Gastrointestinal Block

Pathology lecture

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Diarrhea

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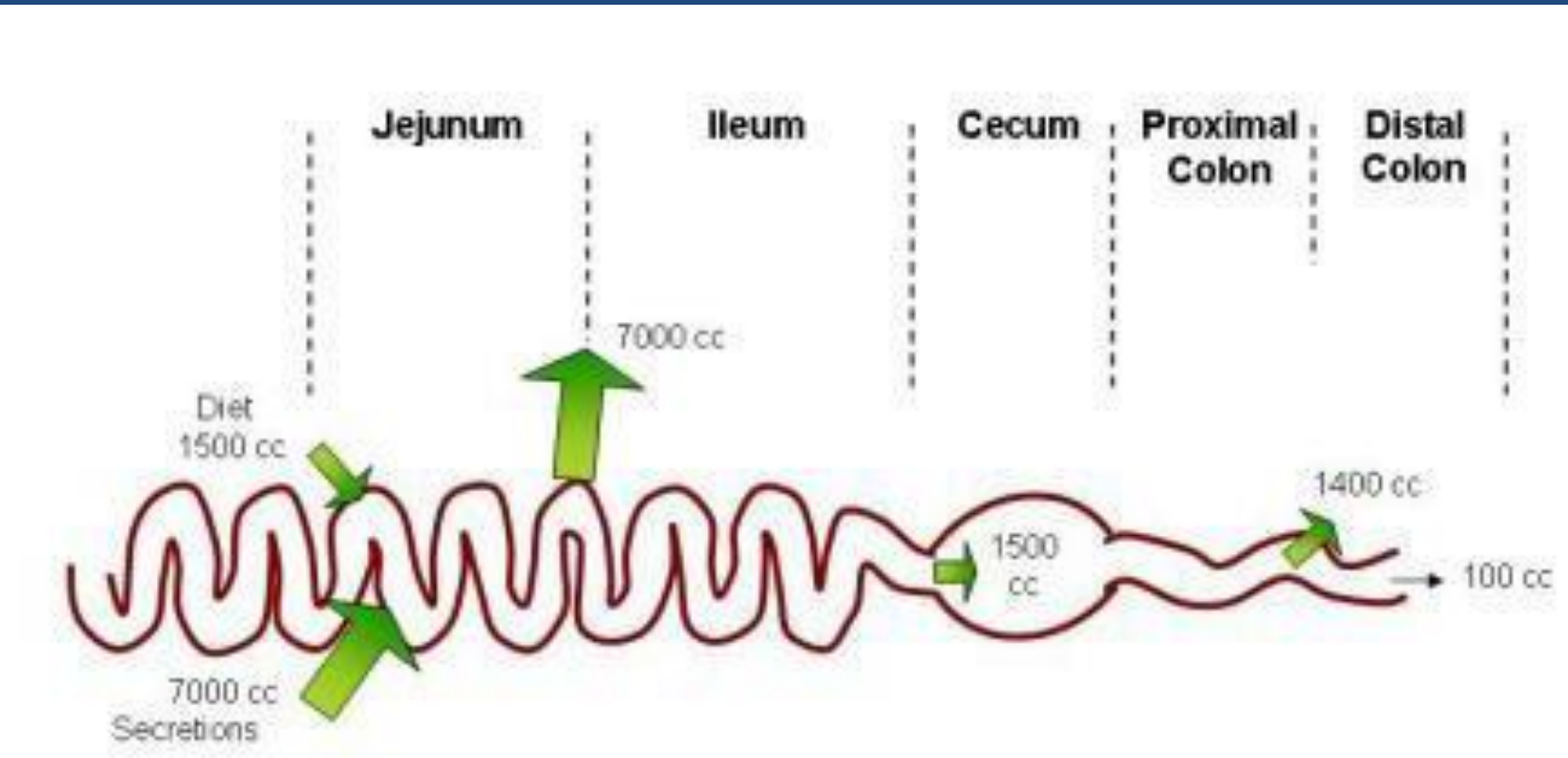
DIARREAHA

Objectives

1. Define diarrhea
2. Describe the pathogenesis of different types of diarrhea
3. List the causes of chronic diarrhea

Physiology of Fluid and small intestine



Define diarrhea

DIARREAHA
DEFINITION

- World Health Organization
  - ➢ 3 or more loose or liquid stools per day
- Abnormally high fluid content of stool
  - ➢ 200-300 gm/day

Define diarrhea

Why important?

