RECENT ADVANCES IN DIAGNOSIS AND MANAGEMENT OF CHRONIC GASTROENTEROPATHIES IN DOGS

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[Received: 28.11.2017; Accepted: 29.5.2018]

Chronic gastrointestinal disorders in dogs are characterized by mucosal inflammation and usually manifested as persistent vomiting and diarrhoea (more than 3 weeks duration), weight loss, debility and death. Potential caus -es of chronic vomiting and diarrhoea in dogs are Inflammatory bowel disease (IBD), dietar -y indiscretion, foreign body, toxin ingestion, food allergy, non-steroidal anti-inflammatory drug usage, metabolic diseases (renal and hep -atobiliary disease), gastrointestinal infections (viral, bacterial, protozoal, fungal and helmint h) and neoplastic conditions (Leib *et al*.,2010)

Most of these chronic gastrointestinal cond -itions are grouped under canine idiopathic in -flammatory bowel disease (IBD) charecteriz- ed by persistent or recurrent clinical signs of vomiting and/or diarrhoea along with histolo- gical evidence of inflammation in the lamina propria of small intestine, large intestine or both. These diseases are classified according to the predominant type of inflammatory cell present (CD4+/CD8+/CD3+T-lymphocytes/ eosinophils/plasma cells/macrophages/neutro- phils) in the intestinal biopsy (German *et al.,* 2003). Increased numbers of lymphocytes and plasma cells have been noted in lymphoplasm acytic enteritis which is the most frequent fro -m of IBD with a prevalence of 56.2 percent (Kawano *et al*., 2016, Simpson and Jergens, 2011).

Dogs rarely suffer from enteropathies cha -racterized by neutrophilic or granulomatous inflammation. They may either occur due to bacterial infections, as with *E coli* in granulo- matous colitis (GC) in boxers, Campylobacter Streptococcus, Yersinia, and Mycobacteri, or with fungi such as Histoplasma or algae like Prototheca infections. Eosinophilic enteri tis is characterized by excessive accumulation of eosinophils in the lamina propria and linked to an immunologic reaction to parasites or diet (Kleinschmidt *et al.,* 2007). The disease may also involve other areas of the GI tract. The primary clinical signs are chronic small bowel diarrhea along with vomiting or weight loss. In some cases, large bowel signs or vomiting predominate. Physical findings range from normal to focally or diffusely thickened intestines and marked weight loss.

Intestinal lymphangiectasia is differentiated by unusual distention of lymphatic vessels wit- hin the mucosa associated with exudation of protein-rich lymph into the intestine and sever- e malabsorption of long-chain fats. Mostly it occurs as a consequence of a localized or gene -ralized lymphatic abnormality or an increased portal pressure in right-sided heart failure, cav- al obstruction or hepatic disease or tumor infilt -ration of lymphatics or lymph nodes.Lipogran -ulomatous inflammation due to lymphatic abn ormalities may be seen as small white granules on the intestinal mesentery. In some cases, a generalized lymphatic abnormality may be app -arent on lymphangiography. Crypt cysts and abscesses may also be observed in intestinal bi opsies. Breeds commonly at risk are Yorkshire terrier, Soft coated wheaten terrier (SCWT) an d Norwegian Lundehund supporting a familial cause in some dogs (Craven *et al.,* 2009). Clini -cal signs occur as a result of intestinal loss of protein and range from weight loss to chronic diarrhea, vomiting, ascites, edema, and chylothorax.

The relationship between Helicobacter spp. infection and chronic gastritis in dogs and cats has always been an issue of debate. American College of Veterinary Internal Medicine (ACV IM) also concluded recently that Helicobacter spp. are very common in healthy as well as sic -k dogs and cats, Secondly, no direct relations- hip among Helicobacter spp. gastritis, and clin -ical signs has been established, Thirdly Helic- obacter gastritis varies in its severity and differentiated by a lymphoplasmacytic

infiltrate in the lamina propria, lymphoid follicular hyperplasia and Helicobacter organisms colonized within gastric glands.

