Hookworms in Cats and Dogs

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

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

Teeth of the Adult Hookworm

Photo courtesy of CDC / Dr. Mae

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.

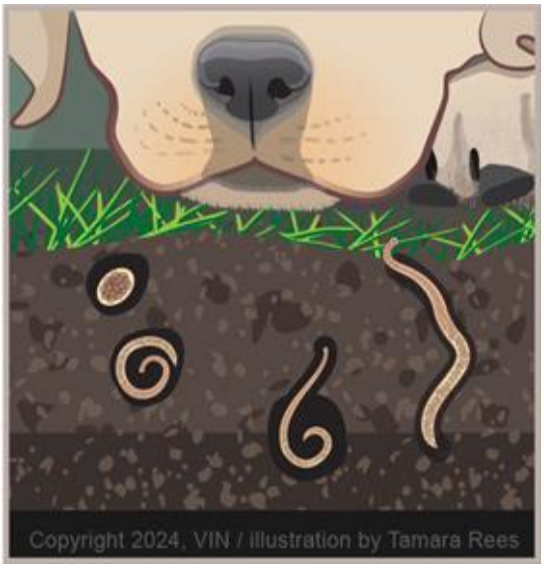
Hookworm Life Cycle

The adult hookworm lives in the small intestine of its host, where it hangs on to the intestinal wall using its six sharp teeth. This means that, like other parasitic worms, it is 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.

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.

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 by contaminated dirt or by eating an infected animal. This could be a prey animal, such as a rodent, or 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 up into the throat, and are swallowed into the esophagus. 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.



Soil becomes infested with worms from infected stool. Cats and dogs can ingest worm larvae (young worms) from soil, and the cycle continues.

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. Only hookworms in the intestinal tract are vulnerable to deworming medications; those in various stages of migration are protected and very difficult to kill.

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 your pet eats an infected rodent or bird, your pet will become infected just the same as if the infection came directly from the soil.

Hookworms Suck Blood

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.

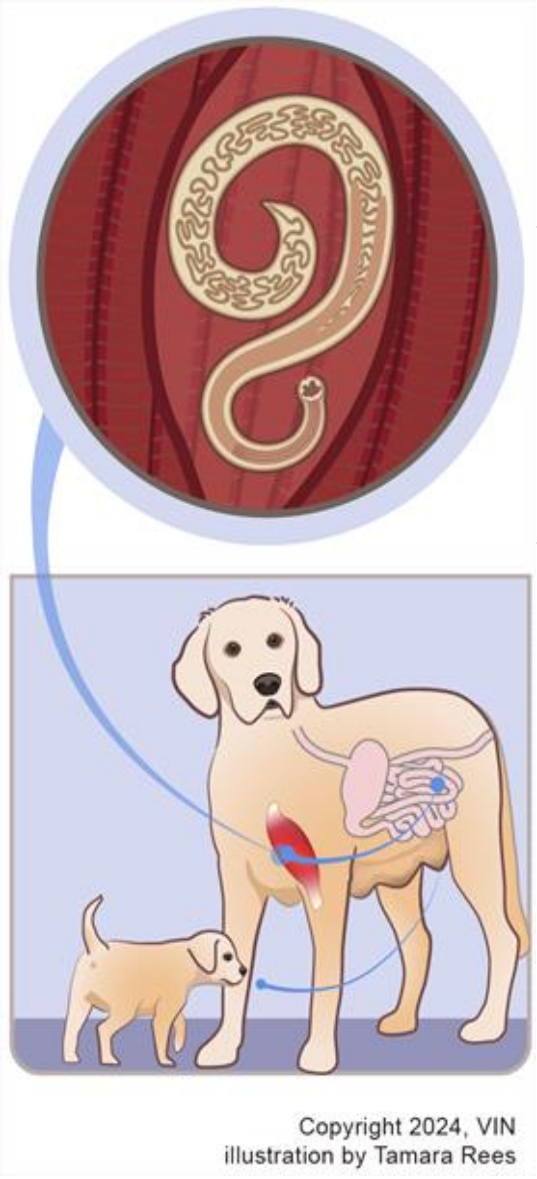
Treatment involves deworming with one of numerous products. Some active ingredients include:

- Mebendazole (oral)
- Milbemycin (oral)
- Moxidectin (topical or injectable)
- Fenbendazole (oral)
- Pyrantel pamoate (oral)

Many newer flea products include one of these dewormers so as to regularly deworm dogs and older puppies. Some of these are suitable for very young puppies seeing as the Companion Animal Parasite Council recommends beginning deworming at age two weeks and continuing to do so every two weeks until age eight weeks when one of the regular monthly products can be started.

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.

Summary: **Adult worms live by sucking blood from the intestine. The host passes their eggs 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.**



Most puppies will become infected with hookworms by drinking their mother's contaminated milk.

Hookworm Transmission 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 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, which will quickly become contaminated with the stool of their infected litter mates.

Ask your veterinarian about this method if you are contemplating breeding a female dog.

Can Transmission From the Mother Be Prevented?

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

Female dogs using Proheart6 or Proheart12 (injectable moxidectin) for heartworm prevention are believed to pass fewer hookworm larvae onto their pups.

