

## PARASITE PROTOCOLS FOR YOUR PRACTICE

# FELINE PROTOZOA

## Recommendations from the Companion Animal Parasite Council

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Feline  
Friendly  
Article

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](http://capcvet.org).

**C**ats can become infected by many different species of protozoan parasites (**Table**). These single-celled organisms affect different body systems, including the gastrointestinal tract and central nervous system.

Protozoan infections range from those with little clinical significance to others that cause devastating disease. As with any parasitic disease, identification and treatment of infection prevents suffering and even loss of life.

### VECTOR-BORNE INFECTIONS

#### *Cytauxzoon felis*

The most clinically significant feline vector-borne protozoan is *Cytauxzoon felis*, which is distributed throughout the southern U.S.

#### 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. They 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, based on the CAPC recommendations:

- Review the diagnosis, treatment, and control of common parasites that affect dogs and cats
- Suggest strategies for implementing them in practice.

The full recommendations are available at [capcvet.org](http://capcvet.org).

Read the first article in the series—Canine Protozoa: Recommendations from the Companion Animal Parasite Council—at [todaysveterinarypractice.com](http://todaysveterinarypractice.com).

**Transmission.** *C felis* is transmitted by the lone star tick, *Amblyomma americanum*, although other ticks have been implicated.<sup>1</sup> Bobcats are a reservoir of disease, exhibiting a high rate of subclinical infection. Organism transmission from bobcats to ticks to domestic cats results in catastrophic infection that is often fatal. Infection typically occurs during the spring and fall—seasons when ticks are most active.

**Clinical Signs.** Clinical findings in affected cats include:

- Profound depression
- Fever, often with body temperatures greater than 106°F
- Icterus, which results from infection-related hyperbilirubinemia
- Nonregenerative anemia
- Extreme leukopenia and thrombocytopenia.

**Diagnosis.** *Cytauxzoon felis* organisms infect red blood cells<sup>2</sup>; diagnosis is made by identifying:

- Piroplasms (protozoan parasites) inside infected red blood cells; most commonly identified by blood smears (**Figure 1**) **or**
- Macrophages infected with schizonts (rapidly dividing stages) in the spleen and lungs; most commonly observed at necropsy (**Figure 2**).

**Treatment.** Therapeutic regimens are based on canine babesiosis treatment. Current research supports treatment with:

- Atovaquone (15 mg/kg PO Q 8 H for 10 days) and azithromycin (10 mg/kg PO Q 24 H for 10 days), which may increase survival rates<sup>3</sup> **or**

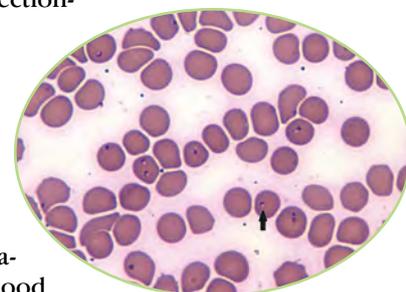


Figure 1. Piroplasms of *Cytauxzoon felis* in red blood cells

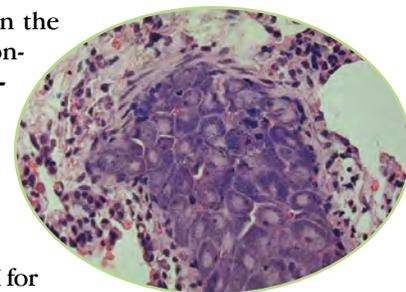


Figure 2. Schizont-infected macrophages of *Cytauxzoon felis*

- Imidocarb dipropionate (5 mg/kg IM Q 2 weeks for 2 doses) following premedication with atropine or glycopyrrolate; anecdotal evidence suggests weekly dosing is also effective. However, infection in most cats is fatal, with mortality rates approaching 100% despite aggressive supportive care and antiprotozoan agents.

**OTHER VECTOR-BORNE PROTOZOA**

Other feline vector-borne protozoa, including *Leishmania* species, *Babesia* species, and *Trypanosoma cruzi* are found worldwide. *Leishmania* and *Trypanosoma* species are responsible for significant zoonotic disease in humans and are becoming more frequently diagnosed in the U.S.

- **T cruzi** infection, or Chagas disease, is one of the leading causes of heart disease in humans who have lived in or immigrated from Latin American countries.<sup>4</sup> Its vector is a triatomid, or kissing bug, and transmission occurs when the trypanosomes in the feces of the feeding bugs enter the cat via the bite wound; transmission has also occurred through cats eating infected mice. Infected cats could serve as potential sources of human infection.
- **Leishmania** is a parasite of macrophages and histiocytes transmitted by skin feeding sandflies; cats are infected by flies that previously fed on naturally infected rodents.

- **Babesia** infections, transmitted through tick bites, are rare in U.S. cats, and the species found in cats have not been implicated in human disease.

