ENDOSCOPIC EVALUATION OF OESOPHAGEAL AND GASTRIC DISORDERS AND ITS MANAGEMENT IN DOGS

LEKSHMI. V.

thesis submitted in partial fulfillment of the requirement for the degree of

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Department of Veterinary Surgery and Radiology
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
MANNUTHY, THRISSUR-680651
KERALA, INDIA

DECLARATION

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

Mannuthy **LEKSHMI. V.**

-05-2009

CERTIFICATE

Certified that the thesis entitled "**ENDOSCOPIC EVALUATION OF OESOPHAGEAL AND GASTRIC DISORDERS AND ITS MANAGEMENT IN DOGS"** is a record of research work done independently by **Ms. Lekshmi, V.**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

Mannuthy
20 -05-2009

Dr.C. B Devanand
(Chairman, Advisory Committee)
Associate Professor
Department of Veterinary Surgery and Radiology
College of Veterinary and Animal Sciences,
Mannuthy

CERTIFICATE

We, the undersigned members of the Advisory Committee of **Ms. Lekshmi, V**., a candidate for the degree of **Master of Veterinary Science in Surgery**, agree that the thesis entitled "**ENDOSCOPIC EVALUATION OF OESOPHAGEAL AND GASTRIC DISORDERS AND ITS MANAGEMENT IN DOGS"** may be submitted by **Lekshmi, V**., in partial fulfillment of the requirement for the degree.

Dr. C.B. Devanand
(Chairman, Advisory Committee)
Associate Professor
Department of Veterinary Surgery and Radiology
College of Veterinary and Animal Sciences, Mannuthy

Dr. T. Sarada Amma
Professor and Head
Department of Veterinary Surgery and Radiology
College of Veterinary and Animal Sciences, Mannuthy
(Member)

Dr. K.D. John Martin
Assistant Professor (S. S)
Department of Veterinary Surgery and and Radiology
College of Veterinary and Animal Sciences, Mannuthy
(Member)

Dr. K.N. Aravinda Ghosh
Professor and Officer in charge
Veterinary College Hospital
College of Veterinary and Animal Sciences, Mannuthy
(Member)

EXTERNAL EXAMINER

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Lekshmi. V.

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INTRODUCTION

1. INTRODUCTION

Today dogs are reared as pets of high esteem, fascinating and delightful companions than the past. Moreover, the social bond between man and dog is getting stronger and the owners are highly concerned about the well being of their pets. It is in this context that the role of veterinarian holds importance, especially in tackling the health problems of the pets. Gastro-oesophageal disorders with the clinical signs of regurgitation, dysphagia, vomiting, reduction in food intake and weight loss are listed among the most frequently encountered disease conditions in dogs. As these clinical signs may be associated with a variety of disorders that can involve any organ system in the body, early and accurate diagnosis of the underlying cause is mandatory to adopt a targeted treatment.

Regurgitation is the most frequent sign of oesophageal disease in dogs. An acute onset of regurgitation in a healthy animal is probably related to the ingestion of a foreign body or to acute oesophagitis whereas chronic regurgitation is more indicative of oesophageal stricture, acquired megaoesophagus or oesophageal neoplasia. Animals with strictures, vascular anomalies and idiopathic megaoesophagus usually have a voracious appetite, whereas animals with oesophagitis, foreign bodies and neoplasia may have anorexia as a result of pain and difficulty in swallowing. Weight loss is related to the severity and chronicity of oesophageal disease (Gualtieri, 2001).

Vomiting is often suggestive of, but not diagnostic of a gastric disease. The character of the vomitus and timing of the vomiting can be important, although this information does not give a definitive diagnosis. Recent onset of severe vomiting may be the result of foreign body ingestion, toxicity, acute metabolic disturbances or acute abdominal disorders such as pancreatitis. Long standing intermittent vomiting

may be more indicative of chronic gastritis and/or inflammatory bowel disorder (Elwood, 2003). The treatment of vomiting should ideally be directed towards correcting the primary problem and providing supportive care, for which a definitive diagnosis is to be established (Richter, 1992a).

A multipronged investigation summoning techniques like endoscopy, radiography, ultrasonography, biopsy etc. is therefore essential to arrive at a conclusive diagnosis in gastro-oesophageal disorders. Unfortunately many of the primary alimentary tract diseases involve mainly the mucosal surface and may not be identifiable via routine radiographic, ultrasonographic or laboratory evaluation methods (Zoran, 2001). The development of flexible fiberoptic endoscope has been considered as a solution to this problem, as endoscopy allows more thorough and less invasive inspection of the interior surface of oesophagus and stomach. In addition, this minimally invasive, atraumatic procedure aids in obtaining biopsies, cytologic samples or fluids from these areas and permits descriptive or photographic documentation of the severity and extends of lesions. Endoscopy thus surpasses other imaging techniques in the diagnosis of oesophageal and gastric mucosal and luminal lesions. The endoscopic removal of gastrointestinal foreign bodies and balloon dilation and bougienage procedures for oesophageal strictures are the best examples of the therapeutic potential of endoscopy.

The present study was undertaken with the objective of assessing the efficacy of endoscopy as a diagnostic technique in oesophageal and gastric disorders in dogs and to adopt appropriate treatment measures for the management of such conditions.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

2.1 CLINICAL EVALUATION OF GASTRO-OESOPHAGEAL DISORDERS

Diamant *et al.* (1974) studied idiopathic megaoesophagus in five dogs for a period from two weeks to two months. Among them there were one German Shepherd Dog, two Miniature Schnauzer litter- mates, one Wire Haired Fox Terrier and a Miniature Schnauzer.

Happe *et al.* (1981) reported hypertrophic gastritis of pyloric antrum in 11 year old female Poodle, 14 year old Maltese Terrier and 13 year old male mongrel in which the main clinical sign noticed was chronic vomiting.

Rivers (1981) reported gastric obstruction caused by a screwdriver in a female Beagle which was presented with the history of anorexia and constipation. Rectal examination revealed some firm stool and a bizarre mass with associated swelling pressing against the cranioventral floor of the pelvic canal.

Marks (1983) reported pylorogastric intussusception in a two year old spayed English Sheepdog in which the clinical signs were depression, severe vomiting and lack of bowel movements for three days. Haematological examination for complete blood count, blood urea nitrogen (BUN), alanine amino transferase and amylase revealed normal results.

Zimmer (1984) reported cases of oesophageal foreign bodies in a fourteen month old spayed female mixed breed dog, a six year old male Lhasa Apso and a seven month old male Boston Terrier and opined that complete oesophageal

obstruction could result in excessive drooling of saliva, regurgitation of all ingesta initially and subsequently complete anorexia, dehydration and depression.

Houlton *et al.* (1985) observed that the presenting sign of oesophageal foreign bodies in dogs included regurgitation (often solid food was returned and liquids were retained).

Sullivan and Miller (1985) reported that the presenting signs in almost all cases of gastro-oesophageal disorders included regurgitation or vomiting and that anorexia, polydipsia and weight loss were less frequently reported. The notable feature in cases of oesophageal disease was the return of solid food shortly after eating and the retention of fluids. When gastric disease was present, vomiting was often delayed and vomitus consisted of partially digested food or frothy saliva / bile.

Farrow (1986) reported gastric foreign body in a 12 year old male Dachshund which was presented with a history of vomiting with increased frequency for three days.

Burrows (1987) reported reversible megaoesophagus in a nine month old male Sher Pei with hypoadrenocorticism in which anorexia persisted despite of appropriate initial therapy. Clinical signs noticed were dehydration, inappetence progressing to anorexia and weakness of approximately one month duration. Megaoesophagus was confirmed by endoscopy and serum immunofluorescence test for anti-adrenal antibodies was positive, suggestive of hypoadrenocorticism.

Fonda *et al*. (1989) pointed out that there appeared to be a breed predisposition to gastric carcinoma, as eight of 11 tumours affected Belgian Shepherd dogs and all of them had neoplasms arising from the lesser curvature with prevailing

histological features of mucin secreting tumours and stated that the most consistent signs included intermittent and unrestrained vomiting or haematemesis. In some cases vomitus consisted of yellow fluid and in the other cases it varied from partially digested food mixed with clotted blood to coffee-like material.

Balasubramanian *et al.* (1990) reported chronic hypertrophic pyloric gastropathy in a four year old nondescript dog with a six month old history of overdistension of stomach and frequent vomiting.

Bellenger *et al*. (1990) observed that chronic hypertrophic pyloric gastropathy occurred most commonly in small terrier type dogs. They noticed that the clinical signs referable to the diagnosis of chronic hypertrophic pyloric gastropathy could be vomiting, weight loss, polydipsia, lethargy, anorexia and abdominal pain. Out of the fourteen dogs studied, four were dehydrated as evidenced by clinical signs, packed cell volume, total plasma protein and / or blood urea concentration.

Burrows and Ignaszewski (1990) reported that medium and large breed dogs were more susceptible to gastric dilatation- volvulus compared to small breeds. They also noticed that the disease had a predilection for older dogs, with a mean age of occurrence of 7.8 $\pm$ 3.5 years (range 0.5 to 4.6 years).

Brunnert *et al*. (1992) reported gastric extramedullary plasmacytoma in a ten year old spayed female mixed-breed dog which was presented with a six week history of daily vomiting and sporadic diarrhoea. Results of serum biochemical analyses were normal and anaemia was the only abnormality detected on complete blood count.

Davidson (1992) observed that the clinical signs of acute gastric dilatation-volvulus included abdominal distension, unproductive retching, excessive salivation and signs of hypovolemic shock.

Jergens and Greve (1992) reported *physaloptera* infection of stomach and duodenum in a six year old spayed Schnauzer-mix with the clinical complaint of intermittent vomiting for six months. The vomiting episodes were preceded by long periods of retching and the vomitus contained frothy bile stained material. Haematological examination revealed marked eosinophilia.

Moore (1992) concluded that gastric foreign bodies that cause pyloric obstruction result in profound hyponatremia, hypokalemia, and alkalosis.

Ritcher (1992a) reported that gastrointestinal ulceration could lead to abdominal pain, depression and anorexia.

Tams (1992) opined that vomiting of undigested or partially digested food more than eight to ten hours after eating could be considered as an important sign of gastric motility disorder or gastric outlet obstruction.

Butinar (1993) reported spontaneous rupture of cervical oesophagus in a six year old Doberman Pinscher following severe tenesmus as a post operative complication of abdominal surgery and the condition was diagnosed on post mortem examination.

Walter and Matthiesen (1993) opined that the main clinical symptom in case of acquired antral hypertrophy included chronic intermittent vomiting often of weeks' or months' duration, with gradually increasing frequency and vomiting would usually

be refractory to antiemetic therapy. They also observed that the condition was noticed in middle age or older dogs.

Campbell and Leib (1993) reported gastric foreign body obstruction caused by bottle caps in a one year old spayed Golden Retriever which was presented with the history of anorexia and occasional vomiting for three months.

Willard and Delles (1993) reported benign oesophageal stricture in a four year old spayed female Poodle with the history of regurgitation for one month duration and the problem started apparently after the animal swallowed a rawhide chew toy.

Hamilton and Carpenter (1994) reported oesophageal plasmacytoma after oesophagoscopy and subsequent histological examination in a 14 year old female mixed breed dog suffering from regurgitation of food for three week duration.

Klein and Leib (1994) reported clinical signs of intermittent vomiting and weight loss in a ten year old spayed Chow, for a period of six weeks associated with gastric carcinoma. Haematological examination revealed mild leucopenia (WBC count 4300/µl) characterized by mild neutropenia (3000/µl) and mild lymphopenia (774/µl).

Kumar and Tayal (1994) opined that the higher incidence of gastrointestinal tract obstruction in young dogs could be attributed to their voracious and indiscriminate feeding.

Whitely (1995) reported megaoesophagus and glucocorticoid deficient hypoadrenocorticism in a seven year old German Shepherd Dog with a profound history of muscle weakness, severe dermatological lesions and a two day history of

acute onset of salivation and regurgitation. Laboratory results revealed nonregenerative anaemia, hypocholesterolemia and hypoalbuminemia. Glucocorticoid deficient hypoadrenocorticism was diagnosed based on the ACTH stimulation test.

Yam *et al.* (1996) reported a study on fifteen dogs with confirmed adult onset idiopathic megaoesophagus with no generalized muscle weakness and concluded that the breeds affected were Labrador Retriever, Standard Dachshund, Cavalier King Charles Spaniel, Great Dane, German Shepherd and a cross breed.

Fallin *et al.* (1996) reported pyloric hypertrophic gastropathy in a ten year old neutered male Pekingese which was presented with a history of intermittent vomiting and recurrent gastric dilatation. The vomitus consisted usually of bile or partially digested food and time between feeding and vomiting varied from one to eight hours. The results of serum chemistry profile and complete blood count were within normal range.

Ludlow (1997) reported lymphocytic plasmacytic gastroenteritis in 11 year old spayed Basset Hound and the clinical signs reported were intermittent vomiting, diarrhoea and weight loss for one month. The complete blood count showed stress leukogram and the serum biochemistry revealed a mild hypoproteinemia, hypoalbuminemia and an increased ALP level.

Penninck *et al.* (1997) pointed out that the most common clinical signs associated with gastric ulceration included vomiting, haematemesis, melaena, weight loss and anaemia.

Watson (1997) reported gastro-duodenal intussusception in a 21 month old German Shepherd cross with a history of intermittent vomiting and weight loss. The vomiting occurred in episodes of a few days interspersed by a week or more of clinical normalcy and faeces were occasionally melaenic. Blood tests showed normal packed cell volume, plasma protein concentration, urea, and creatinine and sodium concentrations with low potassium level.

Beck and Simpson (1999) reported a history of regular episodes of trembling and occasional vomiting and blood stained faeces associated with gastric leiomyoma in a one and half year old Maltese Terrier where routine laboratory tests revealed mild anaemia, neutrophilia, increased activity of hepatic enzymes and hypokalemia.

Gualtieri *et al.* (1999) reported chronic vomiting due to pyloric obstruction caused by pyloric hyperplastic polyps in six French Bulldogs and they noticed that the clinical signs associated with gastric malignancies were usually mild and vague in onset and often chronic ranging from two weeks to 18 months prior to presentation and the median duration was two months. Haematological and serum biochemical abnormalities were uncommon and nonspecific.

According to Hall and Washabau (1999) gastric motility disorders would usually be associated with a history of chronic vomiting. Other signs might include anorexia, belching, polydipsia, pica and weight loss and animals might usually assume a position of relief known as “praying posture” to relieve gastric pain. The condition might result in the net loss of hydrogen, sodium, potassium and chloride ions and the most common electrolyte abnormality would be hypokalemia resulting from potassium losses in vomitus, renal excretion and from reduced dietary intake.

Davies and Leib (1999) reported gastric foreign body obstruction in a 13 year old spayed female Border Collie. They pointed out that haematological and serum biochemical observations revealed normal results even though there was prolonged, intermittent vomiting associated with the condition.

Lamb and Grierson (1999) reviewed 21 cases of gastric neoplasia in dogs, which included six mixed breed dogs, three Labrador Retrievers and three Border Collies and there were nine females and 12 males.

Holt *et al.* (2000) reported oesophageal obstruction caused by a left aortic arch and an anomalous right patent ductus arteriosus in three month old German Shepherd littermates with a history of regurgitation and heart murmur. Regurgitation started soon after weaning from solid to liquid food and the cervical oesophagus was palpable as a flaccid air filled tube.

Kavitha *et al.* (2000) gave a report of endoscopic diagnosis of *spirocerca lupi* nodules in the oesophagus in three dogs. The first case was a two year old male German Shepherd dog, second was a three year old non descript female and the third one was a two year old nondescript female.

Washabau (2001) observed an increased breed incidence of megaoesophagus in Irish Setter, Great Dane, German Shepherd, Labrador Retriever, Chinese Sher-pei and Newfoundland, but inheritability had been demonstrated only in the Miniature Schnauzer and Fox Terrier breeds. Regurgitation was the most frequent clinical sign noticed and it occurred several minutes to several hours after feeding. They also suggested that routine haematology and serum biochemistry should be performed in all cases of megaoesophagus to investigate possible secondary causes of megaoesophagus like hypothyroidism, hypoadrenocorticism etc.

Boria *et al.* (2003) reported oesophageal achalasia and secondary megaoesophagus in a five year old castrated male Golden Retriever which was presented with ten day history of regurgitation and ptyalism. The patient primarily regurgitated solid food, with occasional regurgitation of water and a normal serum free T_4 concentration (11.6 pmol/ L; reference range, 1.03 to 25 pmol/ L) ruled out hypothyroid associated peripheral neuropathy.

Penninck and Mitchell (2003) reported ulcerated and perforating foreign bodies in Labrador Retriever, Shetland Sheepdog and Lhasa Apso and noticed that the haematological abnormalities were high WBC count and eosinophilia.

Brennen *et al.* (2004) reported gastrocutaneous fistula as a result of migration of a foreign body in a six year old female Tibetan Terrier where they noticed a discharging wound over the left 10^{th} intercostal space.

Rani *et al.* (2004) reported gastric foreign body obstruction in a male Doberman pup and a male German Shepherd pup and pointed out that inappetence, depression, haematemesis and melaena were the common clinical signs associated with the condition.

