

- Metazoan (helminthes)
- Phylum: Platyhelminths
- Class: Cestoda
- Order: Pseudophyllidea
- **Ex:** *Diphyllobothrium latum*
- Order: Cyclophyllidea
- Family: Taeniidae
- **Ex:** *Taenia saginata*, *Taenia solium*

Taenia saginata

Common name: beef tapeworm, unarmed tapeworm.

Habitat: adult worm lives in the human small intestine.

Disease: Beef tapeworm infection, Taeniosis and Taeniasis.

Morphology:

-Adult worm: it is white, long measures (4-12 m. long and 12-14mm. wide), segments up to 2000.

-Scolex: is pear-shaped, (with 4 suckers and small rostellum) with long neck.

-Mature segments: have typical reproductive system including a bilobed ovary and genital pore on the lateral wall of the segments.

-Gravid: length 4 times its breadth, uterus has 15-20 lateral branches is full of eggs, the gravid segments are expelled irregularly in the stool, while crawling out of the anus the eggs are laid in the perianal skin.

Egg: spherical, size (31-43 μ m), embryo has 3 pairs of hooks called (hexacanth or oncospher embryo) surrounded by brown, thick walled and radially striated (embryophore).

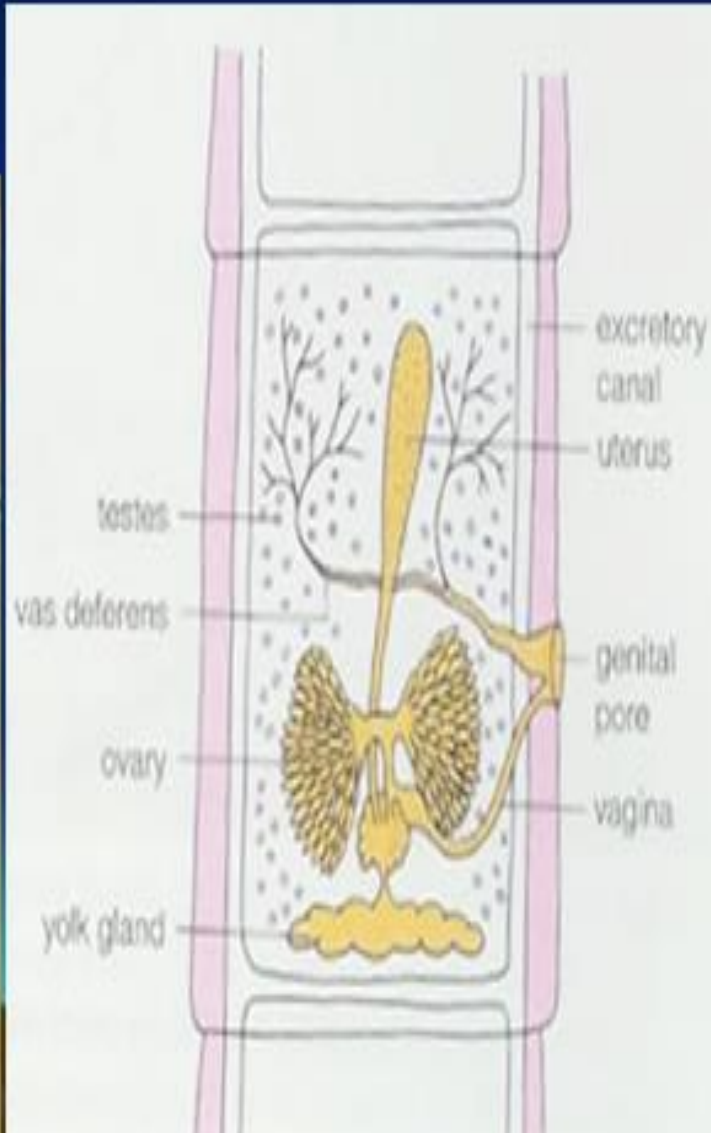
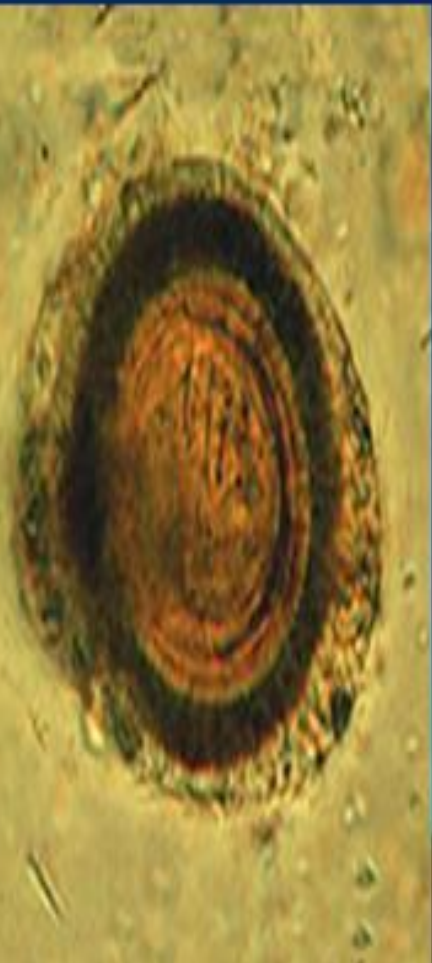
T. saginata adult worm



Taenia saginata
(Scolex and segments)

Mature segment of *Taenia*

Egg



Gravid segment



Life cycle

-Definitive host: man

-Intermediate host: cattle.

