

Heartworm Disease

Information for Dog Owners



Key Facts

Heartworm disease is caused by *Dirofilaria immitis* (a parasitic worm) that is spread by mosquitoes.

Signs of disease can be:

- Subclinical, i.e. no obvious signs.
- Slowly progressive. Dogs may develop cough, weakness and exercise intolerance.
- Severe. Dogs can have signs of congestive heart failure (cough, severe difficulty breathing, fluid accumulation in abdomen), kidney or liver disease, fever, or coughing up blood.

Optimal therapy for adult heartworm infection involves pre-treatment for microfilaria (young heartworms) and suspect *Wolbachia* bacteria, followed by adulticide therapy (elimination of adult heartworms).

Heartworm is found globally.

Regular use of heartworm preventive medication is critical to prevent the disease.

What is it?

Canine heartworm disease is caused by *Dirofilaria immitis*, a nematode (worm) transmitted by mosquitoes. During the early phases of heartworm infection, most dogs will not show signs of disease. Later in the disease course, blood flow carries the heartworms into the lung arteries. This can cause thromboembolism (blood clots), allergic pneumonitis (lung inflammation), and right-sided heart failure. Larger numbers of adult worms result in worse disease.

Wolbachia (a bacterium carried within the heartworm) released from dying adult heartworms is thought to worsen inflammation and predispose to shock (inadequate blood flow to the body, resulting in organ damage).

Who gets it?

Dogs and other canid species can be infected, along with cats and ferrets. Heartworm disease is common in dogs in the southeastern United States.



Microfilaria (young heartworms) under microscopic magnification (used with permission: Stephen Jones, DVM, The American Heartworm Society)

However, heartworms can be found in other parts of the United States or Canada where temperatures rise above 57°F (14°C), especially after movement of infected dogs to northern regions, e.g. after Hurricane Katrina in 2005.

Can people get sick with it?

It is extremely rare for humans to be infected with *D. immitis*. Spread is from mosquitoes, not directly from dogs.

How is it spread?

(Transmission & Infection risk)

Heartworms are spread via mosquitoes. More than 70 species of mosquitoes are capable of transmitting heartworm.

When a mosquito bites an infected dog, the mosquito ingests microfilaria (young heartworms) that mature within the mosquito. After a few weeks, the mosquito can transmit (spread) the heartworm larvae to other dogs when it bites and feeds.

Once within the dog, the immature worms develop into young adult worms that enter the blood (veins) and move into the vessels of the lungs. In the lung vessels and heart they become adult worms and begin to reproduce (creating more microfilaria). This process (from dog infection to microfilaria production), typically takes 6 - 7 months. Adult heartworms can live a long time in the dog (5 - 7 years), while microfilaria can live up to 30 months. Additionally, bacteria (*Wolbachia*) can infect

heartworms and be transmitted into the dog along with the heartworm larvae.

Exposure and infection risk is highest for dogs with an outdoor lifestyle (e.g. hunting dogs, dogs housed outdoors), and those not receiving heartworm preventive. Exposure risk rises with increases in local mosquito populations, warm climate and increased number of infected dogs (or other hosts) in the region. Indoor pets are still at risk as mosquitos frequently enter homes.



