



## Outcome of Supraglottic Horizontal Laryngectomy

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### Abstract

**Introduction:** Nowadays the main objective on treatment for laryngeal carcinomas is to achieve function preservation in addition to cancer cure. The Horizontal Supraglottic Laryngectomy shows adequate outcome in both.

**Objective:** Evaluate the outcome in a group of consecutive patients undergoing HSGL.

**Methods:** Between 1997 and 2016, 15 patients treated for supraglottic and base of the tongue Squamous Cell Carcinoma (SCC) with HSGL were retrospectively studied.

**Results:** There were 9 patients with T2 and 6 with T3 tumors. Among these, 3 patients had clinical negative neck disease. All patients underwent HSGL. Ten patients were submitted to bilateral radical neck dissection, where as 4 patients were submitted to ipsilateral radical and contra lateral neck dissection. Adjuvant radiotherapy was given to all patients. The follow up ranged from 12 to 60 months. Five-year disease-specific survival and loco regional control were 73.3%. All patients recovered a close to normal function after the treatment. A median of 16 days (7–60) was necessary to recover a close to normal diet. Decannulation took a median of 17 days (8–65). One patient died from aspiration. There was no permanent tracheostomy or total laryngectomy for functional purposes.

**Conclusion:** HSGL remains an adequate therapeutic alternative for supraglottic SCC. Good laryngeal function recovery is the rule.

**Keywords:** Laryngeal neoplasms; Laryngectomy; Carcinoma; Squamous cell; Radiotherapy; Adjuvant; Retrospective Studies

### Introduction

Laryngeal cancer is the second most common type of head and neck cancer worldwide [1]. The supraglottis represents the primary tumor site from 30% to 40% of laryngeal carcinoma cases, however, in certain geographic regions it tends to be the most frequently implicated subsite [2]. Due to its rich lymphatic drainage system and the relatively late appearance of symptoms, diagnosis is often made at a more advanced stage; hence, prognosis has traditionally been poorer for supraglottic carcinomas, compared to glottic lesions [1,3]. Nevertheless, the goal of treatment for early supraglottic carcinomas currently is to achieve function preservation in addition to cancer cure [4-6].

Justo Alonso first described the technique of Horizontal Supra Glottic Laryngectomy (HSGL) [7], in 1946. The original surgery allows the resection of supraglottic tumors that are placed anteriorly to the arythenoids without compromising the vocal folds. Modifications to the original technique included avoiding the temporary pharyngostoma [8] by performing primary closure without the skin graft [9] and preserving the hyoid bone, based on larynx embryology studies, which support the compartmentalization of the organ in independent parts [10]. The understanding of the anatomy of the supraglottic larynx and possible avenues of tumour extension, together with the observation that cancer in early stages tends to remain localized within the boundaries of the supraglottis, formed the basis of the HSGL [11].

It is a surgical technique that allows the appropriate resection of the tumor, reestablishing swallowing function and maintains breathing function through its natural way and a good phonation [12]. It is indicated for supraglottic tumors with mobile vocal folds and arythenoids, as well as tumors which extend to the aryepiglottic fold or to the cranial part of the vestibular folds through the posterior epiglottic wall and additionally to tumors compromising the base of the tongue through the anterior epiglottic wall. It can be recommended for tumors affecting the medial

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**Table 1:** Distribution of cases according to demographic and clinical variables.

Variable	Measurements	Freq (%) / Measurements
Age (years)	Variation	42 – 68
	Median	57
	Average	57,3
Gender	Men	12 (80)
	Women	3 (20)
Smoker	No	1 (6.7)
	Yes	14 (93.3)
Alcohol consumption	No	4 (26.7)
	Yes	11 (73.3)
Clinical condition	Dysphagia	11 (73.3)
	Sore in the throat sensation	9 (60)
	Dysphonia	10 (66.6)
	Odynophagia	6 (40)
	Cervical mass	2 (13.3)
Primary site	Supraglottis	11 (73.3)
	Base of the tongue	4 (26.7)
Primary tumor stage	T2	9 (60)
	T3	6 (40)
Clinical cervical staging	N0	3 (20)
	N1	1 (6.7)
	N2a	1 (6.7)
	N2b	5 (33.3)
	N2c	5 (33.3)
Pathological cervical staging	N0	1 (6.7)
	N1	1 (6.7)
	N2a	1 (6.7)
	N2b	2 (13.3)
	N2c	10 (66.6)
Neck dissection	Bilateral radical	10 (66.6)
	Unilateral radical + lateral	4 (26.8)
	Bilateral lateral	1 (6.7)
Arythenoid resection	No	11 (73.3)
	Yes	4 (26.7)

wall of the pyriform recess, one arythenoid, laryngeal ventricle and cranial wall of the vocal fold [13].