Devanand *et al.* (2005) had reported gritty feeling on palpation of the anterior quadrant of the abdomen in a case of gastric foreign body obstruction due to oyster shells in an Alsatian pup

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Simpson (2005) observed that the most common clinical presentation in dogs and cats with gastric *helicobacter* like organisms (GHLO) included chronic vomiting and the unusual symptoms included belching, lip smacking, repeated swallowing and

even regurgitation. He pointed out that naturally occurring GHLO infection in dogs and cats would induce a mild lymphocytic-plasmacytic gastritis together with degeneration of parietal cells.

Mylonakis *et al.* (2006) reported that oesophageal granuloma and occasionally sarcoma, aortic aneurysm and thrombosis, thoracic discospondylitis and spondylosis, hypertrophic osteopathy and salivary gland necrosis had been associated with migration of *spirocerca* larvae and there would be persistence of adult worms in the tissue granulomas.

Parton *et al*. (2006) reported gastric ulceration subsequent to partial invagination of stomach in an eight year old castrated male German Shepherd Dog with a one year history of regurgitation, retching, vomiting white foam and saliva and whining. They noticed that serum biochemical abnormalities included hypoglycemia, hyperphosphatemia, hyperproteinemia, hyperalbuminemia and hyperlactatemia.

Sreenu and Kumar (2006) reported foreign body obstruction of oesophagus by a sewing needle along with thread in a five and half year old Pomeranian dog.

Kumar (2007) reported pyloric obstruction in a three year old male Labrador Retriever due to the presence of a crater like ulcer with raised margins in the antral region.

Rychlik *et al*. (2007) reported lymphocytic plasmacytic gastroenteritis in a ten year old German Shepherd Dog and opined that the clinical signs included recurrent vomiting and diarrhoea.

Vijayakumar *et al*. (2007) reported megaoesophagus in a one and half year old male German Shepherd Dog which had a history of regurgitation in the form of a tubular cast. Clinical examination revealed lean body condition, occasional cough, normal temperature and pulse.

Jain and Tayal (2008) reported megaoesophagus in an eight year old nondescript bitch which had a history of chronic vomiting for previous six months about 1-2 hours post feeding. On examination of vomitus it was found that the undigested food was regurgitated and the animal had turned weak and emaciated.

McCarthy (2008) reported gastric foreign body obstruction caused by a rubber ball in a nine month old male Labrador Retriever where the affected dog was active and asymptomatic.

Ranen *et al*. (2008) observed that the incidence of oesophageal sarcomas was higher in large breed dogs and was consistent with other reports of dogs suffering from spirocercosis. They opined that out of the 32 dogs with neoplasms five were Labrador Retrievers, two were Boxers and 12 were mixed breed dogs.

Leib and Sartor (2008) reported a retrospective study of oesophageal foreign body obstruction caused by dental chew treat in 31 dogs and found out that the median age of the dogs was four years. The most important clinical signs reported were gagging, regurgitation, vomiting, anorexia, ptyalism, lethargy and cough.

Lister and Isakow (2008) reported oesophageal leiomyoma in a 13 year old neutered Bichon Frise which had a history of chronic cough, panting of 4-6 weeks duration and dyspnoea.

Ponnuswamy *et al*. (2008) reported congenital idiopathic megaoesophagus in an eight week old male Dachshund puppy with a history of weaning a week back and since then it was showing dysphagia, repeated swallowing attempts and coughing.

2.2 ETIOLOGY

Burrows (1987) reported reversible megaoesophagus in nine month old male Sher Pei which was associated with hypoadrenocorticism.

Moore (1992) opined that gastric ulceration might be the primary lesion resulting from chronic administration of steroid or nonsteroidal anti-inflammatory drug and that ulceration might also occur secondary to systemic diseases.

Tams (1992) opined that causes of gastric outlet obstruction included foreign bodies, antral mucosal hyperplasia, pyloric mucosal hypertrophy, gastric and duodenal ulcers and antral or pyloric neoplasia or polyps.

Butinar (1993) reported spontaneous oesophageal rupture in a dog following severe tenesmus as a postoperative complication of abdominal surgery.

Gualtieri *et al.* (1999) reported chronic vomiting due to pyloric obstruction caused by pyloric hyperplastic polyps in six dogs.

Holt *et al.* (2000) reported oesophageal obstruction caused by a left aortic arch and an anomalous right patent ductus arteriosus in two three month old dogs.

Washabau (2001) observed that megaoesophagus could occur as a result of hypothyroidism, hypoadrenocorticism and autoimmune diseases like myasthenia gravis.

Boria *et al*. (2003) reported secondary megaoesophagus due to oesophageal achalasia in a five year old dog.

Brennen *et al*. (2004) reported gastrocutaneous fistula as a result of migration of a foreign body in a six year old dog.

Parton *et al*. (2006) reported gastric ulceration subsequent to partial invagination of stomach in an eight year old dog.

Sreenu and Kumar (2006) reported foreign body obstruction of oesophagus in a five and half year old dog following ingestion of a sewing needle along with thread.

2.3 DIAGNOSIS

2.3.1 Radiography

Happe *et al*. (1981) observed that contrast radiographic studies demonstrated thickening in the region of pylorus in cases of hypertrophic gastritis of pyloric antrum in dogs.

Rivers (1981) reported gastric foreign body obstruction caused by a screw driver in a Beagle which was diagnosed by plain radiographic examination. On lateral and ventrodorsal abdominal radiograph a radio-opaque mass of about 19.5 cm length could be detected in the stomach which appeared to be a screw driver.

Marks (1983) reported that in canine pylorogastric intussusception, radiographic examination revealed a gas filled stomach with a thickened wall. The lateral radiographic view showed a 7 cm long mass in the body of the stomach. On contrast radiographic examination, 60 minutes after giving barium, barium remained in the stomach, confirming the diagnosis of gastric foreign body or obstruction.

Zimmer (1984) reported three cases of oesophageal foreign bodies in dogs where the primary diagnosis was made by contrast radiography of the gastrointestinal tract.

Houlton *et al.* (1985) reported that in 83 cases of oesophageal foreign body obstruction, lateral thoracic radiographs were taken in 81 cases while dorsoventral projection was used only in 58 cases. Positive contrast technique was also used in two cases.

Farrow (1986) reported that a postural radiograph in a dog revealed the presence of a gas-capped irregularly marginated, mixed density in the dorsal portion of the stomach and the stomach content was hidden by fluids which were consistent with a foreign body in the stomach.

Allan (1987) stated that a barium swallow produced an image, which when recorded on a radiograph, allowed to evaluate oesophageal motility. The appearance of the oesophageal mucosa (regular or irregular), the size of the oesophageal lumen (normal or dilated) and whether or not the subject was able to propel food aborally could also be assessed.

Balasubramanian *et al.* (1990) reported chronic hypertrophic pyloric gastropathy in a dog which was diagnosed by barium sulphate contrast study at 60

minutes and 3 hours which showed retention of contrast material in stomach. The fundus and pylorus were very much dilated due to the obstruction at pylorus.

Bellenger *et al.* (1990) asserted that plain and contrast radiography in dogs revealed delayed gastric emptying (11 cases), gastric dilatation or enlargement (six cases), pyloric mass or filling defect (8 cases) and increased motility in chronic hypertrophic pyloric gastropathy (4 cases).

According to Davidson (1992) the right lateral recumbent view was the best single view to determine whether the stomach was rotated and that the most important radiographic finding that would identify gastric dilatation-volvulus was a gas filled pylorus located dorsal to the fundus of the stomach.

Kantrowitz and Biller (1992) opined that radiography could be useful in demonstrating obstructive lesions, luminal filling defects or masses and that survey radiographs were sufficient to identify gastrointestinal malpositions, foreign bodies, obstructive bowel disorders and mass lesions.

Walter and Matthiesen (1993) reported that in acquired antral hypertrophy of pylorus in dogs, survey radiographs of abdomen might be normal or reveal a fluid filled distended stomach. Positive contrast radiography might show gastric distension, delayed gastric emptying, pyloric intraluminal filling defects and thickening of the pyloric wall.

Willard and Delles (1993) reported that in benign oesophageal stricture, contrast radiography after giving a barium swallow revealed a partial oesophageal obstruction 5 cm cranial to the lower oesophageal sphincter.

Klein and Leib (1994) reported that in canine gastric carcinoma abdominal radiographic examination revealed thickening of the stomach wall and thoracic radiograph revealed no metastatic lesions.

Ludlow (1997) reported lymphocytic plasmacytic gastroenteritis in a 11 year old spayed Basset Hound in which lateral and dorsoventral radiographs revealed that the stomach was in an unusual 'U' shape and it was markedly distended with fluid and ingesta which suggested a gastric outflow obstruction.

Watson (1997) reported gastro-duodenal intussusception in a dog where lateral plain radiograph revealed a cranial abdominal mass.

Davies and Leib (1999) observed that a lateral abdominal radiograph revealed two circular metallic foreign bodies, a small length of curled wire and a clip or staple, within the stomach of a dog.

Gualtieri *et al.* (1999) observed that contrast radiographic studies would outline masses, thickening of the gastric wall, loss or derangement of the rugal folds, ulcers, filling defects, or delayed gastric emptying in case of gastric neoplasia in dogs and that gastric polyps and leiomyomas became detectable radiographically when they attained considerable size and caused a mass lesion or delayed gastric emptying of the contrast medium.

Hall and Washabau (1999) observed that delayed gastric emptying might be suspected if liquid barium sulphate remained in the stomach for more than four hours in dogs and more than 30 minutes in cats.

Lamb (1999) concluded that crude assessment of gastric emptying could be done using contrast radiography and that gastric emptying times for liquids including barium suspension, were relatively short, normally about one hour in the cat and up to three hours in the adult dog.

Holt *et al*. (2000) reported oesophageal obstruction caused by a left aortic arch and an anomalous right patent ductus arteriosus in two dogs, where the thoracic radiographs showed enlarged left heart, a dilated oesophagus containing food and air cranial to the heart and deviation of trachea to the left of the midline in the cranial mediastinum.

Kavitha *et al.* (2000) reported that in spirocercosis in dogs contrast radiography revealed partial passage of barium meal at the distal third of the oesophagus.

Gualtieri (2001) asserted that radiography and fluoroscopy were the most reliable methods to confirm diagnosis of megaoesophagus. A contrast oesophagogram might reveal an obstructive lesion and might be useful to assess oesophageal motility.

Washabau (2001) opined that survey radiographs would diagnose most cases of megaoesophagus and that a contrast study should always be performed to confirm the diagnosis, evaluate motility and exclude foreign bodies or obstruction as the cause of megaoesophagus.

Rani *et al.* (2004) reported two cases of gastric foreign body obstructions in pups where diagnosis was done by plain radiographic examination.

Parton *et al*. (2006) stated that right lateral thoracic and abdominal radiography revealed gastric dilatation-volvulus with secondary megaoesophagus in case of gastric ulceration subsequent to partial invagination of stomach in a dog.

Vijayakumar *et al*. (2007) reported that survey radiography could reveal dilatation of cervical and thoracic oesophagus with mild pneumonic changes in lungs in megaoesophagus.

McCarthy (2008) reported gastric foreign body obstruction in a dog where the abdominal radiographic examination revealed air filled spherical structure in the stomach.

Jain and Tayal (2008) reported megaoesophagus in a bitch where the condition was diagnosed by contrast radiography at some intervals after administering barium meal which revealed dilated oesophagus in the thoracic region.

Leib and Sartor (2008) reported a retrospective study of oesophageal foreign body obstruction caused by a dental chew treat in 31 dogs and stated that diagnosis in these cases was made by thoracic radiography. A soft tissue mass or a foreign body density was visible in the area of oesophagus in 22 dogs and dilated oesophagus was detected in eight dogs.

Lister and Isakow (2008) reported oesophageal leiomyoma in a 13 year old neutered Bichon Frise where thoracic radiographs revealed a round mass of 4.5 cm diameter in the right caudodorsal thorax.

Ponnuswamy *et al*. (2008) reported congenital idiopathic megaoesophagus in a pup where contrast radiography after administration of barium sulphate suspension

(30% w/v) revealed stasis of barium with dilatation and sacculations in thoracic oesophagus.

2.3.2 Ultrasonography

Penninck *et al*. (1990) evalualed gastric neoplasia, intussusception, ileus, inflammation secondary to pancreatitis, enteritis and gastric and intestinal foreign bodies by ultrasound scanning using a real time sector scanner with a 5.0 MHz and /or a 7.5 MHz transducer, depending upon the animal's size and location of the region of interest. Gastrointestinal motility was observed at different segments of the GI tract for one or two minutes.

Penninck *et al.* (1997) observed that ultrasonographic features of gastric ulceration included local thickening of the gastric wall, possible loss of 5-layer structure, the presence of a wall defect or 'crater', fluid accumulation in the stomach and diminished gastric motility. The ulcer crater was often located in the center of the thickened site and appeared as a mucosal defect associated with persistent accumulation of small echoes, most likely representing microbubbles.

Watson (1997) reported gastro-duodenal intussusception in a dog where ultrasonography revealed the presence of a large craniodorsal abdominal mass with a laminated appearance in some views typical of an intussusception.

Beck and Simpson (1999) reported gastric leiomyoma in a 12 year old Maltese Terrier in which abdominal ultrasonography revealed a 3.5x2.8 cm well circumscribed mass in the wall of the pyloric antrum.

Gualtieri *et al.* (1999) reported that the features to be looked for in ultrasonographic examination of gastric neoplasia were thickening of the gastric wall, disruption of the gastric wall layers, enlargement of abdominal lymph nodes and hypoechoic lesions in other organs like liver or spleen and that solitary or multiple sites of alimentary lymphoma could be identified by ultrasonography.

According to Lamb (1999) ultrasonographic examination using a high resolution transducer would be useful in observing the normal histological layers of the gastric and intestinal walls of animals.

Lamb and Grierson (1999) reviewed ultrasonographic findings of gastric neoplasms in 21 dogs with histologically confirmed gastric neoplasia. They observed that majority of gastric neoplasms in the series caused obliteration of mural layers on ultrasound images and that there was one dog in each tumour group in which the ultrasonographic lesion appeared to be restricted to the muscularis propria. All tumours were predominantly hypoechoic.

Elwood (2003) pointed out that ultrasonography could be useful to detect gastrointestinal mucosal lesions including thickening, ulceration, dilatation and obstruction.

Penninck and Mitchell (2003) concluded that a wooden foreign body appeared ultrasonographically as a linear, bright interface often associated with uniform acoustic shadowing.

Brennen *et al*. (2004) reported ultrasonographic examination of gastrocutaneous fistula as a result of migration a foreign body was consistent with an abnormal rib (12^{th} rib) and there was a hyperechoic area seen within a hypoechoic

area which was suggestive of a demineralised sequestrum of bone from the fracture or a foreign body.

2.3.3 Endoscopy

2.3.3.1 Instrumentation

Sullivan and Miller (1985) used a flexible gastrointestinal panendocope to examine 90 dogs for oesophageal and gastric investigation.

Houlton *et al.* (1985) performed oesophagoscopy with a variety of rigid endoscopes in 83 cases of oesophageal foreign body obstructions. The longest one was 55 cm long with an internal diameter of 2.7 cm and an external diameter of three centimeters.

Jergens and Greve (1992) observed that on endoscopic examination in physalopteriasis infection in a dog, the stomach appeared diffusely erythemic and granular and multiple gastric nematodes (*physaloptera*) were observed on mucosal surface and within rugal folds. Endoscopy allowed a thorough assessment of mucosal lesions and procurement of biopsy samples and parasite retrieval, which was essential to reach a definitive diagnosis.

Ritcher (1992b) described the instrumentation and technique used in performing upper gastrointestinal endoscopy and opined that either a flexible fiberoptic or an electronic videoscope could be used for the endoscopic examination of the upper gastrointestinal tract.

Sullivan (1992) reported that a 1 m long, 9 mm diameter panendoscope was an ideal instrument for general practice because it had the widest range of applications.

Twedt (1993) opined that the gastrointestinal endoscope for dogs and cats should have an insertion tube length of a minimum of 100 cm, but 125-150 cm was ideal to ensure duodenal entry. Biopsy channel should have minimum 2 mm diameter with the ideal size being 2.8 mm.

Ludlow (1997) reported lymphocytic plasmacytic gastroenteritis in 11 year old spayed Basset Hound where endoscopy was performed using a flexible video endoscope with 100 cm working length, 9 mm outside diameter and 2.8 mm biopsy channel.

Gualtieri (2001) reported that endoscopes used for oesophagoscopy in dogs and cats should have a diameter of 7.8-10 mm, a four way tip deflection and a 2-2.8 mm biopsy channel and that a variety of foreign body forceps like two, three and four pronged grasping instruments with basket retrieval device and polypectomy snares would be available with the endoscope.

Rychlik *et al*. (2007) performed gastroduodenoscopy with a flexible video endoscope with a 1030 mm length and 9.8 mm diameter and bioptates of gastric and duodenal mucosa were taken with a biopsy forceps (2.5 mm in diameter).

2.3.3.2 Anaesthesia

Gaag and Happe (1983) reported that anaesthesia for endoscopy was induced by intravenous administration of a barbiturate and maintained with inhalation anaesthesia (nitrous oxide and halothane).

Zimmer (1984) reported three cases of oesophageal foreign body obstructions in dogs where endoscopy was performed under general anaesthesia.

Sullivan and Miller (1985) reported that they performed oesophagoscopy and gastroscopy under general anaesthesia in 90 dogs. Premedication with acepromazine maleate, induction with short acting barbiturate and maintenance with an oxygen/halothane mixture was routine.