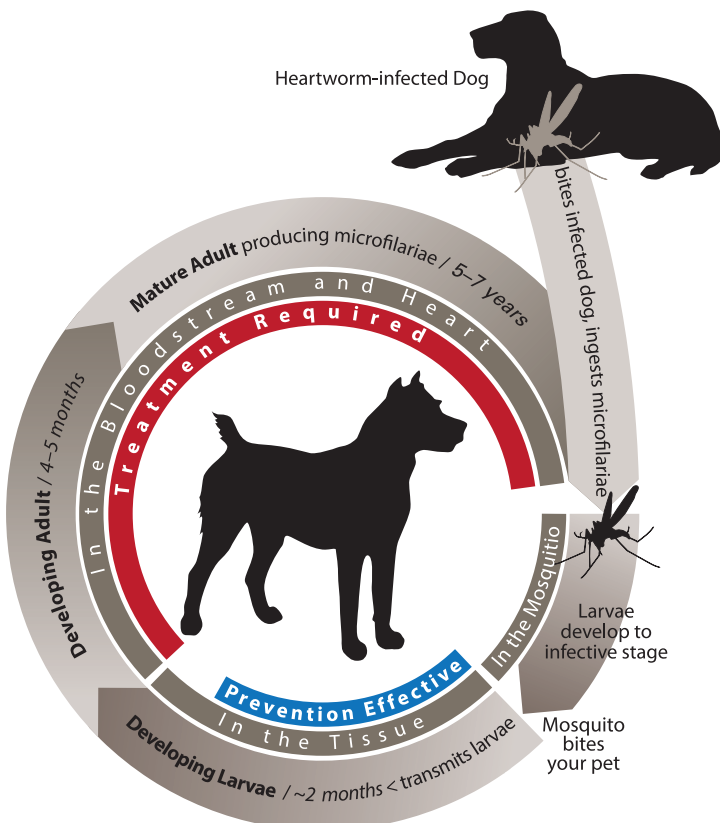
Aedes albopictus mosquito; one of many species able to carry *D. immitis* (Public Domain: Centers for Disease Control and Prevention)

What should I look for? (Signs of disease)

Many dogs have no signs of disease, particularly in the early stages of infection or with low numbers of worms.

Cough, difficulty breathing, and exercise intolerance are the most common signs. Severe disease, such as heart failure (severe cough, inability to breathe, fluid accumulation in body cavities such as the abdomen), coughing up blood and kidney failure can occur.

Rarely, many adult worms can become lodged in the right side of the heart (tricuspid valve). This severe condition (caval syndrome) results in right-sided heart failure, loss of appetite, anemia, difficulty breathing, and liver/kidney failure.



Life cycle for canine heartworm (used with permission: American Heartworm Society)

How is it diagnosed?

Your veterinarian will diagnose heartworm disease based on clinical signs (e.g. cough, change in breathing), examination and most commonly through annual heartworm antigen screening (blood test).

Specific tests for heartworm disease (e.g. microfilaria testing) along with tests for heart and lung disease (e.g. x-rays, echocardiogram or heart ultrasound) can be performed to help confirm infection, determine severity of disease and advise therapy.

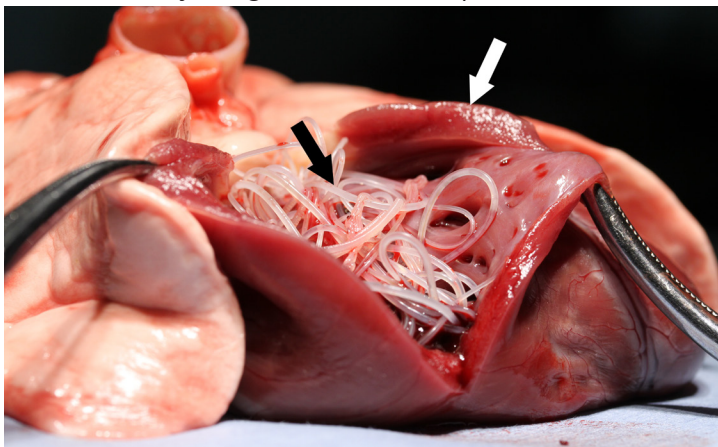
What is the treatment? Will my dog recover?

Typically, therapy is dependent on disease stage and worm location and burden. Treatment consists of pre-treatment with heartworm prevention to control microfilaria, followed by adulticide therapy (elimination of adult worms) in order to prevent ongoing damage to the dog's health. Before beginning adulticide therapy, antibiotics are given to eliminate *Wolbachia* bacteria. Steroids are often given to sick dogs (i.e. those with heart or lung signs) to reduce inflammation caused by dying adult heartworms once adulticide therapy is begun. Exercise restriction is very important during adulticide therapy to reduce the risk of blood clots (thromboembolism).

Dogs with caval syndrome require physical removal of the worms from the heart.

Dogs with microfilaria (young heartworms) require heartworm prevention for elimination.

