GASTROESOPHAGEAL FOREIGN BODIES IN DOGS - ENDOSCOPY AND SURGICAL REMOVAL

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ABSTRACT: ***Background*:** Gastroesophageal foreign bodies (GFD) are commonly diagnosed in dogs and are considered an endoscopic emergency that, although not resulting in serious clinical sequelae or mortality, can compromise the health and well-being of the patient. The use of the digestive endoscopy for the diagnosis and treatment of GFD can be a valuable and viable alterna- tive. There are cases of GFD in dogs for which the indicated treatment is surgery, which can be performed using minimally invasive or conventional techniques, associated or not with flexible endoscopy. The objective of this work is to describe 16 cases of GFD removal in dogs demonstrating the efficiency of upper digestive endoscopy. ***Cases*:** Of the 16 GFD cases, 63% (10/16) were male and 37% (6/16) female. Most aged under 1 year (63%), puppies (5/16) and juveniles (5/16). The patient with the lowest body weight was a miniature pinscher weighing 0.8 kg (Case

14) and the heaviest was an American Pit Bull Terrier weighing 28 kg (Case 11), the mean body weight of patients diagnosed with GFD was 10.2 ± 6.7 kg. Small and medium breeds were more affected, 44.7% (7/16) and 44.7% (7/16), respectively, and large breeds (Golden Retrievier and Bull Terrier), from cases 1 and 4, the least affected, 12.6% (2/16) of the cases. The 16 patients underwent a 12 h food fast and a 4 h water fast, as gastrointestinal emptying in these cases of GFD can be influenced by these foreign bodies. All underwent general inhalation anesthesia with monitoring of physiological parameters (temperature, heart rate, respiratory rate, oxygen saturation and blood pressure) before, during and after EGD, being positioned in left lateral decu- bitus. The 16 canine patients with suspected GFD underwent EGD for diagnostic confirmation and removal of foreign bodies. Five esophageal FB were diagnosed, 31% (5/16), and 11 gastric FB, 69% (11/16). The most frequently diagnosed foreign bodies were bone and tissue, 37.5% (6/16) and 31% (5/16). Other foreign bodies were materials such as plastics, metals, rub- ber, foam and stone. Of the 16 cases of GFD, EGD efficiently treated 88% (14/16) without the need for hospitalization, with only supportive treatment for the remission of complications caused by the presence of foreign bodies in the gastroesophageal tract. The main complications related to the presence of GFD were esophagitis in 25% (4/16) of cases, gastritis in 38% (6/16) and both alterations in 13% (2/16).
***Discussion*:** In this work, we can observe that more than a third of the clinical cases of treated dogs were diagnosed with GFD, demonstrating that these cases are common in the veterinary clinic. Most of these animals were males less than 1 year old. The improvement of learning in this category can lead these animals to exacerbated oral exploration of new objects. Most FBs were found in the stomach because they were of adequate size, consistency and shape for their passage through the esophagus, whereas esophageal FBs were all bone fragments of rigid consistency with diameters and sizes larger than the esophageal lu- men. The interval between the ingestion of the object and the veterinary care can be decisive for the removal of the FB in the esophagus or stomach. Most gastric FBs removed were fabrics and plastics, flexible objects that can pass through the esophageal lumen more easily. Removal of GFD by endoscopy was performed with a high success rate, with only 2 cases being resolved by esophagostomy and gastrotomy. Flexible endoscopy proved to be an efficient technique for removing treated GFD, which can help remove FB during esophagotomy and be associated with rigid endoscopy. Patients recovered quickly and without complications, but it is important to emphasize that inadequate maneuvers and conducts can determine other outcomes. The use of endoscopy for GFD removal needs to be more popularized, as it can ensure better results for dogs treated with GFD.
KEYWORDS: digestive tract, endoscopic extraction, flexible endoscopy, ingested object, rigid endoscopy.

INTRODUCTION

Gastroesophageal foreign bodies (GFD) are commonly diagnosed in dogs and are considered an endoscopic emergency that, although not resulting in serious clinical sequelae or mortality, can compromise the health and well-being of the patient [9,15]. Due to related complications, such as esophagitis, gastritis, gastrointestinal obstruction and perforations, and the high casuistry, using digestive endoscopy for the diagnosis and treatment of GFD can be a valuable and viable alternative [17,24,28].

Upper digestive endoscopy (EGD) enables a non-invasive evaluation of the gastrointestinal mucosa and allows the collection of tissue, cell and/or fluid samples for analysis [27]. In addition, it can provide a definitive diagnosis with adequate prognosis and tre- atment in cases of GFD in dogs, and can be associated with the use of rigid endoscopy [26,33]. There are cases of GFD in dogs for which the indicated treatment is surgery, which can be performed using minimally invasive or conventional techniques, associated or not with flexible endoscopy [1,7,25].

