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Laryngopharyngeal mucosal fold causing upper airway obstruction in a dog

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Abstract:	A 2.4 kg, six-year-old, sterilised, male Pomeranian presented with dyspnoea that had begun 2 years prior and slowly progressed. Pharyngoscopy identified a redundant laryngopharyngeal mucosal fold that was being aspirated cranially into the laryngeal opening causing upper airway obstruction. A diode laser was used to resect the fold. Postoperative laryngeal oedema necessitated the use of a tracheostomy tube for just over 2 days. Otherwise, the dog made an uneventful recovery. To the authors' knowledge, this is the first report of a redundant laryngopharyngeal mucosal fold resulting in upper airway obstruction in a dog.

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TITLE OF CASE

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SUMMARY

A 2.4 kg, six-year-old, sterilised, male Pomeranian presented with dyspnoea that had begun 2 years prior and slowly progressed. Pharyngoscopy identified a redundant laryngopharyngeal mucosal fold that was being aspirated cranially into the laryngeal opening causing upper airway obstruction. A diode laser was used to resect the fold. Postoperative laryngeal oedema necessitated the use of a tracheostomy tube for just over 2 days. Otherwise, the dog made an uneventful recovery. To the authors' knowledge, this is the first report of a redundant laryngopharyngeal mucosal fold resulting in upper airway obstruction in a dog.

BACKGROUND

Obstructive airway syndrome has been well described in both brachycephalic and non-brachycephalic breeds.[1-9] Nasopharyngeal dysgenesis, described in 7 dachshunds,[10] and redundant mucosa originating from or near the laryngeal inlet[6,11,12] are rare causes of upper airway obstruction in dogs. Displacement of glosso-epiglottic mucosa was first described in 2 dogs by Bedford[6] in 1983. Recently, redundant arytenoid mucosa was documented in 16 Norwich terriers[11] and 3 cats.[12]

In humans, upper airway obstruction has very occasionally been associated in children with posterior congenital laryngeal clefts where redundant oesophageal mucosa is inspired through the cleft in the cricoid cartilage. Trimming of the oedematous mucosa and surgical correction of the cleft alleviated the airway obstruction in both cases.[13,14]

Redundant mucosal fold formation is postulated to be linked to increased air flow, or increased negative pressure, sucking mucosa into the laryngeal inlet, resulting in micro trauma and elongation of the mucosa. This occurs secondary to an increase in intrathoracic negative pressure associated with increased effort of inspiration. As the laryngeal inlet is progressively occluded the effort of inspiration is increased perpetuating the cycle.[3,11]

Anatomically the laryngopharynx begins at the caudal end of the intrapharyngeal ostium and nasopharynx and extends caudally to the oesophageal limen or annular fold which marks the pharyngoesophageal junction.[15] The piriform recesses form its ventrolateral borders (Fig 1).[16] The laryngopharynx, as an anatomical origin of redundant mucosal folds causing obstructive airway syndrome, has to the authors' knowledge, never been described in the dog nor any other animal.

CASE PRESENTATION

A 2.4 kg, six-year-old, sterilised, male Pomeranian presented with dyspnoea that began 2 years prior and had slowly progressed. Exercise, hot weather and excitement exacerbated the dyspnoea.

INVESTIGATIONS

Clinical examination revealed an inspiratory stridor and dark pink to mildly cyanotic mucous membranes. The dog became cyanotic when stressed. Haematology and serum biochemistry were unremarkable. Fluoroscopy revealed mild aerophagia, moderate main stem bronchi narrowing with expiration, moderate soft palate thickening, a vertically orientated epiglottis as also noted on endoscopy (Fig 2), and what appeared to be an obstructive pharyngeal band. The dog made several swallowing attempts during fluoroscopy and insisted on sitting despite repeated encouragement to stand. Laryngoscopy and pharyngoscopy under general anaesthesia was performed as follows.

