

Lecture Five:

Diarrhea



432 Pathology Team

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GIT Block

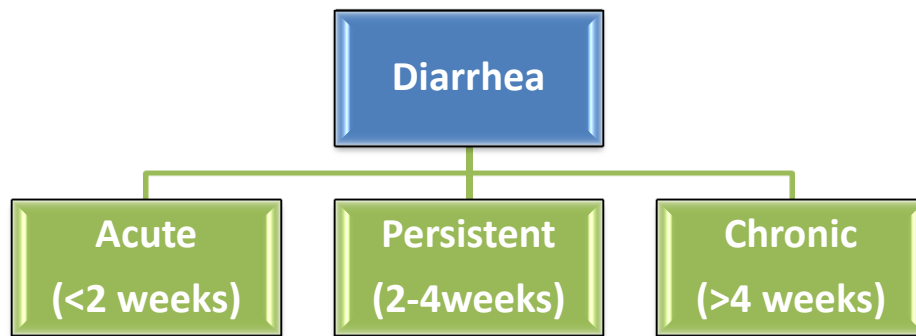


Color Index: female notes are in Green. Male notes are in Blue. Red is important. Orange is explanation.

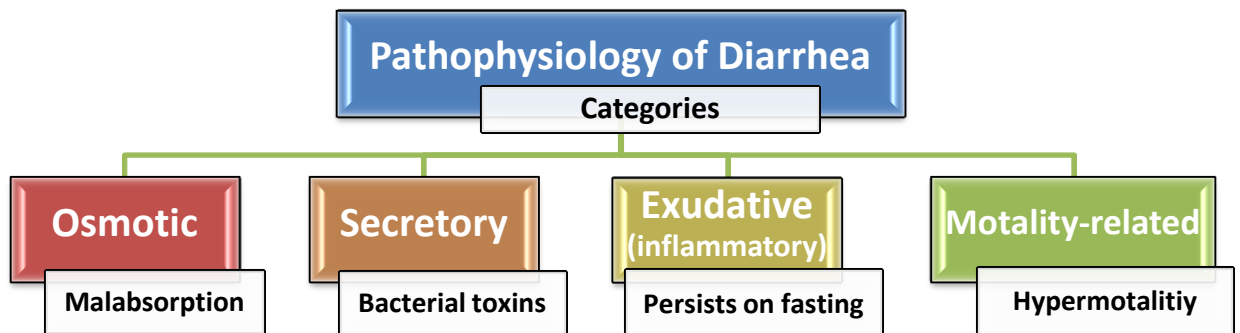
Diarrhea

Mind Map:

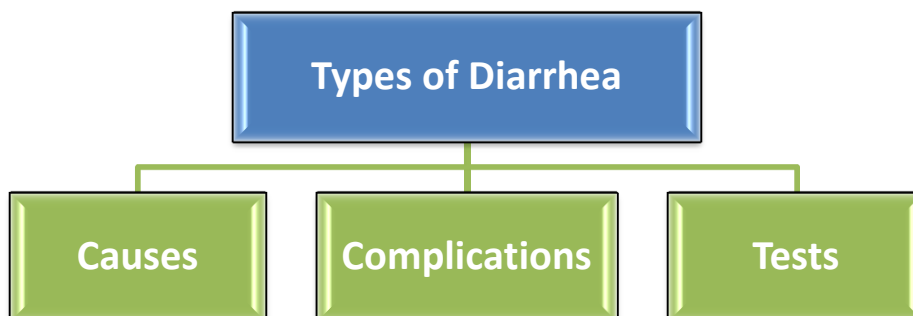
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Diarrhea

Introduction

According to (WHO) “**Diarrhea**” is characterized by:

- 3 or more loose or liquid stools per day due to “Abnormally high fluid content of stool”.
- 200-300 gm. /day (of stool).

Why is it (important)?

- 1) The loss of fluids through diarrhea can cause **dehydration** and electrolyte imbalances.
- 2) Easy to treat but if untreated, may lead to death especially in children.
- 3) More than 70 % of almost 11 million child deaths every year are attributable to 6 causes: (one of them is diarrhea).

NOTE: The most important treatment in case of diarrhea is **fluid replacement** (hydration).