Mucosal immunity and Intestinal microbiota: The intestinal immune system is constantly exposed to a wide array of antigens, including those derived from food, component -s of the endogenous microbial flora and patho -genic organisms. A balance between nature of the antigenic stimulus and protective responses against these pathogens should be maintained. If this delicate balance is interrupted, a state of chronic uncontrolled inflammation may ensue (German *et al.,* 2003). In human beings, Crohn disease has been linked to defects in innate immunity. This leads to upregulated mucosal cytokine production and delayed bacterial clearan -ce in presence of enteric microflora thus prom oting and perpetuating intestinal inflammation. Similar interaction of host susceptibility and miicroflora in dogs has been observed in Boxers and German shepherds. Similarly in granulomatous colitis in boxers, remission relates with eradication of mucosally invasive *Escher -richia coli* which have novel adherent and invasive pathotype associated with Crohn disease. The interaction of genetics and diet is supported by gluten sensitive enteropathy in Iris -h setters which is an autosomal recessive trait. A similar adverse reaction to food has been de -scribed in soft coated wheaten terriers (SCW-T) affected with protein losing enteropathy and protein losing nephropathy. Autoantibodies to pronuclear antineutrophil cytoplasmic antibodies associated with ulcerative colitis in humans has also been demonstrated in SCWT.

A balanced microbial ecosystem is of crucial importance for host health. It provides stimu -li for the immune system, helps in the defense against enteropathogens and provides nutrition -al benefits. Altered epithelial architecture in a germ-free (gnotobiotic) mice shows that the pr -esence of bacteria is also important for proper development of gut structure. The intestinal tracts of dogs and cats harbor a highly complex microbiota, which consists of bacteria, fungi, viruses and protozoa. Traditionally, bacterial culture was commonly used to identify bacteria present in the gastrointestinal tract, but now standard plating techniques are used which have enough resolution for identification of the mostly anaerobic bacteria that reside within the gut. Though, molecular methods are now established for assessing intestinal dysbiosis in dogs and cats with gastrointestinal disease, but not yet routinely used. The loss of normal com -mensal bacterial microbiota (i.e. Lachnosprac -eae, Ruminococcaceae, and *Faecalibacterium* spp.) in acute and chronic intestinal diseases has been linked to metabolic changes, for example alterations in immunomodulatory bacteri -al metabolites, such as short chain fatty acids and secondary bile acids. The interactions between intestinal bacteria and the host immune system are mediated either via direct contact between bacteria and the innate immune syste m (e.g. toll-like receptors, NOD2 receptors) or through microbial metabolites. These metaboli -tes can be produced directly by bacteria (e.g. vitamins, SCFA) or are primary host metabolit -es that are converted through bacterial enzym -es into secondary metabolites (e.g. conversion of primary to secondary bile acids). The impor tance of this intestinal dysbiosis helps in better understanding of pathophysiology of gastrointestinal diseases. Though gut /intestinal bacteria are implicated frequently as a pivotal factor in the development of IBD in humans and animals, the specific bacterial characteristics that drive the inflammatory response haveremained elusive. Eradication of the invasive E coli in Boxer dogs with GC correlates with remission from disease, inferring a causal relationship (Craven *et al.,* 2010). Studies have shown that intestinal inflammation is associated with a shi -ft in the microbiome from gram-positive Firm -icutes (eg, Clostridiales) to gram-negative bac -teria, predominantly Proteobacteria, including Enterobacteriaceae (Janeczko *et al.,* 2008). Du -odenal inflammation and clinical signs in cats with signs of GI disease have been associated with mucosa-associated Enterobacteriaceae. Similarly a complex and variable dysbiosis has been found in dogs with tylosin-responsive enteroapthy (Suchodolski *et al.,* 2009).