Eggs or gravid segments are passed out with the feces on the ground. They are infective to cattle which ingest the eggs. In the intestine the eggs-shell rupture and oncospheres are liberated, then penetrate the intestinal wall and enter systemic circulation and they are filtered in to striated muscles and develop to larva stage.(*Cysticercus bovis*) it's bladder type, white, filled with fluid measuring 5 by 10mm and contain invaginated unarmed scolex this consider infective stage to man, when eating raw or partially cooked beef containing cysticerci. In small intestine of man the larva develops to adult worm and become sexually mature into 2-3 months and starts producing eggs.

Laboratory diagnosis:

- 1-Stool examination for demonstration eggs (undifferential), gravid segment (15-20 lateral uterine branches) and unarmed scolex.
- 2-Perianal swab examination reveals eggs of Taenia deposited in or around anal area.
- 3-Serological test: IHA, IFA and ELISA

i Oncospheres develop into cysticerci in muscle

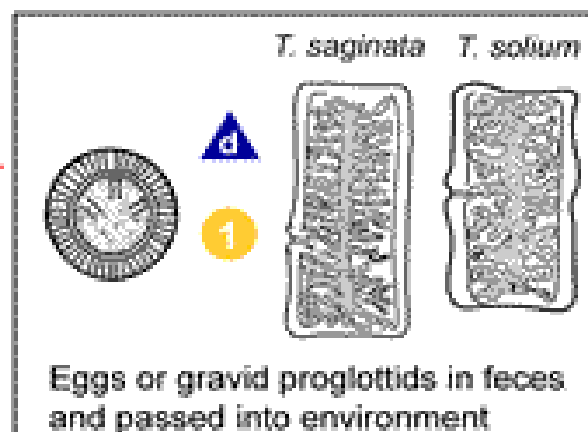
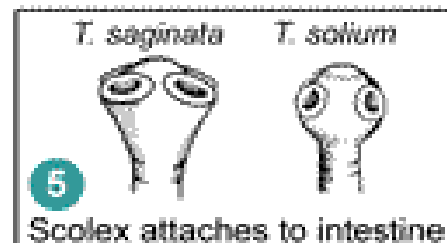
4 Humans infected by ingesting raw or undercooked infected meat

Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

3

2

Cattle (*T. saginata*) and pigs (*T. solium*) become infected by ingesting vegetation contaminated by eggs or gravid proglottids



i = Infective Stage
d = Diagnostic Stage



<http://www.dpd.cdc.gov/dpdx>

Taenia solium

(pork tapeworm and armed tapeworm)

- **Habitat:** Adult worm lives in the human small intestine. larva cysticercus cellulosae occurs in any organ of intermediate host
- **Morphology:**
 - Adults are 2 to 3m. in length
 - Number of segments less than 1000
 - Scolex is pin-head size, globular with 4 suckers and rostellum with double row of hooks, short neck
 - Immature and mature segments like *Taenia saginata*.
 - Gravid segment with 7-13 lateral uterian branches (gravid segments are shed only during bowel movement –weakly motile-)



Scolecex of *Taenia solium*



Gravid proglottids of *Taenia saginata* (Figures D and E)
and *Taenia solium* (Figures F and G)



