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Endoscopic surgical approach to laryngoceles and saccular cysts

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Laryngeal saccular disorders are rare lesions presenting as abnormal saccular dilation, either mainly filled with air (laryngoceles) or fluid (saccular cysts). These are further categorized as internal when confined in the endolarynx, external, or combined. In adults, saccular disorders are mostly idiopathic with various reported proportion associated with laryngeal cancer or increased transglottic pressure. Patients may present with voice disorders, respiratory, or swallowing issues. Workup should include directed history taking, laryngeal endoscopy, neck examination, and imaging. Priority should be given for securing the airway when indicated. The endoscopic approach via direct laryngoscopy with complete resection (by cold, hot instruments, or CO_2 laser) is the treatment of choice for internal saccular disorders or small combined ones. The transoral robotic approach was also recently reported. Needle aspiration or marsupialization can be performed by the less experienced surgeon and provide rapid decompression when needed, although with higher recurrence rates.

Introduction and relevant anatomy

The laryngeal ventricle (Morgagni's sinus) is the space situated between the true and false vocal cords on each side of the larynx. The laryngeal saccule (also referred to as the ventricular appendix or Hilton's pouch) is a tubular structure forming a blind pouch lined with ciliated pseudostratified columnar epithelium and containing mucus secreting glands.[1] The saccule originates from the most anterior aspect of the laryngeal ventricle, lateral to the petiole of the epiglottis, and extends cranially in the supraglottic loose areolar tissue and fat, juxtaposed to the internal aspect of the laryngeal cartilage. The narrow orifice leading from the ventricle into the saccule is bordered anteriorly by a mucosal fold called the ventriculo-saccular fold, believed to direct lubricating saccular secretions, expressed by the external compression forces of the laryngeal musculature, posteriorly onto the vocal cords.[2–5]

Laryngoceles and saccular cysts

Saccular disorders are rare, and represent approximately 5% of the benign laryngeal lesions.[6,7]

A laryngocele is the result of an abnormal dilation of the laryngeal saccule.[8,9] It was Larrey in 1829, a surgeon in Napoleon's army, who described the clinical entity of reducible neck pouches in Egyptian Muezzin loudly calling prayers to the mosque.[10] However, the term "ventricular laryngocele" was originally introduced by Virchow in 1865 to name the abnormal cystic dilation of the laryngeal saccule.[11]

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The most widely used criteria for the classification of a laryngocele vs a merely enlarged saccule was introduced by Burke and Golden in 1958, as saccular herniation above the superior border of the thyroid cartilage.[12] The laryngocele can further expand into the area of the false vocal cords, aryepiglottic folds and even beyond the laryngeal boundaries. A laryngocele confined inside the laryngeal skeleton is termed internal, while extension beyond the laryngeal boundaries through the thyrohyoid membrane will result in an external or combined laryngocele, based on the proportion of the external to the internal component.[9]

Laryngoceles are rare and usually diagnosed on the fifth decade of life. There is a variably reported degree of male predilection of up to 5:1.[7,13–15]

Saccular cyst is a fluid filled saccular dilation, which unlike a laryngocele, lacks a patent outlet into the ventricle.[9,16] Saccular cysts are further classified according to size and location as anterior and lateral. Anterior saccular cysts dominantly occupy the region over the anterior portion of the ventricle, whereas lateral saccular cysts expand in a similar fashion to internal, combined and external laryngoceles.[9,17,18]

Saccular disorders can present as either congenital (in newborns and infants) or acquired (in adults). The exact pathophysiology of laryngoceles is unclear. It was Larrey who originally described laryngoceles as "air goiters" and theorized that they were the result of increased intralaryngeal pressure on the background of high vocal demands.[10] Although probably overstated, laryngoceles were associated with occupations or hobbies involving increased transglottic pressure such as weight lifting, singing, wind instrument playing, and glass blowing.[7,19,20] Also, air trapped by a ball valve mechanism created by an obstructing lesion at the orifice of the saccule was suggested by Holinger et al.[9]

Laryngopyocele results from an acute infection of a laryngocele or a saccular cyst being filled with pus.[21]

Association with laryngeal cancer

The reported association between saccular disorders and squamous cell carcinoma of the larynx ranges at 5%-30%, partially from series involving patients already diagnosed with laryngeal cancer.[17,22–25] For that reason, a diagnosis of laryngocele usually warrants further investigation for ruling out obstruction of the saccular orifice by malignancy.

