

# Tapeworms (Cestodes)

Cestodes are tapeworms. There is a large variety of tapeworms but only those that are pathogenic to humans will be discussed here.

## Tapeworms that are pathogenic to humans

These include:

- *Taenia solium* (pork tapeworm).
- *Taenia saginata* (beef tapeworm).
- *Diphyllobothrium latum* (fish or broad tapeworm).
- *Hymenolepis nana* and *Hymenolepis diminuta* (dwarf tapeworm and rat tapeworm respectively).
- *Echinococcus granulosus* and *Echinococcus multilocularis* (cause hydatid disease).
- *Spirometra* spp. plerocercoid tapeworm larvae (resulting in sparganosis).

## Taenia solium and Taenia saginata

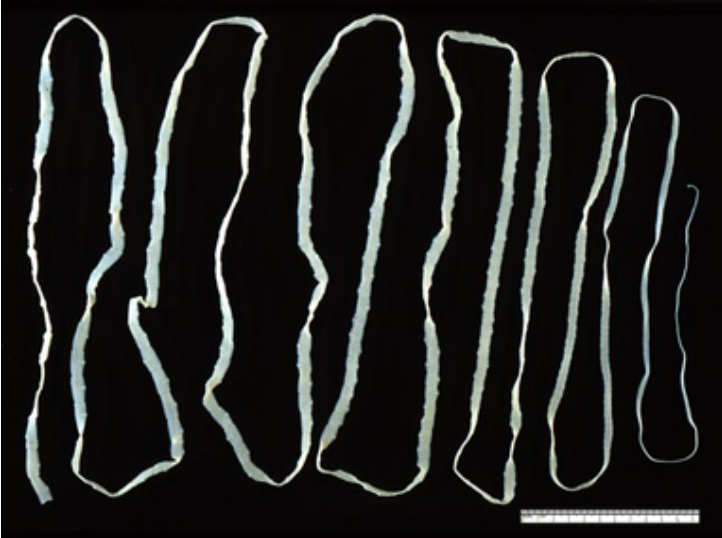
These cause 'taeniasis'.

### Epidemiology

- Present worldwide.
- Incidence is higher in developing countries - 10% of the population can be affected.
- The pork tapeworm has a higher incidence.

### Morphology

#### *T. saginata*



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- Usually less than 5 m long but can grow up to 25 m; 12 mm broad.
- The head, called the scolex, is pear-shaped.
- It has no hooks and no neck.
- It has four suckers in the head.
- The body is long and flat with several hundred segments called proglottids - hermaphroditic, egg-producing sections.
- Each proglottid is 18 x 6 mm with a branched uterus.
- Eggs are round and yellow-brown in colour.

### ***T. solium***

- It has a variable size and can be up to 7 m long; it has a neck and a long flat body.
- The scolex is globular in shape.
- There are four suckers and hooks.
- Proglottids are 5 x 10 mm and also have branched uteri.

### **Life cycle**

Poorly cooked meat is ingested by humans who are the only definitive hosts. The poorly cooked meat includes tapeworm larval cysts (cysticerci) which then release larvae. These attach to the small intestine by the scolex suckers. The tapeworm then matures over 3-4 months during which the proglottids develop. The tapeworm can survive for up to 25 years in humans during which time the gravid proglottids are released into the faeces.

The excreted tapeworm eggs which are excreted in the faeces can survive on vegetation where they are then consumed by cattle or pigs. Once in these animals the eggs hatch and cysticerci are released. These pass into the animal circulation from the small intestine and reside in the muscle. Humans are then infected by eating raw meat containing the cysticerci.

## **Presentation**

### **Taeniasis**

- This results from either *T. saginata* or *T. solium* and relates to the adult tapeworm in the gut.
- This depends on the load of the infectious agents.
- Light infection may be asymptomatic. Heavier infection leads to epigastric pain, diarrhoea and vomiting.

