https://doi.org/10.17221/93/2020-VETMED

An oesophageal benign stricture: Endoscopy treatment limitation and surgical management in a heifer

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Citation: Trovatelli M, Sala G, Romussi S, Boccardo A (2021): An oesophageal benign stricture: Endoscopy treatment limitation and surgical management in a heifer. Vet Med-Czech 66, 272–277.

Abstract: A 4-month-old female red Holstein Friesian heifer was referred with intermittent meteorism and regurgitation associated with poor weight gain. The subject showed a fair physical condition with an increased respiratory rate, normal food prehension, mastication, and swallowing activity. The blood gas analysis showed mild respiratory acidosis. An oral gastric tube introduction followed by an endoscopy confirmed the provisional diagnosis of benign oesophageal stenosis. An endoscopic balloon and bouginage did not result in any stricture release, probably due to the degree of fibrosis of the stenotic ring. A surgical approach with a mucosectomy was performed, which restored the normal oesophageal function. Based on the authors' knowledge, this is the first description of a bovine oesophageal mucosectomy as a definitive surgical treatment for a stricture after the failure of both balloon dilation and a bougienage technique.

Keywords: balloon dilation; calves; oesophageal mucosectomy; oesophageal stricture

An oesophageal obstruction, or choking, is an uncommon condition in cattle. In adult animals, it is generally related to their eating habits (Guard 2009). The main cause of oesophageal stenosis in cattle is related to the healing mechanism of mucosal injuries (Braun et al. 2014; Fubini and Paese 2017). In cattle, there are only three published case reports on the management of the oesophageal stricture (Alexander 1964; Meagher and Mayhew 1978; Ali and Ibrahim 2016). Fubini and Paese (2017) recommend the medical guidelines established for horses with antimicrobial therapy, anti-inflammatory drugs, and frequent feeding with small amounts of food by waiting 30–60 days to assess the possible increase of the oesophageal diameter. Balloon dilatation or bougienage offers alternative treatments for strictures in veterinary medicine, but the use of these techniques seems to be mostly limited to small animals and horses (Bissett et al. 2009; Prutton et al. 2015). The indication for oesophageal surgery is to relieve a stricture that has not been responsive to conservative treatment. Surgical methods include an oesophagomyotomy with a partial mucosal resection and a complete resection with anastomosis (Fubini and Paese 2017).

This report describes a heifer that presented to evaluate chronic bloat and regurgitation caused by an oesophageal stricture that was surgically relieved through an oesophageal mucosectomy after balloon failure bouginage techniques.

Case description

A 4-month-old female red Holstein Friesian heifer was admitted to evaluate an intermittent meteorism and regurgitation associated with poor weight gain. The heifer was purchased at a cattle auction market in Germany at 60 days of age and transported to Italy one week before the hospitali-

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sation. The regurgitation of solid food material was detected early when the animal arrived in Italy. Under the herd practitioner's recommendation, the farmer had started to administer 1 l of milk replacer three times a day, although the regurgitation episodes had progressively worsened. The heifer's medical history before its arrival was unknown.

On admission, the heifer was in fair physical condition (87 kg) with a normal rectal temperature (38.7 °C), an increased respiratory rate (74 breaths/min), and had bradycardia (60 beats/min). Moderate ruminal bloat and sialorrhea with a normal oral cavity and dentition were reported. The prehension, mastication, and suckling behaviour were normal. However, episodes of severe regurgitation of milk and poorly chewed solid material occurred a few seconds after ingestion [Electronic Supplementary Material (ESM) 1]. Increased bronchial sounds with diffuse crackles on both the left and right ventral thirds of the thorax were reported. The venous blood gas analysis showed mild respiratory acidosis without compensatory changes in HCO_3 (pH, 7.33; pCO_2, 49.7 mmol/l; HCO_3, 24.9 mmol/l). The thorax ultrasonography showed a complete lung consolidation from the 5th to the 2nd intercostal space in both the left and right hemithorax (Figure 1).

The oral introduction of a gastric tube through a Frick speculum failed, thus, confirming an oesophageal obstruction.

