

AL-MA'MOON UNIVERSITY COLLEGE

DEPARTMENT OF MEDICAL LABORATORY TECHNOLOGY

MEDICAL PARASITOLOGY

((LECTURE 2))

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Medical Protozoa

INTRODUCTION

Protozoa (singular, protozoan), from the Greek 'protos' and 'zoon' meaning "first animal", are members of eukaryotic protists. They may be distinguished from other eukaryotic protists by their ability to move at some stage of their life cycle and by their lack of cell wall. Protozoa are found in all moist habitats. They are common sea in soil and in fresh water. These organisms occur generally as a single cell.

Morphology of protozoa

Protozoa are predominantly microscopic, ranging in size from 2 to more than 100 μ m. Morphologically, they are within a mass of protoplasm, consisting of a true membrane bound nucleus and cytoplasm. The nucleus contains clumped or dispersed chromatin and central nucleolus or karyosome, which are useful structures to distinguish protozoan species from one another based on the shape, size and distribution of these structures.

Importance of protozoa

Protozoa serve as an important link in the food chain and ecological balance of many communities in wetland & aquatic environments. They are also important in biological sewage treatment, which involves both anaerobic digestion and/or aeration. In addition, protozoa

are important laboratory organisms in research areas, by which their asexual reproduction enables clones to be established with the same genetic make-up. These are useful in the study of cell cycles and nucleic acid biosynthesis during cell division.

Reproduction and regeneration of protozoa

As a general rule, protozoa multiply by asexual reproduction. This is not to say that sexual processes are absent in the protozoa. Some parasitic forms may have an asexual phase in one host and a sexual phase in another host.

Transmission

In most parasitic protozoa, the developmental stages are often transmitted from one host to another within a cyst. The reproduction process is also related to the formation of the cyst. Asexual reproduction of some ciliates and flagellates is associated with cyst formation, and sexual reproduction of Sporozoa invariably results in a cyst. Pathogenic protozoa can spread from one infected person to another by:

- Faecal - oral transmission of contaminated foods and water.
- Insect bit inoculums or rubbing infected insect faeces on the site of bite.
- Sexual intercourse.

Pathogenesis

Protozoan organisms are virtually always acquired from an exogenous source, and as such, they have evolved numerous ways to enter the body of the human host. Factors that are important for pathogenicity include:

- Attachment to the host tissue followed by replication to establish colonization.
- Toxic products released by parasitic protozoa.
- Shifting of antigenic expression to evade the immune response and inactivate host defences.

Antiprotozoal agents

Generally the antiprotozoal agents target relatively rapidly proliferating, young, growing cells of the parasite. Most commonly, these agents target nucleic acid synthesis, protein synthesis, or specific metabolic pathways (e.g. folate metabolism) unique to the protozoan parasites.

Table-1 Important pathogenic protozoa and commonly caused diseases.

Type and location	Species	Disease
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Intestinal tract	<i>Entamoeba histolytica</i> <i>Giardia lamblia</i> <i>Cryptosporidium parvum</i> <i>Balantidium coli</i> <i>Isospora belli</i> <i>Cyclospora cayentanensis</i>	Ambiasis Giardiasis Cryptosporidiosis Balantidiasis Isosporiosis Cyclosporiasis
Urogenital tract	<i>Trichomonas vaginalis</i>	Trichomoniasis
Blood and tissue	Plasmodium species <i>Toxoplasma gondii</i> Trypanasoma species Leishmania	Malaria Toxoplasmosis Trypanosomiasis Leishmaniasis Amoebic Meningoencephalitis

	species	Amoebic
	Naegleria species	Meningoencephalitis
	Acanthamoeba species	Babesiosis
	<i>Babesia microti</i>	

AMOEBIASIS

INTRODUCTION

Amoebas primitive unicellular microorganisms with a relatively simple life cycle which can be divided into two stages:

Trophozoite - actively motile feeding stage.

