Inflammatory bowel disease (IBD) is a multifactorial disease of dogs and cats characterized by chronic enteropathies that can significantly impact quality of life. These enteropathies are usually thought of as being food responsive, antibiotic responsive, steroid responsive, or refractory, regardless of immunosuppressive therapies (idiopathic IBD).

Histologically, the small intestine, large intestine, or both can be affected. Lymphocytes and plasmacytes are the most common cell infiltrates within the lamina propria of the gastrointestinal (GI) tract; eosinophils, macrophages, and neutrophils can also be appreciated, but less frequently.

Although the exact etiologies of IBD are unknown, multiple factors can contribute to this persistent disease state. A confounding issue is that many healthy dogs and cats are exposed to similar factors relative to animals affected by IBD, but never become affected. This article summarizes and discusses the believed influences on gut inflammation, potential diagnostics, treatment options, and clinical outcomes in light of the most recent literature available.

FACTORS ASSOCIATED WITH GASTROINTESTINAL INFLAMMATION

Factors currently believed to be associated with GI inflammation include:

- Genetics
- The mucosal immune system and immune responses
- Environmental factors
- Microbial factors

These have been evidenced by human, mouse, canine, and feline models.

CREATURE DISCOMFORTS

Inflammatory bowel diseases are the most common cause of chronic vomiting and diarrhea in dogs and cats. The term IBD is used to describe a group of conditions characterized by inflammation of the gastrointestinal tract and persistent or recurrent GI signs.
Genetics

The genetic component believed to be associated with an increased risk of IBD is well documented in humans and involves mutations in pattern recognition receptors such as nucleotide binding oligomerized domain 2, Toll-like receptors (TLRs), and interleukin-23. These receptors sense pathogen-associated molecular patterns in the region of the immediate cell surface or intracellular environment.

Specific breeds of dogs are recognized as being prone to chronic enteropathies, which likely suggests a genetic component (TABLE 1).

Although a genetic component is not as well recognized in cats, Siamese and other oriental breeds have been suggested to be more predisposed to developing IBD. In our experience, this has not necessarily been the case, as domestic shorthaired and longhaired breeds account for most cats presenting and diagnosed at our facility.

The pathophysiology behind breed predispositions is not well understood, but triggers have been identified in some breeds. In boxers with granulomatous colitis, genome analysis has identified disease-associated single-nucleotide polymorphisms (SNPs) that may affect killing of pathologic Escherichia coli. The presence of these adherent and invasive E coli within mucosal macrophages of specifically boxers, and this organism's eradication with tailored antibiotic implementation further suggests a breed-specific association relative to disease pathogenesis as well as clinical response.

Genetic analysis of German shepherds has shown that several SNPs in the TLR 4 and TLR 5 genes are significantly associated with the incidence of lymphocytic–plasmacytic IBD. These TLRs are a class of proteins of the innate immune system that span the membrane of sentinel cells, such as macrophages and dendritic cells, and are important in the recognition of lipopolysaccharide of gram-negative bacteria, lipoteichoic acid of gram-positive bacteria, and bacterial flagellin.

TLR 2 mRNA expression, which has been correlated with the clinical severity of IBD, has been noted to be higher in the duodenum of affected dogs compared with healthy dogs. In mouse models, TLR 2 has been implicated in the homeostasis of intestinal tissue after injury.

Mucosal Immune System and Immune Responses

The mucosal immune system, immune tolerance, and other innate and adaptive immune processes also play roles in the development of chronic inflammation of the GI tract.

Immunoglobulin A (IgA), important in the mucosal defense system, provides a barrier to keep luminal bacteria from crossing the luminal epithelial cells. Loosely and tightly adherent mucus produced by goblet cells and tight junctions between luminal epithelial cells also provide an immediate barrier. Any irregularity in these barriers can lead to the transposition of GI pathogens and commensals and result in chronic inflammation.

