EVALUATION AND MANAGEMENT OF GASTROINTESTINAL OUTFLOW DISORDERS IN DOGS

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Thesis submitted in partial fulfilment of the requirement for the degree of

Master of Veterinary Science

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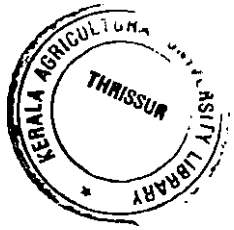

2007

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DECLARATION

I hereby declare that the thesis entitled **"EVALUATION AND MANAGEMENT OF GASTROINTESTINAL OUTFLOW DISORDERS IN DOGS"** is a bonafide record of research work done by me during the course of research and that this 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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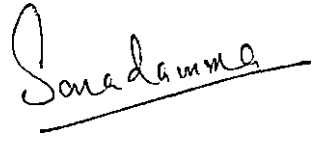
CERTIFICATE

Certified that this thesis entitled **"EVALUATION AND MANAGEMENT OF GASTROINTESTINAL OUTFLOW DISORDERS IN DOGS"** is a record of research work done independently by **Jinesh kumar. N. S** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.



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We, the undersigned members of the Advisory Committee of **Jinesh Kumar. N. S,** a candidate for the degree of **Master of Veterinary Science in Surgery,** agree that the thesis entitled **"EVALUATION AND MANAGEMENT OF GASTROINTESTINAL OUTFLOW DISORDERS IN DOGS"** may be submitted by **Jinesh Kumar. N. S** in partial fulfilment of the requirement for the degree.

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Jinesh Kumar. N. S.

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Introduction

INTRODUCTION

A vomiting and anorectic dog poses a serious challenge for a practicing veterinarian. The onus is on the veterinarian to decide whether the problem is gastric or nongastric. Gastrointestinal outflow obstruction can be a major cause for off feed and vomiting in dogs.

Gastrointestinal outflow obstruction refers to the inability of food and/ or water to pass properly through the pylorus and intestine due to mechanical or functional causes of obstruction. The main causes can be foreign objects or intraluminal masses, mucosal or muscular proliferative or infiltrative diseases, compression of the gastro intestinal tract by the masses or organs outside the stomach and mal positioning of the stomach. (Hall, 1983). Vomiting of undigested or partially digested food, more than eight to ten hours after, eating is an important clinical sign indicative of gastric motility disorder or gastric outlet obstruction (Tams, 1992).

Gastro intestinal diseases seldom produce pathognomonic hematological or serum biochemical abnormalities. Instead the diagnosis of the condition must be based on a combination of certain laboratory results, clinical signs, and the patient's history. The diagnosis of gastrointestinal disease is complicated by the myriad causes of vomiting and diarrhoea which results not only from gastro intestinal abnormalities but also from certain other systemic diseases (Moore, 1992).Hence, a multi pronged investigation summoning techniques like radiography, endoscopy, ultrasonography, and biopsy to arrive at a conclusive diagnosis should be opted for.

Timely intervention combining dietary, medical and surgical management can bring about successful results. Delayed gastrointestinal emptying due to functional obstruction can be treated by dietary management and use of gastric prokinetic agent like Cisapride. Surgical procedures are often unsuccessful in these conditions. Surgical intervention like pyloromyotomy, enterotomy and gastrotomy should be made for conditions like pyloric stenosis, intestinal foreign bodies, gastric

foreign bodies respectively. Irreversible injuries to the bowel necessitate resection and anastomosis. Gastric ulcers should be excised or partial gastrectomy should be done (Larsen and Bellenger, 1974). Complete pyloric obstruction with neoplasms and ulcers at the gastroduodenal junction necessitates procedures like gastroduodenostomy or gastrojejunostomy. In nutshell, the success of treatment depends upon the gravity of the condition, early diagnosis, expertise and discretion of the practitioner in adopting proper management practices for successful treatment of gastrointestinal problems.

Hence, the present study was undertaken with the objective of evaluating the clinical, biochemical and pathological changes associated with gastrointestinal outflow disorders and to assess the efficacy of the treatment adopted in such conditions in dogs.

Review of Literature

REVIEW OF LITERATURE

2.1 Incidence

2.1.1 Breed

Witiak (1967) had reported a case of gastric torsion in a Dachshund.

Sass (1970) reported necropsy findings of presence of a perforating gastric ulcer in a St. Bernard dog.

Dorn *et al.* (1976) reported the incidence of a large excavating ulcer due to diffuse carcinoma in the stomach of a Basset Hound.

A Basset hound with partial intestinal obstruction due to intestinal carcinoma was reported by Boothe *et al.* (1977).

Happe *et al.* (1977) had reported multiple polyps of the gastric mucosa in an Airdale and French Bull Dog.

Frendin *et al.* (1988) reported the incidence of gastric dilatation in an English Blood Hound, two St. Bernard and a Scottish Deer Hound.

A clinico-pathological study of eleven cases of gastric carcinoma by Fonda *et al.* (1989) found that eight were Belgian Shepherd dogs and one each was of Chow, Schnauzer and mixed breed dog.

Balasubramanian *et al.* (1990) reported a case of chronic hypertrophic pyloric gastropathy in a nondescript dog.

Singh *et al.* (1990) reported intestinal intussusception with prolapse of intussusceptum in a Doberman and Alsatian pup.

A case of intussusception in a nondescript dog due to swallowing of audiotapes was reported by Sridhar *et al.* (1992).

Levitt and Bauer (1992) observed no breed predisposition among twenty seven cases of intussusception in dogs in which six were German Shepherd Dogs.

Glickman *et al.* (1994) in a study of 1934 cases of gastric dilatation and volvulus (GDV) observed that pure bred dogs were 2.5 times more likely to develop GDV than were mixed breed dogs. The two breeds with highest risk of GDV were Great Dane and St. Bernard. The breeds like Irish Wolf Hound, Borzoi, Blood hound, Mastiff, Akita and Bull Mastiff were also found to be at significantly increased risk of GDV.

Caecal impaction in a Doberman was reported by Wells *et al.* (1995).

In ultrasonographic study of gastric neoplasia in thirteen canine patients there were three Dalmatians and two Collies (Hotz *et al.*1996).

Watson (1997) reported a rare case of gastro duodenal intussusception in a young German Shepherd dog.

Wacker *et al.* (1998) observed that the incidence of GDV was found more in large or giant breed dogs.

Among twenty one cases of gastric neoplasia in dogs, Lamb and Grierson (1999) observed that variety of breeds were affected including six mixed breed dogs, three Labrador Retrievers and three Border Collies.

Cairo *et al.* (1999) reported four clinical cases of intestinal volvulus in German Shepherd Dogs.

Linear foreign body obstruction in an Alsatian dog was reported by Jayaprakash *et al.* (1999).

In a review of sixty cases of gastrointestinal obstruction, the condition was found to be more in Doberman and nondescript dogs (20 per cent each), followed by German Shepherd (15 per cent), Pomeranian (13.3 per cent), Great Dane (11.67 per cent), Spitz (8.33 per cent), crossbred (5 per cent), Labrador (1.6 per cent), Cocker

Spaniel (1.67 per cent), Silky Terrier (1.67 per cent) and Gambee (1.67 per cent) (Kumar *et al*, 2000a).

Of 123 dogs studied for mechanically induced ileus due to foreign body, 20 were mongrels while 103 originated from 31 different breeds. Mechanically induced ileus in dogs was more frequent in pure bred dogs (83.74 per cent) than in mongrels. The highest incidence was noted in Dobermann (13 per cent) followed by Poodle (8.13 per cent), German Shepherd Dog and Cocker Spaniel (7.32 per cent) (Capak *et al*, 2001)

In a study conducted to analyse serum and biochemical parameters in 12 dogs presented with alimentary tract obstruction , the breeds presented were Labrador(1), Non descript(2), Spitz(1), Great Dane(1), Rottweiler(1), Dachshund(1), Doberman pinscher(1), Alsatian(1), Boxer(1), Cocker Spaniel(1).(Jose, 2001).

Saini *et al.* (2002) had reported a case of chronic intestinal obstruction due to faecolith in a mixed breed dog.

Dass *et al.* (2003) had reported a rare case of complete lower ileal obstruction in a Doberman.

Among fifteen clinical cases of intussusception, the most affected breed was Dobermann (4), Great Dane (3), Nondescript (3), German Shepherd Dog (2), Pomeranian (2) and Labrador (1) (Kumar and Ameerjan, 2003).

Chandrapuria *et al.* (2003) had reported two cases of intestinal adenocarcinoma in a Lhasa Apso and a German Shepherd Dog.

A case of chronic intestinal obstruction at the level of jejunum in a non descript dog was reported by Govindaraju *et al.* (2005).

Dileepkumar (2005) reported the incidence of gastric ulcer in a Cocker spaniel and a nondescript dog. A case of pyloric adeno carcinoma in a Dachshund obstructing the pylorus was also reported.

2.1.2 Sex

Witiak (1967) had reported a case of gastric torsion in a female dog.

Necropsy findings of presence of gastric ulcer in a female dog was reported by Sass *et al.* (1970).

Dorn *et al.* (1976) had reported the presence of a large excavating ulcer due to diffuse carcinoma in the stomach of a male dog.

Among 117 cases of primary gastric neoplasia in dogs 77 were males and females constituted 40 (Weaver, 1976).

A case of partial intestinal obstruction due to an intestinal carcinoma in a male dog was reported by Boothe *et al.* (1977).

Happe *et al.* (1977) had reported multiple polyps of gastric mucosa in two male dogs.

Gibbs and Pearson (1986) observed that breed and sex predilection was unremarkable in a report of 20 cases of localized tumours of canine small intestine.

A clinicopathological study of eleven cases of gastric carcinoma in dogs by Fonda *et al.* (1989) found that nine animals affected were males.

Balasubramanian *et al.* (1990) had reported a case of chronic hypertrophic pyloric gastropathy in a male dog.

A case of intussusception in a male dog due to audio tapes was reported by Sridhar *et al.* (1992).

Levitt and Bauer (1992) observed that there was no evidence of sex predilection for the occurrence of intussusception.

In a study for analysis of risk factors for GDV in 1934 dogs, Glickman *et al.* (1994) observed that the adjusted risk of GDV was one for males compared with that of females and significantly lower for neutered dogs than for sexually intact dogs.

Wells *et al.* (1995) had reported a case of caecal impaction in an intact male dog.

Hotz *et al.* (1996) observed nine females and four males among 13 canine patients with gastric neoplasia,

Watson (1997) had reported a rare case of gastroduodenal intussusception in a male dog.

Elwood (1998) observed that there was no gender association with occurrence of gastric dilatation.

Among 16 dogs presented with GDV, Wacker *et al.* (1998) observed that nine were females and seven were males.

Lamb and Grierson (1999), in an ultrasonographic study of primary gastric neoplasia in 21 dogs, observed that nine were males and 12 were females.

Cairo *et al.* (1999) had reported four clinical cases of intestinal volvulus in dogs of which three were females and one male.

Linear foreign body intestinal obstruction in a male dog was reported by Jayaprakash *et al.* (1999).

Kumar *et al.* (2000a) observed that the incidence of gastrointestinal tract obstruction was found more in male dogs than in females.

In a study of 123 dogs treated for mechanically induced ileus caused by ingestion of a foreign body, 83 were males and 40 were females. (Capak *et al*, 2001)

Among 15 clinical cases of intussusception, the males were more affected with the male female ratio being 10 : 5 (Kumar and Ameerjan, 2003).

A case of intestinal adenocarcinoma in a male and a female dog was reported by Chandrapuria *et al.* (2003).

Govindaraju *et al.* (2005) reported a case of chronic intestinal obstruction at the level of jejunum in a male dog.

2.1.3 Age

Witiak (1967) had reported a case of gastric torsion in a 12 year old dog.

Necropsy findings of presence of gastric ulcer associated with lead poisoning in a 14 year old dog was reported by Sass (1970).

The presence of a large excavating ulcer due to diffuse carcinoma in the stomach of an eight year old dog was reported by Dorn *et al.* (1976).

Weaver (1976) observed that the average of 117 dogs presented with primary abdominal neoplasia was 8.8 years and 50 per cent of the cases were in the range of seven to ten years.

Boothe *et al.* (1977) reported a case of partial intestinal obstruction in a 9.5 year old dog due to intestinal carcinoma.

Happe *et al.* (1977) had reported multiple polyps of gastric mucosa in two six year old dogs.

Gibbs and Pearson (1986) observed that 80 per cent of dogs presented with localized tumours of small intestine were above seven years of age.

Fonda *et al.* (1989), in a clinicopathological study of 11 cases of gastric carcinoma, found that the age of dogs ranged from six to 14 years.

Singh *et al.* (1990) had reported intestinal intussusception with prolapse of intussusceptum in a three month old and four month old pup.

A case of chronic hypertrophic pyloric gastropathy was reported in a four year old dog by Balasubramanian *et al.* (1990).

A case of intussusception in a two year old dog was reported by Sridhar *et al.* (1992).

Levitt and Bauer (1992) observed that 20 out of 27 dogs with intussusception were less than one year of age.

In a study for analysis of risk factors for GDV in 1934 dogs, Glickman *et al.* (1994) observed an increasing GDV risk with increasing age.

Wells *et al.* (1995) had reported a case of caecal impaction in a seven year old dog.

Hotz *et al.* (1996) observed the mean age of 13 dogs with gastric neoplasia as 9.7 years and the age ranged from seven to 13 years.

Watson (1997) had reported a rare case of gastroduodenal intussusception in a 21 month old dog.

Wacker *et al.* (1998) observed that the mean age of 16 dogs presented with GDV was seven years ranging from three to 12 years.

In a study of risk factors for gastric dilatation in Irish Setter dogs, Elwood (1998) observed that there was increased risk of gastric dilatation with age. Pre disposing risks were aerophagia, single food type, feeding once daily. No risk was attributed to intensity or duration of exercise, temperature, appetite, speed of eating, vomiting or diarrhoea.

In an ultrasonographic evaluation of intussusception in ten dogs, Lamb and Mantis (1998) observed the average age of affected dogs as 2.5 years.

Among 21 cases of gastric neoplasia in dogs, Lamb and Grierson (1999) observed that the mean age of affected dogs were 9.1 years.

Cairo *et al.* (1999) had reported four clinical cases of intestinal volvulus in dogs between age group of two and four.

Linear foreign body intestinal obstruction in a seven month old dog was reported by Jayaprakash *et al.* (1999).

Kumar *et al.* (2000a) observed that the occurrence of gastro intestinal tract obstruction was found to be more in dogs below six months of age.

Foreign body occlusive ileus was found more in dogs less than two years of age (Capak et al, 2001).

Dass *et al.* (2003) had reported a rare case of lower ileal obstruction in a four year old dog.

Kumar and Ameerjan (2003) observed that the age of 15 animals affected with intussusception was ranging from one to seven months. The average age was 2.7±0 47 months.

Chandrapuria *et al.* (2003) had reported two cases of intestinal adenocarcinoma in a two year old and twelve year old dog.

A case of chronic intestinal obstruction at the level of jejunum in a four year old male dog was reported by Govindaraju *et al.* (2005)

2.2 Etiology

Witiak (1967) suggested that exercise following a heavy feeding precedes most gastric torsions. Also gastric torsions following dilatation of the stomach could occur without exercise as a result of the over distended stomach merely falling over its long axis.

Sass (1970) had reported necropsy findings of the presence of a perforating gastric ulcer associated with lead poisoning in a St. Bernard bitch.

Larsen and Bellenger (1974) opined that foreign bodies which passed through the pylorus were too large to pass through the small intestine and usually got obstructed in the jejunum and rarely in the duodenum or ileum

Jones *et al.* (1976) attributed peptic ulceration in a six year old male Boxer to an islet cell carcinoma of the pancreas which resulted in excessive production of gastrin. The plasma gastrin level in the dog was elevated and measured 360 pg/ml.

Boothe *et al.* (1977) reported a case of partial intestinal obstruction due to an intestinal adenocarcinoma in a dog.

Three cases of pyloric stenosis caused by hypertrophic gastritis in dogs were reported by Happe *et al.* (1981).

Happe and Brom (1982) observed that excessive duodenogastric reflux of gastric contents which occured in dogs played a role in the pathogenesis of gastritis.

Bright *et al.* (1985) opined that gastric outlet obstruction could be due to gastric neoplasia, peptic ulcer, pyloric stenosis, and phycomycosis.

Farrow (1985) opined that duodenal ulcers are rare in dogs and have been attributed to excessive stomach acid secondary to mastocytosis, use of corticosteroids, steroid like drugs or aspirin.

Dennis *et al.* (1987) observed that gastric outflow obstruction in a cat was due to rugal hyperplasia rather than pyloric dysfunction.

Frendin *et al.* (1988) observed gastric displacement in dogs with non specific signs of digestive disturbances like intermittent vomiting or inappetance.

Sridhar *et al.* (1992) reported the necropsy findings of an unusual case of intussusception due to audiotapes in a dog.

Fossum *et al.* (1995) observed that iatrogenic gastric outflow obstruction could be caused by previous gastric surgery, which could be prevented by minimizing tissue inversion into the gastric lumen when surgery was performed near the pyloric outflow tract.

Watson (1997) had reported a rare case of gastro duodenal intussusception in a young dog which suffered from intermittent vomiting.

Fossum (1997) stated that bones, balls, toys, cloth, pebble, metal objects were common intestinal foreign bodies that are ingested which cause complete or partial obstruction.

Cairo *et al.* (1999) had reported four clinical cases of intestinal volvulus in dogs which resulted in complete intestinal obstruction.

A case of linear foreign body intestinal obstruction was reported by Jayaprakash *et al.* (1999).

In a study of ten cases of intestinal obstruction in dogs by Kumar *et al.* (2000b), the various etiologies observed were intussusception (four), faecolith (four), plastic material (one) and one with a sewing needle with plastic material.

According to Capak et al. (2001) the most frequently ingested foreign bodies which cause mechanically induced ileus in dogs include stones, rubber and plastic objects. The rarest bodies were walnut, apricot kernel, paper, glass objects etc. He also opined that the most frequent site of obstruction was the jejunum.

Saini *et al* (2002) had reported a case of chronic intestinal obstruction for a period more than two months in a dog due to a faecolith.

A report of gastrointestinal foreign body in a Dobermann Pinscher due to gravel piece was made by Vijayakumar *et al.* (2002).

A rare case of a stone causing a complete lower ileal obstruction in a Dobermann was reported by Dass *et al.* (2003).

Rasmussen (2003) opined that gastric and duodenal ulcers, intraluminal and extraluminal neoplasia, pancreatitis, neoplasia of surrounding organ like pancreas, liver, biliary tree, kidney, adrenal gland can create gastric outflow obstruction.

Kumar and Ameerjan (2003) observed that incidence of ileocolic intussusception was very high in comparison to jejuno ileac and ileo caecocolic intussusception. The authors also reported that ileac portion of small intestine was highly prone for intussusception owing to the lack of proper omental support and free mobility.

Chandrapuria *et al.* (2003) had reported two cases of intestinal adeno carcinoma in dogs which resulted in intestinal obstruction.

Sharma *et al.* (2005) had reported a case of linear foreign body obstruction of large intestine in a tom cat.

A case of chronic intestinal obstruction at the level of jejunum in a dog due to ingestion of rubber ball was reported by Govindaraju *et al.* (2005).

Dileepkumar (2005) reported the incidence of gastric outflow obstruction due to plastic scrub, pyloric tumour, and foreign bodies like pebbles/ stones.

Devanand *et al.* (2005) reported gastric impaction and obstruction in a pup by consumption of oyster shells.

2.3 Symptoms

Witiak (1967) had reported pale mucous membrane, laboured respiration, distended and tympanic abdomen, inability to walk in a case of gastric dilatation and torsion in an aged Dachshund. It was reported as crying with colicky pain few minutes after eating.

Rowland and Robinson (1978) had reported a history of vomiting over a period of 48 hours, haematemesis, respiratory distress and collapse in a case of gastro oesophageal intussusception in a dog which eventually died. A subnormal rectal temperature, pale mucous membrane, a rapid thready pulse, dyspnoea and anterior abdominal discomfort were also reported.

Happe *et al.* (1981) reported chronic vomiting as the most common sign observed in three cases of pyloric stenosis caused by hypertrophic gastritis in three dogs.

Intermittent vomiting and reduced food intake in four cases of gastric displacement was reported by Frendin *et al.* (1988).

In a report of 11 cases of gastric carcinoma the most consistent sign observed by Fonda *et al.* (1989) was intermittent and unrestrained vomiting or haematemesis. In three cases the vomitus consisted of yellowish fluid while in others it varied from partially digested food mixed with clotted blood to coffee like material. Time interval between ingestion of food and vomitus was usually of a few hours. Other clinical signs included anorexia, progressive weight loss or marked cachexia and occasionally malaena, anaemia and abdominal pain. Dogs with metastasis exhibited ascites, jaundice and dyspnoea.

Balasubramanian *et al.* (1990) had reported over distension of stomach and frequent vomiting though not at regular intervals after feeding in a case of chronic hypertrophic pyloric gastropathy in a dog. The dog had normal appetite and body temperature.

A history of dullness, off feed, vomiting and bloody diarrhoea for two weeks was reported by Sridhar *et al.* (1992) in an unusual case of intussusception in a dog due to audiotapes.

Watson (1997) had reported a nine month history of intermittent vomiting and weight loss in a case of gastro duodenal intussusception in a young dog. The vomiting occurred in episodes of a few days interspaced by a week or more of clinical normality with large volumes of clear frothy vomitus produced several times a day, occasionally accompanied by bile or food. The dog became anorectic, depressed and salivated profusely. Faeces were occasionally malaenic.

In a study of four clinical cases of intestinal volvulus in dogs, Cairo *et al.* (1999) had observed symptoms like vomiting, pale mucous membrane, tachycardia, abdominal pain, distended abdomen and occasionally bloody diarrhoea with death occurring rapidly between 12 and 18 hours after the first clinical signs became evident.

A dog with linear foreign body intestinal obstruction exhibited inappetance, persistent vomiting, diarrhoea containing blood, dehydration, tucked up abdomen, congested mucous membrane and increased respiration with normal body temperature. Abdominal palpation revealed a mass in the mid abdominal region (Jayaprakash *et al.*, 1999).

According to Capak *et al.* (2001) the symptoms indicating foreign body induced occlusive ileus in dogs were anorexia, vomiting, absence of faecal discharge, dehydration and increased tension of abdominal wall.

Saini *et al.* (2002) reported a case of chronic intestinal obstruction in a dog with a history of not passing faeces for more than two months. Appetite, liquid food intake and urination were normal. Palpation revealed a hard mass occupying almost the entire abdomen.

Dass *et al.* (2003) observed frequent vomiting, anorexia and excessive thirst in a case of complete lower ileal obstruction in a dog with a stone. Animal was depressed and physical examination revealed a tense and tender abdomen. Drinking of water and milk induced more vomiting.

The clinical signs commonly observed by Junius *et al.* (2004) in cases of mesenteric volvulus in dogs were abdominal distension, abdominal pain and rapid development of shock. Other signs were haematochezia, attempts to vomit and salivation.

2.4 Physiology

In an experimental evaluation of canine gastric emptying of solids and liquids Hinder and Kelly (1977) concluded that liquids were emptied from the stomach whereas solids were retained for reduction to a size suitable for passage into the duodenum. Solids readied for emptying were discharged at the same rate as the liquid when present in the stomach. The experiments had proved that breaking digestible solids into a smaller size speeds their emptying.

Hunt (1980) explained that greater the energy density of gastric contents, the lesser is the volume rate of transfer per minute to the duodenum. This was attributed to the presence of two sets of duodenal receptors, one stimulated by osmotic properties of the digestion products of carbohydrates and proteins and the other by digestion products of fat.

Happe and Brom (1982) opined that factors contributing to the duodenal gastric reflux were thought to be diminished rate of gastric emptying, hyper secretion of gastric acid and disturbed duodenal motility as occured in the animals with nausea, vomiting and enteritis. The study also indicated that excessive duodenogastric reflux of intestinal contents which occurs in dogs play a role in the pathogenesis of gastritis.

The most important defense mechanisms of animal stomach explained by Richter (1992b) included the gastric mucus that coats the surface of the stomach, production of bicarbonate which neutralizes acid in the lumen, barrier to back diffusion of hydrogen ions into the mucosa, mucosal microcirculation which allows rapid clearing of hydrogen ions that have back diffused into the mucosa, rapid epithelial cell turn over, protective prostaglandins especially PGE. Conditions or agents that adversely affect these defense mechanism or cause increased gastric acid production can lead to gastric ulceration.

Walker (2003) described the physiology of intestinal motility. The ingesta in the gastrointestinal tract were mixed by segmental contractions and moved aborally by peristaltic contractions. Reduced peristaltic and segmental contractions could result in ileus and diarrhoea respectively. Spontaneous motor activity is established by regular periodic depolarization called slow waves which is initiated by interstitial cells of Cajal. Intestinal motility is characterized by three phases which include a quiescent period, a period of minor contractile activity followed by period of intense contractile activity from migrating myoelectric complexes. The gastrointestinal motility is influenced by acetyl choline which has an excitatory effect whereas vaso active intestinal peptide and nitric oxide have inhibitory effect on motility.

