Pancreatitis is common among cats, although its exact incidence is unknown. The disease can take several forms—acute, chronic (FIGURE 1), and acute on chronic (an episode of acute pancreatitis in a patient with chronic pancreatitis)—and differentiating among the forms clinically and making an antemortem diagnosis in cats remain challenging. According to one study, the prevalence of pancreatitis in cats that had died or had been euthanized for a variety of reasons was more than 50%. This article focuses on the management of chronic pancreatitis in cats: minimizing risk factors, nutritional management, treating symptoms, treating concurrent conditions, identifying and treating autoimmune components, and monitoring.

RISK REDUCTION

Although the underlying cause of chronic pancreatitis in cats often cannot be determined, possible risk factors should be eliminated. In our experience, factors that have been associated with the development of chronic pancreatitis in cats include high-fat diets, infections (i.e., feline parvovirus, Toxoplasma gondii, feline calicivirus, feline herpesvirus, and feline coronavirus), hypercalcemia, some drugs, and potentially autoimmune disease. However, most cases are idiopathic. Thus, as a first step, we recommend the following (depending on the patient): consider a diet change; test for specific infectious diseases, if suspected; identify and treat the underlying causes of hypercalcemia, if present; take a thorough drug history and discontinue any nonessential drugs or replace essential drugs with alternative medications, if possible; and consider immunosuppressants for autoimmune disease, if suspected.
NUTRITIONAL MANAGEMENT
By the time cats with chronic pancreatitis are taken to the veterinarian, most have already been hyporexic or anorexic for days to weeks.\(^1\) Prolonged undernutrition in cats can lead to weight loss or even hepatic lipidosis.

Although appetite stimulants may encourage food intake in hyporexic cats, they rarely result in attainment of caloric requirements. The only Food and Drug Administration (FDA)-approved drug that can be used as an appetite stimulant in cats is mirtazapine transdermal ointment (2 mg/cat, applied daily for 14 days) (FIGURE 2), although the drug has actually been approved for management of undesired weight loss. However, take caution when administering appetite stimulants to cats with hepatic lipidosis.\(^3\) Another drug, capromorelin (a ghrelin-receptor agonist) has been FDA-approved as an appetite stimulant for use in dogs. Also, initial studies have shown that its daily administration was well tolerated by healthy laboratory cats; mild side effects (e.g., vomiting, hypersalivation, lethargy, head shaking, and lip smacking) were associated with its administration.\(^4\) Further studies are needed before the routine use of this drug in cats can be recommended.

In contrast to its effect in dogs, the effect of dietary fat content on pancreatitis in cats is still controversial. However, anecdotal evidence suggests that chronic pancreatitis does develop in some cats that are fed high-fat diets (e.g., diets for the management of chronic kidney disease or low-carbohydrate diets). Thus, if a cat with chronic pancreatitis is being fed a high-fat diet, the cat should be transitioned to a lower-fat diet. However, commercial ultra–low-fat diets are not available for cats and are probably unnecessary for this species.

To prevent food aversion in cats, forced oral feeding is strongly discouraged. For cats with chronic pancreatitis that do not consume adequate amounts of food despite antinausea therapy and appetite stimulants, consider tube feeding. For short-term caloric support, a nasogastric tube (5- to 8-French flexible polyurethane feeding tube) can be placed. However, these tubes can be very disturbing to cats, who are obligate nasal breathers, and an Elizabethan collar will probably be needed to keep the cat from removing the tube. Persistently anorexic patients who need longer periods of supplemental nutrition may do better with an esophageal or gastric tube. These tubes also facilitate administration of oral medications, which can be challenging in any cat. The initial goal of nutritional management is to provide 25% to 50% of target caloric intake. Over the next 2 to 4 days, gradually increase the volume to reach the target caloric intake.

The selection of diet should take into account concurrent conditions. Cats with secondary hepatic lipidosis require a high-protein (30% to 40% of metabolizable energy, while taking caution not to feed excessive amounts of fat), calorie-dense diet. Cats with concurrent inflammatory bowel disease (IBD) may benefit from a novel or hydrolyzed protein diet.

