Giardiasis in Cats

Giardiasis in cats is an infection caused by the single-celled protozoal parasites *Giardia duodenalis* (also known as *G. intestinalis* and *G. lamblia*) or *G. cati*.¹ *Giardia* parasites were found in cats in 1925 and even before that were found in humans in 1865.²,³

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The *Giardia* genus is divided into 8 major assemblages, which vary in their ability to infect different animals. Polymerase chain reaction (PCR) testing is available at commercial laboratories to identify the specific assemblage responsible for causing an infection. For cats, infections are caused by assemblages A1 or F. Assemblage F, in which the cat is the definitive host, is found in *G. cati*; assemblage A1 is found in *G. duodenalis*.1,2

The parasite has undergone numerous name changes based on changes in scientific classification and species in which researchers found the various assemblages.2 Although *Giardia* can pose a zoonotic risk to humans, the primary assemblages of A1 and F of cats have not been shown to conclusively infect humans, who are most susceptible to assemblages A2 and B. Treatment of cats is directed at preventing disease in cats, not for the purpose of preventing transmission to humans.1

**DISTRIBUTION OF THE PARASITE**

*Giardia* parasites are distributed worldwide and survive best in cool, moist environments, especially those with standing water. The cysts are resistant to freezing and municipal water chlorination but can be killed by boiling contaminated water, filtration, and disinfection.2

**INCIDENCE OF INFECTION**

The *Giardia* parasite is transmitted through the fecal–oral route, by contaminated water, fomites (e.g., fur and contaminated housing), and the environment.1,4 Most *Giardia* infections are subclinical;1 however, cats with subclinical infection can be a source of infection for other cats.3

The Companion Animal Parasite Council describes the infection rate of *Giardia* in cats with clinical signs as 10.3%, and in western Canada, *Giardia* is found in 9.9% of samples tested.2 The overall infection rate among cats in North America is as high as 4%.6 Kittens younger than 1 year are at increased risk for infection, as are cats housed in shelters and other crowded situations.1,5,6 Infections do not cause permanent immunity, and cats can easily become reinfected.7

**PARASITE LIFE CYCLE**

*Giardia* can be found in 2 forms, cysts and trophozoites.1 Each cyst contains 2 trophozoites. After a cat ingests a cyst, gastric acid and pancreatic enzymes dissolve the cyst wall, releasing the 2 trophozoites. These trophozoites quickly mature, and within 5 to 16 days signs appear in the host cat.

**Trophozoites** are the active, motile form of *Giardia*. Trophozoites are 12 to 18 μm × 10 to 12 μm, motile, flagellated parasites that are shaped like a teardrop or a pear. They are bilaterally symmetrical, with a large ventral adhesive disc, 2 visible nuclei, and a large endosome, which contribute to the typical “face” seen in the trophozoites.2 Mature trophozoites travel down the small intestine to their preferred sites, the jejunum and ileum, where they use their adhesive disc to attach to the brush border of the intestines. This attachment can cause sloughing of the intestinal epithelial cells and villous blunting. After the trophozoites attach to the intestinal wall, the flagellae help create a vacuum for the adhesive disc, preventing accidental loss of adhesion.3 These intestinal changes reduce the jejunum’s absorptive surface, causing maldigestion and malabsorption of nutrients, ultimately leading to diarrhea.1,4,5 *Giardia* has no intracellular phase and does not cause infections outside of the intestinal tract unless the intestines have been perforated by another cause.2 *Giardia* trophozoites multiply by simple binary fission, in which the organism splits into 2 similar-sized individuals.1,4 As the trophozoites travel down the digestive tract reaching the colon, they may encyst. Encysted immature trophozoites can survive for several months outside the host in cool, wet conditions. Unencysted trophozoites are sometimes found in fresh diarrhea but not usually in normally formed feces.1

**Cysts** each contain 2 immature trophozoites.1 Cysts are elliptical, nonmotile, and measure 8 to 12 μm × 7 to 10 μm. They have 2 nuclei and a thick refractile wall.2 As the cysts leave the infected animal in the feces, they are immediately infective. When picked up by another animal, their life cycle continues.4,8 If *Giardia* cysts are not picked up by another animal, their survival in the environment varies according to conditions. At soil temperatures of 39 °F/4 °C, a cyst can remain infective for 7 weeks; however, at 77 °F/25 °C, they remain infective for only 1 week. When exposed to a dry environment with direct sunlight, cysts will remain infective for a few days. When in water at 50 °F/10 °C, such as a pond or persistent puddle, a cyst can remain infective for 1 to 3 months.8