### TABLE 1 Chronic Enteropathies Associated With Specific Dog Breeds

<table>
<thead>
<tr>
<th>DOG BREED</th>
<th>ASSOCIATED ENTEROPATHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft-coated wheaten terrier</td>
<td>Protein-losing enteropathy</td>
</tr>
<tr>
<td>Basenji</td>
<td>Immunoproliferative enteropathy</td>
</tr>
<tr>
<td>Boxer</td>
<td>Granulomatous colitis, also known as histiocytic ulcerative colitis</td>
</tr>
<tr>
<td>French bulldog</td>
<td></td>
</tr>
<tr>
<td>German shepherd</td>
<td>Lymphocytic-plasmacytic inflammation</td>
</tr>
<tr>
<td>Norwegian lundehund</td>
<td>Inflammatory bowel disease</td>
</tr>
<tr>
<td>Yorkshire terrier</td>
<td>Protein-losing enteropathy with lymphangiectasia</td>
</tr>
</tbody>
</table>

*Protein-losing enteropathy with lymphangiectasia in Yorkshire terriers can have an inflammatory component causing lymphatic dilation; often, IBD is a secondary diagnosis to lymphangiectasia in these dogs.
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The focus of inflammation can exacerbate the degradation of tight junctions. T helper 1 cells and complementary T cell subsets are involved in the secretion of proinflammatory cytokines, whereas T regulatory cells antagonize proinflammatory states for appropriate homeostasis of the gut adaptive immune system. In IBD, this balance is lost.29

Intensive and hyperresponsive states of inflammation result from aggressive T-cell responses to antigens and pathogens with upregulation of inflammatory mediators, as well as defects in microbial extermination and downregulation of inflammatory control mediators.13,23

Environmental Factors

Environmental factors encompass a number of possible etiologies. In humans with chronic enteropathies, etiologies include stress, diet, and previous exposure to pharmaceuticals, including antibiotics.9,29,30 Although stress has not been well established in the literature as an etiology in dogs and cats, stressful events for cats have been associated with other inflammatory diseases, such as feline idiopathic cystitis and recrudescence of feline upper respiratory tract infections.31

There is a diet-responsive component to IBD, as noted in humans.8,12,23,29 Some cats and dogs respond favorably to novel protein and/or hydrolyzed protein diets. Because multiple dietary components are recognized by the GI immune system as foreign antigens,32 the thought is that decreasing the load of antigens decreases inappropriate immune responses.

Microbial Factors

Dysbiosis, or alteration of the normal microbial ecosystem within the intestine, is also observed in IBD.1 This has been demonstrated via fluorescence in situ hybridization analysis (FIGURE 1). Reported common changes in the normal commensals include decreases in *Firmicutes* (eg, clostridia, bacilli), decreases in *Bacteroidetes*, reduced *Clostridium* diversity, and increases in *Enterobacteriaceae* (such as *E coli* and *Pseudomonas* strains).2

Although dysbiosis would explain the occasional response to antibiotics, a number of these organisms are also found in healthy dogs and cats. Therefore, the combined action of the microbiome ecosystem and environmental factors, not solely the presence of these microflora, likely determines progression to IBD.

Alteration of the microbiota by manipulation of commensals, and restricting the diet to one containing fewer structural carbohydrates and more fat, results in decreased production of short-chained fatty acids needed for overall gut health, providing further evidence for the interplay between the factors predisposing to IBD.2,8,23

**CLINICAL SIGNS**

Clinical signs of IBD can include vomiting, diarrhea, melena, hematochezia, weight loss, and hyporexia to anorexia, in any combination. Some patients also present with clinical signs of disease progression, such as subcutaneous edema, pleural effusion, and ascites associated with hypoalbuminemia due to a related PLE.33

The presence of ongoing clinical signs lasting more than 3 weeks is the basis of classification of a chronic enteropathy.34 It is important to get a full history, which includes:

- Characterization of clinical signs
- Duration
- Diet
- Therapies
- Response to therapy

This comprehensive medical history ensures proper consideration of differentials with similar presentation and an appropriate diagnostic plan.

