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Information Bulletin

Feline Giardiasis

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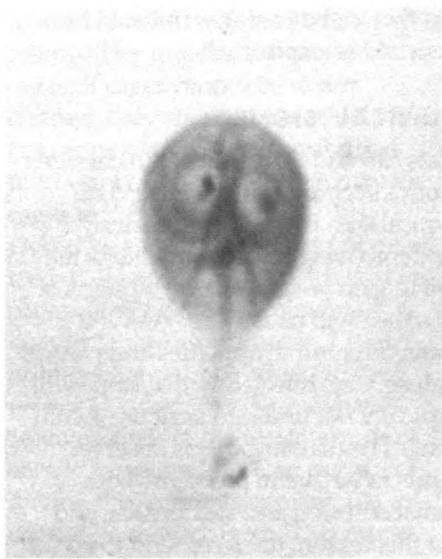
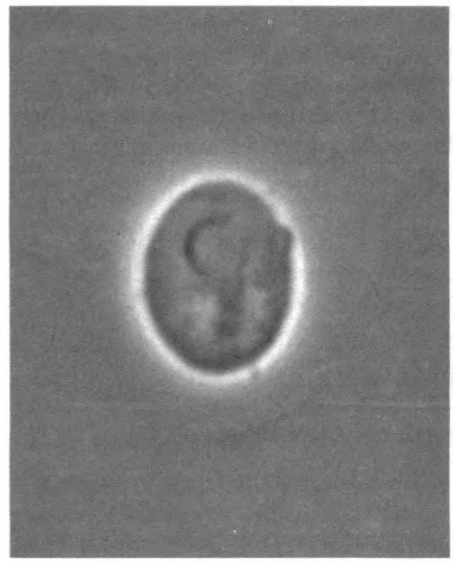
Giardia is a protozoan organism that is found both in hosts and the surrounding environment. Within vertebrate animals, *Giardia* organisms occur as binucleate, flagellate trophozoites. The trophozoite is small (10.5 to 17.5 µm long by 5.25 to 8.75 µm in maximum width), and has eight trailing flagella. The flounder-shaped trophozoite's two nuclei lie in positions similar to those of a mature flounder's eyes; these large nuclei are about 3 µm long by 1.5 µm wide. The ventral surface of the trophozoite bears a sucking disc that occupies about one-third to one-half of the anterior surface. The trailing flagella both propel the organism and create a vacuum for the sucking disc by pumping fluid out from under it. The trophozoite moves along the surface of the intestinal epithelium like a hovercraft and can clamp down tightly using the sucking disc.

A second stage, the cyst form, is found in the surrounding environment. Cysts are about 7.4 µm wide and 10.5 µm long, and have a length-to-width ratio of about 1.4. In response to an undefined stimulus, trophozoites produce a resistant cyst wall as they pass from the small to the large intestine. The trophozoite then divides, resulting in two trophozoites within the cyst. The cyst is passed in the feces of the host and infects a new host by direct fecal-oral contamination. Typically, the cysts are transmitted through contaminated drinking water to the next host. When a host drinks the contaminated water, the trophozoites leave the cyst within the small intestine and take up residence on the intestinal mucosa. They divide repeatedly until they have populated the intestines of the new host with trophozoites. Some trophozoites periodically let go of the intestinal wall and are carried in the fecal stream towards the environment, encysting on the way. Within five to sixteen days after a cat has ingested a cyst, the cat is capable of excreting thousands of cysts into the environment.



***Giardia* trophozoite, stained with iron hematoxylin (approx. ×3,500).**



Phase-contrast micrograph of an unstained *Giardia* cyst (approx. ×2,700).

HISTORICAL PERSPECTIVE

In 1925, Dr. Hegner of Johns Hopkins University described from the domestic cat a species of *Giardia* that he named *Giardia felis*.[1] After examining large numbers of parasites, Dr. Hegner believed that the species from the domestic cat was morphologically different from that of humans, dogs, and mice, and from the form that he found in the feces of the wild feline, the lynx. In 1952, Dr. Filice of the University of San Francisco studied the morphology of several species of *Giardia* from rodents. After examining organisms from many different rodent hosts, he decided that within mammals there were only two species of *Giardia*, and that the species recovered from dogs and cats should probably have the same name as the one in humans, which he called *Giardia duodenalis*.[2] The controversy between proponents of these two opposing viewpoints remains unresolved.[3] Today, most researchers studying *Giardia* believe that a single form of the parasite infects both humans and their companion animals. The resolution of this problem is important, because it has a bearing on whether cats serve as a reservoir for human infections (or from the feline perspective, whether humans pose a constant

threat for spreading the infection to cats).

