Highlights of the Feline Guidelines for the Prevention, Diagnosis, and Management of Heartworm Infection (*Dirofilaria immitis*) in Cats

Revised 2024

These guidelines are a living document and are revised periodically based on information presented at the American Heartworm Society's Triennial Symposium, new research, and additional clinical experience. This summary of the guideline's highlights supersedes previous editions and has been peer reviewed by independent experts. The full Feline Guidelines can be found at the American Heartworm Society's website.

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EPIDEMIOLOGY

- Heartworm infection has been diagnosed in all 50 US states and around the globe.
- Environmental and climatic changes, both natural and those created by humans, relocation of microfilaremic dogs, and expansion of the territories of microfilaremic wild canids continue to be important factors contributing to further spread of the parasite.
- A pivotal prerequisite for heartworm transmission is a climate that provides adequate temperature and humidity to support a viable mosquito population and can also sustain sufficient heat to allow maturation of ingested microfilariae into infective, third-stage larvae (L3) within the intermediate host.
- The length of the heartworm transmission season in the temperate latitudes also depends on factors such as the influence of microclimates, unique biological habits and adaptations of the mosquito vector, variations in time of larval development, mosquito life expectancy, and temperature fluctuations.
- Heartworm transmission does decrease in colder months, but the presence of microenvironments in urban areas suggests that the risk of heartworm transmission never reaches zero.
- Heartworm-infected cats develop a very low, transient microfilaremia and are therefore not a good source of infection for mosquitoes (and therefore unlikely to put other pets at risk).

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For detailed information on heartworm epidemiology, please refer to the complete AHS Current Feline Guidelines.

BIOLOGY

- Significant differences exist between feline heartworm disease and its canine counterpart. Although cats are susceptible hosts, they are more resistant to infection with adult *Dirofilaria immitis* than are dogs.
- Most adult heartworm infections in cats are comparatively light and consist of less than six worms. Usually only one or two worms are present, and approximately one third of these consist of worms of the same sex.

The true prevalence of heartworm infection in cats is probably understated due to diagnostic limitations and the greater tendency of cats to exhibit only transient clinical signs or die without confirmation of infection.

- Nevertheless, because of their relatively small body size, cats with only a few worms are still considered to be heavily infected in terms of parasite biomass.
- The true prevalence of heartworm infection in cats is probably understated due to diagnostic limitations and the greater tendency of cats to exhibit only transient clinical signs or die without confirmation of infection.
- Heartworm antibody (HW Ab) levels nationwide appear to be in the 15–17% range but have been reported to range from a low of 3.5% to as high as 44%.
- Circulating microfilariae are seldom found in infected cats. It appears that feline infections become occult due to host immune-mediated clearance of the microfilariae.
- Aberrant migration occurs more frequently in cats than in dogs. Although uncommon, heartworms are found disproportionately often in the eyes, body cavities, systemic arteries, and central nervous system of cats.
- The life span of the parasite in cats is thought to be 2 to 4 years, which is considerably shorter than that in dogs.

For detailed information on heartworm biology, please refer to the complete AHS Current Feline Guidelines.

PATHOPHYSIOLOGY

- Feline heartworm infection is the presence of migrating heartworm larvae in tissues or adult worms within the pulmonary vasculature.
- Feline heartworm disease (FHWD), also known as heartworm-associated respiratory disease (HARD), is pathology caused by a current or past infection.
- Although live adult worms in the pulmonary arteries cause local arteritis, some cats never manifest clinical signs. When signs are evident, they usually develop during one or more of the three stages of the disease.
- In the first stage, which occurs with the arrival of sexually immature adult worms in the pulmonary arteries and arterioles approximately 75 to 90 days post infection, there is an intense inflammatory response due to the presence of pulmonary intravascular macrophages (PIMs).
- In the second stage, the mature worms begin to die and the suppression of the immune system ends; the degenerating parasites result in pulmonary inflammation and thromboembolism, which often leads to fatal acute lung injury.

Caval syndrome occurs rarely in cats because infections are usually light; however, even one or two worms may cause tricuspid regurgitation and resultant heart murmur.

- The third stage of disease occurs if the cat survives the death of an adult worm. Hyperplasia of Type 2 alveolar cells replaces normal Type 1

alveolar cells, potentially leading to permanent lung injury.

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For detailed information on pathophysiology, please refer to the complete AHS Current Feline Guidelines.

PREVENTION

- The AHS continues to recommend that all cats be on year-round heartworm prevention.
- Any cat living where heartworm-positive dogs and wild animals are in the vicinity is at risk. Given that mosquitoes can enter homes, this includes indoor cats.
- Heartworm chemoprophylaxis can be achieved in cats with monthly doses of milbemycin oxime orally, or topical eprinomectin, moxidectin or selamectin; an every other month topical formulation of moxidectin is also available.
- Heartworm preventives should be administered year-round for the following reasons: 1) added activity against some common intestinal parasites +/- external parasites that may also have zoonotic potential, 2) increased compliance, and 3) some retroactive efficacy as a safeguard for inadvertently missed doses.

