

Introduction to protozoa

It consists of single cell containing nucleus and cytoplasm performs all the necessary functions of life. Thousand species of protozoa have been described; most of them are free-living.

There are four medically important classes classified according to the presence of locomotion apparatus:

1. Sarcodina – Amoebae.
2. Ciliophora – Ciliates.
3. Mastigophora – Flagellates.
4. Sporozoa – No locomotion apparatus.

Class: Rhizopoda or sarcodina (Amoebae)

The general characters of amoebic species:

1. Move by pseudopodia.
2. Asexual reproduction by binary fission.
3. Encystation is common.
4. Usually parasitize intestinal tract.

Mouth and intestinal protozoa

- Pathogenic amoebae:
 1. *Entamoeba histolytica*.
 2. *Blastocystis hominis*.
- Pathogenic free-living:
 1. *Naegleria fowleri*.
 2. *Acanthamoeba* species.
- Non-pathogenic:
 1. *Entamoeba coli*.
 2. *Endolimax nana*.
 3. *Iodamoeba buetschli*.

4. *Entamoeba hartmanni*.
5. *Entamoeba gingivalis* (mouth).

Entamoeba histolytica

Infects man, monkeys, dogs, cats and pigs. Mice, rats, quinea pigs and rabbits can be affected experimentally. The normal habitat is the large intestine.

Geographical distribution:

It is more or less cosmopolitan; but mainly in tropical and subtropical countries. Some studies suggest that 10% of the world's population harbor *E.histolytica*. In certain areas of Africa, Asia and Latin America , the prevalence of asymptomatic infections ranges from 2% to 60%. Approximately 8% will develop colitis or amoebic liver abscess. 5% of students at primary school 6-12 years old are infected with *E.histolytica* in Basrah.

Morphology:

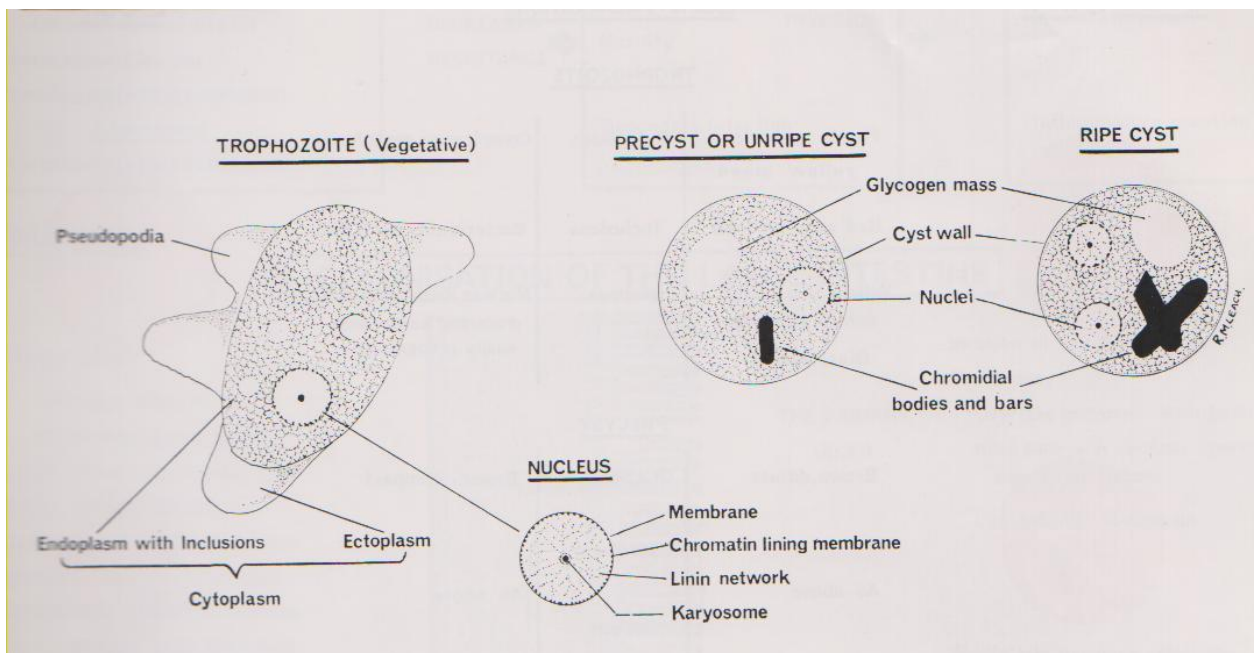
There are 4 stages namely: trophozoite, precyst, cyst and metacyst. Trophozoite seen in faeces and extra-intestinal tissues while cyst present in faeces only.