D



E



F



G

Life cycle

-Definitive host: man

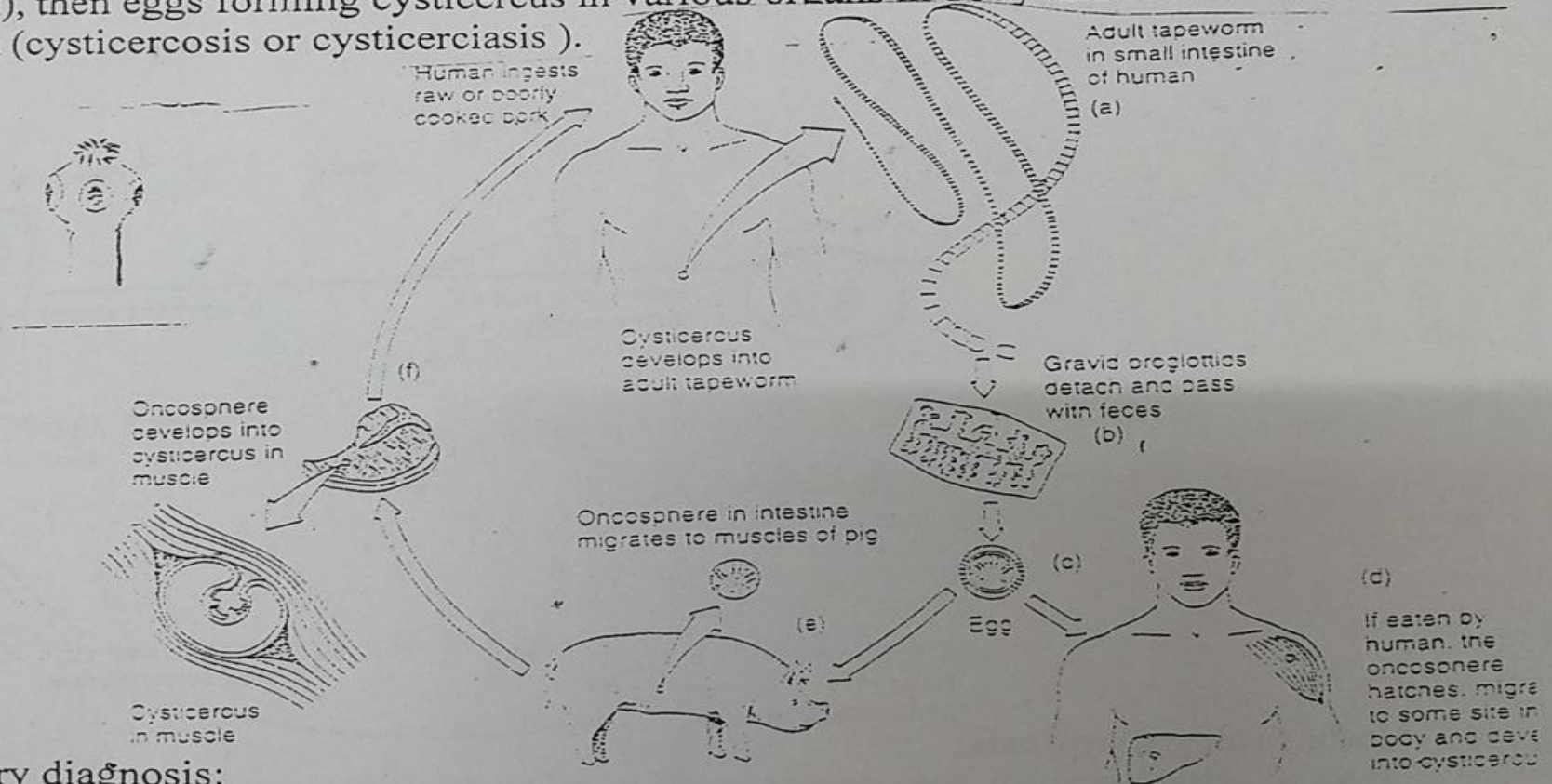
-Intermediate host: pig. The life cycle similar to that of *Taenia saginata*.

When a human is intermediate host this happen by:

1-Ingesting eggs in contaminated food or water (hetero infection).

2-Carrying eggs by fingers to mouth (external auto-infection).

3-When gravid segment has disintegration, eggs return to stomach (internal auto-infection), then eggs forming cysticercus in various organs in body and lead to tissue infection (cysticercosis or cysticerciasis).



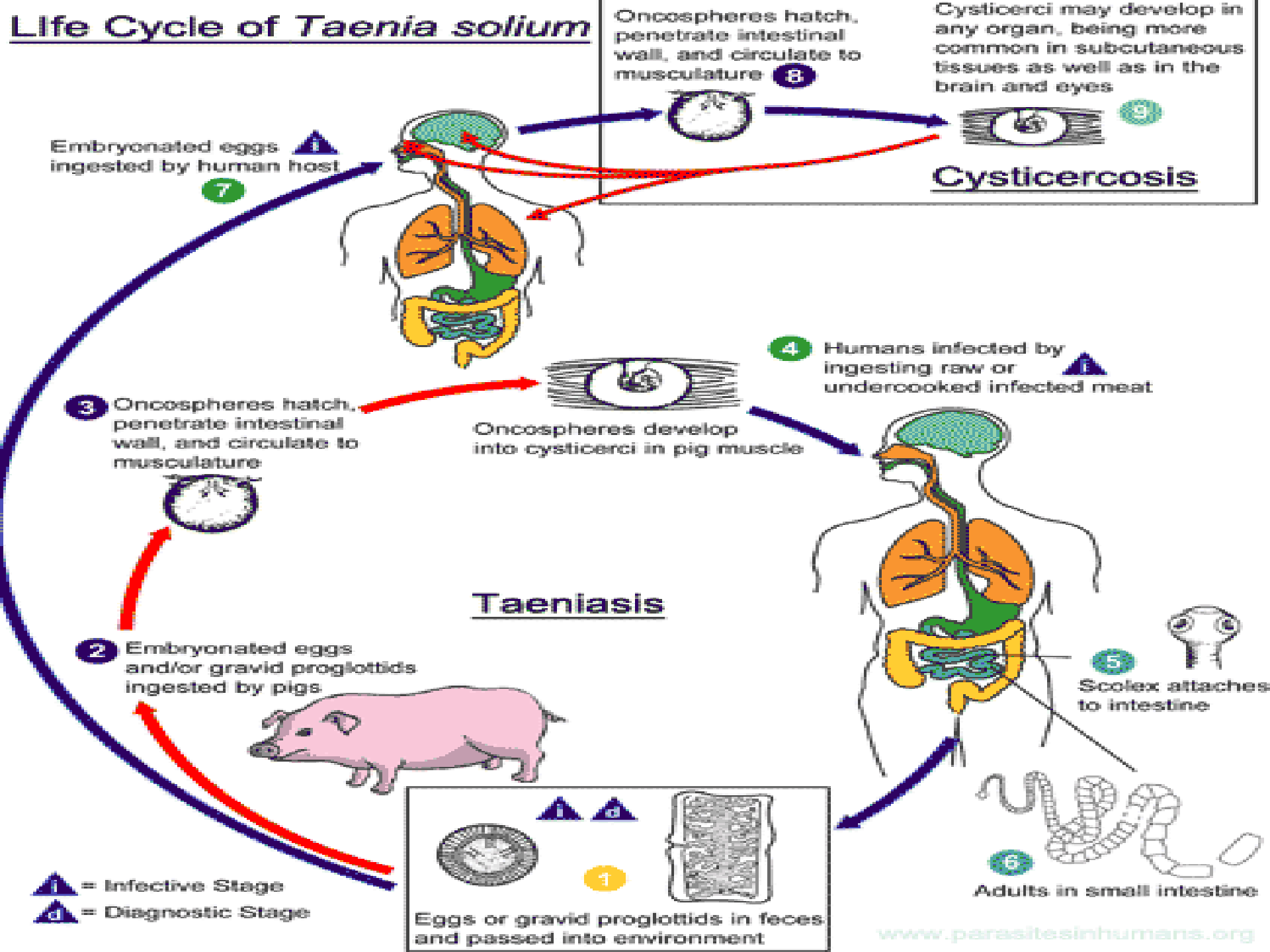
Laboratory diagnosis:

