

# **ALL YOU EVER NEEDED TO KNOW ABOUT WORMS!**

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## **Identifying, Preventing & Treating the Most Common Parasites in Dogs & Cats**

### **General Themes:**

- Always wash your hands!
- Always clean up poop immediately!
- Sanitation and clean environments for puppies and kittens.
- Follow treatment (de-worming) protocols and routine fecal testing.
- Always wash your hands!

### **Public Health Concerns:**

- Many of the common intestinal parasites of dogs and cats can easily be spread to people. Children are especially prone to acquiring these parasites because they tend to spend more time with their hands in their mouths. Many can cause gastrointestinal problems; others can migrate through the skin and organs of people.
- It is important to be aware of the possible human health implications of our pets, and always do as much as possible to prevent infestations of our animals and our environment.

### **Prevention, Treatment, and Control Guidelines:**

- **Importance of guidance by veterinarians for diagnosis and treatment:**
  - Puppies and kittens:
    - Deworming at 2, 4, 6, 8 weeks of age then placed on a monthly heartworm preventative
    - Fecal testing 2-4 times in the first year of life
  - Adult dogs and cats:
    - Monthly heartworm preventative
    - Fecal testing every 6-12 months.
- **Testing:**
  - Fecal flotation: Feces is placed within a solution and either allowed to sit for a period of time or spun down via centrifuge. Eggs will float to the top and can be evaluated on a slide. Most intestinal parasites including hookworms, roundworms and coccidia are diagnosed this way.
  - Giardia is difficult to diagnose, and a direct smear for cysts or an ELISA test may be required. A positive ELISA for giardia simply implies EXPOSURE, and not necessarily actual infection or shedding.
  - Toxoplasma requires serologic (antibody) testing.
- **Treatment:**
  - Why must we repeatedly deworm our puppies and kittens? Shouldn't one treatment be enough?
  - Puppies and kittens require repeated treatment because they are repeatedly exposed to hookworms and roundworms while nursing, and many of these parasites have complex

life cycles. During the early stages of infection (first 2-3 weeks) hookworms and roundworms are migrating through their body and treatment will ONLY kill the parasites present within their gastrointestinal system.

- Also important to deworm pregnant dogs and cats during their pregnancy.
- Therefore, also adult dogs and cats that are positive for roundworms and hookworms on routine testing should be dewormed once, and then 2-3 weeks later before considering retesting to ensure adequate treatment.

- **Medications:**

- Consult a veterinarian before treatment
- Pyrantel Pamoate: Effective against roundworms, hookworms. Safe and to be used for animals as young as 2 weeks old.
- Praziquantel: Effective against all tapeworms
- Fenbendazole: Giardia, whipworms, roundworms, hookworms
- Albon (Sulfadimethoxine): Effective against coccidia
- Drontal Plus (pyrantel pamoate, praziquantel, febantel): Excellent broad spectrum dewormer, not safe for kittens/puppies less than 2 lbs or less than 3 weeks old. Will not treat giardia or coccidia.

- **Prevention:**

- Routine removal of parasites from our pets (via testing and routine treatment)
- Clean up all feces immediately (including the litter box!). Many of the common intestinal parasites can actually inhabit the environment, or may not become infective for the first 24 hours. Therefore immediate cleaning of feces in your backyard or in public places is very important to prevent environmental contamination.
- Good sanitation of our homes and our pet's living area.
- Cover all sandboxes when not in use
- Keep cats in dogs indoors when not under direct supervision, to help minimize their exposure and their potential for contaminating the environment.
- Do not allow cats or dogs to consume wildlife
- Monthly flea and tick prevention (for tapeworms)
- While diluted bleach or ammonia is effective at killing many of the parasite eggs, some require extreme heat (boiling water, steam, propane treatment). Therefore sanitation, treatment, and prevention are the best methods for environmental control.

### **Roundworms (Nematodes: Ascarids):**

**Canine** *Toxocara canis*, *Toxascaris leonine*, *Baylisascaris procyonis*\*

**Feline** *Toxocara cati*, *Toxascaris leonina*

\**Baylisascaris procyonis* is an ascarid of raccoons that is occasionally found in dogs.

### **Transmission:**

- Acquired from ingestion from the environment (soil, stool, wildlife) also during gestation (transplacental) and while nursing (transmammary).
- Will migrate and encyst, eventually migrate to GI where signs can start within 2 1/2- 3 weeks of age.

