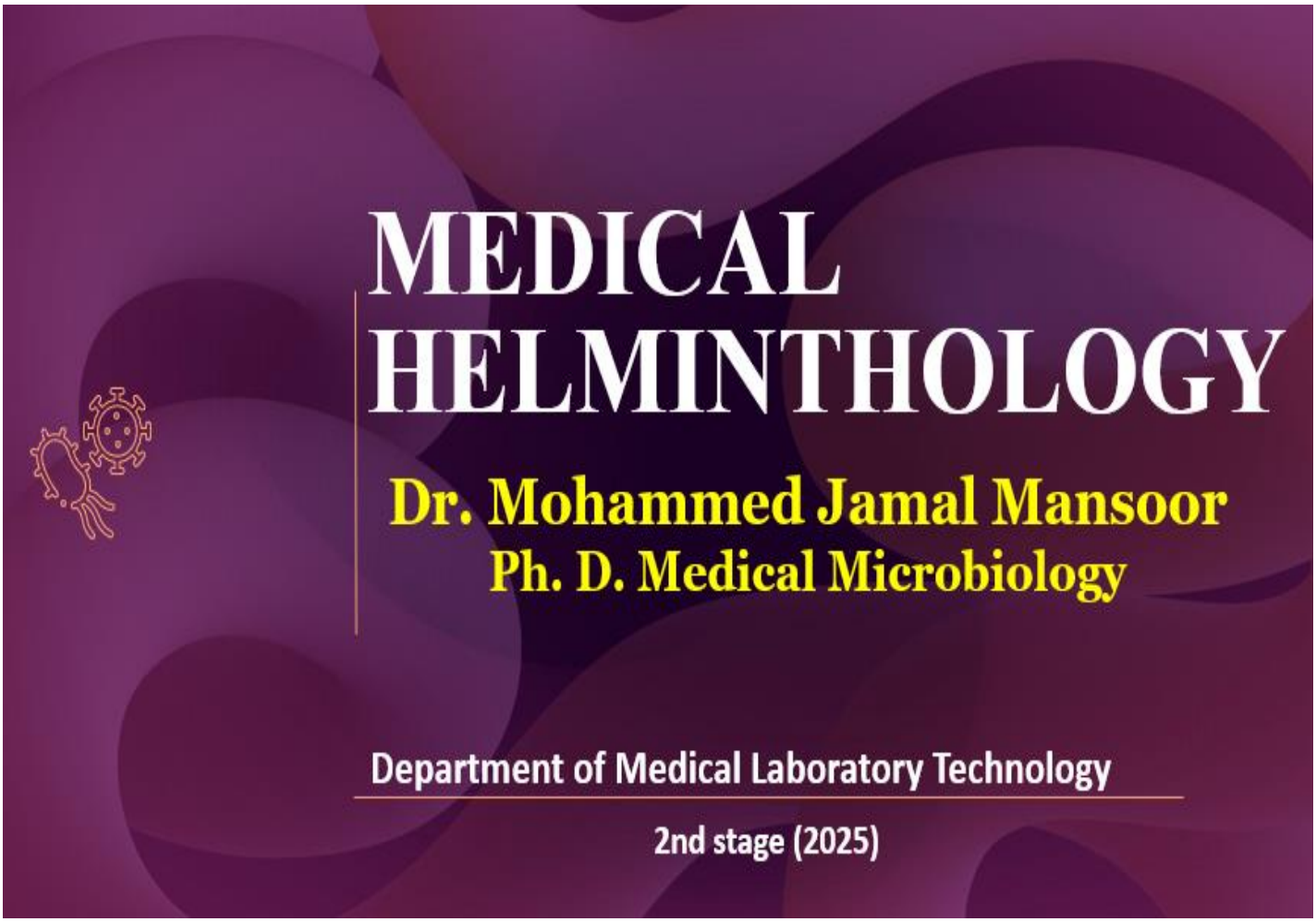

MEDICAL
HELMINTHOLOGY
Dr. Mohammed Jamal Mansoor
Ph. D. Medical Microbiology
Department of Medical Laboratory Technology
2nd stage (2025)

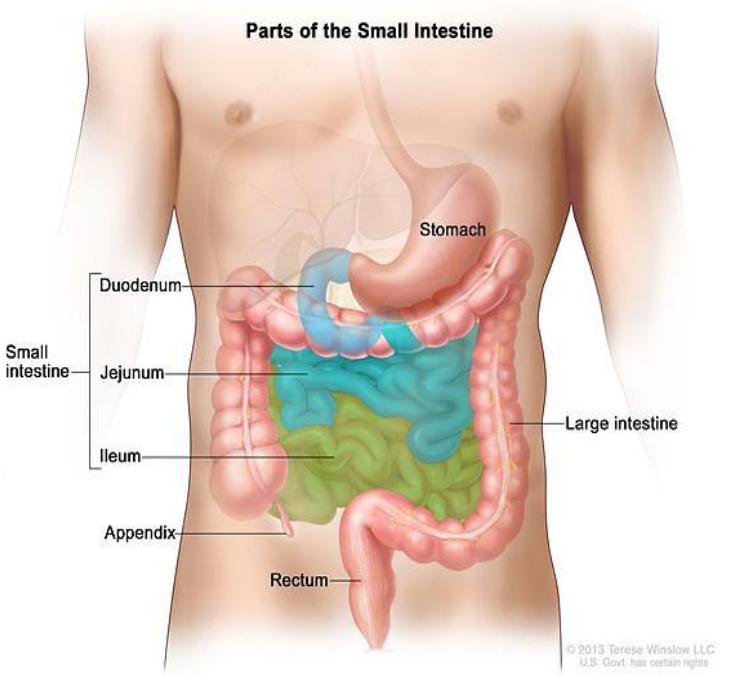
Medical Helminthology – 2nd stage (2025)
Dr. Mohammed Jamal Mansoor
Department of Medical Laboratory Technology

Lecture (2): *Hymenolepis nana*

Common name: Dwarf tape worm

Habitat

The adult worm lives in the proximal **ileum** of man. ***H. nana*** *var. fraterna* is found in rodents like mice and rats, where they are found in the posterior part of the **ileum**.



