



Chanhassen Veterinary Clinic
440 West 79th Street
Chanhassen, MN 55317
Ph: (952)934-8862

CANINE HEARTWORM DISEASE

What causes heartworm disease?

Heartworm disease or dirofilariasis is a serious and potentially fatal disease in dogs. It is caused by a blood-borne parasite called *Dirofilaria immitis*.

Heartworms are found in the heart and adjacent large blood vessels of infected dogs. The female worm is 6 to 14 inches long (15 to 36 cm) and 1/8 inch wide (5 mm). 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 live up to five years and, during this time, the female produces millions of offspring called microfilaria. These microfilariae live mainly in the small vessels of the bloodstream. The immature heartworms cannot complete their life cycle in the dog. The mosquito is required for some stages of the heartworm life cycle. The microfilaria are 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 mouthparts 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 usually 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 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 less than one year of age because the young worms (larvae) take up five to seven months to mature after infection.

What do heartworms do to the dog?

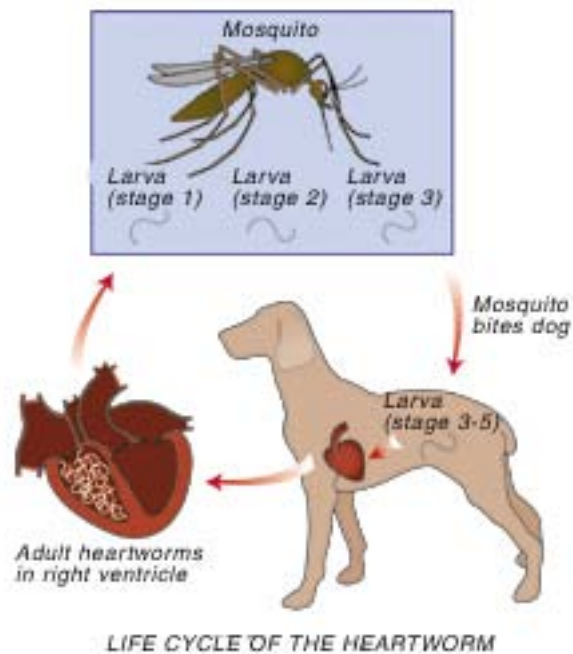
Adult heartworms: Adult heartworms cause disease by clogging the heart and major blood vessels leading from the heart. They interfere with the valve action in the heart. By clogging the main blood vessels, the blood supply to other organs of the body is reduced, particularly blood flow to the lungs, 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 clinical 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 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 heartworms): 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 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 in about 20% of the cases. Dogs with less than five adult heartworms will not have enough antigen to give a positive test result, so there may be an occasional false negative result in dogs with early infections. Because the detected antigen is only produced by the female heartworm, a population of only male heartworms will also give a false negative. Therefore, there must be at least five female worms present for the most common heartworm test to diagnose heartworm disease.



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 blood parasite that is fairly common in dogs that can be hard to distinguish from heartworm microfilariae.

Blood chemistries: Complete blood counts and blood tests for kidney and liver function may give an 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 or ECG) is a tracing of the electric currents generated by the heart. It is most useful to determine the presence of abnormal heart rhythms.

Echocardiography: An ultrasonic examination that allows us to see into the heart chambers and even visualize the heartworms.

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 more frequently. A newer drug is now available that does not have the toxic side-effects, allowing successful treatment of more than 95% of dogs with heartworms.

Some dogs are diagnosed 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 advanced that it will be safer to treat the organ damage rather than risk treatment to kill the heartworms. Dogs in this condition are not likely to live more than a few weeks or months.

Treatment to kill adult heartworms: An injectable drug to kill adult heartworms is given. It kills the adult heartworms in the heart and adjacent vessels. These injections may be divided and given thirty days apart.

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 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 rare. 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 and intravenous fluids is usually good in these cases.

Treatment to kill microfilaria: Approximately one month following treatment to kill the adults, the dog is returned to the hospital for administration of a drug to kill the baby heartworms or microfilariae. Your dog needs to stay in the hospital for the day. Your dog is started on heartworm preventive after this treatment.



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 heart failure, even after the heartworms have been killed. This includes the use of diuretics, heart drugs, 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 approximately half 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. This protocol is also used in moderate cases to provide a safer treatment.

How can I prevent this from happening again?

When a dog has been successfully treated for heartworms, it is essential to begin a heartworm prevention program to prevent future recurrence. With the safe and affordable heart preventives available today, no pet should ever have to endure this dreaded disease.

*This client information sheet is based on material written by Ernest Ward, DVM.
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