

Chronic Cough in a 3-Year-Old Labrador Retriever

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Buddy, a 3-year-old castrated Labrador retriever, was presented for a 2-week history of chronic, intermittent coughing.

History

Buddy, who was presented in February, lived in a rural environment about 50 km (31 miles) north of Toronto, Ontario, Canada, with 1 other dog and 1 cat in the household. Neither of the other animals showed signs of illness. Vaccinations were up-to-date. The dog had previously been on monthly heartworm prevention (ivermectin–

pyrantel) from May through October. Buddy had been receiving corticosteroids (prednisone, 1.0 mg/kg PO once a day) to treat atopy for 1 month prior to presentation. His appetite and general demeanor were normal. No exercise intolerance or dyspnea was reported.

Examination

Buddy appeared bright and alert and was moderately overweight. A nonproductive cough could be elicited on tracheal palpation. Temperature, pulse, and respiratory rate were normal; other than the cough, no abnormalities were detected on physical examination.

Diagnostics

A fresh fecal sample was submitted just before the appointment. A zinc sulfate centrifugal flotation was pursued to detect any possible pulmonary capillarid infection. Eggs of *Trichuris vulpis* and *Alaria* spp and several nematode larvae were detected on the centrifugal flotation examination (*Figure 1*, next page). Identification of the nematode larvae was not possible owing to the effects of the osmotic damage caused by the high specific gravity flotation media.

A fecal sedimentation test was then performed, and a Baermann examination was set up in an attempt to



▲ First-stage larva detected on zinc sulfate centrifugal fecal flotation. The osmotic damage from the high specific gravity flotation media is too severe to allow identification (original magnification 20× objective).

ASK YOURSELF

- ▶ In cases of suspected lungworm infection in North America, which fecal examination diagnostic methods should be used to detect the various lungworm species infecting dogs?

obtain undamaged larvae. All larvae recovered on sedimentation were dead and too degenerated to identify. The larvae were 235 to 245 microns in length, and the anterior end was bluntly rounded (**Figure 2**). The results of the Baermann examination obtained the following day were negative. CBC and serum chemistry profile were within normal limits. Thoracic radiographs revealed a diffuse pulmonary broncho-interstitial pattern.

A transtracheal wash sample was obtained. The sample was highly cellular with a predominance of eosinophils. Moderate numbers of neutrophils; small numbers of macrophages, lymphocytes, and plasma cells; and rare mast cells were also present. A moderate number of larvated nematode eggs and larvae were recovered. Gentle pressure on the coverslip induced the release of many of the larvae from the eggs. The larvae were similar in size to those recovered from the fecal sedimentation but were motile, and the morphology could be

evaluated in greater detail (**Figure 3**). The larvae had a bluntly rounded anterior end, long rhabditiform esophagus (over half the total length of the larvae), and a slight kink in the tail. The size and morphology were consistent with first-stage larvae of *Filaroides hirthi*, *Filaroides milksi*, and *Oslerus osleri* (formerly *Filaroides osleri*).

A presumptive diagnosis of *Filaroides hirthi* infection was made based on clinical signs and history of therapy with an immunosuppressive drug (ie, prednisone).

Diagnosis

Presumptive *F hirthi* infection

Treatment and Outcome

Buddy was treated with fenbendazole (50 mg/kg PO once a day for 14 days) and gradually weaned off prednisone therapy. Clinical signs resolved within the 2-week treatment period. Follow-up treatment with milbemycin oxime (0.5 mg/kg PO once monthly for 4 months) was administered to control the unrelated *T vulpis* infection.

Discussion

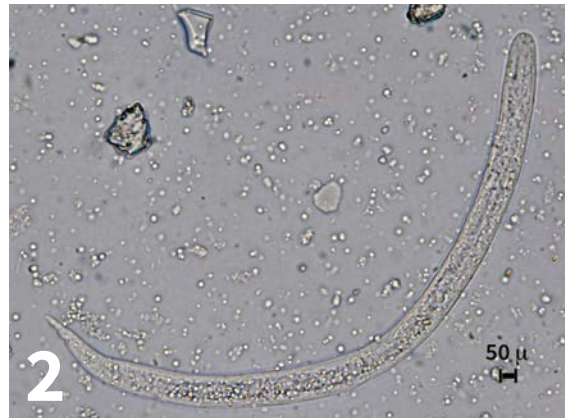
F hirthi is a metastrongyloid that infects the bronchioles and lung parenchyma of dogs. This infection is more commonly associated with research laboratory beagle colonies; diagnoses in client-owned animals are relatively rare.¹ Infections are usually subclinical; however, life-threatening cases occur if there is immunosuppression from concurrent disease processes (eg, distemper, neoplasia, severe trauma) or therapy (long-term corticosteroid treatment).²⁻⁸ Because infection is usually subclinical and diagnosis is difficult, prevalence of infection may be underestimated. Unlike the situation with most other metastrongyloids, the

life cycle of *F hirthi* is direct; dogs become infected through ingestion of first-stage larvae passed in fresh feces or sputum from infected dogs.⁹ Severity of infection in immunosuppressed dogs is likely related to autoinfection leading to hyperinfection.¹