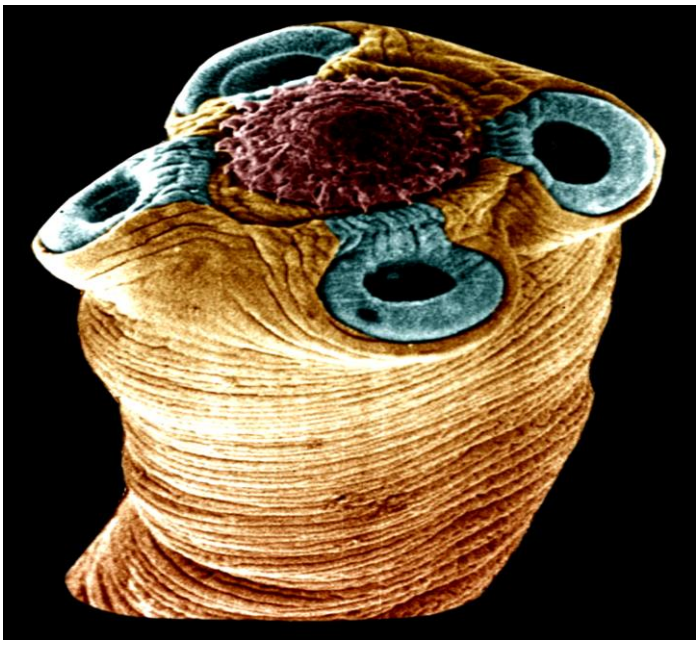
Morphology

Adult Worm

H. nana is the **smallest intestinal cestode that infects man.**

- It is **5–45 mm** in length and less than 1 mm thick. The *scolex* has **4 suckers** and **a retractile rostellum** with a **single** row of hooklets

Is different from other tapeworms because its **eggs** are **directly infectious** for humans **(i.e., ingested eggs can develop into adult worms without an intermediate host).**



