TAENIASIS-CYSTICERCOSIS: AN INTRODUCTION

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Abstract. Cysticercosis is caused by the establishment of *Taenia solium* larvae in the central nervous system, skeletal muscle and eyes of humans and pigs, after ingestion of eggs shed in human feces by the adult tapeworm. Human cysticercosis is increasingly recognized as a public health problem, especially in developing countries, and swine cysticercosis may be an important economic drain to the meat industry. The adult tapeworm is found only in human beings. Recent epidemiological data indicate that the presence of a tapeworm carrier in the close environment is a greater risk factor for acquiring cysticercosis than the spread of eggs through sewage.

INTRODUCTION

The life cycle of *Taenia solium* includes two mammalian hosts: humans, as the definitive hosts, and swine, as intermediate hosts. People harboring the adult cestode may be aware of it because gravid proglottids are released with feces and are visible to the naked eye. An adult worm may remain in its host for up to 20 years inducing minimal symptomatology. Tapeworm carriers seldom know, if ever, that eggs released within proglottids, when ingested by another person, a pig, or even themselves, may cause cysticercosis.

After the ingestion of a *Taenia* egg, the embryophore is released in the intestinal tract, the hexacanth embryo penetrates the mucosa and, through circulation, lodges in different tissues. Cysticerci develop in approximately two months mainly in skeletal muscle, central nervous system and the eye. Eggs and embryos are microscopic, while cysticerci in pig muscle measure between 0.5 and 2 cm. Each cysticercus has the appearance of a white vesicle with an invaginated scolex like a pin head and a fluid-filled bladder. These parasites are of the cellulose type. In human brain, cysticerci may be cellulose, racemose or of intermediate form. Cellulose type parasites are similar to the ones found in pigs, while racemose cysticerci are very big parasites with a multilobulated membrane and a degenerated scolex, and they are found only in spacious areas of human brain (Rabiela *et al*, 1989). Also, calcified parasites are detected in the human but not in the swine brain (Flisser *et al*, 1988).

When a person ingests undercooked pork meat with a living cysticercus, the scolex evaginates in the intestinal tract and attaches to the mucosa; proglottids develop from the neck. Proximal proglottids are immature and transform into mature segments, and distal proglottids become gravid, containing approximately 60,000 eggs each. Approximately three months after ingestion of a cysticercus, gravid proglottids start to appear in feces.

The life cycle includes the human carrier of a tapeworm, free-living eggs, and pigs with cysticercosis. This parasitic disease, especially neurocysticercosis because of its frequency and severity, is now recognized as of public health importance in many developing countries.

Clinical incidence of neurocysticercosis can reach 7% in Mexico (Velasco-Suarez *et al*, 1982) and 18% in the Ekari population of New Guinea (Gajdusek, 1978), while prevalence in autopsies ranges from 0.4% to 3.6% in several countries of Latin America, Asia and Africa (Mahajan, 1982; Schenone *et al*, 1982; Shasha *et al*, 1986). Many cases have also been recently reported in the USA, usually in immigrants (Earnest *et al*, 1987).

Neurocysticercosis, although a life-threatening disease in severe cases, is generally an acute or long-lasting infection affecting the quality of the patient's life and social environment. The disease has socioeconomic importance because 75% of patients with neurocysticercosis are at productive ages, and are frequently unable to work soon after the onset of symptoms (Velasco-Suarez *et al*,

1982). Calculations of costs for medical care, such as hospitalization, chemotherapy, neurosurgery and computed tomography, show that US$14.5 million were spent in Mexico during 1986 to treat only the 2,700 new hospitalized cases of neurocysticercosis (Flisser, 1988). Due to swine cysticercosis, Mexico lost in 1980 over US$43 million, the equivalent of 68.5% of the total investment in pig stock production (Acevedo-Hernandez, 1982).

The problem has been greatly aided by new developments in diagnosis, improved drug treatment and epidemiological findings. These factors will probably be significant in the control of taeniasis -cysticercosis.

Clinical diagnosis of human neurocysticercosis is often difficult due to polymorphic symptomatology (Sotelo *et al*, 1985). Immunologic tests can facilitate the diagnosis of symptomatic patients. Circulating antibodies that react with antigens from *Taenia solium* cysticerci have been detected in most patients by ELISA or by immunoelectrotransfer blot technique using serum, cerebrospinal fluid and, more recently, saliva (Espinoza *et al*, 1986; Tsang *et al*, 1989; Feldman *et al*, 1990). The former is an easier assay to perform, while the latter is specific and more sensitive. Imaging techniques, such as computer assisted tomography (Rodriguez -Carbajal and Boleaga-Duran, 1982) and nuclear magnetic resonance (Rhee *et al*, 1987), have further improved diagnostic accuracy and reduced the need for other more harmful neuroradiological methods. However, hypodense and hyperdense images in computed tomography are not exclusive of cysticerci, and these technologies are more expensive than immunological methods and not always available.

Pigs acquire cysticercosis because they are allowed to roam freely in environments where outdoor defecation exists and, in some cases, they have even free access to latrines (Aluja, 1982). Regarding human cysticercosis, established knowledge indicates that the main risk factors are associated with using sewage for irrigation of fruits and vegetables that are eaten uncooked. Recent epidemiological studies have indicated clustered distribution of people infected with the adult tapeworm together with people showing serological or clinical evidence of cysticercosis and pigs with parasites detected by tongue palpation (Sarti Gutierrez *et al*, 1988; Diàz-Camacho *et al*, 1990).

Because of this information, it should be stressed that people harboring a tapeworm have to know that they are a threat to their families and their communities for acquiring cysticercosis. Chemotherapy of human taeniasis with praziquantel or albendazole is highly efficient and safe. A study done in Ecuador showed that after taeniacidal chemotherapy was given to all inhabitants in a high risk area, the frequency of swine cysticercosis was importantly decreased (Cruz *et al*, 1989). In the dog-sheep cycle of *Taenia ovis*, it has been demonstrated that eggs remain viable on the grass for up to eight months (Gemmell and Lawson, 1982) that distribution of eggs in the environment does not follow water or wind currents, and that eggs may be spread through flies (Lawson, 1982). Nevertheless, the viability of *T. solium* eggs and their intimate transmission between humans is still unknown

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