

CANINE HEARTWORM DISEASE

What causes heartworm disease?

Heartworm disease (dirofilariasis) is a serious and potentially fatal disease in dogs. It is caused by a worm called *Dirofilaria immitis*.

Heartworms are found in the heart and large adjacent vessels of infected dogs. The female worm is six to 14 inches (15 to 36 cm) long and 1/8 inch (5 mm) wide; the male is about half the size of the female. One dog may have as many as 300 worms.

How do heartworms get into the heart?

Adult heartworms live in the heart and pulmonary arteries of infected dogs. They have been found in other areas of the body, but this is unusual. They survive up to five years and, during this time, the female produces millions of young (microfilaria). These microfilaria live in the bloodstream, mainly in the small blood vessels. The immature heartworms cannot complete the entire life cycle in the dog; the mosquito is required for some stages of the heartworm life cycle. The microfilaria are therefore not infective (cannot grow to adulthood) in the dog – although they do cause problems.

As many as 30 species of mosquitoes can transmit heartworms. The female mosquito bites the infected dog and ingests the microfilariae during a blood meal. The microfilariae develop further for 10 to 30 days in the mosquito and then enter the mouth parts of the mosquito. The microfilariae are now called infective larvae because at this stage of development, they will grow to adulthood when they enter a dog. The mosquito bites the dog where the hair coat is thinnest. However, having long hair does not prevent a dog from getting heartworms.

When fully developed, the infective larvae enter the bloodstream and move to the heart and adjacent vessels, where they grow to maturity in two to three months and start reproducing, thereby completing the full life cycle.

Where are heartworms found?

Canine heartworm disease occurs all over the world. In the United States, it was once limited to the south and southeast regions. However, the disease is spreading and is now found in most regions of the United States and Canada, particularly where mosquitoes are prevalent.

How do dogs get infected with them?

The disease is not spread directly from dog to dog. An intermediate host, the mosquito, is required for transmission. Spread of the disease therefore coincides with the mosquito season. The number of dogs infected and the length of the mosquito season are directly correlated with the incidence of heartworm disease in any given area.

It takes a number of years before dogs show outward signs of infection. Consequently, the disease is diagnosed mostly in four to eight year old dogs. The disease is seldom diagnosed in a dog under one year of age because the young worms (larvae) take up to seven months to mature following establishment of infection in a dog.

What do heartworms do to the dog?

Adult worms: Adult worms cause disease by clogging the heart and major blood vessels leading from the heart. They interfere with the valve action in the heart. By clogging the main blood vessels, the blood supply to other organs of the body is reduced, particularly the lungs, liver and kidneys, leading to malfunction of these organs.

Most dogs infected with heartworms do not show any signs of disease for as long as two years. Unfortunately, by the time signs are seen, the disease is well advanced. The signs of heartworm disease depend on the number of adult

worms present, the location of the worms, the length of time the worms have been present, and the degree of damage to the heart, lungs, liver, and kidneys from the adult worms and the microfilariae.

The most obvious signs are: a soft, dry, chronic cough, shortness of breath, weakness, nervousness, listlessness, and loss of stamina. All of these signs are most noticeable following exercise, when some dogs may even faint.

Listening to the chest with a stethoscope will often reveal abnormal lung and heart sounds. In advanced cases, congestive heart failure may be apparent and the abdomen and legs will swell from fluid accumulation. There may also be evidence of weight loss, poor condition, and anemia.

Severely infected dogs may die suddenly during exercise or excitement.

Microfilariae (Young worms): Microfilariae circulate throughout the body but remain primarily in the small blood vessels. Because they are as wide as the small vessels, they may block blood flow in these vessels. The body cells being supplied by these vessels are deprived of the nutrients and oxygen normally supplied by the blood. The lungs and liver are primarily affected.

Destruction of lung tissue leads to coughing. Cirrhosis of the liver causes jaundice, anemia, and general weakness because this organ is essential in maintaining a healthy animal. The kidneys may also be affected and allow poisons to accumulate in the body.

How is heartworm infection diagnosed?

In most cases, diagnosis of heartworm disease can be made by a blood test that can be run in the veterinary hospital or by a veterinary laboratory. Further diagnostic procedures are essential, in advanced cases particularly, to determine if the dog can tolerate heartworm treatment. Depending on the case, we will recommend some or all of the following procedures before treatment is started.

Serological test for antigens to adult heartworms: This is a test performed on a blood sample. It is the most widely used test because it detects antigens (proteins) produced by adult heartworms. It will be positive even if the dog does not have any microfilaria in the blood; this occurs about 20% of the time. Dogs with less than five adult heartworms will not have enough antigen to turn the test positive, so there may be some false negative results in early infections. Because the antigen detected is produced only by the female worm, a pure population of male heartworms will also give a false negative. Therefore, there must be at least five female worms present for the most common test to be positive.

