GIT Module
2021-2022
Protozoan Infections
(Entamoeba, Balantidium, Giardia)

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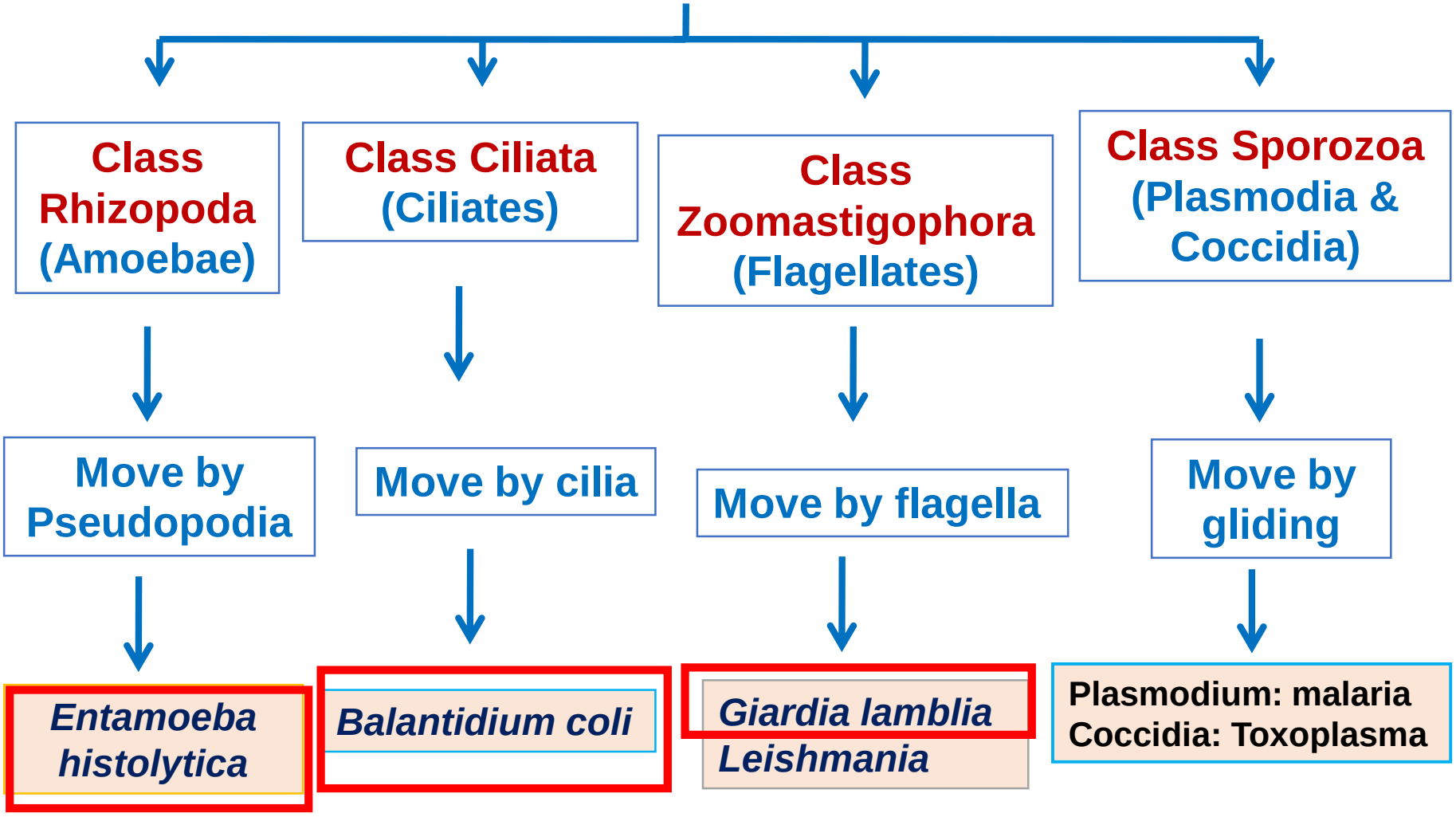
Medical Protozoology

It is the study of protozoa of medical importance.

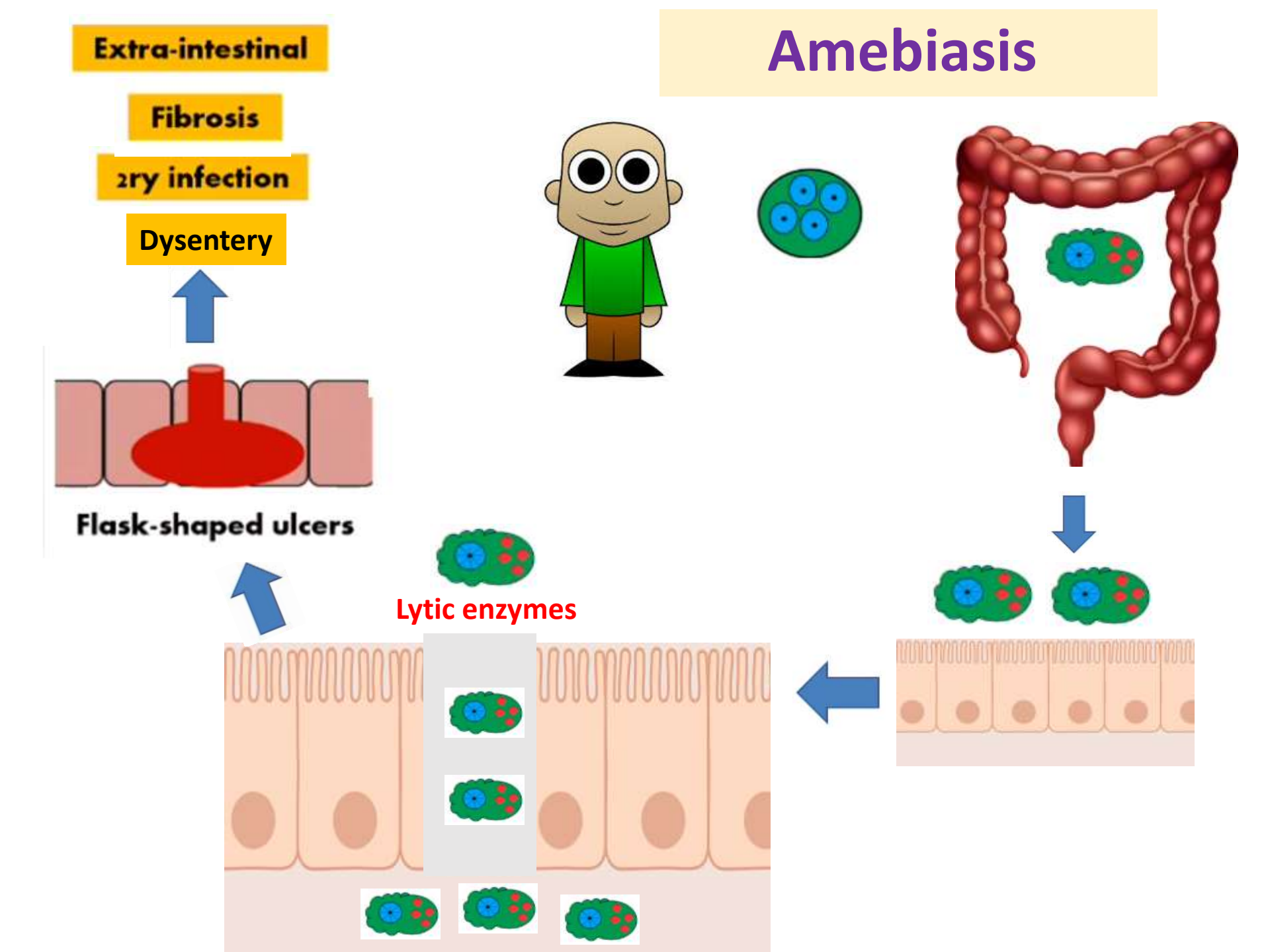
Protozoa are microscopic unicellular organisms performing all physiological functions of life.

