

Vomiting: Sometimes It Is Parasites

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Abstract

Veterinarians in clinical practice often see patients that have vomiting as a clinical sign. As vomiting can have a wide range of etiologies, the cause can be challenging to diagnose. While many gastrointestinal parasites are primarily associated with diarrhea, vomiting may also be a key clinical sign of these infections. Parasitism is often overlooked as a cause of vomiting despite being relatively easy to diagnose and treat. This article provides key information and diagnostic strategies for practicing veterinarians about parasitic differentials for emesis in canine or feline patients.

Take-Home Points

- Vomiting is among the most common clinical presentations to the veterinary clinic and can have numerous causes, including gastrointestinal parasitism.
- Some parasitic infections can result in vomiting without any other clinical signs.
- Fecal diagnostic tests should be considered for all patients with vomiting of unknown etiology before more invasive or expensive diagnostic methods are used.
- Treatment and diagnostic strategies vary between different parasites, and no single diagnostic test can detect every parasite.

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Vomiting is among the most common clinical signs observed in dogs and cats presenting to veterinarians and may result from a wide variety of underlying etiologies, such as various gastrointestinal disorders; dietary indiscretion; and infective agents, including parasites. Many of these diagnoses may be more common in dogs less than 1 year of age, when parasitism is also more commonly diagnosed. As a result, it can be challenging to work up cases of vomiting in pets. Diagnostic tests for common parasitic infections are cost-effective, minimally invasive tools that can help narrow the differential diagnosis.

The Value of Testing for Parasites

Many gastrointestinal parasites can cause vomiting, some even in prepatency. Parasites that cause vomiting include nematodes (roundworms), trematodes (flatworms), cestodes (tapeworms), and protozoa. In some cases, vomiting is an uncommon clinical sign, while in others it is the hallmark clinical sign and pets may present with no other abnormal findings.

Diagnostic tests for parasitic infections often require only a passively collected fecal sample or serial fecal samples for parasites with intermittent shedding. These tests can be performed in-clinic in less than 15 minutes, though some require specialized equipment, and reference laboratory options are commonly pursued. It is important to remember that detectability varies among parasite species, and a specific diagnostic test may not be the best option for every parasitic differential. For example, while centrifugal fecal flotation using a concentrated sugar solution is very effective at floating nematode eggs such as those of hookworms, roundworms, or whipworms, it may not be effective at floating heavier eggs such as *Physaloptera* or flatworm eggs, which are more effectively detected using fecal sedimentation.

In cases of vomiting with no obvious life-threatening etiology (i.e., foreign body, toxin ingestion), quick and minimally invasive tests to rule out parasites should be performed before highly invasive or expensive diagnostics, such as exploratory laparotomy or endoscopic procedures, are considered. **TABLE 1** summarizes diagnostic and treatment options for the most common parasites that should be considered in the differential list for a vomiting cat or dog.

Nematodes

Physaloptera species

Physaloptera species (*Physaloptera rara* and *Physaloptera praeputialis*) are spirurid nematodes that reside in the stomach of vertebrate hosts. Dogs and cats may serve as definitive hosts and are infected by ingesting arthropod intermediate hosts, typically crickets or beetles. Paratenic hosts may also be ingested by the definitive host.[1,2]

Clinical Signs

Vomiting is the hallmark clinical sign of *Physaloptera* infection, sometimes in the absence of any other clinical signs. Vomiting can occur even with low worm burdens and may persist long-term.[3,4] These patients often do not have lethargy or inappetence but may be unable to keep food down.

Diagnosis

Eggs of *Physaloptera* are small and larvated (**FIGURE 1**). Typically, they are not detectable on regular centrifugal fecal flotation and require fecal sedimentation to be seen.[5] Adults may be passed in vomitus and can be identified based on the presence of a cuticular collar and caudal alae.[6]

Toxocara canis and *Toxocara cati*

Toxocara species are roundworms that reside in the small intestine of the definitive host. *T canis* and *T cati* are very common parasites of puppies and kittens, respectively. Animals become infected with *Toxocara*



FIGURE 1. *Physaloptera* egg recovered via fecal sedimentation.