2.5 Pathophysiology

Simple mechanical obstruction of the small intestine caused fluid and gas to accumulate proximal to the site of obstruction resulting in intestinal obstruction. The gas accumulating in the intestine proximal to an obstruction consisted of swallowed air, Carbon dioxide from the neutralization of bicarbonate and organic gases from bacterial fermentation. Swallowed air was the major source of the gas with nitrogen making the highest percentage. The nitrogen which was not absorbed by the intestinal mucosa results in persisting of gaseous distension. Obstruction increased the intraluminal pressure which overcame the hydrostatic pressure of venous and lymphatic vessels resulting in extravasation of fluid into the abdominal cavity. Arterial supply was relatively unaffected perpetuating capillary congestion. Continued distension resulted in significant vascular compromise that anoxia of the intestinal wall might occur making it vulnerable to devitalisation. Prolonged severe intestinal obstruction caused bowel wall injury because of the stasis of the microcirculation, progressive anoxia and ischemia of the intestinal mucosa leading to increased permeability for and migration of bacteria and toxins. When dehydration progressed oliguria, azotemia and haemoconcentration were seen. If dehydration persisted, circulatory changes such as tachycardia, low central venous pressure, and

reduced cardiac output could occur with subsequent development of hypotension and hypo volemic shock (Walshaw, 1985)

Wingfield and Twedt (1986) opined that luminal acid was generally accepted as essential for the pathogenesis of gastric ulceration. Stress ulceration usually involved the body of the stomach and the mechanism was thought to be mucosal ischemia which in most clinical circumstances was due to an episode of hypotension. Focal mucosal necrosis might also result from an energy deficit that was particularly severe in the body of the stomach because of its primarily aerobic energy metabolism. Gastric acid secretion would fall during acute stress and then recover as the patient improves. The foci of ischemic necrosis then undergo acid peptic digestion with bleeding.

Davidson (1992) explained that gastric dilatation resulted in circulatory compromise which was manifested as hypovolaemic shock. Distension of stomach obstructed portal vein and caudal venacava resulting in decreased venous return producing decreased cardiac output and subsequent hypo perfusion of tissues and shock. Poor perfusion caused ischemic damage to the mucosal barrier of the bowel which allowed bacterial endotoxin to pass into the circulatory system and resulted in endotoxic shock. Additionally, ischemic damage to the stomach wall resulted in gastric necrosis and ulceration.

Hedlund (2002) opined that invagination of intestine caused partial intestinal obstruction which might progress to complete obstruction. Vessels attached to intussusceptum collapsed because of the increased intra luminal pressure or kinking and those vessels might avulse. The wall became oedematous, ischemic and turgid. Blood extravasated into the lumen and the serosa fissures. Fibrin sealed the layers of the intestine together and might help localize peritonitis as well as necrosis. Eventually intestinal devitalisation occurred with subsequent contamination of the abdominal cavity.

2.6 Diagnosis

2.6.1 Radiology

Gibbs and Pearson (1973) reported that in contrast radiography dorsoventral and right lateral projections were best for outlining the pylorus and ventrodorsal and left lateral positions produced filling of the gastric contents into the body and fundus. They stated that contrast radiography was helpful in determining gastric emptying time related to pyloric obstruction and displacement of the stomach in case of diaphragmatic hernia. It was also stated that contrast radiography had particular value in detecting the presence of radiolucent materials which might either retain contrast medium or prevent its own dispersion through out the organ. The ingestion of fabrics, string or hair might lead to filling of the gastric lumen and pylorus, and somewhat variable symptoms of vomiting or anorexia. Such materials cause filling defects on contrast radiography and then become readily visible.

According to Larsen and Bellenger (1974) barium sulphate administered per orally had limited use in detecting an intussusception. A barium enema was useful for demonstrating an ileocaecal obstruction, especially when the barium was evacuated and then the colon insufflated with air. The intussusception was then outlined by barium and surrounded by air with in the barium lined colon

In a study conducted for radiological diagnosis and prognosis of primary abdominal neoplasia in the dog, Weaver (1976) concluded that radiography had marked limitation in the demonstration of many pathological entities of the abdomen including tumours. It was opined that contrast studies, though often rewarding, were very time consuming and the ultimate diagnosis depended upon exploratory laparotomy.

Herrtage (1978) stated that contrast radiography is not a suitable substitute for plain radiographic technique but it can be used to supplement or confirm information already obtained from plain radiograph.

Farrow (1985) had described the radiographic signs of a perforated duodenal ulcer in a ten year old boxer. The radiographic signs included an abnormal bowel distribution pattern, reduced visceral detail, delayed or reduced gastric emptying after contrast medium administration and peritoneal leakage of contrast medium.

Kleine (1985) opined that when radiography was properly performed and correlated with clinical finding, it would be an accurate diagnostic technique for evaluating gastric and small intestinal morphology.

Farrow (1986) had reported the use of postural radiography for identifying a gastric foreign material in a twelve year old dachshund with a three day history of vomiting and anorexia. It was opined that postural film delineates abnormal gastric contents by improving lesional contrast. The radiograph was performed with a horizontal X-ray beam centered on the caudal aspect of the left lateral rib cage with the dog in a standing position. Radiographs showed a gas capped irregularly marginated mixed density in the dorsal position of the stomach. The remaining stomach content was hidden by fluid indicating an image consistent with gastric foreign material.

Miyabayashi *et al.* (1986) had advised to use double contrast gastrography for studying morphological changes of stomach mucosa since large amount of contrast medium usually masks existing pathology of the mucosa.

Burns and Fox (1986), in a study conducted to evaluate total gastric emptying time in mongrel dogs using barium food mixture, found that total gastric emptying time ranged from seven to fifteen hours. The contrast meal consisted of 7 ml/kg body weight barium sulphate suspension mixed with 8 g/kg body weight ground dog food.

Allan (1987) recommended administration of liquid barium (30 per cent w/v) or barium impregnated food as positive contrast agent in stomach at a dose rate of 8-12 ml/kg for small to medium sized and 5-7 ml/kg for large sized dogs. For taking double contrast radiography of the stomach, the animal was administered micro

pulverized barium sulphate at the dose rate of 1 ml/kg body weight followed by rolling of the animal to coat the stomach. Stomach was then inflated with infusion of air. The technique was found useful for studies which require good mucosal details. It was also recommended that for negative contrast studies of the stomach air could be used for identifying gastric foreign bodies.

Dennis *et al.* (1987) had reported radiographic observation of enlarged rugal folds of fundus and body of stomach after barium administration in a case of pyloric hyperplastic gastropathy in cats.

Frendin *et al.* (1988) described the use of contrast radiography to diagnose gastric displacements in dogs presented with nonspecific signs of digestive disturbances like intermittent vomiting and inappetance.

Balasubramanian *et al.* (1990) reported a case of chronic hypertrophic pyloric gastropathy in a dog where contrast radiography at 60 minutes and three hours did not show any emptying of contrast material from the stomach.

Kantrowitz and Biller (1992) opined that right lateral projection was usually the most helpful in differentiating between dilatation and volvulus. When the animal was in this position the pyloric region was normally filled with fluid, with gas collecting in the fundus. Left side down and ventrodorsal and dorsoventral projections may also be helpful for differentiation of gastric dilatation and gastric volvulus. Plications of the small intestine may be recognized in survey radiograph with linear foreign bodies because of the development of eccentric or tear shaped gas accumulation.

Levitt and Bauer (1992), in a review of 36 cases of intussusception in dogs and cats, observed that definitive diagnosis of an intussusception on plain film was difficult. Contrast radiography was effective in confirming a presumptive diagnosis of intussusception.

According to Codner and Leib (1992), lesions associated with gastrointestinal ulcers might not be identified with a barium series. Gastric ulcers might not be observed if the barium failed to collect in the ulcer crater or if the patient positioning during radiography did not show the ulcer in profile.

Willard and Twedt (1994) suggested that abdominal palpation and radiography were the best initial diagnostic test in cases of gastric or intestinal obstruction and recommended barium over iodine compounds in the absence of intestinal rupture.

Murdoch (1994) stated that delayed gastric emptying could be diagnosed by contrast radiography with the administration of barium sulphate. It was reported that in normal dogs, barium sulphate should enter the duodenum within 30 minutes of administration and stomach got emptied of barium sulphate by 90 minutes.

Thilagar *et al.* (1994) carried out double contrast radiography of the stomach in dogs after sedating them with triflupromazine hydrochloride. Barium sulphate (3ml/kg) as positive and air (20ml/kg) as negative contrast media were used. According to the observations, double contrast radiographic technique allowed direct visualization of all inner gastric surfaces, thus increased the probability of identifying mucosal lesions.

Burk and Ackermann (1996) opined that retention of significant volumes of barium within the stomach from several minutes (more than 30) to hours after administration was suggestive of gastric outflow obstruction.

Sparkes *et al.* (1997) tried a technique of using barium impregnated polyethylene spheres along with 60 g of a canned food in cat to find the gastro intestinal transit time and claimed no significant advantage for this technique over contrast radiography using barium sulphate suspension or organic iodine compounds.

Jayaprakash *et al.* (1999) reported a case of linear foreign body intestinal obstruction in a seven month old Alsatian dog where survey radiograph revealed

distension and bunching of small intestine with characteristic tapered enteric gas bubbles. Contrast radiography with barium meal showed plicated appearance of the intestine.

Prosek *et al.* (2000) described the signs of intestinal obstruction as varying degrees of distension or ballooning of the small bowel, retention of ingesta proximal to the obstruction and evacuation of the bowel distal to the obstruction, squaring off of the distended loops of the bowel, hair pin turning of the distended loops with layering or loops lying parallel to one another, gas capped fluid levels seen on standing lateral projections and decreased visceral detail associated with a slightly increased volume of peritoneal fluid.

Chourasia *et al.* (2002) reported radiographic changes like irregular stomach mucosal surface and filling defect in acetyl salicylic acid induced gastritis in dogs.

In a retrospective study of 12 cases of mesenteric volvulus in dogs, Junius *et al.* (2004) had described the use of radiography for the diagnosis of the condition. The radiograph was characterized by severely distended gas filled loops of small bowel lying parallel to each other.

Dileepkumar (2005) reported that both contrast radiography with barium sulphate and combination of barium sulphate suspension and air were useful for identifying mucosal lesions, pyloric obstruction, gastric dilatation and volvulus and impaction of the stomach but recommended the use of barium meal for studies related to gastric emptying. Radiographic features of a luminal mass obstructing the pylorus was also reported.

2.6.2 Ultrasound

Penninck *et al.* (1989) opined that ultrasound scanning of the abdomen often offered information not available by other modalities such as radiographic contrast studies or endoscopy. Ultrasonography helped in the evaluation of the layered appearance of gastrointestinal wall which would help in determining the nature and

location of pathologic processes. It was also suggested to perform methods like administration of water via a tube after aspiration of luminal gas or positioning of the animal to remove fluid contents towards the region of interest to create optimal conditions for visualization.

Penninck *et al.* (1990) had described the ultrasonographic appearance of gastrointestinal neoplasm, gastrointestinal obstruction, ileus, intussusception, inflammatory gastrointestinal diseases and congenital disorders in a study conducted on 18 dogs and four cats with gastrointestinal disease. Wall thickening was the most common finding associated with inflammatory disease and neoplasms. Intussusception was observed as multiple concentric rings. Sonographic differences were not noted between gastric or intestinal tumours. A localized thickening of descending duodenum and decreased motility was found associated with pancreatitis. A case of hypertrophic pyloric stenosis in a young Bull Dog was also diagnosed ultrasonographically by measuring the diameter of the pyloric wall.

Hotz *et al.* (1996), in a study involving ultrasonographic findings in 13 canine gastric neoplasia, observed that gastric wall echogenicity was hypo echoic in five patients, hyper echoic in five patients and mixed in three. Loss of wall layering appeared to be more common with tumours than with inflammatory diseases where layering was more commonly preserved.

Watson (1997) had reported the use of ultrasonography for arriving at a tentative diagnosis of upper gastro intestinal intussusception in a rare case of gastro duodenal intussusception in a young dog of 21 months of age.

Manczur *et al.* (1998) had described the ultrasonographic image criteria for small bowel obstruction as (a) the presence of pendulous movement of the ingesta inside the dilated bowel (b) observation of invaginated intestines or an ingested intra luminal foreign body (c) observation of non uniform peristaltic activity of the dilated intestines or (d) observation of akinetic intestinal loops together with abdominal fluid

accumulation. By using these criteria, ultrasonography was successfully used to diagnose eleven of the thirteen dogs with mechanical ileus and obstruction was correctly excluded in 29 of 31 non obstructive cases. The criteria had 85 per cent sensitivity and positive predictive value and 99 per cent specificity and negative predictive value.

Lamb and Mantis (1998) had opined that ultrasonography enabled accurate diagnosis of intestinal intussusception and was a useful method of searching for concurrent or predisposing lesions. It was explained that advantages of ultrasonography compared to barium enema for diagnosis of intussusception included lack of ionizing radiation with the technique and no need for anaesthesia. It was also less time consuming and enabled examination of adjacent structures such as lymph nodes that were not usually visible radiographically.

Wacker *et al.* (1998) reported the successful use of ultrasonography for assessing the site of incisional gastropexy and adhesions formed between stomach and abdominal wall following treatment for gastric dilatation and volvulus.

Lamb and Grierson (1999) described the ultrasonographic findings in dogs with histologically confirmed primary gastric neoplasia. Majority of gastric tumours caused obliteration of mural layers in ultrasound images. Of 15 gastric ulcers present, only eight were recognized ultrasonographically. It was suggested that sensitivity of ultrasonography for gastric ulcers could be increased in animals specifically prepared by fasting and administration of water.

Manczur and Voros (2000) in a review of 265 cases of gastrointestinal disorders in dogs described the indications for ultrasonography as vomiting, chronic diarrhoea, abdominal pain, rectal bleeding, palpable mass in the abdomen and chronic weight loss. It was opined that ultrasonography was a useful diagnostic imaging method in facilitating decision making on further diagnostic processes or treatment of gastrointestinal diseases of dogs.

Ultrasonographic diagnosis of gastrointestinal foreign body due to gravel piece in Dobermann Pinscher was reported by Vijayakumar *et al.* (2002). The mass appeared as echogenic foci with irregular curvilinear border and distended anechoic intestinal segment proximal to it.

Singh *et al.* (2002) had reported the use of ultrasonography for diagnosing a case of intestinal foreign body obstruction in a one and half year old Dobermann which appeared hyperechoic.

In describing the sonographic signs of gastro duodenal linear foreign bodies in three dogs, Hoffman (2003) opined that a thorough and careful sonographic examination may be helpful in identification of canine linear foreign bodies. The sonographic signs of gastro duodenal linear foreign bodies common to all three dogs were an abnormal tortuous path of the descending duodenum, the presence of hyperechoic linear structure within the duodenal lumen which could be carefully followed orally to the pylorus. The presence of a mass with strong acoustic shadow within the pylorus was seen in one dog.

Penninck and Mitchell (2003) in a study performed on a large population of dogs with intestinal disorders showed that ultrasonography was a useful technique for distinguishing enteritis from intestinal tumours. It was opined that the loss of normal wall layering as a strong predictive value in determining the presence of an intestinal tumour.

Sanchez-Margello *et al.* (2003) had used ultrasonogaphy for detecting relevant morphologic changes in the pyloric sphincter after pyloroplasty.

Lee *et al.* (2005) reported the use of ultrasonography for diagnosing a case of pyloro gastric intussusception in a seven year old Maltese female dog. The condition spontaneously underwent reduction in the next morning.

2.6.3 Endoscopy

Zimmer (1981) had demonstrated the use of flexible fibreoptic endoscopy to confirm the diagnosis and aid in the removal of gastric foreign bodies. It was opined that the clinician could avoid many of the risks involved in an exploratory laparotomy and gastrotomy.

Sullivan and Miller (1985) described the successful use of endoscopy for investigating oesophageal and gastric abnormalities in dogs. It was suggested that radiological examination should precede endoscopic examination since the aim of the ancillary aids was to obtain the maximum information with the minimum of intervention.

Bright *et al.* (1985) described the use of endoscopy for confirmation of the diagnosis, location of the lesion, biopsy and curetting of the ulcers.

Codner and Leib (1992) reported a case of gastric ulcer in a 13 year old spayed female Labrador which was diagnosed endoscopically.

Willard and Delles (1993) were of the view that performing plain radiography or liquid barium studies were not adequate when investigating chronic regurgitation. Either barium meal contrast radiography or endoscopy was needed.

Simpson (1993) opined that gastro intestinal endoscopes facilitated investigation of regurgitation, chronic vomiting, haematemesis, malaena and small and large bowel diarrhoea. Mucosal surfaces could be directly visualized and biopsies obtained without recourse to surgery. Therapeutic applications included foreign body removal, stricture dilatation and placement of feeding tubes.

Grooters *et al.* (1994) reported the use of gastrointestinal endoscopy for identifying a case of gastric lymphoma in an eight year old Staffordshire Terrier. Endoscopy allowed direct visualization of the lesions and in many instances, provided a definitive diagnosis through biopsy and histological or cytological

examination. It was recommended to take full thickness surgical biopsies to confirm or rule out diagnosis of neoplasia if endoscopic biopsy specimens failed to demonstrate suspected malignancy.

Jergens and Miles (1994) described the use of endoscopy for arriving at a definitive diagnosis of chronic gastritis. Plain and contrast radiography revealed no abnormalities in a case of chronic postprandial vomiting in a dog which was found to be a case of diffuse lymphocytic gastritis based on histological examination of biopsy specimen obtained with the help of endoscopy.

Leib *et al.* (1998) reported the use of endoscopy for diagnosing cloth foreign bodies in the stomach in three dogs. The foreign bodies were retrieved using endoscopy without performing surgery.

Willard (2002) used endoscopy for removing foreign bodies and for observing severe upper gastro intestinal haemorrhage. Preoperative endoscopy might help to determine luminal obstructions and also helped to identify bleeding points.

2.7 Haematology and serum biochemistry

According to Fickwin and Frujillo(1970), intestinal obstruction might be associated with increased amylase and lipase. It was also opined that intestinal obstructions were usually associated with normal transaminase where as intestinal strangulation and infarction produce moderate elevation of transaminase.

Agarwal and Kumar (1988), in a study undertaken to know the serum electrolyte changes following high intestinal obstruction in dogs, inferred that in high intestinal obstruction there was hyponatremia, hypochloremia and rise in serum bicarbonate levels.

Balasubramanian *et al.* (1990), in a case of chronic hypertrophic pyloric gastropathy in a dog, observed erythrocyte count of 2.8 million/ cu mm, haemoglobin concentration of 8 g per cent, leucocyte count of 17,600/cu mm,

differential count of 62 per cent neutrophils, 36 per cent lymphocytes and 2 per cent eosinophils.

Moore (1992) was of view that animals with persistent vomiting from any cause other than pyloric obstruction generally had mild to moderate hyponatremia and hypokalemia. Those with complete pyloric obstruction had profound electrolyte abnormalities and alkalosis.

Leucocytosis and hypoproteinemia along with hyponatremia, hypokalemia and hypochloremia was observed in a case of gastric ulcer in a dog by Codner and Leib (1992).

Richter (1992a) opined that if a gastric outflow or duodenal outflow obstruction was suspected, hyponatremic metabolic alkalosis should be anticipated especially if the animal ingests water. If a distal intestinal problem was suspected especially in dehydrated, volume depleted patient, hypernatremia and metabolic acidosis should be anticipated.

In a case of gastro duodenal intussusception in a young dog of 21 months, haematology and biochemistry blood screens including pre and post prandial bile salts were unremarkable apart from hypokalemia and a marked elevation in lipase concentration of 1710 IU/litre (Watson,1997).

Intestinal obstruction in a five year old spayed wire haired Fox Terrier was reported by Prosek *et al.* (2000). Serum chemistry revealed hypercholesterolemia, elevated lipase activity, hyponatremia, hypokalemia, hypochloremia and an increased bicarbonate concentration. It was explained that hyperlipasemia and hypercholesterolemia due to secondary pancreatitis can be seen in dogs with intestinal foreign bodies. Increased intraluminal pressure causing duodenal reflux during vomiting or some obstruction of the pancreatic duct can lead to pancreatitis resulting in increased lipase concentration.

Jose (2001) recorded high values of leucocyte count, blood urea nitrogen, serum creatinine, serum total protein, serum albumin, aspartate amino transferase, and alanine amino transferase pre operatively but the level of serum electrolytes, packed cell volume, total erythrocyte count and haemoglobin were lower than normal range in upper gastro intestinal tract obstruction.

Increased lipase concentration was observed in intestinal obstruction. (Benjamin, 2001).

In induced simple and strangulated intestinal obstruction in dogs, Sodhi *et al.*(2002) observed a significant increase in total leucocyte count, haemoglobin, packed cell volume and erythrocyte sedimentation rate. Leucocytosis was attributed to stress, tissue inflammation and necrosis.

Hoffmann (2003) recorded hyponatremia, hypochloremia, azotemia and increased creatinine together with leucocytosis with neutrophilia in three cases of linear foreign body obstruction in dogs.

Lee *et al.* (2005) reported hyperproteinemia and hyperalbuminemia together with increased alkaline phosphatase, phosphorus, blood urea nitrogen and creatinine in a case of pylorogastric intussusception in a seven year old female Maltese dog. The higher protein level observed was attributed to severe dehydration.

2.8 Treatment.

2.8.1 Medical treatment

Walshaw (1985) opined that medical management of the patient with small intestine obstruction was directed to correcting fluid, electrolyte and acid-base imbalance and treating septicemia and endotoxic shock. He recommended immediate intravenous crystalloid fluid replacement therapy to correct animal's fluid deficit in intestinal obstruction. A multiple electrolyte replacement fluid, such as lactated Ringer solution, was the fluid of choice unless vomiting is profuse. The initial fluid

administration rate might be as high as 90 ml/ kg/ hour in severely dehydrated patients, provided that central venous pressure was measured during this period. If vomiting was profuse, hypochloremic hypokalemic metabolic alkalosis might be present; the fluid of choice was either normal saline or non buffered Ringer's solution.

Richter (1992a) advised that the initial therapy for a vomiting patient should include fluid administration to correct dehydration and acid base abnormalities, anti emetics to prevent further volume depletion and electrolyte derangements and appropriate supportive care. When oral intake was possible, proper dietary management with diet of rice and a small amount of low fat cottage cheese was appropriate. Protein and fat diet was strictly prohibited.

According to Richter (1992b), the medical management of gastric ulcers should include antacids like magnesium hydroxide, aluminium hydroxide, calcium carbonate or combination of these compounds, H_2 receptor antagonists like ranitidine, cemetidine, famotidine, nizatidine, cytoprotective agents like sucralfate, synthetic prostaglandin E analogue such as misoprostol, and proton pump blockers like omeprazole.

Hall (1983) reported that dietary management and gastric prokinetic agents like cisapride, erythromycin and ranitidine were useful in treating delayed gastric emptying due to functional obstruction. It was mentioned that surgical procedures were often unsuccessful in this condition.

In a study of 123 dogs treated for mechanically induced occlusive ileus in dogs, Capak et al. (2001) provide ringer lactate, saline and glucosaline on first day after surgery. Tea was given orally on the first and second day and on the third day liquid food like meat soup was given per os. Subsequently, meat with other food on the side was introduced in daily increasing quantities. Animals were given antibiotics like procaine benzyle penicillin and streptomycin, sulfamethoxy pyradizine,

gentamicin, lincomycine, lincospectin together with vitamin AD_3E, vitamin C and B complex vitamins for improvement of general resistance and faster recovery.

2.8.2 Surgical treatment

Bennet and Zydeck (1970) compared through and through everting, inverting and end to end crushing suture patterns with single layers for anastomosis of small intestine in six dogs of mixed breed. The results demonstrated that the end to end crushing pattern resulted in the greatest lumen narrowing, omental adhesions and mural fibrosis. Leakage did not occur with any of the pattern used. The end to end crushing pattern was used clinically in one dog following removal of an intussusception at the ileo caecal junction.

In a study undertaken to compare the ability of everted over inverting anastomosis Abramowitz and Butcher (1971) concluded that everting anastomosis was attended by more adhesions than inverted anastomosis in the dog. Adhesions were required by everted anastomotic lines to seal them from leakage, the absence of sufficient external seal for an everted suture line lead to free leakage through the suture line and widespread peritonitis.

Pass and Johnston (1973) reported nine cases of gastric dilatation and torsion in dogs which were treated by decompressing the stomach by gastrotomy performed under local analgesia. The technique involved a para costal incision to expose the stomach wall which was then sutured to the skin. Incision through the stomach wall allowed drainage of gastric contents. Laparotomy to correct the gastric torsion was delayed until shock had been treated and the dog had been stabilized. Seven of the nine cases survived the acute episode which compared favourably with results of treatment by immediate laparotomy to decompress the stomach and correct the torsion.

In a comparative study made between everted interrupted suture and the inverted interrupted suture techniques using silk, vetafil and chromic catgut in

intestinal anastomosis in 30 dogs, Kumar *et al.* (1973) observed that there were more adhesions between intestinal mucosa and peritoneum in everted technique. The narrowing of the lumen was more with the everting type anastomosis. No appreciable difference could be detected in tissue reaction in inverted and everted suture techniques. Microscopic examination revealed more tissue reaction with chromic catgut than with silk or vetafil.

Boothe *et al.* (1977) reported complete intestinal resection in a case of partial intestinal obstruction due to an intestinal carcinoma in a dog. Intestinal anastomosis was done with chromic catgut No. 3/0 in a simple interrupted pattern.

Wolfe (1977) reported prevention of recurrent intestinal intussusception by performing intestinal resection and creation of multiple intestinal adhesions by suturing the serosa of the intestine to the peritoneum or to itself using simple interrupted sutures of 4/0 silk spaced every eight centimetre from the duodenocolic ligament to the descending colon.

