

Intestinal Helminths

Editing File

- Important
- Doctor's notes
- Extra explanation
- Only F or only M

"لا حول ولا قوة إلا بالله العلي العظيم" وتقال هذه الجملة إذا
داهم الإنسان أمر عظيم لا يستطيعه ، أو يصعب عليه القيام به .

OBJECTIVES:

- Name the 3 main groups of parasitic Helminths and their characteristic morphological features.
 - Know the 5 common examples of Nematodes with their scientific and common names.
 - Describe the life cycle of these 5 examples of Nematodes with pathology, diagnosis and treatment.
 - Describe the life cycle of *Taenia saginata* and *T. solium* and *Hymenolepis nana*
 - Describe the life cycle *Echinococcus granulosus* and diagnosis
 - Know treatment of Tapeworms.
-

Parasitology

PROTOZOA

- Unicellular
- Single cell for all functions

1- Amoebae:
move by
pseudopodia.

2- Flagellate:
move by
flagella.

3- Ciliates:
move by cilia

4- Apicomplexa
(Sporozoa):
tissue parasites
(malaria parasite)

HELMINTHS

- **Multicellular** (have special cells forms each system)
- Specialized cells

Flat worms

Trematodes:
- leaf-like
- unsegmented.

Cestodes:
- tape-like
- segmented.

Round worms
(Nematodes):
- elongated
- Cylindrical
- unsegmented

Nematodes

General features

- **Multicellular**
- Elongated worm, cylindrical, unsegmented and tapering at both ends.
- Variable in size, measure <1 cm to about 100cm.
- Sex separate and male is smaller than female

Location in the human body

1. **Intestinal nematodes**
2. Tissue nematodes

Common intestinal infections

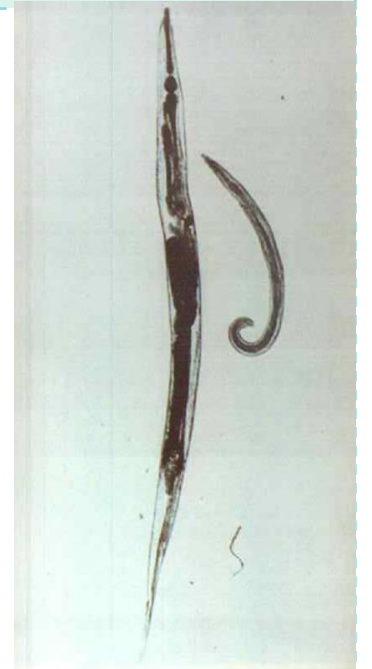
All are important

1. **Enterobius (Oxyuris) vermicularis ** (Pinworm, seatworm, threadworm)**
2. Trichuris trichiura (whipworm)
3. Ascaris lumbricoides (roundworm)
4. Ancylostoma duodenale & Necator americanus (hookworms)
5. Strongyloides stercoralis ****



1-Enterobius vermicularis (THREAD WORM) - Enterobiasis
(Common names: Pin worm, seat worm)

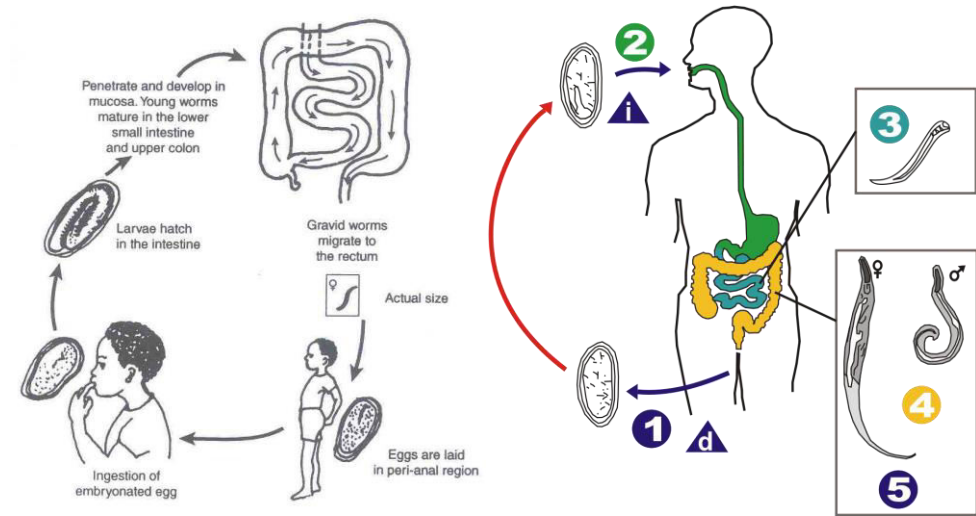
- it is a very small parasite
- Found all over the world but more common in temperate regions, infects only human.
- Children are more often infected than adults, it tends to occur in groups living together such as families, army camps or nursery.
- Adult worms are mainly located in lumen of cecum and the female migrate to rectum to deposit her eggs on perianal skin.
- Adult worms live in the large intestine.
- Direct human to human infection occurs mainly by swallowing the eggs. when a child touch the anal part the eggs will be on his hand and it will spread by touch someone's hand. In addition, **autoinfection** occurs by contamination of the fingers.
- It can be seen by naked eye as white thread \pm 1cm.
Male is smaller than female \pm 0.5cm, with coiled end.



Enterobius vermicularis (Oxyuris)

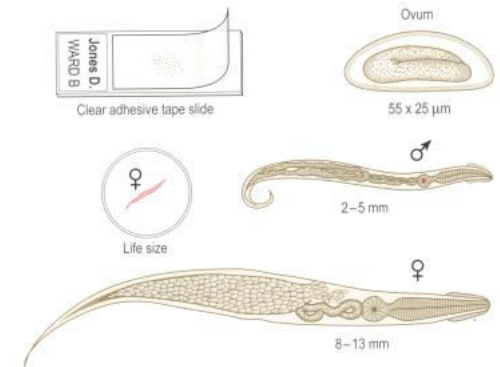
Pathology

- Majority of infections are asymptomatic
- Main clinical presentation pruritus and which can be very troublesome and occurs more often during the night, persistent itching may lead to inflammation and secondary bacterial infection of the peri-anal region.
- Infected children may suffer from emotional disturbance because of lack of sleep, insomnia, anorexia, loss of weight and loss of concentration and enuresis. Also involuntary urination and the eggs
- Ectopic enterobiasis occurs in infected adult female when invade vulva and vagina result in valvo-vaginitis, salpingitis, also adult worm can lodged in the lumen of appendix cause appendicitis.



DIAGNOSIS

Unlike other intestinal Nematodes, the eggs are not usually found in feces. The best method is to look for them around the anus by taking an anal swab or by using CELLULOSE ADHESIVE TAPE, the examination should be done before defecation or bathing.



