Parasitology

Cestodes Lecture: 3

5-6/12/2021

Adult tapeworm infections

Hymenolepiasis

Is caused by two cestodes (tapeworms) species:

1. ***Hymenolepis nana* (dwarf tapeworm) .**
2. ***Hymenolepis dimnuta* (rat tapeworm). A cestode of rodents infrequently seen in humans and frequently found in rodents .**

Hymenolepis nana

Disease: Hymenolepiasis or Dwarf tapeworm infection

***Hymenolepis* species**

- Genus is derived from the membranous character of the egg shell "hymen".
- 3 testes in each mature segment.
- Uterus is sac-like and transverse.
- Eggs possess two membranes' outer membrane is thin and transparent.
- Larval stage is called cysticercoid. Small bladder containing the invaginated head proximally and a solid, elongated portion as a caudal appendage.
- There are 2 species:
    - *Hymenolepis nana*
    - *Hymenolepis diminuta*

Notes:

- Smallest tapeworm infecting man.
- Found worldwide.
- Mainly among children. Infection more in school children and institutional population.
- The infection is primarily limited to children in warm climates.
- Only human tapeworm that can complete its life cycle in a single host.
- Man can harbour both the adult and larval stages of the parasite.
- No intermediate host is required in some infection.

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- It can utilized flees and beetles for development of cysticercoids.
- Exception to the general rule that "Helminths do not multiply inside the body of the definitive host".
- Parasite of small intestine.

Morphology:

- *H. nana* is the smallest of the tapeworm of man.
- Found in the ileum.
- Delicate strobila.
- It length is 25-40 mm. X 1mm. (it contain 200 proglottids and they are broader than their long).
- Scolex is provided with four suckers and rostellar crown of 20-30 minute hooklets.
- The neck is long and slender.
- Worms may be present in large numbers from 1,000 to 8,000.
- Short life span, about 2 weeks.
- Transverse uterus.
- 3 testes.
- Mature segment: wider than long testes 3 globes mid-lateral genital pore.
- Terminal gravid proglottids usually disintegrate before separating from the strobila, so that the eggs are randomly mixed with the feces.
- Eggs are spherical, measured 30-47µm. There are two thin membranes shells, the inner one of which has polar thickenings, each provided with 4-8 long thread like filaments extending into the space between the inner and outer shell. Floats in saturated solutions of common salt.

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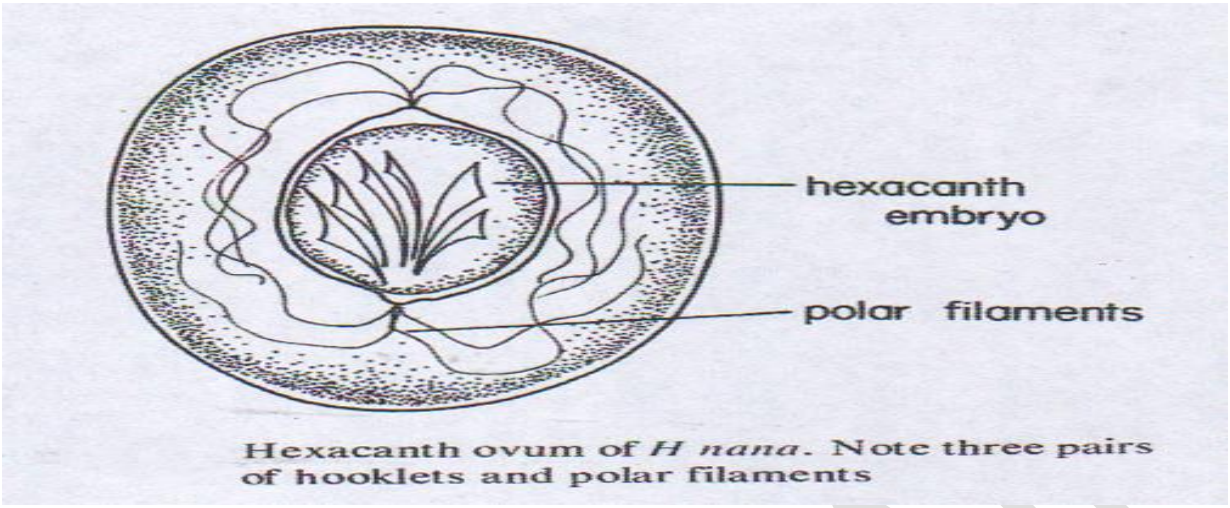


