

PARASITE PROTOCOLS FOR YOUR PRACTICE

CANINE PROTOZOA

Recommendations from the Companion Animal Parasite Council

Susan E. Little, DVM, PhD, Diplomate ACVM,
and Emilio DeBess, DVM, MPVM

The mission of the **Companion Animal Parasite Council (CAPC)** is to foster animal and human health, while preserving the human–animal bond, through recommendations for the diagnosis, treatment, prevention, and control of parasitic infections. For more information, including detailed parasite control recommendations, please visit capcvet.org.

Protozoan parasites, including vector-borne infections and intestinal protozoa, are responsible for a number of different diseases in dogs (Table, page 44). Although many infections are acquired by direct ingestion of infective stages, others may be transmitted by arthropods. These parasites are distributed worldwide or regionally. Accurate, prompt diagnosis and appropriate, specific treatment are critical to managing and preventing protozoan parasitic diseases in dogs.

VECTOR-BORNE INFECTIONS

Babesia Species

Distribution. Worldwide, dogs may become infected with *Babesia canis*, *B vogeli*, *B rossi*, *B gibsoni*, *B conradae*, and other small and large *Babesia* species, some that have yet to be named.^{1,2}

About This Series

One of CAPC's principal achievements has been creating recommendations that support practitioners in their efforts to protect pets and people from parasites. These recommendations are based on peer-reviewed, published research findings and the collective parasitologic and clinical expertise of the CAPC board.

In this series, CAPC board members will:

- Review the diagnosis, treatment, and control of common parasites of dogs and cats
- Suggest strategies for implementing specific CAPC recommendations in practice.

The full recommendations are available at capcvet.org.

Vectors & Transmission. Many different tick species transmit *Babesia* species when feeding on dogs; the most common U.S. species include:

- *B vogeli* (formerly, *B canis vogeli*), transmitted by *Rhipicephalus sanguineus* ticks
- *B gibsoni*; transmission with this species has been associated with dog fighting.

Transmission of any *Babesia* species can occur following blood transfusion.¹

Diagnosis. Dogs with babesiosis present with fever, anorexia, depression, and often, hemolytic anemia.¹ Diagnosis is achieved by examining stained blood smears for characteristic piroplasms in erythrocytes (Figure 1).

Treatment. Preferred treatment options include:³

- Imidocarb dipropionate for large *Babesia* species (*B canis*, *B vogeli*, *B rossi*)
- Atovaquone/azithromycin for small *Babesia* species (*B gibsoni*, *B conradae*).

Prevention. Infection prevention requires careful attention to tick control and avoidance of fighting among dogs.

Hepatozoon Species

Distribution. *Hepatozoon americanum* has only been described in the U.S., while *H canis* is found worldwide.⁴

Vectors & Transmission. *H canis* and *H americanum* are transmitted to dogs by ingestion of the vector—ticks—rather than their bite. *H americanum* can also be transmitted by ingestion of paratenic vertebrate hosts.

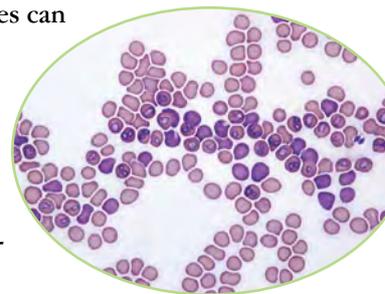


Figure 1. Piroplasms of a large *Babesia* species in canine erythrocytes

Diagnosis. *H. americanum* infection presents as severe, febrile disease, with lethargy, myalgia, and muscle wasting commonly reported. It also infects skeletal and cardiac muscle, and induces pyogranulomatous myositis. Chronically infected dogs often develop periosteal proliferative lesions on their long bones and bloodwork reveals profound neutrophilia. Clinical disease with *H. canis* is relatively mild by comparison.⁵

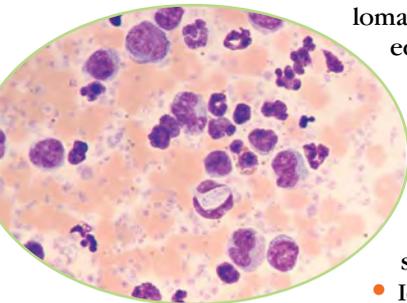


Figure 2. Gamont of *Hepatozoon americanum* in canine leukocyte

Diagnosis of both *Hepatozoon* species can be made by:⁵

- Identifying gamonts in leukocytes on stained blood smears; gamonts are rare in *H. americanum* infection but much more common in *H. canis*

infection (Figure 2).

- Polymerase chain reaction (PCR) of whole blood
- Histologic examination of muscle biopsy (more sensitive in detecting *H. americanum* infection than PCR).

