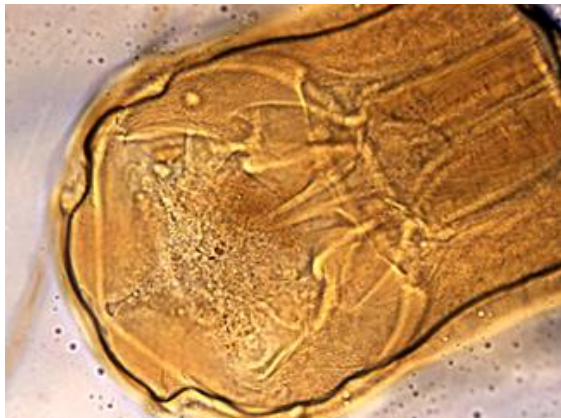


## Hookworms in Cats and Dogs

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Notice the teeth of the adult hookworm. Photo courtesy of CDC / Dr. Mae

Hookworms (*Ancylostoma caninum*, *Ancylostoma braziliense*, *Uncinaria stenocephala*) are one of the classical groups internal parasites of puppies, the others being roundworms, tapeworms, and coccidia. Hookworm infection has several features that are of interest to the caretakers of dogs.

- Hookworms (particularly *Ancylostoma caninum*) suck blood.
- Hookworms can be transmitted to unborn pups.
- Hookworms can infect humans.

Before elaborating on these aspects of hookworm infection, it is important to understand the life cycle of the hookworm, encompassing how infection happens, how the parasite lives, etc.

### Life Cycle of the Hookworm

The adult hookworm lives in the small intestine of its host where it hangs on to the intestinal wall using its 6 sharp teeth. This means that, like other parasitic worms, they are bathed in intestinal contents but while other worms share the host's food by absorbing it directly through their skin, hookworms feed by drinking their host's blood. The adult worm lives and mates within the host's intestine and ultimately, the female worm produces eggs. Hookworm eggs are released into the intestinal contents and passed into the world mixed in with the host's stool.



Hookworms are attached to the intestinal lining. Photo courtesy of CDC.

The egg hatches in the environment and develops from a first stage larva (the hatchling) to a second stage larva and finally a third stage larva, which is ready to infect a new host.



Illustration by Dr. Wendy Brooks

The larva can infect its new host in several ways. One way is to penetrate the host's skin directly through the feet or belly or whatever part of the skin is touching the ground. Another way for the larva to gain entry to the new host is to be in soil that is licked and swallowed by the host as it cleans itself. The pet can be infected from contaminated dirt or by eating an infected animal. This could be a prey animal, such as a rodent, or could be an insect such as a cockroach.

Once the larvae are inside the host, they make their way to the intestine where some worms simply stay and mature into adulthood. Other individuals are bolder, tunneling out of the intestine and migrating to the lung tissue. In the lung, the larvae develop into fourth stage larvae, and when they are ready they break out of the lung, climb up the trachea (windpipe), get coughed into the throat, and swallowed. Once back in the intestine, these well-traveled worms will complete their maturation to adulthood, rejoining any friends they had that never left the intestine on a migration.

Not all the worms that begin this treacherous migration complete it. As they emerge from one tissue to move on to the next, some fall into a state of arrest where they go dormant and encyst. These larvae remain inactive, periodically emerging and continuing their migration.

**Summary: The adult worms live by sucking blood from the intestine. Their eggs are passed by the host into the environment where a new host picks them up.**

**The developing larvae may migrate widely through the new host's body before settling down to complete their maturation.**

It is worth repeating that the host is not always a pet. Other vertebrates, such as rodents and birds, can pick up hookworm larvae from the soil. If the pet eats an infected rodent or bird, the pet will become infected just the same as if the infection came directly from the soil.

Now let's return to the points we want to emphasize.

### Hookworms Suck Blood



Photo by Morguefile.com

Hookworm infection can be looked at as a natural check in the canine population as it is frequently lethal to young puppies. A young puppy is growing, and growth includes making enough new blood to serve not only its current oxygen needs but what is required for growth as well. Growing requires a tremendous red blood cell production from the puppy's bone marrow, yet in the hookworm-infected puppy this process is being sabotaged by numerous tiny vampires within. The puppy may effectively bleed to death.

Infected puppies are commonly pale, weak, and have long-standing deficiencies. They may or may not have diarrhea.

Treatment involves deworming with one of several products:

mebendazole (Telminic®), fenbendazole (Panacur®), or pyrantel pamoate (Nemex®, Drontal®, or Strongid T®). Deworming should be repeated in approximately 2 to 4 weeks. These products are not absorbed into the host's body from the GI tract and can only kill the worms living within the GI tract. The point of the second deworming is to kill worms in the process of migration at the time of the first deworming, allowing them an additional month to complete their migration. We currently do not have a deworming strategy effective against the encysted larvae in other areas of the host's body.

