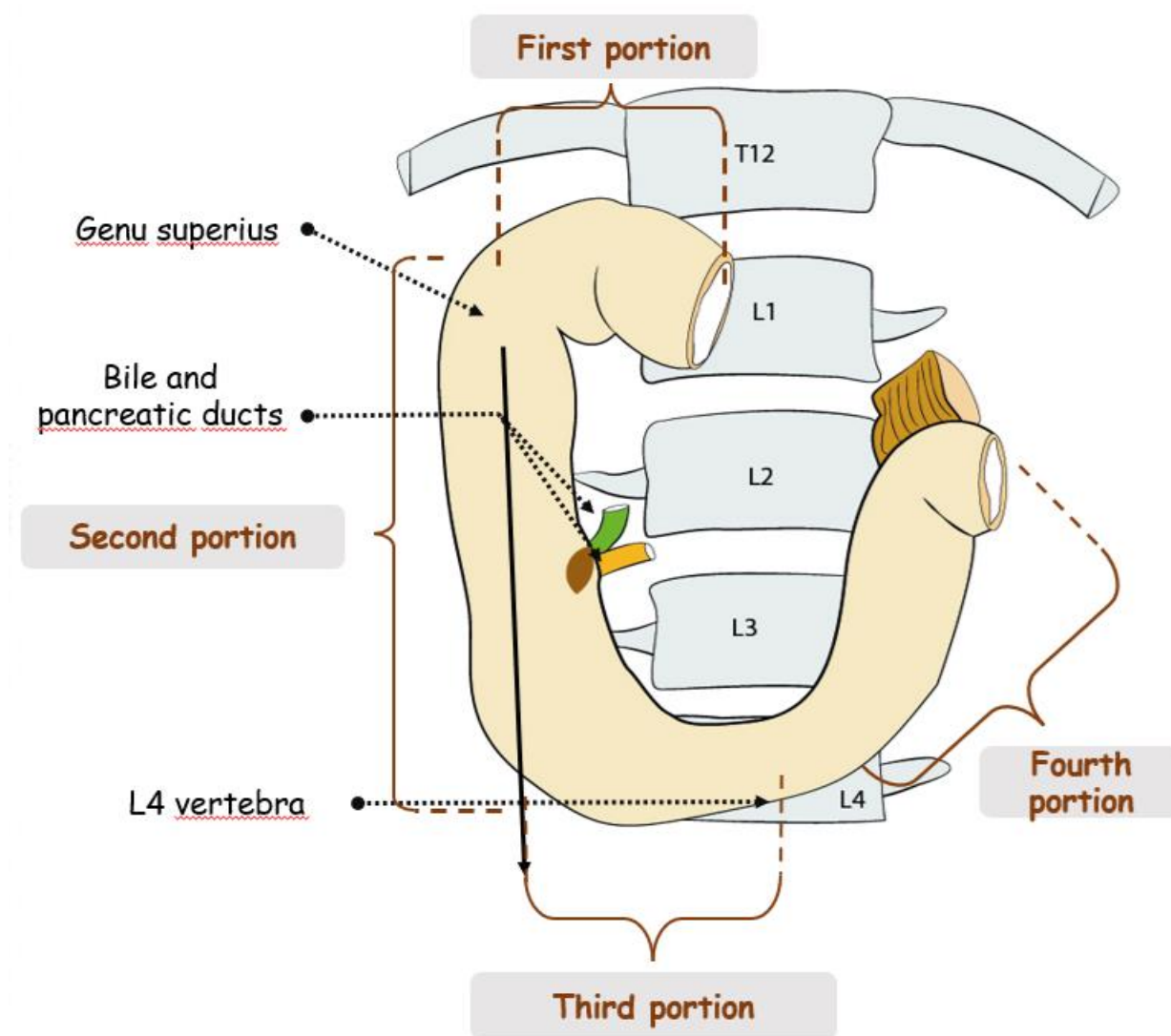


Figure 1: Anterior view of the duodenum

C- DIMENSIONS

The total length of the duodenum is twenty-five centimetres. The first portion is five centimetres long, the second seven centimetres and half, the third ten and the fourth is two centimetres and half long. The internal diameter of the duodenum is four centimetres.

