

Medical Parasitology

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Lec. 6 Helminths

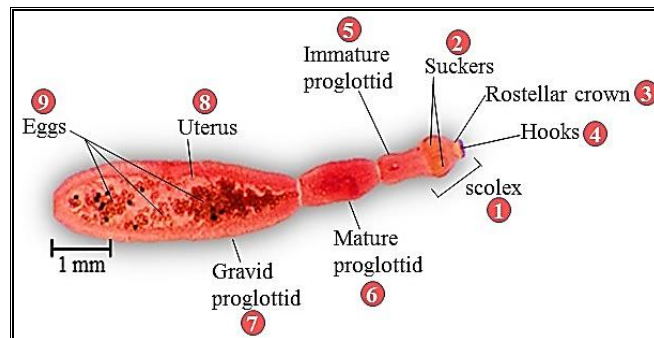
Class: Cestoda (Tapeworms)

B- Larval Tapeworm infection

1 *Echinococcus granulosus*

This parasite causes a disease called unilocular or cystic (hydatid disease, or echinococcosis, or hydatidosis). It is widely distributed throughout temperate and subtropical regions where sheep are extensively raised. The adult worm lives in the small intestine of the canine host (dog, fox, wolf, ...), whereas the larval stage lives in the herbivorous animals (sheep, cattle, goats, cows, horses, camels) and man; the human is an accidental intermediate host. It infects all the body organs except the nails and hair, especially the liver and the lungs.

The adult worm is small in size, it measures 2-9mm length and characterized by its limited number of proglottids, it has a pyriform scolex provided with 4 suckers and a rostellar crown of 28-50 hooks. After the scolex, there are three proglottids, immature, mature, and the gravid proglottids. The mature one has (45-65) testes (pyriform) and pair of ovaries and a single vitelline gland (vitellaria) behind the two ovaries, and the genital pore is lateral in position. The gravid proglottid has a uterus filled with eggs and it measures more than the half of the body long.



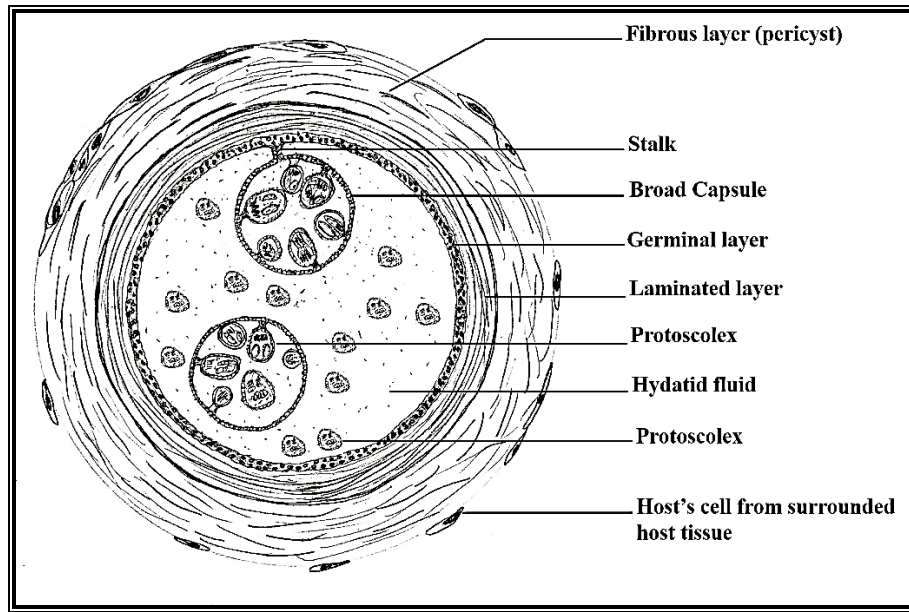
Echinococcus granulosus: adult worm.

