AGRICULTURAL
MU Guide
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Canine Heartworm Disease

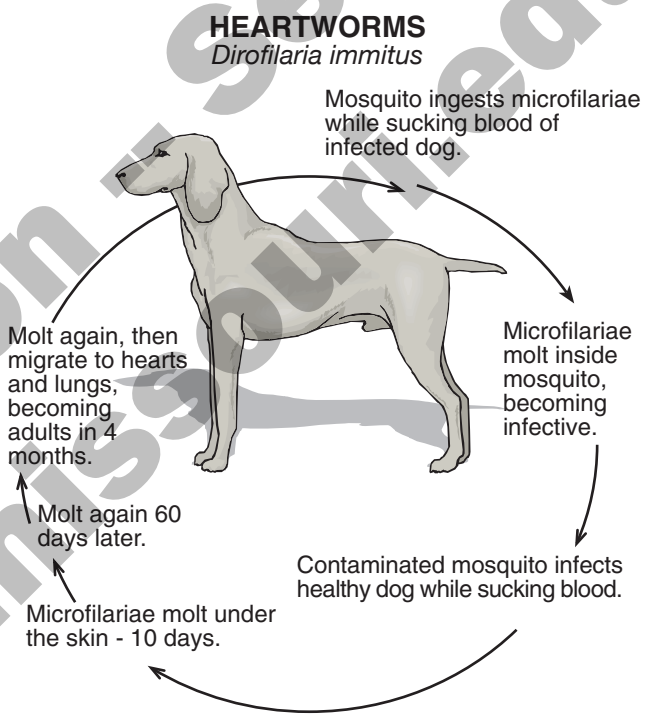
College of Veterinary Medicine

Canine heartworm infection causes disease primarily in the small pulmonary arteries and secondarily in the heart. *Dirofilaria immitus* adults are thin worms that reach 10 to 12 inches in length. The adult worms live in the peripheral branches of the pulmonary arteries and produce large numbers of microscopic offspring (microfilaria), which circulate throughout the bloodstream.

Heartworm disease is caused by the body's immunologic reaction to the presence of the adults and offspring. The body produces a number of different substances to destroy these foreign proteins. In the process, the vascular system of the lungs is damaged.

The heartworm life cycle begins when a dog with circulating microfilaria is bitten by a mosquito. The mosquito takes up microfilaria with its blood meal; these mature into infective larvae within the mosquito. When the infective mosquito bites a dog, larvae are injected into the dog's skin. Once in the dog, the larvae migrate and mature into adult worms in the blood vessels of the lungs. The adults (male and female) produce microfilaria after about six months.

Canine heartworm is widespread throughout the world, but mainly occurs in the tropics, subtropics and some temperate areas. It has been reported in all 50 of the United States. It is found in dogs, cats, foxes, wolves and other wild carnivores as well as in sea lions and humans.



Diagnosis

Heartworms must reach maturity (about six months from infection) before tests for heartworm antigens or microfilaria become positive. Because of this, there is no reason to test puppies less than six months old.

The two basic methods for detecting heartworm infection are microfilaria testing and antigen testing. Antigen tests look for the presence of adult female worms. These tests are almost 100 percent specific for *Dirofilaria immitus*, but may be falsely negative if there is a low burden of worms. Microfilaria tests are done by Knott tests or membrane filtration tests. These tests are also very specific, but may be negative if the adult worms are not producing offspring or if the body is destroying the offspring.

Recently it has come to light that dogs on monthly heartworm preventative medications will become microfilaria-negative if they are infected with heartworms before or during preventative administration. Therefore, all animals on a monthly preventative should be tested by antigen tests. Dogs on daily preventatives should be checked for microfilaria prior to starting preventative medication, since these drugs

Authors

The original author of this publication was **Elizabeth L. Settles,** Department of Veterinary Medicine and Surgery.

Scott E. Poock, MU Veterinary Medical Extension and Continuing Education, reviewed and updated this publication using information from the American Heartworm Society.

may cause severe adverse reactions in animals with circulating microfilaria.

Symptoms

Clinical signs of heartworm disease may occur at any stage of the infection. The physical presence of the worm has little effect on the disease state. The disease state is caused by the body's own immune reaction to the worms. This reaction causes the small arteries of the lungs to thicken, which makes the heart work harder to pump blood into the lungs. The reactions in the lungs also make it more difficult for normal exchange of oxygen and carbon dioxide to occur. These changes lead to clinical signs that include coughing, exercise intolerance and indications of right heart failure including fluid accumulations in the chest and abdomen.

Prevention

Prevention of heartworm infection can be accomplished by a number of medications. Diethylcarbamazine (DEC) is a daily preventative. Ivermectin, milbemycin oxime, moxidectin, and selamectin are preventatives that are given once a month. The ivermectin, milbemycin oxime, and moxidectin are available for oral administration. Selamectin is applied topically. There is a topical application with an ivermectin/imidacloprid combination as well. These medications are instituted only after negative heartworm tests are obtained. Dogs can remain on a heartworm preventative year round or only during the mosquito season. In any event, the dogs should be retested each year.

Treatment

Treatment of heartworm infection involves different drugs for eliminating the adults and microfilaria. Thiacetarsamide sodium intravenous injection is the only available treatment for adult worms. Unfortunately, the death of the worms can cause problems even worse than the presence of live worms. The dying and dead adult worms can cause blood vessels in the lungs to clog, which can develop into fatal lung disease. The chances of this occurring can be greatly reduced by enforcing strict rest for a minimum of six weeks after treatment.

Microfilaria are eliminated about three weeks after adult treatment. A number of different preparations are available, including Dizan (the only drug labeled for this purpose), levamisole, ivermectin and milbemycin.

Another therapy for removing adult heartworm is melarsomine dihydrochloride. This is given via deep intramuscular injection into the epaxial lumbar muscles. Mild swelling and some soreness may occur. As with thiacetarsamide, the dog must have strict rest. The standard protocol is two injections 24 hours apart. However, for dogs at greater risk of pulmonary thromboemboli, an alternative protocol is to give three injections. The first dose is followed 4-6 weeks later with two doses 24 hours apart. In contrast to thiacetarsamide, a microfilariacide may be instituted immediately at the start of treatment for the adults.

Summary

Heartworm disease is a problem throughout the United States. It takes approximately six months from the time an infective mosquito bites a dog for the worms to mature and produce microfilaria. Testing of dogs should be done on a yearly basis. Preventative medication also should be administered year-round or during the mosquito season.

Symptoms of heartworm disease can occur from about four months after infection to years later. Treatment of heartworm infection can cause disease at least as bad as, if not worse than, the infection itself. Preventing heartworm infections with daily or monthly medications is the best way to manage this potential disease state.

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