

# Original Article

## Alaryngeal Communication Effectiveness And Long-term Quality Of Life

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### Abstract

**Background:** Primary or salvage total laryngectomy is a surgical procedure used to treat patients with advanced-stage larynx and hypopharynx cancer. The resultant alaryngeal communication is usually considered unsatisfactory and a profound impairment.

**Objectives:** The purpose of this study was to evaluate the efficacy of alaryngeal communication after total laryngectomy and its association with long-term quality of life evaluation. **Material and Methods:** 82 patients with squamous cell carcinoma of the larynx and hypopharynx underwent a total laryngectomy associated or not with irradiation therapy. The type of alaryngeal communication was 18 (21.9%) tracheoesophageal voice, 12 (14.6%) esophageal speech, 11 (13.4%) electrolarynx and 41 (50%) non-vocal. Communication effectiveness was judged according perceptual, acoustic and temporal parameters. The European Organization for Research and Treatment of Cancer Quality of Life Core Questionnaire (EORTC QLQ-C30) was used to measure quality of life. **Results:** Tracheoesophageal voice was considered good in 13 cases (72.2%), moderate in 4 (22.2%) and poor in 1 (5.6%); esophageal speech, good in 2 (16.7%), moderate in 8 (66.6%) and poor in 2 (16.7%); electrolarynx, good in 1 (9.1%), moderate in 9 (81.8%) and poor in 1 (9.1%); non-vocal communication, 100% poor. Total range of QLQ score varied from 8.3 to 100 (median, 75). Total QLQ scores were not associated with the effectiveness of communication ( $p=0.2512$ ).

**Conclusion:** Tracheoesophageal voice was more effective than esophageal speech or electrolarynx, but surprisingly alaryngeal communication was not considered by the patients essential to maintain or improve long-term quality of life.

**Key words:** Laryngeal neoplasm. Laryngectomy. Speech, Alaryngeal. Tracheoesophageal Voice. Speech, Larynx. Voice quality. Quality of life.

### Introduction

Primary or salvage total laryngectomy is a surgical procedure traditionally used to treat patients with advanced-stage cancer of the larynx and hypopharynx, when the tumor cannot be resected by a partial surgical procedure. The recent introduction of organ-preservation chemoradiotherapy protocols established an alternative to total ablation of the larynx, but at least one third of the patients will require a salvage

laryngectomy. The outcome of patients who underwent organ-preservation protocols, especially quality of life, must be compared with

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the baseline results achieved in the population submitted to a total laryngectomy.<sup>1</sup>

Alaryngeal communication rehabilitation consists of learning tracheoesophageal voice, esophageal speech or the use of electrolarynx. There is a huge variability of esophageal voice acquisition rate, from 1% to 97%,<sup>2-6</sup> and its effectiveness in communication is not always considered satisfactory. Several recent studies showed that the use of tracheoesophageal prosthesis promotes a better adaptation and communication effectiveness than the other methods.<sup>6,7</sup> On the other hand, the use of electrolarynx has variable results, from 5% to 66%.<sup>3-6,8</sup> Quick reestablishment of an acceptable, fluent and intelligible voice is rehabilitation's principal focus after total laryngectomy. Unfortunately, a significant number of patients have been either unsuccessful or dissatisfied with rehabilitation. Furthermore, non-vocal communication after laryngectomy is not usually ever mentioned in most publications, but probably it accounts for at least 5% to 40% of the cases.<sup>2-4, 8</sup>

Quality of life is a multidimensional important issue that does not have a universally accepted definition. According to Ferrans and Powers,<sup>9</sup> it is the "person's sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important". Total laryngectomy is usually considered a major rehabilitation problem because it creates a tremendous disability regarding communication and a definitive tracheotomy disrupts interactions of patients with other people, causing social and psychological dysfunction.<sup>10</sup> In the present report, we evaluated the type and success rate of different methods of alaryngeal communication and the quality of life in patients submitted to a total laryngectomy associated or not with irradiation. The aim of this study was to evaluate effectiveness of alaryngeal communication after total laryngectomy and its connection with quality of life.

