



Hydatid disease & Hymenolepis nana

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2nd stage

Medical microbiology II (Parasitology)

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Classification

Kingdom: Animalia

Phylum: Platyhelminthes

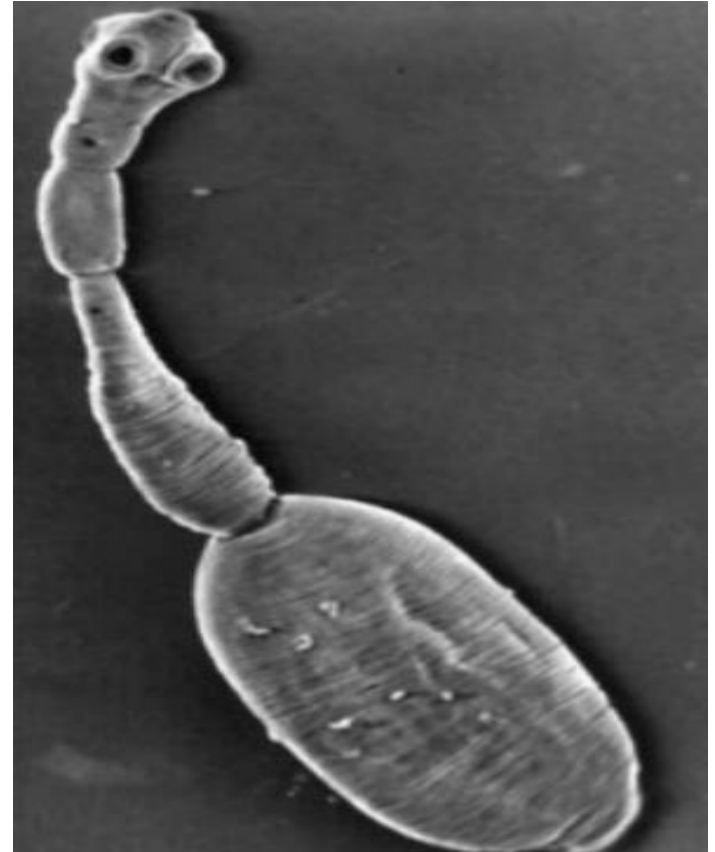
Class: Cestoda

Order: Cyclophyllidea

Family: Taenidae

Genus: *Echinococcus*

Species: *granulosus*



Introduction

➤ Echinococcus causes hydatid disease , there are four species of Echinococcus known to infect humans.

1- *E. granulosus* causes Hydatid cysts disease

2- *E. multilocularis* causes alveolar Hydatid disease

3- *E.vogeli* & *E.oligarthrus* causes polycystic Hydatid disease



Introduction

Ref: Eckert and Deplazes (2004)

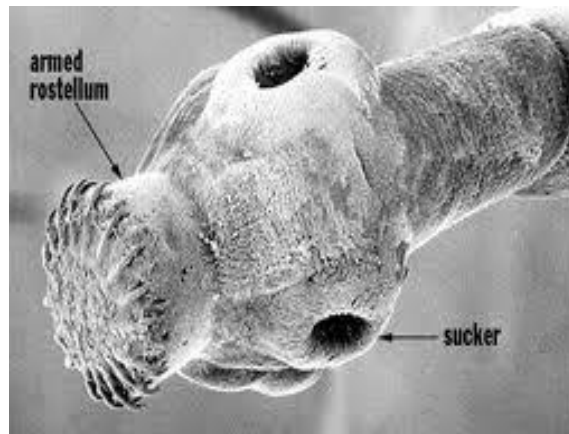
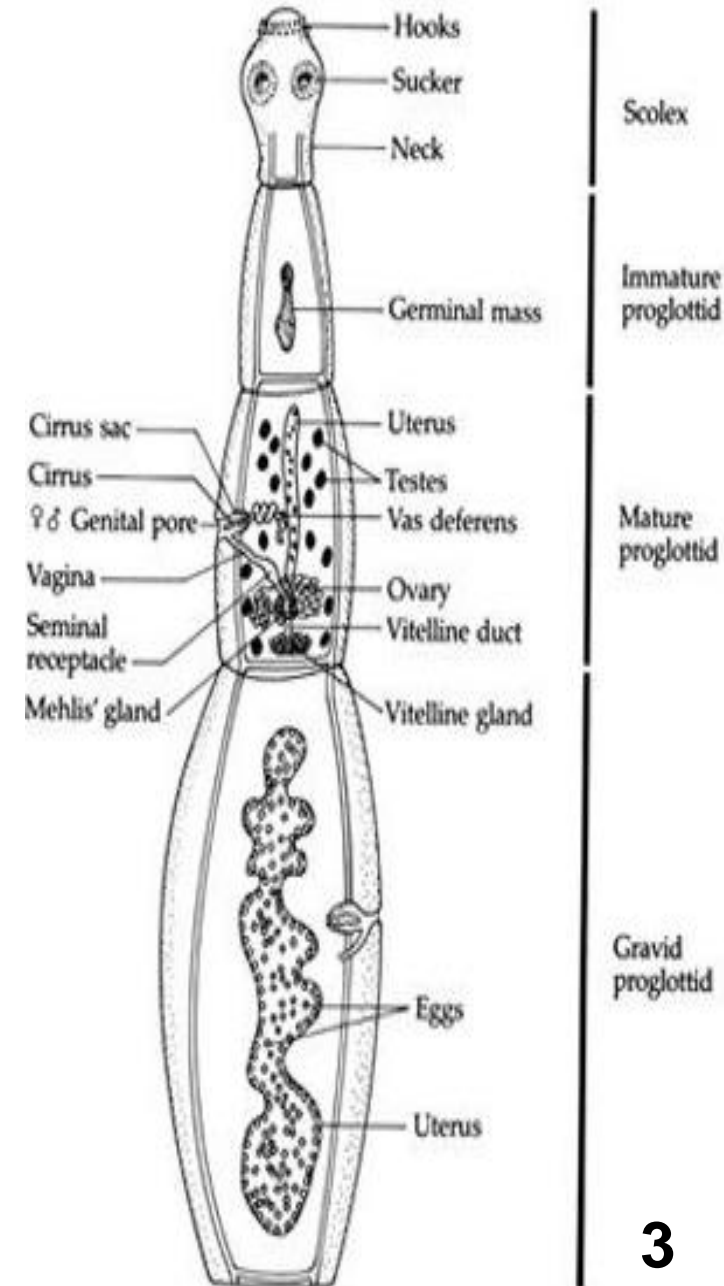
- Definitive hosts (canines)



dog, fox, wolf, coyote, jackal and dingo
(Contain Adult worm and egg)