Clinical presentation

Small saccular disorders can be asymptomatic and present as an incidental finding, particularly nowadays, with the expanding utilization of various and advanced imaging modalities.[23,26] In newborns and infants, saccular disorders can manifest as weak cry, aphonia, hoarseness, respiratory distress, cyanosis, stridor, and difficulty feeding.[9,16,21] In adults, the most prevalent presenting symptom is dysphonia/hoarseness. Other presenting symptoms are globus sensation and cough. As the lesion grows, the mass effect can cause respiratory distress, stridor, dysphagia, and odynophagia. An external/combined laryngocele can present as a reducible neck mass that may increase with Valsalva maneuver.[9,27] A laryngopyocele can present as acute infectious condition with fever, neck pain, and rapidly expanding endolaryngeal and/or neck abscess, with the potential to result in airway compromise.[28,29]

Evaluation and diagnosis

A detailed history taking should include vocal, respiratory, swallowing complaints, and the presence of neck masses. Occupational and social history should exclude activities associated with increased transglottic pressure and risk factors of laryngeal cancer. Physical examination begins with assessment of any vocal and respiratory abnormalities. The neck should be palpated to exclude reducible lateral masses with and without a Valsalva maneuver. Laryngeal examination can be performed by fiber optic laryngoscopy, mirror indirect laryngoscopy, or videostroboscopy. An internal saccular disorder can manifest as supraglottic submucosal mass typically bulging from the anterior aspect of the laryngeal ventricle, in cases of an anterior saccular cyst or a small laryngocele. In cases of lateral saccular cysts or larger laryngoceles, the mass can extend into the false vocal cord, aryepiglottic fold, pyriform sinus, and even significantly obscure the glottic view.[21,27,30] Cases of external laryngoceles with a relatively smaller internal component, may present with subtle endolaryngeal findings or even normal laryngeal examination. Computed tomography (CT) can confirm the diagnosis and demonstrate a circumscribed air/fluid containing structure, determine its size, location, and its relation to the thyrohyoid membrane.[26,27,31]

Endoscopic management of saccular disorders

The surgical treatment of saccular disorders consists of endoscopic, open (transcervical), and combined approaches. Management of saccular disorders by an open approach will be discussed in the next section.

Small asymptomatic saccular disorders with benign appearing overlying mucosa can be observed. In adults however, due to the reported association with laryngeal cancer, further investigation by direct laryngoscopy with possible biopsies from the ventricle (next to the saccule's orifice) is an adequate approach. Symptomatic laryngocele necessitates a temporary or a definitive surgical treatment.

In cases of airway compromise, securing the airway should be the first step in management. Decompression of a fluid containing saccular disorder can be achieved through a direct laryngoscopy approach by needle aspiration, incision and drainage, or marsupialization. Aspiration can provide instant and mostly temporary relief serving as a bridge for a definitive procedure. A saccular cyst or a laryngopyocele with an external component can be aspirated percutaneously for immediate decompression.

