ENDOSCOPIC DIAGNOSIS AND THERAPEUTIC APPROACHES OF THE UPPER DIGESTIVE TRACT IN ANIMALS

Debashish Sarker

Registration No.: 818

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A thesis submitted in the partial fulfillment of the requirements for the degree of Master of Science in Surgery

Department of Medicine and Surgery

Faculty of Veterinary Medicine

Chattogram Veterinary and Animal Sciences University

Chattogram-4225, Bangladesh

June, 2022

Authorization

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Debashish Sarker

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This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made

……
Supervisor
Prof. Dr. Bibek Chandra Sutradhar
Department of Medicine and Surgery
Chattogram Veterinary and Animal Sciences University, Bangladesh

……
Co-supervisor
Prof. Dr. Bhajan Chandra Das
Department of Medicine and Surgery
Chattogram Veterinary and Animal Sciences University, Bangladesh

……
Chairman of the Examination Committee
Prof. Dr. Azizunnesa
Head of the Department of Medicine and Surgery
Chattogram Veterinary and Animal Sciences University

Department of Medicine and Surgery, Faculty of Veterinary Medicine
Chattogram Veterinary and Animal Sciences University
Chattogram-4225, Bangladesh
June, 2022

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The Author

June, 2022

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List of Abbreviations and Symbols

Abbreviation	Elaboration
CVASU	Chattogram Veterinary and Animal Sciences University
SAQTVH	Shahidul Alam Quadery Teaching Veterinary Hospital
GI	Gastrointestinal
CT	Computed Tomography
MRI	Magnetic Resonance Imaging
IBD	Inflammatory Bowel Disease
CCU	Camera Control Unit
UES	Upper Esophageal Sphincter
GERD	Gastroesophageal Reflux Disease
LES	Lower Esophageal Sphincter
mg	Milligram
kg	Kilogram
Hb	Hemoglobin
ESR	Erythrocyte Sedimentation Rate
TEC	Total Erythrocyte Count
TLC	Total Leucocyte Count
PCV	Packed Cell Volume
TP	Total Protein
BG	Blood Glucose
ASA	American Society of Anesthesiologists
GABA	γ-Aminobutyric Acid
µg	Microgram
gm	Gram
dl	Deciliter
mm	Millimeter
hr	Hour
IM	Intramuscular
SC	Subcutaneous
IV	Intravenous
ECG	Electrocardiogram
Fr	French gauge
PEG	Percutaneous Endoscopic Gastrostomy
AIPC	Association for Professionals in Infection Control
SGNA	American Society for Gastrointestinal Endoscopy and the Society of Gastrointestinal Nurses and Associates

HLD	High Level Disinfectant
OPA	Ortho Phthal Aldehyde
FBO	Foreign Body Obstruction
℉	Degree Fahrenheit
EDTA	Ethylene Diamine Tetra Acetic Acid
SD	Standard Deviation
%	Percentage
<	Less Than
>	Greater Than
≤	Less Than or Equal To
et al.	And His Associates
MS	Master Of Science

Abstract

Flexible endoscopy is a minimally invasive technique of the visualization, investigation and biopsy of gastrointestinal (GI) tract. Practicing gastroscopy in small animals is still apparently new in Bangladesh. Diagnostic implications include the evaluation of structural abnormalities, inflammatory conditions, intraluminal masses, injuries, and foreign bodies (FB). Due to difficulties of visual examination of the upper GI tract, various diseases of the GI system remain undiagnosed. The aim of this study was to diagnosis and management of complications in upper GI tract by minimally invasive method in appropriate anesthesia. In addition, to determine the digestive health of an animal compared with its history and physical examination. The present study was conducted on 30 animals (10 goats, 10 dogs and 10 cats) during July 2021 to March 2022. Depending on the conditions of the animal, all goats (n=10) were sedated with diazepam while, most of the dogs (n=8) and few number of cats (n=4) were gone for general anesthesia with xylazine premedication and few dogs (n=2) and most cats (n=6) were without premedication. Ketamine was administered in a dog and four cats, a combination of ketamine with diazepam was used in six dogs and a cat and propofol was administered in three dogs and five cats. The fasting duration in goats, the time of hospitalization and procedural time in dogs and cats were statistically significant ($P \leq 0.05$) in subgroups. Gastroscopy broadly 80% of goats (n=8), 40% of dogs (n=4) and 80% of cats (n=8) had normal ruminal or gastric mucosal appearance; 20% of goats had abnormal ruminal nature, mild to moderate gastritis obtained on 50% of dogs and 10% of cats, and severe gastritis documented on 10% of dogs and cats. Therapeutically, 80% of the FB in cats (n=4/5) were successfully retrieved by endoscope. On endoscopic examination, 30% of dogs and 50% of cats were diagnosed as healthy with history of anorexia or FB obstruction while, 20% of dogs had gastritis without clinical illness. All animals returned to its normal behavior with minimum difficulties.

Keywords: Flexible endoscopy, anesthesia, foreign body, gastritis, animals.

Chapter- 1: Introduction

The word ‘endoscopy’ comes from the Greek ‘Endon’ means inside and ‘Skopeo’ means to look at. With the help of an endoscope, a medical practitioner has gained the ability to look inside cavities and viscera. The first endoscope came from Bozzini, a German urologist in 1806. He used concave mirrors and candle light to allow examination of the bladder through a hollow tube, called the ‘Lichtleiter’ (light conductor) (Schwab and Singh, 2011). The first clinically useful fiber optic endoscope was constructed by Curtiss et al. 1957 and used by Hirschowitz et al. 1958 at the University of Michigan Hospital (McBride et al., 1983).

Pathological alterations to internal organs can be detected using specific imaging techniques, such as radiography, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and endoscopy. The most common practice is to examine patients using X-ray and ultrasound to determine the origin of the disorder for both logistical and economic constraints. Endoscopy is used in veterinary medicine for diagnostic, therapeutic and prophylactic purposes. The visualization of organ surfaces in vivo enabled rapid evaluation of pathological changes and the ability to display the features in natural and color authentic way offered advantages over other imaging techniques such as ultrasonography or radiography. Endoscopy was minimally invasive and caused less trauma and pain in comparison to conventional surgical intervention; it also permitted diagnosis and therapy to be undertaken at the same time (Franz et al., 2006).

There are two types of endoscopes, one is rigid and another one is flexible endoscope. Rigid endoscopes are commonly used in minimally invasive surgical procedures like rhinoscopy, thoracoscopy, cystoscopy, vaginoscopy, urethroscopy, arthroscopy, theloscopy, laparoscopy, otoscopy and endoscopy in birds, reptiles and amphibians. Flexible endoscopes comprise bundle of optical fibers which can bend various direction and transmit light with clear image. It is commonly used in nasopharyngoscopy, tracheoscopy, bronchoscopy, esophagoscopy, gastroscopy, gastroduodenoscopy, colonoscopy and male animal urethrocystoscopy.

Gastroscopy is the most common flexible endoscopic procedure performed in veterinary practice. There are many cases seen in small and large animal practices that

could benefit from earlier diagnosis of GI disorders. Various digestive disorders (e.g., mucosal inflammation, inflammatory small bowel disease, GI neoplasia, malignant catarrhal fever, esophageal obstruction, structural changes in esophagus, recurrent tympany, abomasal ulcer, abomasal displacement) in small and large animals requires gastroscopy for definitive diagnosis. Endoscopy is highly efficient in retrieval of gastric foreign bodies. It can also be used as, placement of a stomach tube, serial biopsy of ruminal papillae or reticular mucosa, observation of physiological events in fore stomach (McBride et al., 1983; Sasikala et al., 2017; Sasikala et al., 2019).

Flexible Endoscopy is widely used in the diagnosis of diseases of the respiratory tract in cattle (Cohen et al., 1991), but there are only a few reports on the use of oesophagoscopy (Franz & Baumgartner, 2002). In small ruminants, endoscopy of the respiratory tract is rarely mentioned although the endoscopic diagnosis of nasal adenocarcinoma and adenopapilloma (Rings & Robertson, 1981) and laryngeal chondritis in sheep (Lane et al., 1987) have been reported. There are few reports detailing the normal appearance of the respiratory tract and esophagus of small ruminants (Stierschneider et al., 2007). Endoscopy in small animals were widely used for gastrointestinal observation (Hall, 2015). The technique of gastroscopy for diagnosis of gastric disorders and therapeutic approaches in small animals were described in various literature.

Despite these benefits, performing a regular inspection using endoscopic procedures is mostly observed at "specialist hospitals" and they are infrequently employed by "practicing veterinarians" in our country. The high cost of the equipment, which is a financial factor, contributes to the cost-benefit analysis, playing a significant role. The rationale for endoscopic operations in ruminants may also be limited by anatomical and physiological factors. Multiple research investigations on various endoscopic examination methods and indication areas attest to the endoscopy's broad range of potential applications in ruminants and small animals. On the other hand, due of training, choice, referral patterns, or concerns of privilege, many surgeons do not now actively practice endoscopy. Even if a surgeon does not personally do endoscopy, they still need to be aware of the range and prevalent manifestations of endoscopic problems. This is even more crucial when an emergency hospital clinician rather than an endoscopist requests surgical consultation for a new patient. Lack of familiarity with

these unusual issues may cause delays, inability to acquire, or a failure to recognize vital info, which may significantly lower the probability of a successful outcome. Additionally, a patient's capacity to tolerate an endoscopic consequence may be significantly reduced by the disease process or coexisting sickness that led to the endoscopy. Although endoscopic complication rates may be decreased by expertise, the mere presence of an experienced endoscopist does not in and of itself ensure the absence of problems.

Though, endoscopy is not as accurate as measuring luminal diameter or detecting functional GI disorders like esophageal dysmotility, irritable bowel syndrome as other methods (Moore, 2003). Again, only mucosal and intraluminal disease can be detected by the procedure. By the process, the scope can visualize to duodenum in large sized dogs and proximal jejunum in cats. It also cannot recover the image of ventral site of rumen and intestine of ruminants (Franz, 2011). But most of the severe inflammation occurs in small and large intestine in animals (Jacobs et al., 1990).

The aim of the present study was to describe endoscopy of upper gastrointestinal tract in small ruminants, dogs and cats. The gastroscopic procedure for confirmatory diagnosis of various pathological conditions with their therapeutic management in suitable anesthetic management was conducted in the study. Additionally, to determine the digestive health of an animal comparing with its history and physical examination to use as a diagnostic tool in veterinary practice.

Chapter- 2: Review of Literature

In both surgical and medical specialties, flexible endoscopes are commonly used. Flexible endoscopes have the one-of-a-kind capability to access cavities and viscera that are not apparent to the unaided eye. The imaging system provides direct investigation of symptoms associated clinical signs, gives confirmatory diagnosis and pathological changes with therapeutic approaches.

For many years, endoscopy has been a crucial diagnostic tool in veterinary clinics all over the world. But in recent years, an increasing number of privet practitioners have come to understand the value of endoscopy as a way to enhance the standard of care provided in their practices, both in terms of providing a method of early diagnosis of many disorders in animals in minimally invasive way with specific therapeutic measures (e.g., foreign body retrieval, gastric feeding tube placement) (Moore, 2003). As a result, there has been an increase in the demand for and usage of flexible endoscopes for gastrointestinal (GI) and respiratory endoscopy.

Endoscopy can bring many things to veterinary field, not the list of which are improved capabilities, for definitive diagnosis in early progression of disease, a renewed excitement about clinical practice, and increased revenues.

2.1. Clinical Applications of GI Endoscopy

The upper and lower endoscopy in animals is the most common procedure in veterinary field. The gross examination of GIT and retrieval of biopsy samples are the common clinical applications of flexible endoscope. The gastric foreign body retrieval is highly efficient and less invasive procedure of endoscope. For definitive diagnosis of various types of gastritis, inflammatory bowel disease (IBD), colitis and gastric neoplasia, endoscopy could be beneficial. With the ready availability of endoscopic instrumentation and the development of sufficient expertise in its use, veterinarians can provide this for their patients. For taking biopsy sample and foreign body extraction, endoscopy is more convenient than expletory laparotomy.

2.2. Selection of Instrumentation

The standard size for endoscopy of upper and lower GIT in animals should be, 100cm long with ideal diameter of 7.8- 9mm, have four-way distal tip deflection, at minimum

180° upward deflection, water flushing, air insufflation port, suction capabilities, locking deflection control, working channel (inner diameter 2mm) and optimum forward viewing optics (Tams and Rawlings, 2011) **(Figure 2.1)**. Processed video monitorization from monitor is an important configuration. The advanced camera control unit (CCU) within fiberscope deliver standard video image in monitor. The printing system connects with processing unit. It allows printing and documentation of recorded video **(Figure 2.2).**

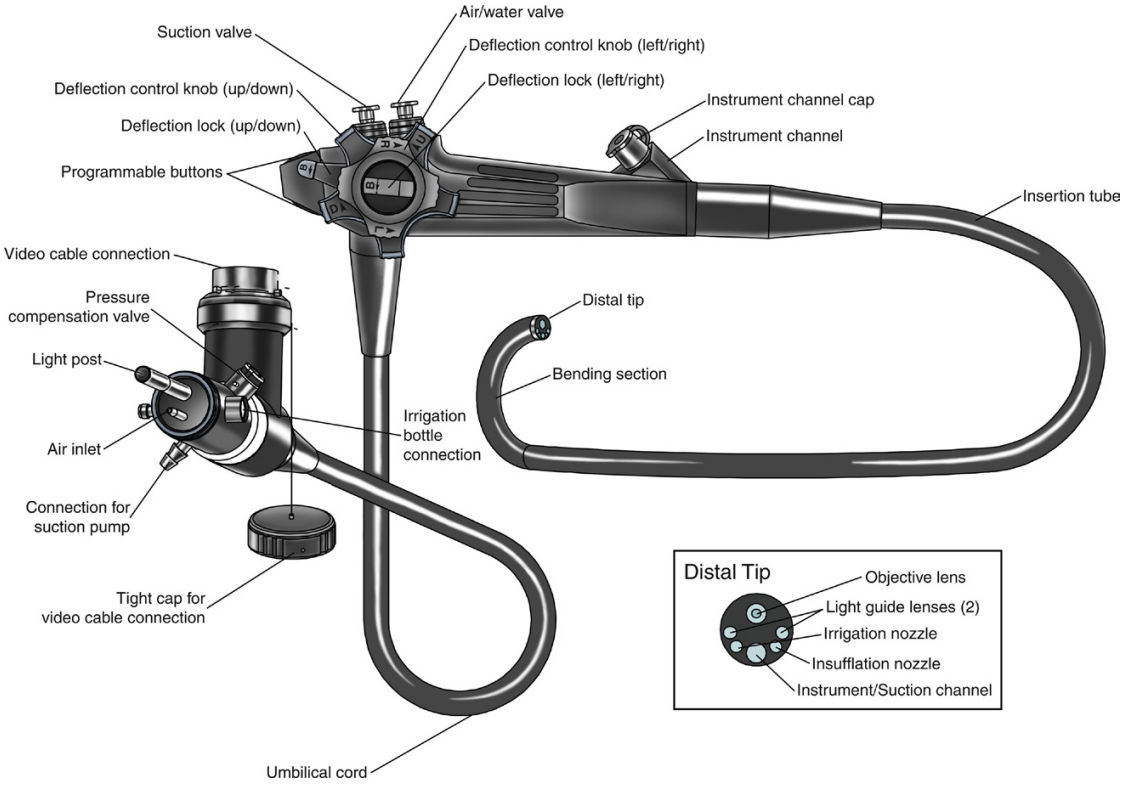

Figure 2.1: Parts of flexible endoscope. (Adapted from, Cox, 2015)

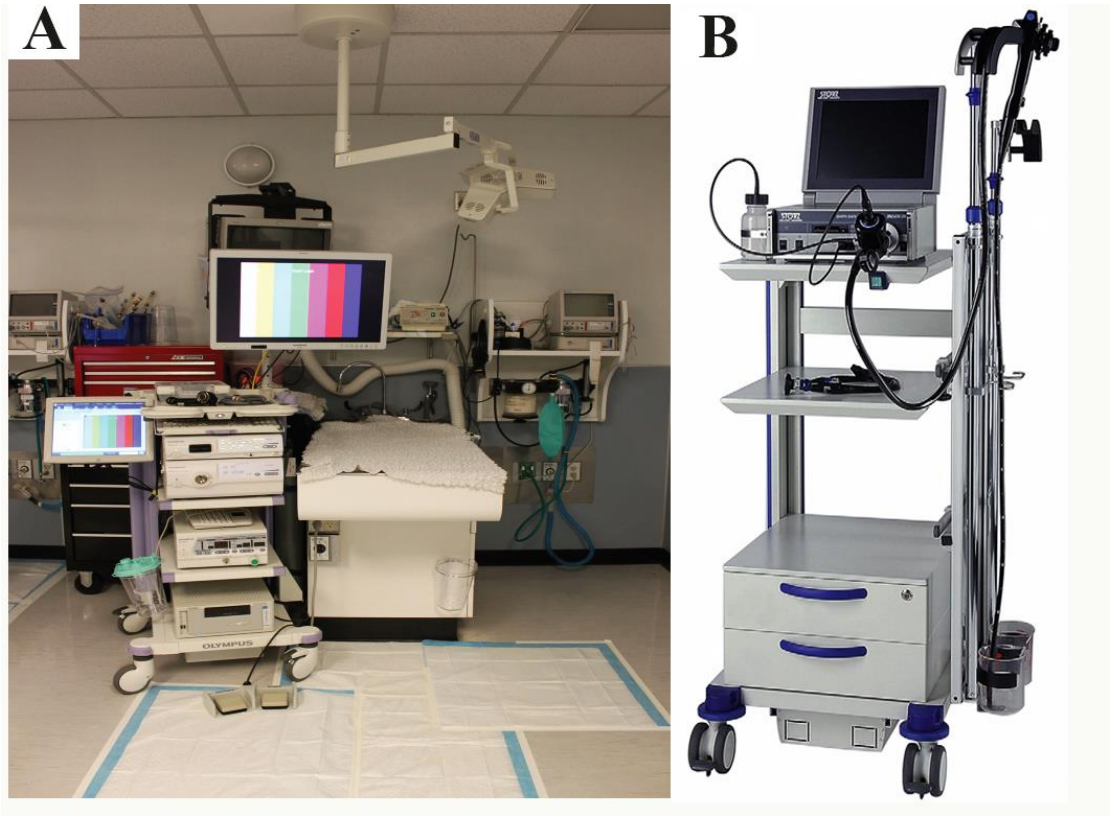

Figure 2.2: (A) Workstation with endoscopy tower. (B) Endoscopy cart with flexible endoscope stored in a hanging position. (Adapted from, Tams and Rawlings, 2011; Cox, 2015)

2.3. Esophagoscopy

The examination of lumen and mucosal lining of esophagus with endoscopic instrumentation is called esophagoscopy. It is indicated when an animal expressed clinical signs associated with esophageal disorder, abnormal regurgitation, dysphagia, vomition, gaging, retching, respiratory distress and restlessness (Gianella et al., 2009; Cox, 2015). The non-invasive property of flexible endoscopy allows direct visualization and therapeutic approaches in esophagus. It can also useful for correction of esophageal deformities eg; esophageal stricter, foreign body obstruction, stenosis and neoplasia (Cox, 2015). The endoscopist should have to know the full anatomy of esophagus in operated species **(Figure 2.3)**.

In ruminants, the endoscope is inserted into the esophagus via the lateral laryngeal recess, lateral to the two arytenoid cartilages in conscious animals (Franz and

Baumgartner, 2002). Animals can be sedated or tranquilized depends on conditions (Stierschneider et al., 2007). General anesthesia should be necessary in small animals and provided food should be withdrawn at minimum 12 hours before procedure (Cox, 2015). The endotracheal tube and mouth gag should be placed thorough out the procedure. It is recommended to prevent aspiration and safety of fiberscope from biting (Cox, 2015). The animal should be placed in left lateral recumbency for endoscopy.