Treatm-ent

Albandazole, Mebendazole for whole family (it is not important but you can memorize albandazol for all)

Ascaris lumbricoides (roundworm)

General

- Look like spaghetti
 - The commonest human helminthes infection all over the world.
 - **HUMAN** is the only definitive host. (live as adult)
- The largest intestinal NEMATODE of human , which is normally located in **the small intestine.**

- Found in jejunum and upper part of ileum.
- Female ± 20 cm longer than male ± 10 cm
- Feed on semi digested food. Causes malnutrition
- Needs soil area to be in the infective stage

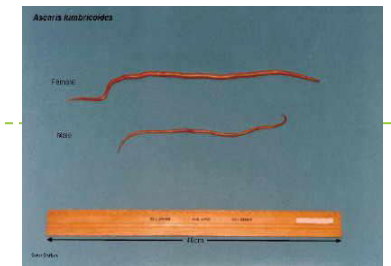
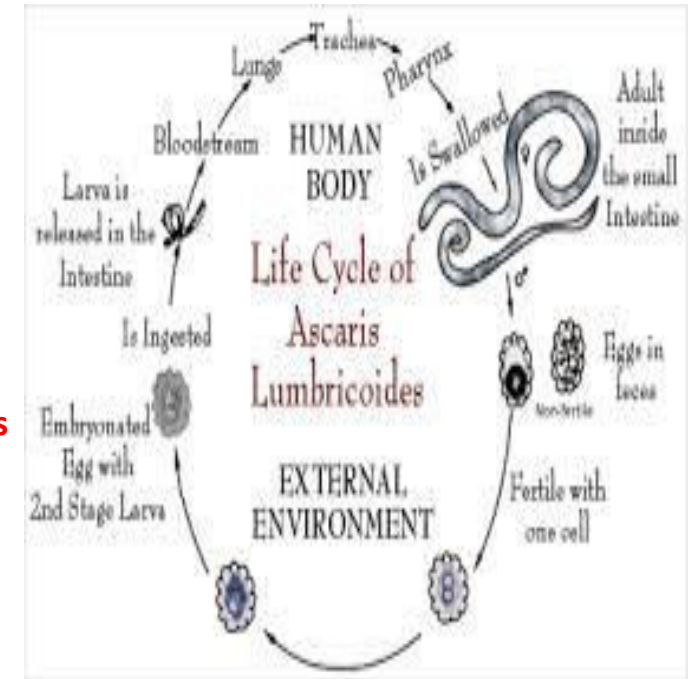
LIFE – CYCLE only in female

It infect only human when man ingest an **fertilized egg** contaminated with food or water, egg shell is dissolved by digestive juices and a **Larva** penetrate the wall of the **duodenum** to the portal circulation for (3days) and then from right heart into the pulmonary circulation and stay in the **alveoli** ,where it grow and molts for (3weeks), then **Larva** crawl up bronchi, trachea,larynx and pharynx and be **coughed up** , then swallowed ,returned to the **small intestine** where it mature to adults male &female ,fertilization take place producing eggs which pass in stool.

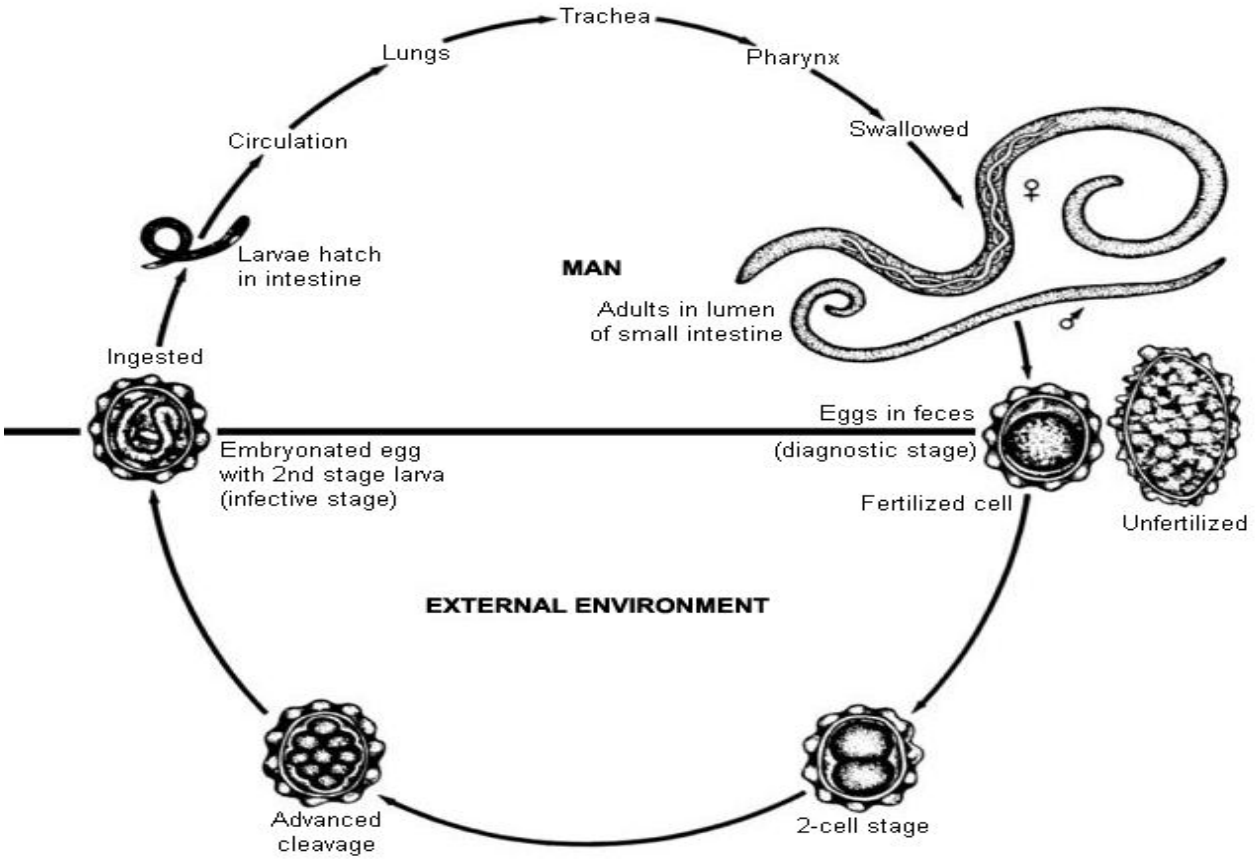
Unfertilized eggs in the stool →soil area →**embryonated egg** →Mouth →stomach → small intestine →**larva** → circulation→lung→mature rich with O₂ →pharynx →coughed up →swallowed→intestine→adult and mature male &female

Infective stage is embryonated egg

Diagnostic stage is unfertilized egg



Ascaris lumbricoides life cycle



Ascaris eggs



Ascaris egg (embryonated)



Ascaris larva emerging from egg



Pathogenicity female only

1-Migrating LARVA :

Ascaris pneumonia (Loeffler's syndrome) , some times LARVA reach aberrant sites like brain ,heart or spinal cord can cause unusual disturbance.

2-Adult WORM:

The worm consumes proteins and vitamins from host's diet and leads to **malnutrition**. Because it use semi digested food Can cause **intussusception** (block to the intestine due to movement of the worms and it is an emergency case) , intestinal ulcers and in massive infection can cause intestinal obstruction.