Fecal osmolality:

- ❖ As stool leaves the colon, fecal osmolality is **equal** to the serum osmolality.
- ❖ Under normal circumstances, the major osmoles are Na^+ , K^+ , Cl^- , and HCO_3^-
- **Stool osmotic gap** (by measuring the osmotic gap, we can decide if the patient has osmotic diarrhea or not)

Stool osmolality - 2 x (stool Na + stool K)

Fecal Osmotic Gap

$290 \text{ mosm/kg H}_2\text{O} - 2 ([\text{Na}^+] + [\text{K}^+])$

Osmotic diarrhea: > 125

This means that the amount of Na^+ and K^+ is (low) but H_2O is (high).

“According to the formula”

REMEMBER:

- 1- The serum osmolality is 290 mosm/kg.
- 2- **Normal fecal fluid values are:**
 - *Osmolality: ~290 mOsm/kg
 - * Na^+ : ~30 mmol/L
 - * K^+ : ~75 mmol/L

1- Osmotic diarrhea

- ❖ Excess amount of poorly absorbed substances 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 (**loss of hypotonic fluid**).

Can be the result of:

- a- **Malabsorption** in which the nutrients are left in the lumen to pull in water e.g. lactose intolerance.
- b- Osmotic laxatives (**are medicines that are used to treat constipation, they work by retaining fluid in the large bowel by osmosis**).
- c- Hexitols (poorly absorbed): (sorbitol, mannitol, xylitol). (**Because hexitols are poorly absorbed**).

NOTE: “from Robbins” (in osmotic diarrhea, the diarrheal fluid is more than 50 mOsm more concentrated than plasma).

2- Secretory diarrhea

- There is an increase in the active secretion of water.
- High stool output.
- **Lack of response to fasting.**
- Normal Stool osmotic gap < 100 mOsm/kg.

Can be the result of:

- a- **bacterial toxin** (E. coli , cholera) that stimulates the secretion of anions. (**most common**) [Active secretion in the small intestine].
- b- Enteropathogenic virus e.g. rotavirus and Norwalk virus.
- c- Also seen in neuroendocrine tumors (carcinoid tumor, gastrinomas)
- d- Rectal villous adenoma (**rectal benign tumor, we will talk about it in the next lecture**).

3- Exudative (inflammatory)

- ❖ Results from the outpouring of blood protein, or mucus from an inflamed or ulcerated mucosa.
- ❖ Presence of blood and pus in the stool. [Using Fecal leucocyte test]
- ❖ **Persists on fasting.**
- ❖ Occurs with inflammatory bowel diseases, and invasive infections e.g. E. coli, Clostridium difficile and Shigella.
- ❖ Some bacterial infections cause damage by invasion of the mucosa. Many cause diarrhea with blood and pus in the stool (**bacterial dysentery**).

The main organisms are:

- i. **Campylobacter** invades mucosa in the jejunum, ileum and colon, causing ulceration and acute inflammation.
- ii. **Salmonella typhi**, S. paratyphi A, B, and C
- iii. **Shigella** infections are mainly seen in young children.
- iv. **Enteroinvasive** and **enterohemorrhagic E. coli**.

NOTE: “from Robbins” (Exudative diarrhea is due to inflammatory disease and characterized by purulent, bloody stool that continue during fasting).

4- 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 (**is characterized by chronic relapsing abdominal pain and the pathogenesis is poorly defined**).

Types of Diarrhea

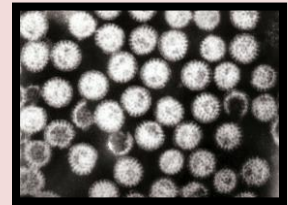
1- Acute diarrhea:

Causes of acute Diarrhea:

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

NOTE: Rotavirus

- The cause of nearly 40% of hospitalizations from diarrhea in children under 5.
- Rotaviruses cause 50% of infantile diarrhea. (what is the most Common cause of acute diarrhea in infants? "MCQs question").

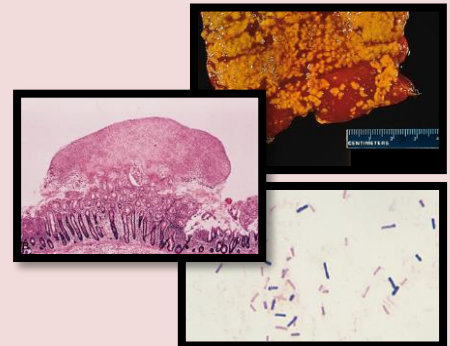


Antibiotic-Associated Diarrheas:

Diarrhea occurs in 20% of patients receiving **Broad-Spectrum Antibiotics**; about 20% of these diarrheas are due to **Clostridium difficile** → leading to pseudomembranous colitis.

