



## Udaipur Pratap (Autonomous) College, Varanasi

### E-learning Material

Module/Lecture	03
Subject	Zoology
Year/Semester	B.A. II Semester (Minor)
Unit	I
Topic	Applied Zoology
Sub-topic	<i>Entamoeba histolytica</i>
Key- Words	Life Cycle, Pathogenecity and Control
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### **Entamoeba histolytica:**

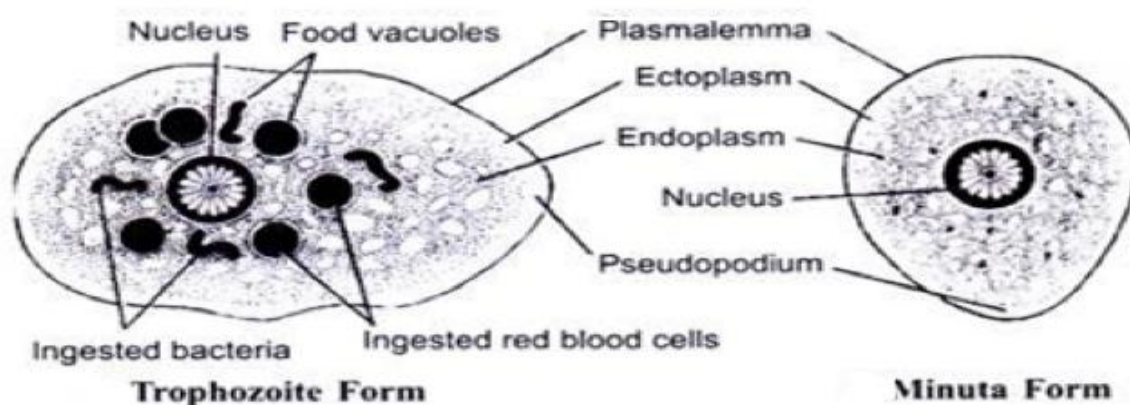
*Entamoeba histolytica* is a common protozoan parasite found in the large intestine of human. It is the third leading parasite cause of death in the developing countries. The parasite is responsible for amoebiasis and liver abscesses.

It can affect anyone, although it is more common in people who live in tropical areas with poor sanitary conditions. Diagnosis can be difficult because other parasites can look very similar to *E. histolytica* when seen under a microscope. Infected people do not always become sick. If doctor determines that you are infected and need treatment, medication is available.

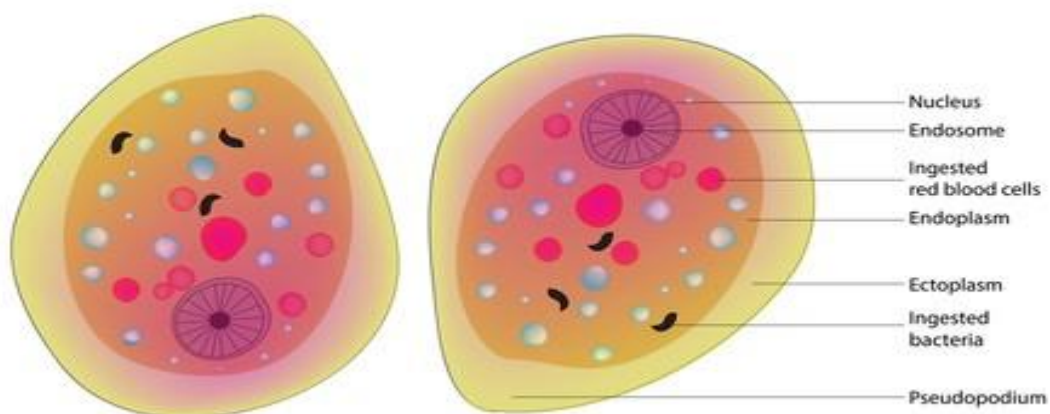
**Losch (1875)** first described *Entamoeba histolytica* as Amoeba coli.

