King Saud University
College of Medicine
Second year – GIT block

Pathology of Diarrhea

Lecture 3

430 Pathology Team

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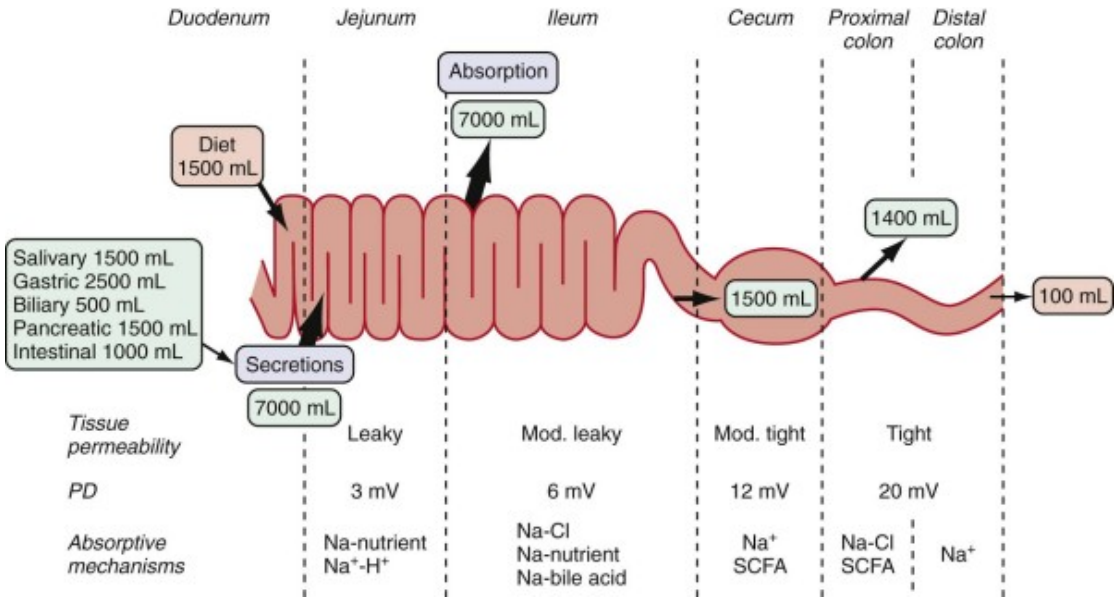
Red: Doctors' and important notes.
Green: Team notes.

Physiology of Intestinal Absorption:



The fluid in the bowel is generally considered as part of the transcellular compartment. Turnover of fluid in the bowel is large. A net amount of about **9 to 10 liters** of fluid enter the gut each day.

About 98% of this fluid is reabsorbed. This results in fecal water loss of only 100 mls/day.
This reabsorption occurs predominantly in the jejunum and ileum. About 1500 mls/day enter the colon from the ileum.
This means that over a liter per day is absorbed in the colon.

Diarrhea:

Definition according to the World Health Organization:

- 3 or more loose or liquid stools per day
- Abnormally high fluid content of stool > 200-300 gm/day

Importance:

- The loss of fluids through diarrhea can cause dehydration and electrolyte imbalances
- Easy to treat but if untreated, may lead to death especially in children

More than 70 % of almost 11 million child deaths every year are attributable to 6 causes:

1. Diarrhea
2. Malaria
3. neonatal infection
4. Pneumonia
5. preterm delivery
6. Lack of oxygen at birth.

Classification:

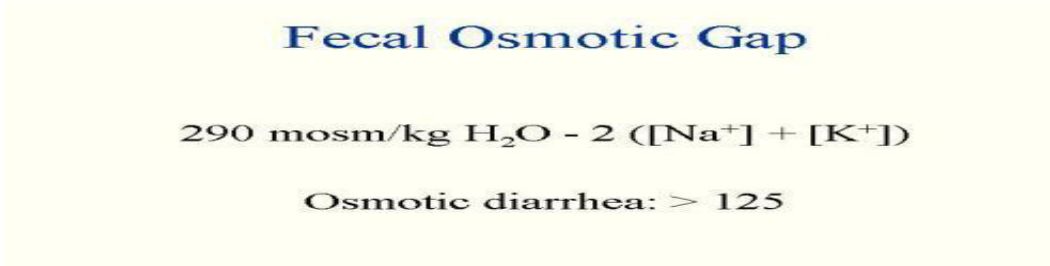
- **According to the time interval:**
  1. *Acute* → *if* 2 weeks,
  2. *Persistent* → *if 2 to 4 weeks,*
  3. *Chronic* → *if 4 weeks in* duration.
- **Pathophysiology** :
  1. Secretory
  2. Osmotic
  3. Exudative (inflammatory)
  4. Motility-related

Fecal osmolarity:

- As stool leaves the colon, fecal osmolality is equal to the serum osmolality i.e. 290 mosm/kg.
- Fecal osmotic gap = Stool osmolality - 2 x (stool Na + stool K).

