

PARASITE 101



Toxoplasmosis, Cats, and Human Health

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Toxoplasma gondii is a protozoan parasite that can infect virtually all warm-blooded mammals and birds, including about 50% of humans worldwide.¹⁻⁴ The parasite is of veterinary importance primarily because of its zoonotic potential. Transmission from cats to humans can occur if cat owners contaminate their hands while cleaning a litter box and accidentally swallow infectious oocysts before washing their hands. Other more likely routes of transmission are underrecognized⁵ and include ingestion of contaminated soil or water;^{6,7} eating inadequately washed raw vegetables or fruit,^{8,9} and consuming raw or undercooked meat and shellfish.¹⁰⁻¹⁵

Life cycle

T. gondii has a two-host life cycle, with all members of the wild and domestic felids serving as oocyst-shedding definitive hosts and most warm-blooded animals, including humans, as intermediate hosts. Cats become infected with *T. gondii* when they catch and eat infected small mammals and birds or, more rarely, by ingesting sporulated oocysts in soil or water.^{8,16} Sexual multiplication of *T. gondii* parasites occurs only in the intestine of the definitive felid host, resulting in the production of millions of unsporulated oocysts that are deposited onto soil through the feces^{17,18} (Figure 1).

Oocysts sporulate to become infective in about 24 hours at room temperature and are extremely hardy in the environment.^{19,20} Therefore, changing the cat's litter boxes daily as well as wearing disposable plastic gloves and washing hands after cleanup, considerably reduce the risk of contracting toxoplasmosis from cat

litter. Cat litter and feces should not be deposited in toilets or recycled into soil around the home but instead should be disposed of in garbage containers that can be sealed and transported to landfills, where runoff and animal exposure can be controlled to prevent soil and water from becoming contaminated with oocysts. Proper disposal of cat litter and feces also can reduce the likelihood that cats or other animals — including humans — ingest or inhale *T. gondii* oocysts.

When susceptible hosts become infected with *T. gondii*, the fast-replicating tachyzoite stages disseminate by way of blood and lymph throughout the host and eventually transform into cysts that contain slowly dividing bradyzoite stages in host tissues, such as the brain and muscles of the limb, heart, and diaphragm. Domestic cats begin shedding oocysts 3 to 5 days after ingestion of infected animal tissues, and the shedding period lasts about 8 days but may continue for up to 3 weeks.²¹⁻²³ It is generally accepted that oocysts are produced only during initial infection, but domestic cats may shed oocysts if they are superinfected with other coccidian parasites,²⁴ are undernourished,²⁵ are treated with high doses of corticosteroids,²⁶ or become reinfected years after the initial infection.²¹ Repeat oocyst shedding has been documented in nondomestic felids in zoos.^{27,28}

Serologic methods

Various serologic methods are available to test for antibodies to *T. gondii* in cats, including a modified agglutination test,^{29,30} latex agglutination test,³¹ ELISAs,^{32,33} and indirect fluorescent antibody test.³⁴

Protecting Pets and People from Parasites

The Companion Animal Parasite Council (CAPC) is an independent council of veterinarians and other animal health care professionals established to create guidelines for the optimal control of internal and external parasites that threaten the health of pets and people. It brings together broad expertise in parasitology, internal medicine, public health, veterinary law, private practice, and association leadership. Initially convened in 2002, the CAPC was formed with the expressed purpose of changing the way veterinary professionals and pet owners approach parasite management. The CAPC advocates best practices for protecting pets from parasitic infections and reducing the risk for zoonotic parasite transmission. Sponsoring the peer-reviewed Parasite 101 column is one more avenue for reaching veterinarians on important topics and issues related to the prevention of parasitic transmission and disease.



These tests also can be used to estimate the prevalence of *T. gondii* infection and assess health risk in epidemiologic studies. High serologic titers or detection of circulating antigens, along with clinical signs and response to treatment may suggest active toxoplasmosis,³⁵ but veterinarians should be aware that cats are usually seronegative when shedding oocysts.

Toxoplasmosis is of particular concern for pregnant women who become infected for the first time during pregnancy and are unable to prevent the parasite from infecting their fetus, which is the reason that pregnant women are cautioned to avoid changing cat litter and to wear gloves when gardening in areas where cats may defecate. Congenital toxoplasmosis manifests most



Figure 1. *Toxoplasma gondii* oocysts (10 × 12 μm) purified from cat feces (100× magnification). Inset: Fluorescent microscope image showing two sporocysts.

At-risk individuals

Restricting access to the outdoors is a key strategy to prevent cats from acquiring *T. gondii* organisms and serving as a source of infection for humans and other animals. Because the species was named based on its initial discovery in a North African rodent, the gundi (*Ctenodactylus gundi*),³⁶ rodent control in and around the home by trapping or by application of rodenticides is another means of reducing the exposure of cats to *T. gondii*. Poor rodent control may be associated with the maintenance of *T. gondii* both on swine farms³⁷ and in human residences.^{38,39} Rodents and other intermediate hosts acquire *T. gondii* parasites from the environment by ingesting oocysts in soil, water, or transport hosts. They also may acquire infection directly by carnivorousism (e.g., from mouse to fox). Therefore, cats are not necessary to maintain *T. gondii* in the wild.

commonly as hydrocephaly, vision abnormalities, and brain lesions accompanied by neurologic deficits and may result in spontaneous abortion.⁴⁰ These effects are most serious if the mother is infected in the first trimester of pregnancy. However, avoiding infection remains important throughout the pregnancy because the probability of transplacental transmission increases as pregnancy progresses.⁴¹

Pregnant women are not the only individuals who are at risk when infected with *Toxoplasma* spp. Because most infected individuals have no clinical disease or only a flu-like illness, if they become severely immunocompromised, they may suffer from severe, sometimes fatal, toxoplasmosis when parasites are released from latent tissue cysts and travel to the brain. For this reason, all clients should be informed about the proper handling of cat feces.

Client education and awareness

The domestic cat remains centrally important to the dissemination of oocysts into the environment. Approximately 82 million owned cats are in US households today,⁴² and about 48 million owned cats are in Western Europe.⁴³ In the United States, up to 50% or more of owned cats are allowed outdoors and, therefore, have ample opportunity to defecate and contaminate the environment.

There are also an estimated 29 to 55 million feral cats in the United States. Feral cats live and defecate exclusively outdoors and are at high risk of acquiring *T. gondii* infection through carnivorousism.

Cats rarely exhibit clinical disease as a result of *T. gondii* infection but have been implicated in human outbreaks of toxoplasmosis as well as disease in food and zoo animals.^{6,37,44-50} Most owners probably do not recognize the potential risks to human and animal health posed by feral and owned cats that roam outdoors. Until a vaccine to prevent cats from shedding oocysts is developed, the challenge for veterinarians is to educate cat owners about environmentally-friendly cat management and safe methods for collection and disposal of cat litter. Strategies to manage feral cat populations, which may include adoption, sterilization, relocation, removal, and/or provision of indoor housing, also are needed. **VF**

Reviewer Comment

Toxoplasmosis is a difficult infection to understand because of the infectious cycle and some historical non-factual information that is commonly repeated by uninformed medical professionals. Diagnostic serology can be used correctly or incorrectly, depending on the adviser's understanding of the disease process. Veterinarians need to be well versed so that clients understand the reasons for their recommendations, which are given to encourage the public's health.

For more information:

Go to the downloadable materials section at capvet.org or www.pathogenpollution.org for a copy of the brochure "*Toxoplasma gondii*: What Everyone Should Know," which can be printed out and distributed to clients at no cost.

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