Pathology:

1-Adult worm: (small intestine)

- **Light infection** : asymptomatic.
- **Heavy infection** : intestinal obstruction
- **Migrating adult** : to bile duct -jaundice

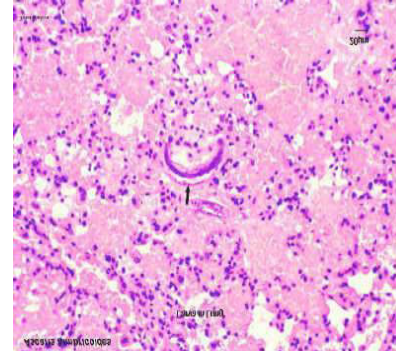
2-Larvae: in lung Loeffler's syndrome

Pneumonitis and broncho-spasm, cough with bloody sputum
Eosinophilia, urticaria



Loeffler's syndrome:
Larvae in lung

pneumonia, cough
,bloody sputum



Ascaris larva in lung

Diagnosis


- eggs in stool. (unfertilized)
- larvae in sputum.
- adult may pass with stool.



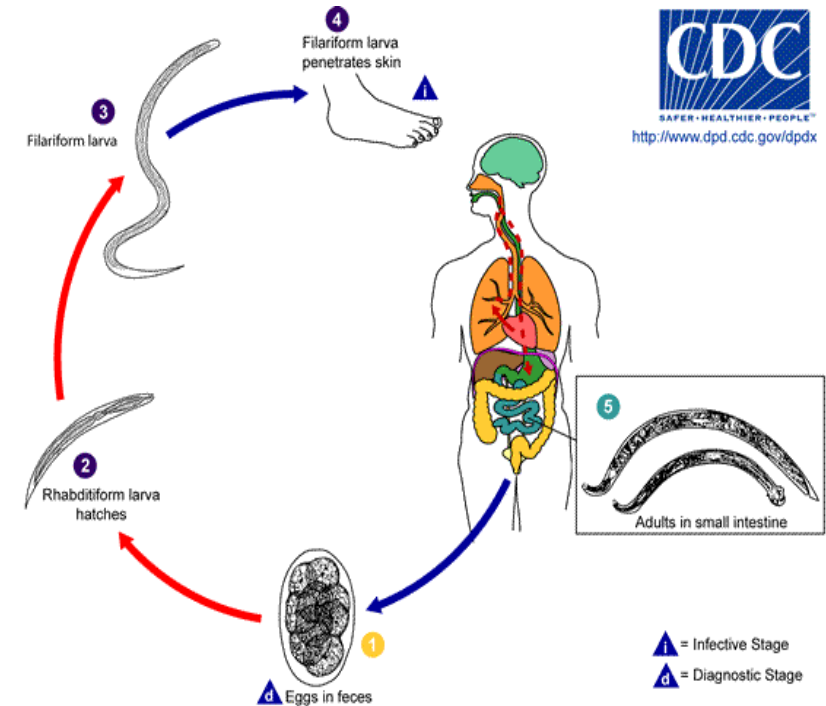
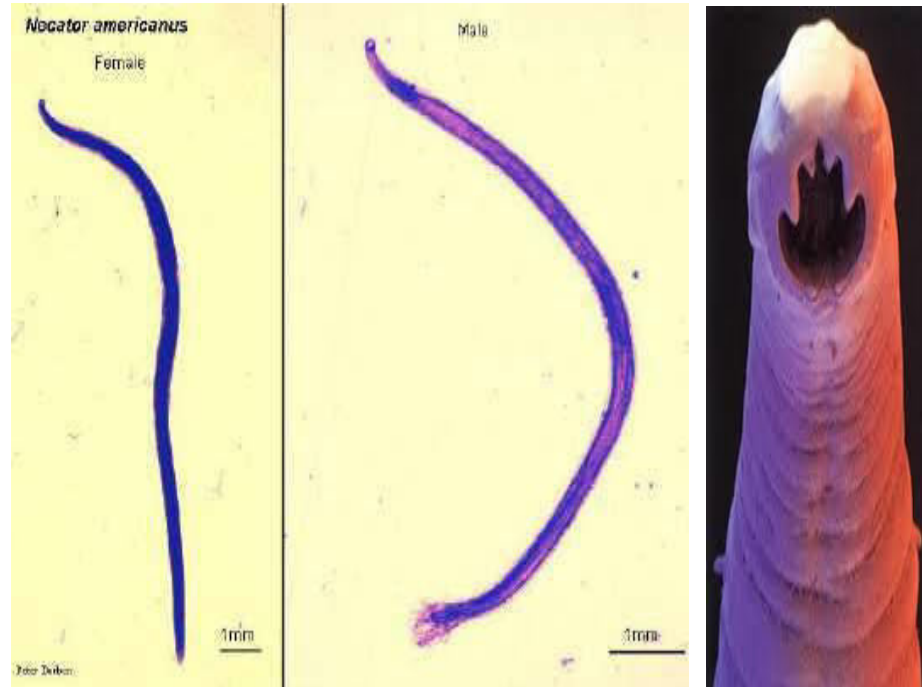
Treatment

Albendazole , Mebendazole

2-Trichuris trichiura (Whipworm)

General	<ul style="list-style-type: none">• World wide ,common in poor sanitation.• Infect only human• It <u>coexists with Ascaris</u> because of similar requirement(the eggs to be embryonated egg infective stage it needs to be 3 weeks in the soil).• Adult live in large intestine especially caecum and appendix –in heavy infection the whole length of large intestine affected.• Male and female worm have narrow anterior portion penetrate the intestinal mucosa
Pathology and Symptoms	<ul style="list-style-type: none">• light infection : asymptomatic• heavy infection :abdominal pain ,bloody diarrhea• Rectal prolapsed why? because it live in the large intestine in children is a common complication.
Diagnosis	<p>egg in stool characterized by its barrel shape with mucoid plugs at each pole .</p> 
Treatment	<p>Albendazole. (for all helminths)</p>

Hook worms (just remember this short name)
Ancylostoma duodenale (in the middle east) & Necator americanus (in US)



Its buccal capsule (mouth) lined with hard hooks, triangular **cutting plates** and **anticoagulant glands**.

Hook worms Ancylostoma duodenale & Necator americanus

General

- Needs **soil** such as the previous but the difference is we eat ascaris and whipworm but hook worm enter to the circulation by barefoot
- Buccal cavity attached to intestinal mucosa
- There are no specific symptoms or signs of hookworm infection, but they give rise to a combination of intestinal **inflammation** and progressive **iron-deficiency anemia** and **protein deficiency**
- **Filariform Larval (infective stage)** invasion of the **skin** can produce a skin disease called **cutaneous larva migrans** also known as creeping eruption, this is commonly caused by walking **barefoot** through areas contaminated with fecal matter. Larva migrate through the **vascular system** to the **lungs**, and from there up the **trachea**, and are swallowed. They then pass down the **esophagus** and enter the digestive system, finishing their journey in the **small intestine where the larvae mature** into adult worms. They mate inside the host, females laying up to 30,000 **eggs** per day, **which pass out in feces (diagnostic stage)**. The eggs need to be in soil for about one week to become **FILARIFORM LARVA**

Pathology & clinical picture

- **larvae:**
 - **At the site of entry** of larvae intense itching (ground itch) and dermatitis.
 - **Migration phase:** cough with bloody sputum, pneumonitis and bronchitis but less severe than Ascaris, eosinophilia, urticaria.

