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Hypopharyngeal pharyngoplasty procedure in the rehabilitation of swallow in patients with vagal paralysis

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Pharyngeal paralysis in patients with high vagal paralysis (HVP) is a problem that can be devastating. The hypopharyngeal pharyngoplasty procedure is an adjunctive static procedure designed to address some of the difficulties with swallow seen in these patients. The procedure can be used acutely in patients with HVP to avoid gastrostomy tube dependence, or it can be done late in patients with persistent dysphagia. The purpose of this article is to delineate the indications for this procedure and the technical aspects of performing the procedure. The procedure partially corrects the aspiration and dysphagia in patients after HVP by reshaping the hypopharyngeal anatomy to promote better bolus transit, thereby improving cervical dysphagia. Because it is a static procedure, its indications in patients with complex swallow dysfunction should be well understood in consideration of the many other surgeries that have been proposed in patients with swallow dysfunction.

Introduction

High vagal paralysis (HVP) causes functional deficits different than those in patients with recurrent nerve paralysis. The pharyngeal paralysis accompanying HVP may be devastating to the swallow function. The problems may occur in patients with skull base lesions, iatrogenic unilateral high vagal injury, brain stem lesion, and stroke. HVP often occurs in conjunction with multiple cranial palsies that include tongue paralysis, palate paralysis, and laryngeal paralysis. Vital functions including voice, swallow, and airway protection are often severely affected, resulting in hoarseness, cervical dysphagia, gastrostomy (g)-tube dependence, and chronic aspiration. The severe functional effects of isolated pharyngeal paralysis are especially devastating because they often occur in young patients with little other systemic morbidity. The severity of functional deficits from lower cranial nerve injury has caused surgeons to pause and recommend nonsurgical approaches in the consideration of treatment option for patients with glomus tumors, carotid body tumors, schwannoma, and other benign tumors of the skull base.

In patients with HVP, the multiple layers of airway protection that are normally present during the pharyngeal phase of swallow may be disrupted, thus, resulting in severe dysphagia and aspiration. Poor coordination owing to pharyngeal paralysis may result in prolonged pharyngeal transit and incomplete pharyngeal clearance. This coupled with vocal fold paralysis may result in severe cervical dysphagia with clinical evidence of penetration and

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aspiration. When aspiration is severe, the patient may become g-tube dependent. In some patients, even despite the diversion of food intake by gastrostomy tube, aspiration of saliva may lead to pneumonia.

A common significant complaint of patients with pharyngeal paralysis is the incomplete swallow despite multiple swallow attempts. Patients may then feel the need to constantly expectorate into a cup. The voice is wet, and silent aspiration of saliva makes it difficult for the patient socially and to sleep through the night. The clinical findings on laryngoscopy include pyriform sinus pooling, pharyngeal paralysis, and lack of laryngeal elevation on the side of paralysis.

Surgery for aspiration and dysphagia in patients with pharyngeal paralysis has been limited. It can be divided into those that are intended to enhance function and those that may be considered to reduce the morbidity of chronic aspiration. The definitive procedures are those that anatomically separate, partially or totally, the airway from the pharynx. These include chronic laryngeal stenting;[1] supraglottic closure procedures, such as epiglottis closure,[2] laryngoplasty, glottic closure,[3] subglottic closure, and cricoid collapse;[4] laryngeal diversion;[5] and finally, narrow-field laryngectomy.[6] Most of these procedures are done in stroke and severe neurologically impaired patients and are meant to save the patient from recurrent pneumonitis and death. Our patients with HVP have, in general, good performance status and not otherwise debilitated; and thus, these procedures are usually not appropriate in HVP as they usually deprive the patient of airway, swallow, and speech. Patients with HPV are typically not tracheostomy dependent and also not dependent on suction of secretions from the airway to avoid pneumonia.

Reinnervation has been proposed for patients with vocal fold paralysis. Although dynamic pharyngeal and laryngeal reinnervation is possible, the reinnervation procedures largely are geared toward improved adduction and abduction of the vocal folds and not toward pharyngeal reinnervation.[7] The adjunctive anatomically based procedures to improve swallow function include use of tracheostomy to remove the aspirated tracheal content and improve pulmonary toilet. The procedures reduce the amount of volume transiting the pharynx but do not address the saliva expectoration problem that remains. External medialization laryngoplasty with or without arytenoid adduction or injection laryngoplasty is designed to improve glottis closure, cough, and glottic competence.[8,9] External medialization laryngoplasty cannot improve pharyngeal paralysis and its functional deficits. Cricopharyngeal myotomy can be done to increase upper esophageal sphincter patency.[10] Laryngeal suspension can place the larynx into a higher position and simulate the elevated laryngeal position during swallow. Tubed epiglottoplasty to increase the interarytenoid height and place the opening of the larynx higher into the hypopharynx or the oral pharynx has also been used in base-of-tongue resection patients to avoid aspiration.[11] These procedures have mixed results in addressing the problems in patients with pharyngeal paralysis.

The hypopharyngeal pharyngoplasty is a procedure aimed at reducing the pyriform sinus pooling and improves pharyngeal clearance in patients with unilateral pharyngeal paralysis.[12] The surgical procedure is a static procedure done often in conjunction with other procedures for rehabilitation of swallow dysfunction in the patient with HVP. By changing the anatomy of the pharynx, we believe it can improve function in patients with pharyngeal paralysis and restore partially pharyngeal swallow function to avoid g-tube dependence and improve swallow in this group of patients.

Background and rational for the surgery

Some of the initial observations of patients' swallow dysfunction were made clearer in studies of laryngeal function in patients with HVP using echo-planar magnetic resonance imaging (MRI).[13] Echo-planar MRI allows the MRI to look at the axial view of the pharynx during swallow at 20 frames per second. This gives much more anatomical details of the swallow function at the level of the pharynx during swallow. The echo-planar MRI in patients with HVP showed the bolus traveling from the innervated side to the paralyzed side. This gave the impression that the paralyzed side acted like a pharyngeal diverticulum and prevented the complete transit of the bolus into the esophagus. After this observation, the initial attempt was to obliterate the pyriform sinus by the procedure of pharyngectomy of the pyriform sinus mucosa. Despite this, weak swallow persisted. It was not until the pharyngectomy was combined with stabilization and advancement of the inferior constrictor to the thyroid cartilage that further improvement in swallow was observed. This gave rise to the 2-part procedure of pharyngectomy with removal of the pyriform sinus mucosa followed by inferior constrictor advancement. Hence, the hypopharyngeal pharyngoplasty procedure was named.

The importance of stabilization of the inferior constrictor onto the thyroid cartilage can be reinforced by the author's own experience in the performance of the arytenoid adduction procedures. It was noted earlier in the experience of doing arytenoid adductions that patients had much less dysphagia after arytenoid adduction when careful repair of the inferior constrictor muscle was done. This maneuver reduced the postoperative pooling and dysphagia in our patients undergoing arytenoid adduction for unilateral vocal fold paralysis without pharyngeal paralysis. When the inferior constrictor was not repaired and reattached, the patients often had a prolonged swallow dysfunction much as patients with HVP. It was our conclusion that restoration of the pharyngeal constrictor by attachment of the inferior constrictors back onto the posterior lamina of the thyroid cartilage after the arytenoid adduction procedure allowed the patient to resume pharyngeal swallow with less morbidity. This pointed to the importance of pyriform sinus and why it is necessary to repair the inferior constrictor muscle during the performance of the arytenoid adduction and medialization laryngoplasty procedures. When the inferior constrictor