INFLAMMATION

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Gastric disease is typically the result of inflammation, ulceration, neoplasia, or obstruction. Clinical manifestations include vomiting, hematemesis, melena, retching, belching, hypersalivation, abdominal distention, abdominal pain, and weight loss. The clinical approach is guided by considering gastric disease as a group of clinical syndromes that segregate on the basis of etiology, pathology, and clinical presentation (Table 56-3).[1]

A large and varied group of gastric and nongastric disorders can cause similar clinical signs, so a systematic approach is essential to determine the cause. The diagnostic approach focuses initially on historical and physical findings, with clinicopathologic testing and diagnostic imaging used in patients with systemic involvement or chronic signs. This section focuses on etiopathogenesis, diagnosis, and treatment of acute and chronic gastritis.

Acute Gastritis

Etiology

Acute gastritis is the term applied to the syndrome of vomiting of sudden onset suspected to be associated with gastric mucosal insult or inflammation (Box 56-2). In most patients the cause is inferred from the history (e.g., dietary indiscretion), the diagnosis is rarely confirmed by biopsy, and treatment is more symptomatic and supportive than disease specific. Animals with acute gastritis associated with drug toxicity, foreign-body ingestion, or metabolic disorders frequently present with hematemesis, melena, concurrent diarrhea, or other signs of systemic illness and require a more thorough diagnostic approach to determine the cause and to provide optimal care. There is little evidence in the literature to suggest that viral infections such as parvovirus, distemper, or infectious canine hepatitis, have a role in acute gastritis.

Table 56-3 Diseases of the Stomach

Clinical Syndrome	Predominant Features
Acute gastritis	Sudden onset of vomiting
Ulceration or erosion	Vomiting, hematemesis, melena, ± anemia
Gastric dilation volvulus	Nonproductive retching, abdominal distention, tachycardia
Chronic gastritis	Chronic vomiting of food or bile
Delayed gastric emptying	Acute to chronic vomiting more than 8 to 10 hours after feeding
Neoplasia	Chronic vomiting, weight loss, ± anemia

Box 56-2 Causes of Acute Gastritis

- Dietary indiscretion or intolerance (nonallergic and allergic)
- Foreign bodies (e.g., bones, toys, hairballs)
- Drugs and toxins (e.g., antibiotics, digoxin, nonsteroidal antiinflammatory drugs, corticosteroids, heavy metals, plants, cleaners, bleach, dietary contaminants)
- Systemic disease (e.g., hypoadrenocorticism, uremia, liver disease)
- Parasites (e.g., *Ollulanus, Physaloptera* spp.)
- Bacteria (e.g., bacterial toxins, *Helicobacter*)
- Viruses

Clinical Examination

Vomiting of sudden onset is the principal clinical sign of acute gastritis. In some instances it is accompanied by hematemesis or melena and a variable degree of systemic involvement. The history may reveal access to garbage, toxins, medications, foreign bodies or ingestion of spoiled food. Signs of toxicity may be evident, such as jaundice and pallor with zinc ingestion, salivation or defecation with organophosphate toxicity or mushroom ingestion, and hypersalivation and oral ulceration with chemical ingestion.

Diagnosis

A diagnosis of acute gastritis is usually based on clinical findings and the response to symptomatic treatment. A specific diagnosis may be sought if the patient has access to foreign objects or toxins, is systemically ill, or has hematemesis, melena, and vomiting that fails to respond to symptomatic therapy, or other signs of more serious disease.

Laboratory testing in most animals with primary acute gastritis reflects mild dehydration and is often not performed in the absence of a suspicion of more serious disease. Abdominal radiographs can be taken to detect foreign objects or GI obstruction. Further diagnostics, such as ultrasonography and endoscopy, are rarely indicated, and most animals with simple gastritis respond to symptomatic therapy and "tincture of time."

