Intestinal Protozoa

Lecture objectives:

- Know morphology of cysts and trophozoites of Giardia lamblia parasites
- Describe life cycle of Giardia parasites
- Describe Giardia trophozoites in tissue sections
- Discuss the clinical picture of Giardia parasites (Typical and Atypical).
- How to diagnose Giardia in the labs
- Know the chemotherapy against Giardia parasites.
- Summarize general features of Intestinal Entamoeba.
- Know the six types of Entamoeba.
- Compare between E. histolytica and E. dispar.
- Describe Life cycle of E. histolytica
- Discuss Pathology of E. histolytica (intestinal and extraintestinal).
- Diagnosis and treatment of Amoebae
- Life cycle of Cryptosporidium and diagnosis

Color index:

- Important
- Doctors' note
- Extra
- Found in Girls' slides
- Found in Boys' slides

EDITING FILE

Giardia lamblia

Classification of parasites

Protozoa

Unicellular, a single cell for all functions.

- Amoebae: moves by pseudopodia
- Flagellates: moves by flagella
- Ciliates: moves by cilia
- Apicomplexa (Sporozoa): tissue parasites

Helminths

Multicellular, specialized cells.

- Round worms (nematodes):
  - Elongated, cylindrical, unsegmented
- Flat worms:
  - Trematodes: leaf like,unsegmented
  - Cestode: tape-like, segmented

Introduction

- Giardia lamblia is a **protozoan parasite** capable of causing **sporadic or epidemic** diarrheal illness.
- Giardiasis is an important cause of **waterborne** and **foodborne** disease, daycare center outbreaks, and illness in international travelers,
- Giardiasis is especially common in areas with **poor sanitary** conditions and limited water-treatment facilities, **Water is a major source of giardiasis transmission.**
- Giardia species have two forms, **cysts** & **trophozoites:**

Cysts

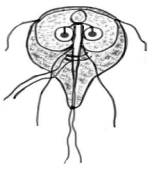
infectious[1] and diagnostic[3] stage

- **Resists gastric acidity**
- **Survives the environment**
- Multinucleated (4)
- Non-flagellated

Trophozoites

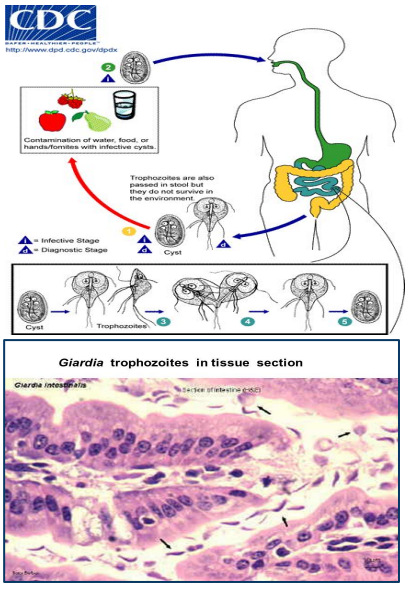
Replicative[2] and diagnostic[3] stage

- Can't resist gastric acidity
- Can't Survive the environment
- Pear-shaped
- 2 nuclei & adhesive disc
- **Multi-flagellated (8)**
- Divides by binary fission



Life cycle

Cyst **ingestion (resist acidity)** → **excystation** occurs in the **small intestine** → with release of **trophozoites**(pear-shaped) → replicate by binary fission→Trophozoites are then localized in the **small intestine**, they attach to the mucosal surface of the **duodenum[4] and jejunum**. However, the trophozoite **does not invade the mucosal epithelium** → excretion in the **stool as cyst or trophozoite.**



- Following cyst ingestion, infections have an incubation of a week or more before symptoms of acute giardiasis may develop.
- Cysts Survive in the environment and stay infectious in the environment for more than 3 months

1: Infectious: the active form that causes the disease
2: Replicative: the form that multiplies
3: Diagnostic: Seen under microscope.
4: Especially in the duodenum causing diarrhea

Giardia lamblia

Clinical manifestations

- It is mainly an asymptomatic infection that occurs in both **children**[1] and adults
- Asymptomatic cyst & trophozoites shedding can last six months or more
- If symptoms occur, they include diarrhea, malaise, abdominal cramps, flatulence, weight loss & vomiting .

Complications

- In a small number of patients
- persistent infection is associated with development of malabsorption and weight loss
- Chronic giardiasis may affect growth and development in **children**[2] .

Diagnosis

Antigen detection assays

a number of immunoassays using antibodies against cysts or trophozoites antigens have been developed for stool analysis.

