Parasitic infections of the GI tract

By : Nader Alaridah MD, PhD

- **Protozoa:**

➢ *Entamoeba histolytica*

➢ *Giardia lamblia*

➢ *Cryptosporidium parvum*

- **Helminthis:**

Ascaris lumbricoides , Entrobius vermicularis

Echinococcus granulosus

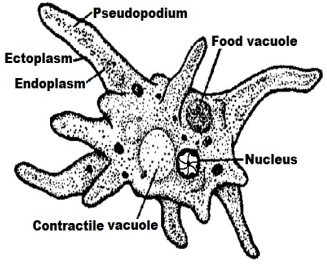
Schistosomia mansoni

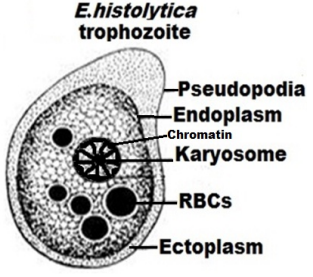
Entamoeba histolytica

- **Geographical distribution:** Worldwide especially in the temperate zone and more common in areas with poor sanitary conditions.
- **Habitat:** Large intestine (caecum, colonic flexures and sigmoidorectal region).
- **D.H:** Man
- **R.H:** Man, Dogs, pigs, rats and monkeys.
- **Disease:** Amoebiasis or amoebic dysentery

Morphological characters

1- Trophozoite stage (Vegetative form or tissue form):



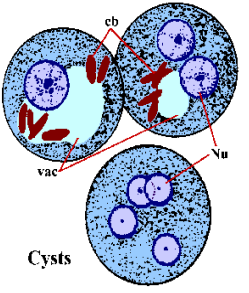


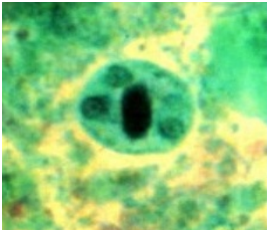
2- Cyst stage (Luminal form):

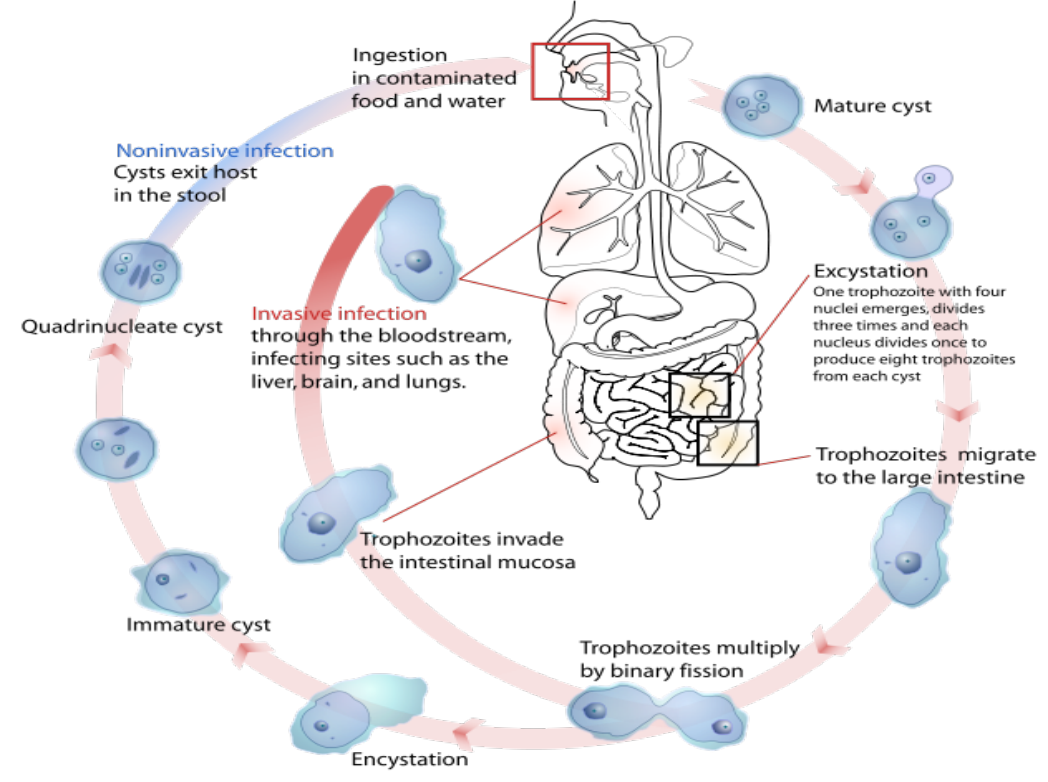
(a) Immature cyst (Uninucleate cyst and Binucleate cyst):