**FIGURE 1.** Three-color fluorescence in situ hybridization identifies Cy-3-labeled *Clostridia* species (labeled orange) localized within adherent mucus of a colonic biopsy specimen obtained from a dog with IBD. The mucus is also occupied by other bacteria (total bacteria labeled green with FITC-Eub). The dark blue structures are nuclei (note some epithelial cells sloughed into the mucus) stained with DAPI. Courtesy of Angela Bryan.
DIFFERENTIAL DIAGNOSIS

A clinical diagnosis of IBD is based on:
1. Presence of persistent (>3 weeks) GI signs
2. Inability to identify enteropathogens or other causes of GI disease
3. Histopathologic evidence of intestinal inflammation

A diagnosis of IBD is primarily one of exclusion and requires elimination of IBD mimics through complete clinical examination, laboratory testing, and specialized instrumentation. Differentiation of severe IBD from well-differentiated (small cell) lymphoma may be especially problematic in cats. After the exclusion of infectious and parasitic agents, nongastrointestinal disorders, exocrine pancreatic insufficiency, and intestinal structural abnormalities requiring surgery (BOX 1), the most common diagnoses of chronic enteropathy include food-responsive enteropathy (FRE), antibiotic-responsive diarrhea (ARD), and idiopathic IBD.

DIAGNOSTICS

Fecal Examination

Fecal examination by direct wet mount or flotation techniques can rule out parasitic causes for mucosal inflammation (BOX 1).

*Giardia* and *Cryptosporidium* infections are best detected using indirect fluorescent antibody tests.

Cats with chronic large bowel diarrhea should be screened for *Tritrichomonas foetus* infection by polymerase chain reaction.

Hematology

Routine hematology may reveal nonregenerative anemia reflective of chronic inflammation or enteral blood loss. **Neutrophilia with or without a left shift** is associated with erosive/ulcerative intestinal lesions. **Eosinophilia** is seen with some forms of IBD such as eosinophilic enteritis.

Serum Biochemistry and Specialized Serologies

Results from biochemical analysis rarely provide definitive evidence for IBD, but they do facilitate the recognition of abnormalities in other organs that may cause GI signs.

### BOX 1. Diagnostic Differentials for IBD in Dogs and Cats

#### GASTROINTESTINAL

**Parasites**
- *Giardia* species
- *Toxocara* species
- *Trichuus* species
- *Isospora* species
- *Tritrichomonas* species (cats)
- *Physaloptera* species
- *Oliulanus* tricuspis (cats)
- *Heterobilharzia americana*

**Pathogenic bacteria**
- *Escherichia coli*
- *Campylobacter* species
- *Salmonella* species
- *Mycobacteria* species

**Fungi and algae**
- *Histoplasma* species
- *Prototheca* species
- *Pythium insidiosum*

**Neoplasia**
- Lymphoma
- Mast cell tumor
- Adenocarcinoma
- Leiomyosarcoma
- Gastrinoma

**Anatomic and functional disorders**
- Hypertrophic pyloric gastropathy
- Gastric emptying disorders

**Other**
- Food allergy
- Dietary indiscretion
- Transient gastroenteritis
- Persistent foreign body

#### EXTRA-GASTROINTESTINAL

**Viruses**
- Feline leukemia virus
- Feline immunodeficiency virus

**Organ dysfunction**
- Hepatic disease
- Renal disease
- Pancreatitis
- Exocrine pancreatic insufficiency
- Hyperthyroidism
- Hypoadrenocorticism

**Other**
- Neoplasia
- Persistent toxin exposure
In cats with IBD, hyperproteinemia and mild elevation in liver enzymes (alanine aminotransferase and alkaline phosphatase) are often reported.\(^7,22,40\)

