ENDOSCOPIC EVALUATION AND MANAGEMENT OF LARGE BOWEL DISORDERS IN DOGS

BY

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THESIS

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DECLARATION

I hereby declare that this thesis, entitled **"ENDOSCOPIC EVALUATION AND MANAGEMENT OF LARGE BOWEL DISORDERS IN DOGS"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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3/5/2010

CERTIFICATE

Certified that this thesis, entitled **"ENDOSCOPIC EVALUATION AND MANAGEMENT OF LARGE BOWEL DISORDERS IN DOGS"** is a record of research work done independently by **Raji K. C.,** under my guidance and supervision and it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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Dedicated to My Family

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Introduction

1. INTRODUCTION

Large bowel includes caecum, colon and rectum. Colon is the final site of electrolyte absorption within the gut. Also it temporarily stores faeces for appropriate defecation and provides an environment for microorganism. Water absorption accompanies active sodium transport and is facilitated by tight mucosal junctions and rhythmic segmental and antiperistaltic motility. In the distal colon a powerful contraction called mass movement leads to defecation. Mucus secretion helps to lubricate mucosal surfaces and in normal conditions other types of colonic secretion probably do not occur. Disruption of mucosal integrity or neuro-humoral control of secretion, absorption or motility leads to an increase in the frequency, fluidity or volume of bowl movements i.e. diarrhoea.

Chronic diarrhoea lasting for two weeks or more is a common problem in dogs. Dogs with diarrhoea are frustrating inconvenience for their owner. It has been estimated that about one – third of dogs with a history of chronic diarrhoea can occur from variety of causes such as bacterial (e.g. *Salmonella spp*., *Clostridium spp*. and *Campylobacter spp*.), parasitic (Trichuris, Ancylostomes and Giardia), inflammatory (eosinophilic, neutrophilic, lymphocytic- plasmacytic, histiocytic and granulomatous), dietary intolerance, neoplasia (adenocarcinoma, lymphosarcoma, polyps), anatomic (stricture, ileocaecolic intussusceptions, caecal eversion, foreign body), functional (motility disorders, idiopathic) and finally secondary to small intestinal diseases.

Dogs with large bowel diarrhoea exhibit many of the following signs. A moderate to severe increase in the frequency of defecation, decreased faecal volume per defecation, urgency, tenesmus, excess faecal mucus, hematochezia and anal pruritus or pain. Weight loss is uncommon and vomiting is seen in approximately 30% cases.

The initial step in evaluating dogs with chronic diarrhoea is to localize the origin of diarrhoea as whether from small intestine or large intestine. Localization is vital because differences exist between small intestinal and large intestinal diseases, regarding the diagnostic plan, differential diagnosis and expense of diagnosis. Localization should be based on a comprehensive history, specific clinical signs and characteristics of faeces.

For accurate diagnosis, colonoscopy plays a major role along with routine clinical examination and biochemical investigation. A flexible endoscope allows visualization of entire large bowel and caecum. Endoscopy with mucosal biopsy is necessary to arrive at an accurate diagnosis.

The treatment of large bowel diarrhoea involves withholding food for 24hrs and introducing easily assailable hypoallergenic diet. Immune mediated inflammatory colitis is treated with anti-inflammatory drugs such as sulfasalazine at the dose rate of 20 mg / kg BW bid for at least 20days along with corticosteroids (Prednisolone 1-2 mg/kg BW p.o) in a tapering dose.

Endoscopic evaluation and management of large bowel diarrhoea in dogs was undertaken with the following objects

1. To study the etio- pathogenesis of large bowel disorders in dogs.
2. To suggest suitable line of therapy.

Review of Literature

2. REVIEW OF LITERATURE

2.1 STRUCTURE AND FUNCTIONS OF LARGE BOWEL

2.1.1 Caecum and Colon

Goldschmidt and Zoltowski (1981*)* reported that colonic mucosa contained mucus-producing goblet cells that normally helped to lubricate faecal mass.

Leib *et. al.* (1992), Simpson *et. al.* (1994) and Leib and Matz (1995) reported the functions of colon as absorbing water and electrolytes from faeces and storing faeces for appropriate defecation. Sodium and chloride were actively absorbed, whereas water moved passively following the osmotic gradient (Leib *et. al.,* 1992).

Water absorption accompanied active sodium transport, facilitated by tight mucosal junction and rhythmic segmental and anti- peristaltic motility (Simpson *et al.*, 1994). The author also stated that 20 to 30 percent water and sodium absorption took place in colon.

According to Leib and Matz (1995) and Dyce *et. al.* (2002), large bowel had a length of 28 – 90cm in dogs and anatomically it was divided into caecum, colon and rectum. Caecum joined the colon through caecocolic orifice and colon was divided into ascending, transverse and descending segments.

2.1.2. Rectum and Anus

Carnivores possessed a pair of anal sacs or anal glands. They were tubulo-alveolar glands located in the sub mucosa around the anus at anocutaneous junction. These glands produced lipid secretions on to the skin surfaces. (Goldschmidt and Zoltowski, 1981*).*

According to Chambers (1986), Burrows and Ellison (1989) and Esplin *et. al.* (2003), each anal sac was lined by stratified squamous epithelium and had a single excretory duct.

Duijkeren (1995) stated that secretions of anal glands played a part in sexual attraction, social communication and in delineation of territory and home range.

According to Welsh (2001), the anal canal located at the terminal rectum was encircled by internal and external sphincters, one on each side of the anus.

2.2. ETIOLOGICAL CLASSIFICATION

2.2.1 **Disorders Causing Diarrhoea**

2.2.1.1. Parasitic Colitis

Balantidium coli infection was an uncommon cause of ulcerative colitis and severe dysentery in dogs, it was commonly found as a commensal in the large bowel of swine (Wittnich, 1976).

Lieb *et. al.* (1991) reported that endoparasites especially *Trichuris vulpis* were the second most common cause of chronic large bowel diarrhoea. Also the author found that acute Giardiosis usually caused small intestinal diseases and it resulted in signs of secondary chronic large bowel diarrhoea.

Harvey (1993) and Bright *et. al.* (1994) observed that migration of Trichuris ova in the course of the disease induced lesions in caecum and colon.

According to Leib and Matz (1995), protozoan infection by *Entamoeba histolytica* caused erosion or ulceration of colonic mucosa and finally secretory diarrhoea.

Jergens and Willard (2000) reported that heavy worm burden with Ancylostomes caused minute ulceration in the ascending and transverse colon.

2.2.1.2. Infectious Colitis

Clostridial colitis was the major cause of bacterial colitis and a definitive diagnosis was difficult (Kruth , 1989).

Acute enterocolitis was the most common sign in salmonellosis, invading the intestine and produced diarrhoea secondary to subsequent inflammation (Cantor, 1997).

Turk (1998) found out the presence of *E. coli* adhered to the colonic mucosa in dogs affected with colibacillosis, and production of virulent enterotoxins by these bacteria caused acute small and large bowel diarrhoea (Jergens and Willard, 2000).

.

According to Jergens and Willard (2000), campylobacteriosis caused acute or chronic large bowel diarrhoea in dogs less than six months of age.

2.2.1.3. Acute Colitis

Jergens and Willard (2000) reported that acute colitis was generally a self-limiting condition and it occurred due to sudden dietary alteration, foreign materials, presence of parasites (Lieb *et. al.,* 1991), or bacterial infection (Cantor, 1997 and Turk 1998).

Guilford (1994) reported that malabsorbed fatty acids and bile acids promoted acute large bowel secretory diarrhoea.

2.2.1.4. Chronic Colitis or Idiopathic Inflammatory Bowel Disorders (IBD)

Batt and Hall (1989) documented gluten sensitive enteropathy in young Irish Setter dogs, and it was represented as a first definitive description of dietary induced chronic intestinal disease in dogs. The authors explained that there was an age related delay in the expression of specific enzyme 'amino peptidase – N' which was responsible for the degradation of toxic gluten peptides, and reduced level of this enzyme permitted development of gastrointestinal hypersensitivity.

Dietary indiscretions that occurred in free roaming dogs were the common cause of chronic large bowel diarrhoea (Leib *et. al.* 1991). The author found that common dietary allergens were whey, soybean, wheat, beef and beef products.

Halliwell (1992) stated that the gastrointestinal tract was exposed to large quantities of varying food antigens and any of them could elicit local immune mediated hypersensitivity reaction. Diets containing excessive carbohydrate resulted in excessive fermentation and production of histamines. Histamine caused allergic reaction in gastrointestinal tract. The author also opined that a genetically defective binding of gliadin fraction of gluten to mucosal cells might precipitate immune responses.

Hall *et. al.* (1994) reported that genetic defect in mucosal immune system played a role in the pathogenesis of histiocytic ulcerative colitis.

Simpson *et. al.* (1994) found that most of the basic food ingredients had the potential to induce an immunological inflammatory response and immune mediated dietary hypersensitivity, which acted as the primary cause of colitis.

According to Jergens and Willard (2000), chronic colitis occurred due to an abnormal immune response and which was characterized by mucosal, epithelial or glandular alteration and severe mucosal cellular infiltration. They

also found that the disease in dogs had similarities to idiopathic inflammatory bowel disorders (Chron's disease and ulcerative colitis) in human beings.

Based upon the types of cellular infiltrates, chronic colitis further classified.

2.2.1.4.1. Lymphocytic Plasmacytic Colitis (LPC)

Batt and Hall (1989) identified lymphocytic- plasmacytic colitis as the most common inflammatory bowel disease in middle aged dogs.

Leib *et. al.* (1991) reported that diagnosis was based on finding increased numbers of plasma cells and lymphocytes in the colonic biopsy specimens.

2.2.1.4.2. *Eosinophilic Colitis*

Leib *et. al.* (1991) reported that lamina propria was infiltrated with increased number of eosinophils in eosinophlic colitis and other signs were similar to lymphocytic plasmacytic colitis.

Jergens and Willard (2000) reported that the etiology behind this condition was allergic response to dietary or parasitic antigens

2.2.1.4.3. *Histiocytic Ulcerative Colitis*

Leib *et. al.* (1991) and Jergens and Willard (2000) reported that histiocytic ulcerative colitis was the most frequently diagnosed inflammatory bowel disorder (IBD) variant in male Boxer dogs of less than one year of age, characterized by colonic ulceration and moderate to severe anaemia and hypoproteinaemia.

2.2.1.4.4. Granulomatous *Colitis*

According to Leib and Matz (1995), granulomatous enterocolitis (regional enteritis) was a chronic progressive inflammatory bowel disease of unknown cause characterized by transmural inflammatory response in the stomach, distal ileum, proximal colon, and rectum.

Granulomatous enterocolitis was uncommon but a serious IBD variant in male dogs. Jergens and Willard (2000) reported salient histological lesions, characterized by presence of macrophages, multinucleated giant cells, lymphocytes, plasma cells, neutrophils, fibrosis and large numbers of eosinophils.

Granulomatous colitis had similarities to Crohn's disease in human beings (Khaikin *et al.*, 2007).

2.2.1.4.5. Suppurative *Colitis*

Suppurative colitis was commonly seen in cats associated with bacterial infection and erosive lesions of alimentary tract. The mucosa was infiltrated with lymphocytes, plasma cells, and neutrophils (Jergens and Willard, 2000).

2.2.1.5. Motility Disorders

Leib *et. al.* (1991) reported that acute intussusception was classically a motility disorder causing scant bloody diarrhoea and vomiting in young animals. They were either ileo-colic or caeco-colic types.

Leib *et. al.* (1991) and Leib and Matz (1995) reported that in fiber-responsive diarrhea (FRD), the abnormal colonic motility occurred due to fiber deficient diet, which was ameliorated by dietary fiber supplementation.

Leib *et. al.* (1991), Francis (1997) and Jergens and Willard (2000) reported that Irritable Bowel Syndrome (IBS) was referred to as a functional gut disorder associated with stress and characterized by abnormal colonic myoelectrical activity and motility.

Wells *et. al.* (1995) and White (1997) reported that motility disorder was the most probable cause of faecal retention in caecum. In young dogs, residual meconium acted as a nidus, around which solid materials were precipitated and resulted in faecal impaction (White, 1997).

2.2.1.6. Neoplasia

McColl (1969) studied that rectal polyps were either neoplastic or inflammatory types. The inflammatory or pseudo polyposis occurred due to colonic inflammation and may be mistaken as malignant condition and usually resolved with the treatment of underlying condition. Author also reported that benign polyps had the tendency to become malignant.

Potet and Soullard (1971) found that only histopathololologically differentiated rectal polyps were undergoing malignant changes.

Adenocarcinoma was encountered as the most common non-haematopoietic malignant tumor of canine colon (Gaag, 1988 and Bedford, 1998), characterized by tenesmus, rectal bleeding, and scant faeces.

According to Leib *et. al.* (1992), adenocarcinoma caused large bowel diarrhoea if located at the proximal or middle colon. If occurred at the distal colon it produced an abnormally shaped stool associated with hematochezia and tenesmus with mucus.

Jergens and Willard (2000) reported that adenoma were the most common benign tumor raised from mucosal layer of colon appeared as sessile masses with

smooth surfaces, whereas leiomyomas were slowly growing benign neoplasms raised from colonic smooth muscle layers.

