# Tracheoesophageal Voice Restoration Following Laryngotracheal Separation Procedure

Rahul K. Shah, MD; Elie E. Rebeiz, MD

Objectives: Laryngeal dysfunction leading to incompetence and intractable aspiration can be a life-threatening problem. Laryngotracheal separation (LTS) can be used to prevent aspiration, but results in aphonia. The options for alaryngeal speech following LTS are limited.

Methods: We performed tracheoesophageal puncture (TEP) and insertion of a Blom-Singer valve in 3 patients in an attempt to restore their voice after LTS for chronic aspiration.

**Results:** Two patients had intractable aspiration (5 and 14 years) after full-course radiotherapy for laryngeal cancer, and 1 patient had aspiration after a stroke. In the first patient TEP was done as a secondary procedure, and in the other 2 patients it was done at the time of the LTS. The TEP was successful in providing these patients with phonation ability after their LTS procedure. There was no morbidity from these procedures.

Conclusions: Creation of a TEP after an LTS procedure is relatively simple and relatively safe, and allows for the control of aspiration while maintaining vocal function.

Key Words: aspiration, Blom-Singer valve, Lindeman procedure, speech pathology.

#### INTRODUCTION

The functions of the larynx are multifold: vocalization, respiration, protection of the airway, and aiding in swallowing. Patients who are severely neurologically impaired from either congenital or acquired disease can have such progression of disease that they become unable to control their secretions. In these patients, significant morbidity and potential mortality can occur when frank aspiration of uncontrolled secretions occurs. Chronic aspiration results in morbidity and frequent hospitalization for bacterial infections, chemical pneumonitis, or obstruction of the distal airway from secretions. 1 In patients who are unable to be managed via conservative measures, surgical interventions are necessary to prevent aspiration. One surgical principle involves separating the upper aerodigestive tract and the trachea — the principle of the laryngotracheal separation (LTS) procedure.<sup>2,3</sup> The LTS is successful in preventing aspiration; the resulting aphonia, however, can be devastat-

In patients treated for neoplasms of the head and neck, radiotherapy is often used as primary or adjuvant therapy. External-beam irradiation to the larynx can result in a dysfunctional larynx causing hoarseness and intractable aspiration. Unfortunately for these patients, the aspiration is of such a degree that surgi-

cal interventions such as LTS are needed. Although their aspiration is controlled, the resulting aphonia from the LTS procedure is distressing.

Darrow et al<sup>1</sup> reported performing tracheoesophageal puncture (TEP) in a patient who underwent LTS for intractable aspiration as a potential mechanism for restoring his voice. We report a series of cases of TEP performed for restoration of phonatory ability in patients after LTS. This case series highlights the role of TEP in patients being evaluated for LTS.

## **METHODS**

This study, a retrospective review, was approved by the Tufts-New England Medical Center Institutional Review Board. Patients who underwent a laryngotracheal separation were identified in the Department of Otolaryngology-Head and Neck Surgery at Tufts-New England Medical Center. Pertinent information extracted from the chart included indications for the surgery, surgery performed, outcomes of the surgery, timing of the TEP, potential phonatory ability, and long-term follow-up.

#### RESULTS

We describe 3 patients with intractable aspiration who underwent LTS and TEP by the senior author (E.E.R.).

From the Department of Otolaryngology–Head and Neck Surgery, Tufts–New England Medical Center, Boston, Massachusetts. Presented at the 12th World Congress of Bronchology/Bronchoesophagology, Boston, Massachusetts, June 19-22, 2002. Correspondence: Elie E. Rebeiz, MD, Dept of Otolaryngology–Head and Neck Surgery, 750 Washington St, NEMC #850, Boston, MA 02111.

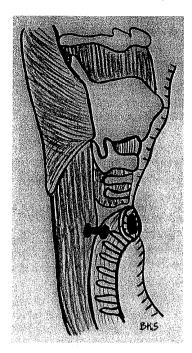


Fig 1. Sagittal representation of patient after laryngotracheal separation with tracheoesophageal puncture in place.