GFD are non-digestible or potentially digesti- ble objects, such as gastric bones that in some cases can be left *in situ* for digestion, depending on clinical signs and bone/body size ratio [1]. Radiography and ul- trasonography can help in the diagnosis of these GFD, but endoscopy is the initial option of choice, including for the removal of these foreign bodies (FB), as long as there are no complications that require surgical intervention [3,20,32].

Based on this, the objective of this work is to describe 16 cases of GFD removal in dogs demonstra- ting the efficiency of upper digestive endoscopy based on clinical, diagnostic and therapeutic aspects.

CASES

The 16 cases of GFD reported come from 50 consultations at the Small Animal Veterinary Hospital of the Institute of Veterinary Medicine of the Federal University of Pará (HOVET/UFPA) by the research group on Videosurgery, Obstetric and Reproductive Affections of the Federal University of Pará (VOR/ UFPA) from January 2018 to December 2019, ac- counting for a total of 32% of cases attended (16/50). The survey of data related to the patients (race, sex, age and weight) and the clinical aspects of the 16 cases of GFD were carried out based on clinical records and reports produced during routine hospital care. Data related to races allowed classification according to Mila *et al.* [19] in small (< 15 kg), medium (15-25 kg) and large (> 25 kg) breeds. Age-related data enabled the categorization according to Harvey [13] into puppy (0 month - 6 months), Juvenile (> 6 months - 1 year), Adult (> 1 year - 6 years), elderly (7 years - 11 years) and geriatric (> 12 years). All data were tabulated in tables and analyzed descriptively based on absolute and relative values.

Of the 16 GFD cases, 63% (10/16) were male and 37% (6/16) female. Most aged under 1 year (63%), puppies (5/16) and juveniles (5/16). The patient with the lowest

body weight was a miniature pinscher weighing 0.8 kg (Case 14) and the heaviest was an American Pit Bull Terrier weighing 28 kg (Case 11), the mean body weight of patients diagnosed with GFD was 10.2 ± 6.7 kg. Small and medium breeds were more affected, 44.7% (7/16) and 44.7% (7/16), respectively, and large breeds (Golden Retrievier and Bull Terrier), from cases 1 and 4, the least affected, 12.6% (2/16) of the cases (Table 1).

The patients underwent a general clinical examination, some referred from another veterinary service, accompanied by radiographic, ultrasound and other routine clinical examinations. Cases confirmed by radiography or suspected of GFD were referred for EGD, aiming at diagnostic confirmation and en- doscopic or surgical removal, after analysis of risk factors and prognostic indicators, such as duration of imprisonment, body weight, anorexia, lethargy, rectal temperature and esophageal perforation.

The 16 patients underwent a 12 h food fast and a 4 h water fast, as gastrointestinal emptying in these cases of GFD can be influenced by these foreign bodies [16]. All underwent general inhalation anesthesia with monitoring of physiological parameters (temperature, heart rate, respiratory rate, oxygen saturation and blood pressure) before, during and after EGD, being positioned in left lateral decubitus.

EGD was performed with a flexible endoscope (Endovision®)[1] measuring 8 mm in diameter and 120 cm in length, with a 2.5 mm working channel, a camera with a resolution of 160,000 pixels, and coupled emit- ting diode (LED) light. Alligator-mouth2, basket-type2, loop-type2 and net-type2 endoscopic grasping forceps were used to remove foreign bodies. In one case, a rigid electronic optic (Optica Scope®)1 measuring 2.5 mm in diameter and 20 cm in length was used, with a 160,000-pixel resolution camera coupled to LED light and babcock laparoscopic forceps2.

A total of 14 patients with GFD showed clini- cal signs related to gastrointestinal disorders, such as emesis, 87.5% (14/16), anorexia or hyporexia, 56.2% (9/16), regurgitation, 31.2% (5/16), dysphagia, 31.2% (5/16) and abdominal pain, 31.2% (5/16). In 2 patients, no clinical signs were observed, cases 12 and 13, due to immediate referral to veterinary care right after in- gestion of foreign bodies. One patient showed signs of nervous disorders, in addition to anorexia and emesis, such as drooling, convulsions, muscle tremors and hyperexcitability, signs of intoxication due to the in- gestion of a flea collar containing pyrethroid (Table 2).

The 16 canine patients with suspected GFD underwent EGD for diagnostic confirmation and removal of foreign bodies. Five esophageal FB 31% (5/16), were diagnosed and 11 gastric FB 69% (11/16). The most frequently diagnosed foreign bodies were bone and tissue, 37.5% (6/16) and 31% (5/16). Other foreign bodies were materials such as plastics, metals, rubber, foam and stone (Table 2).