- **Uninucleate cyst (one nucleus)**
- **Binucleate cyst (2 nucleus)**

b) Mature cyst (Quadrinucleate cyst)






Ingestion
in contaminated
food and water
Mature cyst
Noninvasive infection
Cysts exit host
in the stool
Excystation
One trophozoite with four nuclei emerges, divides three times and each nucleus divides once to produce eight trophozoites from each cyst
Quadrinucleate cyst
Invasive infection
through the bloodstream, infecting sites such as the liver, brain, and lungs.
Trophozoites migrate
to the large intestine
Trophozoites invade
the intestinal mucosa
Immature cyst
Trophozoites multiply
by binary fission
Encystation

Mode of infection

1- Contaminated water and foods (ex. green vegetables) or drinks or hands with human stool containing mature cyst.

2- Handling food by infected food handlers as cookers and waiters.

3- Flies and cockroaches that carry the cysts from faeces to exposed food.

4- Autoinfection (faeco-oral or hand to mouth infection).

5- Homosexual transmission.

Clinical pictures

I) Intestinal amoebiasis

1-Asymptomatic infection

Most common and trophozoites remain in the intestinal lumen feeding on nutrients as a commensal without tissue invasion (Asymptomatic patient known as a healthy carrier and cyst passers)

2-Symptomatic infection

a) Acute amoebic dysentery

Presented with fever, abdominal pain, tenderness, tenesmus and frequent motions of loose stool containing mucus, blood and trophozoites.

b) Chronic infection

-Occurs if acute dysentery is not properly treated.
-With low grade fever, recurrent episodes of diarrhea alternates with constipation.
- Only cysts are found in stool.

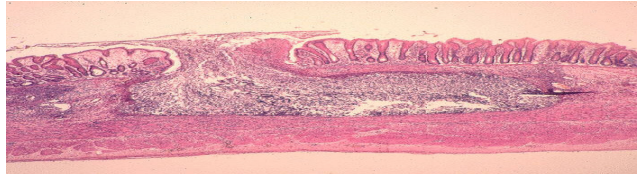
3-Complications

- Haemorrhage due to erosion of large blood vessels.
- Intestinal perforation peritonitis.
- Appendicitis.
- Amoeboma (Amoebic granuloma) around the ulcer stricture of affected area.

With heavy infection and lowering of host immunity

The trophozoites of *E. histolytica* invade the mucosa and submucosa of the large intestine by secreting lytic enzymes □ amoebic ulcers

The ulcer is flask- shaped with deeply undermined edges containing cytolyzed cells, mucus and trophozoites.



The most common sites of amoebic ulcers are caecum, colonic flexures and sigmoidorectal regions due to decrease peristalsis & slow colonic flow at these sites that help invasion.

II) Extra-intestinal amoebiasis

Due to invasion of the blood vessels by the trophozoites in the intestinal ulcer reach the blood to spread to different organs as:

Liver

-Amoebic liver abscess or diffuse amoebic hepatitis.
-Affect commonly right lobe either due to spread via portal vein or extension from perforating ulcer in right colonic flexure.
-CP: include fever, hepatomegaly and pain in

Lung

•Lung abscess pneumonitis with chest pain, cough, fever.
•Amoebic lung abscess usually occur in the lower part of the right lung due to direct spread from the liver lesions through the diaphragm or very rarely trophozoites may reach the lung via blood.

Brain → Brain abscess □ encephalitis (fatal).