The dog was hydrated with 24 ml/hr ringers lactate solution iv (Ringers lactate solution, Fresenius Kabi), premedicated with 0.3mg/kg morphine sulfate iv (Morphine, Fresenius Kabi), 0.2mg/kg diazepam iv (Pax injection, Aspen); 20mg/kg cephalexin sodium iv (Zefkol 1g, Aspen) and 0.3 mg/kg dexamethasone iv (Kortico, Bayer), induced with 3mg/kg alphaxalone iv (Alfaxan, Afrivet), and maintained on isoflurane (Isoflor, Safeline Pharmaceuticals) via a 3.5 mm non-cuffed paediatric plastic tracheostomy tube (Portex® Blue Line® Pediatric Tracheostomy Tube; Avacare™) placed via a transverse temporary tracheostomy as described.[17] The dog was placed in sternal recumbency, the maxilla suspended from a support stand and the mandible stabilised ventrally in an open position with tape. A pink, soft and partially pedunculated teardrop shaped soft tissue mass, with an elliptical base originating just aboral to the interarytenoid groove and extending aborally along the ventral laryngopharyngeal midline to just cranial to the pharyngoesophageal junction was visualised with a 30º arthroscope (HOPKINS Optik 30°, 2.7 mm, Karl Storz GMBH & Co. KG). The rostral free end hung ventrally, resting on the cuneiform processes, and was sucked into the laryngeal opening upon inspiration, causing partial upper airway obstruction (Figs 3, 4 and 5).

TREATMENT

A 980-nm wavelength diode laser (Ceralas E; Ceramoptec; Bonn, Germany) was used with a 600-μm fibre, in continuous contact mode, with 4W power, to resect the mass and the caudal margin of the soft palate, which was judged marginally too long intraoperatively (Fig 6). No haemorrhage was noted and the tissue sections were submitted for histopathology. No other causes of obstruction were found during inspection of the region.

OUTCOME AND FOLLOW-UP

Post surgically the patient was maintained on intravenous fluids and additional treatment included 0.2 mg/kg morphine sulfate iv (Morphine, Fresenius Kabi), 6 times a day for 24 hours replaced by 4.4 mg/kg carprofen sc (Rimadyl, Pfizer), 1 mg/kg omeprazole orally (Omez, Dr. Reddy's), 20 mg/kg cephalexin iv (Zefkol 1g, Aspen), 3 times a day for 24 hours changing to an oral solution (CPL Alliance Cephalexin, Alliance Pharma), twice a day for 3 days. The tracheostomy tube was nebulized and suctioned every 15 minutes for the first hour, changing to hourly thereafter. The tube was exchanged with a new one every 4-6 hours. It was removed at 51 hours, the neck was bandaged and the wound allowed to heal by second intention. The dog started voluntarily eating and drinking 14 hours post-surgery, and was discharged on day 4 with 1 mg/kg omeprazole orally (Omez, Dr Reddy's) twice a day for 2 days, 20 mg/kg cephalexin solution orally (CPL Alliance Cephalexin, Alliance Pharma) twice a day for 2 days, and bromhexine hydrochloride orally (Bronkeze Compound Linctus, Aspen) 3 times a day for 7 days.

Histopathology revealed normal oropharyngeal and soft palate soft tissue. Twenty weeks post-surgery the owner reported that the patient was healthy, with no further signs of respiratory distress.

DISCUSSION

This case represents the first report describing a mucosal fold originating from the laryngopharynx causing upper airway obstruction in a dog. The aetiology remains speculative and the history suggests a progressive disease. History could not identify any initiating factors. These may have been overlooked as the initial formation of the mucosal fold may not have caused signs of respiratory distress, may then have progressively elongated ultimately necessitating surgical correction. The obstructive pharyngeal band noticed on fluoroscopy was confirmed as the redundant laryngopharyngeal mucosal fold. The vertical orientation of the epiglottis noted on fluoroscopy and thickened soft palate likely also contributed to crowding of the laryngeal opening. However, the repeated swallowing attempts and insistence on sitting whenever possible are consistent with the dog trying to use gravity to keep the mucosal fold positioned in the laryngopharynx and out of the laryngeal opening.

The use of a temporary tracheostomy tube intra-operatively permitted unrestricted access to the laryngopharyngeal area, aiding visualisation and assessment of the laryngeal structure and function. It prevented accidental damage to the endotracheal tube with the laser fibre with subsequent leakage of anaesthetic gases and afforded post-operative airway management.

