**Dr.Ahmed Khudhair Al-Hamairy (2nd lecture) Postgraduate student Microbiology**

**Parasitology**

**Subphylum: Sarcodina**

**Class: Lobosea**

**- Intestinal Species :**

( *Entamoeba histolytic, Entamoeba hartmanni ,Entamoeba coli, Entamoeba polecki ,Endolimax nana , Iodamoeba bütschlii*)

**-Extra-intestinal Species**

*Entamoeba gingivalis ,Acanthamoeba species ,Naegleria fowleri*

Countries that have poor sanitary conditions. In the United States, amebiasis is often found in immigrants from and people who have traveled to underdeveloped countries. Furthermore ameobas may be present and thus infect individuals in areas and institutions in which crowded conditions prevail It is important to note that only one of the intestinal ameobas, *E. histolytica*, may produce characteristic symptoms, and is universally considered to be a pathogen. Infections with each of the extraintestinal amebas may cause symptoms that are other than intestinal in nature, often involving such areas as the mouth, eye, and brain.

***Entamoeba histolytica***

Common associated disease or condition names Intestinal ameobiasis, amebic colitis, amebic dysentery , extraintestinal ameobiasis.

**Morphology**

**Trophozoites.** The trophozoites (trophs) of *E. histolytica* range in size from 8 to 65 μm, with an average size of 12 to 25 μm (Figs. 3-2 to 3-4 Table 3-1). Note that parasite names are often shortened to just the first letter of the genus followed by the species name; *E. histolytica* is the abbreviated version of *Entamoeba histolytica*.

The trophozoite exhibits rapid, unidirectional progressive movement, achieved with the help of finger-like hyaline pseudopods. The single nucleus typically contains a small central mass of chromatin known as a karyosome (also referred to as karyosomal chromatin).

Variants of the karyosome include eccentric or fragmented karyosomal material. The karyosome of this amebic parasite is surrounded by chromatin material, a morphologic structure called peripheral chromatin This peripheral chromatin is typically fine and evenly distributed around the nucleus in a perfect circle. Variations, such as uneven peripheral chromatin, may also be seen.

Although the karyosome and peripheral chromatin appearance may vary, most trophozoites maintain the more typical features described. The invisible nucleus in unstained preparations becomes apparent when stained. Stained preparations may reveal lightly staining fibrils located between the karyosome and peripheral chromatin. The *E. histolytica* trophozoite contains a finely granular cytoplasm, which is often referred to as having a ground glass in appearance. Red blood cells (RBCs) in the cytoplasm are considered diagnostic because *E. histolytica* is the only intestinal ameba to exhibit this characteristic. Bacteria yeast, and other debris may also reside in the cytoplasm, but their presence, however, is not diagnostic.



***Entamoeba histolytica* trophozoite showing typical central karyosome and even peripheral chromatin resulting in a smooth nuclear perimeter (trichrome stain ×1000).**



***Entamoeba histolytica* trophozoite.**

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***Entamoeba histolytica* cyst. Note single nucleus and prominent chromatoid bars (iron hematoxylin stain, ×1000).**

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| **TABLE 3-1 *Entamoeba histolytica* Trophozoite: Typical Characteristics at a Glance** | |
| **Parameter** | **Description** |
| **Size range** | **8-65 μm** |
| **Motility** | **Progressive, finger-like pseudopodia** |
| **Number of nuclei** | **One** |
| **Karyosome** | **Small and central** |
| **Peripheral chromatin** | **Fine and evenly distributed** |
| **Cytoplasm** | **Finely granular** |
| **Cytoplasmic inclusions** | **Ingested red blood cells** |

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| --- | --- |
| **TABLE 3-2 ; *Entamoeba histolytica* Cyst Typical Characteristics at a Glance** | |
| **Parameter**  **Size range**  **Shape**  **Number of nuclei**  **Karyosome**  **Peripheral chromatin**  **Cytoplasm**  **Cytoplasmic inclusions** | **Description**  **8-22 μm**  **Spherical to round**  **One to four**  **Small and central**  **Fine and evenly distributed**  **Finely granular**  **Chromatoid bars, rounded**  **ends in young cysts**  **Diffuse glycogen mass in**  **young cysts** |

**Cysts.**

The spherical to round cysts of *E. histolytica*  are typically smaller than the trophs measuring 8 to 22 μm, with an average range of 12 to 18 μm . The presence of a hyaline cyst wall helps in the recognition of this morphologic form. Young cysts characteristically contain unorganized chromatin material that transforms into squared or round ended structures call chromatoid bars, defined as structures that contain condensed RNA material A diffuse glycogen mass, a cytoplasmic area without defined borders that is believed to represent stored food, is also usually visible in young cysts. As the cyst matures, the glycogen mass usually disappears, a process that likely represents usage of the stored food. One to four nuclei are usually present.

