

Lecture series

Gastrointestinal tract



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GASTROINTESTINAL MOTILITY- II

MOVEMENT OF SMALL INTESTINE

- TYPES OF MOVEMENT
- 1) MIXING / SEGMENTATION CONTRACTIONS
- 2) PROPULSIVE CONTRACTIONS

- However both the contraction occurs simultaneously in small intestine

Small Intestine

(mixing/segmentation)

- Mixing movements – segmentation – also helps propulsion
- Propulsive – peristaltic - velocity of **0.5 to 2.0 cm/sec**,
- faster in the proximal intestine and slower in the terminal intestine - very weak and usually die out after traveling only **3 to 5 cm**
- Net movement 1 cm/min - **3 to 5 hours** are required for passage of chyme from the pylorus to the ileocecal valve



Regularly spaced



Isolated



Irregularly spaced



Weak regularly spaced

Segmentation movements of the small intestine.

Small Intestine

- Peristaltic activity of the small intestine is greatly **increased after a meal** - by the beginning entry of chyme into the duodenum causing stretch of the duodenal wall
- *gastroenteric reflex* that is initiated by distention of the stomach and conducted principally through the **myenteric plexus** from the stomach down along the wall of the small intestine.
- gastrin, CCK, insulin, motilin, and serotonin, all of which **enhance** intestinal motility
- secretin and glucagon **inhibit** small intestinal motility

Small Intestine

- The function of the peristaltic waves in the small intestine is not only to cause progression of chyme toward the ileocecal valve but also to spread out the chyme along the intestinal mucosa
- On reaching the **ileocecal valve**, the chyme is sometimes blocked for several hours until the person eats another meal;
- *gastroileal reflex* intensifies peristalsis in the ileum and forces the remaining chyme through the ileocecal valve into the cecum of the large intestine

Small Intestine

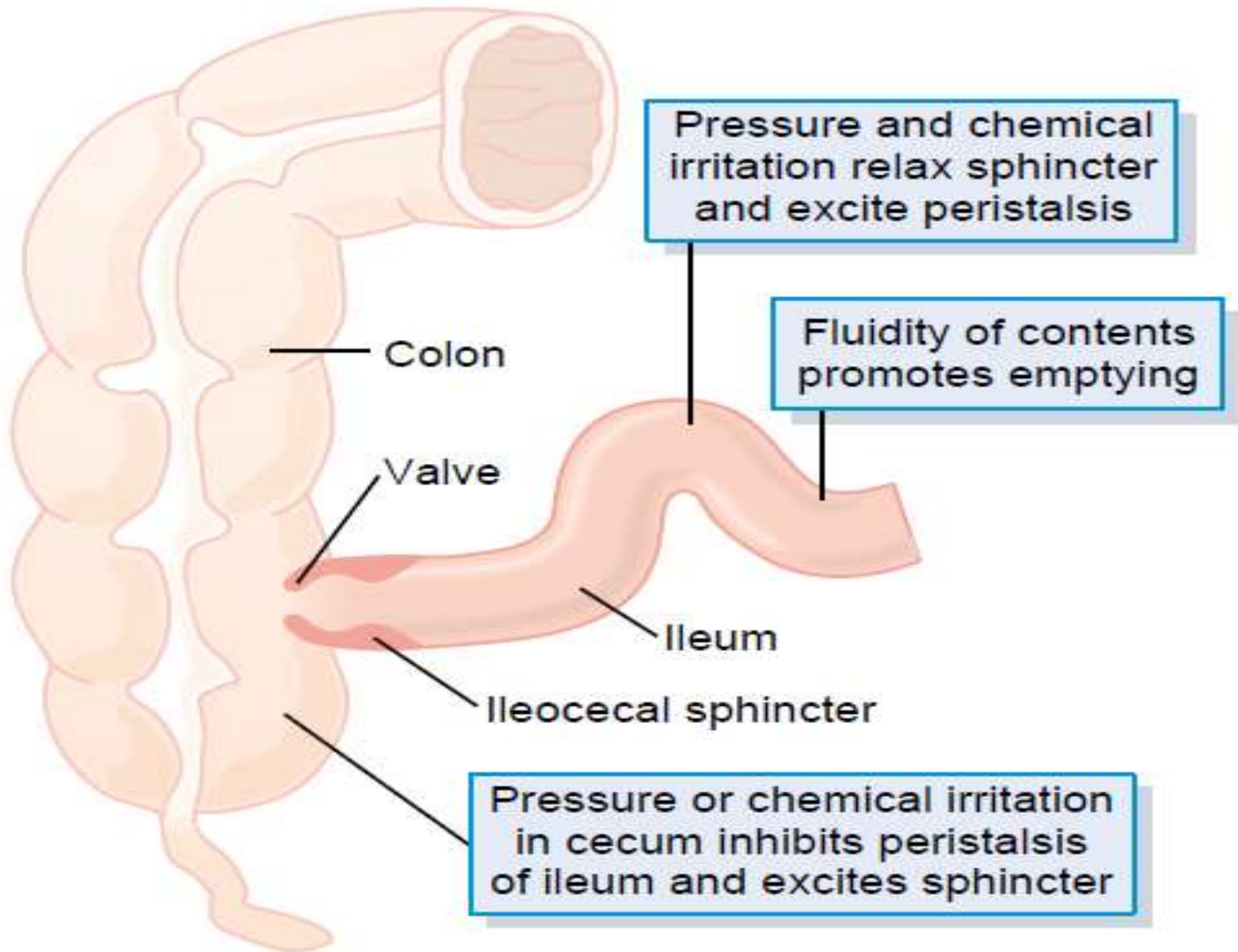
- Although peristalsis in the small intestine is normally **weak**, intense irritation of the intestinal mucosa, as occurs in some severe cases of infectious diarrhea, can cause both ***powerful and rapid peristalsis***, called the ***peristaltic rush***
- nervous reflexes that involve the **ANS and brain stem** and partly by **intrinsic enhancement of the myenteric plexus** reflexes
- The powerful peristaltic contractions **travel long distances** in the small intestine **within minutes**, sweeping the contents of the intestine into the colon relieve the small intestine of irritative chyme and excessive distention

