

## 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 inches 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.

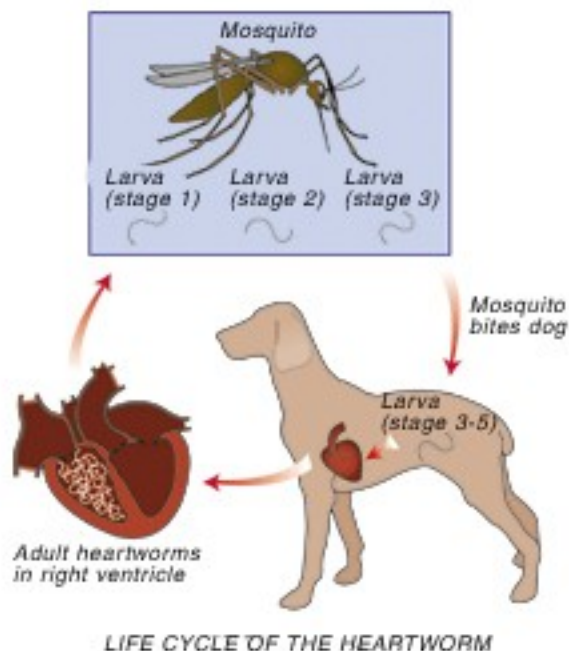
**Microfilariae** (Young heartworms): Microfilariae circulate throughout the body but remain primarily in the small blood vessels. Because they are as wide as the small vessels, they may block blood flow in these vessels. The body cells being supplied by these vessels are deprived of the nutrients and 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 do I prevent Heartworm disease?***

Heartworm disease is preventable. Dogs six weeks and older should be started on a monthly heartworm preventative which should be given year around. Heartworm preventatives are supplied in various forms, ie. Oral tablets or topical. Most heartworm preventatives also contain products to treat and/or prevent various internal parasites as well.

#### ***How are dogs treated for heartworms?***

There are various options in treating heartworm disease. The goal of treatment is to kill all adult worms and microfilariae. 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.

**Treatment to kill adult heartworms:** There is currently one drug available to treat adult heartworms. It is an injectable medication given in the lumbar muscles of the back. These injections are divided into several doses. The first injection is given after a comprehensive physical and blood panel then 30 days later two more injections are given 24 hours 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:** The most effective drug in eliminating the microfilaria is the macrocyclic lactone (monthly heartworm preventative).

**Alternate Therapies:**

Research from the American Heartworm Society has indicated that the use of a Tetracycline antibiotic helps shorten the life expectancy of the adult heartworm by killing the bacterial parasite, Wolbachia, which allows the heartworm to thrive. Starting the dog on a 4 week regimen of Doxycycline every 4 months for a total of 3 doses reduces the longevity of the heartworms.

Also, giving a regimen of a glucocorticosteroid, such as prednisone, diminishes the instance of pulmonary thromboembolism which can occur while the worms are dying.

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.

Freeburg Animal Hospital's  
Treatment Protocol Options:

Option 1:

Month 1

- Start or continue heartworm preventative (Triheart or Heartgard)  
This will eliminate the larvae that is less than two months old.  
Start Doxycycline (4 week dose)  
Kills the Wolbachia
- Start Prednisone (4 week dose)  
Reduces pulmonary thrombolisms
- Chest radiographs  
This is done to assess the health and possible damage to vital organs  
such as the heart and lungs.
- Keep very quiet! Reduce exercise during the entire treatment.

Month 3

- Continue heartworm preventative.
- Give 1<sup>st</sup> immiticide injection.  
Starts to eliminate adult heartworms
  - a. Stay at hospital for the day
  - b. Pre-Heartworm treatment blood panel
  - c. Injection given
  - d. Home in evening
  - e. Refill prednisone

Month 4

- Continue heartworm preventative
- Give 2nd and 3rd immiticide injections 24 hours ap**Kills remaining heartworms**
  - a. 1<sup>st</sup> day: pre-heartworm treatment panel-2<sup>nd</sup> injection-monitor for the day-spend the night.
  - b. 2<sup>nd</sup> day: pre-heartworm treatment panel-3<sup>rd</sup> injection-monitor for the day-home in the evening

Month 10

- Recheck physical and follow up heartworm test.

Option 1 has been explained to me and I fully understand the consequences of this treatment plan.

\_\_\_\_\_  
Owner

\_\_\_\_\_  
Date

Option 2:

Month 1

- Start or continue heartworm preventative (Triheart or Heartgard).  
**This will eliminate the larvae that is less than two months old.**
- Start Doxycycline(4 week dose)  
**Kills the Wolbachia**
- Start Prednisone(4 week dose)  
**Reduces pulmonary thrombolisms**
- Chest radiographs  
**This is done to assess the health and possible damage to vital organs such as the heart and lungs.**

- Keep very quiet! Reduce exercise during the entire treatment.