Skin → **Cutaneous amoebiasis (Amoebiasis cutis) due to either extension of acute amoebic colitis to the perianal region or through rupture on the abdominal wall from hepatic, colonic or appendicular lesions.**

Laboratory diagnosis

I)Intestinal amoebiasis

a) Direct

•**Macroscopic:** Offensive loose stool mixed with mucus and blood.

•**Microscopic:**

1-Stool examination: Reveals either trophozoites (in loose stool) or cysts (in formed stool) by direct smear, iodine stained & culture.

2-Sigmoidoscopy: To see the ulcer or the trophozoites in aspirate or biopsy of the ulcer.

3-X-ray after barium enema: to see the ulcer, deformities or stricture.

b) Indirect

-Serological tests: CFT, IHAT, IFAT, ELISA and GDPT (gel-diffusion precipitin test).

N.B. These serological tests are positive only in invasive intestinal amoebiasis but negative in asymptomatic carriers.

II)Extra- intestinal amoebiasis

According to the organ affected

a) Direct

1- X- ray:

In liver space occupying lesion.

In lung pleuritis with elevation of the diaphragm

2- Ultrasonography, CT scan& MIR: For liver abscess.

3- Aspiration of abscess content: For liver abscess to detect trophozoites.

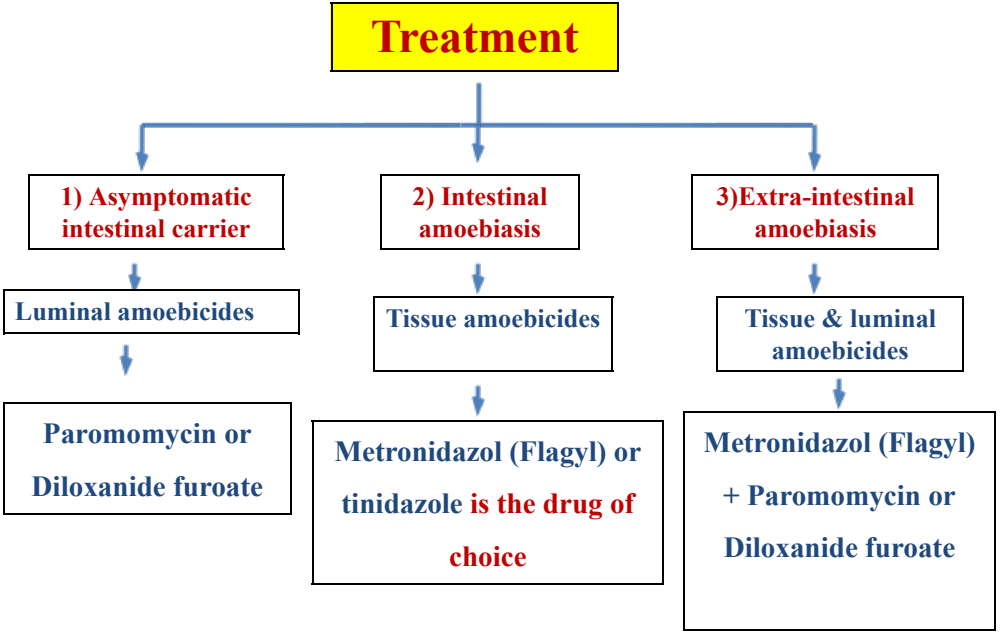
b) Indirect

1- Serological tests: As intestinal amoebiasis. They are positive and can persist for years.

2- Molecular by PCR.

3- Blood examination: Leucocytosis.

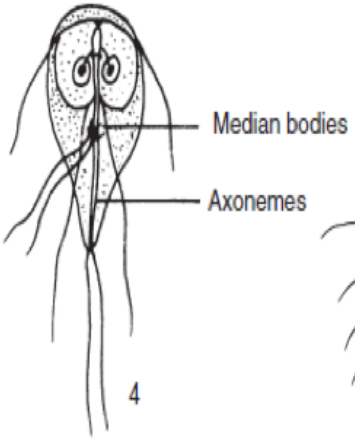
4- Liver function tests: Increased in amoebic liver abscess.


