# Diamond's Many Dilatations

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## Introduction

Esophageal stricture is a structural pathology of the esophagus that occurs in both dogs and cats, which limits quality of life and puts a strain on both the patient and the owner. The primary reported reason for occurrence of acquired esophageal strictures is secondary to esophagitis induced by gastrointestinal reflux, usually during an anesthetic event [1-7]. The anesthetic event could be due to surgery of the esophagus, such as with esophageal foreign body removal, or due to other procedures. Other reported causes of esophageal strictures include persistent vomiting, ingestion of caustic or corrosive chemicals, medications, or foreign body ingestion [3, 4]. Clinical signs observed with this condition include dysphagia, regurgitation, ptyalism, or weight loss [1-5]. Affected animals may also exhibit signs of aspiration pneumonia, due to excessive saliva production and inability to swallow [1].

Diagnosis of esophageal stricture is obtained primarily through diagnostic imaging, although clinical signs and history will be helpful in determining the cause of esophagitis. Radiography and endoscopy are the two pillars of imaging primarily used; however, some reports are available of CT, MRI, and endoscopic ultrasound being performed [8-10]. Treatment is utilized to widen esophageal diameter and thus, improve comfort of the patient. Esophageal balloon dilatation, stenting, bougienage, and placement of a B-tube have been utilized to increase esophageal diameter at stricture sites, each with varying levels of success [4-6, 10-14]. Current modalities often involve numerous rounds of treatment for extended periods of time.

## History and Presentation

Diamond, a 7 year old, female spayed Pitbull, presented to Mississippi State University College of Veterinary Medicine (MSU-CVM) Emergency Service on October 9, 2020 for persistent vomiting and regurgitation when given any substance orally. Her owner had also

noticed significant weight loss over a period of several weeks. On September 16, 2020 Diamond was diagnosed with a pyometra by her referring veterinarian, who performed an emergency ovariohysterectomy at that time. The surgery and associated recovery were uneventful, however approximately 2 weeks after her surgery, Diamond began vomiting food and water. Medical management with metoclopramide, ranitidine, and Hill's I/D diet failed, so her referred veterinarian proceeded with a positive contrast esophagram. The esophagram revealed delayed movement of barium within the esophagus at the level of C4-C5, consisted with either an esophageal obstruction or stricture. On October 9, 2020 after physical examination, it was determined that Diamond was stable enough to go home and return to MSU-CVM on October 11, 2020 to transfer to the Internal Medicine department for further diagnostics and treatment.

**Diagnostic Approach**

Prior to referral to MSU-CVM, Diamond's referring veterinarian performed two positive contrast esophograms with barium. The esophagram allowed visualization of an area of decreased diameter within the esophagus, with subsequent buildup of contrast material oral to the lesion several minutes after administration. These findings were most consistent with an esophageal stricture. Esophagrams are a useful modality for examining esophageal dysfunction, as the images allow you to determine the location and number of strictures [(9)]. The esophagram is limited in its capacity to visualize the cross section of the stricture, which is useful in determining severity of inflammation at the stricture and within the rest of the esophagus. Similar to the esophagram, fluoroscopy has been described in the literature as another available tool for examining esophageal motility in real time [(2)].

Another diagnostic option, and the one used most often in Diamond's case, is esophagoscopy. Endoscopic examination of the esophagus while the patient is under general anesthesia will

allow direct visualization of the stricture. This allows for close examination of the mucosal integrity of the stricture and the severity of esophagitis present [8,9]. Esophagoscopy will be able to detect the presence of intraluminal masses, diverticula, or lodged esophageal foreign bodies that may be missed with esophagram [8]. Esophagoscopy was utilized frequently with Diamond to visualize her stricture and determine the response of medical management to her esophagitis. In Diamond's case esophagoscopy served as both a diagnostic tool and a treatment modality. Once examination of her stricture was complete, treatment with balloon dilatation or bougienage was able to proceed simultaneously, negating the need for more anesthetic events than were necessary. Esophagoscopy is limited in its ability to examine past a stricture in cases where more than one stricture is present. In cases of severe esophageal stricture, it may not be possible to pass the gastroscope into the lumen of the stricture due to decreased diameter.

**Pathophysiology**

The most common cause of esophageal stricture reported in the literature is stricture formation secondary to severe esophagitis. Esophagitis can develop from various etiologies such as gastroesophageal reflux, persistent vomiting, ingestion of corrosive agents, or certain prescribed medications such as doxycycline [3,4]. Esophagitis causes fibrosis due to inflammation that extends into the lamina propria and muscular layers of the esophagus, resulting in circular or semi-circular bands of fibrotic healing [4,9]. It has been reported that up to 65% of cases of acquired esophageal strictures occurred due to anesthesia induced gastroesophageal reflux [3]. Preanesthetic medications such as atropine, xylazine, morphine, and inhalant anesthetics have been shown to have relaxing effects on lower esophageal sphincter tone, placing a large predisposition to gastroesophageal reflux on anesthetized patients [3,9]. Even though the percentage of animals with esophageal strictures related to anesthetic events are relatively high,

overall the percentage of animals who undergo anesthesia and subsequently develop an esophageal stricture is low. Speculations for this phenomenon include theories that other factors must also be present to develop a stricture, and not just merely the presence of reflux within the esophagus. Other contributory factors could include altered esophageal mucosal junctions, or diminished mucosal resistance [9].

