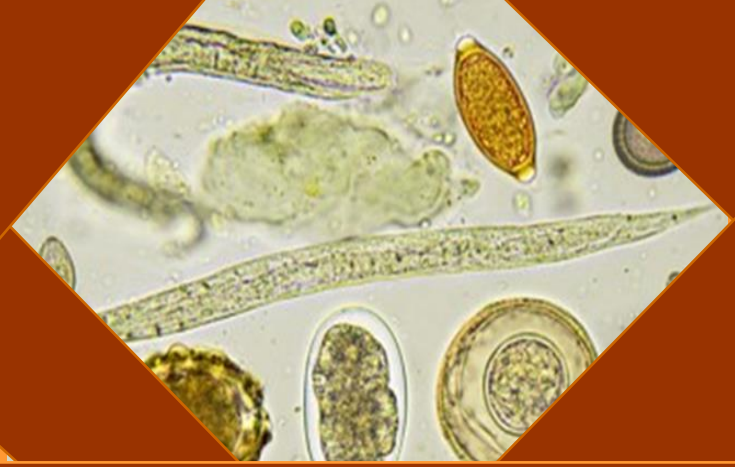


Medical Parasitology

Prof. Dr. Ahmed Ali Mohammed



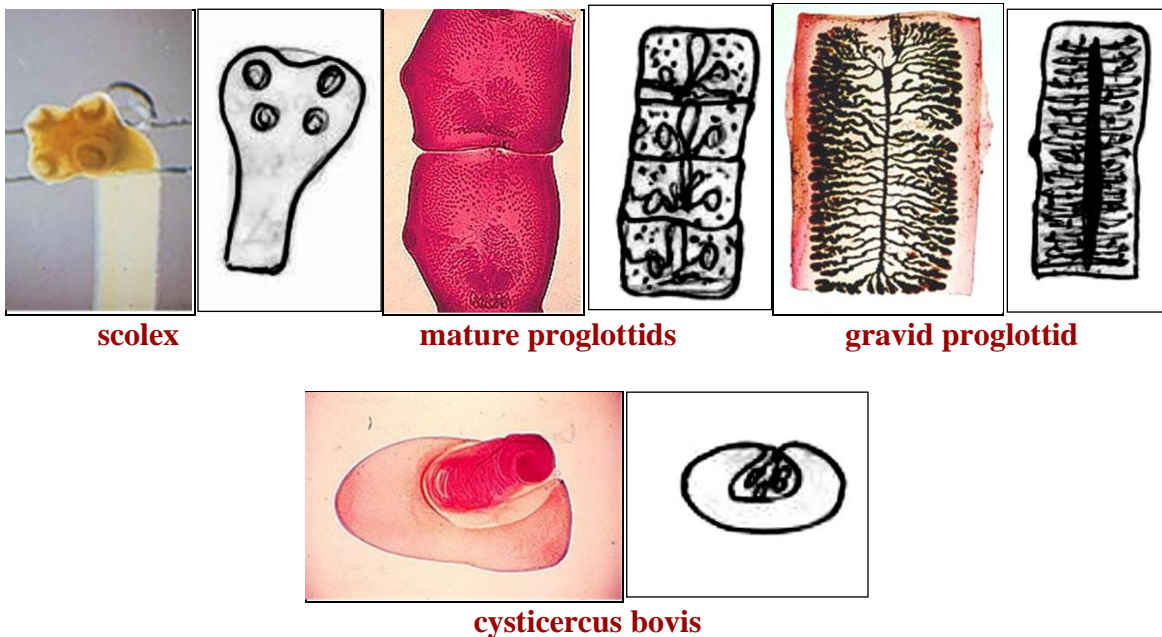
Lec. 5 Helminths-Cestodes/ Part I

2. Class: Cestoda (Tapeworms)

A. Adult Tapeworm Infections

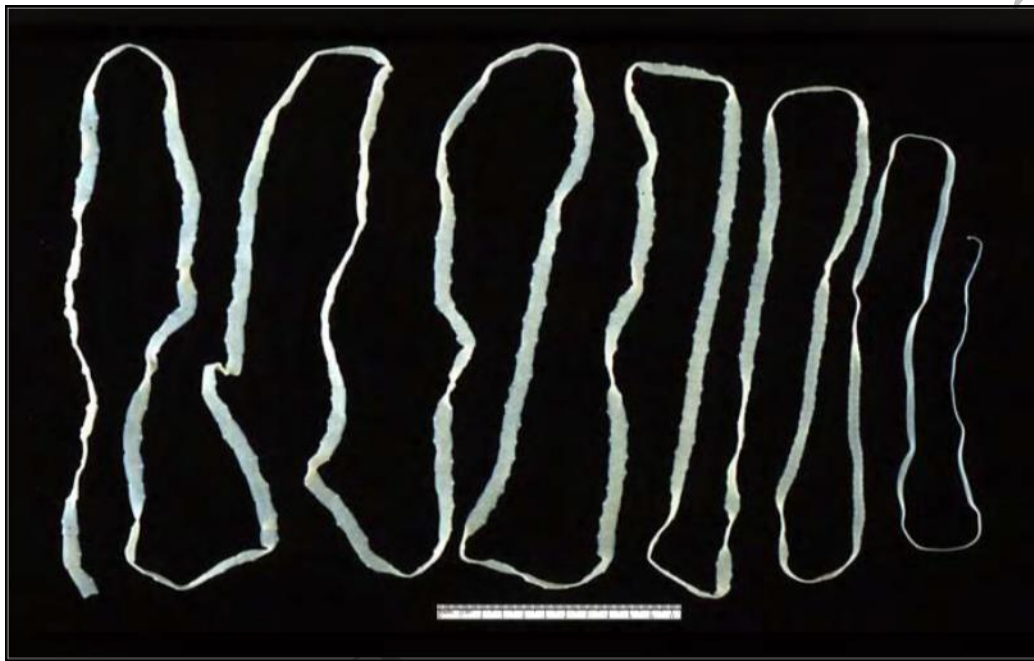
1. *Taenia saginata*

Taenia saginata is the most common of the large tapeworms of humans. This parasite causes beef tapeworm infection. The adult worm typically develops in the middle third of the small intestine. The average length of the relaxed worm is approximately 5 meters, although there are records of specimens of far greater length. It has 1000 to 2000 proglottids of which from one third to one half are nearly gravid. Usually, only a single specimen occurs in an infection, but there may be more.



The fully developed worm is delicate anteriorly and more robust posteriorly. The **scolex** is unarmed, having neither hooks nor rostellum, bears four suckers and a slight apical

depression. Immediately behind the delicate unsegmented **neck**, there is a region of **immature proglottids** in which the genital organs are not yet developed. Gradually the more distal of these proglottids increase in breadth and width until they reach a maximum width of 12mm, these proglottids are the **mature proglottids**, each of which contains a full set of functioning male and female reproductive organs. More distally, the mature unite have transformed into more elongated, narrower, **gravid** ones as a result of the development of a large number of branched lateral arms of a uterus (usually 12 to 30).



“Taenia saginata adult worm”

The terminal gravid proglottids become separated from the **strobila** and actively migrate out of the bowel or are evacuated in the stool with only partial loss of eggs. The eggs are essentially spherical, measure 31-43µm in diameter and have a thin, transparent outer embryonal envelope and a thick brown shell composed of many slender rods cemented together. Within this shell there is a **hexacanth embryo** which has three pairs of delicate lancet-shaped hooklets.



Egg of Taenia sp.

