

Paragonimus & E. granulosus

Class Trematoda (Flukes)

Trematodes are classified into four groups:

1. Liver flukes
 - Fasciola
2. Intestinal flukes
 - Heterophyes heterophyes
 - Fasciolopsis buski
3. Blood flukes
 - Schistosoma mansoni
 - Schistosoma haematobium
 - Schistosoma japonicum
4. **Lung fluke**
 - Paragonimus westermani



Paragonimus westermani (Oriental Lung Fluke)

Geographical Distribution

Endemic in the Far East of Asia (Japan, Korea, China, Philippines, and Central & South America).

Habitat

Lungs — in cyst-like pockets.

Definitive Host (D.H)

Man, fish-eating animals, and carnivorous animals.

Intermediate Hosts (I.H)

- 1st: Freshwater snail (**Semisulcospira**)
- 2nd: Freshwater crayfish or crabs

Disease

Paragonimiasis

Morphological Characters

Egg (Diagnostic Stage)

- Size: $90 \times 50 \mu\text{m}$
- Shape: Oval
- Shell: Thick shell with operculum
- Color: Golden brown
- Content: **Immature** ovum

Snail (1st I.H): Semisulcospira

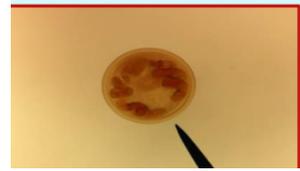
Crabs (2nd I.H)



Cercaria



Encysted metacercaria (I.S)



Cercaria

- Type: Microcercous cercaria with a small tail
- Infective Stage (I.S): Encysted metacercaria

Mode of Infection

Infection occurs by **eating raw** or **undercooked crabs** or **crayfish** containing **encysted metacercaria** (I.S).

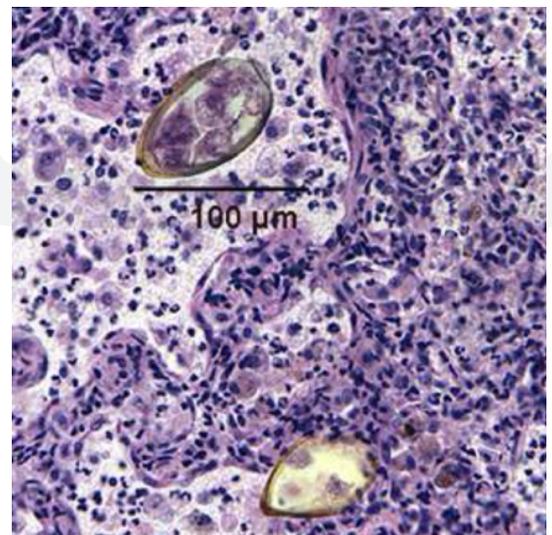
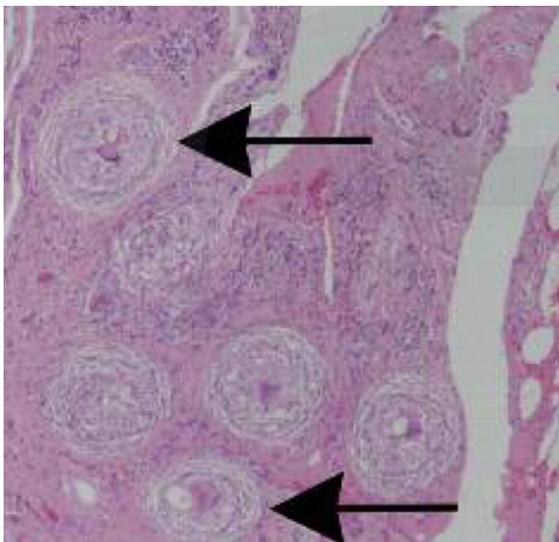
Pathogenesis & Symptomatology

Migration Stage

- **Non-specific symptoms:**
- Diarrhea
- Abdominal and chest pain
- Allergic reaction
- Fever and chills

Adult Worms in the Lungs

- Stimulate **granulomatous reaction** → formation of a **fibrous capsule** surrounding worms and eggs → formation of a **cyst containing blood-tinged fluid**.
- Small blood vessels in the capsule leak metabolites into bronchioles → **paroxysmal coughing** due to **discharge of eggs and metabolites**.
- Blood leakage from cyst **mixed** with **ova** → **blood-tinged sputum**.