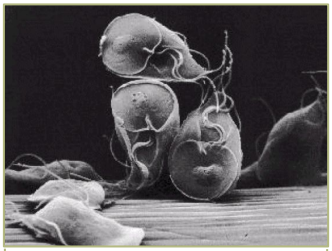
Stool examination

Microscopy for **cysts & trophozoites.**

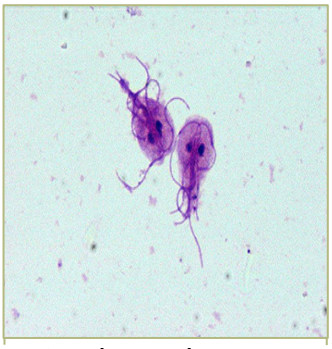
Examination of **duodenal contents** for **trophozoites.**

Treatment

- Drug of choice is Metronidazole.

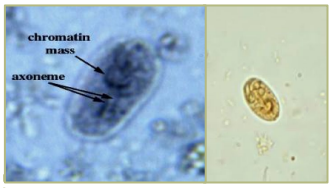


Giardia trophozoites (Electron Microscopy)



Giardia trophozoites (Trichrome stain)

Giardia trophozoites (Light Microscopy)



Giardia Cyst (Light Microscopy)

1- Mainly affects children
2-Due to malabsorption

Intestinal Amoebae

Entamoeba histolytica

- Amebiasis occurs worldwide; the prevalence is increased in developing countries because of poor socioeconomic conditions and sanitation levels.
- It is a **waterborne infection.**
  - 500 million people worldwide are infected.
  - 100,000 deaths per year.

- There are 6 species of Entamoeba :
  - **E.Histolytica amoebae are pathogenic & invasive.**
  - E.dispar is non-pathogenic, non-invasive form.
  - E.coli[1]
  - E.gingivalis
  - E.hartmanni
  - E.polecki
- E. histolytica and E.dispar can't be distinguished by microscopic observation.

The parasite exists in two forms:

Cysts

Infective and diagnostic stage

- Resist to the harsh conditions of the environment[2].
- Has 4 nuclei

Trophozoites

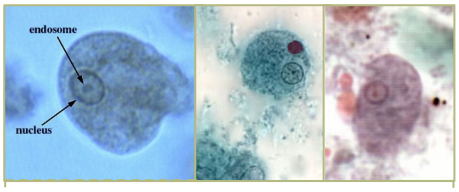
Vegetative and diagnostic stage

- causes **invasive** disease.
- fragile structure.
- must encyst to survive.
- Has 1 nucleus.

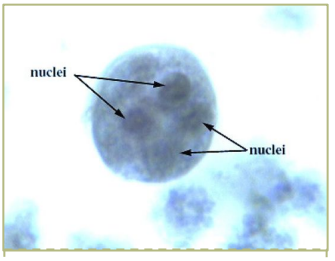
Consumes RBCs

Modes of transmission

1. Fecal-oral route, **Water** & Food.
2. Flies can act as vector
3. Can be sexually transmitted person - to - person contacts (homosexual)
4. Not a zoonosis[4]



Entamoeba histolytica
(Trophozoite)



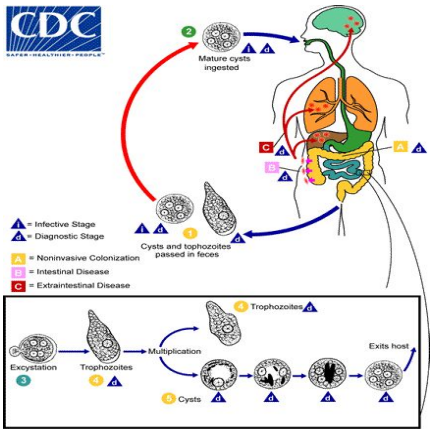
Entamoeba histolytica
(Cyst)

1: Entamoeba coli
2: Like the stomach acidity
3: Making it easier to control

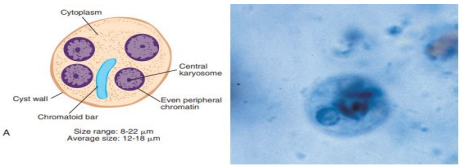
Entamoeba histolytica

Life cycle

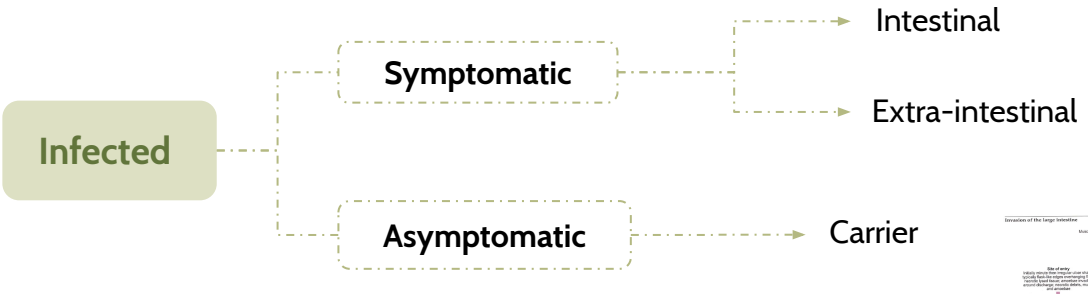
- The cysts pass through the stomach → to the **small intestine**, where they **excyst** to form **trophozoites** → The trophozoites can **invade and penetrate** the mucous barrier of the **colon (large intestine)** → causing tissue destruction **colitis** and increased intestinal secretion and can thereby ultimately lead to **bloody diarrhea .**
- **The infective dose can be as little as 1 cyst (very virulent).**
- The incubation period can be from few days to few weeks depending on the infective dose
- Cysts can survive for weeks at appropriate temperature and humidity.