Interestingly, among the literature there appears to be a predisposition among females undergoing ovariohysterectomy to developing esophagitis and subsequent stricture [9,10]. It is unclear whether this risk factor is simply due to the high volume of ovariohysterectomies performed, or due to intra-abdominal manipulation that may be required during surgery. It is known in humans that progesterone and estrogen influence lower esophageal sphincter tone, thus leading to an increase in clinical signs of reflux in pregnant women [9]. This effect of sex hormones could be extrapolated to intact animals undergoing ovariohysterectomies, as high levels of progesterone at the time of surgery could result in a higher chance of reflux.

**Treatment and Management Options**

Esophageal balloon dilatation remains the mainstay of treatment for esophageal strictures. Balloon dilatation is performed during esophagoscopy in which a catheter balloon of the appropriate length of the stricture is placed through the gastroscope or over a guide wire in a position to where the balloon is extending orally and aborally past the stricture site [5]. The balloon is then inflated with sterile saline to the appropriate pressure or until mucosal bleeding is observed [4,5]. Often the balloon is left inflated for approximately 60 seconds to ensure adequate stretching of the stricture. The principal mechanism of action behind balloon dilatation is the application of radial forces to the stricture which allows for even pressure and symmetrical circumferential stretching of the stricture [4, 5, 10]. Triamcinolone acetonide injections have been

combined with esophageal ballooning in some cases to assist with local inflammation. In this method, triamcinolone is injected directly into the submucosa of the stricture in a circumferential fashion [5]. By injecting a steroid locally, subsequent reduction in inflammation and scar tissue formation can occur, thereby reducing the likelihood of recurrence of the stricture [5].

Bougienage is another applicator used for esophageal dilation. This method involves placement of lubricated bougies into the stricture in progressively increasing sizes. Suggested size frames involve the initial bougie being approximately the same size as the stricture, with subsequent bougies increasing in diameter by 2-3 mm [10]. Bougienage provides longitudinal forces in addition to radial forces obtained by balloon dilatation, however shear forces are also encountered when utilizing this method, so potential for mucosal tearing is a common concern[4,10]. Often, esophageal ballooning is combined with bougienage until the desired esophageal diameter is achieved or until evidence of mucosal bleeding occurs.

Placement of either a permanent or temporary esophageal stent has been utilized in the treatment of strictures and has been postulated to cause less trauma by avoidance of iatrogenic mucosal trauma and perforation [12]. Various stent models have been placed in animals with strictures, each with varying levels of success. The most common complications of esophageal stenting included stent migration, stent shortening, hyperplastic tissue formation, or patient discomfort after stent placement [12]. Another variation of an indwelling esophageal stent is placement of a balloon dilatation esophagostomy tube (B-tube). The B-tube was designed to be analogous to balloon dilatation utilized during esophagoscopy, however with the B-tube dilatation can be performed twice daily while the animal is awake [11]. With this treatment modality, the number of anesthetic events during treatment can be reduced and animals can be discharged from hospital quicker, as subsequent therapies can be performed by the owner after

placement of the B-tube. Animals often experienced minor episodes of gagging during dilation of the B-tube, however owner compliance and infection around the B-tube site were the most reported complications with this method [11].

Medical management is often performed prior to and in conjunction with these treatment modalities. It is imperative to control the esophagitis in order to reduce the likelihood of stricture recurrence. This is often addressed with a combination of proton pump inhibitors, H2 receptor antagonists, and prokinetic agents. Proton pump inhibitors, such as omeprazole, are historically used to treat esophagitis due to the noncompetitive inhibition in reducing gastric acid secretion [3, 5, 14]. The use of sucralfate has also been instituted due to proposed effects of adhering to inflamed and exposed esophageal mucosa, however the actual benefit of this use is controversial [5, 14]. Metoclopramide, a popular gastrointestinal motility agent, has also been used to increase lower esophageal sphincter tone and reduce nausea, thereby protecting the esophageal mucosa from further irritation due to reflux and vomiting [4, 15]. A key component of medical management is pain management. The constant exposure of compromised esophageal mucosa to acidic gastric reflux is a source of great discomfort. Additionally, iatrogenic micro-tears of the esophageal mucosa can occur during any dilatation procedure [14]. This, in combination with the breakdown of fibrous connective tissue formations, will further exacerbate any pain and discomfort when eating and swallowing. The use of opioids, either a pill or liquid formulation, should be utilized in any treatment protocol to manage pain and to provide comfort when oral feeding is attempted [1-14].

