

Heartworm Disease (Dirofilariasis) in Dogs

What is heartworm disease?

Heartworm disease is a parasitic infection caused by a worm whose scientific name is *Dirofilaria immitis*, for which dogs and other canines are the natural host. Part of the worm's life cycle occurs in the mosquito, which obtains the *L₁ larval* form of the worm from the bloodstream of an already-infected dog. Within the mosquito, the *L₁* develops into a stage that is infectious to other dogs (the *L₃ larva*). When another dog is bitten by the mosquito, the *L₃* exits from the mosquito in its saliva, enters the dog's bloodstream and develops into a juvenile adult worm, and then a mature adult worm. Although this condition is known as *heartworm disease*, most adult worms actually reside in the dog's lungs, specifically within the arteries that carry blood to the lungs from the heart (the pulmonary arteries). Only in severe infections do some of them "back up" into the chambers on the right side of the heart. From the lungs (and the heart in heavy infections), female adult worms produce the youngest offspring called *microfilariae*, which develop into *L₁* larvae in the bloodstream. Then, when the dog is bitten by another mosquito, this cycle continues.

How is heartworm disease diagnosed?

Dogs with mild infections may show no outward signs of disease. In such cases, the diagnosis is made from routine screening bloodwork (see below). For dogs with heavier infections, the provided history may raise suspicion for heartworm disease. Coughing is the most common symptom. More severe infections can result in poor tolerance to exercise and difficulty breathing. The most severe and chronic infections may lead to weight loss, coughing of blood, and signs of congestive heart failure such as distension of the abdomen.

The test that is used to confirm or screen for heartworm disease in dogs is called the heartworm *antigen* test. This is a blood test that detects a protein from the female adult worm, and a positive result indicates that adult heartworms are present. If this occurs, then a second blood test is used to detect microfilariae, the pre-larval offspring of adult worms. This latter test (either a *filter test* or a *modified Knott's test*) is important because the treatment for adult worms is different than that for microfilariae.

Chest x-rays provide a "big picture" view of the heart, the lungs, and the pulmonary arteries. They are used to corroborate the diagnosis of heartworm disease and to assess its severity. An **echocardiogram** (ultrasound examination of the heart) complements chest x-rays in this regard. It is used to determine the presence of heartworms inside the heart, the size of the heart's chambers, and the pressure in the pulmonary arteries. The results of the chest x-rays and echocardiogram may influence the way in which therapy is administered. Routine bloodwork and urine analysis should be performed in all dogs that test positive for heartworm disease. While most dogs have only mild abnormalities or even none at all, the kidneys and liver may be affected in more severe cases.

How is heartworm disease treated?

Following diagnosis, monthly prophylactic therapy is begun using the medication *ivermectin* (brand name *Heartgard*). This serves not only to prevent new infection, but also begins to sterilize female adult worms and kill microfilariae. Monthly preventive treatment should continue indefinitely thereafter. In the most severe cases involving visible worms within the heart, early surgical extraction of those worms is generally recommended. The obvious advantage of doing so is that a potentially significant part of the infection may be quickly removed, resulting in a lower total worm burden. This procedure carries its own risks, however, and breakage of worms can result in fatal anaphylactic reactions.

Within a few weeks of initial diagnosis, treatment continues with a medication aimed at killing the adult worms (*melarsomine*, brand name *Immiticide*). This is divided into two steps in order to avoid killing too many worms at once. In the first step, one dose of melarsomine is administered. One month later, two doses are administered 24 hours apart. Approximately six months after that, an antigen test is repeated to make sure that treatment was successful. Although the vast majority of dogs will test negative at this time, some dogs do require additional doses of melarsomine. For severely infected dogs, there is serious risk associated with this part of therapy. The simultaneous death of numerous worms can result in sudden blockage of blood flow through the pulmonary arteries. Dogs are hospitalized overnight following each treatment and are monitored for problems such as difficulty breathing. Despite this precaution, some fatalities do occur. During the two-month period beginning with the first melarsomine treatment and ending one month after the last treatment, it is essential that activity be limited to cage rest when inside, and only short leash walks outside for urination and defecation. It is during this time that most problems occur, and **strict activity restriction is the best way to minimize life-threatening complications.**

Approximately 4-6 weeks after the last melarsomine treatment, therapy aimed at killing the microfilarial offspring may be administered using either a higher dose of ivermectin or a different medication called *milbemycin* (brand name *Interceptor*). Some controversy exists regarding the necessity of this step since it appears that microfilariae will eventually die with preventive therapy alone. While it has the theoretical benefit of rapidly eliminating this reservoir of infection for other dogs, its true importance in this regard remains unclear. There is some risk associated with microfilaricidal therapy as well, due to the sudden death of many larvae in the bloodstream. If used, dogs should be treated in the morning and then remain in the hospital for observation throughout the rest of the day.

What is the prognosis? What should I watch for?

For dogs with mild heartworm disease, prognosis following treatment is excellent. For those with more severe infections, prognosis is guarded in the initial post-treatment period due to the risks of therapy as described above. However, long-term prognosis following successful therapy is excellent provided that monthly prophylaxis is consistently administered. As discussed above, **coughing** is the most common symptom of heartworm disease, with **exercise intolerance** and **difficulty breathing** noted in more severe cases. **Weight loss, coughing of blood, fainting, and abdominal distension** may occur in extreme or chronic infections. If any of these are noted, please call your veterinarian or the Cardiology Service at Veterinary Specialty Services immediately to discuss a plan. If you feel the problem should not wait and requires immediate attention, then an emergency visit is warranted.