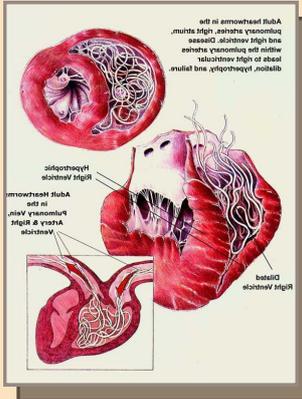


# Heartworms (*Dirofilaria immitis*)

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## All about this disease



Heartworms inside view

**Heartworm** (*Dirofilaria immitis*) is a parasitic roundworm that is spread from host to host

## Distribution

Although at one time confined to the southern United States, heartworm has now spread to nearly all locations where its vector, the mosquito, is found. Transmission of the parasite occurs in all of the United States (cases have even been reported in Alaska), and the warmer regions of Canada. The highest infection rates are found within 150 miles of the coast from Texas to New Jersey, and along the Mississippi River and its major tributaries. It has also been found in South America, southern Europe, South

through the bites of mosquitoes. The heartworm is a type of filaria, a small thread-like worm, that causes filariasis. The definitive host is the dog, but it can also infect cats, wolves, coyotes, foxes and other animals, such as ferrets, sea lions and even, under very rare circumstances, humans. The parasite is commonly called "heartworm"; however, adults often reside in the pulmonary arterial system (lung arteries) as well as the heart, and a major effect on

the health of the animal is a manifestation of damage to the lung vessels and tissues. Occasionally, adult heartworms migrate to the right heart and even the great veins in heavy infections. Heartworm infection may result in serious disease for the host, with death typically as the result of congestive heart failure.

east Asia, the Middle East, Australia, Korea, and Japan.

## Course of infection

Heartworms go throughout several life stages before they become adults infecting the pulmonary artery of the host animal. The worms require the mosquito as an intermediate stage to complete their life cycles. The rate of development in the mosquito is temperature-dependent, requiring about two weeks of temperature

at or above 27°C (80°F). Below a threshold temperature of 14°C (57°F), development cannot occur, and the cycle will be halted. As a result, transmission is limited to warm months, and duration of the transmission season varies geographically. The period between the initial infection when the dog is bitten by a mosquito and the maturation of the worms into adults living in the heart takes six to seven months in dogs and is known as the "prepatent period".

## Special points of interest:

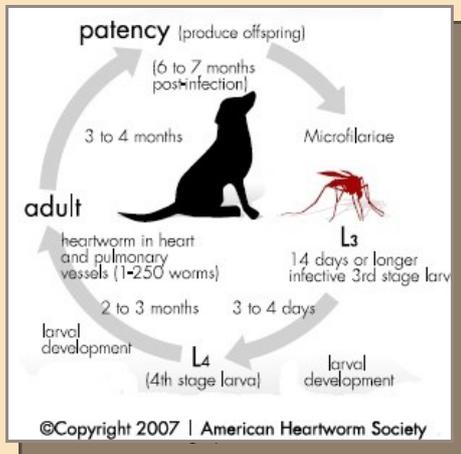
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### *Course of infection*



Over the next three to four months, they increase greatly in size. The female adult worm is about 30 cm in length, and the male is about 23 cm, with a coiled tail. By seven months after infection, the adult worms have mated and the females begin giving birth to live young, called microfilariae.

After infection, the third-stage larval heartworms (L3) deposited by the mosquito grow for a week or two and molt to the

### *Clinical signs of infection*

Dogs show no indication of heartworm infection during the six-month prepatent period prior to the worms' maturation, and current diagnostic tests for the presence of microfilariae or antigens can not detect prepatent infections. Rarely, migrating heartworm larvae get "lost" and end up in unusual sites, such as the eye, brain, or an artery in the leg, which results in unusual symp-

fourth larval stage (L4) under the skin at the site of the mosquito bite. Then, they migrate to the muscles of the chest and abdomen, and 45 to 60 days after infection, molt to the fifth stage (L5, immature adult). Between 75 and 120 days after infection, these immature heartworms then enter the bloodstream and are carried through the heart to reside in the pulmonary artery. Over the next three to four months, they increase greatly in size. The female adult worm is about 30 cm in length, and the male is about 23 cm, with a coiled tail. By seven months after infection, the adult worms have mated and the females begin giving birth to live young, called microfilariae.

The microfilariae circulate in the bloodstream for as long as two years, waiting for the next stage in their life cycles in the gut of a bloodsucking mosquito. When ingested by a mosquito, the microfilariae undergo a series of molts to the infective third larval stage, and then migrate to the salivary glands of the mosquito, where they wait to infect another host. The incubation period required to reach the stage where the microfilariae become transmittable to another host can be as little as two weeks or as long as six weeks, depending on the warmth of the climate, and the larval life cycle ceases entirely if the ambient temperature drops below 14°C (57°F).

toms such as blindness, seizures and lameness. But normally, until the larvae mature and congregate inside the heart, they produce no symptoms or signs of illness.

Many dogs will show little or no sign of infection even after the worms become adults. These animals usually have only a light infection and live a fairly sedentary lifestyle. However, active dogs and those with

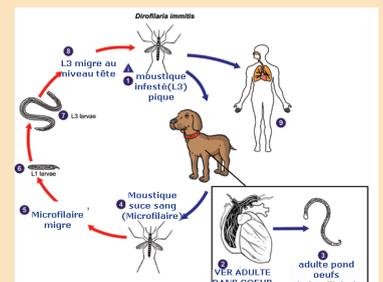
heavier infections may show the classic signs of heartworm disease. Early signs include a cough, especially on exercise and early exhaustion upon exercise. In the most advanced cases where many adult worms have built up in the heart without treatment, signs progress to severe weight loss, fainting, coughing up blood and, finally, congestive heart failure.