Classification of Phylum Protozoa

1- According to the organ of locomotion



Amebiasis


Extra-intestinal
Fibrosis
2ry infection
Dysentery
Flask-shaped ulcers
Lytic enzymes

Amebiasis-Introduction

- Amebiasis is infection with the parasitic intestinal protozoan Entamoeba histolytica (the “tissue-lysing ameba”).
- Most infections are probably asymptomatic, but E. histolytica can cause disease ranging from dysentery to extraintestinal infections, including liver abscesses.
- Entamoeba has more than one species:

Entamoeba histolytica	Invasive

Entamoeba dispar Entamoeba moshkovskii	Noninvasive

Class: Rhizopoda

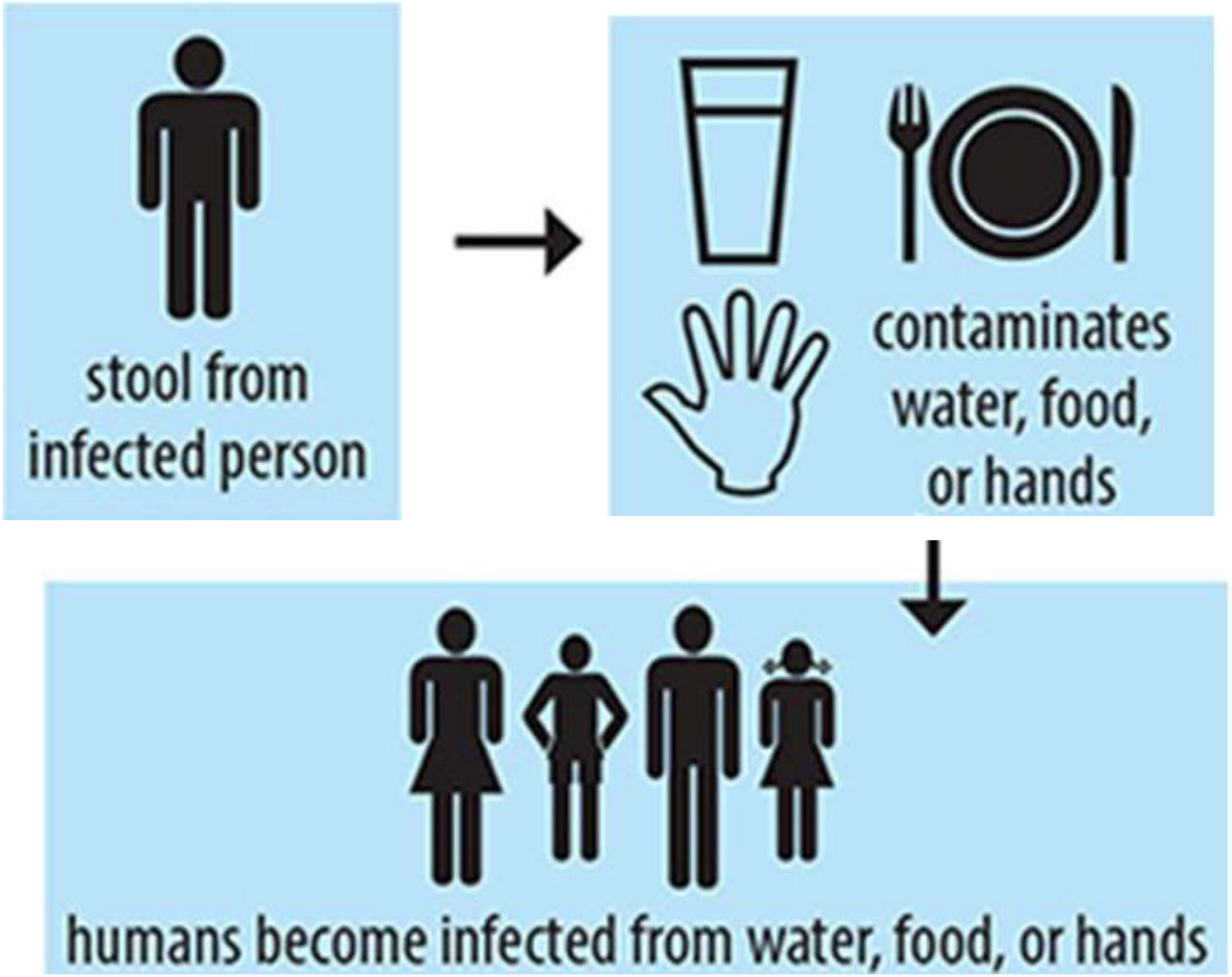
Entamoeba histolytica

- **Geographical distribution: Worldwide especially in the temperate zone and more common in areas with poor sanitary conditions.**
- In USA and other developed countries, disease is unusual and is found almost exclusively in travelers or immigrants from endemic areas.
- **Habitat: Large intestine (caecum, colonic flexures and sigmoidorectal region).**
- **D.H: Man**
- **R.H: Dogs, pigs, rats and monkeys.**
- **Disease: Amoebiasis or amoebic dysentery**

Amebiasis-Life Cycle and Transmission

- *E. histolytica* exists in **two stages**:
  - a hardy multinucleate **cyst form**
  - the motile **trophozoite stage** .
- Trophozoites can live within the large-bowel lumen without causing disease or can invade the intestinal mucosa, causing amebic colitis.