1-Stool examination for demonstration eggs (not differential), gravid segment (7-13 branches) and armed scolex.

2-Perianal swab exam. Reveals eggs of *Taenia* deposited in or around anal area.

3-Cysticercosis is diagnosis by x-ray, biopsy and serological tests.

Life Cycle of *Taenia solium*



Cysticercosis

(infection with the *C. cellulosae*)

- Cerebral Cysticercosis:

*epilepsiform attacks, headache, visual and aural symptoms and ...

*Muscular Cysticercosis

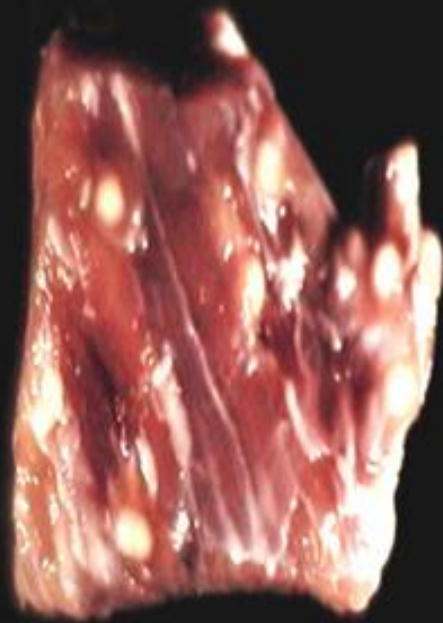
Ocular Cysticercosis

Subcutaneous Cysticercosis

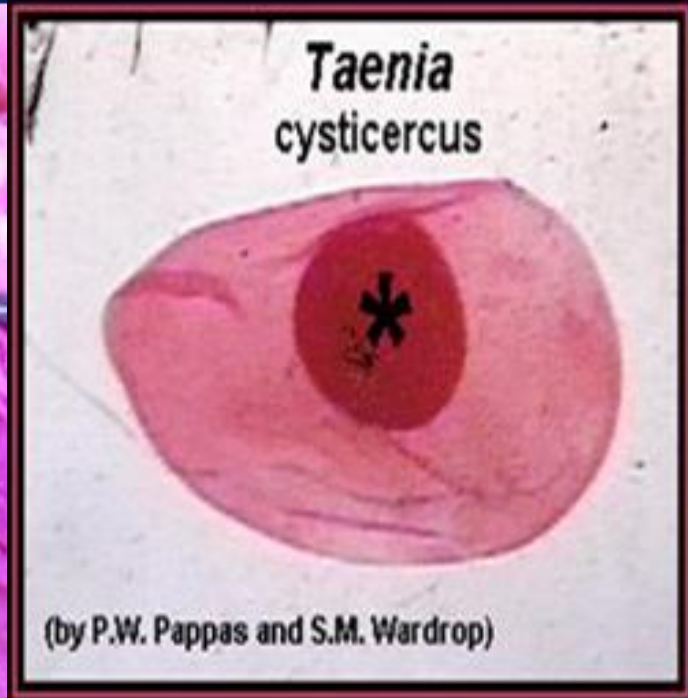


Cysticercus bovis

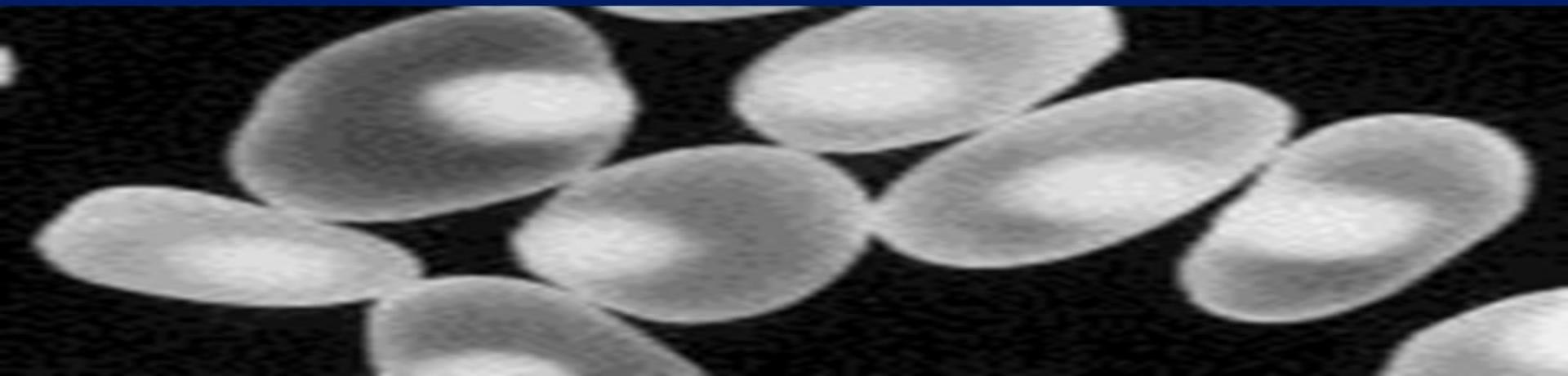
cysticercus



Cysticercus bovis



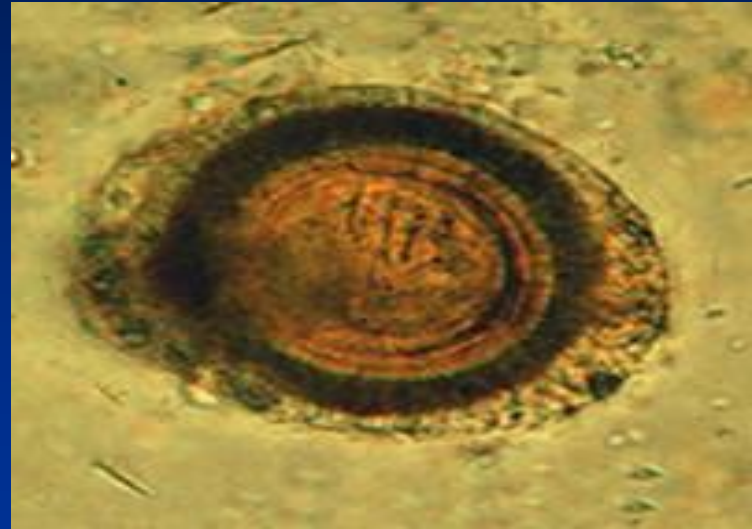
***T. solium*, cysticercus cellulosae with invaginated scolex**



Microscopy Findings



A



B

A, B: Taeniid eggs. The eggs of *Taenia saginata* and *Taenia solium* are indistinguishable morphologically.

The eggs are rounded, diameter 31 to 43 μm , with a thick radially striated brown shell. Inside each shell is an embryonated oncosphere with 6 hooks.

Phylum: Platyhelminths

Class: Cestoda

Order: Cyclophylidea

Family: Taeniidae

Echinococcus granulosus

Echinococcus multilocularis

- Dog Tapeworm
- Hydatid Worm
- Man harbors the larval form and not the adult worms which however is found in the intestine of dogs and canines

3- Echinococcus granulosus (hydatid worm)