Case 1. The patient was a 53-year-old man who had undergone radiotherapy for a primary vocal cord carcinoma 5 years earlier. His past medical history was significant for chronic obstructive pulmonary disease, hypertension, and gastrointestinal bleeding. After radiotherapy he was without evidence of disease, but he had a weak voice and chronic aspiration. Medialization thyroplasty was performed in an attempt to correct the problem; however, aspiration persisted. He subsequently underwent LTS and TEP with secondary placement of a Blom-Singer valve.

Case 2. The patient was a 76-year-old woman who had a history of epiglottic carcinoma. She underwent radiotherapy 14 years before presenting to the senior author with chronic aspiration. She had a tracheotomy performed for respiratory difficulty and aspiration, and had a gastrostomy tube for feeding. The

patient underwent an LTS procedure; however, she complained significantly of the resultant aphonia. Three months after the LTS, she underwent TEP.

Case 3. A 67-year-old man with laryngeal dysfunction following a stroke had resultant aspiration and a weak cough. He was admitted on several occasions with recurrent pneumonias. After failure of conservative treatment, placement of a J-tube, and a tracheotomy, he still was developing recurrent pneumonias from the chronic aspiration and underwent LTS with TEP at the time of the initial surgery.

Placement of the TEP in these patients is similar to placement in the postlaryngectomy patient.<sup>4</sup> Our technique includes the creation of a TEP that is then cannulated with a red rubber catheter. This catheter is left in place for 2 to 3 weeks. After this time interval, the patient is seen in the office, the catheter is removed, and a Blom-Singer valve is placed. One of our patients had the TEP placed primarily, and the other 2 had them placed secondarily (Fig 1).

All of the patients and their family members were subjectively satisfied after the procedure. Surgery (LTS) achieved control of their aspiration while maintaining the ability to phonate (TEP). There were no morbidities or deaths from the LTS or the TEP. The patient in case 1 is 3 years post-LTS with TEP, remains without evidence of disease, and has the ability to phonate. The patient in case 2 is 5½ years post-surgery, remains without evidence of disease, and is satisfied with the control of her aspiration and her ability to phonate. The patient in case 3 is 2½ years postoperative and is also subjectively satisfied with his phonating ability.

## DISCUSSION

Intractable aspiration can result from neurologic diseases such as stroke and amyotrophic lateral sclerosis or from major head and neck tumor therapy with surgery, chemotherapy, or irradiation. Half of patients with strokes suffer from some degree of aspiration,

Chronic aspiration suspected

1

Document clinically and with studies (barium swallow, functional endoscopic evaluation of swallowing with sensory testing)

Assess vocal function, ability/desire to phonate and communicate

Treat aspiration conservatively (speech pathologist to assist with head maneuvers, pharmacological interventions for antireflux therapy and to decrease secretions)

Cricopharyngeal myotomy, vocal fold medialization, or tracheotomy

1

Laryngotracheal separation
Tracheoesophageal puncture same setting or delayed

Fig 2. Tufts-New England Medical Center algorithm for chronic aspiration.

depending on the extent of the cerebral damage.<sup>5</sup> The aspiration causes significant morbidity and potential secondary mortality. Fortunately, many patients ultimately recover their swallowing function as they recover from their stroke.<sup>5</sup>

