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Retrospective Cohort Study Open Access

Results of the Conservative Surgery for Laryngeal Cancer

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Abstract

Introduction: The techniques of partial laryngectomy are based on the compartimentalization of the larynx and their aims are to provide the oncologically radical excision and to preserve the laryngeal function.

Objective: To evaluate the oncological results and the complications in patients submitted to these techniques. Methods: A consecutive series of 120 patients underwent partial laryngectomy from 1996 to 2016, according to the local clinical staging (T). The surgical margins were evaluated for frozen section examination during the surgery. The follow up varied from 4 to 120 months (median, 48.5). Adjuvant radiation therapy was indicated according to the lymph node staging (pN+). The following complications were evaluated: edema of the arytenoid, pharyngocutaneous or laryngocutaneous fistula, pneumonia, haemorrhage, dysphagia, wound infection, laryngeal stenosis and glottic insufficiency.

Results: The free of disease survival was: 84.6% for T1 tumors; 84.5% for T2; and 40% for T3. After the surgical salvage, the ultimate survival was: 97% for T1; 92.9% for T2; and 40% for T3. There was edema of the arytenoid in 7 patients, laryngocutaneous fistula in 4; wound infection in 3; pneumonia in 5; dysphagia in 1; and laryngeal stenosis in 6.

Conclusions: The global disease free survival rate after treatment was of 84,6% in T1, 84,5% in T2 and 40% in T3, with better results in earlier staged tumors. Complications incidence is acceptable and can be treated conservatively.

Keywords

Laryngectomy, Laryngeal neoplasms, Carcinoma, Squamous cell, Follow up studies, Neoplasms staging

Introduction

Laryngeal cancer shows unique treatment considerations due to the vital role of the larynx in human communication, deglutition and quality of life [1]. It varies in incidence throughout different geographical regions, being more common in Southern Europe (10.9-100,000), Eastern Europe (9.2-100,000) and South America (7.2-100,000) and more prevalent in men [2], corresponding to 2.5% of all tumors in men, representing the sixth most common malignancy in men in Brazil [3].

Since Billroth performed, in 1874, the first total laryngectomy [4], there has been great progress in laryngeal cancer surgery, mainly in its technique, culminating in the partial laryngectomies. There have also been developments in its approaches, with less invasive procedures such as transoral endoscopic surgery and, in the last decade, robotic surgery [5]. The conservative larynx surgery is based on the organ anatomical and embryological development. The supraglottis is originated by the III and IV gill arches, while the glottis derives from the IV and VI, constituting two separate unities [6]. Through the larynx compartimentalization, the horizontal and vertical laryngectomies were developed, with the purpose of,

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without compromising oncological parameters, allowing the functional preservation of the organ, without a definitive tracheotomy.

Although the main direction is shifting away from open surgery, there are still some indications for this approach [7]. The decision should not only be guided by the extent of the disease, its morphological factors such as subsite and staging or the surgeon's experience and preferences, but also by patient individual characteristics, such as comorbidities, oral exposure, treatment acceptance and socioeconomic factors [8].

The main objective of this article is to evaluate the oncological results and complications of a series of patients who underwent larynx cancer conservative surgery.

Methods

A series of 120 patients underwent partial laryngectomy from January, 1996 to July, 2014 at the Departments of Head and Neck Surgery, Hospital Ana Costa, Santos and Irmandade da Santa Casa da Misericórdia de Santos, Santos, Brazil, with the following indication protocol [2], according local staging (T):

- *in situ* carcinoma, glottic T1 and supraglottic T1: Transoral endoscopic resection (37 cases);
- Glottic T1b (vocal fold lesion, compromising anterior commissure but no more than 5 mm from the contralateral vocal fold): frontolateral laryngectomy (54 cases);
- Glottic T1b mainly compromising anterior commissure (not compromising more than 5 mm of each vocal fold): Anterior frontal laryngectomy (3 cases);
- Glottic and transglottic T2 and T3: 16 patients (4 underwent supracricoid laryngectomy with cricohyoid epiglottopexy (CHEP), being 4 T2s, 7 underwent hemilaryngectomy, being 3 T2s and 4 T3s, 2 underwent near total laryngectomy[X], being 2 T3s and 3 underwent frontolateral laryngectomy, being 3 T2s);
- Supraglottic T2 and T3: Supraglottic horizontal laryngectomy (10 patients, being 5 T2s and 5 T3s).
- Surgical margins were systematically removed from the patients' surgical bed after the specimens resection and evaluated through frozen section histopathological study during surgery. If needed margin enlargement was performed till the results confirmed negative margins.

Radical neck dissection was performed in case of clinical or radiological evident metastasis (N+), whereas lateral neck dissection (levels II-IV) was performed in clinical no patients with T3/T4 primary tumors and/or supraglottic spread.