**Leidy** first established the genus *Entamoeba* in 1879.

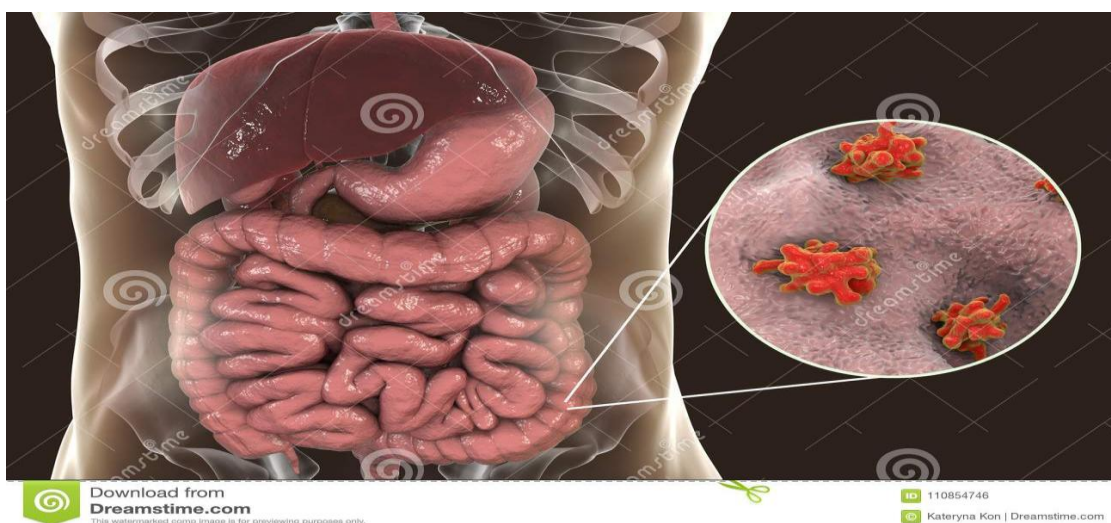
**Schaudin** established the species *Entamoeba histolytica* in **1903** and differentiated into pathogenic and nonpathogenic types.



Entamoeba histolytica



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There are 5 species of Entamoeba in human beings are found which are-



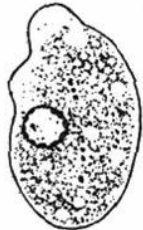

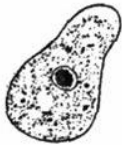






*Entamoeba histolytica*,

*Entamoeba hartmanni*

*Entamoeba coli* are non-pathogenic

*Entamoeba polecki* are pathogenic

*Entamoeba gingivalis*.

	<i>Entamoeba histolytica</i>	<i>Entamoeba hartmanni</i>	<i>Entamoeba coli</i>	<i>Endolimax nana</i>	<i>Iodamoeba butschlii</i>	<i>Dientamoeba fragilis</i>
trophozoite						
cyst						

### Geographical Distribution of *Entamoeba histolytica*:

The parasite is worldwide in distribution and more common in most countries of tropics and subtropics rather than temperate zones.

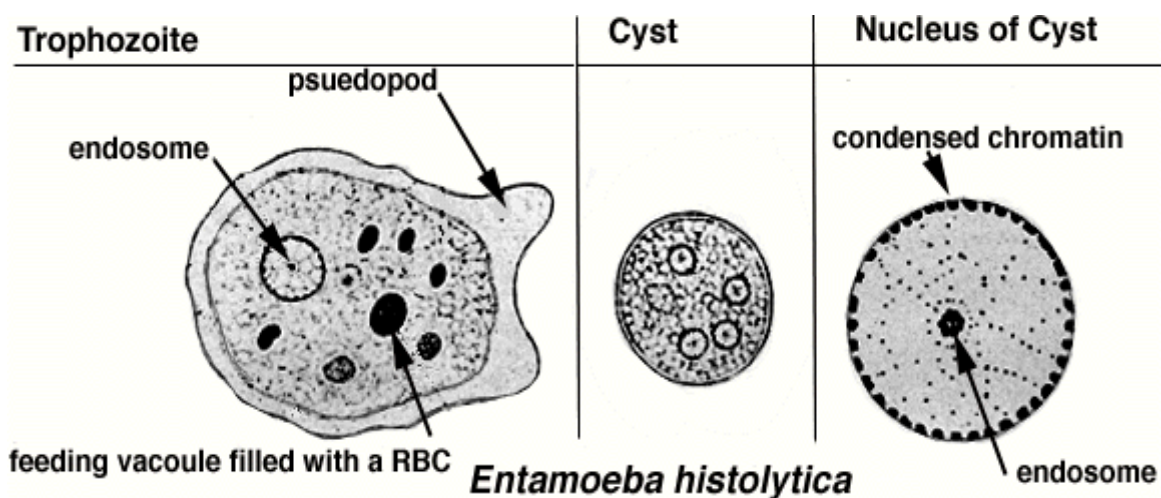
*Entamoeba histolytica* is scarcely pathogenic found in human beings of temperate zones.

