

**Title: Treatment of Intractable Aspiration – Combined Open Medialization
Thyroplasty with Intraglandular Botulinum Toxin Injection**

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Abstract

Objective This paper aims to introduce our combined approach which provides definitive treatment for intractable aspiration while preserving phonation and highlight the importance of performing of both procedures together.

Methods We describe a case of intractable aspiration requiring nasogastric tube and tracheostomy tube. We propose a combined technique, consisting of an open medialization thyroplasty with intraoperative intraglandular botulinum toxin injection. The thyroplasty procedure medializes the left vocal cord to overcome the glottic insufficiency. Botulinum toxin injection reduces salivary flow and prevents excessive pooling.

Results The patient was followed up for 12 months. Video fluoroscopy demonstrated no evidence of aspiration. The patient was allowed regular oral diet and decannulated 2 months postoperatively.

Conclusion This paper demonstrates the feasibility of our combined approach as a viable treatment option for intractable aspiration, particularly in patients with a strong desire for vocalization. The cases must be selected carefully to ensure a favourable outcome.

Keywords: aspiration pneumonia, thyroplasty, botulinum toxin, vocal cord palsy

Introduction

Impairment of the protective function of the larynx can lead to intractable aspiration owing to repeated soilage of the tracheobronchial tract and result in frequent life-threatening pneumonia.¹ While surgery is very effective, it often sacrifices the phonatory function. Hence, we propose a combined technique, consisting of an open medialization thyroplasty with intraoperative salivary botulinum toxin injection, which provides definitive treatment for intractable aspiration while preserving phonation. This paper aims to introduce our approach which offers these patients a better quality of life and highlight the importance of performing of both procedures together to ensure a successful outcome.

Materials and Method

Case Report

A 43-year-old man diagnosed with a left pontomedullary cavernoma underwent excision via a left retrosigmoid approach. Post-operatively, he complained of a weak, breathy voice, swallowing difficulties and a chronic cough, particularly when drinking. Flexible nasopharyngolaryngoscopy revealed a left vocal cord palsy in cadaveric position with a large phonation gap and pooling of saliva.

Subsequently, he was hospitalized for aspiration pneumonia and a tracheostomy was performed for prolonged ventilation. Fiberoptic endoscopic evaluation of swallowing further confirmed evidence of aspiration, and he was only allowed feeding via a nasogastric tube. His left glossopharyngeal (CN IX) and vagus (CN X) nerve injury following his surgery was a debilitating complication which significantly impacted his

quality of life. His weak, breathy voice resulted in poor communication and his prohibition of oral intake led to considerable weight loss.

He was referred to the speech language pathologist but there was only minimal improvement following 6 months of consistent therapy. Despite his intractable aspiration, the patient refused PEG tube and was very adamant in weaning off both nasogastric tube and tracheostomy tube. This was a challenging case as we would need to overcome his intractable aspiration and improve his vocal function.

Surgical Approach

We devised a combined technique of open medialization thyroplasty with intraoperative Botulinum toxin type A injection into the salivary glands. The thyroplasty procedure medializes the left vocal cord to overcome the glottic insufficiency. Botulinum toxin type A injection into the salivary glands reduces salivary flow and prevents excessive pooling caused by the dysfunction of his pharyngeal muscles. For this treatment, patients should be carefully selected and fully informed of the potential benefits and harm.

The operation was performed under general anesthesia as the patient could not tolerate lying in a supine position due to his constant coughing triggered by aspiration. He was ventilated via a cuffed tracheostomy tube. A 5 cm horizontal incision was placed in a skin crease at the level of the mid-thyroid cartilage. Subplatysmal flaps were raised superiorly to the hyoid and inferiorly to the upper cricoid. Division of the midline raphe between the strap muscles exposed the thyroid cartilage.

It was imperative to ensure optimal placement of the window in the thyroid cartilage to minimize risk of poor voice outcome after medialization. The vocal fold was medialized, and the effect of the displacement was visualized on the monitor via the flexible nasopharyngolaryngoscope. After taking the appropriate measurements, an implant was carved out of medium-grade silicon block. Once the implant was in place, the laryngoscopic image was observed to confirm adequate medialization. The wound was irrigated with diluted povidone and closed in layers.

Next, we injected 20 units to each submandibular and parotid gland respectively under ultrasound guidance in the same setting. The dilution protocol was as follows; 2 mL of 0.9% normal saline to a vial of 100 units, creating a dilutional concentration of 5 units of toxin in every 0.1 mL of the reconstituted mixture. We believe the injection technique with a surgeon performed-ultrasound increases the accuracy and allows dynamic monitoring during the procedure.

The patient was discharged well the next day without any immediate post-operative complications.

Results

The patient was followed up for 12 months, by which he was seen monthly for the first 6 months and 3 monthly thereafter. The patient's voice quality exhibited significant improvement during postoperative day 1 while substantial salivary reduction was noticeable after 2 months. Flexible nasopharyngolaryngoscopy revealed a left vocal cord palsy in median position with no phonation gap and no obvious penetration or aspiration. He continued seeing the speech language pathologist for intensive

therapy. Eight weeks later, the video fluoroscopy demonstrated no evidence of aspiration. Following that, the patient was allowed regular oral diet with removal of his nasogastric tube and successful decannulation.