All patients were affected by laryngeal squamous cell carcinoma, confirmed after histological exam and were followed up for a period varying from 4 to 120 months, with a median of 48.5 months. Three patients (1 T1b and 2 T2s) previously underwent radiotherapy being submitted to salvage surgical therapy. No patients on the Tis group underwent postoperative radiotherapy. Four patients on the T1a and T1b received postoperative radiotherapy (1 T1a and 3 T1b). Of the 24 patients classified as T2, 9 received postoperative radiotherapy. All 11 patients staged as T3 have shown neck metastases confirmed by histopathological exam after the neck dissection (pN+) and underwent radiotherapy.

The following complications were evaluated: arytenoid edema, pharyngocutaneous fistula, pneumonia, bleeding, dysphagia, site infection, larynx stenosis and glottic insufficiency.

The patients were evaluated monthly during 18 months and every 2 months after that for 6 months and every 3 months after that till 60 months. When showing any signs of recurrence, they underwent salvage therapy.

Results

Disease free survival rates are shown based on the initial surgical approach, followed or not by postoperative radiotherapy. The final result after salvage demonstrates the patients who have shown local disease recurrence during the follow up period and underwent a second surgical procedure. Globally the disease free survival rate after 2 years was: 84.6% in T1 patients; 84.5% in T2 patients; and 40% in T3 patients. After surgical salvage, final survival rate was: 97% for T1; 92.9% for T2; and 40% for T3 (Table 1). In the T3 stage group, out of the patients who underwent supraglottic horizontal laryngectomy, 2 presented regional recurrence in whom there was no salvage therapy possibility, with no local recurrence evidence till death.

The presence of arytenoid edema was verified in 7 patients, being 5 in the T3 stage group and 2 in the T1b stage group, 3 months after the surgical approach. All had undergone postoperative radiotherapy. Two patients who underwent frontolateral laryngectomy have shown infection in the surgical site and laryngeal fistula, after 1 week, which were conservatively managed, using antibiotics and local care. Both had been previously managed with radiotherapy, with failure. Four patients have shown a single pneumonia episode from 10 to 30 days in the postoperative period and 1 patient has shown multiple episodes and eventually died from chronic aspiration after 2 months. One patient who underwent supraglottic horizontal laryngectomy complained of early dysphagia with progressive improvement. Laryngeal stenosis leading to the impossibility of the removal of the tracheoto-

Table 1: Oncological results after partial laryngectomy (n = 120).

Surgery	Tumor site	Primary tumor stage	n	Disease free survival rate	Final survival rate after salvage (if necessary)
Endoscopic	Glottis	Tis/T1a	36	83.3%	94.4%
	Supraglottis	T1	1	100%	100%
Frontolateral	Glottis	T1b	45	88.8%	93.3%
		T2	12	91.6%	91.6%
Anterior frontal		T1b	3	66.6%	100%
Hemilaryngectomy	Glottis	T2	3	66.6%	100%
		T3	4	50%	50%
Near total	Transglottic	T3	2	50%	50%
Supraglottic horizontal	Supraglottic	T2	5	80%	80%
Supracricoid		T3	5	20%	20%
	Glottic	T2	4	100%	100%

Tis: carcinoma *in situ*.

Table 2: Complications after partial laryngectomy (n = 120).

Complications	Cordectomy	FLL	HL	SGHL	NTL SCPL
Arytenoid edema	0	2	2	1	2 0
Fistula	0	2	2	0	0 0
Wound infection	1	2	0	0	0 0
Pneumonia	1	2	1	1	0 0
Bleeding	0	0	0	0	0 0
Dysfagia	0	0	0	1	0 0
Larynx stenosis	0	3	1	0	2 0
Glottic insuficiency	0	0	0	0	0 0

FLL: Frontolateral laryngectomy; HL: Hemilaryngectomy; SGHL: Supraglottic horizontal laryngectomy; NTL: Near total laryngectomy; SCPL: Supracricoid laryngectomy.

my was observed in 2 patients who underwent near total laryngectomy [9] as was expected and in 3 patients submitted to frontolateral laryngectomy (Table 2).

Discussion

Despite being an efficient oncological technique, total laryngectomy means definitive tracheotomy and eliminates laryngeal voice. This has motivated the development of partial and less invasive procedures in the last century, culminating with transoral laser microsurgery and robotic surgery.

Intraoperatory frozen section margins were evaluated as a routine, in order to accomplish negative resection margins. Nevertheless, this does not guarantee the cure [10]. During the postoperative period, all patients were followed up during 18 months through videolaryngoscopy monthly, trying to detect early signs of possible local recurrence. Worsening of vocal pattern, dyspnea, local pain and otalgy are symptoms that are always important when reevaluating this patient.

In recent years, transoral laser microsurgery has gained wide approval in the scientific community for the treatment of early laryngeal cancer, with several studies underlying its validity also in management of selected intermediate-advanced lesions [11]. In tumors classified as carcinoma *in situ* and vocal fold T1a, it is strongly recommend the endoscopic approach. We have performed such procedure in 36 patients, employing diode contact laser or CO_2 laser.