In cases of pyloric stenosis caused by hypertrophic gastritis in three dogs, Happe *et al.* (1981) had performed gastroduodenostomy in one dog and resection of the circularly thickened mucosa in other two dogs. The mucosa was resected following gastrotomy incision over the pyloric antrum midway between greater curvature and lesser curvature. The mucosa just proximal to the pylorus was sutured to the mucosa of the pyloric antrum with 4-0 chromic catgut. The gastrotomy incision was closed with Lemberts sutures.

Marks (1983) reported the use of ventral midline incision together with a right para costal incision to get a good view of stomach and pylorus for correcting a case of canine pylorogastric intussusception.

A case of chronic hypertrophic pyloric gastropathy was reported by Balasubramanian *et al.* (1990). Pyloroplasty was performed by Heineke-Mickulicz technique and the recovery of the animal was successful.

Singh *et al.* (1990) reported intestinal intussusception with prolapse of intussusceptum in dogs. Resection of the intestine was not possible and an attempt to correct the intussusception failed. Enterotomy was performed on the colon about two inch posterior to the ileocolic junction and the intussusceptum was pulled out through the enterotomy incision and resected. The remaining intussusception was corrected by simultaneous pulling and pushing the intussusceptum. The enterotomy wound was closed with catgut No 2/0 using inversion sutures. The congested and the cyanotic intestine was resected. End to end anastomosis was done by using simple interrupted sutures using catgut No 2/0.

Weismann *et al.* (1999) observed that a continuous suture pattern would be an acceptable alternative to a simple interrupted pattern for enterotomy or anastomosis of the small intestine of companion animals. The modified continuous pattern was easy to perform and differences in healing between the techniques were not detected indicating that this was an effective technique.

Linear foreign body obstruction in a seven month old male Alsatian dog was reported by Jayaprakash *et al.* (1999). Involvement of the stomach and a large segment of the intestine necessitated gastrotomy and two enterotomies to remove the linear foreign body.

In a study of ten cases of intestinal obstruction in dogs by Kumar *et al.* (2000b), the condition of intussusception was relieved by both surgical and non surgical techniques. The other conditions were relieved by enterotomy. It was stated that intestinal obstructions could be managed successfully by surgical or non surgical technique with appropriate fluid therapy.

Saini *et al.* (2002) reported a case of chronic intestinal obstruction due to inspissated faecal matter. The condition was relieved by performing multiple enterotomy but the animal died at the end of the operation. Ringer lactate was given before and after the surgery.

Bhat *et al.* (2002) studied the use of fresh and preserved omental grafts at the intestinal anastomotic sites to see their effect on intestinal healing and prevention of adhesion formation in dogs. The study concluded that the healing was better in the intestinal anastomotic site treated with fresh omentum followed by preserved omentum and was delayed in animals of control group. The adhesions were also less in treated animals. It was opined that honey preserved omental grafts could be used for enhancing anastomotic healing in cases where fresh omentum was difficult to obtain.

A case of chronic intestinal obstruction at the level of jejunum in a dog due to ingestion of rubber ball and its surgical management was reported by Govindaraju *et al.* (2005). Enterotomy was performed and the incision was closed by placing simple interrupted suture pattern using 2/0 chromic catgut with knots placed inside the lumen. Post operatively, animal was kept on intravenous fluids twice daily for five days. Animal was given cefazolin and multi vitamin injection intramuscularly for seven days. Milk was given after five days followed by semisolid diet.

2.9 Anatomy

2.9.1 Stomach

The stomach arises as a spindle shaped dilation of the foregut during embryonic life and is the largest dilation of the alimentary canal. The topographical anatomy of the stomach is divided into following regions: cardia, fundus, antrum and pylorus. The cardia is the entrance of the intra abdominal oesophagus into the stomach. To the left and dorsal to the cardia lies the fundus. When filling with food, the fundus fills first and displaces in a caudal direction. The body is the second part of the stomach to fill and expand. It is the largest region of the stomach and is most capable of dilation. A line drawn from the incisura angularis to the greater curvature represents the juncture between the body and antrum. The antrum forms a region that functions in mechanical digestion and secretion of substances to regulate the release

of hydrochloric acid. At the juncture between the antrum and duodenum is an anatomical sphincter, the pylorus which expels chyme into the duodenum and prevents reflux of duodenal contents.

The ligamentous attachments include the gastro hepatic ligament which restricts the pyloric movement. Additional mesenteric attachment includes the greater omentum and the lesser omentum. The gastro spleenic ligament is derived from the greater omentum and attaches the spleen to the greater curvature.

The principal arterial supply to the stomach is derived from the celiac artery. This artery divides into the hepatic, left gastric and spleenic arteries with each branch contributing arterial blood flow to the stomach.

The parasympathetic nerve supply to the stomach comes from the vagus nerves. Ventral vagus supply mainly the liver and stomach. The dorsal vagus supplies the cardia of the stomach and then forms a plexus on the stomachs dorsal surface. (Wingfield and Twedt, 1986).

2.9.2 Small intestine

The small intestine is the longest part of the gastrointestinal system. The average length of the small intestine is five times the length of the body. It is divided into three portions: the duodenum, the jejunum, and the ileum. The duodenum begins at the pylorus and is approximately ten per cent of the small bowel. The descending part lies to the right of the median plane where it is usually in direct contact with the parietal peritoneum. Caudally the duodenum turns on itself forming the caudal duodenal flexure. It continues toward the stomach as the ascending part. The middle part is the jejunum, which is the longest part of the small intestine and fills the mid abdomen. The terminal portion of the small intestine is the ileum, which terminates at the ileocolic orifice.

The cranial mesenteric artery is the major source of blood for the small intestine. The cranial aspect of the duodenum receives its blood supply from the

gastroduodenal artery, which originates from the common hepatic branch of the celiac artery. Venous drainage is by the cranial and caudal mesenteric vein and the gastroduodenal vein into the portal vein and is filtered by the liver.

Innervation of the small intestine is by the autonomic nervous system, which is divided into extrinsic and intrinsic systems. The vagus and the splanchnic nerves supply the extrinsic innervation. (Franklin *et al,* 1986).

2.9.3 Large intestine

The large intestine of the dog is divided into cecum, colon, rectum and anal canal, with the colon and anorectum forming a continuous tube. The cecum forms a diverticulum from the proximal portion of the colon, with distinct ceco colic and ileocolic junctions or sphincters. The colon is divided into ascending, transverse and descending sections. The ascending colon is short, about 3-8 cm in the dog. It begins with the ileocolic sphincter and runs cranially adjacent to the right limb of the pancreas, and terminates at the right angled right colic or hepatic flexure. The transverse colon is longer about 5-8 cm in the dog. It runs across the dorsal, cranial abdomen, in contact with left limb of the pancreas and terminates at the left colic or splenic flexure. The descending colon is the longest segment, varying in length with the size of the animal. It begins at the left colic flexure and runs caudally, usually following the curvature of the left abdominal wall and terminates at the rectum. The organ forms the shape of a question mark, with some dogs having a distinct flexure of the distal part, rather like the sigmoid flexure of the human colon. The descending colon is continuous with the rectum which is generally considered to begin at the pelvic inlet. The rectum runs through the pelvic canal and terminates in the anus and anal sphincter. (Burrows, 1986).

Materials and Methods

MATERIALS AND METHODS

The study was carried out in dogs presented to the veterinary hospitals of the College of Veterinary and Animal Sciences at Mannuthy and Kokkalai with the history of off feed, vomiting and/or not passing stools which were not responding to medical treatment. Twelve dogs of either sex, belonging to different breeds and age were utilized for the study. The dogs were serially numbered as G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11 and G12.

3.1 History and clinical observations

The details regarding the breed, sex, age, the symptoms manifested, response to previous medications and duration of illness were recorded. The animals were observed for their general condition, feeding and voiding habits. In all animals physiological parameters *viz.*, respiratory rate (per minute), pulse rate (per minute), rectal temperature (°C), colour of the conjunctival mucous membrane and capillary refill time were recorded.

Blood samples were collected preoperatively and postoperatively from the cephalic vein/saphenous vein using EDTA (ethylene diamine tetra acetic acid) as anticoagulant for haematological parameters. Blood samples without anticoagulant were collected for analyzing biochemical constituents.

The animals were subjected to detailed physical examination to find out presence of any palpable mass in the abdomen, the pain response and condition of the abdominal wall.

3.1.1 Radiographic/ultrasonographic evaluation

The animals were subjected to radiography in left/right lateral recumbency according to the suspected area of lesion. For stomach, left lateral and for pylorus

right lateral recumbency position was preferred. Contrast radiography using barium sulphate suspension[1] 95 % w/v was conducted to locate the lesion/site of obstruction where plain radiography was found insufficient for diagnosis. Ultrasonography was also performed wherever possible. Based on the radiographic and ultrasonographic diagnosis surgical intervention was resorted to.

3.2 Surgical management

3.2.1 Preparation of patient

Emergency cases were operated on the day of admission and in other cases dogs were kept off feed for 24 hours before surgery. The site of operation was shaved, scrubbed with chlorhexidine cetrimide[2] antiseptic lotion, mopped dry, painted Tr. Iodine and draped. Intravenous fluid therapy was given using Ringer Lactate[3] @ 10ml/kg body weight for correcting electrolyte imbalance and dehydration. The fluid line was maintained throughout the period of operation. The operation site selected were cranial mid-ventral / para-costal for stomach and middle mid-ventral site for enterotomy and enteroanastomosis.

The essential requirements like cephalic or jugular intravenous catheter prior to anaesthesia induction and maintenance of fluid drips of dextrose or lactated ringer solutions to every patient was adopted (Crane, 1986). In compromised patients, Ringer Lactate @ 10 ml/kg body weight/ hour was considered to establish hydration at the time of anaesthesia.

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1. Barium sulphate oral suspension, 95% w/v, National Drugs and Chemicals, VAPI, India.
2. Zelon - Chlorhexidine gluconate solution 0.3 % w/v, Cetrimide 0.6% w/v. Unichem Laboratories Ltd., Mumbai
3. Ringer Lactate 540 ml. Parenteral Drugs Ltd., Indore, Madhya Pradesh

3.2.2 Anaesthesia

All the animals were operated under general anaesthesia. Atropine sulphate[4] @ 0.045 mg/kg body weight and 10 minutes later, xylazine hydrochloride[5] @ 1 mg/kg body weight was administered intramuscularly for premedication. For the induction of general anaesthesia, fifteen minutes after premedication, ketamine[6] @ 10 mg/kg body weight was administered intramuscularly. Anaesthesia was maintained using a mixture of xylazine (20 mg/ml) and ketamine (50mg/ml) administered @ 0.2ml as bolus injection and diazepam@ 0.1mg/kg intravenously to effect general anaesthesia.

3.2.3 Surgical procedure

The surgical interventions were made depending up on the site and type of condition. Gastrotomy was performed for foreign bodies in stomach and gastric ulcer. Enterotomy was performed for correcting intestinal obstructions. Both gastrotomy and enterotomy were performed for removal of linear foreign body in the stomach and intestine. Enterectomy and enteroanastamosis were performed for intussusception with necrosis and gangrene. Dilation of the ileo-colic sphincter was performed in the case of stenosis of ileo-colic valve.

3.2.3.1 Gastrotomy

The animal was controlled on dorsal recumbency. The mid-ventral abdomen was shaved, scrubbed with chlorhexidine-cetrimide antiseptic lotion, mopped dry and painted Tr. Iodine. A cranial mid-ventral incision was put on the skin. The subcutaneous tissue was incised and the incision extended through the linea alba to

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4. Atropine Sulphate 0.6 mg/ml, Hindustan Pharmaceuticals, Barauni
5. Xylaxin 20 mg/ml, Indian Immunologicals Ltd., Guntur
6. Ketmin 50, 50 mg/ml, Themis Medicare, Gujarat
7. Calmpose, 10 mg/ml, Ranbaxy Laboratories Ltd., Mumbai

reach the abdominal cavity. The stomach was identified and isolated using sterile drapes. The stomach was palpated for palpable mass and a Doyens clamp was applied at the body of the stomach. An incision was put on the stomach wall at the less vascular area to reach the gastric lumen. Foreign body was removed.

In gastric ulcer, the ulcer was completely extirpated along with stomach wall and the wound was closed by inversion sutures using chromic catgut No 2/0. The gastrotomy incision was then closed by inversion sutures, Connell's followed by Lembert's using chromic catgut No. 2/0. The stomach was cleaned with normal saline, repositioned into the abdominal cavity. The peritoneal cavity was infused with 25ml metronidazole[8] solution. The linea alba along with the peritoneum was closed in a simple continuous pattern using chromic catgut No. 1. The skin wound was closed by vertical mattress suture using coarse monofilament nylon.

3.2.3.2 Enterotomy

The animal was controlled on dorsal recumbency. A middle mid-ventral abdominal incision was put on the skin. The incision was extended through the linea alba to reach the abdominal cavity. The intestinal loop with obstruction was identified and isolated with Doyens' clamp. An incision was put on the anti mesenteric border anterior to the site of obstruction and extending over the mass to enter the lumen. The foreign body was gently removed. The distended loops were milked out to drain the contents. The edges were cleaned and the enterotomy wound was closed by Cushing's followed by Lembert's pattern using chromic catgut No. 2/0. The abdominal cavity was lavaged with normal saline. Metronidazole 25 ml solution was infused into the abdominal cavity. The linea alba along with peritoneum was closed in simple continuous pattern using chromic catgut No. 1. The skin wound was closed by vertical mattress sutures using coarse monofilament nylon.

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8. Metrogyl, 500mg/100ml, J. B. Chemicals and Pharmaceuticals Ltd., Ankleshwar

3.2.3.3 Enteroanastomosis

Laparotomy was performed as for enterotomy. Intestinal loops with intussusception were identified and isolated using sterile drapes. The invagination of intestinal loop was relieved by stretching the cranial and caudal ends of the affected part.

In case of adhesions and devitalisation, resection and anastomosis was performed. The arcadial vessels and communicating branches of vasa recta along the mesenteric border that supplied the diseased segment were identified and ligated with chromic catgut No. 2/0. The devitalized portion was isolated between Doyens' clamp and was resected out. The two segments were anastomosed by Maunsells suture pattern using chromic catgut No.3/0. Checked for leakage. Abdominal cavity was lavaged with normal saline and infused 25ml metronidazole solution. The linea alba along with peritoneum was closed by simple continuous suture pattern using chromic catgut No.1. The skin wound was closed with vertical mattress suture using monofilament nylon.

In all the animals the suture line was sealed with Tr. Benzoin Co. and an abdominal bandage was applied.

3.2.4 Post operative management

Post operatively, as far as possible, all the dogs were maintained under identical conditions of feeding and management including medication and diet. Tea was given per os from first day onwards. Dogs were administered ceftriaxone[9] @ 40 mg/kg body weight, ampicillin-cloxacillin[10] @ 20mg/kg body weight BID intravenously for seven days. Parenteral administration of Ringer Lactate, dextrose normal saline[11] and 10 % dextrose[12] were continued for two days. B complex

9. Safevet, 500 mg, Dosch Pharmaceuticals Pvt. Ltd., Mumbai
10. Megapen Kid Tab (Ampicillin 125 mg, Cloxacillin 125 mg) Aristo Ltd., Mumbai
11. DNS, Baxter Pvt. Ltd. Alathur, Tamil Nadu
12. D10, Baxter Pvt. Ltd. Alathur, Tamil Nadu

vitamins[13], H_2 blockers like ranitidine[14] @ 0.5 mg/kg intramuscularly, laxatives[15] @ 15 ml BID per os and gastric pro-kinetic agents like Cisapride[16] @ 0.5 mg/kg per os BID were given post operatively. Animals were offered diluted milk and arrowroot biscuits from third day onwards post operatively and gradually shifted to normal food. The skin sutures were removed on eighth day post operatively. Dressing of the wound was done daily with framycetin ointment[17].

During the post operative period, the feeding and voiding habits were recorded. General condition of the animal, healing of the surgical wound, suture reaction if any, and any other complications encountered were also recorded.

3.2.5 Histopathology

In the case of animal G4, histopathology of the excised portion of the stomach was performed.

3.2.6 Main items of observation

3.2.6.1 Signalment

Anamnesis regarding the cause of illness, duration of illness and other complaints by the owners were recorded.

3.2.6.2 Physiological parameters

Physiological parameters *viz.*, respiratory rate, pulse rate, rectal temperature, colour of the mucous membrane and capillary refill time were recorded preoperatively, 24th hour after operation and on eighth day post operatively.

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13. Mulmin, Group Pharmaceuticals Ltd., Kolar
14. Ranitin, Torrent Pharmaceuticals, Indrad
15. Cremaffin, Greesha Laboratories Pvt. Ltd., Shadnagar
16. Tab Ciza, 10 mg, Intas Pharmaceuticals, Dehradun
17. Soframycin skin cream, Aventis Pharma Ltd., Goa

3.2.6.3 *Clinical Signs.*

General condition of the animal, clinical symptoms shown by the animal such as feeding, defaecation, vomiting, presence of palpable mass, pain on abdominal palpation, distension of visceral loops and gross appearance of the abdomen were recorded.

3.2.6.4 Radiographic / ultrasonographic evaluation

Plain radiographs were taken for all animals in lateral projection. Contrast radiographs of the abdomen, if necessary, were taken within 15-30 minutes after administration of barium sulphate @ 5-10 ml/kg body weight to observe gastric emptying. A series of radiographs at 30 minutes intervals up to 2.5 hours were also taken to observe the entire intestinal tract in case if necessary. Ultrasonographic evaluation ("L & T symphony" and "HONDA H S 200 VET Ultrasound scanners" having 3.5, 5 and 7.5 MHz mechanical sector transducer) was also made wherever possible.

Observations were recorded on,

a. Gross appearance of stomach, pylorus and intestinal loops.
b. Presence of foreign bodies, space occupying masses if any
c. Extra luminal masses.
d. Gastric and intestinal emptying.

3.2.6.5 Findings during surgery

Findings during surgery like gross appearance of the organ, presence of foreign body, mucosal lesions, space occupying lesion and other changes were also recorded.

3.2.6.6 Haematological parameters

Haematological and serum biochemical evaluation was done pre operatively, 24th hour after operation and on eighth day post operatively. The values obtained were subjected to statistical analysis.

3.2.6.6.1 Haematology

Haematological parameters *viz.*, total leucocyte count, differential leucocyte count, haemoglobin concentration and packed cell volume were estimated. (Benjamin, 2001).

3.2.6.6.2 Serum biochemical evaluation

Serum biochemical parameters like lipase, total protein, alanine amino transferase were estimated using Standard Agappe Diagnostic Kit. Sodium and potassium were estimated by Flame Photometry and chloride using chloride kit.

3.2.6.7 Results of surgery

Result of the surgery was recorded as good, excellent or poor based on general condition, surgical recovery and wound healing.

Results

RESULTS

The study was conducted on twelve dogs presented to the Veterinary Hospitals at Mannuthy and Kokkalai which were diagnosed to have gastrointestinal outflow disorders.

Out of twelve cases studied, four (G1, G5, G6, G8) had foreign body intestinal obstruction, one (G4) had a gastric ulcer at the pyloric antrum region, two cases of intussusception (G3, G10), a case of linear foreign body obstruction (G9), two with foreign body induced stenosis of ileocolic sphincter (G2 and G12), a case of gastric impaction with hardened rubber latex (G7) and a case of dilated colon (G11).

4.1 Incidence

4.1.1 Breed (Table 1)

The breeds affected were Labrador (6), Boxer (2), Rottweiler (1), Cocker Spaniel (1), Basset Hound (1), and Dachshund (1).

4.1.2 Sex (Table 5)

Among the dogs, six were males and six were females. Among six cases of gastrointestinal foreign body obstruction four were females and two were males. Intussusception was observed in two male pups.

4.1.3 Age (Table 5)

The age of the dogs ranged from thirty days to four years with nine among twelve cases less than three years. The age of the animals with foreign body gastrointestinal obstruction ranged from two months to 2.5 years. Intussusception was observed in two pups of one and two months of age.

4.1.4 Weight (Table 1)

The animals weighed between two to thirty three kilograms.

Table 1. OBSERVATIONS ON BREED, SEX, AGE, BODY WEIGHT AND DURATION OF ILLNESS IN ANIMALS.

Sl. No.	Animal No.	Breed	Sex	Age	Body Weight (Kg)	Duration of illness
1	G1	Labrador	Male	2.5 yrs	33	1 week
2	G2	Labrador	Male	3yrs	30	1 week
3	G3	Labrador	Male	2 months	6	1 week
4	G4	Labrador	Male	3yrs	22	6 weeks
5	G5	Rottweiler	Male	1yr	29	4 days
6	G6	Labrador	Female	8 months	30	3 days
7	G7	Boxer	Female	2 months	6	5 days
8	G8	Cocker Spaniel	Female	1.5 yrs	5	2 weeks
9	G9	Dachshund	Female	1.5 yrs	8	1 week
10	G10	Labrador	Male	1 month	2	3 days
11	G11	Boxer	Female	4 yrs	25	3 weeks
12	G12	Basset Hound	Female	2 yrs	12	1 month

4.2 Duration of illness (Table 1)

The duration of illness in eight animals were within one week. Duration was more than one month in two cases while another two cases recorded two and three weeks.

4.3 Physiological observations (Table 2)

The mean rectal temperature (^{0}C) was 38.57 ± 0.15 preoperatively; post operatively 38.75 ± 0.16 at 24th hour and 39.07 ± 0.06 on eighth day.

The mean pulse rate (per minute) was 107.66 ± 3.67 preoperatively; post operatively 110.6 ± 4.01 at 24th hour and 114.66± 2.58 on eighth day.

The mean respiration rate (per minute) was 42.00 ± 4.50 preoperatively; post operatively 38.10 ± 3.14 at 24th hour and 28.44 ± 1.25 on eighth day.

The capillary refill time (seconds) was 1.33 ± 0.18 preoperatively; post operatively 1.20 ± 0.12 at 24th hour and 1.00 ± 0.00 on eighth day.

4.4 Clinical history and signs (Table 3 & 4)

4.4.1 Animal G1

The symptoms shown were vomiting, anorexia and difficulty in defaecation. Animal remained off feed for one week but water intake was reported to be normal. Faeces were green in colour and the vomitus was yellowish with froth and mucus. Animal was dull, slightly dehydrated and lethargic. Abdomen was tensed and on palpation elicited pain. Distended loops of intestine were also palpable.

4.4.2 Animal G2

Animal was reported to vomit 2-3 hours after food intake but water intake was normal. Vomitus was yellowish in colour. Gradually the animal became anorectic and there was difficulty in passing stools. Animal was found very active. Distended intestinal loops and pain on palpating the abdomen was also observed.

Table 2. PRE AND POST OPERATIVE OBSERVATIONS ON PHYSIOLOGICAL PARAMETERS (Mean ± S. E.) n = 10

Parameters	Preoperative period	Postoperative period	
		At 24 hrs	Day 8
Respiration (breaths/ min)	42.00 ± 4.50	38.10 ± 3.14	28.44 ± 1.25
Pulse (per min)	107.66 ± 3.67	110.60 ± 4.01	114.66 ± 2.58
Rectal temperature (°C)	38.57 ± 0.15	38.78 ± 0.16	39.07 ± 0.06
Capillary Refill Time (s)	1.33 ± 0.18	1.20 ± 0.12	1.00±0.00

4.4.3 Animal G3

Anorexia and constipation was the initial sign but later developed diarrhoea. Vomiting was the terminal symptom shown by the animal. Faeces were found to be grey in colour with foul smell. Animal was found to be weak and recumbent. Animal on presenting to the hospital showed incomplete prolapse of rectum. The abdomen was highly distended with dilated intestinal loops, which were visible apparently (Fig. 1). Animal evinced pain on palpation of the abdomen.

4.4.4 Animal G4

Vomiting was the prominent sign which started 1.5 months back and was noticed immediately after food. Animal was reported to pass black coloured faeces. Animal was found dull. On presenting to clinics animal passed blood tinged faeces with green colour. Animal evinced pain on palpation of the abdomen.

The owner reported previous treatment of the animal for lameness and oedema of the limb but was unable to name the medicines used. Later vomiting was treated using domperidone and liver supplements.

4.4.5 Animal G5

Anorexia for four days followed by vomiting was the initial sign. Vomitus contained mucus. Faeces were reported to be scanty and black coloured. The animal was found to be very active. On palpation, a hard mass could be palpated in the distended intestinal loops, which elicited pain.

4.4.6 Animal G6

Animal refused food, but water intake was normal. It did not defecate and later started vomiting. Animal was dull. Palpation of abdomen elicited pain. A mass could be palpated in the intestine, indicating the presence of a foreign body.

Fig. 1. Distended abdomen and intestinl loops (Animal G3)

Fig. 2. Prolapsed intussusceptum (Animal G10)

4.4.7Animal G7

Animal was reported to have consumed two cups of rubber latex. Since then, inappetance followed by anorexia was reported. Constipation was the initial sign. Later, retching was also observed. Animal was found dull, lethargic and dehydrated. Abdomen was tucked up. Palpation of the abdomen revealed a large ball like hard mass in the stomach.

4.4.8 Animal G8

Inappetance, vomiting and diarrhoea were the initial signs. Later constipation and anorexia was observed. The vomitus was colourless with mucus. The faeces were black in colour. The animal was dull, lethargic and moderately dehydrated. The abdomen was tense and the animal evinced pain on palpation of the abdomen but no palpable mass could be felt.