Treatment
1) Asymptomatic intestinal carrier
2) Intestinal amoebiasis
3)Extra-intestinal amoebiasis
Luminal amoebicides
Tissue amoebicides
Tissue & luminal amoebicides
Paromomycin or Diloxanide furoate
Metronidazol (Flagyl) or tinidazole is the drug of choice
Metronidazol (Flagyl) + Paromomycin or Diloxanide furoate

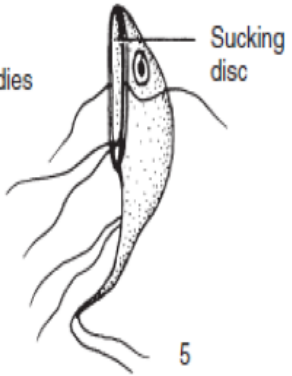
- **Prevention:**
- Amoebic infection is prevented by eradicating fecal contamination of food and water
- Water is a prime source of infection and therefore the most contaminated foods are vegetables such as lettuce
- Amoebic cysts are not killed with low doses of chlorine or iodine
- Bringing water to a boil ensures the absence of amoeba

Giardia duodenalis

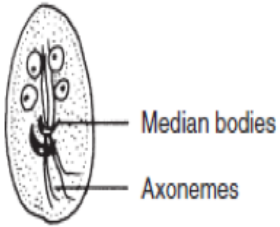
- Common cause of intestinal infection worldwide
- Flagellated
- Both the trophozoite and the cyst are included in the life cycle.
- found most commonly in the crypts in the duodenum.
- Trophozoites are attached to the epithelium of the host villi by means of the **ventral disk.**
- Cyst formation takes place as the organisms move down through the jejunum after exposure to biliary secretions.