Diode laser surgery has been shown to minimise haemorrhage[18] and decrease pain.[19] Furthermore, diode lasers have the ability to cut and vaporise with limited thermal effect. They can be guided through a flexible quartz fibre allowing endoscopic use, with resultant superior visibility and concurrent evacuation of smoke, while ensuring a very precise focal point,[12] a distinct advantage when operating in confined areas. Diode lasers have superior coagulation ability compared with longer wave length lasers above 1400 nm (Erbium: YAG and CO_2), however this comes with the disadvantage of greater peripheral thermal damage to tissues, the extent of which may only become evident hours or days post-surgery.[18] The authors' rationale for choosing diode laser surgery included the small size of the patient with restricted access to the laryngopharyngeal region using conventional surgical techniques. Other surgical options could have included sharp resection with bipolar electrocautery to control haemorrhage, monopolar electrocautery in the cutting and coagulation setting, CO_2 laser excision, use of a bipolar sealing device or use of low temperature, high-frequency radiosurgery.[20-22] However, the authors are of the opinion that these techniques would have compromised intraoperative visibility increasing the risk of unnecessary damage to surrounding structures. In our case no haemorrhage was encountered intra-operatively. However, peripheral thermal damage was particularly outspoken along the line of resection of the soft palate. This may partly represent an overly aggressive diode laser setting relative to the thickness of the tissue excised.

The patient required a temporary tracheostomy tube for 51 hours post operatively due to laryngeal oedema / inflammation. Both findings are consistent with those reported with diode laser usage by Dunié-Mérigot *et al*.[21] A likely explanation is that, despite the limited thermal effect reported for diode lasers,[12] they still cause variable amounts of heat necrosis to surrounding tissues[18] and leave an open wound surface that needs to granulate and epithelialize.

In conclusion, diode laser can be used successfully in treating redundant laryngopharyngeal mucosal folds, especially in very small patients. Laryngopharyngeal mucosal folds should be considered as a differential diagnosis in patients with upper respiratory distress syndrome.

LEARNING POINTS/TAKE HOME MESSAGES

- Laryngopharyngeal mucosal folds should be considered as a differential diagnosis for upper airway obstruction in dogs.
- Diode laser surgery can be used successfully in treating redundant laryngopharyngeal mucosal folds.
- A temporary tracheostomy tube should be placed in small patients when using diode lasers for resection of laryngopharyngeal mucosal folds to mitigate the risks associated with laryngeal oedema or inflammation postoperatively.

REFERENCES

1. Barnhart K, Lewis B. Laryngopharyngeal mass in a dog with upper airway obstruction. *Vet Clin Pathol* 2000;**29**(2):47-50
2. White R. Brachycephalic airway obstructing syndrome: Some further controversies. Association of Veterinary Soft Tissue Surgeons. Cambridge, UK; 2010 October 1 to 2. p. 23-27.
3. Koch DA, Arnold S, Hubler M, *et al.* (2003) Brachycephalic syndrome in dogs. *Comp Cont Educ Pract* 2003;**25**(1)**:**48-54
4. Oechtering GU. Brachycephalic syndrome - new information on an old congenital disease. *Veterinary Focus* 2010;**20**(2):2-9
5. Ginn JA. Kumar MSA, Mckiernan BC, *et al.* Nasopharyngeal turbinates in brachycephalic dogs and cats. *J Am Anim Hosp Assoc* 2008;**44:**243-249
6. Bedford PGC. Displacement of the glosso-epiglottic mucosa in canine asphyxiate disease. *J Small Anim Pract* 1983;**24**:199-207
7. Flanders JA, Thompson MS. Dyspnea caused by epiglottic retroversion in two dogs. *J Am Vet Med Assoc* 2009;**235:**1330-1335
8. Leonard HC. Entrapment of the epiglottis. *Eur J Companion Anim Pract* 1989;**19**:16-20
9. Oechtering GU, Hueber J, Kiefer I, *et al.* Laser assisted turbinectomy (LATE) - a novel approach to brachycephalic airway syndrome. *Vet Surg* 2007;**36**(4):E11
10. Kirberger RM, Steenkamp G, Spotswood TC, *et al.* Stenotic nasopharyngeal dysgenesis in the dachshund: seven cases (2002–2004). *J Am Anim Hosp Assoc* 2006;**42**(4):290-297
11. Johnson LR, Mayhew PD, Steffey MA, *et al.* Upper airway obstruction in Norwich terriers: 16 cases. *J Vet Intern Med* 2013;**27**:1409-1415
12. De Lorenzi D, Mantovani C, Tripaldi F, *et al.* Redundant arytenoid mucosa: clinical presentation, treatment and outcome in three cats. *J Small Anim Pract* 2016;**57**:40-43
13. Kamata S, Ihara Y, Usui N, *et al.* Surgical management for posterior laryngeal cleft developing subglottic airway obstruction. *J Pediatr Surg* 2005;**40**:E15-16
14. Prescott CA. Cleft larynx: repair with a posterior cartilage graft. *Int J Pediatr Otorhinolaryngol* 1995:**31**:91-4
15. Evans HE, de Lahunta A. The Respiratory System. In: Evans HE, de Lahunta A, editors. *Miller's Anatomy of the Dog*. 4th ed. St Louis, Missouri: Elsevier Saunders; 2013. p. 304.
16. Evans HE, de Lahunta A. The Respiratory System. In: Evans HE, de Lahunta A, editors. *Miller's Anatomy of the Dog*. 4th ed. St Louis, Missouri: Elsevier Saunders; 2013. p. 348.
17. Sura PA, Durant AM. Trachea and Bronchi. In: Tobias KM, Johnson SA, editors. *Veterinary Surgery Small Animal*. St Louis, Missouri: Elsevier Saunders; 2012. p. 1737.
18. Berger N, Eeg PH, editors. Types of laser-tissue interaction. In: *Veterinary Laser Surgery: A Practical guide*. Blackwell; 2006. p. 39.
19. Sanz-Moliner JD, Nart J, Cohen RE, *et al*. The effect of an 810-nm diode laser on postoperative pain and tissue response after modified Widman flap surgery: a pilot study in humans. *J Periodontol* 2013;**84**:152-158
20. Brdecka DJ, Rawlings CA, Perry AC, *et al.* Use of an electrothermal, feedback-controlled, bipolar sealing device for resection of the elongated portion of the soft palate in dogs with obstructive upper airway disease. *J Am Vet Med Assoc* 2008;**233:**1265-1269
21. Dunié-Mérigot A. Bouvy B, Poncet C. Comparative use of CO_2 laser, diode laser and monopolar electrocautery for resection of the soft palate in dogs with brachycephalic airway obstructive syndrome. *Vet Rec* 2010;**167**:700-704
22. Elkins AD. Soft palate resection in brachycephalic dogs. *Vet Res Forum* 2005;**22:**43-46