Note: Fecal osmatic gap mean the difference between osmolality of stool and osmolality of the serum, and should be less than 100.

- Under normal circumstances, the major osmoles are Na^+, K^+, Cl^-, and HCO_3^-.

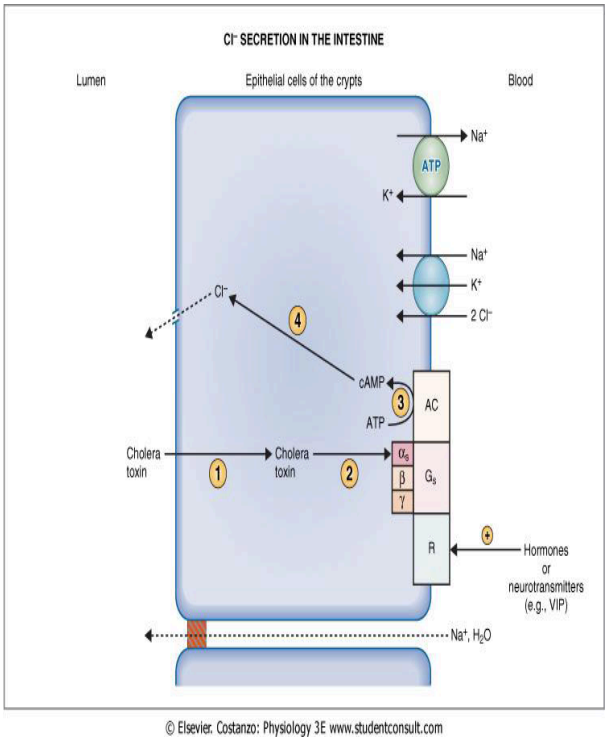


Secretory:

Characteristics:

- There is an increase in the active secretion of water
- The bacterial toxins enter crypt cells and cause changes in cellular messenger systems increasing levels of cAMP that cause the cells to constantly secrete Cl-, which is accompanied by Na+ and water that cause the secretory diarrhea. The intestine can't handle the extra load, which leads to massive diarrhea.
- High stool output
- Normally there is only 7L of fluid of active secretion, but in this case there may be 9L – 12L of fluid secretion with normal absorption rate which causes increased stool output.
- Lack of response to fasting

- Stool osmotic gap < 100 mOsm/kg



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The most common causes:

- Bacterial toxin (E. coli, cholera) that stimulates the secretion of anions.

Note: These two types of bacteria do not invade the gastric mucosa, but only secrete a toxin that stimulates excessive secretion that causes this type of diarrhea. They do not cause inflammation; they only secrete toxins that have this effect.

- Enteropathogenic virus e.g. rotavirus and norwalk virus
- Also seen in neuroendocrine tumours (carcinoid tumor, gastrinomas)

Osmotic:

Characristics:

- This is caused by non-absorbable solutes in the lumen of the intestine that exert osmotic effect → water is drawn into the bowels → diarrhea
- Stool output is usually not massive
- Fasting improve the condition
- Stool osmotic gap is high, > 125 mOsm/kg

Can be the result of:

1. Malabsorption in which the nutrients are left in the lumen to pull in water e.g. lactose intolerance

   Note: Some bacteria in the intestine may degrade lactose to more osmotically active solute particles (more active than lactose), which drag more water and worsen the problem.

2. Osmotic laxatives. **Laxative:** substances or drugs that stimulate the intestines, causing the body to eliminate waste. They are most often taken for constipation.

Exudative (inflammatory):

Characteristics:

- Results from the outpouring of blood protein, or mucus from an inflamed or ulcerated mucosa
- Presence of blood and pus in the stool.
- Persists on fasting

Causes:

- Invasive infections e.g. *Shigella, Salmonella, and some types of E.Coli*
- Inflammatory bowel diseases, (Crohn's& ulcerative colitis).

- Destruction of epithelium + absorptive surface by Microbial pathogens causes inefficient reabsorption of water and electrolytes. It may also cause an inflammatory reaction that leads to more damage and exudation of blood & serum into lumen.