Treatment

Therapy for uncomplicated acute gastritis is an empirical combination of symptomatic and supportive agents such as fluids, dietary restriction and modification, mucosal protectants or adsorbents, and possibly antacids.[2,3]

Fluid Therapy

Small amounts of oral fluids, little and often, can be given in the face of vomiting, with the volume increasing and frequency decreasing as vomiting subsides. Subcutaneous administration of an isotonic balanced electrolyte solution may be sufficient to correct mild fluid deficits (<5%), but is insufficient for patients with moderate to severe dehydration. Patients requiring intravenous fluids should undergo a more extensive diagnostic evaluation. Chapter 48 has more detailed information on fluid therapy.

Dietary Restriction and Modification

Where vomiting is acute, oral intake is typically discontinued for 24 hours. However, a liquid diet can be offered in the face of vomiting to maintain GI barrier function.[4] This can be transitioned to a homemade, nonspicy, fat-restricted, bland diet (e.g., boiled chicken and rice, low-fat cottage cheese and rice [1:3]) or a commercial fat-restricted, rice-based diet that is fed little and often. After a week or so, the normal diet can be reintroduced gradually.

Protectants and Adsorbents

Bismuth subsalicylate, kaolin-pectin, activated charcoal and magnesium, and aluminum- and barium-containing products are often administered in acute vomiting or diarrhea to bind bacteria and their toxins and to coat the GI mucosa. These agents are probably safer and more efficacious than antibiotics or motility modifiers in acute gastroenteritis. Pepto-Bismol (1 mL/5 kg PO TID), bismuth subcitrate, kaolin pectin (1 to 2 mL/kg PO TID), and sucralfate (0.25 to 1 g PO TID) are often employed although evidence-based

data in support of their usage is still incomplete. Acid-reducing drugs such as H_2-receptor antagonists can be administered, but are usually reserved for patients with signs of gastric erosion or ulceration (e.g., melena or hematemesis) or persistent gastritis as described below.

Antiemetic agents may be used in patients with acute gastritis but spontaneous resolution may take place without them. Chapters 23 and 35 provides more detailed information about the use of antiemetic agents.

Prognosis

The prognosis for complete recovery for uncomplicated acute gastritis is usually good to excellent.

Chronic Gastritis

Etiology

The diagnosis of chronic gastritis is currently based on the histologic examination of gastric biopsies and is subclassified according to histopathologic changes and etiology. Histopathologic evidence of gastritis is a common finding in dogs, with 35% of dogs investigated for chronic vomiting and 26% to 48% of asymptomatic dogs affected.[5,6] The prevalence in cats has not been determined.

Gastritis in dogs and cats is usually categorized according to the nature of the predominant cellular infiltrate (e.g., eosinophilic, lymphocytic, plasmacytic, granulomatous, lymphoid follicular), the presence of architectural abnormalities (e.g., atrophy, hypertrophy, fibrosis, edema, ulceration, metaplasia), and their subjective severity (e.g., mild, moderate, severe). A standardized visual grading scheme has been proposed by Happonen et al.[6] and has been adapted for pathologists.[7]

It should be noted that even with standardized grading schemes there is often poor agreement between pathologists.[7,8] Gastritis in dogs and cats is most commonly described as mild to moderate superficial lymphoplasmacytic gastritis, with or without concomitant lymphoid follicle hyperplasia. Eosinophilic, granulomatous, atrophic, and hyperplastic gastritis are less commonly reported.

Pathophysiology

Despite the high prevalence of gastritis in the companion animal population an underlying cause is rarely identified. In the absence of systemic disease, ulcerogenic or irritant drugs, gastric foreign objects, parasites (*Physaloptera* and *Ollulanus* spp.), and in rare instances fungal infections (*Pythium insidiosum*, *Histoplasma* spp.), chronic gastritis is usually attributed to dietary intolerance or allergy, occult parasitism, *Helicobacter* infection, or unknown pathogens. Treatment is often used to further define the cause of gastritis (e.g., diet responsive, antibiotic responsive, steroid responsive, or parasitic).