Esplin *et. al.* (2003) reported that anal sac squamous cell carcinomas had poor prognosis in dogs because origin of tumors from the internal lining of the anal sac might not be detected early, which could allow considerable local infiltration before diagnosis was made. Perianal location of these tumors interfered with normal defecation

2.2.2. Disorders Causing Constipation

Feldman (1996) reported that hypothyroidism could cause diminished colonic motility and there was gradual accumulation of faecal material.

Megacolon was the condition characterized by diffused colonic dilation with ineffective motility. According to Leib and Matz (1995) and Jergens and Willard (2000), it could occurred secondary to mechanical or functional obstructions which prevented defecation for prolong period.

2.2.3. Perianal Disorders

Prolonged retention of secretion in the anal sac was found to be the initiating factor for anal impaction and sacculitis. (Halnan, 1976).

Burrows and Ellison (1989) reported that the predisposing factors for anal sac impaction and sacculitis included chronic diarrhoea, glandular hyper secretion and poor muscle tone.

DeNovo *et. al.* (2000) reported that perianl hernia, rectal tumors, rectal prolapse and rectal and anal strictures were some of the conditions required surgical management. The author also reported that, even though an inflammatory process with secondary bacterial infection initiated fistulas or anal furunculosis,

an immune mediated basis for this disease also demonstrated by positive response to immunosuppressive dose of Prednisolone.

Welsh (2001) reported that anal sac impaction and infection suggested the etiology for development of anal furunculosis. In German Shepherd dogs, low tail carriage and broad tail bases caused smearing of faeces across the perineum and resulted in bacterial infection.

2.2.4. Others

Fan *et. al.* (1999) reported that colonic vascular ectasia, an acquired intestinal sub mucosal vascular anomaly was a potential cause of lower intestinal bleeding in dogs.

2.3. SIGNALMENT

2.3.1. Incidence

The prevalence of anal sac diseases was estimated at 12 per cent in dog population (Halnan, 1976).

Hall *et. al.* (1994) and Stokes *et. al.* (2001) reported that the occurrence of histiocytic ulcerative colitis in non- boxer dogs was 37.5 per cent.

Leib and Matz (1995) reported that 50 per cent of cases of large bowel dairrhoea were associated with parasitic or dietary causes. According to their findings the occurrence of canine gastrointestinal tumors were 30 to 60 per cent and that of felines were 10 to15 percent. The incidence of adenoma was 35 per cent and that of adenocarcinomas was 29.4 per cent in dogs.

Paterson (1995) found that the incidence of beef allergy in dog was 65 per cent, and that of wheat, egg, and chicken were 25 per cent, 20 per cent, and 10 per cent respectively. The dietary hypersensitivity was least reported with fish.

Fan *et. al.* (1999) reported that left hemi colon was the natural predilection site for angiodyplasia development in dogs.

Holt and Durdey (1999) reported that most common rectal tumor in dogs was benign adenomatous polyps.

2.3.2. Age

Gaag (1988) reported that onset of colitis occur in dogs at any age varied from between 4.5 and 5.8 years and the occurrence of intestinal neoplasm observed in dogs above five years.

Leib *et. al.* (1991) reported that lymphocytic plasmacytic colitis usually common in middle aged dogs but could be seen in dogs of all ages.

Chronic colitis was found in younger dogs of below three years (Hall *et. al.,* 1994) and Leib (2000) also supported that chronic colitis observed in less than seven years of age with the mean of 3.1 years.

Anal furunculosis was frequently affected at the age group of 4 to 7 years (Welsh, 2001).

2.3.3. Sex

Gaag (1988) reported that simple chronic colitis had been more frequently found in females.

Gagg and Happe, (1989), Leib (2000) and Stokes *et. al.* (2001) reported that all types of colitis were found more frequently in males except histiocytic ulcerative colitis, in which the ratio was equal.

Males were frequently affected with anal furunculosis (Welsh, 2001).

2.3.4. Breed

Colitis and colorectal tumors were more prevalent in Boxers, Germen Shepherds, Poodles Great Danes and Spaniels (Gaag, 1988). The author also found that eosinophilic colitis was frequently observed in Germen Shepherd dogs.

Gaag (1988) and Gagg and Happe (1989) reported that Boxer breed was highly predisposed to colitis especially histiocytic ulcerative colitis and chronic non-specific colitis, whereas the risk for LPC was seemingly increased in Boxer and German Shepherd (Jergens and Willard, 2000).

DeNovo *et. al.* (2000) and Welsh (2001) reported that Germen Shepherds were the most susceptible breeds for anal furunculosis and other anal sac diseases. Other susceptible breeds were Collie, Jack Russel Terrier and Labrador Retrievers.

2.4. CLINICAL SIGNS

Reports of Gagg (1988), Leib *et. al.* (1992), Bright *et. al.* (1994) and Paterson (1995) suggested that presence of faecal blood, mucus with tenesmus and increased frequency of defecation suggested diarrhoea of large bowel pathology.

Bright *et. al*. (1994) reported that non-specific clinical signs like anorexia, vomiting and weight loss also accompanied large bowel disorders.

Hall *et. al.* (1994) reported that diarrhoea, varying amount of fresh blood and mucus in faeces, increased frequency and urgency of defecation with tenesmus were present in all cases of histiocytic ulcerative colitis and flat ribbon like stools containing blood and excess mucus was characteristic for adenocarcinoma, foreign body or benign stricture.

Duijkeren (1995) and Welsh (2001) observed that perianal sinuses, tenesmus, hematochezia, excessive licking or biting of perineum, flatulence, weight loss, lethargy, faecal incontinence, malodorous perineal discharge, constipation or diarrhoea, pain on tail elevation were clinical signs suggestive of anal furunculosis.

According to Leib and Matz (1995), constipation, tenesmus and frequent unproductive attempt to defecation were the predominant clinical signs in mega colon. Anorexia, weight loss, vomiting and weakness were occurred secondary to severe constipation.

Wells *et. al.* (1995) and White (1997) reported that clinical signs of caecal impaction included vomiting diarrhoea, anorexia, abdominal discomfort, lethargy and faeces containing blood or mucus.

Jergens and Willard (2000), reported varying degree of clinical signs in colorectal neoplasia ranging from changes in stool diameter (caused by annular constriction) to tenesmus, hematochezia or constipation (due to obstruction).

2.5. DIAGNOSIS

2.5.1. Physical Examination

Diagnosis of anal sac diseases based on clinical signs (tenesmus, discomfort when sitting down, biting of anal area, 'scooting', and perianal discharge), physical and rectal examination (Duijkeren, 1995).

A firm mass in the abdomen could be palpated in cases of caecal impaction, foreign body obstruction, colorectal neoplasia and intussusception, and palpation on those structures was uncomfortable for the animal (White, 1997).

According to Jergens and Willard (2000), physical examination findings in most animals with inflammatory colonic diseases were normal.

A distended colon could be palpable in dogs and cats with mega colon (Holt and Brockman, 2003).

Khaikin *et. al.* (2007) reported that history and physical examination were often sufficient for a diagnosis of most perianal lesions and specialized imaging studies were not routinely required.

2.5.2. Rectal Examination

Careful digital rectal palpation detected luminal masses in dogs with history of hematochezia, tenesmus, excess faecal mucus or narrow lumen of colon suggestive of adenocarcinoma, benign polyps, foreign body obstruction or stricture (Leib *et. al.,* 1992).

According to Leib and Matz (1995), markedly distended colon packed with firm faeces on both abdominal and digital rectal palpation was observed in mega colon.

Tumors, polyps and colonic mucosal roughening and enlarged sub lumbar lymph nodes were the abnormalities that might be palpable on rectal examination in dogs (Houston, 2000).

2.5.3. Rectal Cytology

Leib *et. al.* (1992) and Leib and Matz (1995) reported that normal rectal cytology revealed colonic epithelial cells, a mixed bacterial population and a few inflammatory cells. Neutrophilia indicated inflammatory condition, and eosinophilia indicated eosinophilic colitis.

Exfoliative rectal cytology specimens were used to identify etiologic agents and inflammatory cells (Jergens and Willard, 2000).

2.5.4. Faecal Sample Examination

Intestinal parasites must be ruled out by faecal floatation for ova of parasites and direct faecal smears for protozoa, among which zinc sulphate floatation was sensitive means for detecting *Giardia spp*. cyst (Zimmer and Burrington, 1986).

Leib *et. al.* (1991 and 1992) reported that adult whipworm shed ova intermittently, which could result in negative faecal examination.

Leib *et. al.* (1992) and Blagburn and Butler (2006) reviewed that centrifugal flotation was one of the methods for recovering parasites from faecal samples

2.5.5. Faecal Culture

Kelly (1974) suggested that isolation of Salmonella was done by inoculation in 1% peptone broth, and then further isolation continued in tetrathionate broth at a temperature of 43^0 C, whereas *E. coli* isolation was achieved by means of Mac Conkey's medium.

Leib and Matz (1995) reported that faecal culture was reasonable in animals suspecting infectious diarrhoea. According to Jergens and Willard (2000), the pathogens most likely to be cultured form faeces were *Clostridium, Salmonella, Compylobacter* and *Yersinia spp.*

2.5.6. Laboratory Examination

Normal haematological values were erythrocytes 5.5 -8.5 millions / mm^3, haemoglobin 12-18 g %, PCV 37-55 % and total leucocytes 6000-18000 cells / mm^3 with neutrophils 60 –70 %, lymphocytes 12-30 %, eosinophils 0-10% and

monocytes 3-10 % (Benjamin, 1985). Normal level of serum total protein was 5.4 - 7 g / dl with albumin 2.3 – 3.2 g /dl, globulin 2.7 – 4.4 g / dl and A / G ratio 0.68 – 0.85 **(**Benjamin, 1985 and Lording and Friend, 1991).

According to Benjamin (1985), blood loss anaemia could be seen in chronic ulcerative colitis and lower A / G ratio indicating chronic inflammation or antigenic stimulation.

Leib *et. al.* (1991) reported that in histiocytic ulcerative colitis clinical findings were similar to plasmacytic lymphocytic colitis except the colonic ulceration, which caused moderate to severe anaemia and hypoproteinaemia.

Leib *et. al.* (1992) reported that leucocytosis with mature neutrophilia was characteristic of lymphocytic plasmacytic colitis and adenocarcinoma.

Simpson (1993) and Hall *et. al.* (1994) reported that in animals with large bowel diarrhea, physical examination, routine haematology and serum biochemistry analyses had little diagnostic value.

Bright *et. al.* (1994) reported that in chronic diarrhoea serum biochemistry revealed hypokalemia because, the mucosal damage caused chronic loss of potassium rich mucus from goblet cells.

Laboratory evaluation, cytological examination, and biopsy were required for the definitive diagnosis of colonic adenocarcinoma (Bedford, 1998).

2.5.7. Radiography

Leib *et. al.* (1992) reported that in large bowel diarrhoea the survey abdominal radiographs were usually within the normal ranges.

Bright *et. al.* (1994) reported that irregular marginations of colonic mucosa with some fimbriations, in contrast radiography suggested infiltrative inflammatory disease or neoplasia.

Contrast studies using barium enema helped in the diagnosis of histiocytic ulcerative colitis (Hall *et. al.,* 1994).

Leib and Matz (1995) reported that survey abdominal radiographs were helpful to confirm the distension of colon and obstructive cause of megacolon.

Delayed emptying time and barium retention, associated with the caecum aided in the identification of caecal impaction (Wells *et. al.,* 1995 and White, 1997).

2.5.8. Ultrasonography

Sophr *et. al.* (1995) reported the normal ultrasonogram of intestinal wall as with innermost echogenic mucosa, the echo poor muscularis mucosa, echogenic sub mucosa, the echo poor muscularis propria and outer most echogenic serosal layer. The author found that a generalized wall thickening (more than 2 to 3 mm) was suggestive of inflammatory diseases or intestinal neoplasia. In inflammation, the ultasonographic pattern revealed three distinct layers such as an enlarged hyper echogenic inner layer, enlarged echo poor middle layer and an enlarged hyper echogenic outer layer.

According to Jergans and Willard (2000), ultrasonography was the preferred diagnostic technique for intussusceptions.

2.5.9. Dietary Elimination

Anderson and Sogu (1984), Anon (1984), Hall (1994a) and Rutgers *et. al.* (1995) reported that diagnosis of food hypersensitivity (food allergy) required

proof of an immunological basis. Adverse reactions to food that did not have immunological basis were called food intolerance (Hall, 1994a).

Harvey (1993), Paterson (1995) and Rutgers *et. al.* (1995) reported that diagnosis of food allergy could be made by strict elimination of antigenic diet for a minimum of three weeks or until the clinical signs had abated, then fed with original diet and if relapse occurred dietary allergy was suspected.

2.5.10. Colonoscopy

2.5.10.1. Principle

McCarthy (2005) reported that the working principle of endoscopy was fiberoptic transmission of images. As light entered one end of a glass fiber it was reflected internally and refracted until it was emitted at the opposite side. In video endoscope a microelectronic charge coupled device (CCD), located at the distal end of endoscope, senses the images and these images were electronically transferred to a processor and after formatting, these images sent to a video monitor for viewing.

2.5.10.2. Indications

Simpson (1993) and Hall (1994b) suggested that colonoscopy facilitated the investigation of large bowel diarrhea, tenesmus, hematochezia and melena. Mucosal surfaces could be directly visualized for gross abnormalities such as polyp, tumor, strictures, foreign body or parasites that were easily detected and biopsies obtained without resource of energy.