A- Morphology (Adult worm)

- The adult tapeworm range in length from 3-6 mm
- It consist of :-
 - 1- Scolex with four sucking disks and a double row of hooklets
 - 2- Neck is short and thick
 - 3- Strobila containing three proglottids: Immature ,mature and gravid



Scanning electron micrograph showing Scolex

Introduction

Ref: Eckert and Deplazes (2004)

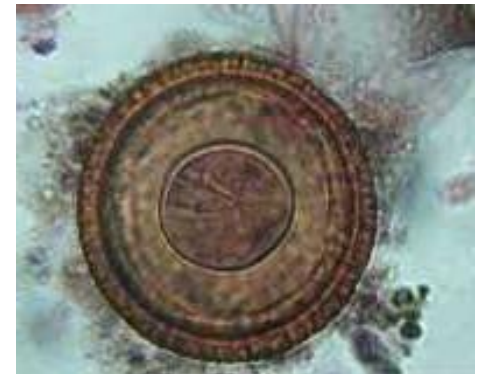
- Definitive hosts (canines)



dog, fox, wolf, coyote, jackal and dingo
(Contain Adult worm and egg)

B- Morphology (egg)

- It is spherical in shape and resemble other Taenia spp.
Measures 32-36 μm X 25 X 32 μm
- It contains hexacanth embryo with 3 pairs of hooks



- Intermediate hosts (herbivores)



Sheep, cattle, swine, deer, moose
(Contain Oncosphere (six-hooked) and hydatid cyst)

- Accidental host : humans serving as dead-end intermediate hosts



Dog's don't feed on human viscera

Mode of infection

➤ Infection is acquired by the ingestion of eggs (**infective stage**) in the dogs faeces. This occurs in following ways:

- 1- By direct contact(handling) with infected dogs.
- 2- By allowing the dog to feed from the same dish.
- 3- By taking vegateble contaminated with infected dog faeces.