- Unfortunately even if an animal has been appropriately dewormed throughout its entire life, it is common for worms to encyst in their tissue. These cysts are very resistant to treatment. These will become activated when an animal is pregnant, and travel to the fetuses and mammary tissue.

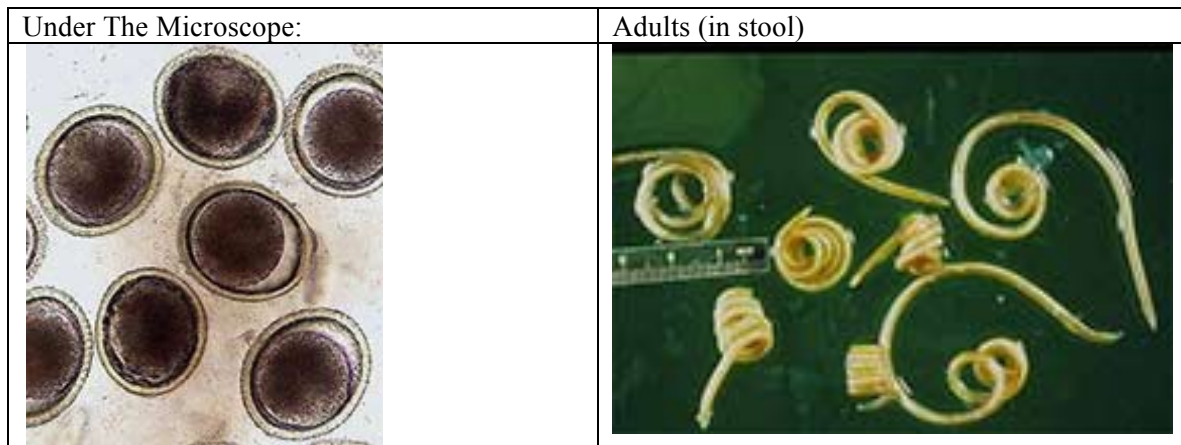
**Signs:**

- Distended (enlarged) abdomen
- Poor body and coat condition
- Diarrhea
- Vomiting

**Public Health Concerns:**

- Acquired from handling/consuming soil containing cat/dog/raccoon feces, most commonly affecting children.
- Visceral migrans (liver, lung, eye, brain (baylisascaris))

**What They Look Like:**



**Hookworms (Nematodes):**

**Species:**

**Canine** *Ancylostoma caninum*, *Ancylostoma braziliense*, *Uncinaria stenocephala*

**Feline** *Ancylostoma tubaeforme*, *Ancylostoma braziliense*, *Uncinaria stenocephala* (rare in cats in the United States)

**Transmission:**

- Eggs will be produced into environment from stool from an infected animal, and will hatch and develop into larva that are free living. This occurs within 2-9 days depending on environmental conditions (temperature, humidity etc).
- Puppies and kittens will acquire via nursing (transmammary), will also become infected through ingestion of these larvae worms (or infected wildlife), or through the larval worms penetrating their skin.
- Larval worms will travel through tissues after ingestion.

- Time from ingestion/skin penetration to laying eggs is approximately 2-3 weeks, but can be as soon as 10 days in puppies, kittens.

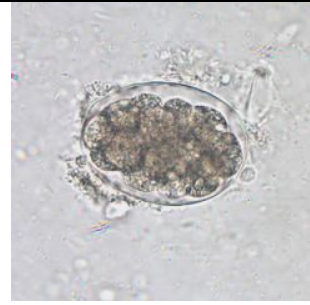

**Signs:**

- Unlike roundworms, hookworms actually feed on the blood from the lining of the intestines. Therefore puppies and kittens can often be anemic (low red blood cells)
- Pale gums
- Distended (enlarged) abdomen
- Poor coat and body condition
- Diarrhea, vomiting, poor appetite
- Respiratory signs (pneumonia) possible through larval migration

**Public Health Concern:**

- Cutaneous larval migrans: Larvae in environment penetrate and travel through skin of children, adults. Red, itchy, infected skin especially along bottoms of feet, legs, or hands. These will not develop into adult parasites, and tend not migrate to other organs or the gastrointestinal tract.

