

# A Novel Laryngeal Preservation Technique following Total Glossectomy with Hyoid Bone Resection

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**Summary:** Despite the recent progress of chemotherapy and sophisticated radiotherapy, surgery still remains the most reliable treatment for advanced tongue cancers in terms of survival. The major disadvantage of this treatment is that it should sacrifice the quality of patients' life. When the tongue cancer is so advanced as to involve the hyoid bone, which is considered a functional part of the larynx, radical operation needs to resect both the entire tongue and the larynx and the hyoid bone en bloc to prevent aspiration pneumonia. As a result of total laryngectomy, the patients will suffer significant disabilities: aphonia and the loss of deglutition that limits the oral intake to only liquid or pasty food. With this clinical background, we have been contriving to overcome these significant surgical shortcomings by conducting larynx-preserving operation. In this case report, we present our newly devised surgical method which consists of free-flap transfer with a combination of laryngeal suspension and a novel reconstructive technique, that is, epiglottis suspension, which enabled favorable swallowing function without aspiration and allowed a sufficiently wide airway for breathing. The operation worked quite successfully for the patient's quality of life. We believe this novel surgical method would serve as a larynx-preservation treatment for locally advanced tongue cancers with hyoid bone invasion. (*Plast Reconstr Surg Glob Open* 2018;6:e1756; doi: 10.1097/GOX.0000000000001756; Published online 9 April 2018.)

In total glossectomy, the whole tongue is resected while the epiglottis and the hyoid bone are preserved. When a tongue tumor invades the hyoid bone, which is considered a functional part of the larynx, it is difficult to preserve the larynx because the loss of the bone causes intractable aspiration. To our best knowledge, there is no standardized larynx-preserving surgery for a tongue cancer with hyoid bone invasion, and such cases are often treated with a combination of total glossectomy and total laryngectomy (TGTL) with hyoid bone resection.

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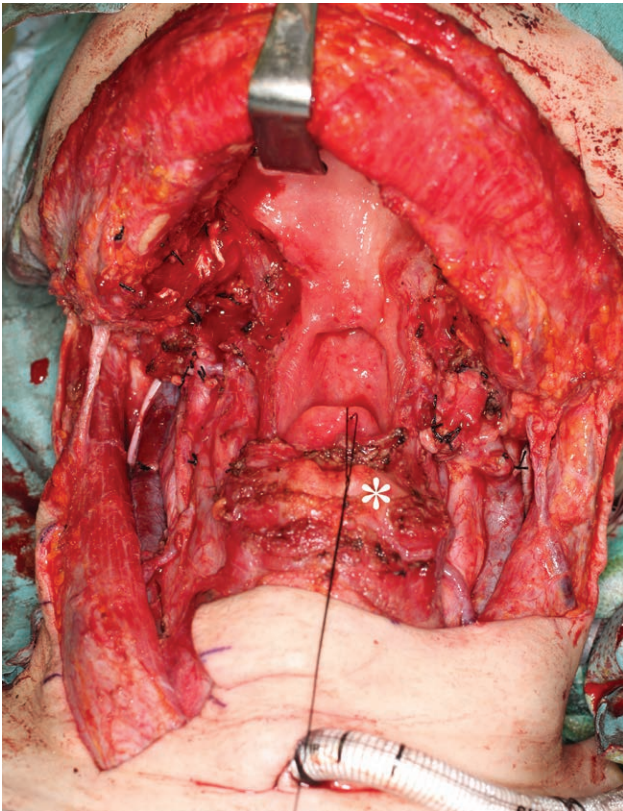
We had previously experienced a case of advanced base-of-tongue cancer with hyoid bone invasion, which was successfully treated by total glossectomy combined with hyoid bone resection while the larynx was preserved [(total glossectomy with laryngeal preservation (TGLP)]. On that occasion, we performed free flap transfer operation with laryngeal suspension which enabled good swallowing function without aspiration. Unfortunately, laryngeal suspension caused overdrooping of the epiglottis and narrowed the air way necessitating continued tracheal cannulation for the following 12 months until the flap volume reduced.

Recently, we experienced another case of TGLP with hyoid bone resection. We performed a free flap transfer with a combination of laryngeal suspension and a novel reconstructive technique which kept the epiglottis from descending and enabled favorable swallowing function without aspiration and allowed a sufficiently large airway for breathing without an assistance of tracheal cannulation.

## CASE

A 41-year-old woman had a tongue cancer invading the hyoid bone (rT4aN2bM0). For this patient, TGLP and bilateral modified neck dissection were performed (Fig. 1).