The cyst has 4 nuclei, while trophozoites has 1 nucleus.



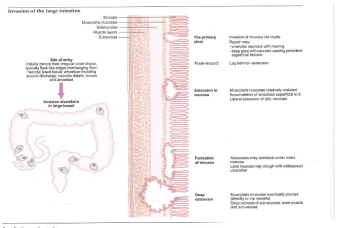
Clinical outcomes of infection

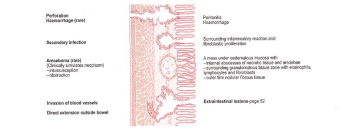


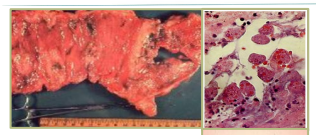
Pathology

A. Intestinal amoebiasis[1]:

- Remarkable and unique ability to produce enzymes that lyse host issues.
- Lesions are found mainly in the colon and they may heal or cause serious complications:
  1- Perforation of the colon.
  2- Amoeboma: Granulomatous mass obstructing the bowel
  3- Blood invasion; **Amoebic liver abscess**, lung, brain.
  4- Direct extension



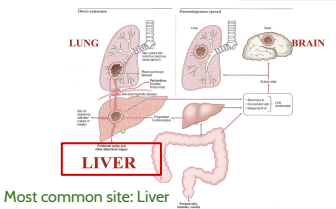




E. Histolytica in mucosa. Numerous trophozoites can be seen with ingested erythrocytes

B. Extra - intestinal amoebiasis:

- **Spreading:**
  - Direct extension: To **liver (progress to abscesses)** → Subdiaphragmatic abscess → To lung (as pleuro-pulmonary abscess).
  - Haematogenous spread: Through **liver (progress to abscesses)** → To ectopic sites (Brain and Lung).



Most common site: Liver

1-they cause conical flask shaped ulcers in the large intestine

Entamoeba histolytica

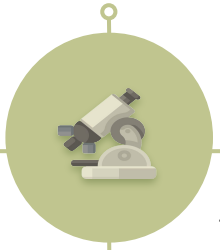
Clinical manifestations

Majority are **asymptomatic** but some may have:

- mild diarrhea
- severe **amebic dysentery (abdominal pain, bloody diarrhea, mucus in stools)**
- Weight loss occurs in about half of patients, fever.
- fulminant amebic colitis:
  Fulminant colitis with **bowel necrosis** leading to **perforation** and **peritonitis** has been observed in approximately 0.5 percent of cases; associated mortality rate is more than 40 percent

Diagnosis

Serology antigen detection
(Mainly for invasive infections)
1. IHA 2. ELISA



Stool Examination (Microscopy)

1. Wet mount **(cysts and trophozoites[1])**
2. Concentration methods **(only cysts)**

Molecular testing

Detection of parasitic DNA or RNA in feces via probes, can also be used to diagnose amebic infection & differentiate between the different strains.

For Extra-intestinal infections:

1. **Serology**: IHA, ELISA.
2. **Surgical aspirate** (not done as a diagnostic procedure due to risk of extension): Trophozoite.
3. **Sigmoidoscopy** and/or **colonoscopy** and t**aking biopsy**: Trophozoite.

Treatment

- **Intestinal**:
  1. **Asymptomatic** (cysts only): **diloxanide furoate (Furamide).**
  2. **Symptomatic** (cysts and trophozoites): **Metronidazole**.
- **Extra-intestinal:**
  Metronidazole.