Amebiasis-**Transmission**

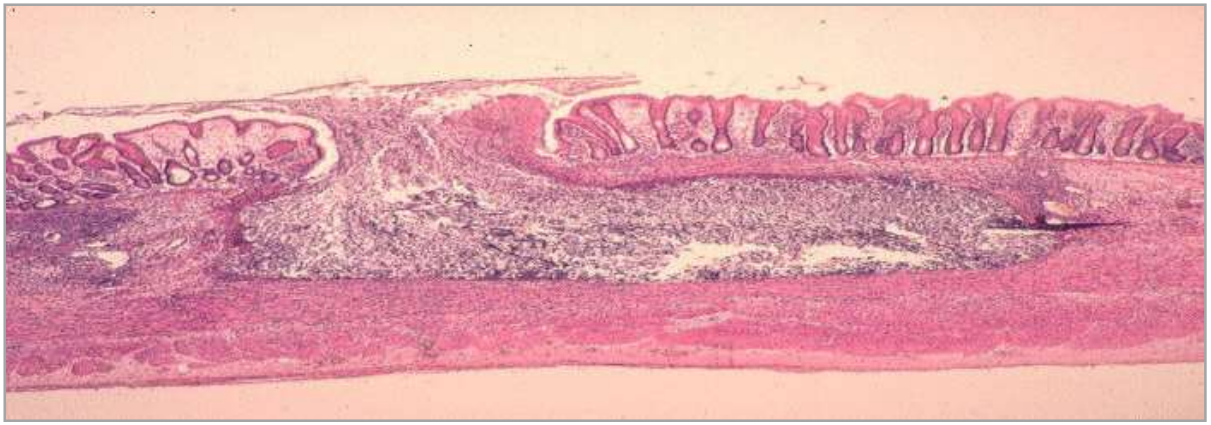


Pathogenesis

With heavy infection and lowering of host immunity

The trophozoites of *E. histolytica* invade the mucosa and submucosa of the large intestine by secreting lytic enzymes ➲ amoebic ulcers

The ulcer is flask- shaped with deeply undermined edges containing cytolyzed cells, mucus and trophozoites.



The most common sites of amoebic ulcers are caecum, colonic flexures and sigmoidorectal regions due to decrease peristalsis & slow colonic flow at these sites that help invasion.

Clinical pictures

I) Intestinal amoebiasis

1-Asymptomatic infection

Most common and trophozoites remain in the intestinal lumen feeding on nutrients as a commensal without tissue invasion (Asymptomatic patient known as a healthy carrier and cyst passers)

2-Symptomatic infection

a) Acute amoebic dysentery

Presented with fever, abdominal pain, tenderness, tenesmus (difficult defecation) and frequent motions of loose stool containing mucus, blood and trophozoites.

b) Chronic infection

-Occurs if acute dysentery is not properly treated.
-With low grade fever, recurrent episodes of diarrhea alternates with constipation.
- Only cysts are found in stool.

3-Complications

- Haemorrhage due to erosion of large blood vessels.
- Intestinal perforation ➲ peritonitis.
- Appendicitis.
- Amoeboma (Amoebic granuloma) around the ulcer ➲ stricture of affected area.

II) Extra-intestinal amoebiasis

Due to invasion of the blood vessels by the trophozoites in the intestinal ulcer ➲ reach the blood ➲to spread to different organs as:

→ **Liver** →

-Amoebic liver abscess or diffuse amoebic hepatitis.
-Affect commonly right lobe either due to spread via portal vein or extension from perforating ulcer in right colonic flexure.
-CP: include fever, hepatomegaly and pain in right hypochondrium.

→ **Lung** →

•Lung abscess ➲ pneumonitis with chest pain, cough, fever.
•Amoebic lung abscess usually occur in the lower part of the right lung due to direct spread from the liver lesions through the diaphragm or very rarely trophozoites may reach the lung via blood.

→ **Brain** → Brain abscess ➲ encephalitis (fatal).

→ **Skin** →

Cutaneous amoebiasis (Amoebiasis cutis):

- when the invasive amoebae escape from the large gut and stick to adjacent skin, usually the perianal and perigenital area.
- Nappy-wearing children.

Laboratory diagnosis

I)Intestinal amoebiasis

a) Direct

•**Macroscopic:** Offensive loose stool mixed with mucus and blood.

•**Microscopic:**

1-Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) by direct smear, iodine stained & culture.

2-Sigmoidoscopy: To see the ulcer or the trophozoites in aspirate or biopsy of the ulcer.

3-X-ray after barium enema: to see the ulcer, deformities or stricture.

b) Indirect

-Serological tests: CFT, IHAT, IFAT, ELISA

- These serological tests are positive only in invasive intestinal amoebiasis but negative in asymptomatic carriers.

II)Extra- intestinal amoebiasis

According to the organ affected

a) Direct

1- X- ray:

In liver ➲ space occupying lesion.

In lung ➲pleuritis with elevation of the diaphragm

2- Ultrasonography, CT scan& MRI:

For liver abscess.

3- Aspiration of abscess content:

For liver abscess to detect trophozoites.