Ileocecal Valve

- **prevent backflow of fecal contents** from the colon into the small intestine
- the ileocecal valve **protrudes into the lumen of the cecum** and therefore is forcefully closed when excess pressure builds up in the cecum
- thickened circular muscle - the **ileocecal sphincter** remains **mildly constricted** and slows emptying of ileal contents into the cecum - immediately after a meal, a **gastroileal reflex** intensifies peristalsis in the ileum

Ileocecal Valve

- Resistance to emptying at the ileocecal valve **prolongs the stay of chyme in the ileum** and thereby facilitates absorption.
- Normally, only **1500 to 2000 milliliters** of chyme empty into the cecum each day
- When the **cecum is distended**, contraction of the ileocecal sphincter becomes intensified and ileal peristalsis is inhibited
- When a person has an ***inflamed appendix***, the irritation of this vestigial remnant of the cecum can cause such intense spasm of **the ileocecal sphincter** and partial paralysis of **the ileum**

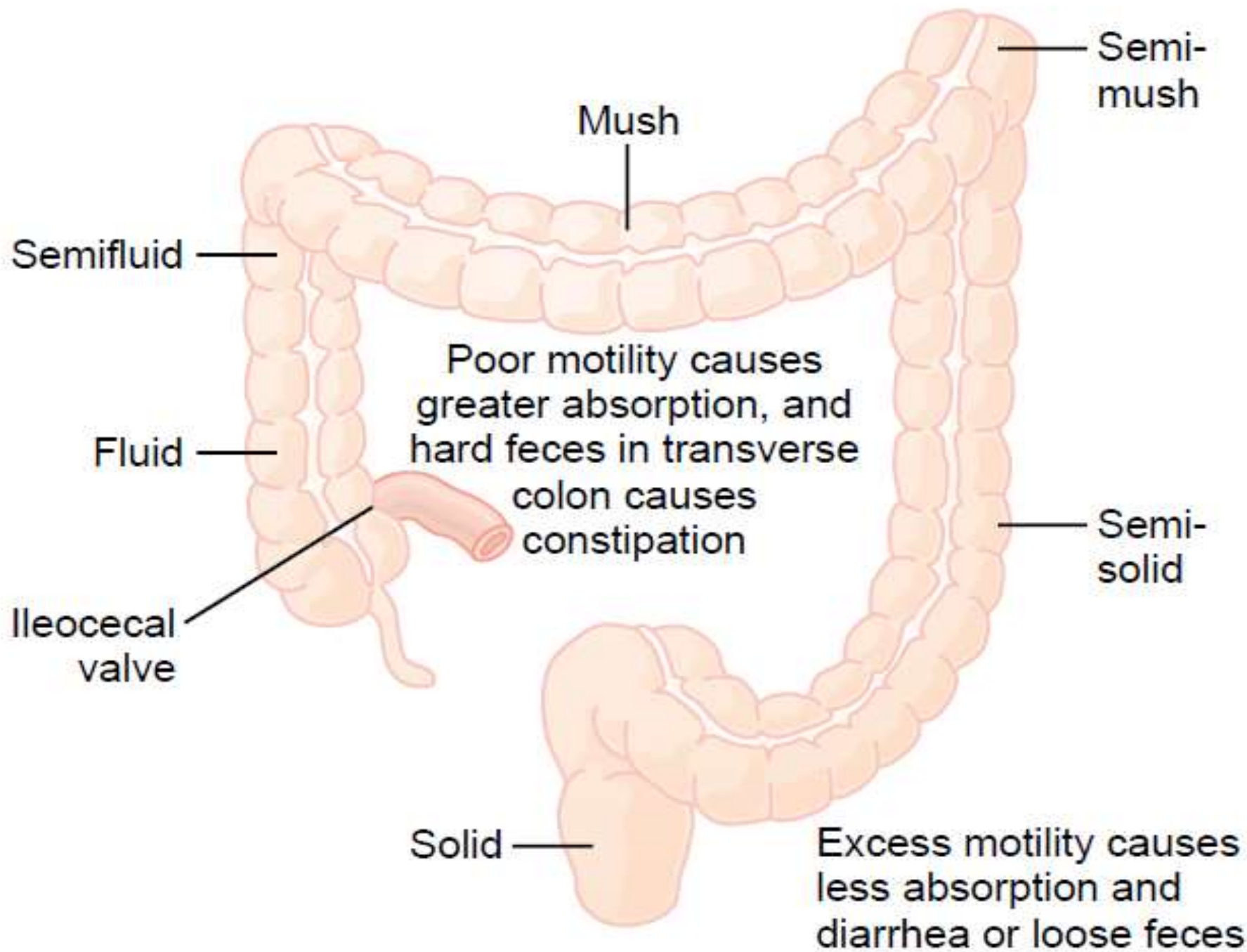


COLON

(1) Absorption of water and electrolytes from the chyme to form solid feces

(2) storage of fecal matter until it can be expelled.

