Trichuriasis

Trichocephaliasis, Trichocephalosis, Whipworm Infestation

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Etiology

Trichuriasis is caused by various species of *Trichuris*, nematode parasites in the family Trichuridae. These parasites are also known as whipworms. Both larval and adult whipworms are normally found only in the intestines. They do not undergo tissue migration. Most human cases are caused by *Trichuris trichiura*, a parasite of humans and some non-human primates. Zoonotic trichuriasis is caused by the animal parasites *Trichuris vulpis* and *Trichuris suis*. Adult *T. vulpis* and *T. suis* are found occasionally in the intestinal tract of humans. Very rare cases of *T. vulpis* visceral larva migrans have been reported. Other species of *Trichuris* are also found in animals, but have not, to date, been reported in humans.

Geographic Distribution

T. trichiura, *T. vulpis* and *T. suis* are found worldwide, but are most prevalent in warm, humid climates. They are rare or nonexistent in arid, very hot, or very cold regions.

Transmission

Trichuris spp. have a direct life cycle, and mature in a single host. The host becomes infected when it ingests embryonated eggs from the environment. The eggs hatch in the small intestine. They are said to develop in the small intestinal crypts for up to 14 days before finishing their maturation in the large intestine; however, this is controversial. The adults are found in the cecum and adjacent portions of the large intestine, and shed their eggs in the feces. *T. vulpis* begins to produce eggs in approximately 70 to 90 days in dogs. *T. suis* infections become prepatent in 41 to 45 days, and *T. trichiura* in 1 to 3 months. *T. vulpis* adults survive for approximately 16 months in dogs, and *T. suis* for approximately 4 to 5 months in pigs.

Trichuris eggs are unembryonated and are not infectious when they are excreted. Development to the infectious stage, an egg containing the first-stage larva, takes 2 weeks or longer. Larval development is very sensitive to environmental conditions: the first-stage larva develops in 54 days at a constant 22ºC, but development can take up to 7 months if the temperature fluctuates between 6 and 24ºC. The eggs survive best in moist, shady areas. Under ideal conditions, *T. vulpis* and *T. suis* eggs can remain viable for years. Humans probably become infected with the zoonotic *Trichuris* spp. by ingesting contaminated soil or water.

Disinfection

Trichuris eggs are destroyed by dehydration and sunlight. *T. trichiura* eggs die above 52ºC or below -9ºC. In the laboratory, *T. muris* eggs can be inactivated with 30% (v/v) ammonia, combined with temperatures greater than 30°C.

Infections in Humans

Incubation Period

The incubation period in humans does not appear to be published. *T. trichiura* eggs are reported to occur in the feces 3 months after ingesting eggs.

Clinical Signs

Trichuriasis is often asymptomatic in humans but heavy infections can cause chronic diarrhea, which may be bloody. Other symptoms may include abdominal pain and distention, nausea, vomiting, flatulence, headache, weight loss, malnutrition and anemia. Nonspecific signs such as nervousness, anorexia and urticaria have been reported in some individuals. Untreated severe infections can lead to clubbing of the fingers in children, through an unknown mechanism. Complications may include rectal prolapse (particularly in children), appendicitis, colitis and proctitis. Very rare cases of visceral larva migrans, due to *T. vulpis*, have also been reported in humans.

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Communicability

Humans with patent infections can transmit trichuriasis by contaminating the environment with eggs. If zoonotic infections become patent in humans, the eggs are probably viable. The unembryonated eggs are not infectious when they are first shed and must develop for 2 weeks or more in the environment.

Diagnostic Tests

Intestinal trichuriasis is diagnosed by detecting *Trichuris* eggs in the feces. The eggs are oval, yellowish-brown and thick-shelled, with two polar plugs. *T. vulpis* eggs (approximately 72-90 µm by 32-40 µm) are nearly twice the size of most human whipworm eggs. Most *T. trichiura* eggs are 50 to 56 µm by 21 to 26 µm, although a very small percentage of the eggs can be as large as 78 µm by 30 µm. Although these large eggs resemble *T. vulpis*, they can be differentiated by their morphology. *T. suis* eggs are very similar to *T. trichiura*.