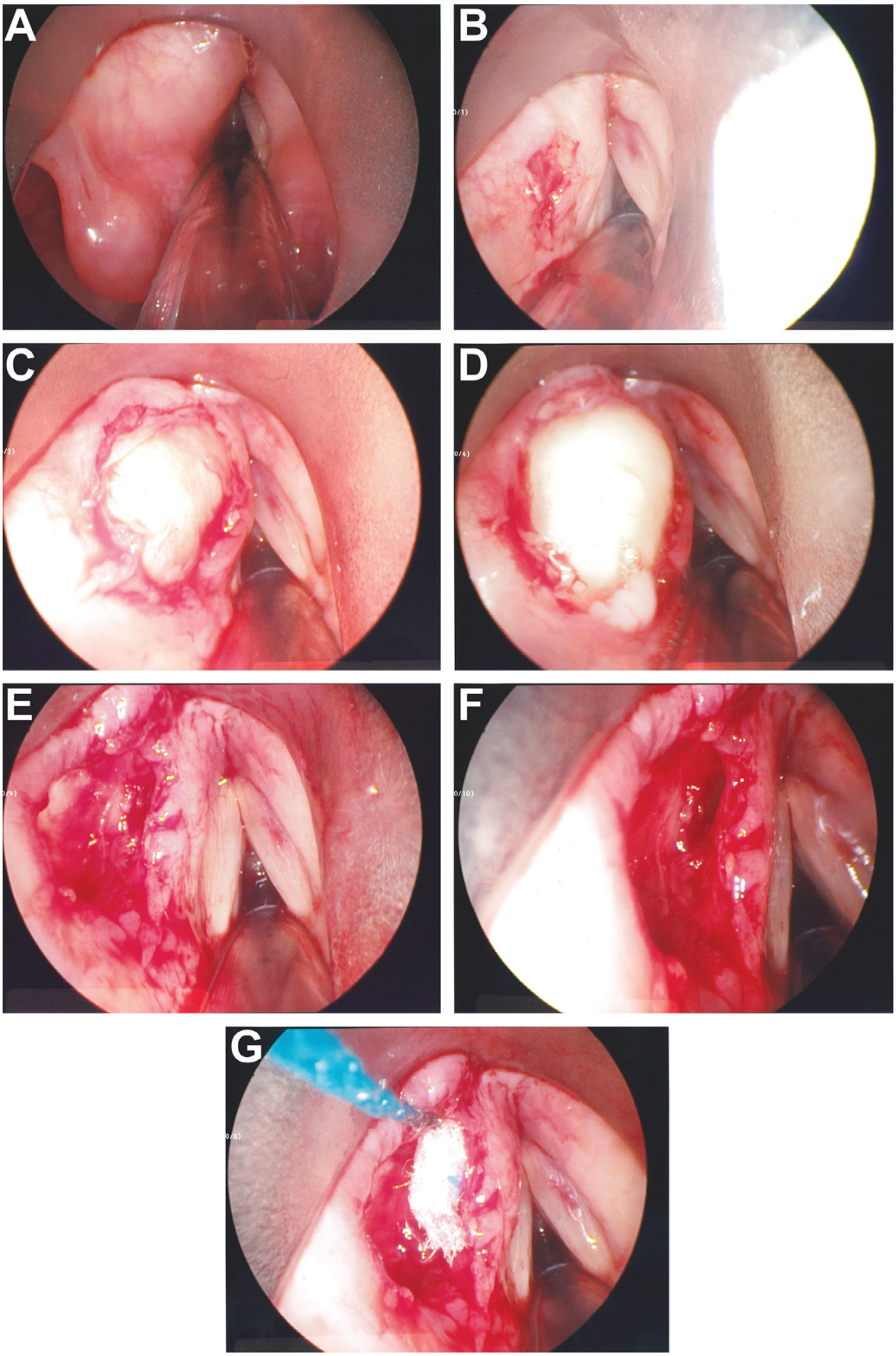

Figure 1 (A) Direct laryngoscopy view of a left lateral saccular cyst in a 60 year old female demonstrating a left supraglottic mass overlying the true vocal cord, covered by benign appearing mucosa. (B) Initial mucosal incision performed with a sickle knife along the superior surface of the false cord. (C) Cold dissection with exposure of the cyst's capsule by a combination of blunt and sharp instruments. (D) Further exposure of the intact capsule. (E) The view following decompression of the cystic content to enable further circumferential dissection toward the saccular origin. (F) The remaining supraglottic defect post excision. (G) Hemostasis obtained with Afrin soaked pledget.

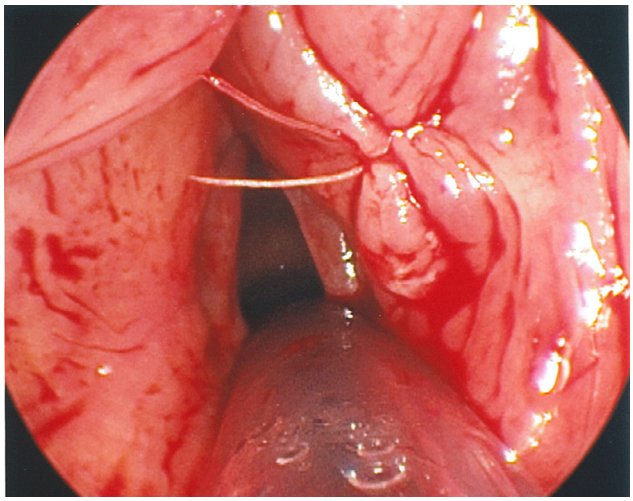

Figure 2 Approximation of the mucosal edges over the supraglottic defect with a Vicryl suture following resection of an internal laryngocele, from a different patient.

Marsupialization is performed by unroofing the lesion with cup forceps, laryngeal microsurgical instruments or CO_2 laser, and can include stripping of the internal mucosal lining to reduce the chance for recurrence.