Dogs with PLE frequently have hypoalbuminemia and hypoglobulinemia, which may be accompanied by hypcholesterolemia and hypocalcemia. The presence of hypoalbuminemia correlates with a negative outcome in dogs.\(^35,38\)

Cats with IBD may have increased serum pancreatic lipase concentrations (suggestive of pancreatitis). This association does not appear to influence clinical outcome, based on a recent report.\(^31\) However, increased serum pancreatic lipase concentrations in dogs with IBD have been associated with a poorer clinical outcome.\(^42\)

Dogs and cats with chronic small bowel disease may have decreased serum cobalamin concentrations secondary to cobalamin malabsorption. Failure to recognize and correct hypocobalaminemia can delay clinical recovery, even with specific therapy for IBD.\(^43\) Hypocobalaminemia has also been correlated with a poor prognosis in dogs with chronic enteropathies.\(^33\)

**Diagnostic Imaging**

**Abdominal radiographs** can be used to assess the following:

- Extra-alimentary tract disorders causing gastroenteritis (eg, neoplasia)
- Caudal displacement of the small intestine and potential abdominal effusion with loss of cranial radiographic abdominal detail associated with pancreatitis (FIGURE 2)
- Overt renal or hepatic changes (FIGURE 3) associated with dysfunction, damage, or neoplasia

**Abdominal ultrasonography** is superior to abdominal radiography in defining diffuse GI mucosal disease, intestinal wall thickness (FIGURE 4), and mesenteric lymphadenopathy seen with IBD as well as other infiltrative (eg, lymphoma) disorders.\(^44\)

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**FIGURE 2.** Lateral abdominal radiograph of a dog with pancreatitis. Note the loss of abdominal detail in the cranioventral abdomen with caudal displacement of the small intestine. *Courtesy of Dr. Eric Van Eerde.*

**FIGURE 3.** Lateral abdominal radiograph of a dog with hepatocellular carcinoma. Note the increase in soft tissue opacity (mass effect) in the cranioventral abdomen. *Courtesy of Dr. Eric Van Eerde.*

**FIGURE 4.** Ultrasound images showing jejunal muscularis thickening in a cat with IBD. (A) Cross-sectional image showing thickened small intestinal wall (0.44 cm). (B) Longitudinal section demonstrating a similar thickened appearance (0.38 cm). Normal small intestinal wall thickness in cats is reported as 0.16 to 0.36 cm.\(^24\) *Courtesy of Dr. Jacob Ewing.*
Ultrasonographic examination allows fine-needle aspiration of focal wall thickening and enlarged lymph nodes to provide samples for cytologic analysis.

Cats with ultrasonographic evidence of muscularis propria thickening are more likely to have lymphoma than IBD.

**Endoscopy and Mucosal Biopsy**

Endoscopic examination with mucosal biopsy is essential to confirm a diagnosis of IBD and determine the extent of disease. The most widely reported endoscopic abnormalities seen with canine and feline IBD include mucosal friability, increased granularity, and mucosal erosions (FIGURE 5).

The association between endoscopic lesions and disease activity in small animal IBD has been investigated to a limited extent. In separate investigations, endoscopic abnormalities of the duodenum of dogs with IBD did not always correlate with clinical indices of inflammation. The presence of severe mucosal lesions of the duodenum, but not the colon, was associated with a negative outcome in one study.

In contrast to dogs, cats with IBD have endoscopic abnormalities that correlate to both clinical disease activity and histopathologic lesions at diagnosis.

Standard mucosal biopsies of the stomach and duodenum alone may miss more distal sites (e.g., ileal mucosa) of cellular infiltration. Ileal biopsies should be obtained in all dogs and cats to increase diagnostic yield whenever gastroduodenoscopy or colonoscopy is performed, especially as lymphoma is an important differential diagnosis in cats.

The need to perform ileoscopy may be guided by the presence or absence of hypocobalaminemia, because cobalamin is absorbed in the ileum.

