Communication

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Surgical management and outcome of a laryngeal myxosarcoma in a dog

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Abstract: A 9-month-old female spayed French Bulldog presented for respiratory stridor and exercise intolerance. Laryngeal examination showed an abnormally thickened left arytenoid cartilage. Fine needle aspirate of the mass was consistent with a well-differentiated spindle cell proliferation. The mass was marginally excised via a left-sided arytenoid approach and per os. Histopathology confirmed a well-differentiated myxosarcoma. Following surgery, the dog developed severe dyspnea and marked respiratory stridor consistent with airway obstruction secondary to laryngeal edema and inflammation. A permanent tracheostomy was performed. Three months post-operatively the dog was completely recovered, but early tumor regrowth was observed. This is the first report of laryngeal myxosarcoma in a dog. Permanent tracheostomy should be considered early in the surgical management of laryngeal neoplasia when more invasive surgical procedures are not elected to achieve a good outcome.

Keywords: larynx, sarcoma, tumor, tracheostomy, dog

1 Introduction

Laryngeal neoplasia is rare in the dog, and it often involves tumors of epithelial, mesenchymal, or round cell origin [1–8]. There is no breed or sex predilection and dogs between the ages of two and twelve are most commonly affected [9]. Dogs with a laryngeal neoplasm can present with respiratory stridor, exercise intolerance, dysphagia, gagging, coughing, dysphonia, dyspnea, or life-threatening airway obstruction [9,10].

Diagnosis is typically made via a combination of laryngeal examination, advanced diagnostic imaging, biopsy, and histopathology [14]. Surgical management can involve mass excision and either partial or total laryngectomy [11–13]. A temporary or permanent tracheostomy may be needed to manage post-operative swelling and inflammation or if the tumor can only be marginally excised and tumor regrowth is expected. Depending on the tumor type, radiation therapy and chemotherapy can be considered in addition to surgery.

To date, there are only several isolated case reports discussing laryngeal tumor diagnosis, management, and outcome in the veterinary literature [1–8,11–13]. This report describes the diagnosis, surgical management, and outcome of a laryngeal myxosarcoma in a dog.

1.1 Case history

A 10 kg 9-month-old female spayed French Bulldog presented to a referral center for a 3-month history of cough, exercise intolerance, and stridor. The dog was initially seen by a general practitioner three months prior for congestion, dysphonia, occasional cough, and stridor. No significant exercise intolerance or dyspnea was noted. Diagnostics at that time included thoracic radiographs, which were normal, and a sedated oral exam which showed a thickened, abnormal left arytenoid cartilage causing partial airway occlusion. Fine needle aspirate of the thickening was performed which was consistent with a well-differentiated spindle cell proliferation. The dog was initially treated with amoxicillin–clavulanate (12.5 mg/kg PO q 12 h for 14 days) and a tapering dose of prednisone (0.5 mg/kg PO q 24 h for 4 days, 0.25 mg/kg PO q 24 h for 4 days, 0.25 mg/kg PO q 48 h for 2 days), but no significant improvement was noted.

The dog then presented to a referral center with progressive cough, exercise intolerance, and stridor when active and at rest. A repeat oral examination revealed a

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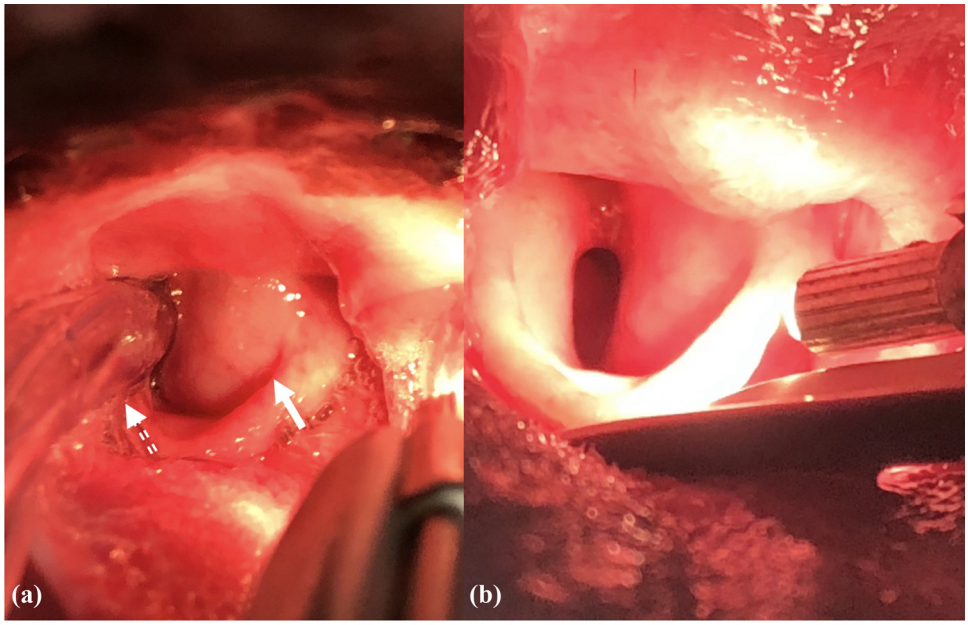

