Lecture 5:

Diarrhea

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Objectives

Upon completion of this lecture the students should :

1. Describe the pathophysiology and causes of various types of diarrhea (Secretory, osmotic, Exudative, Motility-related)
2. Define acute diarrhea and enumerate its common causes
3. Define chronic diarrhea and enumerate its common causes

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Definition :

The condition of passing at least 3 loose or liquid stools per day.
(> 200-300 gm/day)
- Mostly affect children.

Classification depends on pathophysiology:

1. Secretory
2. Osmotic
3. Exudative (inflammatory)
4. Motility-related

Classification depends on severity :

1. Acute diarrhea.
2. Persistent diarrhea.
3. Chronic diarrhea.

Categories of diarrhea depends on pathophysiology:

1. Osmotic diarrhea :

Excessive poorly absorbed substances → ↑ osmotic pressure → water is drawn into lumen → osmotic diarrhea.

<u>Characteristic :</u>
1. Stool output is usually not massive.
2. Fasting improve the condition (لأن الطعام داخل الأمعاء يقل وتبعًا لها تقل الأوسمولارتي).

<u>Causes :</u>
1. **Malabsorption** such as lactose intolerance, celiac disease.
2. **Osmotic laxatives** ملينات (↑ osmotic pressure).
3. **Hexitols** (poorly absorbed sugar found mostly in gum, such as sorbit**ol,** mannit**ol,** xylit**ol**.)
4. Giardiasis (loss of brush border → ↓ absorption)
5. Disaccharidase deficiency (so the sugar will be non-absorpable)

<u>Screening test :</u>
- Fecal smear for leukocytes : negative.
- Stool osmotic gap * >125 mOsm/kg (loss of hypotonic fluid)

For your knowledge

* Differentiation between Osmotic diarrhea and Secretory diarrhea by Fecal osmolarity :
- Fecal osmolality is equal to the serum osmolality (= 290 mosm\kg)
- Normally, the major osmoles are Na^+, K^+, Cl^-, and HCO_3^-.
- Normal fecal fluid values (Na+: ~30 mmol/L K+: ~75 mmol/L)

- Stool osmotic gap = stool osmolality − 2 x (stool Na^+ + stool K^+)
 → if it's >125 → osmotic diarrhea
 → if it's <100 → secretory diarrhea

2. Secretory diarrhea :

An increase in the active secretion of water.

Characteristics :

1. High stool output.
2. Loss of Isotonic fluid.
3. Lack of response to fasting (because it's not related to osmosis).

Causes :

1. The most common cause is the bacterial toxins (E.coli, cholera) that stimulate the secretion of anions.
2. Enteropathogenic **virus** e.g. rotavirus & Norwalk virus
3. Neuroendocrine tumors such as carcinoid tumor[1] & gastrinomas[2]
4. Rectal villous adenoma (increase the absorptive surface area → ↑ secretion).

Screening test :

1. Fecal smear for leukocyte : negative - .
2. Stool osmotic gap < 100 mOsm/kg
3. Measure the 5-HIAA[3] (the main metabolite of serotonin) to exclude the carcinoid tumor .

Note : there is no invasion of the mucosa of intestine (that's how we differentiate secretory diarrhea from exudative diarrhea).

1: (serotonin-secreting tumor in small or large intestine → ↑ ion secretion)
2: gastrin-secreting tumor found in duodenum and pancreas → ↑ HCL → ulceration of small intestine → ↑ secretin → diarrhea)
3: 5-Hydroxyindoleacetic acid

3. Exudative (inflammatory) diarrhea :

- outpouring تدفق of blood protein, or mucus from an inflamed or ulcerated mucosa
→ Presence of blood and pus in the stool (usually loose stool)

Characteristics :

1. Persist on fasting
2. Bacterial **dysentery** (bloody diarrhea with mucus due to infection or IBD).

Causes :

1. Invasive bacterial infection, the main organism are :
   - Campylobacter which invades mucosa in the jejunum, ileum & colon.
   - Salmonella typhi, S. paratyphi A, B, and C.
   - Shigella infections : are mainly seen in young children.
   - Enteroinvasive & Enterohemorrhagic E. coli
   - Entamoeba histolytica (Picture)