**What They Look Like:**

Under The Microscope:	Adults (in stool)
	

**Tapeworms (Cestodes):**

**Species:**

**Canine** *Dipylidium caninum*, *Taenia crassiceps*, *Taenia hydatigena*, *Taenia multiceps*, *Taenia pisiformis*, *Taenia serialis*, *Echinococcus granulosus*, *Echinococcus multilocularis*

**Feline** *Dipylidium caninum*, *Taenia taeniaeformis*, *Echinococcus multilocularis*

**Transmission:**

- All true tapeworms require an intermediate host, which is often prey of the affected animal. Infected animals will shed sections of adult worms (proglottids) which contain eggs. When these are consumed by the appropriate intermediate host, the larval cysts develop. When these intermediate hosts (fleas, lice, rodents etc) are ingested by a cat or dog, they will develop into mature intestinal tapeworms.
- Time from infection to shedding of proglottids is usually 2-3 weeks.

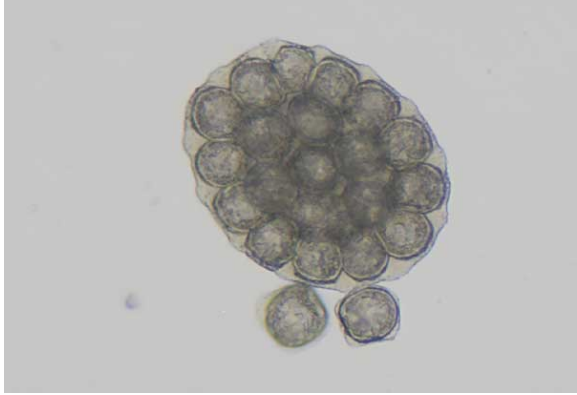

**Signs:**

- Usually none
- Perianal (around the anus) irritation

**Public Health Concern:**

- Ingestion of infected fleas can cause mild gastrointestinal signs in children
- Rare human infections, usually from ingestion of activated eggs. Occasionally will develop cestode cysts that require drainage or surgical removal.

**What They Look Like:**

Under The Microscope:	Proglottids (in stool)
 A microscopic view showing a cluster of numerous small, oval, translucent eggs, likely cestode eggs, arranged in a roughly circular pattern. The eggs have a distinct outer shell and internal structure.	 A photograph showing several proglottids (segments) of a cestode (tapeworm) against a black background. The segments are yellowish, elongated, and segmented, with a thin, hair-like structure extending from one end.

**Whipworms:**

**Species:** *Trichuris Vulpis*

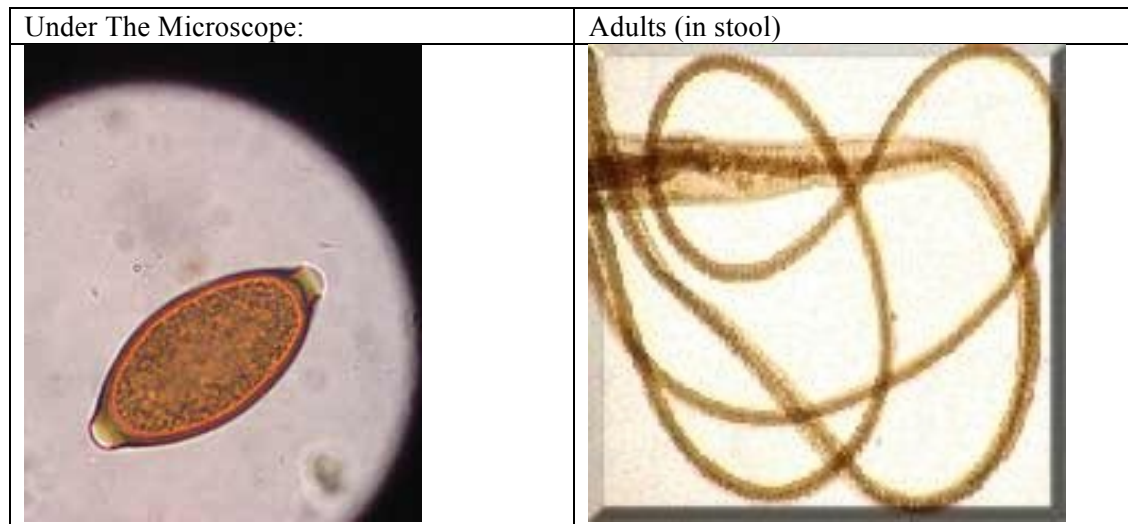
**Transmission:**

- Only affects dogs in the United States
- Direct fecal to oral life cycle
- Once eggs are produced and are in the environment they are very resistant to temperature, dryness and sunlight.
- Become infective within 9-21 days, and can remain in the environment for years
- Very common in urban areas with high volumes of dogs (dog parks etc.)
- Very long period from exposure to signs (74-90 days)
- Possible for signs to occur without production of eggs, therefore fecal float may be negative.