Month 3

- Continue on heartworm preventative
- Give 1st and 2nd immiticide injections 24 hours ~~apart~~ **Starts to eliminate and kills off adult heartworms.**
  - a. 1<sup>st</sup> day: pre-heartworm treatment panel-1st injection-monitor for the day-spend the night.
  - b. 2<sup>nd</sup> day: pre-heartworm treatment panel-2<sup>nd</sup> injection-monitor for the day-home in the evening
  - c. Refill prednisone

Month 10

- Recheck physical and follow up heartworm test.

Option 2 has been explained to me and I fully understand the consequences of this treatment plan.

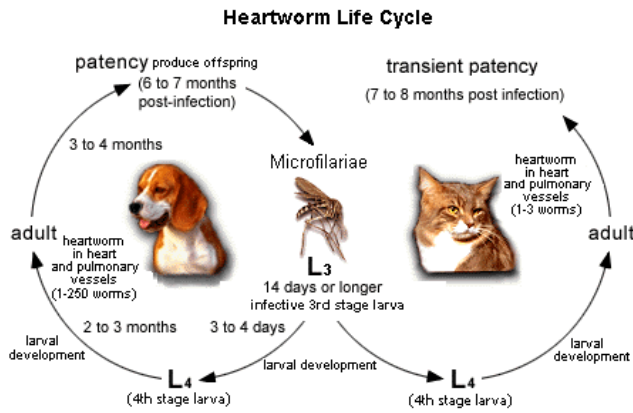
\_\_\_\_\_  
Owner

\_\_\_\_\_  
Date

**What is it?**

It is a disease caused by *Dirofilaria immitis*, a worm that is carried by mosquitoes and transmitted through blood. Outdoor animals are more at risk, but there is no breed or age

predilection. Risk for infection is highest during July to August with the peak of mosquito



populations.

### ***What are the symptoms?***

Dogs – Early stages of the disease can cause depression, fever, increased heart rate, increased respiratory rate and/or difficulty breathing, and soft dry cough. Later stages in animals with severe cardiac insufficiency will also see exertional dyspnea, fatigue, and fainting.

Cats – Disease symptoms are more variable and transient. Dyspnea and/or paroxysmal cough may be present but also looks like feline asthma. Lethargy, anorexia, vomiting, syncope, neurologic signs, and even sudden death may be seen.

### ***Prevention***

There are several products available as once a month oral medications. Some of the more common products are Triheart (ivermectin) and Interceptor (milbemycin oxime).

### ***Testing and Diagnostics***

Heartworm testing should be performed yearly, even if the pet is on heartworm preventative, and especially if the pet has access to the outdoors.

Dog heartworm screening tests detect adult heartworm antigen as soon as 6.5 to 7 months after infection. It is recommended that your pet be tested 7 months after mosquito season.

Cat heartworm screening tests detect antibodies formed against heartworms as early as 60 days after exposure. This indicated that the pet has been exposed to heartworms but adult worms are not necessarily present. Further diagnostics are required to confirm a positive test.

A weak or ambiguous test can be checked by another kit or by the same kit after a short period of time.

A positive test, especially along with supporting symptoms, must be followed with chest radiographs and an echocardiogram to assess the health and damage to vital organs, such as the heart and lungs.



## Treatments

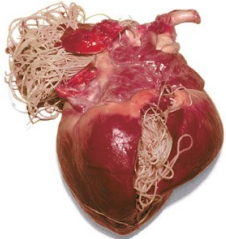
### Treatment Option 1

- **Month 1**
  - ✓ Start or continue heartworm preventative
  - ✓ Start Doxycycline 10mg/kg twice a day for 4 weeks
  - ✓ Start Prednisone
    - ✓ 0.5mg/kg twice a day for 7 days *then*
    - ✓ 0.5mg/kg once a day for 7 days *then*
    - ✓ 0.5mg/kg once every other day for 7-14 days

- **Month 3**

✓ Continue heartworm preventative

- ✓ Run pre-heartworm treatment panel and give first immiticide injection *\*animal will have to stay for the day but will be able to go home in the evening*
- ✓ Refill Prednisone
- **Month 4** – Give 2 immiticide injections 24 hours apart with pre-heartworm treatment panels run before each injection *\*animal will have to stay overnight for monitoring but will be able to go home the following evening*
- **Month 10** – recheck and physical



### Treatment Option 2

- **Month 1**
  - ✓ Start or continue heartworm preventative
  - ✓ Start Doxycycline and Prednisone (dosing same as in Treatment Option 1)
- **Month 3**
  - ✓ Continue heartworm prevention– Give 2 immiticide injections 24 hours apart with pre-heartworm treatment panels run before each injection *\*animal will have to stay overnight for monitoring but will be able to go home the following evening*
  - ✓ Refill Prednisone
- **Month 10**
  - ✓ Recheck and physical

**\*Keep very quiet during the entire treatment and reduce exercise with both treatment options\***

***Why is this important?***

Heartworms can lead to various serious diseases such as: pulmonary hypertension, caval syndrome, right-sided congestive heart failure, embolisms, and glomerulonephritis