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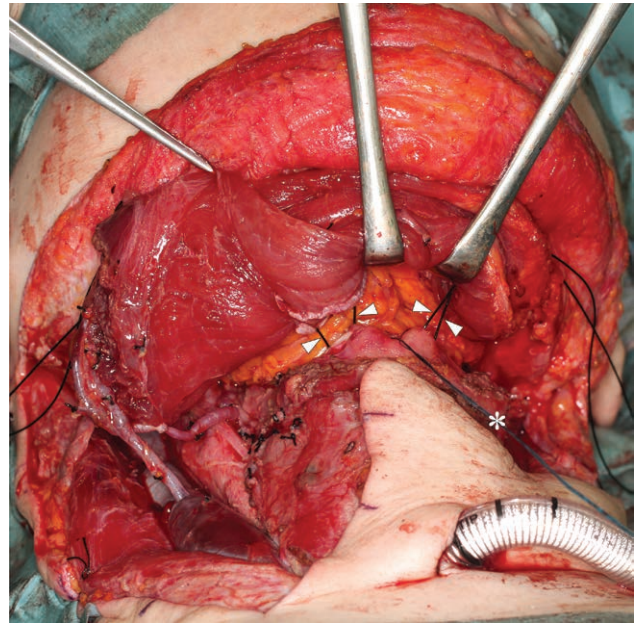


**Fig. 1.** The large tissue defect after total glossectomy plus hyoid bone resection instead of TGTL, and bilateral modified neck dissection. Note the deeply sunken larynx (\*).

The superior laryngeal nerve was identified and preserved to allow reflex closure of the vocal cords and aryepiglottic folds upon contact of the pharynx with food or liquid.

A neo tongue was created with a free rectus abdominis musculocutaneous flap. Because she was very thin to ensure the adequate flap volume, we devised a 2-skin-island method: the first island was used to reconstruct the mucosal defect of the oral floor, and the second was de-epithelialized and then applied to the first one to increase the flap volume.<sup>1</sup> While suturing the flap, we placed nonabsorbable monofilament thread between epiglottic cartilage and subdermal tissue of the flap to reconstruct an alternative ligament in place of the hyoepiglottic ligament (Fig. 2). After laryngeal suspension between the lower margin of the mandible and the thyroid cartilage, we tied the threads to suspend the drooping epiglottis and enlarged the air way under nasal endoscopic observation.

She recovered without complications. After video fluorography on seventh postoperative day that demonstrated neither leakage nor aspiration, she started oral intake. The tracheostomy was closed on 21st day postoperatively after confirming by endoscopy the adequate air way between epiglottis and arytenoid. She resumed pasty food without difficulty when she was discharged from the hospital on 31st postoperative day. She received chemoradiotherapy (CRT) because there was extracapsular invasion of metastatic lymph nodes in the neck. After CRT, she could drink water and eat regular diet without difficulty.



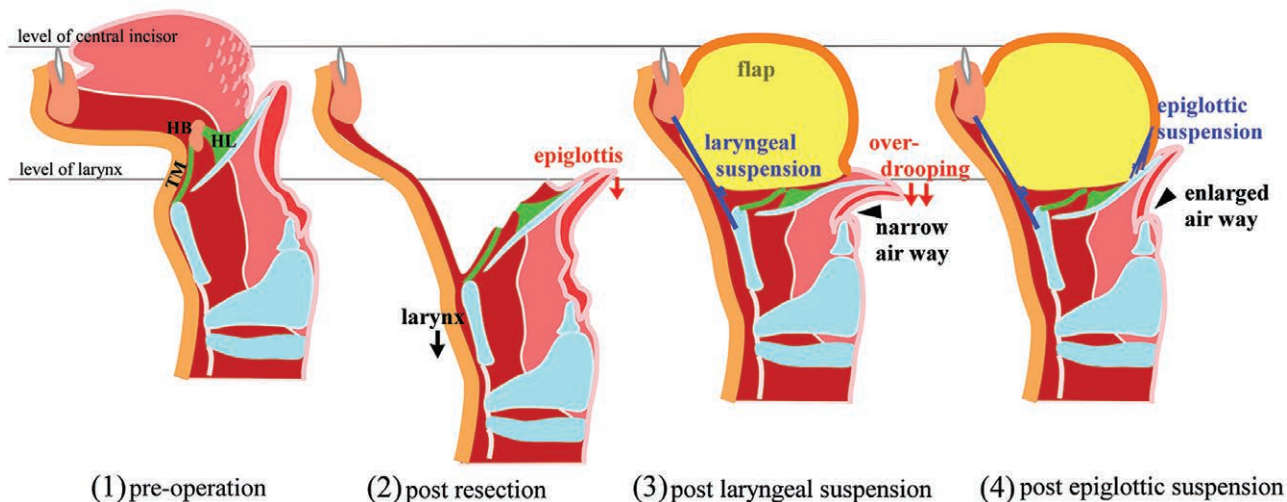
**Fig. 2.** The laryngeal suspension between lower margin of the mandible and thyroid cartilage was performed (▲). To reconstruct hyoepiglottic ligament, the untied suture with nonabsorbable monofilament thread between epiglottic cartilage and subdermal tissue of flap was performed (\*).

