LETTER TO THE EDITOR

FUNCTIONAL OUTCOMES AFTER SUPRACRICOID MODIFIED PARTIAL LARYNGECTOMY

C. SARANITI[1], R. SPECIALE[1], M. SANTANGELO[1], N. MASSARO[1], A. MANIACI[2], S. GALLINA[1], A. SERRA[3] and S. COCUZZA[2]

[1]ENT Department of the University of Palermo, Italy; [2]ENT Department of the University of Catania, Italy; [3]ENT Department, G.B. Morgagni Foundation, Catania, Italy

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To the Editor,

Open partial horizontal laryngectomy (OPHL) was developed in the 1950s by Hoffman-Saguez (1) and subsequently described by Mayer and Rieder (2) in 1959 (OPHL IIa). The resection performed by Hoffman-Saguez (1), Tucker's frontal laryngectomy (3) and Guerrier's (4) OPHL IIa are similar in terms of resected structures, but they differ in terms of reconstructive techniques: Hoffman (1) reconstructs the cartilaginous structure by preserving external perichondrium of thyroid cartilage while Tucker (3) proposes a closure with mobilized epiglottis displaced inferiorly into the laryngeal defect, and Guerrier (4) performs a pexy between preserved laryngeal structures (cricoid-epiglottis-hyoid; cricoid-hyoid). In 1987, Guerrier (4) described his technique as a combination of Tucker's technique (3), i.e. a frontal resection, and an OPHL IIa reconstruction. Therefore, the maximum extent of resection does not include the posterolateral portion of thyroid cartilage alae and does not require the detachment of pyriform sinuses. OPHL is a standard surgical procedure consisting of a resection followed by reconnection of preserved structures: cricoid-hyoid-epiglottis (CHEP) in OPHL IIa, or cricoid-hyoid (CHP) in OPHL IIb. The key objective is the preservation of neoglottic functions, such as laryngeal functions in terms of voice quality, swallowing and breathing. Moreover, no permanent tracheostomy is required after performing an OPHL. The crucial point in this surgical procedure is the preservation of no less than one functional and mobile crico-arytenoid unit, including arytenoid cartilage, cricoid lamina, posterior and lateral cricoarytenoid muscles, superior and recurrent laryngeal nerves, allowing the preservation of the pharyngolaryngeal sensitivity, protecting the airways and maintaining physiologic coordination during deglutition (5).

The purpose of this study was therefore to assess the neoglottic capabilities retrospectively, in relation to voice quality, swallowing and breathing, after having modified OPHL type II in relation to the Guerrier technique, in a group of selected T2 and T3 patients.

MATERIALS AND METHODS

A multicenter prospective randomized study was conducted on 59 patients who had previously untreated T2 and T3, glottic and transglottic squamous cell carcinoma, and whohad been treated with modified OPHL IIa or OPHL IIb (Guerrier's technique) in the University Departments of ENT of Palermo and Catania (Sicily-Italy) from December 2010 to December 2016 (Protocol of approval

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Corresponding Author:
Dr. Antonino Maniaci,
ENT Department of University of Catania,
95100, Via Santa Sofia, Catania, Italy
Tel.: +39 3204154576
e-mail: tnmaniaci29@gmail.com

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of the Ethics Committee No. 11/2017). Exclusion criteria included: no evident disease (NED) during the last follow-up (n = 0); patients with follow-up < 3 years (n = 7); loco-regional and distant (n = 1 pulmonary metastasis after 2 years) metastases and secondary to the residual tumor laryngeal after 6 years of age (n = 1); presence of a tracheostomy (n = 0). Of the 50 remaining patients, 25, (21 males, 4 females) aged 43-74 (median 59.1) years, were randomly selected, and underwent OPHL IIa with or without arytenoidectomy (ARY) (18 patients: 6 OPHL IIa; 12 OPHL IIa + ARY) or OPHL IIb with or without ARY (7 patients: 4 OPHL IIb; 3 OPHL IIb + ARY) with the modified Guerrier technique (Table I); mono or bilateral neck dissection was performed on each patient.