NOTE: Pseudomembranous colitis

- Occurs in patients received broad-spectrum antibiotics.
- Caused by *Clostridium difficile* (Gram-positive rods)
- Under the microscope, we will see fibrin and chronic inflammatory cells.

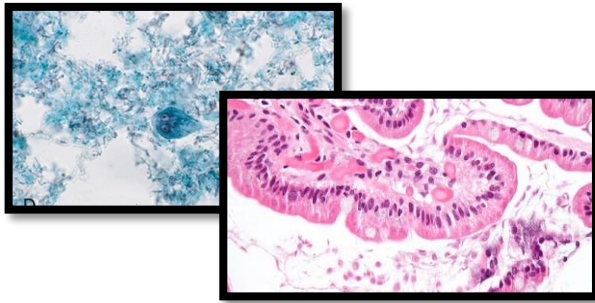


2- Chronic diarrhea:

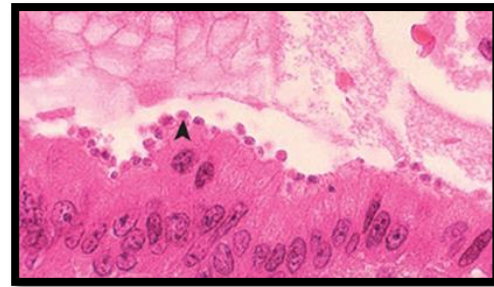
Causes of Chronic Diarrhea:

1. Infection e.g. *Giardia lamblia*. AIDS often have chronic infections of their intestines that cause diarrhea.
2. Post-infectious Following acute viral, bacterial or parasitic infections
3. Malabsorption
4. Inflammatory bowel disease (IBD) "we will talk about it later".
5. Endocrine diseases
6. Colon cancer
7. Irritable bowel syndrome (motility diarrhea).

Giardia Lamblia:



Cryptosporidiosis in AIDS:



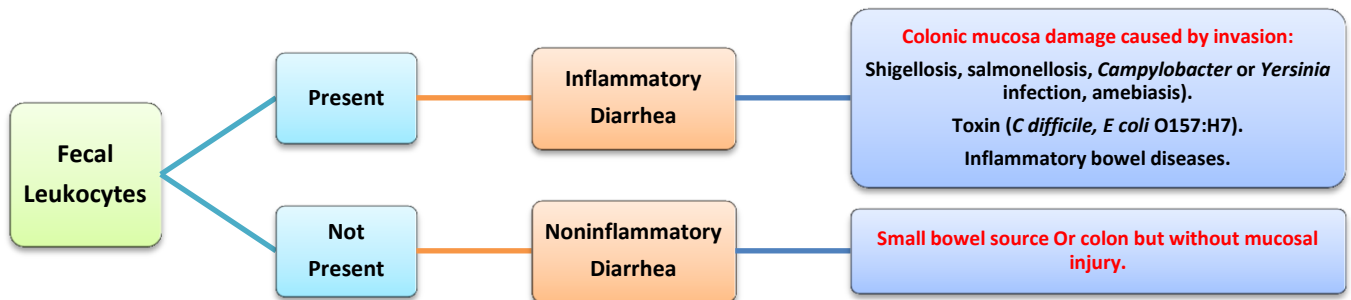
REMEMBER: Parasitic and protozoal infections affect over half of the world's population on a chronic or recurrent basis.