Blood test for microfilariae: A blood sample is examined under the microscope for the presence of microfilariae. If microfilariae are seen, the test is positive. The number of microfilariae seen gives us a general indication of the severity of the infection. However, the microfilariae are seen in greater numbers in the summer months and in the evening, so these variations must be considered. Approximately 20% of dogs do not test positive even though they have heartworms because of an acquired immunity to this stage of the heartworm. Because of this, the antigen test is the preferred test. Also, there is another microfilarial parasite which is fairly common in dogs; on the blood smear, these can be hard to distinguish from heartworm microfilariae.

Blood chemistries: Complete blood counts and blood tests for kidney and liver function may give an indirect indication of the presence of heartworm disease. These tests are also performed on dogs diagnosed as heartworm-infected to determine the function of the dog's organs prior to treatment.

Radiographs (X-rays): A radiograph of a dog with heartworms will usually show heart enlargement and swelling of the large artery leading to the lungs from the heart. These signs are considered presumptive evidence of heartworm disease. Radiographs may also reveal the condition of the heart, lungs, and vessels. This information allows us to predict an increased possibility of complications related to treatment.

Electrocardiogram: An electrocardiogram (EKG) is a tracing of the electric currents generated by the heart. It is most useful to determine the presence of abnormal heart rhythms.

Echocardiography (Sonogram): An echocardiogram allows us to see into the heart chambers and even visualize the heartworms themselves. Although somewhat expensive, this procedure can diagnose heartworms when other tests fail.

How are dogs treated for heartworms?

There is some risk involved in treating dogs with heartworms, although fatalities are rare. In the past, the drug used to treat heartworms contained arsenic so toxic effects and reactions occurred somewhat frequently. Now a newer drug is available that does not have the toxic side-effects of the old one. We are able to successfully treat more than 95% of dogs with heartworms.

We see some dogs with advanced heartworm disease. This means that the heartworms have been present long enough to cause substantial damage to the heart, lungs, blood vessels, kidneys, and liver. A few of these cases will be so far advanced that it will be safer to just treat the organ damage rather than risk treatment to kill the worms. Dogs in this condition are not likely to live more than a few weeks or months.

Treatment to kill adult worms: An injectable drug to kill adult heartworms is given for two days. It kills the adult heartworms in the heart and adjacent vessels.

Complete rest is essential after treatment: The adult worms die in a few days and start to decompose. As they break up, they are carried to the lungs, where they lodge in the small blood vessels and are eventually reabsorbed by the body. This can be a dangerous period so it is absolutely essential that the dog be kept quiet and not be allowed to exercise for one month following treatment. The first week after the injections is very critical because the worms are dying. A cough is noticeable for seven to eight weeks after treatment in many heavily infected dogs.

Prompt treatment is essential if the dog has a significant reaction in the weeks following the initial treatment, although such reactions are not common. If a dog shows loss of appetite, shortness of breath, severe coughing, coughing up blood, fever, and/or depression, you should notify us. Response to antibiotics, cage rest, and supportive care, such as intravenous fluids, is usually good in these cases.

Treatment to kill microfilaria: Approximately 1 month following treatment to kill the adults, the dog is returned to the hospital for administration of a drug to kill microfilariae. Your dog needs to stay in the hospital for the day. Seven to ten days later a test is performed to determine if microfilariae are present. If they have been all killed, the treatment is complete. If there are still some present in the blood, treatment for microfilariae is repeated.

In some cases, the heartworm infection is "occult," meaning that no microfilariae were present. In this case, a follow-up treatment at one month is not needed.

Other treatments: In dogs with severe heartworm disease, it may be necessary to treat them with antibiotics, special diets, diuretics to remove fluid accumulations, and drugs to improve heart function prior to treatment for the heartworms.

Dogs with severe heart disease may need lifetime treatment for the failing heart, even after the heartworms have been killed. This includes the use of diuretics, heart drugs, aspirin, and special low salt, low protein diets.

Response to treatment: Dog owners are usually pleasantly surprised at the change in their dog following treatment for heartworms, especially if the dog had been showing signs of heartworm disease. The dog has a renewed vigor and vitality, improved appetite, and weight gain.

Are changes made in the treatment protocol for dogs that have severe heartworm disease?

Yes. The state of heart failure is treated as described above. However, we also treat the adult heartworms in a two stage process. Only one treatment with the drug to kill the worms is given initially. This causes the death of some of



the worms. One month later, the full treatment is given to kill the remaining worms. By killing them in two stages, the severe effects on the lungs are much less likely to occur.

How can I prevent this from happening again?

When a dog has been successfully treated for heartworms, you cannot sit back and relax because dogs can be reinfected. Therefore, it is essential to begin a heartworm prevention program. There are three drugs which can be used to prevent heartworm infection. One is a daily, chewable tablet; the others are chewable tablets that are given only once monthly. All three products are very safe and very effective. Their costs are essentially identical. One of these should be started immediately after the treatment is completed.