Hookworms

The hookworm (*Ancylostoma caninum, Ancylostoma braziliense*) is one of the classical internal parasites of puppies, the others being roundworms, tapeworms, and coccidia. (There are species of hookworms that infect cats but hookworm infection in cats is not nearly as common as hookworm infection in dogs.) Hookworm infection has several special features that are of interest to us as the caretakers of dogs:

- Hookworms suck blood.
- Hookworms can be transmitted to unborn pups.
- Hookworms can infect humans.

adult hookworm (note teeth)

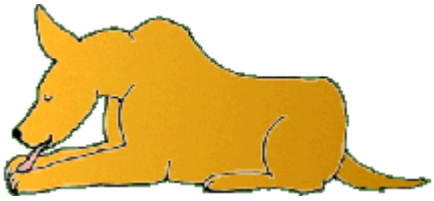
Before elaborating on these important aspects of hookworm infection, it is important to understand the life cycle of the hookworm, encompassing how infection happens, how the parasite lives, etc.

Hookworms living inside the intestines

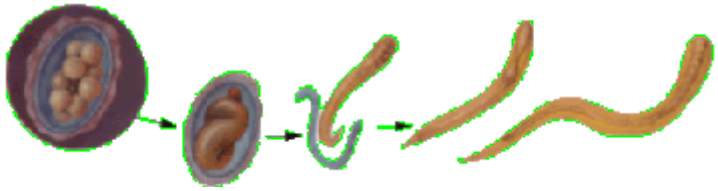
Life Cycle of the Hookworm

The adult hookworm lives in the small intestine of its host. It hangs on to the intestinal wall using its six sharp teeth and unlike other worms that just absorb the digested food through their skin as it passes by; the hookworm drinks its host's blood. The adult worm lives and mates within the host 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 present in soil that is licked and swallowed by the host as it cleans itself.



Hookworm eggs develop into larvae, ready to infect host through the skin

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, tunnel out of the intestine, and migrate to the lung tissue. In the lung, the larvae develop into 4th stage larvae and when they are ready they break out of the lung, climb up the trachea, get coughed into the throat and swallowed. Once back in the intestine, these well-traveled worms will complete their maturation to adulthood.

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 but periodically some will emerge and complete their migration.

The adult worms live by sucking blood from the intestine. The host passes the 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.

Now let us return to the three points we want to emphasize.

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 that includes making enough new blood to serve not only its needs but also the needs of its growth. 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 be effectively bled 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 (Telmintic®), Fenbendazole (Panacur (R)), Pyrantel pamoate (Nemex ®, Drontal ®, or Strongid T ®). Deworming should be repeated in approximately 30 days. 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 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 in the above description of transmission and will be described now.

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.

The hormones of pregnancy 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.

Some members of the litter will be born infected. Others will become infected by drinking the contaminated milk of their own mother. 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 the infected litter. It is clear why puppies are at a special risk over adult dogs when it comes to hookworms. The Centers for Disease Control and Prevention recommends automatically deworming puppies for hookworms beginning at age 2 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 special 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.