Heartworm Treatment For Dogs

It has been said that the treatment of heartworm infection is something of an art. There are several strategies that can be used depending on the dog's medical condition, including the option of not treating at all. The important concept to realize is that, while there are off label alternative heartworm-killing protocols, the FDA-approved method of killing adult heartworms involves very harsh arsenic-based drugs and killing large adult heartworms is neither simple nor safe. Let's review some of the dangers and options in clearing the body of this parasite.

Patient Evaluation

Prior to therapy, the heartworm patient is assessed and rated for risk into one of four categories. Important factors include: how many worms are thought to be present based upon the tests performed, the size of the dog, the age of the dog, concurrent health factors, severity of the heart disease, and the degree to which exercise can be restricted in the recovery period. Some hospitals use computerized formulas to categorize heartworm infected patients. The categories into which patients are grouped are as follows:

- **Class I: Lowest Risk.** These dogs are typically without symptoms and their infection is a surprise discovery during a routine annual health examination when a positive test comes up. Other blood tests are normal and radiographs show mild changes if any change at all.
- **Class II: Moderately Affected.** Healthy dogs with minimal signs as above, occasional coughing, fatigue only with exercise but with radiographs that show definite evidence of heart disease. Lab testing shows mild anemia, urine dipsticks show some protein present but not severe urinary protein loss.
- **Class III: Severely Affected.** Dog is suffering from weight loss, cough, difficulty breathing, and blatant damage to the vasculature is apparent on radiographs; lab work reveals a more severe anemia and marked urinary protein loss. The damage to the lung blood vessels from the worms creates extra resistance for the heart to pump against, and often, episodes of collapse occur with exercise.

If the damage is severe enough, the heart can actually fail trying to pump through all the clogged-up blood vessels. Class III dogs are expected to die without treatment but are, unfortunately, sick enough that treatment itself is not without risk.

- **Class IV: Caval Syndrome.** Dog is collapsing in shock with dark brown urine evident. Heartworms are visible by ultrasound in the AV valve of the right side of the heart, with very abnormal bloodwork. These dogs are dying and can only be saved by the physical removal of adult heartworms via an incision through the jugular vein. If such a dog can be saved from this crisis, further treatment cannot be contemplated until the dog is stable enough to fit into one of the other categories above. In this video (*we warn you this is not for the faint of heart*), view the physical removal of adult heartworms from the jugular vein of a dog with caval syndrome.

After knowing what class the patient fits in, treatment can be determined. The dog has three groups of heartworms in their body: microfilariae (basically newborn worms whose parents are living inside the dog in question), newly arrived immature worms (relatively fresh from the mosquito bite and living in the skin tissues), and adult worms themselves.

- Microfilariae are the first stage larvae (basically the youngest stage). These are the children of the adult worms living in the heart and blood vessels. The mother worm gives live birth (no eggs involved) and the babies swim freely in the host's bloodstream. They must be killed so that they cannot be picked up by mosquitos and transmitted to new dogs..
- The newly arrived heartworm larvae, freshly delivered from mosquito bites in the last 3 months. These are third and fourth stage larvae living in the skin. For practical purposes, we will include the L5 larvae in this group. The L5's are old enough to leave the skin tissues and enter the circulation but they are not really mature enough to be called adults. This group of young worms (L3's and L4's in the skin and L5's in the circulation) represent the first 5-7 months of infection. We need to kill them before they reach maturity and begin to wreak havoc on the cardiovascular system of the host.
- The older L5 larvae and adult worms live inside the heart and pulmonary arteries. This group requires the arsenic compounds for destruction while the other two groups can be killed with less toxic products.

Now that it's Staged, Let's Get Rid of it

The goal is to get rid of all three groups of worms with as little inflammatory reaction as possible. Since the adult worms are the largest, it is not surprising that their deaths generate the most inflammation. We hope to stage the worm-killing process so that when the time comes to kill the adult worms, there are as few adult worms as possible and the patient should be as healthy as possible going into the process. For the sake of terminology, adulticides are products that kill the adult worms and larvicides kill the immature worms.