2. Inflammatory bowel disease (IBD).

Screening test :

1. Fecal smear for leukocytes : positive +.
2. Stool culture for ova & parasites.
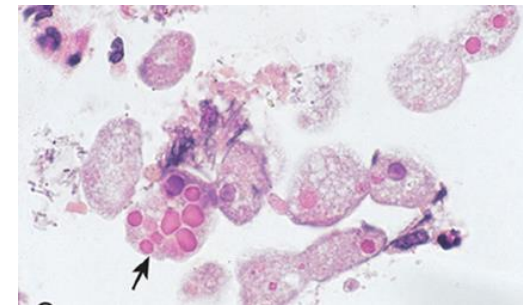
4. Motility-related diarrhea :

Rapid movement of food through the intestines (hypermotility).

Causes :

Irritable bowel syndrome (IBS) : a motor disorder that causes abdominal pain and altered bowel habits with diarrhea predominating.

Classification depends on severity :

1. Acute diarrhea :

- Duration : Less than 2 weeks.

-Causes :

1. **Infections** (bacteria, viruses, helminths & protozoa).

    A. viral gastroenteritis:

is **the most common** cause of acute diarrhea worldwide.

- Usually caused by **rotavirus** (commonly in children).

    b. - Antibiotic-associated diarrhea (pics) :

- Occurs in 20% of patients receiving **broad-spectrum antibiotics.**

- 20% of these diarrheas are due to clostridium difficile which lead to

    pseudomembranous colitis (تقوم بصنع غشاء كاذب على الأمعاء يتكون من) neutrophils, dead

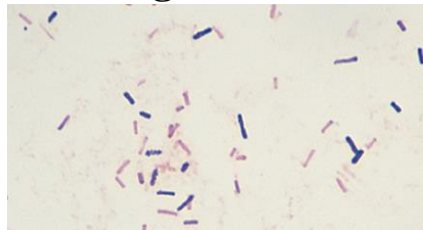   epithelial and inflammatory debris)

- (antibiotic will lead to overgrowth of the organism → ulceration & necrosis of bowel wall).
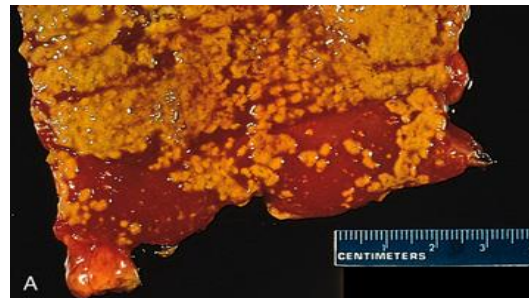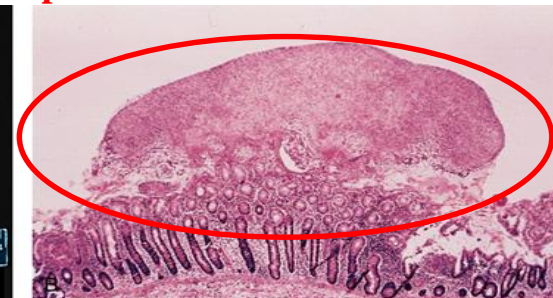
2. **Food poisoning.**