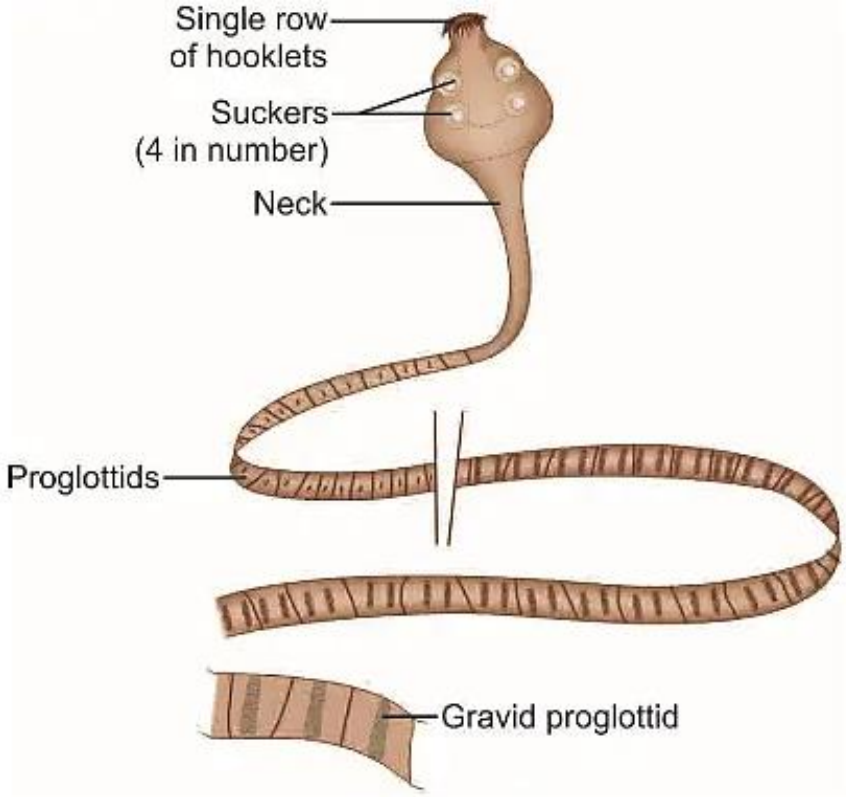


Fig: Adult worm of Hymenolepis nana

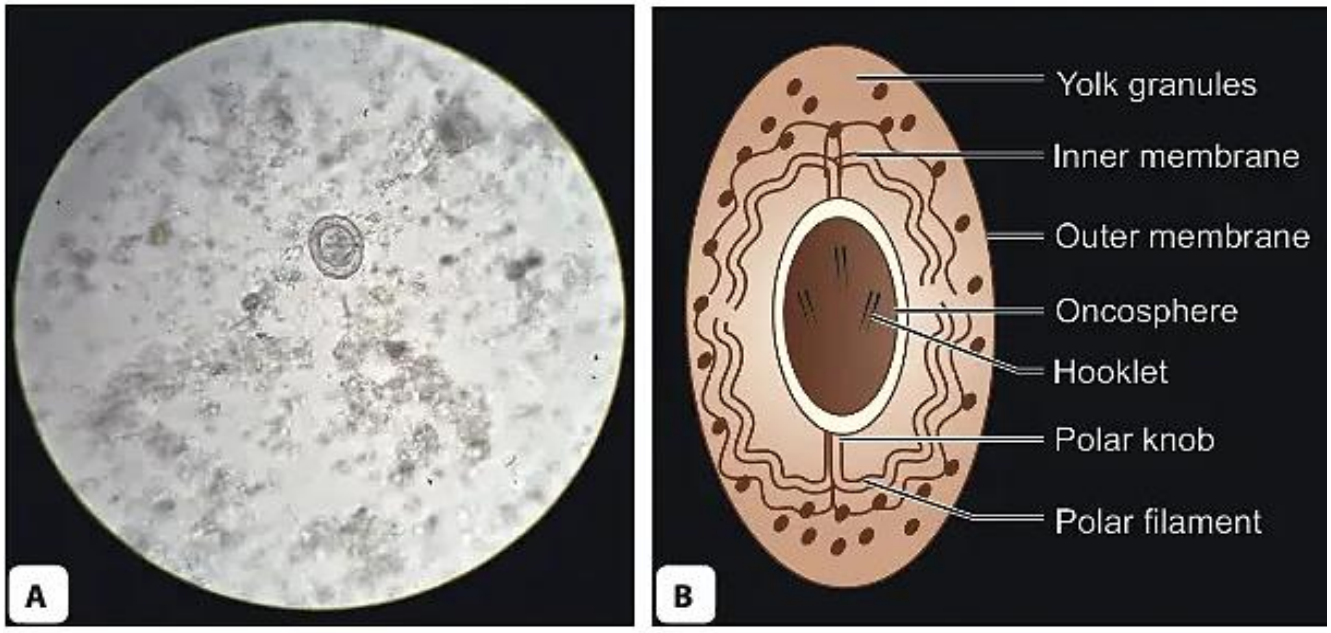


Fig: Egg of Hymenolepis nana. A. As seen under microscope; B. Schematic diagram

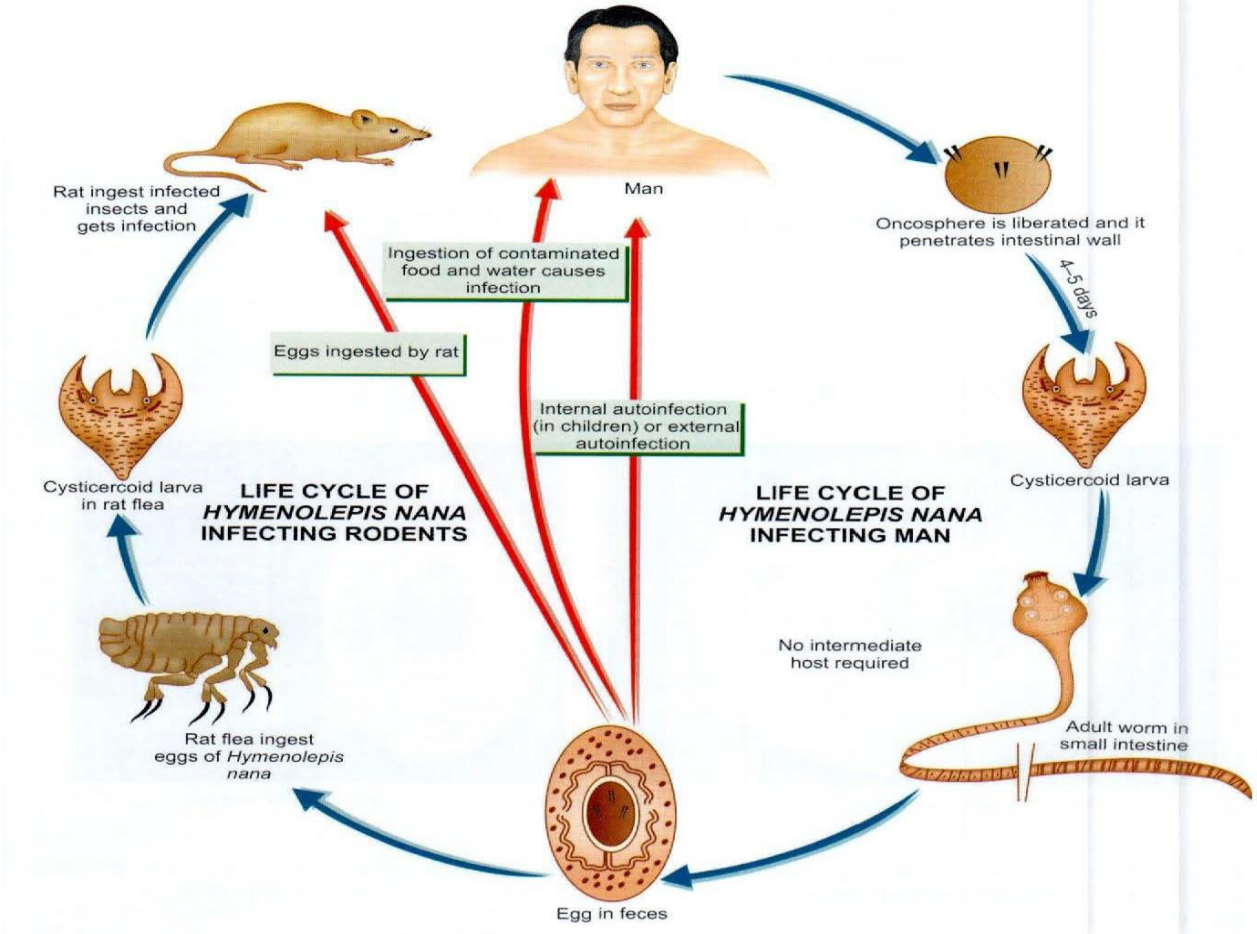
Life Cycle

Host: Man.

- **There is no intermediate host.**
- **Mode of transmission:** Infection occurs by ingestion of the food and water contaminated with eggs.
  - **Internal autoinfection** may also occur when the eggs released in the intestine hatch there itself.
  - **External autoinfection** occurs when a person ingests own eggs by **fecal oral route**.
- *H. nana* is unusual in that it undergoes multiplication in the body of the definitive host.
- When the eggs are swallowed, or in internal autoinfection, they hatch in the small intestine.
- The **hexacanth embryo** penetrates the intestinal villus and develops into the cysticercoid larva.
- After about **4** days, the mature larva emerging out of the villus evaginates its scolex and attaches to the mucosae.
- It starts **strobilization**, to become the mature worm, which begins producing eggs in about **25** days.

A different strain of *H. nana* infects rats and mice. The eggs passed in rodent feces are ingested by **rat fleas (*Xenopsylla cheopis* and others),** which acts as the **intermediate host**. The eggs develop into **cysticercoid larvae** in the hemocele of these insects. Rodents get infected when they eat these insects.

The **body cavity** of insects consists of a series of **sinuses** that are collectively referred to as the **hemocele**



Life Cycle of H. nana

Clinical Features

Hymenolopiasis occurs more commonly in **children**.

- There are usually no symptoms but in **heavy infections**, there is nausea, anorexia, abdominal pain, diarrhea, and irritability.
- Sometimes **pruritus** may occur due to an **allergic response**.

Laboratory Diagnosis

The diagnosis is made by demonstration of characteristic eggs in feces by direct microscopy. Concentration methods like salt flotation and formalin ether may be readily used. ELISA test has been developed with 80% sensitivity.

Treatment

Praziquantel (single dose of 25 mg/kg) is the drug of choice**, since it acts both against the adult worms and the cysticercoids in the intestinal villi.**

- Nitazoxanide 500 mg BD for 3 days may be used as alternative.

Q: *Hymenolepis nana* is also known as the.....tapeworm

A- Giant
B- Fish
C- Pork
D- Beef
E- Dwarf

Q: Dwarf tapeworm refers to:

A- *Echinococcus granulosus*
B- *Loa loa*
C- *Hymenolepis nana*
D- *Schistosoma mansoni*
E- None above

Q: Which of the statements is not true regarding *H. nana*:

A- Large tapeworm
B- Infective stage egg or cysticercoid
C- host is man
D- Cestoda
E- Dwarf tapworm

Q: *Hymenolipis nana* they habitat in:

A- Brain
B- Liver of rat
C- Intestine of human
D- Sand-fly
E- None of the above

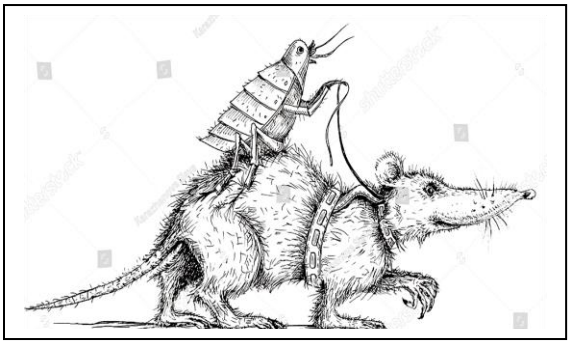
Hymenolepis Diminuta

Differs from ***Hymenolepis nana*** in that:

- The adult worm measures about **10-60 cm**
- The **rosetellum on the head has no hooks**
- In the mature segment, there are two testes at one side and another testis on the other side.

Life cycle

The adult worms are present in the small intestine of man and rats. Eggs passed in stool are similar to the eggs of ***H. nana*** **but are brown in color with no polar** filaments arising from the polar thickening. The eggs are ingested by the rat flea where they develop to cysticercoid stage. Infection to man takes place accidentally by food or contaminated hands by cysticercoid stage.