Disease: hydatid disease, Echinococcosis, hydatidosis.

Habitat: adult worms are found in small intestine of dogs, wolf and fox, larva form (unilocular hydatid cyst). In liver and lungs of herbivores like sheep, as well as man.

Morphology:

-**Adult** worms are quite small, measuring 3 to 6 mm in length.

-**Scolex** has arostellum with 2 rows of hooks and 4 suckers followed by short neck.

-**Commonly** this worm has 3 segments immature, mature and gravid segment contain uterus is an irregular longitudinal sac and measures more than half of total length.

-**Eggs** are similar to those of family taeniidae and excreted in faeces of dog.

Life cycle of Echinococcus granulosus.

-**Definitive host:** dog, wolf and fox (carnivores).

-**Intermediate host:** sheep, pig, goat, cattle and man.

Larval stage: (unilocular hydatid cyst) cyst wall secreted by the embryo consists of 2 layers

1-Ectocyst: outer laminated layer (surrounding by fibrous layer called pericyst).

2-Endocyst: inner germinal layer which formation A- Outer layer, B- Secretion hydatid fluid (antigenic and highly toxic), C- Giving rise to brood capsules and protoscolices.

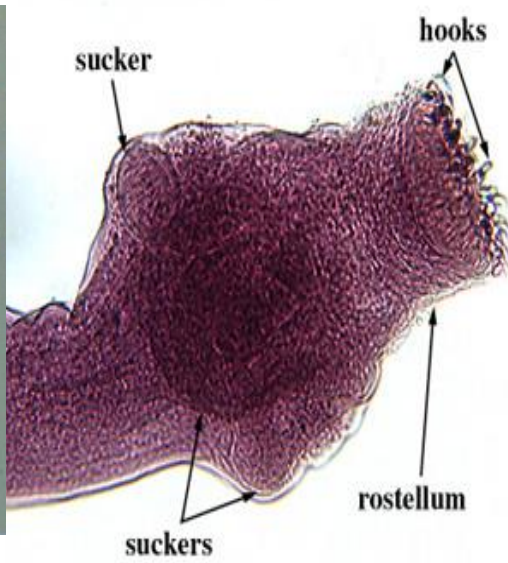
When the scolices and brood capsules may break free in cyst, they are known as hydatid sand [the distribution of cyst in intermediate hosts 70% liver, 20% lungs and 10% in (Brain, kidney, spleen and bone)].