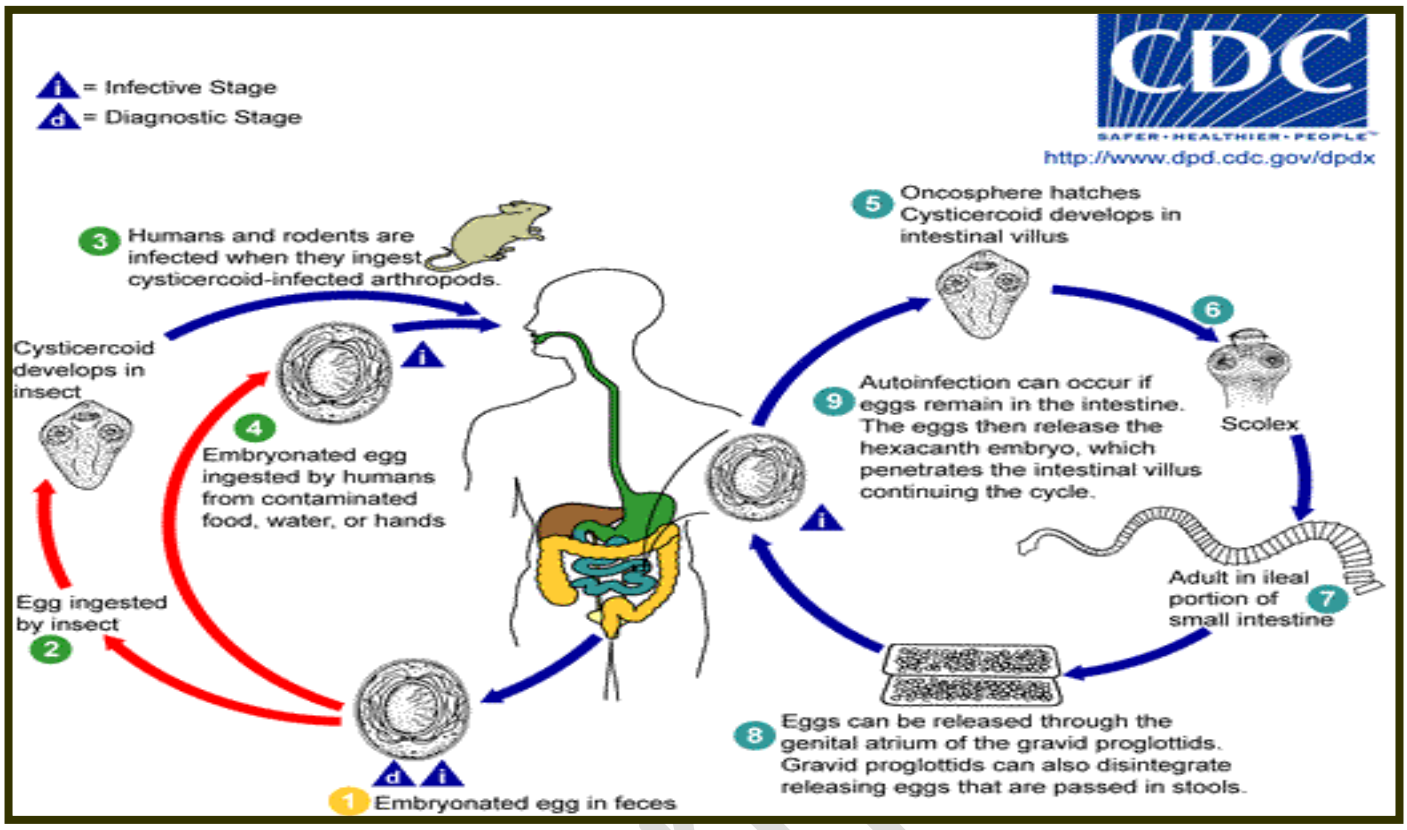
Hexacanth ovum of *H nana*. Note three pairs of hooklets and polar filaments

- **cysticercoid larvae (a small solid larva with the scolex enveloped by tissue of its body).**

Mode of transmission is through:

- **Direct**
  - Host ingests eggs that hatch in the duodenum.
- **Indirect pathway**
  - Accidental ingestion of infected arthropod intermediate host like rice and flour beetles in which cysticercoid larvae are released and develop into adult worms in the small intestine of the host.