Motility-related:

- Caused by the rapid movement of food through the intestines (hypermotility).
- Irritable bowel syndrome (IBS) – a motor disorder that causes abdominal pain and altered bowel habits with diarrhea predominating
- Water and nutrients are not retained in intestines long enough to be efficiently absorbed

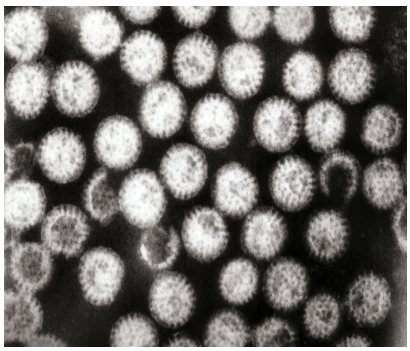
Disorders in motility accelerate transit time → decrease absorption → diarrhea, even if the absorptive process was proceeding properly. Decreased intestinal retention time maybe caused by:

- Surgical reduction of gut length
- Neural dysfunction, including irritable bowel syndrome
- Hyperthyroidism

Etiology:

1. **Acute diarrhea:**

- Approximately 80% of acute diarrheas are due to ***infections*** (viruses, bacteria, helminths, and protozoa).
- Viral gastroenteritis (viral infection of the stomach and the small intestine) is the most common cause of acute diarrhea worldwide
- Food poisoning (e.g. staphylococcus)
- Drugs
- Others



Rotavirus the cause of nearly 40% of hospitalizations from diarrhea in children under 5 .

2. **Antibiotic-Associated Diarrheas:**

- Diarrhea occurs in 20% of patients receiving broad-spectrum antibiotics; about 20% of these diarrheas are due to *Clostridium difficile*
- Leading to pseudomembranous colitis

Taking antibiotic ➔ reduce normal flora ➔ overgrowth of clostridium difficile → psudomembranus colitis: you will see inflammatory exudates – fibrin – neutrophils.
In this case stop antibiotic and switch to another like ampicillin.

3. **Chronic diarrhea**:

1. Infection e.g.*Giardia lamblia* . AIDS often have chronic opportunistic infections of their intestines that cause diarrhea.
2. Post-infectious Following acute viral, bacterial or parasitic infections
3. Malabsorption

4. Inflammatory bowel disease (IBD)
5. Endocrine diseases (usually neuroendocrine tumors) ➔ release substances e.g. (5HT) which increase motility of intestine ➔ chronic diarrhea
6. Colon cancer e.g: villous adenoma
7. Irritable bowel syndrome.

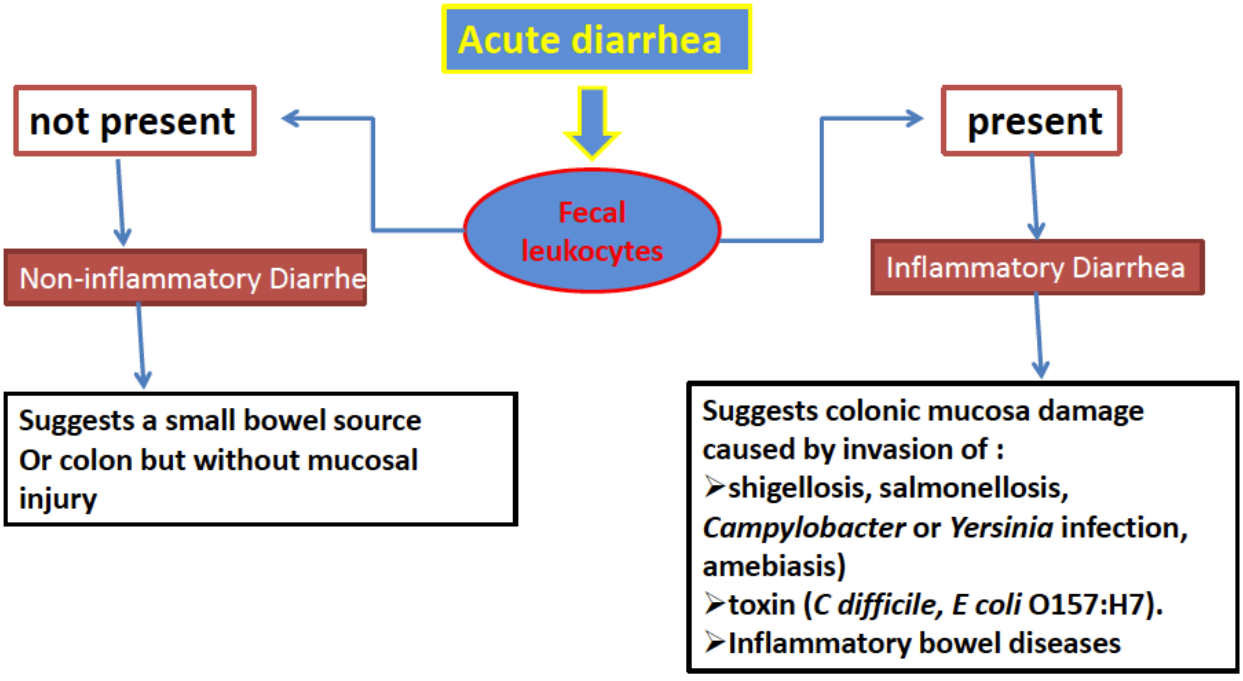
Complications:

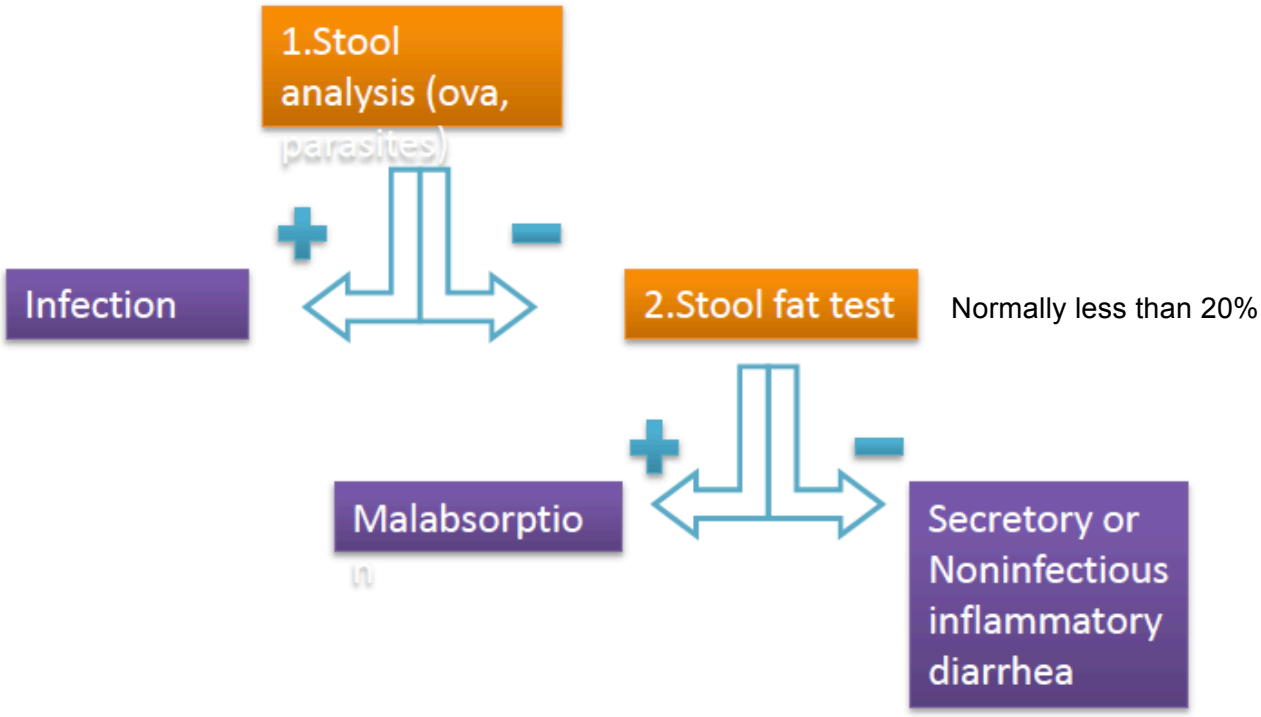
1. Fluids → Dehydration

The decrease in total body water causes reductions in both the intracellular and extracellular fluid volumes. Clinical manifestations of dehydration are most closely related to intravascular volume depletion. As dehydration a progress, hypovolemic shock ultimately ensues, resulting in end organ failure and death.

2. Electrolytes → Electrolyte imbalance can cause many abnormal conditions like cardiac arrest or arrhythmias and seizures.
3. *Sodium bicarbonate* → Metabolic acidosis
4. If persistent → Malnutrition

Tests useful in the evaluation of diarrhea:




1.Stool analysis (ova, parasites)
+
-
Infection
2.Stool fat test
Normally less than 20%
+
-
Malabsorptio n
Secretory or Noninfectious inflammatory diarrhea