During EGD, some cases were difficult to resolve, either because of the conformation and size of the GFD or even because of their adherence to the mucosa. In case 1, the rubber suction cup located on the patient's stomach and which was rigid, making it difficult

to grasp with the endoscopic forceps, was visualized and grasped with the alligator's mouth endo- scopic forceps (Figure 1C), after a few attempts, it was carefully rotated until it passed through the esophagus and complete removal through the mouth (Figure 2B).

In case 3, the semilunar bone fragment adhered to the esophageal mucosa was visualized and grasped with endoscopic alligator mouth forceps (Figure 1A), gently rotated until the mucosa was detached, with subsequent passage through the esophagus and endos- copic removal (Figure 2A) . After removing this bone fragment, erosions, hyperemia and mucosal edema were observed (Figure 1B). In the patient who ingested the antiparasitic collar, case 10, shortly after the into- xication had stabilized, fragments of the collar were seen in the stomach and removed by EGD (Figure 2C).

In cases 12 and 13, pieces of clothing were seen in the stomach, one made of cotton fabric and the other of synthetic fabric, both of which were easily removed with flexible endoscopy and endoscopic alligator mouth forceps. The synthetic fabric caused more irritation to the gastric mucosa (Figure 1F). In both cases, the patients recovered well after the procedure.

In the smallest patient attended, case 14, a bone fragment adhered to the esophageal mucosa with little mobility near the cardia region was identified (Figure 1D). Because it adhered to the mucosa and had little mobility, the fragment was removed by rigid endos- copy, for which a 5 mm Babcock laparoscopic forceps were used, whose gripping power was greater than the alligator mouth endoscopic forceps, and a 2 mm rigid optic 5 mm. After removal of the adhered bone fragment, ulcers, hyperemia and local edema were seen (Figure 1E). Other smaller bone fragments located in the stomach were removed with a flexible endoscope and loop-type endoscopic forceps.

In the abdominal X-ray of the 8-year-old American Pitbull Terrier patient, case 11, a radiopa- que structure with a diameter greater than 4 cm was observed located in the stomach, confirmed by EGD as a large-diameter stone. In the chest X-ray of the patient SRD - No Race Defined at 11 months, case 16, a radiopaque pyramid-shaped structure with the base facing orally was observed, located in the esophagus, close to the cardia region, confirmed by EGD as a bone fragment with little mobility.

Due to the format, conformation and location of these GFDs, it was not possible to remove them only with EGD. In case 11, the removal was performed through gastrotomy (Figure 2F & 2G). In case 16, the bone fragment was moved by EGD to the cervical por- tion of the esophagus and removed by cervical esopha- gotomy (Figure 2D & 2E), avoiding a more traumatic procedure in the thorax. Due to conventional surgical removal, patients were discharged 24 h after surgery, and full recovery occurred within 10 to 12 days.

Of the 16 cases of GFD, EGD efficiently trea- ted 88% (14/16) without the need for hospitalization, with only supportive treatment for the remission of complications caused by the presence of foreign bodies in the gastroesophageal tract. The main complications related to the presence of GFD were esophagitis in 25% (4/16) of cases, gastritis in 38% (6/16) and both alterations in 13% (2/16).

DISCUSSION

In this work, we can observe that more than a third of the clinical cases of treated dogs were diag-