FIGURE/VIDEO CAPTIONS

FIG 1. The pharynx (sectioned coronally just below the soft palate). The laryngopharynx (orange) extends to the pharyngoesophageal junction and includes the piriform recesses (star). The wide base of the aberrant mucosal fold is indicated in blue and its outline in black. Oropharynx (green) "Adapted from the original image published in Dyce, Sack and Wensing's Textbook of veterinary anatomy, Singh, B., The Head and Ventral neck of the dog and cat, p 369, Copyright Elsevier Inc (2018)." – with permission.

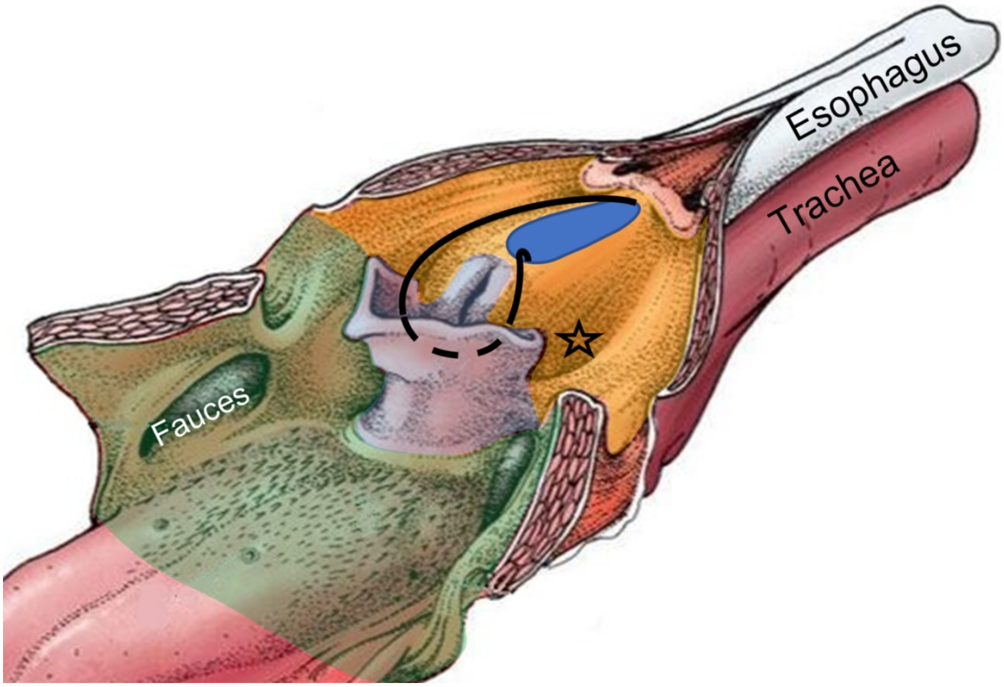
FIG 2. Pharyngoscopic view of the laryngeal area. The oesophageal temperature probe is evident at 1 o'clock position (arrow). The soft palate has been retracted rostrally and dorsally and is not visible. The vertical orientation of the soft palate is evident (X). The laryngopharyngeal mucosal fold (Z) is partially visible behind the epiglottis (X). Piriform recess (star).

