

# Metazoa

Phylum: Platyhelminths

Class: Cestoda

Order: Cyclophyllidea

Family: Taeniidae

*Echinococcus granulosus*

*Echinococcus multilocularis*

# Echinococcus

Human echinococcosis (hydatidosis, or hydatid disease) is caused by the larval stage of the genus *Echinococcus*.

*Echinococcus granulosus* causes cystic echinococcosis (CE), the form most frequently encountered.

- *E. multilocularis* causes alveolar echinococcosis (AE)
- *E. vogeli* causes polycystic echinococcosis.

*Echinococcus granulosus*, also called the Hydatid worm or Hyper Tape-worm or Dog Tapeworm.

# *Echinococcus*

There are three different forms of echinococcosis found in humans, each of which is caused by the larval stages of different species of the tapeworm of genus *Echinococcus* .

- ❖ The first of the three found in humans is cystic echinococcosis (unilocular echinococcosis ), which is caused by *Echinococcus granulosus* .
- ❖ The second is alveolar echinococcosis (also known as alveolar colloid of the liver, alveolar hydatid disease, multilocular echinococcosis , “small fox tapeworm”), which is caused by *Echinococcus multilocularis* .
- ❖ The third is polycystic echinococcosis (also known as human polycystic hydatid disease, neotropical echinococcosis ), which is caused by *Echinococcus vogeli*
- ❖ and very rarely, *Echinococcus oligarthus* .

- **Cystic echinococcosis (CE)** disease results from being infected with the larval stage of *Echinococcus granulosus*, Most infections in humans are asymptomatic, but CE, also known as hydatid disease, causes slowly enlarging masses, most commonly in the liver and the lungs. Treatment can involve both medication and surgery
- **Alveolar echinococcosis (AE)** disease results from being infected with the larval stage of *Echinococcus multilocularis*, Although human cases are rare, infection in humans causes parasitic tumors to form in the liver, and, less commonly, the lungs, brain, and other organs. If left untreated, infection with AE can be fatal.

# Morphology

*E. granulosus* & *E. multilocularis* are small cestode,  
Measures 3 – 6 mm (0.6 cm or less) in length.

## Body divided into:

- **Scolex** having 4 suckers, armed with 2 rows of hooked rostellum bearing about 22-28 hooklets.
- **Neck.**
- **Strobila contains 3 proglottids.**

(One immature, one mature and one gravid).

The size of the gravid segment is more than half of the body length.

- The uterus is unbranched ,Genital pore is positioned behind the middle line of gravid segment
- Eggs are rounded and indistinguishable to those of *Taenia* Spp.

# *Echinococcus granulosus*

- Definitive Host
  - Dog
  - Wolf
  - Fox
  - Jackal
- Intermediate Host
  - Sheep
  - Pig
  - Cattle
  - Horse
  - Goat
  - Human

# *Echinococcus granulosus*

- Adult worms are small (3-6 mm in length)
- It is composed of a
  - Scolex
  - Neck
  - Strobila
- 3 segments (occasionally 4)
  - Immature
  - Mature
  - Gravid



- **Scolex**

bears shape ,4 suckers  
and rostellum with 2  
circular rows of hooks.