Pathogenicity

Most infections are asymptomatic, but occasionally, patients may present with nausea, anorexia and diarrhea.

Treatment

same as *Hymenolepis nana*.

Dipylidium Caninum

This common tapeworm of **dogs** and **cats**, it may accidentally cause human infection, mainly in children.

Morphology

- The adult worm in the intestine is about **10–70** cm long
- The **scolex** has 4 prominent suckers and a retractile rostellum with up to **7 rows of spines**.
  - The mature proglottid has ***2 genital pores***, 1 on either side, hence the name ***Dipylidium (dipylos—2 entrances).***
- Gravid proglottids are passed out of the anus of the host singly or in groups.

Life Cycle

Definitive host: Dogs, **cats**, and rarely man. **Intermediate host: Fleas**.

- Man acquires infection by ingestion of flea harboring cysticercoid larva.
- The eggs or proglottids passed in feces of dogs and cats are eaten by larval stages of dog and cat fleas, The embryo develops into a tailed cysticercoid larva

Clinical Features

Human infection is generally asymptomatic, but the actively motile proglottids passed in stools may **raise an alarm**.

Diagnosis

The diagnosis is made by detection of **proglottids or eggs in stool.**

Treatment

The drug of choice is **praziquantel**.

Q: How long does it take for the mature larva of *Hymenolepis nana* to begin producing eggs after attachment to the mucosae?
a) 4 days
b) 10 days
c) 25 days
d) 40 days

Q: Which of the following is NOT an intermediate host for *Hymenolepis nana*?
a) Rat fleas
b) Rodents
c) Humans
d) Mosquitoes

Q: How does external autoinfection occur in *Hymenolepis nana*?
a) By inhaling eggs released in the air
b) By ingesting contaminated food and water
c) By consuming infected meat
d) By ingesting own eggs through the fecal-oral route

Q: What is the morphology of the scolex of *Dipylidium caninum*?
a) It has 3 prominent suckers and a retractile rostellum
b) It has 4 prominent suckers and a retractile rostellum with up to 7 rows of spines
c) It has hooks for attachment
d) It is round with no distinct features

Q: What is the significance of the name "Dipylidium"?
a) It refers to the number of rows of suckers on the scolex
b) It means "common tapeworm"
c) It indicates the number of segments in each proglottid
d) It signifies the presence of two genital pores in each proglottid

Q: What is the intermediate host for *Dipylidium caninum*?
a) Dogs and cats
b) Humans
c) Rodents
d) Fleas

Diphyllobotherium latum

1- **In contrast** to the other **cestodes**, which have **suckers**, the scolex of *D. latum* has two elongated **sucking grooves** by which the worm attaches to the intestinal wall.
2- The **scolex** has **no hooks**, unlike ***T. solium*** **and** ***Echinococcus***.
3- The proglottids are **wider than** they are **long**, and the gravid uterus is in the form of a rosette.
4- Unlike other **tapeworm eggs**, which are round, ***D. latum*** **eggs are oval** and have **a lidlike opening (operculum) at one end**.
5- *D. latum* is the **longest** of the tapeworms, measuring up to 10 M.
6- Humans are infected by ingesting raw or undercooked **fish** containing larvae (called **plerocercoid or sparganum larvae**).

In the small intestine, the larvae attach to the gut wall and develop into adult worms. Gravid proglottids release fertilized eggs through a genital pore, and the eggs are then passed in the stools. The immature eggs must be deposited in fresh water for the life cycle to continue. The embryos emerge from the eggs and are eaten by **tiny copepod (first intermediate hosts).** There, the embryos differentiate and form **procercoid larvae** in the body cavity. When the copepod is eaten by freshwater fish, the larvae differentiate into **plerocercoids** in the **muscle of the fish (second intermediate host)**. **The cycle is completed when raw or undercooked fish is eaten by humans (definitive hosts).**

General information's

1-life cycle: indirect life cycle

2-**F**inal host: **Man**

3-**I**ntermediat host: **need 2**

First ___**cyclops**

Second _____**Fish** (fresh water fish)

4-**Infective** stage: **plerocercoid**

5-Disease name: **Fish tape** worm disease (**Diphyllobothriasis**)

Morphology:

A-Scolex elongated

B-Has no rostellum and no hooks

C-Large tape worm may reach to 10 M

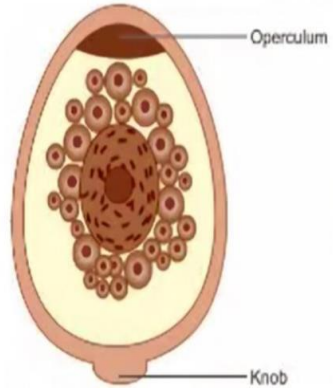
D-Egg is oval in shape **operculated** and has **hexacanth embryo**, the color of worm is **Ivory**

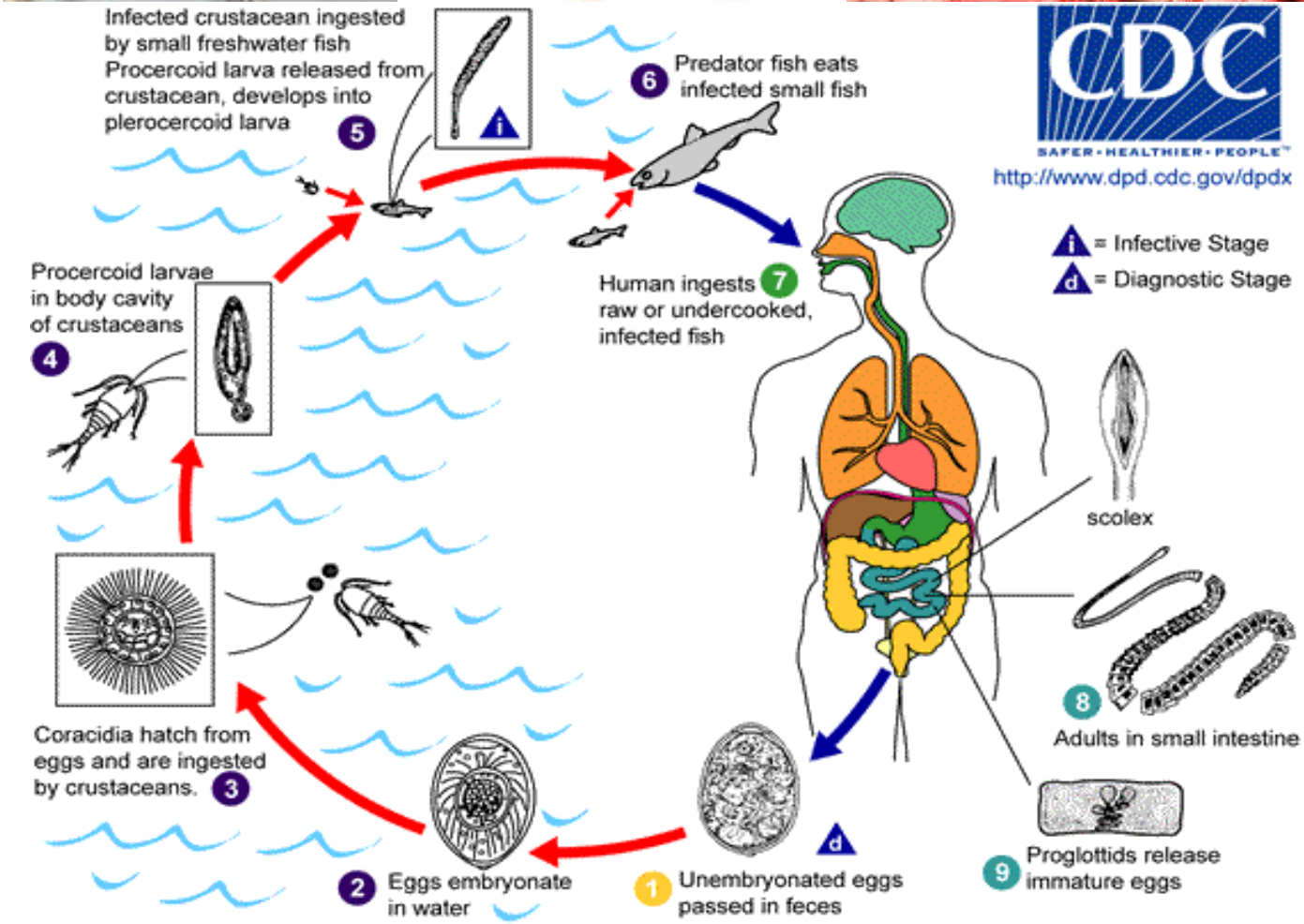
Diphyllobothrium spp. eggs are oval or ellipsoidal and range in size from 55 to 75 µm by 40 to 50 µm.