- The **proximal half** of the colon is concerned principally with absorption and the **distal half** with storage.
- Because intense colon wall movements are not required for these functions, the movements of the colon are normally **very sluggish**.



Defecation

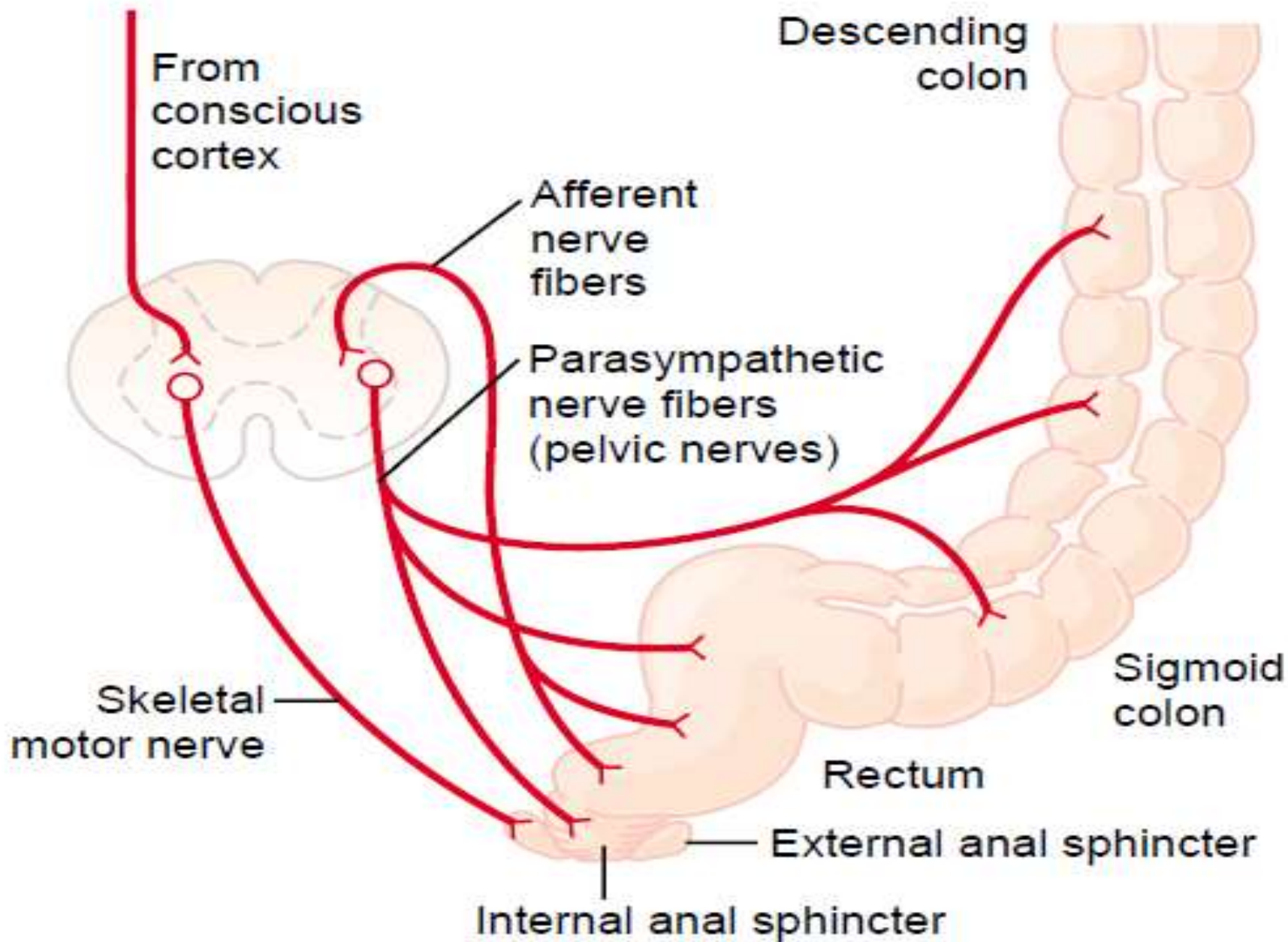
- Most of the time, the **rectum is empty of feces** - weak functional sphincter exists about 20 centimeters from the anus at the junction between the sigmoid colon and the rectum.
- There is also a **sharp angulation** here that contributes additional resistance to filling of the rectum.
- When a mass movement forces feces into the rectum, the **desire for defecation** occurs immediately, including reflex contraction of the *rectum* and relaxation of the *anal sphincters*.
- Internal & External (Voluntary, striated, pudendal nerve) sphincters

Mixing Movements of colon — Haustrations

- **large circular constrictions** occur in the large intestine. At each of these constrictions, about 2.5 centimeters of the **circular muscle contracts**
- the **longitudinal muscle** of the colon, which is aggregated into three longitudinal strips called the teniae coli, contracts
- These **combined contractions** of the circular and longitudinal strips of muscle cause the unstimulated portion of the large intestine to bulge outward into bag like sacs called **haustrations**.