FIG 3. Intrapharyngeal schematic of the laryngeal opening and laryngopharynx showing the location and extent of the redundant laryngopharyngeal mucosal fold. Laryngopharyngeal attachment of the mucosal fold (blue outline and fill). Outline of the pedunculated portion of the mucosal fold partially obstructing the laryngeal opening (black outline). Blind ending mucosal invagination centrally located in the mucosal fold (white dotted circle). Submucosal locations of: Cricoid cartilage (light blue), arytenoid cartilage (yellow), epiglottic cartilage (red), dorsal border of thyroid cartilage (green), pharyngoesophageal junction (a), interarytenoid groove (b), corniculate process (c), cuneiform process (d), aryepiglottic fold (e), piriform recess (star). "Adapted from the original image published in Veterinary Surgery Small Animal, Volume II, Monnet, E. and Tobias, K.M., Larynx, p 1719, Copyright Saunders (2012)." – with permission.

FIG 4. Pharyngoscopic view of the laryngopharyngeal mucosal fold (Z) partially obstructing the laryngeal inlet. The soft palate has been retracted dorsally and rostrally and is not visible. The epiglottis (X) maintained a vertical orientation in this patient. Oesophageal temperature probe (arrow), Piriform recesses (stars). Blind ending mucosal invagination in the mucosal fold (arrow head).

FIG 5. Pharyngoscopic view of the apex of the laryngopharyngeal mucosal fold resting on the cuneiform processes (*) of the arytenoid cartilage resulting in partial obstruction of the laryngeal inlet. Corniculate processes (#), interarytenoid groove (y), rostral portion of larygopharyngeal mucosal fold (Z), blind ending mucosal invagination in the mucosal fold (arrow head).

FIG 6. Oropharyngeal view immediately following surgery shows a wide base of excised laryngopharyneal mucosa (Z) extending caudally from the interarytenoid groove towards the pharyngoesophageal junction, which is obscured by the resected caudal margin of the soft palate (arrows). Note the blanching of the resected soft palate margin. Epiglottis (X), cuneiform processes (*), region of the oesophageal opening obscured by the soft palate (black dotted oval).



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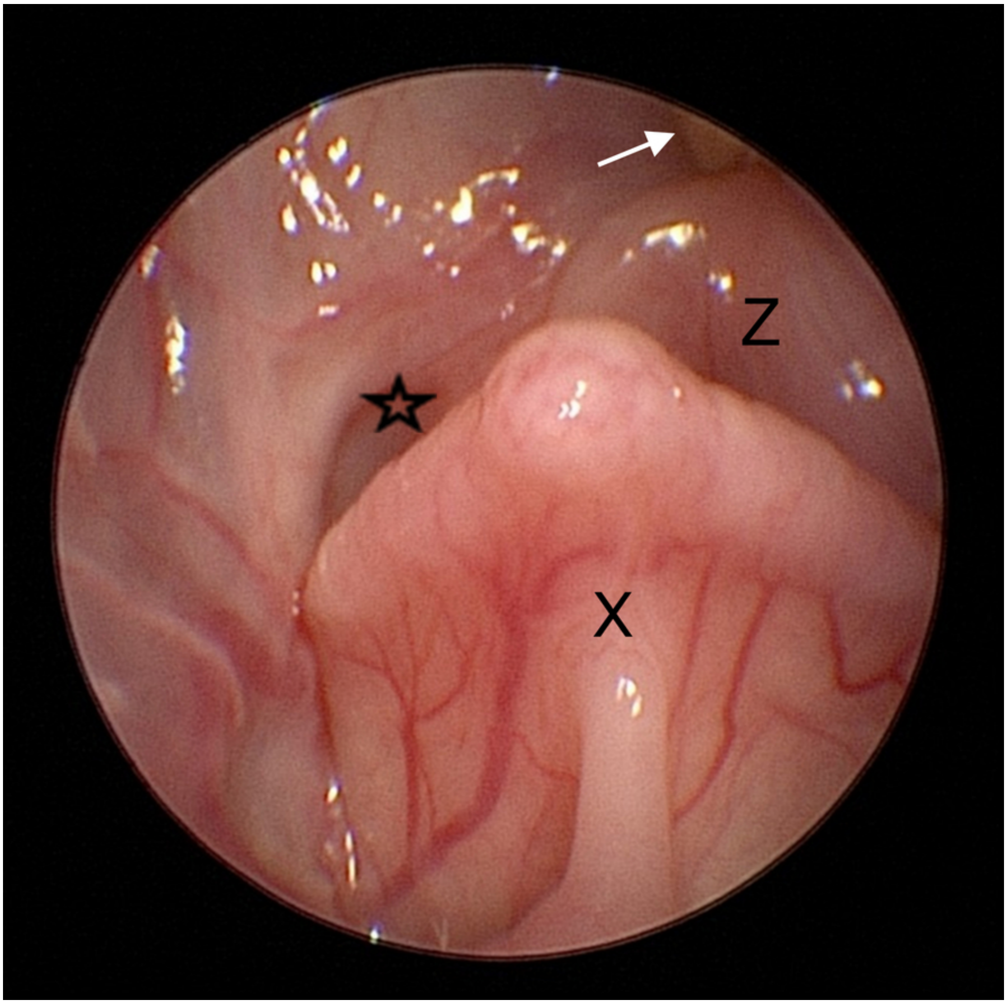