Larva migrans cases are very rare, and there is no standard diagnostic procedure. In two pediatric cases, the diagnosis was established by serology and by the recovery of *T. vulpis* eggs from the family dog and environmental samples. In one adult case, the diagnosis was confirmed by serology and by histology of a pulmonary mass.

Treatment

Trichuris spp. are treated with anthelmintics, including mebendazole, albendazole and oxantel.

Prevention

Prevention of zoonotic trichuriasis depends on the treatment and prevention of *Trichuris* infections in animals, the removal of feces before the eggs can become embryonated, good hygiene and public education.

To reduce human exposure, infected dogs should be dewormed. Canine feces should be removed from areas where children play before the eggs become embryonated. There is no practical way to remove parasite eggs from the soil once contamination has occurred; however, *Trichuris* eggs are less likely to survive and develop in drier, sunnier locations. Lawns where dogs defecate should be kept short, to reduce shade on the soil, and should not be overwatered. Contamination can be decreased in public areas by restrictions on uncontrolled dogs, collection of feces by dog owners, and prevention of animal access to areas such as children's playgrounds.

Good hygiene can help prevent infections or severe disease. Hands and raw foods should be washed before eating. Unsafe drinking water should be boiled or filtered. Children should be taught not to eat soil, and to wash their hands after playing with pets or outdoor activities. Children should not be allowed to play in areas where animal feces are found. Families may also consider postponing the acquisition of a new pet until children are past the toddler stage.

Morbidity and Mortality

Most cases of human trichuriasis are due to *T. trichiura*; in some parts of the world, up to 98% of children may be infected with this parasite. The prevalence of zoonotic trichuriasis is uncertain. Until recently, *T. vulpis* was thought to be an uncommon zoonosis; however, a recent study in India suggests that it may be relatively widespread in some slums. In three surveys, the reported prevalence rates of *T. vulpis* trichuriasis were 0.2% in New York, 12.3% in Vietnam, and 6% in India. Most cases have been reported in children and institutionalized patients. *T. suis* has rarely been reported in humans, and its prevalence is unknown.

The clinical signs vary with the host's age, health and nutritional status. The prognosis is good if the infection is either light or is treated. Untreated heavy infections, particularly in malnourished patients, can be serious.

Trichuris spp. are very rarely associated with larva migrans; three cases caused by *T. vulpis* have been documented in the literature.

Infections in Animals

Species Affected

T. vulpis is found in domestic and wild canids. *T. suis* is found in domestic pigs and wild boars. *T. trichiura* is found in humans and non-human primates. Infections have also been reported in pigs. Other species of *Trichuris* are found in other animal hosts.

Incubation Period

In pigs, the incubation period can be as short as 10 to 12 days.

Clinical Signs

Most cases of trichuriasis are asymptomatic, although some animals may be in poor condition or have reduced performance. Heavy parasite burdens can cause diarrhea, which may be mucoid or hemorrhagic, as well as weight loss, unthriftiness and anemia.

Outbreaks of severe mucohemorrhagic diarrhea associated with anorexia, depression and deaths have been seen in pigs. Trichuriasis can be particularly serious in pigs up to 3 months old. Pigs carrying *T. suis* are also more susceptible to other intestinal infections including salmonellosis and swine dysentery. *T. suis* synergizes with *Campylobacter jejuni* to produce mucohemorrhagic colitis.

In dogs, chronic bowel irritation may cause intussusception. However, unlike *T. trichiura* in humans, *T. vulpis* is not associated with rectal prolapse in dogs. Secondary pseudohypoadrenocorticism, with severe dehydration, hyponatremia, hyperkalemia and metabolic acidosis, has been reported in some dogs.

