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**Objective**—To evaluate the signalment, clinical signs, diagnosis, treatment, and outcome associated with esophageal obstruction caused by a dental chew treat in dogs.

**Design**—Retrospective case series.

**Animals**—31 dogs.

**Procedures**—Medical records were contributed from 19 hospitals via responses to a questionnaire that was developed for veterinarians who managed the cases.

**Results**—Esophageal obstructions with the dental chew treat occurred primarily in small dogs (26/31 [83.9%]). The most common clinical signs were gagging, regurgitation, vomiting, anorexia, and lethargy. Diagnosis was usually made via survey thoracic radiography. Obstructions were most commonly located in the distal portion of the esophagus (23/31; 74.2%). Esophageal lesions were moderate or severe in 86.7% (26/30) of the dogs. Orad endoscopic removal of the foreign bodies was uncommon (8/31 [25.8%]); most were pushed into the stomach. Thoracotomy was necessary in 6 dogs. Esophageal strictures developed in 6 of 25 (24%) dogs that survived initial hospitalization. Overall mortality rate was 25.8%.

**Conclusions and Clinical Relevance**—Esophageal obstructions with a dental chew treat were difficult to remove orally via endoscopy, resulted in moderate or severe esophageal damage, frequently were associated with stricture formation, and were associated with a high mortality rate. (*J Am Vet Med Assoc* 2008;232:1021–1025)

Bones are the most common esophageal foreign bodies that have been reported in dogs, although fishhooks, rawhide, pieces of plastic or metal, and other miscellaneous objects have been described.1–8 Small breeds of dogs are often affected. Common clinical signs include regurgitation or vomiting, anorexia, salivation, and signs of depression. Esophageal obstructive foreign bodies, such as bones, most commonly lodge in the distal portion of the esophagus, whereas the second most common location is at the level of the heart base. Diagnosis is usually made via survey thoracic radiography. Successful treatment typically involves oral removal with fluoroscopic guidance or endoscopy, or advancement of the foreign body into the stomach with a rigid tube. Thoracotomy is indicated if the foreign body cannot be retrieved or if a medium-sized or large esophageal perforation has developed.3,8 A mortality rate of approximately 10% has been reported. Long-term complications after foreign body removal are uncommon.

A chlorophyll-containing, toothbrush-shaped, injection-molded, dental chew treat is manufactured for dogs. In 2004, the product received the seal of acceptance for plaque and tartar removal from the Veterinary Oral Health Council® of the American Veterinary Dental College. The manufacturer’s Web site reported sales of > 300 million chew treats in 2005. In June 2005, discussion occurred about the difficulty in removing esophageal obstructions caused by the dental chew treat during a special interest group meeting sponsored by the Comparative Gastroenterology Society at the Medical Forum of the ACVIM. Further investigation of this problem was pursued via the ACVIM small animal internal medicine list serve, and additional dogs with obstruction of the esophagus with the dental chew treat were identified. The purpose of the study reported here was to determine the signalment, clinical signs, diagnosis, treatment, and outcome of dogs with esophageal obstructions caused by the dental chew treat that were identified from the list serve discussions. In August

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<th>ABBREVIATION</th>
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2006, the manufacturer released a reformulated product with increased solubility. Throughout this report, the term dental chew treat refers to a piece or pieces of the dental chew treat with the original formulation manufactured prior to August 2006.

Materials and Methods

Case selection—To be included in this retrospective case series, dogs had to be given the dental chew treat shortly before development of clinical signs and a green foreign body had to be identified during endoscopy or surgery.

Procedures—The primary author posted a request for information regarding the diagnosis and management of esophageal foreign bodies in dogs caused by the dental chew treat on the Small Animal Internal Medicine list serve of the ACVIM in June 2005 and January 2006. Thirty-two specialty clinics initially responded with information from 48 cases. Brief summaries of those responses were reported on the list serve. Additional cases were identified from previously responding clinics or other clinics that received the summary list serve postings. A questionnaire regarding the details of diagnosis and management was prepared and sent to each veterinarian that had managed a case of esophageal obstruction with the dental chew treat. Thirty-one questionnaires were completed and returned to the primary author (MSL). One of these dogs was the subject of a published case report.11

For each dog, the following information was abstracted from the medical record into responses to the questionnaire by a clinician involved in case management: hospital, endoscopist and other clinicians involved in case management, date of endoscopy, breed, age, body weight, clinical signs, past medical or surgical problems, radiographic findings, endoscopic findings (location, efforts to remove the foreign body, and esophageal mucosal condition), treatments, case outcome and follow-up, and duration that the dog had received the dental chew treat.

The location of the obstruction within the esophagus was determined from radiographs and via endoscopic examination and characterized as being in the cervical portion of the esophagus, the thoracic portion of the esophagus cranial to the heart base, or the thoracic portion of the esophagus caudal to the heart base.