- **Acute** and **chronic** inflammatory cell infiltrate with **eosinophils**.

- Eggs of *Paragonimus* spp. (from lung biopsy): 80–90 μm x 40–45 μm, stained with hematoxylin and eosin (H&E).

- Eggs entrapped in **non-necrotizing granulomas** surrounded by **concentric fibrosis**.

Clinical Manifestations

- **Rupture of cyst into bronchioles** → **pulmonary symptoms:**
- Fever
- Chest pain
- Cough with rusty sputum (blood tinged with eggs)

Complications:

- Pneumonia
- Bronchitis
- Lung abscess
- Pneumothorax and pleural effusion

Chronic cases resemble pulmonary tuberculosis.

Chronic Paragonimiasis

- 10–20% of radiograph findings are normal.
- Abnormal findings include:
- Lobar infiltration
- Cavities
- Calcified nodules
- Hilar enlargement

Paragonimus westermani is often diagnosed after TB treatment has failed, so differential diagnosis is very important.

Extrapulmonary Paragonimiasis

Flukes that miss the lungs produce extrapulmonary symptoms due to cysts, granulomas, and abscesses:

- **CNS:** Seizures, coma, paralysis
- **GIT:** Abdominal pain and diarrhea
- **Skin:** Migratory allergic skin lesions

CNS Paragonimiasis may occur.



Laboratory Diagnosis

Direct

- Detection of eggs (and sometimes adults) in rusty sputum.
- Detection of eggs in stool.
- Chest X-ray and CT scan.

Indirect

- Serological tests: Complement fixation test (CFT) and ELISA
- Eosinophilia

Treatment

1. Praziquantel — drug of choice
2. Surgical excision of extrapulmonary lesions



Echinococcus granulosus (Hydatid Worm)

Classification of Cestodes According to Habitat

1. Intestinal Cestodes

(Adult in small intestine of man — man is D.H)

- *Diphyllobothrium latum*
- *Taenia saginata*
- *Taenia solium*
- *Hymenolepis nana*

2. Tissue Cestodes

(Larvae in tissues of man — man is I.H)

- *Cysticercus cellulosae* (larva of *T. solium*) → Cysticercosis
- **Hydatid cyst** (larva of *E. granulosus*) → Hydatidosis
- *Cysticercoid nana* (larva of *H. nana*) → Cysticercoid nana

Echinococcus granulosus

Geographical Distribution

Cosmopolitan.

Habitat

Small intestine of the definitive host.

Hosts

- Definitive host (D.H): Dogs, foxes, and other canines
- Intermediate host (I.H): Sheep, cattle, pigs, and occasionally man

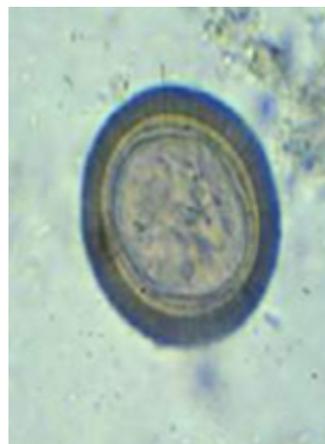
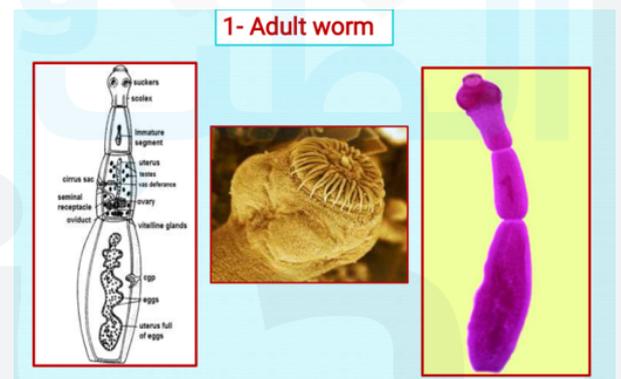
Morphological Characters

