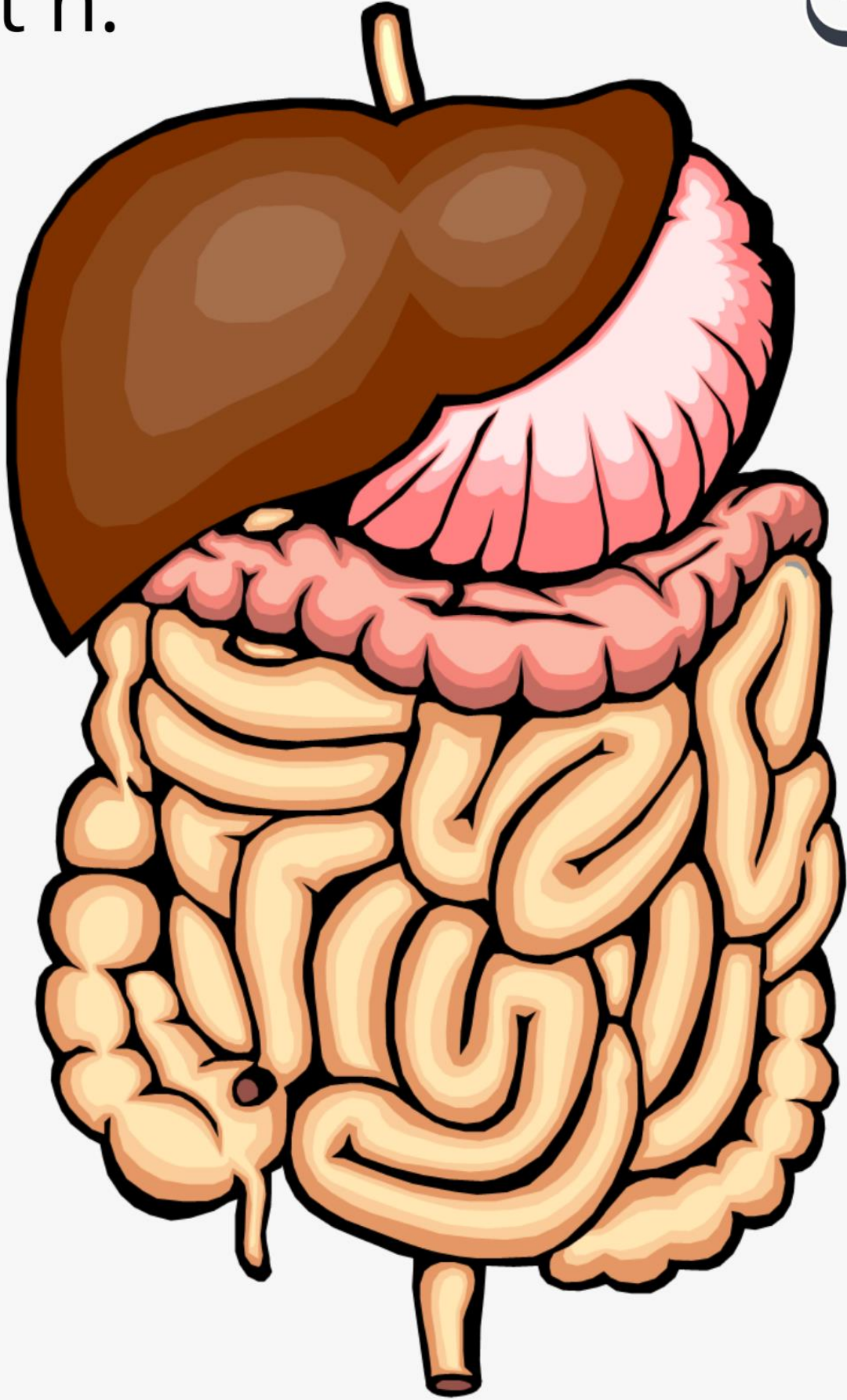


Physiology

Sheet n.