Holt and Durdey (1999) and Khaikin *et. al.* (2007) reported that proctoscopy was successfully used to obtain biopsies of rectal tumor.

Agthe (2009) reported that for the diagnosis of colitis, colonoscopy was more sensitive than ultrasonography.

2.5.10.3. Equipment

McCarthy (2005) explained that rigid proctoscopy could be used for visualization of the descending colon and rectum, whereas flexible endoscopes allowed visualization of the entire large bowel. Fiberoptic endoscope and video endoscope were the two types of flexible endoscopes.

The different parts of flexible endoscope included an umbilical cord, hand piece, and insertion tube with distal tip at the end, and a video tower system. The video tower consisted of a light source (mostly 175 watt halogen light), insufflators for carbon dioxide insufflation in to the sterile body cavities, video image system, digital endoscopic video camera, video monitors and documentation devices. Accessory instruments included biopsy forceps, retrieval equipment, cytology brush etc.

2.5.10.4. Patient Preparation

Leib *et. al.* (1991) reported that rigid colonoscopy could be performed with tranquilization in many dogs, while flexible colonoscopy required heavy sedation or general anesthesia

Leib *et. al.* (1991) and McCarthy (2005) recommended oral gastrointestinal lavage solution, poly ethylene glycol (GoLYTELY) @ 25ml/kg BW via orogastric tube 3 to 5 times 1hr apart 12 to 18 hrs before colonoscopy.

Simpson (1993) and McCarthy (2005) reported that food should be withheld for 24 to 36hrs before colonoscopy. They observed that for mechanical flushing of faeces from the colon, a large volume of gastrointestinal lavage solutions and multiple warm water enemas at the dose rate of 20ml/kg body weight were necessary. The last enema should be resulted in the return of clear fluid without feacal material and which was administered at least 1 to 2 hrs before the procedure to facilitate evacuation and minimized artificial hyperemia of the mucosa.

2.5.10.5. Procedure

Leib *et. al.* (1991) and McCarthy (2005) given detailed procedure that the animal should be placed in left lateral recumbency. To facilitate the passage, the scope should be advanced using air insufflation. The lumen should always be kept visible and the scope advanced easily while visualizing the entire surface of the colonic wall. Anorectal lesions could be clearly visualized by retroflexion of scope by deflecting the tip 180 degree in the "up" direction while advancing. After examining the rectum the scope should further advanced in to colon. If any resistance was met, it should be withdrawn and gently manipulated and air insufflated to straighten any flexures or folds in the colon. Colon could be visually examined during ante grade and retrograde movement of the scope. In a properly prepared animal ileo-caeco-colic junction could be easily identified.

2.5.10. 6. Normal Colonoscopic Pattern

McCarthy (2005) opined that normal colon is smooth, glistening, pink and easily distended with air. Submucosal blood vessels were easily visualized especially at the transverse and descending colon. The colon wall should be examined for texture, colour, friability, diameter, and distensibility. Lymphoid follicles seen as small, depressed grey plaques were normal. Opening of ileum appeared as a circular raised mound of tissues with central opening or depression. Immediately adjacent to the ileum is the opening to the caecum. The caecal mucosa had longitudinal folds, similar to the appearance of rugal folds in the stomach.

2.5.10.7. Abnormal Findings

Usually adult worms could be visualized in the caecum and ascending colon (Lieb *et. al.,* 1991).

Demonstration of colonic wall thickening, mucosal serrations, friability and granularity, loss of visualization of sub mucosal blood vessels, and irregular folds with varying degrees of mucosal hyperemia, ulceration and haemorrhages

were reported in case of chronic inflammatory colitis. (Leib *et. al.,* 1991 and Hall *et. al.,* 1994).

Simpson (1993) reported that the mucosa should be carefully observed for redness, pallor, petechiea, erosion, ulcer and increased granularity.

Fan *et. al.* (1999) found that a cluster of dilated tortuous mucosal blood vessels was visualized in intestinal vascular ectasia, which caused acute lower intestinal bleeding.

Jergens and Willard (2000) suggested that in intussusceptions the colonoscopy revealed lumen filled with intussusceptum and sometimes protruded from the rectum mimicking a rectal prolapse.

2.5.10.8. Colon Biopsy

According to Leib *et. al.* (1991) and McCarthy (2005), biopsy specimens should be obtained from multiple levels as the scope was withdrawn. Biopsies were necessary even though the mucosa appeared grossly normal. The authors recommended that in focal lesions, additional multiple samples were necessary because many neoplastic ulcers had superficial area of ulceration and repeated sampling only provided diagnostic tissues.

2.5.11. Histopathology

2.5.11.1. Normal

Reith and Ross (1977) and Gaag (1988) observed that histopathology of normal mucosa had straight unbranched crypts lying parallel and close to each other. The surface epithelium consisted of simple columnar epithelium and the crypts lined by goblet cells next to the columnar cells except at lowest one third. Lamina propria contained delicate connective tissues with some capillaries, small number of lymphoid cells, plasma cells and some macrophages.

2.5.11.2. Abnormal

According to Gaag (1988), increased cellular infiltration and flattening of surface epithelium indicating mild to moderate colitis, and increased amount of connective tissue exceeding the normal level in fibrosis. In atrophy, the mucosal thickness was below the normal range without increased cellular infiltration.

According to Gaag (1988) and Dunn and Villiers (1998), in severe colitis the distance between the base of the crypts and the muscularis mucosa increased by infiltration of mononuclear inflammatory cell (lymphocytes, monocytes, macrophages or plasma cells) and smaller number of neutrophils. Also numbers of goblet cells were reduced.

According to Batt and Hall (1989) and Halliwell (1992), subtotal or partial villous atrophy with increased inflammatory infiltration in to the lamina propria indicated gluten sensitive colitis

According to Roth *et. al.* (1990), lymphocytic plasmacytic colitis in dogs could be graded on a scale of 0 – 5, based upon the quantity of lymphocytes and plasma cells in the lamina propria, epithelial changes and the presence of ulcers and erosions.

Presence of sub mucosal eosinophils filled pustules in the ductal epithelium of anal sac was reported in anal furunculosis (Day, 1993).

Bright *et. al.* (1994) and Dunn and Villiers (1998) reported that in chronic colitis there was an asymmetrical inflammation, extensive mucosal granularity, lymphocytic - plasmacytic infiltration, and focal areas of ulceration that extended into muscularis mucosa and was accompanied by an extensive infiltration of neutrophils.

Histiocytic ulcerative colitis was diagnosed by abundant histiocytic infiltration in the lamina propria (Hall *et. al.,* 1994 and Stokes *et. al.,* 2001).

Dunn and Villiers (1998) reported that the presence of a large number of eosinophils suggested either a hypersensitive component to the inflammatory response or the presence of parasites

Histopathology of vascular ectasia revealed diffused expansion of sub mucosa with numerous variably dilated arteries, veins and lymphatics (Fan *et. al.*, 1999).

In anal furunculosis, inflammatory infiltration contained lymphocytes, macrophages, neutrophils and eosinophils (Welsh, 2001).

Matsushita *et. al.* (2007) reported that acute colitis characterized by mild infiltration of inflammatory cells and oedema and inflammation of lamina propria. The glands became atrophied and decrease in number of goblet cells.

2.6. TREATMENT

2.6.1. Dietary Treatment

Leib *et. al.* (1991) found that adequate fiber supplementation could be alleviating irritable bowel syndrome. Both soluble and insoluble fibers increased faecal bulk leading to colonic distension and thereby normalized myoelectrical activity and colonic segmentation.

Leib *et. al.* (1991) and Hall (1994a) observed that feeding of protein of high biological value from a single source reduced the amount of variety protein antigen that reached colon and exclusion of antigenic diet for at least three weeks had been recommended in case of dietary hypersensitivity.

Affected animals respond to gluten free diet in gluten sensitive colitis and the histamine release was blocked by treatment with Naloxone (Halliwell, 1992).

Incorporation of omega 3 fatty acids in the diet had anti-inflammatory effect on colon (Guilford, 1994).

Highly soluble fibers were useful in treatment of colitis as they nourished the colonic epithelium (Guilford, 1994) because, fermentation of dietary fibers by large intestinal anaerobic bacteria produced short chain fatty acids (acetate, propionate, and butyrate), which acted as the preferred energy source of colonocytes (Reinhart, *et. al.,* 1994).

Bright *et. al.* (1994) suggested that if the cause of large bowel diarrhoea was not determined, the therapy should aimed to minimize the sign of diarrhoea by decreasing the number of inflammatory cells or by manipulating diet with use of more fiber.

According to Guilford (1994) and Simpson *et. al.* (1994), dietary manipulation provided a non- pharmacological option for long-term management of large bowel disorders.

Guilford (1994), Simpson *et. al.* (1994) and Paterson (1995) reported that an ideal hypoallergenic diet should be with carbohydrate, low fat and a single protein source that the animal had not commonly exposed, and the diet must be selected for each patient on the basis of careful dietary history. The authors suggested that rice as the carbohydrate source, and any one among fish, chicken or lamb can be used as the protein source.

Jergens and Willard (2000) reported that acute colitis could be managed by reduced oral intake for 1 to 2 days so as to minimize the amount of stool passing through the colon.

2.6.2. Deworming

Leib *et. al.* (1991 and 1992) reported that dogs with chronic large bowel diarrhea should be treated for whipworms even if multiple feacal sample examination were negative for ova of endoparasites. The authors recommended deworming schedule with Fenbendazole at the dose rate of 50mg/kg BW daily for three days and repeated in three weeks and again in three months.

2.6.3. Drugs

2.6.3.1. Sulfasalazine

Prolonged sulfasalazine therapy caused high incidence of gastrointestinal side effect in human beings (Dick *et. al*., 1964) and transient or partial kerato conjunctivitis sicca in small animals (Morgan and Bachrach, 1982).

Dissanayake and Truelove (1973) and Leib *et. al.* (1991) reported that sulfasalazine was proven as the first choice drug for the treatment of colitis.

According to Selby (1983) and Pierik *et. al*. (2006), the drug had the role in treatment of ulcerative colitis, Crohn's ileitis and ileocolitis in human beings.

The recommended dose of sulfasalazine in dog was 15-50 mg/ kg BW (Leib *et. al.,* 1991 and Burrows, 1992).

Signs of colitis can be successfully managed by combination of hypoallergenic diet and sulfasalazine therapy (Simpson, *et. al.* 1994).

Karagozian and Burakoff (2007) studied that sulfasalzine consisted of 5-amino salicylic acid (5- ASA) (anti-inflammatory component) linked by an azo bond to sulfa pyridine (anti- bacterial agent). The sulfonamide moiety delivered active component 5-ASA to the colon and there it was released by bacterial action.

2.6.3.2. 5- *Amino Salicylic Acid (5-ASA) preparations*

Houston and Keller (1989) reported that prolonged use of sulfasalazine and other preparations containing 5 –ASA caused keratoconjunctivitis sicca (KCS), a condition deficient of tear production and subsequent inflammation of cornea and conjunctiva in dogs.

5-ASA had potential use in treating inflammatory bowel disorders in dogs and human beings (Ruberman, 1990 and Pierik *et al*., 2006), and Olsalazine, Mesalamine, Asacol, Pentasa, Balzalazide were some of the preparations that containing 5-ASA (Karagozian and Burakoff 2007).

The side effects of sulfasalazine could be reduced by mesalamine preparations (Carter *et al*., 2004), which were containing only 5-ASA moieties without sulfa pyridine carrier molecules (Karagozian and Burakoff, 2007).

Karagozian and Burakoff (2007) found that combination of oral and rectal mesalamine therapy produced complete relief in proctitis and ulcerative colitis than any of these therapies alone.

Mesalamine was equally effective for both continuous (daily) and intermittent (first week of each month) treatment protocol (Moshkovsca and Mayberry, 2007).

2.6.3.3. Immunomodulators

Fraser *et al.* (2002), Carter *et al*. (2004) and Sood *et al.* (2006) confirmed the efficacy of azathioprine at the dose rate of 2 to 2.5 mg /kg BW for the treatment of inflammatory bowel diseases in animals and human beings.

CAT *et al.* (2003) reported that in anal-perianal ulcerative lesions associated with inflammatory bowel disorders, cyclosporine had an important agent in providing regression and healing of lesions in cases refractory to

standard treatment. The author described the duration of treatment from thirty days to two years according to the degree of severity and also recommended as an alternative treatment in restorative surgical interventions.

The duration of treatment was varied from 3 to 6 weeks (Carter *et. al*., 2004) to five years (Fraser *et. al.,* 2002) with minimal toxicity.

Pierik *et. al*. (2006) and Sood *et. al.* (2006) reported that azathioprine (AZA) and prodrug 6-mercapto-purine were the most extensively used immunosuppressive agents for the treatment and maintenance of remission in patients with ulcerative colitis.

2.6.3.4. Corticosteroids

Combination therapy with lower doses sulfasalazine and prednisolone resulted in successful management of diarrhoea without side effect from either drug (Leib *et. al.,* 1991).

Hall (1994b) and Wells *et. al.* (1995) found that beneficial responses were obtained with prednisolone at the dose rate of 1 – 2 mg per kg body weight daily in conjunction with restricted antigen diet in cases of inflammatory bowel diseases due to food allergy.

