



PREVENTION FIRST Although hookworms are slightly easier to treat than roundworms, prevention is always preferable to treatment options.

PARASITOLOGY

Hookworms in Dogs

Andrew Moorhead, DVM, MS, PhD, DACVM (Parasitology)
University of Georgia College of Veterinary Medicine

Dogs can become infected with many infectious agents, but the “unholy trinity” of roundworms, hookworms, and whipworms ranks among some of the most common and well known. For many reasons, including persistence of infectious stages in the environment and zoonotic potential (i.e., larva migrans), it is advantageous to prevent these parasitic infections and the resulting contamination in the soil.¹ In this second article in a series of 3, we will discuss hookworms. More information about these parasites is located at capcvet.org.

Hookworms is the common name for a group of strongylid parasites that affect dogs and live in the small intestine. Although there are several species, I will focus this discussion on *Ancylostoma caninum*. The hookworms *Uncinaria stenocephala* and *Ancylostoma braziliense* will be discussed briefly.

Hookworms are shaped like a hook, hence their name, and the length of a hookworm is roughly the diameter of a penny. A characteristic feature of *A. caninum* hookworms is the large buccal cavity, or mouth, that possesses 3 sets of teeth (**FIGURE 1A**). These teeth enable attachment to the wall of the small intestine, where the parasite can then ingest blood. It follows that the primary sign associated with infection is anemia.

Fortunately, treatment is relatively straightforward.² As with other parasites, if we understand their life cycle, we can better treat and prevent their transmission.

THE HOOKWORM LIFE CYCLE

Adult male and female hookworms mate in the dog’s intestine. The female worm then produces a large number of eggs per day (**FIGURE 1B**), which are shed in the feces into the environment. When shed, these eggs contain a morula and are not immediately infective. Within 24 to 48 hours, they develop to first-stage larvae (L1) and hatch. During the next week (5 to 10 days), L1 will molt to infectious third-stage larvae (L3). L3 can then infect a host through either ingestion or, more commonly, skin penetration.³

Infection via ingestion: After L3 hookworms have been ingested, they traverse the stomach and arrive in the small intestine, where they enter the glands in the intestinal wall. After a few days, they emerge and develop into adults. From the time of infection, the prepatent period is approximately 2 to 4 weeks. Although the definitive host can be directly infected, the host can also become infected after ingesting insects or rodents (i.e., paratenic or transport hosts) that were infected with L3.⁴

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Infection via skin penetration: After L3 hookworms penetrate the skin, they migrate via blood to the lungs, where they access the trachea and are swallowed. Similar to those that gained entry through oral infection, these L3 then end up in the intestine.^{1,3,4} L3 can also undergo somatic migration, in which larvae reenter the alveolar blood vessels and travel to the muscles or organs, where they become encysted and their development is arrested.^{1,2,4} The arrested larvae

may become reactivated under 1 of 2 conditions: larval leak or transmammary transmission to puppies.

Larval leak: When adults are eliminated, somatically stored larvae from muscle and intestinal wall migrate to the lumen of the intestine and develop into adults. Larval leak leads to refractory egg shedding and frustration that, despite anthelmintic treatment, hookworm eggs are still detected in the dog's feces.²

Transmammary transmission: Arrested larvae can become reactivated during parturition and as a result can be transmitted to puppies through the bitch's milk. Transmammary transmission is a very important route of infection for puppies.

Please note that, unlike with roundworms, *A. caninum* hookworms are *not* transmitted transplacentally.

CLINICAL DISEASE

Regardless of the means of infection, hookworms attach to the small intestinal mucosa, after which they will suck blood—*lots* of blood. The primary cause of pathology and clinical disease from hookworms is blood loss. Disease can take 1 of 4 forms: peracute, acute, compensated, and decompensated.

Peracute: This form of hookworm disease involves dramatic anemia and is usually associated with newborn puppies (~1 week of age) infected by transmammary transmission. Peracute hookworm disease is life-threatening. Because the worms are not yet patent, eggs will not be detected by fecal flotation. Deworm severely anemic puppies and provide supportive care, including transfusions.