Fonda *et al.* (1989) reported that gastroscopy was performed under general anaesthesia in 11 cases of gastric neoplasia in dogs.

Ritcher (1992b) suggested that to minimize the likelihood of damage to the endoscope during the procedure, the patient should be completely anaesthetised and a speculum should be placed in mouth to prevent inadvertent biting of the instrument in the event plane of anaesthesia was too light.

Simpson (1993) suggested that all flexible endoscopic procedures should be done under general anaesthesia and that premedication with atropine should be avoided for gastroscopy and duodenoscopy if possible because of its adverse effects on gastric motility and intestinal secretions.

Davies and Leib (1999) stated that for endoscopy in gastric foreign body obstruction in a dog, the animal was premedicated with diazepam (0.2 mg/ kg i/m) and butorphanol tartrate (0.2 mg/ kg i/m), anaesthesia was induced with thiopental sodium (8.6 mg/kg i/v) and maintained with isofluorane in oxygen.

Zoran (2001) reported that general anaesthesia was required for gastroduodenoscopic examinations in dogs and cats for the safety and comfort of the patient and operator as well as for the protection of the fiberoptic or video endoscopic instruments.

Vijayakumar *et al.* (2007) performed oesophagoscopy under general anaesthesia using xylazine premedication (1 mg/kg bodyweight i/m) and ketamine (10 mg/kg bodyweight i/m).

2.3.3.3 Oesophagoscopy

Zimmer (1984) reported oesophageal foreign body in a mixed breed dog where endoscopic examination revealed the presence of a white glistening foreign body suggestive of a bone piece just orad to the gastroesophageal junction. The bone was dislodged from the mucosal clefts with a medium sized retrieval basket and removed with a four pronged grasping forceps.

Houlton *et al.* (1985) reported that out of 83 cases of thoracic oesophageal foreign bodies, oesophagoscopy and forceps delivery was performed in 61 cases.

Sullivan and Miller (1985) reported removal of oesophageal foreign bodies in dogs with flexible endoscope and rigid crocodile forceps.

Burrows (1987) reported reversible megaoesophagus in nine month old male Sher Pei with hypoadrenocorticism where endoscopy confirmed generalized oesophageal dilatation and revealed an area of diffuse inflammation of the distal oesophageal mucosa, immediately above the oesophageal sphincter. The stomach contained a quantity of clear fluid and the mucosa appeared oedematous with diffuse petechial haemorrhage. A small quantity of blood, both fresh and digested was also seen in the lumen and biopsies revealed oesophagitis and gastritis.

Ritcher (1992b) observed that on endoscopic examination the normal oesophageal mucosa appeared pale pink and glistening and that fine submucosal vessels could easily be visualized. He also opined that it was difficult to take a biopsy of a normal oesophagus with the endoscopic forceps because of the tough oesophageal epithelium and also it was difficult to direct the biopsy forceps perpendicular to the mucosal surface.

Twedt (1993) concluded that oesophageal foreign bodies and oesophagitis were the most common oesophageal disorders identified endoscopically whereas gastritis, gastric ulceration and foreign bodies were the most common gastric disorders.

Willard and Delles (1993) reported that in benign oesophageal stricture, endoscopic examination revealed a smooth constriction of the oesophageal lumen, an opening distinctly smaller than the rest of the lumen at the level of heart was visible and endoscope could not be passed through the constriction. Thus a benign oesophageal stricture ostensibly due to cicatrix (scar tissue) was diagnosed.

Hamilton and Carpenter (1994) reported oesophageal plasmacytoma where oesophagoscopy revealed the presence of a large, ulcerated, haemorrhagic,

multinodular mass obstructing the oesophagus. A cautery loop passed through the endoscope was used to decrease the size of the mass and to obtain samples for histological examination which helped in establishing a diagnosis preoperatively.

Dilipkumar *et al.* (2000) evaluated normal canine gastrointestinal tract endoscopically in six apparently healthy dogs and opined that occasional presence of clear foam or fluid and complete emptiness were considered as the normal features of canine oesophagus. The lower oesophageal sphincter was identified by its change in colouration at the gastroesophageal junction

Gualtieri (2001) observed that the indications of oesophagoscopy included clinical signs referable to oesophageal disease, specifically regurgitation, dysphagia, odynophagia, unexplained salivation, anorexia and coughing. He also opined that the main therapeutic indications for oesophagoscopy included the retrieval of foreign bodies and the dilatation and electrocautery of oesophageal strictures under direct visualization.

Washabau (2001) opined that endoscopic examination was helpful in diagnosing myasthenia gravis associated megaoesophagus.

Mylonakis *et al.* (2006) reported that the diagnosis of spirocercosis could be made by oesophagoscopy and parasitic nodules were seen in 39 dogs. On oesophagoscopy there was visual evidence of adult worm protrusion into the lumen or typical nipple like orifice associated with parasitic nodules.

Vijayakumar *et al*. (2007) reported marked dilatation of oesophagus from cervical region to gastroesophageal sphincter presenting a cavernous appearance during oesophagoscopy in megaoesophagus in a dog and they noticed that the flaccid

redundant walls of the oesophagus were draped against trachea producing an outline of the structure.

Leib and Sartor (2008) reported a retrospective study of oesophageal foreign body obstruction caused by a dental chew treat in 31 dogs in which the retained pieces of dental chew treats were endoscopically removed through mouth in eight dogs and in 16 dogs the dental chew treat was pushed into the stomach with a rigid tube left in place.

Lister and Isakow (2008) observed oesophageal leiomyoma in a 13 year old bitch and oesophagoscopy could reveal the presence of a marked right sided protrusion into the lumen of the thoracic oesophagus. The mass appeared to be submucosal and had a smooth covering of normal mucosa.

Ranen *et al.* (2008) concluded that oesophagoscopy was a reliable tool in the diagnosis of oesophageal tumours, however, endoscopic biopsies of oesophageal masses might not differentiate between tumours and granulomas.

2.3.3.4 Gastroscopy

Happe *et al*. (1981) stated that gastroscopic examination in dogs with hypertrophic gastritis of the pyloric antrum revealed that the mucosa surrounding the pylorus was extremely thick and that endoscopic biopsies of the regions revealed chronic gastritis with fibrosis, round cell infiltration and a decrease in number of gastric glands.

Gaag and Happe (1983) suggested that pyloric passage of endoscope could be facilitated by preventing accumulation of air in the stomach and preventing excessive angulation of the tip of the endoscope probe.

Sullivan and Miller (1985) detected gastritis (26), peptic ulcer (1), foreign body (2), pyloric stenosis (1), gastric neoplasia (26) and an abnormal kink in the greater curvature of stomach (1) in dogs via endoscopic examination..

Fonda *et al*. (1989) observed that in seven out of eight cases of gastric carcinoma in dogs, histological diagnosis was achieved by transendoscopic biopsy.

Brunnert et al. (1992) reported that in gastric extramedullary plasmacytoma in a dog gastroscopy revealed the presence of a crateriform mass on the greater curvature of the stomach, approximately 2.5 cm from the pylorus and that the mass consisted of a central ulcer surrounded by a raised crater wall 0.5 cm high.

Ritcher (1992b) observed that a shelf of tissue called the incisura fold or angulus which formed part of lesser curvature served as a useful landmark to orient the endoscope and helped to identify which part of the stomach was being examined, because one side of it located the antrum and pylorus and on the other side were the fundus and cardiac portions of the stomach.

Campbell and Leib (1993) reported endoscopic removal of a gastric foreign body in a Golden Retriever. The foreign body was composed of two bottle caps pressed together and it was retrieved successfully using a basket forceps. Moderate erosions could be noticed around the area where the bottle caps had been located.

Simpson (1993) observed that on endoscopic examination gastric mucosa was normally salmon pink to reddish colour, though the mucosa of the pyloric antrum often appeared paler. The endoscopy enabled detailed examination and sampling of the gastric mucosa with minimal patient discomfort and was generally accepted as a better method than radiographic contrast studies for the evaluation of mucosal abnormalities.

Walter and Matthiesen (1993) suggested that endoscopic examination could be useful for preoperative visual assessment of the pyloric antral lumen and retrieval of a mucosal biopsy in case of acquired antral hypertrophy. On endoscopic examination enlarged mucosal folds could be seen occupying 90^{o} to 360^{o} of the pyloric canal.

Klein and Leib (1994) reported gastric carcinoma in a dog where upper gastrointestinal endoscopy revealed thickening of gastric rugae along the lesser curvature and the junction with the antrum. Thickened rugae were identified by their persistence despite insufflation of air into the stomach. There was also presence of multifocal ulcers.

Ackerman and Carpenter (1995) reported endoscopic removal of a 3x6 feet linen bed sheet from the stomach of a four year old Burmese python using wire basket forceps.

Fallin *et al.* (1996) reported pyloric hypertrophic gastropathy in a ten year old neutered male Pekingese where endoscopy revealed multiple raised masses in the distal antrum. There were two large mucosal folds which completely surrounded the pylorus. Histopathological examination of biopsy specimen taken from the pylorus

demonstrated glandular hyperplasia and muscular hypertrophy which were consistent with the diagnosis of pyloric hypertrophic gastropathy.

Ludlow (1997) reported lymphocytic plasmacytic gastroenteritis in 11 year old spayed Basset Hound where endoscopic examination revealed multifocal slightly raised areas of hyperemia and oedema in the antral region with marked accumulation of mucus. The pyloric sphincter appeared hypertrophied and the opening was not readily visible.

Beck and Simpson (1999) reported gastric leiomyoma in a 12 year old Maltese Terrier in which endoscopic examination revealed a smooth mucosa covered mass protruding into the lumen of the pyloric antrum.

Davies and Leib (1999) pointed out that gastroscopic examination helped to detect the presence of multiple foreign bodies in the stomach of a dog and all the foreign materials were successfully retrieved endoscopically using a rat- tooth forceps and a wire snare.

Gualtieri *et al.* (1999) opined that the size, location and morphology of gastric tumour, including the proximal and distal extend of the spread, as well as other mucosal abnormalities could be evaluated by gastroscopy. They pointed out that biopsy could be performed at the same time and also the possibility of surgical treatment could be evaluated.

Hall and Washabau (1999) observed that endoscopic examination of the stomach would be useful in identifying lesions associated with gastric outflow obstruction like foreign bodies, ulcers, neoplasms and inflammatory or obstructive lesions.

Dilipkumar *et al.* (2000) evaluated normal canine gastrointestinal tract endoscopically in six apparently healthy dogs and reported that gastroscopy revealed prominent rugal folds and the incisura fold which was the part of the lesser curvature of the stomach and was a useful landmark for the orientation of the endoscope.

Zoran (2001) pointed out that to visualize the cardia and lesser curvature completely, the endoscope should be retroflexed, an action that could also be called a "J maneuver". This procedure gave a face-on view of the proximal stomach which aided to ensure that masses, ulcers, or foreign objects were not overlooked.

Moore (2003) reported that gastroscopy could detect ulcerations and erosions and also gastric mucosal hypertrophy and polyps.

Rychlik *et al.* (2007) performed gastroduodenoscopy with a flexible video endoscope with a 1030 mm length and 9.8 mm diameter and bioptates of gastric and duodenal mucosa were taken with biopsy forceps (2.5 mm in diameter) for histopathological evaluation. In their opinion histopathological examination of the bioptates and classification of abnormalities allowed to choose the optimum treatment strategy.

McCarthy (2008) reported laparoscopic removal of a rubber ball from the stomach of Labrador Retriever.

2.6 TREATMENT

Brewer *et al.* (1956) evaluated the operative procedures such as Heineke-Meckulicz cardioplasty, Hegrovsky-Grondahl cardioplasty, oesophagogastrostomy, Heller's cardiomyotomy and oesophago-jejunostomy in Roux-Y-fashion for

oesophageal achalasia through retrospective study of 89 cases of achalasia. They concluded that Heller's cardiomyotomy had proven to be the most satisfactory surgical method for dealing with uncomplicated achalasia.

Diamant *et al.* (1974) concluded that administration of a cholinomimetic drug, urocholine caused an increase in contraction amplitude and the appearance of motor activity in a previously nonfunctioning portion of oesophageal segment and that it might provide a means of therapy for idiopathic megaoesophagus in dogs.

Bennet (1980) reported that Heller's cardiomyotomy using a double incision (anterior and posterior) was later modified to a single incision. He also commented that the main problem with cardiomyotomy was the subsequent occurrence of gastro-oesophageal reflux and possibly later on an oesophageal stricture. He also suggested that the drug nifedipine would lower the tone of gastroesophageal sphincter and that it could be used in the treatment of achalasia.

Happe *et al*. (1981) performed laparotomy in three dogs with hypertrophic pyloric gastropathy of the pyloric antrum, gastroduodenostomy was performed in one dog and in the other two dogs the circularly thickened mucosa of the pyloric antrum was resected.

Rivers (1981) reported the removal of a screw driver from the stomach of a female Beagle through exploratory laparotomy and gastrotomy.

Zimmer (1984) reported a case of oesophageal obstruction by a bone piece in a Boston Terrier dog and it was removed through a thoracic oesophagotomy.

Burrows (1985) suggested that tylosin or metronidazole could be used for treating chronic diarrhoea associated with inflammatory bowel disease or bacterial overgrowth. He observed that for motility disorders, motility modifiers of narcotic or anticholinergic group could be used.

Houlton *et al.* (1985) reported that out of 83 cases of thoracic oesophageal foreign bodies in dogs, surgical removal of the foreign bodies through a transthoracic oesophagotomy was done in seven cases.

Farrow (1986) reported gastric foreign body in a Dachshund dog where the foreign body was a shredded deep pile carpeting which was removed surgically through gastrotomy.

Burrows (1987) reported reversible megaoesophagus in nine month old male Sher Pei with hypoadrenocorticism where treatment consisted of intravenous infusion of 0.9% sodium chloride solution, prednisolone (5 mg once daily), metoclopramide (0.04 mg/ kg TID) and cimetidine (5 mg/kg TID).

Fonda *et al.* (1989) opined that among 11 cases of gastric carcinoma in dogs complete surgical excision could be possible in only one case because of the advanced stage of the tumours at the time of diagnosis.

Balasubramanian *et al.* (1990) reported chronic hypertrophic pyloric gastropathy in a dog which was treated successfully by Heineke-Meckulicz pyloroplasty through a cranial midventral approach under general anaesthesia.

Bellenger *et al.* (1990) attempted surgical treatment in 13 dogs with chronic hypertrophic pyloric gastropathy by performing pyloromyotomy in seven cases,

pyloroplasty in four cases and gastroduodenostomy in two cases and concluded that pyloromyotomy was a satisfactory procedure for circular muscle hypertrophy in young dogs with pyloric stenosis.

Clark and Pavletic (1991) performed partial gastrectomy with gastrointestinal anastamosis stapling instrument in nine dogs undergoing emergency surgery for treatment of acute gastric dilatation-volvulus.

Brunnert *et al.* (1992) reported that in gastric extramedullary plasmacytoma in a dog chemotherapy was done with doxorubicin hydrochloride (25 mg/m^2 body surface) diphenhydramine hydrochloride (1 mg/ kg, i/m) for 21 days. This treatment was repeated for 21 days later and the dog became clinically normal.

Davidson (1992) concluded that in gastric dilatation-volvulus the goals of surgery would be to return the organs to their normal anatomic positions, evaluate gastric and spleenic viability and perform a gastropexy to prevent volvulus from recurring. He also opined that any of three gastropexy procedures like incisional gastropexy, tube gastropexy and circumcostal gastropexy could be selected for the purpose.

Jergens and Greve (1992) treated gastric physalopteriasis in a dog with fenbendazole (50 mg/ kg orally once daily for three consecutive days) and metronidazole (20 mg/ kg orally three times a day for two weeks) to reduce gastrointestinal inflammatory signs.

Ritcher (1992a) reported that histamine H2 receptor antagonists, sucralfate, anticholinergic drugs, misoprostol, omeprazole etc. could be used in treating gastric ulcers.

Walter and Matthiesen (1993) observed that the surgical objectives in acquired antral pyloric hypertrophy in dogs were to identify and excise abnormal tissue and then to restore gastrointestinal continuity with adequate gastric outflow using the least radical procedure possible. They concluded that Y-U pyloroplasty provided good luminal exposure, which allowed excision of hypertrophic rugal folds or polyps.

Willard and Delles (1993) reported benign oesophageal stricture in a Poodle where balloon dilatation of the stricture was performed under endoscopic guidance and the procedure was repeated for a total of four times. The patient was administered with prednisolone @ 1.1 mg/kg once daily following the dilatation inorder to avoid reformation of the cicatrix.

Hamilton and Carpenter (1994) reported oesophageal plasmacytoma in a dog in which surgical excision of the tumour mass was performed through a thoracotomy at right fourth intercostal space. The segment of oesophagus invaded by tumour was resected and the remaining oesophageal segments were anastamosed primarily and the recovery was uneventful.

Michels *et al*. (1995) conducted endoscopic retrieval of fish hooks from the stomach and oesophagus of dogs and cats and stated that the retrieval time and hospitalization time for the endoscopic retrieval were significantly shorter than the time for surgical retrieval. They recommended surgical retrieval of foreign bodies in unsuccessful endoscopic retrieval or gastric perforation.