According to Jergens and Willard (2000), oral corticosteroids were the reasonable first choice drug for induction therapy of colitis along with aminosalicylates in dogs and cats and had short duration of action, cost effective and with very wide availability.

Anal furunculosis rarely responded to mere antibacterial treatment, while immuno modullatory agents such as prednisolone or cyclosporine combined with dietary therapy and antibiotics gave a complete response (Welsh, 2001).

Carter *et. al*. (2004) reported that the potent anti-inflammatory action of corticosteroids were used in relapse of ulcerative colitis and Chron's diseases in human beings

Proctitis and perianal lesions were successfully treated with topical steroids and oral mesalamine (Karagozian and Burakoff, 2007).

2.6.3.5. Antibiotics

Kruiningen (1976) reported that macrolide antibiotic tylosin was useful for resolution of diarrhoea.

Burrows and Ellison (1989) reported that anal sac impaction was corrected by manual evacuation of anal sac and antibiotic treatment required only in cases of associated anal sacculitis.

Duijkeren (1995) reviewed that chloramphenicol and sulphadimidine were very effective in treatment of anal sacculitis.

Metronidazole had beneficial effect in the therapy of canine and feline inflammatory bowel disorders (Guilford, 1996).

Metronidazole was most often combined with corticosteroids or sulfaslazine in patients having moderate to severe histological lesions in colon (Jergens and Willard, 2000).

Westermark, *et. al.* (2005) opined that combination of diet and tylosin was more effective in controlling diarrhoea.

Fibrin glue injection was a safety therapeutic for fistula tracts of patients with Crohn's disease. It activated thrombin to form a fibrin clot, which mechanically seals the fistula tract (Grimaud *et. al*., 2010).

2.6.3.6. Motility Modifiers

Leib *et. al.* (1991) and Leib and Matz (1995) reported that megacolon medically managed by stool softeners (dioctyl sodium sulfosuccinate), prokinetics (cisapride) and nervine stimulants.

Loperamide and diphenoxylate along with fiber supplementation were benefit for treating irritable bowel syndrome and fiber responsive diarrhoea (Jergens and Willard, 2000).

2.6.4. Surgical Treatment

For solitary pedunculated lesions colotomy and polypectomy was sufficient but segmental resection should be used for sessile or multiple lesions (McColl, 1969).

Leib *et. al.* (1992) and Holt and Durdey (1999) reported that adenocarcinoma required an exploratory laparotomy for colonic resection and anastamosis, after that the animal should be fed with highly digestible diets containing more fiber.

White (1997) reported that typhelotomy and typhelectomy were the surgical procedures indicated in caecal impaction.

Bedford (1998) reported that resection of the neoplasm and its associated mesentery was the treatment of choice for adenocarcinoma.

Subtotal colectomy was advised in megacolon if medical management was unsuccessful (Jergens and Willard, 2000).

Materials and Methods

3. MATERIALS AND METHODS

The study was conducted in the Department of Clinical Veterinary Medicine, College of Veterinary and Animal Sciences, Mannuthy during the period from January 2009 to March 2010.

Dogs brought to the veterinary college hospital, Mannuthy and University Veterinary Hospital, Kokkala with Clinical signs suggestive of large bowel diseases were selected and utilized for the present study. Out of 22 cases selected, fifteen dogs with large bowel diarrhoea were subjected to detailed endoscopic evaluation.

Selection of cases

Cases exhibiting any of the specific clinical signs of large bowel disorders such as straining, hematochezia, mucoid dairrhoea, tenesmus and increased frequency of defecation were selected (Plate 1). These animals were subjected to detailed clinical examination and endoscopic evaluation as per the proforma.

3.1. OUTLINE OF STUDY

3.1.1. History

A detailed history was obtained which included information about the managemental and feeding practices.

3.1.2. Clinical examination

A thorough clinical examination conducted as per the proforma and significant changes, if any were recorded.

3.1.3. Digital rectal examination

Digital rectal examination conducted in selected animals for identifying palpable gross abnormalities such as thickened and corrugated mucosa, intra

luminal masses, narrowing of the colonic lumen due to stricture or extra luminal obstruction

3.1.4. Rectal cytology

Rectal cytology was studied during the rectal examination. A gloved finger abraded against the rectal wall and the finger gently rolled across a microscopic slide. The slides were stained with Wright's stain and examined under low power magnification of a microscope (Plate 2).

3.1.5. Faecal examination

Multiple faecal examinations were carried out in all cases. Direct, centrifugal and floatation methods were adopted. Routine deworming was done in all the cases even if the faecal samples were negative for ova of intestinal parasites.

3.1.6. Faecal culture

Faecal culture was done only in cases suspected of bacterial infection. A small amount of fresh faecal materials collected per rectum were immediately inoculated in to routine culture medium-BHIA (brain heart infusion agar) and Mc Conkey's agar and observed for the growth of specific bacteria (salmonella or E. coli).

3.1.7. Haematological Parameters

The following haematological parameters were studied.

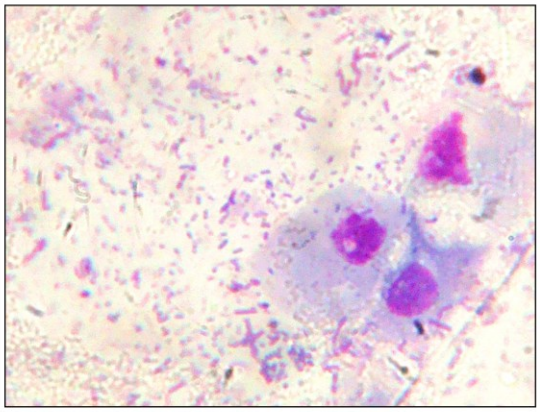
3.1.7.1. Erythrocyte Count

Erythrocytes Count was estimated using Hayem's fluid and values expressed as X 10^6 cells/mm^3 of blood.

Plate 1. Clinical Signs

Straining

Plate 2. Normal Rectal Cytology



Epithelial cells and faecal bacterial colonies

3.1.7.2. Haemoglobin (Hb)

Haemoglobin was estimated by acid-haematin method using Sahli's haemoglobinometer and expressed as gram percentage (Jain, 1986).

3.1.7.3. Packed Cell Volume (PCV)

Packed cell volume was estimated by Wintrobe's method as per Coles (1986) and expressed as per cent.

3.1.7.4. Total Leukocyte count (TLC)

Total leukocyte count was estimated using Thoma's fluid as per Coles (1986) and value expressed as X 10^3 cells/mm^3 of blood.

3.1.7.5. Differential leukocyte count (DLC)

Blood smear was stained with Leishman's stain and 100 leukocytes were counted under oil immersion objective and differential counts were expressed as percentage (Benjamin, 1985).

3.1.7.6. Total Protein and Albumin

Serum total protein was estimated by modified Biuret method described by Weichselbaum (1946) while albumin was estimated by bromcresol green dye binding method as described by Doumas *et. al.* (1971). Total protein and albumin were estimated by spectrophotometry in Secoman Basic spectrophotometer using commercially available kits. (Agappe Diagnostics). Serum Globulin and A: G was calculated from the above obtained values.

3.1.8. Survey Radiography

Radiography was performed only in cases suspected for megacolon, partial intestinal obstruction and abdominal masses.

3.1.9. Colonoscopy

3.1.9.1. Equipment

Animals with diarrhoeic disorders were subjected to detailed colonoscopic evaluation. Flexible colonoscopy was done using STORZ ENDOSKOPE machine, having insertion tube with 140 cm length, outside diameter of 9mm, and a biopsy channel of 2.8 mm. The instrument had four way distal tip deflections, automatic water – air insufflations and a separate suction pump apparatus (Plate 3A).

3.1.9.2. Patient preparation

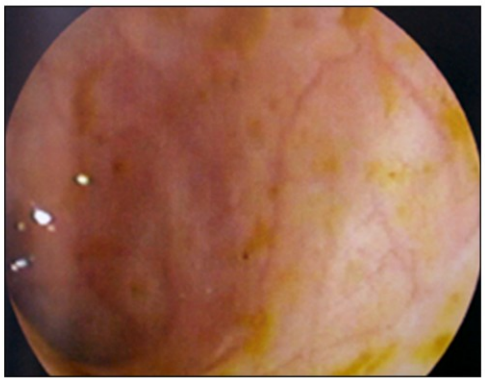
Food was totally withheld for 24 -36 hours, and an oral laxative solution 'Cremaffin' was given to the animals for laxative effect. Multiple warm water enemas were given during the preparation days, at the dose rate of 20 ml / Kg BW for evacuating the colon. On the day of procedure enema was given again, at least 2 hrs before the colonoscopy to make sure that the colon was empty. The procedure was conducted under general anesthesia (Leib *et al.,* 1991).

3.1.9.3. Colonoscopy procedure

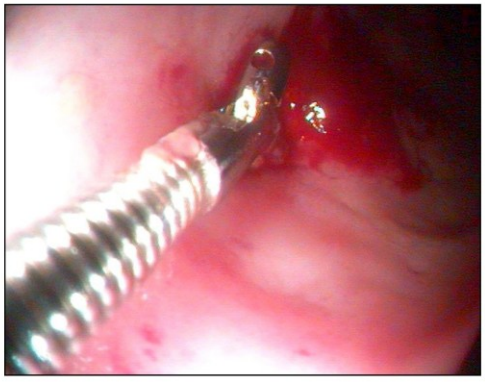
Anesthetized animals were positioned in left lateral recumbency. The endoscope tip was inserted into the rectum, insufflated air to distend the lumen and the tip advanced and deflected in different direction according to visualization of lumen. After advancing through the descending colon, the fold at junction of transverse colon was identified. The tip deflected upwards and advanced slowly by the splenic flexure in to transverse colon. At the end of transverse colon the tip was deflected caudally and slowly advanced past the hepatic flexure in to the ascending colon. Both ileocolic and caecocolic junctions were visualized. Complete evaluation of the colon was performed during the slow withdrawal of endoscope (Plate 3B). Mucosal surfaces were closely evaluated for colour, friability, granularity, ulceration and presences of any gross lesion in the

Plate 3. Colonoscopy

3A. Colonoscopy in progress



3B. Normal colonic mucosa



3C. Mucosal biopsy

lumen. Multiple biopsies were taken from all the lesions. The images were recorded and photographed.

3.1.9.4. Biopsy

The biopsy forceps were advanced through the biopsy channel until they were visible through the endoscope. The forceps was then opened and advanced until mucosal contact was made. Then the forceps was closed and teared off tissue samples by withdrawing the forceps into biopsy channel (Plate 3C). Tissue samples were then gently removed from forceps into vial containing 10% formalin, for further histological studies.

3.1.10. Histopathology

Tissue samples collected during colonoscopy were subjected for histopathological studies. The correlation between colonoscopy and histopathology were studied.

3.1.11. Treatment Trials

After colonoscopy or proctoscopy, deworming was done in all animals and advised dietary management including low protein, low fat, and high fiber diet with easily digestible food. Treatment protocol was decided after getting the histopathology results. Response to treatment was assessed by follow up studies and constant clinical monitoring.

Results

4. RESULT

Dogs presented to the Veterinary College Hospital, Mannuthy and University Veterinary Hospital, Kokkala with clinical signs suggestive of large intestine involvement were subjected to detailed clinical examination as per the proforma. Out of twenty-two cases selected, fifteen cases of large bowel diarrhoea were diagnosed as colitis, and remaining cases were diagnosed as mega colon, large intestinal obstruction and perianal disorders.

4.1 OCCURRENCE OF LARGE BOWEL DISORDERS

Large bowel diarrhoea was recognized in fifteen cases, disorders characterized by constipation were diagnosed in four cases and another three cases were diagnosed as perianal disorders.

Based upon endoscopic evaluation and histopathological examination, diarrhoeic disorders were identified as acute colitis in four animals, chronic colitis in eight animals and chronic colitis with proctitis in three animals.

Acute colitis was associated with parasites and dietary sensitivity. Based upon the type of inflammatory infiltration, chronic colitis was grouped into lymphocytic-plasmacytic colitis and histiocytic ulcerative colitis.

Disorders characterized by constipation were identified as mega colon and ileo-caecal obstruction. Perianal diseases observed in this study were anal furunculosis.

4.1.1. Age

The age wise distribution of colitis among dogs showed that 80 % cases (12 / 15) represented young ones (0 – 4 years) followed by 20 % cases in middle aged (4 – 8 years) dogs. Mean age of affected animals with colitis was 2.9 years ranging from three months to seven years.

The average age of animals affected with anal furunculosis was five years.

4.1.2 Breed

Highest incidence of colitis was found in German Shepherd (46.6 %) followed by Doberman (20 %), Dachshund (13 %), Dalmatian, Boxer and Rottweiler (6 %).

Incidence of mega colon was seen in different breeds, such as Labrador, Doberman and a non descriptive dog. Anal furunculosis was frequently observed in German shepherd dogs (66.6 %).

4.1.3 Sex

Male dogs (63.6 %) were more affected with large bowel disorders when compared to female dogs.

4.1.4 Clinical Signs

Non- specific clinical signs reported were reduced food intakes (70 %), vomiting (25 %), scanty faeces (5 %), diarrhoea (5 %) and constipation (20 %). Specific clinical signs noticed were frequent defecation with small volume of faeces (30 %), straining (85 %), hematochezia (70 %), dyschezia (18) and mucoid stool (45 %).