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- Whereas vector control to supplement prevention of infection typically includes mosquito-repellent products applied to dogs, in cats a multimodal vector-control program is usually geared toward reducing the risk of mosquitoes in the environment rather than mosquito repellents on the cat itself.
- Vector control measures include eliminating sources of standing water or treating them with chemical and/or biological tools such as insect growth regulators, Bacillus species, and mosquito fish.
- Utilize local environmental application of insecticidal sprays/fogs and adult mosquito traps.

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- Other measures include reducing exposure of cats by limiting outdoor activities and using FDA- or EPA-approved ectoparasiticide products designed for use in cats as many products approved for dogs contain levels of permethrin or related compounds that can be toxic if applied to or accidentally ingested by cats.
    - DEET, which is approved for human use, is NOT recommended for use on cats. (Dorman, 1990; Gwaltney-Brant, 2004)
- While vector mitigation strategies and lifestyle management alone or together are helpful, they are not completely effective as monotherapy for heartworm prevention with a macrocyclic lactone.

For detailed information on heartworm prevention, please refer to the complete AHS Current Feline Guidelines.

PHYSICAL DIAGNOSIS

- Clinical signs associated with FHWD may be only a vague malaise or can consist of respiratory, gastrointestinal (e.g., emesis), or occasionally neurologic manifestations, either chronically or acutely.
- Signs of chronic respiratory disease such as persistent tachypnea, intermittent coughing, and increased respiratory effort are most common.
- A right sternal border systolic heart murmur may be present in cats when worms reside in the right atrioventricular junction interfering with tricuspid valve function.
- Anorexia and weight loss occur in some cats. Intermittent vomiting unrelated to eating is reported frequently and in endemic areas when

no other cause is evident should raise suspicion of heartworm infection.

- A peracute syndrome consisting of some combination of signs including respiratory distress, ataxia, collapse, seizures, hemoptysis, or sometimes sudden death may arise without warning.

For detailed information on physical diagnosis, please refer to the complete AHS Current Feline Guidelines.

DIAGNOSTIC TESTING

- Heartworm infection in cats is a more elusive diagnosis than in dogs and can be easily overlooked; therefore, we STRONGLY RECOMMEND annual testing of cats for heartworm.
- In the cat, no single test will detect all heartworm cases. While the antigen tests are highly specific for detecting adult heartworm antigen, they will not detect infections with only live male worms. The clinician must use a combination of test results to determine the likelihood of heartworm disease as the etiology of the cat's symptoms.
- Since microfilaremia in cats is uncommon, transient, and below concentration levels that might trigger an adverse reaction to microfilaricidal chemoprophylactic drugs, pretesting for microfilariae prior to prescribing a heartworm preventive is unnecessary.

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- The preferred method for screening includes the use of both a heat-treated antigen and a Heska (an Antech company) antibody test.
- Antibody tests have the advantage of being able to detect infection by both male and female worms, as larvae of either sex can stimulate a detectable immune response as early as 2 months post infection.
- The antigen test is the "gold standard" in diagnosing heartworms in dogs but because unisex infections consisting of only male worms or symptomatic immature infections are more common in cats, none of the presently available antigen tests can be relied upon to rule out heartworm disease in cats.

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- The routine heating of blood samples for antigen recovery IS RECOMMENDED for cats and is available at most reference laboratories. This recommendation is different than the AHS Canine Guidelines and may interfere with the results of combination tests that include an antibody test for detection of other infectious agents.
- Heartworm test results should only be recorded as positive, no antigen detected (NAgD), or no antibody detected (NAbD) and should not be recorded as "negative."
- Radiographs and echocardiography are the most useful tests to evaluate cardiopulmonary structures in the cat suspected of having heartworm disease. However, point of care ultrasound (POCUS) is useful in the cage-side evaluation of cats with respiratory distress.
- Making an antemortem diagnosis of heartworm infection may be difficult and thus necropsy confirmation should be attempted in cats suspected of dying of the disease or in which the cause of death is unexplained.

For detailed information on diagnostic testing, please refer to the complete AHS Current Feline Guidelines.

TREATMENT

- While there is no approved adulticide treatment for cats as there is for dogs, there are medical options to manage cats infected with heartworms.
- These measures can relieve the clinical signs of disease and, in cases of adult infection, prevent sudden death of the cat.
- Medications to consider include the following:
  - Prednisolone to relieve coughing and other respiratory signs
  - Doxycycline to eliminate *Wolbachia* organisms from heartworms, which contribute to the pathogenesis of the disease
  - Supportive therapy with corticosteroids, bronchodilators, oxygen, fluids and thermal support to relieve respiratory distress
  - Antileukotrienes to prevent respiratory crisis

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- Melarsomine is not recommended for use in cats; preliminary data suggests that melarsomine is toxic to cats at doses as low as 3.5 mg/kg.
- Adult heartworms in cats can be surgically removed if the precise location of the worms can be identified using ultrasonography.
- Serologic retesting at 6-month intervals for the purpose of monitoring infection status is recommended for all infected cats whether or not they have clinical signs that are treated empirically or are given medical/surgical adulticide therapy.

***For detailed information on heartworm treatment, please refer to the complete* AHS Current Feline Guidelines.**