All patients underwent the same rehabilitation procedure, with obvious exception of those with severe early complications. Each patient started talking and swallowing within 7 days of surgery with rehabilitation, teaching them correct posture, while coordinating swallowing the saliva and correct breathing during conversation to mobilize the cricoarytenoid unit. The nasogastric tube (NGT) was removed as soon as a good level of swallowing of both solids and liquids was achieved. We considered a minimum follow-up of 36 months, and a maximum of 72 months.

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was given by all patients involved in the study.

Pre- and intraoperative assessment

For pre- and intraoperative assessment, patients underwent laryngoscopy with flexible fiberoptic and CT and/or MR, to verify paraglottic and pre-epiglottic space invasion. Intraoperative assessment was performed by direct microlaryngoscopy under general anesthesia to assess the patient suitability for Guerrier's OPHL II. An important parameter was the extension of the superficial tumor no more than 5 mm on both the ventricles and the subglottis.

Surgical procedure

Guerrier's modified OPHL (4) follows the same surgical steps as in Labayle and Mayer-Piquet's OPHL II (2): an incision of cricothyroid membrane from below to the superior edge of the cricoids, then an incision from above to the glosso-epiglottic vallecula. When OPHL IIb is performed, the latter incision follows the resection of thyroid membrane at the level of the hyoid, or, in the case of OPHL IIa, after a horizontal section over the thyroid cartilage superior edge. Guerrier's modification refers to lateral section lines: performing vertical incisions on thyroid cartilage at the level of the oblique line, no detachment of the piriform sinuses from the thyroid wings or from the paraglotitic space is required (4).

Such procedure allows to maintain pervious and gaping pyriform sinus as well as allowing preservation of the superior laryngeal nerve, responsible for pyriform sinus and epiglottic sensitivity; both these factors are very important for successive laryngeal rehabilitation.

Analysis of neoglottis functionality

Patient neoglottis anatomy and physiology were assessed via videolaryngoscopy after treatment with the modified technique. Vibratory characteristics of the neoglottis, degree of arytenoid motion, and anterior-posterior valving of the arytenoid/epiglottal/base-of-tongue complex were analyzed. Neoglottis motility considering the same parameters as Zacharek (6) et al. and Schindler (7) et al., were assessed but each parameter was attributed a score between 1 and 3. Thus, vibration was described as excellent (grade 1), good (grade 2) and poor (grade 3); arytenoid motility was classified as normal (grade 1), hypomobile (grade 2) and absent (grade 3); antero-posterior movement was classified as complete (grade 1), incomplete (grade 2) and absent (grade 3). Such variables are mutually influenced by neoglottis incompetence, tissue stiffness and neoglottis mucosal thickness (7-8).

Swallowing functional analysis

A comprehensive analysis to assess swallowing ability was performed. For the objective assessment, Bastian's FEES (Flexible endoscopic assessment of swallowing) (9) with milk testing the premature spillage of food, laryngeal motility and laryngeal aspiration of each patient and videofluroscopic examination (VFS) with semi-liquid contrast medium were performed in both right and antero-posterior projection, to study swallowing functionality.

Each patient was assigned a value on the Donzelli scale (10) after three specialists (ENT, phoniatrician and

radiologist) had separately evaluated FEES and VFS results. An MD Anderson Dysphagia Inventory (MDADI) questionnaire was administered to assess physical, functional and emotional components of dysphagia and to quantify the subjective component with codified questions. Each question matches a pre-determined range from 1 to 5 to get an overall score between 20 and 100, which corresponds to the highest level of disability perceived by the patient swallowing (11).

Perceptual analysis of voice

For assessment of dysphonia, all patients were administered the Voice Handicap Index (VHI-10) questionnaire proposed for self-assessment of vocal disability. This is a questionnaire consisting of 30 items referring equally to three different aspects of vocal disorders: physical, functional and emotional. The patient may provide five possible answers, from never to always, assigning a score from 0 to 4. Summing the values assigned to the 30 responses, an overall score between 0 and 120 is obtained that corresponds to the highest level of phonatory disability perceived by the patient.