Life cycle

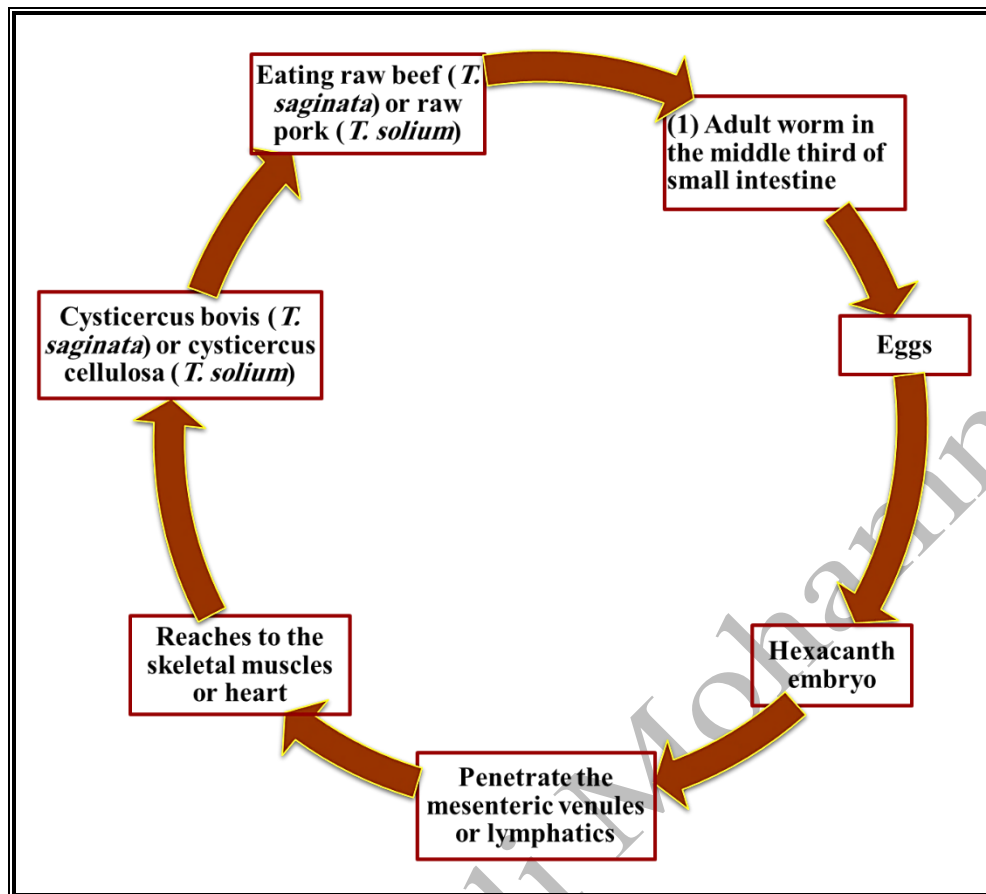
Cattle acquire *Cysticercus bovis* by grazing in fields upon which human excrement has been deposited either through fertilization with “night soil” or from poor sanitation. Pastures flooded by rivers and creeks contaminated with human excrement provide another source of infection for cattle. Under such conditions, eggs may remain viable for 2 months or longer. The evacuated gravid proglottids extrude the eggs while crawling on the ground, vegetation, or other surfaces. Cattle grazing on the infested ground picks up the eggs which hatch in the duodenum.

The emerging embryos penetrate the mesenteric venules or lymphatics and reach the skeletal muscles or the heart where in about 2 months they transform into a typical **cysticercus** stage called **cysticercus bovis**, which measures roughly 5-10mm and has a head like that of the adult worm invaginated into a fluid-filled bladder. Thereafter, for a period of more than a year, a person who eats the raw or poorly cooked infected beef as in dishes such as steak tartare is subject to infection. Whenever, the larva escapes the cyst and passes to the small intestine where it attaches to the mucosa by the scolex suckers.