Diagnosis: Diagnosis is always challenging in these disorders because, the veterinarian needs to eliminate other systemic infection, foreign body or obstruction, intussusception, tumor, poisoning, exocrine pancreatic insufficiency (EPI), hypoadrenocorticism, chronic liver dise -ase. A diagnosis of chronic gastroenteropathy

(CGE) usually involves careful incorporation of signalment, environment, history, physical examination, clinicopathologic testing, diagnostic imaging, intestinal biopsy and histopathology. Dogs with CGE are typically presented with signs of diarrhea or vomiting, weight loss and debility. The primary approach to persistent diarrhea or vomiting is depends upon its nat -ure and severity and specific or localized clini -cal signs. The clinical signs help in localizing the possible cause and region of gut involved. Tenesmus and dyschezia is common in large bowel disease, melena in upper GI bleeding or ulceration, difficulty breathing if there is abdominal distention and peripheral edema if there is protein losing enteropathy. In diarrhea cases increased frequency and small volume of feces containing mucus and blood, dyschezia, tenasmus are characteristics of large bowel disease, whereas large volume of diarrhea, weight loss, and possible vomiting occur as a consequence of small intestinal disease or exocrine pancreatic insufficiency. Abdominal pain, dehydration frequent vomiting, or localized findings are usually present in case of abdominal mass and must be taken ahead of systematic workup for chronic diarrhea. In diarrhea patients with no obvious cause, a systematic approach should be followed after localization of diarrhea to the small or large bowel. Patients with signs of large and small bowel involvement are usually evaluated for diffuse GI disease. After exclusion of infectious and parasitic agents, non-GI disorders, exocrine pancreatic insufficiency, and intestinal structural abnormalities requiring surgery, the most common groups of intestinal diseases associated with chronic small bow el diarrhea are idiopathic IBD, diet-responsive enteropathy, antibiotic-responsive enteropathy, and lymphangiectasia.

The approach to these patients is based on severity of the clinical signs of recurrent severe diarrhea, too much weight loss, decreased appetite or activity along with low serum albumin or cobalamin, mesenteric lymphadenopath -y and intestinal thickening. Intestinal biopsy is required in these patients with these abnorm -alities to pinpoint the accurate cause (lymphangiectasia, lymphoma) and to initiate therapy.

Severity of intestinal disease can be measured by determining canine IBD activity index (CIBDAI) by assessing attitude, activity, appetite, vomiting, stool consistency, stool frequency, weight loss in these patients (Jergens *et al.,* 2003). A corresponding systemic inflammatory response has also been observed in relation to CIBDAI score attributed by rise in serum C-reactive protein (CRP) levels which may be useful to determine the response to treatment.

Low serum albumin and low serum cobalamin concentration (<200 ng/L) is associated with a poor prognosis in dogs with chronic enteropathy (Allenspach *et al.,* 2007). Hemostatic function of the patient should be evaluated to ascertain hypo/hypercoagulability as a consequence of enteric protein loss.

Measurement of serum cobalamin and folate levels can help in determining the necessity for intestinal biopsy and localizing the site of intes -tinal disease (cobalamin is absorbed in the ileum) in chronic diarrhea patients which are stab -le and have good attitude, appetite, mild weig -ht loss, normal serum proteins, no intestinal thickening, or lymphadenopathy and in those with undefined weight loss and determine the need for cobalamin supplementation, and estab -lish a prognosis. In stable diarrhea patients with normal serum cobalamin levels, the empirical treatment trials using diet may be tried followed by antibiotics in case no response to diet. In case empirical therapy fails or there is worsening of signs, endoscopy and intestinal biopsy is the only option. Some studies also recommend endoscopic evaluation followed by intestinal biopsy rather than empirical treatment in patients with chronic diarrhea and subnormal serum cobalamin levels.