4.2. DISORDERS CAUSING DIARRHOEA

Diarrhoeic disorders were diagnosed in fifteen cases among which four cases were identified as acute colitis, eight cases as chronic colitis and three cases as chronic colitis with proctitis.

4.2.1 Acute Colitis

Acute colitis was diagnosed in four cases, out of which, two cases were due to parasitic origin and remaining two cases with dietary sensitivity. Average

age of dogs affected with acute colitis was 8.5 months with a range of three months to 17 months.

4.2.1.1. Parasitic colitis

Parasitic colitis was reported in a six-month-old female Dalmatian and a three-month-old male Rottweiler. These animals were presented with clinical signs like frequent defecation with small volume of faeces, straining, hematochezia and excess mucus in stool. Non-specific clinical signs like anorexia and vomiting were also observed.

Vaccination and deworming history was regular in all dogs. Dietary history revealed that they were usually fed with milk, raggi, biscuits, egg and rice.

Visible mucous membrane was pale pink. Clinical examination revealed an elevated body temperature (103 ^{0} F) in one animal, and blood smear of that animal was negative for haemoprotozoan infection. On physical examination thickened intestinal loops could be palpated in both animals. On faecal sample examination ova of Ancylostomes were detected in two cases by direct method, and ovum of Trichuris was detected in Rottweiler by centrifugation method. Rectal cytology revealed presence of few neutrophils, squamous epithelial cells and faecal bacterial colonies (Plate 4A). Feacal culture was attempted in both cases, but there was no specific bacterial growth.

Clinical Pathology

Mean erythrocyte count was 5.02 millions / mm^3. The mean haemoglobin and PCV were 10.35 g % and 30.12 % respectively. Total leucocyte count was 18865 cells / mm^3 with neutrophils 58.75 %, lymphocytes 29.75 %, and eosinophils 8.75 % respectively.

Mean serum total protein level was 6.28 g / dl with albumin 2. 62 g /dl, globulin 3.66 g /dl and A: G ratio 0.71 respectively.

Colonoscopy

Colonoscopy revealed mucosal oedema, hyperemia and disappearance of sub mucosal blood vessels. No other gross abnormality could be detected (Plate 4 B and C).

Histopathology

Histopathology of mucosal biopsy revealed mild to moderate lymphocytic plasmacytic infiltration and cryptitis in some area.

Therapeutic Response

Deworming was done with fenbendazole at the dose rate of 50 mg / kg BW for three consecutive days. A positive response was reported in all cases and regular deworming was advised.

4.2.1.2 DIETARY SENSITIVITY

Dietary sensitivity was diagnosed in an eight month old male German Shepherd and 1.5 year old female Doberman by successful bland diet trial. All the animals were presented with varying clinical signs like frequent defecation with small volume of faeces, straining, hematochezia and mucoid stool as the salient features.

Vaccination and deworming history was regular in all animals. The dietary history revealed that these animals were usually fed with all kinds of food.

Visible mucous membrane was pale roseate. On clinical and physical examination, no abnormality could be detected. Rectal examination evinced pain in one animal and rectal cytology revealed presence of neutrophils, squamous epithelial cells and bacterial colonies. The results of faecal sample examination and faecal culture were insignificant.

Clinical Pathology

Mean erythrocyte count was 5.99 millions / mm^3. The mean haemoglobin and PCV were 12.35 g % and 39.63 % respectively. Total leucocyte count was 15562 cells / mm^3 with neutrophils 63.75 %, lymphocytes 29.75 %, and eosinophils 3.75 % respectively.

Mean serum total protein level was 6.35 g / dl with albumin 2. 45 g /dl, globulin 3.9 g /dl and A: G ratio was 0.64.

Colonoscopy

Colonoscopy revealed mucosal oedema, hyperemia and disappearance of submucosal vascularity.

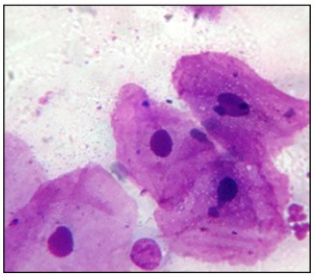
Histopathology

Histopathology of mucosal biopsy revealed intact crypt architecture in all cases. Lamina propria showed oedema and mild lymphocytic plasmacytic infiltration (Plate 4D).

Therapeutic Response

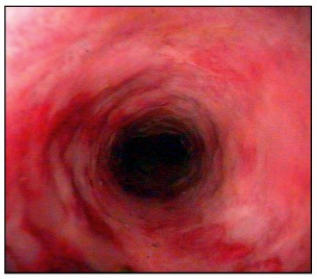
All the dogs were treated with sulfasalazine at the dose rate of 20 mg/ kg BW twice daily orally for 10 days. Diet of the dogs was shifted to hypoallergenic one, which was containing only rice and fish and incorporated more fiber such as vegetables and oats. Therapeutic deworming also done with fenbendazole at the dose rate of 50 mg / kg BW for three consecutive days. The dietary management was continued for two weeks and significant improvement in clinical signs was noticed after two weeks. Advised to continue with hypoallergenic diet and avoid dietary indiscrimination

Plate 4. Acute Colitis

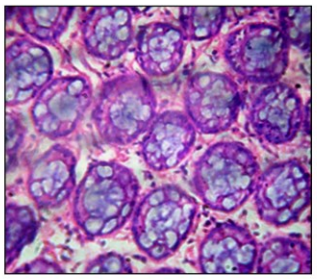


4A. Rectal cytology - epithelial cells and neutrophils

4B. Mucosal oedema



4C. Mucosal hyperemia



4D. Histopathology - mild lymphocytic plasmacytic infiltration with normal crypt architechture (H&E 40x)

4.2.2. Chronic Colitis

Eleven cases were diagnosed as chronic colitis, out of which seven were due to lymphocytic plasmacytic colitis, three were due to lymphocytic plasmacytic colitis with proctitis, and one case was histiocytic ulcerative colitis.

4.2.2.1 Lymphocytic- Plasmacytic Colitis (LPC)

Seven cases were diagnosed as lymphocytic- plasmacytic colitis

Average age of dogs affected with LPC was 3.8 years ranging from two to five years. The cases were reported in Dachshund, German Shepherd, Boxer and Doberman Pincher. Three male dogs and four female dogs were affected with lymphocytic-plasmacytic-colitis in the present study.

Dietary history revealed that animals were daily fed with rice, bread, beef and milk. All animals were presented with varying degree of clinical signs such as hematochezia (n = 7), straining (n = 7), mucoid stool (n = 3), frequent defecation (n = 4), anorexia (n = 4) and vomiting (n = 1).

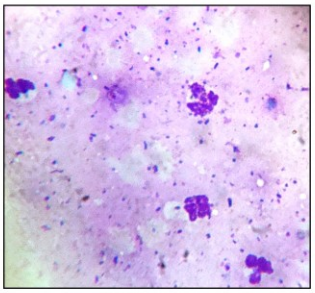
Visible mucous membrane was pale roseate and temperature was within normal range. Digital rectal examination evinced pain in three cases. Rectal cytology revealed the presence of faecal bacterial colony, normal lining epithelial cells and infiltration with neutrophils (in three cases) (Plate 5A). Faecal culture was attempted, but no specific growth could be obtained.

Clinical pathology

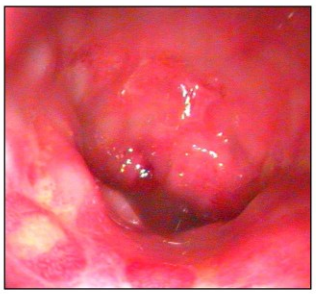
Erythrocyte count was 5.83 millions / mm^3. Haemoglobin and PCV were 13.78 g % and 37.5 % respectively. Total leucocyte count was 17480 cells / mm^3 with neutrophils 70.66 %, lymphocytes 25.16 % and eosinophils 4.16 %.

Serum total protein was 6.6 mg / dl with albumin 2.68 g / dl, globulin 3. 92 g / dl, and A: G ratio 0. 69.

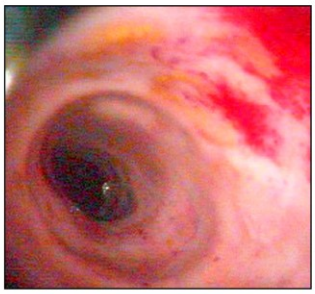
Plate 5. Lymphocytic Plasmacytic Colitis



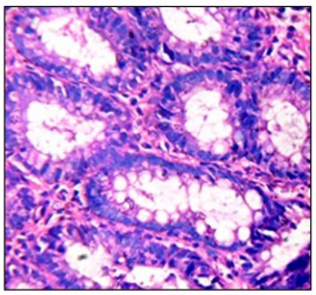
5A



5B



5C



5D

5A : Rectal cytology - neutrophils

5B : Narrowing of lumen due to oedema and hyperplasia of colonic mucosa

5C : Haemorrhagic mucosa

5D : Severe lymphocytic plasmacytic infiltration

Colonoscopy

Hyperemia and extensive oedema of colonic mucosa was observed which gave an irregular appearance to the colonic lumen (Plate 5B). Sub mucosal blood vessels were not visible in all the cases, ulcerative lesions were observed in three cases and petechiae and heamorrhage in one case (Plate 5C).

Histopathology

Surface ulceration with oedema and congestion of lamina propria was observed in three cases and severe infiltration with mononeuclear cells (lymphocyte and plasma cells) was present in all cases (Plate 5D).

Treatment

All animals were treated with sulphasalazine at the dose rate of 20 mg / kg BW twice daily orally for first 10 days along with prednisolone at the dose rate of 1 mg / kg BW orally. Deworming was done in dogs having irregular deworming history, with fenbendazole at the dose rate of 50 mg / kg BW for three consecutive days. All the animals were kept on a bland diet containing only rice and fish for ten days and reviewed after 10 days and observed clinical improvement. Then the dogs were challenged with their old diet and most of them again reproduced the clinical signs. It was diagnosed that five animals had allergy to beef and two animals to wheat protein (bread). The therapy was continued with oral Prednisolone with tapering dose and sulphasalazine with same dose rate for another two weeks. Beef and bread were excluded from the diet and fish and vegetables were incorporated. All the cases responded well to the therapy.

4.2.2.2 Histiocytic Ulcerative Colitis (HUC)

One case was diagnosed as histiocytic ulcerative colitis

The condition was reported in a four-year-old female Doberman. The animal had increased frequency of diarrhoea and presence of fresh blood in the faeces for the last one month. The animal was emaciated but very active with

voracious appetite and normal water intake. The visible mucous membrane was pale. The history of deworming and vaccination was irregular and the animal was fed with all types of food. On clinical examination no abnormality could be detected and faecal sample examination and faecal culture were insignificant.

On rectal palpation no gross abnormality could be detected but the gloved finger was smeared with fresh blood. Rectal cytology revealed characteristic infiltration of large number of small round cells – histiocytes along with plasma cells, lymphocytes, epithelial cells and faecal microbes (Plate 6A).

Clinical pathology

Erythrocyte count was 4.02 millions / mm^3. Haemoglobin and PCV were 7.09 g % and 19.3 % respectively. Total leucocyte count was 7900 cells / mm^3 with neutrophils 52 %, eosinophils 5 % and lymphocytes 32 %.

Serum total protein was 6 g / dl with albumin and globulin 1.2 and 4.8 g / dl respectively and A: G was ratio 0.25.

Colonoscopy

Hyperemic, thickened and oedematous colonic mucosa was observed with extensive mucosal ulceration (Plate 6 B and C).

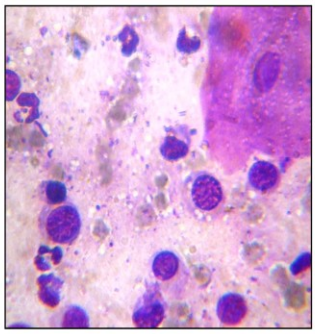
Histopathology

Based upon the histopathology and rectal cytology the condition was diagnosed as histiocytic ulcerative colitis in which lamina propria showed a dense infiltration with lymphocytes, plasma cells and histiocytes. The ulcerated areas showed inflammatory exudates and necrotic material (Plate 6D).