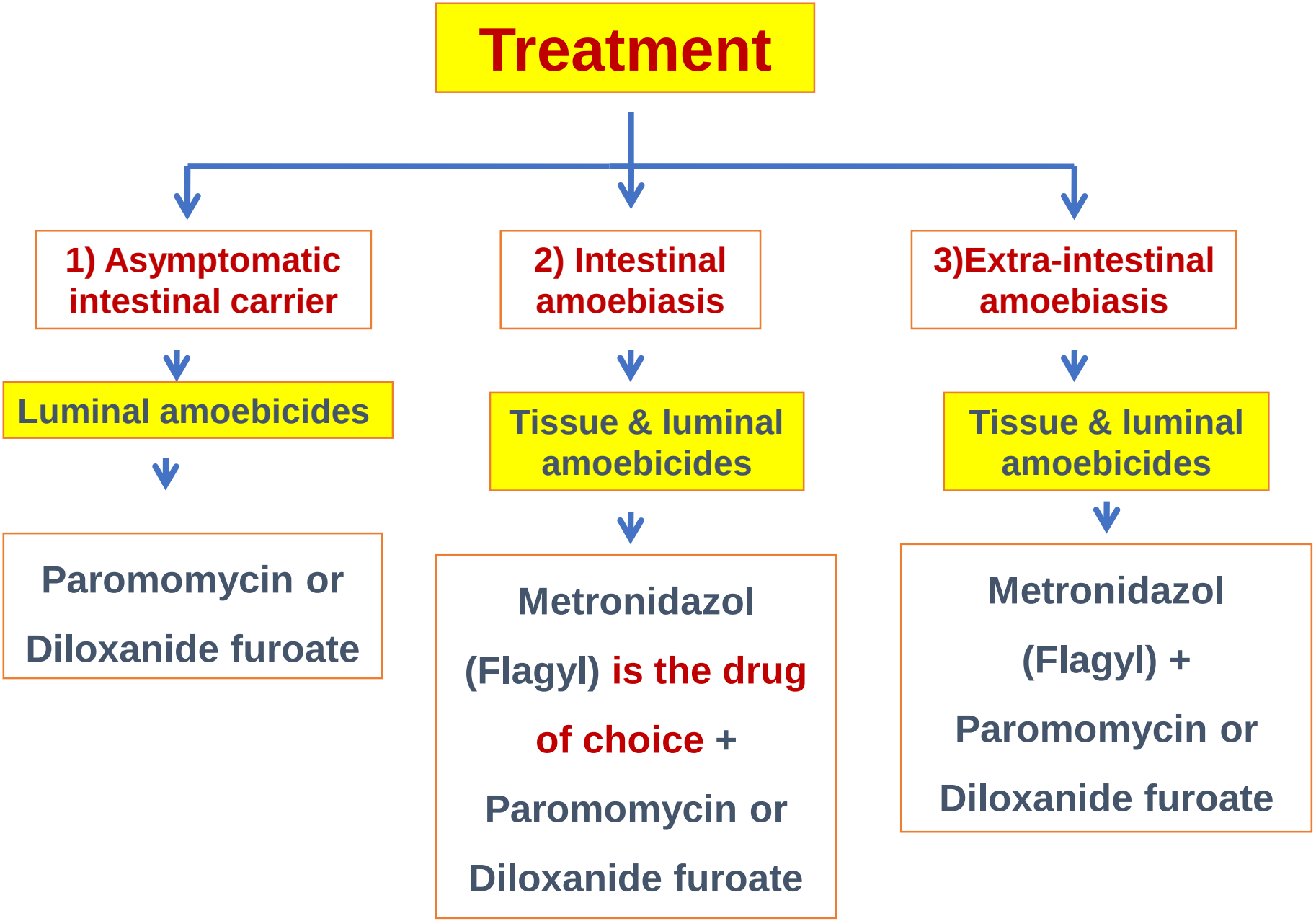
b) Indirect

1- Serological tests: As intestinal amoebiasis. They are positive and can persist for years.

2- Molecular by PCR.

3- Blood examination: Leucocytosis.

4- Liver function tests: Increased in amoebic liver abscess.


Treatment
1) Asymptomatic intestinal carrier
2) Intestinal amoebiasis
3)Extra-intestinal amoebiasis
Luminal amoebicides
Tissue & luminal amoebicides
Tissue & luminal amoebicides
Paromomycin or
Diloxanide furoate
Metronidazol
(Flagyl) is the drug of choice +
Paromomycin or
Diloxanide furoate
Metronidazol
(Flagyl) +
Paromomycin or
Diloxanide furoate

Ciliates

Balantidium coli
The largest protozoa

❖**Geographical distribution:** Cosmopolitan especially in pig raising countries.

❖**Habitat:** Large intestine (caeum &rectosegmoid region).

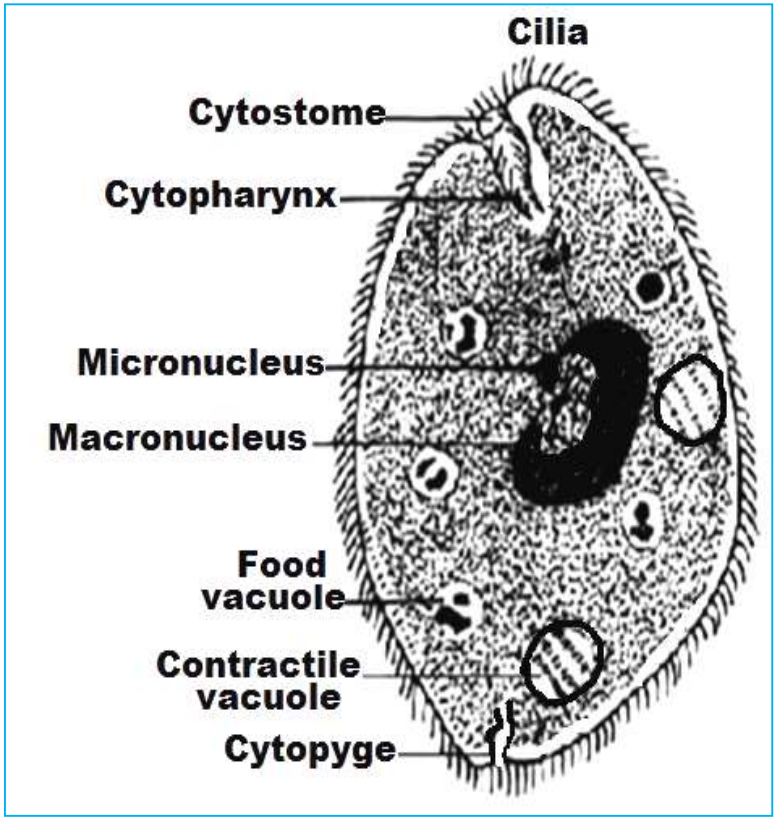
❖**D.H:** Man.

❖**R.H:** Pigs and rats.

