Horizontal Vertical Laryngectomy in Transglottic Laryngeal Cancer

Nermin Başerer*
Department of Otolaryngology, Istanbul University, Turkey

Abstract
Organ preservation surgery in the larynx cancer started with cordectomy technique in 1850s. Leading laryngologists have described alternative techniques to total laryngectomy (TL). But the extent of their indications, resection limits and reconstruction problems led to oncological and functional failure. Therefore, these techniques were forgotten until 1950s. Studies on the embryology, surgical anatomy of the larynx and biologic behavior of squamous cell cancer provided surgical return. In the organ preservation surgery vertical partial laryngectomy (VPL), horizontal supraglottic partial laryngectomy (SGPL) and their extended modifications were developed by the pioneer laryngologists. Adoption and application of any new technique usually take some time. However, the important problem is that when a technique becomes popular it is being used instead of other techniques. In this article, I would like to introduce our horizontal vertical laryngectomy (HVL) technique that we have been using successfully in unilateral selected T2-T3 transglottic cancer since 1977. In this 3/4 laryngectomy, SGPL and VPL are applied together. Reconstruction with restoration of glottis is performed with two stage Cevanşir’s laryngostoma technique. Early decanulation (from 4-5 days) and aspiration free swallowing (from 7-10 days) are the important advantages along with its oncological safety.

ABBREVIATIONS

INTRODUCTION
The laryngologist surgeon should have a broad spectrum from cordectomy to supracricoid subtotal partial laryngectomy (SCPL) of conservation laryngectomy techniques. All speech methods including near total laryngectomy (NTL) should be added to this spectrum. Key of successful oncological results regarding any technique is the appropriate indication and patient selection. Until 1970s, immobility of vocal cord T3 without discrimination of the cause of fixation was considered absolute contraindication for conservation surgery. In these years selected T3 concept was unanimously accepted. In selected T3, the fixation of vocal cord is due to invasion of thyro-arytenoid muscle in paraglottic space (PGS), crico-arytenoid joint and muscles should be intact. Since these years selected T3 has not been accepted a contraindication for conservation surgery [1-4]. This concept led to the development of new conservative techniques for advanced laryngeal cancer. Already since 1960s more extensive partial laryngectomy procedures have begun to be described. However, there were no large series of these techniques. The reports described rather the procedures without functional and oncologic long term outcomes. Comparative publications containing years of experiences of larynx cancer surgery centers are not sufficient. Glottic or supraglottic laryngeal cancer that crosses the ventricle is called transglottic carcinoma. These cancers invade laryngeal framework in high percentage (76%) and carry big risk of cervical metastases [5]. In the limited thyroid cartilage involvement SCPL techniques that remove the entire of thyroid cartilage became a very useful alternative to TL [6-8]. However, the framework of larynx usually is not being invaded if the unilateral transglottic cancer crosses only behind the posterior of ventricle [5]. Besides, glottic and transglottic cancers have unilateral developmental tendencies. Forth is reason, alternative techniques that do not require excessive tissue removal in the presence of appropriate indications in unilateral transglottic cancers have been described. In the literature there are various techniques for HVL [6-8]. However, these techniques have not been popularised, and almost forgotten. In Figure (1) [9], right transglottic carcinoma convenient for HVL technique is given. Our leading laryngologist Cevanşir described in 1965 a new VHL and HVL procedure by modifying very old laryngostoma technique of Glück-Sorensen [10] for reconstruction in unilateral glottic and transglottic cancer surgery [11-14]. In the Department of Ear Nose and Throat in the Medical Faculty of Istanbul University these techniques have been used successfully in the oncologic and especially functional aspect. For the oncologic safety of HVL technique, with appropriate indication of unilateral...
selected T2-T3 transglottic cancer is very important. In all the conservative surgery techniques of the larynx, invasion of the thyroid cartilage in the T4 stage, subglottic extension of the cancer to cricoid and/or crico-arytenoid joint involvement are absolute contraindications.