Complications of Diarrhea:

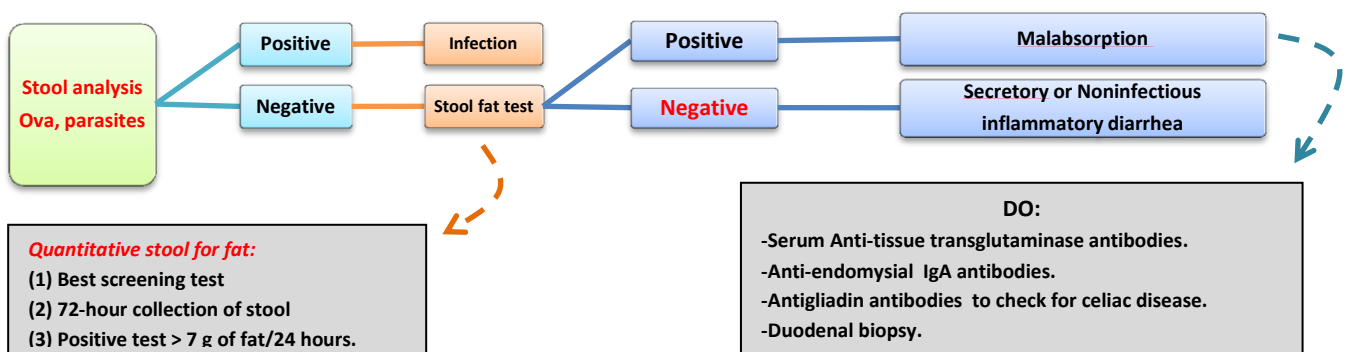
- Fluids → Dehydration.
- Electrolytes → Electrolytes imbalance.
- Sodium bicarbonate → Metabolic acidosis.
- If persistent → Malnutrition.

Tests useful in the evaluation of diarrhea:

Acute diarrhea:



Chronic diarrhea:



Quantitative stool for fat:
 (1) Best screening test
 (2) 72-hour collection of stool
 (3) Positive test > 7 g of fat/24 hours.

DO:
 -Serum Anti-tissue transglutaminase antibodies.
 -Anti-endomysial IgA antibodies.
 -Antigliadin antibodies to check for celiac disease.
 -Duodenal biopsy.

Summary (from Robbins Basic Pathology)

Malabsorptive Diarrhea:

- Diarrhea can be characterized as *secretory, osmotic, malabsorptive, or exudative*.
- The malabsorption associated with cystic fibrosis is the result of *pancreatic insufficiency* (i.e., inadequate pancreatic digestive enzymes) and *deficient luminal breakdown* of nutrients.
- *Celiac disease* is an immune-mediated enteropathy triggered by the ingestion of gluten-containing grains. The malabsorptive diarrhea in celiac disease is due to *loss of brush border surface area* and, possibly, deficient enterocyte maturation as a result of immune-mediated epithelial damage.
- *Lactase deficiency* causes an *osmotic diarrhea* owing to the inability to break down or absorb lactose.
- *Irritable bowel syndrome* (IBS) is characterized by chronic, relapsing abdominal pain, bloating, and changes in bowel habits. The pathogenesis is poorly defined.
- The two forms of microscopic colitis, *collagenous colitis* and *lymphocytic colitis*, both cause chronic watery diarrhea. The intestines are grossly normal, and the diseases are identified by their characteristic histologic features.

Table 14-3. Defects in Malabsorptive and Diarrheal Disease

Disease	Intraluminal Digestion	Terminal Digestion	Transēpithelial Transport	Lymphatic Transport
Celiac disease		+	+	
Tropical sprue		+	+	
Chronic pancreatitis	+			
Cystic fibrosis	+			
Primary bile acid malabsorption	+		+	
Carcinoid syndrome			+	
Autoimmune enteropathy		+	+	
Disaccharidase deficiency		+		
Whipple disease				+
Abetalipoproteinemia			+	
Viral gastroenteritis		+	+	
Bacterial gastroenteritis		+	+	
Parasitic gastroenteritis		+	+	
Inflammatory bowel disease	+	+	+	