Life cycle:



Eggs of *Hymenolepis nana* are immediately infective when passed with the stool and cannot survive more than 10 days in the external environment[1]. When eggs are ingested by an arthropod intermediate host [2](various species of beetles and fleas may serve as intermediate hosts), they develop into cysticercoids, which can infect humans or rodents upon ingestion [3]and develop into adults in the small intestine. A morphologically identical variant, *H. nana* var. *fraterna*, infects rodents and uses arthropods as intermediate hosts. When eggs are ingested [4](in contaminated food or water or from hands contaminated with feces), the oncospheres contained in the eggs are released. The oncospheres (hexacanth larvae) penetrate the intestinal villus and develop into cysticercoid larvae[5]. Upon rapture of the villus, the cysticercoids return to the intestinal lumen, evaginate their scoleces [6], attach to the intestinal mucosa and develop into adults that reside in the ileal portion of the small intestine producing gravid proglottids [7]. Eggs are passed in the stool when released from proglottids through its genital atrium or when proglottids disintegrate in the small intestine[8]. An alternate mode of infection consists of internal autoinfection, where the eggs release their hexacanth embryo, which penetrates the villus continuing the infective cycle without passage through the external environment[9]. The

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life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years.

Note:

- **An alternate mode of infection consists of internal autoinfection (in heavy infection), where the eggs release their hexacanth embryo, which penetrates the villus continuing the infective cycle without passage through the external environment .**
- **The life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years .**

Pathogenesis & Symptoms:

- Infection with *H. nana may* produce no detectable symptoms.
- Heavy infection is more pathogenic (Intestinal disturbances and Neurological manifestation).
- Symptoms are produced due to patient's immunological response to the parasite.
- Diarrhea.
- Anorexia.
- Vomiting.
- Insomnia.
- Loss of appetite & weight.
- Irritability.
- Headache.
- Dizziness.
- Pruritus of the nose and anus.
- Abdominal pain.
- Pallor.
- Desquamation of intestinal epithelial cell or as serious as necrosis may occur.
- Occasionally epileptic seizures (children)

Regulatory immunity will eventually limit the infection.

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Diagnosis:

Stool examination

Diagnostic stage:

Egg,Proglottids are not recovered because they undergo degeneration prior to passage.

Note:

Diagnosis complicated by small size of worms, making their observation in stools difficult; eggs may sometimes be observed in fecal flotation examinations.

Treatment:

- Praziquantel 25mg/kg single dose. (Repeated after 10 days and Treat all family).
- Drug dosage is higher than that of taeniasis because of resistant cysticercoids in intestinal tissue.

Control:

- **Personal hygiene esp.children**
- **Mass treatment of patients**
- **Sanitation.**
- **Fleas control**
- **Rodents control**

Hymenolepis diminuta

Disease: Hymenolepiasis or Rat tapeworm infection

Parasite of rats, mice & other rodents also it has been reported from human, usually children.

- Rat tapeworm
- Common parasite of rats and mice
- Accidental human infections
- Differs from *Hymenolepis nana* in morphology and life cycle because it requires an intermediate host
- 2 Hosts
    - Larval stage: cysticercoid is passed in fleas.