TABLE 1 Diagnostic and Treatment Options for Common Parasites Associated With Vomiting

PARASITE	DIAGNOSTIC STAGE	DIAGNOSTIC TEST	RECOMMENDED TREATMENTS*	
			CATS	DOGS

Toxocara species	▪ **Egg:** Round, thick, pitted shell containing single cell
	  ▪ ***Toxocara cati:*** 71–75 × 61–65 µm
	  ▪ ***Toxocara canis:*** 85–90 × 75 µm
	▪ **Adult:** Long, thin worm with cranial alae in arrowhead (*T cati*) or lancet (*T canis*) shape
		▪ Centrifugal fecal flotation
		▪ Fecal PCR
		▪ Coproantigen
			▪ Emodepside
			▪ Eprinomectin
			▪ Fenbendazole
			▪ Ivermectin
			▪ Milbemycin oxime
			▪ Moxidectin (transdermal)
			▪ Pyrantel pamoate
			▪ Selamectin
				▪ Fenbendazole
				▪ Milbemycin oxime
				▪ Moxidectin (transdermal)
				▪ Pyrantel pamoate

Physaloptera species	▪ **Egg:** Smooth, elliptical, larvated, 42–53 × 29–35 µm ▪ **Adult:** Small worm with cuticular collar and caudal alae	▪ Fecal sedimentation ▪ Endoscopy	▪ Pyrantel pamoate (20 mg/kg every 14 days)	▪ Pyrantel pamoate (20 mg/kg every 14 days)
Heterobilharzia americana	▪ **Egg:** Round, smooth, contain miracidium, 74–113 × 60–80 µm	▪ Fecal sedimentation with saline (water will cause miracidium to emerge)	▪ N/A	▪ Fenbendazole (50 mg/kg PO for 10–24 days) ▪ Praziquantel (25 mg/kg q8h for 2–3 days)
Spirometra species	▪ **Egg:** Smooth, yellow to brown, operculated, 65–70 × 35–37 µm	▪ Fecal sedimentation ▪ Centrifugal fecal flotation	▪ Praziquantel (25 mg/kg for 2 days)	▪ Praziquantel (25 mg/kg for 2 days)
Cystoisospora species	▪ **Oocyst:** Smooth, clear, contains 1 sporoblast ▪ ***Cystoisospora felis* or *Cystoisospora canis:*** 38–51 × 27–39 µm ▪ ***Cystoisospora rivolta* or *Cystoisospora ohioensis:*** 17–27 × 15–24 µm	▪ Centrifugal fecal flotation	▪ Ponazuril or toltrazuril (10–30 mg/kg PO q24h for 1–3 days) ▪ Sulfadimethoxine	▪ Ponazuril or toltrazuril (10–30 mg/kg PO q24h for 1–3 days) ▪ Sulfadimethoxine

Giardia species	▪ **Cyst:** Smooth-walled, clear; may be collapsed in some flotations resulting in half-moon appearance; 9–13 × 7–9 µm
	▪ **Trophozoite:** 12–17 × 7–19 µm
		▪ **Cysts:**
		  ▪ Centrifugal fecal flotation with zinc sulfate (sucrose solutions are less sensitive)
		  ▪ Fecal antigen testing
		  ▪ Fecal PCR
		▪ **Trophozoites:** Can be seen on direct smear of fresh feces; less sensitive
			▪ Febantel (30 mg/kg PO q24h for 3 days)
			▪ Fenbendazole (50 mg/kg PO q24h for 3 days)
				▪ Febantel (30 mg/kg PO q24h for 3 days)
				▪ Fenbendazole (50 mg/kg PO q24h for 3 days)

**Treatment per label, unless dose is described. Options are listed alphabetically.*

species through multiple routes: after ingesting infective eggs from the environment, by consuming a paratenic host, or through transplacental transmission.[7] Roundworms are extremely common, and nearly every litter will encounter them early in life.

Clinical Signs

Common clinical signs may include coughing (prepatent), vomiting (especially cats), and abdominal discomfort with a potbelly appearance. Severe disease is more often seen in young animals. If left untreated, severe infections can result in large masses of worms. Vomiting is more likely to be seen in cats than dogs.

Diagnosis

If roundworm infection is suspected, the ideal choice for in-clinic diagnostic testing is centrifugal fecal flotation using sugar solution.[8] However, fecal PCR or coproantigen testing options exist for samples submitted to reference laboratories.[9] Puppies and kittens should be tested frequently in the first year of life.