Whitely (1995) reported successful treatment of megaoesophagus and glucocorticoid deficient hypoadrenocorticism in a seven year old German Shepherd Dog by the administration of dexamethasone (0.02 mg/ kg body weight intravenously every 12 hours), cimetidine (5mg/kg body weight intravenously every 8 hours) and metoclopramide (0.5 mg/ kg body weight every 24 hours by intravenous infusion).

Fallin *et al.* (1996) reported a pyloric hypertrophic gastropathy in a ten year old neutered male Pekingese where surgical correction was performed by resection of the pyloric region and gastroduodenostomy. The animal was given parenteral fluid and antibiotic therapy for subsequent seven days and advised the owner to continue prescription diet and the recovery was uneventful.

Ludlow (1997) treated lymphocytic plasmacytic gastroenteritis in 11 year old spayed Basset Hound with prednisolone (1 mg /kg orally BID) for inflammatory bowel disease and metoclopramide (0.4 mg/kg orally TID) to improve gastric emptying. *Helicobacter* infection was treated with amoxicillin (20 mg/ kg orally TID) and metronidazole (50 mg/kg orally TID) for three weeks.

Ayali and Simpson (1999) concluded that a treatment combination with amoxicillin (20 mg/kg administered orally twice daily for 14 days), metronidazole (20 mg/kg administered orally twice daily for 14 days) and famotidine (0.5 mg/kg administered orally twice daily for 14 days) gave good results for *helicobacte*r gastritis in dogs. They observed that re-evaluation of infection status three days after treatment revealed to be free of *helicobacter* spp in six out of eight dogs on the basis of histology, urease testing and the ^{13}C- urea breath test.

Beck and Simpson (1999) reported gastric leiomyoma in a 12 year old Maltese Terrier where surgical excision was done through a ventral midline

laparotomy. The ulcerated mass was removed by partial thickness intraluminal resection of the gastric wall and recovery was uneventful.

Hall and Washabau (1999) opined that treatment for delayed gastric emptying could be done by dietary management and by the use of gastric prokinetic drugs like cisapride, metoclopramide, erythromycin, ranitidine and nizatidine.

Holt *et al.* (2000) reported oesophageal obstruction caused by a left aortic arch and an anomalous right patent ductus arteriosus in two dogs. The condition was diagnosed by radiographic examination and was corrected surgically by dividing and oversewing the patent right ductus arteriosus through a left fourth intercostal thoracotomy.

Washabau (2001) reported that the dogs with megaoesophagus due to myasthenia gravis should be treated with pyridostigmine (1-3 mg/ kg BID orally) and/ or corticosteroids, dogs with hypothyroidism should be treated with levothyroxine (0.22 mcg/kg BID orally) and dogs affected polymyositis should be treated with prednisolone (1-2 mg/kg BID orally). Affected dogs should be fed from an elevated or upright position to take advantage of the gravity drainage through a nonperistaltic oesophagus.

Boria *et al*. (2003) reported megaoesophagus secondary to oesophageal achalasia in a dog which was treated successfully with a distal oesophagomyotomy (modified Heller's operation) through a midline abdominal incision extending from the xiphoid process to the umbilicus.

Rani *et al.* (2004) reported two cases of gastric foreign body obstruction in pups where the foreign bodies were removed surgically through gastrotomy

Simpson (2005) concluded that *helicobacter* associated gastritis in dogs could be treated with clarithromycin @ 5-10 mg/kg body weight twice daily and omeprazole @ 1 mg/kg body weight or amoxicillin @ 10-20 mg/kg body weight twice daily together with metronidazole @ 20 mg/kg body weight and omeprazole @1 mg / kg body weight/day.

Parton *et al*. (2006) reported gastric ulceration subsequent to partial invagination of stomach in a dog which was corrected surgically and an incisional gastropexy was performed to secure the pyloric antrum to the right body wall.

Sreenu and Kumar (2006) reported a case where an oesophageal foreign body in a dog was removed by cervical oesophagotomy through a left lateral approach. The oesophagus was then closed in double layer of continuous pattern with 4-0 catgut.

Rychlik *et al*. (2007) reported lymphocytic plasmacytic gastroenteritis in a dog which was treated with prednisolone @ 1 mg / kg body weight sid PO for 14 days, the dose of which was then gradually reduced.

Jain and Tayal (2008) reported that treatment in a case of megaoesophagus was initiated using antibiotics, nonsteroidal anti-inflammatory drugs (neoprofen), vitamin B complex and prokinetic drugs like cisapride which failed to give desirable results. Later on the condition was managed by feeding the animal from an elevated platform and by giving oral preparations containing vitamins and minerals.

Ponnuswamy *et al*. (2008) reported congenital idiopathic megaoesophagus in a pup which was treated by amoxicillin- cloxacillin 50 mg /kg orally BID for seven

days and the owner was then advised to strictly follow an elevated feeding programme where the animal's body was elevated about 45^0-90^0 during feeding and maintained in the same position for about 15 minutes after feeding with which the clinical signs started resolving after 15 days.

Lister and Isakow (2008) reported that in oesophageal leiomyoma in a 13 year old bitch the enucleation of the mass was done after performing thoracotomy. The mass was separated with blunt dissection from the surrounding tissues which avoided oesophageal resection and spared oesophageal mucosal surface. Histological examination of the mass revealed it as leiomyoma.

Ranen *et al*. (2008) reviewed 32 cases of oesophageal sarcomas in dogs and found out that out of nineteen dogs which underwent surgical intervention to remove the tumours only ten were survived. Three cases received medical treatment with doxorubicin (30 mg /m^2) and a case received one treatment with doxorubicin followed by one treatment with carboplatin (300 mg/ m^2) and the animals recovered uneventfully.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

Endoscopic evaluation of oesophagus and stomach was conducted in seven dogs of either sex, belonging to different breeds and age groups presented to the Veterinary Hospitals of the College of Veterinary and Animal Sciences at Mannuthy and Kokkali with the history of reduction in food intake, regurgitation or chronic vomiting. The dogs were serially numbered as A1, A2, A3, A4, A5, A6 and A7 and after endoscopic examination appropriate treatment measures were adopted based on the endoscopic findings.

3.1 MAIN ITEMS OF OBSERVATION

3.1.1 Signalment

The details about breed, sex, age, colour and body weight of all the dogs were recorded.

3.1.2 History

Anamnesis regarding the symptoms exhibited, response to previous treatments if any and duration of illness in all the dogs was recorded.

3.1.3 Physiological Parameters

The observations on physiological parameters *viz*., respiratory rate (per minute), pulse rate (per minute), rectal temperature (^{o}C), and colour of the visible mucous membrane were recorded before endoscopic evaluation and on eighth day of initiation of treatment.

3.1.4 Clinical Observations

The dogs were observed for their general condition, feeding and voiding habits, and presence of abdominal distension. After systemic examination, abdominal palpation was carried out in all the animals to identify the presence of any abnormal mass, pain or tenderness.

3.2 HAEMATOLOGICAL PARAMETERS

Blood samples were collected in EDTA for routine haemogram and without anticoagulant for preparation of serum from all the dogs before endoscopic evaluation and on eighth day of initiation of treatment.

3.2.1 Routine Haemogram

Haematological parameters on haemoglobin concentration (g%), total leukocyte count ($10^3/mm^3$), differential leukocyte count (%) and volume of packed red cells (%) as per the methods described by Schalm *et al*. (1975) were recorded.

3.2.2 Serum Biochemical Studies

Serum biochemical parameters on creatinine[1] (mg%), blood urea nitrogen[2] (mg%), total protein[3] (g%) and chloride[4] (mEq/l) were estimated using kits. Sodium (mEq/l) and potassium (mEq/l) were estimated by emission flame photometry (Systronics 128) as

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1. Creatinine kit, Agappe Diagnostics Ltd., Ernakulam
2. Urea- B kit, Agappe Diagnostics Ltd., Ernakulam
3. Total Protein kit, Agappe Diagnostics Ltd., Ernakulam
4. Chloride kit, Agappe Diagnostics Ltd., Ernakulam

described by Oser (1971). Serum T_4 level was estimated by Radio Immuno Assay (RIA) in animals (A6 and A7) in which hypothyroidism was suspected.

3.3 RADIOGRAPHIC EVALUATION

Radiographic evaluation (plain or contrast or both) of oesophagus and stomach, was performed in animals for conditions necessitating its requirement. Left lateral position for oesophagus and stomach and right lateral position for pylorus were adopted for radiography. Contrast radiography was performed after administering barium sulphate[5] at the dose rate of 4ml/kg body weight orally.

3.4 ENDOSCOPIC EVALUATION

Flexible video endoscope with a length of 140 cm, outer diameter of 9.7 mm and biopsy channel of 2.8 mm diameter (Karl Storz Veterinary Video Endoscope PV-SG 28-140) was used for the present study. The endoscope had a four way tip deflection which enhanced its maneuverability and there was a locking system to fix the deflection of the distal tip (Fig. 1).

3.4.1 Anaesthesia

The examination of the patient was performed after withholding food for approximately 12 hours. In condition of delayed gastric emptying food was withheld for 24 hours for obtaining a better visualization of the mucosal surface. Catheterization of

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5. Barium sulphate oral suspension, 95% w/v, National Drugs and Chemicals, VAPI, India

cephalic/saphenous vein was performed prior to the endoscopic procedure for administration of anaesthesia/fluids.

Atropine sulphate[6] at the dose rate of 0.045 mg/kg body weight and ten minutes later xylazine hydrochloride[7] at the dose rate of 2 mg/kg body weight were administered intramuscularly for premedication. Fifteen minutes later, ketamine hydrochloride[8] at the dose rate of 5 mg/kg body weight was administered intramuscularly to effect anaesthesia.

The anaesthesia was maintained throughout the procedure by administering a 1:1 mixture by volume of xylazine (20mg/ml) and ketamine (50mg/ml) intravenously whenever animal showed signs of recovery. Diazepam[9] at the dose rate of 0.1 mg/kg body weight was also administered intravenously to obtain desirable level of muscle relaxation for the procedure.

3.4.2 Procedure

The dog was restrained on left lateral recumbency and mouth was kept open with the help of muzzle tapes, applied separately to the upper and lower jaws. While keeping the dog's head and neck extended and tongue pulled out, the endoscope was directed through the oropharynx (Fig. 2) and guided dorsal to the trachea and larynx so that the cranial oesophageal sphincter (Fig. 3) came into view first. With firm pressure the endoscope was then progressed through the cranial oesophageal sphincter to enter the cervical oesophagus (Fig. 4). The oesophagus was then insufflated with air until sufficiently distended to visualize the lumen. As the oesophagus dilated, the longitudinal mucosal folds of the proximal oesophagus could be reduced in size which helped to

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

observe the lumen of the entire cervical oesophagus. Once the oesophagus was adequately distended the scope was advanced down in a slow continuous motion. Full luminal view was managed by minor adjustments of the up-down deflection knob in combination with small torquing movements. After viewing of the oesophageal lumen the distal oesophageal sphincter was passed (Fig. 5). To move the endoscope from the thoracic oesophagus into the stomach, the tip of the endoscope was deflected 30 degree to the left with slight upward deflection as the tip advanced through the cardia (Zoran, 2001). A sudden loss of resistance was felt as the endoscope entered the stomach (Fig. 6).

Upon entry into the stomach, air insufflation was continued till the rugal folds began to separate allowing for the spatial orientation and identification of most gross abnormalities such as an ulcer, a mass or a foreign body. Both the fundus and the body of the stomach were inspected by twisting the tip of the fiberscopic probe. Flushing of the lumen and suctioning were carried out wherever necessary for more visibility. After examination of the fundus and body of the stomach, the endoscope was pushed and guided to the pyloric part with the incisura angularis as the guide (Fig. 7).

Endoscopic examination of oesophagus and stomach was done in this manner before treatment and on eighth day of initiation of treatment and observations on the endoscopic appearance and mucosal changes of oesophagus and stomach, presence of foreign bodies or space occupying lesions or other abnormalities if any, were recorded.

3.5 ENDOSCOPIC GUIDED BIOPSY

Biopsy sample was collected endoscopically using biopsy forceps with round cupped jaws from an oesophageal nodule in dog A5. Once the oesophagus and stomach had been thoroughly visualized, biopsy sites were selected. Biopsy forceps was extended

beyond the endoscopic tip (Fig. 8 and Fig. 9) and advanced to the area to be sampled. When the biopsy instrument was close to the sampling site, it was opened and advanced firmly into the tissue. The oesophageal wall was pushed away to some degree as the instrument was advanced against tissue. Once resistance to the movement was felt the forceps was closed firmly and tissue sample was then torn off as the forceps was withdrawn into the accessory channel (Fig. 10). Biopsy samples were preserved in 10% formol saline for histopathological studies.

3.6 HISTOPATHOLOGICAL EXAMINATION

Biopsy samples were subjected to histopathological examination after H & E (Haematoxylin and Eosin) staining.

3.7 ENDOSCOPIC FOREIGN BODY RETRIEVAL

A six wired basket retrieval device was used for extraction of foreign bodies from the stomach in animals A1 and A3 (Fig. 11). The ensheathed basket was passed through the operating channel of the endoscope and when it neared the object to be retrieved, the basket was extended from the sheath. The basket when sprang apart was maneuvered over the object and while withdrawing the basket into the sheath, it could be compressed after entrapping the foreign body.

3.8 TREATMENT

3.8.1 Medical Treatment

Medical treatment was adopted in animals A2, A3, A5, A6 and A7. In cases of megaoesophagus (A3, A5, A6 and A7), neostigmine[10] at the dose rate of 0.5 mg/kg body weight administered twice daily orally and gravity feeding were followed for prolonged

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10. Tab Tilstigmine 15 mg, Tablets (India) Ltd., Chennai

period. In no response condition (A6), mosapride[11] (5mg twice daily) and rabiprazole[12] (20 mg twice daily) were administered orally for a period of one month and when this treatment did not show any cure, cardiomyotomy was performed after confirming stricture of cardia by contrast radiography. When hypothyroidism (Kaneko, 1997) was diagnosed to be the cause of megaoesophagus (A6 and A7; Table 6), thyroxine[13] at the dose rate of 20µg/kg body weight /day was administered orally for indefinite period.

In the dog suffering from pyloric ulcer along with hypertrophy (A2), triple therapy (amoxicillin-cloxacillin[14] at the dose rate of 20mg/kg body weight thrice daily, metronidazole[15] at the dose rate of 10mg/kg body weight twice daily and pantoprazole[16] at the dose rate of 0.7 mg/kg body weight twice daily administered intravenously) was followed (Simpson, 2005) for one week.

3.8.2 Surgical Treatment

Cardiomyotomy was performed through abdominal approach in the case of megaoesophagus consequent to stricture of cardia in dog A6.

3.8.2.1 Anaesthesia

The dog was kept off-feed for 18 hours prior to surgery. The left lateral thoraco-abdominal region was shaved from mid thorax to mid abdomen and prepared for aseptic

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11. Tab Moza MPS, Intas Pharmaceuticals Ltd.,Dehradun
12. Tab Razo-20, Dr. Reddy's Laboratories Ltd., Bollaram, Medak district
13. Tab Eltroxine, GlaxoSmithKline Pharmaceuticals Ltd., Nashik
14. Intamox 500 mg, Intas Pharmaceuticals, Dehradun
15. Metrogyl, 500 mg/ 100 ml, J. B Chemicals & Pharmaceuticals Ltd., Ankleshwar
16. Tab Pentab 40, Brooks Laboratories Ltd., Baddi

surgery (Fig. 12).

The anaesthetic regimen and maintenance followed for endoscopic procedure was adopted for the conduct of surgery. The dog was controlled on the operation table in right lateral recumbent position. Mouth was kept open using muzzle tapes and a cuffed endotracheal tube was introduced into the trachea, inflated the cuff and secured in position.

3.8.2.2 Technique

A 10 cm long skin incision was made along the 12th rib starting four centimeters distal to its vertebral articulation extending downwards to the costochondral junction (Fig. 13). The dissection was continued through the *cutaneous trunci* and *latissimus dorsi* muscles to expose the 12th rib and thereafter the attachment of *serratus dorsalis caudalis* and the *obliques abdominus externus* muscles were reflected (Fig. 14). A longitudinal incision was made on the periosteum and separated it from the rib all around. The rib was then resected and removed to allow better exposure of the surgical site (Fig. 15). The periosteum was then sutured in simple continuous pattern using 1-0 chromic catgut. A longitudinal incision was then put through the center of the intercostal space cutting through the external and internal intercostal muscles and the wound edges were then kept retracted with a Finochietto rib retractor. The greater curvature of the stomach was brought in level with the intercostal incision by gentle traction and held in position to expose the gastro-oesophageal junction near the oesophageal hiatus (Fig. 16). The attachment of the phreno-oesophageal ligament at the hiatus with the oesophagus was separated on the dorsolateral aspect, after initiating positive pressure ventilation.

A four centimeter long longitudinal incision was made beginning from the stomach wall a little caudal to the cardia and extending cranially through the oesophageal wall, just enough to cause separation of the musculature without any damage to the submucosa and mucosa of both the stomach and oesophagus. The edges of the

oesophageal incision were undermined on either side to allow protrusion of the oesophageal mucosa through the myotomy incision and the bleeding points were ligated using 2-0 chromic catgut (Fig. 17). The border of the phreno-oesophageal ligament at the region of hiatus oesophagus was sutured with the muscular layers of oesophagus at the level of the cranial edge of the oesophageal incision in simple continuous pattern using 1-0 chromic catgut after full inflation of the lungs. This facilitated the protruded oesophageal mucosa to lie in abdominal position (Amma and Nayar, 2000).