**Histopathology**

Definitive diagnosis requires histopathologic evaluation of biopsy specimens. The microscopic findings in IBD consist of minimal to pronounced inflammatory cell infiltration, often accompanied by varying degrees of mucosal architectural disruption. Unfortunately, biopsy interpretation is notoriously subjective, suffering from extensive interobserver variability, the technical constraints of specimen size, and procurement/processing artifacts inherent in evaluation of endoscopic specimens.

One recent effort to standardize the assessment of GI inflammation resulted in a histopathologic monograph that defines numerous morphologic and inflammatory features in endoscopic biopsies. However, even with this standardized scheme, there was very poor agreement between pathologists, resulting in the design of a simplified model for IBD, currently under review.

Recent studies indicate that changes in mucosal architecture, such as villous morphology and goblet cell mucus content, are related to the presence and severity of GI disease. These studies have used quantitative, observer-independent variables (e.g., inflammatory cytokines, intestinal mucus) to identify histopathologic correlates of disease.

In cats with signs of GI disease, villous atrophy and fusion correlate with the severity of clinical signs and degree of proinflammatory cytokine upregulation in the duodenal mucosa. Architectural changes in the gastric mucosa correlate with cytokine upregulation in dogs with lymphocytic gastritis. In the colon, loss of mucus and goblet cells correlates with the severity of disease in dogs with lymphoplasmacytic and granulomatous colitis.
**TREATMENT**

IBD patients with mild to moderate clinical disease activity and normal serum albumin concentrations are first treated sequentially with dietary and antibiotic trials. If they fail to respond to either of these trials, immunosuppressive therapy is initiated.

**Diet**

A positive response to a dietary trial allows the patient’s disease to be classified as FRE, a term that includes both dietary allergy and intolerance. The primary option for a dietary trial is switching to a diet that leads to antigenic modification (eg, novel protein source, protein hydrolysate). The diet must be palatable and introduced in gradually increasing amounts over 4 to 7 days.

In dogs with FRE, a clinical response is usually observed within 1 to 2 weeks of changing the diet. In one study, dogs that responded to diet were younger and had higher serum albumin concentrations and predominant signs of large bowel diarrhea compared with dogs that did not respond to diet.33

**Antibiotics**

An antibiotic trial typically involves administration of tylosin, oxytetracycline, or metronidazole (TABLE 2). A positive response suggests ARD. The patient is typically maintained on antibiotics for 28 days. If signs recur after discontinuation of therapy, long-term antibiotic therapy is instituted with tylosin.

**Anti-inflammatory and Immunosuppressive Therapy**

Patients that do not respond to a diet or antibiotic trial are usually administered prednisolone or prednisone (TABLE 2). However, as the side effects of glucocorticoids are usually more marked in large-breed dogs than in small breeds, azathioprine may be combined with glucocorticoid treatment for a faster taper period in dogs weighing >30 kg. If there is poor response to immunosuppression or a relapse is seen after tapering, cyclosporine may be considered.

In cats, chlorambucil with prednisolone is used if the response to glucocorticoid treatment is inadequate. Hematologic parameters should be monitored regularly if chlorambucil is used. If the patient responds, then the medication can be tapered gradually, starting with the steroid, to a q48h dosing regimen.

**Budesonide** is a glucocorticoid medication that has been shown to be successful in the treatment of canine IBD.33,34 However, hypothalamic–pituitary–adrenal suppression and development of steroid hepatopathy has been demonstrated in dogs. Therefore, the hepatic first-pass effect of this drug in dogs may not be as beneficial as in human beings.34