**Expected Outcome and Prognosis**

Prognosis is variable for dogs affected with esophageal strictures and is often dependent on finances and owner willingness to adhere to treatment protocols. Esophageal balloon dilatation

and bougienage both require an approximated 3-6 separate procedures, which can put financial and emotional strain on the owner [13]. An estimated 30% of affected animals are euthanized or die due to stricture related complications such as esophageal perforation [13]. Esophageal balloon dilatation and bougienage both have reported success rates of 70-80%, however 15-30% of animals must remain on a slurry diet and are not able to tolerate a solid food diet [12, 13].

**Case Outcome**

On October 12, 2020 Diamond was placed under general anesthesia for an esophagoscopy. A cervical esophageal stricture was identified and was corrected with balloon dilation up to 14 mm. Additionally, moderate esophagitis, mild laryngitis, and secondary partial laryngeal paralysis were also noted. Diamond was placed on a sucralfate, omeprazole, Tylenol 4, and magic mouthwash. She was offered small meatballs of food once she had recovered fully from anesthesia. Diamond did well following her procedure, and she was deemed fit to be discharged on October 13, 2020 with instructions to return only if her clinical signs of regurgitation and vomiting recurred.

On November 18, 2020 Diamond returned to MSU-CVM Internal Medicine with complaints of regurgitation following a hospitalization event at her referring veterinarian for diarrhea. The referring veterinarian performed another positive contrast esophagram, which showed delayed barium swallowing at the level of her previous stricture site. On presentation, Diamond was bright and alert, although she had lost approximately 6 kilograms since her last visit. On November 19, 2020 Diamond was placed under general anesthesia for esophagoscopy and subsequent balloon dilatation. Her esophageal stricture was identified and corrected from 7 mm to 16 mm. A 30-32 French tapered bougienage was used after the ballooning to further stretch the stricture. Triamcinolone (5 mg) was then injected circumferentially at the stricture at 12, 3, 6,

and 9 o'clock positions. She was placed on the same medication regimen as described previously, and she was fed a slurry of I/D once she recovered from anesthesia. On November 21, 2020 a mild wet cough with accompanying harsh lung sounds were noted. Thoracic radiographs performed did not show any evidence of aspiration pneumonia, and her cough was improved by the next day. Due to her stable condition, Diamond was moved out of ICU to wards on November 25, 2020, however she became highly anxious and agitated while in wards and she began to regurgitate. A third esophagoscopy was performed on November 27, 2020 which confirmed recurrence of the stricture due to inability to pass the gastroscope past the stricture site. The stricture was stretched to 16 mm with the endoscopic balloon catheter, and further dilated to 20 mm with a 60 French tapered bougienage. On November 30, 2020 a fourth esophagoscopy was performed to assess her progress. The stricture site was still dilated from previous procedures and the gastroscope could be easily placed past the stricture. To ensure continued dilation, the stricture was again bougienaged to 20 mm. Diamond was discharged on December 1, 2020 with an analgesic, sucralfate, and omeprazole.

Diamond required a total of four esophageal dilatation procedures to correct her esophageal stricture. Each procedure was performed with successful dilation of her stricture, and no anesthetic complications were reported. Upon her final discharge, Diamond was sent home with a week-long course of a proton pump inhibitor and sucralfate to help manage her mucosal damage and esophagitis. A few days of Tylenol 4 were also prescribed for at home use to manage any lingering discomfort and pain from her repeated ballooning procedures. Her diet at discharge consisted of small meatballs of I/D, no larger than a quarter in size, fed to her in an upright position to assist with esophageal motility. It was recommended to continue to monitor Diamond at home for signs of esophageal stricture recurrence, such as regurgitation, increase in

swallowing, and vomiting. As of December 2020, Diamond is doing well at home with her canned food diet, and she has not had any episodes of regurgitation. Her owner reports that her energy level is increased, and she is gaining weight.

## Conclusion

Esophageal stricture is often a sequela to severe esophagitis induced by anesthesia related gastroesophageal reflux. Regurgitation is the main clinical sign of stricture, however ptyalism, vomiting, or signs of aspiration pneumonia are also reported. Radiography, fluoroscopy, and endoscopy are the best diagnostic aids for visualizing the esophagus and associated pathology. Esophagoscopy with esophageal balloon dilatation and bougienage are the cornerstone treatments for correcting strictures, however multiple procedures are often required due to the high recurrence rate of strictures. Medical management with the use of proton pump inhibitors, promotility agents, and opioids are often used in combination with dilatation modalities to treat underlying esophagitis and manage pain. The prognosis for esophageal stricture can be fair to good if the owners are financially able to commit to multiple esophagoscopies and major complications such as esophageal perforation are avoided.

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