Finally, the GRBAS (grade, roughness, breathiness, asthenia, strain) scale regarding dysphonia was applied, assigning values from 0 to 3 to each patient.

Statistical analysis

Inter-rater reliability (IRR) was generated by randomly reanalyzing a sample of 50% of the total population data. Weighted kappa with quadratic weighting was calculated; k values were interpreted as follows: ≤ 0.20 poor agreement; 0.21-0.40 fair agreement; 0.41-0.60 moderate; 0.61-0.80 good; and 0.81-1.00 very good (12).

RESULTS

Laryngeal functionality analysis

Each patient was examined and assessed by three ENT specialists, who, individually, assigned the patient a score according to the scale we developed. The assessment for vibration assigned grade 1 to 44% of the patients (11 patients), grade 2 to 24% (6 patients) and grade 3 to 32% (8 patients) (k = 0.79) with an average value of 1.93 (range 1-3).

The evaluation of arytenoid mobility assigned grade 1 to 80% of the patients (20 patients), grade 2 to 16% (4 patients), and grade 3 to 4% (1 patient) (k = 0.86) with an average value of 1.27 (range 1-3). The anterior-posterior movement was assessed as grade 1 in 60% of the patients (15 patients), grade 2 in 33% (8 patients), and grade 3 in 7% (2 patients) (k = 0.91) with an average value of 1.47 (range 1-3).

Swallowing analysis

FEES analysis, according to the Donzelli scale, assigned grade 0 to 72% of the patients (18 patients) grade 1 to 28% (7 patients) (k = 0.77), with an average value of 1.27 (range 1-3). VFS evaluation assigned grade 0 to 72% of the patients (18 patients), grade 1 to 20% (5 patients) and grade 2 to 8% (2 patient) (k = 0.80), with an average value of 1.33 (range 1-3) (Table II). The study of swallowing function was completed by self-assessment of dysphagia using the MDADI questionnaire, and scores were stratified by the type of intervention. Generally, 60% of patients maintained a low level of swallowing disability with MDADI scores of 20–40. The most significant perceived swallowing disability, with MDADI scores > 61, was observed in three interventions (12%) (Table II). The feeding tube was removed within an average time of 12 (range 7-14) days and a median time of 12. Mean time to decannulation was 21 (range 7- 45) days with median time 20 days. No patient suffered from aspiration pneumonia.

Voice analysis

Assessment via the GRBAS scale underlined that 28% (7 patients) achieved grade 2, corresponding to moderate dysphonia, and 72% (18 patients) achieved grade 1, corresponding to slight dysphonia (k = 0.65). Generally, the average patient value was 1.27 (range 0-3) (Table III). The study of phonatory function using the VHI questionnaire demonstrated that a large number of patients, representing 32% of the study cohort, maintained a low level of vocal handicap (VHI score 0–30), while 7 of the 25 patients (28%) complained of a moderate-high degree of speech handicap (Table III).

DISCUSSION

OPHL type II a-b plays a significant role in

Fig. 1. *Surgical time of the modified technique. The limit of the lower section on cricoid cartilage represents the crucial point in both techniques.*

glottic and transglottic tumour treatment. Due to the major alterations to the normal anatomy of the upper digestive tract, the maintenance of adequate function can be difficult to achieve (6, 7). Guerrier's OPHL II can be performed when extension to the paraglottic space has been excluded by endoscopy and imaging (CT) (4). This extension is the critical point in OPHL II, both in the classic or modified Guerrier technique, above all in T3 tumours with mobile arytenoid. The crucial point in both techniques is the limit of the lower section on cricoid cartilage (Fig. 1). It is in these cases that the margins of the section could be close or involved, without necessarily involving cartilage. Original indications by Guerrier include T1a, T1b, and T2 (4). However, we excluded patients with T1 treated with transoral surgery, while T3 patients, glottis-supraglottis with extension into the pre-epiglottic space and with compromised cordal motility but with mobile arytenoid, were included. In our study the anatomy and physiology of each single component of the neoglottis were assessed according to a scale we developed. We evaluated neoglottis motility considering the same parameters as Zacharek et al. and Schindler et al. (6, 7). The overall results showed a well performing laryngeal physical examination demonstrated by an overall average value of 1.5 (range 1-3). The GRBAS values reported in our series a slight dysphonia in 72% of patients ($k = 0.65$) with a low level of vocal handicap (VHI score 0–30) in 32% of the study cohort (Table III). Video laryngoscope analysis showed an absolutely atypical mucosal vibration. Swallowing is a fundamental outcome for quality of life in patients undergoing supracricoid partial laryngectomy (9). Using FEES/VFS scoring and MDADI methods to evaluate swallowing function, the score showed