Defecation Reflexes

- When feces enter the rectum, **distention of the rectal wall initiates afferent signals** that spread through the myenteric plexus to initiate peristaltic waves in the descending colon, sigmoid, and rectum, forcing feces toward the anus
- As the peristaltic wave approaches the anus, the **internal anal sphincter is relaxed** by inhibitory signals from the myenteric plexus;
- if the **external anal sphincter is also consciously, voluntarily relaxed** at the same time, defecation occurs
- *Parasympathetic defecation reflex* that involves the sacral segments of the spinal cord – pelvic nerves – **enhance intrinsic myenteric reflex**



APPLIED

GASTRIC OBSTRUCTION

- Obstruction can occur in any part of the gut

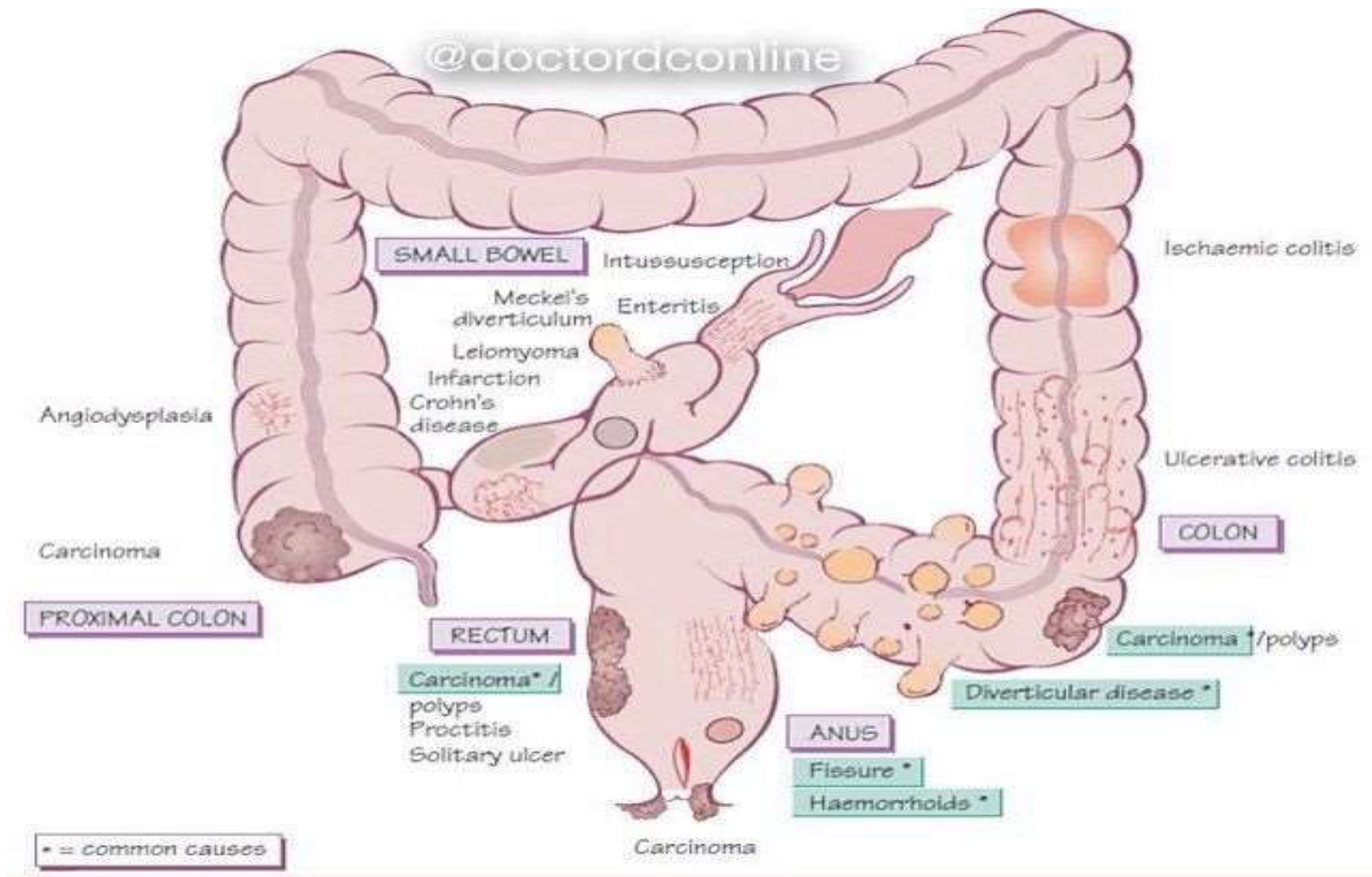
Causes:

- Spasm of a segment of gut
- Paralysis of segment of gut
- Peritoneal adhesion
- Fibrotic constriction from ulcer
- Cancer

SITE OF OBSTRUCTION

- At pylorus--persistent vomiting of stomach content result in loss of excessive hydrogen ion causing metabolic alkalosis
- At small intestinal --vomitus contain large amount of water and electrolyte resulting in severe dehydration.
- At distal end of large intestine--constipation ,rupture of intestine, circulatory shock resulting from severe vomiting.