Notice:

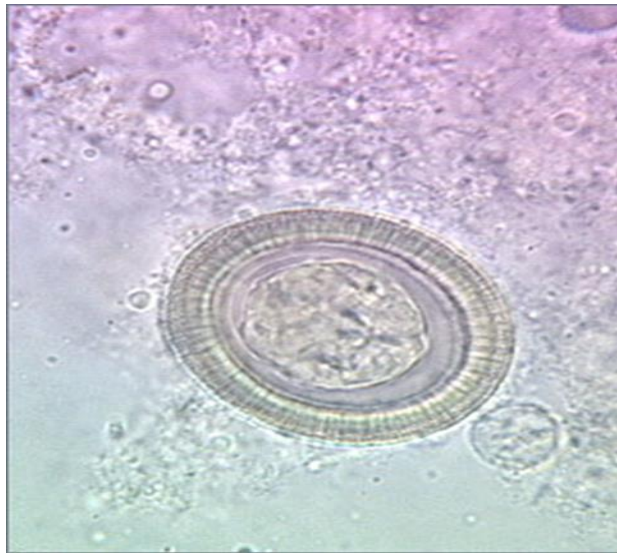
-The life cycle comes to a dead-end in case of man (because dog does not access to it) life span of adult worm in the definitive host (6 months), while larval form may continue to develop for many years .

-Fertile hydatid cyst: that contains brood capsule and protoscolices

-Sterile hydatid cyst: Cyst does not produce brood capsule and scolices (acephalocysts).