Results

Thirty cases were evaluated between March 2003 and January 2006. The case previously reported occurred in July 2000. Eight dogs were evaluated at university teaching hospitals and 23 at private specialty hospitals. One hospital contributed 6 cases, 2 hospitals contributed 3 cases, and 3 clinics contributed 2 cases each. Thirteen clinics contributed 1 case each. Median age of the dogs was 4 years (mean, 5.3 years; range, 0.5 to 14.5 years). Median body weight was 4.7 kg (10.3 lbs; mean, 6.9 kg [15.2 lb]; range, 2.2 to 36.4 kg [4.8 to 80.1 lb]). Twenty-six of 31 (83.9%) dogs weighed ≤ 8 kg (17.6 lb). There were 15 males (9 neutered) and 16 females (14 spayed). There were 4 Pomeranians; 3 Chihuahuas; Shih Tzus, Maltese, Pekingese, and Yorkshire Terriers; 2 Miniature Poodles; and 1 each of the following breeds: English Bulldog (puppy), Cairn Terrier, Dachshund, French Bulldog, German Shepherd Dog, Havanese, Labrador Retriever, Lhasa Apso, Pekingese cross Miniature Poodle, and West Highland White Terrier. There were no coexisting medical or surgical problems that were thought to predispose any dog to esophageal obstruction. The length of time that dogs were fed the dental chew treat was known for 19 dogs. Nine (47.4%) had been given the dental chew treat for > 3 months prior to the episode of obstruction.

The most common clinical signs were gagging (n = 17 dogs); regurgitation, vomiting, or both (16); anorexia (12); lethargy (7); pyotaxis (5); and cough (4). Survey thoracic radiographs were obtained in all dogs, but findings were only entered into questionnaires for 29. A soft tissue or foreign body density was visible in the area of the esophagus in 22 (75.9%) dogs, and a possible or suspicious density in that area was seen in 7 (24.1%) others (Figure 1). A dilated esophagus was detected in 8 dogs, and evidence of aspiration pneumonia was seen in 4. Barium sulfate was administered to 7 dogs, and a foreign body was identified within the esophagus in all 7. Among all 31 dogs, the retained portions of the dental chew treat were located within the cervical esophagus in 1 (3.2%) dog, in the thoracic portion of the esophagus proximal to the heart base in 7 (22.6%) dogs, and caudal to the heart base in 23 (74.2%) dogs.

Retained pieces of the dental chew treat were endoscopically removed through the mouth in 8 dogs. Three dental chew treats were removed with rigid forceps passed alongside of the endoscope, 2 were removed with flexible endoscopic forceps passed through the endoscope operating channel, and 2 were retrieved by passing a balloon catheter distal to the foreign body, inflating the balloon, and withdrawing the balloon and foreign body. In 1 dog, the dental chew treat spontaneous-
ously moved into the stomach prior to endoscopy and was removed with flexible endoscopic forces. In 16 dogs, the dental chew treat was pushed into the stomach with a rigid tube and left in place. In 1 dog with an obstruction of the distal portion of the esophagus, the dental chew treat was removed via gastroscopy; endoscopic removal was not attempted. In that dog, postgastroscopy endoscopy revealed esophageal perforation. The esophagus was repaired via ventral sternotomy; but the dog was euthanatized at the owner’s request.

In 6 dogs, the dental chew treat could not be endoscopically removed or pushed into the stomach. Four of those dogs underwent thoracotomy (perforations identified in 2 dogs during endoscopy), 1 was euthanatized because the owner did not wish to pursue surgery, and 1 died because of severe hemorrhage associated with attempts to endoscopically remove the dental chew treat.

Esophageal lesions observed during endoscopy were recorded in 30 dogs and were considered to be moderate to severe in most (n = 26 [86.7%]). Twenty-one (70%) dogs had erosions or ulcerations, 5 (16.7%) had perforations or necrosis, 3 (10%) had hyperemia, and 1 (3.3%) had a normal-appearing esophagus. Treatment after removal varied greatly. Although dosages, treatment intervals, and duration of treatment were not recorded in the questionnaires, commonly used treatments included sucralfate (n = 22), histamine2 antagonists or proton pump blockers (15), antimicrobials (9), analgesics (8), corticosteroids (6), and metoclopramide (2). Gastrostomy tubes were placed in 5 dogs; 2 of those dogs died after surgery. Specific diet recommendations were not commonly recorded, but in 7 dogs, canned food was suggested.

Twenty-nine dogs survived endoscopic examination. Six of those dogs died or were euthanatized as a direct result of the esophageal foreign body or from complications associated with treatment. Four of the 5 dogs that underwent thoracotomy died or were euthanatized within 36 hours after surgery. The fifth dog developed an esophageal stricture and was euthanatized 3 weeks after thoracotomy. One dog had severe hemorrhage associated with removal of a gastrostomy tube.11 Fifteen dogs recovered without major complications. Two dogs had mild persistent regurgitation, but further diagnostic testing was not performed. Two other dogs regurgitated for 3 to 4 weeks after discharge from the hospital.