The incretion tube must be inserted in animals head and neck extended, the scope should direct through oropharynx and pushed dorsal to the endotracheal tube. The upper esophageal sphincter (UES) is the first part visualize through endoscope. The UES of animals are normally closed, appearing as a star-shaped area of folded mucosa at the dorsal to the larynx. The insufflation of minimum air will guide the scope into the cervical esophagus. The cervical esophagus normally collapsed so that as the scope passes the esophagus minimum air insufflation is necessary (Tams and Rawlings, 2011). With minimum adjustment of control knob, it easy to obtain full panoramic view with mucosal surface and impressions. The lumen of the thoracic esophagus generally opens with minimal or no insufflation. At the base of the heart, pulsation of common carotid artery will find.

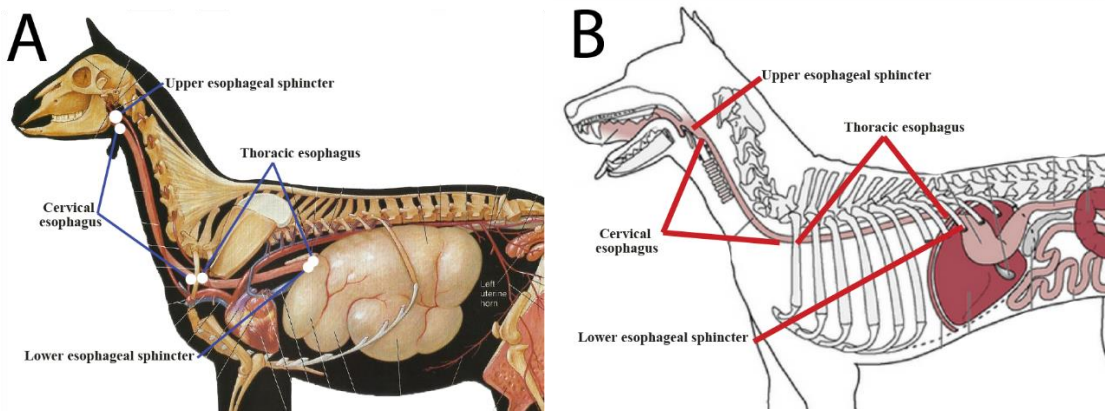

Figure 2.3: Anatomy of different parts of esophagus, (A) goat, (B) dog. (Adapted from, Google image)

2.3.1. Appearance of the Normal Esophagus

Esophagoscopy in fasting conditions of animal exposed empty or presence of minimum amount of clear fluid and foam. The mucosal lining appears light pink, glistening and smooth in goats (Stierschneider et al., 2007). The vascularization of submucosal vein

observed after insufflation of air **(Figure 2.4)**. The lower esophageal sphincter appears as a horizontal slit (Stierschneider et al., 2007). Normally the esophagus of small animals are light pink, smooth, glistening and grayish in color **(Figure 2.5)** (Cox, 2015).

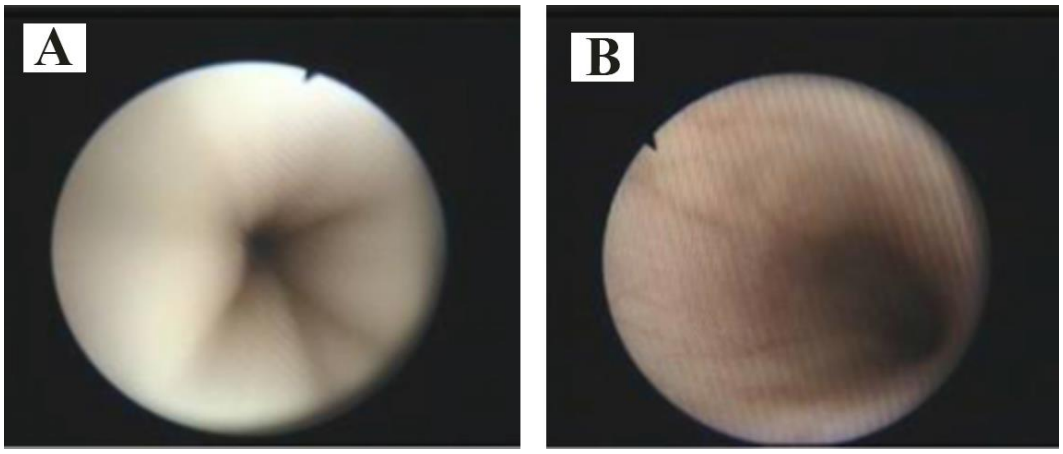

Figure 2.4: Esophageal mucosa of goat, (A) without insufflation of air, (B) Submucosal vascular pattern of the esophagus of goat (after the insufflation of air. (Adapted from, Stierschneider et al, 2007)

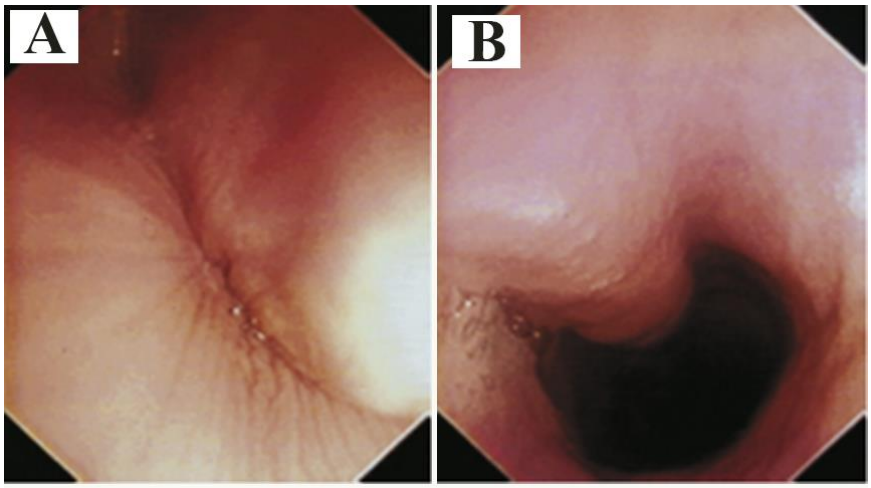

Figure 2.5: (A) The closed upper esophageal sphincter (UES) and (B) The cervical esophagus with tracheal impression in a dog. (Adapted from, Tams and Rawlings, 2011)

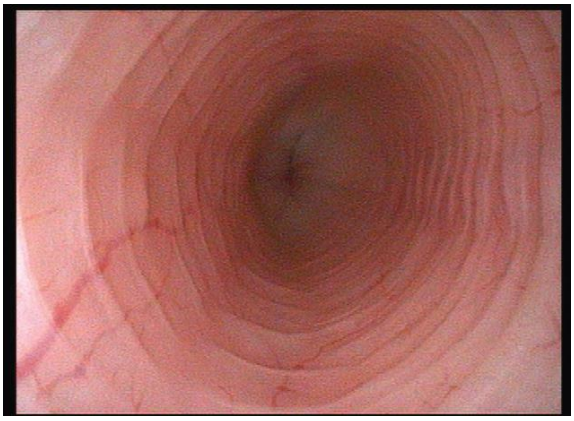

Figure 2.6: The "herringbone" pattern of esophagus of cat. (Adapted from,Nicpoń et al., 2000)

Presence of any feed particle, large amount of fluid or bile fluid in esophagus of small animal indicate gastroesophageal reflux disease (GERD), dysfunction of GIT or Foreign body obstruction (FBO) of the animal (Cox, 2015).

In cats, longitudinal folds are obtained in cranial parts of esophagus and in esophagus in dogs, the longitudinal folds are observed all over the esophagus (**Figure 2.6)** (Tams and Rawlings, 2011). The circumferential mucosal folds create annular ridges in caudal esophagus in cats which appears as a "herringbone" pattern, this ring is uncommon in dogs (Cox, 2015).

2.4. Rumenoscopy

Rumenoscopy is mainly used experimentally. Researcher investigated the effect of a parasympathomimetic on the hood psaltery opening in 1991, detection of endoscopic pathological changes in the forestomach mucosa as a result of "rumen drinking" in calves (Breitner et al., 2002). With rumenoscopy through the esophagus, only the gullet groove could not be viewed endoscopically (Franz, 2011). The visibility with this technique is heavily dependent on the size and the filling status of the rumen. The ruminal surface can be evaluated endoscopically by positioning the scope in following sites **(Figure 2.7)** was described in a study (Franz et al, 2006),

1. Dorsal sac of the rumen and caudodorsal blind sac.
2. Ventral sac of the rumen and caudoventral blind sac.
3. Caudal pillar of the rumen, dorsal and ventral coronary pillars and cranial pillar.

4. Atrium of the rumen and the ruminoreticular opening.
5. Reticular groove.
6. Reticulum.

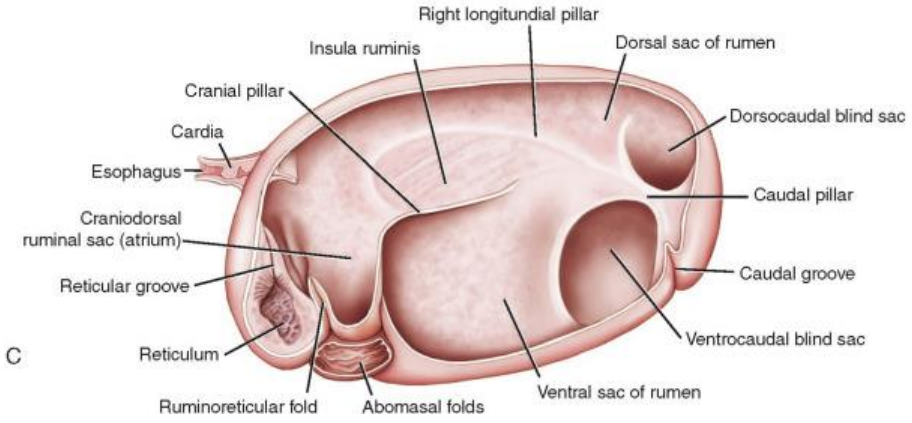

Figure 2.7: Internal anatomy of rumen. (Adapted from, Google image)

All the pillars of internal rumen can be recognized as light pink in nature with shiny and smooth surface which is different from surrounding ruminal mucosa **(Figure 2.8 & 2.9)** (Franz et al., 2006). The impression of spleen and splenic vein can be visible at the dorsocranial and lateral direction of rumen. The bright pink ruminoreticullar fold can be obtained on craniomedioventrally direction of rumen (Franz et al., 2006; Sasikala et al., 2019). The typical structure of honeycomb like reticular mucosa can be obtained after passing ruminoreticullar fold.

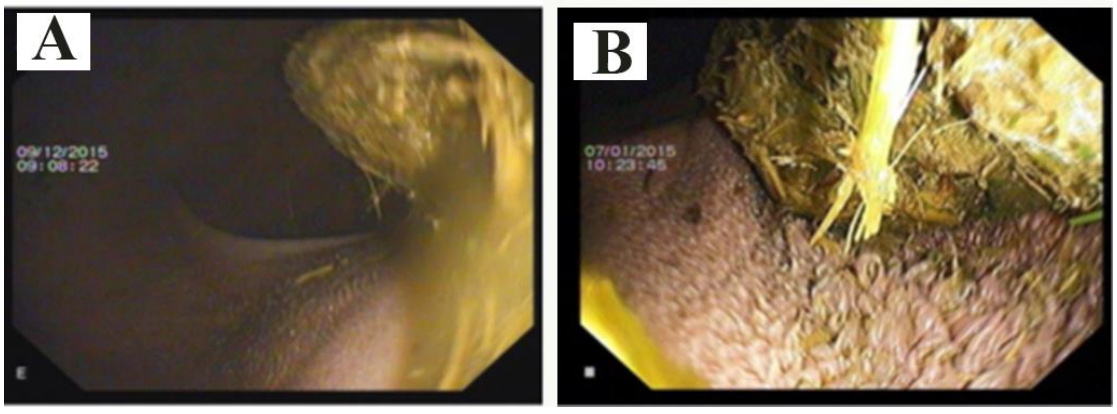

Figure 2.8: Endoscopic view of (A) ruminal pillars and (B) rumen. (Adapted from, Sasikala et al., 2019)

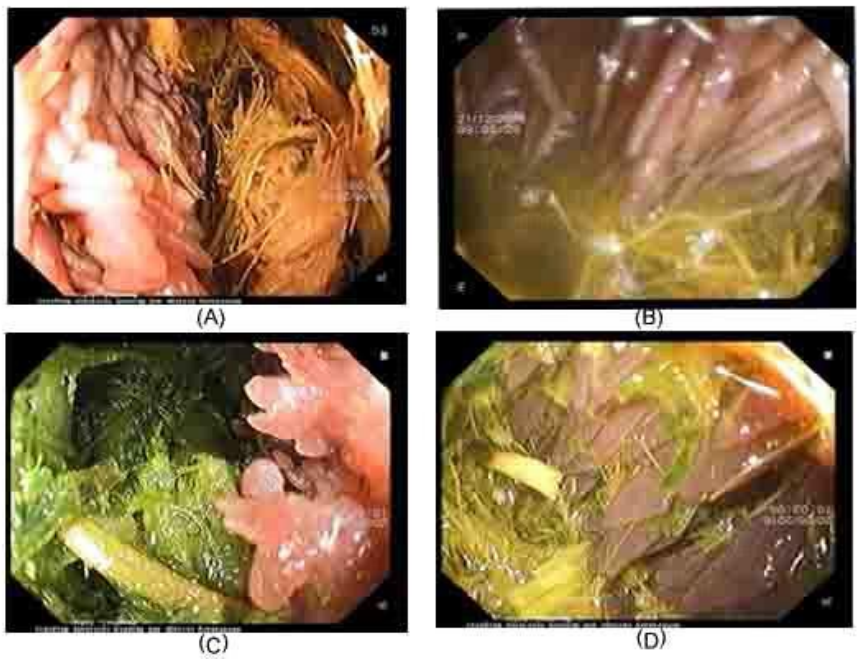

Figure 2.9: Endoscopic imaging of rumen papillae (A) Millet shaped, (B) Pointed finger like projections of papillae, (C) Petal shaped and (D) Neem leaf shaped. (Adapted from, Sasikala et al., 2019)

2.5. Gastroscopy

After anesthesia, animals should be positioned on left lateral recumbency. All the parts of stomach should be examined on each animal gone through gastroscopic procedure **(Figure 2.10)**.

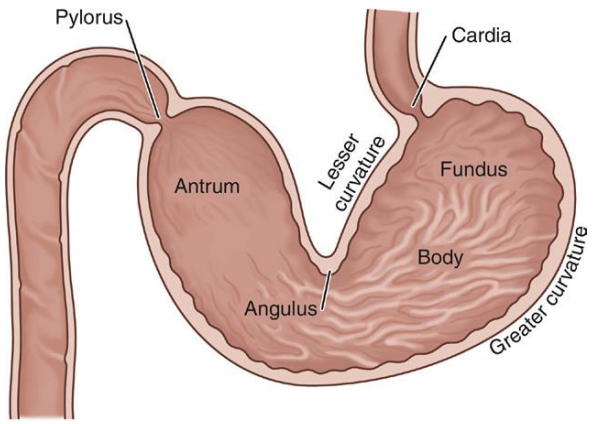

Figure 2.10: Internal anatomy of stomach in small animals. (Adapted from, Tams and Rawlings, 2011)

2.5.1. Gastroesophageal Junction

After passing the tip of scope through lower esophageal sphincter (LES), it enters the gastroesophageal orifice. The tip of the endoscope has to deflected 30° on the left and slightly upward to observe the gastroesophageal junction **(Figure 2.11)**.

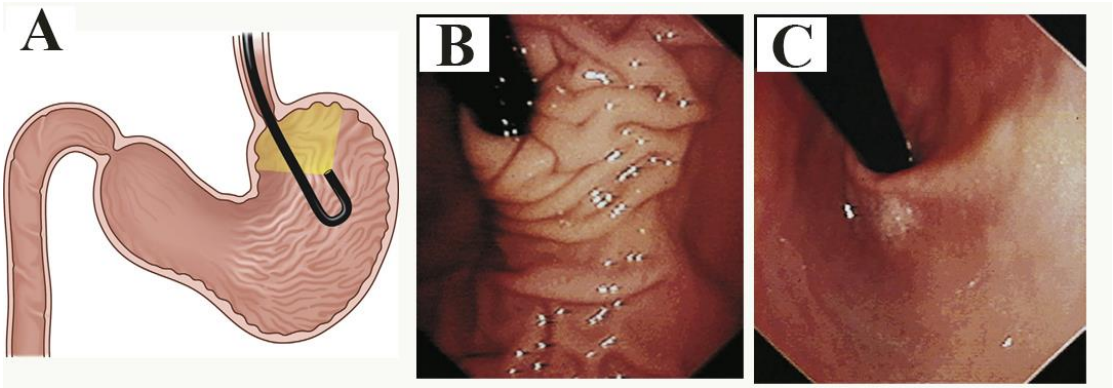

Figure 2.11: (A) Illustration of obtaining retroflexed view of gastroesophageal junction. (B) Gastroesophageal junction of canine, (C) Gastroesophageal junction of feline. (Adapted from, Tams and Rawlings, 2011)

2.5.2. Gastric Body and Proximal Part of Stomach

As the tip of the endoscope enters into the stomach, the rugal folds and gastric lumen can be obtained **(Figure 2.12)**. After insufflation of air the rugal folds became flattened and mucosal vascularization observed (Tams and Rawlings, 2011). The greater curvature can be seen after the rugal folds disappears. The amount of air insufflated should be controlled, larger amount of air can cause over distension of stomach and hampers respiratory function (Cox, 2015). Usually, the respiratory rate increases significantly. A sufficient volume of air to moderately deflate the stomach should be suctioned off as soon as possible. At the time the rugal folds separate, the insufflation should be stopped. All the parts of gastric body can be observed by controlling the rotation of deflection. Required amount of angulation and forward direction provides panoramic view of greater curvature and angulus. The angulus stands with a large fold which extends from laser curvature. It separates the body of stomach from antrum.

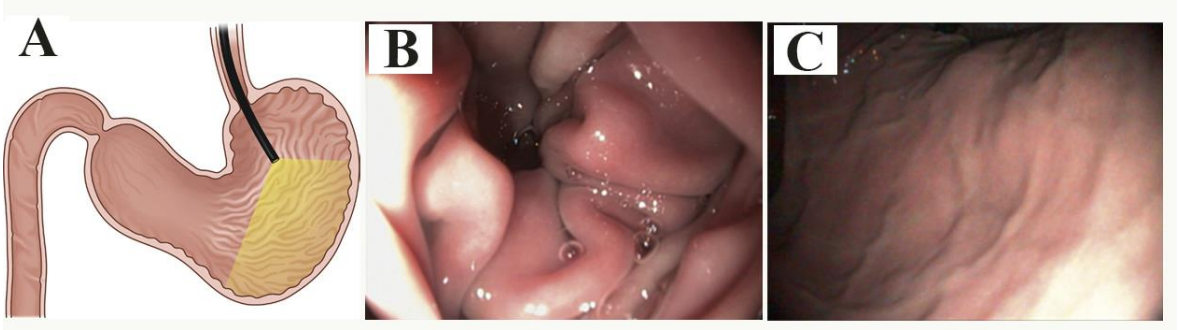

Figure 2.12: (A) Illustration of obtaining view of gastric body, (B) Normal gastric rugae. (C) Additional insufflation has caused the rugal folds to become flattened. (Adapted from, Tams and Rawlings, 2011)

2.5.3. Retroversion (J-Maneuver)

The retroversion maneuver provides an en-face view of the angulus, cardia and fundus. For obtaining the en-face view, the tip of the endoscope has to be deflected at the point opposite to the angulus **(Figure 2.13)**. The up and down control knob is turned counterclockwise and as the endoscope is gradually advanced, the angulus can be seen en-face. Generally, at least 180 degrees of tip deflection will be required for this maneuver. In cats the J-Maneuver is started when the endoscope tip is in the mid body area. The tip is deflected upward as the endoscope is advanced. Because of a smaller working area when compared with most dogs, an en-face view of the angulus is not achieved as often in cats.