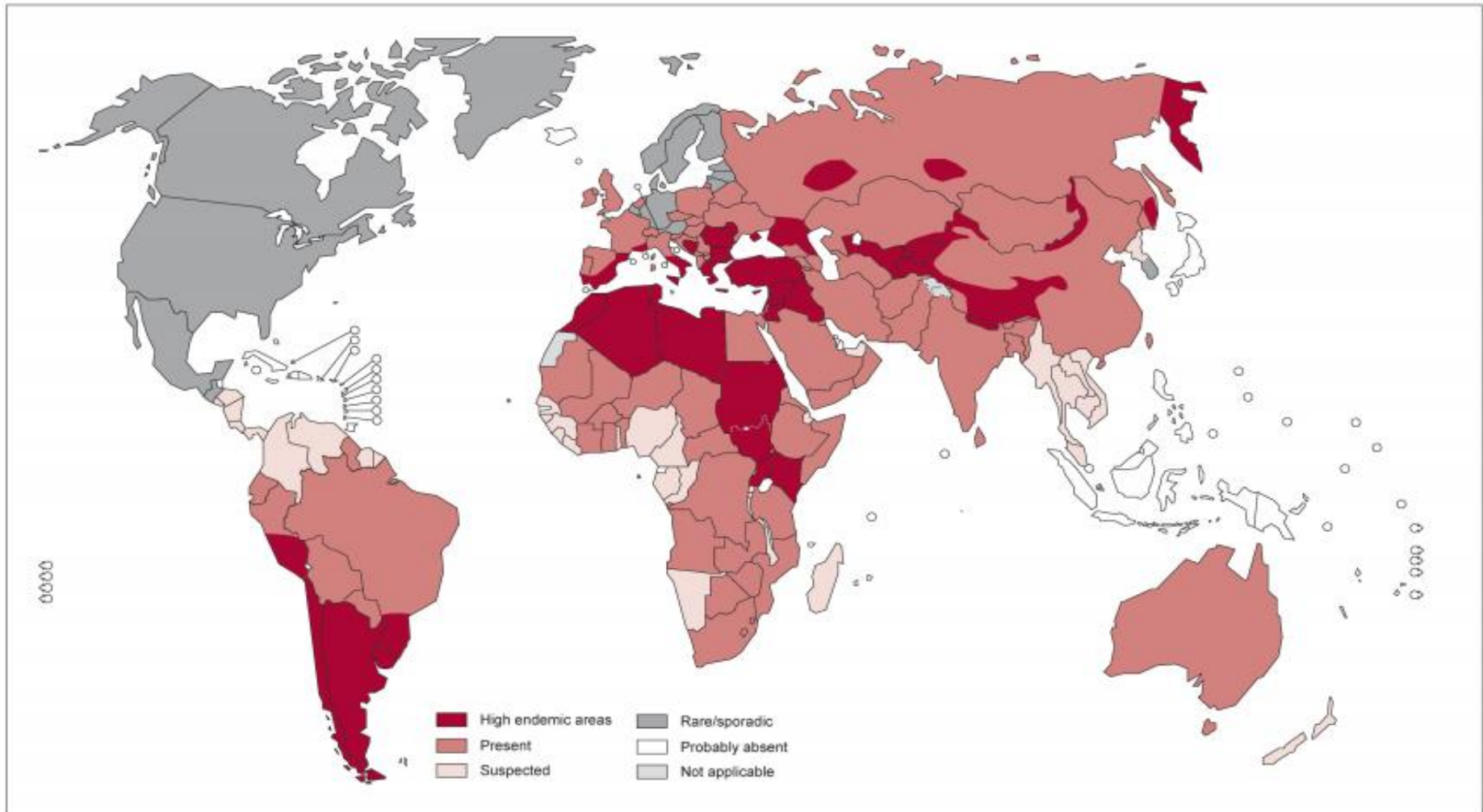
Epidemiology

- ❖ globally distributed in most pastoral and rangeland areas of the world
- ❖ The highest prevalence occurs in rural areas where older animals are slaughtered.
- ❖ highly endemic areas in the eastern part of the Mediterranean region, northern Africa, southern and eastern Europe, at the southern tip of South America, in Central Asia, Siberia and western China.



Epidemiology

Distribution of *Echinococcus granulosus* and cystic echinococcosis, worldwide, 2011



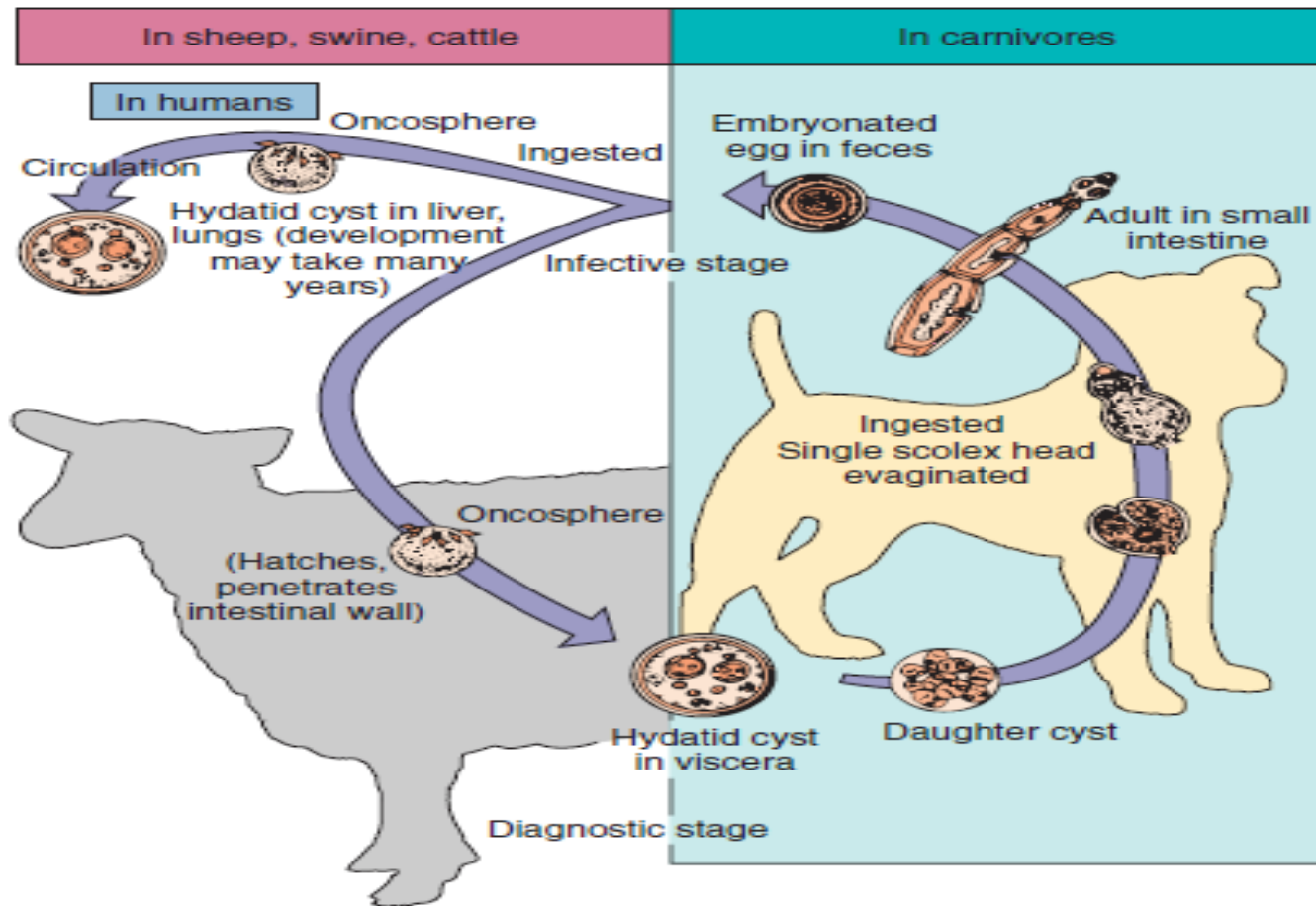
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Life cycle

Adult tapeworms in the canine intestine produce infective eggs that pass in feces. When these eggs are ingested by humans and other intermediate hosts (sheep and cattle), the oncosphere (six-hooked larval stage) is released by the rupture of egg. The oncosphere hatches and penetrates the human intestinal wall and enters the circulation to be carried to various tissue sites, primarily the liver and lungs but also the central nervous system and bone. The oncosphere are encysted by the fibrous tissue (produced by fibroblast) and transform into fluid filled bladder like cyst called as hydatid cysts (larvae form). The hydatid cyst undergoes maturation increases in size and full development takes 10-18 months in sheep. The hydatid cyst is infective to dog and other definitive hosts. When the herbivore is killed by a canine predator or viscera is fed to canines, the ingestion of hydatid cysts produces adult tapeworms in the canine intestine to complete the cycle and initiate new egg production.