- 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

Why important?

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.

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Define diarrhea

CLASSIFICATION

1. ***Acute*** *……..if* 2 weeks,
2. ***Persistent*** *……. if 2 to 4 weeks,*
3. ***Chronic*** *……..if 4 weeks in* duration.

Pathophysiology
Categories of diarrhea

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.

- Under normal circumstances, the major osmoles are Na^+, K^+, Cl^-, and HCO_3^-
- **Stool osmotic gap** =
  Stool osmolality - 2 x (stool Na + stool K)

Normal fecal fluid values:
Osmolality: ~290 mOsm/kg
Na+: ~30 mmol/L
K+: ~75 mmol/L

Stool osmotic gap

Fecal Osmotic Gap

$290\ \text{mosm/kg}\ H_2O - 2\ ([Na^+] + [K^+])$

- is a calculation performed to distinguish among different causes of diarrhea.
- A normal gap is between 50 and 100 mosm/kg
- A low stool osmotic gap (<50 mosm/kg) can imply secretory diarrhea
- A high gap (>125 mosm/kg) can imply osmotic diarrhea
- The reason for this is that secreted sodium and potassium ions make up a greater percentage of the stool osmolality in secretory diarrhea, whereas in osmotic diarrhea, molecules such as unabsorbed carbohydrates are more significant contributors to stool osmolality.

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**

1. Malabsorption in which the nutrients are left in the lumen to pull in water e.g. lactose intolerance
2. Osmotic laxatives e.g. Lactulose (non-absorbable sugar)
3. Hexitols (poorly absorbed): sorbitol, mannitol, xylitol)

Secretory Diarrhea

- There is an increase in the active secretion of water
- High stool output
- Lack of response to fasting
- Stool osmotic gap < 100 mOsm/kg
- The most common cause of this type of diarrhea is a bacterial toxin (E. coli , cholera) that stimulates the secretion of anions.
- Other causes:
  - Enteropathogenic virus e.g. rotavirus and norwalk virus
  - Also seen in neuroendocrine tumours (carcinoid tumor, gastrinomas)
  - Rectal villous adenoma

Exudative (inflammatory) Diarrhea

- 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
- Occurs with inflammatory bowel diseases, and invasive infections e.g. *E. coli, Clostridium difficile* and *Shigella*

Exudative (inflammatory) Diarrhea

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

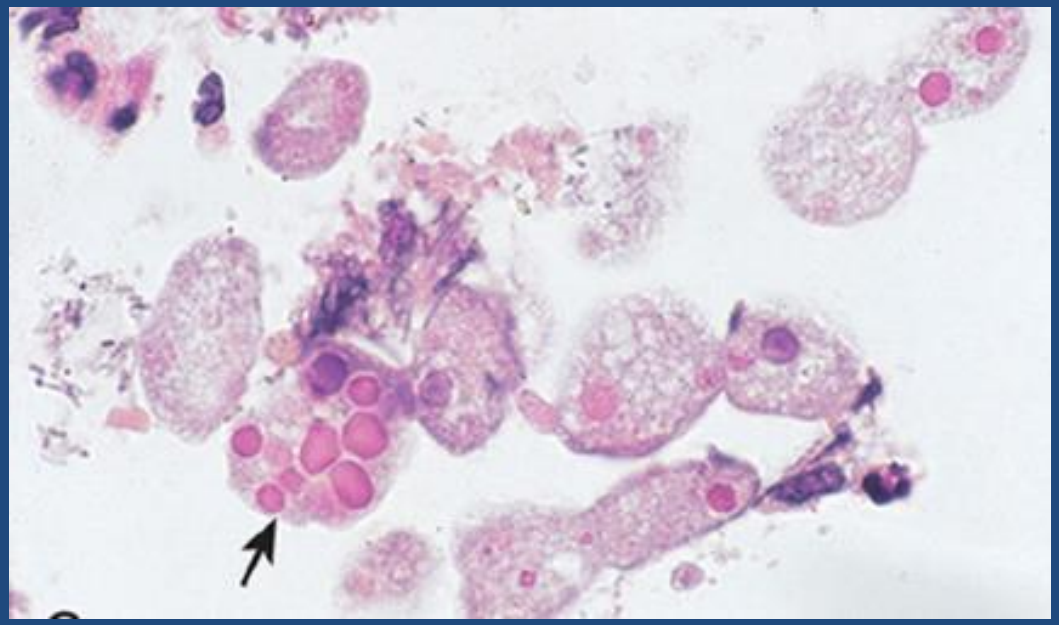
Motility-related Diarrhea

- 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
- Increased serotonin: carcinoid syndrome
  - Serotonin increases bowel motility
    No inflammation in bowel mucosa