Median bodies
Axonemes

4


Sucking
disc

5


Median bodies
Axonemes

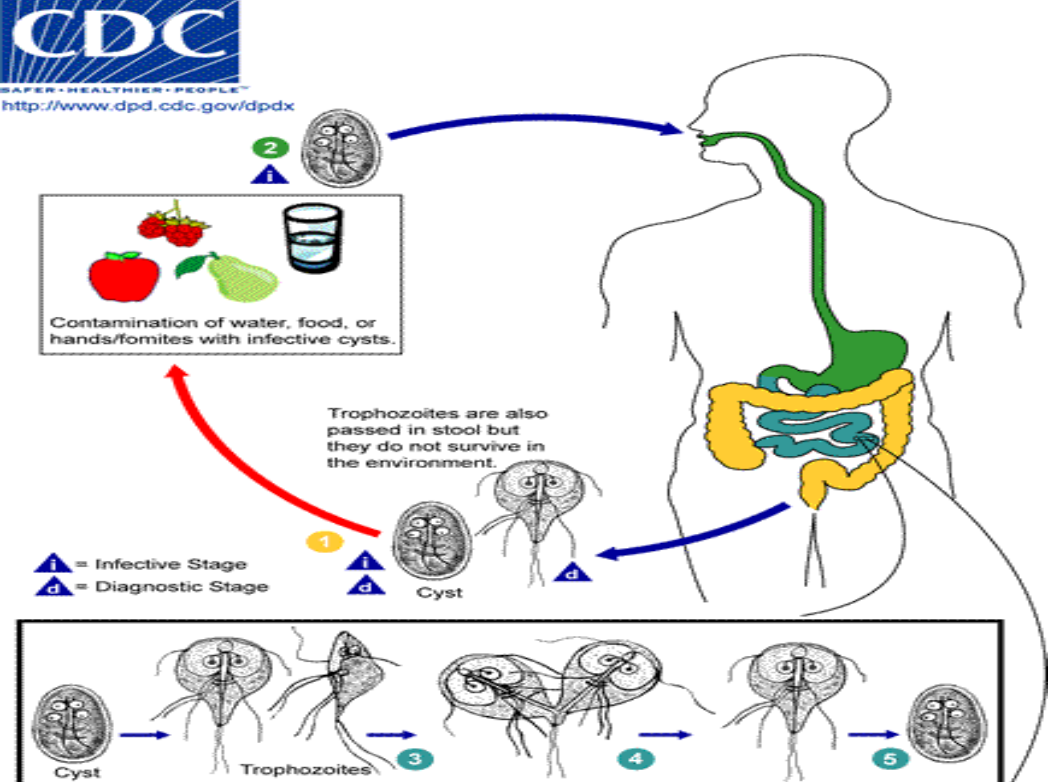
6

Epidemiology

- Transmission of *G. lamblia* occurs by ingestion of viable cysts by fecal oral route
- high incidence of giardiasis occurs in patients with immunodeficiency syndromes.
- The incubation period ranges from approximately 1-2 weeks and infectious dose is 10.

clinically

- ➢ Asymptomatic Infection (treatment not recommended)
- ➢ Symptomatic:
- Diarrhea usually watery: profuse watery diarrhea that later becomes greasy foul smelling and may float (steatorrhea)
- Abdominal cramps, bloating, malaise, weight loss,
- Malabsorption and weight loss
- Vomiting and tenesmus are not common


CDC
SAFER·HEALTHIER·PEOPLE
http://www.dpd.cdc.gov/dpdx
2
i
Contamination of water, food, or hands/fomites with infective cysts.
Trophozoites are also passed in stool but they do not survive in the environment.
1
i
d
Cyst
d
i = Infective Stage
d = Diagnostic Stage
Cyst
Trophozoites
3
4
5

Lab Diagnosis

- **Routine Methods:**
  - Stool analysis: cysts and sometimes trophozoites
- **Antigen Detection:**

  - Sensitive and specific in detecting *G. lamblia* in fecal specimens.

  Treatment: Metronidazole or tinidazole

Cryptosporidium spp.

- Intracellular enteric parasites that infect epithelial cells of the stomach, intestine, and biliary ducts.
- *C. parvum* (mammals, including humans) and *C. hominis* (primarily humans).
- infections begin with ingestion of viable oocysts, each oocyst releases four sporozoites, which invade the epithelial cells and develop into merozoites then oocyst.
- Prevalence of fecal oocyst 3-10%

- **Clinically:**

➢ Copious Diarrhea: These patients may have 3-17 liters of stool per day

➢ Abdominal pain and vomiting

- **Diagnosis:** oocyst in stool using modified acid fast stain
- **Treatment:**

➢ Usally self limited with Oral or intravenous rehydration.

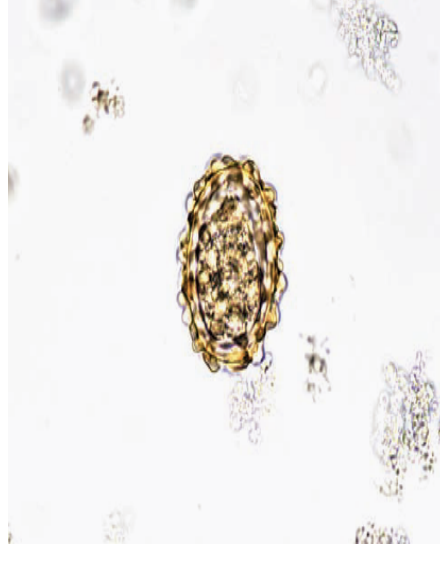
➢ Nitazoxanide is used for immunocompromised individuals e.g HIV patients.

ASCARIS LUMBRICOIDES

Morphology :

- Male adult worm measures 15-20 cm in length
- Female adult worm measures 20-40 cm in length
- The posterior end of male adult worm is curved while the female adult worm is straight
- Estimated prevalence more than 1 billion .