An optimal dose of budesonide has not yet been determined. The response rate to budesonide has been shown to be similar to prednisone; however, this drug should be reserved for dogs that are known to respond to steroids but suffer severe

| TABLE 2 Dosages of Drugs for Management of Chronic Enteropathies |
|----------------------|--------------------------|-----------------------------|
| DRUG CLASSIFICATION  | DRUG                     | DOSAGE                      |
| Antibiotic           | Tylosin                  | 10 to 15 mg/kg PO q8h for 28 days |
|                      |                          | 5 mg/kg PO q24h, long-term   |
|                      | Oxytetracycline          | 20 mg/kg PO q8h for 28 days |
|                      | Metronidazole            | 10 mg/kg PO q12h for 28 days |
| Anti-inflammatory and immunosuppressant | Prednisolone | 2 mg/kg PO q24h for 2 weeks, then tapered over 6–8 weeks |
|                      | Cyclosporine             | 5 mg/kg PO q24h for 10 weeks |
|                      |                          | 5 to 10 mg/kg PO q24h        |
|                      | Chlorambucil             | 2 to 6 mg/m2 PO q24h         |
|                      | Budesonide               | 1 mg/m2 PO q24h              |
|                      | Sulfasalazine            | 20 to 50 mg/kg PO q8h for 3 to 6 weeks |
side effects. Some dogs still develop side effects of steroid administration while on budesonide, and owners should be warned about this.

Sulfasalazine and related drugs are often used in dogs when IBD is limited to the large intestine. However, because side effects include keratoconjunctivitis sicca, tear production should be monitored regularly.

Treatment of Patients With Severe PLE

PLE is a recognized complication in a subset of chronic enteropathy cases, and hypoalbuminemia has been shown to be a poor prognostic indicator. Patients with albumin concentrations <1.5 g/dL are at risk of developing ascites, pleural effusion, and subcutaneous edema. Many of these patients succumb to PLE within the first 1 to 2 months of starting prednisone treatment. Some studies have shown a better outcome with single-therapy cyclosporine, making it a better option for many of these patients. One recent study has shown that the combination of prednisolone and chlorambucil was superior to prednisolone and azathioprine for survival.

Evaluation of hemostatic function in these patients is recommended to ascertain if hypercoagulability has developed as a consequence of enteric protein loss. Concurrent therapy with ultra-low aspirin 0.5 mg/kg PO every 24 hours or other platelet inhibitors, such as clopidogrel, is recommended in these patients to prevent thromboembolism.

In addition, elemental diets and partial parenteral nutrition may be indicated in some dogs with severe PLE. Some PLE patients can fare relatively well with dietary treatment alone, and some studies show that Yorkshire terriers with PLE may be a subgroup of solely diet-responsive dogs. In such cases, try a low-fat diet first and wait for 1 to 2 weeks before adding immunosuppressive treatment. Adequate protein content in such diets for these patients is probably even more important than fat restriction. If in any doubt, or if the patient is already anorexic, any diet will be better than no food intake.

Finally, these patients may be at risk of complications associated with intestinal biopsy by laparotomy. Therefore, plasma transfusion, human or canine albumin infusion, or synthetic colloid may be indicated during anesthesia for endoscopy.

Adjunctive Therapy With Probiotics

The use of probiotics in people with IBD has led to some promising results, although there is still an insufficient number of large, multicenter, randomized, double-blind, placebo-controlled trials. Similarly, there has been only 1 randomized, placebo-controlled trial investigating the use of Enterococcus faecium probiotic as an adjunctive treatment in canine FRE, and no additional effect was demonstrated in the group of dogs receiving probiotics.

In another clinical trial, dogs with IBD were treated with the probiotic Visbiome (visbiome.com) in addition to standard treatment with immunosuppressives. The group that received the additional daily probiotic treatment improved more than the group treated with standard therapy alone. It should be noted that consistent use of probiotics may have a greater association with their benefits.

PROGNOSIS

FRE is highly prevalent among dogs with chronic enteropathies (at least 60% to 70%), and a favorable response to elimination or hydrolyzed diets within 2 weeks has been associated with a very good prognosis over 1 year after diagnosis. In these studies, the dogs were kept on the diet for at least 12 weeks after diagnosis before they were switched back to their original diet.