Infections with *Giardia* are not uncommon in cats.[4] Surveys report that up to 40 percent of some cat populations are infected, although typical prevalence rates are around 5 to 10 percent. Such infections were once relatively common in humans in the United States. In a survey of children in Washington, D.C. in 1902, 13 percent of boys and 15 percent of girls were found to be infected. In 1936, an examination of 4,270 clinic patients in New Orleans, LA found 16.6 percent of the patients to be infected. Today prevalence rates in humans in the United States are lower, due mainly to the marked improvements in hygiene and public health in the last fifty years.

In cats, *Giardia* may or may not cause recognizable signs of disease. For a long time, it was considered to be nonpathogenic in humans. To quote from Craig and Faust's 1940 edition of *Clinical Parasitology* concerning human cases of giardiasis:[5]

> There is a marked tendency among clinicians to regard *G. lamblia* [N.B., another name for the form that is observed in humans] as a pathogenic parasite of man, and a distinct form of dysentery has been described as giardial or lamblial dysentery. A careful survey of the evidence for its pathogenic nature must convince one that most of it is untrustworthy and that there is not sufficient evidence available to demonstrate that it is the cause of any lesions of the intestine. As in the case of the other intestinal flagellates, the trophozoites are only found in diarrheal stools but this far from proves that it is the cause of the diarrhea, and usually some other cause has been found . . . . It is possible that multitudes of these flagellates present in the small intestine might aggravate an already existing inflammatory condition, or aid in the persistence of such a condition, but it must be admitted that up until now there is little evidence of real scientific value that *G. lamblia* initiates lesions in man or is solely responsible for any definite clinical symptoms of disease.

Within the United States, infection with *Giardia* is currently considered to be a common cause of diarrhea. Clinical outbreaks of giardiasis have occurred when individuals share water that is contaminated with fecal material, or contract the infection while traveling. One possible reason for the observed difference in epidemiology of the infections is that people are no longer being infected during childhood and constantly reinfected in adulthood, and thus, are not maintaining the immune status that in the past was induced by constant re-exposure.[6]

CLINICAL SIGNS

Cats can and do develop clinical signs from infections with *Giardia*.[7] The typical sign is diarrhea. Cats may undergo weight loss, and kittens may fail to gain weight. Cats with signs of diarrhea will usually be observed to maintain normal appetites and clinical values. Cats infected with *Giardia* will typically not undergo periods of vomiting. The diarrhea that is observed tends to be due to problems with malabsorption and steatorrhea, and for this reason, the feces tend to be soft and pale in color, and to have increased levels of neutral fats.

DIAGNOSIS

If a cat has diarrhea and an accompanying infection with *Giardia*, a confirmatory diagnosis will often require that a direct saline examination of a small quantity of **fresh** feces be performed. This will allow the identification of the trophozoite stage. Examination of diarrheic feces for cysts is often inconclusive because only trophozoites are shed in the feces. In human medicine, fixed fecal smears are often prepared and stained with iron hematoxylin or by using a trichrome method for the examination of protozoa. The major reason for the examination of fixed smears of human feces is the many kinds of protozoa that must be differentiated. Fewer fecal protozoans are present in cats, and it is typically not necessary to perform such procedures. Fixed fecal samples do have the advantage, however, of producing a permanent slide that can be examined at a later date.

Another method now used routinely in human medicine is the detection of *Giardia* in fecal smears using fluorescein-conjugated antibodies to *Giardia*, and subsequent examination under a fluorescence microscope. This method increases the likelihood of finding the trophozoites and cysts, because they will fluoresce when examined, but the equipment is costly, and other procedures would still be required to concentrate the organisms in any sample.

A method that eliminates some of these problems is the detection of *Giardia* antigens within fecal samples. Antigen-detection tests developed for use with human feces are capable of detecting infections in diarrheic fecal samples in which, due to the degeneration of non-viable trophozoites, there may be no detectable organisms. Such tests work by detecting antigens of the *Giardia* organism that are shed in the feces.[8] These tests, such as ProSpecT®/*Giardia* ™ (a product of Alexon Inc., Mountain View, CA), have not yet been approved for use in cats, but there are indications that they are likely to work very well. Cats should not be examined for giardiasis using the duodenal aspirate method used for dogs, because the organisms may live further posteriad in the intestine of the cat than they do in the dog.