Microscopy

Eggs

Diphyllobothrium spp. eggs are **oval or ellipsoidal**. There is an **operculum** at **one end** and at the opposite (opercular) end is a **small knob**. The eggs are passed in the stool unembryonated.





Life cycle of D. latum

Pathogenesis

1-GIT disturbance such as (diarrhea, abdominal pain, vomiting, Intestinal obstruction and may occurs appendicitis.
2-cause decrease of Vit.B12 in the blood.
3-cause Megaloplastic anemia or called (Cephalous anemia)
4-worm may secrete toxic material.

Diagnosis

Laboratory Diagnosis:

Microscopic identification of eggs in the stool are oval, yellow-brown with an operculum at one end.
Examination of proglottids passed in the stool is also of diagnostic value.

Treatment: Praziquantel

Direct life cycle: a parasite is transmitted directly from one host to the next without an intermediate host or vector of another species.

Q: Head of cestodes is also known as
A- Bothria
B- Hooks
C- Scolex
D- Suckers
E- All of the above repeat

Q: Direct life cycle
A- Has two host
B- Enter host directly
C- *Dipyllobothrium latum*
D- Plasmodium spp.
E- Has one host

Q: The infective stage of *Diphyllobothrium latum* is
A- Cysticercus
B- Sporocyst
C- Precyst
D- Cercaria
E- Eggs

Q: Which of the following worm requires two intermediate host
A- ***Taenia saginata***
B- ***Diphyllobothrium latum***
C- ***Hymenolepis nana***
D- ***Echinococcus granulosus***
E- ***Taenia solium***

Q: First intermediate host of *Diphyllobothrium latum* is
A- **Cyclops**
B- **man**
C- **cow**
D- **dog**
E- **egg**

Q: Second intermediate host of *Diphyllobothrium latum* is
A- **Cyclops**
B- **man**
C- **snail**
D- **fresh water fish**
E- **all of the above**

Q: Direct life cycle
A- **Has two host**
B- **Has 3 host**
C- **Has one host**
D- **found in intermediate host**
E- **All of the above**

Q: What is the final host for the life cycle of the fish tapeworm disease?
a) **Cyclop**
b) **Fish**
c) **man**
d) **Intermediary host**

Q: What is the shape of Diphyllobothrium spp. eggs?
a) **Circular**
b) **Oval**
c) **Ellipsoidal**
d) **Hexagonal**

Q: Which of the following is NOT a symptom of fish tapeworm disease?
a) Diarrhea
b) Intestinal obstruction
c) Increased appetite
d) Abdominal pain

What is the primary cause of megaloblastic anemia in fish tapeworm disease?
a) Vitamin C deficiency
b) Iron deficiency
c) Decrease in Vitamin B12
d) Increase in Vitamin D

What is the morphology of the scolex of the fish tapeworm?
a) Elongated with rostellum and hooks
b) Circular with hooks
c) Elongated with no rostellum and no hooks
d) Circular with rostellum and no hooks

What is the primary method of laboratory diagnosis for fish tapeworm disease?
a) Blood test
b) microscopic identification of eggs in stool
c) X-ray
d) MRI

What is the typical size range of Diphyllobothrium spp. eggs?
a) 20-30 µm
b) 40-50 µm
c) 70-80 µm
d) 90-100 µm

What is the term used to describe the anemia associated with fish tapeworm disease?
a) Megaloblastic anemia
b) Iron-deficiency anemia
c) Hemolytic anemia
d) Sickle cell anemia

Echinococcus granulosus

Common name: **Dog** tape worm

Habitat

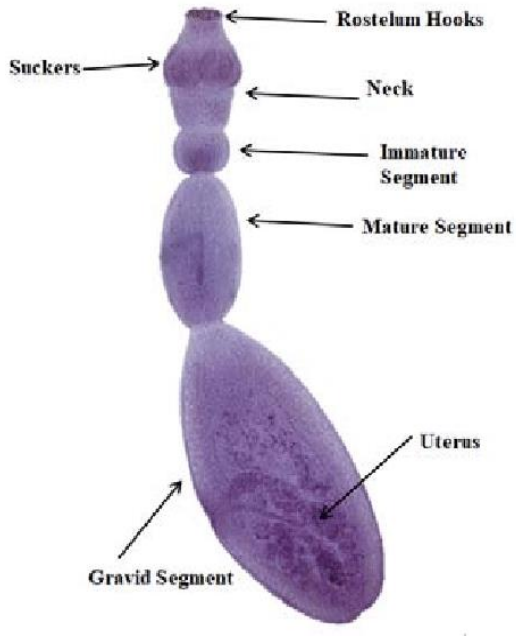
- The adult worm lives in the **jejunum and duodenum** of dogs and other canine carnivora (wolf and fox).
- **The larval stage (hydatid cyst)** is found in **humans** and **herbivorus animals** (sheep, goat, cattle and horse).