Trophozoite: It is 90m in diameter in faeces. It has glassy ectoplasm and finely granular endoplasm. The nucleus is single spherical. It has got fine chromatin granules arranged regularly on the nuclear membrane. In the centre, there is chromatin body called karyosome (it is characteristic feature) which is surrounded by clear zone. There are several delicate chromatin fibrils directed from the clear zone toward the nuclear membrane. In the endoplasm, there are number of food vacuoles containing red blood cells at various stages of digestion. The pseudopodium is finger like projection.

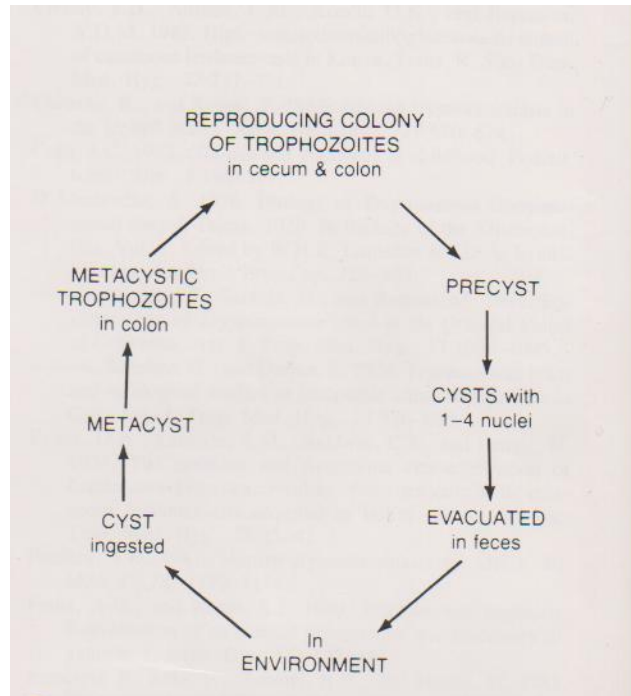
Precyst: At this stage, the parasite withdraws its pseudopodia, tends to be rounded, no food vacuoles and cigar-shaped chromatoidal bar start to develop.

Cyst: It is spherical in shape with a well-developed cyst wall. Therefore, it has the ability to resist unfavorable environmental conditions. It has 4 nuclei and a cigar-shaped chromatoidal bar. It remains viable in moist and cool conditions for up to 12 days, in water for 10-30 days. It is the infective stage.

Metacyst: It is simply a cyst without a cyst wall.



Life cycle:



Excystation occurs in the small intestine while colonization takes place in the large intestine.

Trophozoites do not become cysts after evacuation from the bowel to outside the body.

Pathogenesis:

The predisposing factors for acquiring infection and transmission are:

- 1. Contaminated food and water with cyst stage.**
 - 2. Infected food handlers and carriers.**
 - 3. House flies and cockroaches.**
 - 4. Human stool as fertilizer.**
 - 5. Person to person contact.**
- **The rapidity with which the infection occurs depends on:**
 - I. Pathogenic capacity of the strain.**

- II. Condition of the intestinal mucosa (healthy or diseased).
- III. Physiological and immunological status of the host.

Superficial minute ulcer in the mucosa resulting from lytic effect of the trophozoites. Then lesion enlarges.