Life cycle



Life cycle of *E. granulosus*

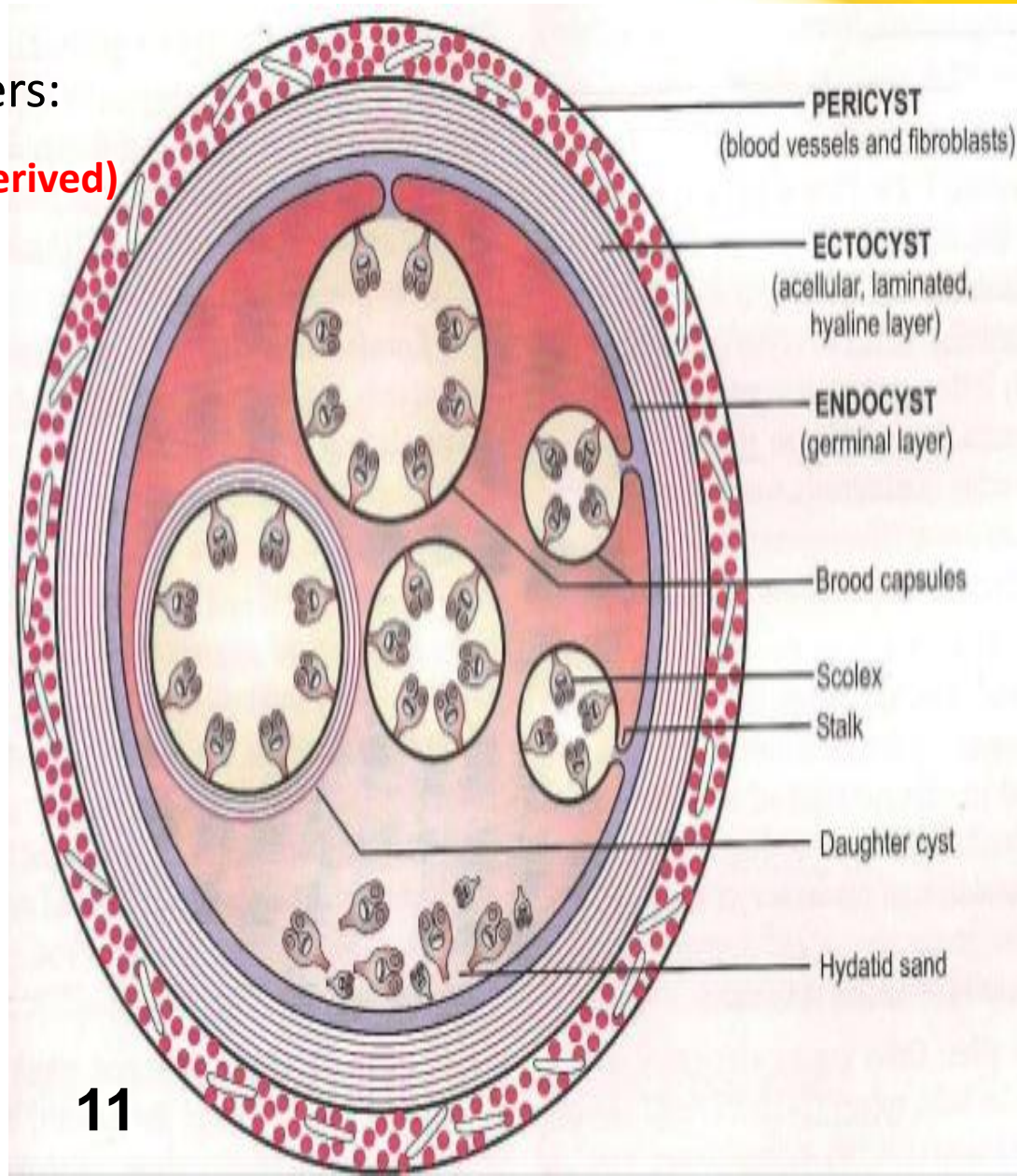


hydatid cyst structure

✓ The hydatid cyst has three layers:

B- Ectocyst (middle layer or parasite derived)

- It is a tough , acellular, laminated , elastic hyaline layer of variable thickness (1 mm)
- It resembles the white of a hard boiled egg
- Protects the cyst from host enzymes, bile and bacteria