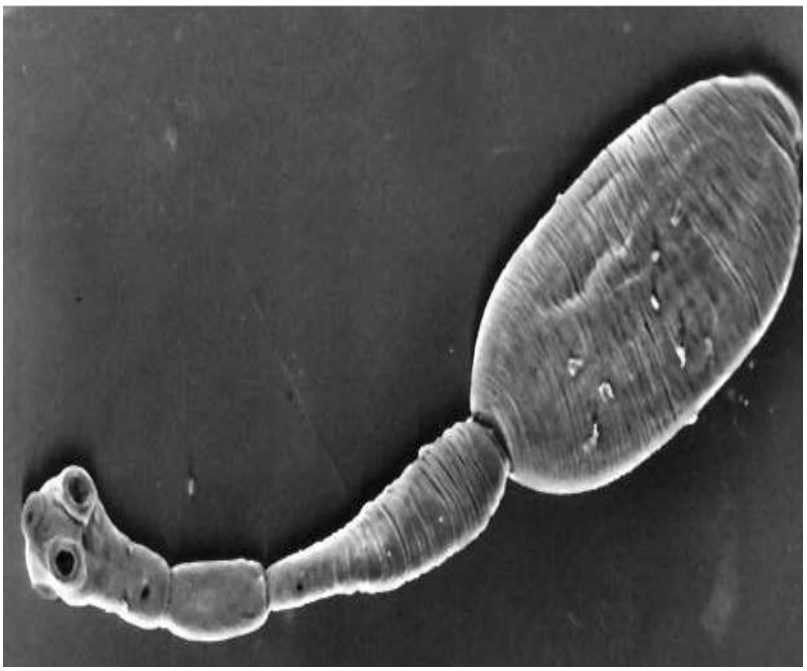
Morphology

Adult Worm

It is a **small tapeworm**, measuring **only 3–6 mm** in length.

- It consists of a **scolex, a short neck, and strobila**.
- The scolex is **pyriform (Pear-shaped),** with **4 suckers** and a prominent rostellum bearing circular rows of hooklets **(25–30).**
- The neck is short than the rest of the worm (3 mm × 6 mm).
- The **strobila** is composed of **only 3 proglottids**, the **anterior immature, the middle mature, and the posterior gravid segment**.
- The terminal proglottid is **longer and wider than the rest** of the worm and contains a branched uterus filled with eggs.
- **The adult worm lives for 6–30 months.**





Egg

- The eggs of *Echinococcus* are indistinguishable from those of *Taenia* species.
- It is **ovoid** in shape and **brown** in color.
- It contains an embryo with **3 pairs of hooklets**.

Larval Form

The larval form is found within the **hydatid cyst** developing inside **various organs of the intermediate host.**

- It represents the structure of the scolex of adult worm and remains **invaginated** within a **vesicular body.**
- **After entering the definitive host**, the scolex with suckers and rostellar hooklets, becomes **exvaginated** and develops into adult worm.

Life Cycle

Definitive hosts: Dog (optimal host), wolf, jackal, and fox
Intermediate host: Sheep and **Cattle**. Sheep is the ideal intermediate host.

- Man acts as an accidental intermediate host (dead end).
- The larval stage of the parasite is passed in intermediate hosts, including man, giving rise to **hydatid cyst**.

- **The adult worm lives in the small intestine of dogs and other canine animals. These animals discharge numerous eggs in the feces.**
- **Intermediate hosts (sheep and cattle) ingest them while grazing**.
- **Human infection follows ingestion of the eggs due to intimate handling of infected dogs or by eating raw vegetables or other food items contaminated with dog feces.**
- The **ova ingested by man or by sheep and cattle** are liberated **(releasing)** from the chitinous wall by gastric juice liberating the **hexacanth embryos** which penetrate the intestinal wall and enter the **portal venules**, to be carried to the **liver** along the portal circulation.
- These are **trapped in hepatic sinusoids**, where they eventually develop into hydatid cyst. About 75% of hydatid cyst develop in liver, which acts as the **first filter for embryo**.
- However, some embryo which **pass** through the **liver**, enter the right side of heart and are caught in **pulmonary capillaries** (forming pulmonary hydatid cysts), so that the lung acts as the **second filter**.
- A few enter the systemic circulation and **get lodged (steady)** in various other organs and tissues such as the spleen, kidneys, eyes, brain, or bones.

- When sheep or cattle harboring hydatid cysts die or are slaughtered, dogs may feed on the carcass or offal. **Inside the intestine of dogs, the scolexes develop into the adult worms that mature in about 6–7 weeks and produce eggs to repeat the life cycle.**
- When infection occurs in humans accidentally, **the cycle comes to a dead end because the human hydatid cysts are unlikely to be eaten by dogs.**