In recent years, partial laryngectomy by laser microsurgery and through robotic surgery have become a recognized alternative to transcervical approach for supraglottic laryngeal cancer treatment. The oncological results are comparable to those achieved by classic supraglottic laryngectomy; despite this, the endoscopic and robotic approaches offer several advantages, such as avoiding tracheotomies, reducing the incidence of pharyngocutaneous fistula, allowing a faster swallowing rehabilitation, preventing aspiration pneumonia and shortening hospitalization [14-17]. The objective of this article is to analyse the oncological results of a series of patients who underwent HSGL.

## Methods

Fifteen consecutive medical records of patients who underwent

HSGL at the Departments of Head and Neck Surgery of Irmandade da Santa Casa de Misericórdia de Santos and Hospital Ana Costa, Santos, from January, 1997 to December, 2015 were retrospectively reviewed. Demographic data, clinical condition, tumor site and staging, surgical procedure, complications, oncological results and the need for tracheotomy and feeding tube were evaluated. Besides technical indications shown above, we also consider pulmonary conditions, not age alone, one of the indications criteria for HSGL.

## Results

The 15 medical records were retrospectively reviewed. Age varied from 42 to 68 years (median, 57). Twelve patients were men; 14 were chronic smokers; and 11 were alcohol users. The main complaints were dysphagia and foreign body sensation in the throat. There were 11 supraglottic tumors and 4 of the base of the tongue, being 9 patients staged as T2 and 6 as T3. Three patients had clinical negative neck – Table 1.

All patients underwent bilateral neck dissection and its extension was based in the clinical staging and intraoperative findings. When evaluating clinical and pathological staging, we notice that there was a clinical under evaluation of the neck. In four cases there was the need for total resection of one arythenoid – Table 1. All patients underwent postoperative radiotherapy, whose dosis varied from 5,500 to 7,020 cGy (median, 7,020 cGy), due to pathological neck staging [14] or primary tumor margins [1].

The follow up varied from 12 to 60 months. Seven patients were alive and without evidence of disease; 2 patients died of a second primary tumor (esophagus and lung); 1 patient died of another cause (cardiopathy); 1 patient died due to aspiration; and 4 patients died of the disease, being 1 with a distant metastasis and 3 with locoregional recurrence. Thus, specific survival rate and its locoregional control were of 73.3% in five years.

All patients were decannulated, within 8 to 65 days (average, 17 days) and feeding tube was also removed in all cases, within 7 to 60 days (average, 16 days). In cases which the primary tumor compromised the base of the tongue, decannulation and feeding tube removal occurred later (after 4 weeks). No definitive tracheotomy or total laryngectomy for functional reasons were necessary. Unfortunately, 1 patient removed the feeding tube precociously by himself, despite advice from the medical staff and eventually died due to aspiration.

## Discussion

In the past two decades organ preservation has been a major target for clinical research in head and neck cancer. Since the first total laryngectomy was undertaken in 1873, efforts have been made to avoid removing the entire larynx. The objective of conservation laryngeal surgery was designed to be oncologically sound, however, also to be voice saving and to avoid morbidity [18]. Nowadays, the treatment of supraglottic carcinoma is still a controversial issue. Two accepted oncological treatments have been currently established, namely standard supraglottic laryngectomy and radiotherapy or both options may be utilized [19]. Early or moderately advanced supraglottic carcinoma may be treated successfully with either supraglottic laryngectomy or radiotherapy [20].

Supraglottic partial laryngectomies require the resection of natural protective barriers, such as epiglottis, aryepiglottic folds and false vocal folds; this could lead towards penetration and/or aspiration in either latent or clinical manifestation. Moreover, surgical

resection extended to the tongue base and/or arytenoid cartilage could expose patients to major risk of swallowing disturbances [21]. For infiltrative tumors staged as T2 and T3 or with extension to the vallecula or the base of the tongue with laryngeal mobility preserved, HSGL is recommended, since the patient's clinical status allows [22]. Contraindications include extension to the ventricles, anterior commissure, paraglottic spaces and thyroid cartilage [23].

After HSGL, patients have an increased risk for deglutition and aspiration, as they may not be able to put the tongue base over the laryngeal entrance during swallowing, especially if the surgical defect of the tongue base has increased. However, the duration until nasogastric tube removal had a highly significant association with the tongue base infiltration width. The radiologically determined infiltration height of the base of the tongue width and area are useful tools for surgical planning as they can be used to predict postoperative swallow function. Thereby, in a patient group with the tongue base infiltration area  $<6.20 \text{ cm}^2$ , 50% of the nasogastric tubes were removed after 4 days (95% CI 0–8.6 days). In patients with base of the tongue infiltration area  $>6.20 \text{ cm}^2$ , 50% of the nasogastric tubes were removed after 22 days (95% CI 6.8–37.2 days) [24].