## Materials and methods

The sample consisted of patients who underwent a curative total laryngectomy associated or not with irradiation therapy between 1969 and 2001. All patients had

advanced-stage squamous cell carcinoma of the larynx or hypopharynx and were treated at the Hospital do Câncer A. C. Camargo, São Paulo, Brazil. A total of 635 patients were registered, but 312 patients had already died, due to tumor relapse or non-cancer related causes, and of 197 there was no recent follow-up information. Of the remaining 126 eligible patients invited to participate, 44 did not accepted. Thus, 82 patients (76 men and 6 women) were included in the study. Age ranged from 17 to 84 years (mean 63 ±11.3). Tumors were re-staged according to the 1997 version of the American Joint Committee on Cancer Staging System<sup>11</sup>. Eighteen patients were previously treated by radiation therapy, and underwent laryngectomy as a salvage procedure.

Surgical procedures were 52 total laryngectomies, 17 total laryngectomies with partial pharyngectomy, 10 total laryngopharyngectomies and 3 total laryngopharyngoesophagectomies. Sixteen patients were not submitted to a neck dissection, 19 underwent unilateral dissection and 47 a bilateral one. Reconstructive procedures performed at the time of laryngectomy included: 65 primary closures, 13 pectoralis major myocutaneous flaps, 1 jejunal free flap, and 3 gastric pull-ups. Forty-

**Table 1** - Distribution of treatment characteristics – surgery, reconstruction, neck dissection, radiotherapy and method of the alaryngeal communication

Variables	Categories	N (%)
Surgery	TL	53(63.4)
	TL + PPH	17 (20.7)
	TLF	10 (12.2)
	TLFE	3(3.7)
Reconstruction	Primary closure	65 (79.3)
	Pectoralis major	13 (15.8)
	Jejunal free flap	1(1.2)
	Gastric pull-up	3(3.7)
Neck dissection	None	16 (19.5)
	Unilateral	19 (23.2)
	Bilateral	47 (57.3)
Radiotherapy	None	18 (22.0)
	Previous	18 (28.1)
	Postoperative	46 (71.9)
Alaryngeal communication	Tracheoesophageal	18 (22.0)
	Esophageal voice	12 (14.6)
	Artificial larynx	11 (13.4)
	Non-vocal	41 (50.0)

NOTE: TL – total laryngectomy; TL + PPH – total laryngectomy with partial pharyngectomy; TLF – total laryngopharyngectomy; TLFE – total laryngopharyngoesophagectomy

six patients were submitted to postoperative radiation therapy. Radiation doses ranged from 4000cGy to 7000cGy (mean 6228 cGy) (Table 1).

At the time of the first evaluation, at least 6 months after the end of oncologic treatment, alaryngeal communication was distributed thus: 18 tracheoesophageal voice, 12 esophageal speech, 11 electrolarynx and 41 non-vocal (Table 1).

Communication effectiveness was judged according perceptual, acoustic and temporal parameters adapted for all types of alaryngeal communication from Global Protocol of Voice (Hilgers et al., 1995),<sup>12</sup> described to analyze tracheoesophageal voice (Table 2). All parameters were evaluated as good, moderate or poor by 5 speech pathologists with experience in rehabilitation of alaryngeal patients. The final judgment of communication effectiveness was classified as good: up to 3

moderate scores; moderate: up to 1 poor score; and poor: 2 or more poor scores.

Alaryngeal communication was registered in high quality tape recording. The patients were comfortably positioned standing upright, at a 15 cm distance from the microphone (Shure 8700). As regards tracheoesophageal and esophageal voice, we recorded sustained vowel phonation and connected speech. For the sustained vowel phonation recording, each patient was asked to sustain the vowel /a/ at a comfortable pitch and intensity as long and as steadily as possible, for three times. For connected speech recording, patients were asked to speak about a standardized history. The voice was then analyzed perceptually, acoustic and temporally according to: fluency (syllables per intake of air), maximum phonation time (in seconds), intensity (dynamic range in dB and maximum loudness in dB), availability of voice,