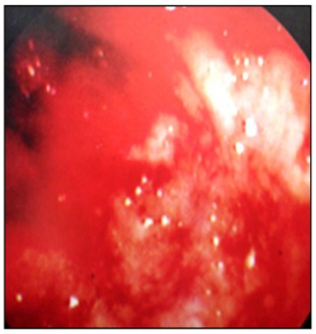
Therapeutic response

Injection with sulphadiazine trimethoprim combination* at the dose rate of 15 mg / kg BW and injection metronidazole* * at the dose rate of 25 mg /kg

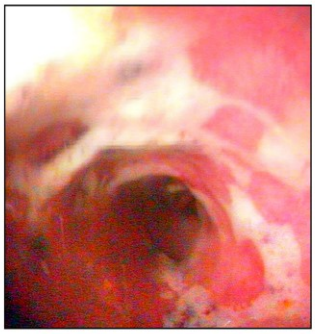
Plate 6. Histiocytic Ulcerative Colitis



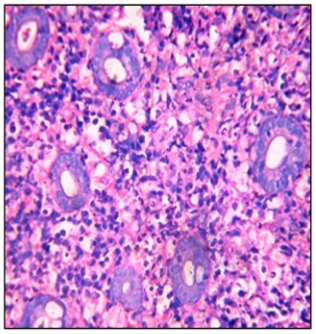
6A



6B



6C



6D

6A : Rectal cytology - large number of histiocytes and plasma cells

6B & 6C : Hyperemic oedematous colonic mucosa with extensive ulceration

6D : Histopathology- dense infiltration with histiocytes, plasma cells and lymphocytes (H & E 40x)

BW were given intravenously for five days to correct diarrhoea but no response could be obtained. A mild response was obtained with sulfasalazine* * * at the dose rate of 20 mg / kg BW orally along with injection prednisolone[4]* at the dose rate of 1 mg / kg BW intramuscularly for two weeks. Deworming was done with fenbendazole[5]* at the dose rate of 50 mg / kg BW for three consecutive days. Diet was restricted to completely avoid beef and wheat products, and incorporated more vegetables, curd and fiber. No significant improvement was noticed after two weeks of treatment and hematochezia and diarrhoea were still present. The prognosis was bad and the animal was discharged with the advice to continue the treatment orally. The animal succumbed to death after one week.

4.2.2.3 Chronic Colitis with Proctitis

Three cases were diagnosed as chronic colitis with proctitis. Average age of dogs was four months. All the affected animals were male German shepherd dogs.

Clinical signs observed were straining (n = 3), frequent defecation (n = 1), hematochezia (n = 2), mucoid stool (n = 1), and reduced food intake (n = 3). Elevated body temperature was observed in one animal (104 ^{0} F) and it was positive for Ehrlichiosis. Digital rectal examination evinced severe pain in all the three cases and thickened rectal mucosa and nodular lesions in the rectum could be noticed in two cases. Faecal sample examination was positive for ova of Ancylostome in one animal.

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* Inj BIOTRIM IV (Vetnex RFCL)

* * Inj METROGYL (JB Chemicals)

* * * Tab SAZO- EN (Wallace)

4 * Tab WYSOLONE (Weyth)

5 * Bls FENTAS (Intas)

Clinical Pathology

Erythrocyte count was 5.52 millions / mm^3. Haemoglobin and PCV were 11.8g % and 30.3 % respectively. Total leucocyte count was 20683 cells / mm^3 with neutrophils 48.57 %, eosinophils 14.7 % and lymphocytes 33.7 % and monocytes 3 %.

Serum total protein was 6.5 g / dl with albumin and globulin as 2.5 and 4 g / dl respectively. A: G ratio was 0.64.

Colonoscopy

Colonoscopy revealed erythematous mucosa of the entire colon and rectum in two cases, corrugated lumen just behind the anal sphincter in one case and ulcerated rectal mucosa in one case. Sub mucosal blood vessels had disappeared in all the three cases (Plate 7 A and B).

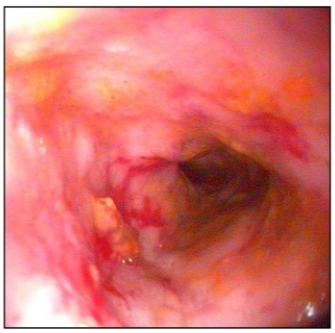
Histopathology

Histopathology of mucosal biopsy revealed severe infiltration with lymphocytes and plasma cells in the lamina propria (Plate 7C).

Treatment

All animals were treated with sulfasalazine at the dose rate of 20 mg / kg BW twice daily along with prednisolone at the dose rate of 1 mg / kg BW orally for 10 days. For proctitis, Proctosedyl ointment was applied in the rectum. Deworming was done in the case of Ancylostomiasis with fenbendazole at the dose rate of 50 mg / kg BW for three consecutive days. Ehrlichiosis was treated with tetracycline (inj. Terramycin) for five days. Follow up examination showed clinical improvement and therapy continued for next 10 days and advised to feed with hypoallergenic diet for prolong period.

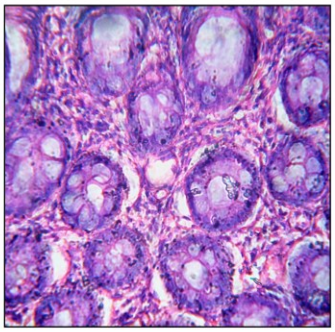
Plate 7. Chronic Colitis with Proctitis



7A

7B

7A & 7B : Ulcerated colonic mucosa with loss of sub-mucosal vascularity



7C

C : Histopathology- severe lymphocytic plasmacytic infiltration in the lamina propria (H & E 40x)

4.3. DISORDERS CAUSING CONSTIPATION

Mega colon and ileocaecal obstruction were diagnosed in total four animals.

4.3.1 Mega colon

Idiopathic mega colon was diagnosed in three animals.

All the affected dogs were males and the average age was 4.3 years ranging from three to five years. The breeds of dogs involved were Labrador, Doberman and a non descriptive dog.

Anorexia, constipation, severe straining with unproductive attempts for defecation were the clinical signs in all animals. Vomiting was reported earlier in Labrador and Doberman dogs. The affected Doberman was very weak, emaciated and vomitus had faecal odour and was in recumbent stage. Temperature was within normal range and visible mucous membrane was pale roseate in two cases and injected in one case (Doberman). The movement of air filled distended colon could be visible from out side in case of Doberman. On abdominal palpation, highly distended colon could be palpable in all cases. On digital rectal examination hard faecal materials were tightly packed in the rectum and it was taken out manually.

Clinical Pathology

Erythrocyte count was 5.04 millions / mm^3. Haemoglobin and PCV were 10.09 g % and 30.28 % respectively. Total leucocyte count was 20683 cells / mm^3 with neutrophils 76.5 %, eosinophils 2.3 % and lymphocytes 21 %.

Serum total protein was 6.18 g / dl with albumin and globulin were 2.78 and 3.40 g / dl respectively with A: G ratio was 0.81.

Radiography

Survey abdominal radiographs detected highly distended colon with faecal materials (Plate 8 A and B).

Treatment

Labrador referred for surgical intervention to evacuate colonic contents.

Non- descriptive dog with idiopathic mega colon was managed with fluid therapy, injections neostigmine* at the dose rate of 0.5 mg / kg BW and mecobalamine* * intramuscularly for three days. Tablet bisacodyl* * * 5mg was given twice daily orally for softening the faeces. Slight clinical response was noticed, and the animal was discharged and advised to continue with neostigmine and methyl cobalamine orally. The animal did not turn up for follow up. The Doberman succumbed to death on the next day of hospitalization. Labrador successfully recovered after surgery but died after one week.

4.3.2 Ileo-caecal obstruction

One case was diagnosed as ileo- caecal obstruction

The case was reported in a two-year-old male Labrador retriever dog. The animal was anorectic, and had vomiting, straining with unproductive attempts to defecate for last three days. The owner reported that the dog had pica and used to eat stones.

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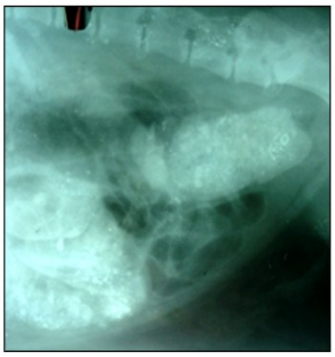
* Inj TILSTIGMIN (Tablets)

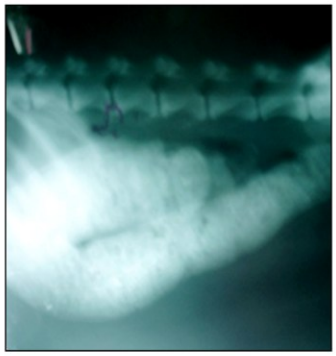
* * Inj METHYCOBAL (Wockhardt)

* * * Tab DULCOLAX (German Remedies)

Plate 8. Skiagram of disorders causing constipation

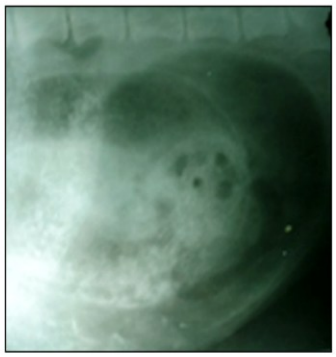


8A



8B

8A & 8B : Megacolon



8C

8C : Ileocaecal obstruction

The dog was active. Clinical examination revealed mild dehydration and on abdominal palpation a hard mass on the ventral abdomen could be palpated and it was painful on deep palpation. Rectum was empty on digital examination.

Clinical Pathology

Erythrocyte count was 6.86 millions / mm^3. Haemoglobin and PCV were 13.9 g % and 41.16 % respectively. Total leucocytes count was 23100 cells / mm^3 with neutrophils 80 %, eosinophils 2 %, lymphocytes 16 % and monocytes 2 %.

Serum total protein was 6.2 g / dl with albumin and globulin were 1.2 and 5 g / dl respectively with A: G ratio was 0.2

Radiography

Radio dense materials could be detected in the ileo-caecal junction, and posterior to that area the lumen was filled with air column (Plate 8C).

Treatment

The dog was referred to surgery unit for explorative laparotomy. The animal responded well to the surgical management and recorded clinical improvement.

4.4 PERIANAL DISORDERS

4.4.1 Anal furunculosis

Anal furunculosis was diagnosed in three cases.

Anal furunculosis was recorded in a two-year-old male Dalmatian and four-year and nine-year-old male German Shepherd dogs. These dogs were presented with the complaint of bleeding ulcerative lesions in the perianal region, straining, hematochezia, tenesmus and anorexia for the last one week (Plate 9 A and B)

Plate 9. Anal Furunculosis

9A

9B

9A & 9B : Ulcerative bleeding tract in the perianal region

Detailed examination of perianal region revealed many bleeding draining tract surrounding the anal opening. Rectal palpation elicited severe pain and animals were with elevated body temperature (103.2 ^{0} F). Results of faecal sample examination, rectal cytology and faecal culture were not significant.

Clinical Pathology

Erythrocyte count was 5.92 millions / mm^3. Haemoglobin and PCV were 11.83 g % and 35.5 % respectively. Total leucocytes count was 9250 cells / mm^3 with neutrophils 50 %, eosinophils 2% and lymphocytes 48 %.

Serum total protein was 6.26 g / dl with albumin and globulin as 2.57 and 3.69 g / dl respectively with A: G ratio 0.7.

Treatment

The dog was under therapy with parentral fluids and injection B-complex. Injection enrofloxacin was given at the dose rate of 5 mg / kg BW intramuscularly once daily for five days with Proctosedyl ointment topical application daily in rectum. Complete recovery was reported after two weeks of treatment.

Discussion

5. DISCUSSION

Large bowel disorders observed in this study were classified as disorders causing diarrhoea, constipation and perianal affections. Based upon the endoscopic evaluation and histopathologic findings the diarrhoeic disorders were again classified into acute colitis, chronic colitis and chronic colitis with proctitis. Disorders causing constipation were diagnosed as mega colon and ileocaecal obstruction by radiography and physical examination.

5.1 OCCURENCE

Out of 22 cases of large bowel disorders, 15 cases of diarrhoea were utilized for detailed endoscopic evaluation. Out of 15 cases, four cases were diagnosed as acute colitis; eight cases as chronic colitis and three cases as chronic colitis with proctitis.

Remaining seven cases were diagnosed by physical examination and radiography as mega colon (three cases), ileocaecal obstruction (one case) and perianal diseases (three cases).

Colitis was reported in 68 % (15 / 22) cases. Simpson (1993) observed that colitis constituted the largest group of large bowel disorders. In the present study, majority of colitis cases (73.3 %) were diagnosed as chronic colitis or idiopathic inflammatory bowel disorders.

5.1.1. Age

Average age of dogs affected with colitis in the present study was 2.9 years, which was in agreement with the findings of Hall *et. al.,* (1994) and Leib (2000), whereas Gaag (1988) reported that colitis in middle age dogs.

The average age of dogs affected with perianal diseases was five years and was in agreement with the observation of Welsh (2001).

5.1.2. Breed

Large bowel disorders were found to be more in German Shepherd (40.9 %) followed by Doberman (18 %).

Based on disease wise incidence, colitis was found to be more in German Shepherd (7 / 15), followed by Doberman (3 / 15). Gaag and Happe (1989) and Jergens and Willard (2000) observed that Boxer and German Shepherd breeds were highly predisposed to chronic colitis. The higher incidence in German Shepherd may be due to the over representation of this breed in local population.

The incidence of anal furunculosis was also more in German Shepherd (2 / 3cases). It is in agreement with the reports of Welsh (2001) and DeNovo *et. al*. (2000).

5.1.3. Sex

Male dogs (63.6 %) were more affected with large bowel disorders when compared to female dogs.

It was found that 57 % male dogs affected by colitis in the present study were in agreement with observations of Gaag and Happe (1989), Stokes *et. al*. (2001) and Leib (2000), whereas Gaag (1988) reported that chronic colitis frequently encountered in females. The predominance of males over females in the population also has to be considered.

In the present study, anal furunculosis was observed in male animals only, as in accordance with Welsh 2001.