**Signs:**

- Diarrhea
- Blood in stool
- Can be asymptomatic

**Public Health Concern:** None



### **Coccidia:**

#### **Species:**

**Canine** *Isospora canis* *Isospora ohioensis* *Isospora neorivolta* *Isospora burrowsi*

**Feline** *Isospora felis* *Isospora rivolta*

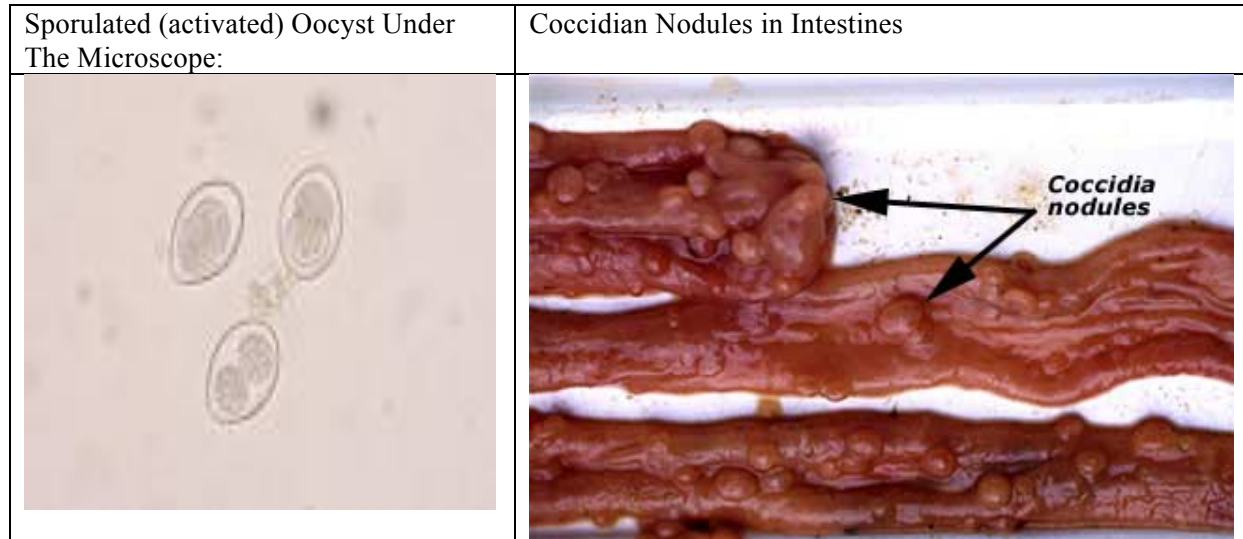
#### **Transmission:**

- Protozoan single celled organism.
- Complex life cycle with many different stages (Oocysts, Schizonts, Gametes, Zoites)
- Transmission via contaminated environment and through ingestion of intermediate hosts (mice, rats, etc)
- Very host specific, therefore coccidia cannot be spread from dogs to cat or vice versa.
- Invade and destroy intestinal cells, causing poor digestion and absorption.
- Is very common for adult dogs to continue to shed oocysts (eggs) even when asymptomatic.
- Eggs can survive in the environment for very long periods of time (1+ year) in the right conditions.

#### **Signs:**

- Signs include diarrhea, weight loss, dehydration, rarely bloody stool
- Can progress to vomiting, depression, and loss of appetite.
- Puppies are most commonly affected, and will eventually clear the parasite as their immune system develops.
- Adult dogs/cats do not usually show clinical signs of coccidia unless their immune system is compromised.
- Certain stages of the parasites (Zoites) can travel to tissues outside of the intestines including lymph nodes, spleen, or liver but does not usually cause any clinical disease.