SITE OF OBSTRUCTION IN LARGE INTESTINE



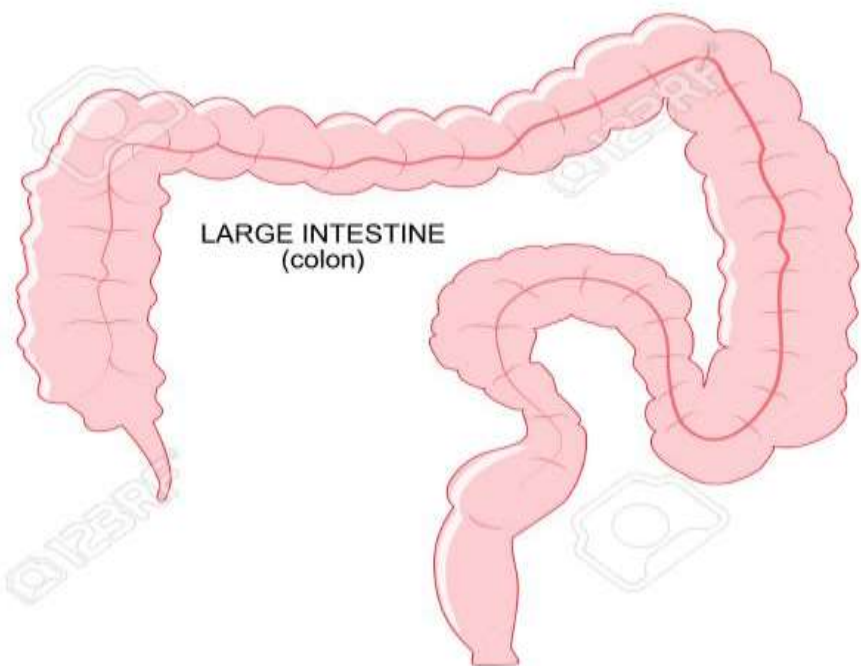
VOLVULUS

- It is an obstruction caused by twisting or knotting of the GIT.
- Most common site is sigmoid colon

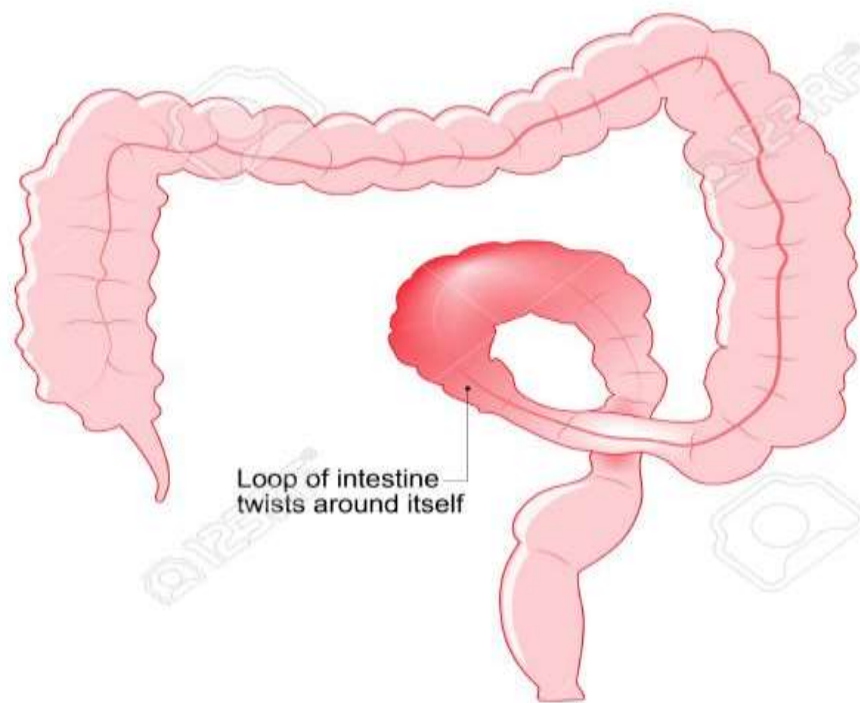
Causes- abdominal adhesion after surgery/injury
-disease of LI such as Hirschsprung disease

Treatment-colonoscopy in mild cases
- surgery in severe cases

VOLVULUS



NORMAL



VOLVULUS

DIARRHEA

- Diarrhea is the frequent and profuse discharge of intestinal contents in loose & fluid form.
- It occurs due to the increased movement of intestine

Cause :-

- Dietary abuse
- Infection
- Intestinal disease

Types of diarrhea

1-ACUTE

2-CHRONIC

- Acute diarrhea lasts for around 1-2 days. It is mostly due to viral/bacterial infection
- Also known as travellers diarrhea
- Chronic diarrhea lasts for around at least 4 weeks. It usually results due to intestinal disease or disorder such as celiac or Crohn's disease