- **Ova**

Ovoid in shape

Resemble Taenia ova

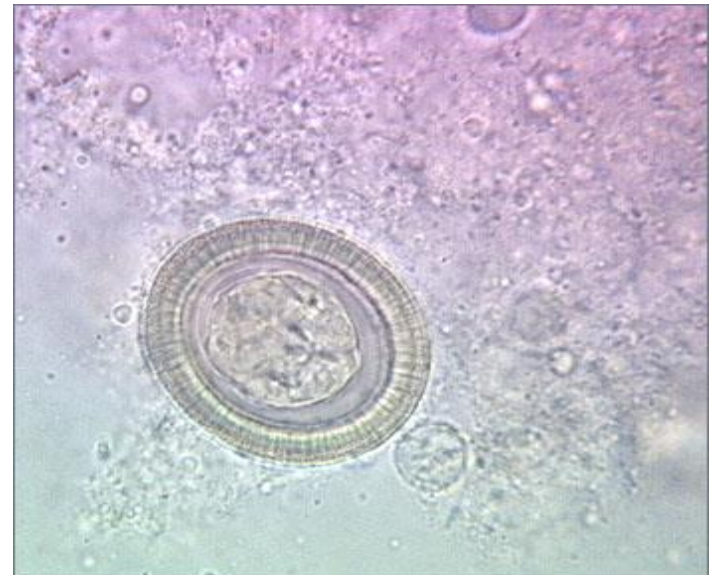
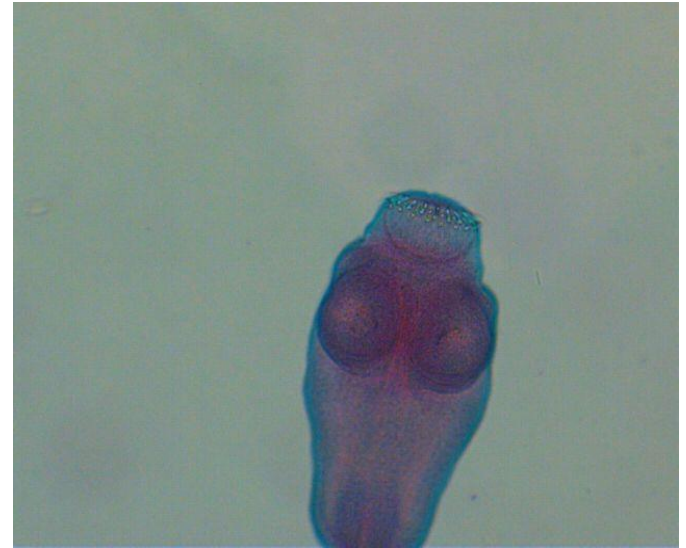
Hexacanth embryo with 3  
pairs of hooks

- Infective to:

Man

Cattle

Sheep and other  
herbivorous animals





- **Larva**

- Found within the hydatid cyst developing inside the intermediate host
- Represents the structure of the scolex of the future adult worm
- Young larva are transformed into a hollow bladder (hydatis , drop of water)
- Brood capsules develop within the cysts and may contain thousands of scolices
- On entering the final host, the scolex armed with a rostellum and 4 suckers become adult worms

# Larvae Stage

- *E. granulosus*

- Hydatid cysts are large, roughly spherical, fluid filled hollow bladders containing numerous protoscolices.
- They vary in size; those found in the liver are aprox. 20 cm in diameter, but those found in the peritoneal cavity are usually larger

- *E. multilocularis*

- The cyst grows invasively by external budding, forming a diffuse growth through the infected organ, replacing that organs tissues. In contrast to *E. Granulosus* this growth is very rapid, infective prosocialises being present only 2 to 3 months.

# Life Cycle

The adult worm lives in the jejunum and duodenum of dogs and other canine carnivora. Enormous numbers of them may be seen in infected dogs.

