



General Information

- Giardiasis is a disease caused by the protozoan parasite *Giardia intestinalis*, also known as *G. duodenalis* or *G. lamblia*. It is the most commonly identified pathogen in outbreaks of waterborne human disease in the USA. Clinical disease typically manifests as diarrhea. By far the most common source of infection for people is surface water contaminated by human fecal material.
- Within *G. intestinalis* there are a number of genotypes which are grouped into “assemblages” A to F. Assemblages A and B are capable of infecting several animal species, as well as humans. Other assemblages occur only in animals.
- *Giardia*, including zoonotic and species-specific assemblages, occurs frequently in dogs, and less commonly in cats, but the parasite can infect many species including beavers, livestock, ferrets, guinea pigs, gerbils, rats and chinchillas.
- The risk of zoonotic transmission of *Giardia* from pets remains controversial and unquantified, but the potential certainly exists. It is therefore important to be aware of the potential risk and encourage pet owners and people who handle animals to take steps to help prevent the spread of *Giardia*.



Prevalence and Risk Factors

Humans

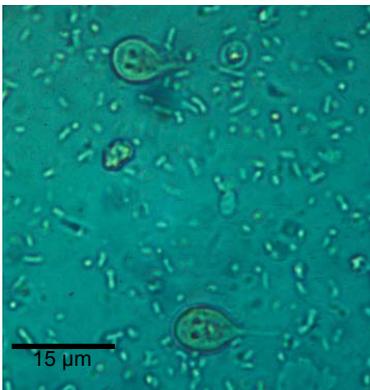
- Giardiasis is endemic worldwide. In industrialized countries the prevalence of *Giardia* in people is estimated to be between 1-7%, but it may be as high as 50% in developing countries.
- All age groups are equally affected during epidemics, but both subclinical infection and clinical disease are more common in children in endemic areas. Outbreaks occur regularly in childcare facilities. Immunocompromised individuals are also more commonly affected than members of the general population.
- *Giardia* is also a cause of “travellers’ diarrhea,” especially among hikers and campers in which the disease is sometimes also called “beaver fever.”

Animals

- *Giardia* is most common in young animals of all susceptible species. The prevalence of *Giardia* in dogs in North America has been estimated to be approximately 7%. The majority of these infections are subclinical. The parasite is more prevalent among dogs in high-density housing such as kennels and shelters.
- The prevalence of *Giardia* in cats is generally lower than in dogs. As in dogs, *Giardia* in cats is usually subclinical and more common in high-density populations such as catteries.
- The prevalence of *G. intestinalis* in pocket pets such as mice, rats, gerbils, hamsters, and guinea pigs is likely very low, but some of these animals may be infected by *Giardia muris*, which is not infective to humans.
- Giardiasis is the most common parasitic infection of chinchillas, and can even be fatal in this species. Some of the infections are caused by the potentially zoonotic *Giardia* assemblages, A and B.

Zoonotic Risk

There is actually very little direct evidence of natural transmission of *Giardia* infection from companion animals to humans, or vice versa. However, contact with farm animals and pets were found to be risk factors for giardiasis in humans in one study. It is therefore prudent to treat all *Giardia* infections, especially in pets, as potentially zoonotic.



Life Cycle

- *Giardia* organisms exist in one of two forms: trophozoites, which reside primarily in the proximal small intestine and are responsible for causing clinical disease, or environmentally-resistant cysts, which are responsible for transmission of the organism from host to host.
- Trophozoites are normally only seen in very fresh feces of a diarrheic patient. They have a very characteristic appearance which is likened to a smiling face (see picture to left). Different assemblages of *G. intestinalis* are morphologically similar and therefore cannot be differentiated on microscopic fecal examination, however this species can be differentiated from *G. agilis* (found in amphibians) and *G. muris* (found in birds, rodents and reptiles), which are not known to infect humans.



- Typically, as the trophozoites pass down the small intestine they develop a resistant wall, forming ovoid cysts approximately 10 µm in length and containing four nuclei (see picture to right).
- The cysts are passed in the feces and are immediately infective to the next susceptible host that ingests them.
- The cysts can survive for more than eight weeks in cool water (8°C), or four weeks in warmer water (21°C), but they are killed by freezing, drying, direct sunlight, and most ordinary disinfectants.
- After ingestion the organism excysts in the proximal small intestine, and can attach to the mucosal surface by its adhesive disk. However, it usually does not invade the epithelium. The trophozoites then divide by binary fission and the cycle begins again. In diarrheic individuals, the trophozoites can cause villous atrophy, crypt hyperplasia and extensive invasion of the lamina propria by inflammatory cells within the small intestine.



Transmission

Giardia is transmitted by ingestion of cysts of an appropriate species and assemblage from the feces of a human or animal. In humans, this most commonly occurs with fecal contamination of drinking water or recreational water such as lakes, ponds and inadequately treated swimming pools. As few as ten cysts can cause infection in a person. Animals may be infected by fecal contamination of water, food or any object they lick or chew.

