Cestodes

Cestodes or tapeworms are the most specialised of the Platyhelminthe parasites. All cestodes have at least one, and sometimes more than one, secondary or intermediate host as well as their primary host. While the intermediate hosts are often invertebrates of some sort, the primary host is normally a vertebrate. Having said this, in some cases both hosts are vertebrates, as in the common Beef Tapeworm *Taenia saginatus*, and in a few species their may be only a single host. A number of tapeworms include mankind in their life cycles but infection is not normally a serious health problem and can be cured.

Cestodes that infect the human 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 diseaseeworm.

**Taenia saginata*, The Beef Tapeworm***

**Structure**

Adults are ribbonlike, flattened, segmented, hermaphroditic flatworms 5 to 10 m long, consisting of scolex, neck, and immature, mature, and ripe segments in linear sequence. The distinctive morphologic and physiologic properties of the adult tapeworm reflect on the one hand their remarkable specialization for survival in the vertebrate intestine, and on the other hand their massive reproductive powers which are made possible by the multiple sexual units, the proglottides or segments. This ensures the worm species against the enormous rate of loss of the segments or eggs passed in the feces, with only the most remote probability of any one egg succeeding in reaching an intermediate host and being transferred to another human. The terminal one-third to one-half of the worm's length consists of gravid (egg-filled) segments. These segments are muscular and can crawl caterpillar-fashion through the anal sphincter to the outside environment—which renders them available to their herbivore intermediate hosts.

The larval cyst of *T saginata*—the cysticercus—is a pea-sized, fluid-filled cyst, which develops in the muscles of the intermediate host. Within the cyst is a single inverted scolex, formed from a germinative portion of the inner cyst wall

Larval types found in the taeniid tapeworms. . (From Muller R: Worms and Disease: A manual of Medical Helminthology. William Heinemann Medical Books, London, 1975, with permission.)

**Multiplication and Life Cycle**

Gravid segments break off from the worm and are carried in the fecal bolus or by their own crawling activity to the soil. The segments move away from the bolus and adhere to grass. If ingested by a bovine intermediate host, the segments are digested open in the gut, each releasing 50,000 to 100,000 eggs. The eggs hatch, each releasing a six-hooked larva, the oncosphere (also called the hexacanth), which penetrates the gut wall and reaches the muscles via the circulation. There the oncosphere fills with fluid and develops into the 8-mm cysticercus. If a human eats raw or undercooked infected beef, the cysticercus is digested free and inverts the scolex, which attaches to the wall of the small intestine and begins to bud off the long chain of segments. In about 3 months the worm reaches 4-5 m in length and gravid segments begin to pass through the anus. The worm is long-lived, surviving 5 to 20 years or more.

Life cycles of Taenia solium and T saginata. . (a) The port (pig) tapeworm (outer developmental cycle); (b) the beef (cattle) tapeworm (inner developmental cycle). A. Final host: humans only. Tapeworm in the small intestine

**Pathogenesis**

Rare intestinal blockage or penetration have been reported, but pathology is usually inconsequential—although the psychological distress at passing motile segments may be extreme.

**Host Defenses**

Because of its limited contact with the epithelial lining, the gut-dwelling adult tapeworm induces little host inflammatory, allergic, cell-mediated, or humoral response. The sucking action of the scolex appears to have relatively limited immunogenic effect. The long life span of the worm suggests the absence of an effective inhibitory mechanism.

**Epidemiology**

*Taenia saginata*, the commonest large tapeworm of humans, is transmitted as cysticerci in beef (“measly beef”). Partially cooked, smoked, or pickled beef can be infective, although raw beef (steak tartare) is the commonest bearer of infection, as witnessed by the frequency of taeniasis in countries such as Ethiopia and Argentina where raw or undercooked beef is often eaten.

Large worms may grow by 15 to 30 cm a day in the human gut, passing 10 segments daily, which may convey up to a million eggs a day into the environment throughout the long life span of the worm. Eggs may also be found in pastures flooded by human sewage or on which human sewage is used as fertilizer.

**Clinical Manifestations**

The clinical manifestations of infection with adult *T saginata* tapeworms are confined to occasional nausea or vomiting, appetite loss, epigastric or umbilical pain, and weight loss. Moderate eosinophilia may develop. A disturbing manifestation of *T saginata* infection is the active crawling of the muscular segments out of the anus. Rarely, intestinal perforation may occur from the scolex of *Taenia*, or proglottides may be vomited and then aspirated.

**Diagnosis**

Adult infections can be diagnosed by identifying segments in the feces. The species of *Taenia* can be identified only by the segments, because their eggs are identical. The uterus of *Tsaginata* usually forms 12 to 20 branches on each side of the main uterine stem, whereas there are 7 to 10 branches in the smaller and relatively wider *T solium* segment .

**Control**

Inspection of beef for cysticerci is the best preventive measure. Beef must be thoroughly cooked in endemic areas—to at least 56°C throughout the meat, which may be difficult to accomplish with large cuts of fatty meat, particularly pork. Freezing at 10°C for 10 days usually is lethal to *Taenia cysticerci*, but they can withstand 70 days at 0°C.

Treatment is readily available for the intestinal adult worms. Niclosamide, is a nonabsorbed oxidative phosphorylation inhibitor that kills the scolex and anterior segments on contact, after which the worm is expelled. Praziquantel, a synthetic isoquinoline-pyrazine derivative, is an equally effective and relatively nontoxic cesticidal compound. Since the scolex is usually but not always destroyed, and a new worm can regenerate if the scolex and a minute portion of the neck survive, the patient should be observed for several months, as egg-bearing segments can reappear in 10-12 weeks.