2.5.4. Antrum

Antrum is a part of stomach, where no rugal fold observed. The whole antrum is visible when the upward forward direction of the scope form distal greater curvature of stomach **(Figure 2.14)**. Various symmetrical rings are observed as a rolling wave from the proximal antrum to the pylorus. The pylorus was frequently closed during antral contraction. Presence of duodenal bile as the result of reflux can be obtained during the procedure. The presence of folds or mucosal hypertrophy that may be caused by chronic inflammatory illnesses or chronic gastric hypertrophy, polyps, ulcers, and masses should be thoroughly examined in the antrum. Adenocarcinoma is the most common malignant tumor in the stomach of the dog, while lymphosarcoma is the most common in the cat.

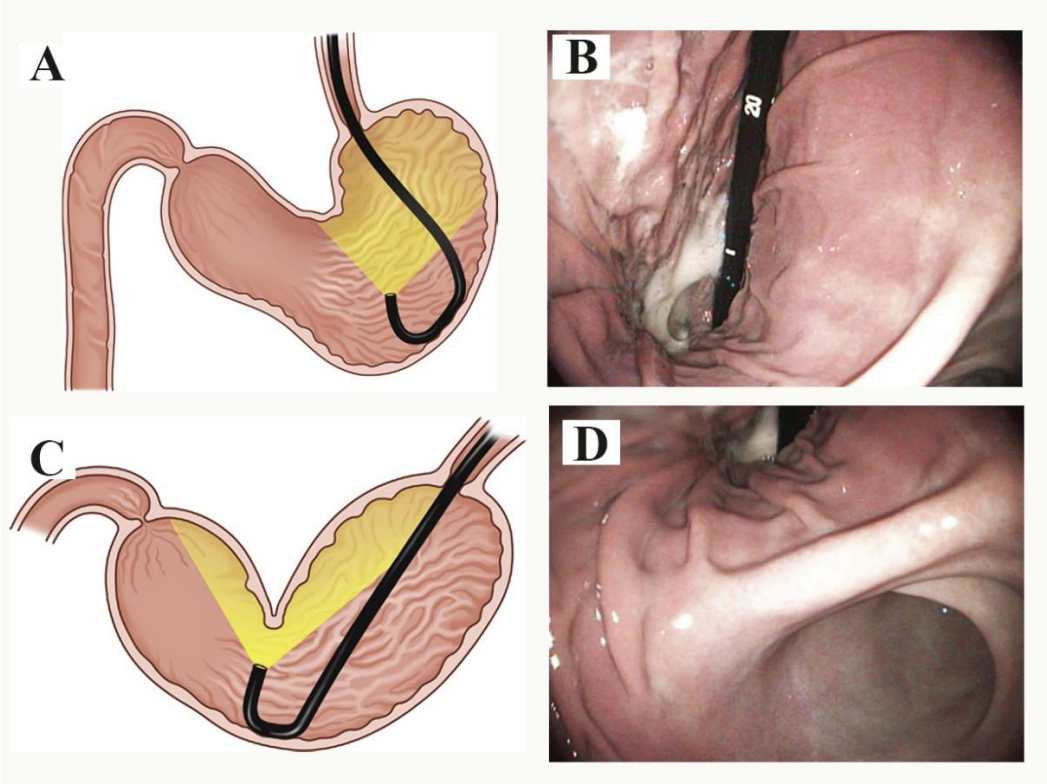

Figure 2.13: (A) Illustration of retroversion maneuver. (B) The gastroesophageal junction with fundus and part of angulus. (C) Illustration of Completion of retroversion maneuver. (D) The gastric body and antrum are seen in a single view dividing angulus. (Adapted from, Tams and Rawlings, 2011)

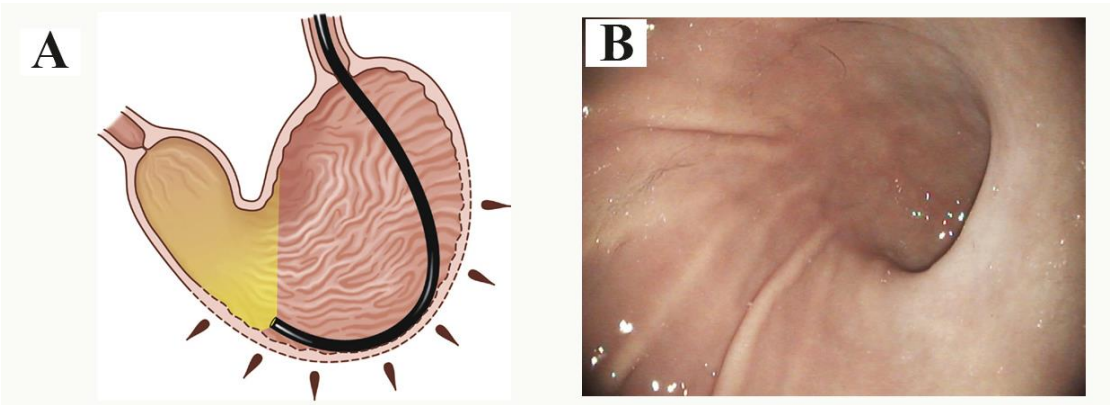

Figure 2.14: (A) Illustration of viewing of the proximal antrum. (B) Body of the antrum in dog. (Adapted from, Tams and Rawlings, 2011)

2.6. Preanesthetic Choice for Endoscopy in Animals

2.6.1. Diazepam

Benzodiazepines can act as anxiolytic, mild sedatives, muscle relaxant and anticonvulsant except for analgesic property (Hall et al., 2001; Riebold, 2007; Valverde and Doherty, 2008). As the cardiovascular and respiratory effects of this groups are minimal and transient (Valverde and Doherty, 2008). Drugs of this group may produce minute ventilation and transient hypoxemia (Valverde and Doherty, 2008). Diazepam is one of the most commonly used drugs in benzodiazepines group (Galatos, 2011). It is fast-acting and short elimination half-life (Lemke, 2007). As diazepam is water insoluble, it is delivered with an organic solvent propylene glycol that causes pain and unpredictable absorption when administered subcutaneously or intramuscularly. Due to irritant property and unpredictable absorption and degree of sedation after intramuscular administration (Hall et al., 2001; Valverde and Doherty, 2008) a slow intravenous route is preferable to avoid momentary excitement (Gray and McDonnell, 1986). In small ruminants, diazepam is usually administered at doses of 0.1 mg/kg - 0.5 mg/kg, intravenously for premedication (Dzikitia et al., 2009; Ghurashi et al., 2009).

2.6.2. Xylazine

The α2 agonist sedatives are commonly used in veterinary medicine to perform sedation and analgesic properties. It induces significant cardiopulmonary changes, CNS depression, hypnosis, decrease gastrointestinal motility and analgesia. In some dogs, second degree atrioventricular heart block can be developed. Xylazine is one of the most common agent in α2 agonist. The dosage range of xylazine in dogs is 0.5–2.2 mg/kg body weight intramuscularly and 1-2 mg/kg body weight in cats (Hall et al., 2001). The vomition tendency in cats are commonly seen after administration of xylazine (Lamont et al., 2001; Selmi et al., 2004).

2.7. Anesthetic Choice for Endoscopy in Animals

Before selecting an anesthetic procedure, a comprehensive physical evaluation and baseline blood tests should be considered. Hematological parameters include, packed cell volume (PCV), total protein (TP), blood glucose (BG) (Cox, 2015). Other diagnostic imaging includes, radiography, and ultrasonography. The demands of each patient should be considered while developing an anesthetic protocol. All the records include, physical examination, blood work, previous disease status, medication or

surgical history and anesthetic complications have to consider before anesthesia. Administration of bolus fluid of crystalloid or colloid in nature should be administered at 5-10 ml/kg/hour in compromised patients (Cox, 2015). Antithetic complications include hypothermia, hypoventilation, hypotension, and bradycardia. The American Society of Anesthesiologists (ASA) has developed a method for classifying animals status which should be assigned to each patient prior to anesthetic drug administration. This technique is employed to classify potential risks for each patient. Animals with a higher ASA status are considered to be at a greater risk for anesthetic complications. To increase their chances of a complete recovery, these patients generally require multi parameter monitoring.

Table 2.1: Classification of animals by The American Society of Anesthesiologists (ASA).

Classification	Definition
ASA Physical Status 1	A normal healthy patient
ASA Physical Status 2	A patient with mild systemic disease
ASA Physical Status 3	A patient with severe systemic disease
ASA Physical Status 4	A patient with severe systemic disease that is a constant threat to life
ASA Physical Status 5	A moribund patient who is not expected to survive without the operation

Patients with associated clinical signs of digestive disturbances (eg; chronic vomition, dehydration and electrolyte imbalance) should to be rehydrated before anesthesia (McCarthy, 2021). Required amount of crystalloid or colloid solution can be use when it is necessary. Administration of opioid with or without anticholinergic is recommended. Drugs that cause vomition should not be given in patients with foreign body obstruction, , hence opioids such as methadone, buprenorphine, or butorphanol are often chosen (Cox, 2015). An increase in gastroduodenal sphincter tone is a possible

adverse effect of opioid administration. It may become more challenging for the endoscopist to slide the endoscope through the sphincter if the sphincter tone is increased(Cox, 2015). Whatever the anesthetic technique, the objective of anesthesia induction with these patients is quick intubation and cuff inflation to secure the airway and prevent aspiration of gastrointestinal contents. The removal of foreign body are considered as a painful procedure, analgesia can be given prior to the procedure (Gianella et al., 2009). Where a chance of development of pneumothorax, Nitrous oxide (N2O) should not give, because it cause distention as it enters air spaces from the blood (Cox, 2015).

2.8. Anesthetics

2.8.1. Ketamine

Ketamine cause convulsion in dogs. Only the agent is not recommended to produce anesthesia in dogs, it should be recommended with sedation of xylazine of diazepam and maintenance with gaseous anesthetics (Hall et al., 2001). A common combination used for induction of anesthesia is diazepam, 0.25 mg/kg, and ketamine, 5 mg/kg, given IV at the same time (Hall et al., 2001). Premedication may also include a sedative, opioid, or any combination of these, such as acepromazine, 0.02– 0.05 mg/kg, with butorphanol, 0.3–0.4 mg/kg, IM/SC or acepromazine with hydromorphone, 0.1 mg/kg, IM/SC (Hall et al., 2001). The onset of action is much slower than thiopental or propofol and the signs of anaesthesia differ. Dexmedetomidine, 0.003–0.005 mg/kg (3–5 μg/kg), IM/IV with a low to moderate dose of an opioid is a useful premedication for induction of anaesthesia with ketamine– diazepam before inhalation anaesthesia (Hall et al., 2001).

2.8.2. Propofol

Propofol is non barbiturate, noncumulative, ultrashort acting, intravenous anesthetic agent which produce dose-dependent depression of the cerebral cortex and CNS polysynaptic reflexes. It binds to GABA A receptors; acts as a sodium channel blocker (Hall et al., 2001). The dose for induction of anesthesia in non-premeditated dogs is 6–8 mg/kg and 2-6 mg/kg body weight in cats. And in premeditated animals 2–4 mg/kg IV (Hall et al., 2001). Propofol does not provide analgesia and so premedication with sedatives and opioids is recommended practice.

2.9. Monitoring Equipment

When an animal is under general anesthesia, monitoring equipment is required to help the anesthetist. The palpebral reflex, toe pinch, jaw tone, heart and respiratory rates, depth of the breath, capillary refill time, and mucus membrane color should be continuously monitored during anesthesia. Vital signs have to monitor in every 5 minutes during anesthesia. Additionally, ECG, capnography, pulse oximetry, arterial blood gas monitoring, direct arterial blood pressure and central venous blood pressure can be monitored.

2.10. Postoperative Management

After the procedure, post-operative analgesia should be provided after a painful intervention. Commonly, full mu-opioids, partial agonists (eg;buprenorphine), kappa agonist mu antagonist opioids (eg; butorphanol), and non-steroidal anti-inflammatory drugs (NSAIDs) can be used. NSAIDs used in conjunction with opioid administration help provide multimodal analgesia and should only be used in healthy patients not concurrently receiving steroids (Cox, 2015). Ideally, the postoperative patient should recover in a warm, low-stress environment. The heart rate, respiration rate, body temperature, and pain should be monitored for at least 30 minutes after extubation. Patients should be observed until they are recovered fully and able to keep their body temperatures stable without the assistance of a heat source.

2.11. Therapeutic Approaches in Gastroscopy

Various instruments are available for therapeutic intervention in endoscope. Biopsy forceps, foreign body retrieval forceps, cytology brush, basket retrievers are the most common ancillary equipment in flexible endoscopy **(Figure 2.15)** (Cox, 2015). Mucosal sample can be obtained by cup biopsy forceps. Mucosal cytology/culture samples are collected using cytology brushes and guarded microbiological brushes. The sample is retrieved using brushes, which are subsequently retracted into the covering to protect it from contamination (Tams and Rawlings, 2011).

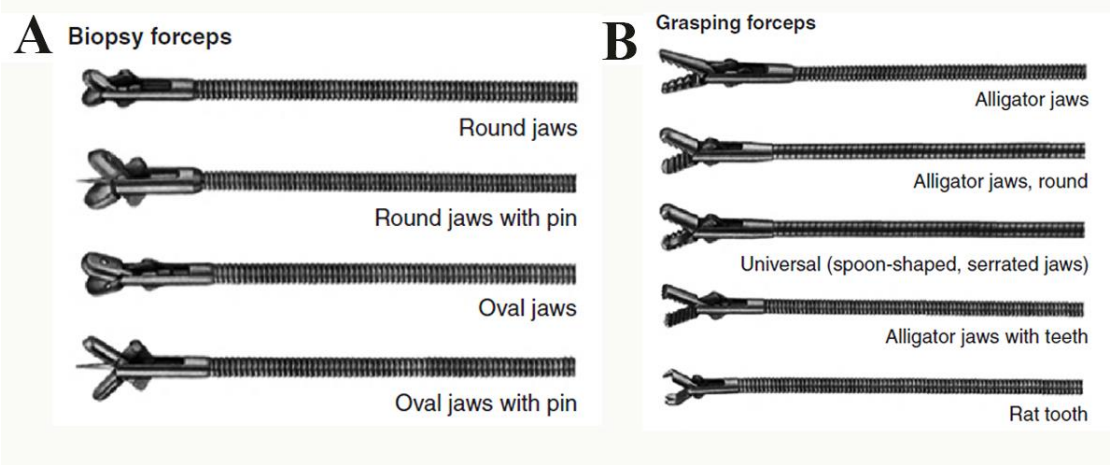

Figure 2.15: (A) Various types of biopsy forceps. (B) Various types of grasping forceps. (Tams and Rawlings, 2011)

Objects like bones, toys, or any other foreign substance can be removed using foreign body retrieval forceps (Gianella et al., 2009). Some examples include snares, baskets, rat-tooth, two-prong, and roth nets. Spiked forceps are not generally used in GI endoscopy because of their crushing nature (Cox, 2015). Samples may also be collected using aspiration tubes for collecting duodenal fluid and guarded cytology brushes. Sets of balloon dilators with guide wires are necessary for treating esophageal strictures.

Table 2.2: Patient size versus endoscope size for upper gastrointestinal endoscopy procedures

Species/weight	**Diameter (mm)**	**Working length (m)**	**Channel size (mm)∗**
Feline	7.9	1.4	2.0
Canine <10 kg	7.9	1.4	2.0
Canine 10–20 kg	8.5	2.0	2.8
Canine >20 kg	10.0	2.1	2.8

∗Instruments should be 0.2 mm smaller than channel size. For example, a 2 mm channel will accept a 1.8 mm instrument. (Cox, 2015)

Esophageal dilator diameters range from 6 to 20 millimeters. Accurate pressure measurements at the stricture site can be obtained using a balloon inflation method (Melendez et al., 1998). Percutaneous endoscopic gastrostomy (PEG) is the process of

placing a catheter in the abdominal wall, for the purpose of feeding patients (Cox, 2015). It is indicated, when the animal is not recommended to take food orally. PEG tube kits are commercially available in sizes 18 and 24 French gauge (Fr).

2.11.1. Esophageal Stricture Treatment Utilizing Endoscopy

Endoscopy can be used for stricture management to diagnose, evaluate the severity of the stricture, and direct the insertion of dilatation catheter balloons **(Figure 2.16)**. It should be necessary to treat the stricture 2-4 days successively to correct the stricture. Accurate documentation of the stricture's length, location, size of the dilator and guide wire utilized, placement of the dilator within the stricture, and dilation intervals can help with therapy and shorten the duration of anesthetic for following surgeries. Gastric over distension at the time of procedure with insufflation should be considered. A Well-lubricated dilator placed at stricture site. The balloon should be inflated to recommended pressure points with inflation device. Then the radial pressure maintained for 1-3 min intervals. The procedure should be followed up until any clinical issues have been resolved.

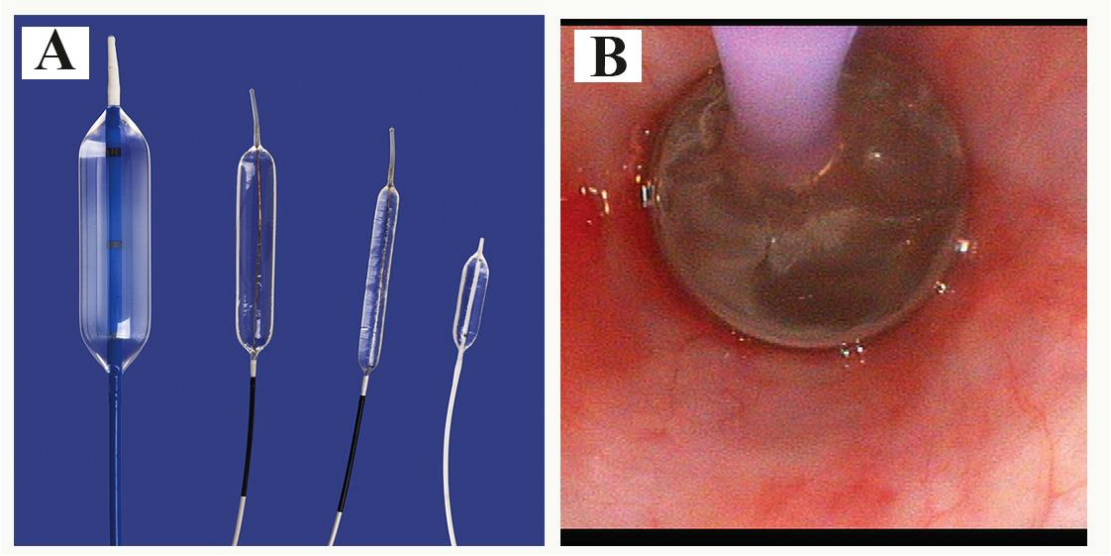

Figure 2.16: (A) Various sizes of balloon dilators (inflated). (B) Balloon dilation of an esophageal stricture. (Tams and Rawlings, 2011; Cox, 2015)

2.11.2. Endoscopic Foreign Body Retrieval

Foreign bodies initially observed on radiographs. Some foreign items may enter the duodenum and necessitate surgery or close observation, while others may pass through the digestive tract without causing any problems (Cox, 2015). Foreign objects that are

trapped in the esophagus, like as bones, fishhooks, or rawhide chews, can lead to pain and need to be removed as quickly as possible **(Figure 2.17)**. It is difficult to pass through the lower esophageal sphincter with smooth or massive, spherical things like corncobs and big objects should be avoided. The identification and removal of foreign bodies are complicated by an abundance of food inside the stomach. Following the removal of an esophageal foreign body, patients should be checked for symptoms of esophageal strictures, such as regurgitation and difficulty /painful swallowing. A gastrostomy tube may need to be inserted in the circumstances. Ineffective endoscopic retrieval may call for surgical intervention. Proper idea of detection grasping the site of foreign body is necessary. The forceps should be withdrawn after firmly grasping the item, and the foreign body brought as close to the endoscope as feasible. Radiographs are not always accurate, especially if there are several potential foreign items or if the object is radiopaque.

