

Clinical Advances in Head & Neck Surgery

Chapter 1

Functional outcome of supracricoid laryngectomy with cricohyoidoepiglottopexy in the elderly

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Abstract

Background: Supracricoid laryngectomies (SL) were introduced to radically treat laryngeal tumors while respecting laryngeal function. Despite SL with cricohyoidoepiglottopexy (CHEP) allows good functional results in terms of swallowing, breathing function and voice quality, older age has been traditionally considered a contraindication to SL. Aim of this study is to investigate the functional outcomes of SL with CHEP among elderly patients (age older than 70 years) and compare them with those obtained in younger subjects submitted to CHEP for laryngeal cancer.

Materials and methods: Thirty-eight (36M, 2F; mean age: 61.9 years, age range: 51-79 years) patients were submitted to SL with CHEP for laryngeal carcinoma between January 2012 and December 2015. Preoperative endoscopic and imaging assessment was carried out. The surgical treatment performed was CHEP with preservation of both arytenoids (CHEP+AA) in 10 (68.4%) cases and with preservation of one arytenoid (CHEP+A) in 28 (31.6%) patients. Basing on their age, our patients were divided into 2 groups: age < 70 years (group 1) and age > 70 years (group 2). Among the 26 subjects of group 1, 6 were submitted to CHEP+AA, while 20 to CHEP+A; among the 12 patients of group 2, 4 were treated with CHEP+AA, while 8 with CHEP+A. Functional assessment was performed as follows: (a) Swallowing assessment was carried out considering the days required to resume an oral diet

and number of swallowing acts necessary to clear the pharynx out one month after surgery; (b) Phonation was assessed by GIRBAS Scale; (c) Breathing function was assessed by measuring the time necessary to obtain tracheostomy-occluded satisfactory respiratory function (decannulation) and complete tracheostomy closure.

Results: No significant local complication was notice postoperatively. All patients were decannulated a part from 1 patient of group 1 who had undergone CHEP+A. The average time to decannulation in the other 37 patients was 31.02 ± 4.12 days after surgery. The nasogastric tube remained in place for an average of 16.83 ± 2.43 days. One patient of group 2 was submitted to total laryngectomy because of recurrent aspiration pneumonia. All patients could clear their pharynx out of any food remnant with up to 3 swallowing acts one month postoperatively. GIRBAS total score ranged from 1.1 to 3.1 (mean: 1.9). Group 1 patients showed better ($p=0.02$) pharyngeal clear out and swallowing recovery with respect to group 2 subjects, even though no statistically significant difference was noticed in terms of days required for feeding tube removal ($p=0.068$). As to phonation, group 1 subjects showed better voice quality on GIRBAS Scale ($p<0.001$) in comparison to group 2. Group 1 subjects also showed a shorter decannulation time ($p<0.001$) and time required for tracheostomy complete closure ($p=0.046$) with respect to group 2 patients.

Discussion: Supracricoid laryngectomy with CHEP is an oncologically safe and functionally efficacious procedure also in the elderly and should be considered as a possible alternative for the treatment of laryngeal cancer in older adults as well. Patients selection is of the utmost importance for the functional success of such procedure.

Keywords: supracricoid laryngectomy; cricohyoidoepiglottopexy; elderly; functional outcome; quality of life; laryngeal cancer.

1. Introduction

Supracricoid laryngectomies (SL) were introduced to radically treat laryngeal tumors (LT) while respecting laryngeal function [1-8]. The basic principle of these techniques is to spare at least one cricoarytenoid unit, necessary for the functional recovery of the residual larynx. The first attempts to preserve laryngeal function after treatment of LT were described in 1896 by Foderl [2], who proposed a laryngectomy that spared the epiglottis and the arytenoids followed by a reconstruction of the upper respiratory tract by suturing the epiglottis and the arytenoids to the first tracheal ring. In 1954, Hoffmann Saguez introduced the term “subtotal or re-constructive laryngectomy” [3]. In 1959, Majer and Rieder proposed a similar technique, which spared the cricoid cartilage [4]. In 1971, Labayle and Bismuth [7] proposed the technique of cricohyoidopexy, while in 1974, Piquet, Desaulty and Decroix [8] described the cricohyoidoepiglottopexy (CHEP). SL with CHEP have been widely popular over the last decades, especially in Europe, thanks to their good oncological and functional results in terms of swallowing, tracheostomy-occluded breathing function and voice quality. However, older age has been traditionally considered a contraindication to SL, since aging is related to the decline of many physiological and cognitive functions, which may compromise swallowing, breath-

ing and phonation recovery after surgery. Nowadays, this common perception is changing: the progresses in science, technology and lifestyle are allowing people to live longer and better than those who lived even few decades ago. Therefore, excluding elderly patients without significant comorbidities from standard therapeutic options is becoming less justifiable.