Esophageal strictures developed in 6 dogs (19.4% of all 31 dogs, and 24% of the 25 dogs that survived the initial hospitalization). Five dogs underwent from 1 to 9 stricture dilations (median number of dilations, 3). One dog was euthanatized after diagnosis of the stricture prior to dilation. The only dog that was treated via dilation once died from hemorrhage that occurred during removal of the gastrostomy tube after the stricture was dilated.11 The diagnosis of esophageal stricture was made a median of 20 days (range, 14 to 25) after the initial endoscopic examination in the 5 dogs in which this information was recorded.

Discussion

The ages, breeds, clinical signs, radiographic findings, and location of the dental chew treats in the dogs described in this report were similar to cases reported in the literature with obstructive esophageal foreign bodies.2–7 However, the following aspects differ from previous reports in the literature: higher percentage of small dogs, lower percentage of oral delivery of the foreign body, increased severity of esophageal lesions, higher percentage of dogs requiring surgery, higher percentage of dogs developing strictures, and higher mortality rate. A precise comparison with other reported studies was not possible because approximately 23% of other reported dogs did not have bone foreign bodies, and details regarding which cases were associated with specific findings were not reported.

In the present report, 83.9% (26/31) of dogs weighed < 8 kg. This is a higher percentage than in published studies2–3,7,8 in which approximately 67% of affected dogs were considered to be of small breeds. This difference may reflect variation among study populations, inclusion of nonobstructing foreign bodies in previous studies, or the fact that small dogs are at a greater risk of esophageal obstruction with the dental chew treat than they are with bones. If the latter is true, it could be attributable to the greater ease of swallowing an object with a smooth tubular shape, compared with an irregular bone fragment.

In only 8 of 31 (25.8%) dogs in the present report was the chew treat removed through the mouth. This contrasts with 5 reports2–4,7 in the literature containing 285 dogs, most of them with bones lodged in the esophagus, in which the median rate of oral removal was 78.4%. In most previous cases,2–4,7 a rigid endoscope or rigid forceps guided with fluoroscopy was used for foreign body removal. Thus, it is possible that the use of a flexible endoscope for removal of the chew treat in the dogs of the present report was responsible for the lower rate of successful oral retrieval. However, this has not been the experience of the primary author (MSL) during the previous 20 years, in which most esophageal obstructive foreign bodies have been orally removed with a flexible endoscope. Another possibility for the low rate of oral removal of the dental chew treat could reflect institutional bias. Previous reports in the literature might have been contributed from institutions with vast clinical experience, great expertise, or high success rates in removing esophageal foreign bodies. However, the authors believe the low oral retrieval rate was likely attributable to some characteristics of the dental chew treat. The tubular shape of the pieces of the dental chew treat resulted in diffuse mucosal contact and tight wedging in the esophagus. In addition, the relatively insoluble nature of the dental chew treat and its tendency to swell slightly after hydration (observed by the primary author [MSL] in vitro) most likely increased the tightness of the impaction. Irregularly shaped foreign bodies, such as impacted bones, often have uneven surfaces that make it possible to grasp the object with flexible snares, baskets, or graspers. The smooth surfaces of the impacted dental chew treat did not allow easy or firm purchase by flexible forceps.

Pyloric or small intestinal obstructions were not reported in any of the 16 dogs in which the dental chew treat was pushed into the stomach during endoscopy. However, follow-up data for > 2 weeks were available.
or specifically reported for only 8 of the 23 long-term survivors. The authors are aware of dogs that had small intestinal obstructions with the dental chew treat, so owners should be informed about the clinical signs of small intestinal obstruction in cases in which the dental chew treat is pushed into and left within the stomach. In the present report, most dogs (n = 26/30 [86.7%]) had moderate or severe esophageal lesions, including 5 with esophageal perforation or focal necrosis. In published reports8,9 of 59 dogs with bone foreign bodies, severe esophageal lesions were not seen as frequently as in the dogs of the present report. The frequency of severe lesions most likely reflected the tubular shape of the dental chew treat and the tightness of the impaction within the esophagus. Esophageal perforations occurred in 4 of 31 (12.9%) of the dogs in the present report. This proportion is similar to that reported in the literature.2–5,7 The authors believe that 2 factors affected the perforation rate in the dogs in the present report. The tightness of the obstruction and the pressure that the dental chew treat exerted on the esophageal wall could have caused pressure necrosis and perforation. These forces were potentially counteracted by the smooth contour of the dental chew treat, which lacked pointed irregular surfaces that could more easily cause perforation of the esophagus.