Treatment. *H. canis* infection is treated with imidocarb dipropionate. *H. americanum* requires more aggressive

and long-term therapy consisting of ponazuril or trimethoprim/sulfamethoxazole combined with clindamycin and azithromycin, followed by long-term decoquinatone therapy and pain management with nonsteroidal anti-inflammatory drugs.⁵

Prevention. Tick control helps prevent infection by limiting the number of ticks ingested. Prevention of *H. americanum* also requires limiting consumption of paratenic hosts, especially rabbits and rodents.⁶

Leishmania Species

Distribution. Although fairly uncommon in North America, dogs are infected with *Leishmania* species throughout much of the world. Infection has been diagnosed in dogs imported from endemic areas, such as the Mediterranean basin and Central and South America.

Vectors & Transmission. In many areas of the world, phlebotomine sandflies that have fed on an infected vertebrate transmit *Leishmania* species to dogs. In the U.S., transmission by sandflies has not been epidemiologically demonstrated, but canine infections are recognized, particularly in foxhound kennels, and are presumably acquired by direct transmission between dogs.⁷

TABLE. U.S. Canine Protozoa: Routes of Acquisition, Diagnostic Strategies, & Preferred Treatments

	TRANSMISSION	DIAGNOSIS	PREFERRED TREATMENT
CANINE VECTOR-BORNE PROTOZOA			
<i>Babesia</i> species	Tick bite Blood transfusion Dog fighting (<i>B. gibsoni</i>)	Blood smear PCR of whole blood Serology	Large <i>Babesia</i> species: Imidocarb dipropionate Small <i>Babesia</i> species: Atovaquone/azithromycin combination therapy
<i>Hepatozoon</i> species	Ingestion of ticks (<i>H. canis</i> , <i>H. americanum</i>) Ingestion of vertebrate paratenic host (<i>H. americanum</i>)	Blood smear PCR of whole blood Histologic examination of muscle biopsy (<i>H. americanum</i>)	<i>H. canis</i> : Imidocarb dipropionate <i>H. americanum</i> : Ponazuril or trimethoprim sulfa combined with clindamycin and azithromycin, followed by long-term decoquinatone
<i>Leishmania</i> species	Sandfly bite Direct dog-to-dog transmission	Impression smear of lesion PCR Serology	Pentavalent antimonials Allopurinol
<i>Trypanosoma cruzi</i>	Stercorarian from kissing bug Ingestion of infected bugs	Blood smear PCR Serology	Benznidazole (not available in the U.S.)
CANINE VECTOR-BORNE PROTOZOA			
<i>Cystoisospora</i> species	Ingestion of oocysts	Fecal flotation	Sulfadimethoxine Ponazuril
<i>Cryptosporidium</i> species	Ingestion of oocysts	Fecal flotation Fecal IFA	Paromomycin Azithromycin
<i>Giardia</i> species	Ingestion of cysts	Fecal flotation Fecal IFA Fecal ELISA	Fenbendazole Febantel

Additional treatment options and dosages for the medications listed in this table are available at capcvet.org (select CAPC Recommendations).

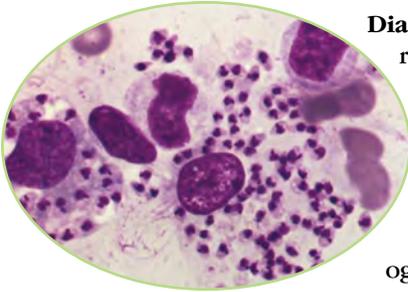


Figure 3. Amastigotes of *Leishmania* species from ruptured macrophages on impression smear

Diagnosis. Infected dogs may remain asymptomatic or can develop severe, chronic disease, involving muscle wasting, ocular signs, renal disease, and alopecia and other skin lesions.⁸ Diagnosis is made by serology or identification of amastigotes in impression smears from affected tissues (Figure 3); PCR assays are also available.

Treatment. Canine leishmaniasis is difficult to treat, although pentavalent antimonials and allopurinol can be used.

Prevention. In endemic areas, protecting dogs from sandflies by routine application of repellent insecticides decreases transmission of *Leishmania* species⁹; isolation of infected dogs is recommended to prevent direct transmission.

Zoonosis. Dogs are a major reservoir host for leishmaniasis—a zoonotic disease. Euthanasia of infected dogs has been recommended to limit transmission to humans and other dogs, particularly in regions where vector-borne *Leishmania* transmission is not yet endemic.