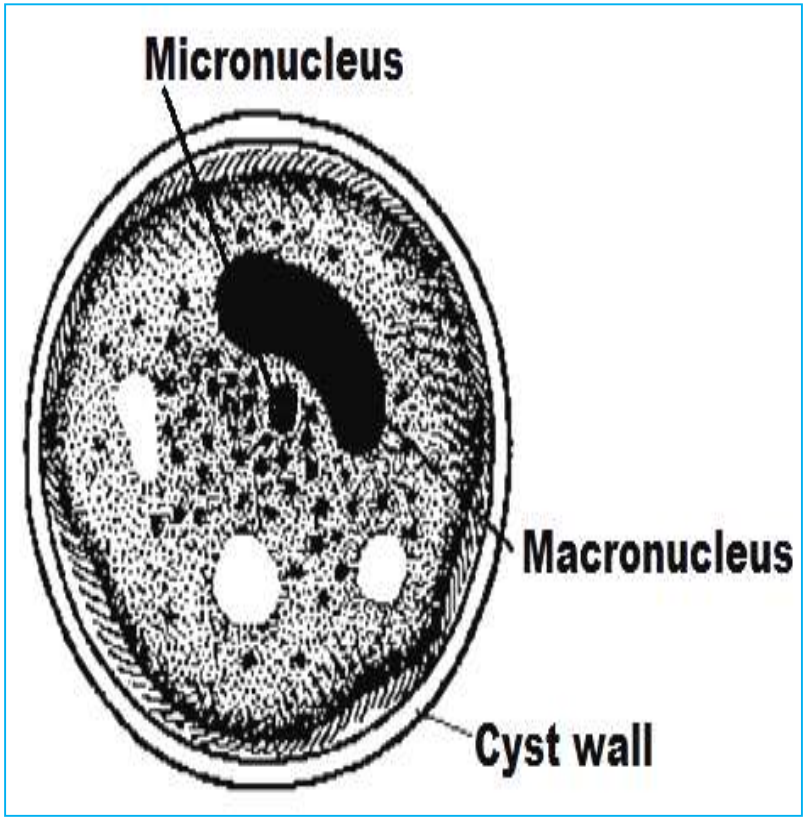
❖**Mode of transmission: the same as ameba.**

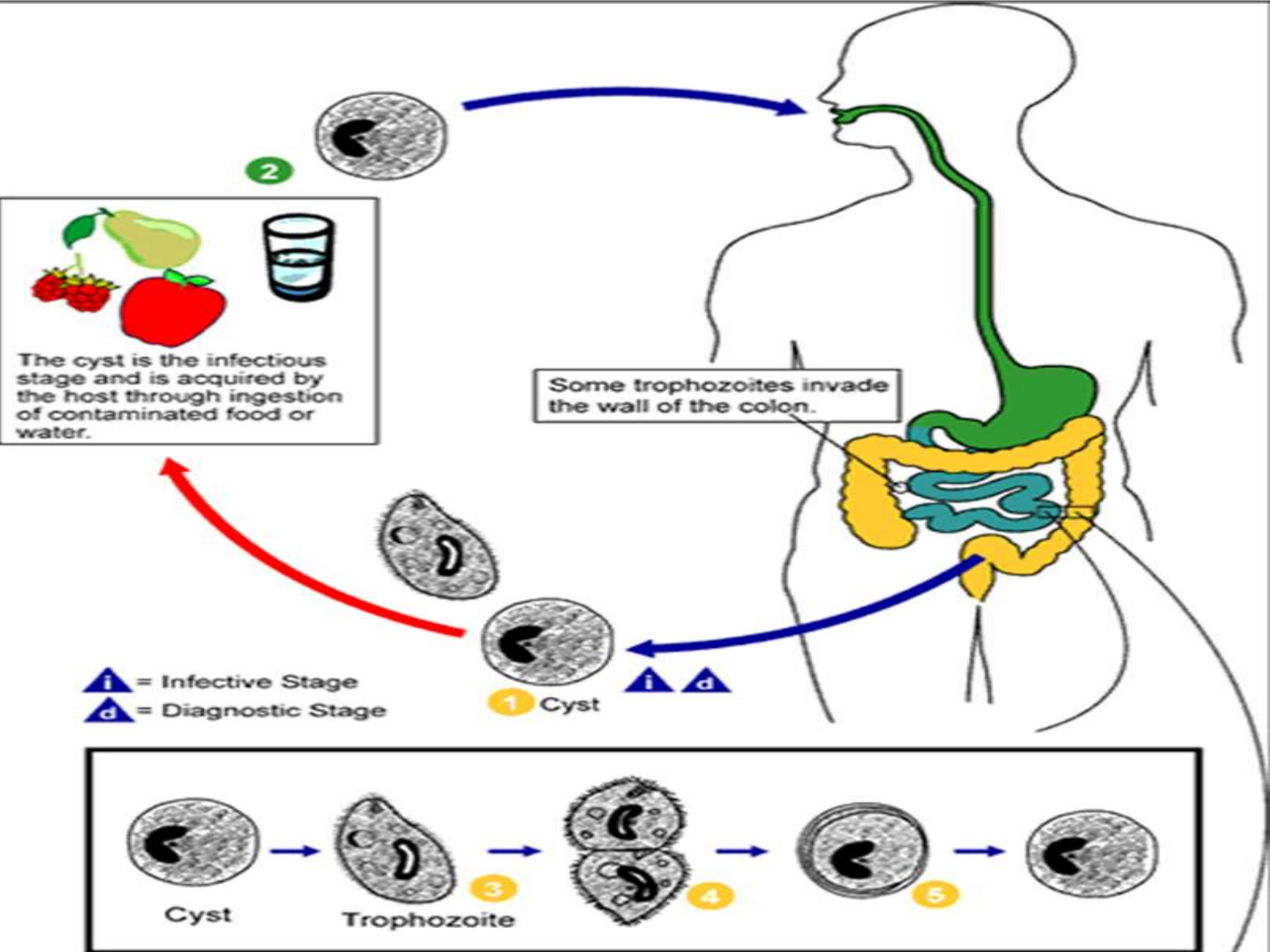
Morphological characters

1- Trophozoite stage



2- Cyst (I.S)




2
The cyst is the infectious stage and is acquired by the host through ingestion of contaminated food or water.
Some trophozoites invade the wall of the colon.
i = Infective Stage
d = Diagnostic Stage
1 Cyst
i d
Cyst
3
Trophozoite
4
5

Pathogenesis and symptomatology

Disease: Balantidiasis or balantidial dysentery

- **In heavy infection**, the mucosa and submucosa of the large intestine are invaded and destroyed by the multiplying organisms. This is **helped by the boring action of the cilia and the proteolytic secretion** ➲ the formation of **small abscesses** that leads to **flask shaped** ulcers with red undermined edges.
- **Infection is severe** in immunocompromised patients

Clinical pictures

The **majority** of infections are **asymptomatic** and are probably due to **avirulent or low-virulence strains**

Dysentery is uncommon and is thought to be related to the immune status of the individual

Extraintestinal balantidiasis is rare but has been reported in several organs, such as the liver, lungs, and genitourinary tract, in immunodeficient and otherwise healthy patients

Clinical pictures

1-Asymptomatic infection

Most common , trophozoites remain in the intestinal lumen feeding as a commensal without tissue invasion (Asymptomatic patient known as a healthy carrier and cyst carrier)

2-Symptomatic infection

Acute balantidial dysentery

Fever, abdominal pain, tenderness, tenesmus & frequent motions of loose stool containing mucus, blood and trophozoites.

