NAME: EMMANUEL COLLINS DANIEL **MAT NO:** 18/MHS/01/121
DEPARTMENT: ANATOMY **COURSE:** HISTOLOGY OF THE SYSTEMS

COURSE CODE: ANA 204

Q: Describe the microanatomy *of small and large intestine. Note: you are expected* ***to state the functions, segment, layers, general features and epithelium*** *of each part of the small and large intestine.*

A:

SMALL INTESTINE

It is the longest component of the digestive tract and consists **of three segments**

- Duodenum
- Jejunum
- Ileum

A)Duodenum (25cm long)- is the first, shortest, and widest part of the small intestine. It begins at the pylorus of the stomach and ends at the duodenojejunal junction.

Function

1. Neutralization of the acidic gastric juice
2. Mechanical digestion of chime
3. mixing of bile and pancreatic enzymes
4. Absorption of water, electrolytes and nutrients

Layers

The mucosa consists of **simple columnar epithelium** (lamina epithelialis), a connective tissue layer (lamina propria) and a smooth muscle layer (lamina muscularis). The intestinal epithelial cells (enterocytes) are overlaid by a layer of glycoproteins and mucin.

The submucosa comprises loose connective tissue, numerous blood vessels and the Meissner's plexus.

The muscularis consists of an inner circular and an outer longitudinal musculature between which the Auerbach's plexus lies. Serosa covers part of the duodenum.

Features

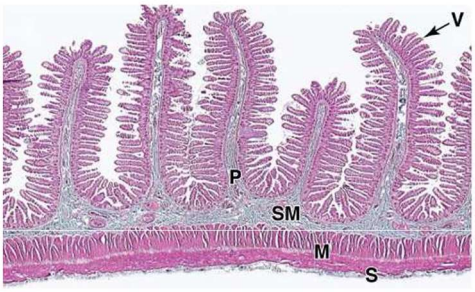
General feature- Brunner's glands-These produce amongst others mucous secret containing bicarbonate which serves to neutralize the gastric acid

Typical for all sections of the small intestines are microvilli (hairlike structures projecting from the surface), finger-shaped villi and circular folds of the mucosa and submucosa (valves of Kerckring). These structures increase the absorption area of the duodenum up to 1500 times.

The duodenum is rich of absorbing enterocytes, mucus producing goblet cells and peptide hormone producing endocrine cells. Furthermore, crypts of Lieberkuhn lie between the villi.

Paneth cells are located in the basal portion of the intestinal crypts below the stem cells. They are exocrine cells with large, eosinophilic secretory granules in their apical cytoplasm. Paneth cells have an important role in innate immunity and in regulating the microenvironment of the intestinal crypt (regulation of normal bacterial flora of the small intestine)

B) Jejunum- (2.5 m long) begins at the duodenojejunal junction and constitutes the upper two fifths of the small intestine. small intestine. It gradually changes its morphologic characteristics to become the ileum



•The mucosa and submucosa (SM) of the small intestine form distinct **projecting folds called plicae (P),** which encircle or spiral around the inner circumference and are best developed in the jejunum.
• On each fold the mucosa forms a dense covering of projecting structures called villi (V).

Plicae ciculares (folds) of the jejunum

Functions

The main tasks of the jejunum are:

1. cleavage of nutrients (e.g. by amylase, proteinase)
2. absorption of lipophilic nutrients (proteins, fats, cholesterol and the fat-soluble vitamins A, D, E and K)
3. absorption of water (about 90% of the secreted water, 6 to 8 liters/day). This induces an osmotic gradient leading to a paracellular transport of electrolytes, carbohydrates and amino acids.