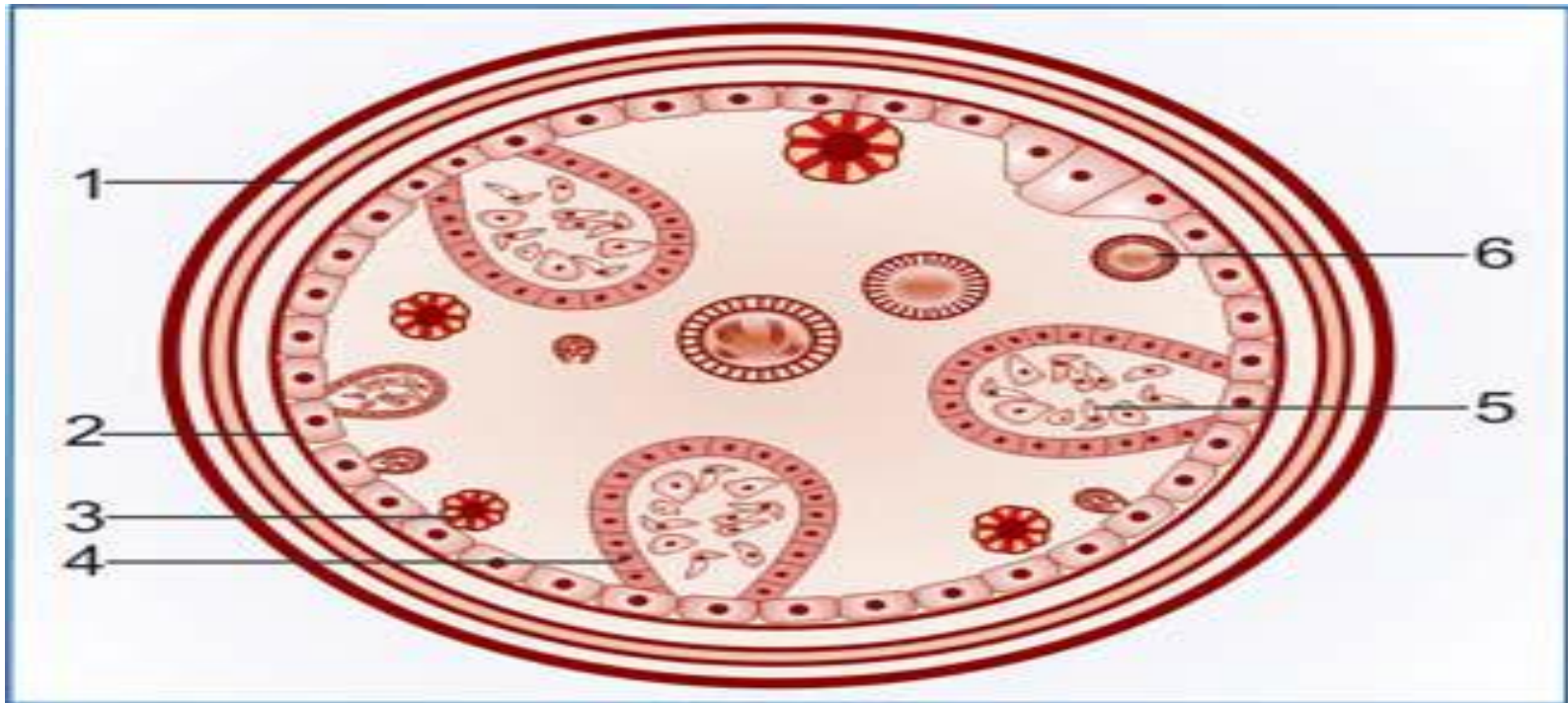
The eggs are passed in dog faeces. Sheep and cattle ingest them. Eggs hatch in small intestine releasing an oncosphere which penetrates the intestinal wall & carried along the body by blood circulation to organs like liver, Lung.

The liver acts as the first filter for the embryos which get arrested in the sinusoidal capillaries, so that the lung acts as the second filter. A few enter the systemic circulation and get lodged in various organs and tissues such as the spleen, kidneys, eye, brain or bones.

At the site of deposition the embryo develops into a bladder or cyst filled with fluid. This becomes the hydatid cyst. It enlarges slowly and reaches a diameter of 0.5 to 1 cm in about 6 months. The growing cyst evokes host tissue reaction leading to the deposition of a fibrous capsule around it. The cyst has outer cuticle or laminated layer, and a thin inner germinal layer containing nucleated cells. The germinal layer is the site of asexual reproduction. It also secretes the hydatid fluid which fills the cyst. The fluid is clear, colourless or pale yellow, with a pH of about 6.7, containing salts and protein. The fluid was used as the antigen for Casoni's intradermal test and other diagnostic serological tests .

From the germinal layer, small knob-like excrescences or gemmules protrude into the lumen of the cyst. These enlarge, become vacuolated and filled with fluid. These are called brood capsules. They are initially attached to the germinal layer by a stalk, but later escape free into the fluid filled cyst cavity. From the inner wall of the brood capsule, protoscolices develop, which represent the head of the potential adult worm, complete with invaginated scolex, bearing suckers and hooklets. Each of these is a potential tapeworm. Several thousands of protoscolices develop in a mature hydatid cyst, so that this represents an asexual reproduction. Many of the scolices float free in the cyst fluid. These, together with the free brood capsules are called the hydatid sand.

