Case 1
A 9-year-old quarter horse gelding weighing 1,221 lb (555 kg) presented with a 2-year history of repeated episodes of esophageal obstruction and progressive weight loss over the past few months. An esophageal stricture near the base of the heart was identified on a contrast esophagogram. Access to fresh grass and a pelleted diet were recommended at this time, and the horse was reevaluated 4 months later. The owners reported that the horse consumed fresh grass with no complications; however, a weight loss of 136.4 lb (62 kg) was evident. With the onset of winter and the lack of fresh grass, the owners initiated a feeding regimen of 2 cups of a complete pelleted diet every 15 minutes via a timed feeder system. Unfortunately, the horse had several episodes of esophageal obstruction while being fed in this manner. At admission to the clinic, the horse was alert but had a moderately thin body condition. The patient’s rectal temperature, heart and respiratory rates, and complete blood count and biochemistry profile values were all normal. Endoscopic examination of the esophagus confirmed the presence of a stricture involving the thoracic esophagus approximately 150 cm from the nares; it was impossible to pass the endoscope (outside diameter: 8.8 mm) beyond the stricture. Orad to the stricture, the esophagus was mildly dilated and had a small amount of fluid accumulation. Endoscopic examination of the trachea revealed a small amount of feed material.

The intrathoracic location of the stricture posed a significant challenge. Although balloon dilation of the cervical esophagus has been reported in horses with variable results, a similar procedure of the thoracic esophagus has not been described. Furthermore, successful dilation with a balloon catheter occurred in a foal, not an adult horse. Because a 145-cm bougie did not appear to be a feasible treatment option, efforts were made to construct a balloon dilator system. Seven human balloon dilators (Boston Scientific Microvasive 18/19/20 mm, No. 806710-12, Natick, MA) were fastened in a staggered fashion to a 5-mm diameter, 160-cm long, semirigid aluminum rod. Four balloon dilators were attached to the tip of the aluminum rod by passing suture (Prolene 0, Ethicon, Piscataway, NJ) through a hole drilled near the tip of the rod. A rubber tip (Steripeel, Borealis Compounds LLC, Port Murray, NJ) was attached to the end of the aluminum rod to prevent esophageal perforation or excess trauma to the esophageal mucosa. Three additional balloon dilators were fastened to the rod 4 cm from the tip through a predrilled hole. The number of balloon dilators and their staggered arrangement were selected to increase the diameter and surface area available for stricture dilation (A).

General anesthesia was induced in a routine fashion and maintained with isoflurane. The horse was placed in right lateral recumbency, and the esophageal dilator was copiously lubricated and advanced through the left naris. The endoscope was advanced via the right naris to observe passage of the balloon dilator into the esophagus and subsequently into the stricture (B). Increasing amounts of resistance were noted during simultaneous advancement of the balloon dilator and endoscope to the stricture site. In addition, because of the size reduction of the esophageal lumen secondary to the stricture, a moderate degree of difficulty was experienced in advancing the balloon dilator into the stricture. After confirmation of correct placement of the balloon dilator in the stricture by endoscopy, each balloon was inflated with 30–40 cm³ of air and maintained for 60–90 seconds. The balloon dilators were expanded and deflated three times during the initial procedure. Mucosal hemorrhage
and small linear tears were observed at this time. Aftercare included treatment with flunixin meglumine (1.1 mg/kg IV q12h for 3 days), access to fresh grass, and feeding of a complete pelleted diet softened in water.

This esophageal dilation procedure was repeated 19 and 71 days later in response to mild episodes of esophageal obstruction. The need for repeated dilation procedures is reportedly common in people with esophageal strictures. Therefore, the need for repeated dilation procedures in this horse was not unexpected. The owners were advised that the dilation procedure might not be curative and that repeated dilation procedures might be necessary if clinical signs of esophageal obstruction were observed. The owners were advised to feed the horse fresh grass, chopped hay, and a complete pelleted diet (Equine Senior, Purina Mills) soaked in water to prevent obstruction. Ten months after the last treatment, the horse presented for severe pneumonia. A recheck of its esophageal stricture with endoscopy showed that the stricture had resolved. Unfortunately, the horse died from suppurative pneumonia on day 7 of hospitalization; no areas of esophageal stricture were noted during necropsy.

Case 2
A 3-month-old Friesian colt foal weighing 198 lb (90 kg) presented with a 6-week history of weight loss and dysphagia. The foal reportedly had an excellent appetite. At 6 weeks of age, the foal regurgitated feed or milk from the nostrils after eating or nursing. At presentation, the foal was alert but very thin and unthrift. A fever (102.1°F [38.9°C]) was noted, along with normal heart (48 bpm) and respiratory (16 breaths/min) rates. Respiratory effort was mildly increased, but auscultation of the lungs yielded normal results. A profuse, green, mucoid discharge was present at both nostrils.