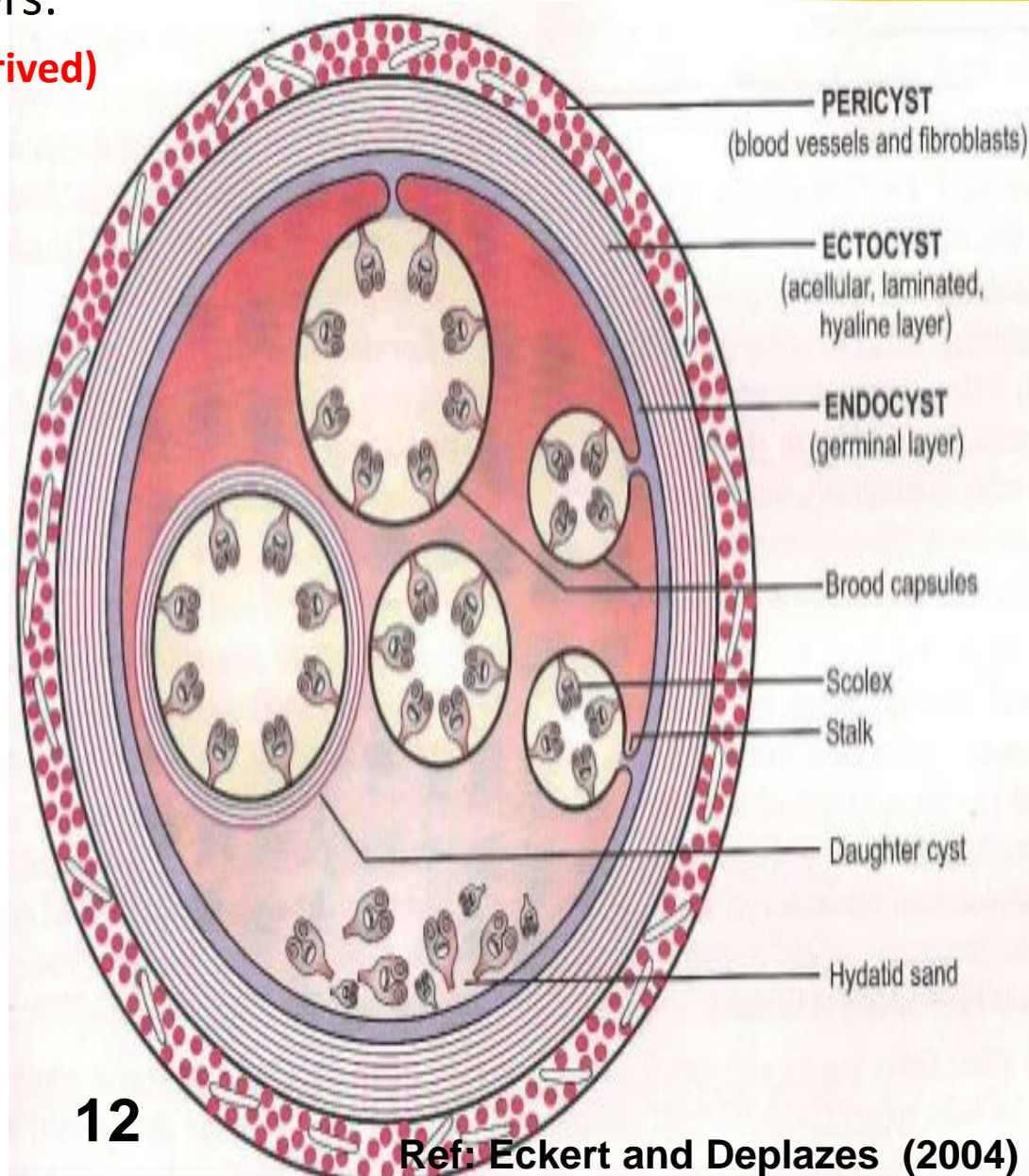
hydatid cyst structure

✓ The hydatid cyst has three layers:

C- Endocyst (Inner layer or parasite derived)

- Germinal layer, living component of the parasite
- Consists of number of nuclei embedded in a protoplasmic mass
- Gives rise to endocyst, brood capsules (arise from the inner side of the endocyst and contains number of protoscolices).
- Secretes hydatid fluid

Note: The brood capsules and daughter cysts rupture within the mother cyst, liberating the accumulated protoscolices . These become known as hydatid sand



Characteristic of hydatid fluid

- It is a clear colourless fluid (may be pale yellow in colour)
- It has a low specific gravity (1.005-1.010)
- It is slightly acidic (pH 6.7) in nature
- It contains sodium chloride, sodium sulphate, sodium phosphate and succinic acids.
- Antigenic- being used for immunological test
- It is highly toxic , when absorbed give rise to anaphylactic shock



Clinical Features

- Symptoms depend upon the site of infection and cyst size
- Distribution of Hydatid cyst: Most common site of location of the cyst is liver (60-70%),Lung(20-30%) but may be found in any organs like spleen and kidney (3-5%), brain and heart (1-1.5%) and rarely bones.
- They grows slowly up to 5-10 cm in size within the first year and can survive for years or even decades
- Asymptomatic: Many cases are asymptomatic and infection is detected only incidentally by imaging studies.



Clinical Features

➤ Cyst specific symptoms :-

A- Pressure effect of the enlarging cyst:

Leads to palpable abdominal mass, hepatomegaly , abdominal tenderness, portal hypertension and ascites

B- Obstruction of the bile duct :

Daughter cyst may erode into the biliary tree and enter into the lumen to cause cholestasis and Jaundice

C- Anaphylactic reactions:

Cyst leakage or rupture may be associated with a severe allergic reaction to hydatid fluid antigens; leading to hypotension, syncope and fever.

D- Secondary bacterial infection:

Bacterial infection of hydatid cysts → pyogenic abscess



Clinical Features

➤ Site specific symptoms:-

A- Pulmonary cysts:

Can cause cough, chest pain , hemoptysis and dyspnea

B- Brain and spinal cord:

Cause epilepsy and blindness

Note: Younger children are more associated with extrahepatic cysts in lungs, brain



Diagnosis

Ref: Garcia (2006)

➤ Skin test (Casoni test)

- It is an immediate hypersensitivity reaction to hydatid fluid antigens. Developed by Casoni in 1911
- Antigen used : Sterile hydatid fluid derived from unilocular cysts from dog or man (sterilized by filtration)
- Procedure : 0.2 ml of the antigen is injected in one arm; sterile saline is injected to the other arm as control
- Interpretation : Sensitive patient's develop large wheal measuring 5 cm or more with formation of pseudopodia within 30 minutes with no reaction in the control arm.



➤ Antibody detection

- Screening tests: Various antibody detection methods are evaluated using crude *E. granulosus* cyst fluid antigen. They show variable results (60-90 % sensitivity). These tests are :-

1- Indirect hemagglutination (IHA)

2- Latex agglutination test (LAT)

3- Indirect fluorescent antibody tests (IFA)

4- Enzyme linked immunosorbent assay (ELISA)

➤ Antigen detection

- ELISA can be used for detection of antigen in the serum



Diagnosis

Ref: Garcia (2006)

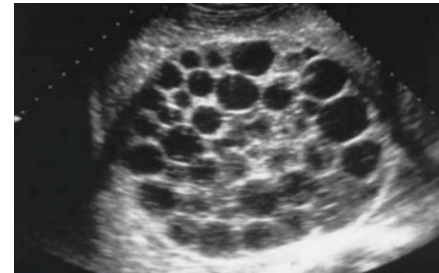
➤ Imaging methods

- Imaging methods play an important role as they are noninvasive methods, which can detect the cysts incidentally in asymptomatic individuals and in seronegative cases.