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Corrector:

Gastrointestinal Motilities

Slides and hand out
Doctor
important

In the previous lecture we have talked about gastric activities, we have receptive relaxation in addition we have peristaltic contraction which having effect over chyme, also we have longer contraction.

The gastric activity mainly the peristaltic are controlled once you are in gastric phase; in that phase we increase that chemicals in the stomach by either enteric or autonomic nervous system.

The bulk during gastric phase is gastrulation but in intestinal phase there is inhibition of gastric activity beside that we have some hormones acting remember that hormones are the main controller for the movement.

During intestinal phase we have release of CCK and secretin and GIP that can inhibit gastric activity.

MOTILITY IN SMALL INTESTINE

- Site of most digestion and absorption: duodenum and jejunum

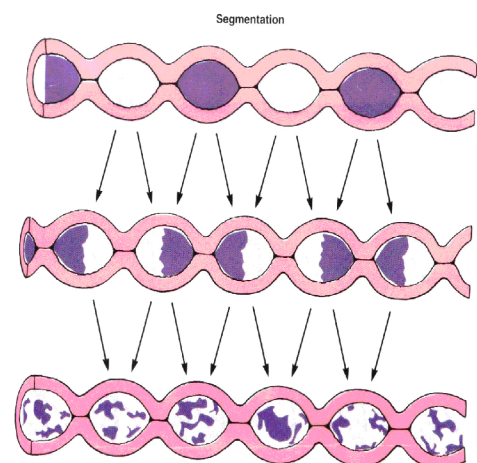
- Types of movement:

- **Segmentation** (mixing) - digestive State

- **Peristalsis** (propulsive)-inter-digestive

- **Migrating** motor complex

- **Peristaltic rush** (power propulsion)



Acetate 153 (Fig. 16-22)

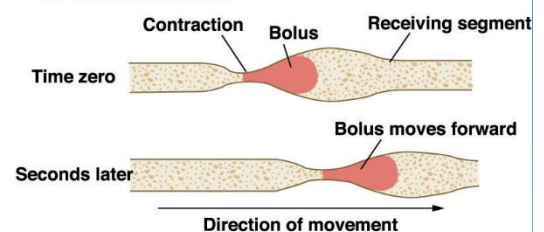
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MIXING MOVEMENTS:

- The mixing of food with secretions in the GI tract is provided by the activity of circular smooth muscle cells (remember this appearance isn't established). The contractions that appear along the intestine which are inter-spaced by the relaxation of adjacent smooth muscle cells up and down to the contracted segment cause spaced segmentations of the intestine which are known as segmentation contractions.

- So, there will be contraction then relaxation and so on.

Peristaltic contractions are responsible for forward movement



- The rate of contractile activity is determined by the rate of slow waves (the electrical activity of smooth muscle cells or BER) in that segment of the intestine. The maximum frequency of contractions is about 12/minute in the upper part of intestine (duodenum and jejunum) and 8/minute in the terminal ileum (the same as the rate of slow waves or Basic Electrical Rhythm (BER)).
- Although these types of contraction have mainly mixing effect on chyme, they also have some propulsive effects which cause movement in analward direction.

PERISTALTIC CONTRACTION

There are two components of peristaltic contraction (contraction up ,relaxation down)

PROPULSIVE MOVEMENTS

- Movements of food along the GI tube are caused by peristaltic contractions that appear at the GI tract. These contractions are described as a contractile ring of the circular muscle layer up to the distension and relaxation down to the distension of segment, which move forward along the GI tract. Other component of the contraction is rhythmic shortening of longitudinal layer. The peristalsis can be initiated usually by local reflexes caused by distention of the gut which induce contractile ring 2-3 cm above the distended part and relaxation of the part of the GI tube down to the distention which is called **receptive relaxation**.
- These changes that appear in the motor activity of the smooth muscle cells of the GI describe complex patterns of activities that are known as peristaltic reflex. After the initiation of this reflex by the formation of the contractile ring and the distention of the segment down to stimulated part of the intestine and shortening and elongation of longitudinal layer results in chyme movements downward along the GI (in analward direction). These changes with the peristaltic wave and including the analward movement of peristalsis are known as the "**law of the gut**", this is called Propulsive effect.
- Every minute the chyme moves about 1 cm
- Although, the main effect of this type of contraction is to propel chyme in caudal direction, they also have some effects on mixing food and spreading chyme along the intestine which help in the absorption of food.
- Rhythmic contractions of longitudinal layer are controlled by electrical activities of smooth muscle cells.