**Table 2** -Vocal parameters adaptation from the Global Protocol of Voice from Hilgers et al., 1995.<sup>12</sup>

Parameters	Tracheoesophageal voice			Esophageal speech			Electrolarynx		
	Good	Moderate	Poor	Good	Moderate	Poor	Good	Moderate	Poor
<b>I. Phonatory skills</b>									
1. Fluency (syllables per intake of air)	19 or more	19-9	<9*	10 or more	8	4 **	-	-	-
2. Maximum phonation time (in seconds)	10 or more	10-3	<3*	2 or more	2-1	<1**	-	-	-
3. a)Dynamic range in dB	25 or more	25-15	<15*	25 or more	25-15	<15*	-	-	-
b) maximum loudness in dB	value<75	75-65	<65***	value<75	75-65	<65***	-	-	-
4. Availability of the voice	A	RD	SD***	A	RD	SD***	A	RD	SD***
5. Articulation	A	RD	SD*	A	RD	SD*	A	RD	SD*
6. Voice (pitch) modulation	A	RD	MT*	A	RD	MT*	A	RD	MT*
7. Speech rate	A	RD	SS*	A	RD	SS*	A	RD	SS*
<b>II. Additional factors</b>									
1. Stoma noise (ST)	No	WSN	MSSN*	No	WSN	MSSN*	No	WSN	MSSN*
2. Audibility of inspiration (AI)	No	WAI	MSAI*	No	WAI	MSAI*	No	WAI	MSAI*
3. Redundant movements (RM)	No	WRM	MSRM*	No	WRM	MSRM*	No	WRM	MSRM*
<b>III. General Judgment</b>									
1. Voice Quality	A	WV	IV****	A	WV	IV***	A	WV	IV****
2. Intelligibility	not/WDI	MDI	SDI	Not/WDI	MDI	SDI	not/WDI	MDI	SDI
<b>Final Judgment</b>									

NOTE: A – adequate; RD – relative difficulty; SD – severe difficulty; MT – monotone; SS – slow speech; WSN- wise stoma noise; MSSN - moderate or severe stoma noise; WAI – wise audibility of inspiration; MSAI – moderate or several audibility of inspiration; WRM – wise redundant movements; MSRM – moderate or several redundant movements; WV – weak voice; IV – insufficient voice; WDI – wise difficulty intelligibility; MDI – moderate difficulty intelligibility; SDI – severe difficulty intelligibility. \* Hilgers et al. 1995;<sup>12</sup> \*\* Berlin (1965);<sup>18</sup> \*\*\* Cecon & Carrara-de Angelis (2000);<sup>19</sup> \*\*\*\* Labruna (1995)<sup>20</sup>

articulation, pitch and modulation, speech rate, stoma noise, audibility of inspiration, movements redundancy, voice quality and intelligibility (Table 2).

The European Organization for Research and Treatment of Cancer's Quality of Life Core Questionnaire (EORTC QLQ-C30) was used to measure quality of life. Patients answered the questionnaire in a private place and received the guaranteed that the answers would not interfere in their treatments.

Statistical Analysis: to examine the association between types of alaryngeal communication, final judgment of alaryngeal communication effectiveness and total Global Quality of Life score, a non-parametric Kruskal-Wallis test was performed. Chi-square test was used to compare voice therapy and final judgment of alaryngeal communication effectiveness. The significance level was set at 5%.

## Results

Of 82 patients, 41 (50%) developed alaryngeal oral communication: 18 (22%) tracheoesophageal voice, 12 (15%) esophageal speech and 11 (14%) electrolarynx. The other 41 (50%) patients were communicating through articulation speech, pharyngeal voice, writing and / or gesticulation.