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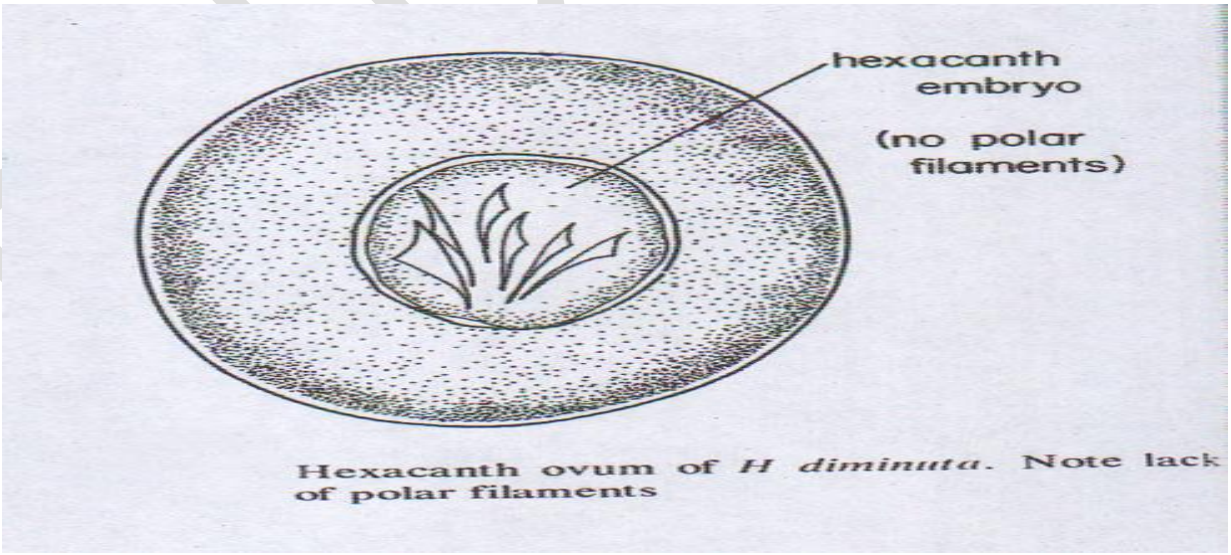
- Adult stage: in rats and mice and accidentally in humans especially children who accidentally ingest infected fleas.

Epidemiology

- World wide.
- Common among children due to ingestion of infected grain beetles, dried fruits, flour and cereals.
- Prevalence of *H. diminuta* in Philippine rats is about 8%.

Morphology:

- **Adult measure 20-60 cm. X 3.5-4.0mm. It contain 1000 or more proglottids**
- **Scolex is provided with four small suckers and a rudimentary unarmed rostellum.**
- **The neck is short and stout.**
- **Mature segment: wider than long testes 3 globes mid-lateral genital pore.**
- **Gravid proglottids usually disintegrate while still attached to the strobila, liberating fully embryonated ovoid to subspherical eggs.**
- **Egg: there is a space between the tanned outer membrane and the inner one. The latter one is provided with a pair of polar thickenings, but lacks the polar filaments the characteristic of *H. nana* eggs.**



Hexacanth ovum of *H diminuta*. Note lack of polar filaments

- **Cysticercoid of *Hymenolepis diminuta* : This larva has no bladder but instead has a tail. The dark body within the spherical portion is the scolex. The longer the tail, the more mature cysticercoid. This stage is found inside an insect such as the mealworm.**

Life cycle:

- **Eggs of *Hymenolepis diminuta* are passed out in the feces of the infected definitive host (rodents & man).**
- **The mature eggs are ingested by an intermediate host (various arthropod adults or larvae).**
- **Oncospheres are released from the eggs and penetrate the intestinal wall of the host, which develop into cysticercoid larvae.**
- **The cysticercoid larvae persist through the arthropod's morphogenesis to adulthood.**
- ***H. diminuta* infection is acquired by the mammalian host after ingestion of an intermediate host carrying the cysticercoid larvae.**
- **Humans can be accidentally infected through the ingestion of insects in precooked cereals, or other food items, and directly from the environment (e.g., oral exploration of the environment by children).**
- **After ingestion, the tissue of the infected arthropod is digested releasing the cysticercoid larvae in the stomach and small intestine.**
- **Eversion of the scolece s occurs shortly after the cysticercoid larvae are released.**
- **Using the four suckers on the scolex, the parasite attaches to the small intestine wall.**
- **Maturation of the parasites occurs within 20 days.**
- **Eggs are released in the small intestine from gravid proglottids that disintegrate after breaking off from the adult worms.**
- **The eggs are expelled to the environment in the mammalian host's feces.**

