Tracheoesophageal Shunt Method With Omohyoid Muscle Loop for Voice Restoration

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Objective: To decrease the aspiration rate of the previously reported simple mucodermal tracheoesophageal (TE) shunt method for voice restoration after total laryngectomy with the use of omohyoid muscle loop.

Design: Retrospective clinical analysis.

Setting: Department of Otorhinolaryngology, Fukui Medical University, Fukui, Japan.

Patients: Ten male patients underwent total laryngectomy and received TE shunt by the omohyoid muscle loop method for voice restoration. There were 5 patients with glottic laryngeal cancer, 2 with supraglottic laryngeal cancer, and 3 with hypopharyngeal cancer. Patients’ age ranged from 46 to 66 years.

Intervention: The dermal incision on the neck was U-shaped with a superiorly pedicled, small U-shaped dermal flap. This small U-shaped flap was used to form the anterior wall of the shunt. Bilateral omohyoid muscles were preserved at the total laryngectomy site with or without neck dissection. After creating a TE shunt directly on the posterior wall of the tracheal stump, the bilateral omohyoid muscles were looped through each other beneath the TE shunt.

Main Outcome Measurements: Maximum phonation time, maximum phonation intensity, and rating scales of shunt voice, aspiration rate, and survival time.

Results: Mean maximum phonation time was 20 seconds, while mean maximum phonation intensity was 83 dB. The first voice was obtained on postoperative day 29 on average. Of the 10 patients, 9 could phonate, with 1 case (10%) of slight aspiration 3 months after the surgery.

Conclusions: Although this omohyoid muscle loop method needs to preserve the hyoid bone with those muscles, aspiration was prevented more effectively compared with the former, direct mucodermal TE shunt method. The indication for this method is preferably glottic laryngeal cancer.


There have been many surgical methods of tracheoesophageal (TE) shunt after total laryngectomy for voice restoration. Among them, TE puncture with the use of voice prosthesis has been widely accepted in recent years, and 2 different types of prostheses have been developed: nonindwelling type, which can be removed and replaced by the patient, and indwelling type, which has to be managed by a clinician. However, TE shunt without using a prosthesis still presents problems such as aspiration, stenosis, and technical difficulties. The goal for the head and neck surgeon is to restore vocalization surgically without causing aspiration or using a prosthesis. Therefore, we used the omohyoid muscle for the previously reported mucodermal TE shunt method as a sphincter to prevent aspiration.

Methods

The omohyoid muscle loop method was performed on 10 male patients: 5 with glottic laryngeal cancer, 2 with supraglottic laryngeal cancer, and 3 with hypopharyngeal cancer. The mean patient age was 58 years.

The dermal incision on the neck was U-shaped with a superiorly pedicled, small U-shaped dermal flap. This small U-shaped flap was used to form the anterior wall of the shunt. Bilateral omohyoid muscles were preserved at the total laryngectomy site with or without neck dissection. After creating a TE shunt directly on the posterior wall of the tracheal stump, the bilateral omohyoid muscles were looped through each other beneath the TE shunt.

sutured to the opposite omohyoid muscle using polyglactin 910 (Vicryl; Ethicon Inc, Somerville, NJ). The middle part of omohyoid muscle is slim and was placed directly under TE shunt. The TE shunt was placed under slight tension toward the hyoid bone by the looped omohyoid muscle. It was not necessary to preserve the ansa cervicalis (Figure 2). Maximum phonation time, maximum phonation intensity, and rating scales of the shunt voice, aspiration rate, and survival time were evaluated.

**RESULTS**

The mean±SD maximum phonation time was 20±5 seconds, and the mean±SD maximum phonation intensity was 83±8 dB. The first voice was obtained on postoperative day 29±13. Three months after the operation, 9 patients (90%) could phonate, with 1 case (10%) of slight aspiration (Table). Tracheoesophageal speech was assessed by nonprofessional listeners as “good,” “average,” or “poor” according to rating scales measuring the number of syllables per breath, use of voice, and intelligibility. Eight patients were assessed as “good,” 1 as “average,” and 1 as “poor.”

Nine patients survived from 11 months to 7 years. One patient (patient 3) died of renal failure. All the patients had no recurrence of disease. This result indicates that preservation of the omohyoid muscle does not inhibit the curability.
The first problem was whether to use the omohyoid muscle unilaterally or bilaterally. One side of the omohyoid muscle was applied in the first case, supraglottic laryngeal cancer (T4 N0 M0) in a 62-year-old man. Although aspiration in this case was slight and was prevented with finger pressure on the shunt, sphincter action at deglutition only seemed to be weak from the unilateral muscle. The bilateral omohyoid muscles were used to form a loop beneath the shunt, with the expectation of stronger sphincter action thereafter. Therefore, this first case was excluded from the series.

The future condition of the looped omohyoid muscle is a matter of concern. We were fortunate to have the opportunity to observe the omohyoid muscle 7 months after looping. Patient 9 complained of passage disturbance 3 weeks after scanning. The patient could phonate smoothly, but a radiographic fluorogram revealed stenosis around the hyoid bone. Therefore, a pharyngeal myotomy along the hyoid bone was carried out under general anesthesia. His swallowing improved following the myotomy. The atrophic omohyoid muscle was macroscopically confirmed during this operation. A biopsy specimen taken from the fibrous muscle revealed the existence of partial fibrosis and atrophy of the omohyoid muscle. This result indicated that fibrous changes in the omohyoid muscle had taken place but that it could still work as a sphincter even after a long time. Although maintaining innervation of the omohyoid muscles prevents atrophy of the muscle, it is doubtful whether patients treated with TE shunt by the omohyoid muscle loop method maintain good phonation without aspiration. Patient 5 failed to achieve a good voice. The reason remains unclear.

Although the omohyoid muscle loop method needs to preserve the hyoid bone with those muscles, aspiration was prevented more effectively compared with the former direct mucodermal TE shunt method. Additionally, this loop formation required only a few minutes to perform. The indication for this method is preferably glottic laryngeal cancer.

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### References


### Table

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<th>Rad</th>
<th>V, d</th>
<th>MPT, s</th>
<th>MPI, dB</th>
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Abbreviations: Asp, aspiration; G, glottic laryngeal cancer; Hypo, hypopharyngeal cancer; NE, aspiration was prevented using a neck extension; PS, phonation could not be obtained due to pharyngeal spasm; Rad, postoperative radiation; SG, supraglottic laryngeal cancer; V, the day of the first voice.

*Phonation was obtained in 9 (90%) of 10 patients after 3 months and 7 (78%) of 9 patients after 1 year. Mean ± SD V, MPT, and MPI were 29 ± 13 d, 20 ± 5 s, and 83 ± 8 dB, respectively. Aspiration occurred in 1 (10%) of 10 patients.