HVL technique is indicated in the selected T2-T3 unilateral transglottic carcinoma. In the cases of transglottic cancers that reach over the anterior commissure and/or thyroid cartilage involvement in T3 stage, HVL technique is contraindicated, in these cases SCPL is an alternative to TL. The presence of an intact hyoid region is essential for the application of cricohyoidopexy in SCPL. In the involvement of the hyoid region near total laryngectomy (NTL) technique can be successfully used [15-17]. NTL is a dynamic musculomucosal-cartilaginous shunt technique. It is described for speech in larynx or laryngopharyngeal cancer requiring TL or laryngo-pharyngectomy [18-20]. This partial laryngectomy cannot be accepted as conservative surgery because the patient must carry a permanent tracheostomy cannula. In all partial laryngectomy techniques including NTL subglottic extension should be contraindicated. Our experience has shown that subglottic extension with cricoid involvement and pharyngeal extension to the apex of pyriform sinus is a very important risk factor of recurrence for partial laryngectomy [21].

**MATERIAL AND METHODS**

Laryngologist surgeon should be able to recognize and apply all surgical techniques. There should be other alternatives at the limit of any technique. HVL technique described in this article is based on our experience of over 30 years in larynx cancer surgery.

The material of this study consists of 349 cases of HVL technique (including 30 HVLF) applied between 1977 and 2009. In this period, a total of 3128 cases treated with the different techniques are reported respectively according to the case numbers: 1307 total laryngectomy, 528 supraglottic laryngectomy, 349 HVL (including 30 HVLF), 326 cordectomy (laryngofissure, endoscopic), 189 NTL, NTLF, 185 laryngopharyngectomy, 93 FLL-FAL (L. Robert’s technique, Cevanşir’s technique, Tucher’s technique, Calaero-Teatini’s horizontal glossectomy technique), 79 SCPL, and 72 VHL.

**Indication of HVL technique**

HVL is indicated in unilateral T2-T3 (cord fixation with intact crico-arytenoid joint and muscles) transglottic cancer. The anterior commissure, contralateral true and false cord and both crico-arytenoid joint, cricoid region with thyroid cartilage should be intact.

**Contraindications for HVL**

Crico-arytenoid joint invasion, anterior commissure involvement or its suspicion, cricoid and/or thyroid cartilage invasion, subglottic extension of cancer more than 10 mm anteriorly, 5mm posteriorly, pharyngeal extension to the apex of pyriform sinus, massive invasion of PES.

**Contraindication outside the larynx**

Incurable neck metastases, insufficiency of vital capacity of the lung (FEV1<50%), poor health condition, physiologic and chronologic old age.

Preoperative and intraoperative careful assessments of the tumoral extension are essential for the strict indication of conservation surgery. Preoperative routine laryngoscopic examinations are video-laryngoscopy and micro-laryngoscopy for biopsy and mapping of tumor. For the clear evaluation of anterior commissure and subglottic area is performed with 0°, 70°, 120° telescopes, under general anesthesia without intubation at 100% oxygenation. MRI/CT, and in the suspicion of distant metastases PET/CT are imaging methods. In all cases of transglottic cancer according to the state of the neck, the elective or curative neck dissection is performed. Preoperative and postoperative view of the larynx in the HVL technique is presented in Figure (2).

Figure (1). Right transglottic carcinoma, convenient for HVL technique, treated with total laryngectomy [9]

Figure (2). (a) Preoperative view of T3 left transglottic cancer, (b) postoperative endoscopic view of HVL in this case.
ala with subperichondral dissection, in the necessity of frozen section, is performed in Figures (5a,b)). Specimen of the HVL procedure contains supraglottis (epiglottis with PES), and lesion side of glottis (false and true vocal cord, arytenoid with PGS and subglottis up to cricotracheal membrane) (Figures 6a,b). Ipsilateral intact thyroid ala is removed for facilitation of glottis reconstruction, thus strap muscles approach more easily to intact hemyglottis. Resection limits of HVL technique are illustrated in Figure (7). In the HVL technique reconstruction is performed with two staged laryngostoma. In the first stage of the reproduction of the resected hemyglottis is performed by the replacement of the prelaryngeal strap muscles instead of hemiglottic soft tissue and the flap skin instead of resected mucosa. The entire incised mucosa is stitched to the flap skin in order not to leave uncovered area. Absence of the bare endolaryngeal area is a key factor in preventing postoperative stenosis. Monofilament non-absorbable 0000 is preferable as the suture material (Figure 8). Prevention of bare endolaryngeal area by stitching mucosa and flap skin is a prerequisite for avoiding stenosis. This is a principal benefit of HVL with laryngostoma technique. The postoperative stenosis is the most common problem for other immediate reconstruction techniques of the larynx conservation surgery. Gauze pad tamponade for 2-3 days is applied to reshape the neo larynx lumen after the first reconstruction stage of HVL. This laryngostoma technique permits early decannulation (after 4-5 days), and swallowing without aspiration after 7-10 days (Figure 8). From 3rd week, laryngostoma is closed with the local anesthesia in two layers simple suture (Figure 9).