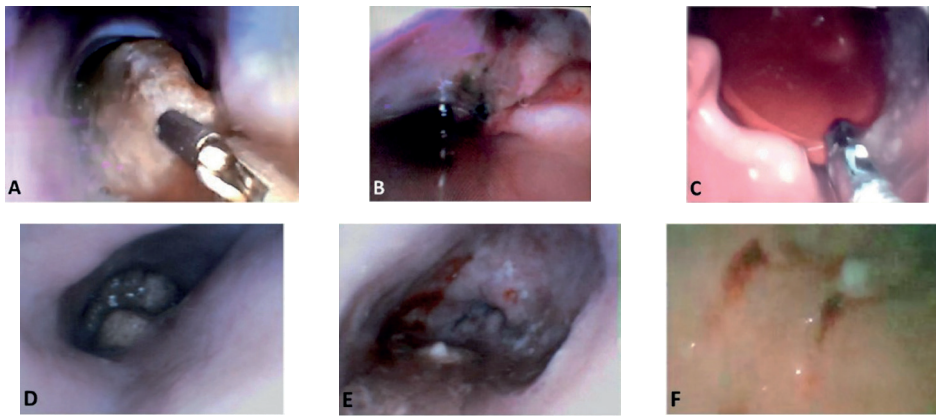

Figure 1. Endoscopic visualization of gastroesophageal foreign body and mucosal changes after removal. A- Grasping the esophageal foreign body with alligator-mouth forceps, a fragment of the semilunar bone (Case 3). B- Erosions, hyperemia and edema in the esophageal mucosa after removal of the bone fragment (Case 3). C- Grasping the gastric foreign body with alligator-mouth forceps, a rubber suction cup (Case 1). D- Endoscopic visualiza- tion of esophageal foreign body (bone) [Case 14]. E- Ulcers, hyperemia and mucosal edema after foreign body removal (case 14). F- Gastric erosions visualized after foreign body removal (Case 13).

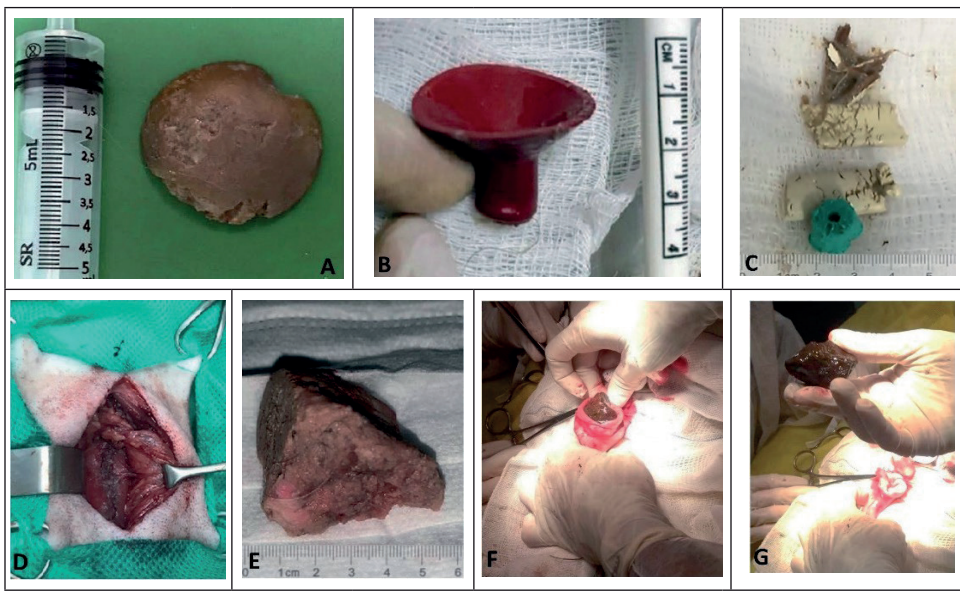

Figure 2. Some gastroesophageal foreign bodies removed by endoscopy and demonstration of esophagotomy and gastrotomy for foreign body removal. A- Lunate bone removed by esophagoscopy (Case 3). B- Rubber cup removed by endoscopy (Case 1). C & D- Cervical esophagotomy for bone removal (Case 16). E- Pyramidal bone removed by esophagotomy (Case 16). F- Gastrotomy for foreign body removal (Case 11). G- Stone removed by gastrostomy (Case 11).

Cases	Breed	Sex	Age	Category[A]	Weight (kg)	Breed size[B]
1	Golden retriever	Male	3 months	Cub	7.5	Large
2	American pit bull terrier	Female	5 months	Cub	10.8	Medium
3	Shih Tzu	Female	3 years	Adult	4.6	Small
4	Bull terrier	Male	5 months	Cub	12.8	Large
5	American pit bull terrier	Female	3 months	Cub	3.5	Medium
6	Dachshund	Male	12 months	Juvenile	10	Small
7	Shih Tzu	Female	6 years	Adult	8.2	Small
8	Shih Tzu	Male	14 years	geriatric	6.5	Small
9	Miniature pinscher	Male	9 years	Elderly	4.3	Small
10	German Spitz	Male	3 months	Cub	4	Small
11	American pit bull terrier	Male	8 years	Elderly	28	Medium
12	French bulldog	Male	12 months	Juvenile	11.7	Medium
13	French bulldog	Male	12 months	Juvenile	12	Medium
14	Miniature pinscher	Male	10 months	Juvenile	0.8	Small
15	No breed defined	Female	24 months	Adult	20	Medium
16	No breed defined	Female	11 months	Juvenile	15.9	Medium
descriptive analysis		10 males (63%) 6 Females (37%)		5 Puppies (31.2%) 5 Juveniles (31.2%) 3 Adults (18.7%) 2 Seniors (12.5%) 1 Geriatric (6.2%)		7 Small (<15 kg) - 44.7% 7 Medium (15-25 kg) - 44.7% 2 Large (> 25 kg) - 12.6%

[A]Category according to Harvey [13]. BBreed size according to Mila *et al.* [19].

