

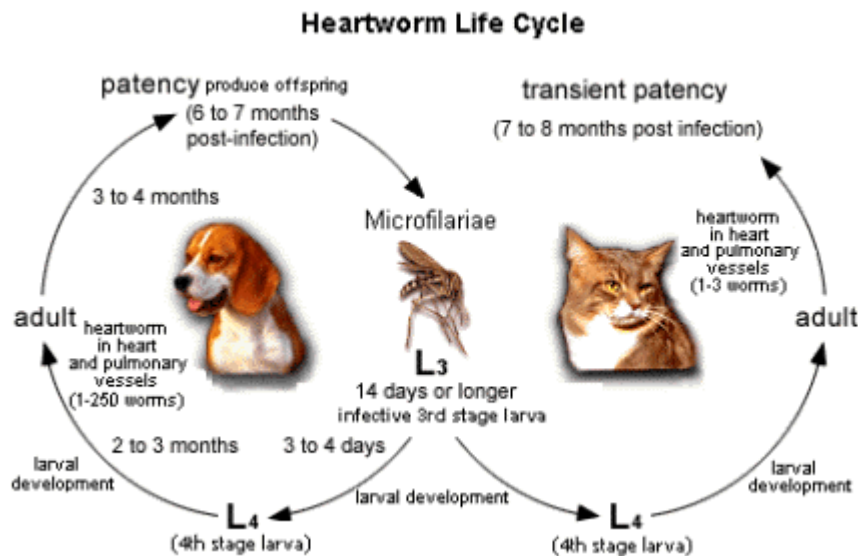
About Heartworms

By: C. Steubing

Some of these pictures are graphic

Dogs are considered the definitive hosts for heartworm infections. In experimental infections of heartworms, the percentage of infective larvae developing to adult heartworms in dogs is 40% to 90%. However, the percentage of experimentally-infected dogs from which adult worms are recovered is virtually 100% of infected dogs. The worm burden in dogs is usually high ranging from 1 to 250 worms. The life span of the worms in dogs appears to be about 5 to 7 years. The average prepatent period (the time elapsed from when the larvae enter the host until the adult female worms begin to produce *Microfilaria*) in dogs is about 6-7 months.

Microfilaria (The minute larval form of a heartworm) are relatively common in dogs. *Microfilaria* are the larval stage of heartworms. Not all heartworm infections result in circulating *Microfilaria* that can be found upon examination of the dog's blood, however. When there are no *Microfilaria* in the bloodstream the infection is known as an occult heartworm infections and can be the result of a number of factors. Single sex heartworm infections, host immune responses affecting the presence of circulating *Microfilaria* and the administration of heartworm preventives can be factors which produce occult infections in dogs.



The onset and severity of disease in the dog is in part a reflection of the number of adult heartworms present. Dogs with higher numbers of worms are generally found to have more severe cardiac and pulmonary disease changes. Until the number of heartworms exceeds 50 in a 25-kg dog, nearly all of the heartworms reside in the caudal pulmonary arteries. Higher numbers of heartworms will result in their presence in the right ventricle, and possibly the right atrium, of the dog's heart. The most common pathological changes created by heartworms are due to inflammatory processes that occur in and around the caudal pulmonary arteries in response to the presence of heartworms.

Canine heartworm infection is widely distributed in the United States. Heartworm infection has been found in dogs native to all 50 states, and is considered at least regionally endemic in each of the contiguous states and Hawaii. All dogs regardless of their age, sex, or habitat are susceptible to heartworm infection. The

About Heartworms

By: C. Steubing

highest infection rates (up to 45%) in dogs not maintained on heartworm preventive are observed within 150 miles of the Atlantic coast from Texas to New Jersey and along the Mississippi River and its major tributaries. Other areas of the United States have lower incidence rates (5% or less) of canine heartworm disease, while some regions have environmental, mosquito, and dog population factors that allow a higher incidence of heartworm infection. Endemic regions have heartworm infections diagnosed in dogs as young as 1 year, with most areas diagnosing infections primarily between the ages of 3 and 8 years of age. The infection rate in male dogs is as much as 4 times that of female dogs and dogs housed outdoors are 4 to 5 times more likely to be infected than indoor dogs. Although there are differences in frequency of infection for various groups of dogs, all dogs in endemic regions should be considered at risk and placed on surveillance/prevention programs.