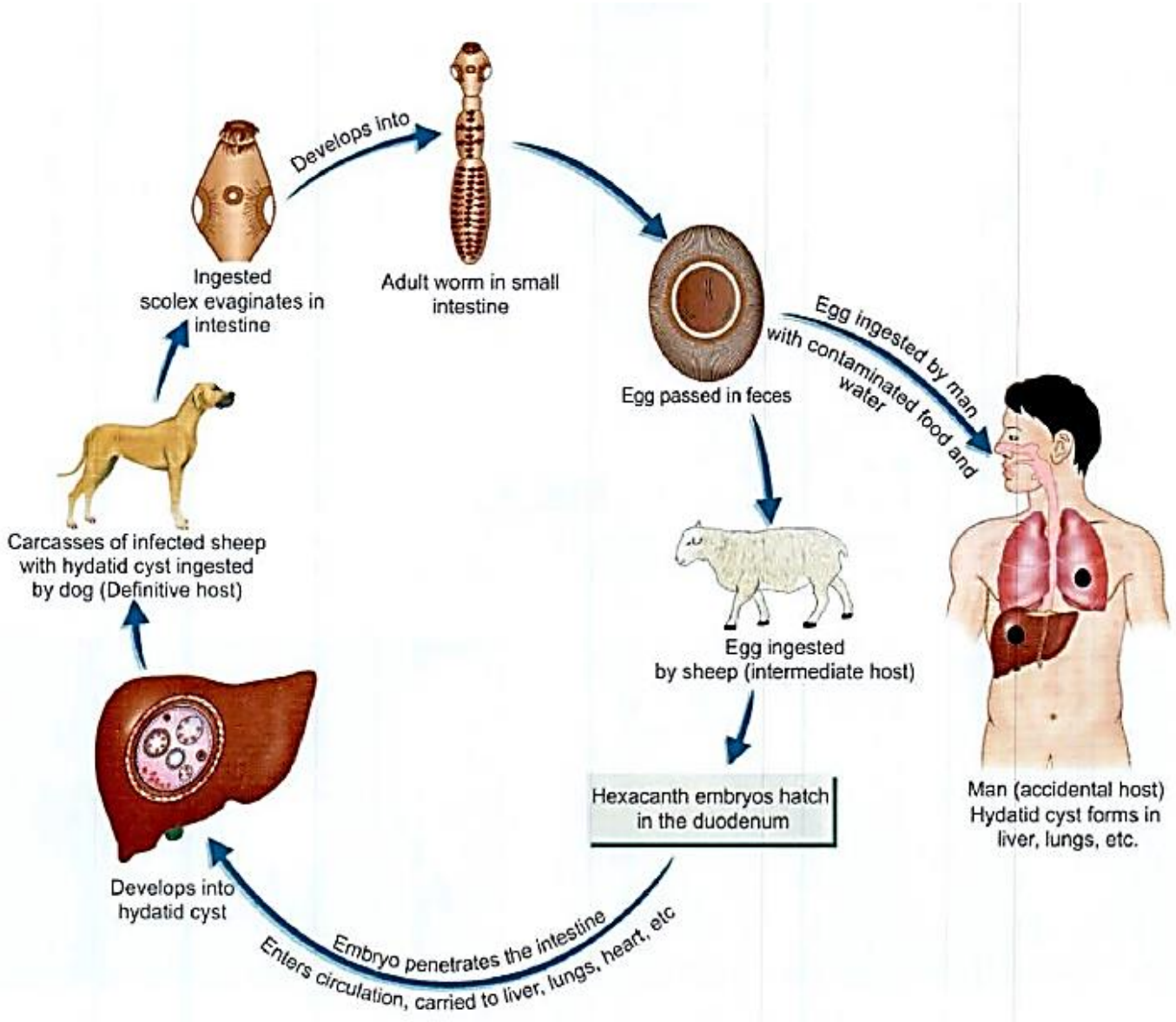


Fig. 17: Life cycle of *Echinococcus granulosus*

Pathogenesis

Evolution of Hydatid Cyst

At the site of deposition, the embryo slowly develops into a hollow bladder or cyst filled with fluid. This becomes the hydatid cyst (Greek *hydatis: a drop of water*).

- It enlarges slowly and reaches a diameter of 0.5–1 cm in about 6 months. The growing cyst evokes host tissue reaction leading to the deposition of fibrous capsule around it.

Clinical Features: (انتبه هذه مهمة بأسئلة الكيسات)

- Most of the times infection is asymptomatic and accidentally discovered.
- Clinical disease develops only when the **hydatid cyst has grown big enough to cause obstructive symptoms**. Disease results mainly from pressure effects caused by the enlarging cysts.
- **In about half the cases**, the primary hydatid cyst occurs in **liver** (**63%**) mostly in the right lobe. Hepatomegaly, pain, and obstructive jaundice are the usual manifestations.
- The next common site is the **lung** (**25%**) (most common being the lower lobe of the right lung). Cough, hemoptysis, chest pain, pneumothorax, and dyspnea constitute the clinical picture.
- In the kidney (**2%**), hydatid cyst causes pain and hematuria.
- **Other sites** affected include spleen (**1%**), brain (**1%**).
  - Cerebral hydatid cysts may present as focal **epilepsy**
    - The bone tissues. This is called osseous hydatid cyst. Erosion (necrosis) of bone may lead to pathological fractures.
- Apart from pressure effects, another pathogenic mechanism in hydatid disease is **hypersensitivity** to the echinococcal antigen. The host is sensitized to the antigen by minute amounts of hydatid fluid seeping through the capsule.

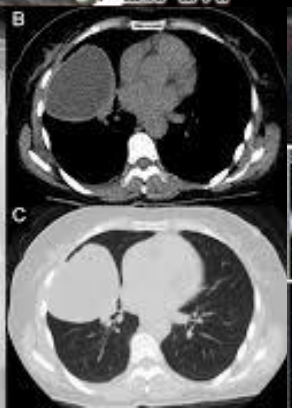
Hypersensitivity may cause **urticaria**. But if a hydatid cyst ruptures spontaneously or during surgical interference, massive release of hydatid fluid may cause severe, even **fatal anaphylaxis.**

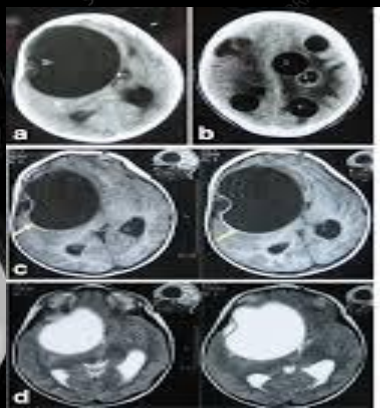
Laboratory Diagnosis

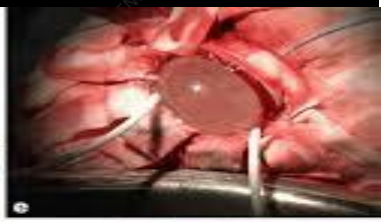
Flow chart 2: Laboratory diagnosis of *Echinococcus granulosus*

Laboratory Diagnosis

Imaging techniques	Examination of cyst fluid	Casoni's test	Serodiagnosis	Others
• **USG:** Diagnostic procedure of choice • **CT scan:** For extrahepatic disease • **MRI:** For cysts in spinal vertebrae and cardiac cysts • **X-ray:** For cysts of bones and lungs • **IV pyelogram:** For renal cysts	• Reveals-Scolices, brood capsules and hooklets • Diagnostic puncture of cyst is not recommended	• Immediate hypersensitivity skin test • Abandoned due to nonspecificity	1) **Antibody detection** Tests detecting antibody against antigen B (8 and 16 KDA) • IHA • Indirect immunofluorescence • ELISA Tests detecting antibody against hydatid fluid fraction 5 antigen • CFT • Precipitation test 2) **Antigen detection** • Double diffusion • CIED	• Blood-shows eosinophilia • Molecular diagnosis by DNA probes and PCR