### **Cysticercosis**

*T. solium* can also lead to cysticercosis whereby larval cysts infiltrate the lung, liver, eye or brain. This results in inflammation leading to clinical features such as severe sight impairment and neurological symptoms. In some countries (eg, Peru and Mexico) neurocysticercosis accounts for 30% of seizures,<sup>[1]</sup> making it an important cause of morbidity and mortality worldwide.

## **Investigations**

- Recover eggs or proglottids in stool or perianal area.
- Cysticercosis is confirmed by the presence of antibodies and imaging - eg, CXR, CT scan of the brain.

## **Treatment and management**

- Niclosamide or praziquantel (single dose) can be used (available on a named-patient basis).<sup>[2]</sup>
- Treatment is very effective.<sup>[3]</sup> Satisfactory treatment requires expulsion of the scolex.
- There has been suggestion to use a purgative before and after to improve expulsion of the tapeworm.<sup>[4]</sup>

## Prevention

- Inspect meat thoroughly.
- Adequate handling of food – eg, freezing or cooking.
- Cysticerci do not survive temperatures of <10°C and >50°C.
- The World Health Organization (WHO) advocates the periodic treatment of tapeworms such as *T. solium* in endemic areas with albendazole. This can prevent neurocysticercosis at a later stage.<sup>[1]</sup>

## Diphyllobothrium latum (fish or broad tapeworm)

Tapeworm infection results from eating raw or improperly cooked freshwater fish.

### Epidemiology

Present worldwide, especially in subarctic and temperate regions.

### Morphology

- This is the longest tapeworm in humans – 3–10 m in length.
- It has >3,000 proglottids which are more broad than long.
- The scolex is shaped as two almond leaves.
- Eggs are 35–55 x 55–75 micrometres.

### Life cycle

Man and some animals are infected by this tapeworm. The plerocercoid larvae result in infection in humans. The cycle begins by the ingestion of uncooked fish containing plerocercoid larvae which attach to the small intestine. In 3–5 weeks the tapeworm matures to adult size. The adult tapeworm releases eggs that are passed into the faeces. These eggs hatch in fresh water, releasing ciliated coracidia. These are subsequently ingested by the water flea (cyclops) and release proceroid larvae. The cyclops are then ingested by freshwater fish, forming plerocercoid larvae which when ingested lead to infection.

### **Fish tapeworm symptoms**

This depends on the number of tapeworms. Mild infection leads to:

- Abdominal discomfort.
- Loss of appetite.
- Loss of weight.
- Malnutrition.
- B12 deficiency, which may occur with heavier infections and may lead to anaemia and even subacute combined degeneration of the spinal cord.

### **Investigations**

Recover typical eggs or proglottids in stools.

### **Treatment and management**

Praziquantel is first-line. Niclosamide can also be used. <sup>[5]</sup>

### **Prevention**

- Freeze fish for 24 hours.
- Thoroughly cook fish.
- Pickle fish.
- Prevent sewage contamination of fish reservoirs.

# Hymenolepis nana (dwarf tapeworm)

This is a relatively small tapeworm (15–40 mm) and tends to infect children. The reservoir is rodents and transmission is oro-faecal. Thus, cross infection and auto-infection are common in children.

## Life cycle

The eggs are ingested and invade the small intestine where they mature into adult tapeworms. These adults reside for several weeks.

## Dwarf tapeworm symptoms

Light infection is associated with vague abdominal pain but enteritis can occur with heavier infections.

## Investigations

Presence of eggs in faeces.

## Treatment and management

Niclosamide or a single dose of praziquantel are the drugs of choice.

## Prevention

Good hygiene can effectively prevent spread.

*Hymenolepis diminuta* is the rat tapeworm. It is much longer than *H. nana* and primarily affects rats but very rarely it can be accidentally ingested by humans - eg, by ingestion of insects that carry the parasite. Most interest in it relates to research. The presentation and management are similar to those of *H. nana*.

# Echinococcus granulosus and Echinococcus multilocularis<sup>[6]</sup> <sup>[7]</sup>

*E. granulosus* and *E. multilocularis* cause hydatid disease. Dogs and other canids are the definitive hosts.

