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What is This?
Primary Tracheoesophageal Puncture with Supraclavicular Artery Island Flap after Total Laryngectomy or Laryngopharyngectomy

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Abstract
The supraclavicular artery island flap (SCAIF) is increasingly employed for laryngectomy reconstruction with excellent success. Although tracheoesophageal puncture (TEP) with intraoperative prosthesis placement is also positively reported, this is not described in patients following SCAIF. We review our experience with primary TEP with prosthesis placement and voice outcomes in patients after SCAIF reconstruction. Seven patients underwent SCAIF with primary TEP after laryngectomy from 2011 to 2013. Five underwent total laryngectomy (TL) and 2 underwent TL with partial pharyngectomy. All patients had 16 French Indwelling Blom-Singer prostheses placed intraoperatively without complications. Six patients achieved tracheoesophageal voice (median time = 1.5 months). Two patients required cricopharyngeal segment Botox injections. One patient remained aphonic. One patient developed prosthesis leakage addressed with prosthesis replacement. Our preliminary data demonstrate that similar to free tissue transfer reconstruction, primary TEP with intraoperative placement of the voice prosthesis at the time of SCAIF reconstruction is safe and effective.

Keywords
supraclavicular artery island flap, tracheoesophageal puncture, voice prosthesis, voice restoration, total laryngectomy

Introduction
Tracheoesophageal speech is considered the gold standard for voice restoration following laryngectomy. Tracheoesophageal puncture (TEP), which allows for a voice prosthesis, may occur at the time of laryngectomy (primary TEP) or postoperatively (secondary TEP).1 Primary TEP has been associated with earlier voice acquisition, is safe, and has higher rates of successful voice rehabilitation as compared to secondary TEP.2-4 Successful voice outcomes have also been reported in primary TEP with laryngopharyngectomy that require advanced reconstruction techniques, such as free tissue transfer.4,5

The supraclavicular artery island flap (SCAIF) is an effective alternative to free tissue transfer and is being used with increasing frequency after laryngectomy.6,7 The SCAIF has potential associated benefits: ready access to the operative field, dependable blood supply, ease of harvest not requiring microvascular expertise, and decreased operative time.8 There are limited data, however, on primary TEP placement or voice restoration following SCAIF reconstruction, which theoretically should be equivalent to other fasciocutaneous or myocutaneous reconstructions. Herein, we describe (1) our experience of primary TEP with intraoperative placement of the voice prosthesis for patients undergoing total laryngectomy (TL) or total laryngectomy with partial pharyngectomy (TLPP) requiring SCAIF reconstruction and (2) TEP voice outcomes after 1 year of follow-up.

Methods
Institutional review board approval was obtained from the Massachusetts Eye and Ear Infirmary (MEEI). A retrospective review of patients who underwent SCAIF following TL or TLPP at MEEI between January 2011 and October 2013 was performed. Primary TEP was performed after TL or TLPP and prior to SCAIF in the same fashion as insertion prior to inset of free tissue transfer as previously described.9 An indwelling 16 French Blom-Singer prosthesis (InHealth Technologies, Carpinteria, California) was placed in all

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patients (Figure 1). Two senior surgeons (KE and DD) performed the TEP and SCAIF reconstruction and evaluated patients postoperatively.

Results

Fourteen patients underwent SCAIF reconstruction following TL or TLPP. Primary TEP was performed in 7 patients; 6 had prior chemoradiation for laryngeal squamous cell carcinoma (SCC). One patient had a dysfunctional larynx from radiation treatment for tonsillar SCC. The average patient age was 64.1 years. There were 2 women and 5 men. Five patients underwent TL, and 2 underwent TLPP. Six patients underwent SCAIF patch graft reconstruction of the anterior pharyngeal wall defect, and 1 patient underwent SCAIF pharyngeal interposition graft reconstruction.

There were no intraoperative TEP-related complications, such as prosthesis displacement, or fistula widening in the perioperative period. One patient developed prosthesis transluminal salivary leakage after 3 months that resolved with prosthesis resizing. One patient developed a peristomal pharyngocutaneous fistula that healed by secondary intention and was unrelated to TEP. Two of 7 patients not undergoing primary puncture developed a pharyngocutaneous fistula.

The primary surgeon and a speech-language pathologist assessed voice outcomes. Six patients achieved tracheoesophageal voice within 10 months after TEP placement, and most occurred earlier (median time = 1.5 months) (Table 1). Of the 6 patients who achieved successful voice acquisition, 2 required cricopharyngeal muscle segment botulinum toxin injections. The seventh patient was aperiodic. Shortly after prosthesis resizing the patient developed prosthesis leakage. Shortly after prosthesis resizing the patient developed lymph nodes recurrence and voice acquisition was deferred.

Discussion

The SCAIF flap is an effective alternative to regional or free flaps for reconstruction after TL or TLPP. As with all types of vascularized soft tissue reconstruction, voice rehabilitation planning should begin preoperatively. As the SCAIF was only recently described, there is limited data on primary TEP placement with SCAIF. Chiu et al mention voice outcomes in a cohort of 20 patients who underwent TL with partial or complete pharyngeal reconstruction with SCAIF between 2006 and 2009, noting only that patients who underwent TEP (primary or secondary) had reportedly better speech than electrolaryngeal speakers.

Table 1. Summary of Patient Demographics, Treatment Characteristics, and Time to Voice Acquisition.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Indication</th>
<th>Prior Treatment</th>
<th>Procedure</th>
<th>Type of SCAIF Reconstruction</th>
<th>Time to TEP Voice (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>Dysfunctional larynx</td>
<td>XRT</td>
<td>TLPP</td>
<td>Patch graft</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TL</td>
<td>Patch graft</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TLPP</td>
<td>Interposition graft</td>
<td>9.2</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TL</td>
<td>Patch graft</td>
<td>2.4</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TL</td>
<td>Patch graft</td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TL</td>
<td>Voice acquisition deferred</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>Laryngeal carcinoma</td>
<td>Chemo/XRT</td>
<td>TL</td>
<td>Patch graft</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Abbreviations: SCAIF, supraclavicular artery island flap; TEP, tracheoesophageal puncture; M, male; F, female; XRT, radiation therapy; Chemo, chemotherapy; TLPP, total laryngectomy with partial pharyngectomy; TL, total laryngectomy.
additional procedures and decreases risk of posterior esophageal perforation compared to secondary TEP. Secondary TEP with prosthesis placement also permits use of a more natural and horizontally placed tract, smaller device in the stoma, lower profile device within the esophageal lumen, and more stable stent for the puncture tract. Secondary TEP is associated with later voice restoration and may not be ideal with complex postoperative anatomy. Primary placement of the TEP may be deferred in select patients undergoing SCAIF for issues related to: significant extend of resection (3/7 patients without primary puncture in this series), immediate postoperative stoma anatomy not favorable for primary puncture (2/7 patients), or patient preference (2/7 patients).

In conclusion, SCAIF is becoming a widely adopted flap for reconstruction following TL or TLPP. Consideration and planning for voice acquisition remains a crucial part of the preoperative workup. Our preliminary experience suggests primary TEP is a safe and effective option for voice restoration in patients with SCAIF reconstruction.

Author Contributions
Rosh K. V. Sethi, conception, design, acquisition of data, analysis, drafting, final approval; Elliott D. Kozin, conception, design, acquisition of data, analysis, drafting, final approval; Allen C. Lam, conception, design, drafting, final approval; Kevin S. Emerick, conception, design, acquisition of data, analysis, drafting, final approval; Daniel G. Deschler, conception, design, acquisition of data, analysis, drafting, final approval.

Disclosures
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