On the other hand, exclusive radiotherapy is also offered as an option to the patients. Surgical and non surgical treatment modalities have both associated advantages and disadvantages. Surgery offers the benefits of immediate treatment, the ability to analyze tumor histopathology, as well as increased salvage options in case of recurrence. Conversely, (chemo) radiotherapy does not require general anesthesia, is not dependent on accessible tumor location and adequate surgical exposure to the glottis [1,12]. A wide consensus shows that oncological and functional results of glottic and supraglottic T1 and T2 tumors treated by transoral microsurgery or radiotherapy are equivalent, reaching 80% to 95% of disease local control [13-17].

In our protocol, glottic lesions staged as T1b (with anterior commissure invasion and, eventually of a segment of the other vocal fold) are not treated endoscopically. Despite the anterior commissure tendon, where the vocal folds meet, the thyroid cartilage internal perichondrium and the epiglottic-thyroid ligament being considered an area of resistance against tumoral spread, the cranial and caudal sites are considered areas more susceptible to tumor recurrence [18]. In more than a third of local recurrence cases after endoscopic laser resection of early glottic tumor, the anterior commissure is affected [19].

After the successful resection of a small glottic lesion after thyrotomy by Sands [20] (1865), techniques performed through laryngofissure became popular. Anterior frontal laryngectomy was first described in 1940 [21] and frontolateral laryngectomy in 1956 [22], showing that the removal of the anterior thyroid cartilage seg-

ment provided and additional security margin in lesions close to or crossing the anterior commissure.

In our 3 cases of frontal anterior laryngectomy, there was one local recurrence with total laryngectomy performed as salvage therapy. In our 57 patients who underwent frontolateral laryngectomy, 90.2% were disease free after one intervention and 92.4% after salvage in recurrence cases. These results match other articles for this type of vertical laryngectomy, which vary from 74% to 95% [23-26].

Limitations for performing hemilaryngectomy include spread to posterior commissure, aryepiglottic fold cranial, thyroid cartilage and arytenoid invasion [27]. We believe that vocal fold paralysis (T3 tumor) is not an absolute contraindication for the procedure which classically removes the arytenoid vocal process. In two of our cases, an arytenoid was removed. In none, however, the cricoarytenoid joint was unaffected, implicating the paralysis to thyroarytenoid muscle infiltration. The procedure's first description was for T3 tumors in 1975 [28] and the local control rate reaches 85% [29].

We had one case of vegetative tumor in the epiglottis in which we performed endoscopic epiglottectomy. Such approach for early tumors of the supraglottis allows avoiding a tracheotomy, however, as a disadvantage, needs second intention healing [30]. The horizontal partial laryngectomies were first described in 1957 [31]. It has been, and still is, widely used to resect tumors arising from the supraglottic structures of the larynx [32]. In all our 10 supraglottic horizontal laryngectomies, the classic procedure was performed, without the need to extend surgery to the base of the tongue or pyriform sinus. Tumors located in this area demand special care when addressing the neck, where the control rate is smaller than the primary site due to high incidence of lymph node metastasis.

We had 4 cases of supracricoid partial laryngectomy, procedure initially proposed in 1959 [33] becoming popular recently [34]. It allows great oncological and functional results and the possibility to avoid the definitive tracheostoma because it grants "en bloc" removal of the entire thyroid cartilage and its surrounding soft tissue structures with wide surgical margins and the recovery of the 3 main functions of the larynx: voice, breathing and swallowing [13]. The technique allows two standardized reconstructions: the cricohyoidoepiglottopexy and cricohyoidopexy, depending on the remaining structures. Recent articles also show that given the most extensive surgery applied for CHP, functional outcomes were better in patients with CHEP. Additionally, unilateral resection of an arytenoid had a negative effect on swallowing function [35].

Temporary tracheotomy is a routine procedure recommended after open partial laryngectomies. Besides, when postoperative radiotherapy is indicated, patients may develop several endolaryngeal edema which can compromise respiratory pattern. In local recurrence cases, radiotherapy as salvage therapy is of low value [36], being surgical treatment (radical laryngectomy or, in selected cases, another partial laryngectomy) the best option. Speech therapy for vocal and swallowing rehabilitation is fundamental for good functional outcomes in these patients.

We did not had, so far, any experience with robotic surgery. It is known that this technique improves visualization of the operative field due to its three-dimensional image and enhances the surgeon's dexterity due to bimanual control of the robotic arms which can modulate tremor. The flexible CO_2 laser also provides fine incisions with excellent hemostasis and minimal peripheral tissue injury [12]. It also allows early feeding without the need of a tube and also eliminates the need for tracheotomy in many cases, as the rates of aspiration, fistulas or other complications are significantly reduced when compared with conventional surgery and with oncologic and functional results quite similar to transoral microsurgery [5].

Conclusion

The global disease free survival rate was of 84.6% in T1, 84.5% in T2 and 40% in T3, showing better results in earlier stages. Complications incidence is acceptable and can be treated conservatively with a great success rate.

Institutions

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