A complete resection of the saccular disorders will provide significantly lower recurrence rates compared to marsupialization, but requires sound surgical skills and experience. The key for a successful resection of an internal saccular cyst/laryngocele is adequate exposure by choosing the proper laryngoscope along with appropriate suspension. Ideally, the entirety of the lesion should be visualized in order to perform a circumferential capsular dissection (Figure 1A). In cases of a lesion with a diameter larger than the lumen of the laryngoscope, partial decompression can be accomplished by needle aspiration prior to dissection. A curvilinear incision along the superior surface of the false vocal cord followed by partial resection of its anterior portion will facilitate the exposure of the lesion's capsule in the paraglottic space (Figure 1B). The dissection is then carried on, circumferentially and eventually inferomedially, toward the anticipated location of the saccular orifice (Figures 1C-E). The surgeon should be cautious not to violate the lesion's capsule and the true vocal cord beneath it.[9,15,21,30,32] The resulting supraglottic defect can be addressed by approximating the false cord's mucosa with dissolvable sutures or simply left for healing by secondary intention, with excellent results from the author's experience (Figures 1F-G and 2).

In experienced hands, the endoscopic approach is also feasible for resecting combined saccular disorders, even with a palpable neck component. In such cases, the dissection will typically extend to the inner surface of the thyroid alar cartilage, over its superior border beyond the thyrohyoid membrane and into the neck. Care should be taken to avoid injury to the superior laryngeal bundle that may be encountered.[30]

In cases of lesions causing a prominent endolaryngeal mass effect with a concern for postoperative edema (especially in neonates and infants), consideration should be made for keeping the patient temporarily intubated, or for performing a tracheotomy. The endotracheal tube can also serve as an endolaryngeal stent reducing the risk for laryngeal stenosis due to unfavorable scarring.[21,32,33]

Transoral robotic surgery (TORS) for a laryngocele was first reported in 2013. The surgical principles are similar to those reviewed here for the endoscopic approach with the advantage of superior exposure, 3-dimensional visualization and the availability of continuously evolving precise and flexible operating instruments.[34,35]

Laryngopyoceles are extremely rare and result from an acutely infected laryngocele/saccular cyst being filled with pus, and can lead to rapidly progressive airway obstruction in a toxic patient. Securing of the airway is of upmost importance. An emergent, possibly awake tracheotomy may be indicated, followed by endoscopic/percutaneous drainage, and decompression. Antibiotic treatment and supportive care are administered. A definitive surgical excision can be performed subsequently when the patient is stabilized and the infection in the surgical field has subsided.[28,29,36,37]

Complications and postoperative management

Avoiding pre/postsurgical airway compromise is the major concern in the short term, and recurrence is the major concern in the long term. When endoscopically resecting large saccular disorders with significant secondary tissue edema, consideration should be made for keeping the patient intubated while treated with steroids, antireflux medications and possibly antibiotics. Bedside endoscopic evaluation and leak test should be performed prior to extubation. In extreme cases, when intubation is expected to be prolonged, a tracheotomy might be needed. Intraoperative nasogastric tube placement should be considered when significant postoperative pain or aspirations are anticipated. As discussed earlier in this text, a complete resection of the saccular disorder significantly lowers the recurrence rates.

As with other types of endolaryngeal surgeries, the risk for bleeding exists, particularly with more extensive resections, therefore, meticulous hemostasis should be obtained prior to extubation. In cases of postoperative voice disorders secondary to vocal cord injury, unfavorable scarring or the resulting alteration of the endolaryngeal anatomy, further phono surgery or speech therapy may be necessary.

Conclusion

Saccular disorders are benign and rare laryngeal lesions with a wide range of presenting symptoms. Nowadays, a large proportion of saccular disorders are an incidental finding on imaging studies. Directed history taking, neck examination, indirect laryngeal examination in office and

proper imaging will straightforwardly lead to the correct diagnosis. Adults should be evaluated for occult laryngeal cancer. For internal laryngoceles, a complete endoscopic resection is the definitive treatment of choice. In cases of lesions with significant endolaryngeal mass effect or infection, maintaining a safe airway is a major consideration in the management algorithm.

Conflict of interest

The author has no funding, financial relationships, or conflicts of interest to disclose.

Disclosure

The authors reported no proprietary or commercial interest in any product mentioned or concept discussed in this article.

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