### *Hosts*

Hosts of *Dirofilaria immitis* include:

- ⇒ Dog
- ⇒ Cat
- ⇒ Wolf
- ⇒ Coyote
- ⇒ Fox
- ⇒ Ferret

- ⇒ Sea lion
- ⇒ African leopard (*Panthera pardus pardus*)
- ⇒ Human (rare)
- ⇒ Beaver



## How is diagnosed

### Three methods can be used for the diagnosis:

**1. Microfilarial detection** was accomplished most commonly in the past by the microscopic identification of microfilariae on a direct blood smear, above the buffy coat in a microhematocrit tube (or capillary tube), using the modified Knott test, or after millipore filtration. The accuracy of these tests, typically used for routine screening or diagnosis of heartworm infection, is improved by multiple testing. The modified Knott test and millipore filtration are more sensitive because they concentrate microfilariae, im-

proving the chance of diagnosis. The direct smear technique allows examination of larval motion, helping in the distinction of *Dirofilaria immitis* from *Acanthocheilonema reconditum*. This distinction is important because the presence of the latter parasite does not require expensive and potentially harmful therapy. However, the potential for amicrofilaremic infections is 5-67%. The number of circulating microfilariae does not correlate with the number of adult heartworms, so is not an indicator of disease severity.

### 2. Immunodiagnosis

name **Immiticide**. It has a greater efficiency and fewer side effects than previously used drug (thiacetarsamide sodium, sold as **Caparsolate**) which makes it a safer alternative for dogs with late-stage infections.

During and after treatment, the dog must rest (restricted exer-

tics (ELISA) to detect heartworm antigen in the host's blood are now regularly used. The weakness of these tests is they only detect the antigens released from the adult female worm's reproductive tract, so will produce negative results during the first five to eight months of infection.

**3. X-rays** are used to evaluate the severity of the heartworm infection and develop a prognosis for the animal. Typically the changes observed are enlargement of the main pulmonary artery, the right side of the heart, and the pulmonary arteries in the lobes of the lung.



### 4DX test: Heartworm, Ehrlichia canis, Lyme (Borrelia) and Anaplasma

Antigen testing, in most practices, has supplanted or supplemented microfilarial detection. Combining the microfilaria and adult antigen test is most useful in dogs receiving diethylcarbama zine or no preventative .

## Treatment

Before the worms can be treated, however, the dog must be evaluated for heart, liver, and kidney function to evaluate the risks of treatment. Usually, the adult worms are killed with an arsenic-based compound. The currently approved drug in the US and Europe is melarsomine dihydrochloride, is marketed under the brand

name **Immiticide**. It has a greater efficiency and fewer side effects than previously used drug (thiacetarsamide sodium, sold as **Caparsolate**) which makes it a safer alternative for dogs with late-stage infections.

During and after treatment, the dog must rest (restricted exer-

cise) for several weeks so as to give its body sufficient time to absorb the dead worms without ill effect. Otherwise, when the dog is under exertion, dead worms may break loose and travel to the lungs, potentially causing respiratory failure and death. The use of **aspirin** in dogs infected with heartworms is no longer recommended. **Surgical** removal of the adult heartworms as a treatment also may be indicated, especially in advanced cases

## Human health considerations

The dog heartworm is of negligible public health risk, because it is unusual for humans to become infected. Additionally, human infections usually are of little or no consequence, although rarely an infected human may show signs of respiratory disease. In most cases, however, the heartworm dies shortly after arriving in the human lung, and a nodule, known as a granuloma, forms around the dead worm as it is being killed and absorbed. If an infected person happens to have a chest

X-ray following granuloma formation, the nodule may be large enough to resemble lung cancer on the X-ray and require a biopsy for a pathologic assessment. This may well be the most significant medical consequence of human infection by the dog heartworm.

At one time, the dog heartworm was thought to infect the human eye, with most cases reported from the southeastern United States. However, these cases are now thought to be caused by a closely related para-

site of raccoons, *Dirofilaria tenuis*. Several hundred cases of subcutaneous infections in humans have been reported in Europe, but these are almost always caused by another closely related parasite, *Dirofilaria repens*, rather than the dog heartworm.

## *Treatment advice from our experience*

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If you will treat your dog with Immiticide, there are 2 types of treatment. We also advice you to choose a very good vet that already did this type of treatment and most of the dogs survived.

Should be administered by deep intramuscular injection in the lumbar (epaxial) muscles (L3 - L5) ONLY.

**DO NOT USE IN ANY OTHER MUSCLE GROUP. DO NOT USE INTRAVENOUSLY.**

Use a 23 gauge 1 inch needle for dogs equal to or less than 10 kg (22 lb) in weight. Use a 22 gauge 1 1/2 inch needle for dogs greater than 10 kg (22 lb). Use alternating sides with each administration. If repeated administrations are warranted avoid injecting at the same lumbar location.

During the course of clinical field trials, IMMITICIDE was administered concurrently with anti-inflammatories, antibiotics, insecticides, heartworm prophylactics, and various other drugs commonly used to stabilize and support dogs with heartworm disease with no adverse drug interactions noted.

### **Bellow are the 2 versions of treatment:**

- ⇒ In the two-dose protocol, the dog receives a second injection the next day on the opposite side of the lower back.
- ⇒ In the three-dose protocol, the dog comes back one month later for two doses 24 hours apart (the first dose represents an introductory treatment to kill some of the more sensitive worms.)

**Keep in mind, too many worms dying at once creates circulatory shock.** So we recommend the three-dose protocol because it creates a more gradual kill of the adult worms, which is safer in terms of embolism and shock.

Help us help them!



**Animals Voice**