Acute: Acute hookworm disease is observed in slightly older puppies, and although these puppies will be anemic, the anemia is not as dramatic as that of peracute disease. However, acute disease can also be life-threatening if untreated. Eggs can be detected by fecal flotation.

Compensated: Adult dogs are more resistant than puppies to hookworm infection. Some adult dogs can appear clinically normal but still be infected with some level of hookworms, potentially resulting from larval leak.

Decompensated: Compensated hookworm disease can develop into decompensated disease. Dogs with



FIGURE 1. *Ancylostoma caninum* hookworms as viewed on fecal flotation at 40x magnification. **(A)** Adult worm; note the 3 pairs of teeth. **(B)** Eggs.



decompensated hookworm disease show signs consistent with hookworm disease, specifically anemia. Decompensation is typically secondary to a chronic disease (e.g., cancer).²

OTHER HOOKWORMS

Two other species of hookworm affect dogs: *U. stenocephala* and *A. braziliense*. Worms of both of these species can also infect cats. *U. stenocephala* worms are referred to as cold-weather hookworms because of their presence in more temperate (versus tropical) regions. The primary means of infection is oral, and the pathology associated with infection is less than that of *A. caninum* worms because they have cutting plates instead of teeth in the buccal cavity.^{1,2} *A. braziliense* worms can cause disease in dogs, but the primary concern is human infection.

ZOONOTIC POTENTIAL

Hookworms can infect humans. The most well-known form of infection is cutaneous larva migrans, commonly known as “creeping eruption.”

A. braziliense worms are the primary cause of zoonotic disease. People with cutaneous larva migrans will have red serpiginous tracks that are extremely pruritic. This condition is also known as “plumber’s itch,” which, as the name implies, affects plumbers who crawled in areas contaminated with larvae.

Infection with *A. caninum* worms results in more focal punctate skin lesions instead of the persistent tracks associated with *A. braziliense* infection. Infection by ingestion of *A. caninum* worms can also cause eosinophilic enteritis.³ The easiest way to prevent these serious diseases is to regularly deworm dogs before the worms become adults. If the worms do not make it to the adult stage, they cannot produce eggs.¹ The other obvious way to prevent this disease is to pick up and discard dogs’ feces.

PREVENTION

Hookworm larvae are much more susceptible than roundworm eggs to environmental changes and decontamination with bleach. Also, hookworm larvae will be killed by a hard freeze.² However, it is more prudent to prevent contamination by instituting appropriate control measures before the worms can contaminate the environment.

The Ben Franklin quotation “An ounce of prevention is worth a pound of cure” can apply to hookworm infections. This preventive ounce can be condensed for clients into 3 simple points to prevent hookworms as well as roundworms:

- **Pick up dog feces.** If hookworm eggs/larvae are not in the environment, other animals cannot become infected. Follow this practice at your clinic and convince your clients to do it at home.
- **Cover sandboxes.** Covered sandboxes cannot become contaminated by dogs and cats randomly passing by.
- **Deworm dogs regularly.** Using an approved anthelmintic, deworm puppies at 2, 4, 6, and 8 weeks of age and then monthly, if possible.

Emphasizing prevention information to clients in a concise, bullet-point format will help them understand and adhere to the recommendations. Client adherence can markedly reduce the risk for hookworm infection of pets and humans. If you emphasize only one point, it should be that one easy way that clients can control hookworms is to routinely pick up their dog’s feces.

TVP

References

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Andrew R. Moorhead

Dr. Moorhead is a small animal parasitologist and Assistant Professor at the University of Georgia College of Veterinary Medicine. Dr. Moorhead received a DVM degree from North Carolina State University, followed by an MS degree in Veterinary Parasitology from Purdue University. He then received his PhD degree from Cornell University. He became a Diplomate of ACVM (Parasitology) in 2015. He is also an at-large member of the Executive Board of the American Heartworm Society. Dr. Moorhead’s main research interest is the role of host-specific cues in development of filarial worms, specifically *Dirofilaria immitis* and *Brugia malayi*.