Female
Male



Mode of transmission

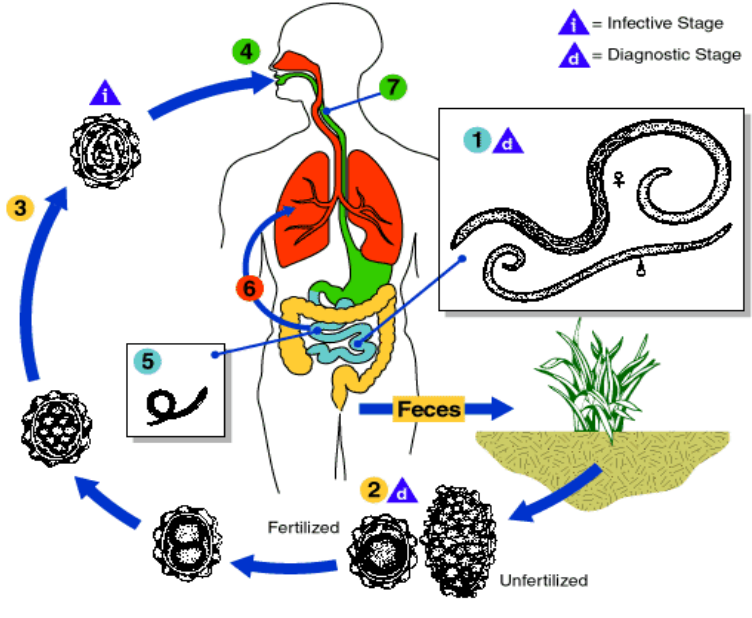
- Fecal – oral transmission
- Reinfection possible

Habitat

- small intestine

Infective stage

- Embryonated egg
- Each female produces 200,000 eggs a day
- Ascaris eggs are capable of survival within harsh environmental conditions, including dry or freezing temperatures.
- When ingested they hatch in small intestine , migrate through the venous system to lungs where they break into the alveoli then to the bronchial tree before they are swallowed and develop into mature worm in the intestine.


i = Infective Stage
d = Diagnostic Stage
1 d
2 d
3
4
5
6
7
Feces
Fertilized
Unfertilized

Pathogenesis and spectrum of disease

- Disease is called Ascariasis
- Children and young adolescents have higher infection rate
- Many A. lumbricoides infections are asymptomatic
- Symptomatic:

➢ Pulmonary symptoms during migration (loeffler's syndrome which is respiratory symptoms, infiltrates and eosinophilia)

➢ GI manifestations: malnutrition, anemia, malabsorption, steatorrhea and intestinal obstruction, biliary obstruction and jaundice

Lab diagnosis

- Eosinophilia
- Microscopic examination (looking for eggs)

  Direct smear (stool mixed with saline) identified for both (fertilized and infertile)eggs
- Adult worm may also be identified in feces
- Larvae may be found in sputum or gastric aspirates

THERAPY

oral Albendazole 400MG STAT

ENTEROBIUS VERMICULARIS (pinworm)

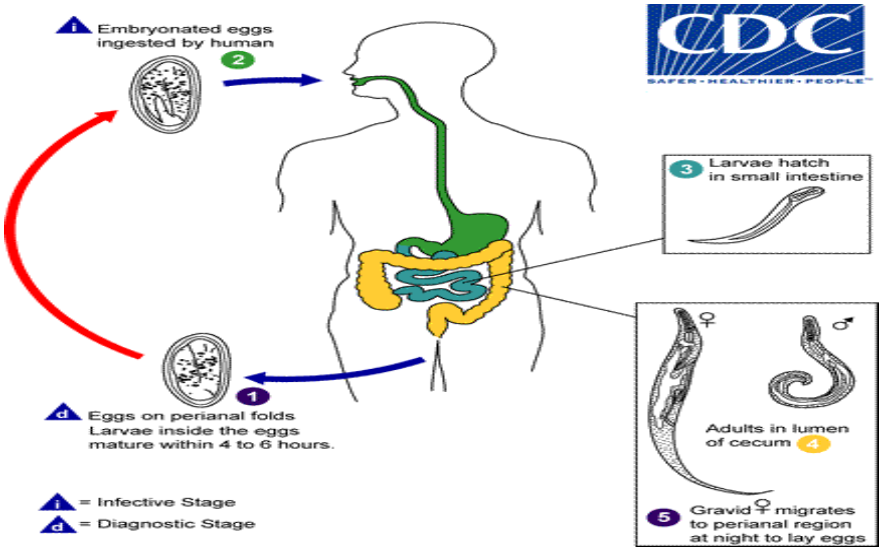
- Small , thin and white worm
- distributed worldwide and commonly identified in group settings of children ages 5 to 14 years
- The female worm measures 8 to 13 mm long with a pointed “pin” shaped tail (11000 ova and live for a month)
- The males measure only 2 to 5 mm in length, die following fertilization, and may be passed in feces.
- Habitat : large intestine (Caecum)