In this paper, we report the functional outcomes of SL among elderly patients (age older than 70 years) and compare them with those obtained in younger subjects submitted to CHEP for laryngeal cancer.

2. Patients and Methods

We retrospectively analyzed 38 (36M, 2F) patients submitted to CHEP for laryngeal carcinoma between January 2012 and December 2015 at the Department of Otolaryngology-Head and Neck Surgery of “Carlo Poma” Civil Hospital, Italy. Patients’ mean age was 61.9 years (age range 51-79 years). For 30 patients, SL was the primary treatment, while 8 patients (21%) had been treated previously for laryngeal carcinoma: 2 (5.2%) with cordectomy and 6 (15.8%) with radiotherapy. Tumor staging was carried out according to UICC 7th Edition [9]. All patients were M0.

2.1. Preoperative assessment

All patients were submitted to flexible videolaryngoscopy, laryngoscopy with biopsy under general anesthesia, laryngeal/neck computed tomography (CT) or magnetic resonance imaging (MRI), thorax-CT and nutritional evaluation, performed by clinical dieticians, who scheduled postoperative enteral nutrition with a nasogastric feeding tube (12 F diameter).

Indications for CHEP were: (a) T1b involving both true vocal cords or one vocal cord with radiological suspicion of thyroid cartilage invasion of the anterior commissure; (b) Glottic T2 with extension to the false vocal fold, to the base of the epiglottis or anterior surface of the arytenoid and/or with impairment of cordal mobility; (c) Selected cases of T3 glottic carcinoma, without invasion of paraglottic space.

Contraindications for CHEP were: supraglottic/pre-epiglottic space extension; posterior commissure involvement; extensive posterior invasion of paraglottic space; arytenoid fixation (cordal fixation without arytenoid mobility impairment was not considered a contraindication); cricoid/subglottis (10mm from free vocal cord edge); lateral and posterior extralaryngeal spread; T4 carcinomas; low performance status (Karnofsky’s index < 80%); severe heart or lung disease; uncooperative patients [10,11]. All patients signed a written informed consent.

2.2. Surgery

The surgical treatment performed was CHEP with preservation of both arytenoids

(CHEP+AA) in 10 (68.4%) cases and with preservation of one arytenoid (CHEP+A) in 28 (31.6%) patients. All patients received perioperative antibiotic prophylaxis with ampicillin/sulbactam 3g twice/day. Attitudes to the treatment of the cN0 neck have varied basing on the location and extension of the primary tumor. A total of 18 patients (47.3%) underwent some type of neck dissection (ND): ipsilateral to the tumor in 16 (42.1%) patients and bilateral in 2 (5.2%) cases. Postoperative histopathological examination showed squamous cell carcinoma in all cases. Overall nodal metastases were detected in 2 out of the 18 patients submitted ND (11.1%); in both patients, metastases were unilateral. All patients were R0. Adjuvant radiotherapy was planned when the pathology report showed two or more positive lymph nodes or extracapsular spread. One patient was submitted to postoperative radiotherapy for nodal involvement. The total dose ranged from 45 to 60 Gy.

2.3. Postoperative functional assessment

On the 7th-8th postoperative day, patients started an oral diet under logopedic control. The tracheostomy tube was removed when patients were able to breathe and feed autonomously. Functional assessment was performed as follows: (a) Swallowing assessment was carried out with colored water jelly (percent of inhalation and number of swallowing acts necessary to clear the pharynx out 30 days after surgery); the nasogastric feeding tube was removed when satisfactory (at least 70%) swallowing of both solids and liquids was achieved [12]; (b) Phonation was assessed by GIRBAS Scale[13]; (c) Breathing function was assessed by measuring the time necessary to obtain tracheostomy-occluded satisfactory respiratory function (decanulation) and complete tracheostomy closure. Complete tracheostomy closure was obtained by spontaneous healing after placement of compressive gauze on the stoma.

Basing on their age, our patients were divided into 2 groups: age<70 years (group 1) and age >70 years (group 2). Among the 26 subjects of group 1, 6 were submitted to CHEP+AA, while 20 to CHEP+A; among the 12 patients of group 2, 4 were treated with CHEP+AA, while 8 with CHEP+A (Table 1). The differences of functional results among the different groups were analyzed to assess the impact of age and possible surgical variables (one/two arytenoids preservation) on SL functional results.