Layers

The mucosa is lined by simple columnar epithelium towards the lumen (lamina epithelialis). It contains enterocytes and goblet cells. Characteristic features are the crypts of Lieberkuhn and finger-like villi protruding in the intestinal lumen. Similar to the duodenum paneth cells are found deep in the crypts. projecting folds called plicae(P), which encircle or spiral around the inner circumference and are best developed in the jejunum and are found in the mucosa and submucosa

The epithelial layer is followed by a connective tissue layer (lamina propria) and a muscle layer (lamina muscularis mucosae) which is composed of an inner circular and an outer longitudinal layer of smooth muscle

The submucosa consists of loose connective tissue with blood vessels, lymph nodes and the Meissner's plexus.

As usual, the muscularis has an inner circular and outer longitudinal layer of smooth musculature between which the Auerbach's plexus lies.

The entire jejunum is covered by serosa from the outside which consists of simple squamous epithelium and a connective tissue layer underneath (lamina propria serosae).

the jejunum differentiates from the rest of the small intestine by the absence of Brunner's glands (duodenum) and Peyer's patch (ileum) however single lymphoid follicles are present

C)Ileum

Ileum (3.5 m long) is a continuation of the jejunum and constitutes the lower three fifths of the small intestine. It ends at the ileocecal junction, the union of the distal ileum and cecum

Functions

The main tasks of the ileum are:

1. enzymatic cleavage of nutrients absorption of vitamin B12 (with intrinsic factor from the stomach), fats (especially fatty acids and glycerol) and bile salts
2. Mesentery Explore study unit
3. Ileum Explore study unit
4. immunological function (access and transfer of antigens)

Layers

The mucosa is lined by **simple columnar epithelium** (lamina epithelialis) comprising enterocytes and goblet cells. Underneath lies a connective tissue layer (lamina propria) and a muscle layer (lamina muscularis mucosae). Compared to the rest of the small intestine the circular folds are rather flat and the villi relatively short.

The submucosa contains blood vessels, lymph nodes and the Meissner's plexus.

The muscularis consists of an inner circular and outer longitudinal muscle layer. The ileum is entirely covered by serosa from the outside. It is made up of simple squamous epithelium and a connective tissue layer underneath (lamina propria serosae).

Features

A characteristic feature of the ileum is the **Peyer's patches** lying in the mucosa. It is an important part of the GALT (gutassociated lymphoid tissue). One patch is around 2 to 5 centimeters long and consists of about 300 aggregated lymphoid follicles and the parafollicular lymphoid tissue. The dome-like bulge above one follicle is called dome area. M cells (microfold cells) are found in the dome epithelium which are counted among the FAE

cells (follicle-associated epithelial cells). Their function is to pick up antigens from the intestinal lumen and transport them to the antigen-presenting cells (APC).

LARGE INTESTINE

The large intestine comprises the cecum with its projecting vermiform appendix, the colon, the rectum, and the anal canal

The colon is further divide into

•ascending colon

•transverse colon

•descending colon

•sigmoid colon

General Function.

1. It helps in reabsorption of electrolytes and water and elimination of undigested food and waste.
2. It houses bacteria that produce vitamin B12 and vitamin K; the former is necessary for hemopoiesis and the latter for coagulation
3. Produces abundant mucus, which lubricates its lining and facilitates the passage and elimination of feces
4. It contains some digestive enzymes received from the small intestine

Cecum and colon - The microscopic structure of the cecum is equal to that of the colon

Function

Cecum The main tasks of the cecum are the absorption of water and salts and the lubrication of the feces with mucus. Especially components from plant-rich food (e.g. cellulose) are bacterially decomposed here

Layers

a. The mucosa of the cecum and colon lacks villi and possesses no specialized folds.
   •The epithelium of the mucosa of the cecum and colon is **simple columnar** with numerous goblet cells, surface absorptive cells, and occasional DNES cells. The lamina propria is similar to that of the small intestine, possessing lymphoid nodules, blood and lymph vessels, and possessing lymphoid nodules, blood and lymph vessels, and closely packed crypts of Lieberkühn, which lack Paneth cells.
   •The muscularis mucosae consists of an inner circular and outer longitudinal layer of smooth muscle cells.