1. Adult Worm

(Small tapeworm)

2. Egg (Infective Stage to Man & Herbivores)

- Size: 30–40 μm
- Shape: **Spherical**
- Shell: Thick, radially striated embryophore
- Color: Brownish
- Content: **Mature** hexacanth embryo (oncosphere)



Life Cycle of E. granulosus

3. Hydatid Cyst (Larval Stage)

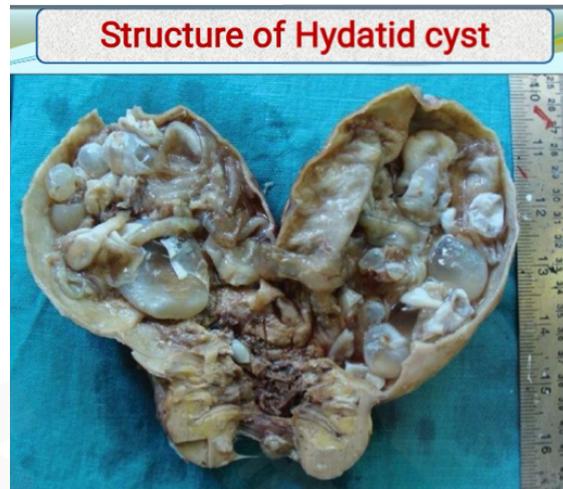
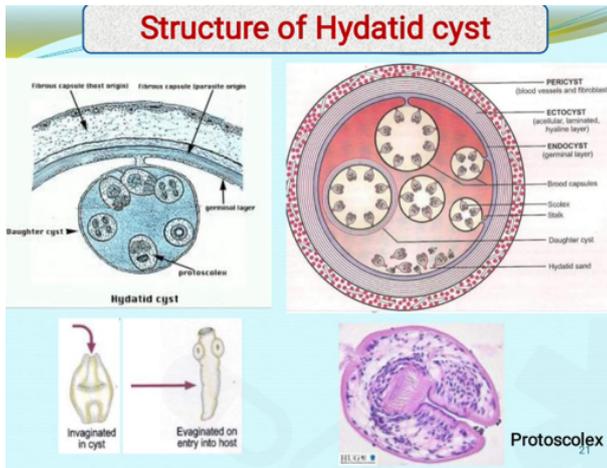
- Type: Simple unilocular hydatid cyst
- Size: Variable (1 mm – 20 cm; from pinhead to head of fetus)
- Shape: More or less spherical



Structure of Hydatid Cyst

Includes:

- Germinal layer
- Laminated membrane
- Hydatid fluid
- Brood capsules with protoscolices



Definition

A parasitic infection of humans and mammals (sheep, cattle, pigs) with hydatid cyst, the larval stage of Echinococcus species.

Mode of Infection

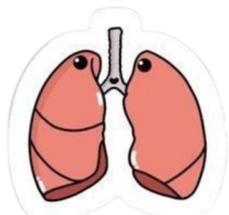
Ingestion of eggs with contaminated food or drink, or by handling dogs whose hair is contaminated with eggs.

Pathogenesis

1. Local inflammatory reaction → **fibrous capsule** (may calcify or ossify)
2. Symptoms depend on **size** and **site** of cyst
3. Large cysts → pressure atrophy of affected organs
4. **Liver (70%) most common** → Lung (20%) → others (10%): brain, bones, kidney, heart, muscles, eyes
5. Rupture of cyst → **anaphylactic shock** or **secondary cysts**
6. **Bacterial infection** → **abscess formation**

Pulmonary Cystic Echinococcosis

- More common in **children** than adults.
- Usually **asymptomatic** until cyst enlarges.