Inside mature hydatid cysts, may develop—daughter cysts and granddaughter cysts. The cyst grows slowly, often taking 20 years or more to become big enough to cause clinical illness. Unilocular cysts are usually less than 5 cm in diameter, but occasionally may grow to 20 cm or more in size, with about 2 litres of fluid inside. *E. granulosus typically forms unilocular hydatid cysts, but* may rarely produce multilocular cysts. Sometimes the scolices may escape from the cyst and get transported to other parts of the body, where they may initiate secondary hydatid cysts. Some cysts are sterile and may never produce brood capsules, while some brood capsules may not produce scolices.



## Hydatid cyst.

- 1. Outer laminated layer
- 2. Germinal layer
- 3. Gemmule
- 4. Brood capsule
- 5. Protoscolex
- 6. Sterile daughter cyst

When hydatid cysts form inside bones, the laminated layer is not well-developed. The parasite migrates along the bony canals as naked excrescences that erode the bone tissue. This is called the *osseous hydatid*.

*When sheep or cattle harbouring hydatid cysts die or are slaughtered,* When sheep or cattle harbouring hydatid cysts die or are slaughtered, dogs may feed on the carcass or offal. Inside the intestine of dogs, the scolices develop into the adult worms that mature in about 6 to 7 weeks and produce eggs to repeat the life cycle. The adult worm lives from 6 to 30 months. The above is the natural cycle of the parasite. When infection occurs in humans, the cycle comes to a dead end, because the human hydatid cysts are unlikely to be eaten by dogs.



Hydatid cyst is a bladder that contains inverted scolices, brood sacs with scolices, and within those brood sacs, daughter cysts with their own inverted scolices.

hydatid sand If the scolices separate from the inner lining of the capsule,

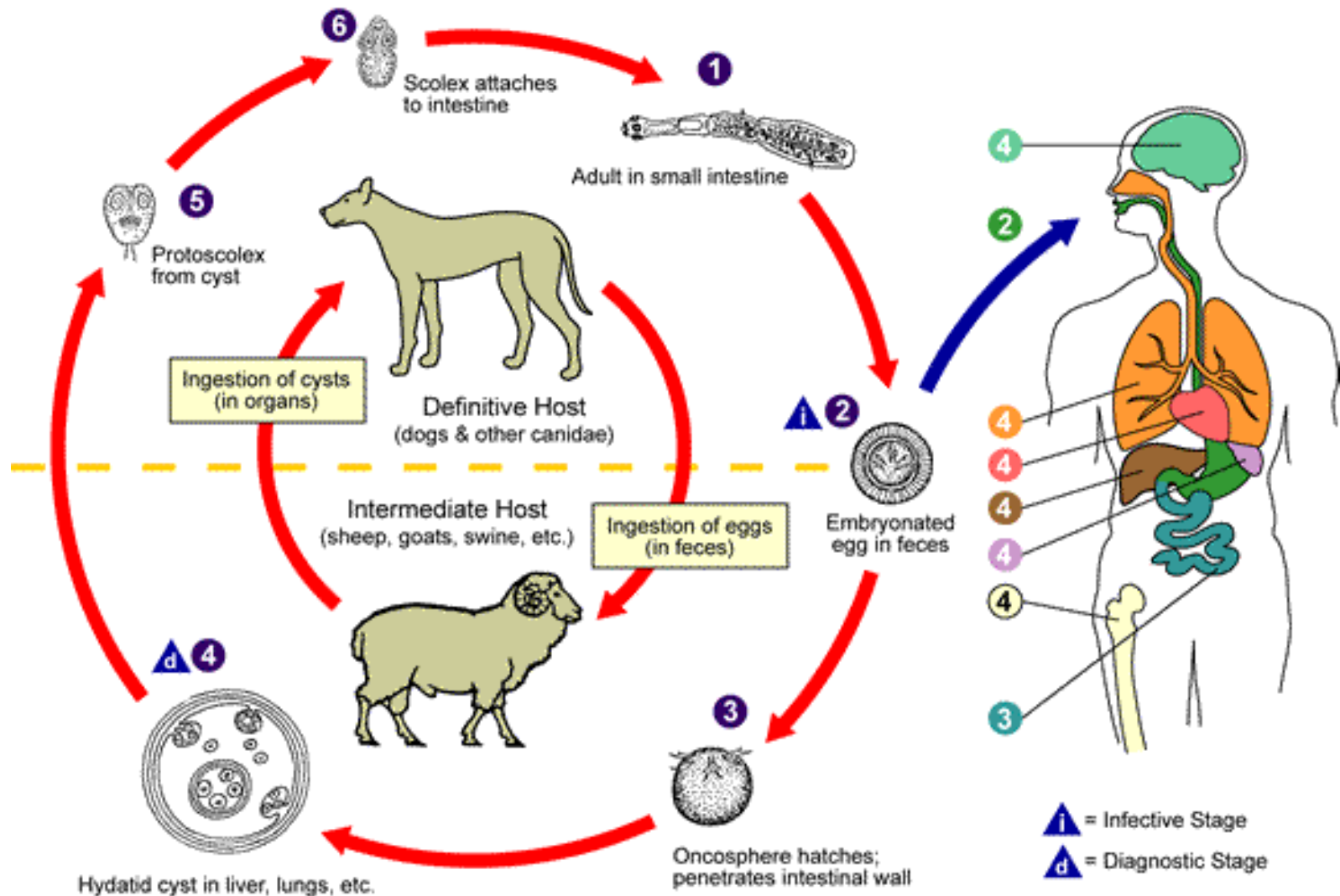
Hydatid cyst may be unilocular, osseous (*E. granulosus*) or alveolar/multilocular (*E. multilocularis*)