The parietal peritoneum and the edges of the intercostal muscles were apposed in simple continuous pattern using chromic catgut No: 1 (Fig.18). The reflected edges of the *serratus dorsalis caudalis* and oblique abdominal muscles were then apposed in simple continuous pattern using No.1 chromic catgut. The skin incision was apposed in horizontal mattress pattern using monofilament nylon. A gauze piece was fixed along the sutured incision and soaked it with tincture benzoin (Fig. 19).

3.8.2.3 Postoperative management

Postoperatively ceftriaxone[17] at the dose rate of 40mg/kg bodyweight twice daily intravenously for seven days, lactated ringer solution[18] in the morning and dextrose normal saline[19] solution in the evening at the dose rate of 10ml/kg body weight intravenously for three days were administered. Oral feeding with milk and biscuits was started from fourth day and continued for the next two days, followed by cooked rice and milk thereafter. Skin sutures were removed on tenth postoperative day.

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17. Safevet 500 mg, Dosch Pharmaceuticals Pvt. Ltd., Mumbai

18. Ringer Lactate 540 ml, Parenteral Drugs Ltd., Indore, Madhya Pradesh

19. DNS, Baxter Pvt. Ltd., Alathur, Tamil Nadu

3.8.2.4 Radiographic evaluation

Contrast radiography of the oesophagus and stomach (left lateral view) was performed on 12th postoperative day, 10 minutes after administering barium sulphate at the dose rate of 4ml/kg body weight orally.

3.8.2.5 Endoscopic evaluation

Endoscopic evaluation of oesophagus and stomach was performed and blood sample without anticoagulant was collected for estimation of serum T_4 level on 15th postoperative day.

3.9 RESULTS OF TREATMENT

Results of treatment were assessed based on the general condition, recovery from clinical signs and review by endoscopic evaluation.

3.10 STATISTICAL ANALYSIS

The data obtained were analysed and compared using paired ‘t’ test (Snedecor and Cochran, 1994).

Fig.1. Endoscopy unit

Fig.2. Endoscopy procedure in progress

Fig. 3. Cranial oesophageal sphincter

Fig. 4. Oesophageal lumen with pale pink mucosa

Fig. 5. Gastro-oesophageal sphincter

Fig. 6. Gastric rugae and mucosa with bright pink colour

Fig. 7. Incisura angularis and pyloric antrum

Fig. 8. Round cupped biopsy forceps

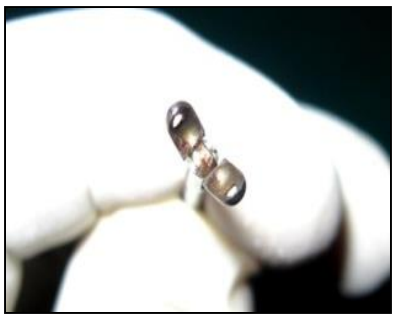

Fig. 9. Tip of biopsy forceps

Fig. 10. Collection of biopsy sample using round cupped forceps (1st day, A5)

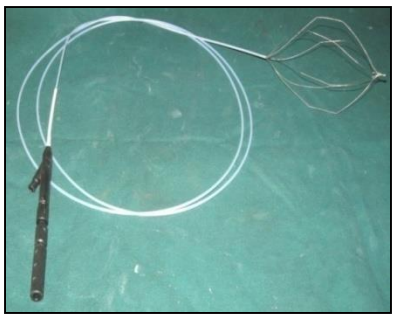

Fig. 11. Six wired basket retrieval device

Fig. 12. Dog prepared for surgery (A6)

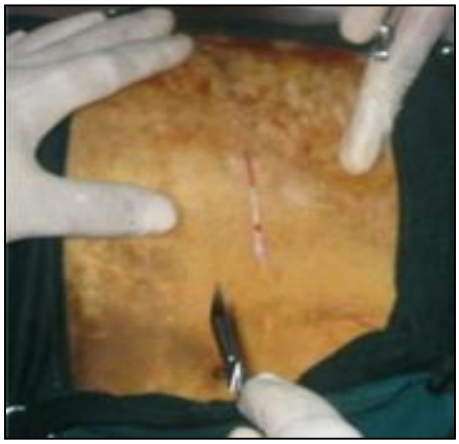

Fig. 13. Incision at the 12th intercostal space

Fig. 14. Dissection continued through *cutaneous trunci* and *latissimus dorsi*

Fig. 15. Resection of 12th rib

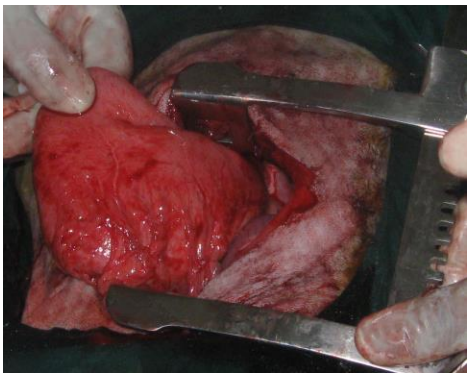

Fig. 16. Exteriorisation of the greater curvature of the stomach

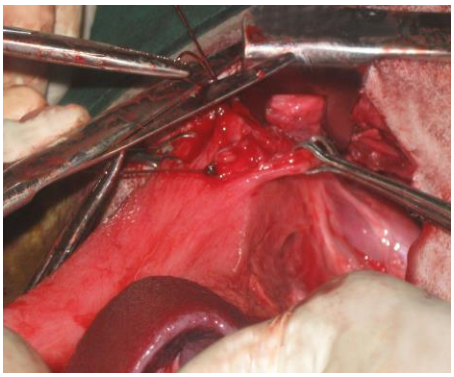

Fig. 17. Ligation of bleeding points after division of muscles at gastro-oesophageal junction

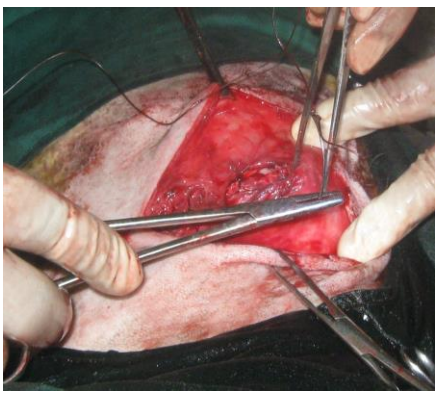

Fig. 18. Suturing of intercostal muscles

Fig. 19. Intercostal incision sealed with sterile gauze

RESULTS

4. RESULTS

Endoscopic evaluation of oesophagus and stomach was conducted in seven dogs of either sex, belonging to different breeds and age groups presented to the Veterinary Hospitals of the College of Veterinary and Animal Sciences at Mannuthy and Kokkali with the history of reduction in food intake, regurgitation or chronic vomiting. The dogs were serially numbered as A1, A2, A3, A4, A5, A6 and A7 and after endoscopic examination appropriate treatment measures were adopted based on the endoscopic findings.

Out of the seven dogs studied, two (A1 and A4) had gastric foreign body obstruction, four had megaoesophagus (A3, A5, A6, A7), one (A2) had pyloric ulcer along with hypertrophy.

4.1 MAIN ITEMS OF OBSERVATION

4.1.1 Signalment (Table 7)

The breeds affected were Labrador Retriever (2), Dalmatian (1), Great Dane (1), Golden Retriever (1) and nondescript (2) and among the dogs, three were females and four were males. The age of the dogs ranged from six months to nine years with a mean age of 3.57 $\pm$ 1.21 years. The body weight of dogs ranged from 12 kg to 38 kg with a mean of 23.14 $\pm$ 3.34 kg.

4.1.2 History (Table 1)

4.1.2.1 Dog A1

The dog swallowed a Chinese rubber ball three days before it was presented to the hospital. Occasional vomiting was noticed on the subsequent two days. Food intake was normal, but there was no report of defaecation.

4.1.2.2 Dog A2

The dog was presented with a history of anorexia and vomiting for 12 days. Vomitus was yellowish in colour and contained partially digested food materials. There was a history of previous treatment with ranitidine and metoclopramide, but no improvement was obtained.

4.1.2.3 Dog A3

Regurgitation immediately after taking food was the prominent symptom noticed and the condition started ten days back. The expelled material was yellowish in colour and contained undigested food materials. The dog had been previously treated with metoclopramide for four days, but the treatment was not successful.

4.1.2.4 Dog A4

The dog was showing occasional vomiting for two months. Feeding and voiding habits were normal. There was no history of previous treatment.

4.1.2.5 Dog A5

Regurgitation of undigested food immediately after feeding was the prominent clinical sign. The condition was existing for one month and the dog had been treated previously with metoclopramide and ranitidine, but no improvement could be noticed. The dog was having normal appetite and faecal matter was reported to be loose in consistency.

4.1.2.6 Dog A6

Regurgitation was the prominent sign which started 10 days before. The expelled material was yellowish in colour and consisted of undigested food materials. The interval between regurgitation and food intake varied from 10 minutes to 30 minutes.

4.1.2.7 Dog A7

Regurgitation immediately after food intake was the clinical sign which started two months back. The regurgitated material consisted of undigested food materials and the dog had previously been treated with antibiotics (amoxicillin-cloxacillin), antihistaminic (pantoprazole) and antiemetic (metoclopramide) for five days. No improvement with these medications was reported.

4.1.3 Physiological Parameters (Table 2)

The mean respiratory rate (per minute) was 34.71 $\pm$ 5.75 before endoscopic evaluation and 33.57 $\pm$ 4.47 on eighth day of initiation of treatment. The mean pulse rate (per minute) was 97.43 $\pm$ 4.85 before endoscopic evaluation and 95.43 $\pm$ 1.94 on

eighth day of initiation of treatment. The mean rectal temperature (^{0}C) was 38.93 $\pm$ 0.15 before endoscopic evaluation and 38.92 $\pm$ 0.10 on eighth day of initiation of treatment.

4.1.4 Clinical Observations (Table 3)

4.1.4.1 Dog A1

The dog was active and alert and was in good body condition. On abdominal palpation no pain or hard mass could be detected.

4.1.4.2 Dog A2

The dog was found to be dull and weak. Palpation of epigastric region elicited pain.

4.1.4.3 Dog A3

The dog was dull, weak and emaciated. On abdominal palpation no hard mass or pain could be detected.

4.1.4.4 Dog A4

The dog was active and alert, and was in good body condition. On palpation of upper half of left anterior abdomen, a hard mass could be detected, but no pain was elicited. The animal was suspected for pregnancy and subjected to ultrasound scanning of abdomen. On scanning an oval moving mass could be detected in the stomach region.

4.1.4.5 Dog A5

The dog was active, alert and was in good body condition. On palpation of abdomen no pain or hard mass could be detected.

4.1.4.6 Dog A6

The dog was dull and emaciated. On palpation of the abdomen no pain or hard mass could be detected.

4.1.4.7 Dog A7

The dog was dull, weak and emaciated. On abdominal palpation there was no pain or presence of any hard mass.

4.2 HAEMATOLOGICAL PARAMETERS

4.2.1 Routine Haemogram (Table 4)

4.2.1.1 Haemoglobin concentration

The mean haemoglobin concentration (g/dl) was 13.57 $\pm$ 0.44 before endoscopic evaluation and 14.06 $\pm$ 0.49 on eighth day of initiation of treatment. There was no statistically significant difference between the two values ($P>0.05$).

4.2.1.2 Total Leukocyte Count

The mean total leukocyte count (10^3/cu.mm) was 10.93 $\pm$ 5.68 before endoscopic evaluation and 10.75 $\pm$ 3.32 on eighth day of initiation of treatment. There was no statistically significant difference between the two values (P>0.05).

4.2.1.3 Volume of Packed Red Cells

The mean volume of packed red cells (%) was 40.63 $\pm$ 3.84 before endoscopic evaluation and 34.29 $\pm$ 2.78 on eighth day of initiation of treatment. The value was found to be greater before endoscopic evaluation which became reduced on eighth day of initiation of treatment and there was statistically significant difference between the two values (P< 0.05).

4.2.1.4 Differential Leukocyte count

The mean neutrophil count (%) was 77.57 $\pm$ 2.26 before endoscopic evaluation and 73.86 $\pm$ 1.22 on eighth day of initiation of treatment. The mean lymphocyte count (%) was 19.00 $\pm$ 1.80 before endoscopic evaluation and 22.00 $\pm$ 1.02 on eighth day of initiation of treatment. The mean monocyte count (%) was 3.00 $\pm$ 0.69 before endoscopic evaluation and 2.57 $\pm$ 0.53 on eighth day of initiation of treatment. The mean eosinophil count (%) was 0.43 $\pm$ 0.20 before endoscopic evaluation and 1.57 $\pm$ 0.48 on eighth day of initiation of treatment.

There was no statistically significant difference between the values before endoscopic evaluation and those on eighth day of initiation of treatment (P>0.05).

4.2.2 Serum Biochemical Studies (Table 5)

4.2.2.1 Serum sodium concentration

The mean serum sodium concentration (mEq/L) was 140.63 + 0.98 before endoscopic evaluation and 142.86 ± 0.54 on eighth day of initiation of treatment. There was no significant difference between the two values (P> 0.05).

4.2.2.2 Serum potassium concentration

The mean serum potassium concentration (mEq/L) was 4.47 ± 0.22 before endoscopic evaluation and 4.98 ± 0.15 on eighth day of initiation of treatment. There was no significant difference between the two values (P> 0.05).

4.2.2.3 Serum chloride concentration

The mean chloride concentration (mEq/L) was 99.57 ± 0.64 before endoscopic evaluation and 100.87 ± 0.36 on eighth day of initiation of treatment. There was no statistically significant difference between the two values (P> 0.05).

4.2.2.4 Serum blood urea nitrogen

The mean value of blood urea nitrogen (mg %) was 19.14 ± 3.17 before endoscopic evaluation and 15.93 ± 2.27 on eighth day of initiation of treatment. There was no significant difference between the two values (P> 0.05).

4.2.2.5 Serum creatinine concentration

The mean serum creatinine concentration (mg %) was 0.86 ± 0.17 before endoscopic evaluation and 0.74 ± 0.14 on eighth day of initiation of treatment. There was no statistically significant difference between the two values (P> 0.05).

4.2.2.6 Serum total protein

The mean value of serum total protein (g %) concentration was 5.44 ± 0.15 before endoscopic evaluation and 5.71 ± 0.14 on eighth day of initiation of treatment.

4.2.2.7 Serum T_4 level (Table 6)

In dogs A6 and A7 as serum T_4 levels were estimated which were found to be lower than the normal level. In A6 the level was 1.4 µg/dl and in A7 it was 1 µg/dl.

4.3 RADIOGRAPHIC EVALUATION

4.3.1 Dog A1

Lateral survey radiograph of the abdomen showed image of radio-opaque round mass of approximately four centimeter diameter in the stomach and distended intestinal loops (Fig. 20).

4.3.2 Dog A2

Contrast radiographic examination of gastrointestinal tract revealed presence of barium sulphate in the stomach and it was retained at the area of pyloric antrum even after two and half hours of administration (Fig. 21).

4.3.3 Dog A3

Lateral survey radiograph of thorax revealed severe degree of dilatation of oesophagus towards its distal third (Fig. 22). Contrast radiograph of the lateral thorax immediately after barium sulphate administration showed the shadow of barium sulphate in the terminal third of the severely dilated oesophagus (Fig. 23).

4.3.4 Dog A5

Contrast radiographic examination of the oesophagus five minutes after oral administration of barium sulphate revealed severe degree of dilatation of thoracic oesophagus towards its distal third (Fig. 24)

4.3.5 Dog A6

Contrast radiographic examination of the gastrointestinal tract immediately after the administration of barium sulphate revealed severe degree of dilatation and sacculation of thoracic oesophagus towards its distal half (Fig. 25). Radiographs after 15 minutes and four hours revealed that barium had partially entered the stomach, indicative of a stricture at the region of cardia (Fig. 26 and Fig. 27).

4.3.5 Dog A7

Contrast radiographic examination of the oesophagus 10 minutes after the administration of barium sulphate revealed the presence of mild degree of dilatation of oesophagus throughout the entire length (both cervical and thoracic) (Fig. 28).

4.4 ENDOSCOPIC EVALUATION

4.4.1 Anaesthesia

General anaesthesia provided adequate depth and muscle relaxation for the endoscopic procedure. No complication was noticed during induction, maintenance and recovery from anaesthesia.

4.4.2 Endoscopic Findings

4.4.2.1 Dog A1

Oesophageal mucosa had normal pale and smooth appearance (Fig. 29). Gastric mucosa also was normal with bright pink colour and was free of any lesion (Fig. 30). Presence of a Chinese ball of about 4 cm diameter could be detected in the stomach (Fig. 31). The ball was freely moving inside the stomach. Endoscopic evaluation was repeated subsequently on the eighth day which revealed that oesophageal (Fig. 32) and gastric mucosa were healthy and normal in appearance (Fig. 33).

4.4.2.2 Dog A2

Endoscopic evaluation revealed that oesophageal mucosa had normal pale and smooth appearance (Fig. 34) but there was presence of ulcers on gastric mucosa (Fig. 35). Ulcers were more prominent towards the pyloric region (Fig. 36). Thickening of mucosa and narrowing of pyloric ostium was also noticed. It was difficult to pass the endoscope through the pylorus.