4.4.9 Animal G9

History revealed ingestion of a piece of ribbon one week back. Vomiting was the initial clinical sign. Defaecation was absent and animal became anorectic. The animal was dull, lethargic and dehydrated. Intestinal loops were palpable and palpation of abdomen elicited pain.

4.4.10 Animal G10

The initial signs were vomiting, reduced milk intake and diarrhoea. Diarrhoea was foul smelling and vomitus was yellowish in colour. Animal was dull, lethargic, dehydrated, severely anaemic and recumbent. Abdominal palpation elicited pain. The rectum was found prolapsed through the anus (Fig. 2).

4.4.11 Animal G11

Anorexia and constipation were the initial signs exhibited. Vomiting was observed one week later. Water intake was normal. The faeces contained slight amount of blood and mucus. Animal was dull and slightly dehydrated. Abdomen was

Table 3. CLINICAL HISTORY OF ANIMALS UNDER STUDY

Sl. No.	Animal No.	Anorexia	Vomiting	Diarrhoea	Blood tinged faeces	Defaecation
1	G1	+	+	–	+	+
2	G2	+	+	–	–	+
3	G3	+	+	+	–	+
4	G4	+	+	–	+	+
5	G5	+	+	–	+	+
6	G6	+	+	–	–	–
7	G7	+	+	–	–	–
8	G8	+	+	+	+	+
9	G9	+	+	–	–	–
10	G10	+	+	+	–	+
11	G11	+	+	–	+	–
12	G12	+	+	–	–	–

+ Present - Absent

Table 4. OBSERVATIONS ON CLINICAL SIGNS IN THE DOGS ON THE DAY OF PRESENTATION.

Sl. No.	Anim. No.	Mucous membrane	Dullness	Lethargy	Active	Weak and Recumbent	Dehydration	Pain	Palpable mass	Distended loops
1	G1	Congested	+	+	–	–	+	+	–	+
2	G2	Congested	–	–	+	–	–	+	–	+
3	G3	Congested	+	+	–	+	–	+	–	+
4	G4	Slightly pale	+	–	–	–	–	+	+	–
5	G5	Congested	–	–	+	–	–	+	+	+
6	G6	Congested	+	–	–	–	–	+	+	–
7	G7	Pale	+	+	–	–	+	+	–	–
8	G8	Congested	+	+	–	–	+	+	–	–
9	G9	Congested	+	+	–	–	+	+	–	+
10	G10	Pale	+	+	–	+	+	+	–	–
11	G11	Congested	+	–	–	–	+	–	–	+
12	G12	Congested	+	+	–	–	+	+	–	+

+ present - absent

found to be tensed and the animal was moderately dehydrated. The condition subsided with antibiotic treatment and fluid therapy. The symptoms recurred two weeks later with the animal showing dullness, anorexia and constipation. An occasional vomiting was also reported. Distended loops could be palpated with no pain on palpating the abdomen.

4.4.12 Animal G12

There was intermittent vomiting for the last 1.5 months. Vomitus contained undigested food and occurred with in two hours after food. Water intake was reported to be normal and later developed anorexia. Animal was emaciated, dull, lethargic and dehydrated. Eyes were sunken. The distended intestinal loops with hyperperistalsis and intestinal sounds could be observed apparently. Abdomen was found tucked up and evinced slight pain on palpation.

4.5 Radiographic and ultrasonographic evaluation

4.5.1 Animal G1

Ultrasonography revealed dilated and pouched intestinal loops from the pyloric region onwards (Fig. 3). To and fro movements of the intestinal contents were observed indicating the presence of an obstruction. Peristaltic movements of the loops could also be observed.

Plain radiograph revealed dilated gas filled intestinal loops. Contrast radiography after 30 minutes showed normal gastric emptying. A shadow of a radio opaque oval body could be observed together with distended stomach and intestinal loops suggestive of intestinal obstruction (Fig . 4).

4.5.2 Animal G2

Ultrasonographic examination revealed uniformly dilated intestinal loops.

On plain radiography, dilated intestinal loops could be observed. In contrast radiographs after 30 minutes, contrast material had reached the small intestinal

loops. Mesh like material coated with the contrast material was observed in the small intestinal loops indicating the presence of foreign body (Fig .5).

4.5.3 Animal G3

Plain radiography revealed highly distended air filled intestinal loops with an increased soft tissue density at the ileocaecocolic junction suggestive of obstruction (Fig.6).

4.5.4 Animal G4

Ultrasonography revealed a hyperechoic image at the pyloric antral region.

Plain radiograph was not diagnostic. Contrast radiography at 15 minutes showed filling of the stomach. A delay in gastric emptying was noted in contrast radiograph taken at 60 minutes. Contrast material had reached the small intestine but a large quantity of the material was observed retained in the pyloric antral region of the stomach indicating delayed emptying (Fig. 7).

4.5.5 Animal G5

Ultrasonography revealed a hyperechoic mass in the intestinal loops casting an acoustic shadow (Fig. 8).

Plain radiography revealed a radiopaque mass in the intestinal loops at the middle abdominal region (Fig. 9).

4.5.6 Animal G6

A hyperechoic mass casting an acoustic shadow was observed during ultrasonographic evaluation (Fig. 10).

Plain radiograph revealed a radiopaque mass inside the intestinal loops at the caudal abdominal region suggestive of a foreign body obstruction (Fig. 11).

4.5.7 Animal G7

Ultrasonography revealed hyperechoic mass in the stomach and intestine (Fig. 12).

Plain radiograph revealed a highly distended stomach with a foot ball like radiodense mass in the stomach indicating foreign body impaction (Fig. 13).

4.5.8 Animal G8

A large radiopaque mass with pointed edges, suggestive of a stone, was observed in plain radiograph at the cranioventral abdominal region (Fig. 14).

4.5.9 Animal G9

Ultrasonography revealed a hyperechoic mass lodged at the pyloric region of the stomach which was found moving with the movement of the stomach (Fig 15).

Plain radiograph revealed bunching of the intestinal loops with gas pockets starting from the pyloric end of the stomach (Fig. 16).

4.5.10 Animal G10

Contrast radiograph after barium enema showed telescoping of the ileum through the large intestine suggestive of intussusception (Fig. 17).

4.5.11 Animal G11

Ultrasonography revealed slightly dilated intestinal loops with floating small hyperechoic materials in the lumen overruling the possibility of a mechanical obstruction.

Air filled intestinal loops with slightly radio opaque sedimented sand like material could be observed in the intestinal loops.

Contrast radiograph immediately after barium meal showed filling of the stomach. At 60 minutes, contrast material had reached small intestinal loops with a

Fig.3. Ultrasonographic image showing dilated intestinal loops. (Animal G1)

Fig.4. Skiagram after administration of contrast material at 30 minutes. Dilation of intestinal loops with shadow of foreign body at the centre of abdomen (Animal G1)

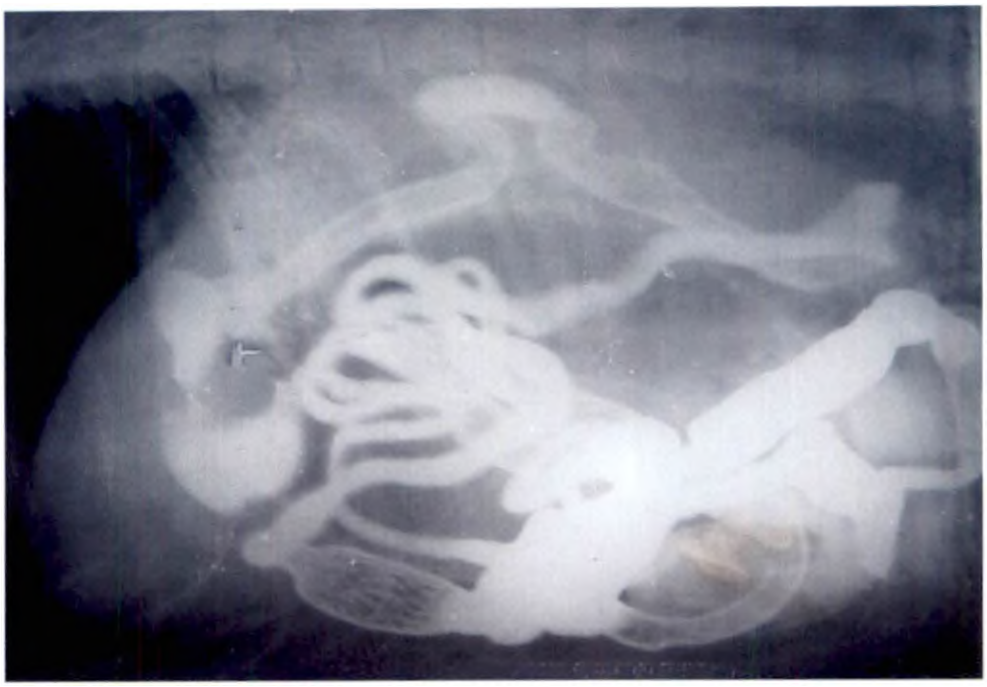


Fig.5. Skiagram after administration of contrast material at 30 minutes. Contrast material reached the small intestinal loops with mesh like appearance in the intestine (Animal G2)

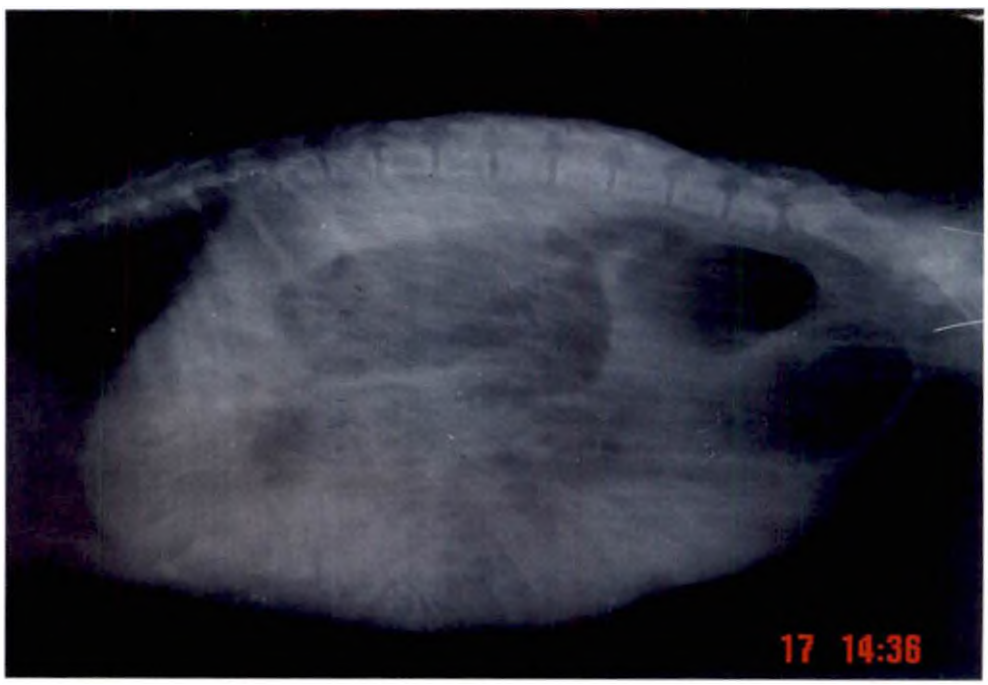


Fig.6. Skiagram of plain radiograph showing distended abdomen and air filled dilated intestinal loops with increased soft tissue density at ileocolic junction (Animal G3)

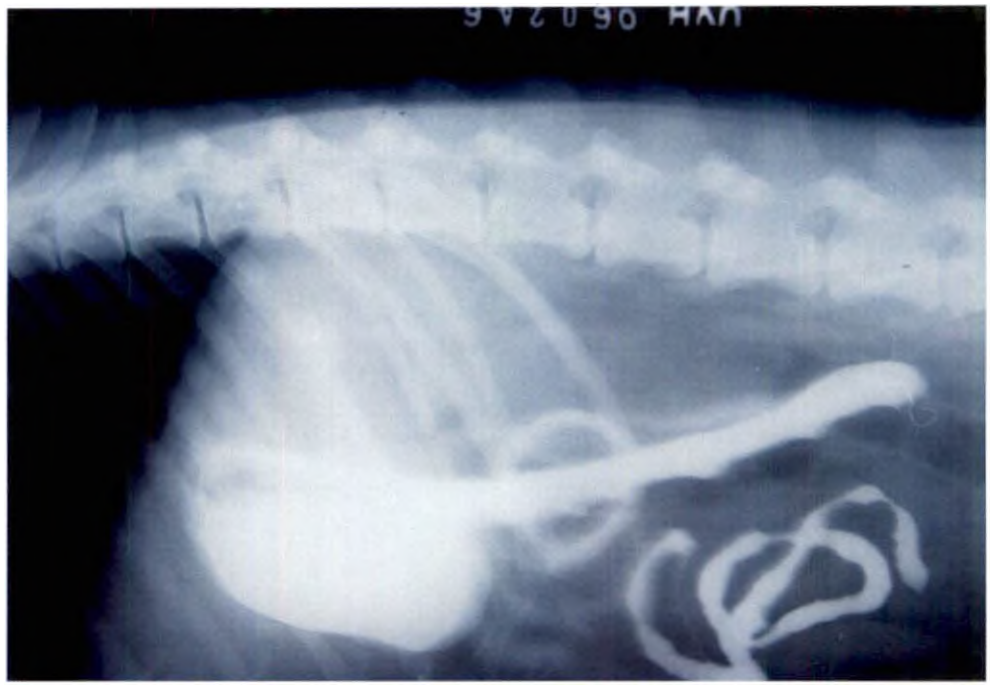


Fig.7. Skiagram after administration of contrast material after 1 hour
Delayed gastric emptying with seopage of contrast material into the intestinal walls (Animal G4)

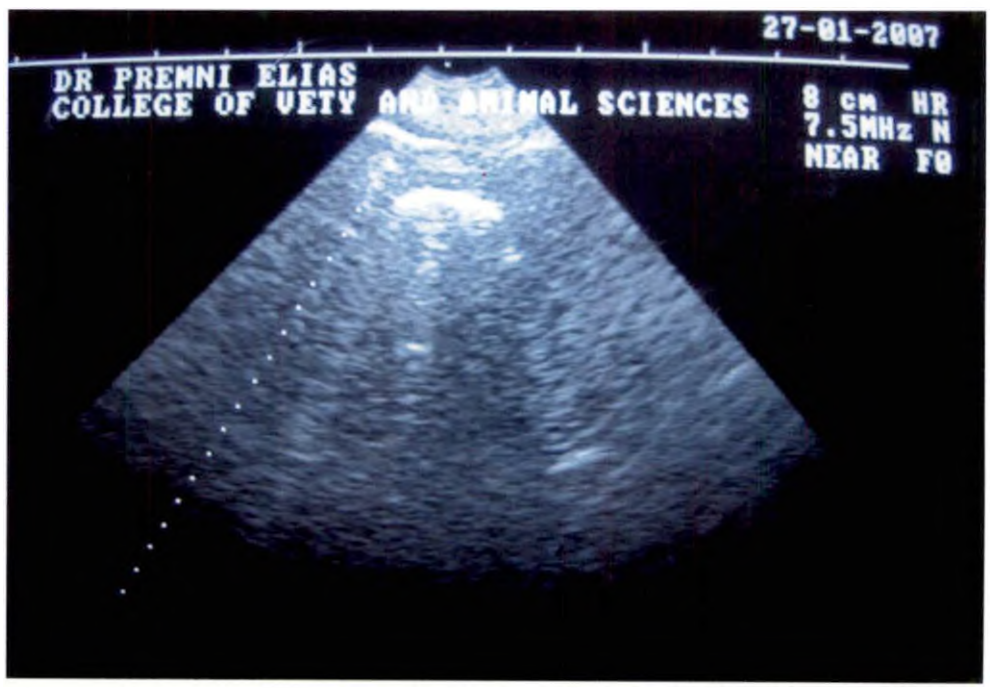


Fig.8. Ultrasound image showing hyperechoic mass casting an acoustic shadow (Animal G5)

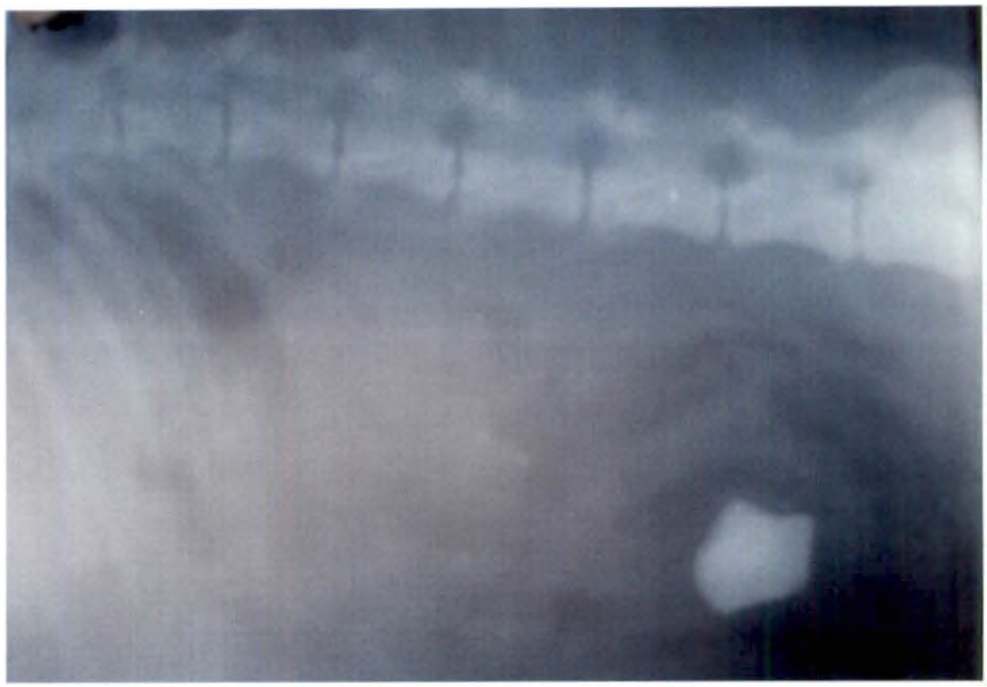


Fig.9. Skiagram of plain radiograph showing radioopaque mass in the abdomen (Animal G5)

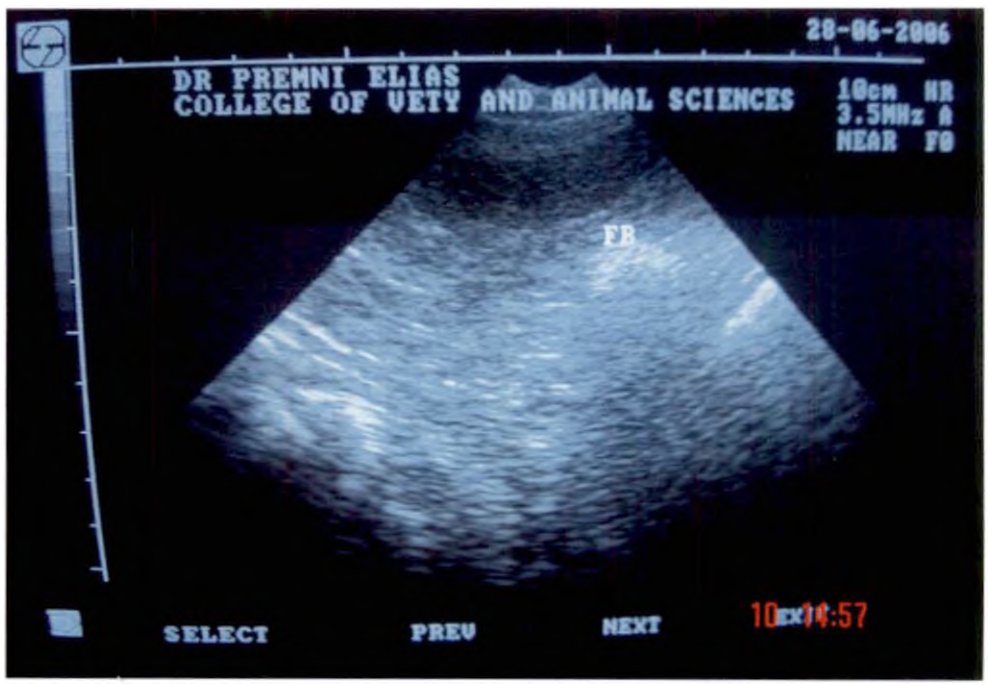


Fig.10. Ultrasound image showing hyperechoic mass in the abdomen casting an acoustic shadow (Animal G6)

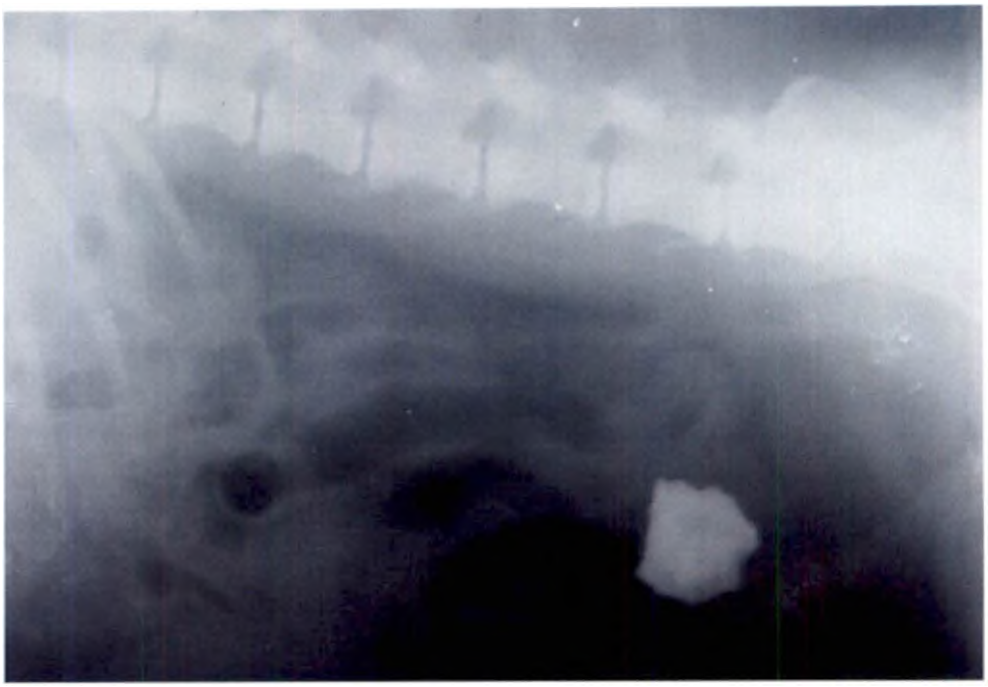


Fig.11. Skiagram of plain radiograph showing radioopaque mass in the abdomen (Animal G6)

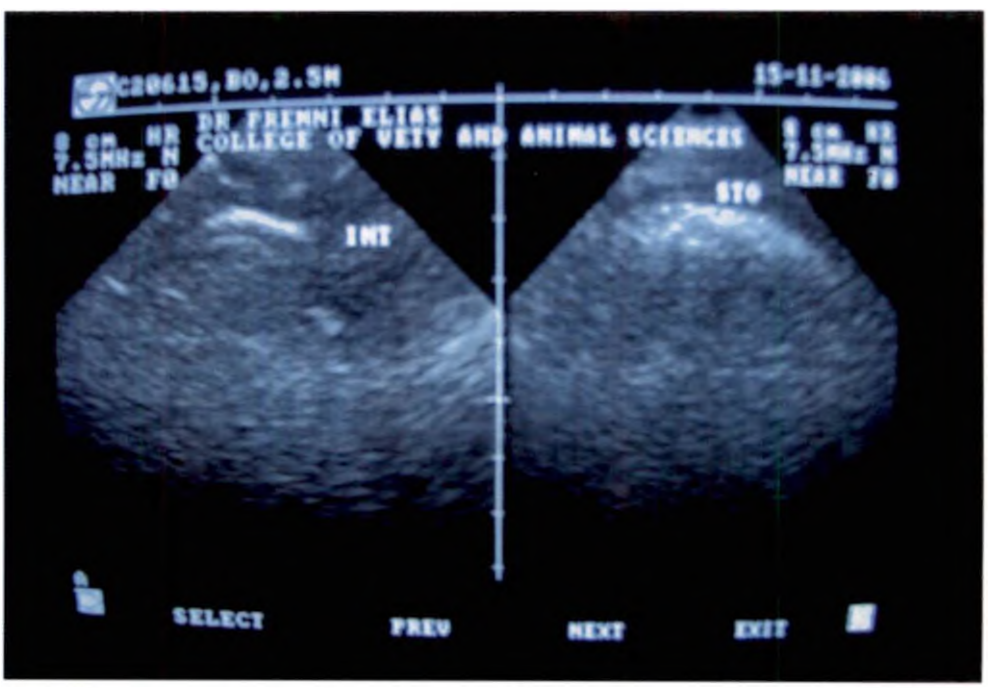


Fig.12. Ultrasound image showing hyperechoic mass in the stomach and intestine (Animal G7)

Fig.13. Skiagram of plain radiograph showing radiodense mass in the abdomen (Animal G7)

Fig.14. Skiagram of plain radiograph showing radioopaque mass in the cranioventral abdomen (Animal G8)