SUMMARY: TYPES OF DIARRHEA

TYPE	CHARACTERISTICS	CAUSES	SCREENING TESTS
Invasive Inflammatory	Pathogens invade enterocytes Low-volume diarrhea	*Shigella* spp. *Campylobacter jejuni*	Fecal smear for leukocytes: positive in most cases
	Diarrhea with blood and leukocytes (i.e., dysentery)	*Entamoeba histolytica*	Order stool culture & for O&P
Secretory	Loss of isotonic fluid High-volume diarrhea Mechanisms:Laxatives Enterotoxins stimulate Cl^- channels regulated by cAMP and cGMP	Laxatives: melanosis coli with use of phenanthracene laxatives Production of enterotoxins: *Vibrio cholerae* Enterotoxigenic *E. coli*	Stool osmotic gap < 50 mOsm/kg Fecal smear for leukocytes: negative
Osmotic	Osmotically active substance is drawing hypotonic salt solution out of bowel High-volume diarrhea No inflammation in bowel mucosa	Disaccharidase def. Giardiasis, Celiac Dis. Ingestion of poorly absorbable solutes	Fecal smear for leukocytes: negative Stool osmotic gap > 125 mOsm/kg
Motility-related	Rapid movement of food through the Intestines Serotonin increases bowel motility No inflammation in bowel mucosa	Irritable bowel syndrome (IBS) – a motor disorder Increased serotonin: carcinoid syndrome	Increased 5-HIAA