Table 1. Details of patients diagnosed with GFD by VOR/UFPA from January 2018 to December 2019.

Cases	Clinical Signs	Endoscopic Diagnosis	Gastroesophageal Foreign Bodies (GFB)	GFB Removal
1	Emesis	Gastric Foreign Body	Rubber suction cup	With flexible endoscope and endoscopic forceps
2	Anorexia Emesis Abdominal pain	Gastric Foreign Body	Plastic bag	With flexible endoscope and endoscopic forceps
3	Regurgitation Dysphagia	Esophageal Foreign Body	Fragment of lunate bone	With flexible endoscope and endoscopic forceps
4	Emesis Dysphagia	Gastric Foreign Body	Metal pendant	With flexible endoscope and endoscopic forceps
5	Anorexia Emesis Abdominal pain	Gastric Foreign Body	Bone, plastic bag and foam	With flexible endoscope and endoscopic forceps
6	Anorexia Emesis Abdominal pain	Gastric Foreign Body	Cotton fabric (sock)	With flexible endoscope and endoscopic forceps
7	Emesis	Gastric Foreign Body	Cotton fabric (sock)	With flexible endoscope and endoscopic forceps
8	Anorexia Emesis Abdominal pain	Gastric Foreign Body	Cotton fabric (sock)	With flexible endoscope and endoscopic forceps
9	Anorexia Emesis Regurgitation Abdominal pain	Esophageal Foreign Body	Bone	With flexible endoscope and endoscopic forceps
10	Anorexia Emesis Sialorrhea Convulsion Muscle tremors Hyperexcitability	Gastric Foreign Body	Antiparasitic collar	With flexible endoscope and endoscopic forceps
11	Emesis Hyporexia	Gastric Foreign Body	Stone	Gastrostomy
12	No signs*	Gastric Foreign Body	Cotton tissue	With flexible endoscope and endoscopic forceps
13	No signs*	Gastric Foreign Body	Synthetic tissue	With flexible endoscope and endoscopic forceps
14	Emesis Regurgitation Hyporexia Dysphagia	Esophageal Foreign Body	Bone fragment	With 2.5 mm rigid optics and Babcock laparoscopic forceps (5 mm)
15	Regurgitation Emesis Dysphagia	Esophageal Foreign Body	Bone fragmente	With flexible endoscope and endoscopic forceps
16	Emesis Regurgitation, Hy- porexia Dysphagia	Esophageal Gastric For- eign Body	Bone fragmente	Esophagotomy

*Tutor saw the ingestion and was immediately sent for removal, there were no clinical signs.

Table 2. Clinical, diagnostic and therapeutic aspects of 16 cases of gastroesophageal foreign bodies in dogs attended by VOR/UFPA from January 2018 to December 2019.

nosed with GFD, demonstrating that these cases are common in the veterinary clinic and need to be treated in order to guarantee a good recovery and well-being of the patients [4,5]. It is important to consider factors related to the patient and the environment in cases of GFD that may determine greater or lesser casuistry in different realities.

Most of these animals were males less than 1 year old. The improvement of learning in this category can lead these animals to exacerbated oral exploration of new objects. Dog behavior can be influenced by breeding characteristics, such as confinement, degree of environmental enrichment, little social interaction, which lead to anxiety, stress and compulsive disor- ders. Therefore, there is no consensus regarding the most affected age group, requiring further studies on behavioral disorders associated with the ingestion of foreign bodies [6,9,18].

The highest occurrence was in medium and small breeds, in animals with an average body weight of 10 kg. Cases of GFD in smaller animals are treated more frequently, as the clinical signs caused by the presence of GFD in these animals are more frequent. Due to the lower body score, FB easily interfere with gastrointestinal transit, obstructing or reducing peris- taltic movements, so the gastrointestinal tract of these animals is proportional to their body size. In this way, even smaller foreign bodies can cause gastrointestinal changes and related complications that lead patients to present clinical signs perceptible by the tutor [8,30,31]. Clinical signs are important because they indicate the need for veterinary assistance and support the presumptive diagnosis, however, there have been cases of GFD in dogs diagnosed without apparent clinical signs, cases in which the tutors observed the ingestion of FB, remaining a short time in the stomach. For the appearance of clinical signs, the time the FB remains in the gastrointestinal tract, the type, size, location and the ratio FB/ body size of the animal must be taken into account because they influence the appearance of clinical manifestations [3,9,14].