Figure 1: Laryngeal examination (a) pre- and (b) post-surgery. A thickened left arytenoid cartilage and soft tissue mass (solid arrow) arising from the left arytenoid cartilage causing partial airway obstruction. The endotracheal tube (dashed arrow) is to the right of the dog. Following surgery, the endotracheal tube was removed, and normal rima glottidis diameter and a patent airway were visualized.

subjectively larger left arytenoid mass with greater airway occlusion (Figure 1a). Pre-surgical cervical computed tomography (CT) and either partial or complete laryngectomy to remove the laryngeal mass with appropriate margins were recommended. The owners of the dog were not interested in advanced diagnostic imaging or radical surgical management of the laryngeal mass; therefore, marginal excision of the laryngeal mass without CT was elected.

Surgery was scheduled for a later date, but the following day the dog re-presented in acute respiratory distress. Physical examination revealed severe respiratory stridor, dyspnea, tachypnea, and left arytenoid mass. An intravenous (IV) catheter was placed, and butorphanol (0.15 mg/kg, IV) and acepromazine (0.01 mg/kg, IV) were given. Respiratory rate and effort improved, and the dog was moved to an oxygen cage (40%). The dog remained in an oxygen cage overnight and was maintained with Lactated Ringer's Solution (LRS, 37 mL/h, IV) and acepromazine (0.01 mg/kg, IV, as needed). The dog remained stable overnight in the hospital, and surgery was performed the following day.

Pre-operative complete blood count and chemistry were normal. The dog was given maropitant (1 mg/kg, IV) and pantoprazole (1 mg/kg, IV) pre-operatively. The dog was sedated with methadone (0.3 mg/kg, IV) and midazolam (0.2 mg/kg, IV), induced with propofol to effect and then intubated. The dog was maintained on a fentanyl continuous rate infusion (CRI, 10–30 µg/kg/h, IV), metoclopramide CRI (0.08 mg/kg/h, IV), and cefazolin (22 mg/kg, IV, q 30 min). A left lateral laryngeal exploration and tumor cytoreduction were then performed. A 6 cm incision was made over the lateral aspect of the larynx, caudal to the angle of the left mandible, and ventral to the jugular vein. Hemostasis was achieved with electrocautery. The subcutaneous tissues, platysmus muscle, and parotidoauricularis muscle were bluntly dissected to expose the thyropharyngeus muscle. The thyropharyngeus muscle was then sharply dissected along the dorsal edge of the thyroid cartilage which was then retracted laterally. An irregular, lobulated, grey mass was encountered between the thyroid and arytenoid cartilages. No pseudocapsule was noted. All visible tumor was excised with sharp and blunt dissection. The surgery site was lavaged with sterile saline, and the thyropharyngeus muscle was reopposed with 2-0 polydioxanone in a simple continuous suture pattern. The remaining muscle layers and subcutaneous tissue were closed with 3-0 Monocryl in a simple continuous suture pattern. The skin was closed with 3-0 Monocryl in a simple continuous intradermal pattern. Following extubation, the laryngeal examination was performed to assess improved airway diameter (Figure 1b). A small amount of redundant laryngeal mucosa was removed per os with a small Ligasure Precise Vessel sealing device. The dog recovered uneventfully.