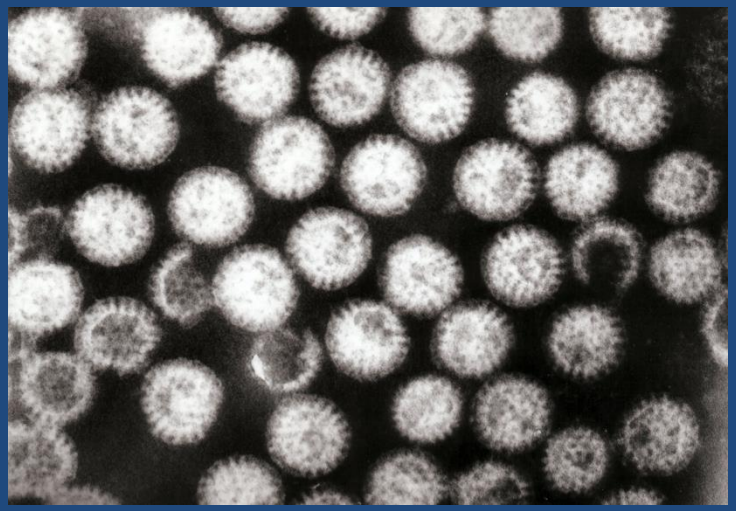
Entamoeba histolytica



Acute diarrhea

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**
- **Drugs**
- **Others**



Rotavirus

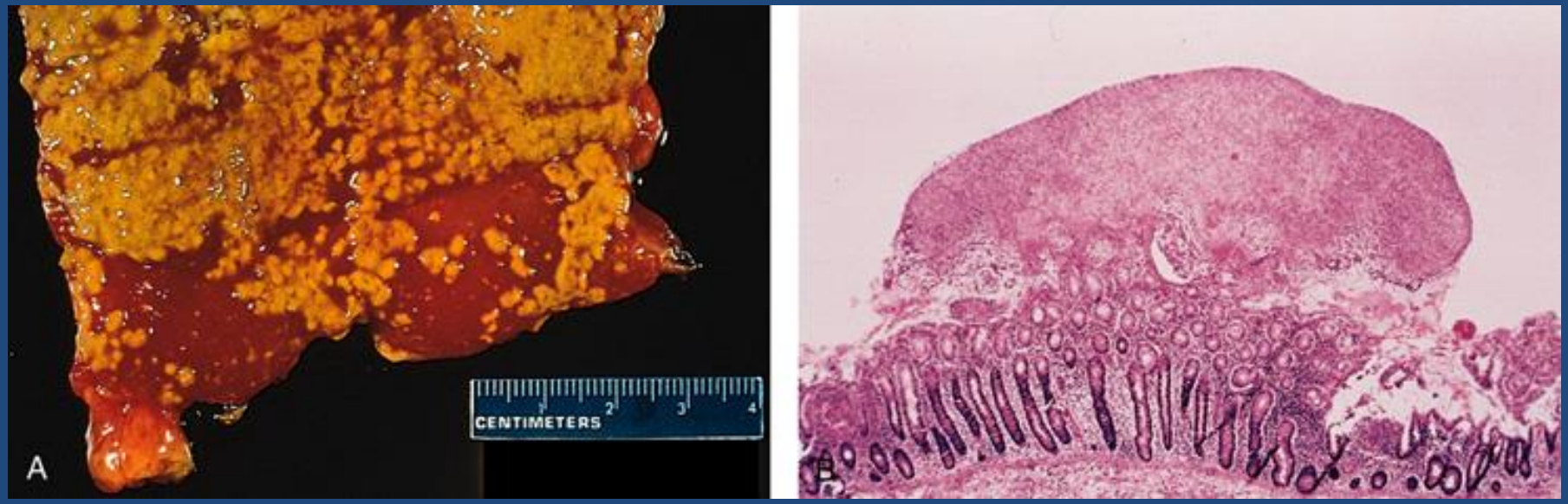
- The cause of nearly 40% of hospitalizations from diarrhea in children under 5
- Rotaviruses cause 50% of infantile diarrhea

Clinically person become dehydrated with electrolyte disturbance and low bicarbonate in blood