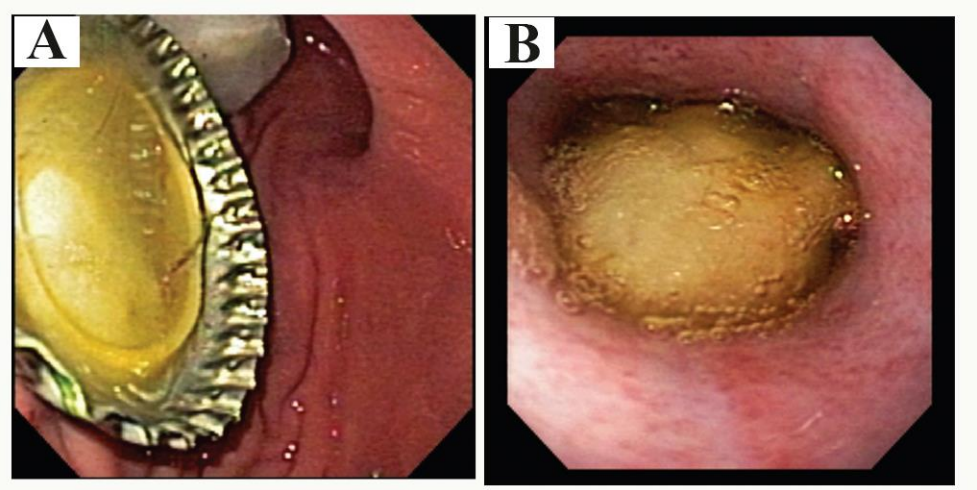

Figure 2.17: (A) A metal bottle cap and (B) Rock in the stomach body of a canine patient. (Adapted from, Cox, 2015)

2.11.3. PEG Tube Placement

When a patient with normal GI motility is unable to consume enough calories, percutaneous endoscopic gastrostomy (PEG) tubes are employed **(Figure 2.18)**. The PEG tube placement in animals should be under general anesthesia and endotracheal tube intubation. Dogs more than 20 kg is not recommended for the procedure, because of the mucosa of stomach cannot hold the PEG tube (Cox, 2015). After 8-12 weeks of

post-operative days, PEG tube can be replaced with low-profile gastrostomy device (LPGD).

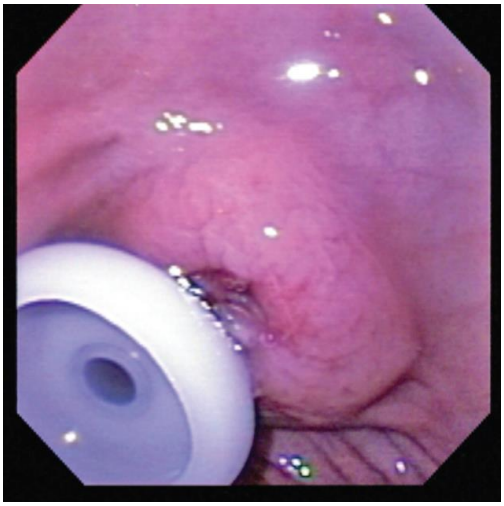

Figure 2.18: PEG tube placed in the antrum of a canine patient. (Adapted from, Cox, 2015)

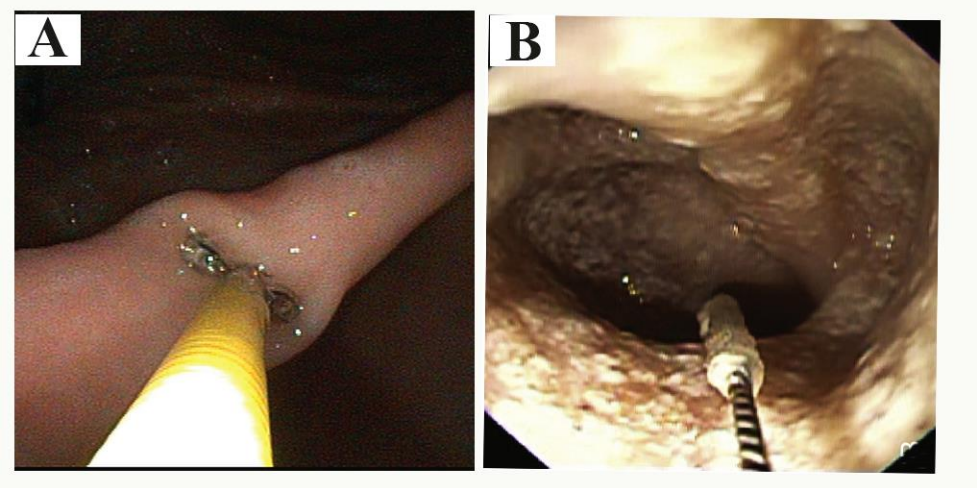

Figure 2.19: (A) Taking biopsy sample from incisura angularis. (B) Using brush cytology for Esophageal candidiasis in a canine patient. (Adapted from, Tams and Rawlings, 2011; Cox, 2015)

2.11.4. Sample Collection and Processing

The objective of taking biopsy sample from GIT is to detect pathological changes in suspected area. The biopsy sample should have to take where the submucosa and muscularis mucosa are thick and strong, improper technique of GI biopsy leads to perforation **(Figure 2.19)**. Three or four diagnostic biopsy samples should be taken from each area; pyloral area, antrum, body, and cardia (Cox, 2015). The biopsy from

pylorus and lower esophageal sphincter should be avoided. Biopsy from the suspected area and healthy region around the suspected area is recommended.

2.11.5. Biopsy of Ruminal Papilla

Ruminal biopsy sample can be taken at the time of ruminoscopy **(Figure 2.20)**. After detection of desired papillae or suspected region, individual or couple ruminal papillae can be taken with biopsy forceps. Rumen papillae biopsies were collected from one of the animals that had been fasted for 4-24 hours (McRae et al., 2016).

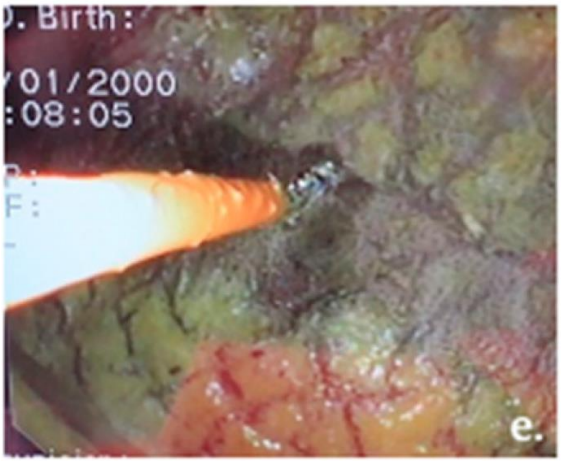

Figure 2.20: Ruminal papilla biopsy from dorsal sac of rumen. (Adapted from, Ramos-Zayas et al., 2022)

2.12. Cleaning of Endoscope

Understanding the functioning parts and design of the endoscope is essential for effective cleaning and disinfection, troubleshooting, and prolonging the life of the endoscope. It is essential to comprehend the significance of a thorough cleaning strategy in order to minimize infectious problems from flexible endoscopic treatments. Both endogenous and external microorganisms can cause infections. The endoscopic technique can transfer bacteria from the digestive or respiratory system into the bloodstream or other healthy bodily areas. Exogenous infections can spread from patient to patient through contaminated working surfaces, infected endoscopes or auxiliary equipment, and inappropriate cleaning and sanitizing procedures(Cox, 2015).

The Association for Professionals in Infection Control (APIC) created guidelines specific to the cleaning and high-level disinfection of endoscopes, which are endorsed

by the American Society for Gastrointestinal Endoscopy and the Society of Gastrointestinal Nurses and Associates (SGNA).

2.12.1. Components of a Complete Cleaning Protocol

Because each endoscope is different, the care, cleaning, and disinfection instructions provided by the manufacturer must be followed. The endoscope and its accessories should be cleaned with a gentle, low-foaming enzymatic detergent before being treated with a high-level disinfectant (HLD) that won't destroy the rubber or metal parts of the endoscope. Use of an enzymatic detergent, which may break down proteins from blood and tissue remaining inside the channels, is a crucial first step in the endoscope cleaning routine. Debris left over from an endoscopic procedure that is exposed to HLDs can become very hard and clog channels without the use of an enzymatic solution. A chemical germicide known as an HLD is one that can completely eradicate all viruses, vegetative bacteria, fungus, mycobacteria, and some but not all bacterial spores. Some types of HLD include 2.4% glutaraldehyde, 0.55% ortho-phthalaldehyde (OPA), accelerated hydrogen peroxide 2%, and 7.5% hydrogen peroxide with 0.23% peracetic acid (Cox, 2015). Personal protective attire, such as gloves and eyewear, should be worn when working with enzymatic cleaners and HLDs.

2.12.3. Cleaning Protocols

Endoscopes should be cleaned promptly after each procedure **(Figure 2.21)**. After the procedures, suction, insufflation, and water capacities should be checked once again. The air/water channel should be flushed using the air/water cleaning valve and suction of water or enzymatic solution through the suction/biopsy channel. Once a clean stream of water can be seen in the suction hose attachment, suctioning should continue until that point. After cleaning the scope should be kept in working station with detaching all the connection with electronic ports. At this time, the endoscope should be moved to a designated cleaning station with a sink available. All the ports, valves and tips should be clean with smooth brush in clean water. After cleaning, the HDL solution have to pass through working channel and suction port (Cox, 2015).

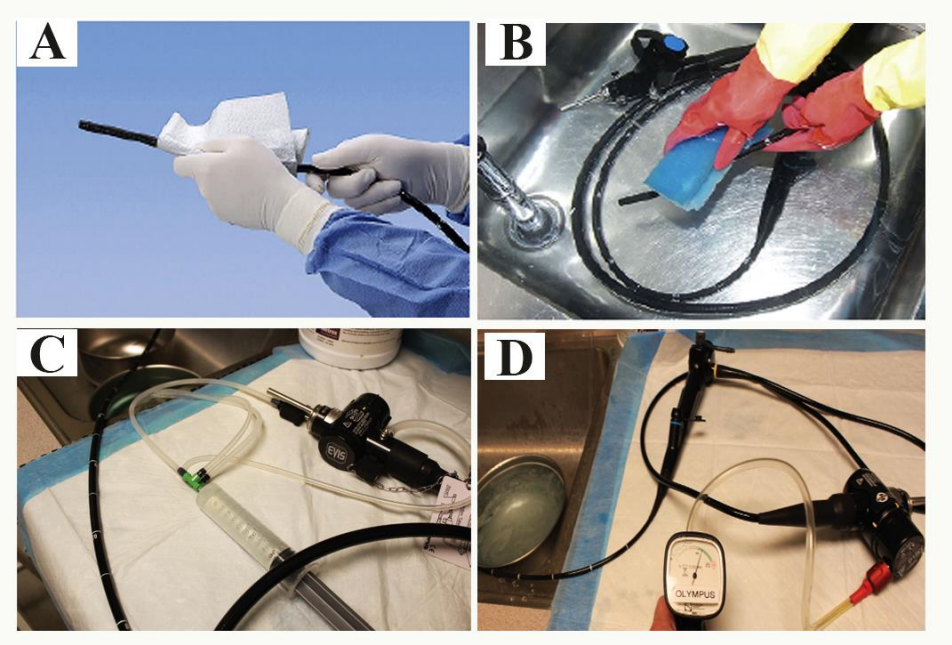

Figure 2.21: (A) Cleaning of external surface of scope. (B) Cleaning of scope with immersion sink containing enzymatic solution. (C) Cleaning of scope with HLD solution. (D) Leak testing of scope. (Adapted from, Tams and Rawlings, 2011; Cox, 2015)

2.13. Leak Testing

Leak testing should be performed after every procedure and prior to immersing the endoscope to prevent fluid invasion repairs and to ensure the integrity of the scope. This will also eliminate potential cross-contamination. Leak testing can be accomplished with an automated constant air infuser or with a hand-held bulb and gauge device. By placing the distal tip including the bending section in a bowl of enzymatic cleaner. Engage the leak tester and watch for air bubbles. Deflecting the tip under the water can increase the success of finding smaller leaks. If a continuous flow of air bubbles is detected, or a continuous drop in pressure is visualized (Cox, 2015). Full scope immersion is sometimes necessary to determine where the leak is originating from. Cleaning may be continued with constant pressure from the automated leak tester.

Chapter - 3: Materials and Methods

3.1. Study Area

The study was conducted at Shahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH), Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh. From July 2021 to March 2022.

3.2. Criteria for Case Selection

The conducted study on experimental animals and clinical cases came to SAQTVH with the history of anorexia, digestive disturbances, foreign body obstruction, chronic vomition and dysphagia.

3.3. Study Design

Ten goats, dogs and cats of different age, breed and sex of animals suffering from digestive problems for treatment at SAQTVH and experimental animals, formed the material of this study. Based on species, three main groups were formulated from total population. The overall study design illustrated in figure 3.1. Each group was divided into subgroups on the basis of clinical history. Ruminants were in the first group (G) was divided into two subgroups, subgroup (G1) includes animals with history of no clinical illness and subgroup (G2) includes animals with history of digestive disturbances. Canines were in the second group (D), this group was sub dived into three groups, subgroup (D1) includes dogs with history of no clinical illness, subgroup (D2) includes dogs with history of digestive disturbances and (D3) subgroup includes dogs with history of foreign body obstruction (FBO). Felines were in the third group. This group was divided into two groups, subgroup (C1) includes cats with history of digestive disturbances and subgroup (C2) includes cats with history of FBO. The subdivision was summarized in table 3.1.

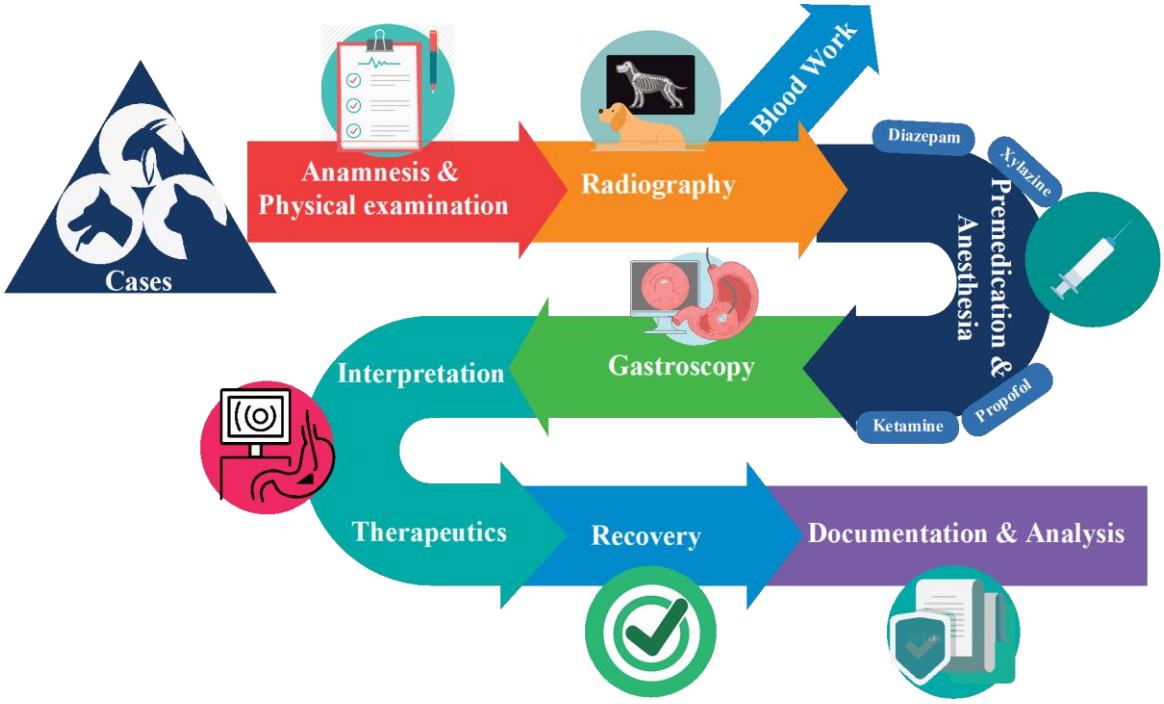

Figure 3.1: The overall study design in a schematic diagram.

Table 3.1: Table of groups and subgroups of total population in this study

Groups	**Subgroups**	**Category of animals**
Goats (G)	G1	Goats with history of no clinical illness
	G2	Goats with history of digestive disturbances
Dogs (D)	D1	Dogs with history of no clinical illness
	D2	Dogs with history of digestive disturbances
	D3	Dogs with history of FBO
Cats (C)	C1	Cats with history of digestive disturbances
	C2	Cats with history of FBO

3.4. Data Collection

3.4.1. Medical History

A complete history of the age, breed and sex of the animal, duration of illness, feeding habits of the animal, early signs of the disease, previous treatment, if any, were recorded.

3.4.2. Clinical Examination

Heart rate (beats/min), respiration rate (breaths/min), rectal temperature (°F), skin fold test time (seconds), general body condition (alert/dull/depressed/other), dehydration (mild/moderate/severe), besides other clinical signs exhibited by the animals were recorded.

3.4.3. Hematological Study

For hematological study, 2-3 ml blood was collected from patients aseptically by jugular venipuncture or cephalic vein in animals. Blood sample was taken into an EDTA (Ethylene diamine tetra acetic acid) anticoagulant containing vacutainer for hematological study. Hematological tests were done in Celltac Alpha (MEK-1301K/1302K; Nihon Kohden Europe) automated hematology analyzer. Hb, ESR, TEC, TLC, PCV and DLC parameters were estimated.

3.4.4. Ruminal pH and Microfloral Motility Test

Ruminal samples were collected through abdominocentesis from left paralumbar fossa. Ruminal pH was determined by pH strips **(Figure 3.2)**. Ruminal microfloral motility were determined under microscope.

Figure 3.2: (A) Collection of rumen fluid by abdominocentesis. (B) Determination of rumen pH by strip.

3.4.5. Radiographic Evaluation

All suspected animals were gone through Radiological evaluation **(Figure 3.3)**. Lateral radiographic examination was made to detect any foreign body or presence of any abnormal growth in upper digestive tract.

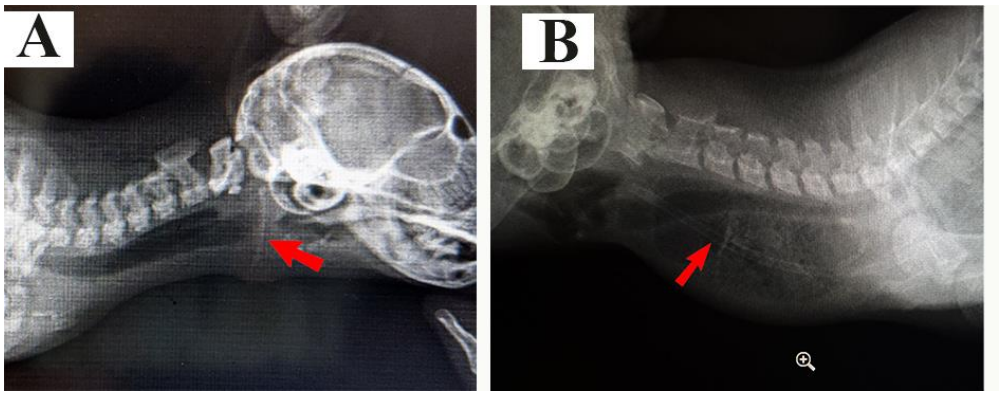

Figure 3.3: Foreign body detection in radiography (A) Bone obstruction at proximal esophagus. (B) Feeding tube obstruction in cervical esophagus with mega esophagus in a cat.

3.4.6. Endoscopic Preparation

EickView HD LED USB-Video Endoscope 150 model (Eickemeyer, Germany) was used in this study. The total length of the insertion tube is 185 cm, and the working length is 150 cm. The diameter is 8 mm. Before every endoscopic observation, the equipment should be checked to ensure it works. An image should be visible and all components such as, air pump, suction, air/water valve, suction valve, disposable cap on biopsy/accessory channel, tip deflection, should be checked before the patient was anaesthetized. Biopsy forceps, grasping forceps should be available and checked before procedure. Recording and the light source should be switched on just before the induction of anesthesia. Mouth gag was placed after sedation or anesthesia to protect the instrument. The full preparation of endoscopy in animals showed in figure 3.4.

Figure 3.4: Endoscopic procedure in a canine patient of our study.