Repair process may reestablish the normal mucosa and thus the amobae will be confined to the lumen. This person becomes carrier.

In many cases, the amoebae gradually erode a passage through the muscularis mucosa into submucosa, where they are able to spread out radially into the surrounding tissues leading to flask-shaper ulcer. If this primary lesion is not complicated by bacteria, there is essentially no tissue reaction to the amoebic invasion. On contrast, there will be infiltration of neutrophilic leucocytes.

Sloughing of some mucosal tissues may takes place when 2 intestinal ulcers joined together.

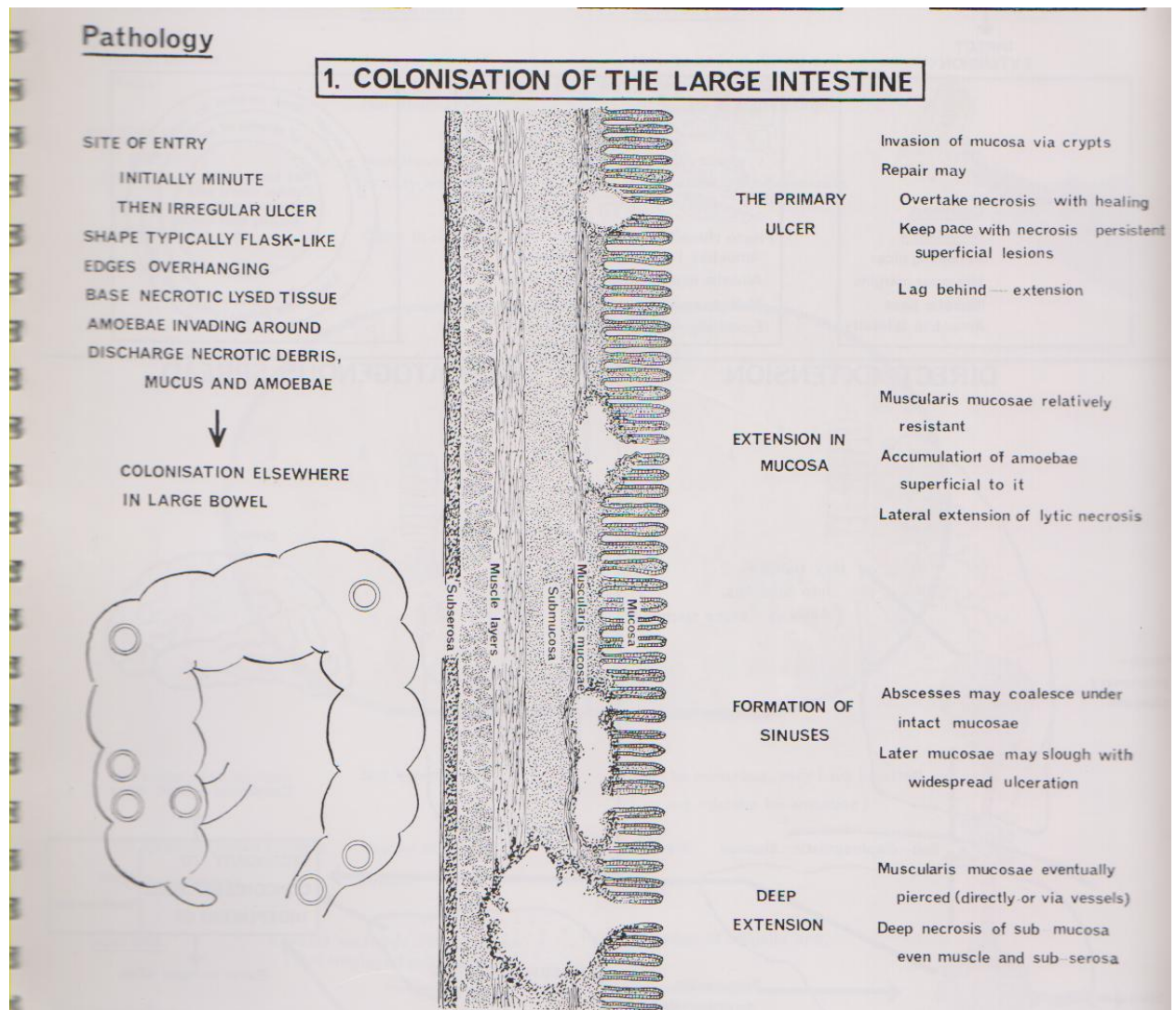
From submucosa --- muscular layer --- serosa leading to complete perforation, peritonitis and hemorrhage, the via mesenteric venules and lymphatic to liver and other extra-intestinal organs. This condition called extra-intestinal amoebiasis. This is usually secondary to the primary amoebic lesions in the large intestine.