- **Adult worm:**
 - low worm burden (INFECTION): **no** symptoms.
 - Moderate to heavy burden: Epigastric pain, vomiting, hemorrhagic enteritis. Protein loss: hypo-proteinaemia, edema. **Anemia:** due to withdrawal of blood by parasites and hemorrhage from punctured sites lead to **severe anemia = microcytic hypo chromic anemia or iron-deficiency anemia**

Diagnosis


Eggs in stools.;
-occult blood (+)

Treatment

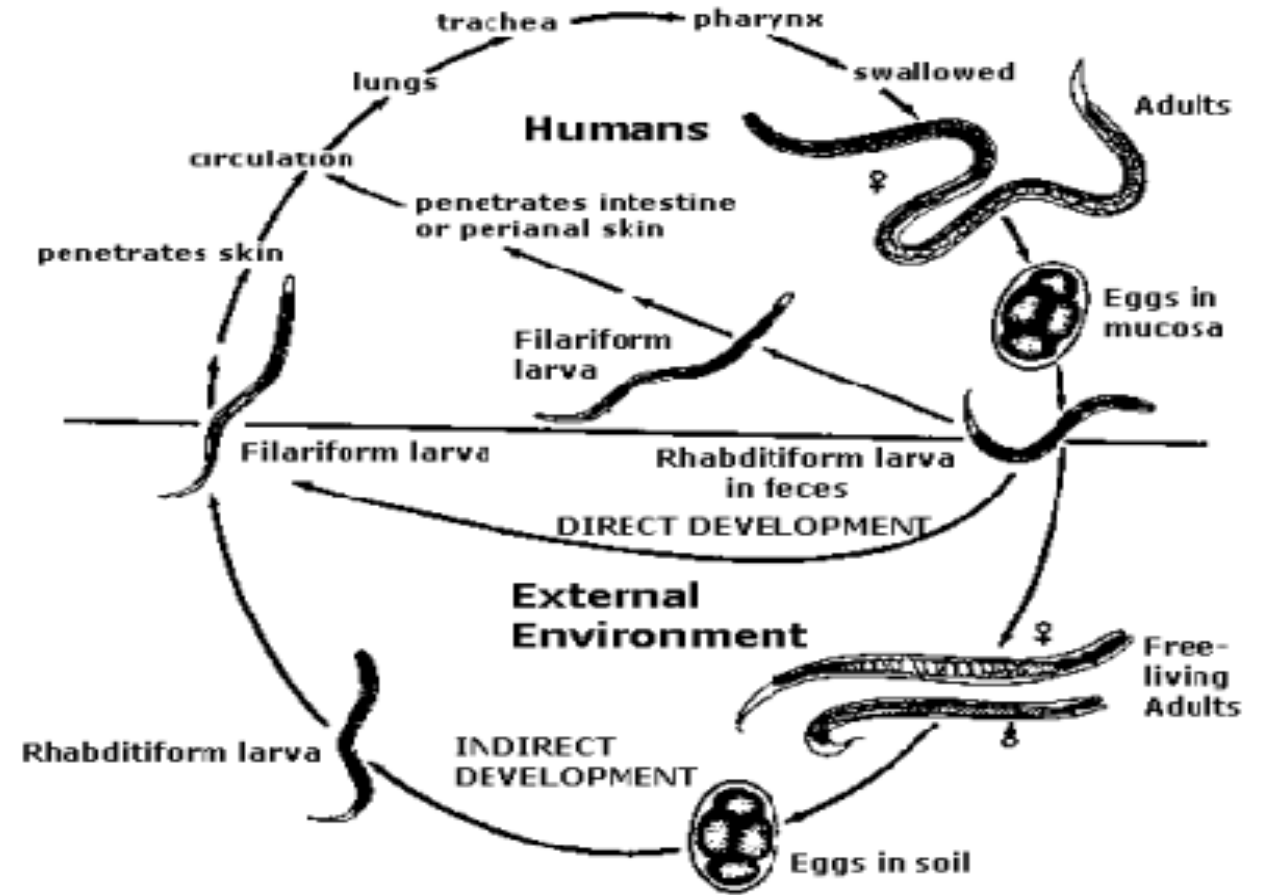
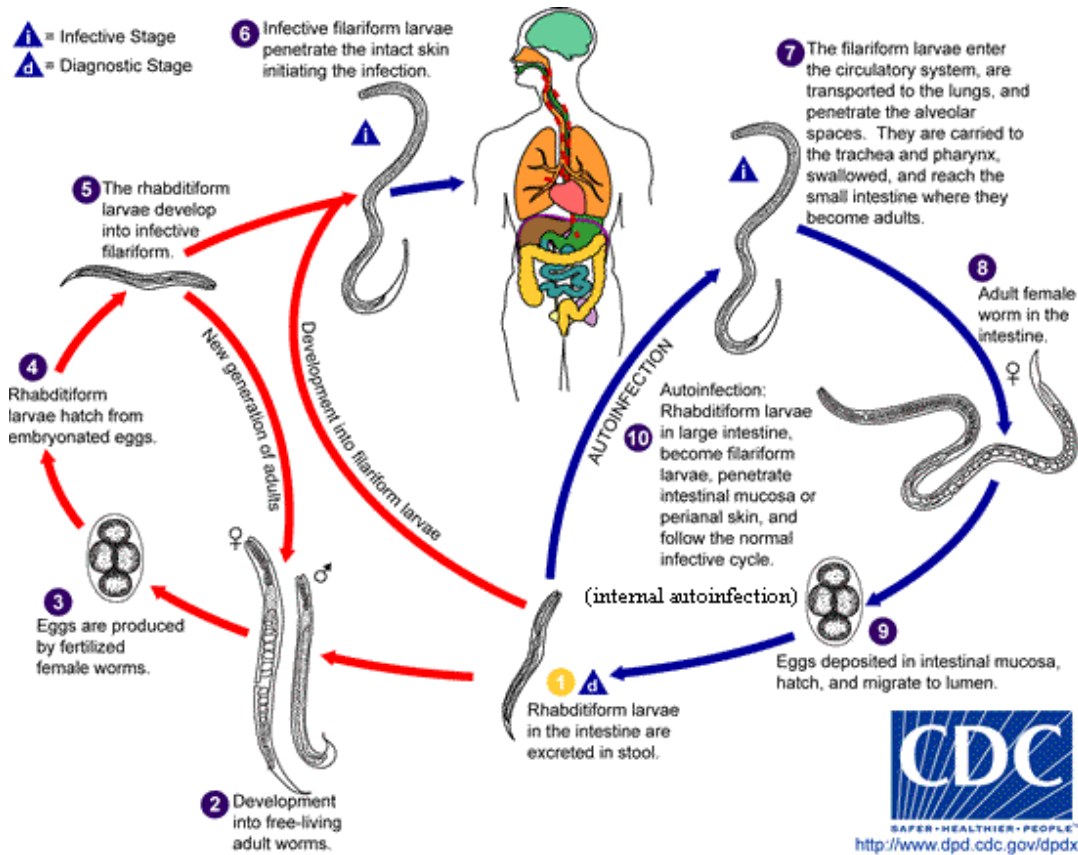
Albendazol, Mebendazole