5.1.4. Clinical Signs

Non – specific clinical signs reported were anorexia (70 %), vomiting (25%), scanty faeces (5%), and constipation (20 %). Specific clinical signs noticed were straining (85 %), hematochezia (70 %), mucoid stool (45 %) and frequent defecation with small volume of faeces (30 %).

Inflammation of colon stimulated the defecation reflex, resulting in increased urgency and frequent defecation of small faecal volume. Continued stimulation of the defecation reflex even after emptying of the colon lead to tenesmus with scanty stool. Inflammation or irritation of the goblet cells lead to excess mucus production and erosion or ulceration of the colonic mucosa caused hematochezia (Leib *et. al.,* 1991)

5.2. DISORDERS CAUSING DIARRHOEA

Diarrhoeic disorders were diagnosed in 15 cases. Four animals had acute colitis, eight animals had chronic colitis, and three animals had chronic colitis with proctitis.

5.2.1 Acute colitis

Acute colitis was observed in four cases and based on the etiology they were grouped into parasitic colitis (two cases) and colitis due to dietary sensitivity (two cases).

Average age of dogs affected with acute colitis was 8.5 months ranging from three months to 17 months. Gaag (1988) reported that colitis could occur in dogs at any age.

5.2.1.1 Parasitic colitis

Specific clinical signs observed such as straining, hematochezia, mucoid stool and frequent defecation with small volume of faeces were similar to the observations made by Gaag (1988), Leib *et. al,* (1992) and Bright *et. al.* (1994).

Non – specific clinical signs like anorexia and vomiting observed were in accordance with the findings of Bright *et. al*. (1994). In parasitic colitis, clinical signs varied from none to intermittent diarrhoea depending upon the number of worms and host response (Jergens and Willards 2000). One dog showed elevated body temperature (103 ^{o} F), and could be due to excitement. Blood smear examination ruled out the chance of haemoprotozoan infection. Thickened intestinal loops could be palpated in two animals (Houston, 2000) and they were positive for ova of Ancylostome and Trichuris in faecal sample examination. These findings agreed with Leib *et. al*. (1991), who reported that endoparasites were the second most common cause of acute and chronic large bowel diarrhoea. The thin anterior portion of the adult worm burrows into the mucosa of caecum and ascending colon producing localized inflammation and mucosal hyperplasia (Leib *et. al.,* 1991 and 1992).

CLINICAL PATHOLOGY

The haematological parameters revealed a mild reduction in total erythrocyte count, haemoglobin and packed cell volume, and were in accordance with Benjamin (1985). Morgans (1967) reported reduced haemoglobin level in intestinal parasitism in dogs and it attributed to secretion of haemolysin, production of myelotoxins, which injure the organs of blood formation, blood sucking activities of the parasites and depletion of haemopoietic hormones. The cause of reduced haematological values was attributed to parasitism.

A mild leucocytosis was noticed (18865 cells / mm^3) with eosinophilia (8.75 %). Benjamin (1985) reported that eosinophilic leucocytosis was characteristic to parasitism and allergic reaction, which was in agreement with the present findings. No significant change could be observed in serum biochemistry.

COLONOSCOPY

On colonoscopy, mucosal hyperemia and loss of sub mucosal vascularity were noticed. Similar findings were reported by Leib *et. al.* (1991) and Hall *et. al.* (1994).

Histopathology

Histopathology revealed mild to moderate lymphocytic plasmacytic infiltration with cryptitis in some areas, which was similar to the observation made by Matsushita *et. al*. (2007) and Gaag (1988).

Treatment

In the present study all the animals responded to the standard treatment. According to Leib *et. al.* (1991 and 1992), a presumptive diagnosis of whipworm infestation could be made if the clinical signs improved within 2 to 5 days of appropriate anthelminthic therapy.

5.2.1.2. Dietary Sensitivity

In the present study, the affected animals were fed with all kinds of food and some sort of dietary indiscrimination was also reported. The histopathology results also proved a moderate immune reaction that was in agreement with the findings of Marks and Fascetti (2000), and according to them any repeatable adverse reaction to food that can be successfully managed solely by the exclusion of specific dietary component is defined as dietary sensitivity, and it may be either immune mediated or non – immune mediated.

CLINICAL PATHOLOGY

The haematological parameters and results of serum biochemistry analysis were within normal range, which was similar to the reports of Leib *et. al.* (1992), Simpson (1993) and Hall *et. al.* (1994). Benjamin (1985) opined that in colitis total leucocyte count would remain within normal range, but leucocytosis might occur secondary to bacterial infection.

Colonoscopy

In all cases diffuse mucosal oedema, loss of sub mucosal vascularity and wall thickening were noticed. Similar findings were reported by Leib *et. al.* (1991) and Hall *et. al.* (1994).

HISTOPATHOLOGY

Mild lymphocytic plasmacytic infiltration and oedema of lamina propria with intact crypt architecture were observed which were similar to the observations made by Matsushita *et. al*. (2007).

TREATMENT

Animals were responded positively to the exclusion diet and medical management. Leib (2000) observed that most of the animals could be successfully managed with hypoallergenic diet only and in some cases medical therapy also added to control the clinical signs. Therapeutic deworming was done in all cases because adult Trichuris worm shed ova intermittently, which could result in false negative results on faecal examination (Leib *et. al.,* 1991 and 1992.)

5. 2.2. Chronic colitis

5.2.2.1. Lymphocytic- Plasmacytic Colitis

The specific clinical signs like hematochezia, straining, mucoid stool and frequent defecation recorded were similar to the observations made by Gagg (1988), Leib *et. al.* (1992) and Bright *et*. *al.* (1994). Non- specific clinical signs such as anorexia in four animals and vomiting in one animal were also observed in the present study. Magne (1989) reported that vomiting could be associated with large bowel diarrhoea due to visceral stimulation or as a result of its effect on gastric emptying.

Dietary history revealed that most of the affected dogs were fed with beef, bread and rice. Jergens and Willard (2000) reported that inflammatory bowel

disorders were initiated by an appropriate immune response. The present study found that most of the affected animals had allergy to beef and some had allergy to bread, which was in accordance with Paterson (1995) and Leib *et. al.* (1991). Food allergy was diagnosed by observing the gastrointestinal signs and was resolved by elimination of antigenic diet and could be reproduced when challenged with initial diet (Paterson, 1995). All the dogs tolerated the hypoallergenic diet that consisted of rice as the major carbohydrate source and fish as the novel protein source (Guilford, 1994 and Simpson *et al.*, 1994). Leib *et. al.* (1991) suggested a protocol for identifying the offending allergens in the diet, i.e. the hypoallergenic diet should be reinstituted until the diarrhoea resolves and addition of foodstuffs can then be added individually for seven to ten days until diarrhoea develops. Many owners were so delighted with the clinical improvement seen with hypoallergenic diet and were not much interested for specific diagnosis.

Rectal cytology revealed normal lining epithelial cells, infiltration with few neutrophils, and bacterial colony. Leib *et. al.* (1992) Leib and Matz (1995) also had similar findings.

Faecal culture was reasonable in animals with infectious diarrhoea (Leib and Matz 1995). In the present study faecal culture did not reveal any pathogen.

Clinical pathology

Haematological studies and the results of serum biochemistry analysis were within normal range except for the mild elevation of leucocyte and neutrophil count, which was similar to the observation made by Leib *et. al.* (1992).

Colonoscopy

Grossly, hyperemia, diffuse oedema and loss of submucosal vascularity of colonic mucosae and ulcerative lesions were observed. This was in agreement with the findings of Leib *et. al.* (1991) and Hall *et. al.* (1994).

Histopathology

Histological findings of surface ulceration with oedema and congestion of lamina propria and severe lymphocytic plasmacytic infiltration were in agreement with the findings of Bright *et. al.* (1994) and Dunn and Villiers (1998).

Treatment

Clinical improvement was observed after treatment with sulfasalazine, prednisolone and dietary management (Simpson *et al.,* 1994). The response to dietary management and relapse when challenging with dietary antigen confirmed immune mediated food hypersensitivity (Harvey, 1993, Paterson, 1995 and Rutgers *et. al.,* 1995). In the present study, the allergic components were diagnosed as beef and wheat, which was in accordance with Paterson (1995).

5.2.2.2. Histiocytic Ulcerative Colitis (HUC)

Histiocytic ulcerative colitis was an uncommon chronic idiopathic large bowel disease characterized by progressive colonic ulceration and histiocytic infiltration of lamina propria.

According to Jergens and Willard (2000) and Hall *et. al.* (1994), histiocytic ulcerative colitis (HUC) had been regarded as a disease unique to Boxers or other closely related breeds. In the present study a disease with similar symptoms was diagnosed in a four-year-old Doberman. Stokes *et. al.* (2001) reported the occurrence of HUC in a one-year-old castrated male Doberman pincher, which had similar clinical and histopathological finding as in boxer with HUC.

Clinical signs observed were similar to the observation made by Leib *et. al.* (1991) and Hall *et. al.* (1994). Pale mucous membrane observed in this case could be due to anaemia associated with chronic bleeding ulcers in the colon. Rectal smear revealed massive histiocytic infiltration along with normal epithelial cells, as in accordance with findings of Jergens and Willard (2000).

Clinical pathology

Mean erythrocyte count, haemoglobin and packed cell volume were 4.02 millions / mm^3, 7.09 g % and 19.3 % respectively indicating marked anemia, which might be due to substantial enteric hemorrhage owing to extensive colonic ulceration observed during endoscopic evaluation.

Results of serum analysis revealed hypoalbuminaemia, hyperglobulenaemia with altered A/G ratio. In the present study hypoalbuminaemia was relative to hyperglobulenaemia. Increased globulin level and low A / G ratio were indicative of chronic inflammation and antigenic stimulation (Benjamin, 1985 and Lording and Friend, 1991).

Colonoscopy

Colonoscopy revealed thickened, hyperemic and oedematous colonic mucosa with extensive ulceration. The findings were in agreement with the observations of Leib *et. al.* (1991) and Hall *et. al.* (1994). Stokes *et. al.* (2001) reported diffuse, hyperemic nodular mucosa with multifocal haemorrhages and superficial ulcers in dogs affected with HUC.

Histopathology

In the present study HUC was diagnosed by histopathological examination characterized by infiltration of histiocytes and other mononeuclear cells in the lamina propria. This finding was correlated with the huge infiltration of histiocytes in the rectal smear (Stokes *et. al.,* 2001).

Presence of Periodic Acid Schiff (PAS) positive histiocytes was another method for confirming HUC. The PAS positive inclusions represented phagocytosed glycoprotein and cellular debris, and accumulation of these materials which indicated greater amount that could not be cleared by macrophages. Such striking accumulations of macrophages were not seen in other ulcerative colitis (Stokes *et. al.,* 2001).

Treatment

Only temporary relief was obtained by medical therapy. Prognosis of HUC was often worse than other types of colitis (Hall *et. al.,* 1994 and Stokes *et. al.,* 2001) and the affected animal succumbed to death.

5.2.2.3 Chronic colitis with proctitis

Three cases were diagnosed as chronic colitis with proctitis. Inflammation of entire colon and rectum was observed in all dogs. Clinical signs like straining, increased frequency of defecation, hematochezia, and mucoid stool were similar to the observations made by Leib *et. al*., (1992); Bright *et. al.,* (1994) and Paterson (1995).

Rectal palpation was painful in three animals with thickened mucosa and nodular lesions in the rectum. Severe rectal inflammation elicited pain on digital palpation. Kelly (1974) reported that in painful conditions of rectum and anus, animals showed some resentment to perectal examination and evincing a painful response on introduction of finger into the rectum confirmed the presence of such lesions.

One animal had elevated body temperature (105 ^{o} F) at the time of presentation. Blood smear examination confirmed Ehrlichiosis, and another one animal was positive for Ancylostomiasis.

Clinical pathology

Haematology revealed mild anemia, due to chronic blood loss from colonic bleeding ulcers. In addition, there was a chance of occult parasitism, usually with whipworm infestation in which faecal sample examination gives a false negative result (Leib *et. al.,* 1991 and 1992). In the present study one animal was positive for Ancylostomiasis. Eosiniphilic leucocytosis might be due to food allergy or gastrointestinal parasitism and presence of mild lymophocytosis also characteristic to prolonged antigenic stimulation and hypersensitivity (Kelly, 1974).

Colonoscopy

Colonoscopy findings such as hyperemia, mucosal ulceration and irregular folds were in agreement with the observations of Leib *et. al.* (1991) and Hall *et. al.* (1994).

Histopathology

Histopathology revealed severe infiltration with lymphocytes and plasma cells in rectal and colonic mucosa as observed by Bright *et. al.* (1994) and Dunn and Villiers (1998).

Treatment

All animals responded well to the standard treatment adopted and were strictly placed on hypoallergenic diet. Simpson *et. al.* (1994) described the rationale behind the use of hypoallergenic diet that, high digestibility of macronutrients reduce the digestive challenge to the large intestine (the colon may get irritated by coarse fibre particle); low antigen diversity reduce the chance of immunological reaction, and the chance of potential dietary antigen reaching the colon was minimized as most digestion occurs in small intestine.

Clinical signs suggestive of colitis were confirmed by endoscopic evaluation and histopathologic findings.

5.3. DISORDERS CAUSING CONSTIPATION

5.3.1. Mega colon

Mega colon was diagnosed in three animals characterized by diffuse colonic dilation with ineffective motility.