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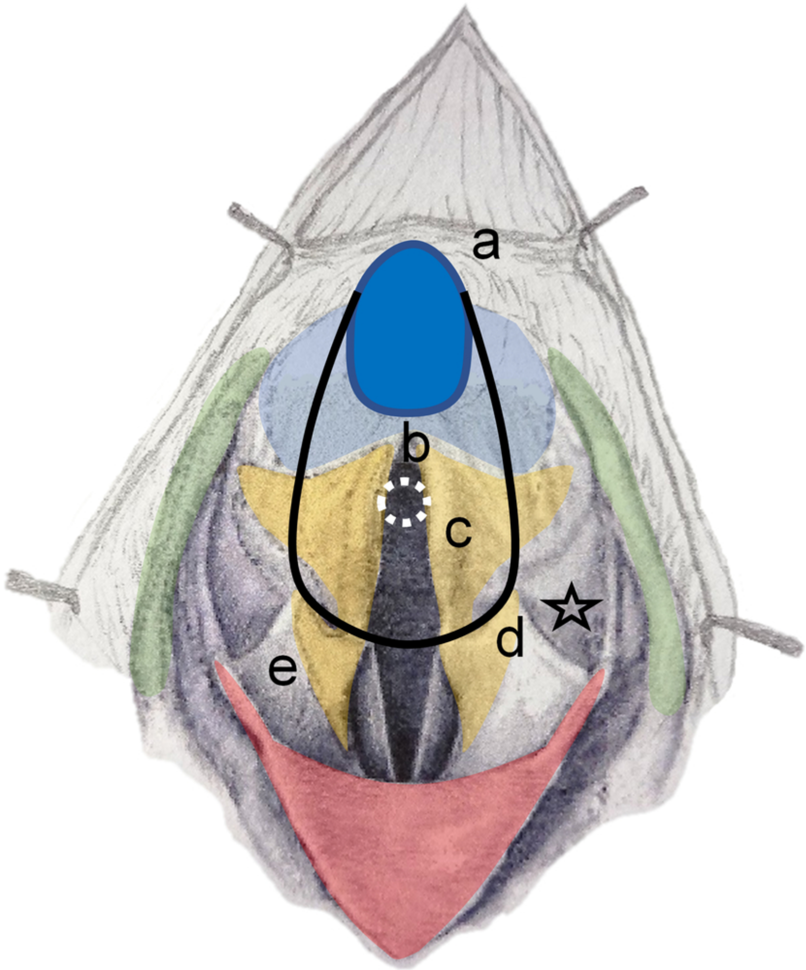