MIGRATING MOTOR COMPLEX (MMC):

- Cycle of **quiescence** and **intense motor activity** that begins in antrum and continues along the small intestine.
- **Function:** Sweeps the stomach and intestine between meals.
- MMC is other type of motor activity that begins in the stomach in the inter-digestive periods(**between digestion**). The activity begins in the distal part of the **stomach** as a constricted ring traveling along the whole small intestine from the **stomach until the ileocecal part** and **continues along the entire small intestine**. The contractions that forming MMC appear in 3 phases:
- **In the first phase: slow waves (as electrical activity) without contraction are present.**
- **In the second phase: not all slow waves are followed by contractions (one slow wave is followed by contraction and 1-5 slow waves are not followed).**
- **In the third phase lasts for 5-15 minutes all slow waves are followed by contractions.**
- The function of these contractions is to sweep the intestinal content in the time between meals.
- These movements are controlled by hormonal (**Motilin is believed to be involved**) and neural mechanisms.

PERISTALTIC RUSH:

- Can take place if a pathogen or toxins invades the small intestine, this cause the irritation of the mucosa which will lead to powerful peristaltic contraction (peristaltic rush) and transit time (the time needed to reach from point A to point B) become shorter causing low level of absorption and this will result in emptying the content of the intestine with high amount of fluid, this finally lead to watery diarrhea (because of absorption of water and electrolytes).
- The body tries to protect itself by a protective mechanism against toxins and pathogens, so when a patient Came to you with diarrhea don't immediately give him anti-diarrheal drugs instead give him only fluid for replacement.

MOVEMENTS CAUSED BY THE ACTIVITY OF MUSCULARIS MUCOSA:

- In addition, there is movement of mucosa(at the base there is muscularis mucosa so there is shortening and elongation)
- **The activity of muscularis mucosa is responsible for the shortening and elongating mucosal folds. This activity helps more in the absorptive process by intestinal mucosa.**

- The contractions caused by muscularis mucosa are also affected by the activity of enteric nervous system.
- Powerful and rapid peristalses that occur along small intestine caused by mucosal irritation and/or intestinal distension.
- Remove harmful agents
- Movements caused by the activity of muscularis mucosa: Spreading chyme over the mucosa

CONTROL OF INTESTINAL MOVEMENT

- Main control for movement: Electrical activity of muscle & Neural control: ENS, ANS
- Other effectors (not main control): Hormonal control & **Gastrin, CCK, Serotonin** enhance intestinal motility
- **Secretin** and **Glucagon** inhibit intestinal motility.

SUMMARY OF MOTILITIES OF SMALL INTESTINE

- **Segmentation contraction**: characterize the digestive or fed state and have mixing effects
- **Peristaltic contractions**: mainly Propulsive effect
- **Migrating motor complex** characterizes the inter-digestive state, ended with ingestion of food
- **Peristaltic rush** is a response to harmful agents