### Habit and Habitat of *Entamoeba Histolytica*:

*Entamoeba histolytica* is an endoparasite and the parasite inhabits the mucous and sub-mucous layers of the large intestine of

man. It may also occur in the liver, lungs and rarely invades brain, spleen, etc. producing ulcers, but the cyst is found in the intestinal lumen of man.

*Entamoeba histolytica* has also recorded in Orang-utang, Gorilla, Chimpanzee, Gibbon, Baboon, Donkey, Dog, Cat, Rat and Pig.



### Morphology of *Entamoeba Histolytica*:

#### (a) Trophozoites:

The trophozoites are active feeding stage vary in size from 15 to 40 ( $\mu$ )micron, the average being 18( $\mu$ ) to 25( $\mu$ ) micron. **Dobell (1919)** and others have shown that the parasite has got two races, one large and the other small. The trophozite of *Entamoeba histolytica* in living condition shows two distinct portions, ectoplasm and endoplasm. The ectoplasm is clear and translucent while the endoplasm is granular. Ingested RBCs, tissue granules and food materials are also found in

endoplasm Trophozoites are anaerobic parasite, (present in large intestine)

The endoplasm often contains ingested red blood corpuscles. The pseudopodia may be long, finger-like or short and rounded in shape (Above figure). In freshly passed stool the parasite is very active and moves rapidly in a straight line with a single clear pseudopod at the anterior end.

This is known as '**directional movement**'. The movement becomes sluggish when the faeces cool down and in this condition the amoeba throws out pseudopodia at various directions and remains stationary.

The nucleus is indistinct in living condition but when stained with haemato-xylene it shows a small dot-like central **karyosome** or **endosome**, a uniform ring of small peripheral chromatin granules and at some times some chromatin granules in between them.

Sometimes there may be traces of **linin network** in the form of fine fibrils in between karyosome and nuclear membrane. The nuclear membrane is very delicate. The size of the nucleus is about 4 ( $\mu$ ) to 6 ( $\mu$ ) micron in diameter.

### **(b) Cystic Form :**

The cysts of both races of *Entamoeba histolytica* vary in size from 10 ( $\mu$ ) to 20 ( $\mu$ ) micron (average 12 ( $\mu$ ) micron in diameter. In haematoxylin stained preparation a matured cyst looks spherical and

**quadrinucleate.** Its cytoplasm is clear and often contains black rod-like chromatoid bars or bodies with rounded ends (Fig. 10.23D).

The young cysts are uninucleate or binucleate and their nuclear structure is just like that of the trophozoites. But it shows a very small central karyosome and a delicate nuclear membrane.

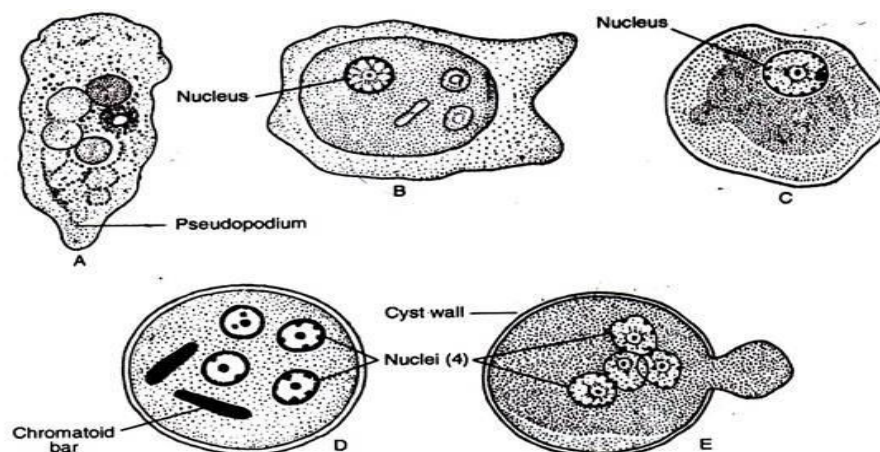


Fig. 10.23 *Entamoeba histolytica* (from various sources). A. Living trophozoite. B. Stained trophozoite. C. Precystic stage. D. Cystic stage. E. Excystment.

