Entamoeba histolytica: Morphology, life cycle, Pathogenesis, clinical manifestation, lab diagnosis and Treatment
Entamoeba histolytica is a common protozoan parasite found in the large intestine of human. The parasite is responsible for amoebiasis and liver abscesses. It is the third leading parasite cause of death in the developing countries.
- Morphology:
- Parasite occurs in three stages; trophozoite, precyst and cyst

<table>
<thead>
<tr>
<th>Trophozoite</th>
<th>Cyst</th>
<th>Nucleus of Cyst</th>
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<tbody>
<tr>
<td>psuedopod</td>
<td></td>
<td>condensed chromatin</td>
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<tr>
<td>endosome</td>
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<td>feeding vacoule filled with a RBC</td>
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*Entamoeba histolytica*
• 1. **Trophozoite:**

• It is the growing and feeding stage of parasite

• **Shape:** not fixed because of constantly changing position

• **Size:** ranging from 18-40 µm; average being 20-30 µm

• **Cytoplasm:** cytoplasm is divided into two portion; a clear transparent ectoplasm and a granular endoplasm. Ingested RBCs, tissue granules and food materials are also found in endoplasm

• **Nucleus:** It is single, spherical shape and size ranging from 4-6 µ. Nucleus contains central karyosome and fine peripheral chromatin.

• Trophozoites are actively motile with the help of pseudopodia.

• Trophozoites are anaerobic parasite, (present in large intestine)
2. Pre cyst:
It is the intermediate stage between trophozoite and cyst
It is smaller in size; 10-20µ
It is round or slightly ovoid with blunt pseudopodium projecting from periphery
No RBC or food materials are found on its endoplasm.
3. Cyst:

- It is the infective form of parasite.
- **Shape:** It is round or round or oval in shape
- **Size:** 12-15 µm in diameter
- It is surrounded by a highly refractile membrane called cyst wall. The cyst wall is resistant to digestion by gastric juice in human stomach
- **Nucleus:** A mature cyst is quadrinucleated.
- **Cytoplasm:** Cytoplasm shows chromatid bars and glycogen masses but no RBCs or food particles.
- Mature cyst passed out in stool from infected patient and remained without further development in soil for few days.
Life cycle:
• Life cycle of *histolytica* is relatively simple and consists of infective cyst and invasive trophozoites stage.
• Life cycle completes in single host, ie human
• Human get infected with E. histolytica cyst from contaminated food and water. Infection can also acquired directly by sexual contact.
Fig. 1.13: Reproduction and life-history of *Entamoeba histolytica*.
Life Cycle of Entamoeba histolytica

1. Mature Cysts
2. Excystation
3. Trophozoite
4. Multiplication
5. Cysts
6. Feces

- A = Non Invasive Colonization
- B = Intestinal Disease
- C = Extra-Intestinal Disease

- Infective Stage
- Diagnostic Stage
• The mature Cyst is resistant to low pH of stomach, so remain unaffected by the gastric juices.
• The cyst wall is then lysed by intestinal trypsin and when the cyst reaches the caecum or lower part of illium excystation occurs. The neutral or alkaline environment as well as bile components favor excystation.
• Excystation of a cyst gives 8 trophozoites. Trophozoites are actively and carried to large intestine by peristalsis of small intestine. Trophozoites then gain maturity and divide by binary fission.
• The trophozoies adhere to mucus lining of intestine by lectin and secretes proteolytic enzymes which causes tissue destruction and necrosis. Parasite, when gain access to blood, migrates and causes extra-intestinal diseases.
• When the load of trophozoites increases, some of the trophozoites stop multiplying and revert to cyst form by the process of encystation.
• These cysts are released in faeces completing the life cycle.
• **Pathogenesis:**

• **1. Mode of infection:**
  - Faeco-oral route
  - Ingestion of cyst contaminated foods and water

• **2. Virulence factors:**
  - **i. Cyst wall:** cyst wall is resistant to low pH and gastric juice of stomach.
  - **ii. Lectin:** Surface of trophozoite contains lectin that is specific to link to (N-acetyl-galactosamine and galactose sugar) present in surface of intestinal epithelium.
  - **iii. Ionophore** like protein: It causes leakage of ions such as Na+, K+, Ca++ from target cells.
  - **iv. Hydrolytic enzymes:** Phosphatase, proteinease, glycosidase and RNase causes tissue destruction and necrosis.
  - **v. Toxin** and **haemolysin**
• **3. Pathogenesis;**
• The parasites express large number of virulence factors including lectin, lytic peptide, cysteine, proteineases and phospholipase.
• Excystation of cyst in intestine releases 4 trophozoites which then colonizes the large intestine. The binding of trophozoites with the colonic epithelium is a dynamic process in the pathogenesis. After adherence trophozoite lyse the target cell by its ionophore like protein that causes leakage of ions from cytoplasm. The proteolytic enzymes secreted by the amoeba causes tissue destruction giving flask shaped amoebic ulcer, is a typical feature of intestinal amoebiasis.
• Trophozoites penetrates the columnar epithelium of mucosa causing lysis and moves deep inside till they reached submucosa layer and multiply rapidly. Ultimately amoeba destroy considerable area of the submucosa leading an abscess formation which breaks down to form ulcer. The ulcer is flask shaped with narrow neck and broad base. The ulcer may be localized in ileo-caecal region or generalized throughout the large intestine.