3. **Drugs.**
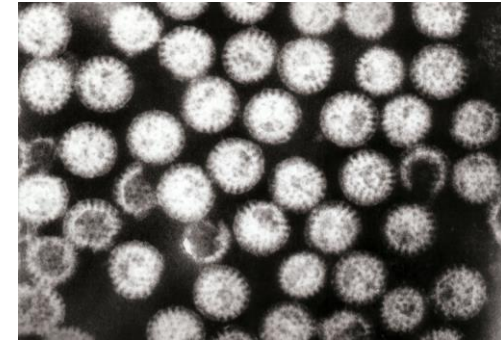
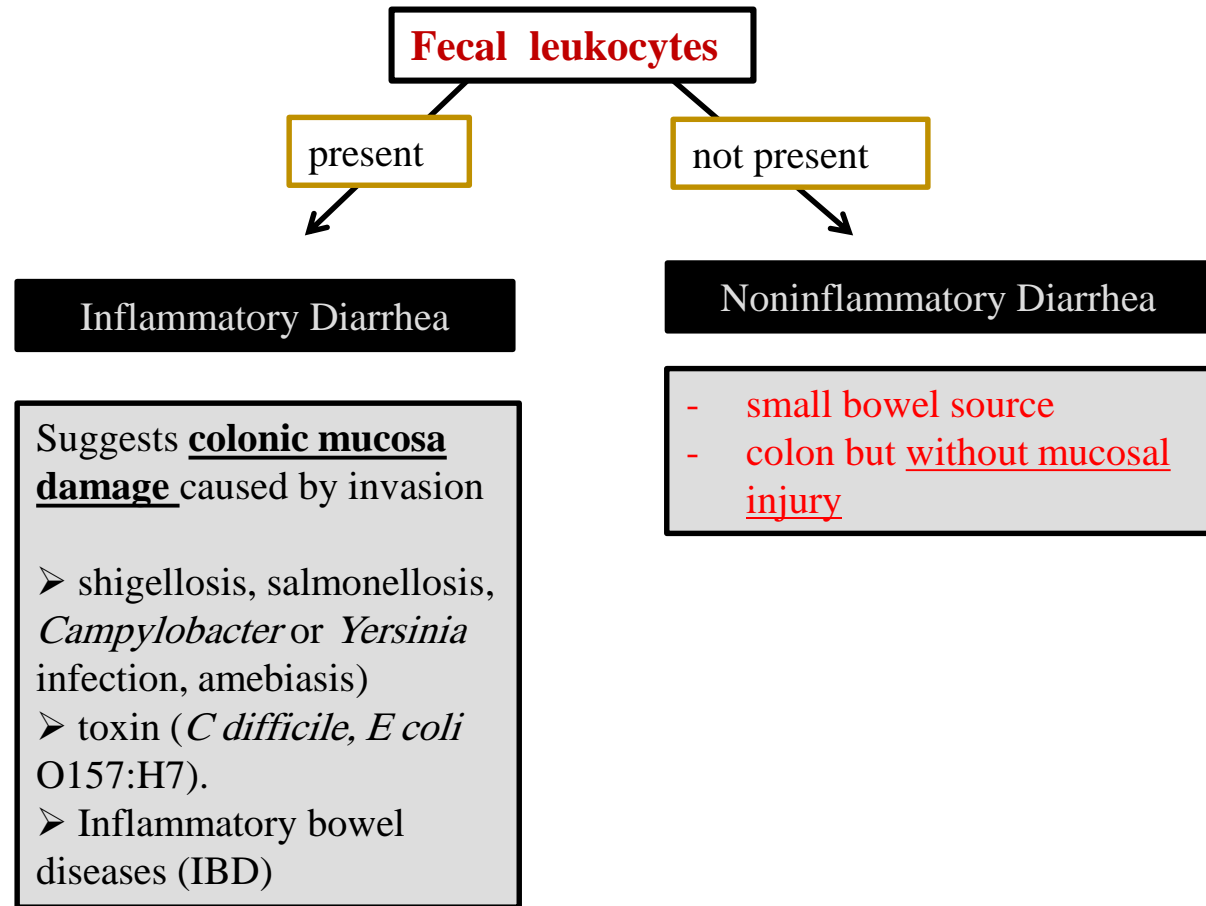
rotavirus

Clostridium species.
Gram positive rods

pseudomembranous colitis

Classification depends on severity :

Tests useful in the evaluation Acute of diarrhea :

Fecal leukocytes

present | not present

Inflammatory Diarrhea

Suggests **colonic mucosa damage** caused by invasion

➤ shigellosis, salmonellosis, *Campylobacter* or *Yersinia* infection, amebiasis)
➤ toxin (*C difficile, E coli* O157:H7).
➤ Inflammatory bowel diseases (IBD)