An oesophagoscopy was performed in sternal recumbency under sedation with an intravenous injection of 0.2 mg/kg xylazine. The oesophagus was endoscopically examined using a Fujinon® EG-250 WR5 Gastroscope, 9.8 mm in diameter, 150 cm in length. The device was orally inserted with a standard manoeuvre. An oesophageal stricture was located in the cervical oesophageal region, with a prestenotic oesophageal ectasia. The stenotic ring was also totally visible in its length, even if the tip of the scope was unable to pass it (Figure 2A).

After hospitalisation, the heifer was housed in an individual calf brick pen (3 m × 2 m) bedded with a rubber mattress without straw. Fresh water was offered via a nipple bottle two times daily. The heifer was fed 3 l of a milk replacer three times daily by a nipple bottle. To reduce the amount of regurgitated material, the heifer was allowed to drink only a few sips during both the milk meal and water ingestion. The heifer underwent a specific treatment for the oesophageal stricture 15 days after admission with a good clinical recovery of the lung functions and an increased body weight of 7 kg.

General anaesthesia was induced with xylazine [0.2 mg/kg, intravenously (i.v.)] and ketamine (2 mg/kg, i.v.) and maintained after orotracheal intubation with isoflurane in 100% oxygen. The oesophagus was endoscopically examined in right lateral recumbency with a Fujinon® EG-250 WR5 Gastroscope with the same technique as previously described.

Repeated balloon dilation attempts were performed with a 15-mm diameter, 5.5 cm length bal-

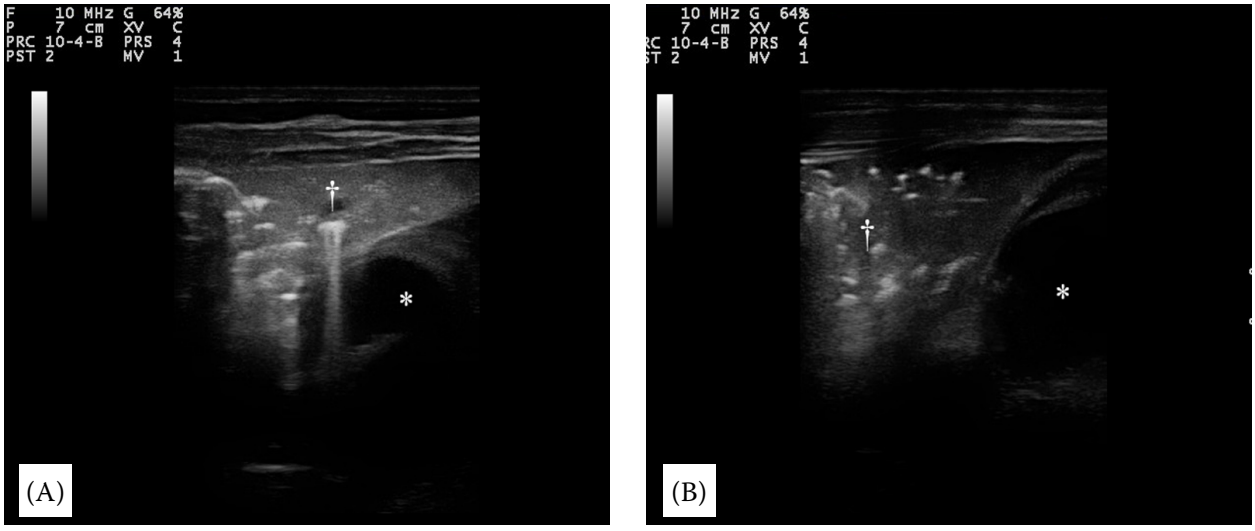

Figure 1. Ultrasonographic images of the cranial aspect of the left cranial lung lobe from the 3rd intercostal space on the left (A) and of the caudal aspect of the right cranial lobe from the 4th intercostal space (B) on the right performed with a 10 MHz linear transducer. Both lobes were affected by a full thickness consolidation (†). The heart is the ventral image landmark in both locations (*)