Villous morphology, lymphatic dilatation, goblet cell mucus content, and crypt lesions are common mucosal architectural changes related to the presence and severity of GI disease. In cats with signs of GI disease, villus atrophy and fusion correlate with the severity of clinical signs and degree of proinflammator -y cytokine upregulation in the duodenal mucosa (Janeczko *et al.,* 2008). Similarly, architectural changes in the gastric mucosa also correlate with cytokine upregulation in dogs with lymphocytic gastritis (Wiinberg *et al*., 2005). Loss of mucus and goblet cells in the colon has been encountered in dogs in

granulomaous colitis (GC) and also correlated with severity of lymphoplasmacytic colitis (van der Gaag, 1988). In protein-losing entro-pathies, dilation of lymphatics and the presenc -e of crypt abscesses and cysts are most freque -ntly observed and are often accompanied by lymphoplasmacytic inflammation of varying severity (Craven *et al*., 2004)..

Intestinal biopsies can be taken using endoscopy or by exploratory laprotomy. Diagnostic endoscopy is useful in patients with intestinal masses, anatomic or structural disease, perforation to visually examine the esophageal, gastric, and intestinal mucosa and to procure biopsy samples. The endoscopic appearance of the small intestine correlates better with prognosis than the histopathologic appearance in some cases. In suspicion of ileal involvement (low cobalamin levels) on ultrasound examination, transcolonic ileoscopy is performed in addition to the gastroduedenoscopy. Two important factors affecting histopathologic evaluation are operator experience and quality and number of biopsy samples. Surgical biopsy is usually favored in suspicion of submucosa or muscularis involvement or when endoscopic biopsy findings do not able to diagnose or pinpoint the exact clinical picture.

The most common causes of chronic diarrhea in dogs diagnosed with histopathology are IBD, lymphoma and lymphangiectasia. Histopathology of intestines in dogs most commonly indicates increased cellularity of the lamina propria and is usually referred to as IBD. The inflammation varies from focal to diffuse involvement of the small and large intestines. There is variable kind and degree of cellular accumulation which is subjectively categorized as normal, mild, moderate, or severe. The cellularity has been found rather more suitable due to their correlation with proinflammatory cytokines and clinical severity of disease though the abnormalities in mucosal architecture are also important (Wiinberg *et al.,* 2005). Histopathological changes are a common end point for diagnosis of various diseases.

Cellular Infiltrates decide about the probable etiology of CGE. Infectious process is commonly suspected in case of intestinal infiltration with macrophages or neutrophils and indicates the need of culture, special staining, and FISH (German *et al*., 2003). Moderate to large number of eosinophils in intestinal biopsy analysis suggests possible dietary intolerance or parasitic infestation and frequently accompanied by circulating eosinophils (Kleinschmidt *et al.,* 2007). Lymphoplasmacytic enteritis, the most frequen -tly reported form of IBD is represented by inc -reased numbers of lymphocytes and plasma cells and often expressed in association with a protein-losing enteropathy (Peterson and Willa -rd, 2003). Basenji, Lundehund, and Shar-Pei breeds are mostly predisposed. The term lymp-hoplasmacytic enteritis becomes irrelevant sometimes particularly in the small intestine because cats with and without signs of intestin -al disease have similar numbers of lymphocyt -tes and plasma cells and dogs have similar numbers of duodenal CD3-positive T cells before and after clinical remission induced by diet or steroids(Schreiner *et al.,* 2008).

Helicobacter spp., *H pylori* is the most com-mon cause of chronic gastritis and duodenal ulceration in human beings and has also been identified in laboratory cats. *H felis*, *H salomo -nis, H bizzozeronii*, and *Flexispira rappini*, have been isolated from the stomach of cats and dogs. It has been said that *Helicobacter* spp disrupt the gastric mucosal barrier by secreting phospholipases and interfering gastric secretory activity. A number of tests are there to detect *Helicobacter* spp infection in dogs and cats but the pathogenic role of *Helicobacter* in canine and feline gastritis is not clear. Most of these diagnostic tests requir-e gastroscopy. Gastroscopic findings mainly include superficial nodules suggesting lympho -id follicle hyperplasia, diffuse rugal thickenin -g, punctate hemorrhages and erosions.

