

## **Speech Results with Tracheoesophageal Voice Prosthesis after Total Laryngectomy**

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### **Abstract**

**Objective:** To assess the success rate of tracheoesophageal voice prosthesis as the primary mode of voice rehabilitation in patients after total laryngectomy.

**Methods:** Medical record files of 35 patients subjected to total laryngectomy were reviewed for determining success or failure of the voice prosthesis. The indicators used were quality of speech and utility of the device. Subsequent complications that developed were also assessed. In addition other factors taken into consideration were pharyngeal myotomy, use of radiation, and timing of replacement. All thirty five patients (n=35) had prosthesis placed at the time of laryngectomy.

**Results:** The success rate at one month and four months follow up was 85.18%. Of note, 3 patients were lost to follow-up, 3 patients died of disease and 2 had recurrence of disease.

**Conclusion:** Our results confirm the effectiveness, longevity and safety of the tracheoesophageal voice prosthesis for speech rehabilitation following total laryngectomy (JPMA 55;540:2005).

### **Introduction**

Voice rehabilitation after total laryngectomy has traditionally centered on the development of esophageal speech and the use of the artificial larynx. Tracheoesophageal puncture and prosthetic rehabilitation of voice have become commonplace since the first successful placement of voice prosthesis by Singer and Bloom in 1980.<sup>1</sup> The possibility of achieving effective speech using the prosthetically-rehabilitated voice is greater. The resulting quality of voice is also considered superior to the esophageal speech.<sup>2,3</sup> Complications involving the voice prosthesis have been few and minor. Problems documented in the English literature include colonization of the pharynx with *Candida*, a high air flow resistance of the prosthesis and hypertonic pharyngeal segment. The two major types of prosthesis: indwelling and non-indwelling, need differentiation because of the latter's demands on and the ability of the patient to change and replace the prosthesis without a physician's assistance.

The recently designed Bloom-Singer valve is low-resistance indwelling silicone voice prosthesis. Encouraged by the success reports we began using the tracheoesophageal speaking valve as the primary prosthesis to rehabilitate patients after total laryngectomy at our institution. The objectives of this study were to assess initial speaking success and complication rates, and to compare the findings with other reports.

### **Patients and Methods**

Between September 2000 and October 2004, a total of 35 male patients underwent primary tracheoesophageal puncture with insertion of Bloom-Singer valve

prosthesis in the section of Otolaryngology, Aga Khan University Hospital. Ages ranged from 38 to 83 years with a mean of 35 years. After excluding 3 patients, who did not return, the follow-ups since the placements of Bloom-Singer prosthesis, ranged from 2 to 18 months with a mean of 11 months. Total laryngectomy was indicated in all patients with laryngeal squamous cell carcinoma. Due to fear of radiation induced necrosis and subsequent dislodgment of prosthesis, none of the patients who had undergone external beam radiotherapy were selected for placement of voice prosthesis. Prosthesis was placed primarily at the time of their laryngectomy. None had a delayed tracheoesophageal puncture. Patients who needed replacement for another type of prosthesis were not included in this study. Of the 35 patients, 17 had pharyngeal myotomy at the time of tracheoesophageal puncture.

Patients ability to produce speech (yes or no), the quality of the speech (good, fair or poor), whether they used the device as a primary or a secondary means of communication or not at all, were assessed. The assessment of voice restoration based on Harrison-Robillard Shultz tracheoesophageal puncture (TEP) rating scale was done at one month after placement of prosthesis and later at four months.

### **Surgical Technique**

Four procedures were included in the operative technique to reduce complications. The first step involved creation of a durable tracheostoma that has reduced tendency for stenosis and patency without a tracheal cannula. Tissues are defatted and tracheal ring is fixed to the inferior skin margin. A monofilament suture is placed around the

tracheal ring and is secured by a vertical mattress technique. A triangular wedge of skin from the superior flap is interposed into the resulting defect expand the area of the stoma as a bivalving technique. The membranous tracheal wall is closed with the overlying skin of the superior flap to produce a flat posterior stoma. Placement of TEP involves insertion of a right-angled hemostatic clamp through the unrepaired pharyngostoma until it distends the membranous wall from posterior to anterior. The membranous trachea is incised in order to permit the tips of hemostat to protrude into the tracheostoma. Cautious approach is advised because separation of tracheoesophageal party wall may occur at this stage. If this occurs the risk of salivary contamination increases, with subsequent infection and necrosis of the membranous trachea.

## Results

Of the 32 patients for whom follow-up was available, 3 patients died of disease. Two patients were alive with recurrence of disease, and the remainders were alive with no evidence of cancer. We evaluated the remaining 27 patients for voice production and quality with use of voice prosthesis at one month and four months follow up using the scale shown in table 1. At the initial evaluation, 16 patients had excellent speech, 7 good speech and 4 poor speech (Table 2). No change in voice quality was detected at the second follow up. Based on the ability to produce sound and the quality of speech, 23 of 27 patients were judged to have initial success (85.18%). The main reason for failure of 4 patients was lack of manual coordination.