Noninflammatory Diarrhea

- small bowel source
- colon but without mucosal injury

2. Persistent diarrhea :

- Duration : Persist from 2-4 weeks.
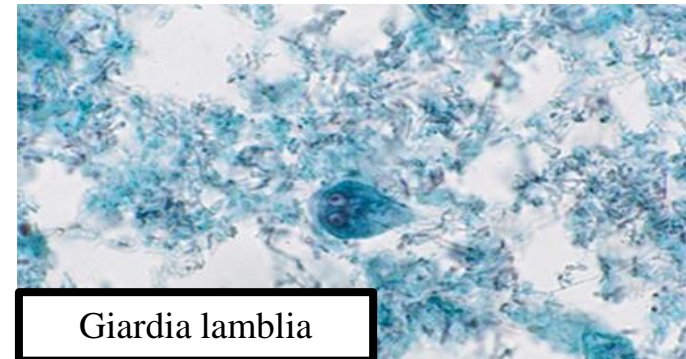
3. Chronic diarrhea :

- Duration : More than 4 weeks

- Causes :

1. Infection e.g. Giardia lamblia(Giardiasis) & chronic intestinal infections in AIDS patient.

2. Post-infectious: Following acute viral, bacterial or parasitic infections

3. Malabsorption.

4. Inflammatory bowel disease (IBD) (Lead to malabsorption).

5. Endocrine diseases.

6. Colon cancer.

7. Irritable bowel syndrome (IBS) (mostly because they always anxious).
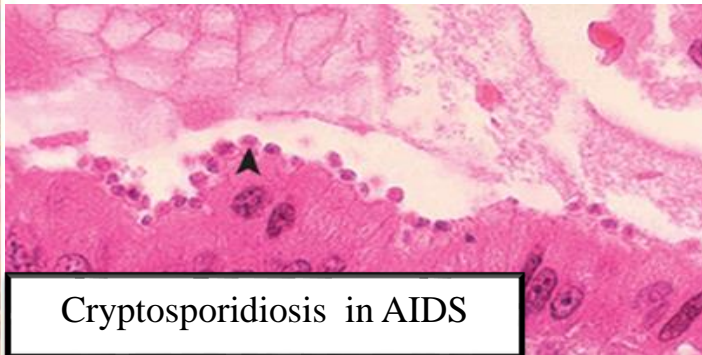
Cryptosporidiosis in AIDS

Giardia lamblia

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

Tests useful in the evaluation of Chronic diarrhea :

I.   **Stool analysis for ova & parasites :**
      Positive + → infection .
      Negative - → **Do step 2**.

II.   **Stool fat test** :
      Negative - → secretory or non-infectious inflammatory diarrhea.
      Positive + → malabsorption & **Do step 3**.

III. **Screen for malabsorption diseases :**
      a)   Do serum Anti-tissue transglutaminase antibodies.
      b)   Anti-endomysial IgA antibodies.
      c)   Antigliadin antibodies to check for celiac disease.
      d)   Duodenal biopsy.

Quantitative stool for fat :
      (1) Best screening test
      (2) 72-hour collection of stool
      (3) Normal < 20%
      (4) Positive test > 7 g of fat/24 hours.

Complications of diarrhea :

1. Dehydration → due to loss of Fluids
2. Electrolytes imbalance → due to loss of electrolytes
3. Metabolic acidosis → due to loss of HCO_3-
4. Malnutrition (if persist).

Summary from Robbins

SUMMARY

- Diarrhea can be characterized as *secretory, osmotic, malabsorptive,* or *exudative.*
- *Irritable bowel syndrome* (IBS) is characterized by chronic, relapsing abdominal pain, bloating, and changes in bowel habits. The pathogenesis is poorly defined.
- *Campylobacter jejuni* is the most common bacterial enteric pathogen in developed countries and also causes traveler's diarrhea. Most isolates are noninvasive. *Salmonella* and *Shigella* spp. are invasive and associated with exudative bloody diarrhea (dysentery). *Salmonella* infection is a common cause of food poisoning. *S. typhi* can cause systemic disease (typhoid fever).
- Pseudomembranous colitis is often triggered by antibiotic therapy that disrupts the normal microbiota and allows *C. difficile* to colonize and grow. The organism releases toxins that disrupt epithelial function. The associated inflammatory response includes characteristic volcano-like eruptions of neutrophils from colonic crypts that spread to form mucopurulent pseudomembranes.
- *Rotavirus* is the most common cause of severe childhood diarrhea and diarrheal mortality worldwide. The diarrhea is secondary to loss of mature enterocytes, resulting in malabsorption as well as secretion.
- *Parasitic* and *protozoal* infections affect over half of the world's population on a chronic or recurrent basis.