

Entamoeba histolytica

Phylum – Sarcomastigophora

Sub- phylum – Sarcodina

Class – Lobosea

Genus – *Entamoeba*

Species – *histolytica*

Several protozoan species in the genus *Entamoeba* colonize humans, but not all of them are associated with disease. *Entamoeba histolytica* is well recognized as a pathogenic amoeba (60µm in size), associated with intestinal and extraintestinal infections. Infections are caused due to ingestion of mature **quadrinucleate cysts** from fecally contaminated food, water or hands.

Habitat and geographical distribution

The parasite resides in the large intestine or lumen of the colon, in host body. Infection is more common in warmer areas, but this is because of both poorer hygiene and the parasitic cysts surviving longer in warm moist conditions. Since amoebiasis is transmitted through contaminated food and water, it is often endemic in regions of the world with limited modern [sanitation](#) systems, including México, Central America, western [South America](#), [South Asia](#), and western and southern [Africa](#).

In its life cycle, it passes through three distinct morphological stages or forms:

1. Trophozoite
2. Precystic
3. Cystic.

1. Trophozoite Stage:

It is also known as the trophic or magna form. It is the active, motile, growing and feeding form which is pathogenic to man. It is a colourless, transparent and irregular mass of living substance, about 20-30 microns in diameter.

Its surface is covered by an exceptionally thin, transparent, elastic and semi-permeable membrane, the plasmalemma. The body cytoplasm is distinctly differentiated into an outer, clear, hyaline and non-granular ectoplasm, and the inner, more fluid and granular endoplasm.

The endoplasm contains a single nucleus, and several food vacuoles. The nucleus is usually invisible in the living parasite. In a fixed and stained specimen, it appears as a rounded and vesicular structure. It is bound by a thin and delicate nuclear membrane, whose inner surface is encrusted with a fine peripheral layer of chromatin granules.

There is a distinct but small central endosome or karyosome, often surrounded by a clear area or 'halo'. The nucleoplasm is marked by spoke-like striations running between the endosome and the nuclear membrane.

Other inclusions of the endoplasm are food vacuoles enclosing red blood corpuscles or erythrocytes, white blood corpuscles or leucocytes, and fragments of epithelial cells and bacteria, etc. Contractile vacuoles are absent since the parasite dwells in an isotonic environment and needs no osmoregulation.

E. histolytica is monopodial, (Gr., monos, single; podos, foot), it gives out a single, large and broad, ectoplasmic pseudopodium in the direction of movement.

In the pseudopodium, the outer clear ectoplasm remains sharply differentiated from the inner granular endoplasm. Pseudopodial movement is slow and sometimes called limax type movement, as it resembles the slow crawling of a garden slug (*Limax* sp.).

Food-vacuoles vary in number and size. They contain red blood corpuscles (a characteristic feature), white blood cells or bacteria in various stages of digestion.

2. Precystic or Minuta Form:

It is pre-cystic form which is smaller, spherical, non-feeding, non-motile and nonpathogenic. It measures to about 7-10 microns in diameter and resembles to the trophozoite form in its structure except that it is smaller in size having no pseudopodium and contractile vacuole. It lives only in the lumen of intestine and rarely found in the tissues. It undergoes encystation and helps in the transmission of the parasite from one host to another.

3. Cystic Stage:

During encystation, the minuta form becomes rounded and is surrounded by a thin highly refractile, resistant, flexible, colourless and transparent cyst-wall. The mature cyst of *E. histolytica* is a spherical body, 12 to 15 microns in diameter. Its cytoplasm is clear and hyaline containing reserve food in the form of one or two glycogen masses which gradually disappear.

There is also present 1 to more characteristic, refractile, bar-like chromatoid bodies or chromatoid bars with rounded ends. These stain deeply with haematoxyline, like chromatin, hence this name. According to Pitelka (1963), the chromatoid bodies are composed of ribonucleoprotein.

These also disappear as the cysts mature. According to Neal (1966), their disappearance is due to the dispersion of their ribonucleoprotein throughout. The nucleus retains the characters of the trophozoite. To start with, the cyst is uninucleate, but the nucleus divides to form a binucleate and finally a tetranucleate or quadrinucleate cyst.