Endoscopic evaluation on eighth day revealed that most of the gastric mucosal lesions had healed up (Fig. 37). Some ulcerative lesions were still present around the pyloric opening yet to be healed. Endoscope could be passed successfully through the pylorus into the duodenum.

4.4.2.3 Dog A3

There was dilatation and sacculations of oesophagus towards its distal one third (Fig. 38). The appearance of the oesophageal and gastric mucosa was normal with pale and bright pink (Fig. 39) colours respectively. The dilatation was present even without insufflating the oesophageal lumen with air. There was retention of fluid and food within the dilated portion of the lumen. It was difficult to pass the endoscope through the cardia into the stomach.

Endoscopic evaluation on eighth day revealed normal mucosa of oesophagus (Fig. 40) and stomach (Fig. 41).

4.4.2.4 Dog A4

Oesophageal and gastric mucosa were found to be perfectly healthy with the normal pale (Fig. 42) and bright pink (Fig. 43) colours respectively. Partially digested mango kernel was found to be entrapped in between the rugal folds of the body of the stomach (Fig. 44).

Endoscopy could not be repeated on eighth day as the animal was subjected to natural service five days back.

4.4.2.5 Dog A5

Dilatation and sacculation of oesophagus towards its distal one third (Fig. 45) was noticed and there was accumulation of fluid and food within the dilated lumen. Oesophageal mucosa was pale and healthy, except for the presence of a nodule protruding into lumen from the dorsolateral wall of the oesophagus towards its distal one third (Fig. 46). Gastric mucosa was normal with bright pink colour (Fig. 47).

Endoscopic evaluation on eighth day revealed normal mucosa of oesophagus (Fig. 48) and stomach (Fig. 49).

4.4.2.6 Dog A6

Dilatation and sacculation of the oesophagus towards its distal half was noticed. There was accumulation of fluid and food within the dilated portion of the lumen (Fig. 50). The mucous membrane of oesophagus was pale and smooth and that of stomach was bright pink in colour and were free of any lesion (Fig. 51). There was difficulty in passing the endoscope through the cardia into the stomach.

Endoscopic evaluation on eighth day revealed normal mucosa of oesophagus (Fig. 52) and stomach (Fig. 53).

4.4.2.7 Dog A7

Dilatation of oesophagus along its entire length was noticed. There was accumulation of fluid and food within the dilated portion of the lumen (Fig. 54). Oesophageal mucosa was pale and smooth in appearance and gastric mucosa was bright pink in colour (Fig. 55).

Endoscopic evaluation on eighth day revealed normal mucosa of oesophagus (Fig. 56) and stomach (Fig. 57).

4.5 ENDOSCOPIC GUIDED BIOPSY

Biopsy sample was collected endoscopically using round cupped biopsy forceps from an oesophageal nodule in dog A5. As biopsy of oesophageal mucosa was difficult with the endoscopic forceps owing to its too tough nature, repeated attempts were tried to obtain sufficient tissue sample.

4.6 HISTOPATHOLOGICAL EXAMINATION

Histopathological examination of the endoscopically obtained tissue sections from the nodule on the dorsolateral wall of the distal third of the thoracic oesophagus in dog A5 showed fragments of neoplasm with strips of stratified squamous epithelium. Cells were polygonal with moderate amount of cytoplasm and

pleomorphic hyperchromatic nuclei and a few areas showed necrosis. These changes were suggestive of carcinomatous lesion (Fig. 58, Fig. 59).

4.7 ENDOSCOPIC FOREIGN BODY RETRIEVAL

In dog A1 the foreign body was a Chinese rubber ball and in A4 it was a partially digested mango kernel. In both the foreign bodies were retrieved successfully through endoscope with a basket retrieval device (Fig. 60, Fig. 61).

4.8 TREATMENT

4.8.1 Medical Treatment

Based on the endoscopic findings medical treatment was adopted in dogs A2, A3, A5, A6 and A7.

The dogs A3, A5, A6 and A7 were suffering from megaoesophagus and A2 had pyloric ulcer along with hypertrophy. Marked improvement was noticed in A3 and A5 with oral administration of neostigmine and gravity feeding. No regurgitation was reported in these dogs after one week of initiation of treatment.

In dogs A6 and A7 as serum T_4 level was lower than normal (Table 6), thyroxine supplementation was provided orally which could improve the condition in both.

In dog A2 for pyloric ulcer along with hypertrophy, triple therapy with amoxicillin- cloxacillin, metronidazole and pantoprazole was adopted which could yield remarkable recovery from the disease as indicated by endoscopic evaluation on

eighth day in which most of the gastric mucosal lesions had healed up except for mild ulcerative lesions around the pyloric opening.

4.8.2 Surgical Treatment

Since no improvement in the condition could be obtained with medical treatment in dog A6, contrast radiographic examination was conducted which revealed cardiac stricture. Cardiomyotomy was performed in this dog as surgical treatment.

4.8.2.1 Anaesthesia

Recovery from anaesthesia was smooth without any complication.

4.8.2.2 Technique

Cardiomyotomy could be conducted to allow adequate protrusion of oesophageal mucosa through the myotomy incision. The technique was performed without any complication.

4.8.2.3 Postoperative management

From fourth day onwards the dog was given milk and biscuits twice daily for three days and no regurgitation was noticed. On the seventh postoperative day, the dog was fed with cooked rice and milk, a part of which was vomited out five minutes after feeding. Gravity feeding was practised thereafter which reduced the frequency of vomiting.

Animal was having normal appetite throughout the period of observation. Later the owner reported that there was improvement in the condition of the animal, even though occasional vomiting still persisted.

The skin wound did not show any abnormal change during the postoperative period and good healing was noticed. The sutures were removed on 10th postoperative day.

4.8.2.4 Radiographic evaluation

Contrast radiography of the oesophagus and the stomach on 12th post operative day after 15 minutes and 30 minutes of barium sulphate administration revealed that the contrast material had emptied completely into the stomach (Fig. 62 and Fig. 63).

4.8.2.5 Endoscopic evaluation

Endoscopic evaluation on 15th postoperative day revealed areas of ulceration on the oesophageal mucosa towards its distal one third (Fig. 64). Endoscope could be passed through the cardia into the stomach without much difficulty. Mucosa of the stomach appeared normal and healthy with bright pink colour (Fig.65).

4.9 RESULTS OF TREATMENT

In dogs A1 and A4 gastric foreign bodies were retrieved successfully through endoscope with a basket retrieval device. Complete recovery from clinical signs and improvement in general condition of the dogs could be noticed one week after treatment.

Endoscopic evaluation in dog A1 revealed the normal bright pink colour to gastric mucosa. The dog A4 could not be subjected to endoscopy on eighth day as it elapsed only five days after natural service. But it was having normal bowel habits and improvement in general condition.

In dog A2, for pyloric ulcer along with hypertrophy, triple therapy with amoxicillin- cloxacillin, metronidazole and pantoprazole was adopted which could yield remarkable recovery from the disease as indicated by endoscopic evaluation on eighth day in which most of the gastric mucosal lesions had healed up except for mild ulcerative lesions around the pyloric opening. The treatment brought about complete recovery from clinical signs and improvement in general condition.

In dogs A3 and A5 with megaoesophagus marked improvement was noticed with oral administration of neostigmine and gravity feeding. No regurgitation was reported in these dogs after one week of initiation of treatment. Endoscopic evaluation on eighth day in both the dogs revealed normal oesophageal and gastric mucosa.

Cardiomyotomy performed in dog A6 was successful to relieve the stricture of cardia. Endoscopic evaluation on 15^{th} day after the surgical treatment revealed ulcerations on the distal third of oesophageal mucosa. Endoscope could be passed through the cardia into the stomach without much difficulty. Gastric mucosa appeared normal and healthy with bright pink colour. Administration of aluminum hydroxide, magnesium hydroxide and oxethazine preparation orally for a week could result in recovery from occasional vomiting.

In dogs A6 and A7 as serum T_4 level was lower than normal and thyroxine supplementation was provided orally which could improve the condition in both. Endoscopic evaluation on eighth day in dog A7 revealed normal mucosa of oesophagus and stomach.

Table 1. Clinical history of dogs under study

Sl. No.	Dog No.	Anorexia	Vomiting	Regurgitation	Defaecation
1	A1	_	+	_	_
2	A2	+	+	_	+
3	A3	_	_	+	+
4	A4	_	+	_	+
5	A5	_	_	+	+
6	A6	_	_	+	+
7	A7	_	_	+	+

+ Present _ Absent

Table 2. Observations on physiological parameters of dogs prior to endoscopic evaluation and after treatment (Mean $\pm$ S.E.) n = 7

Parameters	Before endoscopic evaluation	On eighth day of initiation of treatment
Respiration (breaths/ minute)	34.71 $\pm$ 5.75	33.57 $\pm$ 4.47
Pulse (per minute)	97.43 $\pm$ 4.85	95.43 $\pm$ 1.94
Rectal temperature (^{0}C)	38.93 $\pm$ 0.15	38.92 $\pm$ 0.10

Table 3. Observations on clinical signs of dogs on the day of presentation

Sl. No.	Dog No.	Mucous membrane	Dull	Active	Emaciated	Pain	Palpable mass
1	A1	Pale roseate	_	+	_	_	_
2	A2	Congested	+	_	+	+	_
3	A3	Pale	+	_	+	_	_
4	A4	Pale roseate	_	+	_	_	+
5	A5	Slightly congested	_	+	_	_	_
6	A6	Pale roseate	+	_	+	_	_
7	A7	Pale	+	_	+	_	_

+ Present _ Absent

Table 4. Observations on haematological parameters of dogs prior to endoscopic evaluation and after treatment (Mean ± S.E.) n = 7

Parameters	Before endoscopic evaluation	On eighth day of initiation of treatment
Haemoglobin concentration (g/dl)	13.57 ± 0.44	14.06 ± 0.49
Total Leukocyte count (10^3/cu.mm)	10.93 ± 5.68	10.75 ± 3.32
Volume of Packed Red cells (%)	40.63 ± 3.84	34.29 ± 2.78
Neutrophils (%)	77.57 ± 2.26	73.86 ± 1.22
Lymphocyte (%)	19.00 ± 1.80	22.00 ± 1.02
Monocytes (%)	3.00 ± 0.69	2.57 ± 0.53
Eosiniphils (%)	0.43 ± 0.20	1.57 ± 0.48
Basophils (%)	0	0

Table 5. Observations on serum biochemical evaluation prior to endoscopic evaluation and after treatment (Mean ± S.E.) n = 7

Parameters	**Before endoscopic evaluation**	**On eighth day of initiation of treatment**
Sodium (mEq/ L)	140.63 ± 0.98	142.86 ± 0.54
Potassium (mEq/L)	4.47 ± 0.22	4.98 ± 0.15
Chloride (mMol/L)	99.57 ± 0.64	100.87 ± 0.36
Blood Urea Nitrogen (mg %)	19.14 ± 3.17	15.93 ± 2.27
Creatinine (mg %)	0.86 ± 0.17	0.74 ± 0.14
Total Protein (g %)	5.44 ± 0.15	5.71 ± 0.14

Table 6. Observations on serum T_4 levels in dogs A6 and A7

Animal No.	**Serum T_4 level (µg/dl)**	**Normal serum T_4 level (µg/dl)**
A6	1.4	1.5 - 3.6
A7	1	

Table 7. The details of signalment, duration of illness, endoscopic findings and treatments given in the dogs under study

Dog No:	**Breed**	**Sex**	**Age**	**Colour**	**Body weight**	**Duration of illness**	**Endoscopic finding**	**Treatments adopted**
A1	Labrador retriever	Female	6 months	Yellow	20 kg	3 days	Gastric foreign body (Chinese ball)	Endoscopic retrieval
A2	Dalmatian	Female	7 years	Black and white	22 kg	12 days	Pyloric ulcer and hypertrophy	Medical treatment
A3	Great Dane	Male	9 years	Brindle	38 kg	10 days	Megaoesophagus (distal third)	Medical treatment
A4	Golden Retriever	Female	$2^1/_2$ years	Golden brown	26 kg	2 months	Gastric foreign body (partially digested mango kernel)	Endoscopic retrieval
A5	Labrador retriever	Male	1 year	Brown	31 kg	1 month	Megaoesophagus (distal third)	Medical treatment
A6	Non descript	Male	2 years	Grey	13 kg	10 days	Megaoesophagus (distal half)	Combined medical and surgical treatment (Cardiomyotomy)
A7	Non descript	Male	3 years	Black	12 kg	2 months	Megaoesophagus (throughout the entire length)	Medical treatment

Fig. 20. Skiagram of plain radiograph of lateral abdomen (A1)

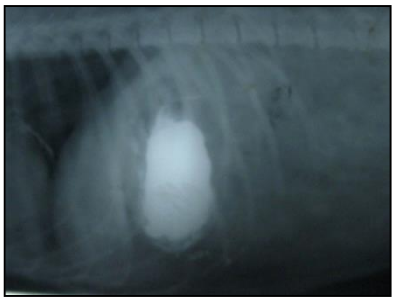

Fig. 21. Skiagram of contrast radiograph (after two and half hours, A2)

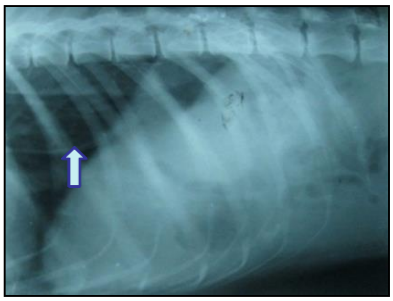

Fig. 22. Skiagram of plain radiograph (A3)

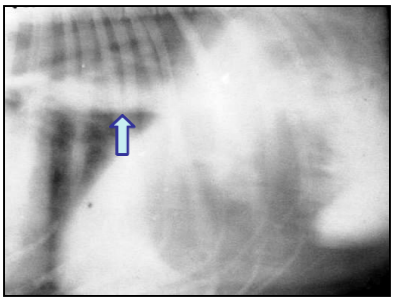

Fig. 23. Skiagram of contrast radiograph (immediate, A3)

Fig. 24. Skiagram of contrast radiograph (after five minutes, A5)

Fig. 25. Skiagram of contrast radiograph (immediate, A6)

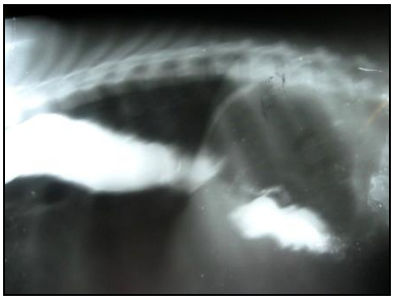

Fig. 26. Skiagram of contrast radiograph (after 15 minutes, A6)

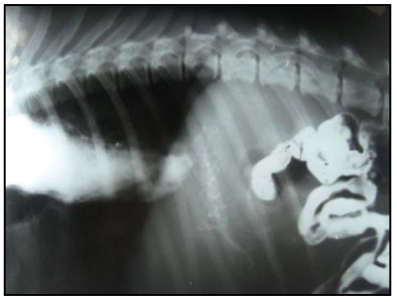

Fig. 27. Skiagram of contrast radiograph (after four hours, A6)

Fig. 28. Skiagram of contrast radiograph (after 10 minutes, A7)

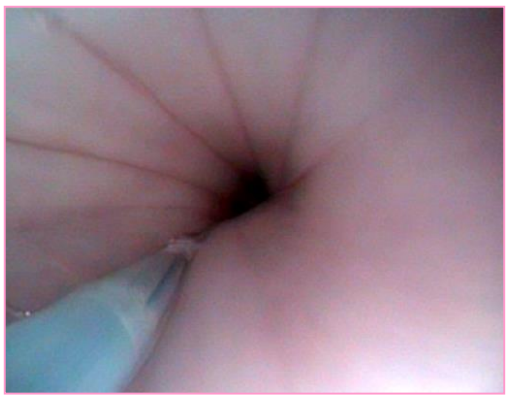

Fig. 29. Normal oesophageal mucosa (1st day, A1)

Fig. 30. Normal gastric mucosa (1st day, A1)

Fig. 31. Chinese ball in the stomach (1st day, A1)

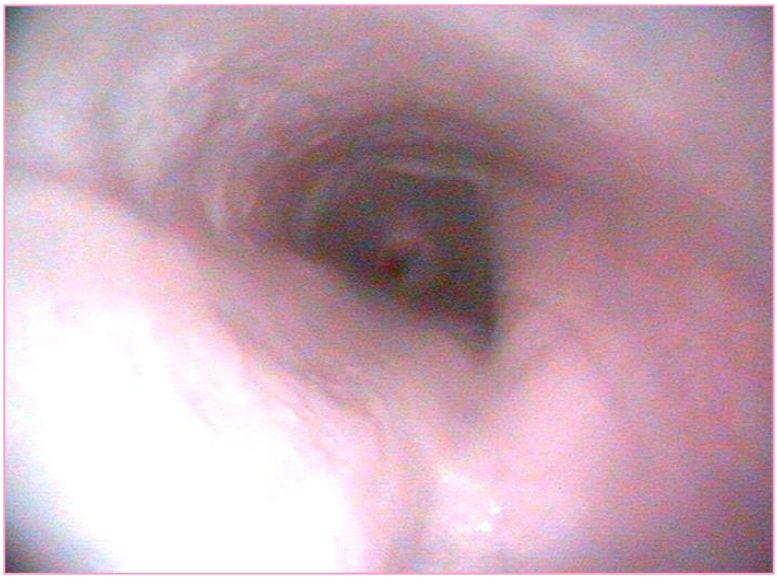

Fig. 32. Normal oesophageal mucosa (8th day, A1)

