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Novel Therapeutic Approach to Relieve Pharyngoesophageal Spasm after Total Laryngectomy

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Introduction

Total laryngectomy results in a variety of functional changes including the loss of normal laryngeal voice and alterations in swallowing physiology [1]. Current literature recognizes tracheoesophageal (TE) voice restoration as the preferred alaryngeal speech alternative in most patients with total laryngectomy. The method depends on the use of a unidirectional valved prosthesis that maintains the TE puncture and also allows pulmonary air flow into the esophagus for phonation while preventing aspiration during swallowing. Although total laryngectomy disrupts the neurophysiology of the oropharynx, patients who have undergone total laryngectomy rarely complain of significant swallowing impairments. The most common reason for TE speech failure after total laryngectomy is constrictor muscle hypertonicity or what has been referred to as pharyngoesophageal spasm (PES). PES is known to increase peak intraesophageal pressure measurements during phonation and is correlated with levels of TE speech fluency [2]. PES has also been shown to impede cricopharyngeal functioning resulting in problems with food transit during swallowing as well as preventing the superior egress of airflow for sound production [3].

Although several methods have been employed with variable success to relieve PES, chemical denervation of the PE segment using Clostridium Botulinum Toxin A (BTA) that acts on the presynaptic cholinergic nerve fibers to prevent the release of acetylcholine at the neuromuscular junction, has become the treatment of choice to facilitate TE speech and swallowing after total laryngectomy. Currently, BTA is injected percutaneously into the pharyngeal constrictor muscles along one side of the neopharynx just superior and lateral to the stoma. The optimal technique uses electromyographic (EMG) guidance into the site of injection that has been previously marked by the speech pathologist during videofluoroscopic recording. However, percutaneous injection is not always possible particularly in patients with significantly distorted cervical anatomy, severe post-radiation fibrosis, postural difficulties that prevent accurate injection, or anxiety or inability to tolerate the procedure. Therefore, the purpose of this case series is to assess the efficacy of the BTA injection through the EGD in patients with PES.

Method

Eight sessions of BTA injections were performed through the EGD in 4 laryngectomized patients (3 males; 1 female) with TE puncture. All patients had decreased TE speech fluency due to PES [3]; 3 patients also had dysphagia due to evidence of shortened duration of PES relaxation during swallows on videofluoroscopic examination. Videofluoroscopic examination was performed by the speech pathologist prior to each injection to identify the location of the spasm [3]. The location of the spastic segment was identified at the time of EGD by transillumination of the marked area on the skin surface of the neck identified as the area of spasticity by the speech pathologist at the time of videofluoroscopic recording. Additionally, during endoscopy, non strictured smooth narrowing/spasticity above the TE prosthesis was identified by resistance to air insufflation without resistance to the passage of the scope. A total of 100 IU of BTA (Onabotulinumtoxin A, Botox®, Allergan, Irvine, California) were injected into 4 quadrants of the PES segment through the EGD (Fig. 1). Our intention was to inject into the muscular layer followed by gentle “massage” with back and forth movement of an 18 mm CRE balloon dilator to facilitate uniform distribution of the BTA. None of the patients had evidence of anastomotic stricture on MBS or endoscopic view and during the procedure there was no resistance to the passage of the endoscope or to the back and forth movement of the CRE balloon dilator. All cases were performed using monitored anesthesia care (MAC).

TE speech fluency was rated before and after injection by the speech pathologist. Fluent TE speech was defined by the ability to produce 10 to 15 syllables per breath and sustain vowel production (/a/) for a minimum of 10 seconds [3]. Intraesophageal air insufflation was performed in all patients [2]. Fluent TE speech and/or a decrease in peak intraesophageal pressures defined improved TE speech production after injection. Diet level was graded according to the Performance Status Scale of Head and Neck Surgery (PSS-HN) normalcy of diet subscale in all patients before and after injection [4]. An increase in PSS-HN normalcy of diet scale and/or decreased gastrostomy dependence defined improved swallow function after injection.

Institutional Review Board (IRB) approval was not required for this small case series.

Results

Case 1

A 67-year-old Caucasian male with a history of total laryngectomy for squamous cell carcinoma (SCC) of the larynx, presented with phonation difficulty and dysphagia requiring gastrostomy tube feedings. The pre-treatment modified barium swallow (MBS) study showed PES (Fig. 2). His speech improved with percutaneous lidocaine injection at the PES segment performed in a clinical setting. Subsequent percutaneous BTA injection failed to improve speech or swallowing dysfunction. The first BTA injection through the EGD yielded no response. The decision was made to perform a second procedure as the patient had responded to the lidocaine injection. After the second BTA injection using EGD, his speech improved immediately with relaxation of the PES (Fig. 3) and he remained symptom free for 10.5 months. His dysphagia improved gradually and he was weaned from gastric

tube feeding. He responded to a third procedure after the recurrence of symptoms, mainly swallowing deterioration, and subsequently he remained symptom free at 5 months follow up. Additional follow up was unavailable due to the patient's diagnosis of recurrent disease.