Chronic infection

low grade fever, recurrent episodes of diarrhea alternates with constipation. Only cysts are found in stool

Complication

- Haemorrhage
- Appendicitis.
- Intestinal perforation & peritonitis.

Laboratory diagnosis

a) Direct

•**Macroscopic:** Offensive loose stool mixed with mucus and blood.

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1-Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) by direct smear, iodine stained.

2-Sigmoidoscopy: To see the ulcer or the trophozoites in aspirate or biopsy of the ulcer.

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b) Indirect

-Serological tests: CFT, IHAT, IFAT, ELISA

- These serological tests are positive only in case of invasion to intestinal mucosa but negative in asymptomatic carriers.

Treatment

1- Tetracycline.

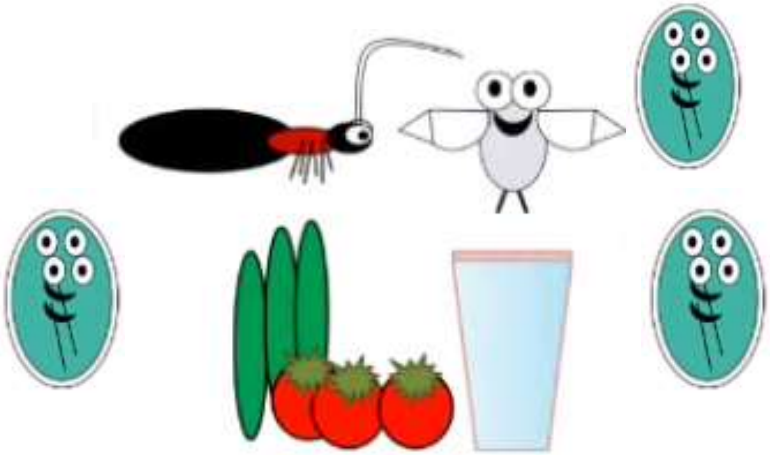
2- Metronidazole (Flagyl).

Intestinal flagellates

Giardia lamblia

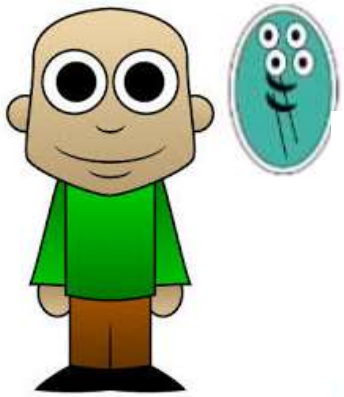
- **Geographical distribution: Cosmopolitan especially tropical and subtropical regions.**
- **Habitat: In the small intestine mainly the crypts of the duodenum and occasionally in the common bile duct and gall bladder.**
- **D.H: Man.**
- ***G. lamblia* one of the opportunistic protozoa.**
- **Mode of transmission: the same as ameba.**