Fig. 33. Normal gastric mucosa (8th day, A1)

Fig. 34. Normal oesophageal mucosa (1st day, A2)

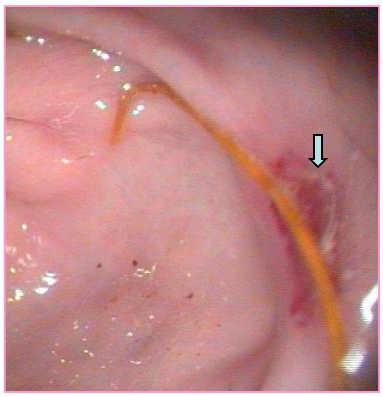

Fig. 35. Ulcer on gastric mucosa (1st day, A2)

Fig. 36. Ulcerations and mucosal hypertrophy at the pyloric region (1st day, A2)

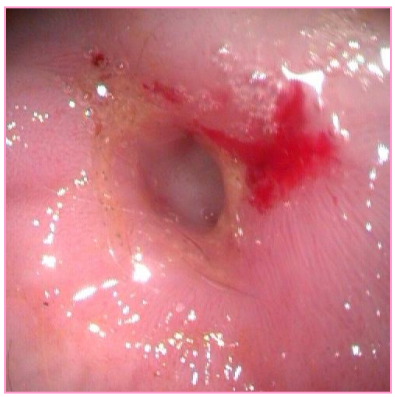

Fig. 37. Ulcers getting healed up (8th day, A2)

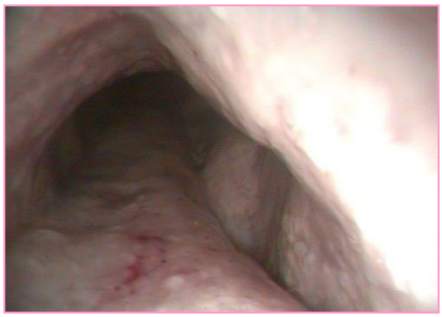

Fig. 38. Dilatation and sacculation of distal third of oesophagus (1st day, A3)

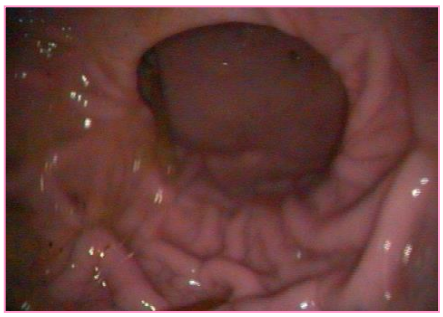

Fig. 39. Normal gastric mucosa (1st day, A3)

Fig. 40. Dilated terminal third of oesophagus with normal mucosa (8th day, A3)

Fig. 41. Normal gastric mucosa (8th day, A3)

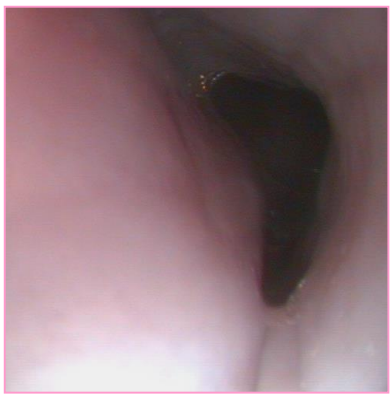

Fig. 42. Normal oesophageal mucosa (1st day, A4)

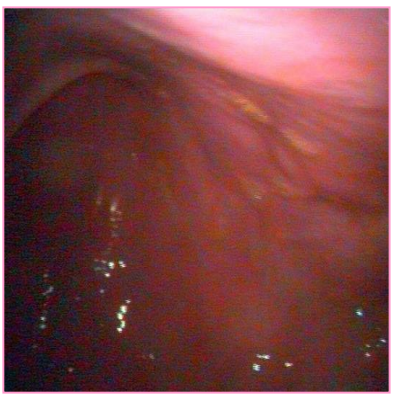

Fig. 43. Normal gastric mucosa (1st day, A4)

Fig. 44. Partially digested mango kernel in the stomach (1st day, A4)

Fig. 45. Dilatation and sacculation of distal third of oesophagus (1st day, A5)

Fig. 46. Nodule protruding into the oesophageal lumen (1st day, A5)

Fig. 47. Normal gastric mucosa (1st day, A5)

Fig. 48. Dilated oesophagus with normal mucosa (8th day, A5)

Fig. 49. Normal gastric mucosa (8th day, A5)

Fig. 50. Retention of fluid and food in the dilated oesophageal lumen (1st day, A6)

Fig. 51. Normal gastric mucosa (1st day, A6)

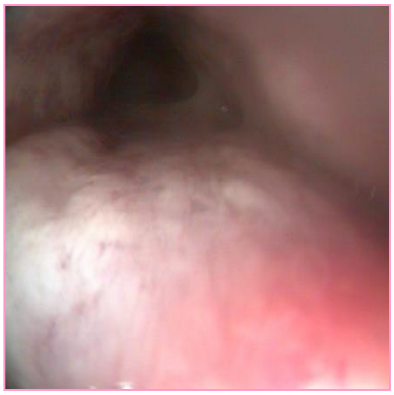

Fig. 52. Dilated oesophageal lumen with normal mucosa (8th day, A6)

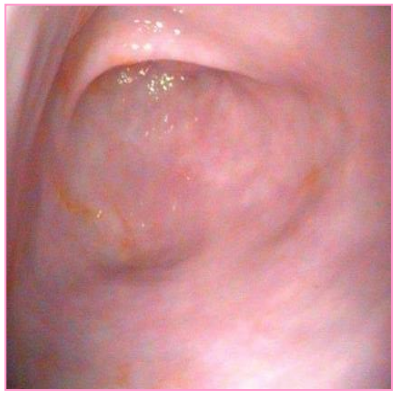

Fig. 53. Normal gastric mucosa (8th day, A6)

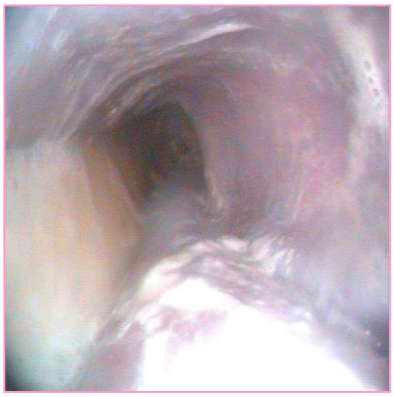

Fig. 54. Retention of fluid within the dilated lumen of oesophagus (1st day, A7)

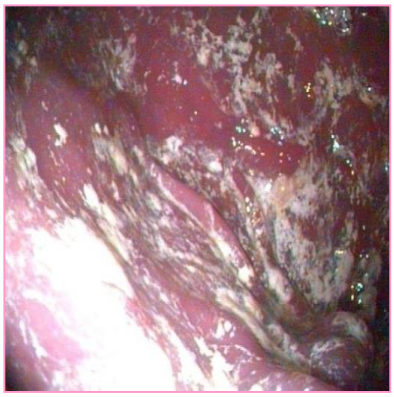

Fig. 55. Normal gastric mucosa, white marks denote barium sulphate (1st day, A7)

Fig. 56. Dilated oesophageal lumen with normal mucosa (8th day, A7)

Fig. 57. Normal gastric mucosa (8th day, A7)

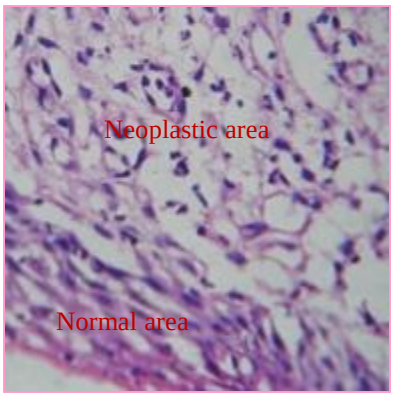

Fig. 58. Histopathology of oesophageal nodule (10x, A5)

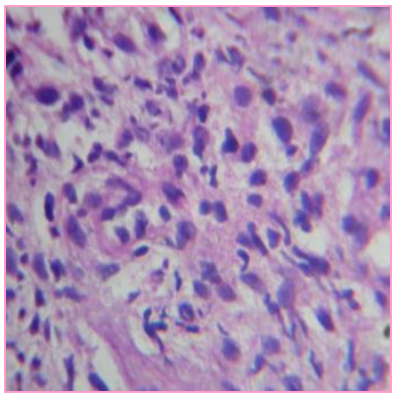

Fig. 59. Neoplastic area (40x, A5)

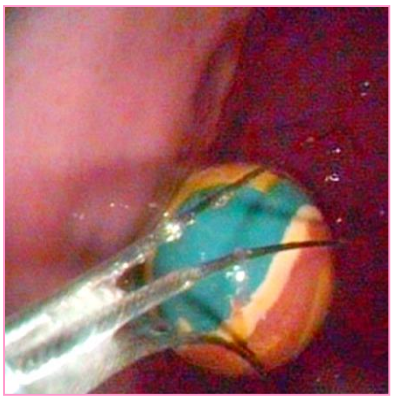

Fig. 60. Endoscopic retrieval of Chinese ball (1st day, A1)

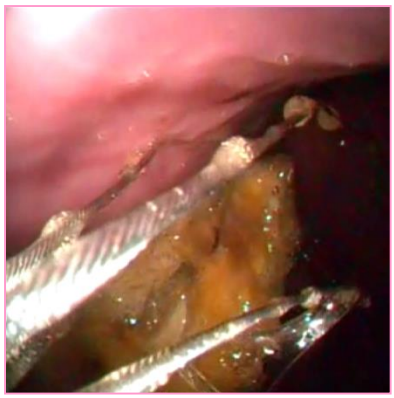

Fig. 61. Endoscopic retrieval of partially digested mango kernel (1st day, A4)

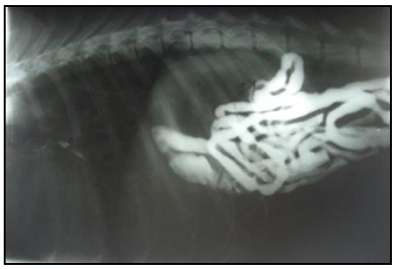

Fig. 62. Skiagram of contrast radiograph after 15 minutes (12th post operative day, A6)

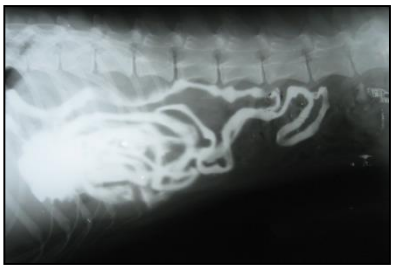

Fig. 63. Skiagram of contrast radiograph after 30 minutes (12th post operative day, A6)

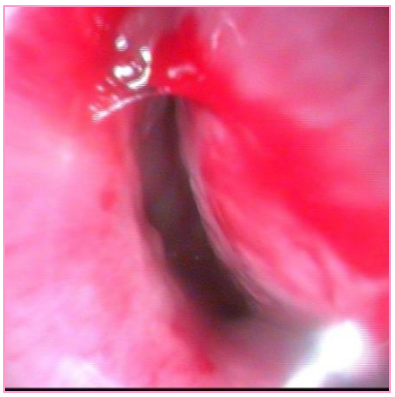

Fig. 64. Ulcers on distal third of oesophageal mucosa (15th postoperative day,A6)

Fig. 65. Normal gastric mucosa (15th post operative day, A6)

DISCUSSION

5. DISCUSSION

Vomiting or regurgitation and anorexia are the most frequent clinical signs of gastro-oesophageal disorders in dogs presented in veterinary clinics. The causes are umpteen that include functional or mechanical obstructions, parasitic or infectious diseases of gastrointestinal tract and other systemic diseases. Early and accurate diagnosis of the underlying cause is mandatory to adopt a targeted treatment in these conditions. Endoscopy has transformed the diagnostic and therapeutic approach in gastro-oesophageal disorders in small animals as it enables direct visualization of the mucosal and luminal lesions. In addition it allows to obtain biopsy samples and retrieval of foreign bodies without recourse to surgery and the procedure is non-invasive as well.

The study was conducted with the objective of assessing the efficacy of endoscopy as a diagnostic technique in oesophageal and gastric disorders in dogs and to adopt appropriate treatment measures for the management of such conditions. In the present study seven clinical cases of dogs in different breeds and age groups of either sex with the history of off-feed, regurgitation or chronic vomiting presented to the Veterinary Hospitals of College of Veterinary and Animal Sciences at Mannuthy and Kokkalai formed the subjects of study. These animals were subjected to endoscopic evaluation of oesophagus and stomach, clinical, haematological, biochemical and pathological investigations and subsequently appropriate treatment measures were adopted.

5.1 MAIN ITEMS OF OBSERVATION

5.1.1 Signalment

Out of the seven dogs selected for the study there were two Labrador Retriever, one Dalmatian, one Great Dane, one Golden Retriever and two nondescript dogs. Gastric foreign body in a Labrador Retriever and a Golden Retriever, pyloric ulcer with hypertrophy in a Dalmatian and megaoesophagus in a Labrador Retriever, a Great Dane and two nondescript dogs were diagnosed. Gastric foreign body as the cause of gastric disorder was reported by Campbell and Leib (1993) in a female Golden Retriever (bottle caps) and McCarthy (2008) in a male Labrador Retriever (rubber ball). Washabau (2001) had reported an increase in breed incidence of megaoesophagus in Irish Setter, Great Dane, German Shepherd, Labrador Retriever, Chinese Sher Pei and Newfoundland.

The age of the dogs ranged from six months to nine years with the majority of the animals below three years. Gastric foreign body was found in dogs with age of six months and two and half years. The higher incidence of gastrointestinal tract obstruction in young dogs could be attributed to their voracious and indiscriminate feeding (Kumar and Tayal, 1994). The age of dogs with megaoesophagus condition ranged from one year to nine years. No sex predisposition related to the incidence of gastric/oesophageal disorders was observed among the animals in this study (three female and four male).

5.1.2 History

The main clinical symptoms noticed in the dogs were chronic vomiting, regurgitation or anorexia as observed by Sullivan and Miller (1985). The vomitus

contained undigested food materials in dogs suffering from megaoesophagus (A3, A5, A6, A7) and this observation was in agreement with the finding of Jain and Tayal (2008). Out of the seven dogs, four had the history of previous treatment (A2, A3, A5, and A7). The duration of illness ranged from three days to two months.

5.1.3 Physiological Parameters

The respiratory rate, pulse rate and rectal temperature were within normal physiological range in all the dogs before endoscopic evaluation and on eighth day of initiation of treatment.

5.1.4 Clinical Observations

Among the seven dogs examined, four were dull and emaciated on the day of presentation (A2, A3, A6, A7). Jain and Tayal (2008) reported megaoesophagus in a nondescript bitch in which the affected dog was weak and emaciated. The dogs having gastric foreign body obstruction were active and in good body condition (A1 and A4). McCarthy (2008) reported gastric foreign body obstruction in which the affected dog was active and asymptomatic.

Pain on palpation of the epigastric region of abdomen was observed in the dog with pyloric ulcer and hypertrophy (A2). Bellenger *et al*. (1990) observed that clinical signs referable to the diagnosis of chronic hypertrophic pyloric gastropathy were vomiting, weight loss, lethargy, anorexia and abdominal pain. Ritcher (1992a) reported that gastrointestinal ulceration in dogs could lead to abdominal pain, depression and anorexia.

A palpable mass could be detected in the anterior abdominal region in dog A4 which was having gastric foreign body obstruction. Devanand *et al.* (2005) had reported gritty feeling on palpation of the anterior quadrant of the abdomen in gastric foreign body obstruction due to oyster shells in a pup.

5.2 HAEMATOLOGICAL PARAMETERS

5.2.1 Routine Haemogram

The observations on haematological parameters of the affected animals were within the normal physiological range. The mean haemoglobin concentration was found to be lower prior to endoscopic evaluation compared to the value on eighth day of initiation of treatment. The mean total leukocyte count was greater with mild degree of neutrophilia prior to endoscopic evaluation. The mean volume of packed red cells before endoscopic evaluation was significantly greater than on eighth day of initiation of treatment which could be attributed to dehydration resulted from chronic vomiting (Bellenger *et al*., 1990). Davies and Leib (1999) reported gastric foreign body obstruction in a 13 year old spayed female Border Collie where haematological and serum biochemical observations revealed normal results even though there was prolonged, intermittent vomiting associated with the condition.

5.2.2 Serum Biochemical Studies

Serum biochemical studies revealed that the mean values of serum sodium, potassium, chloride, total protein, blood urea nitrogen and creatinine prior to endoscopic evaluation and on eighth day of initiation of treatment were within normal range. However the mean values of serum sodium, potassium, chloride and total

protein were lower prior to endoscopic evaluation compared to the values on eighth day of initiation of treatment.

The values of blood urea nitrogen and serum creatinine concentration were higher prior to endoscopic evaluation. This could be attributed to impaired urine output resulted from fluid loss consequent to chronic vomiting.