Case 2

A 71-year-old Caucasian male with a history of total laryngectomy and partial pharyngectomy using radial forearm flap reconstruction for SCC of the larynx, presented with phonation difficulty. Percutaneous BTA was not performed as the site of the PES identified on the MBS study was located too far distal increasing the risk for pneumothorax. BTA injection through the EGD at the PES segment was performed. Speech improved significantly and he remained symptom free for 11 months. A second procedure was performed successfully resulting in a durational effect of 12.5 months. A third procedure proved successful at 8 months follow up.

Case 3

A 76-year-old Caucasian male with a history of SCC of the larynx treated with total laryngectomy presented with phonation difficulty and dysphagia. The MBS study was consistent with PES. He underwent percutaneous BTA injection without improvement of his symptoms. However, he responded to BTA injection through the EGD and remained symptom free at 13 months follow up after a single injection.

Case 4

A 73-year-old Caucasian female with a history of total laryngectomy for SCC of the larynx presented with phonation difficulty and dysphagia. She was unable to tolerate percutaneous BTA injection due to anxiety; therefore, she underwent BTA injection through the EGD. Both TE speech and swallowing improved and she remained symptom free at fifteen month follow up after a single injection.

Discussion

Traditionally, PES after total laryngectomy is managed by otolaryngologists or head and neck surgeons using percutaneous injection in the clinical setting. However, percutaneous BTA injection may not always be successful. In some of these cases, the site of the PES segment cannot be accurately identified for injection. We postulate that BTA injection may be facilitated through EGD because of improved visualization and identification of the involved segment. We are not aware of any reports in which gastroenterologists have used EGD to relieve PES for improved TE speech and swallowing dysfunction in patients with laryngectomy.

Evidence has shown that local BTA injection can successfully improve symptoms of PES that result in speech and swallowing problems after removal of the larynx. Lewin et al. treated 23 patients with 100 U of BTA injected transcutaneously under EMG guidance and reported voice improvement in 87% with an average durational effect of 20 months [3]. Krause et al. described BTA injected through rigid pharyngoscopy under general anesthesia in 10 patients with an average durational effect of 20 weeks [5]. In our case series, the

durational effect ranged from 10.5 to 15 months in our 4 patients. All patients had improved TE speech fluency. Three patients in our series also had dysphagia and they all had swallowing function improvement after the procedure. During the study period, one of the three patients, who had both swallowing and TE speech dysfunction, underwent a second BTA EGD injection in response to swallowing deterioration despite adequate TE speech fluency. We postulate that a swallowing decline occurred before changes in speech production were apparent because the narrow lumen facilitated vibratory contact but impeded food bolus passage. Thus, changes in swallowing function were perceived before changes in speech production.

One patient who was at increased risk for pneumothorax with percutaneous injection because of the distal location of the PES segment did well without any complication following BTA injection through EGD. It is possible that BTA injection techniques through rigid pharyngoscopy or EGD may minimize complications such as pneumothorax or vascular injuries in at-risk patients. One other advantage of BTA injection through EGD is that it does not require general anesthesia. In our experience, BTA injection through the EGD allows direct visualization and accurate site of injection under MAC thereby avoiding the additional cost and recovery time associated with general anesthesia. Interestingly, our first case did not have improvement of symptoms after EGD BTA injection; however, he responded to a second procedure –this is not an unusual situation as it has been reported in the percutaneous BTA injection literature.

The 18 mm CRE balloon dilator was used with the intention to facilitate the uniform distribution of the BTA by massage. There was no mechanical dilation effect. No resistance was noted to the back and forth movement of the CRE balloon dilator and there was no mucosal tear at the end of the procedure. In addition, dilation of the PES segment is proven to be an ineffective treatment for this condition [3].

Conclusion

BTA injection through the EGD improves TE voice production and dysphagia in laryngectomized patients with PES. This procedure is a viable therapeutic option for patients who fail to respond to percutaneous BTA injection, or for whom percutaneous injection is contraindicated or not tolerated. Our experience demonstrates that BTA injection through the EGD is a safe and relatively simple procedure that does not require fluoroscopy, electromyography, or general anesthesia. We believe the use of EGD for BTA injection performed by gastroenterologists offers a new alternative to help improve the quality of life of select laryngectomized patients with poor speech and swallowing function.

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Fig. 1.
BTA injection through gastroscope

Fig. 2.
Incomplete bolus passage from hypertonic cricopharyngeal bar

Fig. 3.
Complete relaxation of cricopharyngeal bar for bolus passage)