Hookworms Can Infect Human Beings

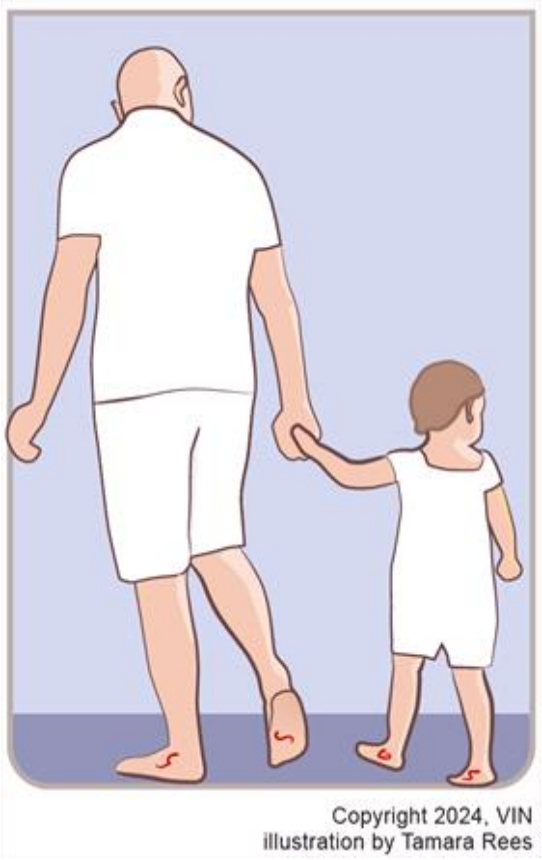
Contaminated soil is an important hookworm source when it comes to the human disease called cutaneous larva migrans. Running barefoot through the park or beach may seem pleasant but if the soil has been contaminated with canine fecal matter, the eager infective

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 infections. This can be a challenging diagnosis, but the good news is that it is treated fairly easily when discovered.

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



Walking with no shoes in areas with infested soil can allow hookworm larvae to penetrate the skin, leading to infections in humans.

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. Boric acid can be raked into the soil to kill hookworm eggs, but this will kill grass and vegetation as well. Steam cleaning inside the home (especially if a detergent is added) should kill any hookworms in the carpet. Obviously, indoors or outdoors, prompt removal of fecal matter is paramount.

The most important thing in fighting hookworms (other than your pet's dewormer medication) is picking up your pet's waste in the yard quickly after your pet eliminates. This can help stop the hookworm life cycle, hopefully keeping your pet from reinfecting themselves and infecting other pets or humans. Keeping land around your home mowed, with yard waste picked up can make cleaning up after your pets easier. Following the removal of feces and routine cleaning, both indoors and outside, hard surfaces can be treated with 1:10 bleach to water solution. Steam cleaning furniture at temperatures above 130° F can kill larvae as well.

In some areas, pest control professionals may also treat your lawn for hookworms.

It is important for all of your human family members to not dig up, garden, or play in potentially contaminated soil or walk without shoes in your yard where your pet eliminates while they are being treated for hookworms.

Preventing Future Infections

The Companion Animal Parasite Council recommends that dogs be dewormed monthly, starting at age eight weeks. In most areas of the U.S., heartworm products are needed monthly to protect against heartworm disease and most (but not all) heartworm preventives will also prevent hookworm infection. Alternatively, tablets or liquids can be given separately. The same products listed above as treatments are also preventives.

Explore products for heartworm prevention that also work against other parasitic worms.

Resistant Hookworms

The influx of retired racing greyhounds into the pet population has brought with it resistant populations of hookworms. In 2020, it was reported that most, if not all, racing greyhounds are coming off the track infected with hookworm infections that do not respond to the usual medications. As these dogs mingle with other canine pets, resistant hookworm populations have spread.

When a hookworm infection seems stubborn, a special test can be performed. This test is called a Fecal Egg Count Reduction Test, which compares egg counts in fecal samples before and 10-14 days or so after treatment (with the product that is believed not to have worked). Counting eggs before and after treatment gives a better idea of whether the hookworm infection is truly resistant.

A special laboratory may be needed to run this type of testing as it is more commonly done in livestock where resistant parasites have been a long-standing farming issue. The goal of therapy becomes not clearing the infection, but clearing the clinical signs and maintaining as low an egg count as possible. Testing is done using pyrantel, fenbendazole, and milbemycin oxime in the hope of finding an effective product. An egg count reduction of greater than 95% is considered effective. An egg count reduction of less than 75% is considered ineffective, and a combination of multiple dewormers will be needed monthly.

Of all the dewormers to which hookworms are generally considered vulnerable, moxidectin is probably the newest, and as long as the dog has not been previously treated with this product, there is a good chance that a combination of dewormers will be effective as long as moxidectin is included. That said, moxidectin-resistant hookworms most certainly exist.

Keep in mind that hookworm larvae encyst throughout an infected dog's body and "leak" into the intestine periodically as they mature. There is no way to clear these encysted dormant hookworms and they cannot be addressed until they make it back to the intestinal tract. There is no way to distinguish an old infection stemming from migrating worms from an infection with resistant hookworms. Of course, a resistant hookworm infection may lead to the migration of resistant worms into the intestine theoretically for a dog's entire life.

Feline Hookworms

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

- Kittens cannot be infected by nursing. Cats are generally infected by larvae invading the skin or by eating an infected prey animal, although infection through the skin from the ground can also occur.
- 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. A cockroach can also infect dogs.
- The Companion Animal Parasite Control Council recommends deworming kittens beginning at age two weeks with pyrantel pamoate and continuing deworming every two weeks through age eight weeks. After that, a monthly deworming is recommended (easily combined with a flea product). The indoor-only lifestyle will greatly lessen the need for this level of parasite protection, however.
- There are numerous products approved for the treatment of feline hookworm infection: ivermectin, milbemycin oxime, emodepside (the 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 the highest risk for blood loss 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.