Presence of chromatoid bodies is the characteristic of the cysts of *Entamoeba histolytica*. They occur either singly or in multiples of two or more.

## Life Cycle of *Entamoeba Histolytica*:

The life cycle of *Entamoeba histolytica* is completed through a single host-man. Hence it is called **monogenetic**. Trophozoite and cyst stages of the parasite are concerned with the life cycle.

### Encystment:

*Entamoeba histolytica* multiplies by binary fission in the trophozoite stage. They have the capacity to encyst. Unfavourable

conditions in the habitat such as lack of nutrients, temperature deviations from the optimum range, decreased O<sub>2</sub> tensions, lowered pH and accumulation of metabolic wastes may be the causes for encystment.

### **Precystic form:**

Prior to encystment the trophozoite of each parasite loses its pseudopodium, eliminates food vacuoles and becomes spherical, called a precystic form. The diameter of this stage varies 10-20 µm and the structure of the nucleus is like the trophozoite stage of the parasite.

### **Mature cyst form:**

The precystic form secretes a thin, tough and transparent membrane around it called the cyst wall. The animal having a cyst is called a cyst. The process of enclosing in a cyst is called encystment or encystation. At the early stage the cyst contains a single nucleus. The single nucleus is divided mitotically forming two nuclei. This is called binucleate cystic stage.

Then the two nuclei are divided by mitosis and four nuclei occur. The nuclear divisions take place without cytoplasmic division and this tetra-nucleate cyst is called mature cyst. The whole process of encystment takes a few hours and the mature cyst lives in the lumen of the intestine of host only **two days**.

**Tolerance of the cyst:**

The cysts of *Entamoeba histolytica* can survive about one **month in water** and about **12 days on dry land**. They can tolerate the temperature up to 50° Celsius and 4 hours in formaldehyde solution.

**Infection:**

At the tetranucleate stage the cyst is infective to a new host. The infective cysts pass out through the host's faeces and are introduced into the gut lumen of a new host through the contaminated drink, food and vegetables.

**Excystment:**

Then the infective cysts pass into the lower portion of the small intestine (colon) of the new host. Here the process of excystment occurs. The excystment is the process by which the cysts are transformed into the trophozoites.

The cyst wall in the colon becomes permeable by the action of intestinal enzymes, the **trypsin of the intestine**. The cyst wall ruptures and 4-nucleate amoeba emerges out from the cyst.

**Factors for excystment:**

Temperature, pH, chemical composition of the medium and the flora of the bacteria may be the reasons for excystment.

**Metacystic form:**

After the emergence of quadrinucleate amoeba, the division of



cytoplasm immediately ensues and produces four small metacystic trophozoites.

### Trophozoites:

Both the nucleus and cytoplasm of each metacystic trophozoite divide and as a result 8 small amoebulae are produced (Fig. 10.24). These are called young uninucleate trophozoites. They are motile and penetrate the mucous membrane.

The young trophozoites feed on host tissues, blood, bacteria and yeast and gradually increase in size to attain maturity. Inside the tissues the trophozoites multiply and start the procystic form of the life cycle.