Strongyloides stercoralis

<p>General</p>	<ul style="list-style-type: none"> World wide ,common in poor sanitation. Widely distributed in tropical area at Asia, Africa & South America . fatal dissemination in immuno-compromised host. Epically HIV patient It is smallest pathogenic nematodes ± 2.5mm. adult live in mucous membrane of duodenum jejunum rarely mucous membrane of bronchus. AUTOINFECTION IS VERY IMPORTANT CRITERIA . There is external and enteral autoinfection 					
<p>life cycle</p>	<p>The parasite shows 3 different modes of development:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="249 486 868 772"> <p>1-Direct development: The rhabditiform larva pass from stool and become directly a Filariform larva if the environment of the soil is suitable.</p> </td> <td data-bbox="868 486 1513 772"> <p>2-Indirect development : in external environment Rh. larva becomes free living adults, produce eggs ,rhabditiform larva (diagnostic stage) and Filariform larva (Infective stage).</p> </td> <td data-bbox="1513 486 2497 772"> <p>3-AUTOINFECTION: mainly in immunocompromised patients Internal :when the rhabditiform larva become a filariform larva in the intestine and penetrate the intestine External : fecal contamination of skin –Rh larva > filariform penetrates the skin</p> </td> </tr> </table>			<p>1-Direct development: The rhabditiform larva pass from stool and become directly a Filariform larva if the environment of the soil is suitable.</p>	<p>2-Indirect development : in external environment Rh. larva becomes free living adults, produce eggs ,rhabditiform larva (diagnostic stage) and Filariform larva (Infective stage).</p>	<p>3-AUTOINFECTION: mainly in immunocompromised patients Internal :when the rhabditiform larva become a filariform larva in the intestine and penetrate the intestine External : fecal contamination of skin –Rh larva > filariform penetrates the skin</p>
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<p>Pathology and clinical picture</p>	<ul style="list-style-type: none"> Cutaneous little reaction on penetration. sever dermatitis at perianal region in case of external autoinfection. Migration :pneumonitis during larval migration. . Intestinal: inflammation of upper intestinal mucosa, diarrhea, upper abdominal pain in the epigastria colicky in nature. Disseminated strongyloidiasis : in patient with immunodeficiency ,uncontrolled diarrhea –granulomatus changes –necrosis--perforation—peritonitis death. 					
<p>Diagnosis</p>	<p>NO EGG IN DIAGNOSIS rhabditiform larvae diagnostic stage in: -Stool examination -Duodenal aspirate</p>		<p>Treatment</p>	<p>Albandazole, Mebendazole</p>		

2- Strongyloides stercoralis



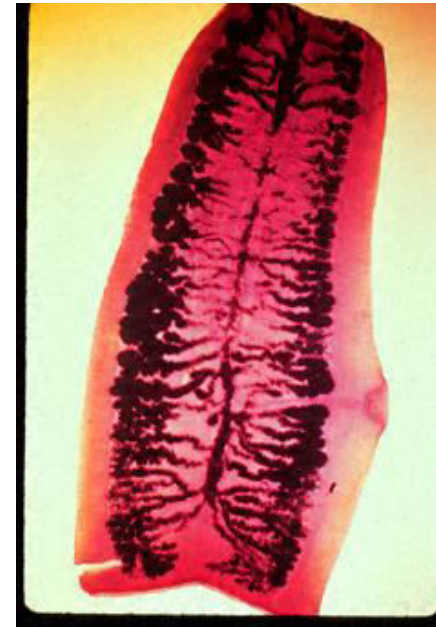
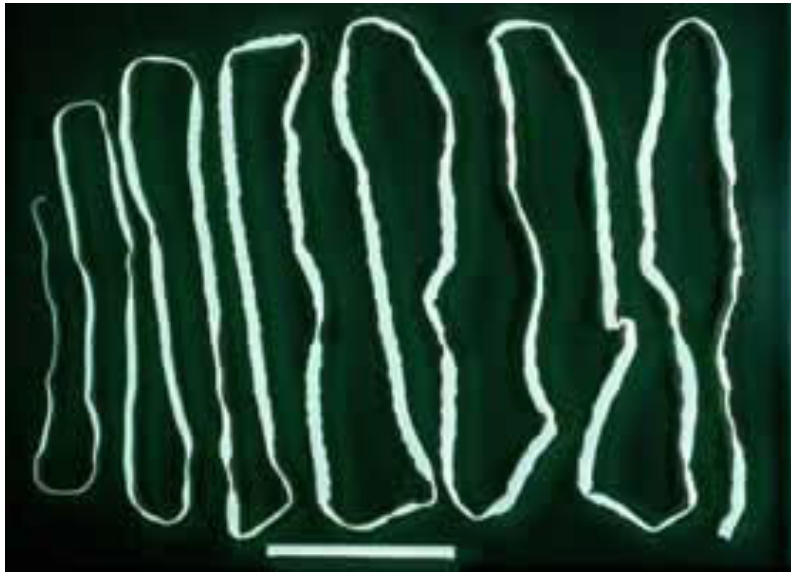
Direct : Rhabditiform larva in the stool → developed directly to adult male & female → eggs → rhabditiform larva → filariform larva (infective stage) → penetrate the skin

Common Tapeworm Infections

TAPEWORM	DISEASE	TRANSMISSION OF INFECTION	LOCATION OF ADULT IN HUMANS	LOCATION OF LARVA IN HUMANS	CLINICAL PICTURE	LAB. DIAGNOSIS
<i>Taenia saginata</i>	taeniasis	ingestion of larva in undercooked beef	Small Intestine	not present	vague digestive disturbances	eggs or proglottids in stools
<i>Taenia solium</i> - <u>ADULT</u>	taeniasis	ingestion of larva in undercooked pork	Small Intestine	not present	vague digestive disturbances	eggs or proglottids in stools
<i>Taenia solium</i> - <u>LARVA</u> (cysticercus cellulosae)	Cysticercosis	ingestion of egg	not present (except in autoinfection: ,small intestine)	sub-cutaneous muscles brain,eyes	depending on locality: from none to epilepsy	X -ray, CT, MRI Serology
<i>Hymenolepis nana</i>	hymenolepiasis	ingestion of egg	Small Intestine	Intestinal Villi	Enteritis diarrhoea	eggs in stools
<i>Echinococcus granulosus</i>	hydatid disease	ingestion of egg	not present	Liver, lungs, Bones etc	depending on locality	X-ray,CT,US Serology Hydatid sand

Taenia saginata

Very long but it cut into pieces in the stool while the head is inside the body and regenerate it self and increase its length