Stabilization First

Expect strict exercise restriction to be needed after adulticide therapy but moderately affected dogs will need restriction from the first. If the dog has heart failure, this will need to be controlled as well. Some dogs will need anti-inflammatory doses of steroids to control the inflammation that stems from the presence of worms. This is often done concurrently with the second step as described below.

Killing the Microfilaria and Migrating Worms

The next step in treatment is clearing the migrating immature worms. Heartworm treatment is a project that lasts at least a couple of months. We do not want immature worms to mature in that time frame. Since our goal is to have fewer adult worms when the time comes to kill the adult worms, it behooves us to kill the younger worms right off the bat.

The tissue-based L3 and L4 larvae are killed by monthly macrocyclic lactone-based heartworm preventive products (avermectins and milbemycin). Killing the L3 and L4 larvae prevents heartworm infection. Some of these products can also kill circulating microfilariae (which need to pass through a mosquito before becoming infective to other animals). The only FDA-approved product for killing microfilariae after adulticide therapy is Advantage Multi®, which contains moxidectin. Other products can be used for this purpose also, but it

should be noted that an anaphylactoid reaction can occur if a large number of microfilariae are killed rapidly with products such as high-dose ivermectin (off-label) or high-dose milbemycin (e.g., Interceptor). This problem has not been noted with Advantage Multi. While low-dose ivermectin products (e.g., Heartgard) will gradually eliminate microfilariae in most dogs, the package insert discourages it for this use.

Killing *Wolbachia*

Wolbachia is a genus of rickettsial organisms (sort of like bacteria, but not exactly) that live inside heartworms of all developmental stages, but their numbers begin to expand once the young worms reach their infectious stage. *Wolbachia* organisms seem to be protective or beneficial to the heartworms that harbor them, aiding in metabolism and general worm health. Without *Wolbachia* colonization, many female worms are not able to reproduce, and third-stage larvae are not able to infect new hosts.

Wolbachia organisms possess inflammatory surface proteins that are released when adult worms die or are killed in treatment, and these proteins greatly increase the chances of severe circulatory reactions in the canine host.

It has been found that killing *Wolbachia* with an antibiotic such as doxycycline is helpful in treating the heartworm infection as the *Wolbachia* can be removed from their heartworm hosts, thereby weakening the worm and minimizing the release of inflammatory proteins when the worm finally dies. To minimize reactions, the American Heartworm Society recommends using doxycycline along with heartworm preventives for a good month as soon as the diagnosis is made and prior to the use of the arsenic compounds needed to kill the adults.

Killing the Adult Worms

The only product currently available for treating adult heartworms is melarsomine dihydrochloride (Immiticide® or Diroban®. If you go by the manufacturer's recommendations, treatment can be done in two or three doses, depending on the class of heartworm infection. Most universities, however, opt to treat all

patients with the three-dose protocol as it creates a more gradual kill of the adult worms (which is safer in terms of embolism and shock).

The patient receives an intramuscular injection deep in the lower back muscles. This is a painful injection with a painful substance, and it is common for the patient to be quite sore at home afterward. Pain medication may be needed. Be careful around the injection site, as the pet may bite. The site may form an abscess that requires warm compresses. Approximately 30% of dogs experience some sort of injection site reaction. These generally resolve in 1-4 weeks.

In the two-dose protocol, the dog returns for 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 is an introductory treatment to kill some of the more sensitive worms.) Keep in mind that too many worms dying at once creates circulatory shock. The benefit of the three-dose protocol (sometimes called the split dose protocol) is that the first injection serves to kill off any older or weaker worms without killing off the stronger, younger ones. When the two consecutive doses occur one month later, there will be fewer worms dying at once.

After treatment, the patient must be strictly confined for one month following the final treatment. No walks, no running around. The dog must live the indoor life. The reason for this is that embolism, to some degree is inevitable, and it is important to minimize embolism-related problems. Exercise increases heart rate and oxygen demand, and we need the heart to rest during this recovery period.

Watch for:

- Coughing
- Fever
- Nose bleeds

If any of these occur, report them to the vet as soon as possible. The most critical time period is seven to 10 days following a melarsomine treatment, but these signs can occur anytime in the following month.