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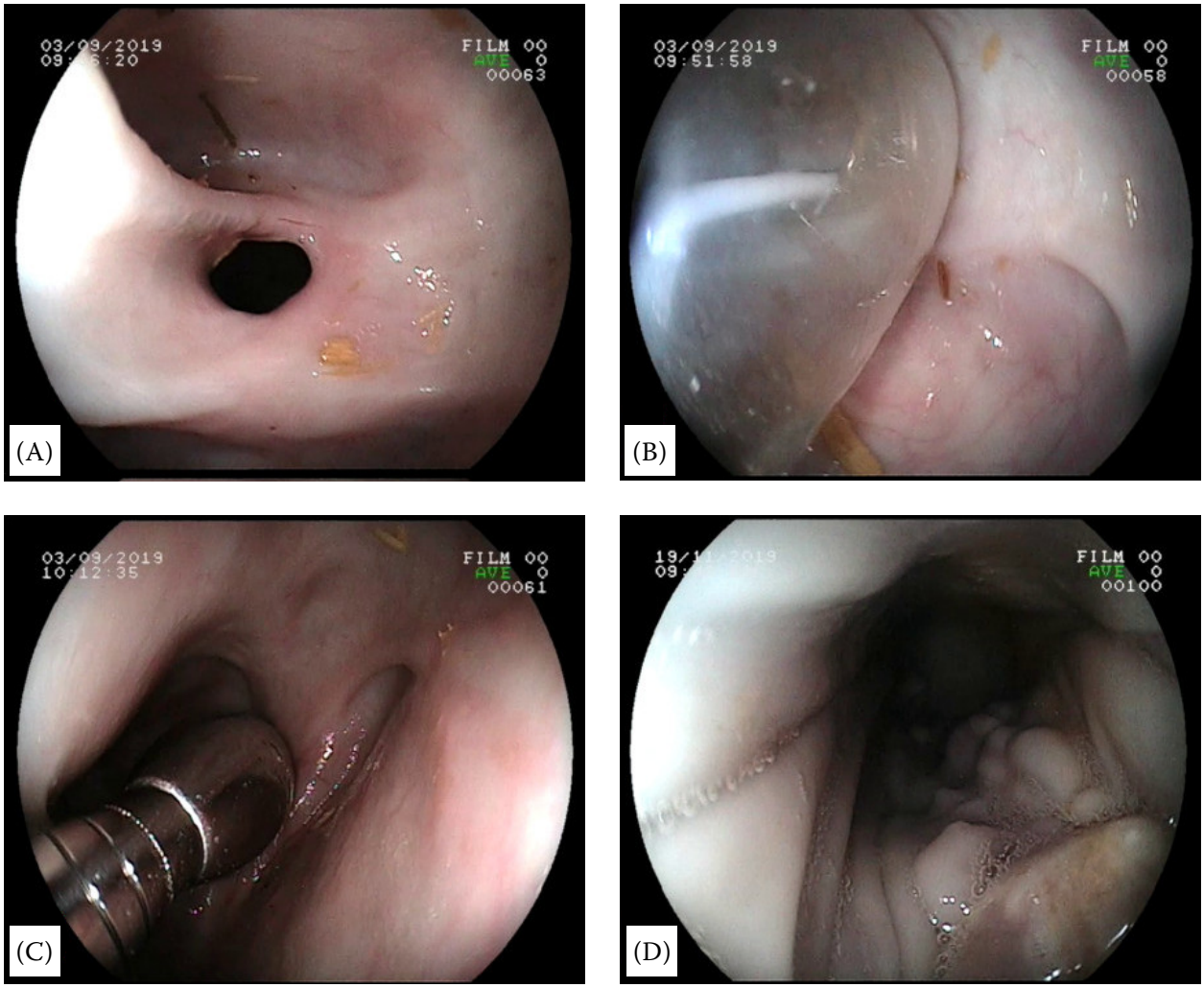