**Public Health Concern:** None



**Giardia:**

**Species:** *Giardia duodenalis*

**Transmission:**

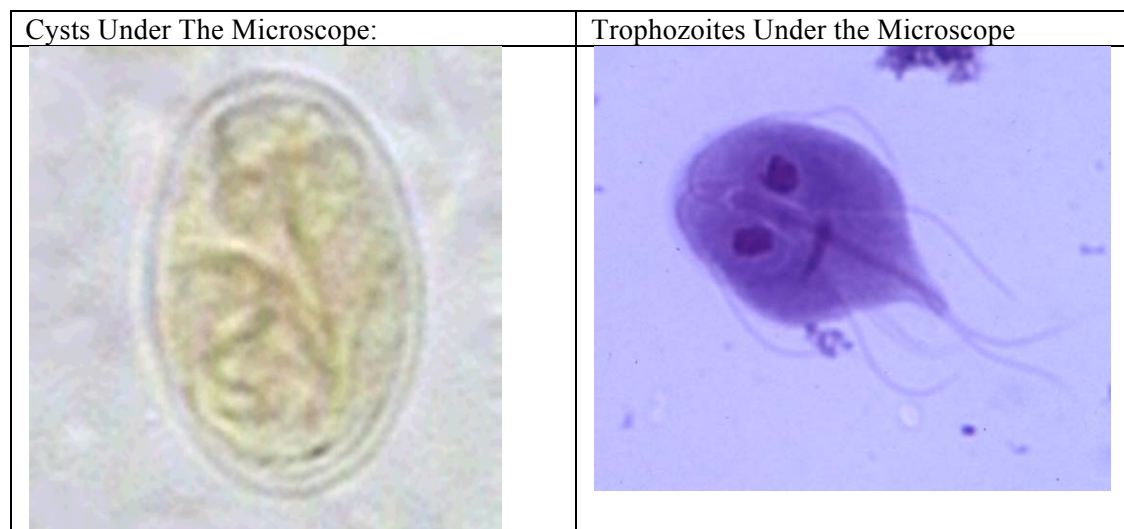
- Protozoan single celled organism
- Ubiquitous in the environment. Most commonly found in stagnant and running water.
- Signs usually dose dependant (more exposure = more likely to have signs)
- Most adult dogs have natural immunity, and can exist as normal members of their gastrointestinal system.
- Direct life cycle with two stages (cysts and trophozoites). Cysts remain in the environment, and once ingested develop into active trophozoites.
- Cysts are immediately infective in the environment

**Signs:**

- Watery diarrhea
- Rarely vomiting

**Public Health Concern:**

- Different “assemblages”, which are strains of Giardia infect dogs, cats, and people
- It’s unlikely, but possible for a dog with Giardia to spread it to their owners
- Most Giardia is spread from human to human, or from drinking contaminated water.



**Heartworm Disease:**

**Species:** *Dirofilaria Immitis*

**Transmission:**

- Has been diagnosed in all 50 states
- Transmission by mosquitoes, requires ideal temperature and humidity
- Adults travel to the pulmonary arteries, but can also inhabit the right side of the heart
- Adults produce small larvae (microfilaria), which circulate in the blood and are consumed by mosquitoes during a blood meal
- Microfilaria develops into stage 3 larvae within the mosquito, which is the larvae that is infectious upon a blood meal on a new host.
- From exposure, to development of an adult worm takes 6 months.

**Signs:**

- Cough
- Exercise intolerance
- Abnormal lung sounds
- Collapse
- Enlarged liver
- Fluid accumulation on the abdomen

**Public Health Concern:** None



### Testing:

- Routine Annual Testing:
  - Testing for female adult heartworm female **antigen** (small pieces of adult worm). This is the standard for dogs. Only shortfall is that this only tests for an active ADULT FEMALE infection, and will not detect other possible migrating heartworms.
  - Testing for a patient's **antibody** to the adult worm is unnecessary in dogs, but it is standard to test for BOTH in cats before considering any preventative.
  - Fresh blood slide or knots test is used to evaluate for circulating microfilaria.
  - Even if a dog is on a monthly preventative year round, it is strongly recommended to test annually for adult heartworms. Cats only require an initial Ab/Ag test, and then can remain on preventative.