Symptoms and Signs

Humans

- Giardiasis infection in humans, as in animals, is usually asymptomatic. When symptoms do occur, there is an incubation period of 3-25 days, followed by acute onset of watery, sometimes explosive, diarrhea (without blood), bloating, and abdominal pain, which last for 3-4 days in acute infections.
- In most individuals the infection is self-limiting, but chronic infections can occur, resulting in similar but intermittent signs for months. Giardiasis can cause considerable illness in immunocompromised individuals.

Animals

- The prepatent period of *Giardia* infection ranges from 5-12 days in dogs and 5-16 days in cats. Infection is usually subclinical, but can be associated with acute, intermittent or chronic diarrhea in both dogs and cats. The stool is often described as very malodorous and steatorrheic. Weight loss may also occur.
- Clinical disease is most common in animals which are young, stressed, immunocompromised or kept in high-density housing. Administration of immunosuppressive steroids can lead to recrudescence of infection in dogs.
- Uncomplicated infections generally should not cause fever, vomiting or inappetence. If any of these signs are present, additional diagnostics should be performed in order to determine their cause.



Diagnosis

- Definitive diagnosis of giardiasis is made by identification of cysts, trophozoites or *Giardia* antigen in the feces.
- A drop of warm, fresh feces mixed with a drop of warm saline can be examined at 40x magnification for trophozoites exhibiting the characteristic “tumbling leaf” motion of *Giardia*.
- A fecal floatation using the zinc sulfate concentration technique (ZSCT), as performed for detection of nematode eggs, can be used to identify cysts in formed or diarrheic feces. The solution specific gravity should be 1.180. The slides are best examined within ten minutes of being made. *Giardia* trophozoites and cysts will stain with Lugol’s iodine, whereas other coccidian oocysts and sporocysts do not.
- Shedding of cysts is inconsistent. In dogs and cats, at least 3 fecal samples should be examined over 3-5 days in order to rule out *Giardia* infection.

Several immunoassays have been developed for the detection of *Giardia* antigen in feces. One study found that the sensitivity and specificity of the ProSpecT/*Giardia* ELISA were actually slightly lower than those of the ZSCT in dogs. However, the ELISA may be slightly more sensitive when compared to a single ZSCT test. The SNAP *Giardia* and ProSpecT/*Giardia* tests have both been shown to perform equally or better than the ZSCT in cats. Use



of a combination of tests (e.g. ZSCT and fecal ELISA) may provide the best results. The currently available FAT (Merifluor Cryptosporidium/Giardia) has been shown to have better sensitivity and specificity than fecal floatation in cats, and it can be used on stored or formalin-fixed samples. Polymerase chain reaction (PCR) can be used to differentiate zoonotic from non-zoonotic strains of *Giardia* and will hopefully be more readily available for commercial use in the near future. Contact your diagnostic laboratory to determine what tests they offer for *Giardia*.

Treatment of Giardiasis

- In most cases, giardiasis is subclinical. Individual cases of this type usually do not require treatment.
- In acute clinical cases, the disease is often self-limiting and therefore may require only supportive therapy, which usually consists of fluids to compensate for fluid losses in the diarrhea.
- The use of anti-giardial medications in subclinical or uncomplicated cases is controversial. In an otherwise healthy animal without contact with high-risk individuals, specific drug therapy is likely unnecessary and may contribute to development of antimicrobial resistance.
- It is unknown how long an untreated animal will take to clear the infection, but this is likely strongly influenced by the degree of opportunity for repeated autoinfection. Measures to control the spread of the pathogen and prevent auto-infection of the patient should be taken whether or not the animal is treated with anti-giardial drugs.

Drugs

- No drug is labeled for treatment of giardiasis in animals.
- Metronidazole (dogs 15-30 mg/kg, cats 10-25 mg/kg PO q12-24h for 5-7 days) has been the mainstay of therapy for *Giardia* infections for years, but it is not universally effective and some animals exhibit side effects ranging from anorexia and vomiting to neurological derangements. It should be avoided in pregnant animals.
- Fenbendazole (50 mg/kg PO q24h for 3 days) is effective against *Giardia* in dogs, as well as other intestinal parasites, and can be used in pregnant animals. The same dose for 5 days in cats is also somewhat effective.
- Drontal Plus (Bayer), a combination of praziquantel-pyrantel-febantel, also appears to be effective for treating *Giardia* when used at the label dose for three days in dogs.
- Please see Additional Information for sources describing other treatment regimens and further details.