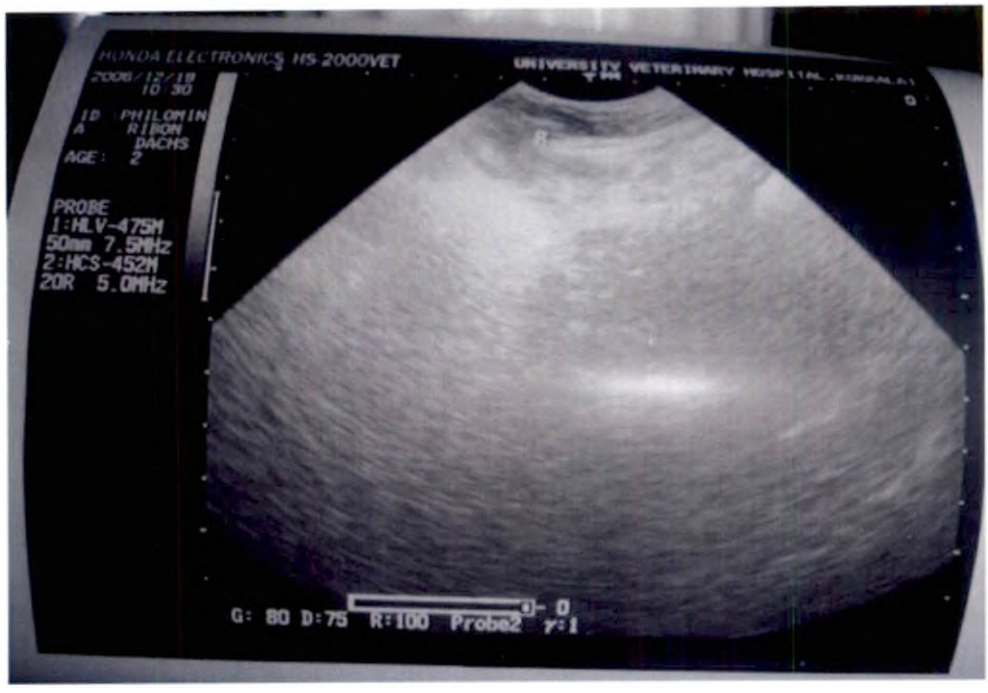


Fig.15. Ultrasound image showing hyperechoic mass in the lumen of stomach (Animal G9)

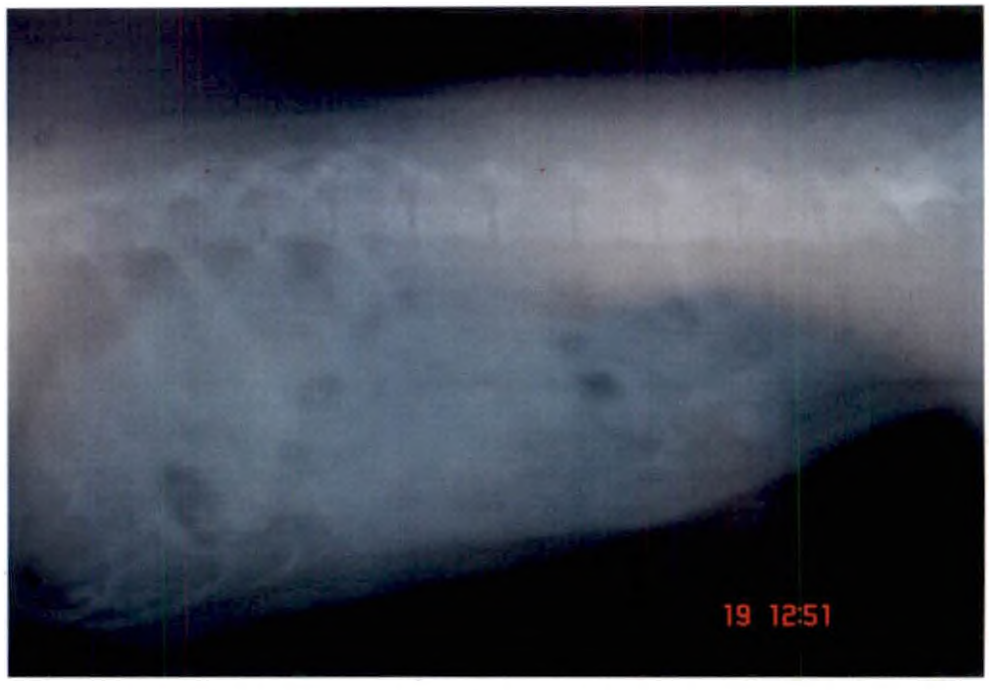


Fig.16. Skiagram of plain radiograph showing bunched intestinal loops with streaks of air pockets starting from the pyloric end (Animal G9)

Fig.17. Skiagram after barium enema. Telescoping of the ileum through the large intestine (Animal G10)

Fig.18. Skiagram of plain radiograph showing dilated colonic loops (Animal G11)

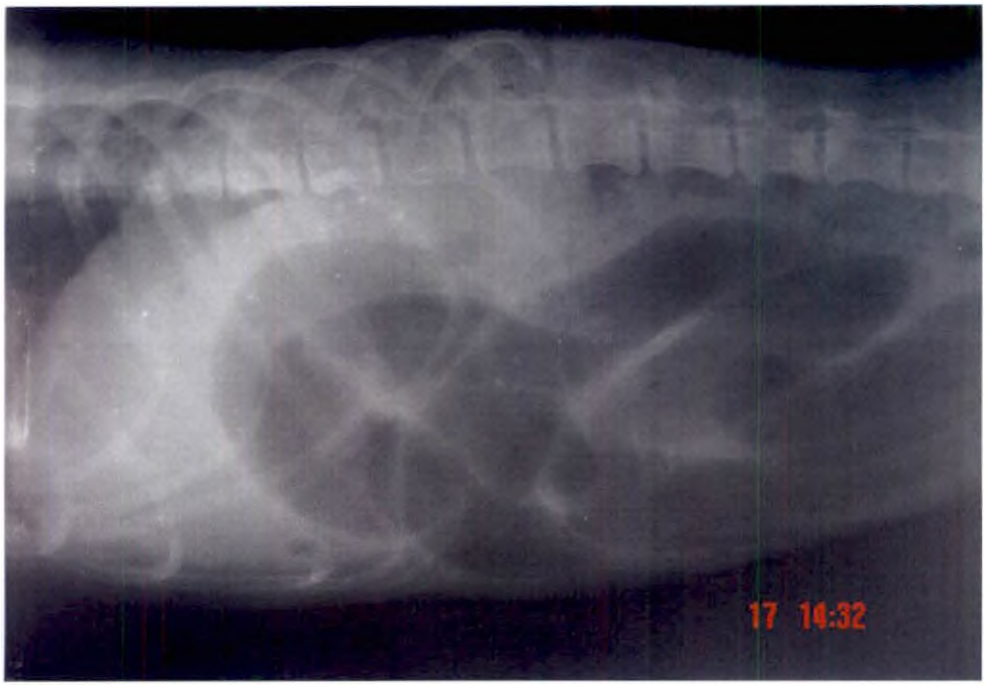


Fig.19. Skiagram of plain radiograph showing gas filled dilated stomach and intestine (Animal G12)

Fig.20. Skiagram after administration of contrast material at 2.5 hours Complete emptying of contrast material from the stomach with dilated small intestinal loops lying in a haphazard manner (Animal G12)

small quantity retained in the stomach. Air filled colonic loops were also observed. Contrast radiograph at 2.5 hours showed that the contrast material had passed the ileocaecocolic junction with accumulation of material at the ascending colon.

Complete evacuation of the contrast material was observed after 20 hours Air filled intestinal loops were observed with faecal material in the colon.

Plain radiograph taken three weeks later showed highly dilated colonic loops with retained faecal material (Fig .18).

4.5.12 Animal G12

Ultrasonography revealed air filled dilated intestinal loops. Ultrasonographic signs of a foreign body obstruction could not be observed. Free movement of the intestinal contents with peristaltic movements of the dilated intestinal loops was observed. Distended gall bladder was also observed.

A gas filled highly dilated small intestine and stomach were observed on plain radiography (Fig. 19). Contrast radiography at 25 minutes showed emptying of the contrast material from stomach with no signs of gastrointestinal out flow obstruction. Small intestinal loops were also found to be dilated. At 2.5 hours, complete emptying of the contrast material from the stomach with highly dilated small intestinal loops lying in a haphazard manner was observed (Fig. 20).

4.6 Surgical procedure (Table 5)

4.6.1 Anaesthesia

General anaesthesia induced and maintained using a combination of atropine, xylazine, ketamine and diazepam was found adequate for surgery.

4.6.2 Site of operation

Cranial midventral abdominal incision selected for gastrotomy and middle mid ventral abdominal incision for enterotomy and enteroanastomosis (Fig. 21) provided adequate space for the surgeries performed.

4.6.3 Gastric ulcer

Gastrotomy followed by extirpation of the ulcer (G4) along with stomach wall was performed in the case of gastric ulcer (Fig. 22).

4.6.4 Intestinal obstruction

Foreign body intestinal obstructions (G1, G5, G6, and G8) were relieved by enterotomy. The enterotomy incision was closed in a Cushing's followed by Lembert's pattern using chromic catgut No. 2/0 (Fig. 23).

4.6.5 Gastric foreign bodies

Gastric foreign body (G7) was removed by gastrotomy (Fig. 24). Linear foreign body (G9) in the stomach and intestine was removed by gastrotomy followed by enterotomy (Fig. 25 and 26). The gastrotomy incision was closed using chromic catgut N0. 2/0 in a connell's followed by Lembert's pattern (Fig. 27).

4.6.6 Intussusception

One case (G3) of intussusception (Fig. 28) was relieved by milking the intussusceptum out (Fig. 29) and the other (G10) by resection and anastomosis (Fig 30). A 15 centimeter long devitalized segment of ileum was resected followed by anastomosing the cut segments (Fig. 31).

4.6.7 Dilated colon

Colotomy was performed in the case of dilated colon (G11).The contents were evacuated and the incision was closed using Cushing's followed by Lembert's pattern using polyglycolic acid No. 2/0 (Fig. 32).

4.6.8 Ileocolic sphincter stenosis

The case of ileocolic sphincter stenosis (G12) was relieved by enterotomy followed by dilation of sphincter. Enterotomy was performed 10 centimeter anterior to the ileocolic junction at the anti mesenteric border to evacuate the

contents and the ileocolic sphincter was dilated using forceps (Fig. 33).Enterotomy alone was performed in animal G2 to evacuate the contents. The enterotomy incision was closed in a routine manner.

4.7 Observation during surgery (Table 5)

In animals G1, G5, G6, and G8 the site of foreign body intestinal obstruction was found to be highly congested. The portion of the intestine anterior to the obstruction was highly dilated and the intestinal and mesenteric vessels were found engorged. The foreign bodies removed were mango kernel (G1) and stones from the other three (G5, G6 and G8). The colour of the intestine returned to normal colour with in ten minutes after relieving the obstruction.

In animals G2 and G12, the whole small intestine anterior to the ileocolic junction was found distended with engorged mesenteric and intestinal vessels. The intestinal walls were found to be oedematous (Fig. 34). Small bone pieces and wooden materials were also found along with the evacuated contents. Caecum in both animals had gravel like material which was squeezed out into the colon.

In animals G3 and G10 intussusception was found at the ileocolic junction with ileum telescoping into the colon. In G3 the intestinal loops anterior to intussusception was found enlarged with engorged vessels. The intussusception was relieved by milking out the intussusceptum. The colour of the intestine returned to normal within ten minutes. The relieved intussusceptum in G10 was found to be having bluish discolouration and adhesion for a length of 15 centimeters indicating non-viability which necessitated resection and anastomosis (Fig. 35).

In animals G4, a large crater like raw ulcer with raised margins was found at the lesser curvature of the pyloric antral region (Fig. 36). Congestion of the pyloro-duodenal junction was also observed.

Table 5 OBSERVATIONS ON TYPE OF CONDITIONS, SURGERY PERFORMED AND FINDINGS DURING SURGERY

Sl. No.	Ani. No.	Age	Sex	Conditions diagnosed	Surgery performed	Findings during surgery
1	G1	2.5 yrs	Male	Intestinal obstruction	Enterotomy	Obstruction by mango kernel
2	G2	3 yrs	Male	Intestinal obstruction	Enterotomy	Stenosis of ileocolic sphincter
3	G3	2 months	Male	Obstruction	Reduction of intussusception	Intussusception
4	G4	3 yrs	Male	Chronic vomiting	Gastrotomy & excision of the ulcer	Gastric ulcer
5	G5	1 yr	Male	Intestinal obstruction	Enterotomy	Obstruction by stone
6	G6	8 months	Female	Intestinal obstruction	Enterotomy	Obstruction by stone
7	G7	2 months	Female	Gastric impaction	Gastrotomy	Impaction by rubber latex
8	G8	1.5 yrs	Female	Intestinal obstruction	Enterotomy	Obstruction by stone
9	G9	1.5 yrs	Female	Linear foreign body obstruction	Gastrotomy & enterotomy	Linear foreign body obstruction by ribbon at the pylorus
10	G10	1 month	Male	Obstruction	Resection and entero anastamosis	Intussusception with adhesions and gangrene
11	G11	4 yrs	Female	Dilated colon	Colotomy	Foreign body colitis
12	G12	2 yrs	Female	Intestinal obstruction	Enterotomy and dilation of the ileocolic sphincter	Stenosis of ileocolic sphincter

Fig.21. Midventral abdominal incision for laparotomy (Animal G11)

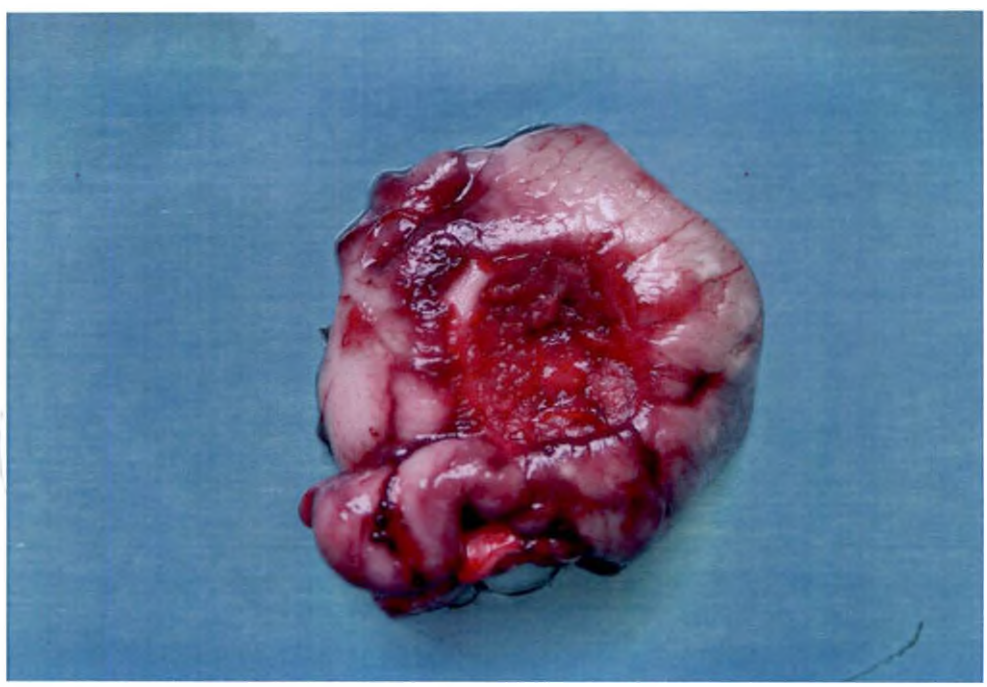


Fig.22. Extirpated gastric ulcer (Animal G4)

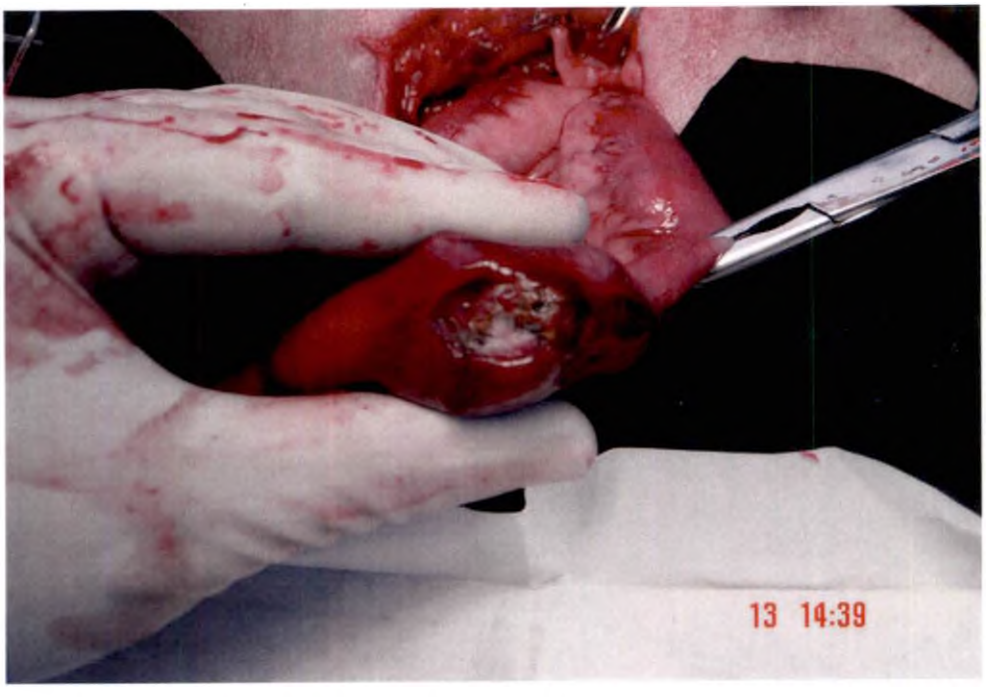


Fig.23. Enterotomy incision showing stone in the lumen (Animal G5)

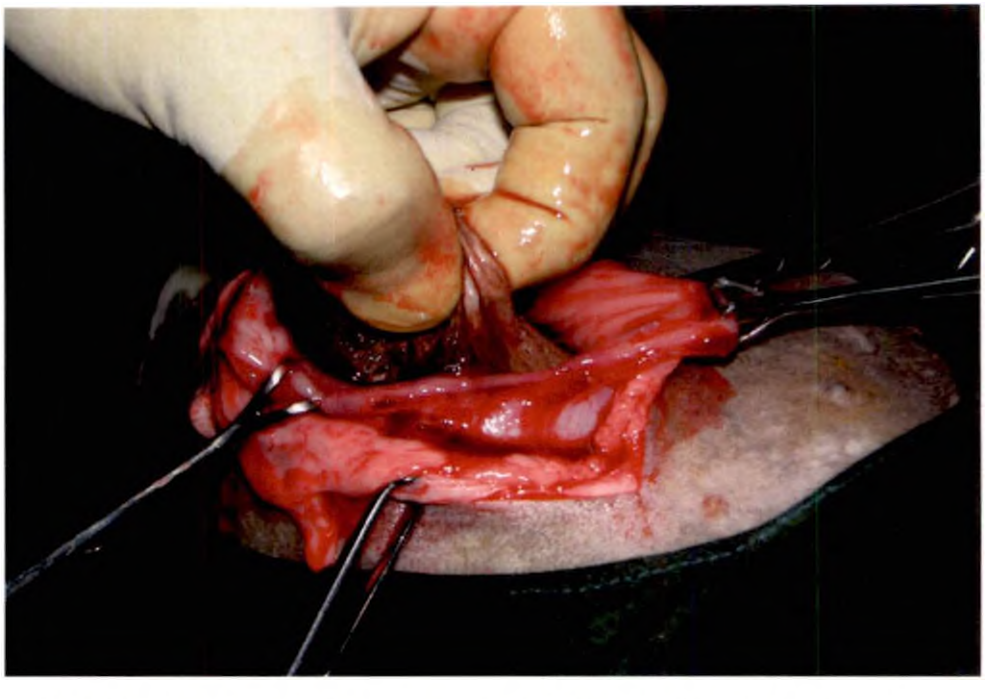


Fig.24. Gastrotomy incision showing hardened rubber latex in the stomach (Animal G7)

Fig.25. Gastrotomy for removal of linear foreign body lodged at the pylorus (Animal G9)

Fig.26. Enterotomy for removal of linear foreign body from intestine (Animal G9)

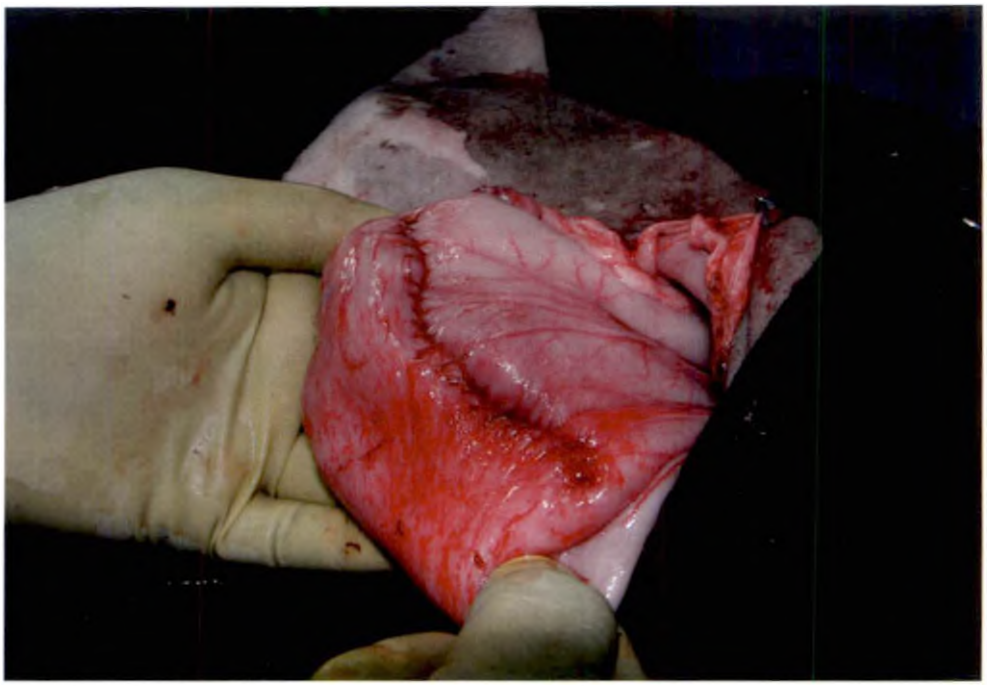


Fig.27. Closure of gastrotomy incision (Animal G7)

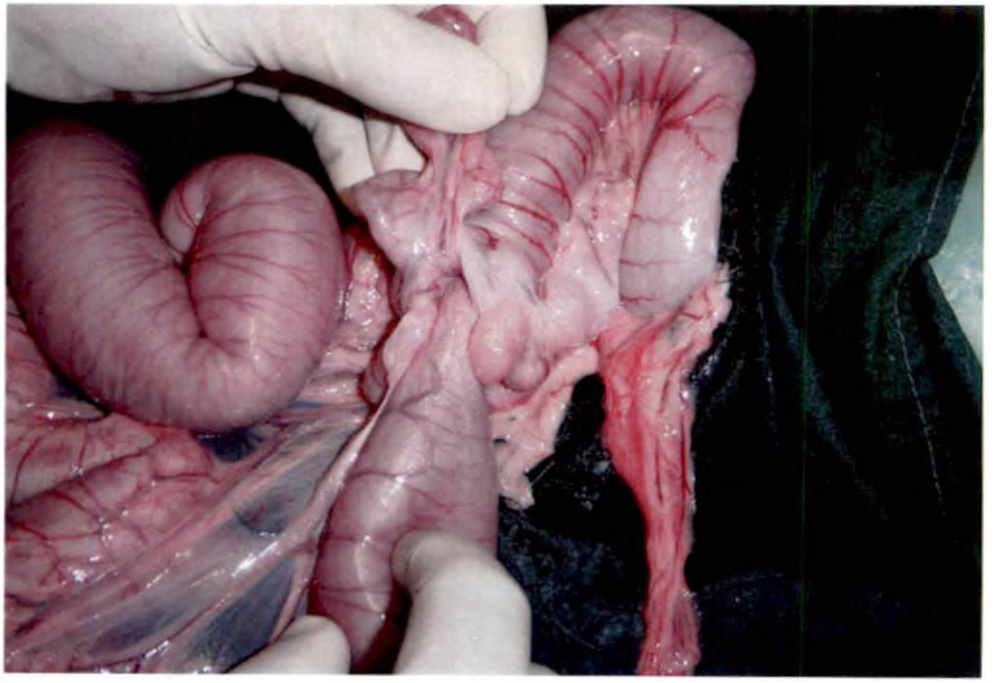


Fig.28. Intussusception at the ileocolic junction (Animal G3)

Fig.29. Intestine after relieving the intussusception by simple reduction (Animal G3)