Cyst-quiescent, resistant, infective stage.

Their reproduction is through binary fission, e.g. splitting of the trophozoite or through the development of numerous trophozoites within the mature multinucleated cyst. Motility is accomplished by extension of pseudopodia ("false foot").

Entamoeba histolytica

Morphological features

(a) Trophozoites

Viable trophozoites vary in size from about 10-60µm in diameter. Motility is rapid progressive, and unidirectional, through pseudopods. The nucleus is characterized evenly arranged **chromatin** on the nuclear membrane and the presence of a small, compact centrally located **karyosome**. The cytoplasm is usually described as f granular with few ingested bacteria or debris in vacuoles. In the case of **dysentery**, however, RBCs may be visible in the cytoplasm, and this feature is diagnostic for *E.histolytica*.

(b) Cyst

Cysts range in size from 10-20µm. **The immature cyst** has inclusions namely; **glycogen mass and chromatoidal bars**. As the **cyst matures**, the **glycogen completely disappears** the **chromotiodials** may also be **absent in the mature cyst**.

Life cycle

Entamoeba histolytica passes its life cycle only in one host (man). Cysts and trophozoites are typically found in diarrheal stool. Infection by *Entamoeba histolytica* occurs by ingestion of mature cysts in fecally contaminated food, and water. Intestinal infections occur through the ingestion of a **mature quadrinucleate infective cyst**, contaminated food or drink and also by hand to mouth contact. It is then passed unaltered through the stomach, as the cyst wall is resistant to gastric juice. In terminal ileum (with alkaline pH), **excystation** takes place. **Trophozoites** being actively motile invade the tissues and ultimately lodge in the submucous layer of the large bowel. Here they grow and multiply by binary fission. **Trophozoites** are responsible for producing lesions in amoebiasis. **Invasion** of blood vessels leads to secondary extra intestinal lesions. Gradually the effect of the parasite on the host is toned down together with concomitant increase in host tolerance, making it difficult for the parasite to continue its life cycle in the trophozoite phase. A certain number of trophozoites come from tissues into lumen of bowel and are first transformed into **pre-cyst** forms. **Pre-cysts** secrete a cyst wall and become a **uninucleate cyst**. Eventually, **mature quadrinucleate cysts form. These are the infective forms.** Both mature

and immature cysts may be passed in feces. **Immature cysts** can mature in **external environments** and become infective.

Pathogenesis

Trophozoites divide and produce extensive local necrosis in the large intestine. Invasion into the deeper mucosa with extension into the peritoneal cavity may occur. This can lead to secondary involvement of other organs, primarily the liver but also the lungs, brain, and heart. **Extraintestinal amebiasis** is associated trophozoites. **Amoebas multiply rapidly in an anaerobic environment, because the trophozoites are killed by ambient oxygen concentration.**

Clinical features

The outcome of infection may result in a carrier state, **intestinal amebiasis, or extraintestinal amebiasis (liver, lung, ect) . Diarrhoea, flatulence, and cramping are complaints of symptomatic patients. Presence of ingested RBCs is a characteristic feature of *E.histolytica*. Amoebiasis causes dysentery. More severe disease is characterised by the passing of numerous bloody stools in a day. Systemic signs of infection (fever, leukocytosis, rigors) are present in patients with**

extraintestinal amebiasis. The liver is primarily involved because trophozoites in the blood are removed from the blood by the portal veins. The right lobe is most commonly involved, thus pain over the liver with hepatomegaly and elevation of the diaphragm is observed.

Laboratory diagnosis

In intestinal amoebiasis:

- Examination of a fresh dysenteric faecal specimen or rectal scraping for trophozoite stage. (Motile amoebae containing red cells are diagnostic of amoebic dysentery).
- Examination of formed or semiformed faeces for cyst stage (Cysts indicate infection with either a **pathogenic *E.histolytica*** or **non-pathogenic *E. dispar.***)