Results of final judgment of alaryngeal communication effectiveness were: a) tracheoesophageal voice: good in 13 cases (72.2%), moderate in 4 (22.2%) and poor in 1 (5.6%); b) esophageal speech: good in 2 (16.7%), moderate in 8 (66.6%) and poor in 2 (16.7%); c) electrolarynx:

good in 1 (9.1%), moderate in 9 (81.8%) and poor in 1 (9.1%); d) non-vocal: 100% poor. Fifty-six (68%) patients received active voice treatment and training by a speech pathologist for more than 3 months. A total of 26 (32%) patients were not submitted to voice therapy and 22 (84.6%) had poor communication ( $p=0.001$ ). Patients submitted to voice therapy had better effectiveness of communication (Table 3). Extension of surgical procedures was not evaluated because of irregular distribution of patients in each group. Surprisingly, the patients who underwent radiotherapy had better communication than those submitted to surgery alone (Table 3).

The total Global Quality of Life score ranged from 8.3 to 100 (median 75). The quality of life scores did not show statistical significant association with different communication methods: median of 79.2 for patients that use tracheoesophageal voice and esophageal voice, 83.3 for the users of electrolarynx and 75 for non-vocal ( $p=0.6597$ ) (Table 4).

The total QLQ score had no relation with the final judgment of communication effectiveness: median of 79.2 for good communication, 83.3 for moderate communication and 66.7 for poor final judgment ( $p=0.2512$ ) (Table 5).

## Discussion

It has long been recognized that late sequelae of total laryngectomy usually have a devastating impact on quality of life, affecting multiple aspects of the patients daily

**Table 3** - Description of the final judgment of the effectiveness alaryngeal communication, according to the method of the communication, voice therapy and radiation therapy

Variables	Categories	Final Judgment of Alaryngeal Communication Effectiveness			p*
		Good (%)	Moderate (%)	Poor (%)	
Type Communication	Tracheoesophageal voice	13 (72.2)	4 (22.2)	1 (5.6)	NA
	Esophageal speech	2 (16.7)	8 (66.6)	2 (16.7)	
	Electrolarynx	1 (9.1)	9 (81.8)	1 (9.1)	
	Non-vocal	0 (0.0)	0 (0.0)	41 (100)	
Voice Therapy	Submitted	15 (26.8)	18 (32.1)	23 (41.1)	0.001 *
	Not submitted	1 (3.8)	3 (11.5)	22 (84.6)	
Radiation Therapy	Submitted	15 (23.4)	19 (29.7)	30 (46.9)	NA
	Not submitted	1 (5.6)	2 (11.1)	15 (83.3)	

\* p – value obtained from chi-square test  
NA = not available

**Table 4** - Description of global quality of life / QLQ C-30 and its correspondence with different methods of alaryngeal communication.

Variables	Categories	Quality of Life / QLQ C-30		Median	p*
		Minimum	Maximum		
Quality of life	Global Quality of Life (N=82)	8.3	100	75	0.6597
Type of	Tracheoesophageal voice (N=18)	8.3	100	79.2	
Communication	Esophageal speech (N=12)	50.0	100	79.2	
	Electrolarynx (N=11)	50.0	100	83.3	
	Non-vocal (N=41)	25.0	100	75	

\* p- value obtained from *Kruskal – Wallis* test

**Table 5** - Description of quality of life scores (EORTC / QLQ C-30) and its correspondence with final judgment of alaryngeal communication effectiveness

Variable	Categories	Final Judgment of Alaryngeal Communication Effectiveness			p*
		Good	Moderate	Poor	
QLQ C-30	Median	79.2	83.3	66.7	0.2512
	Minimum	50	8.3	25	
	Maximum	100	100	100	

\* p- value obtained from *Kruskal – Wallis* test

functioning. Communication and respiration are affected, thereby disrupting interactions social and psychological changes.

Traditional methods of alaryngeal communication rehabilitation are esophageal voice, electrolarynx and more recently tracheoesophageal voice. At the time of this analysis, only 41 of our 82 patients were communicating orally, 18 of the 41 cases with tracheoesophageal voice, 12 with esophageal voice and 11 with electrolarynx. Tracheoesophageal voice was considered to provide the best effectiveness of communication: it was judged good in 13 (72.2%) patients. These data are similar to the literature that refers that tracheoesophageal voice offers the best intelligibility of alaryngeal communication<sup>6,7</sup>. It provides the speaker a higher and more powerful air supply for activating and maintaining the vibration of the pharyngoesophageal segment, resulting in superior overall voice quality, intensity, pitch and articulation. These parameters consequently provide the best communication, being more comparable with the ones of normal laryngeal speakers.<sup>7</sup>