Trematodes

Heterobilharzia americana

H americana is a trematode parasite and the causative agent of canine schistosomiasis. When an infected dog or other mammal excretes feces contaminated with the parasite's eggs, a larva (miracidium) emerges and infects freshwater snails (intermediate hosts). After some development in the snail's tissues, the infective larval stage (cercaria) is released into water. Dogs become infected through skin penetration by these larvae when swimming in contaminated water.[10]

Clinical Signs

Most dogs are presented for veterinary evaluation due to chronic enteropathy. Clinical signs vary among patients and may include diarrhea, vomiting, weight loss, polyuria, polydipsia, fever, and dermatitis.[10-12]

Diagnosis

Diagnosis is achieved through a combination of tests, including fecal sedimentation, CBC, serum biochemical profile, urinalysis, and diagnostic imaging. The common clinicopathologic findings in dogs infected with *H americana* are anemia, eosinophilia, hypercalcemia or hypocalcemia, hyperglobulinemia, hypoalbuminemia, and isosthenuria. Fecal sedimentation for this parasite must use saline solution due to immediate hatching of the larvae when the eggs contact water (**FIGURE 2**).[12,13]

If roundworm infection is suspected, the ideal choice for in-clinic diagnostic testing is centrifugal fecal flotation using sugar solution.[8]

Cestodes

Spirometra species

The adults of this cestode parasite infect the small intestine of dogs and cats, the definitive hosts. Eggs from infected animals are shed in water and subsequently release larvae called coracidia, which infect freshwater copepods. A larval stage called a procercoid develops in the infected copepods and later infects a second intermediate host—frogs, snakes, or any other small vertebrate except fish—where the final infective stage (plerocercoid) develops. Dogs and cats become infected when ingesting small vertebrates infected with the plerocercoid stage.[14]



FIGURE 2. *Heterobilharzia americana* egg recovered from fecal sedimentation with saline.

Clinical Signs

Intestinal infections are usually asymptomatic, but in some cases, dogs and especially cats develop diarrhea, vomiting, lethargy, anorexia, and abdominal pain or distention. In some cats, proglottids can be seen in vomitus.[15-17]

Diagnosis

Fecal centrifugation with zinc sulfate or fecal sedimentation are the recommended diagnostic tests (**FIGURE 3**). Copro-PCR can help identify *Spirometra* species.[14,17]

Protozoa

Cystoisospora species

Infection occurs by ingestion of sporulated oocysts, either from the environment or in infected paratenic hosts or insects.[18,19]

Clinical Signs

Coccidiosis is commonly seen in puppies and kittens. Although the most common observation in infected animals is diarrhea, some animals present with a history of vomiting, lethargy, and abdominal pain.[18,20,21]

Diagnosis

Definitive diagnosis is made by observation of oocysts (**FIGURE 4**) during fecal centrifugal flotation in association with clinical signs.

Giardia species

Animals become infected by ingesting cysts, which are immediately infective once shed in the host's feces.

Clinical Signs

Dogs and cats commonly have diarrhea, dehydration, and weight loss. Vomiting is occasionally observed.[22]

Diagnosis

Detection of *Giardia* cysts is achieved by centrifugal fecal flotation with zinc sulfate solution. Detection of trophozoites via direct smear is less common, as they do not survive in the environment as well as the cyst form does.

Other Parasites

Dirofilaria immitis, the causative agent of heartworm disease in dogs and of feline heartworm-associated respiratory disease, is a nematode parasite transmitted by mosquitoes, with the adult worms residing in the pulmonary arteries. Periodic vomiting is observed more commonly in cats than in dogs.[23]

Ollulanus tricuspis is a nematode parasite that lives in the stomach of cats and, rarely, dogs.[24] Transmission occurs by ingestion of the infective larval stage present in vomitus of cats. The common findings in infected animals are chronic vomiting and gastritis. Diagnosis is made by Baermann testing of vomitus or gastric lavage fluid to recover parasitic larvae.[25]

Spirocerca lupi is a parasite found in esophageal nodules of dogs. It is transmitted by ingestion of



FIGURE 3. *Spirometra* egg recovered from fecal sedimentation.

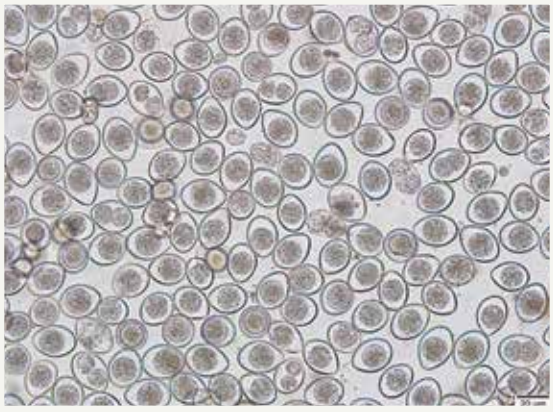


FIGURE 4. Numerous *Cystoisospora* oocysts recovered from fecal flotation.