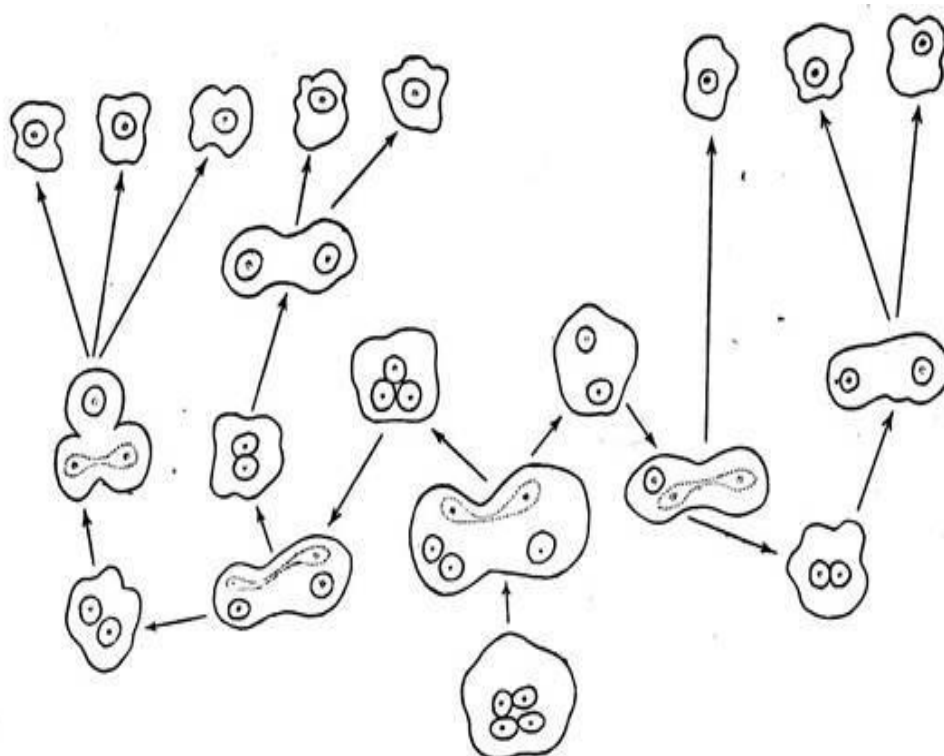
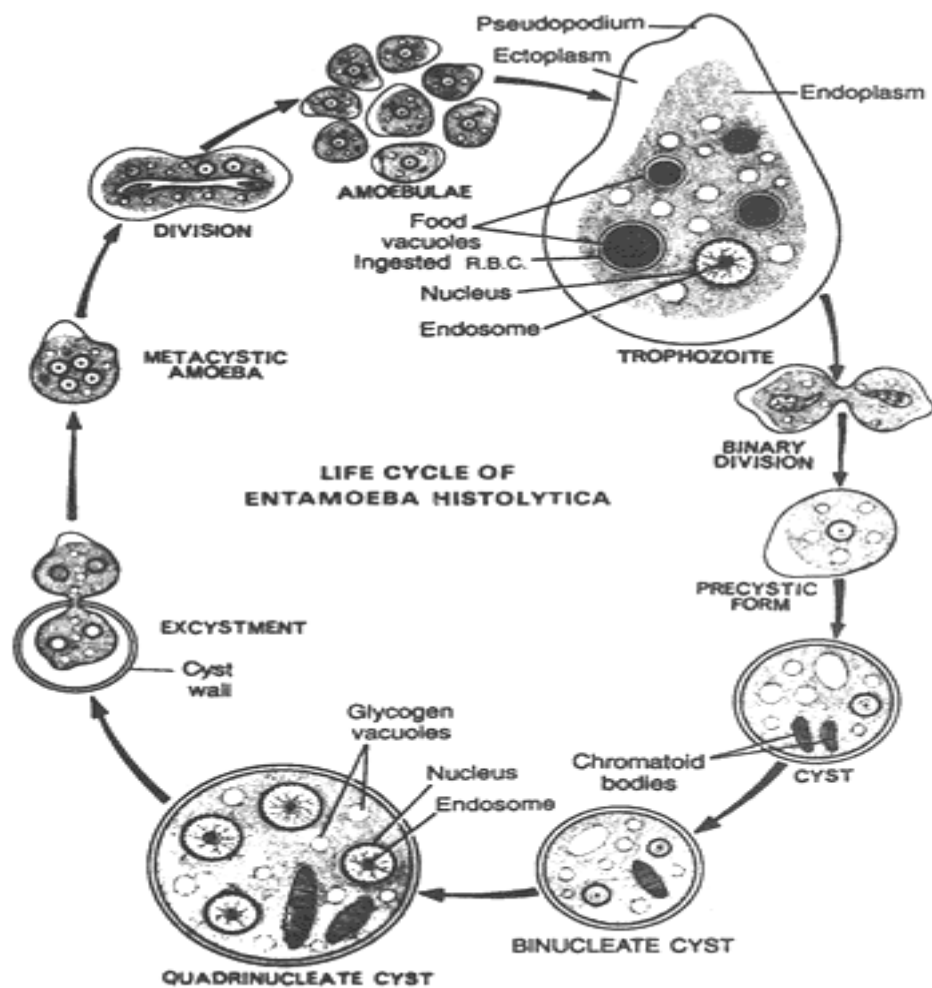