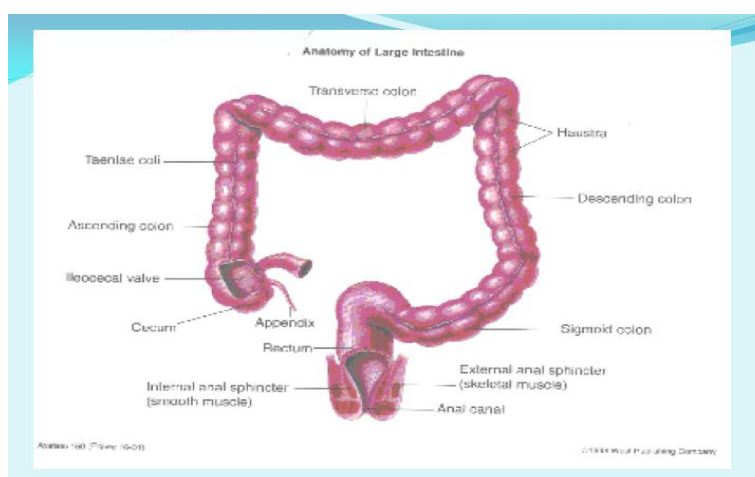
MOVEMENTS OF THE COLON:

- Haustration contractions: effect (propulsive).
- The appearance is similar with segmentation contractions of the small intestine. The activity is represented as rhythmic contraction and relaxation of circular layer of colonic smooth muscle cells at a length of about 2.5cm. Each contraction lasts for 30-60 sec.
- In addition to the activity of circular layer, at the colon the longitudinal layer of muscles is grouped together to form three strips along the colon, forming what we call **taeniae coli** also involved to cause haustral appearance in the colon.

- The role of these contractions is helping in absorption of water and electrolytes by spreading the colonic content over the mucosa. In addition, these contractions have also propulsive effect. Although, they have **slow** effect on the content of cecum and ascending colon, they are **the main responsible** in moving fecal materials into the transverse colon.
- Due to slow contraction, it needs about 9 hours to move the fecal material from cecum to the transverse colon.
- This type of contraction happens all day, with different intensities and keep switching between relaxation and contraction.

PROPULSIVE MOVEMENTS (MASS CONTRACTIONS): EFFECT (PROPULSIVE).

- Are series of contractions that appear 1-3 times/day and last each time about 10-30minutes. These contractions appear mainly in the first hour after breakfast. They are the **main responsible** in moving fecal materials from the beginning of transverse colon to the sigmoid.
- Mass contractions are described as constrictive rings that usually begin at the transverse colon followed by the contraction of about 20cm or more of the colon distal to the constrictive ring. Each contraction lasts for 30 sec, then, followed by 2-3 minutes relaxation and then another contraction wave begins.
- Mass contractions are facilitated by **gastrocolic and duodenocolic** reflexes. These reflexes are conducted through the autonomic nervous system.
- These contractions can also be initiated by the irritation of the colon. As example, in ulcerative colitis that results in mucosal irritation, causes an increase in mass movements of the colon.
- The effect of these contractions: feces will be forced to move into the rectum which may result in the initiation of defecation reflex.



DEFECATION:

A process that involves the discharge of feces from the body. As we know, we have two types of movements in colon:

Mass contraction and Haustration contraction

After multiple mass contractions, the feces now reach the sigmoid part of large intestine, and here there are two different types of reflexes preceding defecation process:

1-INTRINSIC REFLEXES (INTRINSIC MYENTERIC REFLEX)

- in which, distention of the rectum initiates signals through myenteric plexus (ENS) to cause more contractions in descendent colon, sigmoid and rectum. This will force feces to move toward the anus. This reflex is weak and will **not cause** defecation.

2-EXTRINSIC REFLEXES

(Parasympathetic defecation reflex): distension of rectum and sigmoid will result in:

- Increased parasympathetic signals which fortify(increase) contractions that appear in the descendent colon, sigmoid and rectum.
- Signals to the internal sphincter to cause relaxation.

Note: all these reflexes are involuntary.

- After all these reflexes, the defecation in normal people occurs only as a voluntary act by relaxing external sphincter (which is under voluntary control) and increasing abdominal pressure by closure of glottis and contractions of the abdominal wall which cause the pelvic floor to be pulled downward on the anal ring and relax to evacuate feces.