**INTESTINAL INFECTIONS**

**Cystoisospora felis & rivolta**

*Cystoisospora* infection is a frequently seen protozoan infection in clinical practice. Infections occur in the intestine and are host-specific; cats are affected by *C felis* and *C rivolta*.

**Transmission.** Transmission occurs through ingestion of:

- Sporulated oocysts in contaminated feces
- Cysts in tissue of prey species
- Prey infected with cystozoites.

Infected cats shed organisms in their feces, contributing to environmental contamination.

**Clinical Signs.** Many infected cats are asymptomatic, although immunocompromised kittens and cats are more likely to demonstrate clinical signs, such as mucoid diarrhea, hematochezia, and weight loss.<sup>5</sup>

**Diagnosis.** Diagnosis is made by identifying oocysts on centrifugal fecal flotation (Figure 3, page 76). Oocysts are typically present in the feces of clinically normal cats, and these cats, when under stress, may become symptomatic.

**TABLE. U.S. FELINE PROTOZOA: ROUTES OF ACQUISITION, DIAGNOSTIC STRATEGIES, & PREFERRED TREATMENTS**

	ROUTE OF ACQUISITION	DIAGNOSIS	PREFERRED TREATMENT
<b>FELINE VECTOR-BORNE PROTOZOA</b>			
<i>Cytauxzoon felis</i>	Tick bite (frequently lone star ticks)	Blood smear PCR of whole blood Organ aspiration	<ul style="list-style-type: none"> <li>• <b>Atovaquone</b> (15 mg/kg PO Q 8 H for 10 days) + <b>azithromycin</b> (10 mg/kg PO Q 24 H for 10 days)</li> <li>• <b>Imidocarb dipropionate</b> (5 mg/kg IM Q 2 weeks for 2 doses)</li> </ul>
<b>FELINE INTESTINAL PROTOZOA (COCCIDIANS)</b>			
<i>Cystoisospora</i> species	Ingestion of oocysts (feces) or cysts (prey tissue)	Fecal flotation	<ul style="list-style-type: none"> <li>• <b>Ponazuril</b> (20–50 mg/kg PO Q 24 H for 1–3 days)</li> <li>• <b>Sulfadimethoxine</b> (50–60 mg/kg PO Q 24 H for 5–20 days)</li> </ul>
<i>Cryptosporidium felis</i>	Ingestion of oocysts (fecal-contaminated material)	Fecal flotation (sucrose) Stained fecal smear Fecal IFA Fecal ELISA	<ul style="list-style-type: none"> <li>• <b>Tylosin</b> (10–15 mg/kg PO Q 8 H for 14–21 days)</li> <li>• <b>Azithromycin</b> (7–15 mg/kg PO Q 24 H for 5–7 days)</li> </ul>
<i>Toxoplasma gondii</i>	Ingestion of cysts (prey tissue) or oocysts (fecal-contaminated material)	Fecal flotation Antibody titer	<ul style="list-style-type: none"> <li>• <b>Clindamycin</b> (10 mg/kg PO Q 12 H for 4 weeks)</li> </ul>
<b>FELINE INTESTINAL PROTOZOA (FLAGELLATES)</b>			
<i>Giardia</i> species	Ingestion of cysts (fecal-contaminated material)	Direct saline fecal smear Fecal flotation Fecal IFA Fecal ELISA	<ul style="list-style-type: none"> <li>• <b>Fenbendazole</b> (50 mg/kg PO Q 24 H for 3 days)</li> <li>• <b>Metronidazole</b> (10–15 mg/kg PO Q 12 H for 7 days)</li> </ul>
<i>Tritrichomonas blagburni</i> <i>Pentatrichomonas hominis</i>	Ingestion of trophozoites (fecal-contaminated material)	Direct saline fecal smear Fecal culture Fecal PCR	<ul style="list-style-type: none"> <li>• <b>Ronidazole</b> (30–50 mg/kg PO Q 12 H for 14 days)</li> </ul>



Figure 3. Oocysts of *Cystoisospora felis* on fecal flotation

**Treatment.** Treatment options include:

- Ponazuril (20–50 mg/kg PO Q 24 H for 1–3 days\*), a direct anticoccidial treatment (but off-label use) **or**
- Sulfadimethoxine (50–60 mg/kg PO Q 24 H for 5–20 days), which is labeled for treatment of enteritis associated with coccidia.

### **Cryptosporidium felis**

While some *Cryptosporidium* species are zoonotic, *Cryptosporidium felis* has been implicated as a cause of disease in immunocompromised humans in the U.S. and other countries.<sup>6</sup> These very small parasites are found at the microvillous border of intestinal cells.

**Transmission.** Infection occurs following ingestion of sporulated oocysts from fecal-contaminated food, water, or environments.