Symptoms of diarrhea

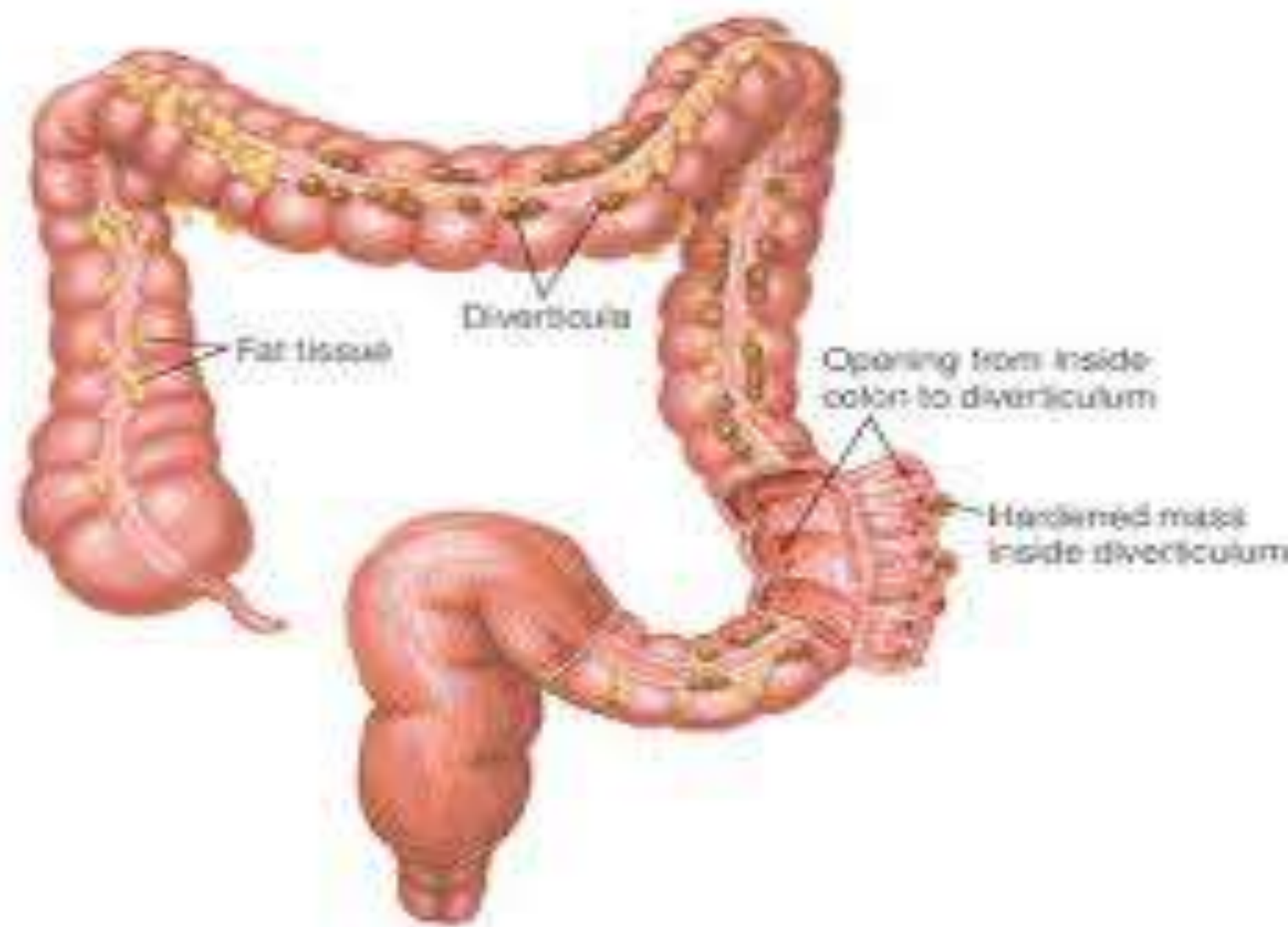
- Nausea, abdominal pain, cramping, bloating
- Dehydration, fever, bloody stools
- Fatigue, increase thirst, decrease urination

Treatment:

- Proper hygiene of hands
- Well cooked food in hygienic condition
- Avoid frozen food
- ORS
- Antibiotics if needed

DIVERTICULOSIS

- It is the condition of having diverticula in the colon, which are out pocketings of the colonic mucosa and submucosa through weaknesses of muscle layers in the colon wall.
- These are more common in the sigmoid colon, which is a common place for increased pressure.
- This is uncommon before the age of 40, and increases in incidence after that age