Thoracotomy was recommended for 6 of the 31 (19.4%) dogs in the present study. One of those dogs was euthanized prior to surgery. Thoracotomy was indicated because of inability to push the dental chew treat into the stomach (because of firmness of impaction), difficulty in grasping the foreign body (preventing oral removal), or severity of esophageal damage (ie, perforation). The percentage of dogs that required thoracotomy was higher than that of other dogs reported with esophageal foreign bodies (approx 11.7%).2–7

In the present report, 19.4% of all dogs and 24.0% of those that survived initial hospitalization developed esophageal strictures. Strictures developed more frequently than in dogs reported in the literature with obstructive foreign bodies. In 3 reports1,2,7 of esophageal foreign bodies in dogs, esophageal strictures were not reported in any dogs. Furthermore, in 4 reports of esophageal strictures among 84 cases, foreign body impactions were responsible for only 9.3% of the strictures. It is also possible that the 2 dogs described in the present report with mild persistent regurgitation after foreign body removal could have also developed strictures, but further diagnostic testing was not performed. Because of the damage caused by the impacted foreign body or its removal, stricture formation develops when inflammation extends into the submucosal and muscular layers of the esophagus and stimulates production of fibrous connective tissue.2–4,12–14 Contraction of fibrous connective tissue, associated with its maturation, reduces the esophageal luminal diameter, impeding delivery of food into the stomach and resulting in regurgitation and malnutrition. The authors can only speculate that a high percentage of dogs developed esophageal strictures because of the severe diffuse esophageal damage caused by the unique characteristics of the dental chew treat. Regardless of the pathophysiology, stricture formation increased the morbidity and mortality rates of these dogs after removal of the foreign body. Stricture dilation is expensive and repeated dilations were necessary (up to 9 dilations). Postdilation treatment usually involves multiple medications,12–14 greatly increasing the clients’ treatment responsibilities.

Several limitations existed for the present study. The identification of cases from the ACVIM list serve and inclusion in this report were voluntary, with only 19 clinics participating. Overall prevalence of esophageal obstruction with the dental chew treat could not be determined. A survey conducted by the Veterinary Information Network in March 2006 identified 136 dogs with esophageal obstruction caused by the dental chew treat with a mortality rate of 19.9%.15 Additionally, it is impossible to determine whether the dogs reported in this study were representative of the entire population of dogs with esophageal obstructions with the dental chew treat. Second, the retrospective nature of this study had inherent limitations, including omission of some data from some cases. The effect of missing data was minimized by inclusion of information that would be commonly recorded in most medical records. Inclusion of cases from 19 clinics resulted in variability in case management, expertise, and medical records. A high quality of diagnosis, treatment, and patient care was ensured by inclusion of dogs treated at either university teaching hospitals or private specialty clinics. However, variability in case management could also be considered an asset because it reduced the influence of institutional bias, procedures, and expertise and provided a more representative sample of case management than would be provided in a large study from a single institution. On the basis of the results of this study, the authors recommend that the original dental chew treat not be given to dogs that weigh < 8 kg and be given cautiously to larger dogs.

References


a. Greenies, S&M NuTec LLC, North Kansas City, Mo.
Selected abstract for JAVMA readers from the American Journal of Veterinary Research

Evaluation of an endoscopically assisted gastropexy technique in dogs
Mauricio Dujowich and S. Brent Reimer

Objective—To evaluate the use of endoscopy in conjunction with a gastropexy technique in dogs as a potential means to aid prevention of gastric dilatation-volvulus.

Animals—12 healthy adult medium- and large-breed dogs.

Procedures—12 adult research dogs that had no abnormal physical examination findings each underwent an endoscopically assisted gastropexy procedure. On completion of the procedure, the dogs were euthanized and exploratory laparotomies were performed to evaluate the surgical site. Data recorded included anatomic location of the gastropexy, gastropexy length, and duration of procedure as well as any complications.

Results—Mean \( \pm \) SD gastropexy length was 3.3 \( \pm \) 0.25 cm, and mean duration of surgery was 18 \( \pm \) 7 minutes. In each dog, the stomach was located in its normal anatomic position and all gastropexies were sutured to the abdominal wall at the level of the pyloric antrum. The only complications during the procedure were needle bending and breakage at the time of stay suture placement.

Conclusions and Clinical Relevance—On the basis of these findings, it appears that endoscopically assisted gastropexy is a simple, fast, safe, and reliable method of performing a prophylactic gastropexy in dogs when undertaken by a person who is skilled in endoscopy. Such a procedure maximizes the benefits of decreased morbidity and shorter duration of anesthesia associated with minimally invasive surgery. Further clinical studies are warranted to evaluate the long-term efficacy of this procedure in dogs at risk for development of gastric dilatation-volvulus. (Am J Vet Res 2008;69:537–541)