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The genus Giardia contains multiple species of flagellated protozoans that are indistinguishable morphologically. Host specificity was thought to be minimal for Giardia spp., but not all small animal isolates cause disease in human beings. There have been varying results concerning cross-infection potential of Giardia spp.. Human Giardia isolates usually grow in cell culture, animal isolates often do not. Recent genetic analysis has revealed 2 major genotypes in people. Assemblage A (G. duodenalis) has been found in infected humans and many other mammals including dogs and cats. Assemblage B (G. enterica) has been found in infected humans and rarely in dogs and cats. It appears that there are specific genotypes of Giardia that commonly infect dogs (G. canis; Assemblages C and D) and cats (G. felis; Assemblage F) but are rarely found in feces of people. Assemblage A and B can be amplified from feces of pets suggesting that the pets have been exposed to human strains. However, healthy pets are not considered a source of Giardia for HIV infected people by the Centers for Disease Control.

Giardia should be on the differential list for any dog or cats with acute or chronic small bowel diarrhea. However, clinical disease associated with Giardia appears to be more common in puppies and kittens. The primary diagnostic tests for Giardia that are available include direct smear of feces, direct saline preparation, passive fecal flotation, centrifugal fecal flotation (zinc sulfate and sugar are used most frequently), fecal immunofluorescence assay (IFA), fecal antigen ELISA, and fecal PCR assay. These tests can be used alone or in combination. Fresh, liquid feces or feces that contains large quantities of mucus should be microscopically examined immediately in the clinic for the presence of protozoal trophozoites of Giardia spp. (small bowel diarrhea), Tritrichomonas foetus (large bowel diarrhea), and Pentatrichomonas hominis (large bowel diarrhea). A direct saline smear can be made to potentiate observation of these motile organisms. A 2mm X 2mm X 2mm quantity of fresh feces is mixed thoroughly with one drop of 0.9% NaCl or water. The surface of the feces or mucus coating the feces should be used as the trophozoites are most common in these areas. After application of a coverslip, the smear is evaluated for motile organisms by examining it under 100X magnification. Culture (T. foetus), antigen testing (Giardia) or PCR (T. foetus or Giardia) can be used to distinguish between specific
organisms. The direct saline preparation is generally combined with fecal flotation to evaluate for the presence of cysts. Centrifugal flotation is more sensitive than passive flotation.

Multiple ELISAs for detection of Giardia antigens in stool are available. In experiments performed in our laboratory, all human and veterinary assays assessed to date have detected G. canis and G. felis. There is approximately a 2-5% false positive and 2-5% false negative rate for the assays. While it is unknown why false positive rates occur, it is likely that other antigens are non-specifically binding to the reagents. False negative results likely relate to the sensitivity cutoffs of the individual assays. It is currently unknown how long Giardia antigens will persist in feces after successful treatment (resolution of diarrhea). In one study in our laboratory (ML), 62.5% of Giardia cyst or antigen positive dogs administered fenbendazole or nitazoxanide previously were again positive for cysts or antigen on day 34. It is unknown whether these infections were not eliminated or if the dogs were re-infected. The IFA for simultaneous detection of Giardia spp. cysts and Cryptosporidium oocysts is currently available in most commercial veterinary laboratories and has been shown in our laboratory to identify C. felis, C. canis, G. felis, and G. canis. In a recent study at Cornell University, this test was shown to be superior to fecal antigen testing.

Because of the presence of PCR inhibitors in feces, some currently available PCR assays appear to be less sensitive than other tests and so should not be used in lieu of fecal centrifugal flotation or fecal antigen tests. These assays should only be used if genotyping of the previously detected Giardia spp. is desired.

While positive Giardia tests results do not prove that diarrhea was from the infection, most clinicians will treat positive dogs with diarrhea. Giardia spp. have specific antimicrobial sensitivity patterns like bacteria and so it is currently impossible to predict which anti-Giardia drug will be effective. Because G. canis and G. felis can be difficult to cultivate, there is little in vitro susceptibility test result information available. While there have been multiple drugs used for the treatment of giardiasis in dogs and cats, there are few studies that utilized dose titrations and evaluation of drugs in experimentally infected animals. In most studies, fecal samples were only assessed for short periods of time after treatment and immune suppression was not induced to evaluate whether infection was eliminated or merely suppressed. Infection with Giardia does not appear to cause permanent immunity and so reinfection can occur, a finding that also hampers assessment of treatment studies. Treatment options currently available or used historically include metronidazole, tinidazole, ipronidazole, ronidazole, fenbendazole, albendazole, pyrantel/praziquantel/febantel, quinacrine, and furazolidone. Newer drugs being studied include paromomycin and nitazoxanide. See the proceedings entitled “Treatment of Giardia infections” for dosing protocols.