The prepatent period usually 10-12 weeks. The proglottids start in development and the worm matures in 3 to 4 months. The adult worm may live in the small intestine as long as 25 years. During this period, the gravid proglottids pass with the feces. Thorough cooking of beef at 57°C until the reddish color disappears or freezing at -10°C for 5 days effectively destroys infective cysticerci.

Pathogenesis and Symptoms

Infection with *Taenia saginata* is often characterized by such symptoms as abdominal pain, greatly diminished appetite and weight loss. Only mild abdominal symptoms for the discomfort, inconvenience or embarrassment resulting from the gravid proglottids crawling out of the anus (in this respect the infection resembles that of *Enterobius vermicularis*). Toward the end of the prepatent period, diarrhea and abdominal cramps may occur. Rarely, a mass of **tangled worms** may cause acute intestinal obstruction. Occasionally, appendicitis or cholangitis can result from migrating proglottids. Unlike victims of *T. solium* infection, *T. saginata* victims rarely develop cysticercosis.



“Scheme for the life cycle of *T. saginata* & *T. solium*”.

Diagnosis

1. The detection of the eggs in the patient's feces.
2. The detection of the gravid proglottids evacuated in the patient's feces.

This is not possible during the first 3 months following the infection, prior to the development of the adult tapeworms. Repeated examination and concentration techniques will increase the likelihood of detecting light infections.

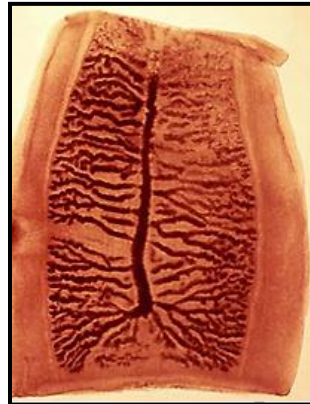
3. The detection of the gravid proglottids migrates from the rectum onto the skin or clothing. For this reason, the diagnosis may be made using the **adhesive cellophane tape technique**, as for Enterobiasis.

The eggs of *Taenia saginata* and *T. solium* are indistinguishable morphologically (morphologic species identification will have to rely on the proglottids or scolices).

Pollen artifact could be mistaken for a taeniid egg; however, the shell is thinner, of non-uniform thickness, and no hooks are visible.

Nevertheless, speciation of *Taenia* is impossible if solely based on microscopic examination of eggs because all *Taenia* species produce eggs that are morphologically identical. Eggs of *Taenia sp.* are also indistinguishable from those produced by cestodes of genus *Echinococcus* (tapeworms of dogs and other canid hosts).

Gravid proglottids are longer than wide and the two species, *T. solium* and *T. saginata*, differ in the number of the primary lateral uterine branches where *T. solium* contains 7-13 lateral branches and *T. saginata* 12-30 lateral branches.



T. saginata Gravid proglottid

Note: You should take the extreme care when processing the fresh samples! Ingestion of eggs can result in **Cysticercosis**!

Other diagnostic techniques used in cysticercosis depends upon serology. MRI scans may reveal the presence of lesions in the brain. Calcified cysticerci are less often seen in the brain. Occasionally, the diagnosis is made histologically on surgical specimens. Calcification in muscles usually appears three to five years after initial infection, and are most typically seen as spindle-shaped calcifications, most numerous in the thighs. Western Blots can also be used in the diagnosis.

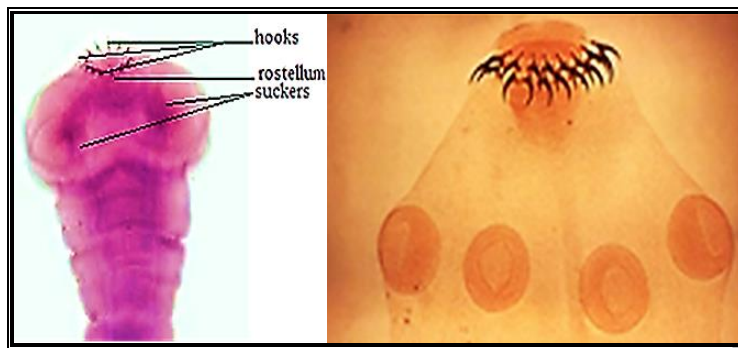
Treatment

Niclosamide (Yomesan), Praziquantel, Quinacrine hydrochloride.