Free mobility of the vocal folds is an essential element to conventional HSGL. Dysphonia comes from vocal fold submucosa infiltration, probably demanding a wider resection [25]. Invasion of preepiglottic space is a diagnostic problem. It should be suspected in cases of infiltration through the thyrohyoid membrane and can be shown by imaging methods and fine needle aspirative puncture with cytopathological evaluation [26].

The modern armamentarium of organ preservation treatment for supraglottic cancer includes Transoral  $\text{CO}_2$  Laser Microsurgery (TLM), open partial laryngectomy and radiotherapy with or without concomitant chemotherapy, in single or combined modality schemes. For accurately staged cases, the outcome of organ-preservation treatment modalities should be comparable with results achieved by total laryngectomy [6]. Moreover, important functions of the larynx, including respiration, safe deglutition and phonation, can be retained with organ-preservation treatment, with significant positive impact on the patient's quality of life [27].

TLM was introduced in laryngeal cancer surgery by Strong and Jacko [28] in 1972. Vaughan [29] first described supraglottic cancer excision with laser in 1978. Nowadays, TLM represents a minimally invasive surgical approach which allows tumors to be removed with limited sacrifice of healthy tissue and with retention of organ function. Functional results of TLM are generally considered superior to those obtained with open approaches and in many cases comparable to radiotherapy. Other advantages of TLM include low morbidity and mortality, avoidance of tracheotomy, shorter periods of hospitalization and lower costs. In addition, TLM has repeatedly demonstrated cure rates for supraglottic cancer comparable with those of open surgery or primary radiotherapy [6].

Supraglottic tumors may be removed through HSGL with a caudal margin which can be measured in millimeters and still be adequate. It is shown that recurrences happen almost invariably in the base of the tongue, not in its caudal margin [30]. However, frozen section control is recommended as an indicator for further resection, although frozen sections do not always correlate with permanent pathology [31]. Nevertheless, local control is excellent, varying from 70% to 100% [32].

Supraglottis contains a rich lymphatic net. Therefore, tumors developing in this area frequently produce neck metastasis – 48% in a series of 932 patients [33]. Due to the large variation and intercommunication of these lymphatic vessels, it is impossible to predict the exact location of the metastasis. It is now widely accepted that the clinically no neck should always be included in the primary treatment plan of supraglottic lesions [34–36]. Such a tactic is based on the knowledge that supraglottic cancer, even during early local stage, is characterized by a significant incidence of occult metastases in the neck [37,38]. Moreover, it has been previously shown that the survival of patients with supraglottic cancer is largely determined by this high rate of cervical node metastases and failure in the neck is generally the most likely cause of treatment failure [34,37]. The procedure is performed ipsilateral to the lesion in laterally localized tumors and bilaterally in the rest of the cases.

Five year survival rate is strictly attached to neck staging, as was verified in an analysis of 10,989 cases of 23 different oncological treatment centers [39]. N0 43%; N1 30%; N2 25% and N3 10%. Regional control of supraglottic tumors varies in the literature from 76 to 96% [32]. Neck recurrences are more common among N2 and N3 patients, especially when there is capsular rupture and extranodal spread [40]. On the other hand, rarely can salvage surgeries be successfully performed for recurrences. Cartilage infiltration influences local control ( $p=0.03$ ) and specific disease survival rates ( $p=0.06$ ), showing worst survival when neck lymph nodes are compromised ( $p=0.15$ ) and in extralaryngeal tumor extension cases ( $p=0.1$ ). The systematical neck bilateral lateral neck dissection (II, III and IV) is not only therapeutic, but also diagnostic.

Second primary tumor is a possible failure cause, happening mainly in lungs and being diagnosed in imaging methods as a routine [41]. In a retrospective 268 series of cases, multivariate analysis has shown that N3 neck staging ( $p=0.0003$ ) and locally T4 staged tumors ( $p=0.004$ ) are two independent predictive parameters of reduced specific disease free survival rate [11].

In a series of 41 patients who underwent HSGL, 87.8% did not show complications. There has been 3 cases of fistula. Functional results were good, with 100% of satisfactory phonation and swallowing after the second or third postoperative week [42]. Decannulation can be postponed due to arythenoid edema when patients are also treated with radiotherapy. Pulmonary function must be compatible with the procedure. Preoperative functional evaluation is highly recommended [43].

## Conclusion

The HSGL remains as a therapeutic option for the supraglottic carcinoma, allowing good reestablishment of laryngeal function.

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