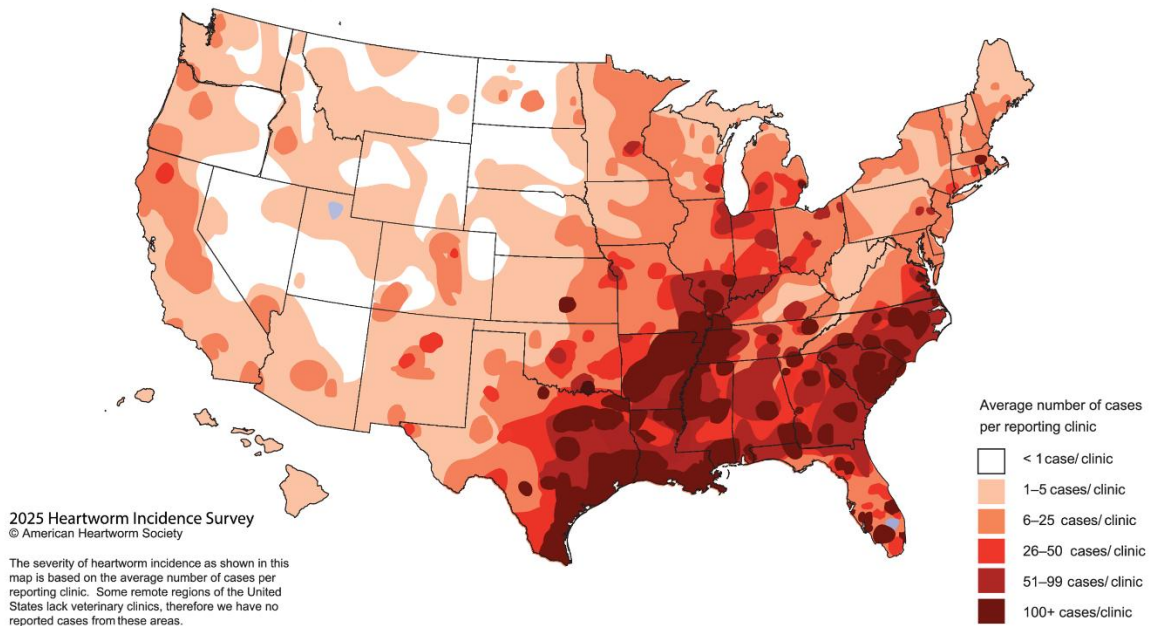
Heartworms are a common disease in many areas. Here is a map of reported Heartworm infections in 2003. Now it is probably greater.

2025 HEARTWORM INCIDENCE



AMERICAN
HEARTWORM
SOCIETY™
EST. 1974

© American Heartworm Society The severity of heartworm incidence as shown in this map is based on the average number of cases per reporting clinic. Some remote regions of the United States lack veterinary clinics, therefore we have no reported cases from these areas.

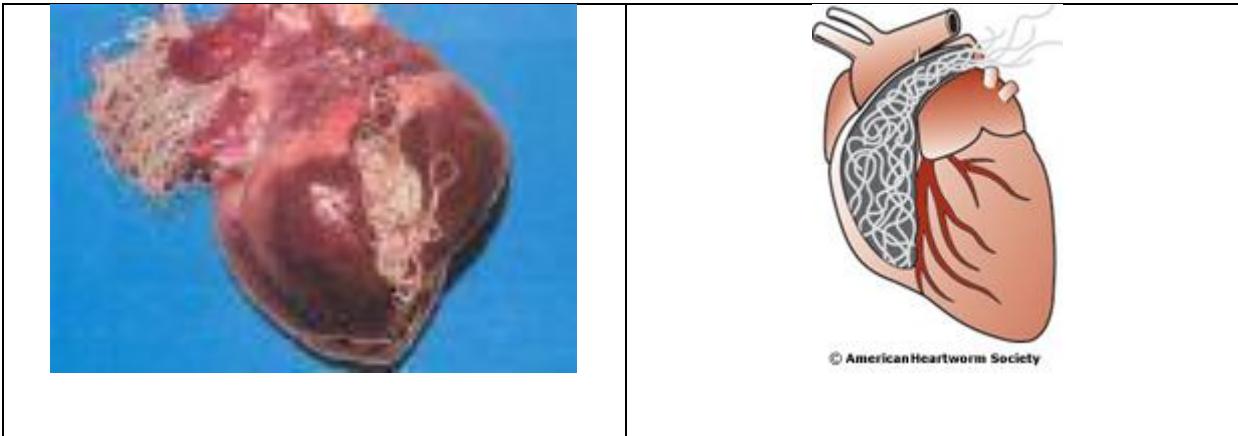


These are actual heartworms in a heart

Diagram of heartworms

About Heartworms

By: C. Steubing



Clinical Signs

Heartworm infection may cause multiple system dysfunction affecting the pulmonary circulation, heart, liver and kidneys. Heartworm disease may have an acute onset, but it is usually insidious, resulting from a chronic infection with a combination of underlying pathophysiologic responses (The functional changes associated with or resulting from disease or injury). Dogs with low worm burdens that receive little cardiopulmonary exercise may never have overt signs of heartworm disease. The heart and lungs are the major organs affected by heartworms in dogs, and they can have no clinical signs, or can present with mild, moderate or severe clinical signs.