The dog did well in the initial post-operative period. However, overnight, the dog developed dyspnea, marked abdominal effort, stridor, and oxygen dependence. The dog was moved into an oxygen chamber and respiratory rate and function improved. The following morning the

dog was reassessed. The dog remained oxygen dependent when moved out of the oxygen chamber. Repeat oral examination showed severe swelling, inflammation, and fluid pocketing where the left arytenoid tumor had been excised, causing partial airway obstruction. Given this finding, and the high likelihood of tumor regrowth in the area, a permanent tracheostomy was recommended and ultimately elected by the owners.

The dog was sedated and induced with propofol to effect and placed under general anesthesia. The same anesthetic protocol was followed as before. A routine permanent tracheostomy was performed without complication. The dog recovered unremarkably and remained in the hospital overnight with IV fluid therapy (LRS, 60 mL/kg/day), fentanyl CRI (10–30 µg/kg/h, IV), acepromazine (0.02 mg/kg, IV, q 8 h, as needed), dexamethasone sodium phosphate (0.1 mg/kg, IV, q 24 h), cerenia (1 mg/kg, IV, q 24 h), pantoprazole (1 mg/kg, IV, q 24 h), cefazolin (22 mg/kg, IV, q 8 h), and gabapentin (10 mg/kg, by mouth [PO], q 8 h).

The dog was discharged the following day with a tapering dose of prednisone (0.25 mg/kg PO q 12 h for 3 days, then 0.25 mg/kg PO q 24 h for 2 days, then 0.25 mg/kg PO q 24 h every other day for 3 doses), trazadone (5 mg/kg, PO, q 8 h–12 h, as needed), cephalexin (25 mg/kg, PO, q 12 h for 7 days), and gabapentin (10 mg/kg, PO, q 8–12 h, as needed). The owners were instructed to feed the dog canned food only and elevate both the food and water bowls and exercise restrict the dog for eight weeks. Appropriate short-term and long-term stoma management was also discussed.

Histopathology of the laryngeal tumor showed a moderately cellular mass of proliferative mesenchymal cells loosely arranged in bundles and arrays within a pale myxoid stroma (Figure 2a). Tumor cells were spindle-shaped to stellate, with amphophilic cytoplasm and oval nuclei. There was mild anisocytosis and anisokaryosis. Mitotic figures were rarely observed. Vascular or lymphatic invasion was not observed, and bundles of tumor cells infiltrated between muscle tissue within the sample (Figure 2b). The lesion extended to surgical margins. Histopathology of the laryngeal tumor was consistent with a well-differentiated myxosarcoma.

Given the tumor type, follow adjunctive radiation therapy (RT) was recommended for local tumor control and to decrease the risk of tumor reoccurrence, which was likely due to the positive surgical margins. Follow-up RT was ultimately not elected by the owners.

1.2 Outcome and follow-up

At recheck two weeks post-operatively, the dog was doing well according to the owners. The stoma site was healing appropriately with only mild contraction of the edges. At recheck two months post-operatively, there was mild contracture of the ventrolateral aspect of the stoma, but the stoma was still of adequate size for normal respiratory function. By three months post-operatively, the stoma site was completely healed, and the dog was breathing comfortably and without exercise intolerance. Intermittent gagging was reported in the dog five months post-operatively. At this time, a sedated laryngeal examination was repeated which showed excessive tracheal secretions and a small mass lesion on the ventral aspect of the left arytenoid consistent with early tumor reoccurrence. Complete laryngectomy or repeat tumor cytoreduction was recommended in addition to outpatient nebulization and humidification of the tracheostomy site. At the time of the telephone follow-up six months post-operatively, the dog was breathing comfortably and not exhibiting exercise intolerance despite the recurrence of the laryngeal mass noted one month prior. The owners elected palliative treatment and would consider additional surgical management if quality of life was more severely affected.

2 Discussion

While uncommon in dogs, myxoid neoplasms have been reported in multiple locations including the brain, eyes, heart, thorax, lung, mesentery, spleen, subcutis, intermuscular fascia, vertebral extradural space, and joint synovia [14,15]. A recent article described a myxosarcoma affecting the larynx in a 2-year-old female Labrador retriever but focused on unique eosinophilic crystals in the tumor [16]. Here, we report for the first time a detailed account of surgical management of a canine laryngeal myxosarcoma. Like the first report, this dog was young, with the first signs seen at 9 months of age.