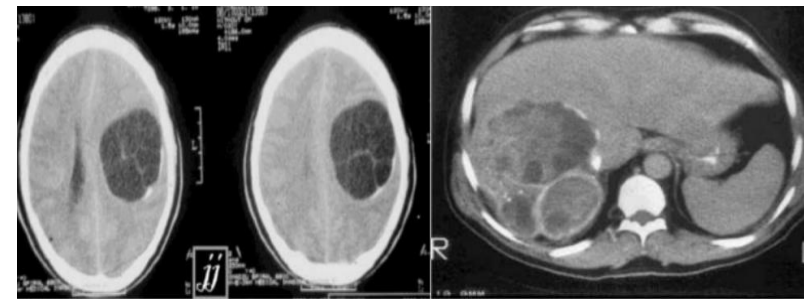
1- X- rays : to detect pulmonary cyst \pm calcification cysts and cysts in lungs



2- Ultrasonography (USG): detects both single and multiple abdominal cystic lesion.

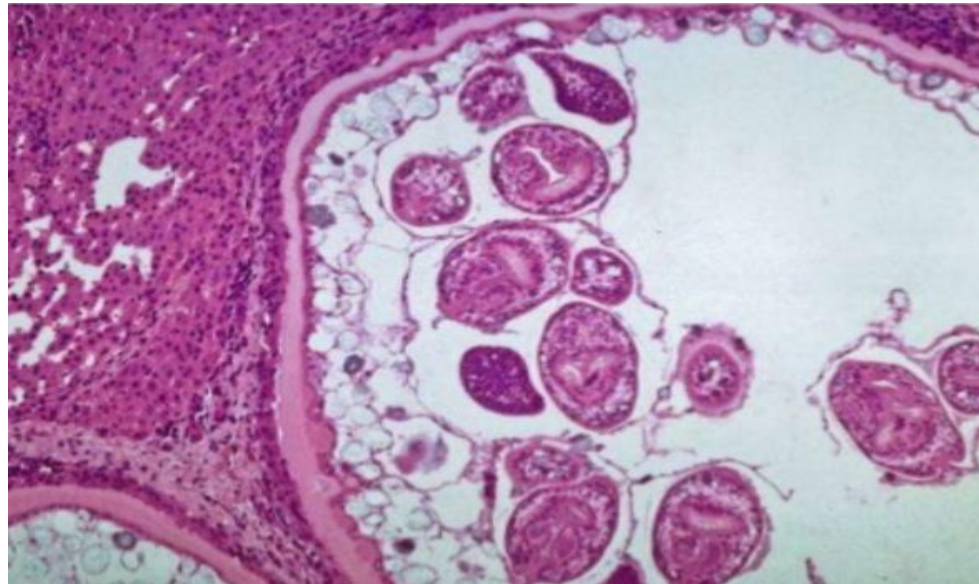


3- Computed tomography (CT scan):
It can detect 90-100% of cases.



➤ Histological examination

- Surgically removed cysts can be subjected to histopathological stains like Giemsa, hematoxylin and eosin (H&E) and periodic acid Schiff (PAS) stain to demonstrate the three layers of the hydatid cyst i.e ectocyst and endocyst.



➤ Blood examination

- Eosinophilia (20-25%) may be present.

➤ Molecular Methods

- Polymerase chain reaction (PCR) is also used to identify the parasite from DNA isolated from eggs or feaces.



Treatment

- ✓ Surgical removal of hydatid cysts 90% effective but can be risk depending on location, size and advancement of cyst
- ✓ It may need chemotherapy to prevent recurrence
- ✓ Chemotherapy :
 - 1- Albendazole is preferred treatment because it penetrates into hydatid cysts.
Dosage : 10 mg/kg body weight or 400 mg 2X daily for 4 weeks
 - 2- Mebendazole
Dosage : 40 mg/kg body weight 3X daily for 3-6 months
- ✓ Dogs are effectively treated with Praziquental



Prevention and Control

➤ **The most important factor in prevention and controlling echinococcosis are :-**

- 1- Education regarding the transmission of infection and the role of canines in the life cycle.
- 2- Proper personal hygiene and the washing of hands and cooking utensils in environments inhabited by dogs are critical.
- 3- Dogs should not be allowed in the vicinity of animal slaughter and should never be fed the viscera of slain animals
- 4- The killing of stray dogs has reduced the incidence of infection.