• From intestine, the parasites may be carried to other vital organs such as liver, heart, brain etc through blood circulation. Pulmonary and hepatic amoebic abscesses are frequent and rarely cerebral, cutaneous and splenic amoebic abscesses.
Clinical manifestation:
• Infection ranges from asymptomatic to invasive intestinal amoebiasis and extra-intestinal amoebiasis
1. Intestinal Amoebiasis
   i. Asymptomatic infection: 90% of *E. histolytica* infection is mild or asymptomatic
   ii. Symptomatic infection
• Non dysentrie amoebieic colitis (mild diarrhea)
• Acute amoebic dysentery: it is more common and characterized by abdominal pain, fever and tenderness. Stool contains RBCs, charcot-leyden crystals and trophozoites.

Complications: toxic megacolon, fulminant amoebic colitis, amoeboma, amoebic peritonitis, perianal ulceration
• **Extra intestinal amoebiasis:**
  
  • i. **Hepatic infection:** non supurative hepatitis, liver abscesses, other complications
  
  • ii. **Pulmonary infection:** chest pain, dyspnoea, non-productive cough
  
  • iii. **Cerebral infection:** it is rare and occurs as a complication of liver of pulmonary amoebiasis
  
  • iv. **Genitourinary infection:** involves kidney and genital organs
  
  • v. **Spleenic infection**
  
  • vi. **Cutaneous amoebiasis**
• **Lab Diagnosis:**
• **Specimen**: stool, pus or liver abscesses, sputum and biopsy samples
• i. **Stool macroscopy**: in amoebic dysentery stool is offensive, semi-solid, dark brown color and acidic in nature, mixed with blood, mucus and faecal materials.

  • ii. **Microscopy**: Normal saline preparation of fresh faecal material reveals trophozoites with RBCs in its cytoplasm and its amoebic motility.

• iii. **Stool Ag detection**: ELISA to detect 170KD lectin of *E. histolytica*

• iv. **Stool culture**: Robinson’s medium and NH polyxenic culture medium are used to culture *E. histolytica*

• v. **Serology**: IHA, IFA etc are used to detect antibody in serum against *E. histolytica*

• vi. **PCR**: It is sensitive test, used to differentiate *E. histolytica* with other Entamoeba species

• vii. **Radiological finding**: X-rays, MRI, CT scan, ultrasonography etc for extra intestinal amoebiasis.

• viii. **Blood test**: blood count, Liver function test, Kidney function test

• ix. **Intradermal test**
Treatment:
Ameobicidal drugs used to destroy the parasite inside human body may be grouped under following categories —

1. Tissue Amoebicides:

These are the drugs which directly act on the trophozoite stage of the parasite residing inside the tissues—

(a) Emetine and dehydro- emetine (DHE) are the drugs of choice to kill trophozoites residing inside intestinal wall, liver and other metastatic lesions.

(b) Chloroquine (4 aminoquinaline) is used specifically for the parasite present in liver and lung.
2. Luminal Amoebicides:

These are the drugs which act when they come in contact with the trophozoites as well as cystic forms of E. histolytica present only in the intestinal lumen. That is why, they are also known as contact amoebicides.

The important luminal amoebicides are Di-iodohydroxyquinoline (diodoquin), iodochlor hydroxy quinoline (clioquinol), chlorophenoxamide (mebinol), chlorbetamide (mantomide), acetarsone (stovarsol), carbarsone (milibilis), emetine bismuth iodide (EBI), paromomycin (humatin) etc.

3. Both luminal and tissue amoebicides:

The new group of drugs administered orally act on parasite residing in tissue as well as the lumen of intestine are —

Niridazole group (Ambilhar) and Metronidazole group (flagyl, Metrogyl etc.,)
Prophylaxis:

The various prophylactic (preventive) measures used to check the spread of E.histolytica are –

**Personal prophylaxis:**

(a) Avoidance of use of raw fruits and vegetables.

(b) Use of boiled drinking water.

(c) Protection of food and drink from contamination through flies and cockroaches.

(d) Obeying the elementary hygienic conditions.

(e) Personal cleanliness.