3.5. Premedication

3.5.1. Sedation

Sedation was used only in goats for gastroscopy. Intravenously diazepam 0.5mg/kg body weight was used in goats.

3.5.2. Preanesthetic

Xylazine was used as a preanesthetic agent for gastroscopy in dogs and cats **(Figure 3.5 A)**. It was used intramuscularly at dosage rate of 1 mg/kg body weight intramuscularly on non-cooperative dogs and cats. It was avoided on suspected foreign body obstruction, depressed and animals with cardiopulmonary complications.

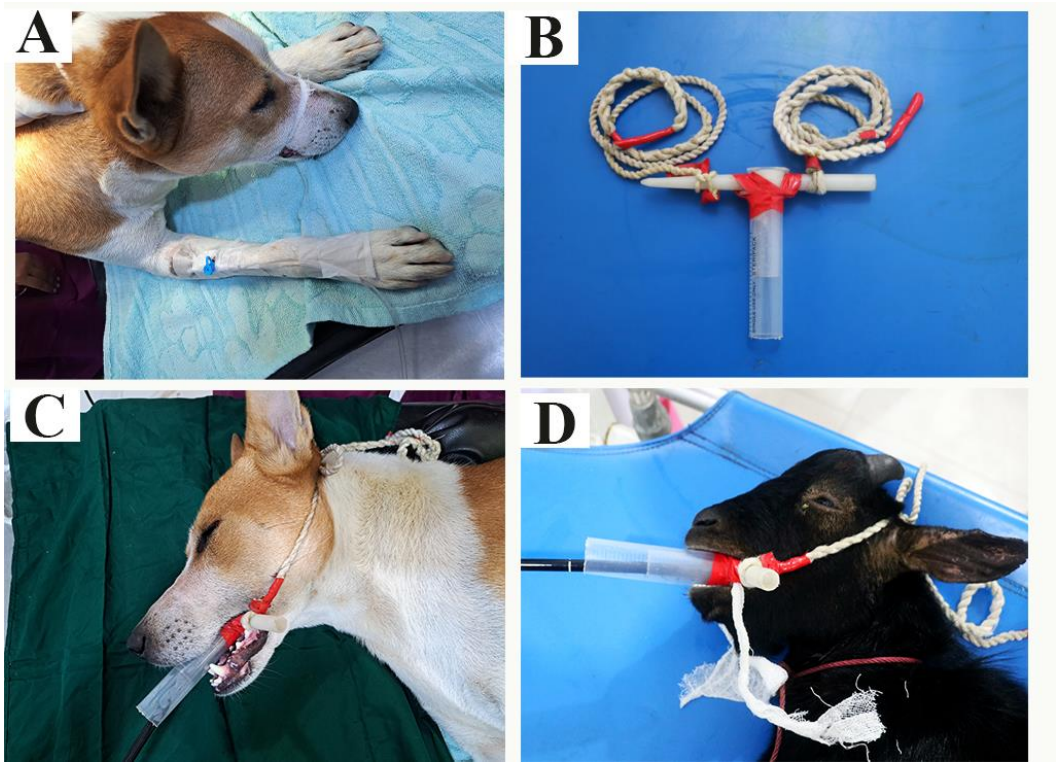

Figure 3.5: (A) Cannulation in cephalic vain in a dog. (B) Preparation of self-modified mouth gag. (C) Placement of mouth gag in a dog. (D) Placement of mouth gag in a goat.

3.6. Fluid Maintenance

After intravenous cannulation on cephalic or jugular vein, maintenance fluid was administered with isotonic saline solution at dose rate of 10 ml/kg body weight/ hour in all animals.

3.7. Anesthesia

For gastroscopy in dogs and cats, the general anesthesia was induced with three different anesthetic protocols. Propofol was used in protocol I at dose rate of 4-6 mg/kg body weight intravenously in non- premedicated animals and 2-4 mg/kg body weight intravenously in premedicated animals. In protocol II ketamine and diazepam combination was used. Diazepam at 0.2-0.3 mg/kg body weight and ketamine at 5.5 mg/kg body weight intravenously used in premedicated animals. In protocol III ketamine was used at dose rate of 8 mg/kg body weight intravenously in non-premedicated or premedicated animals.

3.8. Esophagoscopy

The initial abdominal diameter was measured before positioning. After placement of mouth gag **(Figure 3.5)**, all the animals were placed in a left lateral recumbent position. With the animal's head and neck extended, the endoscope was directed centrally through the oropharynx and the upper esophageal sphincter (UES) comes into view. The scope was easily advanced through the low-resistance sphincter into the cervical esophagus. The esophagus should be insufflated with air until the lumen is clearly visualized. Using only minor adjustments in tip deflection and torque to maintain a full panoramic view of the lumen and mucosal surfaces. Air should be insufflated intermittently to keep the lumen open. The mucosal appearance, tracheal impression, cardiac impression, any foreign body, inflammation, abnormal structure was documented. Detection of gastroesophageal sphincter determines the last part of esophagus. Any therapeutic managed by retrieval forceps was managed through working channel.

3.9. Rumenoscopy

After passing the esophageal sphincter, the endoscope advanced to dorsal sac of the rumen and caudodorsal blind sac. Air should be insufflated intermittently to keep the lumen visible. Water valve was used to clean the camera. The appearance of ruminal content, papillae, ruminal wall, atrium of the rumen and the ruminoreticular opening and parts of reticullum were observed. After rumenoscopy insufflated air were removed by suction or rumenocentesis.

3.10. Gastroscopy

After passing the gastroesophageal sphincter in dogs and cats, the tip of the endoscope was adjusted to observe the gastric lumen. The rugal folds, generally on the greater curvature of the body was appeared. Sufficient amount of air and water were insufflated for clear observation. If respiratory disturbance noticed, A sufficient volume of air to moderately deflate the stomach should be suctioned off as soon as possible. Observation includes appearance gastric contains, nature of gastric mucosa, inflammation, mass, abnormal structure presence in stomach. Proximal part of stomach can be visible by adjusting control knob. incisura angularis, Antrum and proximal part of duodenum can be visible in this part. Cardia and fundus can be seen by retroversion (J-maneuver) at

the position from angulus. Any therapeutic managed by retrieval forceps was managed through working channel. All insufflated air were removed by suctioning through endoscope.

3.11. Postoperative Measurements

After procedure the video document saved in document folder and mouth gag was removed. Face mask oxygenation was provided until recovery. Intra operative and post-operative complication, measurement of abdominal distension and time of recovery (restoration of palpebral reflex, righting reflex and jaw tone) were noted. The abdominal distension was measured after the procedure.

3.12. Statistical Analysis

Data were kept in an MS excel spreadsheet and exported to Stata-IC-13 (Stata Corp, 4905, Lakeway Drive, college station, Texas, USA), for conducting statistical analysis. The results were expressed as frequency, percentage, mean and mean ± SD. The one-way ANOVA was conducted to observe the relationship between the subgroups. The value of $P \leq 0.05$ were considered significant between the variables of subgroups.

Chapter - 4: Results

The study population comprised 10 goats, 10 dogs and 10 cats. All animals were gone through gastroscopic procedure. Among ruminants, four goats had digestive (n=4/10) disturbances following urinary obstruction and the other six goats (n=6/10) had no signs of clinical illness. In canines, five animals (n=5/10) had digestive disturbances like anorexia and vomition, three animals (n=3/10) had a history of foreign body obstruction (FBO), and two animals (n=2/10) were clinically healthy. There were no healthy feline patients in this study. Among the population, six of them (n=6/10) had history of foreign body engulfment and four animals (n=4/10) had disturbances like anorexia and vomition.

Table 4.1: Subgroups of animas based on clinical history

Groups	**Subgroups**	**Number of animals**	**Category of animals**
Goats (G)	G1	6	Goats with history of no clinical illness
	G2	4	Goats with history of digestive disturbances
Dogs (D)	D1	2	Dogs with history of no clinical illness
	D2	5	Dogs with history of digestive disturbances
	D3	3	Dogs with history of FBO
Cats (C)	C1	4	Cats with history of digestive disturbances
	C2	6	Cats with history of FBO

4.1. Medical History

Ten goats of various breeds, body weights, and sexes were taken for the study, three were Jamuna Pari, n=3 and seven were Black Bengal, n=7. The mean age (±SD) of the overall animals was 8.3±9 months (minimum, 2 months; maximum 30 months) and body weight (±SD) was 14.61 ±10.7 kg (minimum, 6.5 kg; maximum 41 kg). Along

with this, 6 animals (6/10, 60%) had no signs of clinical illness, they were sub-grouped in (G1) and 4 animals (4/10, 40%) had history of digestive disturbances (eg; anorexia, tympani, scanty feces) they were sub-grouped in (G2). The mean duration of illness (±SD) of G2 was 66 ±22.97 hours (minimum, 48 hours; maximum 96 hours).

In the canine group, 10 dogs of different breeds, ages, sexes, and body weights underwent gastroscopy. Among them, German shepherds n=2, Lasa apso n=1, Samoyeds n= 2, Spitz n=2 and Indigenous breeds n=3. The mean (±SD) age of overall dogs was 6.3±2.9 years (minimum, 3 years; maximum 12 years). The mean (±SD) body weight of the overall dogs was, 13.57±6.1 kg (minimum, 6.5 kg; maximum 23.6 kg). In subgroup (D1), 2 animals (n=2/10, 20%) were clinically healthy. In subgroup (D2), 5 animals (5/10, 50%) had history of digestive disturbances (eg; anorexia, salivation, vomition and dysphagia) with mean duration of illness (±SD) was 170±193 hours. And in subgroup (D3), 3 animals (n=3/10, 30%) had a history of foreign body obstruction (FBO) with mean duration of illness (±SD) was 48±24 hours.

In the feline group, 10 cats with different breeds, ages, sexes, and bodyweights underwent gastroscopy. Two Persians (n = 2) and eight Native-bred animals (n = 8) were present. Overall, the average (±SD) age of cats was 1.5±1.1 years (minimum, 0.2 years; maximum, 3 years). The mean body weight (±SD) of the overall cats was 3.3±1.2 kg (minimum, 0.8 kg; maximum 4.7 kg). In subgroup (C1), 4 animals (4/10, 40%) had history of digestive disturbances (eg; anorexia, salivation, vomiting, and dysphagia) with a mean duration of illness (±SD) of 170±193 hours. And in subgroup (C2), 6 animals (6/10, 60%) had history of FBO with mean duration of illness (±SD) of 81±59. 89 hours, none of the population had a history of clinical healthiness.

4.2. Physiological Values

Before the gastroscopic procedure, different physiological parameters were taken in all three groups (Table 4.1). In ruminant group, goats of G1 had a mean ± SD rectal temperature (°F) of 100.66±0.57 °F, while goats of G2 had a temperature of 101.32±1.04 °F, both values were within the normal range with reference value (102-104 °F). The mean ± SD heart rate (beats/minute) of G1 was 75.5±14.88, and goats of G2 had 78.25±7.67; both values were within the normal range with reference value (70-90 beats/minute). The average ± SD respiratory rate (breaths/minute) of G1 was

13.17±1.32 breaths/minute and goats of G2 had 13±2.58 breaths/minute, which was within the normal range with the reference value (15-30 breaths/minute). All those above parameters were non-significantly ($p \leq 0.05$) related within subgroups.

In canine group, the mean ± SD rectal temperature (°F) of D1 was 100.5 ± 0.71 °F, dogs of D2 had 101.8±0.78 °F and dogs of D3 had 101.2±1.05 °F, all values were within normal range with reference value (100–102.9 °F). The mean (± SD) heart rate (beats/minute) of D1 had 133± 4.9 beats/minute, dogs of D3 had slightly higher 149± 36 beats/minute and dogs of D2 had 140±30 beats/minute which was within reference range (70-140 beats/minute). The average (±SD) respiratory rate (breaths/minute) of D1 had 25±4 breaths/minute, dogs of D2 had 22±8 breaths/minute and dogs of D3 had 24±6 breaths/minute, all values were within reference range (20-40 breaths/minute). Those values were non-significantly ($p \leq 0.05$) related between groups.

In cats, the mean (±SD) rectal temperature (°F) was 101.22±0.79°F in cats of C1 and 100.16±1.16°F in cats of C2, all values were within normal range with reference value (100–102.9 °F). The mean (±SD) heart rate (beats/minute) was 163±18 beats/minute in cats of C1 and in C2 154±32 beats/minute, those values were within reference range (145-200 beats/minute). The mean (±SD) respiratory rate (breaths/minute) in cats of C1 had 15±3.3 breaths/minute and 16±3.5 breaths/minute in cats of C2, all values were within reference range (20-40 breaths/minute). No significant relationship ($p \leq 0.05$) was obtained in those parameters within groups.

4.5. Hematological Parameters

The hematological parameters were assessed in all animals prior to anesthesia. In table 4.2, the mean (±SD) value of Hemoglobin (Hb) (g/dl) goats of G1 was 7.25±1.11 g/dl and G2 was 4.25±0.64 g/dl which were in the reference range 8-12 g/dl. The average (±SD) Packed-Cell Volume (PCV) in goats of G1 was 22.85±4.55% and 20.5±1.29 % in G2 (reference range 27-45%). The mean (±SD) Total Erythrocyte Count (TEC) (million/cumm) in G1 was 13.77±4.42 million/cumm and in G2 11.75±1.22 million/cumm (reference range 9-15 million/cumm) which was statistically significant ($P \leq 0.05$) between the subgroups.

Table 4.1: Physiological parameters of goats, dogs and cats.

Parameters	**Goat**				**Dog**					**Cat**			
	G1 (mean ± SD)	G2 (mean ± SD)	P	RV	D1 (mean ±SD)	D2 (mean ± SD)	D3 (mean ± SD)	P	RV	C1 (mean ± SD)	C2 (mean ± SD)	P	RV
RT (°F)	100.66 ± 0.57	101.32 ± 1.04	0.27	102–104	100.5 ± 0.71	101.8 ± 0.78	101.2 ± 1.05	0.89	100–102.9	101.22±0.79	100.16±1.16	0.49	100–102.9
HR (beats/minute)	75.5±14.88	78.25±7.67	0.26	70-90	133± 4.9	140± 30	149± 36	0.33	70-140	163±18	154±32	0.34	145-200
RR (breaths/minute)	13.17 ± 1.32	13±2.58	0.22	15-30	25±4	22±8	24±6	0.72	20-40	15±3.3	16±3.5	0.92	20-40

RT= Rectal temperature; HR = Heart rate; RR= Respiratory rate.

RV = Reference value (Fossum, 2019; Norkus, 2018; Walz & Lin, 2014)

The mean (±SD) Total Leukocytic Count (TLC) (thousand/cumm) of goats in G1 was 12.16±7.50 thousand/cumm and in G2 20.65±3.55 thousand/cumm both the subgroups had high TLC count from reference range (4-8 thousand/cumm). The mean (±SD) percentage of neutrophil of goats in G1 was 35.83±4.4% and 34±2.58% in goats of G2 which were in reference range (30-48%). The average (±SD) percentage of lymphocytes of G1 was 7.91±3.29% and 11.92±2.07% in goats of G2. The goats of G2 had higher lymphocyte percentage from reference range (4-8%). The mean (±SD) monocyte percentage of G1 was 0.52±0.63% and 1.05±0.38% in goats of G2 which were in the reference range (0-4%). The mean (±SD) eosinophil percentage of G1 was 1.33±1.03% and 1.75±2.21% in goats of G2 which were in the reference range (0-10%).

In table 4.3, the average (±SD) Hb (g/dl) level of dogs in D1 was 21±1.41 g/dl, 14.5±1.53 g/dl in D2 and 16.67±2.08 g/dl in D3. The dogs of D1 showed higher value of Hb and other subgroups had normal value within reference range (12-18 g/dl). The mean (±SD) Erythrocyte Sedimentation Rate (ESR) (mm in 1st hour) in dogs of D1 was 7.5±0.7 mm in 1st hr, 9.5±11.33 mm in 1st hr in D2 and 4.66±0.57 mm in 1st hr in dogs of D3. The dogs of D1 and D2 had higher ESR value from reference range (0-6 mm in 1st hr) which was statistically significant ($P \leq 0.05$) between the subgroups. The mean (±SD) TEC (million/cumm) value of dogs in D1 was 7.54±1.9 million/cumm, 7.04±1.04 million/cumm in D2 and 7.63±0.32 million/cumm in D3. All the values were within the reference range 5.5-8.5 (million/cumm). The mean (±SD) TLC (thousand/cumm) value of dogs in D1 was 9.14±0.35 thousand/cumm, 19.99±7.83 thousand/cumm in D2 and 15.33±0.57 thousand/cumm in dogs of D3. The dogs of D2 had the higher TLC value from reference range (6-17 thousand/cumm) which was statistically significant ($P \leq 0.05$) between the subgroups. The mean (±SD) percentage of PCV value of dogs in D1 was 56±1.41%, 44.8±4.6% in D2 and 42.33±2.08% in D3. The dogs of D1 had the higher value of PCV percentage than reference range (37-55%). The mean (±SD) percentage of lymphocyte in dogs of D1 was 20±2.82%, 24.6±5.36 % in dogs of D2 and 31.66±6.11% in dogs of D3. All dogs had normal lymphocyte percentage from reference value (10-48%). The average(±SD) percentage of neutrophil in dogs of D1 was 66±2.82%, 69.1±8.08% in dogs of D2 and 78.33±9.29% in dogs of D3. All the values were within the reference range (30-115%). The average (±SD)

percentage of eosinophil in dogs of D1 was 3±0%, 4.5±1% in D2 and 5±3% in dogs of D3. All dogs had normal eosinophil percentage from reference value (1-12%). The average (±SD) percentage of monocyte in dogs of D1 was 7.5±0.7% and 5.3±2.81% in dogs of D2 and 7.66±3.05% in dogs of D3. All dogs had normal monocyte percentage from reference value (1-13%). The percentage of basophil in dogs was rear, which was similar with reference value.

In table 4.4, the average (±SD) value of Hb (g/dl) in cats of C1 was 10.45±2.82 g/dl and 11.06±2.58 g/dl in C2. All cats had normal Hb level from reference range (8-15 g/dl). The mean (±SD) value of ESR (mm in 1st hour) in cats of C1 was 13.5±2.78 mm in 1st hr and 17.58±3.05 mm in 1st hr in C2. All cats had normal ESR level from reference range (6-25 mm in 1st hr). The mean (±SD) TEC (million/cumm) level in cats of C1 was 7.9±1.15 million/cumm and 8.15±1.18 million/cumm in cats of C2. All cats had normal TEC level from reference range (5-10 million/cumm). The mean (±SD) TLC (thousand/cumm) level in cats of C1 11.1±2.8 thousand/cumm and 12.36±3.87 thousand/cumm in C2. All cats had normal TLC level from reference range (5.5-19.5 thousand/cumm). The mean (±SD) percentage of PCV in cats of C1 was 43±17.33% and 34.83±7.25% in C2. All cats had normal value from reference range (24-45%). The mean (±SD) percentage of lymphocyte of cats in C1 was 45.25±19.2% and 48.83±19.93% in C2. All cats had normal lymphocyte value from reference range (15-70%). The mean (±SD) percentage of neutrophil in cats of C1 was 75.25±11.78% and 77.66±9.35% in C2. All cats had normal neutrophil value from reference range (61-94%). The mean (±SD) percentage of eosinophil in cats of C1 was 3±1.82% and 3.83±2.71% in C2. All cats had normal eosinophil value from reference range (0-15%). The mean (±SD) percentage of monocyte in cats of C1 was 1.75±0.95% and 4.33±1.5% in C2. All cats had normal monocyte value from reference range (1-8%). The percentage of basophil in cats was rear, which was similar with reference value.