At 2-year-postoperative magnetic resonance imaging, the sagittal image showed the neo tongue to be large enough to contact the posterior and superior walls of the oropharynx to generate swallowing pressure during deglutition. The epiglottis was suspended in cranial direction against the neo tongue, which had bulged backward with reconstructed hyoepiglottic ligament, which enabled a wide air way (Fig. 3).



**Fig. 3.** A sagittal plane of magnetic resonance imaging at 2 years postoperatively. Descent of epiglottis is not observed, and the space between epiglottis and arytenoid is wide enough to breathe without tracheostomy (\*).

## The changes of elevating level of larynx and the dropping degree of epiglottis



**Fig. 4.** Schematic representation of transition of laryngoepiglottic angle. (1) State of preoperation. (2) Post total glossectomy with hyoid bone resection. The level of larynx and the angle of epiglottis sagged compared with preoperation state. (3) After laryngeal suspension. Although the level of larynx was elevated, the epiglottis has become near level because back ward exclusion of flap was increased at post laryngeal suspension. (4) Post epiglottic suspension. Instead of hyoepiglottic ligament, suspension of nonabsorbable thread between epiglottic cartilage and flap enlarged the air way by lifting the epiglottis. HB, hyoid bone; HL, hyoepiglottic ligament; TM, thyrohyoid membrane.

No aspiration was observed. There was no recurrence as of 2 years after operation. Her speech is intelligible when the other party shares the common information.

### DISCUSSION

Tongue cancers including those of the base of tongue invading the hyoid bone have been treated by TGTL. This extended resection has a severe impact on the patient's quality of life because of the postoperative aphonia and loss of deglutition function, which limits the oral intake to only liquid or pasty food. Therefore, the morbidity associated with the loss of larynx seems to make the indication of the TGTL controversial, and an alternative therapy such as CRT is preferred to avoid this surgery.

Recently, Heaton et al.<sup>2</sup> reported that base-of-tongue cancer patients with hyoid bone invasion treated with chemoradiation were found to have lower percentages in survival metrics compared with those without hyoid bone invasion. They concluded that the presence of hyoid bone invasion may be an indication for the intensification of radiation therapy or additional chemotherapy or may be considered a justification for primary surgery. In their series, they already administered about 70 Gy as maximum dose. Thus, from their results, there is no suitable therapy to preserve laryngeal function for patients with locally advanced tongue cancer (or tongue base cancer) with hyoid bone invasion.

We successfully performed a reconstruction surgery following TGLP with hyoid bone resection. Hyoid bone is 1 of the key structures in deglutition and breathing. The bone is the insertion site of suprahyoid muscles and thyrohyoid membrane that suspends the larynx. In a case with hyoid bone resection, the larynx descends significantly

(Fig. 4), which necessitates suspension of the larynx in reconstructing a neo tongue to preserve good swallowing function without aspiration. Laryngeal suspension without hyoid bone causes dislocation of epiglottis because the hyoepiglottic ligament have been removed from the hyoid bone, resulting in the narrowed air way. Thus, we performed a combination of laryngeal and epiglottic suspensions that enabled good swallowing and a wide air way. This novel technique could avoid TGTL and contribute remarkably to the patient's quality of life.

We conducted this challenging reconstruction with several key procedures: laryngeal suspension,<sup>3-5</sup> preserving the superior laryngeal nerve,<sup>6</sup> large flap volume and its shape,<sup>1,7,8</sup> and hyoepiglottic ligament reconstruction. We believe this technique would serve as an alternative laryngeal preservation treatment for locally advanced tongue or base-of-tongue cancers with hyoid bone invasion.

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