Fig. 10.24: Transformation of a quadrinucleate metacystic stage of *Entamoeba histolytica* to eight uninucleate trophozoites (after Kudo).



*Entamoeba histolytica* : Reproductive and life history

### Transmission:

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

#### (1) Contaminated water.

- Most people in the world don't have indoor plumbing/running water.
- Get water by ground/surface water.

#### (2) Contaminated food.

- Raw vegetable is also another source of infection.

- The cysts are generally transmitted with food or drink.
- Defecation in vegetable gardens, fields.
- Night soil (human excrement used as fertilizer).
- The practice of humans using their bare hands to clean toilet pits continues to this day-”night soil men”.

### (3) Mechanical contamination.

- House flies and cockroaches may transmit cysts mechanically
- Medical Equipment
- Flies, roaches, etc.
- Hand to mouth (finger nails, contaminated objects, toys, etc.)
- Hand to eye (ectopic)
- Hand to open sore (ectopic)

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 *Entamoeba histolytica*.

**The symptoms are:**

- (i) Loose stool
- (ii) Stool with mucous and blood

- (iii) Irregularity of bowel clearance
- (iv) Severe abdominal pain
- (v) Cramps
- (vi) Vomiting
- (vii) Malaise
- (viii) Abdominal discomfort (mimics appendicitis)
- (ix) Rectal tenesmus, and Dysentery - diarrhea with blood

• 10% of people in the world infected with amebas, but only 3% ever have some sort of clinical signs .This means that most people infected with *Entamoeba histolytica* do not know it is Dangerous.

### **Prophylaxis (Prevention of the disease):**

The infection of *Entamoeba 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.

### **Treatment:**

The following effective drugs for amoebiasis and should be used as per doctor's prescription.

- i. Chloroquine,
- ii. Emetin,
- iii. Dehydroemetine,
- iv. Terramycin,
- v. Erythromycin,
- vi. Aureomycin,
- vii. Thiocarbarosone,
- viii. Vioform,
- ix. Diodoquin,
- x. Tinidazole
- xi. Metranidazole (Flagyl)
- xii. Niridazole

### **Clinical manifestation:**

Infection ranges from asymptomatic to invasive intestinal amoebiasis and extra-intestinal amoebiasis

#### **1. Intestinal Amoebiasis**

**i. Asymptomatic infection:** 90% of *Entamoeba histolytica* infection is mild or asymptomatic.

## ii. Symptomatic infection

- Non dysentric amoebic 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

## 2. Extra intestinal amoebiasis:

**i. Hepatic infection:** Non suppurative 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. Splenic infection**

**vi. Cutaneous amoebiasis**

- Amoebic pericarditis

## Lab Diagnosis:

- i. Specimen:** stool, pus or liver abscesses, sputum and biopsy samples
- **ii. Stool macroscopy:** In amoebic dysentery stool is offensive, semi-solid, dark brown colour and acidic in nature, mixed with blood, mucus and faecal materials.
- **iii. Microscopy:** Normal saline preparation of fresh faecal material reveals trophozoites with RBCs in its cytoplasm and its amoebic motility.
- **iv. Stool and detection:** ELISA to detect 170KD lectin of *Entamoeba histolytica*
- **v. Stool culture:** Robinson's medium and NH polyxenic culture medium are used to culture *E. histolytica*
- **vi. Serology:** IHA, IFA etc are used to detect antibody in serum against *E. histolytica*
- **vii. PCR:** It is sensitive test , used to differentiate *E. histolytica* with other *Entamoeba* species
- **viii. 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**

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