Table 4.2: Average (±SD) hematological parameters in goats

	Hb (g/dl)	**PCV* (%)**	**TEC* (million/cumm)**	**TLC (thousand/cumm)**	**Neutrophil (%)**	**Lymphocyte (%)**	**Monocyte (%)**	**Eosinophil (%)**
Reference value	8-12	27-45	9-15	4-8	30-48	4-8	0-87.5	0-10
G1	7.25±1.11	22.85±4.55	13.77±4.42	12.16±7.50	35.83±4.4	7.91±3.29	0.52±0.63	1.33±1.03
G2	4.25±0.64	20.5±1.29	11.75±1.22	20.65±3.55	34±2.58	11.92±2.07	1.05±0.38	1.75±2.21

*Statistically significant (P≤0.05)

Reference value (Weiss & Wardrop, 2011)

Table 4.3: Average (±SD) hematological parameters in dogs

	Hb (g/dl)	**ESR* (mm in 1st hr)**	**TEC (million/cumm)**	**TLC* (thousand/cumm)**	**PCV (%)**	**Lymphocyte (%)**	**Neutrophil (%)**	**Eosinophil (%)**	**Monocyte (%)**	**Basophil (%)**
Reference value	12-18	0-6	5.5-8.5	6-17	37-55	10-48	30-115	1-12	1-13	Rare
D1	21±1.41	7.5±0.7	7.54±1.9	9.14±0.35	56±1.41	20±2.82	66±2.82	3±0	7.5±0.7	0
D2	14.5±1.53	9.5±11.33	7.04±1.04	19.99±7.83	44.8±4.6	24.6±5.36	69.1±8.08	4.5±1	5.3±2.81	0
D3	16.67±2.08	4.66±0.57	7.63±0.32	15.33±0.57	42.33±2.08	31.66±6.11	78.33±9.29	5±3	7.66±3.05	0

*Statistically significant (P≤0.05)

Reference value (Weiss & Wardrop, 2011)

Table 4.4: Average (±SD) hematological parameters in cats

	Hb (gm%)	**ESR (mm in 1st hr)**	**TEC (million/cumm)**	**TLC (thousand/cumm)**	**PCV (%)**	**Lymphocyte (%)**	**Neutrophil (%)**	**Eosinophil (%)**	**Monocyte (%)**	**Basophil (%)**
Reference value	8-15	6-25	5-10	5.5-19.5	24-45	15-70	61-94	0-15	1-8	Rare
C1	10.45±2.82	13.5±2.78	7.9±1.15	11.1±2.8	43±17.33	45.25±19.2	75.25±11.78	3±1.82	1.75±0.95	0
C2	11.06±2.58	17.58±3.05	8.15±1.18	12.36±3.87	34.83±7.25	48.83±19.93	77.66±9.35	3.83±2.71	4.33±1.5	0

Reference value (Weiss & Wardrop, 2011)

4.6. Endoscopic Findings

4.6.1. Esophagoscopy

Gross observations of the tubular organs were taken during the procedure and analyzed using recoded video after the gastroscopic procedure. In goats, the pharyngeal mucosa and the esophageal mucosa were light pink and smooth. After passing the pharyngeal part, the submucosal vascular pattern was visualized by insufflation of air **(Figure 4.1)**.

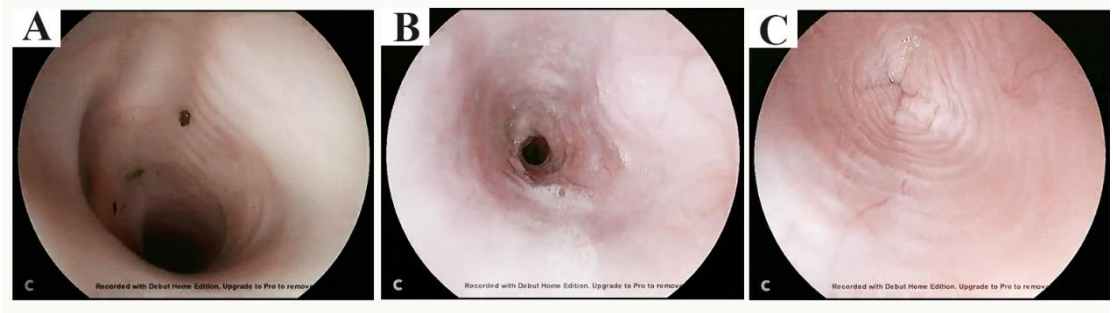

Figure 4.1: Normal view of thoracic esophagus with tracheal impression in (A) Goat and (B) Dog. (C) The herringbone pattern of distal esophagus in cat

All the healthy individuals and animals with a history of digestive disturbances had a normal submucosal vascular pattern (n=10). The tracheal and heart impressions were obtained in esophagus of all animals. Few feed particles (n=1/6), ruminal liquid (n=2/6), and clear esophageal lining (n=3/6) were obtained in esophagus in goats of G1. The presence of feed particles in esophageal lining was documented in all the goats (n=4/4) of G2. The lower esophageal sphincter (LES) was observed open (n=6/6) in all animals of G1 and goats of G2 had open LES (n=2/4) and closed LES (n=2/4).

In dogs, gastroscopy was performed by placing a mouth gag after general anesthesia. The oropharyngeal opening was observed after the introduction of the insertion tube. All animals exposed normal mucosal appearance of pharynx (n=10). After passing the pharyngeal part and upper esophageal sphincter (UES) the star-shaped mucosal fold was observed. With insufflation of air and minimal pressure on the endoscope tip, the mucosal appearance was recorded.

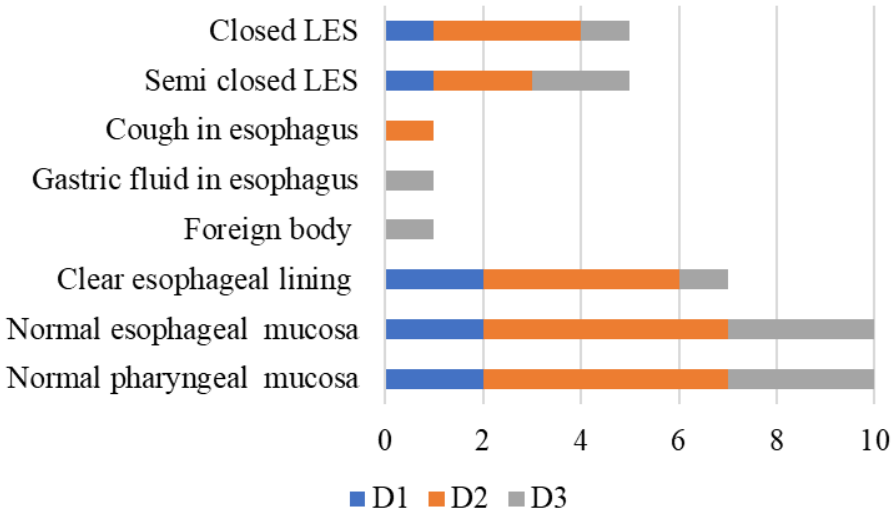

Figure 4.2: Gross findings of esophagoscopy in dogs.

Smooth, glistening, and pink appearances of esophageal mucosa were documented in all animals (n=10). The presence of cough materials in cervical esophageal region was found in a dog (n=1/5) of D2 and gastroesophageal reflux was noticed by detecting the presence of gastric fluid in esophagus in dog (n=1/3) of D3. In radiographic observation, foreign bodies were undetected in dogs of D3 (n=3/3). On esophagoscopy, part of chicken bone was retrieved with foreign body retrieval forceps from anterior to the lower esophageal sphincter (LES) in an animal (n=1/3) of D3, other animals (n=2/3) obtained false history of FBO. The LES obtained semi-closed in a dog (n=1/2) of D1, two dogs in dogs in D2 (n=2/5) and D3 (n=2/3). Closed LES was obtained in a dog (n=1/2) of D1 and a dog of D3 (n=1/3), also three dogs (n=3/5) from D2. The findings were summarized in figure 4.2.

In cats, gastroscopy was performed as the same procedure as in dogs. After examination of the oropharynx, the tip of the scope moved towards the UES. All examined cats exposed normal mucosal appearance in pharynx (n=10). The unique submucosal vascular pattern in esophagus was found in cats (n=3/4) of C1 and cats (n=4/6) of C2. In radiographic examination, radio-opaque foreign bodies were detected (n=4/6) in esophagus in cats of C2. The types of foreign bodies were chicken bone (n=3/6), feeding tube (n=1/6) and cotton thread (n=1/6). One cat (n=1/6) obtained false history of FBO **(Figure 4.3)**.

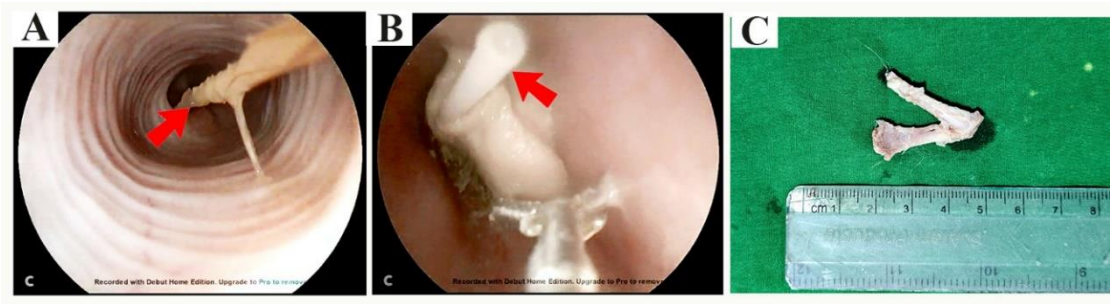

Figure 4.3: (A) Cotton thread which was tied at the base of esophagus and (B) Feeding tube logged within the esophagus in a cat. (C) Chicken bone (3cm) retrieved from proximal part of esophagus in cat.

The cotton thread was removed by gastrotomy, chicken bones (n=3/6) and feeding tube (n=1/6) were removed by foreign body retrieval forceps. The status of FBO in x-ray and endoscopy with their history in dogs and cats was described in figure 4.6. Congested vasculation with esophagitis on distal part of the esophagus (n=1/6), mega esophagus (n=1/6) was noticed in cats of C2 and mid cervical esophagitis was found in a case (n=1/4) from C1 **(Figure 4.4)**.

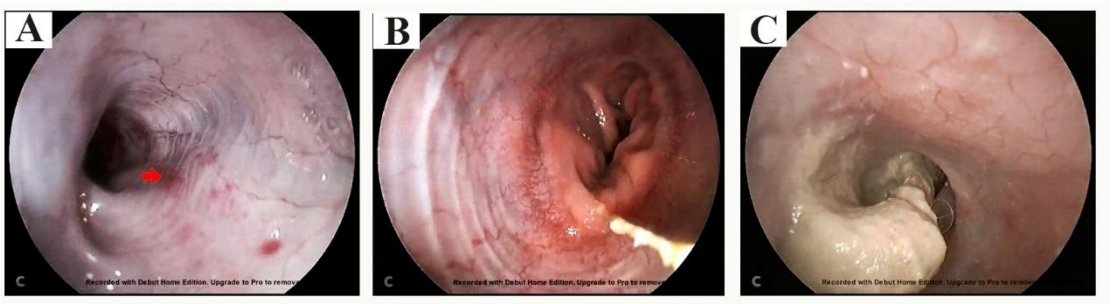

Figure 4.4: Esophagitis at (A) Thoracic part of esophagus and (B) Lower esophageal sphincter in a cat. (C) Mega esophagus with containing feed materials in feline patients.

Closed LES was found in most of the animals of C1 and C2. LES was found open (n=1/6), semi-closed (n=2/6) and closed (n=3/6) in cats of C2, closed (n=3/4) and semi-closed (n=1/4) LES was obtained in cats of C1. The findings of esophagoscopy in cats were summarized in table 4.5.

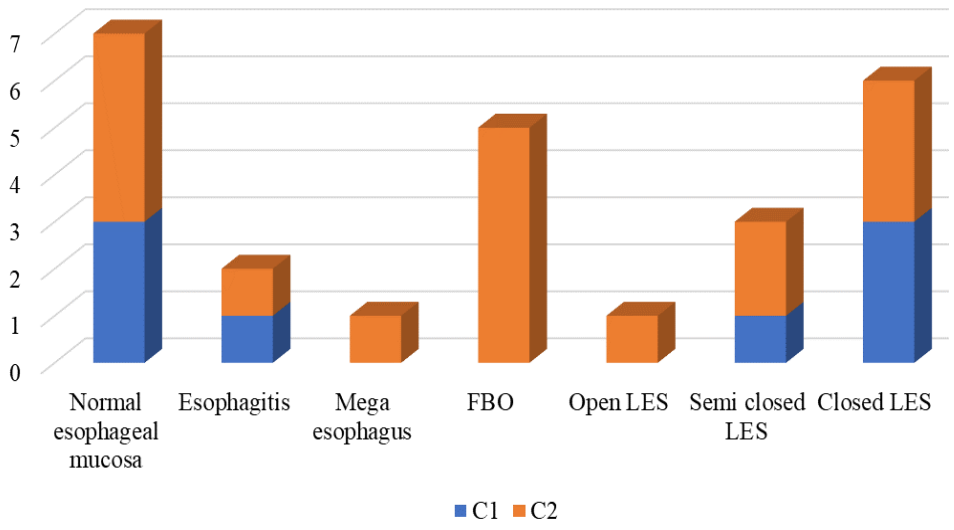

Figure 4.5: Gross findings of esophagoscopy in cats.

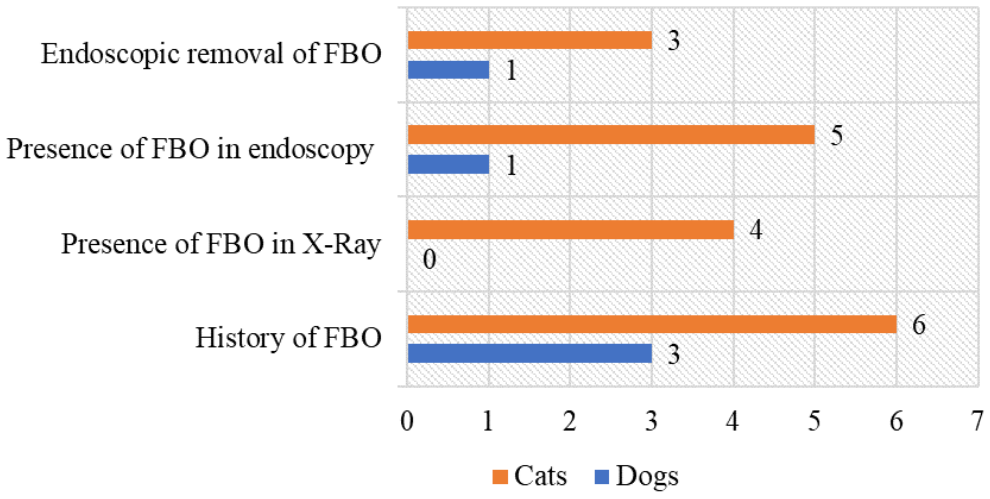

Figure 4.6: Status of FBO in dogs and cats.

4.6.2. Ruminoscopy:

After passing the LES the tip of the scope was adjusted and air was insufflated to inflate the rumen. The mean (±SD) duration of fasting in goats of G1 was 15±5.47 hours and 33.5±16.76 hours in goats of G2. The fasting time was significantly ($p \leq 0.05$) higher in goats with history of digestive disturbances than healthy. The surface of the ruminal mucosal color, smoothness, nature of papillae and nature of ruminal content were evaluated **(Figure 4.7)**. Ruminal dorsal sac and caudodorsal blind sac were obtained in all animals (n=10). Milky gray (n=1/4) and yellowish brown (n=3/4) color of ruminal liquid obtained in G2. Brownish green (n=2/6) and yellowish green (n=4/6) color of ruminal liquid observed in G1. The nature of ruminal content observed, lightly viscous (n=2/6), slimy viscous with gas bubbles (n=26) and slimy viscous with frothy appearance (n=2/6) were found in goat of G1. In G2, slimy aqueous (n=1/4), slimy viscous (n=2/4) and gas bubbles with slimy viscous (n=1/4) ruminal content recorded. Ruminal parasite on ruminal wall (n=1/4), small sized ruminal papillae were (n=1/4) obtained in G2 and other cases exposed healthy ruminal papillae (n=2/4). All goats of G1 had normal ruminal papillae (n=6/10). Ruminoreticular fold and honeycomb like reticular mucosa was observed in only one cases in G1 (n=1/6) (**(Figure 4.9 & 4.10)**. The ruminal pH of G1 was 6.5-7.5 and 5-5.5 was in G2 **(Figure 4.8)**.

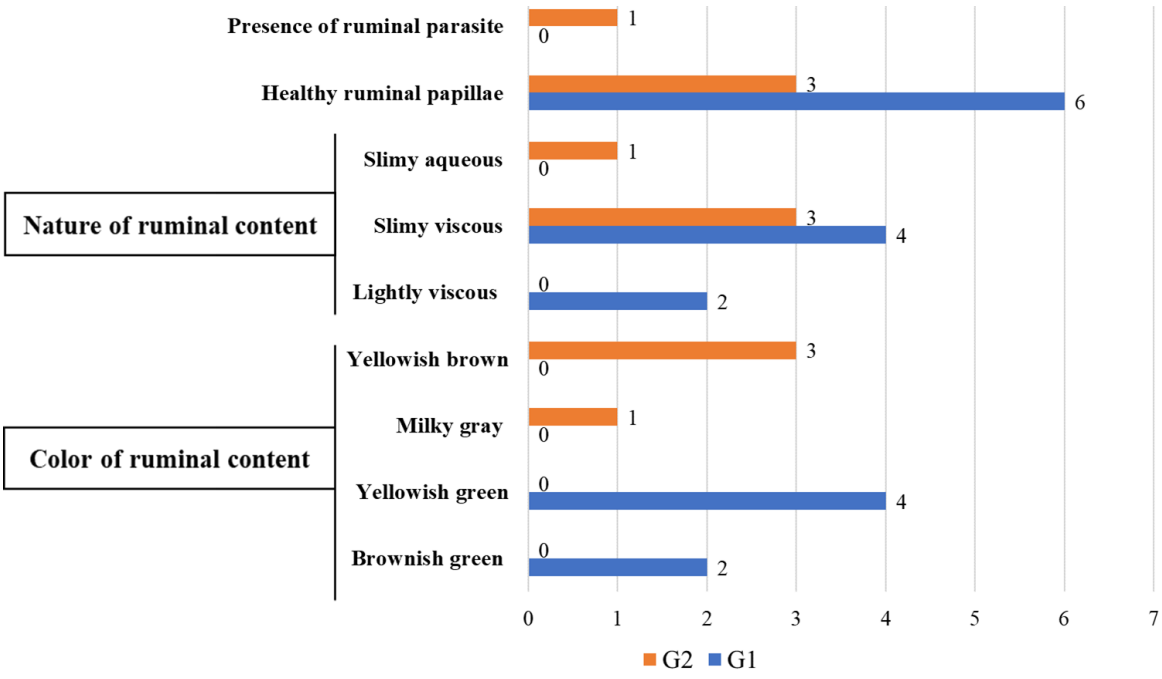

Figure 4.7: Gross findings of ruminoscopy in goats.

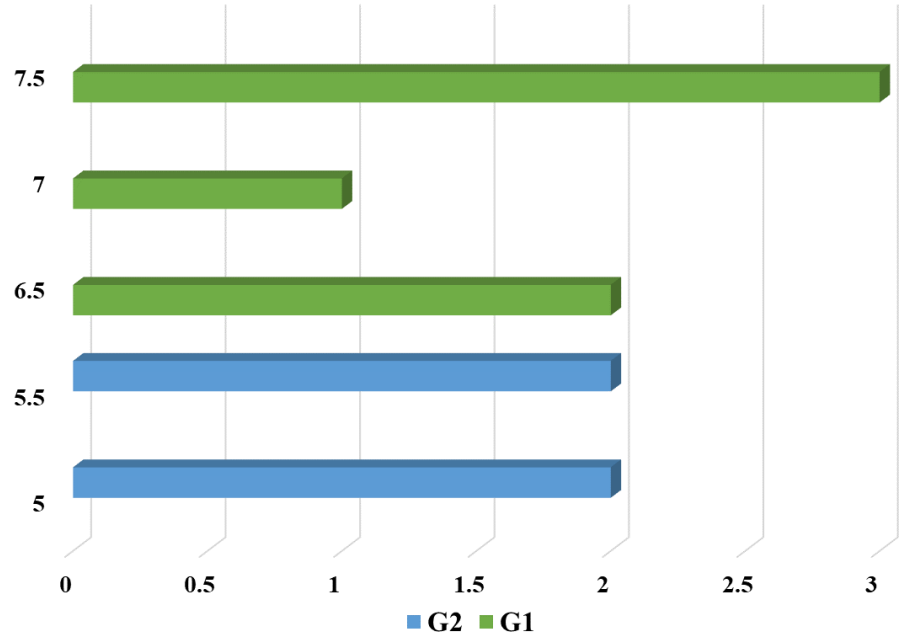

Figure 4.8: Ruminal pH measured by pH strips form sample of rumenocentesis in goats.