Communicability

Animals with patent infections can transmit trichuriasis by contaminating the environment with eggs. The prepatent period is 70 to 90 days for *T. vulpis* in dogs and 41 to 45 days for *T. suis* in swine. The unembryonated eggs are not infectious when they are first shed and must develop for at least 2 weeks in the environment.

Diagnostic Tests

Trichuriasis is diagnosed by detecting *Trichuris* eggs in the feces, usually by fecal flotation. The eggs are oval, yellowish-brown and thick-shelled, with two polar plugs. *T. vulpis* eggs are approximately 72-90 µm by 32-40 µm. *T. suis* eggs are 50-56 µm by 21-25 µm. *Trichuris* eggs can be shed intermittently. Repeated fecal testing or proctoscopy may be helpful in these cases. In pigs, *T. suis* may be found at necropsy.

Treatment

Trichuriasis can be treated with anthelmintics, including fenbendazole, febantel, mebendazole, dichlorvos and butamisole. Milbemycin oxime or a combination of diethylcarbamazine and oxibendazole, used as a heartworm preventative, are effective in dogs. Hygromycin B, as a continuous feed additive, can be used to control *T. suis* in pigs.

Prevention

Infections are difficult to prevent where the soil is contaminated with *Trichuris* eggs. Sanitation and the elimination of moist areas can reduce environmental contamination. *Trichuris* eggs survive best in damp, shady areas.

Pigs

Confinement rearing on slatted floors or concrete, in conjunction with good sanitation, reduces the risk of infection. Pens should be cleaned often to remove feces. Between use, pens should be thoroughly cleaned and disinfected. Outdoor lots and pastures should be well-drained. Land rotation may also be helpful.

Dogs

Cement, gravel or sand runs should be used rather than dirt. (Sand and gravel runs provide better drainage than dirt.) Cement runs should be cleaned daily and disinfected often. Feces should be removed as often as possible. If dogs are allowed on the lawn, the lawn should be kept short, to reduce shade on the soil, and should not be overwatered.

Morbidity and Mortality

Trichuriasis is common in dogs and pigs. *T. vulpis* is found in approximately 10-20% of dogs brought to veterinary clinics, and in 40% of stray dogs. *T. suis* is found in 2-5% of adult swine and 15-40% of nursing piglets. Age-related resistance was recently demonstrated in pigs. In dogs, any age can be affected.

Although most cases are asymptomatic or mild, outbreaks of severe mucohemorrhagic diarrhea and deaths are occasionally seen in pigs, and severe symptoms may be seen in some dogs. In pigs, trichuriasis is most serious in young weaned animals. A mortality rate of 10-12% has been reported, shortly after weaning, in parts of Australia. *T. suis* also increases the susceptibility of pigs to intestinal infections such as campylobacteriosis, salmonellosis and swine dysentery.

Post Mortem Lesions

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Trichuriasis may be associated with catarrhal or mucohemorrhagic enteritis. Mucus, fresh blood and/or necrotic debris may be found in the lumen of the large intestine, and the colon wall may be thickened, inflamed or edematous. Necrotic pseudomembranes have also been found in the intestines of some pigs. The parasites are found in the cecum and adjacent large intestine, with their anterior ends embedded in the mucosa. *T. vulpis* adults are 4.5-7.5 cm long. *T. suis* and *T. trichiura* adults are 30-50 cm long. All species of *Trichuris* are much thinner at the head than the tail.

Internet Resources

Centers for Disease Control and Prevention (CDC)
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/campylobacter_t.htm

International Veterinary Information Service (IVIS)
http://www.ivis.org

Material Safety Data Sheets – Canadian Laboratory Center for Disease Control
http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/index.html#menu

Medical Microbiology
http://www.ncbi.nlm.nih.gov/books/NBK7627/

The Merck Manual
http://www.merck.com/pubs/mmanual/

The Merck Veterinary Manual
http://www.merckvetmanual.com/mvm/index.jsp

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