



# THE GI SYSTEM



## Microbiology

Sheet

Slide

Handout

Number: 3

Subject: Parasitology

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Date: 0/0/2016

Price: .....

## **Tenia solium & Tenia saginata**

### Differences between Tenia solium & Tenia saginata

	T. Solium	T. Saginata
Intermediate host	Pig	Cattle (cow)
Scolex	4 suckers , rostellum	4 suckers , no rostellum
length	2 – 4 meters	4 – 6 meters
Number of Proglottids	1000	2000
Proglottid shape	Extended , rectangular	Square shaped
Ovaries	3 ovaries	2 ovaries
Number of Lateral branches of the uterus in a gravid proglottids	7 – 15 Branches on each side	15 – 30 Branches on each side
Shape of the eggs (similar in both)	Striated border , Hexacanth in the middle	Striated border , Hexacanth in the middle

#### Life cycle of Tenia:

- 1- The worm reaches the small intestine of the human and attach the mucosa by means of the Scolex.
- 2- It releases its gravid proglottids inside the lumen of the intestine.
- 3- Gravid proglottids exit the body along with the feces.
- 4- These proglottids disintegrate and release their eggs in the soil.
- 5- The intermediate host ingests the eggs.
- 6- In the lumen of small intestine of the intermediate host, the hexacanth is then released.
- 7-The hexacanth attaches to the walls of the small intestine, and then penetrates through the wall of the intestine and get distributed to all tissues of the host.
- 8- The hexacanth is converted to a cyst cercus; which is a balloon like structure filled with clear fluid and inside it there is an invagination forming a rudimentary Scolex.
- 9- Human (the primary host) eats raw, undercooked meat which contains alive cysticerci.

10- These cysticerci reach the small intestine, and release the rudimentary Scolex which attaches to the wall of the small intestine.

11- The cysticercus begins to grow and the proglottids proliferate to finally form the adult worm.

\*\*\*We can kill these cysticerci by freezing or cooking with high temperatures.

\*\*\*These worms may live inside the human body for 15-20 years.

\*\*\*Usually only one worm if found at a time inside the GI tract of the human (solium means ‘single’ or ‘one’) but in rare cases we may find 2 or 3 worms simultaneously.

#### Diagnosis:

Looking for active, motile proglottids in the feces. It's rare to find eggs in the feces due to gravid proglottid rupturing in the host's intestines.

\*\*\*Because human tissues somewhat resemble that of the pig but not the cow, in solium but not saginata infections, there is a possibility that the human becomes an intermediate host by the direct ingestion of eggs or by rupture of proglottids in the small intestine.

If a gravid proglottid rupture in the small intestine

1- Eggs are found in feces.

2- Human become an intermediate host and dead end host.

So the eggs release their hexacanth in the intestine of human instead of a pig. This hexacanth then invades the intestinal wall and enter the circulation and spread to all tissues.

\*\*\*The problem with this is that the hexacanth eventually becomes a cysticercus. The presence of

cysticerci in human tissues is called cysticercosis and causes an inflammatory reaction in these tissues.

\* Cysticercosis in muscles and the brain may give rise to epilepsy, focal, motor and sensory deficits

\* Cysticercosis in the eye may give rise to partial or even full blindness.

## **Diphyllobothrium latum**

Known as the fish tapeworm because fish is the intermediate host.

This worm is the largest worm measuring around 10 meters – can be considered the ‘giant’ worm, and they contain 3,000 proglottids

Have 2 longitudinal suckers rather than 4 as in tenia.

The Scolex of this worm is elongated and contains two longitudinal sucking discs on each side.

The egg here doesn’t look like the usual cestodes egg. Rather, it got the characteristics of the egg of trematodes. So, it is large, oval, and contains an operculum.

### **Life Cycle:**

1- The egg is released into the water.

2- The operculum opens releasing the embryo which is Not a hexacanth; it is called coracidium (doesn’t have any hooks but it has cilia, which aid in its movement in water).

3- These ciliated coracidia are ingested by certain crustaceans, which are considered the first intermediate

host. These crustaceans are copepods or Cyclopes.

4- This coracidium then develops inside the first intermediate host.

5- The second intermediate host, which is a fish, eats the first intermediate host. The coracidium will then migrate to the different tissues of the fish.

6- Human eat raw fish ingesting these coracidia which eventually grow to full grown adult.

Because this worm is very long, it may reduce the level of vitamin B12 in the blood causing macrocytic-megaloblastic anemia.

Diagnosis:

Looking for proglottids or eggs in feces.

## **Echinococcus granulosus**

The smallest worm that can infect humans; it's only a centimeter long consisting of 3 proglottids: immature, mature and gravid.

It's actually not a human tapeworm

The primary host is a canine animal like dogs, foxes and wolves.

The intermediate host is herbivore (sheep, cattle or a goat) and occasionally humans.

The Scolex consists of 4 suckers and a rostellum as the usual structure of Scolex of a cestode.

### **Life cycle of the worm**

1- When the worm is present in the lumen of small intestine of the primary host, say a dog, it produces proglottids and eggs.

2- The eggs are excreted with feces and contaminate the grass.

3- Herbivores eat the grass, the egg becomes a hexacanth which penetrate the wall of small intestine and get distributed all over the tissues of the intermediate host.

4- The hexacanth in tissues becomes a cyst (NOT a cysticercus)

5- A dog eats the intermediate host and this cyst becomes an adult worm.

\*\*\*Humans can ingest these cysts by eating this herbivore or food contaminated with dog's feces or by close contact with dogs.

Generally, human is considered a dead end host but sometimes, a wolf may eat a human.

Eating undercooked sheep meat will not cause infection to humans because humans are not a primary host.

*Echinococcus granulosus* causes hydatid cyst disease.

The structure of the hydatid cyst

It has a double-layered membrane:

- 1- Outer: acellular laminated hyaline membrane
- 2- inner: cellular germinal layer

Within the cyst we have yellowish clear fluid and the diameter of the cyst is about 1-2 cm.

The germinal epithelium layer have a neoplastic tendency and can give new daughter cysts inside the original mother cyst and the daughter cyst can produce grand-daughter cysts causing the original cyst to get bigger and reach about 10-12cm in diameter which makes it looks like a neoplasm

Eventually, rounded structures called brood capsules develop inside the original cyst. These brood capsules are

only surrounded by the germinal layer without the laminar layer

These capsules then acquire small structures called protoscolex that look like Scolex but not as developed. These contain suckers and the beginning of rostellum. The protoscolices under the microscope look like grains of sand (thus they're called hydatid sands)

When these hydatid cysts burst, they release their fluid and contents of protoscolices which scatter and live in tissues to produce new cysts giving it a metastatic nature like a malignant tumor.

These cysts most commonly metastasize from GIT to liver (most common), lungs (second most common) or to other organs including Kidneys, skin, bones, or even the brain

Diagnosis:

- 1- Clinical presentation, CT scan, Ultrasound, X-ray.
- 2- Cassoni test which is a hypersensitivity skin test given as injection under the skin.

If there's an inflammatory reaction at the site of injection, then the patient is 80% infected with this worm. (Not 100% because this test gives 20% false positive).

If there's no inflammatory reaction, then the patient is 100% not infected.

Treatment: we can give a drug but the treatment is usually by a surgical procedure.

The cyst is removed avoiding its rupture and spillage of its content that causes anaphylactic shock and dissemination in the adjacent tissues.