In a recent large retrospective study in which all dogs with chronic enteropathy were sequentially treated, only 16% were suspected to have ARD. All ARD dogs relapsed shortly after discontinuation of antibiotics, making long-term management of these patients difficult. An additional decision-making factor may be the increasing problems with antibiotic resistance in dog populations.

Also, evidence is accumulating that antibiotic treatment has long-lasting effects on the intestinal microbiome, which may lead to lasting dysbiosis that in itself could amplify intestinal inflammation. Many of these patients will eventually need steroids or other immunosuppressive treatments to control clinical signs.

A response to prednisone has been shown in up to 50% of dogs with chronic enteropathies. Other immunosuppressives can be considered if more severe disease is present or severe side effects of
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Caution
Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

Indications SENTRY® SPECTRUM® (milbemycin oxime/lufenuron/praziquantel) is indicated for the prevention of heartworm disease caused by *C. oncospira* immature, for the prevention and control of two populations (Dirofilaria immitis), and for the treatment and control of adult roundworm (*Toxocara canis, Toxocara cati*), adult hookworm (*Ancylostoma caninum, adult Dipetalonema*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pluralis, Echinococcus multilocularis, Echinococcus granulosus*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Dosage and Administration SENTRY SPECTRUM should be administered orally, once every month, at the minimum dosage of 0.25 mg/kg (0.5 mg/lb) milbemycin oxime, 4.55 mg/kg (10 mg/lb) lufenuron, and 2.28 mg/lb (5 mg/kg) praziquantel. For heartworm prevention, give once monthly for at least 6 months after exposure to mosquitoes.

Precautions
- Dosage and Administration
- Milbemycin Oxime per chewable
- Lufenuron per chewable
- Praziquantel per chewable

To ensure adequate absorption, always administer SENTRY SPECTRUM to dogs immediately after or in conjunction with a normal meal.

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Contraindications
- There are no known contraindications to the use of SENTRY SPECTRUM.

Warnings
- Not for use in humans. Keep this and all drugs out of the reach of children.

Prescriptions
- Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention.

- Prior to administration of SENTRY SPECTRUM, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. SENTRY SPECTRUM is not effective against adult *D. immitis*.

ADML transient hypersensitivity reactions, such as labored breathing, vomiting, hyperventilation, and itching, have been noted in some dogs treated with milbemycin oxime containing a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

- Do not use in puppies less than six weeks of age.
- Do not use in dogs or puppies less than two pounds of body weight.

- The safety of SENTRY SPECTRUM has not been evaluated in dogs used for breeding or in lactating females. Studies have been performed with milbemycin oxime and lufenuron alone.

Adverse Reactions
- The following adverse reactions have been reported in dogs after administration of milbemycin oxime, lufenuron, or praziquantel: vomiting, depression/lethargy, pruritus, urticaria, diarrhea, anorexia, skin congestion, ataxia, convulsions, salivation, and weakness.

- To report suspected adverse drug events, contact Virbac at 1-800-338-3659 or the FDA at 1-800-FDA-VETS.

Information for Owner or Person Treating Animal
- Echinococcosis multilocularis and Echinococcosis granulosus are tapeworms found in wild canids and domestic dogs. *E. multilocularis* and *E. granulosus* can infect humans and cause serious disease (alveolar hydatid disease, cystic hydatid disease, respectively).

- Owners of dogs living in areas where *E. multilocularis* or *E. granulosus* are endemic should be instructed on how to minimize their risk of exposure to these parasites, as well as their dog’s risk of exposure. Although SENTRY SPECTRUM was 100% effective and effective in laboratory studies in dogs against *E. multilocularis* and *E. granulosus*, no studies have been conducted to show that the use of this product will decrease the incidence of alveolar hydatid disease or cystic hydatid disease in humans. Because the prepatent period for *E. multilocularis* may be as short as 28 days, dogs treated at the labeled monthly intervals may become infected and shed eggs between treatments.