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

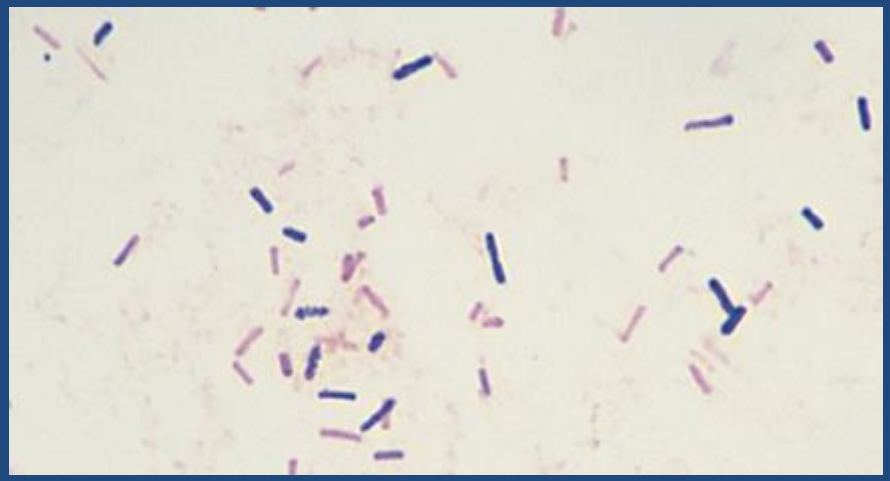
Pseudomembranous colitis



patients received broad-spectrum antibiotics

Caused by *Clostridium difficile*

Clostridium species. Gram-positive rods



Chronic diarrhea

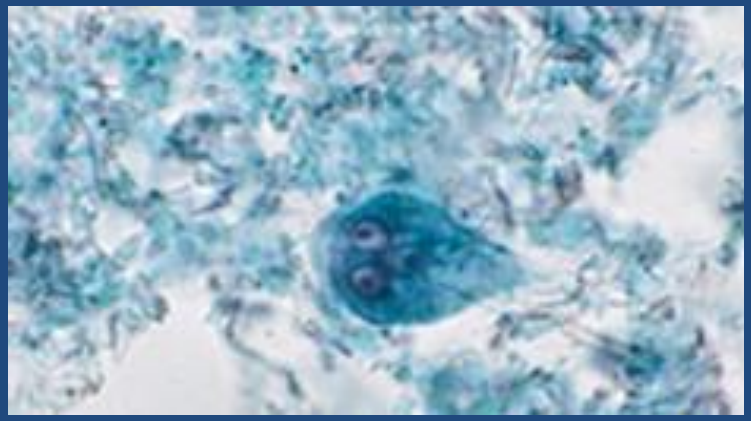
Chronic diarrhea

Aetiology

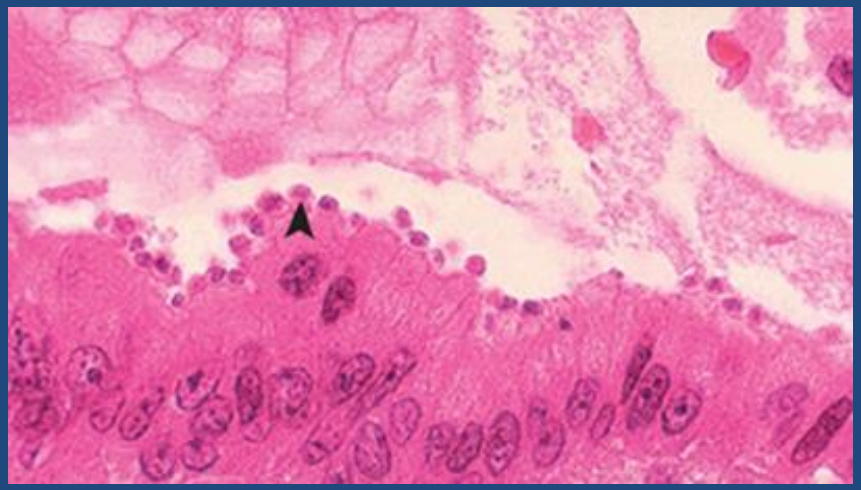
1. **Infection** **e.g.** *Giardia lamblia* . AIDS often have chronic infections of their intestines that cause diarrhea.
2. **Post-infectious** Following acute viral, bacterial or parasitic infections
3. **Malabsorption**
4. **Inflammatory bowel disease (IBD)**
5. **Endocrine diseases**
6. **Colon cancer**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

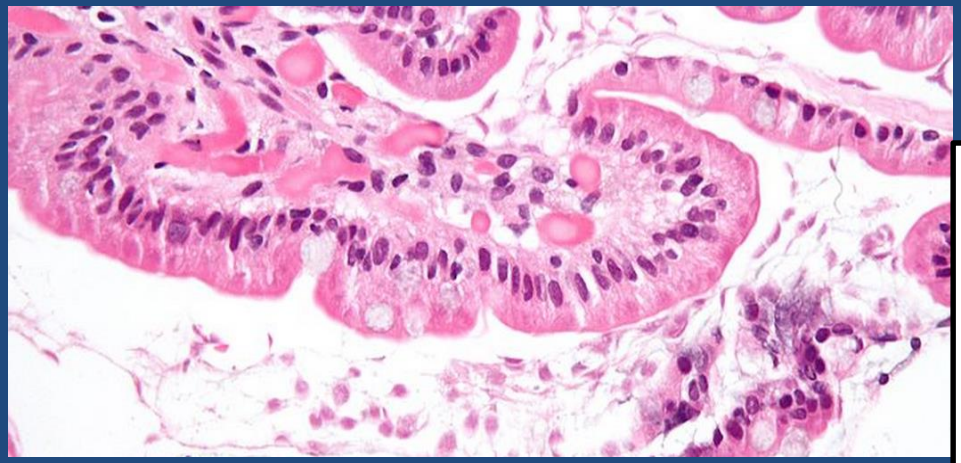
Causes of Chronic Diarrhea

Giardia lamblia



Cryptosporidiosis in AIDS





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

Complications

1. Fluids ……Dehydration
2. Electrolytes …… Electrolytes imbalance
3. *Low Sodium bicarbonate in blood…….* Metabolic acidosis
4. If persistent ……Malnutrition