Failure to detect first-stage larvae by Baermann examination is typical of *F hirthi* infection in dogs. Detection by the Baermann method requires larvae to be alive and active; larvae of *F hirthi* and the closely related *O osleri* and *F milksi* lack sufficient vigor to exit the feces and be detected by Baermann examination.⁹ Centrifugal flotation using zinc sulfate is more reliable than the Baermann method for detecting larvae in feces; however, false negatives are common and morphology may be damaged, preventing identification (as in this case).¹ Detection of larvae and larvated eggs in sputum or transtracheal wash samples is the diagnostic method of choice. Morphologically, the larvae of *F hirthi* closely resemble those of *O osleri* and *F milksi*.¹ Definitive diagnosis of *O osleri* infection is made by observing wart-like nodules (containing the adult worms) clustered at the bifurcation of the trachea via bronchoscopy.⁹ Detection of larvae consistent with *F hirthi*/*O osleri* and the absence of wart-like nodules at the bifurcation would indicate *F hirthi* infection.

The client refused consent for bronchoscopy for economic reasons and because of the strong positive clinical response to fenbendazole therapy. *F hirthi*, the most likely possibility in this case, remains a presumptive diagnosis based on the history of corticosteroid treatment.

Reports of *F milksi* infection in dogs are rare, and the role it plays (if any) in



▲ Dead and degenerating first-stage larva recovered by fecal sedimentation. Larva is about 245 microns in length and has a bluntly rounded anterior end (original magnification 40× objective).



▲ Live, motile first-stage larva detected in the transtracheal wash sample. Note the bluntly rounded anterior end, a long esophagus (over half the length of the larva), and the slight kink in the tail (original magnification 20× objective).

cases such as this remains unknown. Clinical disease from *O osleri* infection in dogs usually occurs in animals younger than the dog in this case.¹⁰ Other nematode larvae detected in the feces of dogs include *Strongyloides stercoralis*, *Crenosoma vulpis*, and *Angiostrongylus vasorum*.¹¹ The larvae of *S stercoralis* and *C vulpis* have simple straight tails in

***F hirthi* is a metastrongyloid that infects the bronchioles and lung parenchyma of dogs.**

contrast to the kinked tails of *F hirthi*.¹¹ The tails of *A vasorum* are also kinked but differ from *F hirthi* in that they contain a dorsal spine.¹¹

Fenbendazole (50 mg/kg PO once a day for 14–21 days or 100 mg/kg PO once a day for 7 days) has been used successfully to treat *F hirthi* infection in dogs.¹ Albendazole and ivermectin have also been used to treat dogs infected with *F hirthi*.^{1,7}

DID YOU ANSWER?

- ▶ Baermann examination (*Angiostrongylus vasorum* L1, *Crenosoma vulpis* L1), centrifugal flotation (*Eucoleus aerophilus* eggs, *Filaroides hirthi* L1, *Filaroides milksi* L1, *Oslerus osleri* L1), and fecal sedimentation (*Paragonimus kellicotti* eggs). ■■■

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Heartgard® Plus

(ivermectin/pyrantel)

CHEWABLES

CAUTION: Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian.

INDICATIONS: For use in dogs to prevent canine heartworm disease by eliminating the tissue stage of heartworm larvae (*Dirofilaria immitis*) for a month (30 days) after infection and for the treatment and control of ascarids (*Toxocara canis*, *Toxascaris leonina*) and hookworms (*Ancylostoma caninum*, *Uncinaria stenocephala*, *Ancylostoma braziliense*).

DOSAGE: HEARTGARD® Plus (ivermectin/pyrantel) should be administered orally at monthly intervals at the recommended minimum dose level of 6 mcg of ivermectin per kilogram (2.72 mcg/lb) and 5 mg of pyrantel (as pamoate salt) per kg (2.27 mg/lb) of body weight. The recommended dosing schedule for prevention of canine heartworm disease and for the treatment and control of ascarids and hookworms is as follows:

| Dog Weight | Cheewables Per Month | Ivermectin Content | Pyrantel Content | Color Coding On Foil Backing and Carton |
|--------------|----------------------|--------------------|------------------|---|
| Up to 25 lb | 1 | 68 mcg | 57 mg | Blue |
| 26 to 50 lb | 1 | 136 mcg | 114 mg | Green |
| 51 to 100 lb | 1 | 272 mcg | 227 mg | Brown |

HEARTGARD Plus is recommended for dogs 6 weeks of age and older. For dogs over 100 lb use the appropriate combination of these chewables.

ADMINISTRATION: Remove only one chewable at a time from the foil-backed blister card. Return the card with the remaining chewables to its box to protect the product from light. Because most dogs find HEARTGARD Plus palatable, the product can be offered to the dog by hand. Alternatively, it may be added intact to a small amount of dog food. The chewable should be administered in a manner that encourages the dog to chew, rather than to swallow without chewing. Chewables may be broken into pieces and fed to dogs that normally swallow treats whole.