CASE EXAMPLE

Toby, a 3-year-old male castrated Chihuahua, presented to the clinic for consistent vomiting and inability to keep food down over the past week. Toby was bright, alert, and responsive; was behaving and drinking normally; and had normal, formed stools. No abnormalities were notable on blood analysis. A barium study was conducted, and the results were within normal limits. Fecal tests to detect parasitism were not performed.

After 10 days of symptomatic care, clinical signs persisted and the owners elected to have an exploratory laparotomy performed. The duodenum was inflamed, and multiple 1-cm–long worms were found attached to the interior stomach wall. Toby's veterinarian submitted these parasites, along with a fecal sample, to a reference laboratory for further examination.

Examination of the worms revealed that they were a species of *Physaloptera*, a stomach worm of dogs that commonly causes vomiting without other clinical signs.

What parasitic differentials could have been considered for Toby?
Of the parasites discussed in this article, *Physaloptera* should have been high on the suspicion list given the age of the patient and clinical presentation. Other parasites that could have been considered include *Heterobilharzia*, *Spirometra*, and *Giardia*, but further history probing could have helped rule out differentials.

What diagnostic test(s) could have been useful prior to surgical intervention?
Fecal diagnostic tests to rule out parasitism should have been performed, as these are fast and inexpensive. When *Physaloptera* is suspected, a fecal sedimentation test is advisable in addition to centrifugal flotation. Although surgery or endoscopy can detect *Physaloptera*, appropriate fecal diagnostics should be conducted first to reduce cost, time, and risk to the patient.

Would fecal diagnostic testing during the clinical manifestations have ensured a definitive diagnosis of *Physaloptera* infection?
Not necessarily. Use of an incorrect fecal diagnostic test, such as a regular passive or centrifugal flotation, will likely miss *Physaloptera* eggs. The best option is to perform fecal sedimentation to recover these eggs.

Prepatent infection can also cause false-negative results for *Physaloptera*. Even if these worms are immature and not yet producing eggs, their presence in the stomach can still cause irritation and clinical signs.

intermediate hosts, primarily dung beetles, or of paratenic hosts such as rodents, rabbits, or chickens.[26] In the United States, it has been reported mostly in wild canids from southern states.[27] Infected dogs present with vomiting, chronic weight loss, dysphagia, and complications that include esophageal neoplasia.[28] Diagnosis can be done by fecal sedimentation or centrifugal flotation with zinc sulfate to observe the larvated eggs, in combination with clinical signs and diagnostic imaging to detect nodules.

Oslerus osleri is a nematode parasite of dogs. Adults are located under the tracheal mucosa. In the United States, it has been mainly reported from coyotes. Transmission from dam to puppies occurs through saliva or feces containing the infective first larval stage. Clinical signs include coughing and vomiting. Diagnosis can be difficult but can be achieved by Baermann testing of feces or transtracheal wash samples. Bronchoscopy can also be utilized to detect tracheal nodules.[29]

Mesocestoides species are cestodes that infect the small intestine of dogs and cats. Infection is usually asymptomatic. On rare occasions, the parasite's larvae penetrate the intestinal wall, leading to peritoneal larval cestodiasis. This condition can be severe and may cause a variety of clinical signs, including vomiting.[30,31]

Platynosomum fastosum is a trematode that parasitizes the bile ducts, gallbladder, and pancreas of cats. Infection occurs by ingestion of lizards, geckos, and other paratenic hosts. Clinical signs vary according to the number of adult parasites and can include vomiting, diarrhea, and icterus. In the United States, infection with this parasite is more common in southeastern states and Hawaii.[32,33]

Spurious Parasites

Dogs are naturally coprophagic, which can lead them to ingest parasites present in the feces of other hosts.

Eimeria species are commonly identified in fecal centrifugation tests. Although spurious parasites are generally nonpathogenic, coprophagia can occasionally result in gastrointestinal signs such as vomiting.

Summary

Vomiting is a common presenting complaint encountered by general practice veterinarians. A wide range of etiologies can be responsible for vomiting in patients, including parasitism, which may sometimes be overlooked (**CASE EXAMPLE**). Various parasitic infections may cause vomiting in dogs and cats across the United States. A thorough understanding of the prevalence of these parasites, how animals get infected, treatment recommendations, and diagnostic strategies may be helpful for the practicing veterinarian to detect and treat parasites in the vomiting patient. TVP

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