Laryngeal neoplasia, also rare in the dog, can include several tumor types including rhabdomyoma, rhabdomyosarcoma, osteosarcoma, chondrosarcoma, melanoma, undifferentiated sarcoma, fibrosarcoma, mast cell, squamous cell carcinoma, and plasmacytoma [1–8]. Like most sarcomas, canine malignant laryngeal tumors are typically locally aggressive but do not metastasize elsewhere in the body. This behavior was seen in a case report of three dogs with significant upper airway obstruction due to laryngeal oncocytoma [4]. Given their frequent aggressive behavior, laryngeal tumors must be managed systematically (Figure 3).

Dogs with a laryngeal tumor can present with a combination of clinical signs including respiratory stridor,

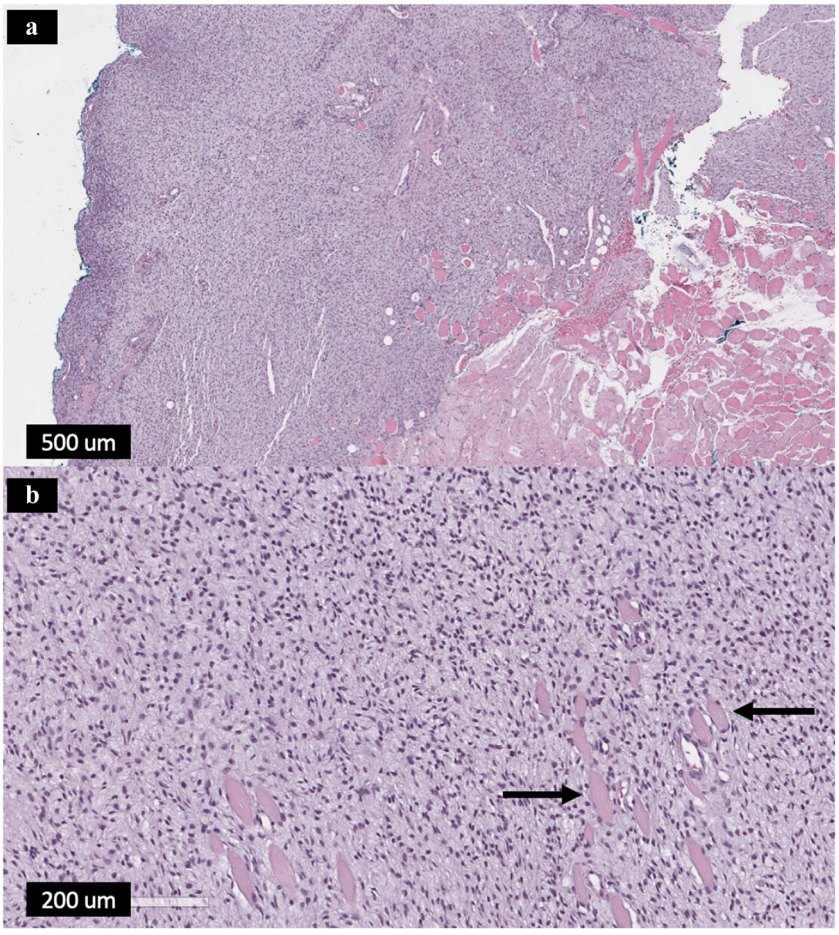

Figure 2: Laryngeal myxosarcoma, dog: (a) proliferative spindle to stellate cells form disorganized bundles and arrays within a myxoid matrix. Hematoxylin and eosin. (b) Neoplastic spindle to stellate cells infiltrate between and separate entrapped myofibers (arrows).

exercise intolerance, dysphagia, gagging, coughing, dysphonia, and dyspnea [9,10]. More severe clinical signs include partial or complete upper airway obstruction which can lead to death. The dog in this report primarily presented with cough, respiratory stridor, and exercise intolerance. Historically, the dog was reported to have dysphonia, although this was not evident on examination. Given these physical exam findings, a lesion involving the larynx was suspected and confirmed via laryngeal examination. This clinical history is comparable to that of a 2-year-old Labrador Retriever with a laryngeal myxosarcoma, confirmed via laryngeal examination and tumor biopsy, that had progressive exercise intolerance and dysphonia over a 10-month period [16]. The dog of our article was even younger, first showing signs at 9 months, stressing the importance of a thorough laryngeal examination in the presence of respiratory signs regardless of patient age.