Cysts can usually be detected by using a centrifugal flotation procedure. The zinc-sulfate method is preferred. Because cyst excretion has been shown to be sporadic,[9] it may be best to examine more than a single sample, or to examine the samples by both flotation and antigen detection. Cysts can be observed in sugar flotations of fecal matter, but the cysts will rapidly collapse. Collapsed cysts look like small crescent moons rather than the ovoid forms that are observed in direct smears or zinc-sulfate preparations, which are examined soon after they are made. Antigen-detection assays will also detect shedding cysts.

TREATMENT

Several formulations of benzimidazole have activity against *Giardia.*[10] Albendazole cleared eighteen of twenty dogs that had all been shedding cysts at the beginning of therapy. A similar treatment (25 mg/kg body weight orally twice daily for two days) did not work in cats. However, increasing the number of treatments (25 mg/kg body weight twice daily for five days) successfully cleared five cats of the cysts they were shedding in their feces. This compound is currently not approved for use in cats or dogs, although it is used as an anthelminthic in cattle.

More recently, fenbendazole has been shown to stop beagles from shedding cysts in their feces at the dosage routinely applied for anthelminthic therapy (50 mg/kg body weight orally once a day for three days). This compound is a routinely-used and approved anthelminthic in dogs, but is not approved for use in cats.

Febantel is approved for use in cats, but has not been examined for its efficacy against *Giardia.* Other drugs that have been used to successfully treat *Giardia* infections in cats include metronidazole, furazolidone, and quinacrine.

In catteries, infections with *Giardia* can become a chronic problem, causing periodic bouts of diarrhea in groups of animals. Typically, older cats tend to become refractory to infection and some cats spontaneously stop shedding cysts; these manifestations have been interpreted to mean that cats may develop some form of acquired resistance to giardiasis. It would seem that as cats are prevented access to cysts through improved hygiene, they, like humans, assume a greater risk of developing disease assignable to *Giardia* if they become infected. When *Giardia* is identified in catteries, all cats housed in contiguous cages must be treated, and particular attention given to increasing the levels of sanitation and fecal control.

ENVIRONMENTAL CONTROL

The task of simultaneously clearing many animals of their infections can make disease control in a cattery very difficult. Important facts to remember in infection control are that (1) the cyst stage of the parasite tends to be waterborne; (2) the cats will not stop shedding cysts in their feces immediately after treatment, and not all will stop at the same time; and (3) if the cysts are not removed from the environment, the condition may persist through reinfection. Thus, control involves the treatment of all cats simultaneously, followed by moving the cats to clean cages. If cages cannot be steam cleaned, they should be washed with hot soapy water, rinsed, and dried thoroughly. If it is possible to dry the cages in the heat of the sun, this would be an excellent means of disinfection. If conditions are such that the cages cannot be dried completely, a disinfectant (e.g., ammonia, Lysol™, or bleach) should be added to the water. The day after the cats have received their initial treatment, they should be moved to clean cages. Following the second treatment, the cats should be moved again. This movement can be repeated a third time. If the cats cannot be moved this often, it will reduce the chances of successfully breaking the cycle of transmission.

Fecal samples to verify that the cats have been cleared of cysts should be taken one week after the first treatment. Because of the short prepatent period following infection, delay of more than a week after treatment in collection of fecal samples should be avoided. If such a delay occurs, a negative examination for *Giardia* will indicate clearance, but a positive result may indicate either failure to clear, or reinfection, or both.

ZOONOTIC POTENTIAL

Giardia cysts passed in the feces of cats may have zoonotic potential. Thus, care should be taken in the handling and disposal of cat feces. Also, feces should be collected and disposed of in a manner that will not contaminate the environment with cysts.

SUMMARY

Overall, it is likely that *Giardia* will remain a constant threat to cats. As fecal testing for giardiasis becomes easier, positive diagnoses are likely to become more common. It will become important to determine whether or not cats regularly share their form of this parasite with their owners. Hopefully, however, the discovery of the activity of benzimidazoles against this pathogen will make treatment easier and more efficacious in the future.

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The ultimate purpose of the Cornell Feline Health Center is to improve the health of cats by developing methods to prevent or cure feline diseases and by providing continuing education to veterinarians and cat owners. The Cornell Feline Health Center is a nonprofit organization supported primarily by private contributions.

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