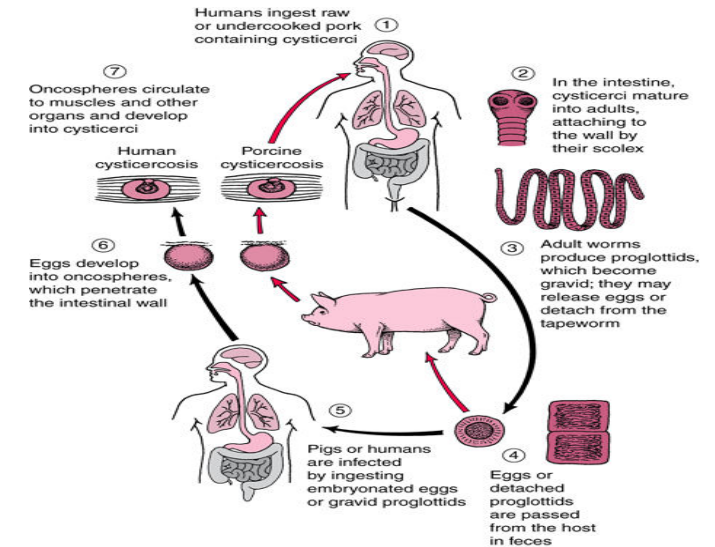
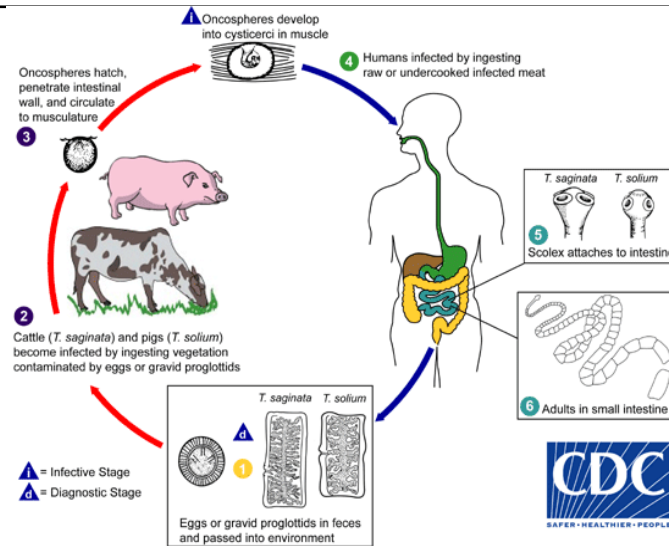


Taenia saginata

General

- one of the cestodes
- Is an obligatory parasite of man ,the adult worm live in the **SMALL INTESTINE** .
- CATTLE become infected by ingesting grass contaminated with **eggs or gravid segments** (womb filled with eggs) which passed from human faeces. In the cattle the oncosphere hatches out go to circulation and transformed to cysticercus stage in the **muscle** known as **CYSTICERCUS BOVIS**.
- Man become infected by **eating undercooked or improperly cooked beef** which contain cyst , the adult worm lives in **small intestine** of man **passing eggs and gravid proglottids to the environment**. Eating the eggs only does not cause infection in taenia saginata only eating undercooked meat containing cyst another type in Europe called taenia solium causes infection by eggs and their will be cyst in the human body and it may radiate to **lung or liver or brain** and it is dangerous as well the pig when eat eggs of **taenia solium** will have cyst
- The majority of cases are Asymptomatic ,some patients have vague intestinal discomfort ,vomiting and diarrhea.

Life cycle of Taenia saginata

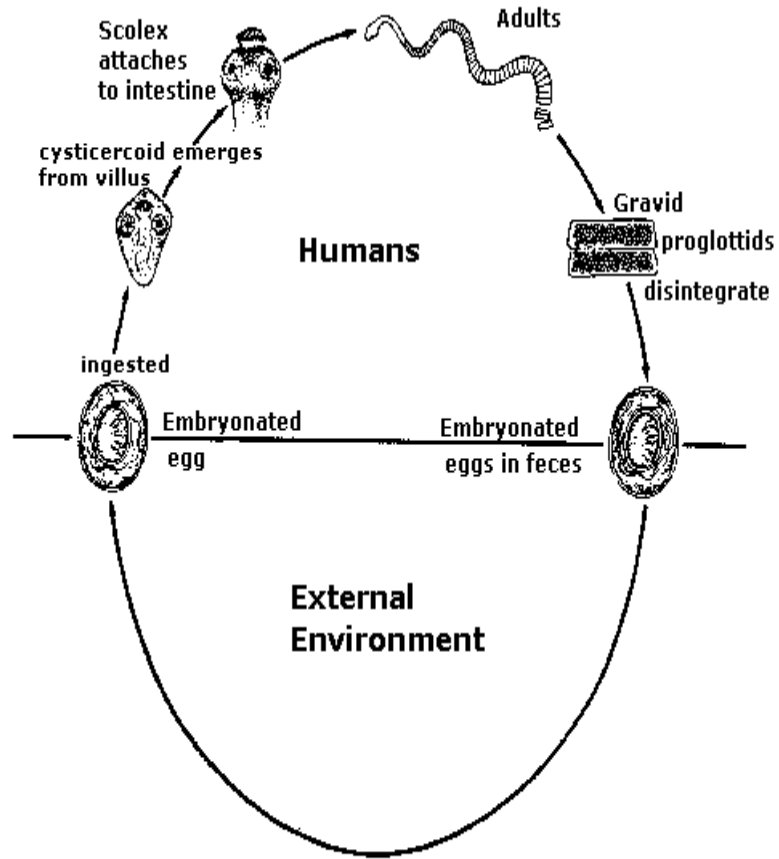
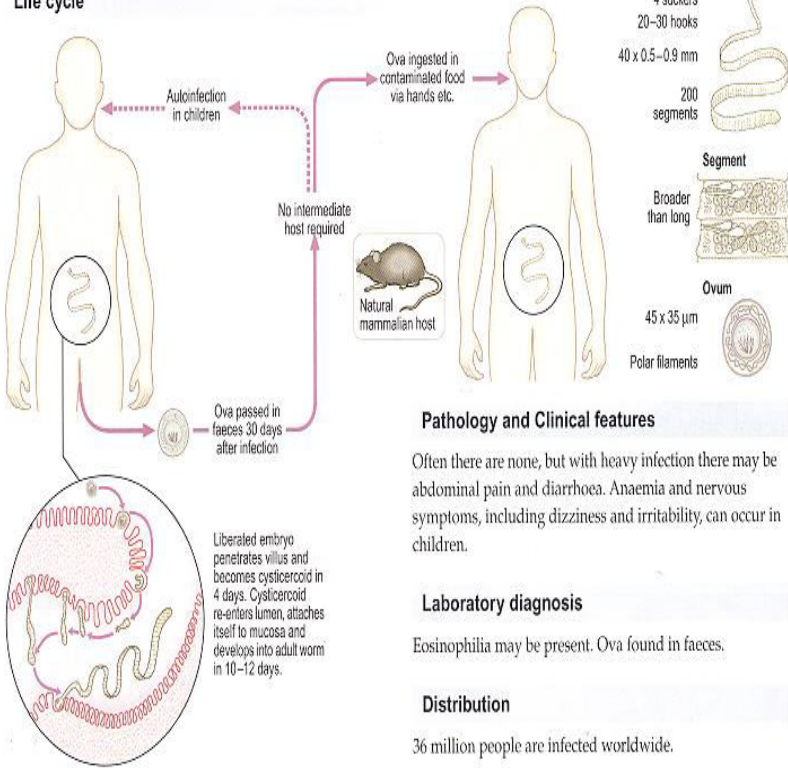


Hymenolepis nana (you should know ONLY that it is one of the cestodes and infect human and rates)