Modalities available to evaluate patients with an incompetent larynx include modified barium swallow and endoscopic examinations.<sup>6</sup> Patients are initially treated by conservative measures utilizing various feeding and head maneuvers, pharmacologic measures to decrease secretions, and antireflux therapy. The algorithm used at our institution for the management of chronic aspiration is shown in Fig 2. Some patients ultimately require a tracheotomy for pulmonary toilet and airway protection; however, this is not a secure defense against aspiration.<sup>5,7</sup> Other surgical options include cricopharyngeal myotomy to reduce upper esophageal tone, vocal fold medialization, and epiglottopexy. However, LTS and narrow-field laryngectomy are the most effective means for prevention of chronic aspiration. Advocates of LTS argue that this is a potentially reversible procedure, allowing for the potential recovery of swallowing in some patients with neurologic conditions.8 Laryngeal diversion is described as a separation of the larynx and the trachea with resulting connection of the laryngeal stump to the esophagus. The LTS is a modification of the procedure described by Lindeman and calls for the complete closure of the laryngeal stump.<sup>2,3,8</sup> A comprehensive review of 34 patients treated for chronic aspiration with LTS demonstrated complete control of aspiration of all patients.8 Of pertinence to our case series, of those 34 patients, 9 had serviceable speech before operation. Three patients had normal speech, and 6 had impaired speech. Such patients may potentially benefit from a secondary TEP. We chose LTS rather than narrow-field laryngectomy in the patients presented herein to retain the possibility of reversing the procedure if their status improved and aspiration was no longer a morbid-

Many patients who undergo LTS as a result of neurologic disease have poor phonatory ability<sup>8</sup> and may not benefit from attempts to maintain speech in the face of chronic aspiration. In these patients, the loss of speech is not a significant morbidity of the LTS procedure,<sup>8</sup> and TEP would not be indicated if they were to have LTS. For example, some patients with muscular dystrophies or with strokes affecting their upper extremities have limited benefit from TEP, since they cannot effectively use their fingers to close their stoma. Although LTS may be of benefit in these patients, they would not be served by TEP. The Table demonstrates our criteria for the ideal patient to undergo TEP after LTS.

TUFTS—NEW ENGLAND MEDICAL CENTER CRITERIA FOR EVALUATION OF POTENTIAL CANDIDATES FOR TEP AFTER LTS

| Criteria                       | Status  |
|--------------------------------|---|
| Age                            | Variable; should have reasonable life expectancy (at least 1 year)  |
| Associated morbidities         | Should not be limiting, TEP can be done under local anesthesia within minimal time frame                              |
| Pre-LTS phonation              | Uses voice in activities of daily living  |
| Morbidity from aphonia         | Significant concerns regarding apho-<br>nia; patient and family emotionally<br>troubled by loss of vocal ability      |
| Neurologic status              | Able to coordinate exhalation with coverage of tracheostoma to produce sound; able to engage in intentional phonation |
| Reversibility of cause         | Not important; TEP can be removed if LTS is reversed and patient regains ability to control secretions                |
| TEP — tracheoesophagea ration. | l puncture, LTS — laryngotracheal sepa-   |

Patients with serviceable speech should be presented with the option to phonate via a TEP and placement of a Blom-Singer valve. In our series, TEP provided patients with the ability to phonate after LTS, affording them an increase in their quality of life; ie, they are without aspiration and can still communicate.

Takano et al<sup>9</sup> noted an increased satisfaction in patients who undergo LTS and regain the ability to take oral feedings. They noted dissatisfaction on the part of patients and their families with the expected loss of the ability to phonate. The cases presented in our series show that patients can potentially both regain the ability to eat and preserve their ability to speak.

## CONCLUSIONS

Chronic aspiration can be the cause of significant morbidity in patients who have severe neurologic disease, have undergone therapy for head and neck cancer, or are trauma patients. The LTS procedure has been shown to be successful in controlling aspiration in these patients. Despite the high success rate of the procedure in preventing aspiration, aphonia remains a significant handicap for the patients and their families. This case series describes 3 patients with longterm follow-up who presented with chronic aspiration and have retained the ability to phonate while controlling aspiration by creation of a TEP and use of a Blom-Singer valve. The TEP with a Blom-Singer valve should be considered in those patients who are aphonic after LTS, and should be presented to patients and their families as an alternative to aphonia.

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The 3rd World Voice Congress will be held June 19-22, 2006, in Istanbul, Turkey. For more information, contact Gursel Dursun, MD, Turgut Reis Caddesi 16/8, 06580 Mebusevleri, Ankara, Turkey; telephone +90-532-790 4790; fax +90-312-310 6371; e-mail dursung@superonline.com; or see the web site at www.voice2006.org.