A complete blood count revealed leukocytosis characterized by neutrophilia, increased numbers of band neutrophils, and hyperfibrinogenemia. Minor hyponatremia, hypokalemia, and hypochloremia were also present. Thoracic radiography revealed an alveolar pattern involving the cranioventral lung consistent with aspiration pneumonia. A transtracheal wash was subsequently performed and submitted for aerobic and anaerobic bacterial culture and sensitivity.

Medical therapy was initiated with potassium penicillin (22,000 IU/kg IV q6h), gentamicin (6.6 mg/kg IV q24h), flunixin meglumine (1.1 mg/kg IV q12h) for 3 days, access to fresh grass, and feeding of a complete pelleted diet softened in water.

B. Esophagoscopy.

Esophagoscopy before the dilation procedure demonstrating esophageal dilation (white arrows) proximal to the stricture site (black arrows), which was located 145 cm from the point of the nares.

Esophagoscopy during the dilation procedure demonstrating placement of deflated balloon dilators (white arrows) into the stricture site (black arrows).
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q12h), omeprazole (4.4 mg/kg PO q24h), and intravenous fluids (lactated Ringer’s solution [1-L bolus] with potassium chloride [20 mEq/L] q4h). A muzzle was used to prevent ingestion of hay but was removed every 2 hours to allow nursing from the mare; small amounts of milk were regurgitated. The next day, esophagoscopy revealed an esophageal stricture that was 45 cm distal from the nares. Contrast radiography and fluoroscopy confirmed and characterized the esophageal stricture (C).

The next day, the foal was anesthetized to facilitate bougienage. Two bougies of different sizes were constructed of nasogastric tubes (outer diameters: 0.8 and 1.9 cm) fitted with a tear-shaped tip made from Technovit (J-61 LB plus J-61 PA, Jorgensen Laboratories, Loveland, CO; D). A semirigid aluminum rod (5 mm) was placed within the nasogastric tubes during use to provide rigidity. The smaller bougie (i.e., a 0.8-cm nasogastric tube fitted with a 2.2-cm wide end) was advanced to the stricture site. Endoscopy of the oropharynx was used to facilitate correct placement of the bougie into the esophagus. Once the bougie was 45 cm from the nares and resistance was noted, the bougie was advanced with light pressure. Endoscopic examination performed directly after the procedure revealed mild mucosal hemorrhage at the stricture site. The larger bougie (i.e., a 1.9-cm nasogastric tube fitted with a 3.2-cm wide end) was then passed in a similar fashion. After bougienage, the diameter of the stricture had become visibly larger, with a moderate amount of hemorrhage noted at the stricture site (E). The foal recovered from anesthesia without complications and was allowed to nurse every hour. Six hours after the procedure, the foal was offered small amounts of fresh grass; however, regurgitation of feed material occurred. The foal was then restricted to nursing the mare.

The following day, the foal was depressed, lethargic, febrile (102.3°F [39.1°C]), tachycardic (102 bpm), and tachypneic (36 breaths/min). Thoracic auscultation revealed increased bronchovesicular sounds and increased respiratory effort. Bacterial culture results of the transtracheal wash revealed mixed bacterial pneumonia characterized by Escherichia coli, Actinobacillus equuli, α-hemolytic Streptococcus spp, and Acinetobacter spp. Based on culture and sensitivity results, the foal was administered ceftiofur (10 mg/kg IM q12h); administration of flunixin meglumine and omeprazole was also continued. Two days later, the foal was afebrile, and the increased respiratory effort was less obvious. The foal was again offered fresh grass, and a smaller amount of nasal discharge was noted. The foal was discharged to the owner with instructions to administer trimethoprim–sulfamethoxazole (30 mg/kg PO q12h for 7 days) and omeprazole (4.4 mg/kg PO q24h for 3 days) and to monitor the patient for signs of dysphagia.

Six weeks after discharge, the foal was reexamined. The foal was alert and had a good body condition (weight gain of 114.4 lb [52 kg]). The owner noted that it had mild, intermittent, bilateral nasal discharge. Endoscopy of the esophagus revealed a stricture at the

C. Fluoroscopic contrast image demonstrating the esophageal stricture site (black arrow) and esophageal dilation proximal to the stricture site (white arrows).

D. Bougies created from nasogastric tubes and Technovit.
same location as previously described; however, the lumen diameter was subjectively larger. No lesions were visible as a result of bougienage (E). Five months after the initial presentation, the 8-month-old foal was alert and had no problems associated with forage consumption. Although less elegant than balloon dilation, bougienage produced acceptable results in this foal.

Esophageal perforation and/or tearing were considerable risks with this procedure. However, because of financial restrictions and the cost of balloon dilators (approximately $200 each), the owner accepted the risks associated with bougienage. As noted, the successful treatment of an esophageal stricture in a foal using a balloon dilator has been reported previously and may be the preferred technique.\textsuperscript{11}

E. Esophagoscopy.

Esophagoscopy immediately after the bougienage procedure demonstrating local dilation of the previous stricture site and areas of hemorrhage.

Esophagoscopy 6 weeks after the bougienage procedure demonstrating dilation of the stricture site.