2. *Taenia solium*

This parasite causes the pork tapeworm infection. In most respects, *Taenia solium* resembles *T. saginata* but it is shorter, usually having a length of fewer than 3 meters due

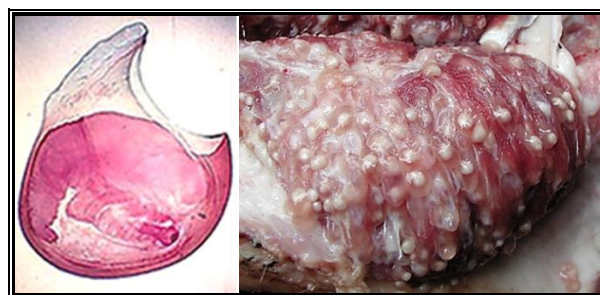
to a smaller number of proglottids (fewer than 1000) and smaller gravid proglottids. The scolex has a rostellum with double circles of alternating large and small hooks (22 to 36 hooks) and also has 4 suckers.



“Scolex of *Taenia solium*”.

The mature proglottid of *T. solium* closely resembles that of *T. saginata*, but the gravid proglottid is usually readily differentiated because it contains approximately one half the number (usually 9 or 10) of the main lateral uterine arms on each side of the longitudinal uterine stem. Eggs of *T. solium* are indistinguishable from those of *T. saginata*.

Gravid proglottids actively migrate from the anus or are passed in the feces. Eggs discharged by migrating proglottids or are become free when they disintegrate on the ground. To develop, the eggs must be ingested by the pig or by the man himself. The hexacanth embryo hatch in the duodenum, migrate through the intestinal wall and reach the blood and lymphatic channels which carry them to the skeletal muscle and myocardium. At that time embryos transform in 2-3 months into cysticerci (**cysticercus cellulosae**), glistening pearly white and measuring about 5-8 or 10mm. The scolex is deeply invaginated into the fluid-filled bladder and is provided with 4 suckers and a rostellum, as in the adult scolex. When people eat pork containing viable cysticerci, the larvae are digested out of the meat and the heads evaginate from the bladder, become attached to the wall of the intestine and mature in 5-12 weeks (direct infection).



cysticercus cellulosae

Pathogenesis and Symptoms

Taenia solium taeniasis is less frequently symptomatic than *Taenia saginata* taeniasis. The armed scolex may cause irritation of the mucosal lining, and there have been cases in which the scolex perforated the intestine leading to peritonitis. The main symptom is often the passage of proglottids. The most important feature of *Taenia solium* taeniasis is the risk of development of **Cysticercosis**. The infection with the adult worm produces the same clinical manifestations as in the infection with *T. saginata*. However, because of its shorter length, there is less likelihood of developing intestinal obstruction.

Diagnosis

Although eggs of *T. solium* may be found in the feces or on anal swabs, specific diagnosis is based on demonstration of the relatively small number of uterus lateral arms in the gravid proglottids which is 7-12 (usually about 9). The morphology of the scolex, particularly the rostellum, is also useful in the diagnosis, as *T. saginata* has no rostellum and its scolex bears no hooks.

Treatment

The prevalence of pork tapeworm infection in humans varies by region. Religious dietary proscriptions forbidding pork consumption by adherents of Islam and Judaism render human infection very rare in Muslim and Jewish communities.

Niclosamide and Praziquantel are the drugs of choice for treatment. However, Niclosamide may cause disintegration of gravid and release the eggs into the bowel lumen, and this is possibly increasing the hazard of **cysticercosis**.