**Table 1. Voice evaluation after using voice prosthesis.**

<b>A. Degree of use of tracheoesophageal speech (TES)</b>	
	Score
TES Never used (0%)	0
TES used less than 50% of time	1
TES used 50-80% of time	2
TES used all the time	3
<b>B. Ease of production and intelligibility of speech</b>	
Voice is too strain or too breathy	0
Voice is mildly strained or mildly breathy	1
Voice is easily produced; speech is intelligible	2

**Table 2. Results of voice evaluation (n = 27).**

Grade	Score	Quality	Number
Grade A	Score between 5-6	Excellent	16
Grade B	Score between 3-4	Good	7
Grade C	Score between 1-2	Poor	4

Till the last follow-up all 27 patients had their prosthesis in place. The commonly documented reasons for the failure of voice prosthesis such as infection, radiation fibrosis, cerebrovascular accident were not seen in our population.

The most common complication encountered with the prosthesis was partial retraction of the prosthesis into the esophagus (3 cases). These were successfully retrieved without untoward consequences. Three patients developed granulation tissue around the prosthesis which was removed with electrocautery. Localized cellulitis leading to the closure of tracheoesophageal puncture, did not develop in any patient.

## Discussion

Tracheoesophageal voice prosthesis is documented as a superior method of speech rehabilitation after total laryngectomy compared with other methods such as electro-larynx and esophageal speech.<sup>4,5</sup> Moreover, the possibility of producing an effective voice is reached much earlier and requires less voice training as reported by other workers.<sup>6</sup> Several studies have also shown that the quality of life of patients with voice prosthesis is higher than patients communicating by other means.<sup>7</sup> Our success rate (85%) was comparable to previous reports.<sup>2,8</sup> This could be due to exclusion of patients with secondary punctures and those with radiation therapy.

The use of muscle-relaxing procedures for the pharyngoesophagus to avoid spasm and resultant dysfluency is well described in literature.<sup>9</sup> This may be in the form of pharyngeal constrictor myotomy or a pharyngeal plexus neurectomy. The myotomy technique consists of a posterior midline incision through the fibers of the middle pharyngeal constrictor muscle, the inferior pharyngeal constrictor muscle, and the cricopharyngeus muscle. A midline posterior approach is minimally traumatic and preserves the vascularity of the underlying mucosal segment while avoiding the possibility of reformation of the upper esophageal sphincter.

The more recently proposed pharyngeal plexus neurectomy offers a number of advantages over the myotomy. It reduces the trauma to the pharyngeal wall and the rise in sphincter tone of the upper esophageal segment during oesophageal insufflation.<sup>10</sup> The elasticity of the constrictor muscles of the pharynx, as well as the vasculature, is preserved. These differences from myotomy are expected to decrease post operative complications while preserving the quality of voice.

The pharyngeal plexus is identified on the ipsilateral laryngopharynx while the larynx is still intact. The fibers are stretched and divided and the edges are electrocoagulated. This effectively denervates the inferior pharyngeal constrictor muscle and partially denervates the cricopharyngeus muscle.

We used muscle-relaxing techniques in half of our patients with other half did not have this procedure. We did not find any significant difference in the quality of the speech in these two groups of patients.

Voice improvement is gradual over time in the first 4 months after the placement. Role of training and speech therapy should be emphasized. Daily speech therapy was started as soon as possible after laryngectomy during hospital stay and continued thereafter at weekly intervals until satisfaction. Desulpehe K et al in his report mentioned that training and speech therapy have important effects on most of the objective and subjective voice criteria.<sup>11</sup>

Although four patients continued to have poor speech on their long term followup, voice failure was not observed in any case. Voice failure is defined as failure to use the voice prosthesis for regular day to day communication.<sup>12</sup> The morbidity associated with tracheoesophageal puncture and prosthesis placement was relatively low and comparable to other reports.<sup>13,14</sup> We did not encounter any major or minor complications, except partial retraction of prosthesis into oesophagus (3 cases). These were successfully retrieved without untoward consequences. Three patients developed granulation tissue around the prosthesis which was effectively treated by repeated chemical cauterization in the clinic. The low incidence of complication in our series is attributed to mainly 2 reasons, the exclusion of patients with prior radiotherapy and tracheoesophageal puncture as a primary procedure. The frequent problems of food and saliva leakage and occasionally oesophageal perforation are usually experienced in patients undergoing secondary tracheoesophageal puncture.<sup>15</sup>

This study concluded that overall good voice quality both objectively and by subjective assessment for tracheoesophageal voice prosthesis after total laryngectomy.

Overall, the Bloom-Singer prosthesis was found to be an effective and safe means for speech rehabilitation after total laryngectomy.

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