Giardia lamblia



Contaminated food with cysts

IS: Cyst



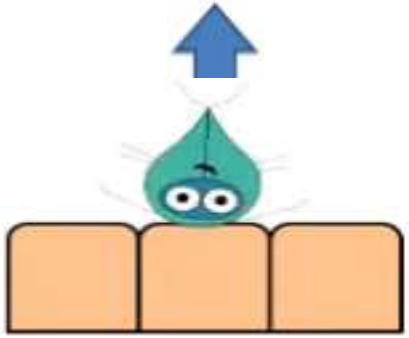
Pathogenic stage: Trophozoite

Cholangitis

Diarrhea

Atrophy of villi → Malabsorption

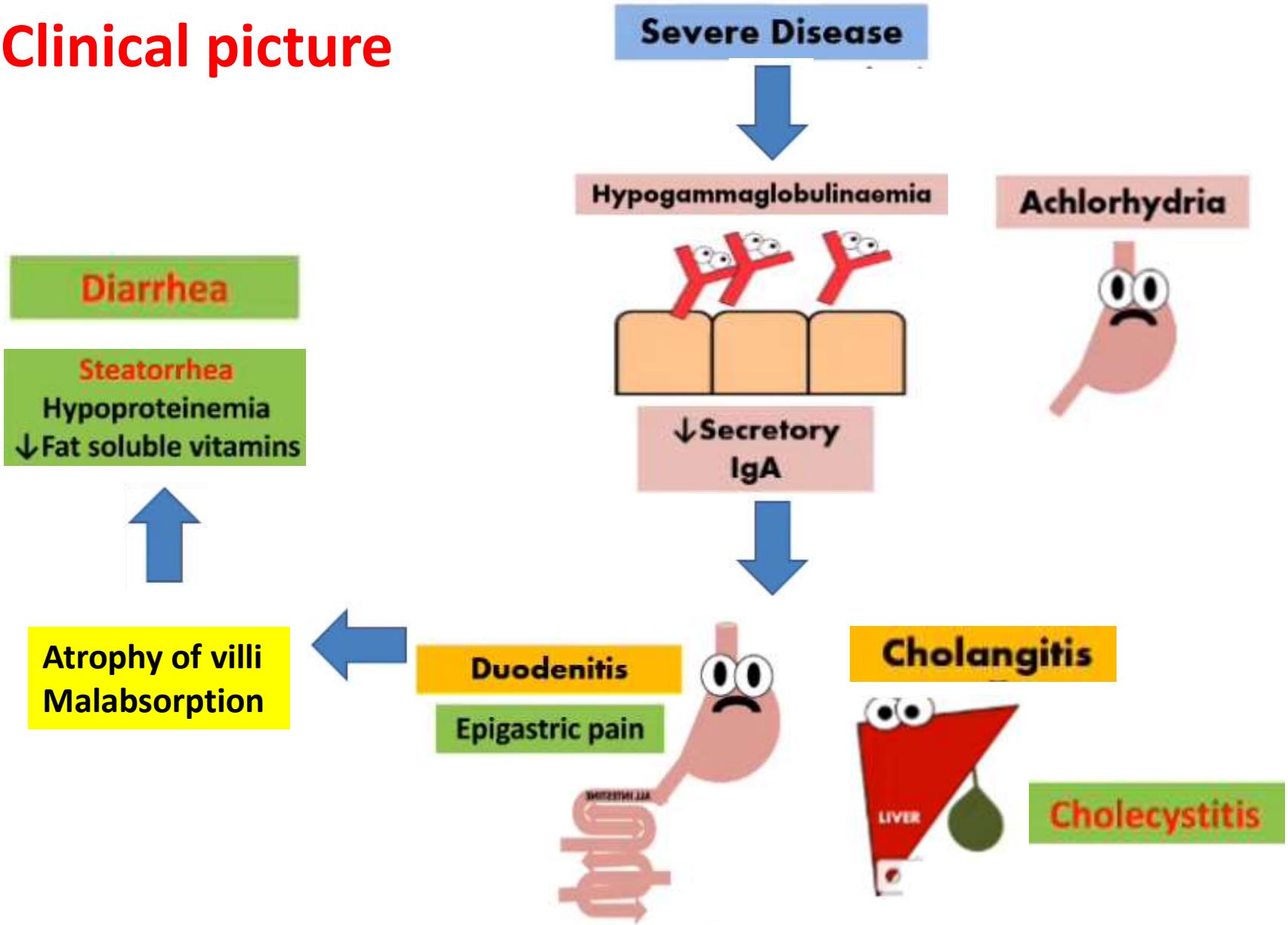
Duodenitis



Sucking Disc

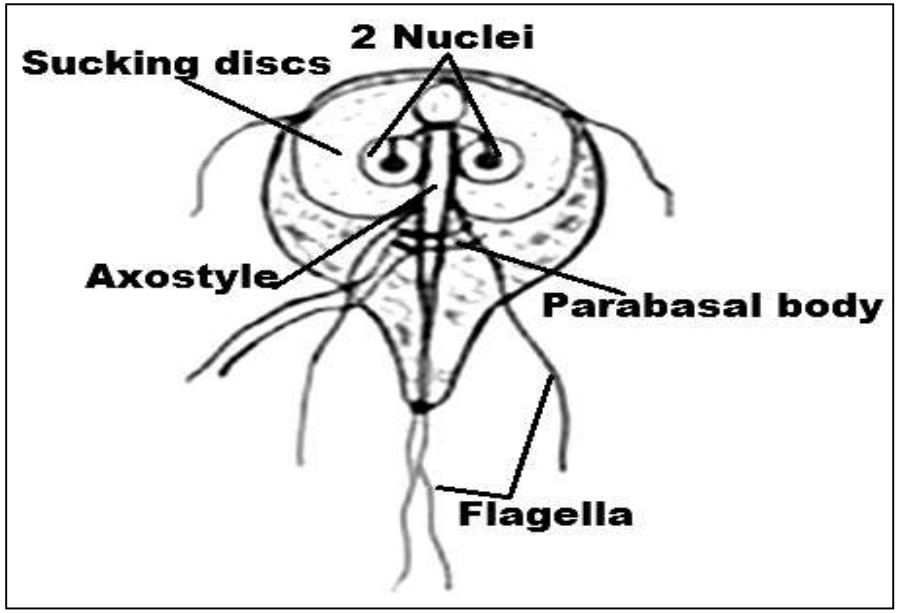
Giardia lamblia

Clinical picture



Morphological characters

1-Trophozoite stage



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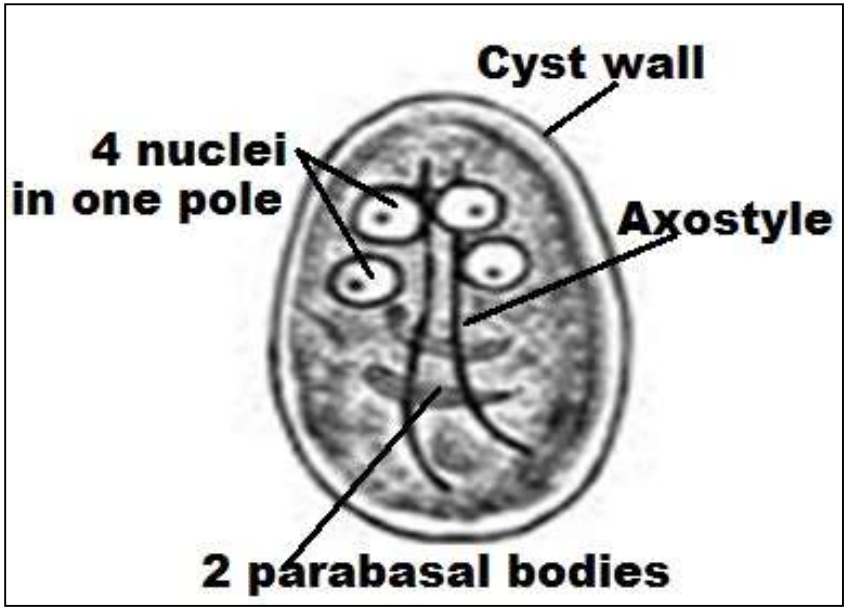