Clinical signs are related to lesions and alte- rations that GFD can cause in the mucosa, motility and lumen of the gastrointestinal tract, from reduced peristalsis to partial or total obstructions of the lumen. Therefore, the clinical manifestations are, in most cases, specific to the digestive system, mainly vomiting and hyporexia or anorexia present in most of the cases presented. Regurgitation was present in all cases of esophageal FB due to changes caused by FB during swallowing. Other clinical signs such as dysphagia, abdominal pain, among others, may be associated with cases of GFD [3,12,16].

Most FBs were found in the stomach because they were of adequate size, consistency and shape for their passage through the esophagus, whereas esopha- geal FBs were all bone fragments of rigid consistency with diameters and sizes larger than the esophageal lumen. The interval between the ingestion of the object and the veterinary care can be decisive for the removal of the FB in the esophagus or stomach. Most gastric FBs removed were fabrics and plastics, flexible objects that can pass through the esophageal lumen more ea- sily. Therefore, preventing dogs from accessing these objects can be an important prophylactic measure to prevent GFD in these animals [1,14,24].

Bones and tissues were the most prevalent FB, followed by plastics and metals, which caused milder clinical signs. The cultural habit of tutors in offering bones as food for these animals is related to this higher prevalence. It should be noted that different materials

interact in different ways with the body, which can cause injuries of varying severity, from mild hypere- mia to severe perforation in one of the gastrointestinal fragments [1,11,14].

Endoscopic removal of GFDs is the first choice alternative because it is not invasive and allows for better patient recovery when compared to surgery. The use of a flexible endoscope was efficient for removing GFD in most cases, with a rigid endoscope and babcock forceps being used in only 1 case, due to the intense adhesion of the bone to the esophageal mucosa. EGD is effective both for FB removal and for intraluminal inspection of the gastrointestinal tract, and may be associated with rigid endoscopy in cases that require greater power to grip and pull the object [9,21,29].

Removal of GFD by endoscopy was perfor- med with a high success rate, with only two cases being resolved by esophagostomy and gastrotomy. Even in cases of removal by conventional surgery, flexible endoscopy can help, as was the case 16, where the FB was displaced to the cervical region of the esophagus. Conventional surgeries can be performed in a mini- mally invasive way using rigid endoscopy, laparoscopy or thoracoscopy, alternatives that can provide patients with better cosmetic results [10,22,33].

There were no deaths or complications after GFD removal. In cases of endoscopic removal, patients' recovery was immediate after the anesthetic effect. Only 2 patients were hospitalized for postoperative follow-up and recovered well, with no complications. EGD provides an effective diagnostic approach and enables the removal of esophageal and gastric FB with a high success rate and low complication rate [2,8,24].

Most complications caused by the presence of GFD were gastritis, followed by esophagitis. These foreign bodies, when ingested, can be located from the pharynx to the intestines, being more frequently diagnosed in the stomach and esophagus, respectively. These can cause mucosal lesions, from esophagitis to gastric ulcers, and obstruction of the gastrointestinal tract depending on the type of ingested object and the time of its deposition in the lumen of the gastrointes- tinal tract [3,14,23].

Flexible endoscopy proved to be an efficient technique for removing treated GFD, which can help remove FB during esophagotomy and be associated with rigid endoscopy. Patients recovered quickly and without complications, but it is important to emphasize that inadequate maneuvers and conducts can determine other outcomes. The use of endoscopy for GFD re- moval needs to be more popularized, as it can ensure better results for dogs treated with GFD.

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DECLARATION OF INTEREST

The authors declare no conflicts of interest. The authors are the only responsible for the content and writing of this article.

REFERENCES

1. Barash N.R., Lashnits E., Kern Z.T., Tolbert M.K. & Lunn K.F. 2022. Outcomes of esophageal and gastric bone foreign bodies in dogs. *Journal of Veterinary Internal Medicine*. 36(2): 500-507. DOI: 10.1111/jvim.16383.

2. Binvel M., Poujol L., Peyron C., Dunie-Merigot A. & Bernardin F. 2017. Endoscopic and surgical removal of oesophageal and gastric fishhook foreign bodies in 33 animals. *Journal of Small Animal Practice*. 59(1): 45-49. DOI:10.1111/jsap.12794

3. Brisson B.A., Wainberg S.H., Malek S., Reabel S., Defarges A. & Sears W.C. 2018. Risk factors and prognostic indicators for surgical outcome of dogs with esophageal foreign body obstructions. *Journal of the American Veterinary Medical Association*. 252(3): 301-308. DOI:10.2460/ javma.252.3.301.