Scolex



egg



Rostellum with No.
of hooks
4 suckers

Immature segment

Mature segment

Gravid segment

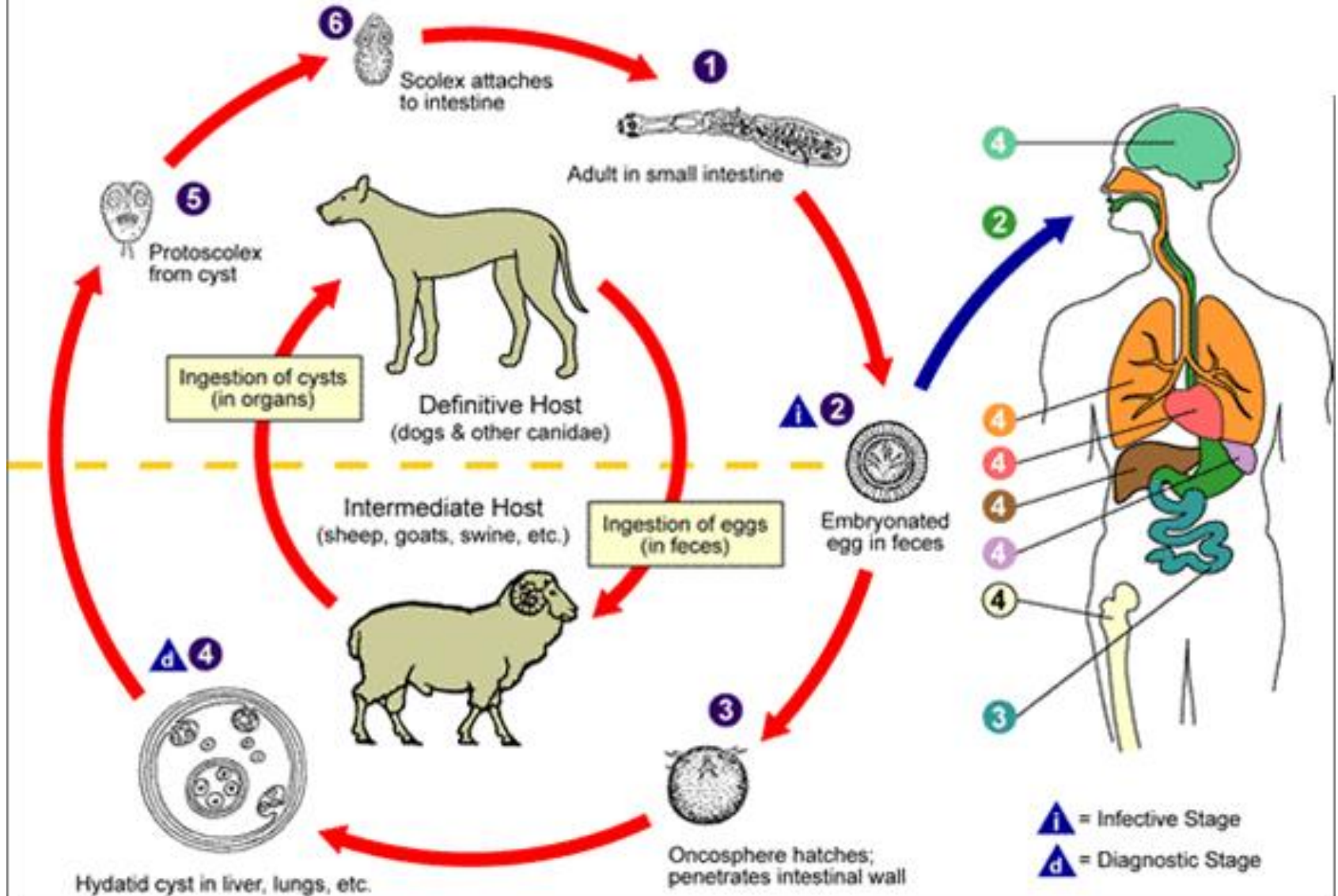
Uterus full with ova

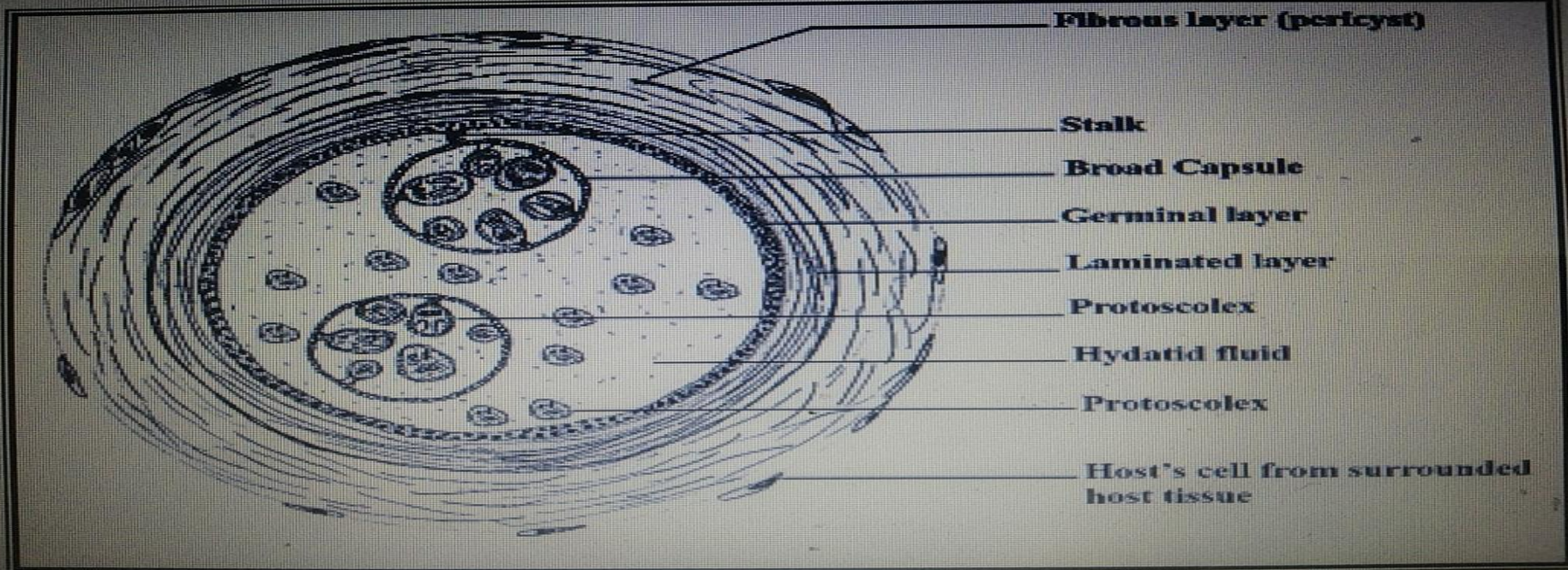
} scolex



adult worm

Life cycle of *Echinococcus*

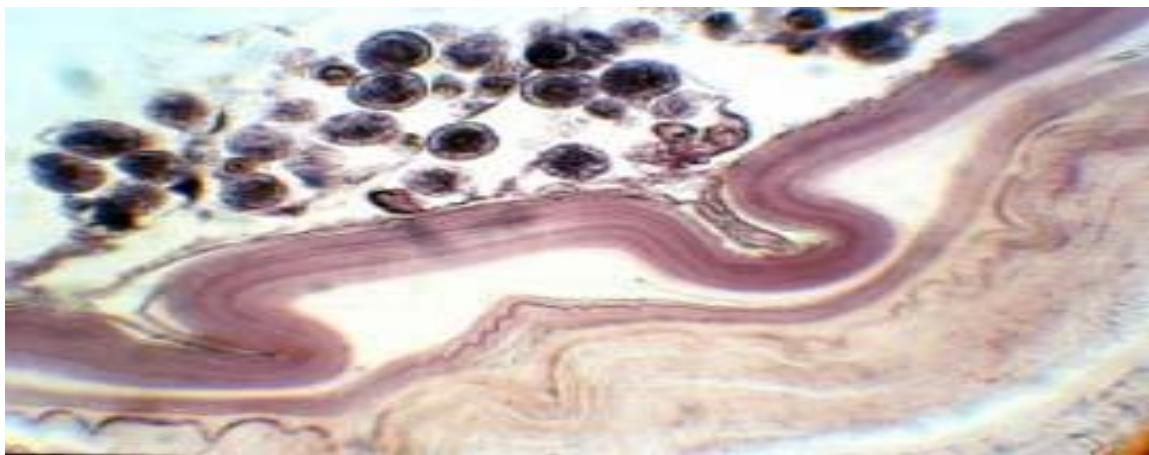




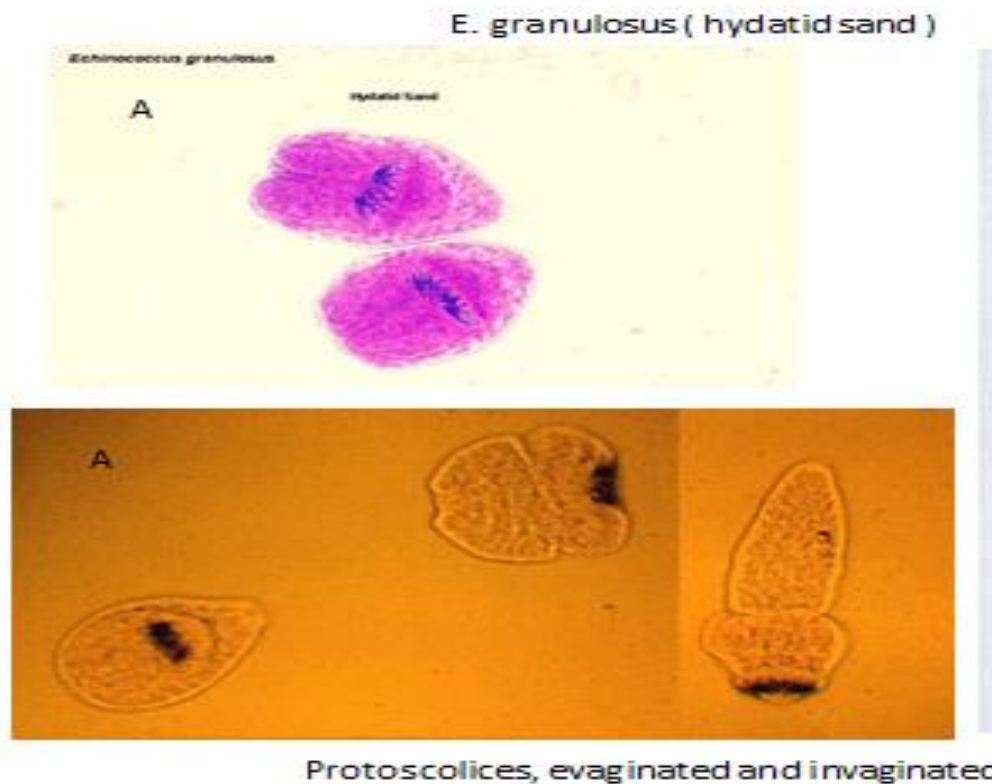
A scheme for a cross section in the hydatid cyst of *Echinococcus granulosus*.



Section in the hydatid cyst of *Echinococcus granulosus*.



Encysted scolices of *Echinococcus granulosus* in lung "hydatid sand"



Laboratory diagnosis:

1-Finding protoscolices and brood capsule in hydatid fluid (after surgical aspiration of fluid from hydatid cyst), stool, sputum and vomitus.

2-Intradermal test (casoni's test): 0.2ml of antigen (sterile hydatid fluid) injected interdermally on one arm, equal volume of saline(as control) on the other arm. In + cases a large wheal about 5 cm in diameter with multiple pseudopodia like projections appears in 30 minutes, the other arm not give +ve result. This sensitive test but not specific, as false +ve reactions occur in many other infections.