## *E. granulosus*

## Epidemiology

*E. granulosus* is common in Asia, Australia, East Africa, southern regions of Spain, South America and North America. In these areas, 1-2 per 1,000 population are affected. Incidence rates are higher in some rural areas.

## **Morphology**

*E. granulosus* is the smallest of the tapeworms (3-9 mm long) and it only has three proglottids.

## **Life cycle**

The adult tapeworms live in domestic and in wild carnivorous animals. Infected animals pass eggs in their faeces, which are then ingested by grazing farm animals and humans. The eggs then localise in various organs, resulting in a hydatid cyst which contains many larvae (called 'hydatid sand'). Other animals may then consume the infected organs and the cysts then release proto-scolices. These pass into the small intestine, leading to adult tapeworms.

In humans, the echinococcus eggs invade the small intestine and then enter the circulation. The cysts then locate and reside in organs including the liver, bone, lung and brain. Cysts are usually 1-7 cm but can be as big as 30 cm.

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## **Symptoms**

Symptoms depend on the site where the cysts have located and are similar to a growing tumour. Examples include:

- Large abdominal cysts which lead to discomfort.
- Liver cysts resulting in jaundice.
- Lung cysts which can lead to abscess formation.
- Brain cysts which can cause focal seizures and raised intracranial pressure.
- Cyst content which can lead to anaphylaxis.

## **Investigations**

- Eosinophilia.
- Abnormal LFTs.

- Antibodies against hydatid fluid.
- Imaging - eg, CXR, CT scan of the liver or abdomen, brain CT or MRI scan.

## Treatment and management

- Surgical removal of a cyst or inactivation of a cyst by injection of 10% formalin followed by resection.
- Often, complete resection of the cyst is impossible due to close proximity to major vessels.<sup>[8]</sup>
- Medication may be necessary to keep the cyst from recurring. The drug of choice is albendazole.<sup>[9]</sup>

## Prevention

- Avoid contact with infected animals.
- Eliminate the infection in domestic animals.

### ***E. multilocularis***

This is similar to *E. granulosus* with similar morphology and life cycle. It tends to occur in parts of Asia and North America and in Europe too. The intermediate host is rodents. The presentation is similar to *E. granulosus* but the cysts are multilocular. Again, therapy involves surgery.

*E. multilocularis* is resistant to praziquantel, although high doses of albendazole or mebendazole may be effective. Prevention involves rodent control measures.

## Spirometra spp.

Plerocercoid tapeworm larvae of *Spirometra* spp. can cause sparganosis, which is rare but has a tendency to affect the following:<sup>[10]</sup>

- Subcutaneous tissue
- Skeletal muscle
- Visceral organs
- Central nervous system



- Spinal cord

## Epidemiology

It is found worldwide – most commonly in East Asia. Infection results from:  
[10]

- Ingesting contaminated water or raw or inadequately cooked flesh of snakes or frogs.
- Applying skin of an infected animal to skin as a poultice.

## Symptoms

This depends on which area of the body is affected – eg, spinal involvement presents with weakness and paraesthesia.

## Investigations

- Eosinophilia may not be present if the tapeworm is localised to an organ.
- ELISA tests of serum or cerebrospinal fluids to detect antibodies to sparganosis.

## Treatment and management

- Treatment involves removal of the tapeworm – eg, surgery.
- Any surrounding inflammation may require corticosteroids.

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## Further reading

- [Tapeworm](#); World Health Organization.
- [Cestodes](#); Medecins Sans Frontieres.
- [Parasites – Taeniasis](#); Centers for Disease Control and Prevention (CDC).

## References

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| <p><b>Last updated by:</b><br/>Dr Colin Tidy, MRCP<br/>14/06/2022</p>       |  |
| <p><b>Peer reviewed by:</b><br/>Dr Hayley Willacy, FRCGP<br/>14/06/2022</p> | <p><b>Next review date:</b><br/>13/06/2027</p> |

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