Most *Giardia* infections are self-limiting; cyst shedding usually ends within 27 to 35 days. However, some hosts
cannot eliminate the *Giardia* parasite on their own, and cyst shedding can last for several months or until treatment is successful.\(^1\)

**CLINICAL SIGNS**

In cats with subclinical infections, no signs are seen. For kittens and stressed adults, clinical signs are typically acute, watery, pale, and malodorous diarrhea with mucus.\(^1,4,6\) The signs may be short-lived, intermittent, or chronic. Steatorrhea and weight loss are seen in cats with chronic cases. Less commonly seen signs include emesis, fever, and anorexia.\(^1\) The diarrhea is caused primarily by malabsorption resulting from disruption of the small intestine lining and hypersecretion.\(^1,4\) If blood is seen in the feces, the cat should be evaluated for a secondary infection with *Ancylostoma* species, *Isospora* species, or *Tritrichomonas* species parasites or with *Clostridium* species bacteria.\(^1\)

**DIAGNOSTIC TESTS**

**Fecal Tests**

Fecal examination techniques include wet mount, fixed fecal smears, and fecal flotation.

**Wet Mount**

The most effective way to detect *Giardia* cysts or trophozoites is by examination of fresh (<30 minutes old), unrefrigerated feces.\(^1,2\) Place a small amount of fresh diarrhea/feces mixed with 2 to 3 drops of saline on a clean microscope slide with a cover slip. Use a darker field (lower the condenser to prevent burning through fragile objects on the slide), and view the slide at 40× and 100×. Motile trophozoites can occasionally be seen, but cysts are more commonly seen. Identification can be enhanced by mixing the sample with Lugol’s iodine.\(^2\) Presence of cysts or trophozoites indicates a definitive diagnosis of giardiasis, but their absence does not indicate a negative diagnosis.\(^4\)

**Fixed Fecal Smear**

Another technique is a fixed fecal smear, also made with fresh feces. Use a wooden applicator stick to collect a small amount of diarrhea/feces. Spread it thinly on a glass slide by rolling the stick across the slide. Allow the slide to air dry, and fix and stain by using a commercial Romanowsky stain such as Diff-Quik. View under oil magnification (100×). Preparing fixed fecal smears enables you to keep a permanent record of the infection and preserves a teaching slide for future use.\(^3\)

**Fecal Flotation**

Fecal flotation is a concentration technique with the potential to yield a larger number of cysts. Trophozoites will not be seen on fecal flotation. The preferred flotation solution is zinc sulfate because it produces the fewest changes to the size and structure of the cysts. The solution should have a specific gravity of 1.18. All samples should be processed by centrifugation, not by using gravity methods.\(^2\) Because cysts are small and translucent, view them with dark-field microscopy.

**Enzyme-linked Immunosorbent Assay**

Enzyme-linked immunosorbent assays (ELISAs) are available for veterinary use. Most diagnostic laboratories use ELISA well-testing methods, and in-house testing is available via the SNAP test (IDEXX Laboratories, idexx.com).\(^2\) Sensitivity and specificity of the ELISA are similar to those of fecal flotation testing (85.3%),\(^6\) and when combined, the sensitivity increases to 97.8%.\(^1\) Unfortunately, however, ELISAs detect cyst wall protein\(^6\) and cannot determine which assemblage the infection belongs to.\(^1\) The benefits are that the test is easy to perform and the results are easy to interpret. Because the antigen can persist for up to 4 weeks after cysts are detected, ELISA testing is not recommended for the purpose of evaluating treatment effectiveness.\(^4,6\)

**Blood Analysis**

Complete blood counts and blood chemistry tests seldom show any significant changes, except for kittens with severe diarrhea, in which total protein plasma levels are low, secondary to maldigestion and malabsorption.\(^1\)

**Radiography**

Changes on abdominal radiographs are nonspecific and may or may not show signs of diffuse enteritis.\(^1\)

**Duodenal Aspiration**

Duodenal aspirates are unlikely to yield results because *Giardia* infections are usually located in the jejunum and ileum.\(^1\)
Other Diagnostic Tests
Additional testing done at diagnostic laboratories includes direct immunofluorescence assays (require fluorescent microscopy) and PCRs (can determine to which assemblage an infection belongs). A positive direct immunofluorescence result is easy to interpret because the organism fluoresces (glows) under the microscope and morphology can be confirmed. PCR consistency can vary with the laboratory conducting the test. False-positive and false-negative results are possible; thus, PCR testing should not be used as the sole testing method.