Prognosis (recovery) is good with appropriate therapy for dogs without clinical signs (typically those in early stages of infection) or with low



Dog heart (white arrow) with numerous adult heartworms (black arrow) (used with permission: Stephen Jones, DVM, The American Heartworm Society)

numbers of adult worms. However, dogs with caval syndrome or many adult heartworms have a guarded prognosis. These dogs require intensive care with a high level of observation and monitoring.

How can I stop this from happening to my dog and other dogs?

Be informed. Know the risks for disease in areas in which you live (or travel), so that you can reduce the risk for your dog and ideally prevent infection. Heartworm can be spread anytime infected mosquitoes are active and feeding. See the Resources section for further information.

Prevent infection and disease by ensuring your dog receives appropriate heartworm testing and preventive. Prevention should begin at the first puppy exam and be continued for life, either year-round or during the mosquito season in your area. Consult with your veterinarian to determine the appropriate plan for your dog.

Available preventives include macrocyclic lactones (e.g., ivermectin, milbemycin oxime, moxidectin, selamectin) often combined with additional drugs aimed at controlling other internal and external parasites (see Resources - Parasite Product Reference Guide). The frequency and route of administration varies with products (i.e. oral or topically given monthly, injectable given every 6 months). Some Collies and other breeds with the MDR-1 gene deletion are highly sensitive to P-glycoprotein-inhibiting drugs (See Resources). The macrocyclic lactones are included in this list with toxicities reported following overdosing the product or when given in combination with other P-glycoprotein-inhibiting drugs. The standard preventive dosages of all macrocyclic lactones have been shown to be safe in all breeds (see Resources for additional information).

There is evidence that some heartworms are resistant to the drugs used for heartworm prevention. In these cases, heartworm infection will develop despite the dog receiving heartworm preventive. Currently this appears to be uncommon. Such infections are identified during annual heartworm screening (or earlier if signs of disease are present), and can be successfully treated. This is why your veterinarian may

recommend annual heartworm testing despite your dog being on a regular preventive regime.

Outbreak management:

Outbreaks of heartworm infections are uncommon. When multiple dogs are believed to have been infected with *D. immitis* in a single location (e.g. kennel, canine event) it is most often due to inadequate use of heartworm preventive (e.g., not providing the dose or frequency as directed). This can also occur when dogs are moved from high-risk locations into lower-risk locations and are not immediately tested (and treated) for heartworm, and while other dogs in the area are not receiving adequate preventive. Infected dogs serve as a source of infection for mosquitoes that can then infect other local dogs. If an outbreak is suspected, it is recommended to contact someone with experience in veterinary infectious disease risk assessment and outbreak management.

Zoonotic (Human Infection) Alert:

Human illness with heartworm infection is very uncommon. When it does occur, infection often results in damage to the lungs. Human infection is prevented by preventing mosquito bites through screening areas where people work and live, including outdoor dog kennels, and by using mosquito repellents, wearing protective clothing, and remaining indoors when mosquitos are biting.



Reducing the occurrence of heartworm infection in the local dog population will also reduce the risk of *D. immitis* transmission to people in the area.

Additional Resources

Companion Animal Parasite Council. Heartworm [Prevalence Maps of the United States and Canada; Guidelines; Parasite Product Reference Guide].

Available at: capcvet.org/

Mealey, K. (2016). MDR1 gene mutations and drug therapy. Clinician's Brief.

Available at: cliniciansbrief.com/article/mdr1-gene-mutations-drug-therapy

Stull, JW, et al. (2016), Disease prevention at canine group settings.

Available at: vet.osu.edu/preventive-medicine/vpm-research/disease-prevention-canine-group-settings

The American Heartworm Society. Heartworm guidelines.

Available at: heartwormsociety.org/

Current research being funded by the AKC Canine Health Foundation to study drug resistance in canine heartworm disease: 02458-A: A laboratory test for detecting drug resistance in canine heartworm disease. Principal Investigator: Matt Brewer, DVM, PhD; Iowa State University Available at: akcchf.org/research/research-portfolio/02458-A.html

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