The tetranucleate cysts pass out with the faeces of the patient and form the infective stage. They appear as minute, shining, greenish, refractile spheres. At low temperature, they can survive for 5-6 weeks and at room temperature for about 1 week. The cysts die if dried or desiccated.

Life Cycle of Entamoeba:

E. histolytica is a monogenetic parasite, i.e., its life cycle involves only one host, the host being the man.

Its life cycle includes the following steps:

(i) Encystment:

Some of the precystic minuta forms exist in intestinal lumen and undergo encystment or encystation. However, before the encystment, they become round, eliminate food vacuoles and accumulate considerable amount of reserve food materials in the form of glycogen granules and chromatoids.

Soon each parasite secretes a thin, rounded, resistant, colourless and transparent cyst wall around it. The cysts of *Entamoeba histolytica* have average size of 12mm (or 12 microns). Each cyst has a clear cytoplasm and single nucleus and is called mononucleate cyst. Ultimately, the nucleus of the cyst divides twice so that each cyst becomes tetranucleate or quadrinucleate. At this stage the cysts are infective to new hosts.

(ii) Infection of New Hosts (Transmission):

The nature quadrinucleate cysts are the most resistant and infective forms of the parasite. They are unable to develop in the host in which they are produced. This necessitates their transference to fresh susceptible hosts.

Infection of fresh human hosts occurs by taking food, vegetables or drinking water contaminated with faecal matter containing mature quadrinucleate cysts. The untreated human faeces in open grounds, or crop and vegetable fields, are a common source of infection. Unhygienic food-handlers, flies, cockroaches, birds, etc. carry viable cysts on their body or in their intestine and convey the infection to unprotected food stuffs.

(iii) Excystment:

The excystment of cysts and metacystic development have been observed and studied specially by Dobell (1924) and Cleveland and Sanders (1930) in cultures. According to Dobell, in the process of excystation a single tetranucleate amoeba (metacystic form) emerges from a cyst through a minute pore in the cyst wall.

The tetranucleate metacystic form produces a new generation of trophozoites by a diverse series of nuclear and cytoplasmic divisions which result in the production of eight uninucleate amoebulae. These are called metacystic trophozoites. They feed on the contents of the intestine and grow in size to form the trophozoites of the next generation. The trophozoites stay in the lumen of the intestine for a particular period when they may attack the wall of the intestine and start the life cycle again.

Transmission:

Cysts of Entamoeba are transmitted from one individual to another in a variety of ways:

1. The cysts are generally transmitted with food or drink.
2. House flies and cockroaches may transmit cysts mechanically.
3. Raw vegetable is also another source of infection.
4. In many countries human faeces are used as fertilizer and thus roots and leaves of plants remain contaminated with viable cysts. Food handlers are also sometimes responsible for the spread of infection owing to imperfect personal sanitary measures.

Symptoms:

Amoebiasis or amoebic dysentery is caused by the infection of *E. histolytica*.

The symptoms are:

- (i) Loose stool
- (ii) Stool with mucous and blood
- (iii) Irregularity of bowel clearance
- (iv) Severe abdominal pain, etc.

Prophylaxis (Prevention of the disease):

The infection of *E. histolytica* can be prevented and the disease caused by the infection of the parasite can be controlled by the following ways:

1. Before meal the hands should be with antiseptic soap.
2. Use of boiled drinking water.
3. The raw vegetables and fruits must be thoroughly washed before use.
4. Foods and drinks must be protected from the contamination by house flies and cockroaches.
5. Proper maintenance of the sanitary disposal of faeces.

6. Protection of drinking water supply lines from faecal pollution.

Pathogenicity

Every harmful parasite causes some disease to its host and also brings some destruction and injury to its tissues. These effects or symptoms are called the pathological effects, such a parasite is known as pathogenic, the phenomenon is known as pathogenicity or pathogenesis, and their study is known as pathology.

Entamoeba histolytica causes amoebic dysentery, abscesses in liver, lungs and brain and non-dysenteric infections.

i. Amoebic Dysentery:

Entamoeba histolytica secretes a tissue dissolving enzyme (probably of histolysis nature) that destroys the epithelial lining of the colon and causes its necrosis and forms the abscesses (small wounds) which later become flask-shaped bleeding ulcers.