If spore-forming rods, morphologically consistent with Clostridium perfringens are concurrently detected with Giardia on assessment of fecal cytology, administration of metronidazole is indicated as this drug is an antibiotic. If there is clinical evidence to suggest concurrent infection with a nematode like presence of eosinophilia, fenbendazole or febantel are indicated. Many clinicians currently utilize fenbendazole once daily for 5 days as initial therapy. Some clinicians currently recommend the concurrent administration of metronidazole and fenbendazole. Others only resort to combination therapy if there is evidence of a persistent infection not cleared by monotherapy. Recently, febantel containing products have been labeled for treatment of Giardia in some countries.
The primary goal of Giardia treatment is to stop diarrhea. Because healthy pets are not considered human health risks, elimination of infection (which is difficult) is a secondary goal. Giardia spp. can have resistant patterns and so if the first drug fails to clear the infection (cysts or antigen) or resolve the diarrhea, a second drug from an alternate class is indicated. The addition of fiber to the diet may help control clinical signs of giardiasis in some animals by helping with bacterial overgrowth or by inhibiting organism attachment to microvilli. Feeding a restricted fat diets may also be effective. In a current study, we are evaluating the use of a probiotic concurrently with metronidazole. Immunotherapy with the Giardia vaccine has aided in the elimination of cyst shedding and diarrhea in some infected dogs. However, in a controlled study in 16 experimentally infected cats, vaccination as immunotherapy was ineffective with one strain of Giardia. In addition, both Giardia vaccines have been discontinued. Probiotic administration may also be beneficial in some animals. In one study, bathing the dog on the last day of treatment was a beneficial adjunct therapy. In dogs and cats with persistent diarrhea and Giardia spp. infection, a more extensive workup to attempt to diagnose other underlying diseases is indicated if several therapeutic trials fail. Common underlying disorders include cryptosporidiosis, T. foetus in cats, inflammatory bowel disease, bacterial overgrowth, exocrine pancreatic insufficiency, and immunodeficiencies.

It is controversial whether to treat healthy dogs and cats with Giardia infection as healthy pets are not considered significant human health risks by the Centers for Disease Control (www.cdc.gov/hiv/pubs/brochure/oi_pets.htm). However, because clinical signs induced by Giardia spp. can be intermittent and since some Giardia spp. may be zoonotic, treatment of healthy infected animals should be considered with each owner. Treatment of healthy animals is controversial because all of the drugs can potentially cause side-effects, animals with normal stools are not considered human health risks, treatment is unlikely to eliminate infection, and re-infection can occur within days. For example, in a recent study of naturally infected dogs, > 65% of treated dogs were still Giardia infected when rechecked 34 days after treatment. If treatment deemed indicated by the clinician and owner, many clinicians currently recommend that a 5 day course of fenbendazole be administered for apparently healthy dogs and cats that test positive for Giardia. The AAFP Advisory Panel on Zoonoses recommends attempting to remove the source of infection during the treatment period and performing a fecal centrifugal flotation after Giardia treatment one time, within 2-4 weeks after the end of the treatment period (www.catvets.com), even if centrifugal flotation was negative while the antigen test was positive when used to establish the initial diagnosis. If the animal is healthy and negative for cysts, retesting is not indicated again until the next scheduled fecal flotation. Currently it is not recommended for any of the Giardia antigen tests to be used as a recheck test in the early post treatment phase. As discussed, it is currently unknown how long Giardia antigens will persist in feces after successful treatment.

Prevention of Giardia infection involves boiling or filtering of water collected from the environment prior to drinking and disinfection of premises contaminated with infected feces with steam cleaning or quaternary ammonium compounds (1 minute contact time). Transport hosts should be controlled and treatment and bathing of all animals in the environment could be considered. Feces from infected animals should be removed from the environment promptly. To date, no study has shown the Giardia spp. vaccines licensed for dogs and cats to have lessened Giardia spp. infections in the field and so both vaccines have been discontinued.

A complete reference list is available on request in writing to mlappin@colostate.edu