Signs of Dehydration

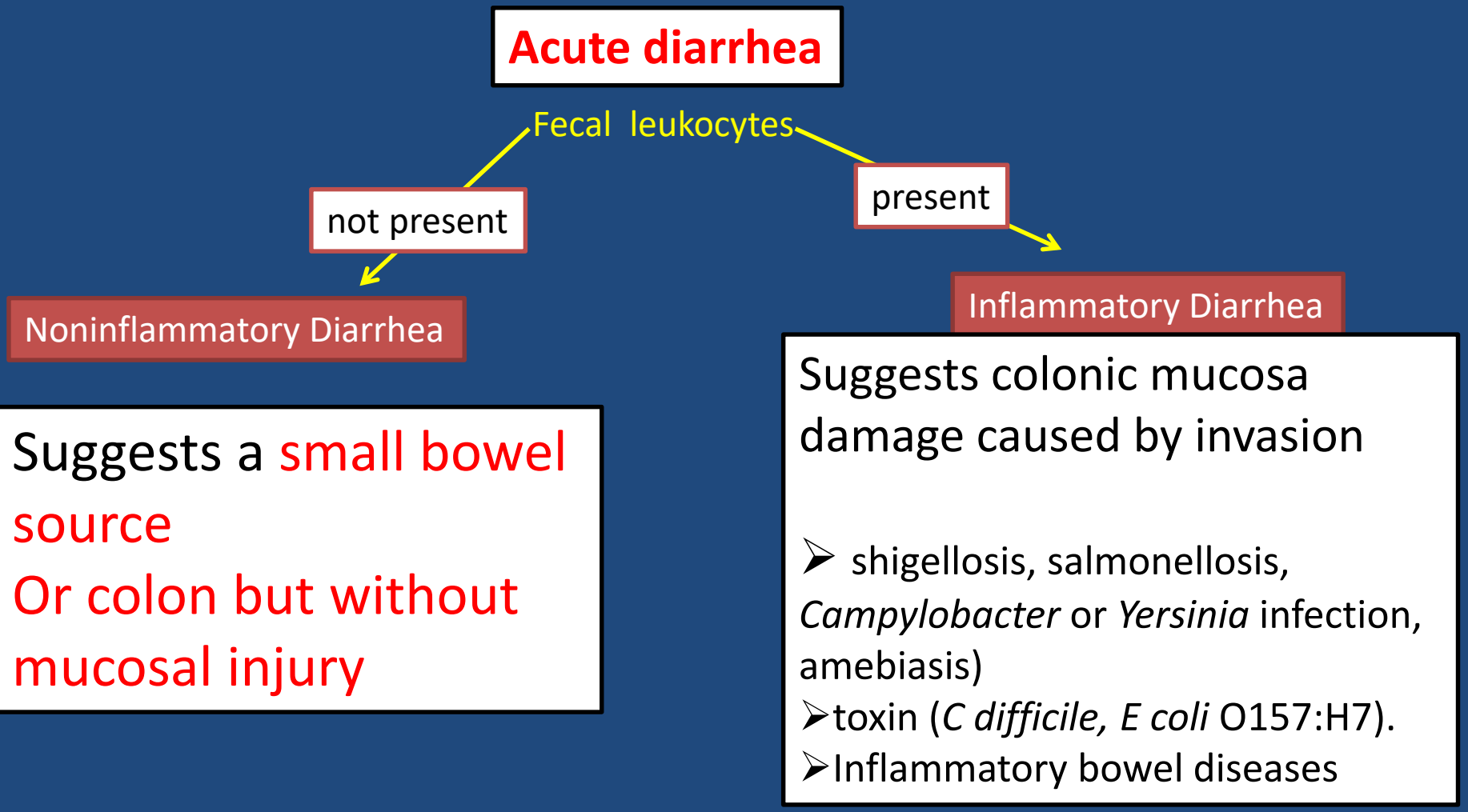
Early Signs

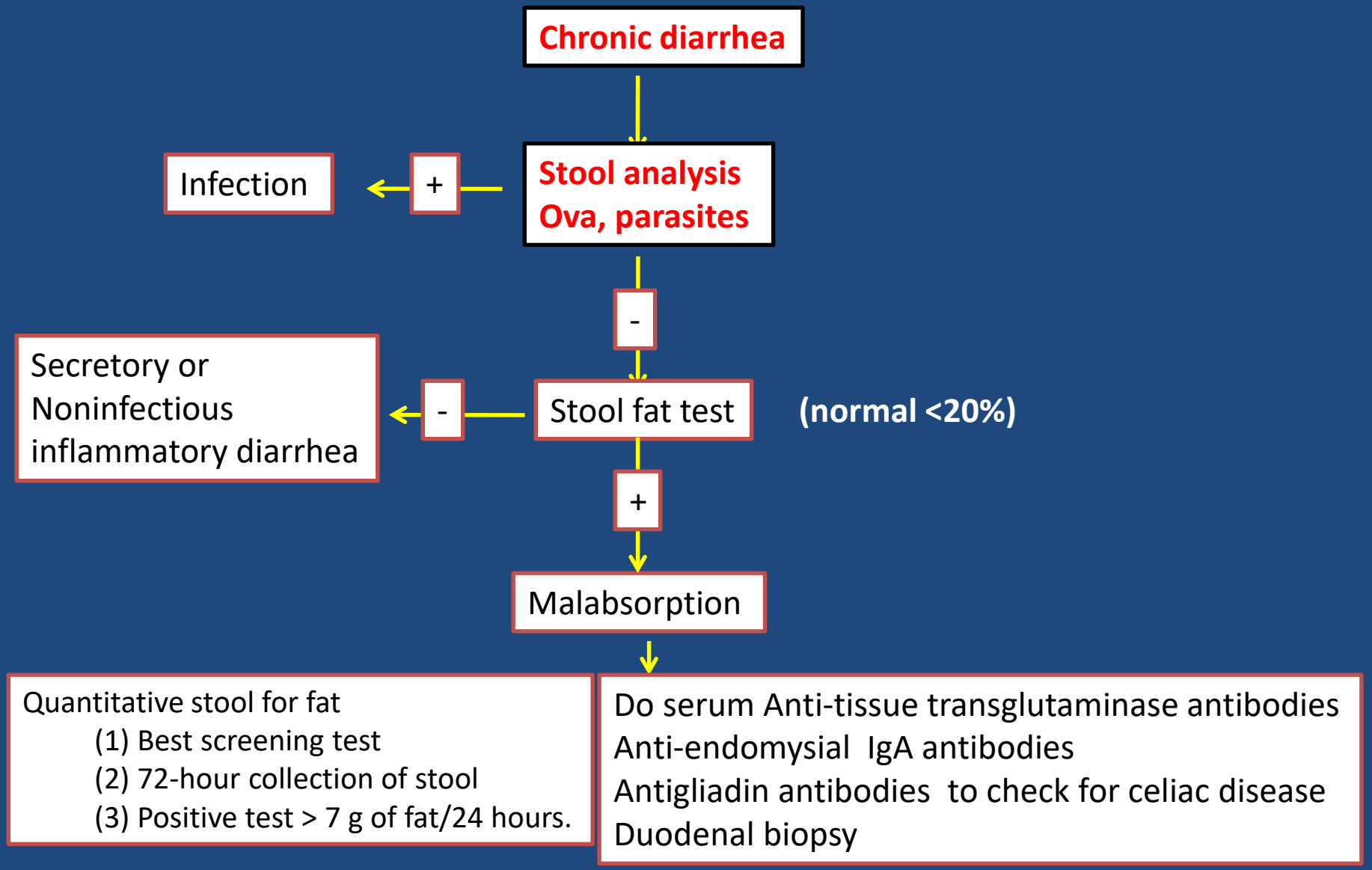
- Fatigue
- Anxiety
- Irritability
- Depression
- Cravings
- Cramps
- Headaches

Mature Signs

- Heartburn
- Joint Pain
- Back Pain
- Migraines
- Fibromyalgia
- Constipation
- Colitis

Tests useful in the evaluation of diarrhea




Chronic diarrhea
Stool analysis
Ova, parasites
+
Infection
-
Stool fat test
(normal <20%)
-
Secretory or
Noninfectious
inflammatory diarrhea
+
Malabsorption
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

A	B
1. Fasting improve the condition	**a) Secretory**
2. inflammatory bowel diseases	**b) Osmotic**
3. High stool output	**c) Exudative (inflammatory)**
4. Presence of WBC in stool	**d) Motility-related**
5. Irritable bowel syndrome	
6. bacterial toxin	
7. Malabsorption	
8. High fecal osmotic gap	

A	B
1. Irritable bowel syndrome 2. Giardia lamblia 3. Viral gastroenteritis 4. Inflammatory bowel disease 5. Food poisoning 6. Antibiotic-Associated Diarrheas 7. Malabsorption	**a) Acute diarrhea** **b) Chronic diarrhea**