Complications (Due to Enlargement or Rupture):

- Cough
- Chest pain
- Dyspnea
- Hemoptysis
- Pneumothorax
- Pleural effusion
- Pulmonary abscess

Diagnosis

A. Clinical

- History of contact with **dogs**
- Slowly growing cystic tumor



B. Laboratory

Direct

- X-ray for calcified cyst
- Ultrasonography, CT scan, MRI
- Scolices in sputum (if cyst ruptures into bronchus)
- Puncture and aspiration of hydatid fluid (dangerous → may cause anaphylactic shock)

Indirect

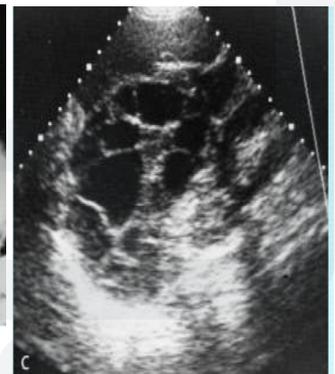
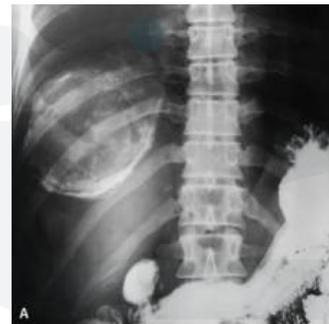
- Intradermal test (**Casoni test**)
- Serological tests: Indirect hemagglutination test, CFT, immunofluorescence antibody test, ELISA
- PCR: Nucleic acid detection
- Eosinophilia

Treatment

1. **Surgical removal of cyst**
 - Most efficient treatment
 - Mortality: 2%
 - Recurrence: 2–25%
2. **Percutaneous Treatment (PAIR method)**
 - **P**: Puncture
 - **A**: Aspiration
 - **I**: Injection of scolicidal solution (hypertonic NaCl or ethanol, left for 5–30 min)
 - **R**: Re-aspiration and final washing
 - Used for large symptomatic cysts or those in danger of rupture
3. **Medical Treatment**
 - Indicated for inoperable cases, before/after surgery
 - Albendazole (ABZ): 1–5 months
 - Combination of ABZ + Praziquantel (PZQ): Better efficacy (synergistic effect)

Disadvantages:

- **Drug resistance**
- **Long-term, high-dose use**



Case Discussion

- **5-year-old male** presented with **chest pain**.
- X-ray was performed which demonstrates a large cyst involving the right lung.
- CT shows a well defined cystic lesion involving the right lung
- Serological tests indicated positive Echinococcus infection



Echinococcus granulosus (Hydatid worm)	Paragonimus westermani (Lung fluke)	Feature
Cestode (tapeworm)	Trematode (fluke)	Type
Hydatidosis (Hydatid cyst disease)	Paragonimiasis	Main disease
Liver (mainly), lungs, brain, other organs	Lungs (cyst-like pockets)	Habitat in human
Dogs, foxes, other canines	Man, carnivorous animals	Definitive host
Sheep, cattle, pigs, occasionally man	1st: Freshwater snail 2nd: Crabs or crayfish	Intermediate host(s)
Egg with hexacanth embryo	Encysted metacercaria (in crab)	Infective stage
Ingesting eggs from contaminated food or dog contact	Eating raw/undercooked crab or crayfish	Mode of infection
Hydatid cyst in tissues	Egg in sputum or stool	Diagnostic stage
Hydatid cyst → pressure on organs, may rupture (anaphylaxis)	Lung cyst → cough with blood-tinged sputum	Main organ lesion
Rupture → anaphylactic shock, secondary cysts	Pneumonia, lung abscess, pneumothorax	Complications
Brain, bones, kidneys, heart, muscles, eyes	CNS, GIT, skin	Extra-pulmonary sites
Imaging (US, CT, MRI), Casoni test, ELISA, PCR	Eggs in sputum/stool, X-ray, CT, ELISA	Diagnosis
Surgical removal or PAIR + Albendazole ± Praziquantel	Praziquantel ± surgery	Treatment
Common in children; history of dog contact	Often misdiagnosed as tuberculosis	Special note



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لَا حَوْلَ وَلَا قُوَّةَ إِلَّا بِاللَّهِ
"من كنوز الجنة"