A thorough laryngeal examination is necessary for determining macroscopic laryngeal tumor margins. More advanced imaging like cervical radiographs and echolaryngography, laryngoscopy, and CT can be used to determine mass effect and tumor infiltration into surrounding soft tissue and osseous structures. Cervical radiographs and CT were used in a recent case report to determine the presence of a laryngeal mass [16]. A combination of CT and laryngoscopy has been effectively used in a prospective study to identify laryngeal tumors and determine the extent of tumor infiltration in cats [17]. Ultimately, tumor biopsy and histopathology are required for a definitive diagnosis. In this report, a laryngeal examination revealed a left-sided laryngeal tumor with partial upper airway obstruction. Thoracic radiographs were performed to rule out lower airway disease and aspiration pneumonia which could accompany the airway obstruction noted as well as evidence of metastasis. Fine needle aspirate confirmed a well-differentiated spindle cell proliferation, and excisional biopsy of the tumor was consistent with a well-differentiated myxosarcoma. Prior to surgery, cervical CT was recommended to explore the invasiveness of the

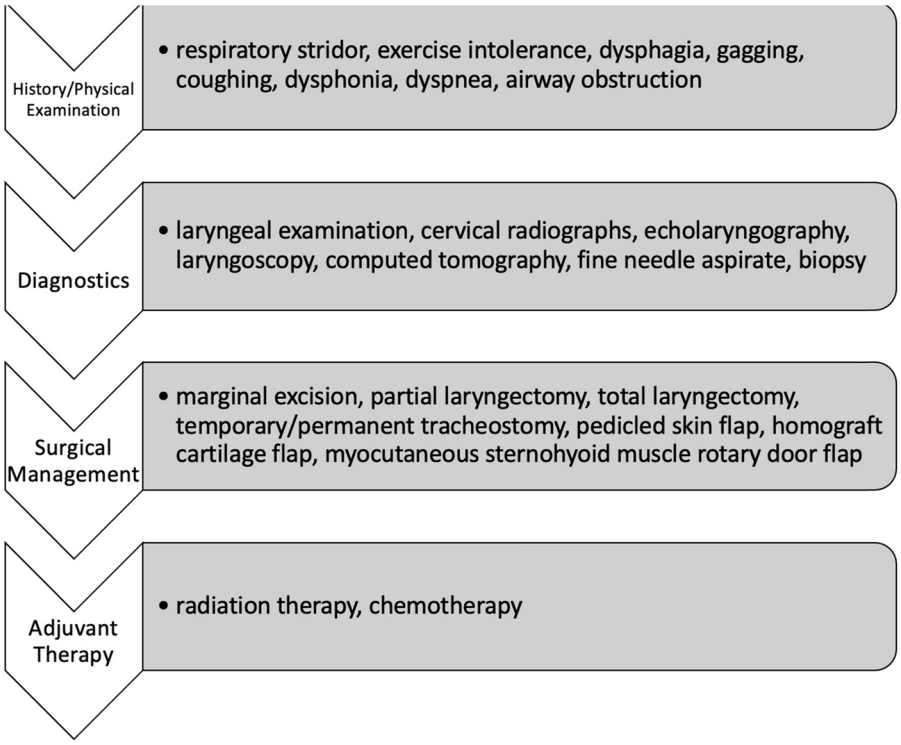

Figure 3: Typical history and physical examination findings, diagnostics, surgical management, and follow-up chemoradiotherapy for canine patients with tumors of the larynx.

laryngeal tumor and to aid in surgical planning, that is, determining whether a partial or total laryngectomy was necessary for best outcome. However, CT was declined by the owners due to financial concerns. Although CT was not performed, surgery was still pursued with the goal of improving respiratory function and overall quality of life.