**Clinical Signs.** *C felis* is a relatively uncommon cause of chronic diarrhea in cats, but immunocompromised cats are more likely to show clinical signs.

**Diagnosis.** The tiny oocysts can be difficult to find on fecal flotation (sucrose); stained fecal smears, fecal smear indirect fluorescent assay (IFA), and fecal antigen enzyme-linked immunosorbent assay (ELISA) tests are more productive.

**Treatment.** Treatment options include:

- Tylosin (10–15 mg/kg PO Q 8 H for 14–21 days) **or**
- Azithromycin (7–15 mg/kg PO Q 24 H for 5–7 days).

### **Toxoplasma gondii**

**Transmission.** Infection in cats occurs through ingestion of:

- Tissue cysts in paratenic hosts
- Less commonly, oocysts from fecal-contaminated materials.

Human infections are typically transmitted via inadvertent ingestion of:

- Raw meat containing tissue cysts or shellfish that have ingested oocysts
- Oocysts in cat fecal material; exposure can occur while working outside.

### **Other Coccidian Species**

In addition to *Cystoisospora*, *Cryptosporidium felis*, and *Toxoplasma gondii*, other coccidians that cause feline infection include:

- ***Hammondia hammondi*** and ***Besnoitia besnoiti***, which are both considered nonpathogenic
- ***Sarcocystis* species** infections, which rarely cause illness in cats; transmission most likely occurs from ingestion of rodents or birds.

**Clinical Signs.** *Toxoplasma gondii* infection in cats is generally subclinical. However, ocular, respiratory, neurologic, and gastrointestinal disease can occur in young or immunosuppressed cats.

**Diagnosis.** Infected cats are typically identified through immunodiagnostic tests (antibody titers) but, sometimes, fecal oocysts can be identified through fecal flotation in cats shedding the organism (Figure 4).

- Infected cats shed oocysts very briefly—typically no more than 3 weeks during a single period of their lives, even when faced with profound immunosuppression.<sup>7</sup>
- Due to their lower immunity, kittens shed much higher numbers of oocysts than adult cats.

**Treatment.** Recommended treatment is off-label use of clindamycin hydrochloride (10 mg/kg PO Q 12 H for 4 weeks). Some potentiated sulfonamides, such as trimethoprim/sulfadiazine, have been used to decrease or stop shedding.

### **Giardia Species**

*Giardia* species are very commonly diagnosed intestinal parasites in cats that also cause human infection.<sup>8</sup> It is unclear whether the different assemblages of *Giardia duodenalis* (= *G lamblia*) are always host specific, which makes it difficult to determine risk for zoonotic transmission.<sup>9</sup>

**Transmission.** *Giardia* infection occurs through direct transmission—consumption of cysts from fecal-contaminated food or drinking water.

**Clinical Signs.** Infected cats may be asymptomatic, but some develop clinical signs, including malabsorption and diarrhea.

**Diagnosis.** Diagnosis focuses on identification of:

- Cysts on centrifugal fecal flotation
- Trophozoites on direct saline fecal smear (Figure 5)
- Fecal antigen through ELISA test
- Fecal IFA.

Direct fecal examination may be unproductive because cysts are shed in the feces sporadically.

**Treatment.** There is no approved treatment for feline *Giardia* infection, but options include:

- Fenbendazole (50 mg/kg PO Q 24 H for 3 days) **or**
- Metronidazole (10–15 mg/kg PO Q 12 H for 7 days).
- A combination of these drugs may also be used.

Increasing the fiber in the cat's diet can help control diarrhea.



Figure 4. *Toxoplasma gondii* oocysts on fecal flotation

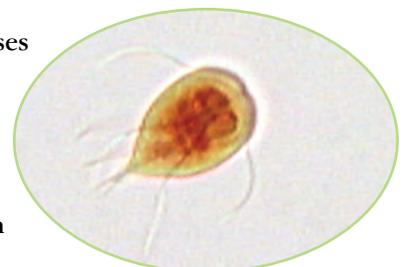


Figure 5. Trophozoite of *Giardia duodenalis* on direct saline fecal smear

\*Treatment with ponazuril has involved various doses and regimens. In some cases, a single dose of 50 mg/kg has been used; its use is more common in dogs but has been used in cats.