Discussion

Recurrent aspiration heightens the risks of pneumonia and death as well as adds to the financial burden in terms of treatment and frequent hospital admissions. Conservative measures such as nutritional support via nasogastric tube or gastrostomy, oral care and swallowing rehabilitation have been described. Surgical treatments are performed when there is unsatisfactory improvement, but they often result in the loss of vocal function. We seek an approach that provides effective treatment for intractable aspiration without damaging the phonatory function and offers the best quality of life. To our best knowledge, this is the first paper to report our coupled technique of open medialization thyroplasty with intraoperative Botulinum toxin type A injection into the salivary glands.

The three main methods to treat intractable aspiration are removal of the larynx including total laryngectomy and central-part laryngectomy,²⁻⁴ altering the tracheal structure such as tracheoesophageal diversion and laryngotracheal separation⁵⁻⁸ and surgical closure of the larynx.⁹⁻¹² The first approach is rather invasive especially total laryngectomy and is associated with a lengthier operation time and greater amount of bleeding. Our technique is advantageous as it is minimally invasive, has a shorter operation time and low risk of bleeding. In addition, laryngectomy can only be carried out under general anaesthesia. Our approach can be performed under local anaesthesia, although in our case, it was not feasible owing to the patient's constant

coughing that was triggered by his aspiration. Nevertheless, it would be ideal in instances where the patient's comorbidities are not suitable for general anaesthesia.

Post-operative sacrifice of vocal function is also an expected drawback of these surgeries. While post-operative voice rehabilitation, such as electrolarynx and oesophageal speech, can enhance the patient's quality of life, the voice is less than ideal. For the first two methods, restoration of phonation can be achieved via a tracheal esophageal puncture and voice prosthesis insertion. However, this is an additional procedure and leads to a longer operating time. There are many complications related to tracheal esophageal puncture and a favourable voice outcome is not guaranteed. Our approach does not require any extra steps and is perfect for patients with a strong demand for vocalization. Our patient was able to phonate immediately, and his voice showed significant improvement in terms of quality and amplitude.

We recommend that our combined therapy should be considered as first-line surgical treatment for patients who have failed conservative therapy. The technique is the least invasive with minimal risks and provides the patient an opportunity to improve his or her quality of life. The more aggressive surgeries can be performed if the patient continues to aspirate. Moreover, the presence of a tracheostoma is inevitable in all the other methods described. From the aesthetic point of view, our combined method has the best outcome as it is the only one which offers patients a chance at tracheostomy decannulation.

Another factor that needs to be considered is the primary disease causing the intractable aspiration. Patients with high vagal lesions resulting from cerebrovascular

accidents, skull base tumours or iatrogenic complications suffer from breathy dysphonia, dysphagia and aspiration. This is because of the impairment of vocal cord movement, loss of laryngeal sensation and poor coordination of the oropharyngeal and hypopharyngeal phases of swallowing. Hence, our coupled technique is ideal for these patients, and it must be emphasized that patient selection is critical to ensure a successful outcome. We would also like to highlight that performing only either procedure will likely lead to unsatisfactory results.

Several known side effects of Botulinum include dry mouth, dysphagia and chewing difficulties. The action of this neurotoxin generally wears off after 3-4 months but can last up to 6 months. Nevertheless, our patients who have received Botulinum, including those with pharyngocutaneous fistula and sialorrhoea, usually do not require repeat injections. In this case, the patient tolerated the procedure well and another dose of Botulinum may be considered if clinically indicated.

Nonetheless, our approach does have its own disadvantages. While suitable for patients with intractable aspiration caused by high vagal lesions, there is a risk of failure when multiple cranial nerves are involved. Our method does not restore sensation to larynx and is not aimed directly at improving the swallowing function. The age of the patient will undoubtedly influence the outcome as compensation from the unaffected side is more likely in younger patients. We believe that this may be overcome with intensive post-operative rehabilitation and the patient's determination to resume oral digestion.

Conclusion

This paper demonstrates the feasibility of our combined approach as a viable treatment option for intractable aspiration, particularly in patients with a strong desire for vocalization. Nevertheless, the cases must be selected carefully to ensure a favourable outcome.

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Bullet Point Summary

- We propose a combined technique, consisting of an open medialization thyroplasty with salivary botulinum toxin injection, which provides definitive treatment for intractable aspiration while preserving phonation.
- This paper aims to highlight the importance of performing of both procedures together to ensure a successful outcome.
- The thyroplasty procedure medializes the left vocal cord to overcome the glottic insufficiency.
- Botulinum toxin type A injection into the salivary glands reduces salivary flow and prevents excessive pooling caused by the dysfunction of his pharyngeal muscles.
- Video fluoroscopy demonstrated no evidence of aspiration; hence the patient was allowed regular oral diet and successfully decannulated.
- Our technique is minimally invasive, has a shorter operation time and low risk of bleeding.
- This approach is ideal for patients with a strong demand for vocalization.
- From the aesthetic point of view, it is the only method that does not require a tracheostoma.
- Patient selection is crucial to ensure a favourable outcome.