Clinical Signs Associated with Canine Heartworm Disease

Acute No Abnormal Clinical Signs

Mild Disease Possible Cough

Moderate
Disease Cough, exercise intolerance, abnormal lung sounds

Severe
Disease Cough, exercise intolerance, dyspnea (difficulty breathing), abnormal lung sounds, hepatomegaly (enlargement of the liver), syncope (temporary loss of consciousness due to poor blood flow to the brain), ascites (fluid accumulation in the abdominal cavity), abnormal heart sounds, death

Diagnosis

The diagnosis of canine heartworm disease depends upon an accurate patient history, the recognition of varied clinical signs, and the use of several diagnostic procedures that may include radiology, angiography and ultrasonography (Diagnostic imaging in which ultrasound is used to visualize an internal body structure. Also called *echography, sonography*.), serologic testing, *Microfilaria* detection and differentiation, clinical

About Heartworms

By: C. Steubing

laboratory tests. Many vets ask that a heartworm test is given every year. This is always a good idea...better safe than sorry.

Radiology

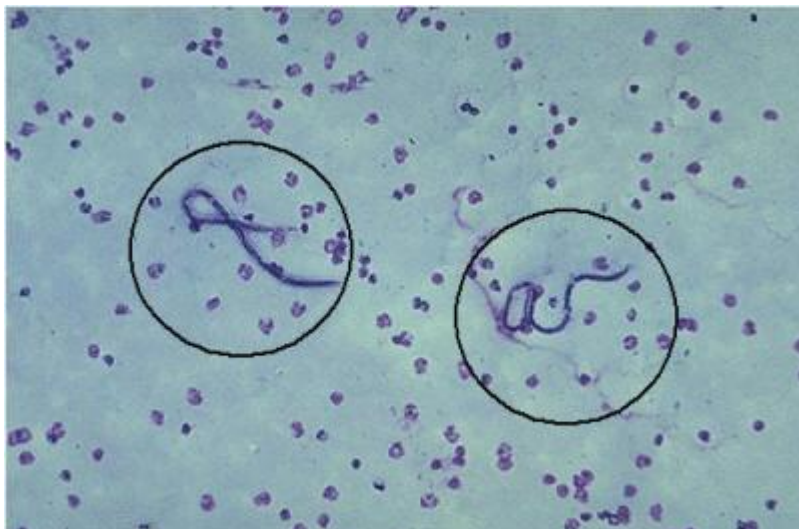
Radiographic abnormalities develop early in the course of the disease. Radiographs of the heart and lungs are the best tool available to evaluate the severity of the disease.

Angiography and Ultrasonography

These forms of imaging are rarely used in the diagnosis of canine heartworm infection outside of referral practices and teaching institutions. Angiography is a technique that permits visualization of blood vessels in the body by taking radiographs within seconds after injecting a contrast material (dye) into those blood vessels. In canine heartworm infection, angiography is used to study changes to the pulmonary arteries. Ultrasonography (echocardiography) has been used to evaluate right ventricular enlargement and to look for the presence of heartworms in the right ventricle or main pulmonary artery.

Microfilarial Detection and Differentiation

The identification of *heartworms* microfilaria from a blood sample is indicative of infection with adult heartworms in over 99% of individuals. Veterinarians will often do a quick examination of a blood smear to look for the presence of *Microfilaria*, but this procedure is not sensitive enough to serve as a final rule out for the absence of microfilaria in a sample.



About Heartworms

By: C. Steubing

Physical Exam

The physical examination may be perfectly normal in heartworm-infected dogs with mild disease, or severely affected dogs may present recumbent, in right-sided heart failure. Labored breathing or crackles may be heard in dogs with severe pulmonary complications, and a history of chronic cough and exercise intolerance are some of the earliest detectable abnormalities. Irregular heart beats indicate right-sided congestive heart failure. Clinical signs and disease experienced in ectopic (other than in typical locations within the body.) infections depend largely on the location of the worm. In dogs, the primary response to the presence of heartworms occurs in the heart and lungs.

Serology

Antigen tests detect specific antigens from adult female heartworms and are used successfully to detect canine heartworm infection. Currently, tests are available as in-clinic tests, as well as at many veterinary reference laboratories. Most commercial tests will accurately detect infections with 1 or more mature female heartworms that are at least 7 or 8 months old, but they generally do not detect infections of less than 5 months duration.

Antibody Tests

In the late 1970's and early 1980's, several canine heartworm antibody tests were developed and introduced. These tests relied on detection of antibodies using a crude mixture of heartworm antigens from adult worms, and while they were very sensitive (i.e. they were able to detect very early infections and infections with small numbers of heartworms), the tests were non-specific and were believed to cross-react to the common gastrointestinal parasites found in dogs. These tests were never very popular as screening tests in dogs.