Ruminal microfloral motility was moderate (++) (n=6/6) in one focal field (10x) was documented in all goats of G1. In goat of G2, nill (-) (n=1/4) and few (+) (n=3/4) ruminal microfloral motility in one focal field were documented.

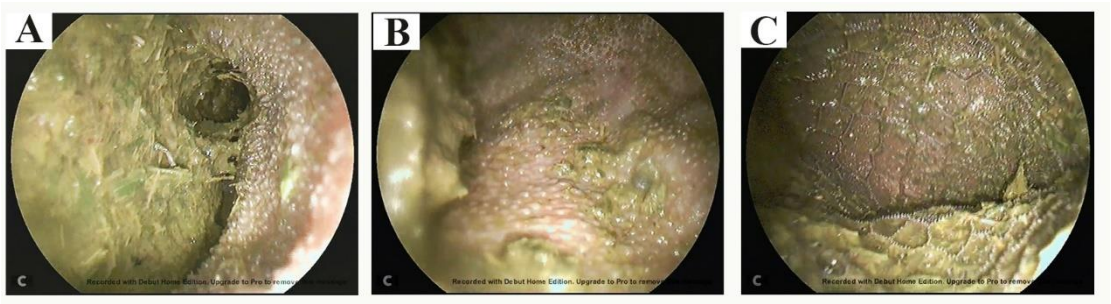

Figure 4.9: (A&B) Healthy ruminal papillae with normal ruminal content. (C) Honeycomb like Reticular mucosa in normal goats.

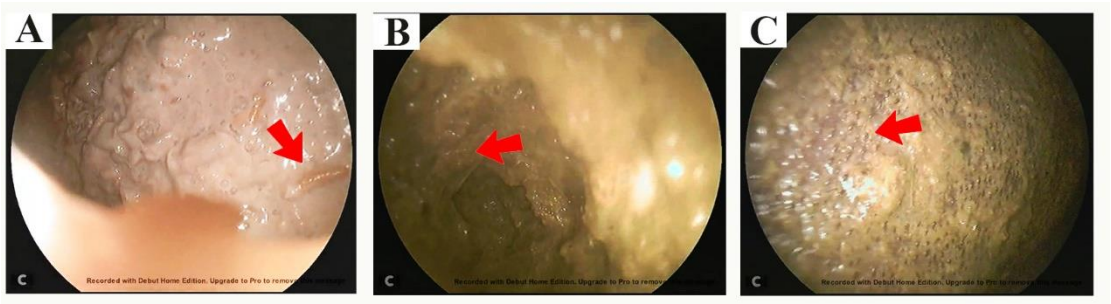

Figure 4.10: (A) Ruminal parasite obtained on ruminal wall with milky grayish ruminal content. (B) Yellowish green frothy ruminal content. (C) Frothy ruminal content with shorter size of ruminal papillae.

4.6.3. Gastroscopy

After passing the LES the tip of the scope was adjusted and air was insufflated inflated the stomach **(Figure 4.11)**. In canine group (D), all the parts of stomach were examined. The stomach contains semi-liquid (n=1/2) and solid feed (n=1/2) in dogs of D1. Dogs of D2 had semiliquid and partially digested feed (n=1/5), liquid (n=2/5), frothy (n=1/5) and presence of cough (n=1/5) in stomach. Partially digested (n=1/3), liquid (n=1/3) and empty stomach (n=1/3) obtained in D3. Most of the mucosal changes noticed at the body of stomach, some of them were on antrum.

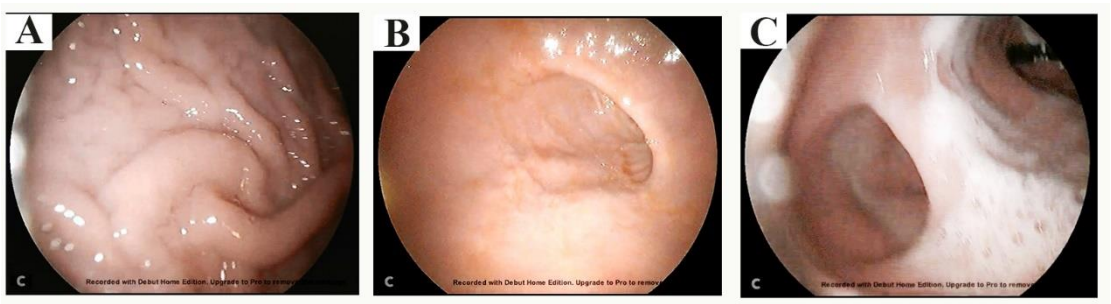

Figure 4.11: (A) Normal appearance of gastric rugae in dogs. (B) Proximal antrum with incisura angularis in cats. (C) Antrum and fundus, incisura angularis dividing in middle in dogs.

In dogs of D1 had mild (n=1/2) and moderate gastritis (n=1/2) on the body of stomach. Dogs of D2 had mild (n=2/5), moderate gastritis (n=1/5) and others in this group had normal gastric mucosa (n=2/5). A dog from D3 exposed severe gastric ulceration in gastric body and antrum (n=1/3), others in this group obtained normal gastric mucosa (n=2/3). **(Figure 4.12 and 4.13)**.

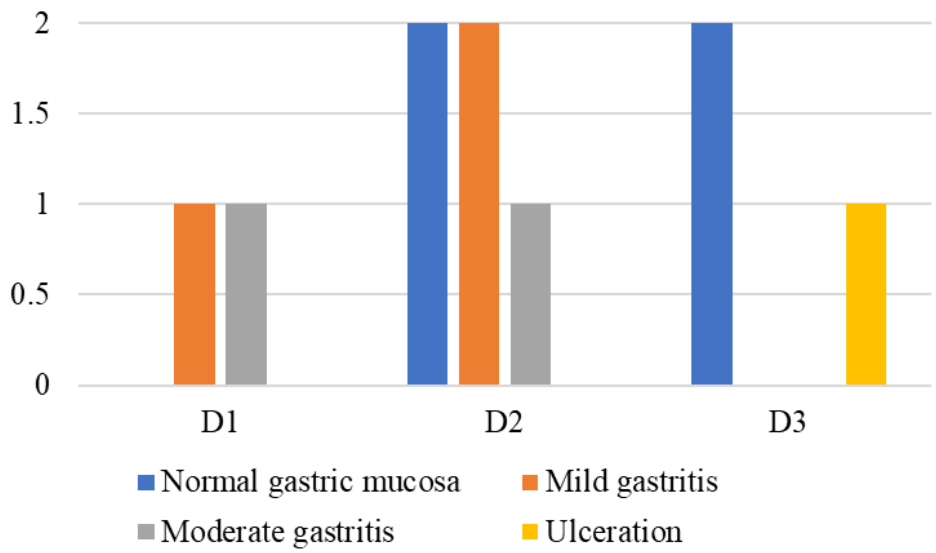

Figure 4.12: Gross findings of gastric mucosa in dogs

In feline group (C), the gastroscopy was done as the same procedure as canine. The stomach contains cotton thread (n=1/6), partially digested feed (n=3/6) and empty stomach (n=2/6) in cats of C2. Cats of C1 had liquid feed (n=1/4) and empty stomach with frothy contains (n=3/4). There was normal mucosal appearance obtained in all (n=4/4) cats of C1. All the gastric mucosal changes obtained in gastric body. Cats of C2 had severe gastric ulceration (n=1/6), mild gastritis (n=1/6) on the body of stomach and normal mucosal appearance (n=4/6) **(Figure 4.13 and 4.14)**.

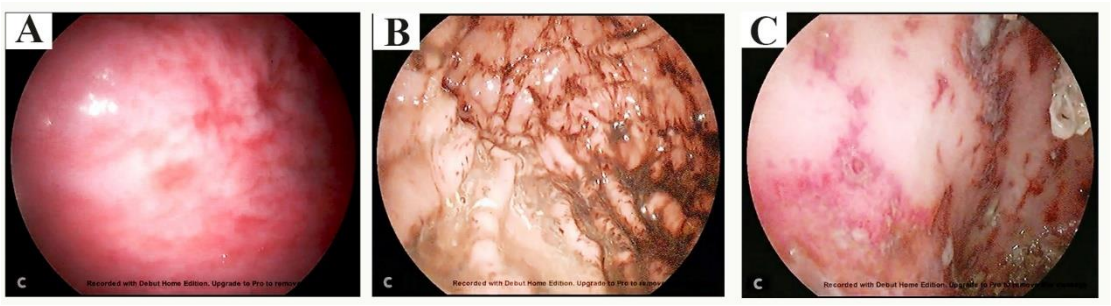

Figure 4.13: (A) Mild gastritis at body of stomach in a dog. (B) Severe gastric ulceration in gastric body and antrum of a dog. (C) Severe gastric ulceration at gastric body and antrum of a cat.

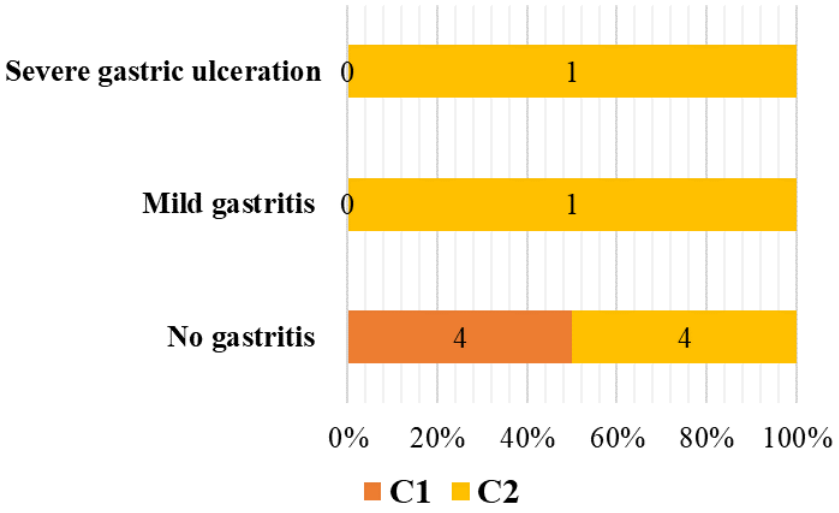

Figure 4.14: Gross findings of gastric mucosa in cats

4.7. Anesthesia and Recovery

The gastroscopic procedure in goats were done only under sedation. Diazepam at the dose rate of 0.5mg/kg body weight was administered intravenously in all the animals (n=10). The mean (± SD) duration of procedure (minute) of G1 was 8.03±4.41 minutes, 11.49±6.93 minutes in goats of G2. The mean (±SD) recovery time in G1 was 12.33±2.25 minutes and 14.75±4.11 minutes in G2. The mean (±SD) abdominal distension (inch) after gastroscopic procedure in G1 was 1.08±0.58 inch and 1.75±0.64 inch in G2. Those values were non-significantly ($p \leq 0.05$) higher in G2 than G1 After gastroscopic procedure some complications observed in both sub-groups of animals (n=4/10), complications include regurgitation of ruminal content (n=1/4) and some of them gone in depression state (n=3/4) which enhance recovery time. The parameters were summarized in table 4.7.

Xylazine was used as premedication in dogs. Depending on conditions of animal premedication were used in most of the animals (n=8/10) and some of them (n=2/10) were gone through general anesthesia without premedication. In general anesthesia, three protocols were maintained. In protocol I, ketamine was administered (n=1/10) intravenously at 5 mg/kg bodyweight for induction. In protocol II, ketamine and diazepam combination was administered (n=6/10) intravenously at dose rate 5.5 mg/kg and 0.2-0.3 mg/kg body weight respectively. In protocol III, propofol was administered (n=3/10) at a dose rate 4 mg/kg body weight intravenously. The parameters were

summarized in table 4.5. The average (±SD) fasting duration (hour) of dogs in D1 was 9±4.14 hours, 24±8.9 hours in dogs of D2 and 22±9.17 hours in dogs of D3. Dogs of D2 had non-significantly ($p \leq 0.05$) longer fasting duration than dogs of D1 and D3. The mean (±SD) duration of procedure (minute) of D1 was 8.13±6.88 minutes. Dogs of D2 took 3.85±1.33 minutes procedural time. And dogs of D3 had 6.90±0.94 minutes of procedural time. Dogs in D2 had significantly ($p \leq 0.05$) less procedural time than dogs in D1 and D3. The mean (±SD) recovery time in D1 was 37.5±3.53 minutes, 34±12.94 minutes in dogs of D2 and 33.33±23.09 minutes in D3. The recovery time was non-significantly ($p \leq 0.05$) less in D3 than in D1 and D2. The mean (±SD) abdominal distension (inch) after the gastroscopic procedure in D1 was 0.25±0.35 inch, 0.1±0.22 inch in D2 and 0.9±0.52 inch in D3. The average abdominal distension was non-significantly ($p \leq 0.05$) less in D2 than in D1 and D3. Vomiting of cough materials were documented in an animal (n=1/10) during gastroscopic procedure, other animals (n=9/10) had no complications during and after the procedure. The parameters were summarized in table 4.8.

Gastroscopy in feline species, most of the animals were selected for general anesthesia without premedication (n=6/10) and xylazine was used as a premeditative agent in some of the animals (n=4/10).

Table 4.5: Summarized general anesthetic protocol in dogs.

Pre-Anesthetic	**Dose (mg/kg body weight)**	**Number of animals**		**Anesthetics**	**Dose (mg/kg body weight)**	**Number of animals**
Xylazine	1	8		Ketamine	5	1
Without premedication	0	2		Ketamine and diazepam	5.5+(0.2-0.3)	6
				Propofol	4	3

Table 4.6: Summarized general anesthetic protocol in cats.

Pre-Anesthetic	**Dose (mg/kg body weight)**	**Number of animals**		**Anesthetics**	**Dose (mg/kg body weight)**	**Number of animals**
Xylazine	1	4		Ketamine	7-8	4
Without premedication	0	6		Ketamine and diazepam	5+0.2	1
				Propofol	4-8	5

All cats were in fasting conditions before gastroscopic procedure. The mean (±SD) fasting duration (hour) in cats of C1 had 18.25±20.1 hours and cats of C2 had 25.83±19.06 hours. The fasting duration was non-significantly ($p \leq 0.05$) higher in cats of C2 than C1. The general anesthesia protocol was the same as gastroscopy in canine species, three protocols were used here. In protocol I, ketamine was administered (n=4/10) intravenously at 7-8 mg/kg bodyweight for induction. In protocol II, ketamine and diazepam combination was administered (n=1/10) intravenously at dose rate 5 mg/kg and 0.2 mg/kg body weight respectively. In protocol III, propofol was administered (n=5/10) at dose rate 4-8 mg/kg body weight intravenously. The parameters were summarized in table 4.6.

The mean (±SD) duration of procedure (minute) was 4.20±3.36 minutes in cats of C1 and 13.55±20.64 minutes in cats of C2. The procedural time was significantly ($p \leq 0.05$) less in C1 than cats of C2. The mean (±SD) abdominal distension (inch) after gastroscopic procedure in cats of C1 had 0.3±0.35 inch and 0.28±0.39 inch in cats of C2. The size of abdominal distension was non-significantly ($p \leq 0.05$) less in cats of C2 than C1. The mean (±SD) recovery time (minute) in cats of C1 was 25±9.12 minutes and 17.83±7.22 minutes in C2. The average time of recovery was non-significantly ($p \leq 0.05$) shorter in cats of C2 than C1.

The mean (±SD) duration of recovery (minute) of ketamine in dogs was 20±0 minutes, 42.5±14.05 minutes in administration of ketamine and diazepam combination and 28.33±7.63 minutes in administration of propofol. The recovery time after administration of ketamine was non-significantly ($p \leq 0.05$) shorter than other protocols in dogs. In cats, the mean (±SD) duration of recovery (minute) of ketamine was 21.25±6.3minutes, 35±0 minutes in administration of ketamine and diazepam combination and 17.4±7.98 minutes in administration of propofol. The recovery time after administration of propofol was non-significantly ($p \leq 0.05$) shorter than other protocols in cats. The parameters were summarized in table 4.10.

Vomiting reflux were documented in an animal (n=1/10) during gastroscopic procedure, one animal (n=1/10) had died after the procedure and other animals (n=8/10) had no complications during and after the procedure. The parameters were summarized in table 4.9.

Table 4.7: Summarized relationship between preclinical observations with post procedural findings in goats.

Subgroup	Duration of illness (mean ± SD) (hour)	P	Duration of fasting (mean ± SD) (hour)	P	Duration of procedure (mean ± SD) (minute)	P	Abdominal distension (mean ± SD) (inch)	P	Duration of recovery (mean ± SD) (minute)	P
G1	0	-	15±5.47	0.04	8.03±4.41	0.40	1.08±0.58	0.85	12.33±2.25	0.26
G2	66±22.97		33.5±16.76		11.49±6.93		1.75±0.64		14.75±4.11	

Table 4.8: Summarized relationship between preclinical observations with post procedural findings in dogs.

Subgroup	Duration of illness (mean ± SD) (hour)	p	Duration of fasting (mean ± SE) (hour)	p	Duration of procedure (mean ± SD) (minute)	p	Abdominal distension (mean ± SD) (inch)	p	Duration of recovery (mean ± SD) (minute)	p
D1	0	0.026	9±4.24	0.765	8.13±6.88	0.03	0.25±0.35	0.43	37.5±3.53	0.29
D2	170 ±193		24.2±8.9		3.85±1.33		0.1±0.22		34±12.94	
D3	48 ±24		22±9.17		6.90±0.94		0.9±0.52		33.33±23.09	

Table 4.9: Summarized relationship between preclinical observations with post procedural findings in cats.

Subgroup	Duration of illness (mean ± SD) (hour)	p	Duration of fasting (mean ± SD) (hour)	p	Duration of procedure (mean ± SD) (minute)	p	Abdominal distension (mean ± SD) (inch)	p	Duration of recovery (mean ± SD) (minute)	p
C1	81 (±59. 89)	0.09	18.25±20.1	0.92	4.20±3.36	0.01	0.3±0.35	0.86	25±9.12	0.66
C2	36.83 (±23.78)		25.83±19.06		13.55±20.64		0.28±0.39		17.83±7.22	

Table 4.10: Comparison of duration of recovery in different anesthetic protocols in dogs and cats.

Species	Recovery time in ketamine (minute) (Mean ±SD)	Recovery time in ketamine and diazepam combination (minute) (Mean ±SD)	Recovery time in propofol (minute) (Mean ±SD)	P
Dog	20±0	42.5±14.05	28.33±7.63	0.39
Cat	21.25±6.3	35±0	17.4±7.98	0.68

Chapter - 5: Discussion

The flexible endoscope used in our study was fully appropriate for gastroscopy of upper digestive tract in animals. The true color and mucosal appearance of internal organs can be viewed by endoscope. The minimally invasive approaches allow smooth gastroscopy in the studied age range of animals. The diagnostic value insures confirmative diagnosis of any digestive disturbances in animals. The oral introduction of endoscope is more suitable than other methods of gastroscope (Franz et al., 2006). Small ruminants can be sedated or non-sedated for gastroscopy (Stierschneider et al., 2007), but general anesthesia must needed in case of gastroscopy in dogs and cats (Cox, 2015). Self-modified mouth gag was used in our study to protect the scope at the time of procedure. The oral approaches of gastroscopy in small ruminants was the most easiest method and less invasive which supports findings of (Franz et al., 2006; McRae et al., 2016). Endoscopy in goats was rarely mentioned, on the other hand, gastroscopy in dogs and cats was very common. In this study, gastroscopy was performed on three different species within different clinical conditions. The clinical history, physiological parameters and radiographic observation were insufficient for diagnosis of digestive disturbances. The findings of this study give confirmatory diagnosis and show a relationship within obtained clinical history and radiographic findings.