Life cycle

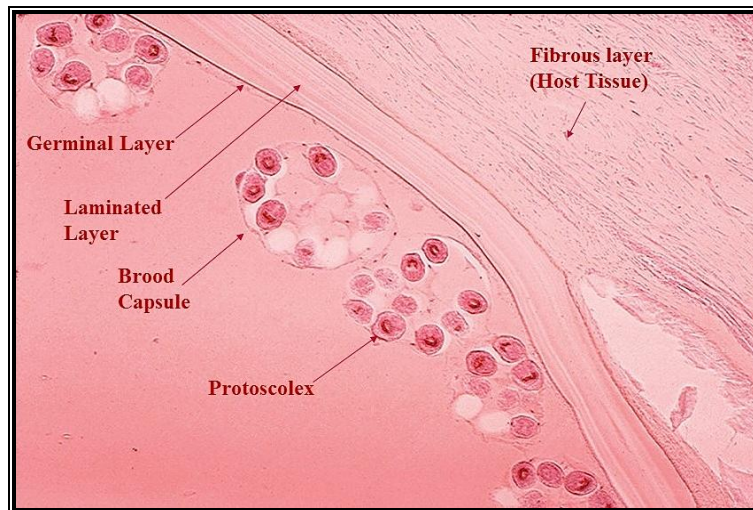
1. The intermediate host:

It is infected by the ingestion of the worm eggs which are hatching in the duodenum into hexacanth embryos and penetrate the intestinal wall and enter the mesenteric venules or the lymph vessels and reach to different tissues in the body where 70% of these eggs will stay in the liver and the others will reach mostly to the lungs and other body organs. The eggs develop rather slowly into unilocular hydatid cysts, which grow and reach to large size depending on the position of the cyst. The cyst surrounded by a fibrous capsule consists of a host connective tissue constructed by the infected organ (as a mechanical immune response). The cyst also surrounded with 2 different layers, the outer one lay

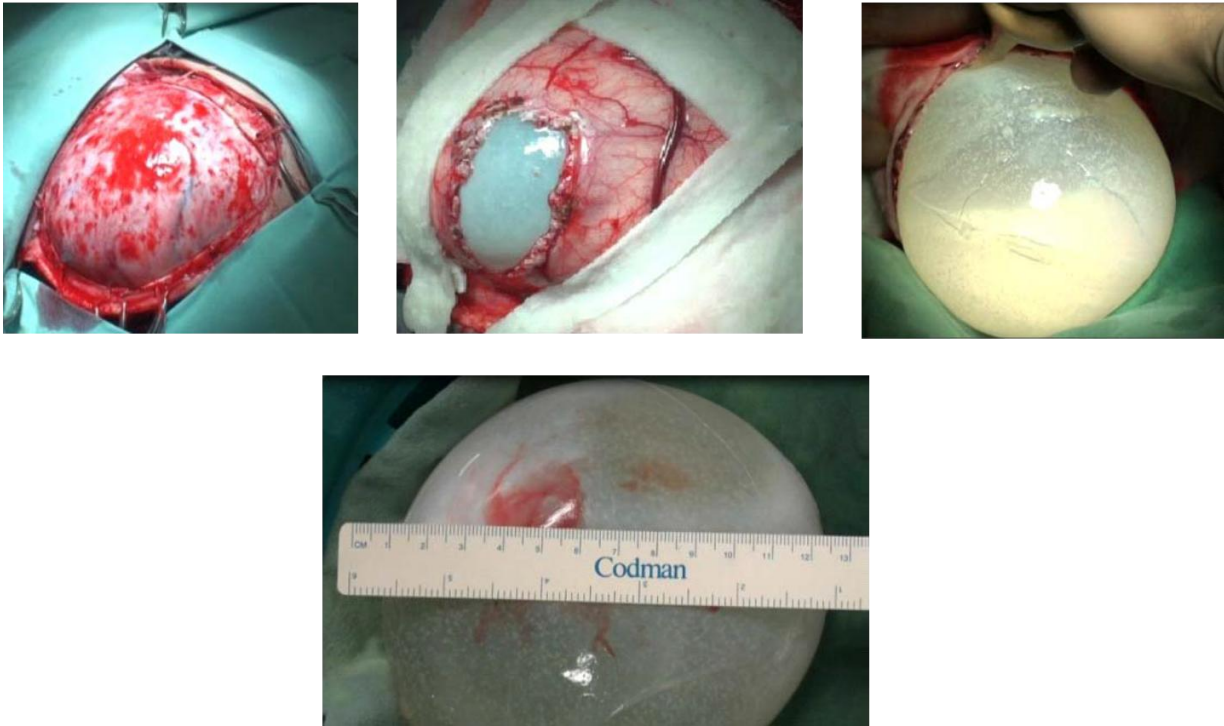
directly under the fibrous capsule; it is milky white, striated and consists of many layers, called the laminated layer. The inner layer consists of a thin layer of (germinative epithelium) and called the germinative layer; it appears as a granular membrane with much nuclei. This layer producing numerous protoscolices and daughter cysts within the parent cyst. The germ layer also produces vesicles or capsules contain 30-40 protoscolices called brood capsules, which become free in the cyst fluid. If the cyst has no protoscolices it is called sterile cyst as the cysts of the camels. The cyst filled with a transparent or white-yellowish liquid called hydatid cyst fluid, it is toxic and responsible for the symptoms which appear if the cyst ruptured.