The characteristic amoebic ulcer has minute opening surrounded by a slightly raised yellow ring leading to a deeper enlargement in the submucosa. It contains a brownish-yellow gelatinous material consisting of mucus, necrotic tissues and trophozoites (flask-shaped ulcer).

Amoebic granuloma (amoeboma):

Occasionally a granulomatous mass with oesinophils, lymphocytes and fibroblasts develops at some locus in the wall of the large intestine as

asequel to an amoebic ulcer. The mechanism is not known but it is likely that secondary infections play an important role.



Extra-intestinal lesions:

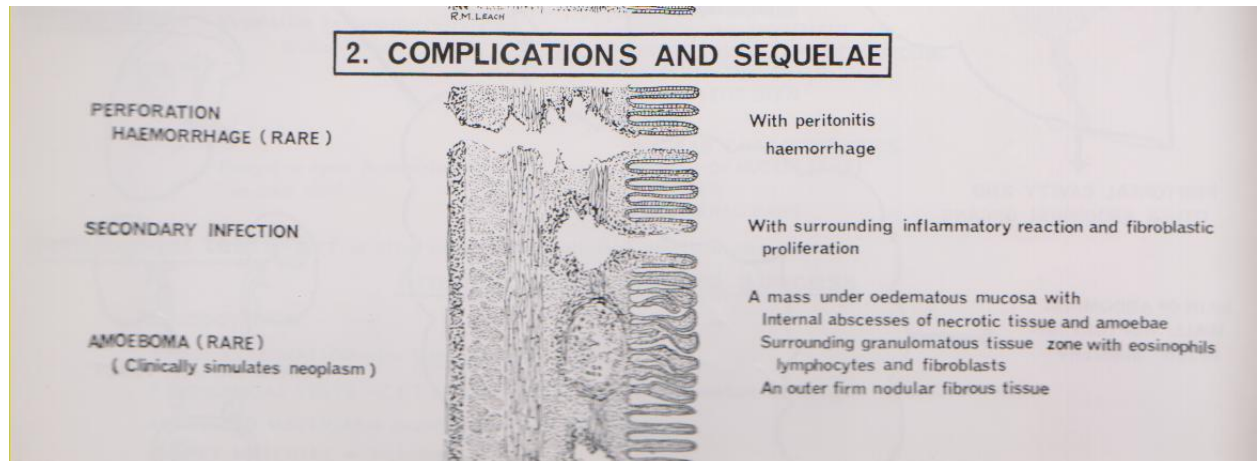
They have demonstrated in every soft organs and tissues of the body.

Amoebic liver abscess: It characterized by presence of one or more rounded or ovoidal abscesses varying in size from a pin-head to a grape fruit. The smaller one contains grayish-brown necrotic materials while the larger one has yellowish-brown materials with fishy odour. There is a

layer of infiltrated fibroblasts separating the abscess from the healthy liver tissues. They are bacteriologically sterile unless there is secondary bacterial contamination which would be associated with leukocytosis.

Complications:

1. Perforation of the intestinal wall.
2. Amoebic colitis.
3. Amoeboma or amoebic granuloma.
4. Amoebic appendicitis.
5. Extra-intestinal amoebiasis including liver, lung, brain, skin etc.
6. Vulva, vagina, cervix and penis.