In this study, endoscopy by oral approaches was adapted in goats aged more than 2 months and body wight more than 6.5 kg. whoever, in a study, researcher described that, scope configured 4mm diameter with 100cm long could not suitable for goats <8 months of age (Stierschneider et al., 2007). But in our study, we smoothly performed endoscopy in 2 month aged goat with 8 mm diameter with 150 cm long fiberscope. The minimum age in canine group was 3 year and maximum 12 year and in feline group, 0.2 years was minimum and maximum 3 year. However, in this study, no technical complications were obtained in younger animals. Smooth, light pink and glistening appearance esophageal mucosa were found in goats and dogs (Cox, 2015; Stierschneider et al., 2007); distinctive herringbone pattern was the unique nature of esophageal lining of cats (Cox, 2015). In the study, the similar mucosal appearance was found. There was no relationship found on breed variation with gastroscopy.

The maximum duration of illness in goats with digestive disturbances was 4 days, and fasting duration 2 days. The longer fasting conditions results better visibility in ruminal environment (Franz et al., 2006; Sasikala et al.,, 2018). The abdominal distension and recovery time were longer in goats with digestive disturbances than goats with no signs of clinical illness, because of longer procedural time to find out the actual causes of disorders. The gross anatomical changes and morphological findings denote digestive disorders in animals.

Presence of ruminal content in esophageal lining was normal in small ruminants due to regurgitation mechanism (Stierschneider et al., 2007). The LES was obtained open or closed depending on time and regurgitation in animals. The appearance of ruminal content and nature was the most important character of ruminal health (Mohamed, 2014). Some goats exposed abnormal ruminal contents with no clinical illness and some goats with normal ruminal content exposed signs of anorexia. Fermentation of ruminal content can be observed in milkfish white in nature. Milky gray color of ruminal fluid with slimy aqueous nature in pH 4.8±0.11 denotes acid indigestion (Mohamed, 2014). Brownish green to yellowish brown with slimy in nature in pH 6.54±0.02 denotes clinically healthy animals (Mohamed, 2014). In our study, milky gray with slimy aqueous nature ruminal content was obtained in a goat with history of digestive disturbances, which was positively related with history. Yellowish brown with slimy viscous in nature color of ruminal liquid obtained in goats with history of digestive disturbances, which results negative relation of anorexia with ruminal disorders. In those cases, anorexia could be shown from any dysfunction of other system in body rather than digestive system. In goats with no history of clinical illness, brownish green to yellowish green color with lightly viscous to slimy viscous nature ruminal content were observed, which was positively relate with history, supported by (Mohamed, 2014).

The ruminal papillae were the important factor to determine ruminal health. Healthy ruminal papillae denote healthy ruminal environment (Jiao et al., 2015). Gross observation of the ruminal papillae was conducted in the study. Most of the animals exposed healthy ruminal papillae, that denotes absence of ruminitis and other developmental changes. Ruminal protozoa are very sensitive to sudden changes of

ruminal pH (Ram et al.,, 2007). Three key elements, ruminal motility, pH, and microflora motility were each a variable that affected the others. Sluggish movement of ruminal protozoa indicates acidic condition in rumen (Ram et al., 2007). In our study, ruminal pH and microloral movement had a close relationship. Based on gross appearance and comparing with those parameters, digestive health could be determined.

Longer fasting period and ruminal lavage gave access to obtain the reticular mucosa (Franz et al., 2006). The oral approaches of ruminoscopy could not determine the reticular mucosa in ruminants was described in a study (Franz et al., 2006). In our study, we obtained reticular mucosa in a case, after longer fasting period. After ruminoscopic procedure, insufflated air should to be suctioned out though suction valve or stomach tube (Cox, 2015). The longer duration of procedure increases complications and recovery. Gastroscopic procedure was smooth in goats using diazepam sedation. Complications after ruminoscopic procedure were not described in any literature. In our study, sudden regurgitation and depression state of animals following abdominal distension were recorded. Those could be due to technical defects or condition of animals.

The physical parameters and hematological values were evaluated in this study before anesthesia. General anesthesia with ketamine and diazepam was shown to produce superior outcomes for gastroscopy in dogs than other protocols. Propofol also suitable for short term anesthesia with proper jaw relaxation (Hall, 2015). Depending on the conditions of animal, different anesthetic protocols were conducted. Radiographic evaluation of animals with history associated foreign body obstruction had a great important to detect the nature and position of foreign body (Gianella et al., 2009). The esophagus is the most common site for foreign body lodgment and it's an emergency condition in animals. Animals with clinical signs eg; gagging, coughing, regurgitation, vomiting, dysphagia had higher degree of suspicion for foreign body ingestion (Thompson et al., 2012). In our study, radiographically, most of the dogs exposed negative results with history of foreign body obstruction and the result had a close relation with endoscopic findings. Most of the animals came with false history which gave misdirection. Only one dog exposed positive findings with foreign body obstruction in endoscopy, though it was undetected in X-ray. Foreign objects in dog was smoothly removed by alligator jaw foreign body retrieval forceps. The severity of

foreign body obstructed cases depends on size, type, localization, duration of illness and other conditions associated esophagus (Rousseau et al., 2007; Gianella et al., 2009). In our study, no inflammation was recorded after removal of foreign body on obstructed site of esophagus. Most of the dogs had mild to severe gastritis. The majority of those lesions was found in gastric body. The duration of illness and fasting were longer in subgroup of dogs had digestive disturbances. This fasting period gave access to examine all parts of stomach within short procedural time in optimum recovery time.

In feline group, most of the foreign body obstruction recorded on proximal part of esophagus. Whare as most of the foreign body lodgment reported at distal site of esophagus (Gianella et al., 2009). Lodgment of foreign body in distal site of esophagus causes more damage than proximal site due to dynamic swallowing process (Thompson et al., 2012). In our study no inflammation was obtained on lodgment site after removal of foreign body in both canine and feline. All obstructed cases in cats were gone through general anesthesia by propofol without premedication. Premedication with xylazine causes vomition in feline group that's why it was avoided in those cases. General anesthesia with propofol with maintenance with gaseous anesthetics were recommended for gastroscopy in animals (Gianella et al., 2009; Cox, 2015;). Though, without intubation of endotracheal tube was sufficient in the study.

Radio opaque foreign body were detected in majority of animals had a history of foreign body obstruction. Most of the foreign body in esophagus in cats were removed by alligator jaw foreign body retrieval forceps and one of them was removed by gastrotomy. The linier cotton thread was ranges from pharynx to small intestine, that's why the gastrotomy was the decision. In a study, the percentage of success of foreign body removal by oral approach was obtained 86% in animals (Gianella et al., 2009). In our study, 80% (n=4/5) of foreign bodies of small animals were smoothly removed by endoscope. The longer duration of hospitalization of animals had close relation with severity of affected region and complication occurs after removal of foreign body (Thompson et al., 2012). In the study, longer procedural time recorded with complication in animal had long time of hospitalization.

The hematological parameters had no relationship with foreign body obstruction and animals had a history of digestive disturbances in the study. The findings had relation

with the observations of similar study (Stierschneider et al., 2007; Gianella et al., 2009; Thompson et al., 2012).

Most of the animals exposed normal mucosal nature in stomach, some of them had mild to severe amount of gastritis. Gross examination of detecting mucosal erosion is more sensitive than histopathological examination (Forsyth et al., 1998). The gross detection of several types of gastritis was conducted in the study. Based on type of gastritis, medicinal management was the decision in the study. Esophageal inflammation, perforation, pneumomediastinum and death were the most common complications after foreign body removal were obtained in a study (Gianella et al., 2009). In our study, less complication was found during and after gastroscopic procedure in cats. One animal died after removal of foreign body from esophagus due to longer duration of procedure and the cat suffers from megaesophagus with aspiration pneumonia.

A large population size and longer period will represent statistically substantial results, which was the limitation of this study. Histopathological observation could be valuable to determination of actual mucosal changes. Combination of several diagnostic imaging with endoscopy could be advantageous for diagnosis of digestive disturbances in animals.

Chapter - 6: Conclusions

The study of endoscopic diagnosis and therapeutic approaches of the upper digestive tract in animals, recorded from July 2021 to March 2022 at Sahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH), Chattogram Veterinary and Animal Sciences University, Chattogram. The study was carried out with the objective to study the normal and pathological observation of upper digestive tract in three different animals. The diagnosis of an appropriate therapeutic approach for digestive disturbances was carried out with minimal complications. The initial clinical history, physiological data and radiological observation were analyzed with the outcome of endoscopy. Finally, endoscopy provides a very useful diagnostic tool for confirmatory diagnosis and therapeutic approaches for various digestive disturbances in animals.

Based on the result of this study, it can be concluded that endoscopy is the only one effective diagnostic tool for detection of digestive health. In proper fasting condition endoscopy can be performed to observe the rumen in oral approaches smoothly by sedation with diazepam in goats. Radiographic observation and clinical history were always not perfect to detect foreign body obstruction or any digestive disturbances in animals. General anesthesia by administration of propofol in cats and ketamine diazepam combination in dogs without premedication exposed better result with optimum time of recovery and minimum complications for endoscopy. The duration of procedure and recovery time were proportional to each other. An expert endoscopist can perform therapeutic intervention in uncompromised patients with minimal complication.

Chapter - 7: Limitations and Recommendations

Limitations:

The small sample size of this investigation was not representative to the population and statistically imperfect due to the short period of the study. There were no proper guidelines for endoscopy in goats. Unavailability of proper fasting condition and gastric lavage to examine whole empty stomach. Lacking histopathological examination, it was tough to detect exact changes in mucosa. Absence of several modern diagnostic methods like CT scan and MRI. Deficient of various ancillary equipment like, rigid biopsy forceps, basket retrievers, aspiration needle, microbiology brush, two prong, oval loop, balloon dilator, PEG tube kit were limited various therapeutic measurements.

Recommendations:

Though a significantly positive conclusion was found in this study. However, large sized population will provide more specified result for better conclusion. So, it is suggested that combining several diagnostic imaging and histopathological observation confirm the diagnosis of digestive disturbances and helps to take a complete decision for better management of healthy life in animals.

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Appendix

Appendix I Table: Medical history of goats.

Serial No.	Subgroup	Breed	Age (month)	Sex	Body weight (kg)
1.	G1	Black bengal	3	Female	10
2.	G1	Black bengal	2	Female	12
3.	G1	Black bengal	4	Male	6.5
4.	G1	Black bengal	4	Male	6.8
5.	G1	Black bengal	4	Male	7
6.	G1	Black bengal	4	M	6.8
7.	G2	Jamuna pari	17	Male	21
8.	G2	Black bengal	3	Male	17
9.	G2	Jamuna pari	30	Male	41
10.	G2	Jamuna pari	12	Male	18

Table: Medical history of dogs.

Serial No.	Subgroup	Breed	Age (year)	Sex	Body weight (kg)
1.	D1	Indigenous breed	3	Male	13
2.	D1	Indigenous breed	3	Male	17
3.	D2	German shepherd	6	Male	22
4.	D2	Spitz	5	Male	8
5.	D2	Lasa apso	8	Male	7.9
6.	D2	Samoyed	9	Female	6.5
7.	D2	Indigenous breed	4	Male	17.4
8.	D3	Spitz	5	Male	9.3
9.	D3	German shepherd	12	Male	23.6
10.	D3	Samoyed	8	Female	11

Table: Medical history of cats.

Serial No.	Subgroup	Breed	Age (year)	Sex	Body weight (kg)
1.	C1	Indigenous breed	1.5	Female	4.2
2.	C1	Indigenous breed	0.25	Female	3.5
3.	C1	Indigenous breed	3	Male	3.2
4.	C1	Indigenous breed	2	Male	4.2
5.	C2	Indigenous breed	0.6	Male	3.25
6.	C2	Indigenous breed	2.5	Male	4.7
7.	C2	Indigenous breed	0.4	Female	1.7
8.	C2	Indigenous breed	3	Female	4.5
9.	C2	Persian	2	Female	3.3
10.	C2	Persian	0.2	Male	0.8

Appendix II

Table: Summarized endoscopic findings in goats.

Subgroup in Goats	Appearance of esophagus	Appearance of esophageal sphincter	Color of ruminal fluid	Consistency of ruminal content	Appearance of ruminal wall	Ruminoreticular fold	Ruminal pH	Motility of ruminal microflora
G1	Presence of feed particle with normal vasculation	Open	Brownish green	Lightly viscous	Healthy ruminal papillae	Unobtainable	6.5	++
G1	Normal vasculation	Open	Brownish green	Lightly viscous	Healthy ruminal papillae	Healthy reticular mucosa	6.5	++
G1	Presence of ruminal fluid with normal vasculation	Open	Yellowish green	Slimy viscous with gas bubbles	Healthy ruminal papillae	Unobtainable	7	++
G1	Normal vasculation	Open	Yellowish green	Slimy viscous with frothy appearance	Healthy ruminal papillae	Unobtainable	7.5	++

G1	Presence of ruminal fluid with normal vasculation	Open	Yellowish green	Slimy viscous with gas bubbles	Healthy ruminal papillae	Unobtainable	7.5	++
G1	Normal vasculation	Open	Yellowish green	Viscous frothy appearance	Healthy ruminal papillae	Unobtainable	7.5	++
G2	Presence of feed particle with normal vasculation	Open	Milky gray	Slimy aqueous	Presence of ruminal parasite	Unobtainable	5	Nill
G2	Presence of feed particle with normal vasculation	Closed	Yellowish brown	Slimy viscous	Healthy ruminal papillae	Unobtainable	5	+
G2	Presence of feed particle with normal vasculation	Closed	Yellowish brown	Slimy viscous	Healthy ruminal papillae	Unobtainable	5.5	+
G2	Presence of feed particle with normal vasculation	Open	Yellowish brown	Slimy viscous with gas bubbles	Small sized ruminal papillae then healthy appearance	Unobtainable	5.5	+

Table: Summarized endoscopic observations in dogs of subgroup D1 and D2.

Subgroup in Dogs	**Appearance of esophagus**	**Appearance of esophageal sphincter**	**Appearance of stomach**	**Grade of gastritis**
D1	Normal vasculation	Semi-closed	Presence of Semiliquid feed particles	Mild gastritis in gastric body
D1	Normal vasculation	Closed	Presence of Solid feed particles	Moderate gastritis in gastric body
D2	Normal vasculation	Semi-closed	Presence of Semiliquid partially digested feed particles	Moderate gastritis in gastric body
D2	Normal vasculation	Closed	Presence of liquid feed particles	No gastritis
D2	Normal vasculation	Closed	Empty stomach with mild frothy contain	No gastritis
D2	Presence of cough with Normal vasculation	Semi-closed	Presence of cough	Mild gastritis in gastric body
D2	Normal vasculation	Closed	Empty stomach with small liquid contains	Mild gastritis in gastric antrum

Table: Summarized endoscopic observations in dogs with history of foreign body obstruction (subgroup D3).

History FB type	**Position of FB in x-ray**	**Position of FB in endoscope**	**Appearance of pharynx**	**Appearance of esophagus**	**Appearance of esophageal sphincter**	**Appearance of stomach**	**Grade of gastritis**	**Intervention**
Chicken bone	Undetected	Proximal to esophageal sphincter	Normal	Presence of gastric fluid with normal mucosal appearance	Semi-closed	Partially digested feed particles	No gastritis	Endoscopic removal
Plastic toy	Undetected	Undetected	Normal	Normal	Semi-closed	Liquid feed particles	Severe gastric ulceration in gastric body and antrum.	Medicinal
Cotton ball	Undetected	Undetected	Normal	Normal	closed	Empty stomach	No gastritis	Medicinal

Table: Summarized endoscopic observations in cats of subgroup C1.

Subgroup in Cats	**Appearance of esophagus**	**Appearance of esophageal sphincter**	**Appearance of stomach**	**Grade of gastritis**
C1	Normal vasculation	Closed	Empty stomach with mild frothy contain	No gastritis
C1	Esophagitis at cervical esophagus	Semi-closed	Empty stomach	No gastritis
C1	Normal vasculation	Closed	Presence of liquid feed particles	No gastritis
C1	Normal vasculation	Closed	Empty stomach	No gastritis

Table: Summarized endoscopic observations in cats with history of foreign body obstruction (subgroup C2).

History FB type	**Position of FB in x-ray**	**Position of FB in endoscope**	**Appearance of pharynx**	**Appearance of esophagus**	**Appearance of esophageal sphincter**	**Appearance of stomach**	**Grade of gastritis**	**Intervention**
Cotton thread	Undetected	Oral pharynx to duodenum	Normal	Congested vasculation, esophagitis on distal part	Open	Presence of cotton thread	No gastritis	Gastrotomy

Fish spine	Undetected	Undetected	Normal	Normal	Semi-closed	Empty stomach	No gastritis	Medicinal
Chicken bone	Proximal part of esophagus	Proximal part of esophagus	Normal	Normal	Closed	Empty stomach	No gastritis	Endoscopic removal
Chicken bone	Distal part of esophagus	Body of stomach	Normal	Normal	Semi-closed	Presence of partially digested feed	Severe gastric ulceration in gastric body	Medicinal
Chicken bone	Pharynx	Pharynx	Normal	Normal	Closed	Presence of partially digested feed	No gastritis	Endoscopic removal
Feeding tube	Cervical esophagus	Cervical esophagus	Normal	Megaesophagus, feed obstruction	Closed	Presence of partially digested feed	Mild gastritis in gastric body	Endoscopic removal

Appendix III

Endoscopic data record sheet in animals**.**

Species:…….	Temperature:……°F
Breed:……..…….	Mucous Membrane: pink/pale
Age: ……..….	Dehydration: Mild/ Moderate/ Severe
Sex: M/F	Heart Rate:……bpm
Body Weight:……. Kg	Resp. Rate:…….bpm

History: ……. ……. ……. ……. ……. …….

Diagnostic imaging:

Xray findings: ……. ……. ……. ……. ……. ……..

Ultrasonographic findings:……. ……. ……. ……. …….

Duration of fasting:……hour
Pre-anesthetic:……
Anesthetic: ……
Onset of anesthesia after induction:……..

Pharynx and Esophagus: Normal☐ Inflamed☐ F. body☐ Mass☐ Stricture☐ Dilation☐ Others☐
Documentation: Video☐ Photographs ☐
Sampling: Foreign body retrieved☐ Biopsy☐ Brush Cytology ☐ Washing☐ Aspiration ☐
Site(s) of intervention:.....

Lesion	Comments (Include location)
Hypermia/Vascularity	
Discoloration	
Friability	
Haemorrhage	
Inflammation	
Erosion/Ulcer	
Perforation	
Stricture	
Dilatation	
Mass	
Aberrant contents	
Apearance of Gastroesophageal sphincter	
Gastroesophageal reflux	

Stomach: Normal☐ F. body☐ Mass☐ Polyp(s)☐ Parasite(s)☐ Others☐
Inflamed ☐
Mild ○ Moderate ○ Severe/ulceration ○
Site(s) of intervention:.....

Lesion	Comments (Include location)
Hypermia/Vascularity	
Discoloration	
Friability	
Haemorrhage	
Inflammation	
Erosion/Ulcer	
Edema	
Mass	
Aberrant contents	

Complications:.....

Abdominal distension after gastroscopy:.....

Time of recovary after anesthesia:.....

Ruminal pH:..... Motility of ruminal microflora:

Haematological test:

Hb

ESR

PCV

WBC

Neutrophil

Lymphocyte

mm

Esinophil

Basophol

Comments:.....

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.....

Biography

Dr. Debashish Sarker is the son of Sudhir Kumar Sarker and Beauty Rani. He passed the Secondary School Certificate Examination in 2011 followed by Higher Secondary Certificate in 2013. He has obtained his Doctor of Veterinary Medicine (DVM) Degree in 2019 from Chattogram Veterinary and Animal Sciences University (CVASU), Bangladesh. Now, he is a candidate for the degree of MS in Surgery, under the department of Medicine and Surgery, Chattogram Veterinary and Animal Sciences University (CVASU). He has published eight scientific articles in national and international journals. He has great interest on small and large animal surgery.