Esophageal voice was considered good in 2 (16.7%) patients, moderate in 8 (66.6%) and poor in 2 (16.7%). Although it is customarily the most used method for alaryngeal communication, esophageal speech depends not only on the laryngectomized individuals' ability to inflate the esophagus by means of inhalation or injection methods and their use of air in the esophagus to generate an esophageal acoustic signal, but mainly on the use of this esophageal voice to produce a sufficiently intelligible, fluent and comfortable speech for communication functions.<sup>2-5</sup> Because of this, acquisition of voice frequently demands a long time of training and its effectiveness may be not satisfactory for many patients. The high level of rehabilitation failure, mainly in the most recent prospective studies, is attributed to increase in patient's age, tumor stage, and intensiveness of adjuvant treatment used (radiotherapy and/or chemotherapy).<sup>13</sup> Salmon & Mount (1991) presented six categories of factors that can preclude esophageal speech acquisition, recognizing that they generally coexist and interact: physical, social, occupational, psychological, training and idiopathic.<sup>13</sup>



Most studies report that esophageal voice is better than electrolarynx,<sup>14,15</sup> but other have revealed that speech production with electrolarynx is more acceptable than esophageal speech<sup>16</sup>, specially in noisy environments. Although some professionals still do not accept artificial larynx as a valid communication tool, our results showed moderate communication effectiveness in 9 (81.8%) patients, a better rate than the esophageal ones.

The remaining 41 (50%) patients did not communicate orally. Routinely our patients are introduced to all methods of communication, and advantages as well as disadvantages of each of them. Frequently they "choose" learning esophageal speech due to financial difficulties to acquire electrolarynx or tracheoesophageal prosthesis that are not paid by private or public health insurance system in Brazil. Besides, although esophageal speech is a difficult task, 26 patients were not submitted to speech therapy. Although there are few data about the role of voice therapy with laryngectomized patients, we observed that patients submitted to therapy achieved better scores of communication effectiveness (table III). All patients are routinely sent to speech therapy, but social, occupational and psychological factors may preclude compliance to adhere to the therapeutic process. In addition, patients that do not live in our city there suffer from the lack of specialized clinicians in other parts of the country to execute the rehabilitation program.

Quality of life and its correlation with performance outcome of patients who underwent total laryngectomy are critical for a comprehensive evaluation of oral communication rehabilitation. As reported in previous studies<sup>10,17</sup>, our results also showed that oral communication was not considered essential to maintain or improve quality of life. The permanent tracheotomy and the fear of cancer recurrence have a higher influence in overall quality of life of patients with larynx cancer. This finding contradicts common sense expectations that functional restrictions, for example, inability to talk, would be a main cause for concern.

The value of communication on daily activities is certain, but it is necessary to consider the global situation of the patient of this sample, several of them with advanced age, with no job,

and with a history of alcohol abuse. We observed that patients who lived alone or were unemployed had lower levels of perceived oral communication because of fewer communication demands placed on them and lower expectations regarding their oral communication. Moreover, many patients reported a family transformation after cancer diagnostic including more attention, with better patterns of familiar communication, in spite of speech difficulties. These findings illustrate the need for prospective studies assessing alaryngeal communication after total laryngectomy, coping, family support and quality of life.

Due to the better outcomes on the effectiveness of speech rehabilitation observed among patients that were rehabilitated with tracheoesophageal voice, this procedure should be recommended for rehabilitation of alaryngeal communication. Esophageal speech and electrolarynx are effective alternatives only when patients are submitted to active and long-term voice therapy. In addition, we suggest periodical re-evaluation of communication functions of all patients submitted to total laryngectomy in order to analyze if they are communicating, how effective their speech is, and finally decide on alternative approaches for those that are not communicating orally.

Finally, tracheoesophageal voice was more effective than esophageal speech or electrolarynx but, surprisingly, alaryngeal communication was not considered essential by patients to maintain or improve quality of life.

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