III. STRUCTURE

A- WALL OF DUODENUM

The wall of the duodenum is made of four layers.

From the outer to the inner layer, the serous coat consists of peritoneum.

The muscle of duodenum is arranged into two layers, outer longitudinal and inner circular, it contains the myenteric plexus of the small intestine also known as the plexus of Auerbach made of motor nerves.

The submucosa contains the plexus of Meissner made of sensitive nerves and is characterized by the mucus-secreting glands of Brunner.

The mucous membrane not only dips down to form the crypts of Lieberkühn but is also thrown up between the gland openings into finger-like connective tissue villi and is lined by columnar epithelium containing mucus-secreting goblet cells and enterocytes in the villi and granular Paneth cells which secrete lysozyme at the base of the crypts and enteroendocrine cells responsible for the production of intestinal hormones in the crypts.

B- LUMEN OF DUODENUM

The lumen of duodenum is dilated in the duodenal cap. The macroscopic aspect of mucosa consists of numerous circular folds, plicae circulares or valvulae conniventes. The latter are less marked in the duodenal cap where the mucous membrane is smooth since it is the most dilated portion. The posteromedial wall of the second portion contains two papillae.

The major duodenal papilla is a thicker opening of mucosa of the hepatopancreatic ampulla of Vater. It is situated halfway along the second part of duodenum ten centimetres from the pylorus. It is guarded by a semilunar flap of mucous membrane which surmounts it continuous downwards with its frenulum. The ampullary sphincter of Oddi is the common sphincter of both the pancreatic and bile ducts, it is made of the fusion of their proper sphincters.

The minor duodenal papilla is two centimetres proximal to the major papilla. It represents the small opening of the accessory pancreatic duct of Santorini.

IV. SUPPORTS

A- MOBILE PART

The duodenal cap is contained between the peritoneum of the lesser and greater omenta.

B- FIXED PART

The duodenum is almost totally fixed except the duodenal cap that remains as the only mobile part of it. It is also the most fixed part of all the small intestine. Its main supports are the pancreas which it moulds mainly at the head, the bile and pancreatic ducts that fix it to the biliary

tract, liver and pancreas. The Treitz fascia to the right and left Toldt's fascia to the left fix the pancreas to retroperitoneal tissues.

At the duodenojejunal flexure as the duodenum breaks free from the posterior parietal peritoneum, the duodenal peritoneum continuous with the mesentery forms two folds defining four duodenal recesses, superior, inferior, retroduodenal to the right and paraduodenal to the left. The root of the transverse mesocolon and the mesentery fix it to the peritoneal cavity and its viscera.

Lastly, the suspensory muscle of the duodenum of Treitz fixes the duodenojejunal flexure to the left psoas fascia. It is a thin digastric band made of smooth muscle near the duodenum and striated near the crus of diaphragm, it ends on the right crus of diaphragm.

V. ANATOMICAL RELATIONS

A- FIRST PORTION

The first portion of duodenum stands between, on top, the lesser omentum, the epiploic foramen and the origin of prepyloric vessels, at the bottom, the upper part of the head of pancreas, forwards, the inferior surface of the right lobe of the liver towards the quadrate lobe and the neck of the gall bladder and, backwards, the right part of the lesser sac, the gastroduodenal artery, the retropyloric lymph node, liver pedicle, namely, the bile duct, the hepatic artery and portal vein, the right crus of diaphragm, the inferior vena cava, the psoas muscle and the medial border of the right kidney.

B- SECOND PORTION

The second portion of duodenum runs vertically downwards between, forwards, the upper half of the hepatorenal pouch and liver towards the supracolic compartment, the right part of the transverse colon towards the transverse mesocolon and jejunal coils towards the infracolic compartment, backwards through the Treitz fascia, the hilum of the right kidney, the right gonadal vessels and the inferior vena cava, medially, the head of pancreas between the pancreaticoduodenal circles, the paraduodenal portion of the bile duct and the hepatopancreatic ampulla of Vater, and, laterally, the medial border of the right kidney and the right colic flexure.