Trypanosoma cruzi

Distribution. *Trypanosoma cruzi* is the agent of American trypanosomiasis or Chagas disease. Autochthonous cases are occasionally reported from dogs in the southern U.S., where natural maintenance cycles exist, and are common in parts of South and Central America and Mexico.^{10,11}

Vectors & Transmission. Infection is transmitted from kissing bugs (triatominae) to dogs and humans. Canine infections occur when infected kissing bugs are ingested or the bugs' feces, which contain the organism, are deposited on or around the skin wound created by their feeding activity; infection is also transmitted transplacentally.¹²

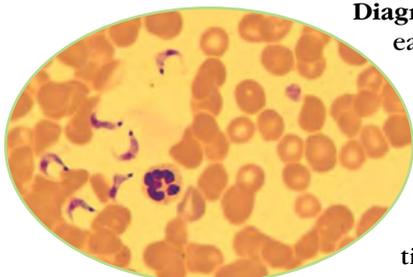


Figure 4. Trypomastigotes of *Trypanosoma cruzi* on blood smear of dog

Diagnosis. Dogs with acute disease develop generalized lymphadenopathy, lethargy, enlarged liver and spleen, and myocarditis. Chronic infection often results in dilative myocarditis.¹² Trypomastigotes may be identified on stained blood smears from acutely infected dogs (Figure 4); serology and PCR are also available.

Treatment. Benznidazole, the drug of choice for treating *T. cruzi* in dogs, is not available in the U.S., and infected dogs are often euthanized.

Prevention. Preventing infection requires limiting access to kissing bugs by sealing kennels and keeping dogs inside. Limiting predation is also recommended because, although unproven, ingestion of infected reservoir hosts is a suspected route of transmission.¹²

Zoonosis. *T. cruzi* is zoonotic and, in endemic areas, people are readily infected from a feeding bug vector's feces. In the U.S., most human infections are associated with blood transfusion or travel to endemic areas.¹¹

INTESTINAL PROTOZOA

Cystoisospora Species

Distribution. Coccidia is a common finding in dogs, with some studies suggesting approximately 1% to 5% of dogs may be infected worldwide.

Vectors & Transmission. Canine infection with *Cystoisospora* species (*Isospora* species) commonly occurs upon ingestion of:^{13,14}

- Sporulated oocysts from an environment contaminated with feces
- Transport hosts.

Diagnosis. Many infected dogs remain asymptomatic, developing immunity to limit infection and protect them from future infections; however, diarrhea, weight loss, dehydration, and even death can occur in severe infections, particularly those in young animals.¹⁵ Infections are diagnosed by fecal flotation, which reveals the characteristic oocysts (Figure 5).

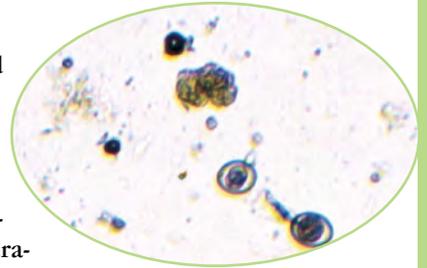


Figure 5. Oocysts of *Cystoisospora canis* on fecal float

Treatment. Treatment with sulfadimethoxine, which is labeled as effective against the enteritis associated with coccidiosis, or ponazuril is recommended.

Prevention. Oocysts are resistant to environmental degradation; careful attention to sanitation, particularly in kennels and shelters where large numbers of young dogs are cohoused, is necessary to prevent infection.¹⁵

Cryptosporidium Species

Distribution. *Cryptosporidium* species infect a variety of vertebrate hosts, including dogs and humans. Active infections are present in a very small percentage of dogs; most of these are due to *C. canis*, which rarely infects people.¹⁶ The more common zoonotic agent, *C. parvum*, is not known to occur in dogs.

Vectors & Transmission. Oocysts of *Cryptosporidium* species are immediately infective when shed in the feces, which usually occurs 3 to 6 days after infection.¹⁵

Diagnosis. Infections can cause secretory diarrhea, which can be particularly severe in immunocompromised individuals. Diagnosis is by sucrose flotation of feces, but recognizing minute oocysts can be difficult and use of a referral parasitology laboratory is recommended.

Treatment. Treatment is difficult—few drugs are consistently effective against *Cryptosporidium* species in dogs.

Prevention. Canine infections are considered a low-risk zoonosis; *C canis* has only been reported in immunocompromised humans in the U.S.¹⁶

Giardia Species

Distribution. Infection with *Giardia duodenalis* is common in U.S. dogs.¹⁷

Vectors & Transmission. Infection occurs following ingestion of cysts from fecal-contaminated water, food, or fomites, or through self-grooming. The different assemblages of *G duodenalis* are considered to be fairly host specific.

Diagnosis. Following infection, trophozoites attach to intestinal villi, resulting in maldigestion, malabsorption, and diarrhea. Diagnosis is achieved by detection of:

- Trophozoites in direct smear of feces
- Cysts on fecal flotation with zinc sulfate (**Figure 6**)
- Antigen in feces of symptomatic dogs.