Figure 2. Oesophageal endoscopy

(A) Endoscopy diagnosis of the oesophageal stricture. (B) Endoscopic balloon dilatation procedure. Repeated balloon dilation attempts were performed with a 15-mm diameter, 5.5 cm length balloon, no benefits were achieved. (C) Endoscopic bouginage dilatation procedure. Eder Puestow dilators were used in a series of subsequent procedures, but no benefits were achieved. (D) Endoscopy examination 16 days after surgery. Knot mucosal sutures are presumably recognisable by button-shaped mucosal neoformations. These are attributable to the sub-mucosal reaction due to the suture points

loon (Balloon Cre; Boston Scientific, Marlborough, MA, USA) controlled via a pressure gauge and a syringe inflator. An insufflation pressure of 50 psi was maintained for repeated cycles of 60–90 s with no sign of evident dilatation (Figure 2B). Eder Puestow metal olive dilators (43 Fr in size), followed by 36 and 39 Fr, (Keymed, Southend-on-Sea, Essex, UK) were used in the series of subsequent procedures, but no benefits were achieved (Figure 2C). The left lateral cervical region was then surgically prepared, and a 15-cm incision was made distally from the caudal aspect of the larynx. A gastric tube was inserted via the oral cavity as a surgical landmark to identify the oesophagus and the anatomical stricture. The oesophagus was then exposed and isolated, and the tube was removed. The oesophageal lumen content was removed from the stenotic lesion through a gentle massage in the caudal direction.

Two Doyen intestinal clamps were positioned cranially/caudally to the lesion to prevent the incisional site's contamination. The external and muscular layers appeared normal and were incised via a scalpel and retracted with sutures (Figure 3). The fibrotic stenotic ring was detected and the mucosa around it was incised and removed carefully for 3 cm of length and then sutured via a simple interrupted suture with USP 2-0 polydioxanone.

https://doi.org/10.17221/93/2020-VETMED

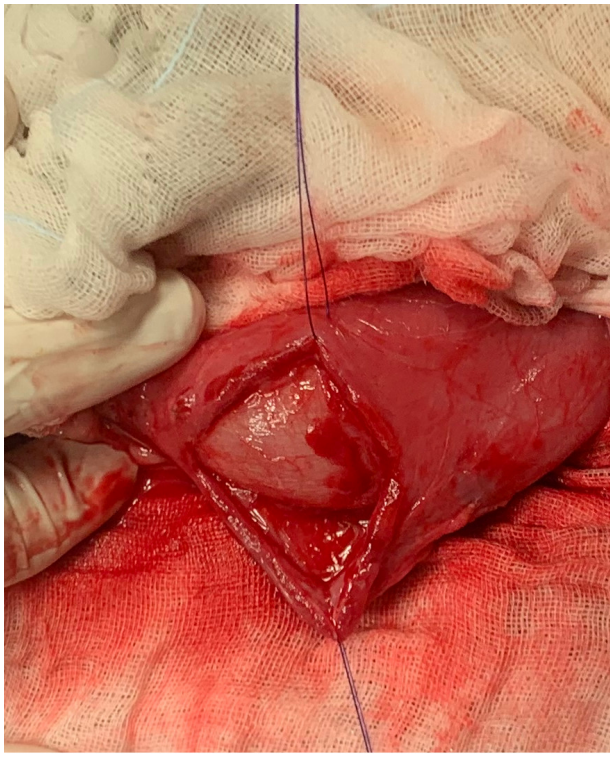

Figure 3. Surgery
Two stay sutures were placed on the adventitia and muscular layer of the oesophagus. The stenosis is identified and the submucosa and mucosa layer are exposed

A sterile lavage with 1 l of sterile saline fluids was performed to decrease the tissue contamination. The muscular layers, submucosa, and skin were closed via a simple interrupted suture with USP 2-0 polydioxanone.

After surgery, flunixin meglumine (2.2 mg/kg i.v. once daily for 2 days) and procaine penicillin G [30 000 IU/kg, intramuscularly(i.m.) once daily for 7 days] were administered. During the first week, the heifer received the same restricted diet established before the mucosectomy and then gradually allowed to increase the amount of milk and water. A control oesophagoscopy was performed 16 days after the surgery, with no signs of recurrence (Figure 2D). Freshwater, hay, and calf starter were then offered *ad libitum*. No infection of the surgical site and no dysphagia or regurgitation were reported in the postoperative phases. The patient was discharged from the hospital one month after surgery in excellent condition and with a bodyweight of 100 kg. Four months after the surgery, the owner reported that the heifer is in excellent condition with no clinical signs of regurgitation, ruminal bloat, or a surgical-site infection.

DISCUSSION AND CONCLUSION

The definitive diagnosis of an oesophageal stricture is well described in human literature, and a trans-oesophageal ultrasound could be considered the gold standard for assessing the anatomical changes (Wang et al. 2015).