The clinical signs observed were anorexia, constipation, intense straining with unproductive attempts to defecation as reported by Leib and Matz (1995). Abdominal palpation revealed distended colon in all the cases (Holt and Brockman, 2003). The affected Doberman was weak, vomitus had faecal odour and was in recumbent stage. Drazner, (1985) reported that vomiting of faecal like material was a poor prognostic sign. The depression of animal indicating toxemia and Kelly (1974) reported that animals were usually dull in chronic constipation due to low level of toxemia or bowel perforation (Drazner, 1985).

Idiopathic mega colon may be congenital, but more commonly acquired in later life. According to Leib and Matz (1995) trauma resulting in damage to colonic innervations and neuromuscular disorders were the infrequent cause of acquired mega colon, while Kelly (1974) reported that the changes in the innervations of colon by decrease in number of autonomic nerves and greatly increased tone of muscle fibers inhibit the passage of faeces.

Radiographic findings confirmed the colonic dilation.

Clinical pathology

Haematology revealed marked leucocytosis and neutrophilia. According to Benjamin (1985), non-infectious generalized inflammatory reaction could be seen in intestinal atony. The magnitude of inflammation could be estimated by degree of neutrophilia.

Treatment

Animals usually fail to respond to the medical management for mega colon. They were initially managed with fluids and electrolytes and then with antibiotics and motility modifiers (Leib and Matz, 1995). Follow up was not available in the case of non descriptive dog which was advised to continue with Neostigmine and stool softeners. The Doberman succumbed to death during the course of treatment and the Labrador responded to the surgery initially, but died after one week. Leib and Matz (1995) and Jergens and Willard (2000) reported that even when the underlying cause of mega colon could be identified and treated, the functional changes in the dilated colon were often irreversible. The present cases agreed with their observations.

5.3.2. Ileo - caecal obstruction

Ileo-caecal obstruction was identified in a two-year-old Labrador dog. The clinical signs recorded like anorexia, constipation, vomiting, and straining were in accordance with Hall and Simpson (2000), in which vomiting was reported as the major feature of intestinal obstruction. Clinical signs were more related to fluid and electrolyte loss, constipation and straining.

Clinical examinations revealed changes suggestive of mild dehydration. Physical examination revealed palpable abdominal mass and pain on deep palpation as observed by Drazner (1985), who reported that palpation of abdomen revealed generalized or localized pain in conditions of mechanical intestinal obstruction.

Survey abdominal radiograph confirmed the presence of radio dense foreign material in the ileo-ceacal junction and air filled lumen posterior to the obstruction. Reidesel (2002) reported that the most consistent radiographic finding of mechanical obstruction was variable dilation of bowel loops at the level of obstruction. Drazner (1985), reported constricted segments in the region of

obstruction and segments posterior to the obstruction had large number of gas-capped loops as radiographical findings.

Clinical pathology

Haematology findings were suggestive of neutrophilic leucocytosis. Benjamin (1985) suggested that neutrophilic leucocytosis was characteristic to foreign body obstruction and elevated haematocrit values indicating haemoconcentration, which might be due to anorexia and fluid loss through vomiting. According to Drazner (1985), leucocytosis might be due to stress condition.

Treatment

The dog responded well to the surgical management and postoperative care.

5.4. PERIANAL DISEASES

5.4.1. Anal furunculosis

Anal furunculosis was diagnosed in three cases. The exact etiology of the condition was not determined suggesting that folliculitis, anal sac diseases, hypothyroidism (by impairing wound healing), tail carriage conformation, bacterial infection, faecolith impaction or immuno suppression might lead to the development of perianal diseases. German Shepherd dogs have greater density of apocrine gland or anal gland in the cutaneous zone and hence the inflammation of anal gland in this region was very common (Welsh, 2001). In the present study, higher incidence of the condition among German Shepherd dogs supported above findings.

The clinical signs (hematochezia, tenesmus, elevated temperature and anorexia) and findings of physical examination (perianal sinuses, bleeding

fistulous tract and pain on digital palpation) were similar to the observations made by Welsh (2001), Day (1993) and Duijkeren (1995).

Clinical pathology

The haematology and results of serum biochemistry were within the normal range and was in accordance with Welsh (2001), who reported that routine haematological and biochemical screening was not useful unless there was an evidence of endocrine pathology.

Treatment

All animals responded well to antibiotic therapy and topical per rectal application of Proctosedyl ointment. Immunopathology of anal furunculosis was well documented by Welsh (2001) and Day (1993) and, suggested treatment with immuno suppressive agents orally. Better clinical improvement was noticed with the use of Proctosedyl ointment, which contained framycetin sulphate and hydrocortisone.

Summary

6. SUMMARY

Large bowel disorders in dogs were subjected to detailed clinical investigation to study the etio-pathogenesis and to correlate the clinical signs with colonoscopic and histopathological findings.

Materials for the present study were selected based on the history and clinical signs. Out of 22 cases selected, 15 cases with signs of large bowel diarrhoea were subjected to detailed endoscopic evaluation, and classified as acute and chronic colitis based on histopathology. Chronic colitis again grouped into lymphocytic plasmacytic colitis, lymphocytic plasmacytic colitis with proctitis and histiocytic ulcerative colitis. Remaining seven cases were diagnosed by physical examination and radiography as mega colon, ileo-caecal obstruction and perianal disorders.

Age of the animals affected with colitis was 2.9 years with a range from three months to seven years and that of perianal disorders was five years ranging from …. Among the various dog breeds, highest incidence of large bowel disorders was found in German Shepherd 40.9 % (9 / 22) followed by Doberman 18 % (4 / 22). Male dogs (63.6 %) were more affected by large bowel disorders than female dogs.

Clinical signs specific to large bowel diarrhoea were straining (85 %), hematochezia (70 %), and excess mucus in the faeces (45 %). Non-specific clinical signs were anorexia (70 %) and vomiting (25 %). Physical examination findings were apparently normal in most of the animals affected with large bowel diarrhoea. Digital rectal palpation was painful in animals affected with chronic colitis, chronic proctitis and anal furunculosis. Rectal cytology revealed presence of inflammatory cells, normal epithelial cells and faecal bacterial colonies. Rectal cytology results were always correlated with the histological findings.

Ova of Ancylostome and Trichuris were detected in dogs affected with chronic proctitis and parasitic colitis. Most often, the haematology and serum biochemistry results were within the normal range. Varying degrees of neutrophilic leucocytosis were present in parasitic colitis, lymphocytic plasmacytic colitis, mega colon and ileo-caecal obstruction. Mild anemia was present in parasitic colitis and severe anaemia with hypoproteinaemia were the findings in histiocytic ulcerative colitis.

Flexible colonoscopy under general anesthesia was carried out in animals with large bowel diarrhoea. Presence of any gross abnormality or changes in mucosal colour, thickness, friability and regularity of lumen were examined with endoscope. Multiple biopsies were taken and studied the histological characteristics.

Inflammations of the colon were acute or chronic. Acute colitis produced mucosal hyperemia or oedema and loss of sub-mucosal vascularity. Histopathology was characterized by mild infiltration of inflammatory mononeuclear cells with or without reduced number of goblet cells. Chronic colitis was characterized by diffused mucosal oedema, hyperemia and ulceration or erosion of the colonic mucosa. Histologicaly, severe infiltration of lymphocytes, plasma cells and rarely histiocytes were present. Crypt architecture and size of the goblet cells were not altered whereas the number of goblet cells was decreased due to increased cellular infiltration

Mega colon and ileo- caecal obstruction were diagnosed by clinical signs (straining and constipation) with the characteristic radiographic findings such as dilated colon and presence of intestinal obstruction at the ileo–caecal junction respectively. Perianal diseases were diagnosed by specific clinical signs like hematochezia, dyschezia, straining, and physical findings of draining ulcerative fistulous tract around the anus.

In most cases, the inciting factors were unknown. Parasitic and allergic causes were detected in acute colitis. Inflammation could be the result of a defect in mucosal immunoregulation. After initial mucosal injury, sub mucosal lymphocytes and macrophages become exposed to luminal antigens and subsequently initiated an inflammatory process. Exaggerated reactions to dietary or bacterial factors within the lumen of the bowel or sequelae of previous infectious or parasitic disease had been implicated.

Majority of the animals affected with colitis responded well to the standard therapy adopted except histiocytic ulcerative colitis. Sulfasalazine was used as the drug of choice for colitis. Acute colitis was managed by deworming and bland diet trial, and sulphasalazine was used only when complete resolutions of clinical signs were not achieved by dietary elimination. Combination of prednisolone and sulfasalazine was found to be highly effective in chronic colitis. Diet had a major role in the development of colonic diseases. Beef, beef products and wheat protein (bread) were found to be allergic in some animals and elimination of antigenic diet resulted in improvement of clinical signs. Incorporation of vegetables and fermentable fibers like oat bran were also useful in resolution of clinical signs.

Dogs with mega colon poorly responded to the clinical management, and in all cases the prognosis was found to be poor. Ileo-caecal obstruction was successfully managed by surgical intervention and anal furunculosis well responded to the therapy with enrofloxacin and Proctosedyl ointment.

It was concluded that

1. Colonoscopy and mucosal biopsy were the most useful diagnostic tools for identification and classification of large bowel disorders.

2. Clinical signs had correlation with endoscopic appearance and histological findings

3. Even though food allergy and gastrointestinal parasitism were diagnosed in some cases, the exact etiology of most of the chronic large bowel diarrhoea was not identified.

4. Sulfasalazine was found to be effective in the treatment of colitis. Idiopathic inflammatory bowel disorders were successfully managed by combination of sulfasalazine, corticosteroids and hypoallergenic diet.

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ENDOSCOPIC EVALUATION AND MANAGEMENT OF LARGE BOWEL DISORDERS IN DOGS

BY

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THESIS

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ABSTRACT

Endoscopic evaluation of large bowel diarrhoea was conducted in 15 dogs and the clinical signs correlated with endoscopic appearance and histological findings.

Parameters studied were detailed history, clinical signs, faecal sample examination for ova of internal parasites and faecal culture, rectal cytology, haematology, serology, colonoscopy and histopathology of mucosal biopsy.

Average age of the affected animals with large bowel disorders was 2.9 years. Among dog breeds, highest incidence was found in German Shepherd followed by Doberman pincher. Male dogs were more affected by the large bowel disorders. Clinical signs specific to large bowel disorders were straining, haematochezia, excess mucus in the faeces and frequent defecation with small volume of faeces.

Rectal cytology helped to identify the type of mucosal inflammation even before doing colonoscopy, since it was always related with the histopathology result. Marked anaemia with hypoproteinaemia was detected in dogs affected with histiocytic ulcerative colitis that had grave prognosis. Mild anaemia was recognized in parasitic colitis and in most cases of chronic colitis. Gastrointestinal parasitism and dietary indiscrimination produced acute colitis in some animals. In chronic colitis even though the exact etiology was not determined the positive response to corticosteroids therapy with hypoallergenic diet indicated that a prolonged antigenic stimulation might be the inciting cause.

On colonoscopy, the mucosa was found to be hyperemic and oedematous in dogs affected with acute colitis. In chronic inflammatory conditions, colonoscopy revealed varying degrees of hyperemia, oedema, mucosal ulcers, haemorrhage and increased mucosal friability.

Histopathological changes in acute colitis were mild lymphocytic plasmacytic infiltrations with or without cryptitis, whereas chronic colitis was characterized by severe infiltration of lymphocytes, plasma cells or histiocytes.

Treatment of the inflammatory bowel disorders were based on the severity of clinical signs and degree of inflammatory infiltrates. Dietary modification was suggested in all types of large bowel disorders.

From the present study, it was inferred that colonoscopy is a valuable diagnostic tool for large bowel disorders.

Appendix

PROFORMA

Case No. / Sl No. **Date**

1. Name And Address Of The Owner :
2. Detatils Of The Animal :
Breed :
Age :
Sex :
Colour :
If vaccinated :
If yes, Details :
3. Clinical History /Diet

Date	Diseases encountered in the past	Treatment adopted

4. General Clinical Examination :

5. System wise Examination :
a) Digestive System :

6. Clinical Observation
a) Clinical Data

1. Respiration rate (per minute) :
2. Pulse (rate per minute) :
3. Temperature :
4. Mucous membrane : (pale / congested/ icteric)
5. Lymph nodes :
6. Faecal sample examination :
7. Faecal culture & sensitivity :

b) Clinical Signs

(Present / Absent **)**

1. Lethargy :
2. Vomiting :
3. Anorexia :
4. Haematochezia :
5. Abdominal pain :
6. Diarrhoea :
7. Tenesmus :
8. Frequent defecation :

7. Results of Special Examination

a. Haemato-biochemical Findings

Sl no	Parameters	Result
		Day 1
1.	Hb (gm/dl)	
2.	RBC (10^6/cu.mm)	
3.	VPRC %	
4.	TLC(10^3/cu.mm)	
5.	DLC	
6.	Neutrophils (%) Lymphocytes (%) Eosnophils (%) Monocytes (%) Basophils (%)	
7.	**Serum Analysis** Total Protein (g/dl) Albumin (g/dl) A:G Ratio	

b. Endoscopic evaluation :

Histopathology of mucosal biopsy :

8. Diagnosis :

9. Treatment :

SIGNATURE OF THE CHAIRMAN **SIGNATURE OF THE STUDENT**