3-Serological test: IHA, CF and ELISA.

4-Blood picture: it shows moderate eosinophilia in about half of the patients.

4- Echinococcus multilocularis

-**Disease:** Alveolar or multilocular hydatid disease.

adult worm length 1.2 to 3.7 (mm.) with 4-5 segments.

-**Definitive hosts:** fox, dogs, wolves, rodents and cats

-Intermediate hosts: rodents, man.

-**Larva stage** (Alveolar or multilocular hydatid cyst): It is composed of numerous minute irregular spaces separated from each other by connective tissue filled with matrix. There is thin laminated membrane and no fibrous capsule. Metastasis is rapid (malignant type). So it is one of most lethal human helminthic diseases.(protoscolices of this cyst may not develop in human).

-**Eggs:** Like other Taeniid eggs.

-**Life cycle:** similar to that of Echinococcus granulosus.

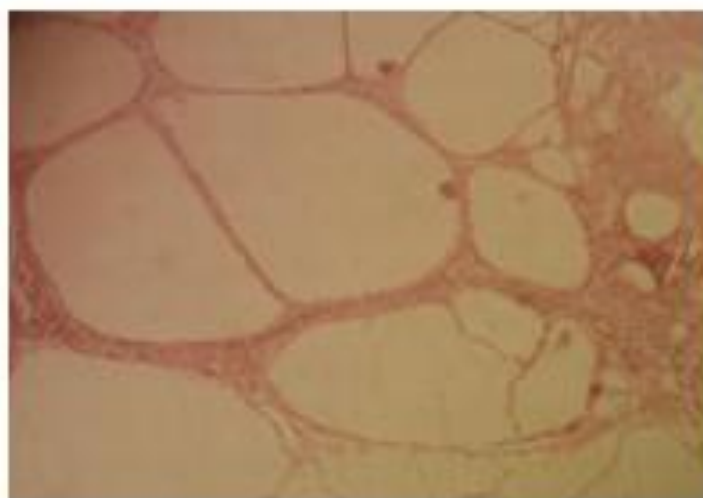


thin
laminated

Alveolar echinococcus



Echinococcus multilocularis,
Hydatid cyst (multivesicular,
Metastasis)



Echinococcus multilocularis Alveolar Cyst (section from human the cysts are sterile)

Hydatid cyst of Echinococcus multilocularis