The diagnosis of an oesophageal stenosis in the patient described in this case report was made during the oesophagoscopy. The definitive diagnosis of a mucosal oesophageal stenosis was made during the surgical exploration.

A mucosal oesophageal stenosis is a consequence of traumatic injuries leading to the chronic inflammation of the mucosa and secondary fibrosis. Although, in this case, the type of oesophageal trauma remains obscure, it is important to consider that the most common cause of oesophageal injuries in cattle is due to the erroneous administration of oral preparations (Mannion et al. 1997). Incorrect use of oral devices usually causes pharyngeal lesions or oesophageal foreign bodies (Gomez et al. 2014; Sala et al. 2019), causing mucosal ulceration that can lead to an oesophageal stenosis (Gomez et al. 2014). In some cases, oral devices can be used incorrectly by farmers to give milk to calves with a weak suckle reflex, completely neglecting this condition's real cause (Boccardo et al. 2017; Sala et al. 2019). Oesophageal traumatic injuries are commonly localised in the cervical tract of the oesophagus and can be characterised by different degrees from a mucosal tear to a complete oesophageal perforation (Mannion et al. 1997). A grading system is provided for horses (Prutton et al. 2015), but to the author's knowledge, one does not exist for cattle. The dysphagia found in our heifer was compatible with an oesophageal stricture. The bronchopneumonia was most likely secondary to aspiration following regurgitation (Panciera and Confer 2010). Furthermore, the partial intraluminal oesophageal obstruction produced a chronic ruminal bloat. Continuous stimulation of the strength receptors in the ruminal wall leads to vagal indigestion, which may explain the bradycardia found in our patient (Ivany et al. 2002).

Balloon and bouginage of oesophageal strictures are commonly used in veterinary medicine (Tan et al. 2018). The balloon procedure creates a radial stretch which is less damaging than the longitudinal forces produced by the bouginage treatment. Benign oesophageal strictures in small animals

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are treated with a good outcome in 70–88% of cases. A mean of 2.2 to 4.5 treatments per patient is needed (Tan et al. 2018). In our case, no signs of dilatation during the endoscopy were detected. The axial and radial forces spread with the balloon and bouginage techniques failed to produce the expected result probably due to the organised fibrosis in the stenotic ring. The failure of this technique, in our case, could be explained by the different behaviour of the bovine fibrous tissue during the healing process and on the possibility that these differences could also play a role in the resistance of the scar tissue in the oesophageal stricture described herein.

A precise diagnosis determining the anatomical involvement of the oesophageal wall is mandatory to plan the surgical procedure. If the oesophageal narrowing is only due to the mucosal and submucosal alterations, a mucosectomy should be the first surgical option. Oesophagoplasty, oesophageal resection, and anastomosis are more challenging procedures due to the high complication rate. The procedure could be performed by endoscopy in humans and dogs. The oesophageal mucosectomy, reported in the present study, was undertaken via an open approach and, both the oesophageal adventitia and the muscular layer were longitudinally incised to reach the mucosal layer. The oesophagus was gently manoeuvred. The two stay sutures revealed their importance in maintaining the exposed the mucosa and allowing the gentle blunt dissection of the stenotic fibrous ring. The authors believe that the transverse closing of the longitudinal muscular oesophageal incision could have played a significant role in determining the increase of the oesophageal transverse diameter, decreasing the disturbance on the underneath layer healing.

In patients with an oesophageal stenosis, food management plays a pivotal role in maintaining the correct supply of nutrients before the surgery and during the first days after the surgical procedures. To minimise tissue swelling, a small amount of hydrated hay and grains should be administered (Guard 2009). Our experience suggests that, in young calves, it is possible to restore the milk-based diet that was shown to impact our patient's health positively and is, at the same time, easy to manage.

In conclusion, the oesophageal mucosectomy was successful in restoring the normal swallowing function of our heifer. This paper also reports the failure of the balloon dilation and bougienage technique. The technique was adapted from other species as possible; however, the fibrotic ring's stiffness made it impossible to dilate.

Conflict of interest

The authors declare no conflict of interest.

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Received: April 22, 2020
Accepted: December 11, 2020