### Preventative:

- A monthly oral heartworm preventative (Heartgard = ivermectin, interceptor/sentinel = milbemycin oximine, revolution = selamectin, advantage multi = moxidectin, etc) is recommended to kill any possible heartworm larvae that a dog/cat is exposed to within the last 4 weeks.
- Some preventatives perform a quick kill (interceptor, sentinel) of microfilaria and larvae, while others treat them more slowly (heartgard, revolution). In the event that a dog is heartworm positive, treating with interceptor or sentinel can be potentially harmful if microfilaria are all killed quickly. Some animals can have an anaphylactic reaction, which can appear as face/limb swelling, collapse, lethargy or death.
- The preventative is effective at killing larvae within 5-6 weeks of exposure, any other heartworms that the dog may have been exposed to will NOT be treated, and will also NOT display a positive when testing for heartworm.
- Therefore, if any doses are missed at any time of year, it is recommended to switch to a preventative that is safe (heartgard, revolution, advantage multi) in the event that a dog acquires an adult heartworm infection

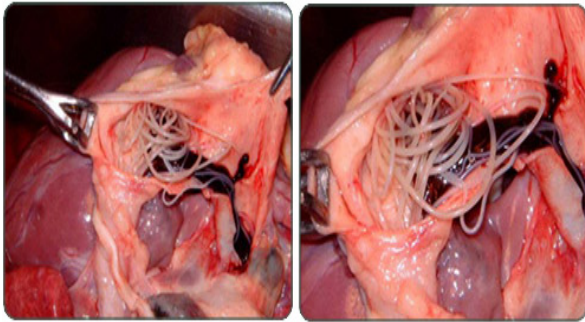
### Treatment:

- If any adult dog becomes positive for heartworm, it is very important for this dog to be evaluated by a veterinarian. Depending on the severity of disease, radiographs (x-rays) or an echocardiogram (ultrasound of heart) may be required to evaluate the extent of the changes of a patient's heart.
- Current protocol by the American Heartworm Society recommends that patient be placed on a macrolytic lactone (Heartgard = Ivermectin) for 2-3 months prior to giving adulticide treatment. Because the adulticide treatment (Melarsomine) only kills heartworms greater than 4 months old, there is the potential for migrating 2-4 month old heartworm larvae to escape treatment and inhabit the patient's heart.
- **Melarsomine:** Deep intramuscular injections into epaxial (back) muscles is the ONLY treatment approved by the FDA for adult heartworms. This is often a very painful injection, and mild swelling and soreness can persist for days afterward.
  - **3 dose protocol:** One injection, followed by a pair of injections 24 hours apart at least 30 days later. This protocol will effectively treat 98% percent of adult dogs.
  - During this entire period of adult worm treatment, keep patient on a macrolytic lactone to minimize worm burden and effectively treat circulating microfilaria.
  - **Alternate protocols:** If a dog can't receive Melarsomine injections, another option is a higher dose of ivermectin with or without doxycycline.
  - During Melarsomine treatments, and/or the initial doses of macrolytic lactones, it is recommended for the infected dog to be under the observation of a vet.

- It's very important to restrict the activity of a heartworm positive dog during and after his heartworm treatment. Many adult worms take 4-6 weeks after treatment to die. It's possible for the adult worms to die suddenly, and travel to the lungs (or rarely, other parts of the body) where they can cause severe inflammatory conditions. Therefore, heartworm positive dogs must have strict exercise restriction (ideally in a crate while not under direct supervision, and only short leash walks 2-3 times daily) for at least 4-6 weeks after treatment, but ideally until they become heartworm negative.
- **Retesting:** While some dogs may become heartworm negative (no more adult worm antigen) as soon as 2-3 months after treatment, it is recommended to wait at least 6-7 months before retesting.