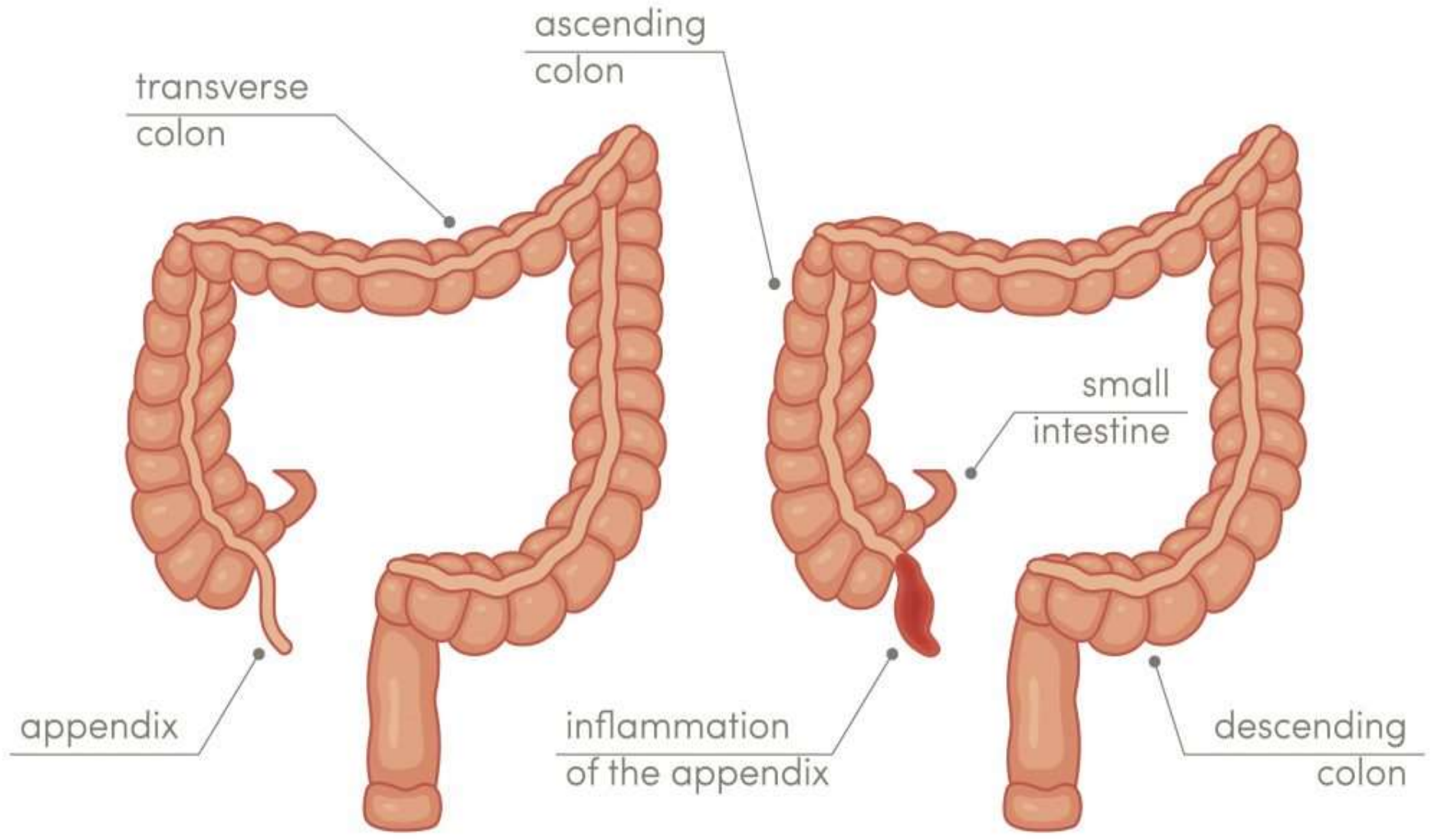


APPENDICITIS

- Inflammation of appendix is known as appendicitis.
- Appendix does not have any function in human being.
- But it can create major problem when diseased.
- Appendicitis can develop at any age.
- It is very common between 10 and 30 years of age.

healthy intestine

inflammation of the appendix



PARALYTIC ILEUS

- It is due to the paralysis of the intestinal muscles
- It is also known as pseudo-obstruction & is one of the major cause of intestinal obstruction in infant and children

CAUSES-

- Gastroenteritis
- Electrolyte imbalance mainly k+
- Abdominal surgery
 - Decrease blood supply to gut
 - Drugs like narcotics
- Adhension,gallstone,hernia,impacted stool,tumor

TUBERCULOSIS OF INTESTINE

- It is infection of the peritoneum, hollow or solid abdominal organs, & abdominal lymphatics with mycobacterium

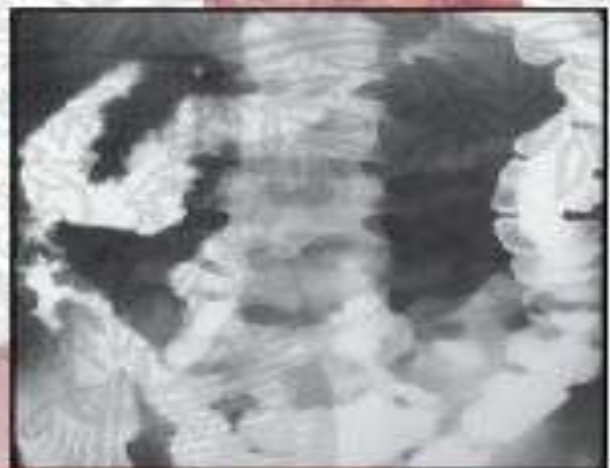
Signs & Symptoms

- abdominal pain
- weight loss
- fever
- anorexia
- change in bowel habits
- nausea, vomiting

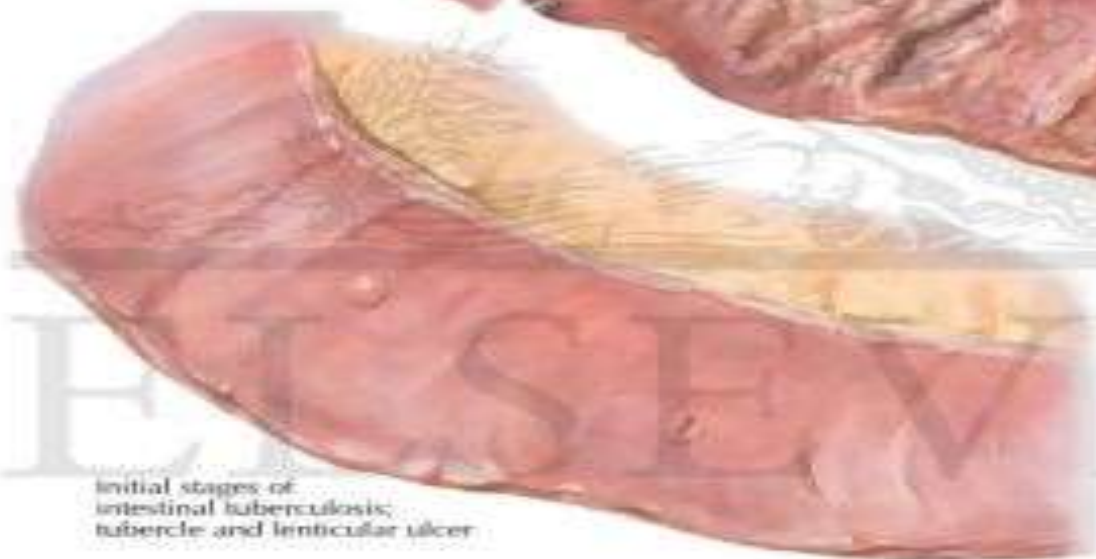
Tuberculosis of ileum and colon



Tuberculosis ulcers in rectum (sigmoidoscopic view)