4. Bongard A.B., Furrow E. & Granick J.L. 2019. Retrospective evaluation of factors associated with degree of es- ophagitis, treatment, and outcomes in dogs presenting with esophageal foreign bodies (2004–2014): 114 cases. *Journal of Veterinary Emergency and Critical Care*. 29(5): 528-534. DOI: 10.1111/vec.12875.

5. Burton A.G., Talbot C.T. & Kent M.S. 2017. Risk Factors for Death in Dogs Treated for Esophageal Foreign Body Obstruction: A Retrospective Cohort Study of 222 Cases (1998-2017). *Journal of Veterinary Internal Medicine*. 31(6): 1686-1690. DOI: 10.1111/jvim.14849.

6. Bray E.E., Gruen M.E., Gnanadesikan G.E., Horschler D.J., Levy K.M., Kennedy B.S., Hare B.A. & MacLean **E.L. 2020.** Cognitive characteristics of 8- to 10-week-old assistance dog puppies. *Animal Behaviour*. 166: 193-206. DOI:10.1016/j.anbehav.2020.05.019.

7. Demars C., Boland L. & Minier K. 2022. Surgical removal of intestinal foreign bodies using a laparotomy-assisted endoscopic approach in dogs and cats and comparison with enterotomy. *Journal of Small Animal Practice*. 1-8. DOI: 10.1111/jsap.13550.

8. Deroy C., Corcuff J.B., Billen F. & Hamaide A. 2015. Removal of oesophageal foreign bodies: comparison between oesophagoscopy and oesophagotomy in 39 dogs. *Journal of Small Animal Practice*. 56(10): 613-617. DOI:10.1111/ jsap.12386.

9. Di Palma C., Pasolini M.P., Navas L., Campanile A., Lamagna F., Fatone G., Micieli F., Esposito C., Donnarumma D., Uccello V. & Lamagna B. 2022. Endoscopic and surgical removal of gastrointestinal foreign bodies in dogs: an analysis of 72 cases. *Animals*. 12(11): 1376. DOI:10.3390/ ani12111376.

10. Gibson E., Culp W., Mayhew P., Runge J.J., Peterson L.C., Balsa I.M. & Kim S.Y. 2020. Laparoscopic-assisted gastrotomy for foreign body retrieval in four dogs. *Veterinary Record Case Reports*. 8(2): e000966. DOI:10.1136/ vetreccr-2019-000966.

11. Gonçalves S.R.F., Barretto M.L.M., Rodrigues E.M.S., Rodrigues E.M.S., Bernardi J.C.M., Feitoza F.M.G., Silva **S.C.G. & Oliveira A.A.F. 2019.** Esophageal Perforation Associated with a Foreign Body in a Dog. *Acta Scientiae Veterinary*. 47: 411. DOI: 10.22456/1679-9216.93608.

12. Grobman M. 2021. Aerodigestive Disease in Dogs. *Veterinary Clinics of North America: Small Animal Practice*. 51(1): 17-32. DOI: 10.1016/j.cvsm.2020.09.003.

13. Harvey N.D. 2021. How Old Is My Dog? Identification of Rational Age Groupings in Pet Dogs Based Upon Norma- tive Age-Linked Processes. *Frontiers in Veterinary Science*. 8: 643085. DOI: 10.3389/ fvets.2021.643085.

14. Hobday M.M., Pachtinger G.E., Drobatz K.J. & Syring R.S. 2014. Linear versus non-linear gastrointestinal foreign bodies in 499 dogs: clinical presentation, management and short-term outcome. *Journal of Small Animal Practice*. 55(11): 560-565. DOI:10.1111/jsap.12271.

15. Hoffman C.L., Mastrocco A. & Drobatz K.J. 2022. Retrospective evaluation of gastrointestinal foreign bodies and presurgical predictors for enterectomy versus enterotomy in dogs (2013-2016): 82 cases. *Journal of Veterinary Emer- gency and Critical Care*. 32(1): 98-105. DOI: 10.1111/vec.13139.

16. Husnik R. & Gaschen F. 2021. Gastric Motility Disorders in Dogs and Cats. *Veterinary Clinics of North America: Small Animal Practice*. 51(1): 43-59. DOI: 10.1016/j.cvsm.2020.09.002.

17. Kan T., Hess R.S. & Clarke D.L. 2022. Clinical findings and patient outcomes following surgical treatment of chronic gastrointestinal foreign body obstructions in dogs and cats: 72 cases (2010-2020). *Canadian Journal of Veterinary Research*. 86(4): 311-315.

18. Masson S., Guitaut N., Medam T. & Béata C. 2021. Link between Foreign Body Ingestion and Behavioural Disorder in Dogs. *Journal of Veterinary Behavior*. 45: 25-32. DOI: 10.1016/j. jveb.2021.04.001.