The cavity of these ulcers is generally filled with mucus, bacteria, amoeba and cell debris. The abscesses pour their contents into the lumen of the intestine. The ulcers vary greatly in number and size; in severe cases almost the entire colon is undermined.

The ulceration of colon may produce severe dysentery. In amoebic dysentery the stools are acidic and contain pure blood and mucus, in which swarms of amoeba and blood corpuscles, are usually present.

ii. Abscesses in Liver, Lungs and Brain:

Sometimes *Entamoeba histolytica* may be drawn into the portal circulation carried to the liver. In liver the parasites settle, attack the liver tissue and form abscesses. The patient has pain in liver region, fever and high leucocyte number, a condition referred to as amoebic hepatitis.

Lung abscesses are fairly frequent; these are usually caused by direct extension from a liver abscess through the diaphragm. The lung abscesses usually rupture into a bronchial tube and discharge a brown mucoid material which is coughed out with the sputum. Sometimes the parasite also forms abscesses in the brain.

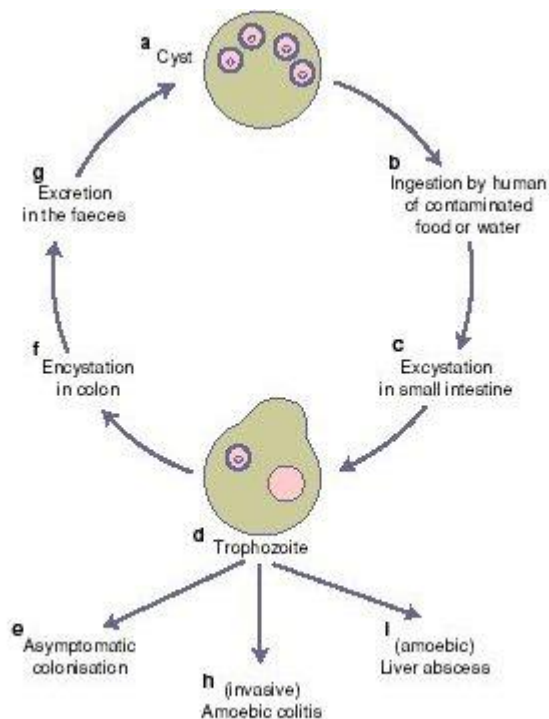
Diagnosis and Treatment of Entamoeba:

Diagnosis:

Presence of 'Charcot-Leyden Crystals,' in stool suggests infection by *E. histolytica*. These are diamond or white-stone-shaped crystals varying in size from 5 to 50 microns. Microscopical examination of fresh stool shows presence of motile trophozoites and cysts. The trophozoites are easily recognized by their characteristic movement and presence of ingested red blood corpuscles.

Treatment:

Metronidazole, Emetin, iodine compounds (Yatren, Diodoquin) and arsenic compounds (Carbarsone, Thiocarbarsone) are used in amoebic dysentery. Bismuth substrate is found beneficial in controlling amoebic dysentery. Certain antibiotics, such as, Fumagillin, Erythromycin, Terramycin and Auromycin have proved to be more effective in case of severe infection. In case of secondary infection, i.e., infection of liver, lungs, etc., Chloroquine is given.



Life cycle of *Entamoeba histolytica* and the clinical manifestations of infection

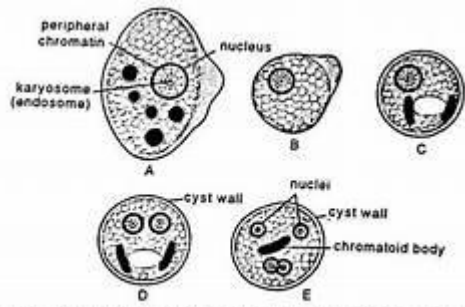


Fig. 18.4. *Entamoeba histolytica*. A. Trophozoite stage. B. Pre-cystic stage. C-E. Cysts. C. Uninucleate. D. Binucleate. E. Quadrinucleate stage.