These nuclei appear basically the same as those of the trophozoite in all respects but are usually smaller. Nuclear variations do occur, with the most common of these being centric (rather than the typical central) karyosomes thin plaques of peripheral chromatin, or a clump of peripheral chromatin at one side of the nucleus that appears crescent shaped. The nuclei in Figure 3-3 are enlarged to show the nuclear detail. The mature infective cyst is quadrinucleated containing four nuclei). The cytoplasm remains fine and granular. RBCs, bacteria yeast, and other debris are not found in the cyst stage

**Laboratory Diagnosis**

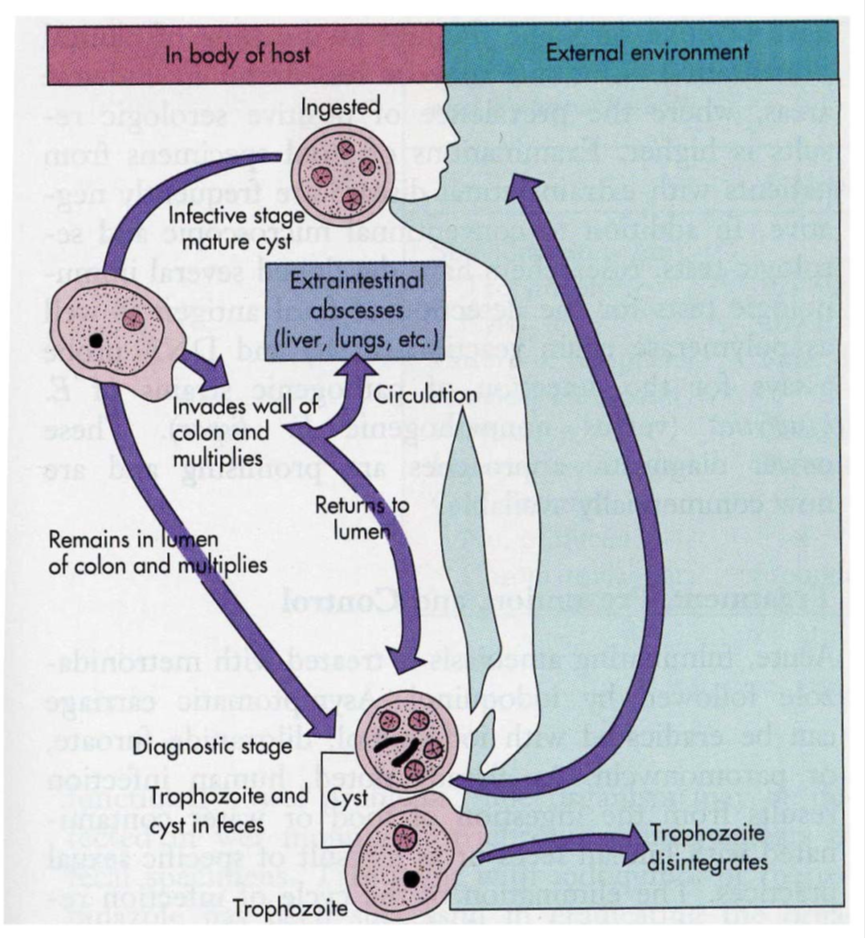
The diagnosis of *E. histolytica* infection may be accomplished by standard and alternative methods. In addition to performing traditional wet preparation and permanent staining techniques on a suspected stool sample, material collected from a sigmoidoscopy procedure, as well as hepatic abscess material, may be processed and examined in the same manner. A special medium known at TYI-S-33 supports *E. histolytica* in culture. When *E. histolytica* is suspected but not recovered in stool samples, other laboratory tests, including immunologically based procedures, may be used. Methods currently available include antigen tests, enzyme-linked immunosorbent assay (ELISA), indirect hemagglutination (IHA), gel diffusion precipitin (GDP( and indirect immunofluorescence (IIF). Serologic tests designed to detect *E. histolytica* are available and are typically only helpful in cases of extraintestinal infections.

**Life Cycle Notes**

Once the infective cyst is ingested, excystation occurs in the small intestine. As a result of the nuclear division, a single cyst produces eight motile trophozoites. These motile amebas settle in the lumen of the large intestine, where they replicate by binary fission and feed on living host cells. On occasion, trophozoites migrate to other organs in the body, such as the liver, and may cause abscess formation. Unless these trophozoites return to the lumen of the large intestine ,their life cycle ceases and diagnosis in such cases will rely on serologic testing. Encystation occurs in the intestinal lumen, and cyst formation is complete when four nuclei are present.

These infective cysts are passed out into the environment in human feces and are resistant to a variety of physical conditions. Survival in a feces contaminated environment for up to 1 month is common .It is important to note that in addition to cysts, trophozoites, under the right conditions may also be present in the stool. Liquid or semiformed samples may show trophozoites if the intestinal motility is rapid. Cysts will form, on the other hand, if the intestinal motility is normal in the intestinal lumen, and cyst formation is complete when four nuclei are present. These infective cysts are passed out into the environment in human feces and are resistant to a variety of physical conditions. Survival in a feces contaminated environment for up to 1 month is common.