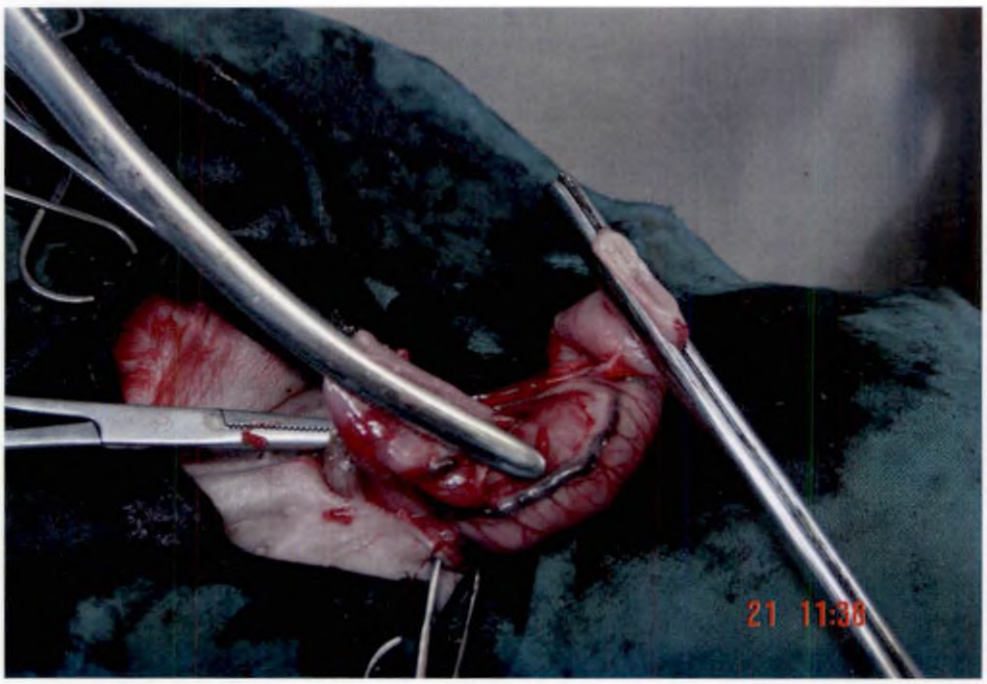


Fig.30. Cut ends of the intestine after resecting the devitilised intussusceptum before anastomosis (Animal G10)

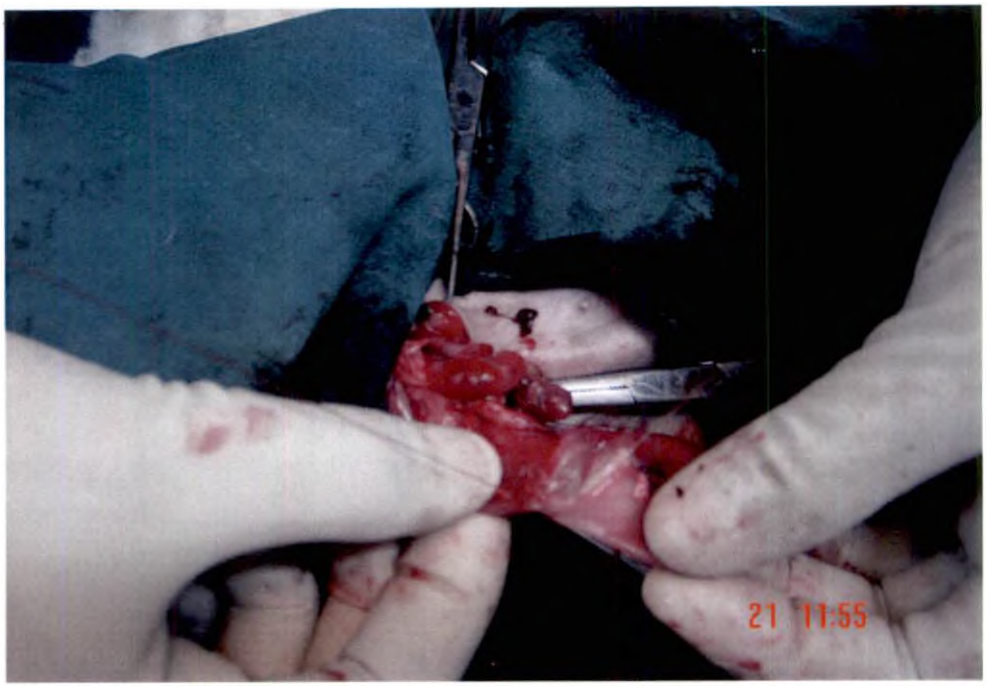


Fig.31. Intestinal anastomosis after resection (Animal G10)

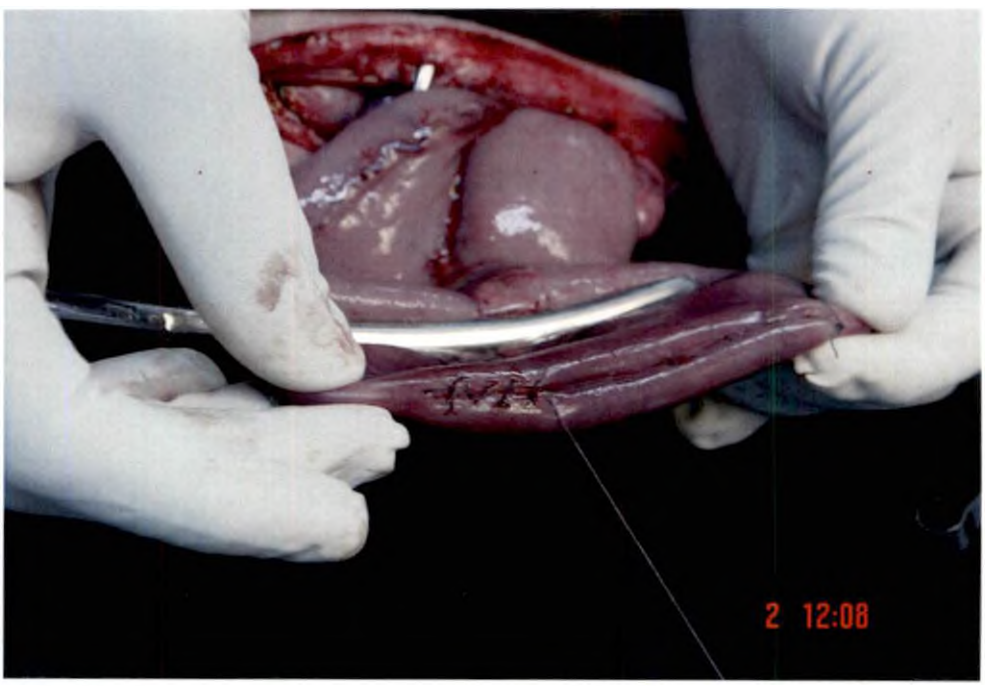


Fig.32. Closure of colotomy incision (Animal G11)

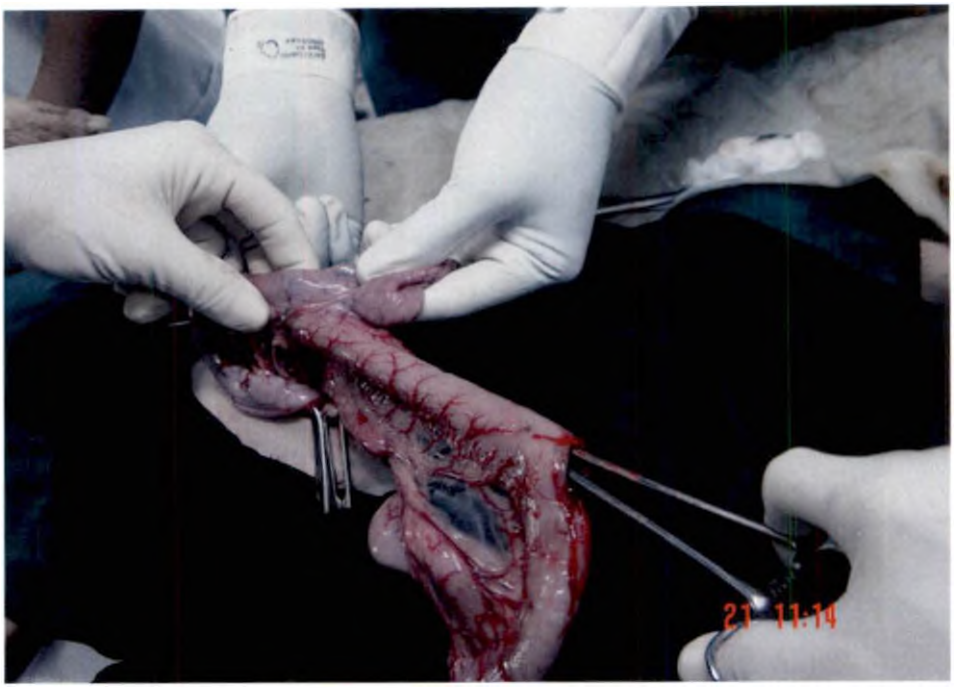


Fig.33. Enterotomy followed by dilatation of ileocolic sphincter using forceps (Animal G12)

Fig.34. Dilated small intestine anterior to ileocolic junction (Animal G2)

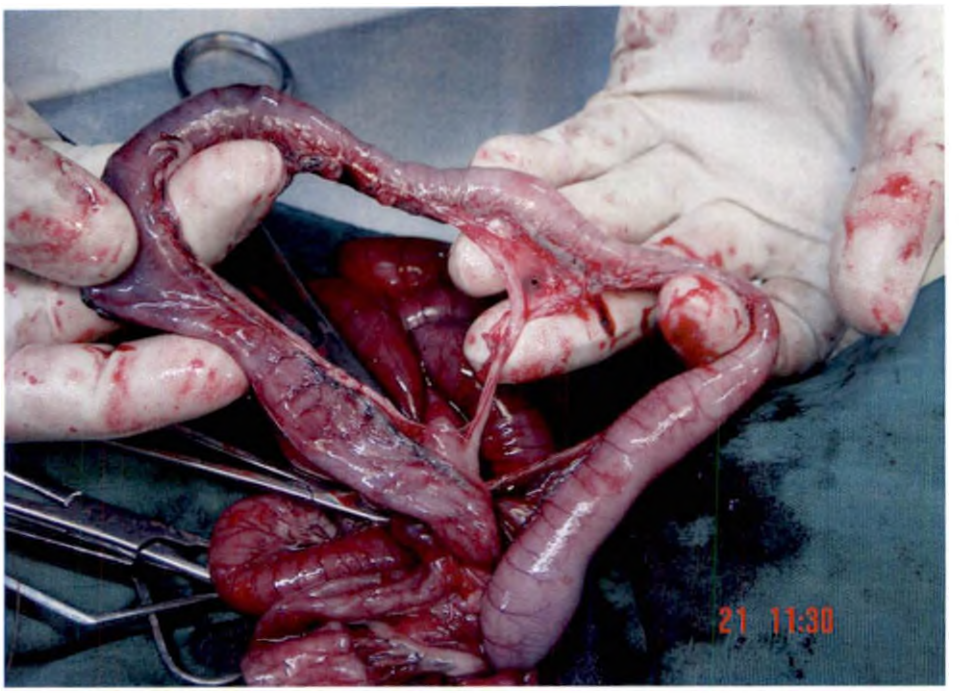


Fig.35. Relieved intussusception with gangrenous segments (Animal G10)

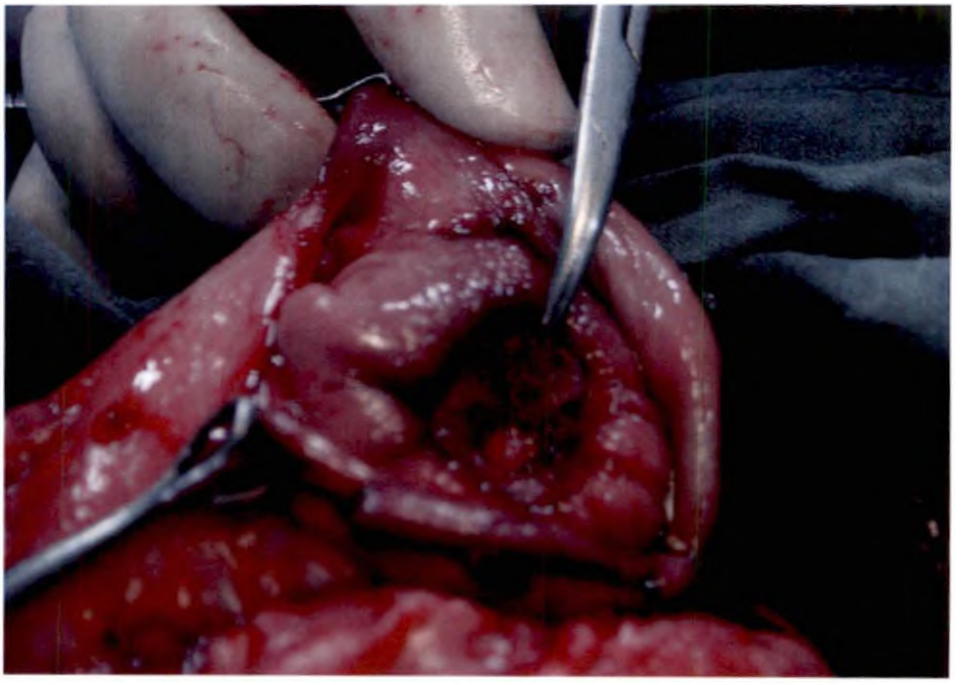


Fig.36. Crater like ulcer in the pyloric antrum of stomach (Animal G4)

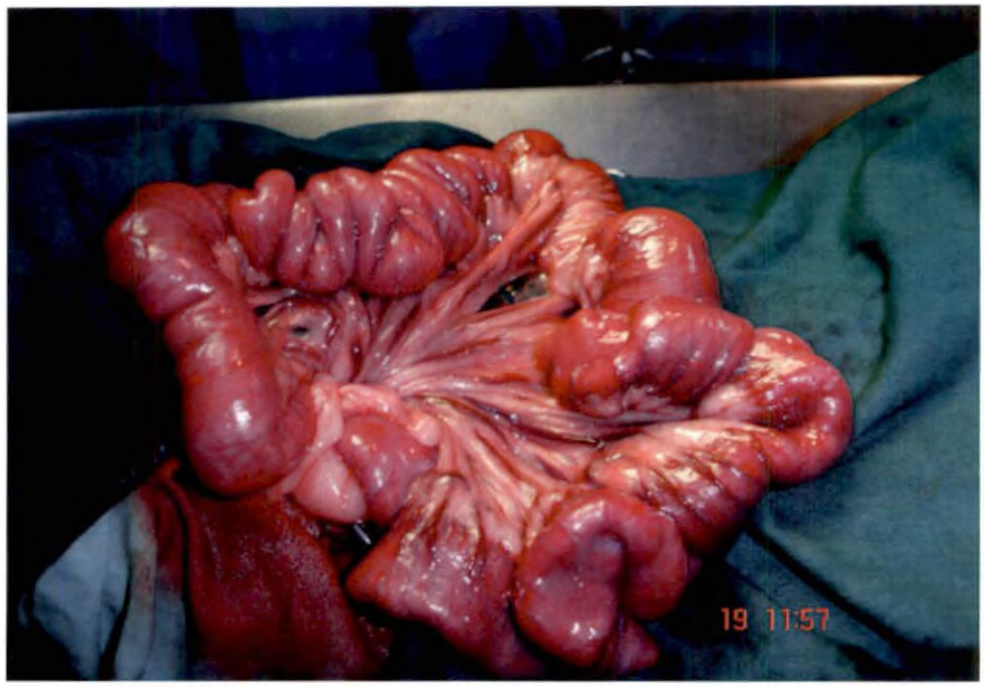


Fig.37. Plicated intestine in linear foreign body obstruction (Animal G9)

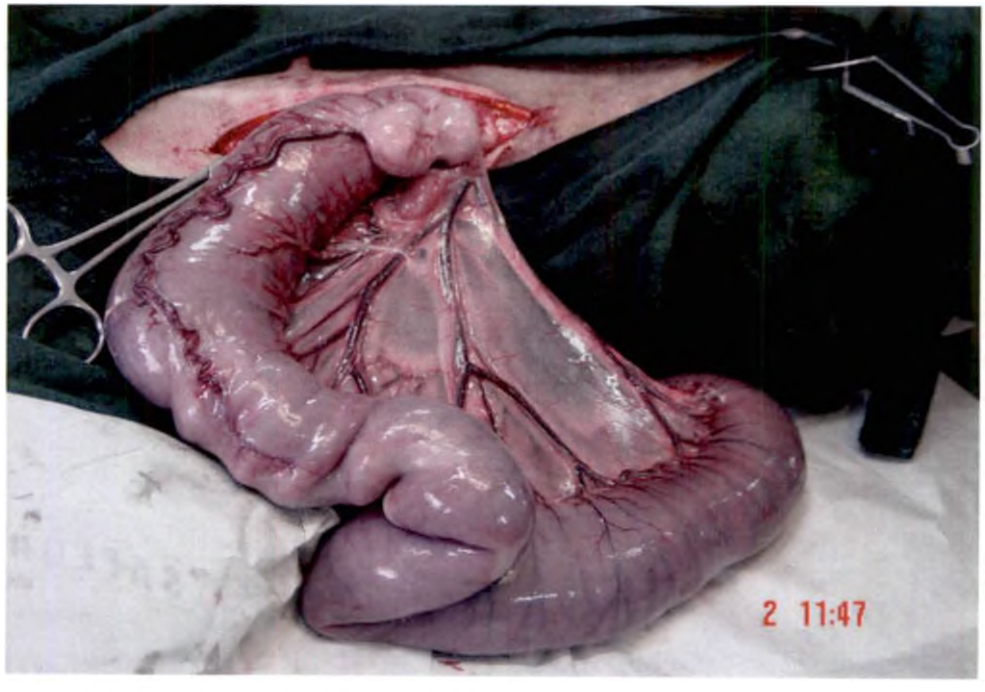


Fig.38. Dilated colonic loops (Animal G11)

Fig.39. Mango kernel (Animal G1)

Fig.40. Stone (Animal G5)

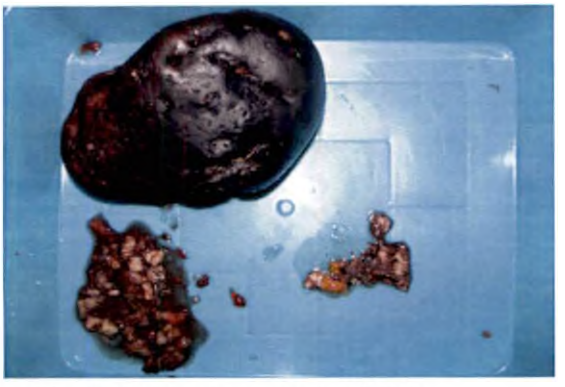


Fig.41. Rubber latex (Animal G7)

Fig.42. Ribbon (Animal G9)

Foreign bodies recovered during surgery

The stomach was found to be highly enlarged and impacted with hardened rubber latex in animal G7. After removing the rubber latex, pylorus was also checked to rule out the presence of any hardened rubber latex obstructing the tract. Erosions of the gastric mucosa were also observed.

In animal G9, gastrotomy revealed one end of the ribbon with a knot lodged and blocked at the pylorus and the remaining part extended into the duodenum. Further examination of the small intestine revealed bunching of the intestinal loops with plication and intussusception over the piece of ribbon (Fig. 37). The intestinal loops and the vessels were found engorged and congested. The colour of the intestine returned to normal colour with the removal of ribbon after enterotomy. The intussusception got corrected with the removal of the foreign body.

In animal G11, the small intestine loops were found to be normal. But the colonic loops were found to be highly dilated with fluid, gas and small foreign body particles. The vessels were highly engorged with congestion of the colonic wall (Fig. 38).

The foreign bodies obtained were mango kernel (Fig. 39), stones (Fig. 40), rubber latex (Fig. 41) and ribbon (Fig. 42). The stones and the mango kernel were found in the jejunal region while one end of the ribbon was found lodged at the pylorus with the remaining part extended into the intestine resulting in plication and intussusception. Intussusceptions in both cases (G3 and G10) were found at the ileocolic junction with one case of prolapsed intussusceptum (G10).

4.8 Haematological parameters (Table 6)

4.8.1 Volume of packed red cells (VPRC)

The mean packed cell volume was (per cent) was 32.34 ± 2.45 pre operatively and post operatively, 32.1 ± 2.36 at 24^{th} hour and 36.46 ± 2.25 on eighth day. VPRC was found to be less than normal preoperatively and on 24^{th} hour post operatively which returned towards normal on eighth post operative day.

Table 6. PRE AND POST OPERATIVE OBSERVATIONS ON HAEMATOLOGICAL PARAMETERS IN DOGS (Mean ± S. E.) n = 10

Parameters	Preoperative period	Postoperative period	
		At 24 hrs	Day 8
Packed Cell Volume (%)	32.34 ± 2.45	32.10 ± 2.36	36.46 ± 2.25
Haemoglobin (g/ dl)	10.66 ± 0.85	10.35 ± 0.76	12.10 ± 0.78
Total leukocyte count (thousands/ mm^3)	15.52 ± 1.12	23.01 ± 1.15	13.23 ± 0.65
Neutrophils (%)	75.25 ± 2.96	82.20 ± 1.90	71.20 ± 1.76
Lymphocytes (%)	20.66 ± 2.72	13.25 ± 2.55	26.44 ± 1.93
Monocytes (%)	2.44 ± 0.37	1.50 ± 0.50	1.44 ± 0.50
Eosinophils (%)	2.33 ± 0.18	1.70 ± 0.38	1.70 ± 0.28
Basophils (%)	0	0	0

4.8.2 Haemoglobin concentration (Hb)

The mean haemoglobin concentration (g/dl) was 10.66 ± 0.85 pre operatively and postoperatively, 10.35 ± 0.76 at 24th hour and 12.10 ± 0.78 on eighth day. Haemoglobin concentration was found to be less than normal preoperatively and on 24th hour after operation, which returned to normal on eighth day post operatively.

4.8.3 Total leukocyte count (TLC)

The mean total leukocyte count (10^3/cu.mm) was 15.52 ± 1.12 pre operatively and postoperatively, 23.01 ± 1.15 at 24th hour and 13.23 ± 0.65 on eighth day. Total leukocyte count was observed to be high preoperatively, became highest on 24th hour and returned towards normal on eighth post operative day.

4.8.4 Differential leukocyte count

The mean neutrophil count (per cent) was 75.25 ± 2.96 preoperatively and postoperatively, 82.20 ± 1.90 at 24th hour and 71.20 ± 1.76 on eighth day. The neutrophil count was near normal on the eighth day.

The mean lymphocyte count (per cent) was 20.66 ± 2.72 preoperatively and postoperatively, 13.25 ± 2.55 at 24th hour and 26.44 ± 1.93 on eighth day.

The mean monocyte count was 2.44 ± 0.37 preoperatively and postoperatively, 1.50 ± 0.50 at 24th hour and 1.44 ±0.50 on eighth day.

The mean eosinophil count was 2.33 ± 0.18 preoperatively and postoperatively, 1.70± 0.38 at 24th hour and 1.70 ± 0.28 on eighth day.

4.9 Serum biochemical evaluation (Table 7)

4.9.1 Serum sodium

The serum sodium concentration (mEq/L) was 129.45 ± 3.36 before surgery and postoperatively, 136.80 ± 2.38 at 24th hour and 140.94 ± 1.27 on eighth day.

Serum Na concentration was observed to be less than normal preoperatively and on 24th hour post operatively. The values returned towards normal on eighth post operative day.

4.9.2 Serum potassium

The serum potassium concentration (mEq/L) was 3.18 ± 0.21 before surgery and post operatively, 3.53±0.18 at 24th hour and 3.86 ± 0.31 on eighth day. Serum K concentration which was less than normal preoperatively and on 24th hour post operatively returned towards normal on eighth day.

4.9.3 Serum chloride

The serum chloride concentration (mMol/L) was 97.53 ± 1.10 before surgery and postoperatively, 100.26 ± 0.76 at 24th hour and 101.82 ± 0.32 on eighth day. Serum chloride concentration was less than normal preoperatively and on 24th hour postoperatively which returned towards normal on eighth post operative day.

4.9.4 Serum alanine amino transferase (ALT)

The serum ALT concentration (IU/L) was 38.16 ± 5.68 before surgery and postoperatively, 36.30 ± 4.26 at 24th hour and 30.22 ± 2.07 on eighth day. Serum ALT was found to be with in normal limits through out the period of study.

4.9.5 Serum total protein

The serum total protein concentration (g/dl) was 5.84 ± 0.30 before surgery and post operatively, 5.92 ± 0.35 at 24th hour and 6.00 ± 0.27 on eighth day. Serum protein remained within normal range, except in G7 and G12, through out the period of study.

Table 7. PRE AND POST OPERATIVE OBSERVATION IN SERUM BIOCHEMICAL EVALUATION IN DOGS (Mean ± S. E.) n = 10

Parameters	Preoperative period	Postoperative period	
		At 24 hrs	Day 8
Sodium (mEq/ L)	129.45 ± 3.36	136.80 ± 2.38	140.94 ± 1.27
Potassium (mEq/ L)	3.18 ± 0.21	3.53 ± 0.18	3.86 ± 0.31
Chloride (mMol/ L)	97.53 ± 1.10	100.26 ± 0.76	101.82 ± 0.32
Alanine Amino Transferase (IU/ L)	38.16 ± 5.68	36.30 ± 4.26	30.22 ± 2.07
Total Protein (g/ dl)	5.84 ± 0.30	5.92 ± 0.35	6.00 ± 0.27
Lipase (IU/ L)	471.66 ± 42.88	468.20 ± 38.92	336.55 ± 18.38

4.9.6 Serum lipase

The serum lipase concentration (IU/L) was 471.66 ± 42.88 before surgery and postoperatively, 468.20 ± 38.92 at 24th hour and 336.55 ± 18.38 on eighth day. Serum lipase concentration was found to be high through out the period of study.