Summary: Types of Diarrhea

TYPE	CHARACTERISTICS	CAUSES	SCREENING TESTS
Invasive	<ul style="list-style-type: none"> • Pathogens invade enterocytes • Low-volume diarrhea 	<ul style="list-style-type: none"> • Shigella spp. • Campylobacter jejuni 	<ul style="list-style-type: none"> • Fecal smear for leukocytes: +ve in most cases
	<ul style="list-style-type: none"> • Diarrhea with blood and leukocytes (i.e., dysentery) 	<ul style="list-style-type: none"> • Entamoeba histolytica 	<ul style="list-style-type: none"> • Order stool culture & for O&P
Secretory	<ul style="list-style-type: none"> • Loss of isotonic fluid • High-volume diarrhea • Mechanisms: <ul style="list-style-type: none"> • Laxatives • Enterotoxins stimulate Cl⁻ channels regulated by cAMP and cGMP • Serotonin increases bowel motility • No inflammation in bowel mucosa 	<ul style="list-style-type: none"> • Laxatives: melanosis coli with use of phenanthracene laxatives • Production of enterotoxins: <ul style="list-style-type: none"> • Vibrio cholerae • Enterotoxigenic E. coli • Increased serotonin: carcinoid syndrome 	<ul style="list-style-type: none"> • Stool osmotic gap < 50 mOsm/kg • Fecal smear for leukocytes: negative • Increased 5-HIAA: carcinoid syndrome
Osmotic	<ul style="list-style-type: none"> • Osmotically active substance is drawing hypotonic salt solution out of bowel • High-volume diarrhea • No inflammation in bowel mucosa 	<ul style="list-style-type: none"> • Disaccharidase def. Giardiasis, Celiac Dis. • Ingestion of poorly absorbable solutes 	<ul style="list-style-type: none"> • Fecal smear for leukocytes: negative • Stool osmotic gap > 100 mOsm/kg
Motility-related	<ul style="list-style-type: none"> • Rapid movement of food through the intestines 	<ul style="list-style-type: none"> • Irritable bowel syndrome (IBS) – a motor disorder 	

Questions

1/ what types of diarrhea these symptom and sign indicate? Osmotic, Exudative (Inflammatory), Motility related or secretory?

- 1- Fasting improve the condition ----- [osmotic]
- 2- Inflammatory bowel diseases -----[Exudative]
- 3- High stool output ----- [secretory]
- 4- Presence of WBC in stool ----- [Exudative]
- 5- Irritable bowel syndrome ----- [Motolitiy related]
- 6- Bacterial toxin ----- [Secretory]
- 7- Malabsorption ----- [Osmotic]
- 8- High fecal osmotic gap ----- [Osmotic]

2/ what types of diarrhea these symptom and sign indicate? Acute or chronic?

- 1- Irritable bowel syndrome ----- [Chronic]
- 2- Giardia lamblia -----[Chronic]
- 3- Viral gastroenteritis ----- [Acute]
- 4- Inflammatory bowel disease ----- [Chronic]
- 5- Food poisoning ----- [Acute]
- 6- Antibiotic-Associated Diarrheas ----- [Acute]
- 7- Malabsorption ----- [Chronic]

3/ what are complications of diarrhea?

- Dehydration
- Electrolytes imbalance
- Metabolic acidosis
- Malnutrition

4/ A 30-year-old woman presents with 2 days of abdominal cramping and diarrhea. Her temperature is 38°C (101°F), respirations are 32 per minute, and blood pressure is 100/65 mm Hg. Stool culture shows a toxigenic Escherichia coli infection. Which of the following best explains the pathogenicity of this organism in this patient?

- (A) Destruction of Peyer patches
- (B) Invasion of the mucosa of the colon
- (C) Invasion of the mucosa of the ileum
- (D) Stimulation of acute inflammation in the superficial bowel mucosa
- (E) Stimulation of fluid transport into the lumen of the intestine

5/ A 1-year-old girl is brought to the emergency room by her parents who report that she had a fever and diarrhea for 3 days. The child's temperature is 38°C (101°F). The CBC shows a normal WBC count and increased hematocrit. Which of the following microorganisms is the most likely cause of diarrhea in this young child?

- (A) Cytomegalovirus
- (B) Rotavirus
- (C) Salmonella typhi
- (D) Shigella dysenteriae

6/ A 53-year-old woman complains of acute diarrhea and severe abdominal pain. She was recently treated with broad-spectrum antibiotics for community-acquired pneumonia. A CBC shows a WBC count of 24,000/ μ L. The patient subsequently develops septic shock and dies. A portion of her colon is shown at autopsy. These findings are typical of which of the following gastrointestinal diseases?

- (A) Crohn disease
- (B) Diverticulitis
- (C) Ischemic colitis
- (D) Pseudomembranous colitis

Answers:

- 4/E
- 5/B
- 6/D

اللهم إني استودعك ما قرأت و ما حفظت و ما تعلمت فرده عليّ عند حاجتي إليه انك على كل شيء قدير

If there is any mistake or feedback please contact us: 432PathologyTeam@gmail.com



432 Pathology Team

Good Luck ^_^