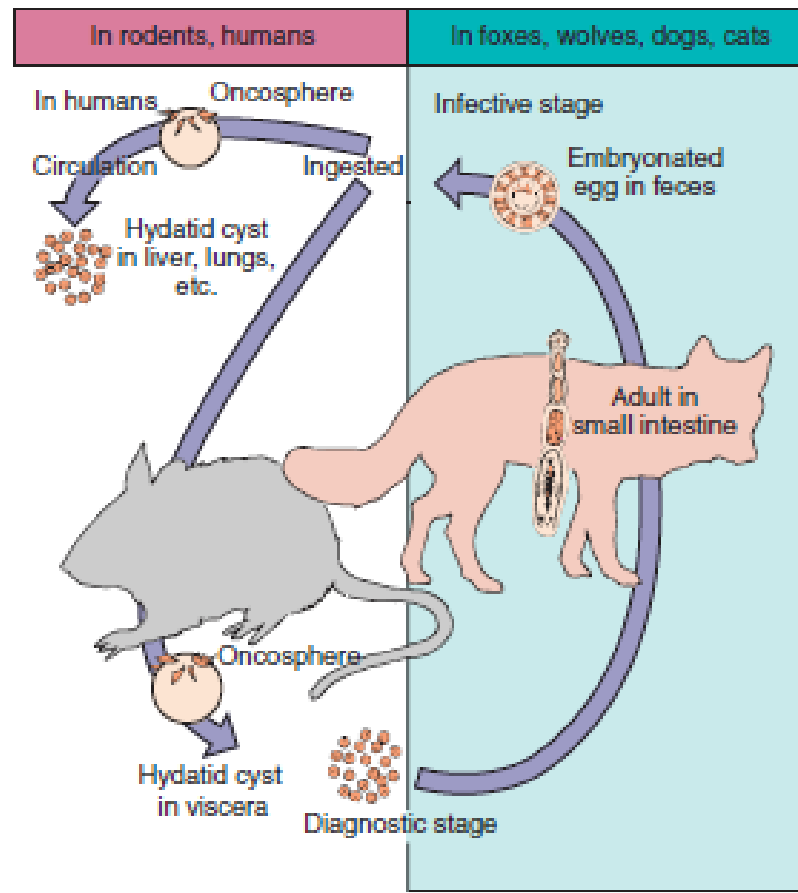


Echinococcus multilocularis

Ref: Eckert and Deplazes (2004)

- *E. multilocularis* cause Alveolar hydatid disease.
- *E. multilocularis* is morphologically similar to *E. granulosus* except it is smaller in size.
- Life cycle is similar to that of *E. granulosus* but the hosts are different.

- ❑ Definitive host : Foxes and wolves
- ❑ intermediate host : Rodents (mice, voles, shrews and lemmings)
- ❑ Man is an accidental host



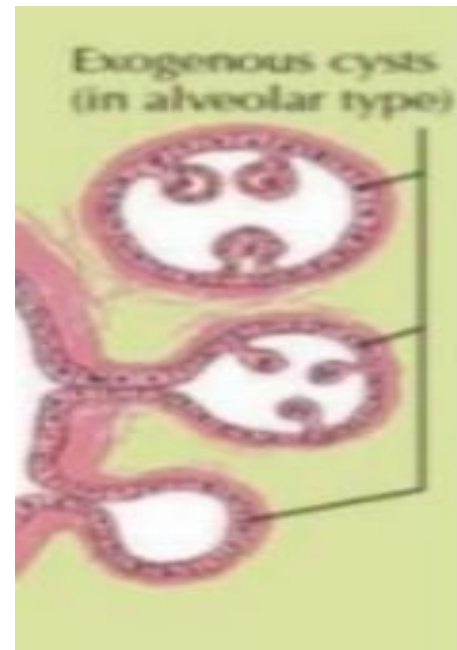
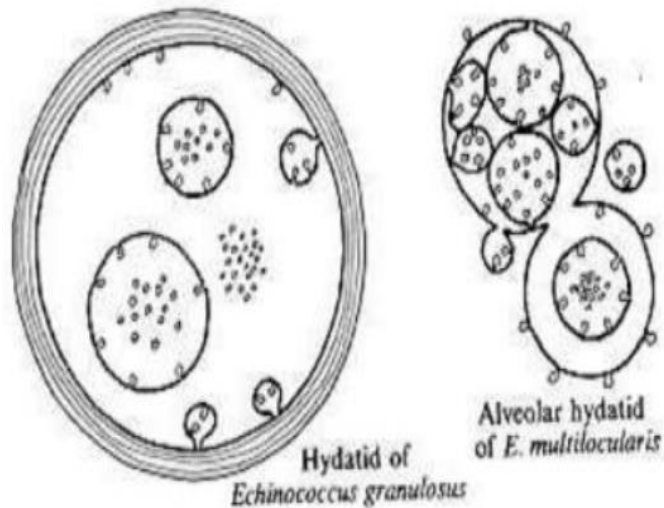
Question

What are the main differences between the hydatid cyst of *E. granulosus* and *E. multilocularis* ?



Echinococcus multilocularis

- The alveolar hydatid cyst develops as an alveolar or honeycombed structure that is not covered by a unilocular-limiting mother cyst-laminated membrane. The cyst grows via exogenous budding



Echinococcus multilocularis

Clinical Features

Ref: Garcia et al.,2011

- In the liver, alveolar hydatid cysts mimic a carcinoma, with liver enlargement and obstruction of biliary and portal pathways
- Malnutrition , ascites and portal hypertension produced by *E. multilocularis* create the appearance of hepatic cirrhosis

Diagnosis

Ref: Garcia (2006)

- Radiologic procedures
- Scanning techniques
- Serologic methods



Echinococcus multilocularis

Treatment

Ref: Garcia et al.,2002

- ✓ Surgical removal of the cyst is indicated , especially if an entire hepatic area can be resected.
- ✓ Chemotherapy : Albendazole and Mebendazole

Prevention and Control

Ref: Sorvillo et al.,2007

- 1- Education , proper personal hygiene
- 2- Deworming of farm dogs and cats are critical
- 3- It is extremely important to treat animals that have contact with children.