Surgical management of laryngeal neoplasia can involve mass excision via a transoral or ventral/lateral laryngotomy, partial laryngectomy, or total laryngectomy [11–13]. Due to airway swelling and inflammation which often accompanies laryngeal surgery, a temporary or permanent tracheostomy may be needed in the short-term or long-term. Furthermore, when a total laryngectomy is performed to achieve tumor-free margins, a permanent tracheostomy is always performed. There is a case report and case series involving total laryngectomy and permanent tracheostomy in seven dogs, all of who achieved good long-term outcomes [11,13]. More intricate, extensive surgical techniques involving pedicled skin, homograft cartilage, and/or a myocutaneous sternohyoid muscle rotary door flap have been used historically for laryngotracheal reconstruction following the excision of larger laryngeal tumors in dogs [18–20]. In the case reported here, because a CT scan was not elected and the owners wished to forgo a more radical surgical approach like partial or total laryngectomy, marginal excision, and tumor cytoreduction was performed via a left lateral laryngotomy and a transoral approach. Following excision, permanent tracheostomy was required for two reasons: 1) marginal excision of the laryngeal myxosarcoma without clean margins virtually guaranteed tumor regrowth which would cause airway obstruction later in life, and 2) in the immediate post-operative period airway swelling caused airway obstruction in the dog, necessitating emergency maintenance of the airway. This highlights the potential reality that permanent tracheostomy is most likely required if only marginal excision of a laryngeal sarcoma is obtained, especially in cases in which advanced diagnostics and more radical surgical procedures cannot be performed.

Following marginal excision of any tumor type, chemoradiotherapy is often recommended for local tumor control and to decrease or stop tumor metastasis. Adjuvant radiation therapy was recommended in this case because the laryngeal myxosarcoma was incompletely excised since partial or total laryngectomy was not elected by the owners. However, radiation therapy was not elected. Other forms of chemoradiotherapy have been used in veterinary medicine to treat laryngeal neoplasia in dogs, including Cobalt-60 teletherapy for a laryngeal adenocarcinoma and plesiotherapy using an electronic brachytherapy device for an epiglottic fibrosarcoma [21,22]. Radiation therapy

could be considered for cases of laryngeal sarcomas in dogs and further investigation is required. In the human patient with a laryngeal neoplasm, the standard treatment is total laryngectomy followed by adjuvant chemoradiotherapy, with other management options including endoscopic resection, open partial laryngectomy, and transoral laser microsurgery [23].

Permanent tracheostomy can have several long-term complications, with one retrospective study reporting major complications including aspiration pneumonia and stoma site failure and minor complications including airway swelling, stoma site dehiscence, and dysphonia [24]. In this study, 26% of the dogs died acutely following discharge from airway obstruction secondary to either stoma stenosis or skin fold occlusion of the airway [24]. Another retrospective study reports major complications, including aspiration pneumonia, skinfold occlusion, and stoma occlusion in 61% of the dogs within the study population that underwent permanent tracheostomy [25]. The majority of these dogs were of brachycephalic breed and good long-term survival (a median survival time of 5 years) was achieved in dogs who survived two weeks post-operatively [24].

In this report, a permanent tracheostomy was performed following marginal tumor excision to afford better long-term quality of life in anticipation of tumor regrowth. Mild contracture of the ventrolateral aspect of the stoma was noted 2 months post-operatively. By 3 months post-operatively the stoma site was matured and completely healed. At this time, the owner reported intermittent gagging. A repeat sedated laryngeal examination was performed to determine an underlying cause of the gagging which revealed a small mass lesion on the ventral aspect of the left arytenoid cartilage consistent with early tumor recurrence. This was to be expected since complete surgical margins were virtually impossible to obtain. Tumor reoccurrence was not expected to be a cause of the gagging episodes which were most likely secondary to increased tracheal secretions from environmental allergies, cooler weather, and lower humidity, and other environmental changes occurring at the time of recheck. Complete laryngectomy versus additional tumor cytoreduction was recommended again in addition to outpatient nebulization or humidification of the tracheostomy site for treatment of the tracheal secretions.

3 Conclusion

To date and to the author's knowledge, this is the first report describing surgical management and outcome of a laryngeal myxosarcoma in a young dog. A good outcome was achieved for 5 months in this dog with marginal excision of the laryngeal tumor and permanent tracheostomy. However, tumor growth reoccurred, and additional surgery was recommended but not elected. Although uncommon, a laryngeal neoplasm like myxosarcoma should be considered when a dog, even a very young dog, is presented with upper respiratory signs, exercise intolerance, airway obstruction, and dysphonia.

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