2.4. Statistics

Statistical analyses were performed using the Statistical Package for Social Sciences Software (SPSS 10.0 for Windows; SPSS, Inc., Chicago, IL) and STATA 7 (Stata Corp., College Station, TX). Parametric (Student's t-test) test and non-parametric (Mann-Whitney U test for nonpaired data) tests were used to compare different values. The criteria for statistical significance was set at a value of p 0.05 (two tailed).

3. Results

3.1. Oncological results

No significant local complication (i.e. surgical field infection, neck bleeding, etc) was noticed postoperatively. During the follow-up (mean follow-up 18 months; range: 8-49 months), 4 (10.7%) cases (pT3N0) of local recurrence were noticed in patients previously submitted to radiotherapy, who were therefore treated with “salvage” total laryngectomy between 8 and 23 months after CHEP. No recurrence in the neck has been noticed so far.

3.2. Functional results

Functional results in terms of swallowing (days required to attain a satisfactory swallowing function to remove the nasogastric feeding tube and number of swallowing acts necessary to clear the pharynx out one month after surgery), phonation, and breathing (days required to allow decannulation and complete tracheostomy closure) are reported in table 1. As to breathing, all patients were decannulated a part from 1 patient of group 1 who had undergone CHEP+A because of a recurrence after radiotherapy. The average time to decannulation in the other 37 patients was 31.02 ± 4.12 days after surgery. The nasogastric tube remained in place for an average of 16.83 ± 2.43 days. Two patients (one of group 1 and the other of group 2) submitted to CHEP+A developed postoperative aspiration pneumonia, which resolved with temporary suspension of oral feeding in the subject of group 1; the patient of group 2 showed recurrent episodes of pneumonia and was submitted to total laryngectomy with tracheoesophageal puncture 6 months after CHEP. By the end of the first postoperative month, all patients could clear their pharynx out of any food remnant with up to 3 swallowing acts. GIRBAS total score ranged from 1.1 to 3.1 (mean: 1.9).

When considering the functional results in relation to age, several differences can be noticed. As to swallowing, group 1 patients showed better ($p=0.02$) pharyngeal clear out and swallowing recovery with respect to group 2 subjects (table 1), even though no statistically significant difference was noticed in terms of days required for feeding tube removal ($p=0.068$). As to phonation, group 1 subjects showed better voice quality on GIRBAS Scale ($p<0.001$) in comparison to group 2 patients. Group 1 subjects also showed a shorter decannulation time ($p<0.001$) and time required for tracheostomy complete closure ($p=0.046$) with respect to group 2 patients.

When considering the functional results related to preservation of one or both arytenoids (CHEP+A vs CHEP+AA), better performances were noticed in AA groups with respect to the corresponding A groups. In particular, CHEP+AA group showed better ($p=0.038$) pharyngeal clear out (table 1), superior voice quality on GIRBAS Scale ($p<0.001$), and shorter decannulation time ($p=0.007$) with respect to CHEP+A patients in group 1. No significant difference was noticed between the two groups in terms of days required for feeding tube removal and complete tracheostomy closure. As to group 2 subgroups, CHEP+AA patients showed bet-

ter voice quality ($p < 0.001$) with respect to CHEP+A subjects. When comparing AA patients (group 1 plus group 2) with A groups (group 1 plus group 2), shorter decannulation time was noticed in AA subjects ($p = 0.036$). No other significant difference was noticed between the two subgroups for the other items.

Finally, when considering the four subgroups separately, CHEP+AA of group 1 showed statistically significant better performances in terms of swallowing, voice quality, and decannulation time with respect to the other 3 subgroups (CHEP+A of group 1, and CHEP+AA or A of group 2).

4. Discussion

Supracricoid partial laryngectomies with CHEP for glottic squamous cell carcinomas were introduced by Majer and Rieder [4], and Piquet et al. [8] in the 1970s [1]. This new surgical procedure was developed to achieve the same local control as total laryngectomy, but avoiding a permanent tracheostomy by creation of a neolarynx thanks to the preservation of at least one functioning cricoarytenoid unit. Our results confirm the oncologic reliability of SL already reported in the literature [1-4,7, 8,10-21], also in treatment of selected locally advanced carcinomas of the larynx. Older age has been traditionally considered a contraindication to SL, since aging is related to the decline of many physiological and cognitive functions, which may compromise swallowing, breathing and phonation recovery after surgery. However, the progresses in life length and quality in the last decades has led to reconsidering older age itself as a single contraindication to laryngeal conservative surgery. From a functional viewpoint, our results confirm the efficacy of SL in creating a functioning neolarynx allowing swallowing, voice generation, and tracheostomy-occluded breathing [1-4,7,8,10-21] in both groups of patients. Despite the good functional outcome offered by SL in general, our experience shows worse functional performances in older patients with respect to younger subjects. Despite such difference, most older patients were decannulated and recovered an appropriate swallowing function, thus obtaining disease resolution with SL advantages in terms of life quality with respect to total laryngectomy. Even though the decannulation and feeding tube removal times were longer than among younger patients, our results confirm the opportunity to consider CHEP as an efficacious treatment of glottic cancer in elderly subjects. Patients' selection is of the utmost importance, especially in the elderly, to choose those subjects who will have the greatest benefits and recover after SL. From this viewpoint, patient's performance status, comorbidities and collaboration (rather than age itself) should be considered when selecting patients candidate to SL [20,21].