A scheme for a cross section in the hydatid cyst of *Echinococcus granulosus*.

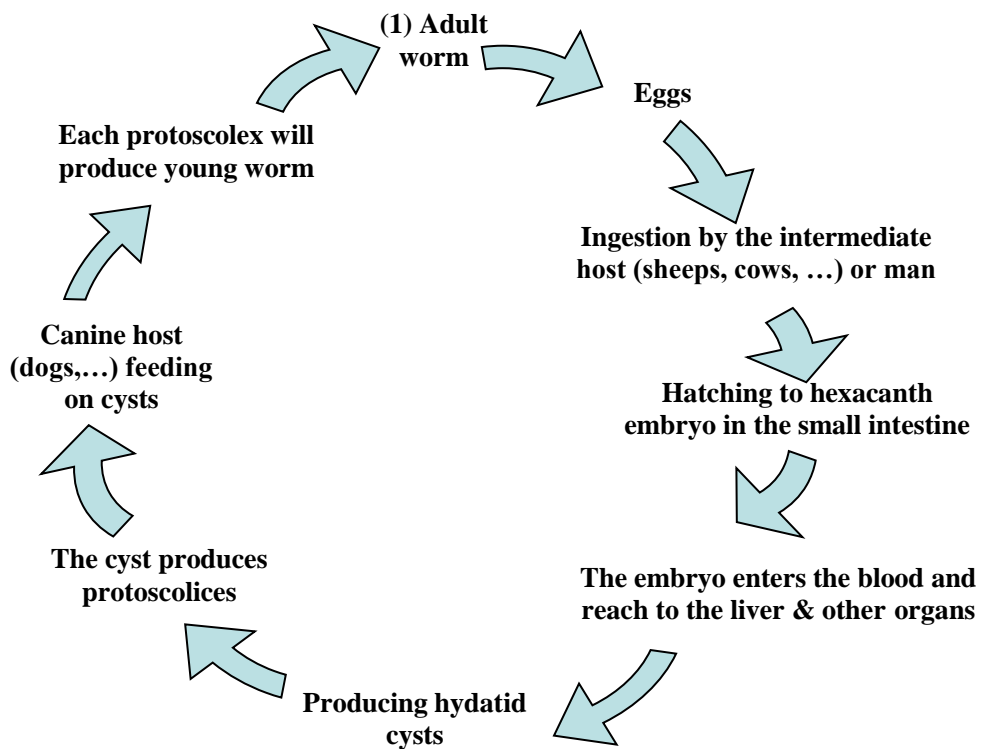


Section in the hydatid cyst of *Echinococcus granulosus*.