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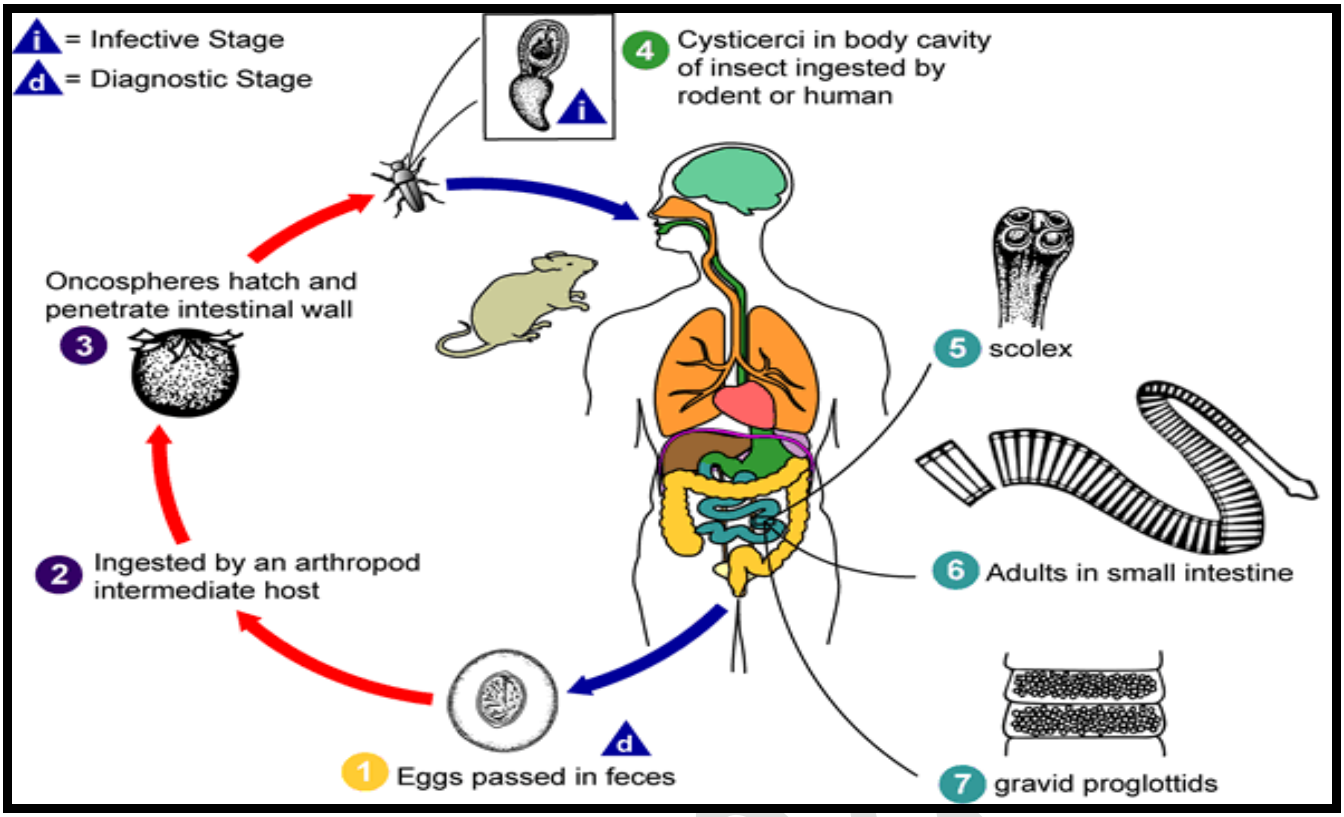

Pathogenesis & Symptoms:

H. diminuta **infection usually produces no symptoms. Worm burden in rodents is relatively low.**

Diagnosis:

Stool examination

Diagnostic stage:

Egg.

Treatment:

Similar to *H. nana* infection (Praziquantel 25mg/kg body weight single dose).

Control:

Eradicate rats around the home.

End of Cestodes Lecture: 3

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