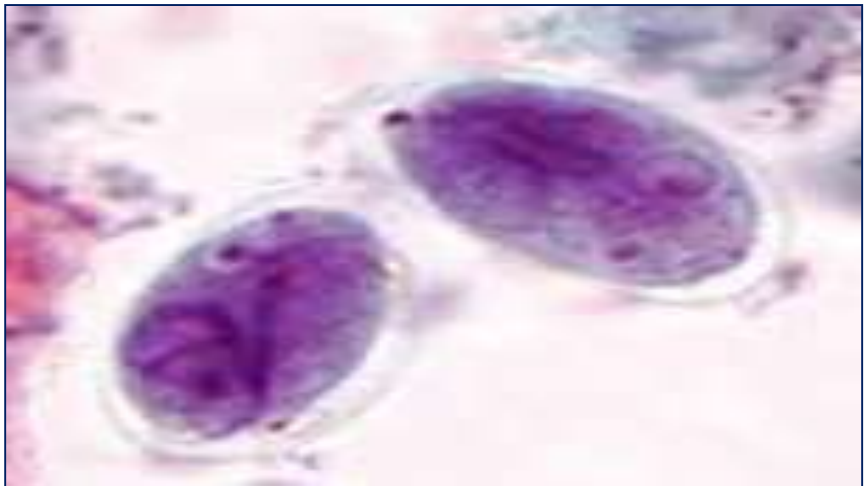

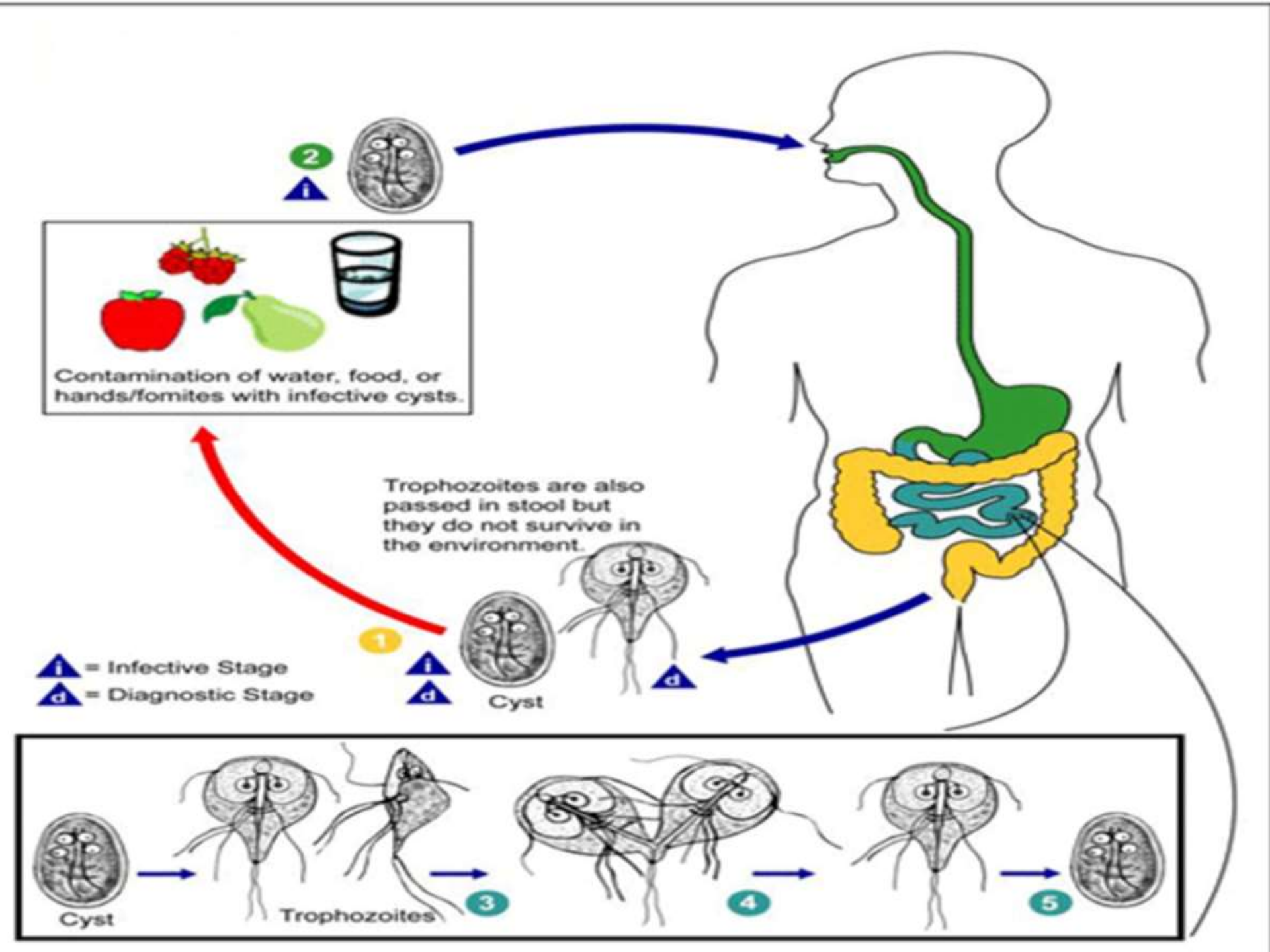
2
i
Contamination of water, food, or hands/fomites with infective cysts.
Trophozoites are also passed in stool but they do not survive in the environment.
1
i
d
Cyst
d
i = Infective Stage
d = Diagnostic Stage
Cyst
Trophozoites
3
4
5

Pathogenesis and symptomatology

Disease: Giardiasis

Predisposing factors for the development of infection with *G. lamblia*

- **Hypogammaglobulinaemia.**
- **Low level of secretory Ig A in the gut.**
- **Achlorhydria (decreased Hcl).**
- **Vitamin A deficiency (protecting epithelium and mucus integrity in the body).**
- **Malnutrition.**

The pathogenesis of *G. lamblia* infection depends on the following factors:

a) Mucosal factors

Direct attachment of the trophozoites to the duodenal mucosa leads to:

- Atrophy of duodenal microvilli and hyperplasia of the crypts➲**malabsorption syndrome for:**

- **Lactose ➲ lactose intolerance.**
- **Glucose and amino acids.**
- **Fat ➲ steatorrhea (light coloured fatty stool).**
- **Fat soluble vitamins (A,D,E,K) and vitamin B12.**

b) Luminal factors

Infection with *Giardia lamblia* infection leads to:

1- Bacterial overgrowth ➲ mucosal damage impaired absorption of fat ➲ steatorrhoea

2- Decrease luminal bile salts: Due to the uptake of bile salts by *Giardia lamblia* trophozoite during its growth ➲ impaired absorption of fat and fat soluble vitamins and also vitamin B12.

3- Inhibition of digestive enzymes such as lipase and trypsin ➲ maldigestion

Clinical pictures

1-Asymptomatic infection

-Most common. The trophozoites remain in the intestinal lumen feeding on surrounding nutrients and mucus without causing manifestations (Asymptomatic patient known as a healthy carrier).

2-Symptomatic infection

Acute giardiasis

- Common in children and travelers to endemic areas.
- Fever, abdominal colic, epigastric pain, anorexia, flatulence, vomiting, watery diarrhoea with excess mucus (no blood) but later steatorrhoea occurs➲ dehydration and loss of weight. Trophozoites are found in the stool in this case.
- Invasion to gall bladder ➲ cholycystitis, jaundice and biliary colics.
- In immunocompetent patient, giardiasis is self limiting.
- In immunodeficient patient, IgA secreation in the gut is decreased ➲ severe infection with persistent diarrhea, steatorrhoea, malabsorption syndrome and weight loss.

Chronic giardiasis

complications

2-Symptomatic infection

- Acute giardiasis
- Chronic giardiasis
- Complications

Chronic giardiasis

- Common in adults.
- The patient suffers from anorexia, epigastric pain, dyspepsia, nausea, vomiting & diarrhoea alternating with constipation. Only cysts are found in stool.

Complications

1- Retardation of growth & development in infant and young children.

2- Malnutrition and malabsorption syndrome.

3- Biliary tract disease.

Laboratory diagnosis

Direct methods

Macroscopic

Stool is bulky, offensive, loose and greasy mixed with mucus and usually float on the water surface in toilet.

Microscopic

1) Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) 2) Examination of duodenal content (enterotest or string test).
3) Endoscopic biopsy from duodenum for trophozoites & pathological changes in mucosa.

Indirect methods

-Serological tests.
-ELISA: for detection of *G. lamblia* antigen in stool.
-PCR: For detection of DNA of *G. lamblia*

Treatment

1- Metronidazole (Flagyl).

2-Nitazoxanide