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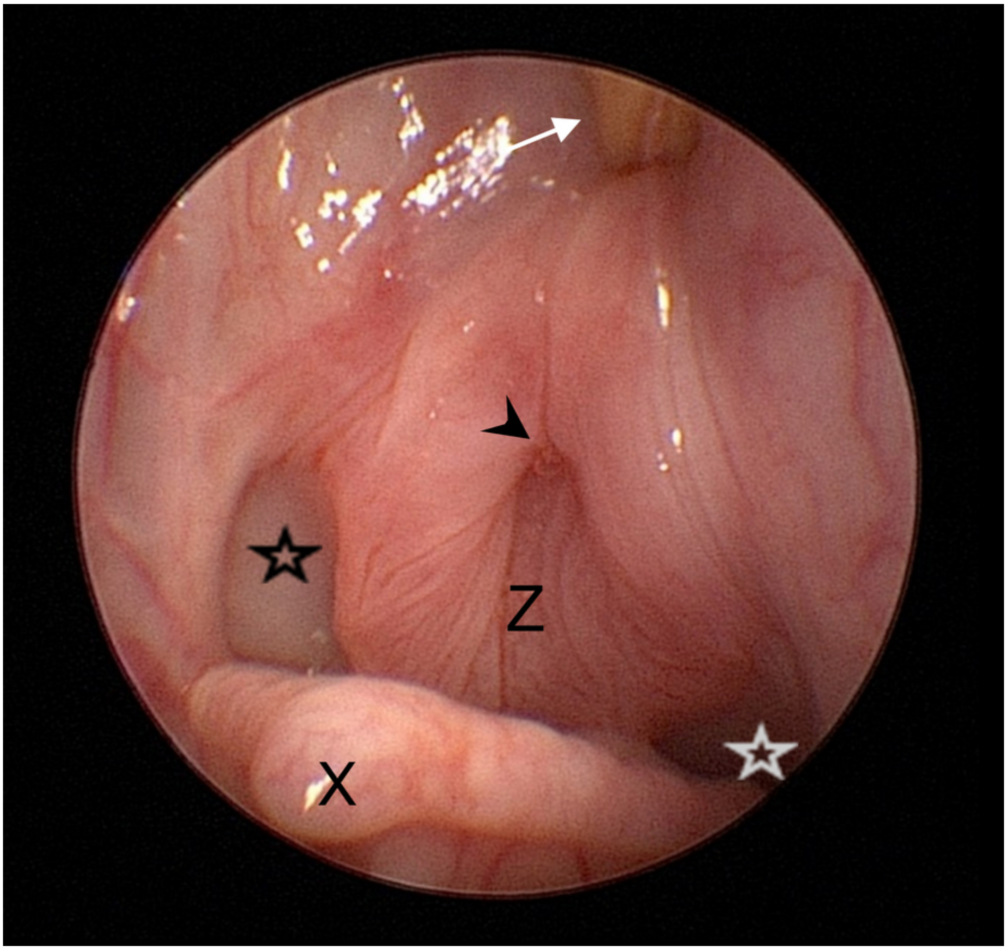

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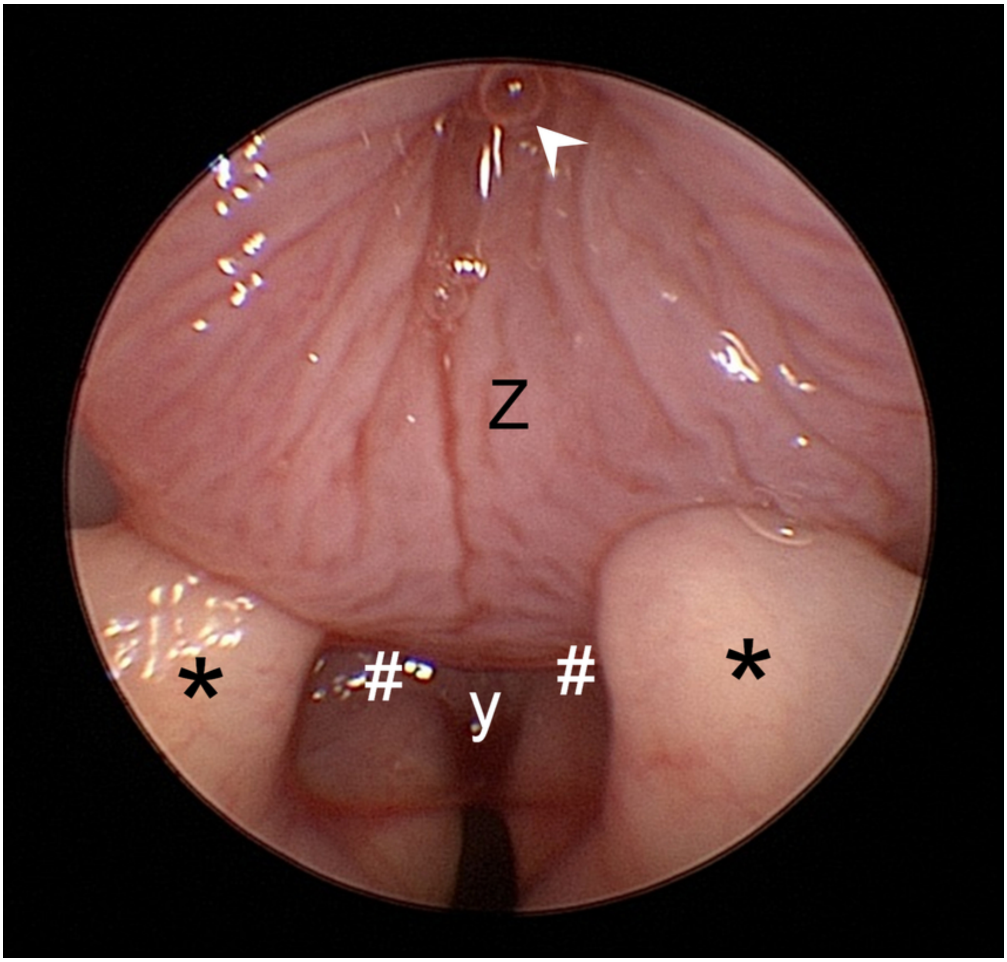