Although the basis of the immunologic response in canine and feline gastritis is unknown, recent studies have shed light on the immunologic environment in the GI tract and reveal a complex interplay between the microflora, epithelium, immune effector cells such as lymphocytes and macrophages, and soluble mediators such as chemokines and cytokines.[9-14] In health, this system avoids active inflammation by antigen exclusion and the induction of immune tolerance. The development of intestinal inflammation in mice lacking interleukin (IL)-10, transforming growth factor (TGF)-β, or IL-2 indicates the central importance of cytokines in damping-down mucosal inflammation. In many of these murine models, GI inflammation only develops in the presence of endogenous intestinal microflora, leading to the hypothesis that spontaneous mucosal inflammation may be the result of a loss of tolerance to this microflora. The role of these mechanisms in outbred species such as the dog and cat remains to be determined, but clearly loss of tolerance to bacterial or dietary antigens should be considered.

The epithelial cell is also emerging as a central coordinator in the inflammatory response. Epithelial cells are involved in sensing luminal constituents (e.g., bacteria) through pattern recognition receptors (also known as Toll-like receptors) and coordinating the inflammatory response. Gram-negative or pathogenic bacteria can induce proinflammatory cytokine secretion (e.g., IL-8, IL-1β) by epithelial cells, whereas "commensals" or bacteria such as *Streptococcus faecium* or *Lactobacillus* spp. induce the production of the immunomodulatory cytokines TGF-β or IL-10.[10] The proinflammatory cytokines produced by epithelial cells are modulated by the production of IL-10 from macrophages and potentially by the epithelial cells themselves.[15] In this context, dogs with lymphoplasmacytic gastritis of undetermined etiology show a correlation between the expression of the immunomodulatory cytokine IL-10 and proinflammatory cytokines (interferon [IFN]-γ, IL-1β, IL-8).[7] Mucosal pathology is related to cytokine messenger RNA (mRNA) expression (e.g., neutrophil infiltration in response to IL-8 and IFN-γ; macrophage and lymphocyte infiltration to IFN-γ; and fibrosis to IL-1β).

Histologic severity of lymphoplasmacytic gastritis in dogs correlates with atrophy, infiltration with lymphocytes and macrophages, and expression of IL-10 and IFN-γ.[7] Simultaneous expression of IL-10 and IFN-γ mRNA has also been observed in the intestines of Beagle dogs (lamina propria cells and the intestinal epithelium) in the face of a luminal bacterial flora that was more numerous than that of control dogs.[16] Thus it is tempting to visualize a "homeostatic loop" consisting of proinflammatory stimuli and responses, countered by immunomodulation and repair, with an imbalance in either of these arms manifest as gastritis.

Clinical Findings

The major clinical sign of chronic gastritis is vomiting of food or bile. Other clinical signs, like decreased appetite, weight loss, melena, and hematemesis, are variably encountered. The concurrent presence of dermatologic and GI signs raises the possibility of dietary intolerance.[17] Access to toxins, medications, foreign bodies, and dietary practices (including nutraceuticals) should be thoroughly reviewed. The signalment should not be overlooked as certain syndromes are breed restricted. Hypertrophy of the fundic mucosa is frequently associated with a severe enteropathy in basenjis[18] and stomatocytosis, hemolytic anemia, icterus, and polyneuropathy have not been noted in the Drentse Patrijshond.[19] Hypertrophy of the pyloric mucosa is observed in small brachycephalic dogs such as the Lhasa Apso and is associated with gastric outflow obstruction.[20,21] Atrophy of the gastric mucosa that may progress to adenocarcinoma has been reported in Lundehunds with protein-losing gastroenteropathy.[22,23]

Young, large-breed, male dogs in the Gulf States of the United States may have granulomatous gastritis caused by *Pythium* spp. with infection more prevalent in fall, winter, and spring.[24] Physical examination is often unremarkable. Abdominal distention may be related to delayed gastric emptying caused by obstruction or defective peristalsis. Abdominal masses, lymphadenopathy, or ocular changes may be encountered in dogs with gastric fungal or algae infections.

Diagnosis

A serum biochemical profile, complete blood count, urinalysis, and measurement of T_4 concentration (in cats >5 years old) should be performed as a basic screen for metabolic, endocrine, infectious, and other non-GI causes of vomiting, as well as the acid–base and