Necropsy
Gross examination of intestines reveals mild intestinal thickening with mucus but usually no blood. Histopathologic examination reveals diffuse loss of the intestinal brush border with shortened villi. Increased intraepithelial lymphocytes and mast cell hyperplasia are seen. Histopathology findings may be unremarkable for some patients, even if they had diarrhea.

TREATMENT OPTIONS
In the United States, there are no *Giardia* treatments approved for veterinary use. All medications available for cats have been extrapolated from human use and are used off-label.

The primary goal of any treatment is to resolve the clinical signs, specifically to stop diarrhea. The antimicrobial sensitivity of *Giardia* is similar to that of bacteria, and there is no way to predict which medication will work for a specific infection. Because *Giardia* protozoa do not grow in culture, sensitivity testing cannot be used to determine drug effectiveness. Repeated courses of the same medication are not indicated.

The drug most commonly used off-label to treat *Giardia* in cats is metronidazole. When administered at 25 mg/kg q12h for 5 days, it is 50% to 60% effective in most cats. There are safety concerns with metronidazole use in both dogs and cats. High doses (>60 mg/kg/day) can cause lethargy, central nervous system depression, ataxia, tremors, seizures, vomiting, and weakness. Use is contraindicated with pregnancy, lactation, and liver disease. Fenbendazole at 50 mg/kg q24h for 5 days is ~50% effective, but combination with metronidazole increases effectiveness. Albendazole is relatively effective when dosed at 25 mg/kg q12h for 5 days, but its use has been associated with pancytopenia and is teratogenic in cats. Although albendazole is effective, the Companion Animal Parasite Council does not recommend its use in cats due to safety concerns.

Treatment failures can be associated with reinfection, inadequate drug levels or duration of therapy, immunosuppression, drug resistance, and sequestration of the parasite in the gallbladder or pancreatic duct.

Adding moderately fermentable fiber to the diet can also help control diarrhea and has the added benefit of helping to modulate small intestinal bacterial overgrowth, another contributor to diarrhea. Feeding lower-fat diets can also be helpful by reducing the work needed to digest the food. Veterinary therapeutic intestinal diets contain both of these modifications.

MONITORING TREATMENT
Therapy effectiveness is indicated by resolution of clinical signs and absence of cysts on centrifuged fecal flotations. ELISAs are not effective for monitoring because the antigen they detect can persist longer than cysts. Retesting and retreatment are not indicated if the cat appears to be healthy, clinical signs have resolved, and fecal flotation is negative for cysts.

PREVENTION
Although a *Giardia* species-specific vaccine was developed, it was not shown to prevent disease and has been removed from the market. Preventing initial environmental infections requires boiling or filtering contaminated water before cats are allowed to drink, using correct disinfection products, and decreasing environmental exposure in crowded housing conditions. Preventing reinfections requires bathing the animal and properly decontaminating the environment to remove infective cysts.
For hard surfaces, clean until all signs of feces are gone, then disinfect with quaternary ammonium products or bleach (1:32 dilution). For carpets and other soft surfaces, remove all signs of feces and steam clean for a minimum of 1 minute. For items that can be washed in a dishwasher, such as toys or food dishes, a regular full cycle is sufficient. For items that can be laundered and dried in machines, ensure that the minimum drying cycle is set on high heat for 30 minutes.\textsuperscript{8} Because the outdoor environment is challenging to disinfect, limit access and remove any sources of standing water. Bleach and quaternary ammonium disinfectants are not effective outside.\textsuperscript{8} When using any disinfectant, ensure that the correct dilution is used and that adequate contact times are followed. This information can be found on the individual product labels.\textsuperscript{2}

**CONCLUSION**

Although *Giardia* species can be challenging to identify because of the small size of the cysts and the fact that they are shed intermittently, use of a multimodal approach (e.g., direct fecal smears, fecal flotation, and ELISA testing) will detect most symptomatic infections. Treatment also requires a multimodal approach of treating only symptomatic cats, cleaning the environment and the cat(s), disinfecting the environment, and decreasing crowding and stress in multicat situations. These tasks are all within the scope of care and responsibilities for veterinary nurses. \textsuperscript{TVN}

**References**