Histopathological examination of gastric biopsy samples using Warthin Starry and Modified Steiner stains is considered most sensitive test that reveals spiral-shaped organisms. Other tests include rapid-urease test performed on gastric biopsy and polymerase chain reaction of deoxyribonucleic acid (DNA) extracted from biopsy samples or gastric juice (highly sensitive). It is important to take many biopsy samples due to patchy

distribution of *Helicobacter* spp infestation throughout the stomach and to increase the diagnostic sensitivity of this test. Alternatively, impression smears can be prepared using cytology brush, from the gastric mucosa. The slide can be then stained either with Gram stain or May-Gru¨nwald-Giemsa or Diff-Quik. This test can easily be performed in a practice setting and shows excellent sensitivity.

Bacterial culture to identify *Helicobacter* spp has a low success rate. Serologic testing although has a comparatively high sensitivity but cannot distinguish between infections with different *Helicobacter* species. Moreover, eradication of *Helicobacter* spp infections with serological testing is not possible as serum IgG concentrations remain high up to 6 months after successful eradication. Another diagnostic test based on the metabolic activity of *Helicobacter* spp. is ^{13}C-urea breath or blood test (^{13}C-UBBT). The urease enzyme produced by *Helicobacter* spp catalyzes the metabolism of orally administered ^{13}C-urea. The ^{13}C is released from the urea is incorporated into ^{13}CO2, that can be measured in either breath or blood samples. This test is very useful for monitoring the eradication of infection and does not require endoscopy. Overall, identification of enormous colonization of the stomach mucosa by spiral-shaped bacteria in combination with inflammatory cells is usually sufficient to choose whether to treat the patient or not for *Helicobacter* infection.

To be more specific, radiography of chest and abdomen and culture of intestinal mucosal biopsies, intestinal lymph nodes, and other abdominal organs should be undertaken in cases of granulomatous or neutrophilic enteritis to detect systemic involvement and infectious organisms. The traditional cytochemical stains used are Gomori methenamine silver, Periodic acid–Schiff, Gram, and Modified Steiner stains to locate infectious agents in fixed tissues. FISH with a probe directed against eubacterial 16S ribosomal RNA is a more sensitive method of detecting bacteria within formalin fixed tissues (Schreiner *et al.,* 2008).

Diagnosed approach in eosinophilic enteritis is similar to that of lymphoplasmacyt -ic enteritis. Clinicopathologic signs include peripheral eosinophilia. Endoparasites, hypoadrenocorticism and mast cell neoplasms can produce similar clinical signs and should be ruled out. Histopathology of intestinal mucosa is characterized by accumulation of large numbers of eosinophils.

Lymphangiectasia usually occurs as a protein-losing enteropathy, with appearance of white blebs on the mucosa (dilated lymphatics) on endoscopy. Endoscopic biopsies are often sufficient. Surgical biopsy should be undertaken carefully due to risk of bleeding, exacerbation of hypoproteinemia by fluid therapy, and potential for dehiscence. Biochemical abnormalities included hypoalbuminemia, hypoglobulinemia, hypocalcemia, hypocholesterolemia, hypomagnesemia, hypokalemia and hypochloremia. Hypocalcemia and hypomagnesemia have been attributed to hypovitaminosis D. Hematologic abnormalities included mild anemia, thrombocytosis, mature neutrophilia and neutrophilia with a left shift.

Management: Treatment in chronic gastroenteropathies is mainly empirical and consists of dietary management and use of nonspecific anti-inflammatory drugs, with corticosteroids providing the most consistent benefit (Simpson and Jergens, 2011). Dietary therapy using a hypoallergenic diet is an important component of treating idiopathic lymphocytic–plasmacytic enterocolitis (LPE) with diet, immunosuppressive agents, antibiotics, probiotics and prebiotics are mostly aimed at modulating the intestinal immune response (Fogle and Bissett, 2007).