SYMPTOMATIC THERAPY
Antiemetic/Antinausea Drugs
Although not all cats with pancreatitis vomit, it is suspected that they often experience nausea. Cats >4 months of age can be given maropitant at 1 mg/kg SC or PO q24h. Maropitant is a neurokinin-1 receptor antagonist. By the time cats with chronic pancreatitis are taken to the veterinarian, most have already been hyporexic or anorexic for days to weeks.\(^1\)
antagonist that has both central and peripheral effects. It has been speculated that maropitant may provide analgesia through inhibition of visceral neurokinin-1 receptors. There is evidence that ondansetron (a serotonin [5-HT₃] antagonist) has poor oral bioavailability and a short half-life; therefore, the preferred route of administration for this drug may be subcutaneous. Another 5-HT₃ antagonist that can be given either subcutaneously or orally and may decrease nausea, and in turn increase appetite, is dolasetron.

Chronic pancreatitis can be associated with concurrent cholangitis and IBD, sometimes referred to as triaditis.

Pain Management
Cats are extremely good at hiding pain. Cats with chronic pancreatitis rarely display signs of abdominal pain.1 Outpatient analgesia can be provided by buprenorphine at 0.01 to 0.03 mg/kg sublingually q4h to q12h or butorphanol at 0.5 to 1.0 mg/kg PO q6h to q8h. For more severe pain, the only feasible modality is a transdermal fentanyl patch q72h to q120h (12 µg/hour for small cats and 25 µg/hour for large cats).6 For cats with chronic pancreatitis, nonsteroidal anti-inflammatory drugs are contraindicated because of the risk for nephrotoxicity, gastroduodenal erosion and ulceration, and because they are considered risk factors for pancreatitis in humans.

Antimicrobial Drugs
Chronic pancreatitis in cats is usually sterile.2 One study suggested that bacterial DNA was present in pancreatic biopsy samples from cats with pancreatitis, but it is unclear whether these findings have any clinical relevance.2 Therefore, antimicrobial therapy is rarely indicated unless patients have evidence of a concurrent bacterial infection (i.e., septic fluid within the pancreas [sometimes referred to as a pancreatic abscess], neutrophilic cholangitis, or severe neutropenia).

Gastrointestinal Protectants
Gastrointestinal protectants (e.g., H₂ antagonists, proton-pump inhibitors, or sucralfate) are sometimes given to cats with chronic pancreatitis, but they are rarely, if ever, indicated. Even in cats with severe acute pancreatitis, gastric ulceration is extremely rare. Gastroprotectants may dramatically shift the gastrointestinal microbiota, which may have detrimental effects on the patient.

CONCURRENT CONDITIONS
Diagnosis and management of concurrent conditions are paramount for the care of cats with chronic pancreatitis. Chronic pancreatitis can be associated with concurrent cholangitis and IBD, sometimes referred to as triaditis.8 According to one prospective study of cats, concurrent pancreatic, hepatic, and/or intestinal inflammation was more common (27/47) than isolated pancreatic inflammation (1/47).7 Also, chronic pancreatitis is often associated with diabetes mellitus. However, some evidence also indicates that hyperglycemia may lead to pancreatic inflammation in cats.10

Cholangitis
Cholangitis is a common liver disease in cats and can take on several forms: neutrophilic, lymphocytic, mixed, or liver fluke associated. Studies have led to different conclusions about the prevalence of each form of cholangitis, resulting in discrepancies regarding which is most common.9,11 Because the clinical presentations of cats with these different forms may be similar, it is important to determine which kind of cholangitis is present before instituting treatment.