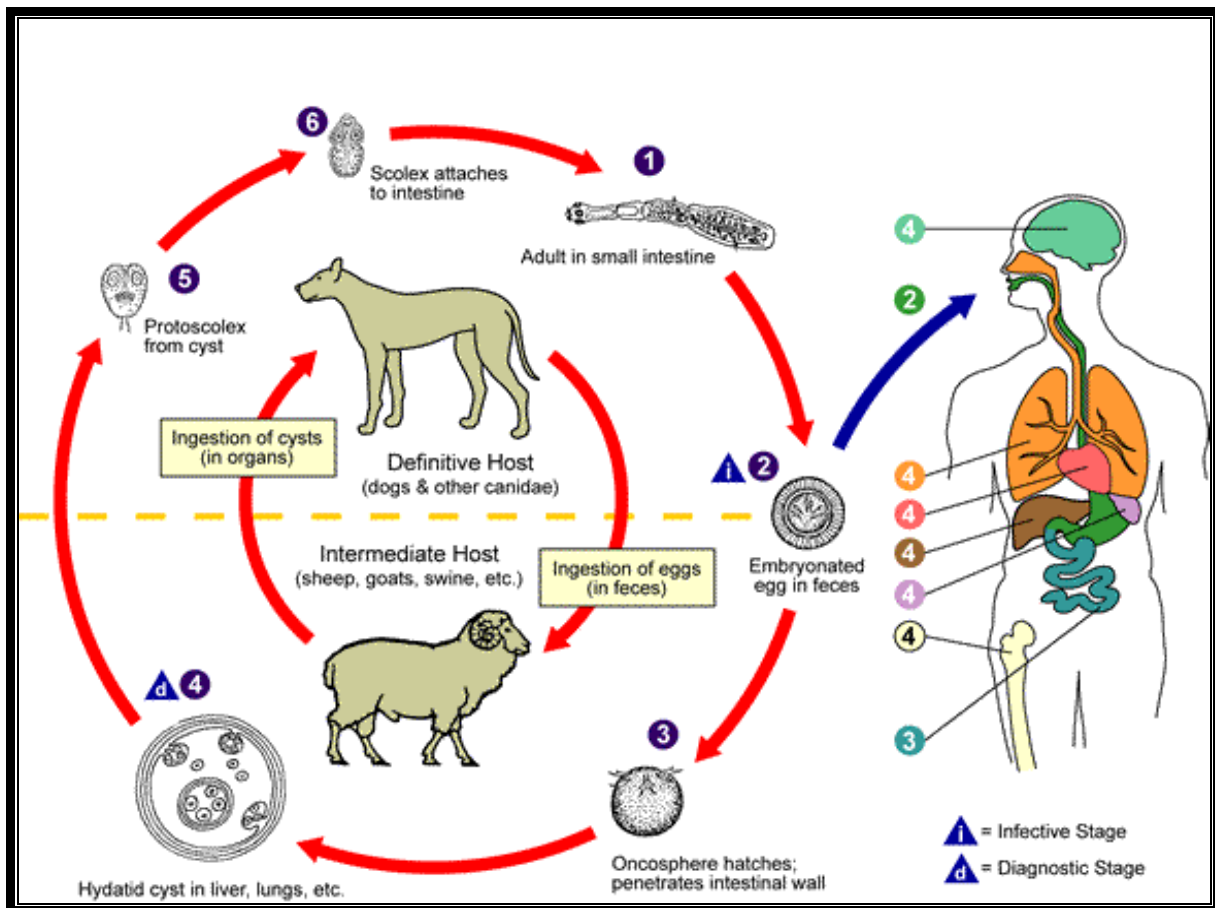


2. The definitive (or final) host:

When the carnivores feeds on the infected organs of the intermediate host, the protoscolices become free in the intestine. They grow into adult worms in about one month. The adult worms lives 5-20 months in dogs.



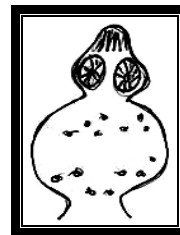
“Scheme for the life cycle of *Echinococcus granulosus*”.



“Diagram for the life cycle of *Echinococcus granulosus*”.



Invaginated protoscolex.



Evaginated protoscolex.

Pathology & Symptomatology

The infections remain silent for years before the enlarging cysts cause symptoms in the affected organs. The signs depend primarily on the size of the cyst which depends on the cyst age. The infection can result in abdominal pain, a mass in the hepatic area, and biliary duct obstruction. Pulmonary involvement can produce chest pain, cough, and hemoptysis.