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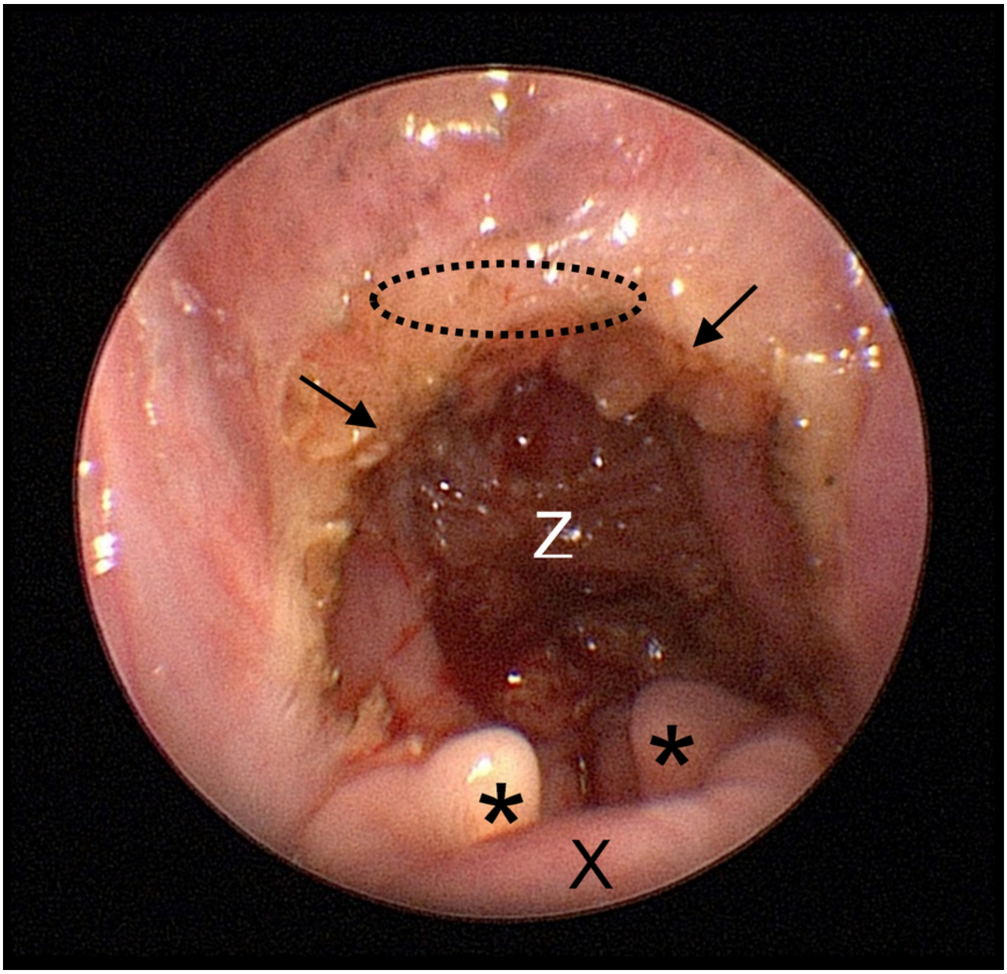

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