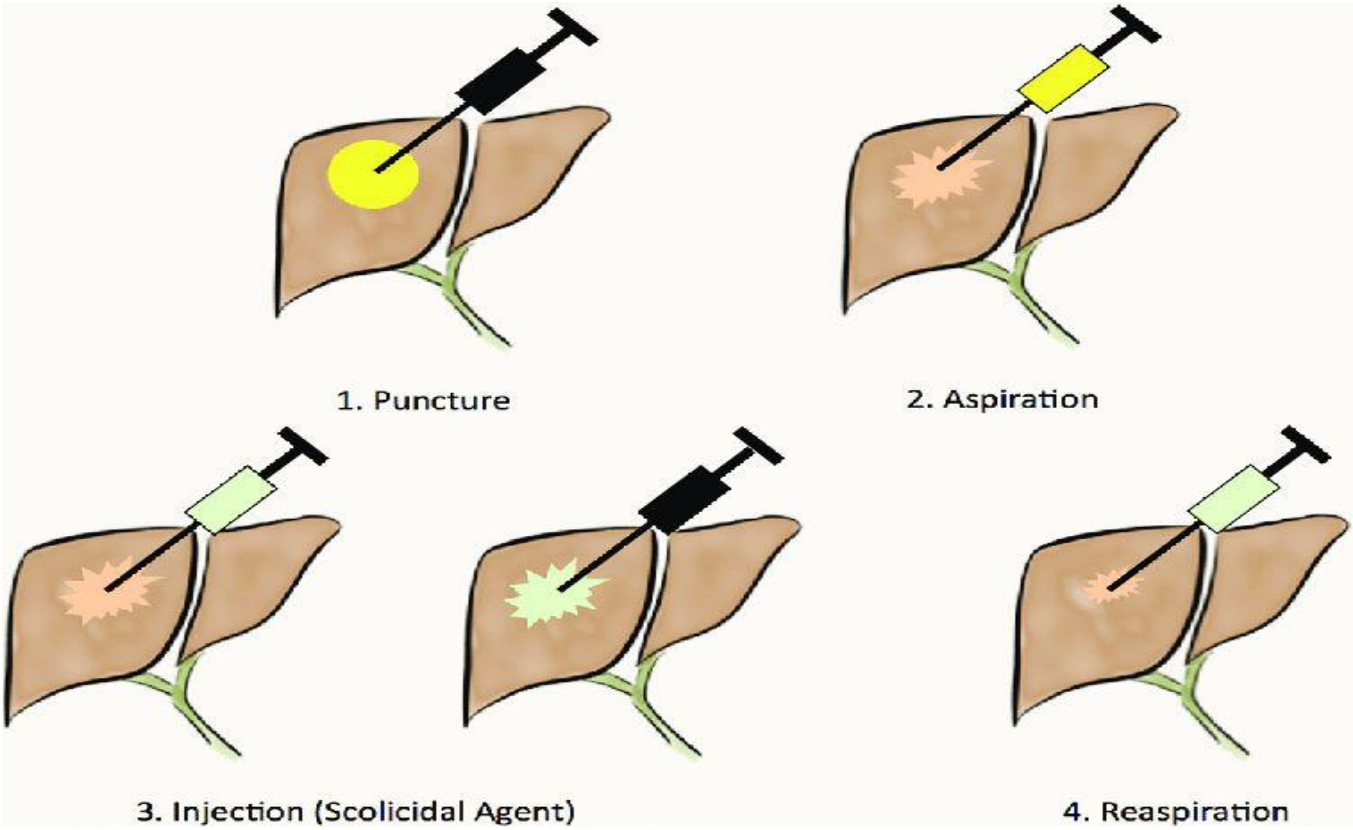


Treatment

Traditionally surgical removal was considered as the the best mode of treatment of cysts. Currently, ultrasound staging is recommended and management depends on the stage.
In early stages, the treatment of choice is puncture, aspiration, injection, and Re-aspiration (PAIR).

Puncture, Aspiration, Injection, and Reaspiration (PAIR)

PAIR, considered as a controversial procedure earlier, is now widely used in early stages of the disease.



SELF-ASSESSMENT QUESTIONS

Q/ Echinococcus granulosus is :
A- Beef tape worm
B- Cysticercus bovis is the infective stage
C- Pig is the final host
D- Small cestode
E- Man is accidental host

Q/Adult form of *Echinococcus granulosus* is seen in :
A- Dog B- Man C- Wolf D- Fox E- Cat

Q/Which parasite causes Hydaited cyst
A- ***Echinococcus granulosus***
B- ***Diphyllobothrium latum***
C- ***H.nana***
D- ***Teania solium***
E- ***Trypanosoma cruzi***

Q/ A man, who had lived in the farm had horses, goats, and dogs. Cyst appears and is clinically diagnosed. Suffering from Nausea, Weight loss, Weakness. Based on what criteria. Diagnosis is
A- ***Taenia Solium***
B- ***Taenia saginata***
C- ***Echinococcus granulosus***
D- ***Diphyllobotherium latum***
E- ***Ascaris lumbricoides.***

Q/ Regarding *Taenia solium*, which one of the following is most accurate?
(A) The scolex of *T. solium* has four suckers and a circle of hooklets.
(B) The drug of choice for the adult worm in humans is metronidazole.
(C) The cysticercus of *T. solium* contains the mature eggs of the organism.
(D) In the laboratory, identification of adult worms is based on finding the typical scolex in the stool.
(E) Ingestion of the terminal proglottids of *T. solium* by pigs results in mature tapeworms in the pig's intestine.

Q/ Cysticercosis is most likely to be acquired by:
(A) Drinking water contaminated with feces of an infected pig
(B) Drinking water contaminated with feces of an infected cow
(C) Drinking water contaminated with feces of an infected human
(D) Ingestion of undercooked pork from an infected pig
(E) Ingestion of undercooked beef from an infected cow

Q/ Regarding *D. latum*, which one of the following is most accurate?
(A) Cattle are the most important intermediate hosts.
(B) Megaloblastic anemia may occur as a result of vitamin B12 deficiency.
(C) The laboratory diagnosis depends on finding a scolex with hooklets in the stool.
(D) Infection is acquired by the ingestion of eggs in food or water contaminated with human feces.
(E) Larvae migrate from the gastrointestinal tract via the portal circulation to theliver, where abscesses can occur.

Q/ Regarding *E. granulosus*, which one of the following is most accurate?
(A) The drug of choice for *E. granulosus* infection is metronidazole.
(B) Dogs are a required part of the life cycle of the causative organism.
(C) *E. granulosus* is one of the longest tapeworms, sometimes measuring 10 ft in length.
(D) *E. granulosus* larvae typically migrate to skeletal muscle, where they cause an abscess.
(E) The main mode of transmission to humans is ingestion of eggs in food or water contaminated with human feces.

Q/ Your patient is a 15-year-old girl with a 2-week history of headache and vomiting and a 3-day history of confusion and incoherent speech. She was born in Ecuador but moved to this country 5 years ago. MRI of the brain reveals multiple lesions bilaterally. The following day, she has a seizure and dies. On autopsy, the brain lesions consist of a cyst-like sac containing a larva. Of the following, which one is the most likely cause?
(A) *D. latum*
(B) *E. granulosus*
(C) *T. saginata*
(D) *T. solium*

Q/. Your patient is a 40-year-old man with occasional mild right upper abdominal discomfort but is otherwise well. On examination, his liver is enlarged. An MRI reveals a cystic mass in the liver. On questioning, he says that he was born and raised in rural Argentina on a sheep ranch and came to this country 10 years ago. Of the following, which one is the most likely cause?
(A) *D. latum*
(B) *E. granulosus*
(C) *T. saginata*
(D) *T. solium*

Q/ Your patient is a 20-year-old woman who is a recent immigrant from Central America. On routine exam, a stool ova and parasite test reveal eggs resembling those of *T. solium*. Which one of the following is the best choice of drug to treat this patient?

(A) Ivermectin
(B) Pentamidine
(C) Praziquantel
(D) Pyrimethamine and sulfadiazine
(E) Stibogluconate

Please accept my sincere regards

Dr. Mohammed Jamal Mansoor AL-taee
Theoretical teacher of medical parasitology- 2nd stage (2025)
University of ALmaarif - Department of Medical Laboratory Technology