level 1 in 73% of the patients, and level 2 in 27%. VFS analysis showed level 1 in 72% of the patients, level 2 in 20% and level 3 in 8%, while the type of partial laryngectomy did not affect the deglutition results (Table II). We successfully decannulated all patients in a mean time of 21 days after surgery, and most patients had their gastric feeding tubes removed 20 days after surgery. In conclusion, these data show that Guerrier's OPHL II is a well-tolerated procedure with generally good functional outcomes, although some voice and swallowing complaints continue long-term. If patients are properly selected, this technique allows oncological radicality.

REFERENCES

1. Hofmann-Saguez MR. Conservative subtotal laryngectomy. Ann Otolaryngol 1950; 67:811-16.
2. Meyer EH, Rieder W. Technic of laryngectomy permitting the conservation of respiratory permeability (cricohyoidopexy). Ann Otolaryngol 1959; 76:677-81.
3. Tucker HM, Wood BG, Levine H, Katz R. Glottic reconstruction after near total laryngectomy. Laryngoscope 1979; 89:609-18.
4. Guerrier B, Lallemant JG, Balmigere G, Bonnet PH, Arnoux B. Our experience in reconstructive surgery in glottic cancers. Ann Otolaryngol Chir Cervicofac 1987; 104:175-9.
5. Holsinger FC, Laccourreye O, Weinstein GS, Diaz EM, McWhorter AJ. Technical refinements in the supracricoid partial laryngectomy to optimize functional outcomes. J Am Coll Surg. 2005; 201:809-20.
6. Saraniti C, Speciale R, Gallina S, Salvago P. Prognostic role of resection margin in open oncologic laryngeal surgery: survival analysis of a cohort of 139 patients affected by squamous cell carcinoma. Braz J Otorhinolaryngol 2018; doi: 10.1016/j.bjorl.2018.04.012.
7. Serra A, Maiolino L, Di Mauro P, Licciardello L, Cocuzza S. The senile functional evolution of the larynx after supracricoid reconstructive surgery. Eur Arch Otorhinolaryngol 2016; 273(12):4359-68.
8. Dispenza F, Saraniti C, Mathur N, Dispenza C. Modified fronto-lateral laryngectomy in treatment of glottic T1(a-b) cancer with anterior commissure involvement. Auris Nasus Larynx 2010; 37(4):469-73.
9. Di Santo D, Bondi S, Giordano L, Galli A, Tulli M, Ramella B, Bussi M. Long-term swallowing function, pulmonary complications, and quality of life after supracricoid laryngectomy. Otolaryngol Head Neck Surg 2019; 161(2);307-14.
10. Donzelli J, Wesling M, Brady S, Craney M. Predictive value of accumulated oropharyngeal secretions for aspiration during video nasal endoscopic evaluation of the swallow. Ann Otol Rhinol Laryngol 2003; 112:469-75.
11. Chen AY, Frankowski R, Bishop-Leone J, et al. The development and validation of a dysphagia-specific quality-of-life questionnaire for patients with head and neck cancer: the M.D. Anderson dysphagia inventory. Arch Otolaryngol Head Neck Surg 2001; 127:870-76.
12. Cohen J. Weighted kappa: nominal scale agreement with provision for scaled disagreement or partial credit. Psychol Bull 1968; 70(4):213-20.