C- THIRD PORTION

The third portion runs horizontally towards the left between, forwards from the top to the bottom, the superior mesenteric vessels, the right colon, the commencement of mesentery and coils of jejunum, backwards from the right to the left through Treitz fascia, the right psoas muscle, the gonadal vessels, the right ureter, the inferior vena cava, the aorta at the commencement of the inferior mesenteric artery and the left psoas muscle, on top, the lower border of pancreas and, at the bottom, the coils of jejunum.

D- FOURTH PORTION

The fourth portion of the duodenum lies between, forwards from the back to the front, the superior mesenteric vessels, the root of transverse mesocolon, the peritoneal floor of infracolic compartment and coils of jejunum, backwards, the left psoas muscle, the left sympathetic trunk

and the left gonadal vessels, medially, the aorta and the root of mesentery, laterally, the left kidney and coils of jejunum. At the duodenojejunal flexure, the paraduodenal fold is raised by the inferior mesenteric vein and the left superior colic artery.

VI. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A- ARTERIES

Most of the duodenum is supplied by the pancreaticoduodenal arteries.

The superior pancreaticoduodenal artery is a branch of the gastroduodenal artery, branch of the hepatic artery passing between the first portion of the duodenum forwards and the head of pancreas backwards, it ends giving two terminal branches, one anterior and one posterior on each surface of the head of pancreas.

The inferior pancreaticoduodenal artery rises from the right border of the superior mesenteric artery towards the uncinate process of the head, passes behind the superior mesenteric vein and ends giving two terminal branches, anterior and posterior as the previous ones. The homonymous branches of the superior and inferior pancreaticoduodenal arteries anastomose forming the anterior and posterior pancreaticoduodenal circles surrounding the head of the pancreas.

The duodenal cap and the duodenojejunal flexure are not supplied by the pancreaticoduodenal circles.

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The gastroduodenal artery is the terminal branch of the common hepatic artery, it passes down behind the first part of the duodenum, to the left of the portal vein, and divides into two, the right gastroepiploic artery and the superior pancreaticoduodenal artery. It gives the supraduodenal and retroduodenal branches supplying the duodenal cap. The infraduodenal branches arise from the right gastroepiploic artery.

The jejunal branches of the superior mesenteric artery participate in the arterial supply of the duodenojejunal junction.

These arteries are subject to anatomical variations; the gastroduodenal artery may arise from the hepatic artery or one of its branches, the superior mesenteric artery or the celiac trunk. The superior pancreaticoduodenal artery may arise from the common hepatic or the superior mesenteric arteries.

B- VEINS

The veins correspond to the arteries.

The superior pancreaticoduodenal vein drains into the portal vein at the posterior surface of the head of the pancreas.

The inferior pancreaticoduodenal vein at the anterior surface of the head of the pancreas drains into the superior mesenteric vein through the right gastro-epiploic artery. The duodenum is drained, as well, by small veins that flow directly into the portal vein.

C- LYMPH DRAINAGE

The lymph drainage of the duodenum follows the course of the arteries.

The retropancreatic nodes drain the second, third and fourth portions.

The suprapyloric and retropyloric nodes drain the duodenal cap.

These nodes flow into the superior mesenteric and celiac groups of preaortic nodes.

D- NERVES

The parasympathetic supply of the duodenum is held by the posterior vagal trunk and celiac plexus.

The sympathetic supply is ensured by the spinal cord segments T6–10 via splanchnic nerves and the celiac plexus.

VII. CONCLUSION

The duodenum is the initial fixed portion of the small intestine. It is retroperitoneal, intraperitoneal, supracolic and infracolic and, thus, is surrounded by several peritoneal, vascular and visceral relations. It has a rich blood supply that binds it to the pancreas forming a common block. Its lymph drainage is ensured by the preaortic nodes.