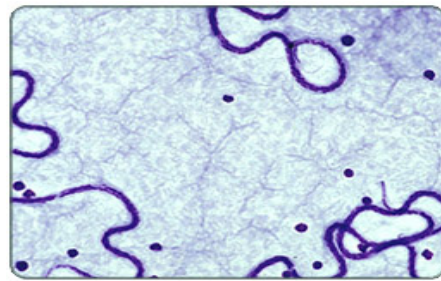
**What they look like:**

**In the pulmonary arteries, right side of the heart:**



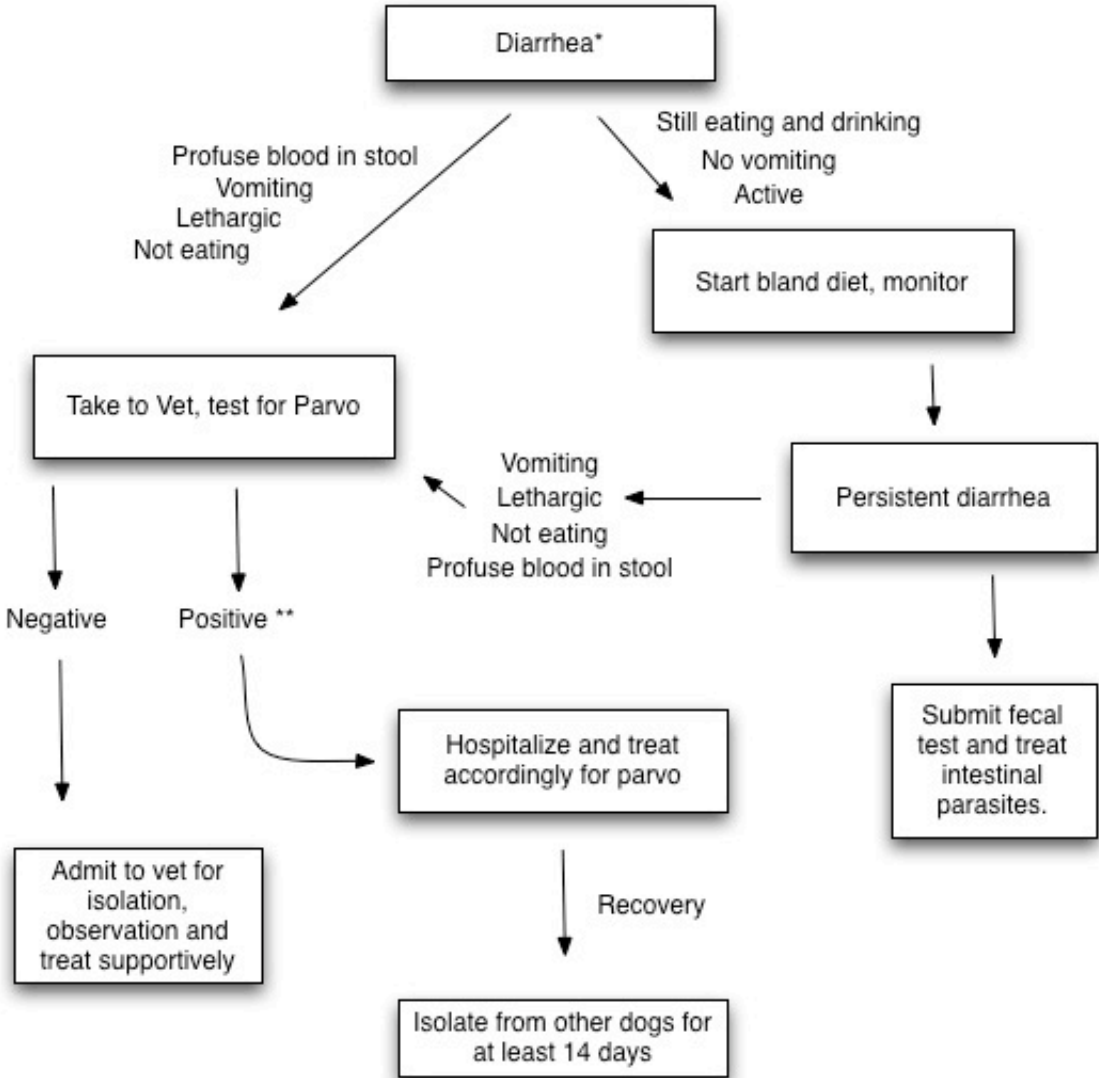
Adult Heartworms in Right Ventricle

**Under the microscope (microfilaria):**



Heartworm Microfilaria in the Bloodstream of a Dog

# Puppy Diarrhea Flow Chart



\*It is very common for a dog of any age to have small amounts of blood from diarrhea caused by stress, a change in diet, or intestinal parasites.

\*\*Dogs with parvo can often test negative, and dogs who have received a vaccination within 5-12 days can have a false positive result.