Classification

Kingdom: Animalia

Phylum: Platyhelminthes

Class: Cestoda

Order: Cyclophyllidea

Family: Hymenolepididae

Genus: *Hymenolepis*

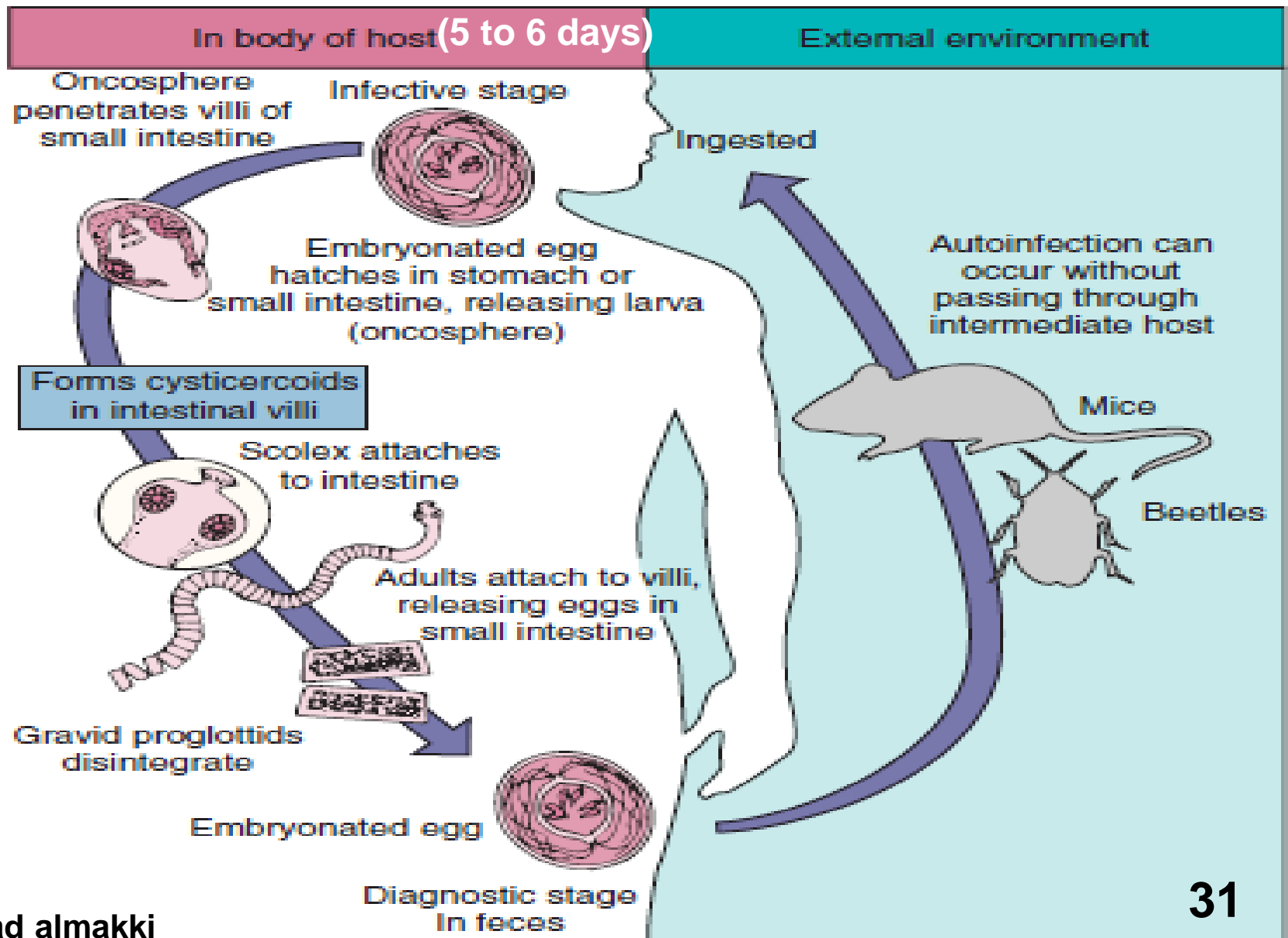
Species: *nana*



- ***H. nana* is commonly called the dwarf tapeworm**
- **Infection prevalence highest among children because of the simple life cycle of the parasite and in warm arid climates with poor sanitation facilities**
- **Transmission :**
 - Ingesting eggs in food or drink or from contaminated hand
 - Internal autoinfection
- **Epidemiology :**
 - The most common tapeworm infection in North America
- **The life cycle simple and does not require an intermediate host, although mice and beetles may be infected and enter the cycle**



Life cycle



Hymenolepis nana

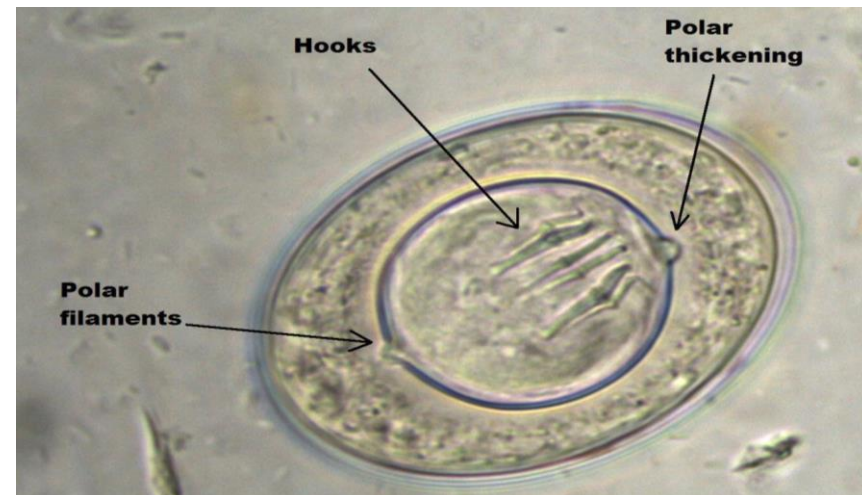
Clinical Features

Ref: Garcia et al.,2011

- Few worms in the intestine , there are no symptoms.
- In heavy infections, especially if autoinfection and hyperinfection occur (Eggs are able to hatch in the intestine, develop into a cysticercoid larva, and then grow into adult worms without leaving the host), patients experience diarrhea, abdominal pain, headache, anorexia and other vague complaints.

Diagnosis

- **Stool examination** reveals the characteristic *H. nana* egg with its six-hooked embryo and polar filaments



Hymenolepis nana

Treatment

Ref :Garcia et al.,2002

- ✓ The drug of choice is praziquantel ; an alternative is niclosamide

Prevention and Control

Ref: Sorvillo et al.,2007

- ❖ Treatment of cases, improved sanitation, and proper personal hygiene, especially in the family and institutional environments, are essential for controlling the transmission of H. nana



**Thank you for
your attention**