1- With engulfed RBCs in the cytoplasm, remember Entamoeba Eats Erythrocytes

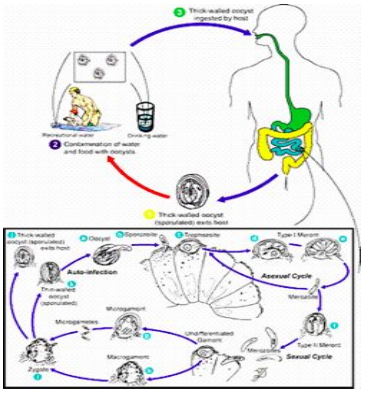
Cryptosporidium Parvum

Introduction

- An **intracellular** protozoan parasite that is associated with:
  - **Self-limited** diarrhea in normal **immunocompetent hosts.**
  - **Severe debilitating diarrhea** with weight loss and malabsorption in **HIV-infected patients.**[1]

Life cycle

Drs explanation:
Before the parasite was not known because it didn't cause diseases,but with the spreading of HIV especially when in reaches the end stage **(AIDS)** it caused infection through the cyst entering the small intestine
Infective stage: Oocyst
Diagnostic stage: Oocyst



Modes of transmission

- Spread from an infected person or animal, by **fecal-oral route.**
- From **a contaminated environment**, such as food or **water** source contamination.

Diagnosis

- Cryptosporidium species **cannot be cultivated in vitro.** (so diagnosis of cryptosporidiosis is generally based upon **microscopy**).

From stool

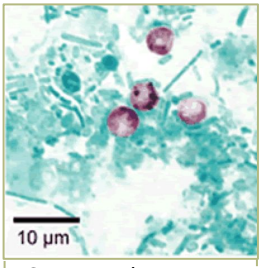
The diagnosis of cryptosporidiosis is made by finding **oocysts** in:
- fecal smears when using modified acid –fast stain(ZN)
- **by Antigen detection by using ELIZA,IF.**

From duodenal aspirates

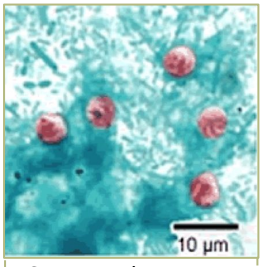
+ Bile secretions & biopsies from affected gastrointestinal tissue:
- Polymerase Chain Reaction(PCR)
- Enzyme immunoassays: (ELIZA) & IF.

Treatment

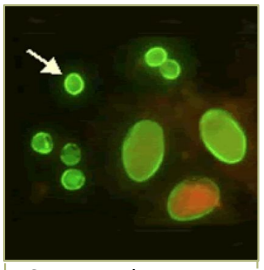
- **Self-limited** in immunocompetent patients.
  - In AIDS patients: Paromomycin.



Cryptosporidium Parvum acid-fast stain ZN.



Cryptosporidium Parvum Safranin



Cryptosporidium Parvum Immunofluorescence (IF)

1- Opportunistic infection

MCQ:

Q1:A, Q2:B, Q3:B, Q4:B, Q5:D

Q1: What form of Giardia lamblia is considered an Infective stage?
A- cyst.
B- trophozoites.
C- both.
D- none of the above

Q2: Which one of the following organisms is the most invasive?
A- Giardia lamblia.
B- Entamoeba histolytica.
C- Cryptosporidium Parvum.
D- all of the above

Q3: Cryptosporidium Parvum can cause Severe debilitating diarrhea with weight loss in which of the following?
A- immunocompetent hosts.
B- HIV-infected patient.
C- old people.
D- All.

Q4: 30 Year old patient came to the hospital complaining of severe weight loss, fever and bloody diarrhea upon examination, the colonoscopy revealed fulminant colitis that lead to perforation of the colon. What other extra-intestinal manifestation could he also have?
A- anemia .
B- Liver abscess.
C- osteomyelitis.
D- Esophagitis.

Q5: Metronidazole is the drug of choice in Entamoeba histolytica infection when it is?
A- Asymptomatic infection.
B- symptomatic infection.
C- Extra-intestinal infection .
D- B and C.

SAQ:

CASE: A 3 year-old child came to the clinic complaining of diarrhea, malaise, abdominal cramps, flatulence, weight loss & vomiting for the past 2 weeks. The doctor noticed that the patient's growth and development is affected. Stool examination microscopy showed cysts & trophozoites, and examination of duodenal contents showed trophozoites. He attends the daycare regularly and lives in a poor village.

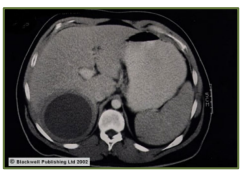
Q1: What is the most likely diagnosis?
Giardiasis infection

Q2: What is the infective stage of this disease?
Cysts

Q3: What is a major source of giardiasis transmission?
Water and food

Q4: What is the treatment?
Metronidazole

CASE (from dr's slides): A 30-year-old male experienced diarrhea for two weeks with fever of 39° C, nausea,vomiting, malaise and right upper abdominal pain. Physical examination revealed hepatomegaly 6 cm below the right costal margin.
CT scan showed a single hypodense mass in the right lobe of 7.8 x 5.2 cm, round, with well defined borders. Serology was positive for Entamoeba histolytica at 1/512.



What is the most likely diagnosis?
Amebic liver abscess

Members board:

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