Vaccination

A *Giardia* vaccine (GiardiaVax, Wyeth) is available for dogs, which is labeled for reduction of the incidence of clinical giardiasis and the incidence, severity and duration of cyst shedding. The vaccine appears to be relatively safe, but its utility in animals that have likely already been exposed to the parasite must be considered. It does not appear to be effective for treatment of subclinical giardiasis in either dogs or cats. It has been used as an immunotherapeutic in chronically infected dogs that are not responsive to chemotherapeutics, but there are no supportive controlled studies for this application.



Infection Control

Giardia can only be transmitted by ingestion of cysts from an infected animal or person, and then only if the species and strain of *Giardia* are compatible with the new host. It cannot be spread by contact with blood or other body fluids. Therefore control of fecal contamination, both human and animal, is of primary importance.

General Recommendations:

- Emphasize to all staff proper hand hygiene with soap and water after handling animal feces
- Pick up dog feces immediately to prevent environmental contamination with resistant cysts
- Prevent animals from drinking from puddles, ponds or any water source that may be contaminated with feces.

Cysts survive well in a cool, wet environment, but they may also be able to survive on an animal's haircoat for some time, particularly if it is damp. Animals with diarrhea are especially likely to have trace fecal contamination of their coats, even if it is not visible to the naked eye. Dogs that eat their own feces or those of other animals (a behavior which should be strongly discouraged), or any pet that grooms its perineal region, may also harbour cysts in the hair around their muzzles. In these cases the infection could also be transmitted by contact with the animal's face.



Infected Animals

An animal infected with *Giardia* should be kept separate from other animals, especially those that are sick or immunocompromised. Pet areas, particularly runs or kennels, should regularly be thoroughly cleaned of all visible fecal material and then treated with 10% bleach or a quaternary ammonium compound (quat), being sure to allow at least 20 minutes of contact time. Complete drying of the area will also help considerably to kill cysts. Bedding and blankets that become soiled with fecal material should be removed and washed separately. Animals treated for infection should be bathed thoroughly before being brought into a clean area.

High-Risk Environments

In catteries and kennels with a high prevalence or clinical outbreak of giardiasis, treatment of subclinically infected animals may be warranted in order to bring the situation under control. A complete control program should address:

- Environmental decontamination
- Treatment of infected animals
- Decontamination of animals in terms of cysts in the haircoat
- Prevention of reintroduction of infection

Zoonotic Disease Risk

The zoonotic risk to the general population posed by *Giardia* is:



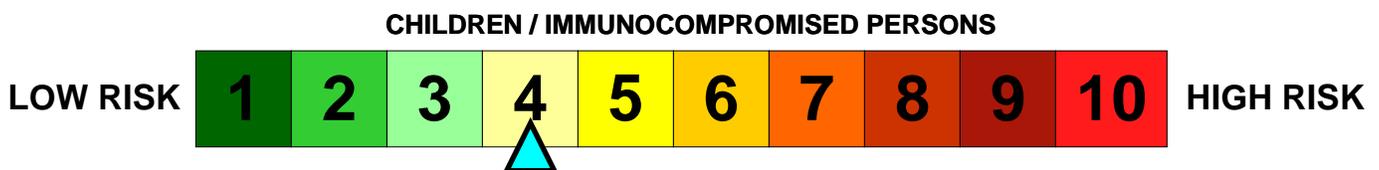
Individuals with Compromised Immune Systems:

- Immunocompromised individuals (e.g. HIV/AIDS, transplant or cancer patients) are more susceptible to many kinds of infections, including those which may be transmitted by pets. It can be safe and even beneficial for such a person to have a pet, if extra precautions are taken to prevent disease transmission.
- It is important for both an immunocompromised person and the people around that person to be particularly diligent about avoiding direct or indirect contact with fecal material of any kind. After touching an animal, the person should immediately and thoroughly wash his/her hands with soap and running water. If the person's clothing becomes visibly soiled from the animal, it should be removed and laundered. Similar precautions can be applied to elderly individuals.

Infants and Young Children:

- Young children are more likely than adults to extensively handle animals if given the opportunity. Children are also more likely to touch their faces or mouths, and are less likely to wash their hands after handling any kind of animal. Many children tend to "snuggle" with animals such as dogs and cats, and this very close contact can increase the risk of disease transmission.
- Young children should be supervised when playing with animals, and an adult should ensure that they wash their hands afterwards, and especially prior to handling food. Older children should be taught to do the same.

For these groups, the zoonotic risk posed by *Giardia* is likely:



Additional Reading

- Barr SC, Bowman DD. Giardiasis in dogs and cats. *Compend Contin Educ Pract Vet.* 1994;16:603-610.
- Greene CE. *Infectious Diseases of the Dog and Cat.* 3rd ed. Edinburgh: Elsevier Saunders, 2006.
- Hunter PR, Thompson RC. The zoonotic transmission of *Giardia* and *Cryptosporidium*. *Int J Parasitol.* 2005;35:1181-1190.