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**Figure-1 life cycle of *Entamoeba histolytica***

**Epidemiology**

*Entamoeba histolytica* infection occurs in as many as 10% of the world’s population and is considered a leading cause of parasitic deaths after only malaria, the clinical manifestation of infection with *Plasmodium* species parasites, and schistosomiasis, the umbrella term for the disease associated with *Schistosoma* spp. infection. In addition to thriving in subtropical and tropical areas of the world, this parasite exists in colder climates, such as Alaska, Russia, and Canada. Locations at which human waste is used as fertilizer, areas of poor sanitation, hospitals for the mentally ill, prisons, and day care centers tend to harbor *E. histolytica*.

This organism has historically been prevalent in homosexual communities because it causes frequent asymptomatic infections in homosexual men, particularly in western countries Several means of transmitting *E. histolytica* are known. Ingestion of the infective stage, the cyst, occurs through hand-to-mouth contamination and food or water contamination. In addition *E. histolytica* may also be transferred via unprotected sex. Flies and cockroaches may also serve as vectors (living carriers responsible for transmitting parasites from infected hosts uninfected hosts) of *E. histolytica* by depositing infective cysts on unprotected food. Improperly treated water supplies are additional sources of possible infection.

**Clinical Symptoms**

*Entamoeba histolytica* is the only known pathogenic intestinal ameba. The range of symptoms varies and depends on two major factors: (1) the location(s) of the parasite in the host; and (2) the extent of tissue invasion

**Asymptomatic Carrier State.** Three factors acting separately or in ombination, are responsible for the asymptomatic carrier state of a patient infected with *E. histolytica*: (1) the parasite is a low-virulence strain; (2) the inoculation into the host is low; and (3) the patient’s immune system is intact. In these cases, amebas may reproduce but the infected patient shows no clinical symptoms ,

**Symptomatic Intestinal Amebiasis**. Patients infected with *E. histolytica* who exhibit symptoms often suffer from amebic colitis, defined as an intestinal infection caused by the presence of amebas exhibiting symptoms. In some cases these patients may transition from amebic colitis into a condition characterized by blood and mucus in the stool known as amebic dysentery ,Individuals with amebic colitis may exhibit nondescript abdominal symptoms or may complain of more specific symptoms, including diarrhea abdominal pain and cramping, chronic weight loss, anorexia, chronic fatigue, and flatulence Secondary bacterial infections may develop after the formation of flask-shaped amebic ulcers in the colon, cecum, appendix, or rectosigmoid area of the intestine. As noted, stools recovered from patients suffering from amebic dysentery are characterized by the presence of blood and/or pus and mucus.

**Symptomatic Extraintestinal Amebiasis**

*E. histolytica* trophozoites that migrate into the bloodstream are removed by and take up residence in the liver. The formation of an abscess in the right lobe of the liver and trophozoite extension through the diaphragm, causing amebic pneumonitis, may occur. Patients in this state often exhibit symptoms similar to those of a liver infection plus a cough ,with the most common of the symptoms being upper right abdominal pain with fever. Weakness weight loss, sweating, pronounced nausea, and vomiting may occur, as well as marked constipation with or without alternating diarrhea ,In addition to the liver, *E. histolytica* has been known to migrate to and infect other organs , including the lung, pericardium, spleen, skin, and brain.

Venereal amebiasis may also occur. Men become infected with penile amebiasis after experiencing unprotected sex with a woman who has vaginal amebiasis. The disease may also be transferred during anal intercourse. It is interesting to note that on examination of these genital areas , the trophozoite form of *E. histolytica* is most commonly encountered.

**Treatment**

Treatment regimens for patients infected with *E .histolytica* vary by the type of infection present ,Because there is concern that an infection with *E .histolytica* may become symptomatic in the intestinal tract only or with subsequent extraintestinal invasion, asymptomatic individuals may be treated with paromomycin, diloxanide furoate (Furamide or metronidazole (Flagyl). Patients showing symptomatic intestinal amebiasis typically respond well to iodoquinol, paromomycin, or diloxanide furoate. Metronidazole or tinidazole, in combination with a symptomatic intestinal amebiasis treatment, is recommended for patients who have progressed to extraintestinal amebiasis.

**Prevention and Control**

Several steps may be taken to prevent *E. histolytica* infections. uncontaminated water is essential this may be accomplished by boiling or treating with iodine rystals. It is interesting to note that the infective (quadrinucleated) cyst is resistant to routine chlorination. A water treatment regimen that includes filtration and chemical treatment is necessary to ensure a safe water supply. Properly washing food roducts, avoiding the use of human feces as fertilizer, good personal hygiene and sanitation practices, protection of food from flies and cockroaches, and the avoidance of unprotected sexual practices serve as a means to break the transmission cycle.