Unilocular has a single compartment with 2 layers, the inner layer produces protoscolices & brood capsules, when these detach they are termed as hydatid sand

Osseous are smaller found in vertebrae & marrow cavities

Alveolar have multiple divisions of the cyst into compartments

# *Echinococcus granulosus*



## Pathogenicity

Persons with cystic echinococcosis often remain asymptomatic until hydatid cysts containing the larval parasites grow large enough to cause discomfort, pain, nausea, and vomiting. The cysts grow over the course of several years the symptoms appear typically depends on the location of the cyst. The cysts are mainly found in the liver and lungs but can also appear in the spleen, kidneys, heart, bone, and central nervous system, including the brain and eyes. Cyst rupture is most frequently caused by trauma and may cause mild to severe anaphylactic reactions, even death, as a result of the release of cystic fluid.

Alveolar echinococcosis (AE) is characterized by parasitic tumors in the liver and may spread to other organs including the lungs and brain. In humans, the larval forms of *E. multilocularis* do not fully mature into cysts but cause vesicles that invade and destroy surrounding tissues and cause discomfort or pain, weight loss, and malaise. AE can cause liver failure and death because of the spread into nearby tissues and, rarely, the brain. AE is a dangerous disease resulting in a mortality rate between 50% and 75%, especially because most affected people live in remote locations and have poor health care.

## Diagnosis

The presence of a cyst-like mass in a person with a history of exposure to sheep, dogs in an area where *E. granulosus* is endemic suggests a diagnosis of cystic echinococcosis. Imaging techniques, such as CT scans, ultrasonography, and MRIs, are used to detect cysts. After a cyst has been detected, serologic tests may be used to confirm the diagnosis. Alveolar echinococcosis is typically found in older people. Imaging techniques such as CT scans are used to visually confirm the parasitic vesicles and cyst-like structures and serologic tests can confirm the parasitic infection.

# Treatment

surgery was the only treatment for cystic echinococcal cysts. Chemotherapy, cyst puncture, and PAIR (percutaneous aspiration, injection of chemicals and reaspiration) have been used to replace surgery as effective treatments for cystic echinococcosis. However, surgery remains the most effective treatment to remove the cyst and can lead to a complete cure.

The treatment of alveolar echinococcosis is more difficult than cystic echinococcosis and usually requires radical surgery, long-term chemotherapy, or both. Drug treatment has only limited application.

Mebendazole, albendazole and praziquantel have been used.