The most common route for development of neutrophilic cholangitis is thought to be an enteric bacterial infection ascending via the biliary tree. Cytology and bacterial culture (aerobic and anaerobic) and sensitivity testing should be performed on bile and/or liver biopsy samples.12 If neither of these samples can be safely obtained, culture can be attempted from a fine-needle aspirate of the liver or gall bladder. If infection is established, antibiotics should be administered. Antibiotics can be selected before culture susceptibility results are available; appropriate choices for gram-positive and gram-negative aerobes and anaerobes include fluoroquinolones, penicillin and metronidazole, or a fluoroquinolone and a potentiated penicillin.12-14 Given the difficulty of achieving adequate concentrations of the antibiotic in hepatic
and biliary tissue, prolonged courses of treatment are recommended. Although duration of treatment should be guided by follow-up sampling, collecting the samples can be risky and costly. If no culture and sensitivity testing can be obtained, empiric antibiotic therapy for 4 to 6 weeks is suggested.\(^{13}\)

Lymphocytic cholangitis is thought to be immune mediated. Given this assumption, treatment usually involves the administration of prednisolone (1 to 2 mg/kg q12h starting dose).\(^{13}\) However, prednisolone should not be initiated until active bacterial infections have been ruled out or treated with empiric administration of antibiotics.\(^{6}\)

**Inflammatory Bowel Disease**

Cats with pancreatitis often have concurrent inflammatory infiltrates (e.g., lymphocytes, plasma cells) of the intestines.\(^{9}\) With better understanding of chronic enteropathies in cats, therapeutic options have become more refined. Most of these cats will respond to dietary therapy (e.g., food-responsive enteropathy); some may respond to modification of the intestinal microbiota (suggesting an underlying dysbiosis), but others may require immunosuppressive therapy (i.e., they have idiopathic IBD).\(^{16}\) Many cats with idiopathic IBD are deficient in cobalamin and require oral or parenteral supplementation with cyanocobalamin.

**Diabetes Mellitus**

Many cats with chronic pancreatitis have concurrent diabetes mellitus. Some of these cats are undergoing dietary management with a low-carbohydrate diet. We believe that these patients may benefit from being switched to a diet with a lower fat content.

**IMMUNOSUPPRESSIVE THERAPY**

Although immune-mediated chronic pancreatitis is well described for humans, it has not been definitively proven whether this condition occurs in cats. Anecdotally, however, cats with chronic pancreatitis may respond to treatment with prednisolone (the dosing varies, but we use 2 mg/kg q12h for 10 days, then 1 mg/kg q12h for 6 weeks, followed by a decreasing dose at 6-week intervals) or cyclosporine (5 mg/kg q12h to q24h for 6 weeks followed by a decreasing dose at 6-week intervals). To determine whether treatment is effective, re-evaluate the patient after the first 2 to 3 weeks of therapy. Therapeutic trials are under way to study the efficacy of these drugs in cats with chronic pancreatitis (vetmed.tamu.edu/gilab/research/feline-chronic-pancreatitis).

**MONITORING**

With appropriate management and symptomatic care, cats with pancreatitis should show clinical improvement (e.g., increased activity, appetite, and body condition score). It is imperative to educate clients about the potential long-term sequelae of chronic pancreatitis, such as diabetes mellitus, exocrine pancreatic insufficiency, or acute exacerbation of this chronic disease. The management of cats with concurrent chronic pancreatitis and diabetes mellitus is more complex.

Long-term follow-up of cats with pancreatitis is indicated. Based on clinical experience, we recommend monitoring feline pancreatic lipase (fPL) immunoreactivity (fPLI), as measured by a Spec fPL test (IDEXX Laboratories Inc., idexx.com) every 2 to 3 weeks until the level reaches a plateau, at which point the monitoring interval can be decreased. Although the goal of management is amelioration of clinical signs and normalization of the spec fPL concentration, some cats will improve clinically but maintain a mildly increased spec fPL serum concentration.

**CONCLUSIONS**

Chronic pancreatitis is a common, yet complex, disease in cats, and its management is nonspecific and multifaceted. The successful management of these patients involves management of risk factors (switching to a diet with a lower fat content, addressing hypercalcemia, minimizing exposure to unnecessary drugs), managing nutrition, symptomatic care (antinausea and analgesic therapy), diagnosing and managing concurrent conditions, administering immunosuppressive drugs, and monitoring fPLI concentration. \textit{TVP}

**References**