## PROTOZOA PRIMER

**Cyst:** Infectious form of many protozoan parasites during which they are encapsulated inside a protective wall; usually found in the feces

**Cystozoites:** Encysted stages of certain coccidia that are found in paratenic hosts; when ingested, the cystozoite continues its development in the definitive host

**Oocyst:** Encysted, highly resistant zygotic stage of some sporozoan parasites that may remain infective for extended periods of time

**Sporulated oocyst:** An oocyst that has developed into the infective stage in the environment

**Trophozoite:** Active, motile feeding stage of the flagellate protozoa as well as the postsporozoite state that is seen in some apicomplexan parasites

**Trypanosome:** A flagellated protozoan found in the vascular system of definitive hosts

**Definitive host:** Host in which parasites reproduce sexually

**Intermediate host:** Host that harbors the parasite for a short transition period, during which (usually) some developmental stage is completed

**Paratenic host:** Host that is not necessary for the development of a parasite, but may maintain its life cycle

## Trichomonads

*Tritrichomonas blagburni* (= *T foetus*) and *Pentatrichomonas hominis* are relatively common infections in cats, especially in those housed together in catteries or shelters. *T blagburni* has not been found in human hosts; *P hominis* is known to infect humans, making transmission between humans and cats a possibility.

Turn to **Journal Club** on page 79 to learn more about the recently named *T blagburni* organism.

**Transmission.** Protozoa transmission occurs through ingestion of trophozoites from fecal-contaminated food or water.

**Clinical Signs.** Recent research provides substantial supporting evidence that *T blagburni* can be a primary pathogen responsible for feline diarrhea. Previously, it was unclear whether it was directly responsible for this sign in cats.<sup>10</sup>

**Diagnosis.** Diagnosis can be made by:

- Trophozoite observation on direct saline fecal smear (Figure 6)
- Fecal polymerase chain reaction (PCR)
- Fecal culture.

**Treatment.** There is no approved treatment for cats, but ronidazole (30–50 mg/kg PO Q 12 H for 14 days) is the drug of choice. As previously mentioned, dietary management can also be helpful in resolving diarrhea.

## APPLICATIONS TO CLINICAL PRACTICE

Feline protozoan parasites are common yet potentially dangerous—both to cats and humans.

Identifying whether cats are at risk for protozoan disease and preventing these diseases helps achieve better clinical outcomes and happy owners.

1. **Keeping cats indoors** prevents exposure to outdoor threats since parasites and contaminated feces are sources of infection.
2. **Preventing cats from hunting** avoids exposure to infected prey; prevention includes safely eliminating rodents within the home.
3. **Applying tick preventive to cats** that are outdoors or exposed to other animals keeps them free from these vectors; consider year-round prevention.
4. **Protecting kittens and immunocompromised cats** by limiting their exposure to other cats, animals, and the outdoors greatly reduces risk for infection.



Figure 6. Trophozoite of *Tritrichomonas blagburni* on direct smear of feces

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### The Dangers of *Toxoplasma* in Humans

While *T gondii* rarely results in significant clinical disease in infected cats, it can cause serious zoonotic disease in humans. Worldwide, upwards of 45% of people have been infected; in the U.S. approximately 15% of humans have positive titers.<sup>11</sup>

- ***T gondii* infection in pregnant women** results in profound disease of the developing fetus, including an array of birth defects and even death
- **In immunocompromised humans**, such as those with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) infections or cancer, it is not unusual for long-dormant *T gondii* infections to become active in affected organs and cause devastating disease.
- ***T gondii* infections in humans with normal immune systems** have been possibly linked with schizophrenia, other mental illnesses, and subtle changes in personality.<sup>12</sup>

The general public is exposed to an enormous amount of information about feline zoonotic disease transmission, which can create anxiety about the risks of owning cats.<sup>13</sup> Therefore, reassure owners that their cats are very unlikely to be a source of infection; then discuss simple preventive measures, such as:

- Washing vegetables and avoiding undercooked meats
- Wearing gloves while gardening
- Changing or cleaning the litter box daily
- Preventing cats from hunting and consuming prey.

**5. Paying close attention to clinical signs of disease**, such as diarrhea, and associated behaviors, including defecating outside the litter box, helps diagnose infection more quickly.

**6. Following recommended diagnostic and treatment protocols** provides the best option for patient recovery.

**7. Separating infected cats from healthy ones** is imperative to prevent spread of disease.

**8. Providing advice to owners on reducing risk for infection** in the home includes:

- » Cleaning litter boxes daily to remove potentially contaminated feces
- » Ensuring food/water location is separate from litter box location to prevent cross contamination.

See **The Dangers of *Toxoplasma* in Humans** for tips on preventing transmission of zoonotic diseases between owners and their cats.

Protozoan diseases can be challenging to diagnose and eliminate; however, implementing appropriate diagnosis, treatment, prevention, and owner education allows practitioners and their teams to manage healthy and infected cats in an effective, comprehensive manner. ■

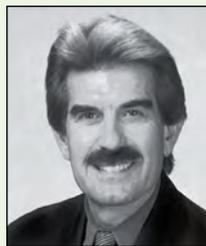
AIDS = acquired immunodeficiency syndrome; ELISA = enzyme-linked immunosorbent assay; HIV = human immunodeficiency virus; IFA = indirect fluorescent assay; PCR = polymerase chain reaction

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