b. The submucosa of the cecum and colon is composed of fibro elastic connective tissue.
   •It contains blood and lymphatic vessels, nerves, and Meissner (submucosal) plexus.

c. The muscularis externa is composed of an inner circular and a modified outer longitudinal layer of smooth muscle. •The outer layer is gathered into three flat, longitudinal ribbons of smooth muscle that form the teniaecoli. •When continuously contracted, the teniaecoli form sacculations of the wall known as haustracoli. Auerbach (myenteric) plexus is housed between the two layers of smooth muscle d. External layer of the cecum and colon

d. External layer of the cecum and colon

•Adventitia covers the ascending and descending portions of the colon.
•Serosa covers the cecum and the remainder of the colon.
•Fat-filled outpocketings of the serosa(appendices epiploicae) are characteristic of the transverse and sigmoid colon.

Rectum (12 cm Long)

The rectum is similar to the colon but contains fewer and deeper crypts of Lieberkühn.

Function

The rectum is the last stop before the feces is eliminated through the anal canal. Similar to the colon electrolytes are absorbed (sodium, potassium, chloride) and indigestible food ingredients are decomposed by anaerobic bacteria. The stool is thickened through water absorption and mixed with mucus.

Layers

The mucosa has the typical intestinal epithelium with simple columnar enterocytes and numerous goblet cells. At the anal transitional zone the columnar epithelium flattens more and more and eventually becomes stratified squamous non-keratinized epithelium. The epithelial layer is followed by the connective tissue layer (lamina propria) with blood and lymph vessels and a muscle layer (lamina muscularis mucosae).

The submucosa contains loose connective tissue with blood vessels, lymph follicles and the Meissner's plexus. It has a dense network of veins (rectal venous plexus) and is thickened at the transverse folds. The muscularis has the typical inner circular and outer longitudinal musculature between which the Auerbach's plexus lies. The ring musculature continues as the sphincter ani externus muscle within the sphincter system whereas the outer longitudinal musculature continues as the corrugator cutis ani muscle inserting at the skin around the anus

Anal Canal

The anal canal is the constricted continuation of the rectum.

Functions

Anal cushions play an important role in fine control, for smooth passage of stool.

a. The anal mucosa displays longitudinal folds called anal columns (or rectal columns of Morgagni), which join each other to form anal valves.

The regions between adjacent valves are known as anal sinuses.

(1) Epithelium of the anal canal

(a) is simple columnar changing to simple cuboidal proximal to the anal valves. anal valves.

(b) is stratified squamous non keratinized distal to the anal valves.

(c) changes to stratified squamous keratinized (epidermis) at the anus.

(2) The lamina propriais composed of fibro elastic connective tissue and contains sebaceous glands, circumanal glands, hair follicles, and large veins.

(3)The muscularis mucosae consists of an inner circular and an outer longitudinal layer of smooth muscle, both of which terminate at the anal valves. The anal submucosais composed of dense, irregular fibroelastic connective tissue that houses large veins. The anal muscularis externais composed of an inner circular and an outer longitudinal layer of smooth muscle. The inner circular layer forms the internal anal sphincter. Anal adventitia attaches the anus to surrounding structures. •The external anal sphincter is composed of skeletal muscle The external anal sphincter is composed of skeletal muscle whose superficial and deep layers invest the anal canal. It exhibits continuous tonus, thus maintaining a closed anal orifice. •The degree of tonus is under voluntary control, so the retention or evacuation of feces normally can be controlled at will.

Appendix

Feature

Histologically the appendix looks quite similar to the colon and cecum. A distinctive feature is however the numerous lymph follicles and the parafollicular tissue in the connective tissue layer of the mucosa (lamina propriae mucosae) and the submucosa. The crypts are particularly deep so that the follicles are in close contact to the intestinal lumen. M-cells (microfold cells) are found in the epithelium which access antigens from the intestinal lumen. As the appendix lacks taeniae it has a regular outer longitudinal musculature.