Intermittent shedding of cysts and trophozoites can make direct microscopic identification of infection challenging.

Treatment & Prevention. No drugs are approved for treatment of canine giardiasis in the U.S., but fenbendazole and febantel have shown effectiveness.¹⁸ Bathing dogs removes cysts adhered to the hair and helps prevent re-infection.¹⁹

Zoonosis. *Giardia* is a common infection in humans, although the most common assemblages found in humans are distinct from those most often found in dogs.²⁰ Human giardiasis contracted from a dog has not been conclusively demonstrated in North America.



Figure 6. Cysts of *Giardia duodenalis* on canine fecal float

APPLICATION TO CLINICAL PRACTICE

Protozoal parasites of dogs can critically affect canine and human health, with overt clinical disease from canine protozoa most often seen in debilitated or young animals. Infected dogs often present with signs of disease; however, asymptomatic infections also occur, and some protozoa may live undetected within the host for years.⁸

Identification

Identifying protozoal infections largely depends on awareness so that appropriate diagnostic tests are pursued, particularly with vector-borne infections. Careful history taking and physical examination, along with a judicious use of diagnostic tools, can lead to better management and improved outcomes.

Prevention

INTESTINAL PROTOZOA. Prevention of infection with intestinal protozoa requires careful attention to environmental sanitation. Re-infection following treatment often occurs, particularly in canine giardiasis.¹⁹

VECTOR-BORNE INFECTIONS. Canine vector-borne diseases are highly prevalent, increasing in distribution, and often difficult to treat; preventing infection by consistent use of insecticides and acaricides and limiting exposure to ticks and other arthropod vectors are the most effective ways to protect dogs from these diseases.

Protection

Protecting dogs from protozoal parasites is critical to human health. Some of these infections, such as *Leishmania* species and *T cruzi*, are well recognized zoonoses, while others, such as canine *Cryptosporidium* or *Giardia* infections, are considered to carry a very low zoonotic risk.^{8,12,16,20} Veterinarians should pay close attention to:

- Limiting protozoal parasite infections in dogs
- Staying up-to-date on emerging zoonotic diseases. ■

ELISA = enzyme-linked immunosorbent assay; IFA = indirect fluorescent assay; PCR = polymerase chain reaction

Canine Protozoan Parasites: Zoonotic Potential

VECTOR-BORNE INFECTIONS	Zoonotic
<i>Babesia</i> species	No*
<i>Hepatozoon</i> species	No
<i>Leishmania</i> species	Yes
<i>Trypanosoma cruzi</i>	Yes
INTESTINAL PROTOZOA	
<i>Cystoisospora</i> species	No
<i>Cryptosporidium</i> species	Rare
<i>Giardia</i> species	Rare†

* Infection in humans with other *Babesia* species does occur.

† Human giardiasis from a dog source has not been conclusively demonstrated in North America.

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Susan E. Little, DVM, PhD, Diplomate ACVM, is the Director of the National Center for Veterinary Parasitology at Oklahoma State University's Center for Veterinary Health Sciences, where she serves as Regents Professor and the Krull-Ewing Chair in Veterinary Parasitology. Her research focuses on zoonotic parasites and tick-borne diseases. She has been recognized for teaching excellence, receiving the Pfizer (Norden) Distinguished Teaching Award (1999, 2010) and national Student AVMA Excellence in Teaching Award (1998, 2005), and for her outstanding research with the Pfizer Award for Research Excellence (2012). Dr. Little received her DVM from Virginia Tech and completed her PhD at University of Georgia.



Emilio DeBess, DVM, MPVM, is the state public health veterinarian with the Oregon Health Authority. His primary job is to track zoonotic diseases in both humans and animals in Oregon. He has received 2 Director Excellence Awards from the Department of Human Services in Oregon. Dr. DeBess conducts surveillance projects related to zoonotic diseases, including leptospirosis, toxoplasmosis, cryptosporidiosis, West Nile virus, and tick-borne illnesses. He received his DVM from University of California-Davis.

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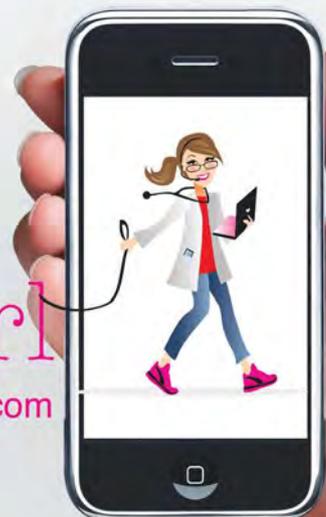
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