The treatment approach in CGE is affected by breed-related problem, the severity of disease as per clinical signs, serum cobalamin and albumin levels, and mucosal architecture on endoscopy (atrophy, ulceration, lymphangiectasia and/or crypt cysts), cellular infiltrate and the presence of bacteria or fungi. Overall therapeutic intervention is aimed at correcting nutritional deficiencies (eg, cobalamin deficiency) and counteracting inflammation and dysbiosis.

Minimal change enteropathy is represented by low clinical disease activity, normal serum albumin and cobalamin concentrations, and no change or normal intestinal histopathologic findings. In this, empirical treatment is done using Fenbendazole, 50 mg/kg, for 5 days orally for Giardia and endoparasitic infections followed by dietary modification and antibiotic trial in case of refractory patients.

Dietary modification: First and foremost step in dietary modification is to switch to a differ -ent diet or a different manufacturer. The purp -ose of dietary modification is to optimize ass -imilation that is diet should be highly digesti -ble (usually rice based), fat restricted (<15% dry matter), easy-to-digest fats (eg, medium-chain triglyceride oil) and restricted fiber. Second step is antigenic modification with antig -en-restricted /novel protein source or protein hydrolysate. Finally immunomodulation usin-g altered fat composition (eg, omega-3 or omega-6 fatty acid, fish oil) and prebiotics (eg, inulin) should be tried. A positive response to dietary modification proposes diet responsive enteropathy, which includes both dietary intol -erance and allergy. Usually clinical response is observed within 1 to 2 weeks of changing the diet (Mandigers *et al.,* 2010). In case resp -onse is good, the diet should be continued. Sometimes rechallenge with the previous orig -inal diet is necessary to confirm that clinical signs are associated to the diet. If owner consents to rechallenge, test with single dietary ingredient to define the specific component eliciting an adverse response. If dietary modification with 2 different diets fails, the next step is to switch over to antibiotics.

Antibiotic Trial: Tylosin, 10 to 15 mg/kg, every 8 hours or oxytetracycline, 20 mg/kg, every 8 hours; or metronidazole, 10 mg/kg, every 12 hours orally are the antibiotics of choice (German et al 2003, Simpson *et al.,* 2006). A positive response indicates antibiotic-responsive enteropathy, which was called small intestinal bacterial overgrowth (SIBO) despite the absence of increase in total bacteria (German *et al.,* 2003). The treatment should be continued for 28 days. In case signs reoccur after discontinuation of therapy tylosin, 5 mg/kg, administered orally once a day can be used to maintain dogs that are tylosin responsive. Otherwise, patient should be carefully reassessed before using other therapeutic options.

Granulomatous or neutrophilic enteropathy For granulomatous or neutrophilic enteropathy, antibiotics may be used after culture sensitivity test. It is necessary not to use immunosuppressive drugs in patients with granulomatous or neutrophilic infiltrates until infection is cleared. Though, eradication of mucosally invasive E coli in boxers with GC helps in clinical cure, but treatment failure due to antibiotic resistance is increasing (Simpson *et al*., 2006, Craven *et al.,* 2010). The prognosis for idiopathic granulomatous or neutrophilic enteropathies is usually poor if an underlying cause is not identified.

Lymphoplasmacytic enteritis: Dogs with chronic diarrhea associated with lymphoplasmacytic enteritis will respond to treatment with diet, antibiotics, or immunosuppressive therapy (Simpson and Jergens, 2011). At present, because there is no reliable means for predicting which dogs will respond to which treatment, treatment consists of a series of therapeutic trials.

In dogs with mild to moderate clinical dise -ase activity, mild to moderate histopathology (lymphocytes and plasma cells are predomina -nt cell type), serum albumin levels greater than 2 g/L, clinician should start with empirical treatment for Giardia and helminths if not already given and supplementation of cobalamin and folate if these are subnormal. In case no positive response to diet, antibiotic trial should be undertaken using Tylosin for 2 weeks. If the response is good, maintain on antibiotics for 28 days and then discontinue or consider transition to probiotics addition. In case of no remission of signs, immunosupp -ression with glucocorticoids using oral prednisolone and azathioprine with initial dose @ 2 mg/kg may be undertaken and there after tapering of dose should be done over time. If the response is poor, reasess all findings before considering increase in immunosuppressant's dose (eg, cyclosporine). If the response is good, first taper immunosuppression and then stop antibiotics.