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One retrospective study demonstrated that only 26% of dogs with chronic enteropathy progress to complete remission, with intermittent clinical signs remaining in approximately one-half of cases. Furthermore, 4% were completely uncontrolled and 13% were euthanized because of poor response to treatment. This suggests that the prognosis of these patients can be poor.

Finally, the main negative prognostic indicator for chronic enteropathy in dogs has been identified as hypoalbuminemia. More prospective treatment trials are necessary, especially in severely affected and hypoproteinemric animals, to improve long-term survival in these cases. TVP

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steroids are anticipated. In dogs, many steroid-refractory cases can be rescued with cyclosporine single therapy.

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# Inflammatory Bowel Disease in Dogs and Cats

## Learning Objectives
By reading this article, participants will acquire a better knowledge base of the known pathogenesis of, and common clinical signs associated with, inflammatory bowel disease (IBD). Readers will also be able to methodically consider the differential diagnoses and diagnostic testing for chronic enteropathies, recognize when it may be best to refer for additional diagnostics, and establish an appropriate treatment plan.

## Overview
This article provides an overview of the factors involved in canine and feline IBD, including the genetic, immune, environmental, and gastrointestinal interactions, as well as clinical findings, diagnosis, treatment options, and prognosis.

### 1. What is/are the most common cell infiltrate(s) within the lamina propria in IBD?
- a. Macrophages
- b. Eosinophils
- c. Neutrophils
- d. Lymphocytic and plasmacytic

### 2. Boxers and French bulldogs are suspected to have a predisposition for which chronic enteropathy?
- a. Histiocytic ulcerative colitis
- b. Lymphangiectasia
- c. Inflammatory bowel disease
- d. Immunoproliferative enteropathy

### 3. In German shepherds with IBD, there is thought to be single nucleotide polymorphisms in which Toll-like receptor (TLR)?
- a. TLR 3
- b. TLR 4
- c. TLR 8
- d. TLR 9

### 4. The pathogenesis IBD is thought to be multifactorial; suspected etiologies include all of the following except:
- a. Genetics
- b. Dysbiosis
- c. Deficiencies in immune tolerance
- d. Immunosuppressive therapies

### 5. Which biochemical finding in dogs correlates with a negative outcome in IBD?
- a. Elevated alanine aminotransferase
- b. Elevated creatine kinase
- c. Hypokalemia
- d. Hypoalbuminemia

### 6. Deficiency of ________ should always be corrected in IBD patients, as failure to correct the deficiency can delay clinical improvement.
- a. Cobalamin
- b. Magnesium
- c. Calcium
- d. Folate

### 7. Confirmation of a diagnosis of IBD involves which specific diagnostic test?
- a. Complete blood count
- b. Ultrasound with fine needle aspiration
- c. Endoscopy with histopathologic review of biopsy samples
- d. Serum chemistry

### 8. A positive response to a dietary trial with a hydrolysate or novel protein involves improvement within ______ weeks.
- a. 1 to 2
- b. 4 to 6
- c. 8 to 10
- d. 12 to 15

### 9. In dogs with IBD refractory to prednisone therapy, which rescue immunosuppressive therapy has shown some proven beneficial response?
- a. Leflunomide
- b. Chlorambucil, single-drug therapy
- c. Azathioprine, single-drug therapy
- d. Cyclosporine

### 10. In cats, which combination of medications has shown successful control of IBD?
- a. Prednisone and cyclosporine
- b. Prednisolone and chlorambucil
- c. Prednisolone and mycophenolate
- d. Prednisolone and cyclosporine

## Note
Questions online may differ from those here; answers are available once CE test is taken at vetfolio.com/journal-ce. Tests are valid for 2 years from date of approval.
Indication: CYTOPOINT® aids in the reduction of clinical signs associated with atopic dermatitis in dogs.

Repeat administration every 4 to 8 weeks, as needed, in individual patients.¹


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