Dianosis:

1. Stool examination.
2. *In vitro* cultivation (stool or aspirates).
3. Examination of biopsies or autopsies materials.
4. Proctoscopic aspirates or scrapings from suspected intestinal sites.
5. Serological tests such as indirect haemagglutination or ELIZA. They are useful during extra-intestinal amoebiasis).

Blastocystis hominis

It is a protozoan parasite inhabiting large intestine of man. Earlier it was described as yeast-like fungus, then as non-pathogenic parasite and by 1980s believed as a pathogenic intestinal amoebic protozoa. It has single cell. The reproduction by binary fission.

There are 3 forms:

- 1) The vacuolated form: There is a large central vacuole compressing the cytoplasm to the periphery. There are 3 or 4 nucleus in the cytoplasm.
- 2) The granular form: It is large sphericle in shape usually found in old culture. It has either central or peripherals granules that they have metabolic function.
- 3) The amoebic form: Usually present in the stool in few number. Its outline is irregular and lobed. There are 1-2 nuclei.

Blastocystis hominis has recently been proved as a cause of recurrent diarrhea with abdominal pain and cramps.

Anti-amoebic drugs as metronidazole with or without methoprine are effective.

Pathogenic free-living amoebae

They are capable of adapting to a parasitic existence and called amphizoic.

Naegleria fowleri

- Lives in fresh water and moist soil.
- It has been reported in USA, Europe and Australia.
- The infection acquired via nasal mucosa to the brain and meninges while swimming in fresh water of lakes or ponds leading to meningoencephalitis in man.

- **Morphology:** Trophozoites are 10-20 mm. They have single nucleus with centrally located karyosome. Cysts are usually about 11mm and they have pores that have mucoid plugs.

Pathogenesis and symptoms:

- It is the causative agent for primary amoebic meningoencephalitis.
- Colonization occurs in the nasal tissue and connected sinuses and extend a long the olfactory nerve into the brain.
- Invaded areas of the brain are soft, meninges are congested and purulent resemble those of bacterial meningitis. Inflammatory cell infiltration is few or absent.
- The incubation period 3-6 days.

Diagnosis:

1. A history of swimming 3-6 days before symptoms.
2. Identification of motile parasite in unstained wet preparation or Gram or Wright stained smears.
3. Culture of cerebrospinal fluid or tissues on a plate of 1.5% non-nutrient agar seeded with living *Escherichia coli* grown separately a added.

Treatment:

Amphotericin B 0.01% in 5% glucose 1mg/kg/day I/V for undetermined period.

Control:

A void exposure to warm fresh water. The parasite cannot be found in pools with free chlorine residual of 1mg/liter and pH 7-7.6.

Acanthamoeba species

- The source of infection is dust or water.
- It is the causative agent for primary amoebic meningoencephalitis.
- Infection has been reported in USA, England, Venezuela, Peru, India, Korea and Zambia.

Morphology:

Trophozoite: Irregular in shape with spine like pseudopodia. Due to its similarity with other species, the specific identification is not feasible.

Cyst: Spherical, double wall forming a smooth or slightly wrinkled ectocyst and stellate endocyst.

Pathogenesis and symptoms:

- Insidious in onset.
- Granulomatous amoebic encephalitis or chronic uveitis or ulceration of the cornea.
- Chronic granulomatous or exudative lesions can be present in the skin, kidneys, liver, adrenal gland, thyroid gland, lymph nodes, breast, ear, prostate and eye.
- Invasion of the brain occurs in chronically ill immunosuppressed patients.
- Sometimes symptoms are sore throat and fever.
- Death in less than 3 weeks.

Diagnosis:

Detection of amoeba in cerebro-spinal fluid, teased tissue or scraping from corneal or skin lesions.

Treatment:

Sulfonamides.

Control:

There is no effective control measures.