4.10 Post operative care

4.10.1 Fluids

All the animals maintained on fluid therapy @ 10ml/kg body weight for the first two days using ringer lactate, dextrose normal saline and/or dextrose 10 per cent solution showed improvement in general condition. Essential aminoacid supplement (HERMIN) @ 10ml/kg body weight was also given for animal G12 which had severe hypoproteinemia.

4.10.2 Diet

300 ml tea was given orally on the first day post operatively. 500ml of diluted milk and arrowroot biscuits were given initially from second day onwards which was gradually shifted to normal food like cooked rice, meat and chappathis. All the animals returned to normal feeding habits within five days except animal G12 which was reluctant to take food on its own. Later the owner, on telephonic consultation, reported improvement in the condition of the animal one week after discharging the animal from the hospital.

4.10.3 Antibiotics

Ampicillin-cloxacillin was used for animal G7 while Ceftriaxone was used for the remaining animals. Antibiotic was changed for three animals (G1, G5 and G9) which developed suture abscess. Ciprofloxacin @ 5mg/kg intravenously was used in G1 while Ofloxacin @ 10mg/kg orally was used for animal G5 and G9 once daily.

4.10.4 Suture removal

Skin sutures were removed on eighth post operative day in all the animals except three with suture reaction.

4.11 Complications

All the animals except three (G1, G5 and G9) showed normal healing. Suture abscess was observed in the above three animals which subsided with the removal of the reacting catgut followed by treatment with povidone iodine or framycetin ointment and prolonged antibiotic therapy.

4.12 Result of surgery

Among the 12 animals studied, the recovery was uneventful in all the animals except three (G3, G4 and G10). Animals G4 and G10 died on the day of operation. Animal G3 was euthanised as per the owner's request due to recurrence of intussusception with in five days. The recurrence was confirmed on postmortem. In general, all the animals with foreign body obstructions showed excellent results.

4.13 Histopathology- Gastric ulcer

Sections of the ulcer (G4) showed inflammatory granulation tissue and necrotic materials. Wall of the ulcer and adjacent areas showed infiltration by lymphocytes, plasma cells and many polymorphs. Many areas of haemorrhage and congested vessels were observed. There was no evidence of malignancy (Fig. 43).

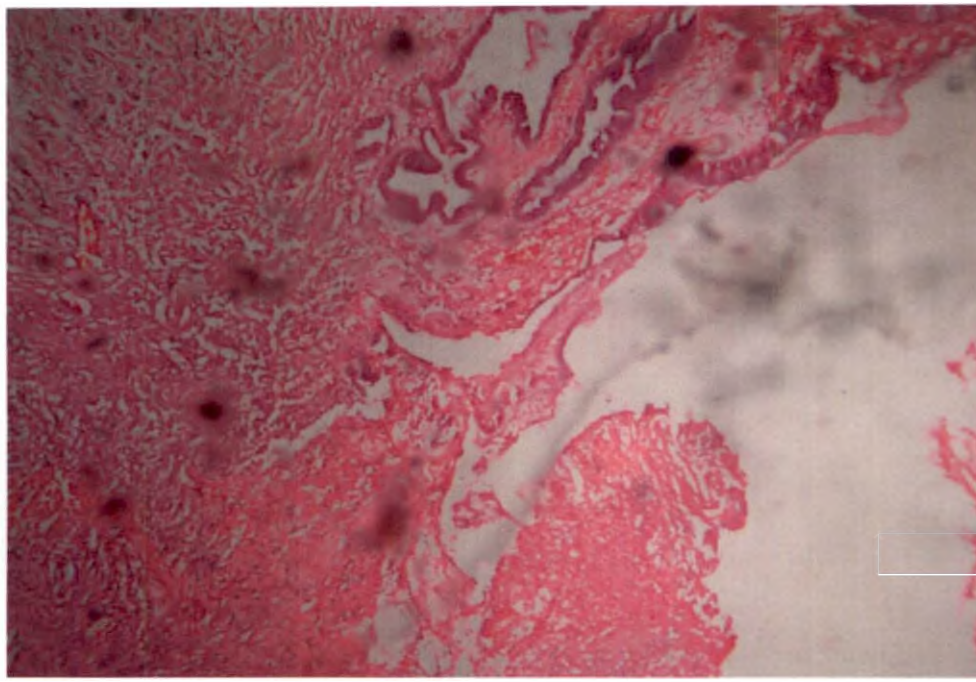


Fig.43. Histopathology of ulcer showing infiltration by inflammatory cells. No evidence of malignancy noticed (Animal G4)

Fig 44. Breed-wise distribution of gastro intestinal out flow disorders in dogs

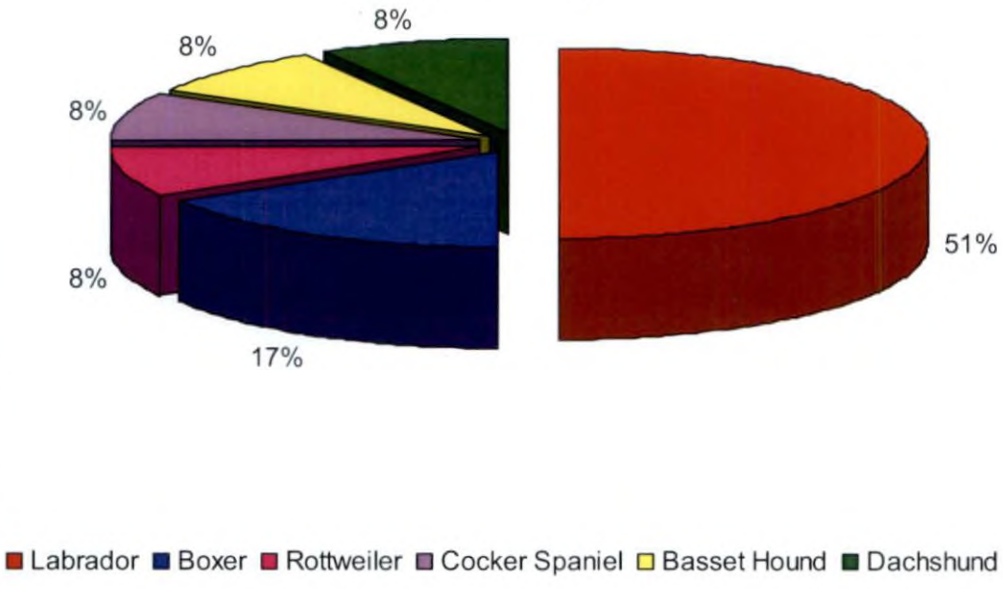


Fig 45. Distribution of conditions diagnosed

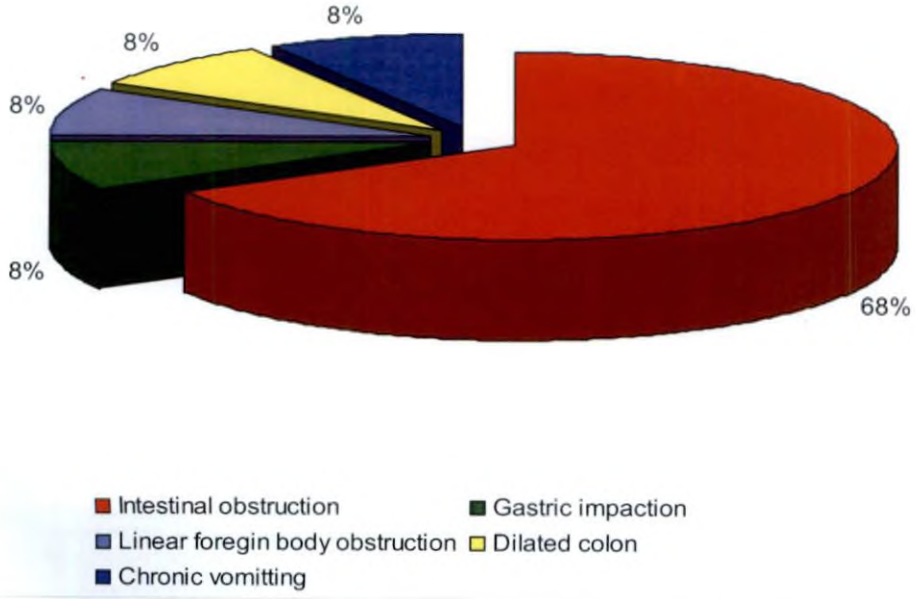


Fig 48. Variation in PCV and DLC in preoperative and post operative days

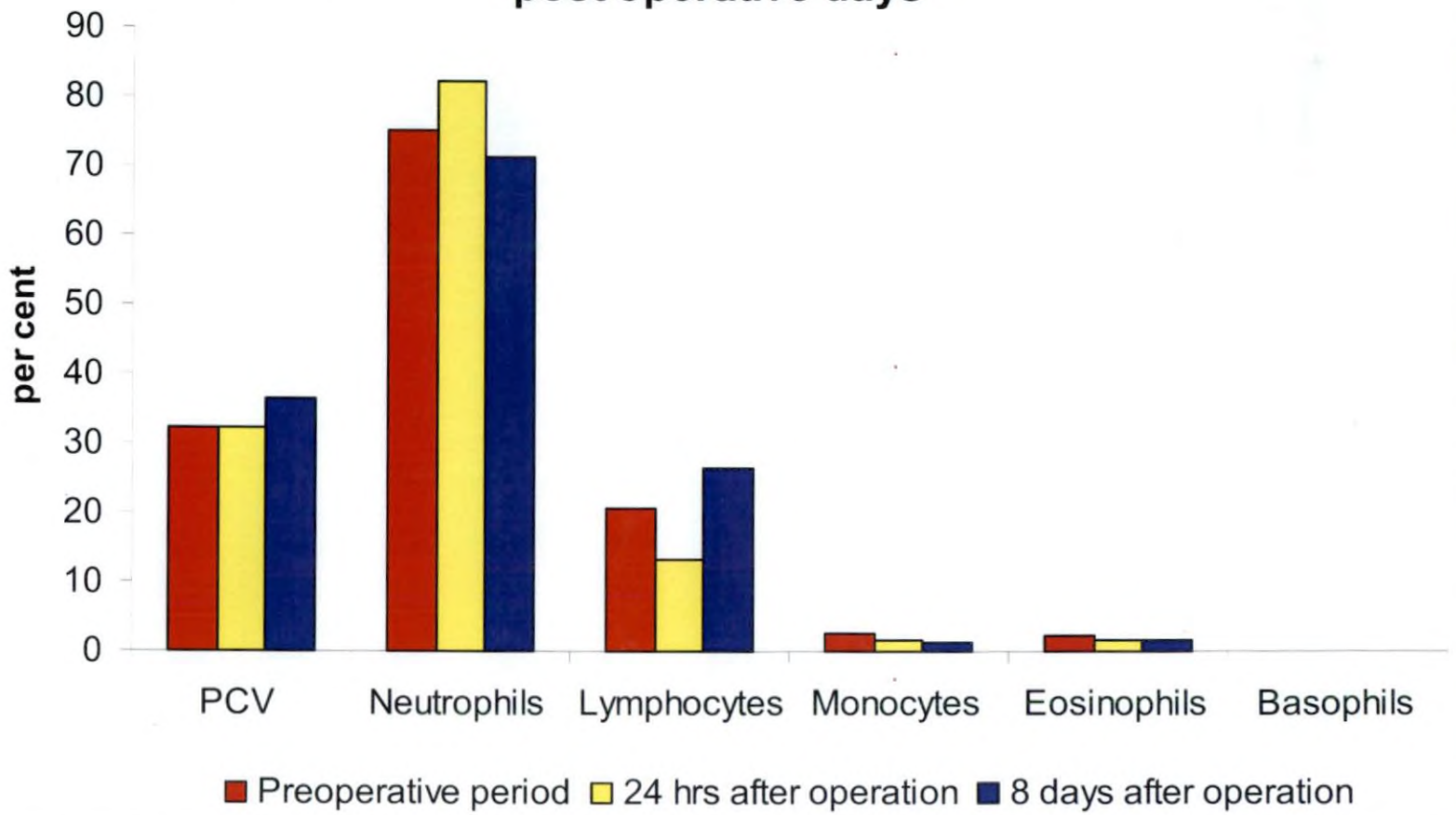


Fig 49. Variation in serum sodium concentration

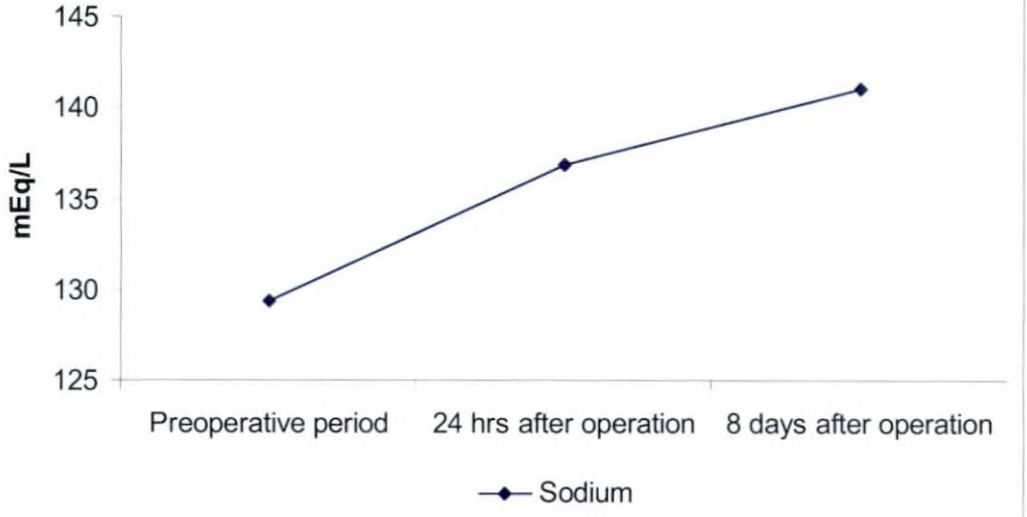
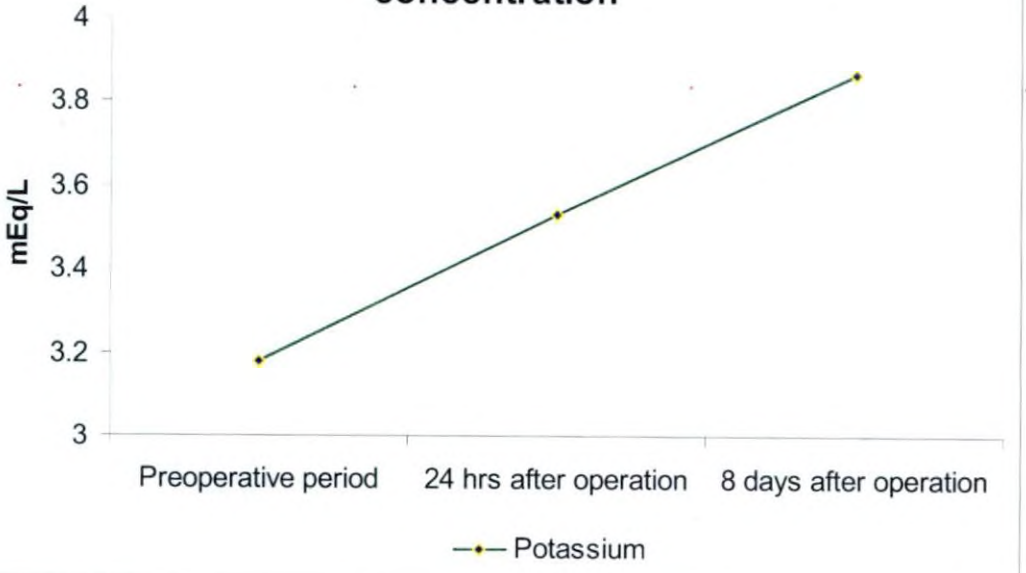


Fig 50. Variation in serum potassium concentration



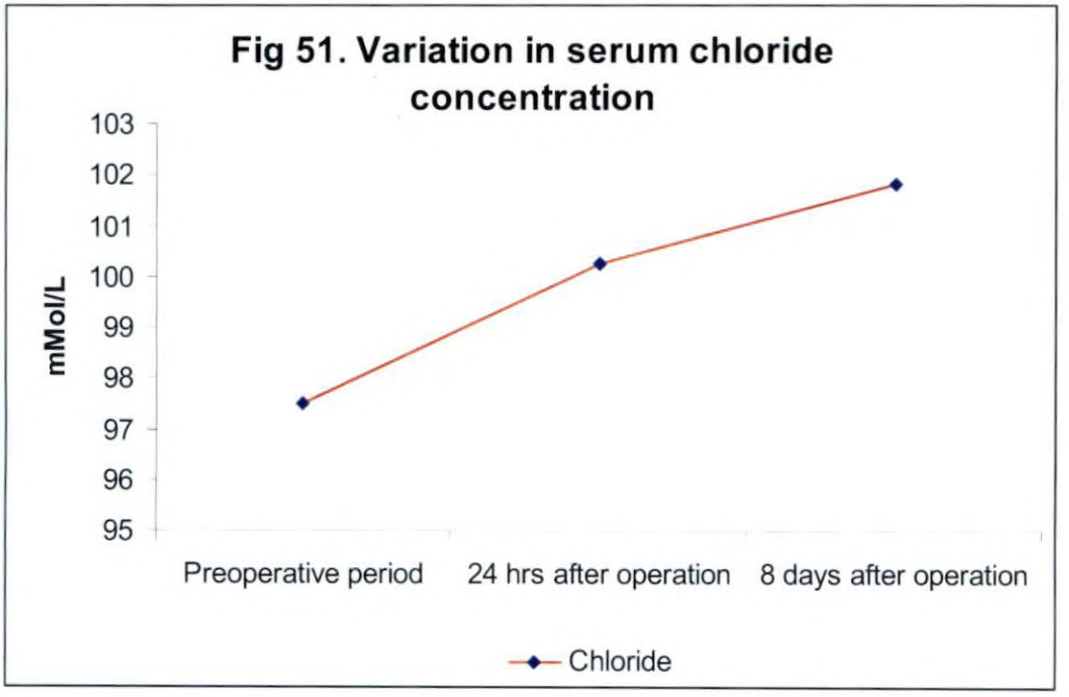


Fig 51. Variation in serum chloride concentration
103
102
101
100
99
98
97
96
95
mMol/L
Preoperative period
24 hrs after operation
8 days after operation
Chloride

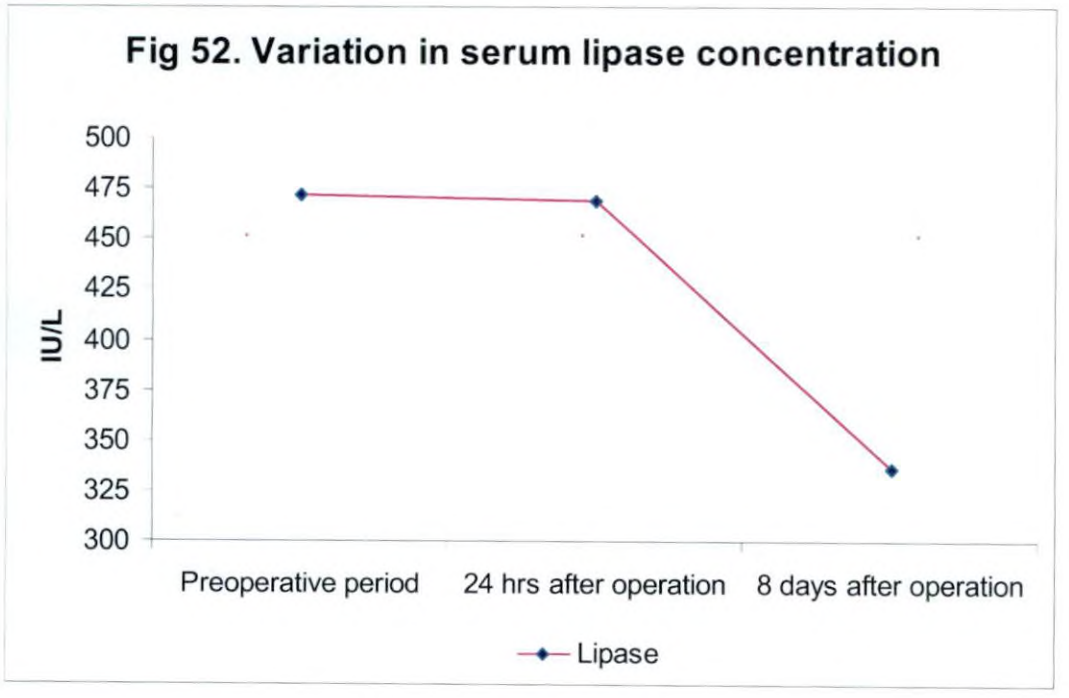


Fig 52. Variation in serum lipase concentration
500
475
450
425
400
375
350
325
300
IU/L
Preoperative period
24 hrs after operation
8 days after operation
Lipase

Discussion

DISCUSSION

Gastrointestinal outflow disorder with vomiting and off feed in dogs is reported to be one of the most frequently presented problems in a veterinary clinic. The causes are umpteen that ranges from functional and mechanical obstruction to systemic diseases. Chronic gastrointestinal outflow obstruction can result in accumulation of the gastrointestinal contents resulting in accumulation of the toxins and finally culminating in toxaemia, anaemia and death.

In the present study 12 clinical cases of gastrointestinal outflow obstruction had been evaluated for clinical, biochemical and pathological changes together with the efficacy of treatment adopted.

5.1 Incidence (Fig 44 and 45)

5.1.1 Breed

Among the 12 animals studied for gastrointestinal outflow obstruction all were pure bred dogs which was in accordance with the observation made by Capak *et al.* (2001). The most common breed was Labrador (6) followed by Boxer (2), Rottweiler (1), Cocker spaniel (1), Basset hound (1), and Dachshund (1). Kumar *et al.* (2000a) had reported the incidence of gastrointestinal foreign body obstruction common in Dobermann and nondescript dogs. High incidence of mechanically induced ileus was observed in Dobermann dogs by Capak et al. (2001).The incidence in a particular breed depends up on the geographical distribution of the dogs.

5.1.2 Sex

No sex predisposition was observed as six were males and remaining were females. Out of six cases of gastro intestinal foreign body obstruction four (66.6 percent) were females and two (33.3 per cent) were males. Foreign body induced gastrointestinal obstruction was found to be more in males(Kumar *et al*, 2000a; Capak *et al*,2001 and Govindaraju *et al*, 2005).Intussusception was observed in two male pups which was in accordance with the observations made by Kumar and

Ameerjan (2003). Levitt and Bauer (1992) reported no sex and breed predilection for the incidence of intussusception.

5.1.3 Age

The age of animals ranged from thirty days to four years. Gastrointestinal foreign body obstruction was found in animals less than 2.5 years which was in accordance with Capak *et al* (2001). Kumar *et al* (2000a) observed gastro intestinal obstruction in dogs less than six months of age. Intussusception was observed in two pups aged less than two months. According to the observations made by Levitt and Bauer (1992), the age of dogs with intussusception ranged from eight weeks to seven years averaging 11.9 months. Kumar *et al* (2000b) observed intussusception in dogs of age between one and four months. Kumar and Ameerjan (2003) observed that the age of animals affected with intussusception ranged from one to seven months with the average age being 2.7± 0.47 months which was almost in accordance with the present study.

5.1.4 Duration of illness

The duration of illness ranged from three days to six weeks.

5.2 Clinical signs

Out of twelve animals, seven (G1, G3, G7, G8, G9, G10 and G12) were dull and lethargic. Three animals (G4, G6 and G11) were dull, while two animals (G2 and G5) were active. Two animals (G3 and G10) were weak and recumbent. General lethargy, weakness and depression in cases of gastrointestinal disorders were reported by Codner and Leib (1992), Sridhar *et al* (1992), Watson (1997), Jose (2001), Hoffmann (2003), and Dileepkumar (2005).

Of the clinical cases presented vomiting, anorexia and lack of voiding was the most common clinical signs observed in all the animals. Vomitus was found to be yellowish, frothy and containing mucus as reported by Jose, 2001.

Pain on palpating the abdomen was observed in nine animals (G1, G3, G4, G5, G6, G7, G8, G9, and G10). Pain on abdominal palpation in cases of

gastrointestinal disorders was reported by Witiak *et al* (1967), Fonda *et al* (1989), Cairo *et al* (1999), Prosek *et al* (2000), Jose (2001), Hoffmann (2003), Junius *et al* (2004), Dileepkumar (2005).

Palpable mass could be observed in three cases of gastrointestinal obstruction (G5, G6, and G7). Palpable mass in the abdomen in cases of intestinal obstruction was reported by Jayaprakash *et al* (1999), Saini *et al* (2002). Devanand *et al* (2005) had reported gritty feeling on palpating the anterior quadrant of the abdomen in a case of gastric obstruction due to oyster shells.

Blood tinged tarry faeces were observed in gastric ulcer (G4), foreign body intestinal obstruction (G5, G8) and in the case of dilated colon (G11). A case of linear foreign body obstruction (G9) exhibited vomiting, anorexia, constipation and abdominal pain. Jayaprakash *et al* (1999) reported linear foreign body obstruction of intestine with vomiting, bloody diarrhoea, tucked up abdomen and congested mucous membrane

In two cases of intussusception (G3 and G10) and one case of foreign body intestinal obstruction (G8) the dogs were depressed, anorectic and showed diarrhoea. Lamb and Mantis (1998) reported similar clinical signs in case of intussusception. The most common clinical signs observed by Levitt and Bauer (1992) in intussusception in dogs and cats were vomiting, depression, anorexia and diarrhoea with diarrhoea most common in dogs. Highly distended abdomen and intestinal loops were apparently visible in ileocolic intussusception (G3) while distended loops could be palpated in seven cases (G1, G2, G5, G8, G10, G11 and G12).