19. Mila H., Grellet A., Feugier A. & Chastant-Maillard S. 2015. Differential impact of birth weight and early growth on neonatal mortality in puppies. *Journal of Animal Science*. 93(9): 4436-4442. DOI: 10.2527/jas.2015-8971.

20. Miles S., Gaschen L., Presley T., Liu C. & Granger L.A. 2021. Influence of repeat abdominal radiographs on the resolution of mechanical obstruction and gastrointestinal foreign material in dogs and cats. *Veterinary Radiology & Ultrasound*. 62(3): 282-288. DOI:10.1111/vru.12953.

21. Nutt L.K., Webb J.A., Prosser K.J. & Defarges A. 2014. Management of dogs and cats with endotracheal tube tracheal foreign bodies. *Canadian Veterinary Journal*. 55(6): 565-568.

22. Otomo A., Singh A., Valverde A., Beaufrere H., Mrotz V., Kilkenny J. & Linden A.Z. 2019. Comparison of out- come in dogs undergoing single-incision laparoscopic-assisted intestinal surgery and open laparotomy for simple small intestinal foreign body removal. Veterinary Surgery. *Veterinary Surgery*. 48(S1): 83-90. DOI: 10.1111/vsu.13131.

23. Perez J.C., Di Bella A. & Juvet F. 2022. Chronic oesophagitis, oesophageal laceration and gastritis in a Dalmatian after ingestion of medium-density fibreboard. *Veterinary Record Case Reports*. 10(4): e447. DOI: 10.1002/vrc2.447.

24. Poggiani F.M., Duarte R.P.C., Santana M.I.S. & Galera P.D. 2020. Endoscopic Removal of Foreign Body in Upper Gastrointestinal Tract in Dogs: Success Rate and Complications. *Acta Scientiae Veterinary*. 48: 1735. DOI:10.22456/1679-9216.100574.

25. Power A.M., Diamond D.W. & Puetthoff C. 2021. Laparotomy-assisted transoral foreign body retrieval in small animals: 10 cases (2018-2020). *Topics in Companion Animal Medicine.* 42: 100504. DOI:10.1016/j.tcam.2020.100504.

26. Pfau P.R. 2014. Removal and management of esophageal foreign bodies. *Techniques in Gastrointestinal Endoscopy*. 16(1): 32-39. DOI: 10.1016/j.tgie.2013.10.004.

27. Rahmani V., Spillmann T., Halttunen J., Syrjä P. & Ruohoniemi M. 2022. Diagnostic value of endoscopic retrograde cholangiopancreatography and therapeutic value of endoscopic sphincterotomy in dogs with suspected hepatobiliary disorders. *BMC Veterinary Research*. 18(1): 146. DOI:10.1186/s12917-022-03241-4.

28. Rimer D., Lerman O., Klainbart S. & Nivy R. 2020. Lethal acute hemorrhage from an aortoesophageal fistula fol- lowing endoscopy-assisted esophageal foreign body removal in a dog. *Journal of Veterinary Emergency and Critical Care*. 30(5): 587-591. DOI:10.1111/vec.12998.

29. Robinson W., Shales C. & White R.N. 2014. The use of rigid endoscopy in the management of acute oropharyngeal stick injuries. *Journal of Small Animal Practice*. 55(12): 609-614. DOI:10.1111/jsap.12282.

30. Sterman A.A., Mankin K.M.T., Ham K.M. & Cook A.K. 2018. Likelihood and outcome of esophageal perforation secondary to esophageal foreign body in dogs. *Journal of the American Veterinary Medical Association*. 253(8): 1053- 1056. DOI:10.2460/javma.253.8.1053.

31. Teh H., Winters L., James F., Irwin P., Beck C. & Mansfield C. 2018. Medical management of esophageal perfo- ration secondary to esophageal foreign bodies in 5 dogs. *Journal of Veterinary Emergency and Critical Care*. 28(5): 464-468. DOI:10.1111/vec.12757.

32. Tyrrell D. & Beck C. 2006. Survey of the use of radiography vs. ultrasonography in the investigation of gastroin- testinal foreign bodies in small animals. *Veterinary Radiology & Ultrasound*. 47(4): 404-408. DOI:10.1111/j.1740- 8261.2006.00160.x.

33. Wood A.N. & Gallagher A.E. 2021. Survey of Instruments and Techniques for Endoscopic Retrieval of Esophageal and Gastric Foreign Bodies in Cats and Dogs. *Topics in Companion Animal Medicine*. 45: 100555. DOI: 10.1016/j. tcam.2021.100555.