RESULTS AND DISCUSSION

Postoperative early rehabilitation is the major advantage of this technique. Laryngostoma permits early decannulation from 4-5 days, and the patients begin speaking with digital closure of laryngostoma, swallowing without aspiration is also regained after 7-10 days. All of the patient’s early decannulation and removal of the naso-gastric tube were provided. Likewise, there was no evidence of late stenosis. The purpose of designing this reconstruction technique with two stage laryngostoma has been to prevent stenosis as a consequence of secondary healing of the endolaryngeal bare field. Overall survival is 82%, disease free survival is 89%. Adjuvant radiotherapy was applied in principle in the presence of neck metastases.

The disadvantages of the HVL technique can be summarized as follows: HVL is actually a technique in which 3/4 laryngectomy is applied, and has more limited indications than the subtotal laryngectomy. It is a two-stage technique, and there is a need for repeated epilation of hair growth on the neck skin flap applied in the reconstruction of the hemiglottis. In the recent years, there has been a tendency to adopt subtotal laryngectomy instead of standard conservation surgery techniques, or non-surgical organ preservation with chemo radiotherapy. Nevertheless, in experienced centers of laryngeal cancer surgery TL decreased until 30% [18]. It is also possible that the organ preservation surgery is often the first choice in larynx cancer. In conservation surgery, anterior commissure involvement is a very important issue that needs to be considered. Anterior commissure techniques applied with partial thyroid cartilage resection are oncologically inadequate. Because remaining ossified thyroid cartilage may be the focus for recurrence. Our experiences led us to apply SCPL instead of FAL and FLL techniques in cancer reaching the anterior commissure and/or in limited T3 stage thyroid cartilage invasion.

In the larynx conservation surgery, some lesions can be treated with two different procedures. Controversies exist concerning which is the most appropriate technique for the patient. There are a wide range of conservation surgery techniques smallest...
to largest from cordectomy to subtotal laryngectomy. Laryngeal surgeon should be able to apply the most appropriate technique. Each technique has its own indications and limits of resection. Rehabilitation and quality of functions depend on the size of the resected endolaryngeal tissue and especially the adequate reconstruction technique. Cevanşir has modified the layngostoma technique described by Glück-Soerensen for reconstruction in VPL and HVL. Reconstruction with laryngostoma provided to be successful for hemiglottic replacement and glottic sphincter compensation. Supraglottic sphincter is preserved with intact hyoid bone and strap muscles, and particularly unchanged larynx position and antero-superior suspension in swallowing. In the selected T2-T3 transglottic cancers, advanced conservation techniques such as HVL (3/4) and SCPL (subtotal laryngectomy) can be successfully applied. In cases where the conservation surgery cannot be applied, new total laryngectomy can be an alternative to total laryngectomy. Dynamic shunt technique NTL, which is described for speech, may be an alternative to TL [18-20]. In the crico-hyoidopexy (SCPL) reconstruction is an end to end anastomosis; therefore noninvolved glottic part must be removed. Consequently, restoring laryngeal function, especially swallowing without aspiration, is a problem and requires postoperative rehabilitation training. Preservation of uninvolved portion of the larynx and adequate reconstruction is a key of functional success in organ preservation surgery. In our two stage technique, reconstruction is done with laryngostoma for restoration of glottis. As a result, early decannulation and especially postoperative period without aspiration is ensured. Consequently, as stated by Biller [22], the appropriately designed laryngostoma technique promises future in the functional satisfied outcomes.

CONCLUSION

Each technique can be sustained wits its successful results. Any procedure should be discussed in terms of functional outcomes and especially its oncologic safety. Replacement of resected tissue, particularly of hemiglottis, is the key to success for glottic competence, and for regaining swallowing function without aspiration. Supraglottic competence was regained by maintaining the position of the reconstructed larynx and ensuring antero-superior suspension in the swallow. It is always necessary to be open to all options for a higher surviving rate and better quality of life.

REFERENCES