Mode of transmission

- Fecal-oral or inhalation (autoinfection)
- Sexual transmission has been reported
- direct; transmission occurs from an infected host to another
- Infections are associated with institutional crowding and families

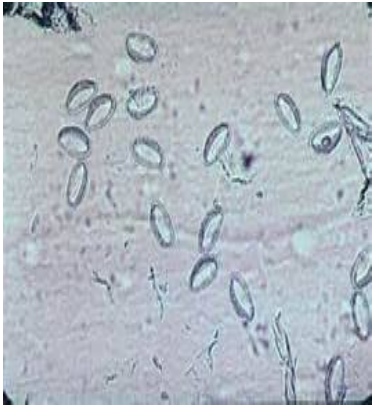
Life cycle

- The female migrate at night to the perianal area where they deposit eggs.
- Eggs embryonate within hours and transferred from their by above mentioned routes

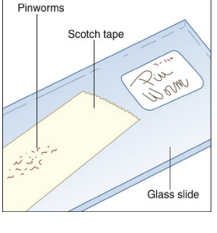

i Embryonated eggs ingested by human
2
3 Larvae hatch in small intestine
Adults in lumen of cecum 4
5 Gravid ♀ migrates to perianal region at night to lay eggs
d Eggs on perianal folds Larvae inside the eggs mature within 4 to 6 hours.
1
i = Infective Stage
d = Diagnostic Stage
CDC
SAFER·HEALTHIER·PEOPLE™

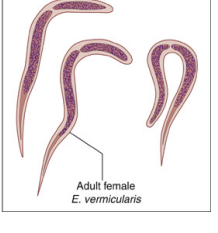
- **Clinically:**
- Infections with E. vermicularis are typically asymptomatic
- The most common complaint is perianal pruritus (itching)
- the parasite may migrate to other nearby tissues, causing appendicitis, oophoritis, ulcerative bowel lesions..

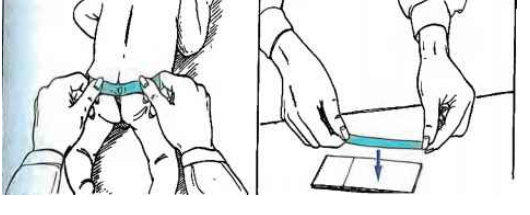
- **Diagnosis** is typically by microscopic identification of the characteristic flat-sided ovum
- the method that used for diagnosis of pinworm is a cellophane (Scotch) tape
- **Treatment**: albendazole 400 mg stat repeated at 2w



Enterobius vermicularis eggs







- **Hydatid cysts (*Echinococcus granulosus*):**

➢ Echinococcus is **the smallest** of all tapeworms (3 to 9 mm long)

➢ E. granulosus is a tapeworm found in the small intestine of the **definitive host**, the **canine**.

➢ Eggs are ingested by the **intermediate hosts** and include a variety of mammals including **sheep, cattle and humans.**

➢ **Humans** are typically **accidental hosts** and are considered a deadend since the life cycle of the organism is unable to continue in a human host leading to **hydatid cysts**

- Hydatid cysts (*Echinococcus granulosus*):

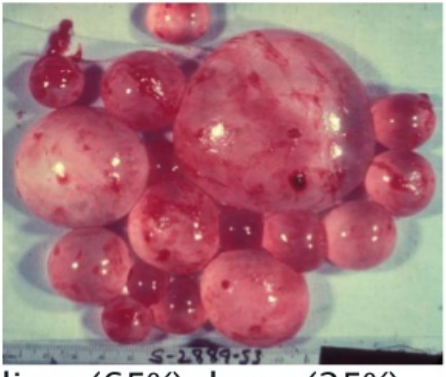
- **Hydatid disease** in humans is potentially dangerous depending on the size and location of the cyst.
- Majority occurs in liver and lungs and usually asymptomatic
- Some cysts may remain undetected for many years until they grow large enough to affect other organs.