In dogs with moderate to severe clinical disease activity, moderate to severe intestinal histopathology (atrophy, fusion, lymphocytes and plasma cells are the predominant cell type), serum albumin levels less than 2 g/L, initiate as above with empirical treatment and supplementation with cobalamin and folate, dietary modification, antibiotics (eg, tylosin), and immunosuppression (glucocorticoids and/or azathioprine). If there is failure to absorb oral prednisolone, then shift to injectable corticosteroids. Dexamethasone may be preferred in patients with ascites to avoid increased fluid retention. Concurrently, ultralow-dose aspirin (0.5 mg/kg) and judicious use of diuretics (furosemide and spironolactone are in patients at risk for thromboembolic disease and in those severely distended with tense ascites, respectively). Elemental diets and partial parenteral nutrition may be used in dogs with severe protein-losing enteropathy. If the response is good, first taper immunosuppressive agents and then stop antibiotics. A positive response to dietary modification in 60% to 88% of dogs with lymphocyte and plasma cell dominant enteritis (Mandigers *et al.,* 2010) suggests that a dietary trial with a restricted antigen or hydrolyzed diet is a good therapeut -ic starting point. However, few dogs require continuous treatment with corticosterids or other immunosuppressive agents.

Eosinophilic gastroenteritis: Potential viscera -l larva migrans associated with eosinophilic gastroenteritis can be treated with prophylactic administration of an anthelmintic, such as oral fenbendazole, 50 mg/kg, every 24 hours for 5 days. Some patients may respond to dietary modification with antigen-restricted or protein hydrolysate diets. Those who did not respond to dietary therapy are usually administered wit -h oral prednisolone @ 2 mg/kg, every 24 hrs tapered over an 8-week period. The prognosis for eosinophilic enteritis is normally good but some patients require incessant immunosuppression.

Lymphangiectasia: Treatment in lymphangie-ctasia is supportive and symptomatic. Dietary recommendations are as per other causes of small bowel diarrhea discussed above (highly digestible, restricted antigen, or hydrolysate). Though, fat restriction is the mainstay of treatment but not evaluated with controlled studies. Medium-chain triglyceride (MCT) oil, eg. coconut oil, @ 0.5 to 2 ml/kg body weight per day can be added to the diet. The use of MCT impr -oves outcome in children with primary lymph -angiectasia (Desai *et al*., 2009) but there are no reports in dogs.

Prednisolone @ 1 mg/kg, every 24 hours orally and tapered over time to the lowest effecti -ve dose, may work by decreasing lipogranulomatous inflammation or concurrent mucosal inflammation. A switch over to dexamethasone may be made in patients with malabsorption and signs of ascites or edema. Oral administrat -ion of cyclosporine @ 5 mg/kg, every 24 hrs may be tried if the patient is unresponsive. As patients with lymphangiectasia appear more prone to sepsis, it is better not to over immuno suppress these patients, and concurrent therapy with metronidazole or tylosin may be frequentl -y undertaken to decrease the risk of bacterial translocation through the markedly compromis -ed gut. In dogs with low antithrombin III leve -ls and at risk for thromboembolism, aspirin, 0.5 mg/kg, every 24 hours is often given orally Diuretics can be used in problematic ascetic dogs. Response to treatment is variable with some dogs with remission of signs for long and others lead to fulminant hypoproteinemia or thromboembolic disease. The prognosis is always guarded. In a recent study of 12 Yorkshire terriers, empirical therapy with corticosteroids, azathioprine, antibiotics (amoxicillin-clavulanate, metronidazole, tylosin and enrofloxacin), plasma, and diuretics was associated with a poor outcome.

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