Lowered serum T_4 level in dogs A6 and A7 revealed that they were suffering from hypothyroidism which could be one of the causes of megaoesophagus. Washabau (2001) recommended to investigate routine haematology, serum biochemistry and urinalysis to confirm possible secondary causes of megaoesophagus like hypothyroidism, hypoadrenocorticism etc.

5.3 RADIOGRAPHIC EVALUATION

Radiographic evaluation was performed in dogs A1, A2, A3, A5, A6 and A7. Lateral survey radiography was helpful in arriving at diagnosis of gastric foreign body (A1). Contrast radiography was performed wherever plain radiography was inadequate for the proper diagnosis (megaoesophagus and delayed gastric emptying).

Lateral survey radiography was adequate to confirm the presence of a rubber ball in the stomach of dog A1. Rivers (1981) also reported gastric foreign body obstruction caused by a screw driver in a Beagle which was diagnosed by plain radiographic examination.

Contrast radiography was performed in five dogs (A2, A3, A5, A6 and A7) and it was helpful in diagnosing megaoesophagus in dogs A3, A5, A6 and A7. Similar observations in dogs were reported by Gualtieri (2001), Jain and Tayal (2008)

and Ponnuswamy *et al*. (2008). In dog A2 contrast radiography of gastrointestinal tract revealed presence of barium sulphate in the stomach and it retained at the area of pyloric antrum even after two and half hours of administration, suggestive of delayed gastric emptying. Lamb (1999) suggested crude assessment of gastric emptying using contrast radiography and gastric emptying times for liquids including barium suspension, were relatively short, normally about one hour in cat and up to three hours in adult dog.

5.4 ENDOSCOPIC EVALUATION

5.4.1 Anaesthesia

Anaesthesia using ketamine after atropine and xylazine premedication and maintenance of anaesthesia using diazepam and xylazine-ketamine mixture provided sufficient anaesthetic depth and muscle relaxation for the endoscopic procedure in all dogs.

5.4.2 Endoscopic Findings

Endoscopic evaluation was helpful in identifying the presence of foreign bodies in the stomach in dogs A1 and A4. In both the cases gastric mucosa was healthy and had the normal bright pink colour. Campbell and Leib (1993) pointed out that endoscopy enabled detection of bottle caps in the stomach of a dog and moderate erosions could be noticed around the area where the bottle caps had been located. In dog A2 endoscopy helped in direct visualization of pyloric ulcer and hypertrophy. Contrast radiographic examination in this dog helped to diagnose delayed gastric emptying, but endoscopy could confirm the underlying cause for this condition. This was in accordance with the finding of Happe *et al.* (1981) where

gastroscopic examination revealed mucosal proliferations in dogs suffering from hypertrophic gastritis of the pyloric antrum. In dogs A3, A5, A6 and A7 endoscopy together with contrast radiographic examination was adequate to diagnose megaoesophagus condition. Burrows (1987) reported reversible megaoesophagus in nine month old male Sher Pei with hypoadrenocorticism where endoscopy could confirm generalized oesophageal dilatation. In dog A5 a nodule protruding into the oesophageal lumen from the dorsolateral wall of the distal third of thoracic oesophagus could be detected endoscopically which was not recognized by contrast radiography.

5.5 ENDOSCOPIC GUIDED BIOPSY

Biopsy samples were collected endoscopically from the oesophageal nodule in A5 using round cupped forceps.

5.6 HISTOPATHOLOGICAL EXAMINATION

Histopathological examination of the biopsy sample in A5 revealed it as carcinomatous lesion. Hamilton and Carpenter (1994) reported oesophageal plasmacytoma in a dog where oesophagoscopy helped to diagnose the condition and obtain samples for histological examination.

5.7 ENDOSCOPIC FOREIGN BODY RETRIEVAL

In dogs A1 and A4 gastric foreign bodies were retrieved endoscopically using a six wired basket retrieval device. Campbell and Leib (1993) reported endoscopic removal of bottle caps from the stomach of a Golden Retriever using basket forceps.

McCarthy (2008) reported laparoscopic removal of a rubber ball from the stomach of Labrador Retriever.

5.8 TREATMENT

5.8.1 Medical Treatment

In dog A2 with pyloric ulcer and hypertrophy medical management with amoxicillin-cloxacillin, metronidazole and pantoprazole was adopted which resulted in remarkable recovery from the condition. Ayali and Simpson (1999) suggested a treatment combination with amoxicillin (20 mg/kg administered orally twice daily for 14 days), metronidazole (20 mg/ kg administered orally twice daily for 14 days) and famotidine (0.5 mg/kg administered orally twice daily for 14 days) could achieve good results for *helicobacter* gastritis in dogs.

In dogs A3, A5 and A7 with megaoesophagus medical treatment with oral administration of neostigmine at the dose rate of 0.5 mg/kg body weight along with gravity feeding resulted in symptomatic relief from the condition. In dogs A6 and A7, serum T4 level was lower than normal and thyroxine was supplemented orally which could improve the condition in both. Washabau (2001) recommended treatment of dogs with megaoesophagus due to myasthenia gravis using pyridostigmine (1-3 mg/ kg body weight twice daily orally) and/ or corticosteroids, hypothyroidism using levothyroxine (0.22 mcg/kg body weight twice daily orally) and polymyositis using prednisolone (1-2 mg/kg body weight twice daily orally). Affected dogs were fed from an elevated or upright position to take advantage of the gravity drainage through a nonperistaltic oesophagus. The beneficial effect of this treatment might be due to an increase in contraction amplitude and the appearance of

motor activity in a previously nonfunctioning portion of oesophageal segment following administration of cholinomimetic drugs (Diamant *et al.*, 1974).

5.8.2 Surgical Treatment

In dog A6 with megaoesophagus, the medical treatment was not successful, hence cardiomyotomy was performed as surgical treatment which helped to improve the condition.

Endoscopic evaluation on 15th day after the surgical treatment revealed ulcerations on the distal third of oesophageal mucosa which might be due to gastro-oesophageal reflux subsequent to cardiomyotomy. Bennet (1980) also noticed similar finding in dogs which underwent cardiomyotomy as a treatment for achalasia. Administration of aluminum hydroxide, magnesium hydroxide and oxethazine preparation orally for a week could give favourable result.

5.9 RESULT OF TREATMENT

In dogs A1 and A4 gastric foreign bodies were retrieved endoscopically using a six wired basket retrieval device. Campbell and Leib (1993) reported endoscopic removal of bottle caps from the stomach of a Golden Retriever using basket forceps.

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SUMMARY

6. SUMMARY

The study was conducted with the objective of assessing the efficacy of endoscopy as a diagnostic technique in oesophageal and gastric disorders in dogs and to adopt appropriate treatment measures for the management of such conditions. Seven dogs of either sex, belonging to different breeds and age groups presented to the Veterinary Hospitals of the College of Veterinary and Animal Sciences at Mannuthy and Kokkali with the history of reduction in food intake, regurgitation or chronic vomiting formed the subject of the study. The dogs were serially numbered as A1, A2, A3, A4, A5, A6 and A7. They were subjected to clinical, haematological, biochemical investigations and radiological and endoscopic evaluation of oesophagus and stomach and subsequently appropriate treatment measures were adopted.

Out of the seven dogs studied, two (A1, A4) had gastric foreign body obstruction, one (A2) had pyloric ulcer with hypertrophy and four had (A3, A5, A6, A7) megaoesophagus. The gastric foreign bodies were a Chinese rubber ball and a partially digested mango kernel. Among the dogs with megaoesophagus, two dogs (A3, A5) had dilatation at the distal third of oesophagus, in one dog (A6) the distal half was dilated and in one (A7) the oesophagus was dilated throughout the entire length.

The breeds affected were Labrador Retriever (2), Dalmatian (1), Great Dane (1), Golden Retriever (1) and non descript (2). Gastric foreign body in a Labrador Retriever and a Golden Retriever, pyloric ulcer with hypertrophy in a Dalmatian and megaoesophagus in a Labrador Retriever, a Great Dane and two non-descript dogs were diagnosed. Among the dogs, three were female and four were male. The age of the dogs ranged from six months to nine years with a mean

age of 3.57 ± 1.21 years. Gastric foreign body was found in dogs with age six months and two and half years and both of them were female. Megaoesophagus condition was noticed only in male dogs. The body weight of dogs ranged from 12 kg to 38 kg with a mean of 23.14 ± 3.34 kg.

The main clinical symptoms noticed in the dogs were chronic vomiting, regurgitation or anorexia. In three of the cases vomitus was yellowish in colour (A2, A3, A6) and vomitus contained undigested food materials in dogs suffering from megaoesophagus (A3, A5, A6, A7). In A3, A5 and A7 vomiting was noticed immediately after food intake and in A6 it was after 10 to 30 minutes following feeding. Among the seven dogs, four had the history of previous treatment (A2, A3, A5, and A7). The duration of illness ranged from three days to two months.

Out of the seven dogs, four were dull and emaciated (A2, A3, A6, A7) on the day of presentation. The dogs having gastric foreign body obstruction were active and in good body condition (A1 and A4). Pain on palpation of the epigastric region was observed in dog with pyloric ulcer and hypertrophy (A2). A palpable mass could be detected in the anterior abdominal region in dog A4 which was having gastric foreign body obstruction.

In all the seven dogs examined the respiratory rate, pulse rate and rectal temperature were within normal limits before endoscopic evaluation and on eighth day of initiation of treatment.

The observations on haematological parameters of the affected animals were within the normal physiological range. The mean haemoglobin concentration

was found to be lower prior to endoscopic evaluation compared to the value on eighth day of initiation of treatment. The mean total leukocyte count was greater with mild degree of neutrophilia prior to endoscopic evaluation. The mean volume of packed red cells before endoscopic evaluation was significantly greater than on eighth day of initiation of treatment which could be attributed to dehydration resulted from chronic vomiting.

Serum biochemical evaluation revealed that the mean values of serum sodium, potassium, chloride, total protein, blood urea nitrogen and creatinine prior to endoscopic evaluation and on eighth day of initiation of treatment were within normal range. Serum T_4 estimation in dogs A6 and A7 revealed that they were suffering from hypothyroidism which could be the cause of megaoesophagus.

Radiographic evaluation was performed in dogs A1, A2, A3, A5, A6 and A7. Left lateral position for oesophagus and stomach and right lateral position for pylorus were adopted for radiography. Plain radiography was adequate to confirm the presence of a rubber ball in the stomach of dog A1. Contrast radiography was performed in five dogs (A2, A3, A5, A6 and A7) and it was helpful in diagnosing megaoesophagus in dogs A3, A5, A6 and A7. In dog A2 contrast radiographic examination of gastrointestinal tract revealed presence of barium sulphate in the stomach and it retained at the area of pyloric antrum even after two and half hours of administration, suggestive of delayed gastric emptying.

Endoscopic examination was done under general anaesthesia in all the dogs before treatment and on eighth day of initiation of treatment. It helped in direct visualization of oesophageal and gastric mucosa. In gastric foreign body obstruction in dogs A1 and A4, the foreign bodies were retrieved endoscopically using six wired basket retrieval device. Contrast radiographic examination in dog

A2 helped to diagnose delayed gastric emptying, but endoscopy could confirm the underlying cause for this condition. In case of megaoesophagus (A3, A5, A6, A7) dilatation of oesophagus and retention of fluid and food within the dilated lumen was detected by endoscopy. In dog A5 a nodule protruding into the oesophageal lumen from the dorsolateral wall of the distal third of thoracic oesophagus could be detected endoscopically. Biopsy sample was obtained from the nodule using round cupped forceps and histopathological examination showed fragments of neoplasm with strips of stratified squamous epithelium. Cells were polygonal with moderate amount of cytoplasm and pleomorphic hyperchromatic nuclei and a few areas showed necrosis. These changes were suggestive of carcinomatous lesion.

Medical treatment was adopted in dogs A2, A3, A5, A6 and A7. In dog A2 with pyloric ulcer and hypertrophy, medical management with amoxicillin-cloxacillin, metronidazole and pantoprazole was adopted which resulted in remarkable recovery from the condition. In dogs A3, A5 and A7 with megaoesophagus medical treatment with oral administration of neostigmine along with gravity feeding were followed which resulted in symptomatic relief from the condition. In dogs A6 and A7, serum T_4 level was lower than normal and thyroxine was supplemented orally which could improve the condition in both.

Medical treatment using neostigmine could achieve clinical cure in all the dogs except A6 where contrast radiographic examination revealed a cardiac stricture. Cardiomyotomy was performed as surgical treatment through abdominal approach with resection of 12^{th} rib to correct the condition.

Postoperatively antibiotics and fluids were administered and subsequently supported by oral feeding with milk and biscuits for three days and milk and

cooked rice in the following days. Gravity feeding was advised when vomiting was observed while feeding with cooked rice and milk, which could reduce the occurrence of vomiting. Contrast radiography of the oesophagus and the stomach (left lateral view) on 12th postoperative day after 15 minutes and 30 minutes of barium sulphate administration revealed that the contrast material had emptied completely into the stomach. Endoscopic evaluation of oesophagus and stomach was performed on 15th postoperative day which revealed ulcerations on the distal third of oesophageal mucosa. Mucosa of the stomach appeared normal and healthy with bright pink colour. Administration of aluminum hydroxide, magnesium hydroxide and oxethazine preparation orally for a week could obtain cure from vomiting.

The following conclusions were drawn from the study:

- Endoscopy should be considered as a reliable method for the evaluation of oesophagus and stomach in dogs suffering from chronic vomiting, since it could enable direct visualization of oesophageal and gastric mucosa for identifying underlying lesions.

- Anaesthesia using ketamine, after atropine and xylazine premedication and maintenance of anaesthesia using diazepam and xylazine-ketamine mixture was adequate to provide sufficient anaesthetic depth and muscle relaxation for the endoscopic procedure and surgery.

- Endoscopy also could help in collection of biopsy sample from a nodular lesion in the oesophagus.

- In megaoesophagus conditions endoscopy could reveal dilatation and sacculation of oesophagus. In certain cases accumulation of fluid and food could also be detected with in the dilated lumen.

- Endoscopy enabled retrieval of gastric foreign bodies and thereby surgical intervention and subsequent postoperative management could be avoided.

- Contrast radiographic examination was adequate to diagnose delayed gastric emptying, but endoscopy could confirm the underlying cause for the condition.
- Medical treatment along with gravity feeding was helpful to cure symptoms associated with uncomplicated cases of megaoesophagus.
- Cardiomyotomy as a satisfactory surgical treatment could relieve the symptoms in megaoesophagus associated with stricture of cardia.

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ENDOSCOPIC EVALUATION OF OESOPHAGEAL AND GASTRIC DISORDERS AND ITS MANAGEMENT IN DOGS

LEKSHMI. V.

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Faculty of Veterinary and Animal Sciences
Kerala Agricultural University, Thrissur

2009

Department of Veterinary Surgery and Radiology
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
MANNUTHY, THRISSUR-680651
KERALA, INDIA

ABSTRACT

Endoscopic evaluation of oesophagus and stomach was conducted in seven dogs of either sex, belonging to different breeds and age groups presented to the Veterinary Hospitals of the College of Veterinary and Animal Sciences at Mannuthy and Kokkali, with the history of reduction in food intake, regurgitation or chronic vomiting. The incidence, clinical signs, haematological and serum biochemical changes, radiographic and endoscopic observations, efficacy of treatment adopted and postoperative management were studied.

The incidence of gastro-oesophageal disorders was more in Labrador Retriever and non descript dogs. The age of the dogs ranged from six months to nine years with a mean age of 3.57 $\pm$ 1.21 years. Gastric foreign body was found in dogs with age six months and two and half years and both of them were female. Megaoesophagus condition was noticed only in male dogs. The body weight of dogs ranged from 12 kg to 38 kg with a mean of 23.14 $\pm$ 3.34 kg.

The prominent clinical signs observed were chronic vomiting, regurgitation or anorexia. Vomitus contained undigested food materials and vomiting was noticed immediately or 10 to 30 minutes after food intake in those dogs suffering from megaoesophagus. Among the dogs examined, four were dull and emaciated. The dogs with gastric foreign body obstruction were active and in good body condition. Pain on palpation of abdomen was observed in the dog with pyloric ulcer and hypertrophy. Palpable mass could be detected in the upper half of the left anterior abdominal region in one dog with gastric foreign body obstruction.

The physiological, haematological and serum biochemical parameters were within normal range in all the animals prior to endoscopic evaluation and on eighth day of initiation of treatment. Serum T4 estimation revealed hypothyroidism in two cases of megaoesophagus.

The different conditions included gastric foreign body obstruction (2), pyloric ulcer along with hypertrophy (1) and megaoesophagus (4) and were diagnosed by radiographic (plain and contrast) and endoscopic examination. Foreign bodies were retrieved by endoscopy, pyloric ulcer and megaoesophagus were treated medically.

In a non-responsive condition of megaoesophagus due to stricture of cardia, cardiomyotomy was performed as surgical treatment. Postoperatively the animal was managed by fluid therapy for three days and antibiotic for seven days. The skin sutures were removed on 10^{th} postoperative day. On 15^{th} day, endoscopic evaluation revealed ulcerations on the distal third of oesophageal mucosa due to gastro-oesophageal reflux. Administration of aluminum hydroxide, magnesium hydroxide and oxethazine preparation orally for a week could give favourable result.

The appropriate treatment measures adopted *viz*. endoscopic, medical and surgical were satisfactory to obtain substantial cure from the conditions in all the dogs and the results of treatments were evaluated endoscopically.