➢ **Diagnosis**: incidentally by radiology , serology

➢ **Treatment:** surgery, albendazole

Cyst structure

At gross examination, the vesicles resemble a bunch of grapes



- Sites of hydatid cyst: liver (65%), lungs(25%), muscle, spleen, kidney, heart, bones, brain etc
- Hydatid cysts – slow growing : 2–3cm/yr

SCHISTOSOMIASIS

Is a human disease syndrome due to infection by *Schistosoma*

Most human schistosomiasis is caused by

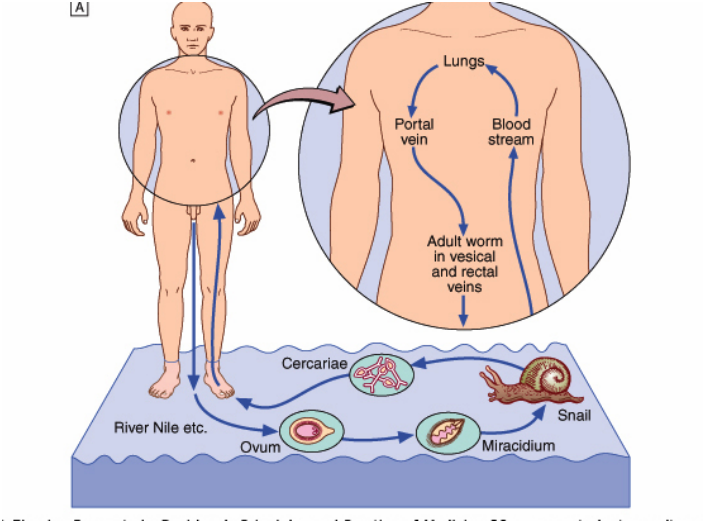
1. Schistosoma mansoni (mainly GIT).
2. Schistosoma japonicum (mainly GIT).
3. Schistosoma haematobium discovered by Theodor Bilharz in Cairo in 1861 (mainly UTS).

- It is estimated that than 200 million are infected all over the world & about 500-600 million are exposed to infection..
- Adult worm inhabits the portal venous system.

LIFE CYCLE

- The ovum is passed in the faeces of infected individuals and gains access to fresh water where the ciliated miracidium inside it is liberated; it enters its intermediate host, a species of freshwater snail, in which it multiplies .
- Large numbers of tailed cercariae are then liberated into the water.
- Infectious cercariae penetrate human skin and migrate through the lung and the liver to reach portal venous system

LIFE CYCLE


[A]
Lungs
Portal vein
Blood stream
Adult worm in vesical and rectal veins
Cercariae
Snail
River Nile etc.
Ovum
Miracidium

- ***Morphology***
- Adult male & female have oral sucker surrounding the mouth anteriorly & ventral Sucker on the ventral surface with which it attaches itself to the wall of the vessel in which it lives.
- **The male** worm is flat, leaf like &folded to form the gynacophoric canal which enfolds the slender female for almost its entire length.
- testes
- ovary


Oral suckers
Ventral suckers
♂
♀
Gynaecophoric canal
1mm

Pathogenesis and manifestations

- Skin penetration causing itchy rash
- Travel via lung causing respiratory manifestations
- Production of eggs causing granulomatous reaction and sclerosis in portal venous system to eggs deposited in tissues. This may lead to portal hypertention, esophageal varices, HSM and liver failure

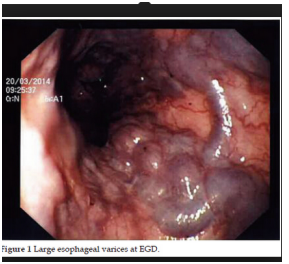


Figure 1 Large esophageal varices at EGD.

DIAGNOSIS

CLINICAL

HEMATOLOGICAL, BIOCHEMICAL

CONFIRMED BY

Detection of ova in STOOL or tissue biopsy

Treatment

Praziquantel 40mg /kg for all types and as a single dose is treatment of choice

The End

Thank you