In addition, our experience shows the functional importance of serviceable cricoarytenoid units in SL [19-21]. In fact CHEP+AA subjects showed better pharyngeal clear out and voice quality with respect to CHEP+A patients. These results may be due to a more efficient sphinc-

ter function offered by a two-arytenoid mobile system with respect to a single-arytenoid neolarynx. The surgical technical details allowing the preservation of a functioning cricoarytenoid unit are represented by preservation of the arytenoid (adequately connected to the cricoid by the cricoarytenoid articulation), the inferior laryngeal nerve (enabling arytenoid motion), and the interior branch of the superior laryngeal nerve (allowing sensitivity of the arytenoid and pyriform sinus mucosa) [6].

According to our experience, respecting the cornerstones of CHEP surgical technique is fundamental in order to optimize the functional performances of the neolarynx in the elderly (as well as in younger patients): (1) Preservation of the internal branch of the superior laryngeal nerve; (2) Preservation of the suprahyoid portion of the epiglottis when oncologically possible, in order to attain better functional results; (3) Sectioning (rather than dissecting) with scissors the thyroid inferior cornu at its base to avoid any injury to the recurrent laryngeal nerve, located underneath the cricothyroid articulation; (4) Attention should be paid when sectioning the vocal process or part of the disease-free arytenoid to avoid trauma to the cricoarytenoid joint and avoid arytenoid luxation; (5) Suturing a pyriform sinus mucosal flap over bare cricoid surface when an arytenoid has been removed for oncologic reasons; (6) Pexy is performed with three separate 0 vicryl sutures passing around the cricoid cartilage and hyoid bone; special care must be taken to trespass the residual epiglottis with the median suture vertically in a submucosal plane to avoid epiglottis posterior dislocations (potentially obstructing the neolaryngeal lumen). The central suture should also include an abundant (at least 3 cm) portion of tongue base, while the lateral pexy should be performed with a minimum amount of tissue to avoid trapping the lingual artery and hypoglossal nerve; (7) During ND, it is mandatory to preserve the hypoglossal nerve to enable tongue movement and swallowing recovery.

5. Conclusion

Supracricoid laryngectomy with CHEP is an oncologically safe and functionally efficacious procedure also in the elderly. It should be considered as a possible alternative for the treatment of laryngeal cancer also in older adults, as it allows organ preservation, thus improving patient's life quality. Patients selection is of the utmost importance for the functional success of such procedure. Additional studies with more extended samples may be useful to further optimize SL functional outcome.

6. Acknowledgements

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Table 1: Functional results in patients submitted to supracricoid laryngectomies (mean \pm standard deviation) in patients of group 1 (age <70 years) and group 2 (age \geq 70 years). CHEP = cricohyoidoepiglottopexy; NGT = nasogastric feeding tube; * = calculated on 19 patients because 1 subject was not decannulated (see text for details); § = calculated on 11 patients because 1 subject was submitted to total laryngectomy (see text for details).

		Group 1 (n=26)		Group 2 (n=12)	
		AA (n=6)	A (n=20)	AA (n=4)	A (n=8)
Swallowing	NGT removal (days)	14.23 (\pm 1.47)	15.65 (\pm 2.81)	18.59 (\pm 0.59)	21.45 [§] (\pm 1.36)
	Number of acts to clear the pharynx	1.65 (\pm 0.52)	2.38 (\pm 0.72)	2.67 (\pm 0.66)	2.95 [§] (\pm 0.51)
Phonation	GIRBAS Score	1.22 (\pm 0.07)	1.56 (\pm 0.16)	2.60 (\pm 0.66)	2.92 (\pm 0.23)
Breathing	Decannulation (days)	25.61 (\pm 1.37)	29.62* (\pm 3.18)	33.53 (\pm 0.59)	37.17 (\pm 3.52)
	Tracheostomy closure (days)	59.45 (\pm 18.12)	73.82* (\pm 28.47)	81.34 (\pm 13.15)	103.52 (\pm 31.32)

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