Distension of the stomach was observed in gastric impaction (G7) with rubber latex. One case (G10) of intussusception was presented with prolapse of the intussusceptum. Two cases of intestinal intussusception with prolapse of intussusceptum were reported by Singh *et al* (1990).

Dog (G4) with a crater like gastric ulcer in the pyloric antrum showed vomiting, black tarry faeces and dullness. The signs were observed for the past one

month. Lead poisoning was reported to be a cause for perforated gastric ulcer as reported by Sass (1970). Jones *et al* (1976) attributed peptic ulceration to an islet cell carcinoma of the pancreas. According to Moore (1992) gastric ulceration might be a primary lesion resulting from chronic administration of steroids or non steroidal anti-inflammatory drugs. It was also associated with systemic diseases and inflammatory bowel diseases. The present case had a history of treatment for lameness but the medicines given were not known.

5.3 Ultrasonography / radiographic evaluation

Radiography was performed invariably in all the animals. Contrast radiograph was performed in cases whenever plain radiography and ultrasonography proved to be inadequate for proper diagnosis. Ultrasonography was performed, whenever possible, to correlate with clinical and radiographic signs. Though the techniques were suggestive of obstructions in the gastrointestinal tract, the ultimate diagnosis depended on exploratory laparotomy except in a few cases.

5.3.1 Ultrasonography

Ultrasonography together with plain radiography was sufficient to identify the presence of foreign bodies in cases G5, G6, G8 and G7. Presence of hyperechoic mass casting an acoustic shadow and an anechoic intestinal segment proximal to it suggestive of foreign body intestinal obstruction was observed. Vijayakumar *et al.* (2002) had made similar observation in a case of foreign body intestinal obstruction. Penninck and Mitchell (2003) reported use of ultrasonography for detection of ingested and perforating wooden foreign bodies in four dogs. Singh *et al.* (2002) used ultrasonography for diagnosing a case of small intestinal obstruction due to a stone.

The ultrasonographic signs observed in gastrointestinal obstruction were dilated intestinal loops with movement of ingesta inside the loop. Manczur *et al.*(1998) had observed increased peristaltic activity with pendulous movement of the

ingesta in case of mechanical obstruction. Similar observations were reported by Manczur and Voros(2000).

In the present study, ultrasonography was found to be effective in diagnosing a case of linear foreign body obstruction (G9). Ultrasonography revealed a moving hyperechoic mass towards the pyloric end in the gastric lumen which was found to be in accordance with observation made by Hoffmann (2003). Manczur and Voros (2000) had described the presence of hyperechoic reflex and shadowing in the middle of the intestinal lumen in a case of linear foreign body intestinal obstruction.

Ultrasonography performed in animal G4 showed a hyperechoic region at the pyloric antrum region which was confirmed to be a crater like gastric ulcer on exploratory laparotomy. Penninck *et al* (1990) had reported the use of ultrasonography for diagnosing benign and malignant gastric ulcers associated with tumour condition.

5.3.2 Radiography

Plain radiography was sufficient to identify radioopaque gastrointestinal foreign body obstruction as reported by Jose (2001) and Dileepkumar (2005).

Contrast radiography was performed in six animals (G1, G2, G4, G10, G11 and G12).contrast radiography in animal G1 showed an oval mass coated with contrast material which was found to be mango kernel on exploratory laparotomy. Animals G2 and G12 showed no signs of foreign body intestinal obstruction of the gastrointestinal tract except that the whole small intestine was dilated up to the level of ileocolic junction.

Contrast radiography at 30 minutes in animal G4 showed no complete obstruction of the pylorus. A second radiograph after one hour showed a major portion of the contrast material retained at the pyloric area with remaining evacuated into the intestine suggestive of a delayed gastric emptying and partial obstruction at the pylorus. The observation was found to be in accordance with Dileepkumar (2005). Chourasia *et al* (2002) had described radiographic changes in acetyl salicylic

acid induced gastritis in dogs. Radiographic characterization of a perforated duodenal ulcer in a dog was reported by Farrow (1985). Codner and Leib (1992) opined that lesions accompanying gastrointestinal ulcerative diseases might be missed with a barium series but can be easily identified with an endoscope.

Barium enema was performed in the case of animal G10. The radiograph showed telescoping of the ileum to the colon with air cavities around the prolapsed mass. The observation was found to be in accordance with Gibbs and Pearson (1973) and Larsen and Bellenger (1974). Levitt and Bauer (1992) had reported the use of barium enema to correct an enterocolic intussusception in a dog.

5.4 Surgical procedure

Anaesthesia using the combination of atropine, xylazine, ketamine and diazepam was found to be satisfactory in all animals. Enterotomy was done in animals G1, G2, G5, G6, G7, G8 and G11. Enterotomy was the major operation performed in cases of foreign body induced ileus as reported by Capak *et al* (2001). Singh *et al* (2002), Dass *et al* (2003), Govindaraju *et al* (2005) had reported enterotomy for removal of foreign body obstruction. In dog G12 obstruction was due to stenosis of the ileo colic junction which was corrected by enterotomy for removal of contents followed by dilation of the ileocolic sphincter using forceps.

Gastrotomy followed by excision of gastric ulcer was performed in animal G4 as suggested by Larsen and Bellenger (1974). Gastrotomy was performed in animal G7. Devanand *et al* (2005) had performed gastrotomy for removal of oyster shells from the stomach of a pup.

Simple reduction of intussusception was done in the case of animal G3 while resection and anastomosis of intestine was done in animal G10. Levitt and Bauer (1992) had performed simple reduction, resection and anastomosis, and simple reduction with plication in 36 cases of intussusception in dogs and cats. Kumar *et al* (2000b) corrected two cases of intussusception by gentle traction and milking of the contents and another two cases by resection and end to end anastomosis. Among 15

cases of intussusception Kumar and Ameerjan (2003) performed resection and anastomosis in 12 cases while gentle traction and milking of the intussuscepted segment was done in remaining three cases. Singh *et al.* (1990) performed enterotomy followed by resection and anastomosis in cases of intussusception with prolapsed intussusceptum.

Gastrotomy followed by enterotomy was done to relieve linear foreign body obstruction (G9). Jayaprakash *et al* (1999) and Hoffmann (2003) reported gastrotomy followed by multiple enterotomy to relieve linear foreign bodies from the gastrointestinal tract of dogs.

5.4.1 Observations during surgery

In animals G1, G5, G6, and G8 congestion of the intestinal loops at the site of foreign body obstruction and dilation of the intestinal loops proximal to the obstruction was the common observation made during surgery.

Intussusception in G3 and G10 was observed at the ileocolic junction with ileum telescoping into the colon. The loops anterior to the intussusception were found distended with engorgement of vessels. The intussusceptum in G10 was found devitalized necessitating resection and anastomosis. Similar observations were made by Levitt and Bauer (1992), Kumar *et al* (2000b) and Kumar and Ameerjan (2003).

Crater like ulcer in animal G4 was found at the pyloric antral region with raised margins causing partial obstruction of the pylorus.

Stomach was found to be impacted and distended due to hardened rubber latex in animal G7. Shallow erosions were also observed in the gastric mucosa of the animal. No other lesions of the intestinal loops or organs were observed.

Distension of the whole intestinal loops up to the level of ileo colic junction was observed in animal G2 and G12.Peristaltic movements of the loops were observed. The vessels were found to be engorged. No signs of physical or foreign body intestinal obstruction were visible though the clinical signs suggested

obstruction in G2. In G12, the contents could be squeezed and drained in to the colon, hence suspected for stenosis and dilation of the sphincter was done.

In animal G9.the linear foreign body (ribbon) was found lodged with its knotted portion lodged at the pylorus. The intestinal loops were found to be plicated and entero enteric intussusception was observed which was similar to the observation made by Jayaprakash *et al* (1999) and Hoffmann (2003).

Highly dilated and congested colonic loops with engorged vessels were the prominent sign in animal G11. The small intestinal loops were found to be normal.

Two cases of intussusception observed (G3 and G10) were at the ileocolic junction which was in accordance with the observation made by Wolfe (1977), Levitt and Bauer (1992) and Kumar and Ameerjan (2003).

The foreign bodies causing intestinal obstruction in G1(mango kernel), G5, G6 and G8(stones) were observed in the jejunum which was in accordance with observation made by Govindaraju *et al*(2005), Capak *et al*(2001). Mantri *et al* (1992) had reported majority of the intestinal obstruction of dogs in the small intestine. According to Larsen and Bellenger(1974) foreign bodies which pass through the pylorus were too large to pass through the small intestine and usually gets obstructed in the jejunum and rarely in duodenum or ileum. Dass *et al* (2003) reported a case of stone causing complete lower ileal obstruction in a dog.

The most common foreign body isolated in the present study was stone followed by ribbon, mango kernel and rubber latex. The common foreign bodies isolated from gastrointestinal obstruction were stones and bones. (Mantri *et al*, 1992; Kumar *et al*, 2000a).

The linear foreign body (ribbon) in G9 was found with one end lodged at the pylorus and the remaining extending to the small intestine resulting in enteroplication and intussusception. The observation was in accordance with the report of linear foreign body intestinal obstruction as made by Jayaprakash *et al.* (1999). Sridhar *et al* (1992) had reported necropsy findings of a case of

intussusception due to audio tapes in a dog. A report of linear foreign body obstruction of large intestine in a tom cat was made by Sharma *et al.* (2005).

5.5 Post operative management

All the dogs were maintained on intravenous fluids comprising Ringer lactate, dextrose normal saline and/or dextrose 10 per cent solution for two days. Vitamins, H_2 blockers like ranitidine and gastric prokinetic agents like cisapride was used.

Ceftriaxone was the most commonly used antibiotic followed by ampicillin-cloxacillin. Both of them were found to be effective. No complication of the peritonitis was observed which could be attributed to flushing of abdominal cavity with normal saline, infusion of metronidazole solution and antibiotic therapy.

Tea was given per os from first day onwards (Capak *et al*, 2001). Diluted milk and arrowroot biscuits were given from third day onwards which was gradually shifted to normal food like cooked rice and chappathis.

5.6 Complication

All the animals showed normal healing except in three cases (G1, G5 and G9) where suture reaction was observed. The condition subsided with the removal of reacting catgut followed by treatment with povidone iodine, framycetin ointment and prolonged antibiotic therapy

5.7 Recurrence

Intussusception in animal G3 was relieved by simple reduction. The animal became active from third day onwards but became dull by fifth day. The abdomen got distended and animal became dull. The animal had to be euthanized as per the owner's request. The condition was found to be intussusception which was confirmed on post mortem. The recurrence of intussusception was found to be similar to conservation made by Levitt and Bauer (1992). They observed recurrence of intussusception with in 24 to 120 hours. Wolfe (1977) reported recurrence of

intussusception with in three days. Kumar and Ameerjan (2003) reported that ileac portion of the small intestine was highly prone for intussusception owing to lack of proper omental support and free mobility. The recurrence of intussusception could be prevented by anti spasmodics like chlordiazepoxide.

5.8 Haematological Parameters

5.8.1 Total leukocyte count (Fig. 46)

The total leukocyte count was more preoperatively and the highest concentration was observed at 24 hours, which later came with in normal limits on 8th day. This was in accordance with Jose(2001). Balasubramanian *et al.* (1990) reported leukocytosis in a case of hypertrophic pyloric gastropathy in a dog. In induced simple and strangulated intestinal obstructions in dogs, Sodhi *et al.* (2002) observed a significant increase in total leukocyte count which was attributed to stress, tissue inflammation and damage. Leukocytosis was also reported by Codner and Leib (1992) and Hoffmann (2003).

5.8.2 Haemoglobin (Fig. 47)

Haemoglobin concentration was found to be below normal in seven cases while remaining cases had normal haemoblobin. Decreased haemoglobin was reported by Balasubramanian *et al.* (1990) and Jose (2001). Cairo *et al.* (1999) reported normal haemoglobin concentration in dogs with intestinal volvulus. Increase in haemoglobin in induced and strangulated intestinal obstructions was reported by Sodhi *et al.* (2002).

5.8.3 Packed Cell Volume (Fig. 48)

Packed cell volume was found to be below normal in seven cases before surgery, which gradually reached to normal limits on 8th day post operatively which was in accordance Jose (2001). Decreased PCV was recorded by Codner and Leib (1992) while a normal PCV was reported by Cairo *et al.* (1999) in case of intestinal

volvulus in dogs. An increased PCV was recorded by Sodhi *et al.* (2002) in induced simple and strangulated intestinal obstruction in dogs.

5.8.4 Differential Leukocyte Count (Fig. 48)

Neutrophilia associated with leukocytosis was the prominent observation made which was in accordance with Codner and Leib (1992), Jose (2001) and Hoffmann (2003).

5.10 Serum Biochemical Evaluation

5.10.1 Serum Sodium (Fig. 49)

The concentration of serum sodium was found to be below normal, which reached towards normal on 8th day. Hyponatremia was observed by Agarwal and Kumar (1988), Moore (1992), Codner and Leib (1992), Prosek *et al.* (2000), Jose (2001), Hoffmann (2003). Hyponatremia was due to excessive loss of gastric juice containing electrolytes during vomiting. Moore (1992) observed hypernatremia in dehydrated animals having distal intestinal problems.

5.10.2 Serum Potassium (Fig. 50)

Serum potassium concentration was found to be below normal before surgery, which later reached normal limits on 8th day. This was in accordance with Moore (1992), Codner and Leib (1992), Watson (1997), Prosek *et al.* (2000) and Jose (2001).

5.10.3 Serum Chloride (Fig. 51)

Hypochloremia was observed which simulated observations made by Agarwal and Kumar (1988), Codner and Leib (1992), Prosek *et al.* (2000), Jose (2001) and Hoffmann (2003).

5.10.4 Serum Total Protein

Serum total protein was found to be within normal range except in two cases (G7 and G12) which recorded severe hypoproteinemia. Jose (2001) recorded high total protein concentration in upper gastrointestinal tract obstruction and normal

protein concentration in lower gastrointestinal tract obstructions. Mild hypoproteinemia was recorded by Grooters *et al.* (1994).

5.10.5 Serum Lipase (Fig. 52)

Serum lipase concentration was found to be above normal which was in accordance with Watson (1997), Prosek *et al.* (2000) and Benjamin (2001). Increased lipase concentration was attributed to the obstruction and increased intraluminal pressure of the gastrointestinal tract which results in some obstruction of the pancreatic duct resulting in pancreatitis. Fickvin and Frujillo (1970) stated that intestinal obstruction may be associated with increased levels of serum amylase and lipase.

5.10.6 Serum Alanine Amino Transferase

The serum ALT concentration was also found to be within normal range. Jose (2001) recorded a normal ALT concentration in upper gastrointestinal tract obstruction and a high ALT concentration in lower gastrointestinal tract obstruction. Fickvin and Frujillo (1970) opined that intestinal obstructions were usually associated with normal transaminase whereas intestinal strangulations and infarction produce moderate elevations of transaminase.

5.11 Histopathology- Gastric Ulcer (G4)

Sections of the ulcer showed inflammatory granulation tissue and necrotic materials. Wall of the ulcer and adjacent areas showed infiltration by lymphocytes, plasma cells and many polymorphs. Many areas of haemorrhage and congested vessels were observed. There was no evidence of malignancy. Codner and Leib (1992) reported a similar observation of ibuprofen induced gastric ulcer in a dog. Evidence of chronic inflammation and gastric mucosal scarring was reported with no malignancy. Histopathology of gastric ulcer with moderate lymphoplasmacytic gastritis involving fundus, body and cardia was reported by Grooters *et al.* (1994).

Summary

SUMMARY

The study was carried out in twelve dogs of different breed, age and either sex, presented to the Veterinary College hospitals at Mannuthy and Kokkalai, with the history of gastric problems.

Out of twelve cases studied, one (G4) had a benign gastric ulcer at the pyloric antrum region, four (G1, G5, G6, and G8) had foreign body intestinal obstruction, two cases (G3 and G10) of intussusception, a case of linear foreign body obstruction (G9), two cases (G2 and G12) of foreign body induced stenosis of ileocolic sphincter, a rare case (G7) of gastric impaction with hardened rubber latex and a case of dilated colon (G11).

Among the animals studied, the breeds affected were Labrador (6), Boxer (2), Rottweiler (1), Cocker Spaniel (1), Dachshund (1) and Basssethound (1). Six animals were males and the remaining were females. The age of animals ranged from 30 days to four years. Among six cases of foreign body gastrointestinal obstruction five animals were less than 1.5 years of age and one was 2.5 years. Of these six animals, four were females and two were males. Intussusception was observed in two pups of less than two months of age.

General appearance of seven animals (G1, G3, G7, G8, G9, G10 and G12) was dull and lethargic. Three animals (G4, G6 and G11) were dull while two animals (G2 and G5) were active. Two animals (G3 and G10) were weak and recumbent. All the animals showed vomiting and anorexia with two animals (G4 and G12) showing intermittent vomiting for one month. In most of the cases vomitus was yellowish in colour with frothy nature. Vomitus contained undigested food particles in some cases. Diarrhoea was observed in three animals (G3, G8 and G10). Four animals (G4, G5, G8 and G11) were reported to have passed black tarry faeces while two animals (G2 and G12) had passed hard, dry and pellet type of faeces. Pain on palpating the abdomen was noticed in nine animals (G1, G3, G4, G5, G6, G7, G8, G9 and G10). Palpable mass could be felt in three cases (G5, G6 and G7). Dilated

intestinal loops were observed in seven animals (G1, G2, G3, G5,, G9, G11 and G12).Dilatation of the intestine and distension of the abdomen were apparently visible in animal G3. Animal G11 had a prolonged complaint of more than three weeks which showed intermittent recovery in between medical management. Variation in the physiological parameters showed severity of the condition. Capillary refill time was found to be with in normal limits.

Plain radiography was performed invariably in all animals while ultrasonography was performed in nine cases. Those six cases, where plain radiography and ultrasonographic findings were not remarkable, were subjected to contrast radiography. Plain radiographs were found to be adequate in identifying radio opaque foreign bodies. Ultrasonography also proved to be a highly useful tool for diagnosing foreign bodies. Foreign bodies were observed as hyperechoic mass casting an acoustic shadow. Observation of a hypoechoic region at the pyloric antrum region in animal G4 gave a presumptive diagnosis of mucosal lesion but confirmed as gastric ulcer during exploratory laparotomy. Contrast radiography in animal G4 showed delayed gastric emptying but no gastric outflow obstruction. In the remaining cases the contrast radiographic observations were indicative of a gastrointestinal obstruction but the ultimate diagnosis was made on exploratory laparotomy

Pre operatively, animals were rehydrated using ringer lactate@ 10 ml per kilogram body weight. Anaesthesia using atropine, xylazine, ketamine and diazepam combination was found to be satisfactory.

Gastrotomy followed by excision and suturing of the mucosa was performed in the case of gastric ulcer. Foreign body intestinal obstruction was relieved by enterotomy. Gastric foreign bodies were relieved after gastrotomy. Linear foreign body was removed by gastrotomy and subsequent enterotomy. Colotomy was performed in animal G11. Simple reduction was performed in the case of intussusception (G3) by milking the intussusceptum out and the other (G10) by

resection and anastomosis. Enterotomy followed by dilation of the ileocolic sphincter was done in animal G12.

In foreign body gastrointestinal obstruction, the foreign bodies obtained were stones (G5, G6 and G8), mango kernel (G1), ribbon (G9), and rubber latex (G7). The stones and the mango kernel were found at the jejunal region while one end of the ribbon was lodged at the pylorus with the remaining part extending into the intestine resulting in enteroplication and intussusception. Intussusception in both cases (G3 and G10) was found at the ileocolic junction with one case of prolapsed intussusceptum.

Leucocytosis with neutrophilia was noticed in all the cases. Decreased haemoglobin and packed cell volume (PCV) were found in seven cases while the remaining animals showed normal haemoglobin and PCV

Hyponatremia, hypokalemia and hypochloremia were observed in all the cases. Serum total protein concentration was found to be with in normal limits in all the cases except two (G7 and G12) where severe hypoproteinemia was observed. Serum lipase concentration was found to be high while serum alanine amino transferase was found to be with in normal limits.

Postoperative antibiotic therapy included the use of ceftriaxone and ampicillin cloxacillin. Fluid therapy was maintained for the first fourty eight hours using Ringer lactate, dextrose normal saline and/or dextrose 10 per cent solution which were sufficient to maintain electrolyte balance and energy supplements. Tea was given orally from the first day onwards postoperatively. Diluted milk and arrowroot biscuits were given initially which was gradually shifted to normal food. Multivitamin injections/ syrup were given to improve the general condition of the animal. Antacids, laxatives and gastric prokinetic agents were given where ever necessary. All the animals returned to normal appetite with in three days except one animal (G12) which showed inappetance even on the eighth day. Animal (G12) was

discharged on eighth day. The owner, in a telephonic consultation, reported a normal appetite one week after the animal was discharged from the hospital.

Three of the animal (G3, G4 and G10) died. Two animals (G4 and G10) died on the day of operation which could mainly be attributed to the highly anemic condition of the animals and extensive tissue damage. In G4, large ulcer was present and in animal G10, a large piece of intussuscepted ileum was resected due to necrosis and gangrene. One case of intussusception (G3) showed improvement on the first three immediate post operative days but became weak and recumbent with the distention of the abdomen on fifth day. The animal was euthanized by the local veterinarian as per the owner's request. The recurrence of the intussusception was confirmed on post mortem.

Histopathology of the gastric ulcer revealed no signs of malignancy. The section showed inflammatory granulation tissue with infiltration of lymphocytes, plasma cells and polymorphs.

All the animals showed normal healing except in three animals (G1, G5 and G9). Suture abscess was observed in all the three cases which subsided with the removal of the reacting catgut followed by treatment with povidone iodine, framycetin ointment and prolonged antibiotic therapy.

From the study following conclusions were drawn:

Labrador was the most commonly affected among breeds.

Gastrointestinal foreign body obstruction was found in animals less than 1.5 years of age with the incidence more in females.

No sex predilection was found in the occurrence of gastrointestinal outflow disorders

Intussusception was observed in pups less than two months of age with the obstruction common at ileocolic junction.

Frequent vomiting with vomitus containing froth and difficulty in passing stools was the most common sign associated with gastrointestinal tract obstructions.

Ultrasonography along with radiography forms a highly useful complementary tool in arriving at a diagnosis

Anaesthetic combination of atropine, xylazine, ketamine and diazepam was found satisfactory for the gastrointestinal surgeries.

The common site of foreign body intestinal obstruction was jejunum.

The most common foreign body isolated was stones.

Leucocytosis with neutophilia, hyponatremia, hypokalemia and hypochloremia was the common haematological and serum biochemical change observed.

Serum lipase concentration was found to be high in cases of gastrointestinal obstruction.

Serum alanine amino transferase and total protein was found to be with in normal limits.

Intravenous administration of Ringer lactate, dextrose normal saline pre operatively and intra operatively hastened the surgical recovery.

Enterotomy was the most common operation performed, all of which recovered successfully.

Early diagnosis and timely treatment for intussusception is essential for successful outcome of surgery.

Putting the animals on fluid therapy up to 36 to 48 hours after surgery favoured excellent post operative recovery of the patients.

Ceftriaxone was the most commonly used antibiotic which was found satisfactory for gastrointestinal disorders.

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EVALUATION AND MANAGEMENT OF GASTROINTESTINAL OUTFLOW DISORDERS IN DOGS

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ABSTRACT

The study was conducted in twelve animals of different breed, age and either sex suspected for gastrointestinal outflow disorders. The incidence, clinical signs, radiographic and ultrasonographic observations, haematological and serum biochemical changes, efficacy of treatment adopted, and postoperative management were studied.

The incidence was more in Labrador breed of dogs. No sex predilection was observed. The age of affected animals ranged from 30 days to four years. Of foreign body obstructions, five were less than 1.5 years and was found more in females. Intussusception was observed in two male pups of less than two months of age.

The most consistent clinical signs observed were vomiting and difficulty in defaecation. The affected animals were dull, weak and lethargic and two were recumbent. Two animals showed chronic intermittent vomiting. Diarrhoea was reported in cases of intussusception. Four animals had scanty black tarry faeces. Pain on palpating the abdomen was noticed in nine animals while palpable mass could be felt in three animals. Dilated intestinal loops with distension of the abdomen were the common observations. The temperature, pulse rate and capillary refill time were within normal range while respiration rate was higher.

Radiography and ultrasonography was found adequate for confirmatory diagnosis in most of the cases.

The different conditions included foreign body obstruction (6), gastric ulcer (1), intussusception (2), dilated colon (1), and stenosis of ileocolic sphincter (2) and were treated by enterotomy, gastrotomy, resection of ulcer, enterectomy and enteroanastamosis, colotomy and dilation of sphincter.

All the animals were rehydrated before surgery and appropriate surgical treatment was carried out under general anaesthesia. Post operatively, fluid was given up to 48 hours. Liquid food followed by solid food was offered. Antibiotics

and supportive medicines were continued up to seven days. The sutures were removed on eighth post operative day.

Leucocytosis with neutrophilia, reduction in haemoglobin, packed cell volume, hyponatremia, hypokalemia, hypochloremia and hyperlipasemia was the major haemato biochemical changes observed.

Of the twelve cases studied, nine cases recovered successfully and three animals died which included a case of gastric ulcer and two cases of intussusception.