An IFA detecting antibodies to microfilarial cuticular antigen has been used for the diagnosis of occult infections that result from immune-mediated clearance of microfilaria in dogs. The presence of sterile worms, worms of only one sex or the absence of a host response to microfilarial surface antigen does not produce a diagnostic titer. A variation on this test includes analyzing microfilaria to assess antibody to somatic antigens. This somatic IFA is nonspecific and not clinically useful in dogs.

Treatments

Most dogs infected with heartworm can be successfully treated. The goal of treatment is to kill all adult worms with an adulticide (Manufactured medication formulated to kill adult heartworms) and all microfilaria with a microfilaricide (Medication to kill microfilaria). It is important to try to accomplish this

About Heartworms

By: C. Steubing

goal with minimal drug toxicity and a tolerable degree of complications created by the dying heartworms. Heartworm infected dogs which are normal or have mild disease have a high treatment success rate. Patients with evidence of more severe heartworm disease can be successfully treated, but the incidence of post-adulticide complications and mortality are greater. Certainly, there are patients whose severity of heartworm disease, or presence of other concomitant life-threatening diseases, prevent treatment of the heartworm infection.

Post-adulticide Complications

The primary post-adulticide complication is the development of severe pulmonary thromboembolism. Pulmonary thromboembolism (The blocking of a blood vessel by a blood clot dislodged from its site of origin) results from the obstruction of blood flow through pulmonary arteries due to the presence of dead heartworms. If heartworm adulticide treatment is effective, some degree of pulmonary thromboembolism may occur. This means that some dogs may have heartworms to such a great extent that the dead worms running through their circulatory system create a sort of blockage. When dead worms are numerous, widespread obstruction of arteries can occur. Clinical signs most observed include fever, cough, hemoptysis (expectoration of blood). These patients require strict reduction in exercise and anti-inflammatory doses of corticosteroids.

Elimination of Microfilaria

Microfilaricide treatment is typically administered 3 to 6 weeks following completion of the adulticide treatment. This allows an adequate amount of time to pass for the adult worms to die and to have ceased production of additional microfilaria. The most effective drugs for this purpose are the macrolide anthelmintics - ivermectin and milbemycin. These drugs are the active ingredients in the commonly use heartworm preventives. However, their usage in this application has not been approved by the FDA, but there are no approved microfilaricidal drugs currently recognized. It is recommended that microfilaria positive dogs being treated with these drugs be hospitalized for 8 hours following treatment for observation of possible adverse reactions resulting from rapid death of the microfilaria.

A microfilaria concentration test is performed 3 weeks after microfilaricide treatment. Pets that are microfilaria negative have completed the treatment for canine heartworm infection and are ready to start a heartworm preventive program.

Confirmation of Adulticide Efficacy

The goal of adulticide treatment is the elimination of all adult heartworms. However, clinical improvement in dogs treated for heartworm infection is possible without the complete elimination of the adult

About Heartworms

By: C. Steubing

heartworms. During and after the heartworm treatment the dog **MUST** be kept on preventative. This can help eliminate the worms that the body is fighting. Another heartworm test is given 3-5 months after treatment is completed. Heartworm antigen testing is the most reliable method of confirming the efficacy of adulticide therapy. If all the adult worms have been destroyed or very few survive, heartworm antigen should be undetectable by 16 weeks post-adulticide. Dogs that remain antigen positive at that time should only be considered as candidates for repeat treatment with an adulticide after a full review of each case.

Preventives

While treatment of canine heartworm disease is usually successful, it is very expensive. Prevention of heartworms is a much safer and more economical way of dealing with this problem. There are currently many different products approved for use in the US for the prevention of canine heartworm infection. Prevention of heartworm disease in dogs can be accomplished through the routine administration of oral or topical heartworm prevention. These drugs are highly effective when administered at the appropriate doses and intervals. All dogs (especially those that live in warmer climates) should be kept on preventative year-round. Before starting a preventive program, all dogs that could possibly be infected with mature heartworms should be tested for the presence of circulating antigen.

Brands of Heartworm Prevention

Heartgard® -- A chewy meat treat

Revolution® -- Topical Solution applied between the shoulder blades

Iverhart® -- A chewable tablet

Inceptor® -- A chewable tablet

Sentinal® -- An oral tablet that needs to be swallowed whole

ProHeart 6 – A 6 month injection

ProHeart12 – A 12 month injection

Trifexis – Monthly chew for heartworms and flea prevention

NexGard Plus - Monthly chew for heartworms and flea prevention

Simperica Trio – Monthly chew for heartworms and flea prevention