Simply killing the worms will not be sufficient to save the life of a severely affected puppy. Like any other blood loss, a blood transfusion may be needed to keep the puppy alive until it can replace its own lost red blood cells. An iron supplement is frequently needed as well.

### Hookworms are Transmitted to Unborn Pups

Infection of a very young puppy can occur in two ways not addressed above.

Typically an infected mother dog will have encysted larvae all around her body. Throughout the adult dog's life, some larvae will awaken, break out of their cysts, and complete their migration to the GI tract.

Pregnancy hormones unfortunately serve as little wake-up calls to encysted hookworm larvae only this

If the mother's milk is contaminated, puppies will become infected by drinking it. Photo by Bobbie Daniel



time, the little worms migrate to the unborn puppies and to the mammary gland. This means that most puppies

will become infected by drinking their mother's contaminated milk. If this is not enough to infect the entire litter, others will become infected from the soil of their own nest that will quickly become contaminated with the stool of their infected litter mates.

It is clear why puppies are at a special risk over adult dogs when it comes to hookworms. The Companion Animal Parasite Council has recommended automatically deworming puppies for hookworms beginning at age two weeks in areas where hookworms are common.

### Can We Prevent Transmission from the Mother?

The answer is yes but daily deworming is required through the second half of pregnancy and into the nursing period. A regular single deworming will not be effective in protecting the litter. A specific protocol using fenbendazole (Panacur®) has been found to be effective in preventing both roundworm and hookworm infection in unborn puppies.

Ask your veterinarian about this method if you are contemplating breeding a female dog. Female dogs using Proheart6 (injectable moxidectin) for heartworm prevention are believed to pass fewer hookworm larvae on to their pups.

### Hookworms Can Infect Human Beings



Cutaneous larva migrans (CLM) occurs as red, inflamed lesions in the skin where the larvae of canine hookworms burrow under the skin. Photo courtesy of CDC.

Contaminated soil is an important hookworm source when it comes to a human disease called cutaneous larva migrans. Running barefoot through the park or beach may seem pleasant but if the soil has been contaminated with canine fecal matter, the eager infective larvae may be waiting to penetrate your skin.

Hookworm infection in the skin is intensely itchy but usually treatable. Local restrictions on bringing dogs to beaches and the strict clean-up laws reflect concern for hookworm (and roundworm) infection in people.

Humans can also become infected by eating improperly washed vegetables that may harbor contaminated soil. Humans have been found with actual hookworm intestinal infection. This would be a challenging diagnosis as it is not usually expected but the good news is that it is treated fairly easily when it is discovered.

For additional information, see the Centers for Disease Control and Protection's (CDC) hookworm fact sheet.

### Decontaminating the Environment

Many people are concerned about how to decontaminate the backyard or property that has housed an infected dog. The good news is that unlike roundworms, which are extremely hardy in the environment, hookworm eggs deplete their energy reserves in a few months and die. Further, hookworm eggs do not survive freezing temperatures. Borates raked into the soil will also kill hookworm eggs but will kill grass and vegetation as well.

### Prevention

Most heartworm preventives will also prevent hookworm infection. See this chart of heartworm preventives to see which ones work against hookworms.

### Feline Hookworms

There are two species of hookworms in cats: *Ancylostoma tubaeforme* and *Ancylostoma braziliense*, the former being the most aggressive blood sucker. The story is pretty much the same for cats as for dogs with a few exceptions:

- Kittens cannot be infected before birth nor can they be infected by nursing. Cats are generally infected by larvae invading the skin or by eating an infected prey animal.



The American Cockroach. Photo by Gary Alpert at the English language Wikipedia.

- Both dogs and cats can be infected by eating a vertebrate host such as a rodent but it is important not to forget the cockroach. A scuttling bug can be a tempting toy for a cat in particular and if eaten, the cockroach can transmit hookworm larvae it is carrying. The cockroach can also infect dogs.
- The Companion Animal Parasite Control Council recommends deworming kittens beginning at age three weeks with pyrantel pamoate.
- There are numerous products approved for the treatment of feline hookworm infection: ivermectin, milbemycin oxime, emodepside (active ingredient in Profender®), selamectin, and moxidectin.
- See a chart of heartworm preventives that also protect against hookworms.

Hookworms are significant parasites in both dogs and cats and constitute a human hazard as well. Very young pets are at highest risk for blood so it is important to deworm regularly. If you have further questions or concerns about hookworms, remember your veterinarian is always there to see that you get the answers you need.

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