MICROANATOMY OF SMALL INTESTINE

FUNCTIONS

small intestine is the part of the intestines where 90% of the digestion and absorption of food occurs, the other 10% taking place in the stomach and large intestine. The main function of the small intestine is absorption of nutrients and minerals from food. involves two distinct parts. The first is mechanical digestion by chewing, grinding, churning and mixing that takes place in the mouth and the stomach. The second part of digestion is the chemical digestion that uses enzymes, bile acids etc. in order to break down food material into a form that can then be absorbed, then assimilated into the tissues of the body. Chemical digestion occurs in the small intestine (and, to a lesser extent, also in some other part of the gastrointestinal tract.

SEGMENTS

The small intestine is approximately 2.5–3 cm in diameter, and is divided into three sections:

The duodenum is the first section of the small intestine and is the shortest part of the small intestine. It is where most chemical digestion using enzymes takes place.

The jejunum is the middle section of the small intestine. It has a lining which is designed to absorb carbohydrates and proteins. The inner surface of the jejunum, its mucous membrane, is covered in projections called villi, which increase the surface area of tissue available to absorb nutrients from the gut contents. The epithelial cells which line these villi possess even larger numbers of microvilli. The transport of nutrients across epithelial cells through the jejunum includes the passive transport of some carbohydrates and the active transport of amino acids, small peptides, vitamins, and most glucose. The villi in the jejunum are much longer than in the duodenum or ileum.

The ileum is the final section of the small intestine. The function of the ileum is mainly to absorb vitamin B12, bile salts, and any products of digestion that were not absorbed by the jejunum. The wall itself is made up of folds, each of which has many tiny finger-like projections known as villi on its surface. The ileum has an extremely large surface area both for the adsorption of enzyme molecules and for the absorption of products of digestion.

LAYERS

There are four main layers:

Mucosa (Innermost layer) – Contains the epithelium, lamina propria and muscularis mucosae.

Submucosa – Connective tissue layer, which contains blood vessels, lymphatics and the submucosal plexus.

Muscularis externa – Consists of two smooth muscle layers; the outer longitudinal layer and inner circular layer. The myenteric plexus lies between them.

Adventitia (Outermost layer) – Comprised of loosely arranged fibroblasts and collagen, with the

vessels and nerves passing through it. The majority of the small intestine adventitia is covered by mesothelium and is commonly called the serosa.

GENERAL FEATURES

The small intestine is an organ located in the gastrointestinal tract, between the stomach and the large intestine. It is, on average, 23ft long and is comprised of three structural parts; the duodenum, jejunum and ileum.

Functionally, the small intestine is chiefly involved in the digestion and absorption of nutrients. It receives pancreatic secretions and bile through the hepatopancreatic duct which aid with its functions

EPITHELIUM

The mucosa of the small intestine is lined by a simple columnar epithelium which consists primarily of absorptive cells (enterocytes), with scattered goblet cells and occasional enteroendocrine cells. In crypts, the epithelium also includes Paneth cells and stem cells

LARGE INTESTINE

FUNCTIONS

The 4 major functions of the large intestine are:

reabsorption of water and mineral ions such as sodium and chloride

formation and temporary storage of faeces

maintaining a resident population of over 500 species of bacteria

bacterial fermentation of indigestible materials.

SEGMENT

The large intestine is subdivided into four main regions: the cecum, the colon, the rectum, and the anus. The ileocecal valve, located at the opening between the ileum and the large intestine, controls the flow of chyme from the small intestine to the large intestine.

Cecum

The first part of the large intestine is the cecum, a sac-like structure that is suspended inferior to the ileocecal valve. It is about 6 cm (2.4 in) long, receives the contents of the ileum, and continues the absorption of water and salts. The appendix (or vermiform appendix) is a winding tube that attaches to the cecum. Although the 7.6-cm (3-in) long appendix contains lymphoid

tissue, suggesting an immunologic function, this organ is generally considered vestigial. However, at least one recent report postulates a survival advantage conferred by the appendix: In diarrheal illness, the appendix may serve as a bacterial reservoir to repopulate the enteric bacteria for those surviving the initial phases of the illness. Moreover, its twisted anatomy provides a haven for the accumulation and multiplication of enteric bacteria. The mesoappendix, the mesentery of the appendix, tethers it to the mesentery of the ileum.

Colon

The cecum blends seamlessly with the colon. Upon entering the colon, the food residue first travels up the ascending colon on the right side of the abdomen. At the inferior surface of the liver, the colon bends to form the right colic flexure (hepatic flexure) and becomes the transverse colon. The region defined as hindgut begins with the last third of the transverse colon and continues on. Food residue passing through the transverse colon travels across to the left side of the abdomen, where the colon angles sharply immediately inferior to the spleen, at the left colic flexure (splenic flexure). From there, food residue passes through the descending colon, which runs down the left side of the posterior abdominal wall. After entering the pelvis inferiorly, it becomes the s-shaped sigmoid colon, which extends medially to the midline (Figure 4). The ascending and descending colon, and the rectum (discussed next) are located in the retroperitoneum. The transverse and sigmoid colon are tethered to the posterior abdominal wall by the mesocolon.

Rectum

Food residue leaving the sigmoid colon enters the rectum in the pelvis, near the third sacral vertebra. The final 20.3 cm (8 in) of the alimentary canal, the rectum extends anterior to the sacrum and coccyx. Even though rectum is Latin for “straight,” this structure follows the curved contour of the sacrum and has three lateral bends that create a trio of internal transverse folds called the rectal valves. These valves help separate the feces from gas to prevent the simultaneous passage of feces and gas.

Anal Canal

Finally, food residue reaches the last part of the large intestine, the anal canal, which is located in the perineum, completely outside of the abdominopelvic cavity. This 3.8–5 cm (1.5–2 in) long structure opens to the exterior of the body at the anus. The anal canal includes two sphincters. The internal anal sphincter is made of smooth muscle, and its contractions are involuntary. The external anal sphincter is made of skeletal muscle, which is under voluntary control. Except when defecating, both usually remain closed.

LAYERS

The large intestine is composed of 4 parts. It includes the cecum and ascending colon, transverse colon, descending colon, and sigmoid colon. The large intestine performs an essential role by absorbing water, vitamins, and electrolytes from waste material

GENERAL FEATURES

In an average adult, the large intestine is about 1.5m long and 5cm wide. It consists of the caecumappendixcolon and rectum

EPITHELIAL

The epithelium is formed of columnar absorptive cells with a striated border, many goblet cells, endocrine cells and basal stem cells, but no Paneth cells. The surface epithelial cells are sloughed into the lumen, and have to be replaced around every 6 days.