Care should be taken that the dog consumes the complete dose, and treated animals should be observed for a few minutes after administration to ensure that part of the dose is not lost or rejected. If it is suspected that any of the dose has been lost, redosing is recommended.

HEARTGARD Plus should be given at monthly intervals during the period of the year when mosquitoes (vectors), potentially carrying infective heartworm larvae, are active. The initial dose must be given within a month (30 days) after the dog's first exposure to mosquitoes. The final dose must be given within a month (30 days) after the dog's last exposure to mosquitoes.

When replacing another heartworm preventive product in a heartworm disease preventive program, the first dose of HEARTGARD Plus must be given within a month (30 days) of the last dose of the former medication.

If the interval between doses exceeds a month (30 days), the efficacy of ivermectin can be reduced. Therefore, for optimal performance, the chewable must be given once a month on or about the same day of the month. If treatment is delayed, whether by a few days or many, immediate treatment with HEARTGARD Plus and resumption of the recommended dosing regimen will minimize the opportunity for the development of adult heartworms.

Monthly treatment with HEARTGARD Plus also provides effective treatment and control of ascarids (*T. canis*, *T. leonina*) and hookworms (*A. caninum*, *U. stenocephala*, *A. braziliense*). Clients should be advised of measures to be taken to prevent reinfection with intestinal parasites.

EFFICACY: HEARTGARD Plus Chewables, given orally using the recommended dose and regimen, are effective against the tissue larval stage of *D. immitis* for a month (30 days) after infection and, as a result, prevent the development of the adult stage. HEARTGARD Plus Chewables are also effective against canine ascarids (*T. canis*, *T. leonina*) and hookworms (*A. caninum*, *U. stenocephala*, *A. braziliense*).

ACCEPTABILITY: In acceptability and field trials, HEARTGARD Plus was shown to be an acceptable oral dosage form that was consumed at first offering by the majority of dogs.

PRECAUTIONS: All dogs should be tested for existing heartworm infection before starting treatment with HEARTGARD Plus which is not effective against adult *D. immitis*. Infected dogs must be treated to remove adult heartworms and microfilariae before initiating a program with HEARTGARD Plus.

While some microfilariae may be killed by the ivermectin in HEARTGARD Plus at the recommended dose level, HEARTGARD Plus is not effective for microfilariae clearance. A mild hypersensitivity-type reaction, presumably due to dead or dying microfilariae and particularly involving a transient diarrhea, has been observed in clinical trials with ivermectin alone after treatment of some dogs that have circulating microfilariae.

Keep this and all drugs out of the reach of children.

In case of ingestion by humans, clients should be advised to contact a physician immediately. Physicians may contact a Poison Control Center for advice concerning cases of ingestion by humans.

Store between 68°F - 77°F (20°C - 25°C). Excursions between 59°F - 86°F (15°C - 30°C) are permitted. Protect product from light.

ADVERSE REACTIONS: In clinical field trials with HEARTGARD Plus, vomiting or diarrhea within 24 hours of dosing was rarely observed (1.1% of administered doses). The following adverse reactions have been reported following the use of HEARTGARD: Depression/lethargy, vomiting, anorexia, diarrhea, mydriasis, ataxia, staggering, convulsions and hypersalivation.

SAFETY: HEARTGARD Plus has been shown to be bioequivalent to HEARTGARD, with respect to the bioavailability of ivermectin. The dose regimens of HEARTGARD Plus and HEARTGARD are the same with regard to ivermectin (6 mcg/kg). Studies with ivermectin indicate that certain dogs of the Collie breed are more sensitive to the effects of ivermectin administered at elevated dose levels (more than 16 times the target use level) than dogs of other breeds. At elevated doses, sensitive dogs showed adverse reactions which included mydriasis, depression, ataxia, tremors, drooling, paresis, recumbency, excitability, stupor, coma and death. HEARTGARD demonstrated no signs of toxicity at 10 times the recommended dose (60 mcg/kg) in sensitive Collies. Results of these trials and bioequivalency studies, support the safety of HEARTGARD products in dogs, including Collies, when used as recommended.

HEARTGARD Plus has shown a wide margin of safety at the recommended dose level in dogs, including pregnant or breeding bitches, stud dogs and puppies aged 6 or more weeks. In clinical trials, many commonly used flea collars, dips, shampoos, anthelmintics, antibiotics, vaccines and steroid preparations have been administered with HEARTGARD Plus in a heartworm disease prevention program.

In one trial, where some pups had parvovirus, there was a marginal reduction in efficacy against intestinal nematodes, possibly due to a change in intestinal transit time.

HOW SUPPLIED: HEARTGARD Plus is available in three dosage strengths (See DOSAGE section) for dogs of different weights. Each strength comes in convenient cartons of 6 and 12 chewables.

For customer service, please contact Merial at 1-888-637-4251.



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