**Community prophylaxis:**

(a) Safe and effective disposal of human excreta coupled with sanitary practices like washing hands after defecation.

(b) Protection of water supplies against faecal contamination.

(c) Avoidance of fresh human faces as fertilizer.

(d) Health education and public awareness about the parasite and its mode of transmission.
Balantidium coli

Causes: Balantidiasis.

Geog. Distribution: cosmopolitan.

Affects man and Pigs are reservoir hosts.

Habitat: large intestine esp. the caecum.

Infective stage: the cyst.

Mode of infection: ingestion of cyst in: Cotaminated food or water. Flies and food handlers.

Faeco-oral. Heteroinfection

Autoinfection
Balantidium coli

- Trophozoite erodes intestine & elicits intestinal symptoms
- Healthy humans are resistant
- Rarely penetrates intestine or enters blood
- Balantidium Coli
- Balantidium coli is the largest protozoan parasite in humans and causes a disease called balantidiasis. It belongs to the ciliophora phylum and is the only protozoan ciliate to infect humans.
- It goes through two development phases; a cyst and a trophozoite. Trophozoites are 0.03–0.15 mm long and 0.025–0.12 mm wide.
- Their shape is either spherical or oblong. Their surface is covered with cilia and are able to move around. Trophozoites have both a micronucleus and a macronucleus, which both are normally visible. The macronucleus is bigger and sausage-shaped whereas the micronucleus is less notable.
• Cysts are spherical and 0.04–0.06 mm in diameter.
• They have a tough multilayered shell which protects them against stomach acid of the host, when ingested.
• They are usually destroyed at a pH lower than five (normal pH of a healthy stomach is about three).
• Some people are weakened by other diseases and thus the cysts are not killed. Unlike trophozoites, cysts cannot reproduce and do not have any cilia for moving.
Balantidium coli

trophozoite

cyst

contractile vacuole
micronucleus
cilia
macronucleus
cyst wall

cytophlole

~70 x 45 μm (up to 200 μm)

~55 μm
2- *Balantidium coli*

- **Type of protozoan:** Ciliate.
- **Disease caused by the protozoan:** Balantidial dysentery.
- **Infective stage:** Cyst.
- **Lab diagnosis (diagnostic stage):** Trophozoite or cyst in stool.
- **Forms of the protozoan:** Trophozoite or cyst.
- **Location in the body:** Large intestine.
Life Cycle of *Balantidium coli*

*Balantidium coli* has 2 developmental stages: a trophozoite stage and a cyst stage. The cyst is the infective stage of *Balantidium coli* life cycle. Once the cyst is ingested via feces-contaminated food or water, it passes through the host digestive system. The tough cyst wall allows the cyst to resist to acidic environment of the stomach and the basic environment of the small intestine until it reaches the large intestine. There, excystation takes place. Excystation produces a trophozoite from the cyst stage. The motile trophozoite feeding on intestinal bacterial flora and intestinal nutrients.

Trophozoites multiply by asexual binary fission or sexual conjugation.

The trophozoite may become invasive and penetrate the mucosa of the large intestine, Trophozoites are released with the feces, and encyst to form new cysts. Encystation takes place in the rectum of the host as feces are dehydrated or soon after the feces have been excreted.
Life Cycle of *Balantidium coli* inside human colon

Pass out in stool

**In the lumen**

Trophozoites multiply by both Transverse binary fission & Conjugation

**Attached to mucosa**

Cyst enters with food
trophozoite

Mucosa of large intestine
Multiplication of *Balantidium* in large intestine

Trophozoites multiply by: **transverse binary fission**

Trophozoites multiply by: **conjugation between large and small trophozoites.**

- Exchange of some nuclear fragments
- Fragmentation of nuclei

**DR. RAFAFAT MOHAMED**
• Diagnosis:
Diagnosis can be made by finding trophozoites from a stool or tissue sample (collected during endoscopy). Cysts are rarely found. Trophozoites are passed irregularly and quickly destroyed outside the colon. For this reason many stool samples are usually required to confirm the disease.
• Balantidiasis is treated with tetracycline according to the instructions of your health care provider.
• Tetracycline is not recommended for pregnant women or children under 8 years old.
• If the drug is not available, then iodoquinol and metronidazole can be used.
- Balantidiasis infections can be prevented by following proper hygiene practices.
- Do not use human feces as fertilizer in agriculture.
- Wash your hands after going to the toilet and before meal.
- Only drink pure water.
- Wash vegetables and cook meat properly. Infective Balantidium coli cysts are killed by heat.
Diagnosis

Stool examination several times.

- Pass in diarrhoeic stool
- Pass in formed stool

Treatment

- Metronidazole OR Oxytetracycline

Control

Care in disposal of pig’s excreta