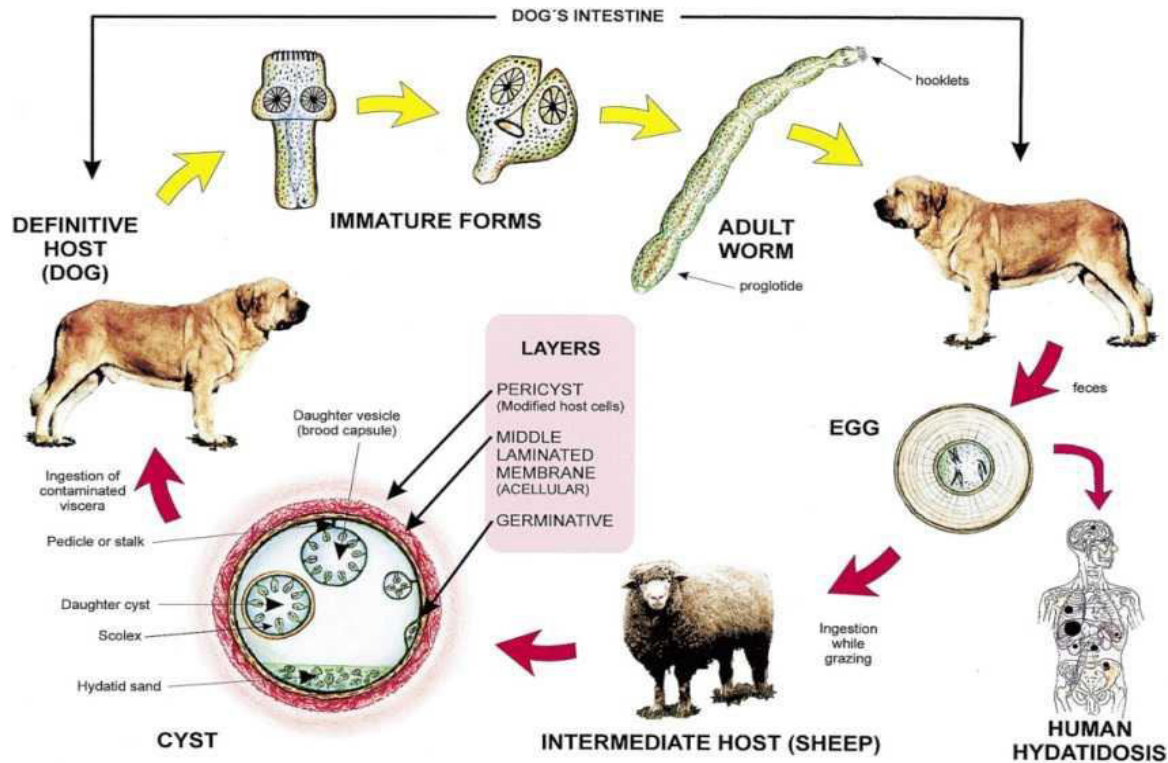
Dwarf tape worms

Hymenolepis nana

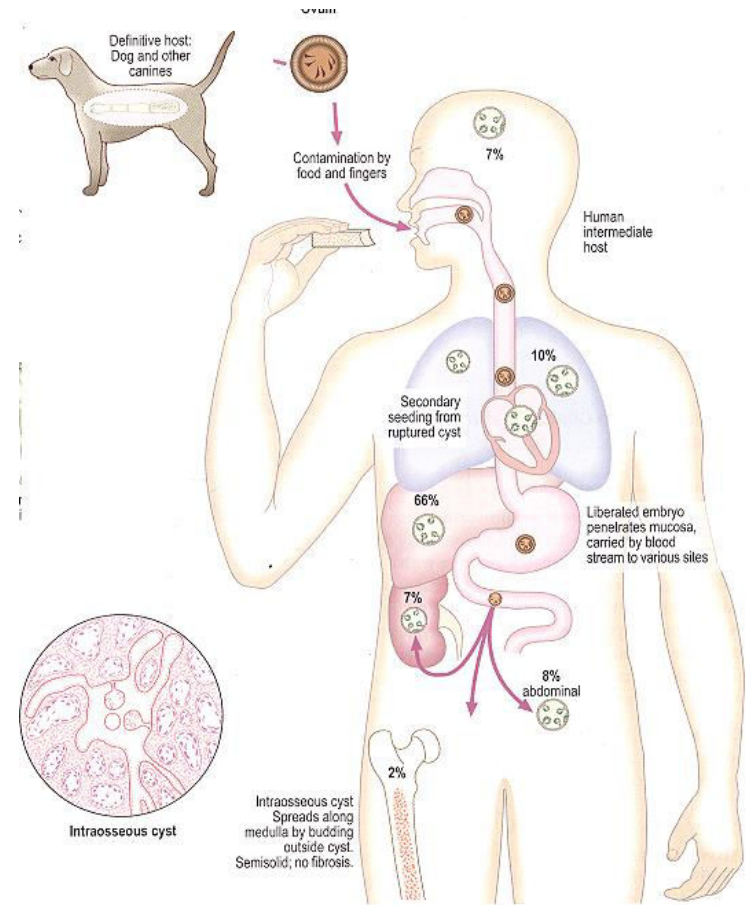
Life cycle



Echinococcus granulosus



Location of hydatid cyst *Echinococcus granulosus*



Echinococcus granulosus dog & sheep (important)

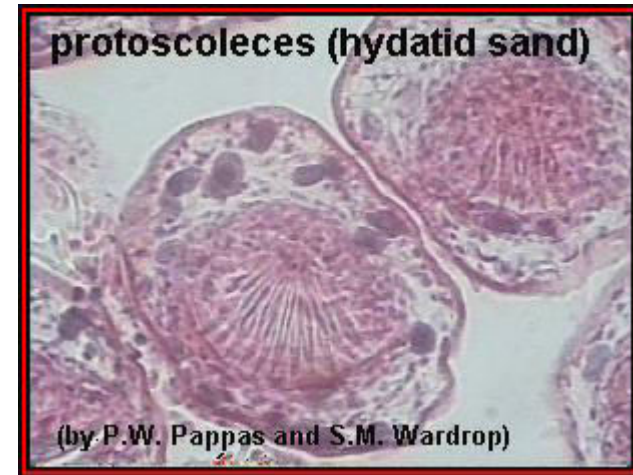
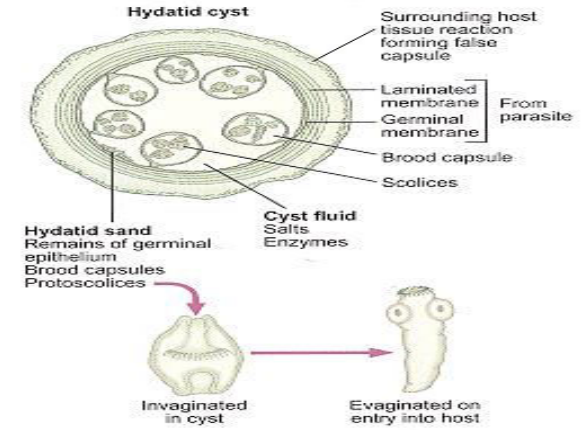
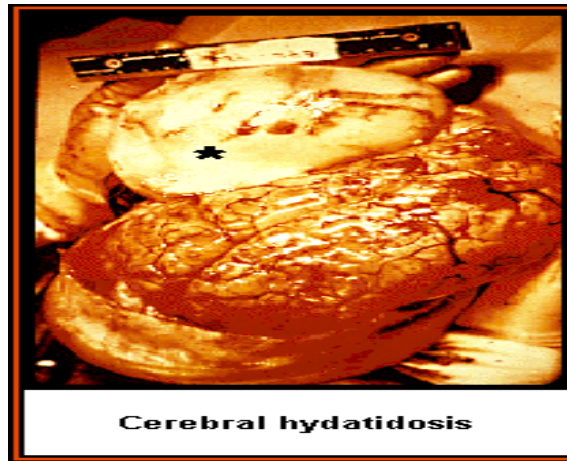
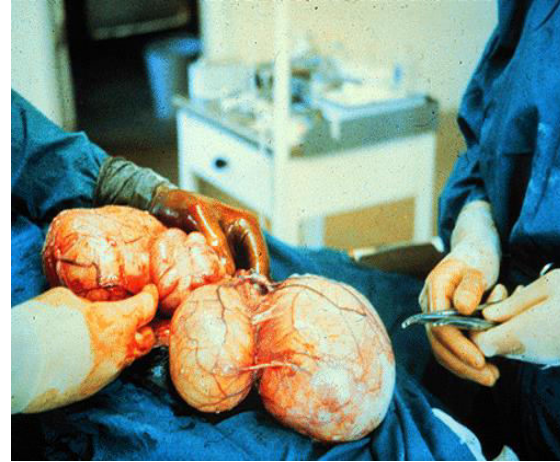
Dog have adult worm → produce eggs → if human or sheep eat a contaminated food (or grass) with the stool of the dog which have eggs → hydrated cyst