If a large abdominal cyst ruptured either spontaneously or following a blow on the abdomen, it can produce fever, urticaria, eosinophilia, and anaphylactic shock, as well as cyst dissemination; anaphylaxis may be precipitated by the sudden liberation of hydatid fluid into the peritoneal cavity. Moreover, protoscolices spilled out of cyst cavity will become implanted in the peritoneum and produce multiple secondary cysts. Rupture of a pulmonary cyst into a bronchus results in patient's coughing up the contents, with possible spontaneous clearance of the infection. In addition, other organs (brain, bone, heart) can also be involved. Hydatid cysts of the brain produces increasing symptomatic evidence of an intracranial tumor. Osteous hydatid cysts is insidious, gradually eroding the bone to a stage at which fracture or crumbling suddenly occurs.

Random signs: Coughing, dizziness, vomiting, nausea, enlargements of the infected organs depends on the size, age and position of the cyst, and also necrosis in the tissue of the organ. In the liver, the cyst may cause obstructive jaundice because of the bile duct obstruction.

Diagnosis

In the patient (the intermediate host):

1. Immunologic tests: the intradermal test (or **Casoni test**), precipitin test, complement fixation (CF), immunoelectrophoresis (IEP), immunodiffusion (ID), Indirect haemagglutination (IHA), indirect fluorescent antibody (IFA) tests, ELISA and enzyme immunoassays (EIA) are sensitive tests for detecting the antibodies in the patient's serum.

False-positive reactions may occur in persons with other helminthic infections, cancer, and chronic immune disorders. Negative test results do not rule out echinococcosis because some cyst carriers do not have detectable antibodies. Whether the patient has detectable antibodies depends on the physical location, integrity, and vitality of the larval cyst. Cysts in the liver are more likely to elicit antibody response than cysts in the lungs, and, regardless of localization, antibody detection tests are least sensitive in patients with intact hyaline cysts. Cysts in the lungs, brain, and spleen are associated with lowered serodiagnostic reactivity, whereas those in bone appear to more regularly stimulate detectable antibody. Rupture of a cyst is followed by a high stimulation of antibodies. A patient with aging, calcified, or dead cysts is generally found to be seronegative.

2. by X-ray: it is useful in the cysts of the lung, bones, liver capsule.

3. Hydatid thrill.

In the final host the diagnosis depends on the recovery of the gravid segments or proglottids in the feces.

Treatment

The surgery is the most common form of treatment for echinococcosis, although removal of the parasite mass is not usually 100% effective. After surgery, medication may be necessary to keep the cyst from recurring. The drug of choice for treatment in echinococcosis is albendazole (or Mebendazole) and sometimes the Biotherapy. PAIR technique used in the diagnosis and treatment of Hydatid cysts.

2 *Echinococcus multilocularis*

This parasite causes a disease called alveolar or multilocular hydatid disease or echinococcosis. The adult worm is smaller than *E. granulosus*, it is 1.2-3.7mm long; the number of testes is less than in *E. granulosus*, they are 15-30, the definitive host is mainly foxes.

The hydatid cyst is different from the above sample. The wall of the cyst is thin, it grows and produces minute irregular cavities or processes in the host tissues as similar as the cancer. The processes may be having many small pockets filled with a liquid and few protoscolices, so that, this type of hydatid cyst called multilocular or alveolar cyst. In the man and other unnatural hosts, the pockets are without protoscolices. These cysts are found always in the liver where 90% of the infection

are in the liver, and rarely they infect the lungs. The infection with this type of hydatid cysts is dangerous because they are spread as in malignant tumors.

Pathology

Echinococcus multilocularis affects the liver as a slow growing, destructive tumor, with abdominal pain, biliary obstruction, and occasionally metastatic lesions in the lungs and the brain.

Diagnosis

Specific diagnosis is likely to be missed in the living patient because of the general unfamiliarity of pathologists with this type of hydatid infection.

Treatment: Albendazole or Mebendazole, the surgical removal is not amenable.