Initial stages of intestinal tuberculosis; tubercle and lenticular ulcer



Handwritten signature

Pathophysiology

- Tubercle bacilli enters git through ingestion of infected milk or sputum.
- Mucosal layer gets infected and form epitheloid tubercles in the lymphoid tissue of the submucosa

Complications-bowel rupture

Treatment-ATT drugs

INTUSSUSCEPTION

- It is a form of bowel obstruction in which one segment of intestine telescopes inside of another.
- It usually occur at junction of small & large intestine

Causes-

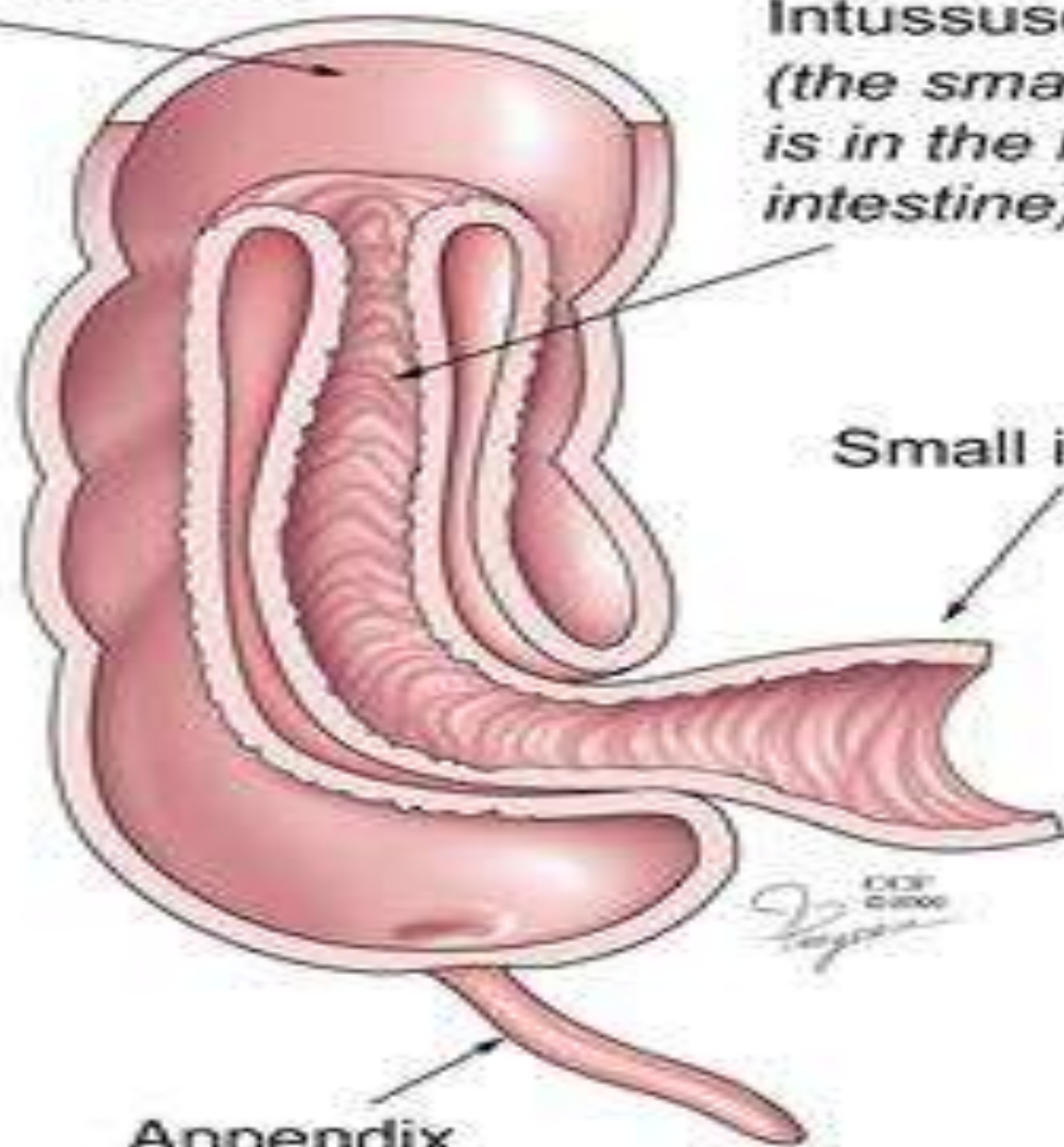
- A)viral infection
- B)child born with polp or diverticulum

Large intestine

Intussusception
(the small intestine
is in the large
intestine)

Small intestine

Appendix



References

- Lippincott's Illustrated Reviews: Physiology (2013)
- Medical Physiology, Updated second edition (walter F. Boron, MD, phd)
- Berne & levy, physiology, sixth edition, updated edition
- Ganong's Review of Medical Physiology, 26 t h e d i t i o n