If the dog eat the lamb meat (which have hydrated cyst) → adult stage parasite

If the human eat the lamb meat (which have hydrated cyst) → nothing will happen because human infected only by eating eggs

- E. granulosus requires two host types, a definitive host and an intermediate host.
 - the **definitive host of this parasite are dogs**
 - The **intermediate host are most commonly sheep, cattle, pigs, goats, and camels and also Humans**
 - E. Granulosus cyst is ingested and attaches to the mucosa of the intestines in the definitive host and there the parasite will grow into the adult stages
 - DOG become infected by eating sheep, cattle muscle having hydrated cyst which become in the intestine of the DOG as an adult and start releasing eggs which excreted in the feces .
 - Human become infected by ingestion of Echinococcus Granulosus eggs, usually by hand-to-mouth contact with infected dog feces. The ingested eggs migrate to the various body tissues, and produce hydatid cysts. The life cycle is terminated at this point Symptoms vary, depending on the location of the cyst in tissues. **Although cysts may form in many areas of the body, the lung and the liver are most commonly affected. One serious complication of hydatid cyst disease is the risk of anaphylactic shock, following rupture of the cyst.**
-

Hydatid cyst



Hydatid cyst

General
Only
female

- hydatid cyst, which may reach **larg size** , has laminated outer layer, and an inner layer of germinal tissues from which the daughter cysts and brood capsules (smaller cysts containing several developing inverted scolices) bud. The cyst also contains loose pieces of germinal tissue and scolices. This is known as hydatid sand. **In addition, there is a great deal of fluid inside the cyst**

Diagnosis

- **Radiological examination**: computed tomography (CT), magnetic resonance imaging (MRI) revealed a cystic swelling with smooth outline.
- **Serological examination**: to detect specific antibodies **ELIZA**,CFT.
- **Casoni`s test**: it is an intradermal test used to detect immediate hypersensitivity in hydatid disease.
- **Microscopical examination**:
 - Hydatid fluid may be withdrawn by the fine needle aspiration and examined under the microscope for scolices or hooklets.**THIS IS DANGEROUS PROCEDURE.**
 - hydatid sand
 - **Usually Radiological examination & Serological examination**

Treatment of Tapeworms

- **Intestinal stages: Praziquantel**
- **Tissue stages (Hydatid , cysticercosis):**
 - **Depends on clinical condition : Surgical and/or Albendazole**

QUIZ:

1. Loeffler syndrome is caused by :
a) Ascaris larva b) Entebius larva c) Trichuris trichiura
2. Cellulose adhesive tape is used to diagnose which of the following?
a) Ascaris lumbricoides b) Enterobius vermicularis c) Trichuris Trichiura
3. Which of the following can give rise iron deficiency anemia?
a) Hookworm b) round worm c) whip worm
4. We diagnose Ascaris Lumbricoides by finding In stool analysis.
a) Embryonic egg b) Larva c) unfertilized egg
5. Wich of the following Nematodes is fatal for pts. On chemotherapy?
a) Ascaris b) Enterobius c) Strongyloids
6. What do you expect to see in stool analysis of pt. with strogyloids?
a) Eggs b) Rhabditiform larva c) Filariform larva
7. Cattle develops Cyticercus Bovis I their muscle by ingesting which of the following ?
a) Taenia Saginata b) Taenia Solium c) Hymenolepis nana
8. Human can get hydatidosis by ingesting which of the following?
a) Taenia Saginata b) Taenia Solium c) Echinococcus granulosus

1.	A
2.	B
3.	A
4.	C
5.	C
6.	B
7.	A
8.	C

SUMMARY:

Helminths	Group commonly infected	location	Method of infection	Diagnosis method	Clinical signs	Extra
Enterobius Vermicularis	In tempered region Mostly kids	Large intestine Lumen of cecum	Fecal oral Autoinfection through fingers	Cellulose adhesive tape	Pruritus ani Emotional disturbances enuresis	Females lay their eggs on anal skin
Ascaris Lumbricoides	Humans are the only host	Small intestine	Through embryonated eggs	Unfertilized eggs	Feed on semi digested food >> malabsorption	Must have soil to thrive
Trichururis truchiura	--	Large intestine, cecum, appendix	Embryonated eggs	Eggs in stool	--	Need soil to be fertilized
Hookworm	--	Invades the skin	Filariform larva Walking barefoot	Eggs in stool	Iron deficiency anemia Microcytic hypochromic anemia	Has cutting plates and anticoagulant glands
Stroglyoides Sterocoralis	Immunocompromised patients Asia, Africa, and S America	--	Flariform larva autoinfection	Rh. Larva No eggs	--	--

SUMMARY:

Tapeworms	location	Method of transmission	Infective organism	Diagnostic organism	diagnosis	treatment
Taenia saginata	Small intestine	Cattle: infected grass Humans: undercooked meat	Cysticerci in muscle	Eggs or gravid proglottidis	--	--
Taenia Solium	Liver, brain, lungs	Eating undercooked pork	--	--	--	--
Echinochoccus granulosus	--	Infected sheep eaten by dog which spreads it to humans	--	--	Radiology, serology, casoni's test, and microscopically (dangerous!)	Intestine: praziquantel Tissue: surgery and albendazole

THANK YOU FOR CHECKING OUR WORK, BEST OF LUCK!



Doctors slides



Hamad Alkhudhairy



Shrooq Alsomali
Safa Alosaimi
Wejdan Alzaid
Leen Altamimi
Najd Altheeb
Jumana alghtani