



Assessment of Voice Related Quality of Life in patients with total laryngectomy and vocal rehabilitation

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Abstract

BACKGROUND: Total laryngectomy in patients with laryngeal cancer is an intervention with a major impact on the patient's quality of life. There are multiple methods of vocal rehabilitation: esophageal speech, tracheoesophageal speech and electrolaryngeal speech. **AIM:** This study aimed to determine the quality of the rehabilitated voice achieved with 3 different post-laryngectomy methods of verbal communication and the impact on patients' perception of their quality of life. **METHODS:** In this retrospective study review of 45 patients with total laryngectomy, we used Voice-Related Quality of Life (V-RQOL) questionnaire database. This instrument measure 2 domains: social-emotional and physical functioning. The inclusion criteria: patients with total laryngectomy, even if they presented postoperatively complications (pharyngeal-cutaneous fistula, cervical or mediastinal suppurations due to resistant germs). We preferred the V-RQOL instrument as it is easy for patients to complete and provides a good assessment of the vocal communication that influences the patient's daily life. Other information collected included details such as age and speech rehabilitation technique. **RESULTS:** The database included 18 esophageal speech (ES), 10 tracheoesophageal speech (TES) and 17 electrolaryngeal speech (ELS) patients. TES group had a significantly better outcome for social-emotional component compared with that of ELS group scores ($p < .05$). No significant difference between these groups for physical/functioning component had been found. The difference on the overall scores, on the 2 components between TES (20.4) and ES (26,27) was small. The relationship between age and the total score was rather weak and positive ($r = 0.27$), meaning that the score increases with age. **CONCLUSIONS:** The assessment identified that patients using TES had similar V-RQOL outcomes compared to ES and patients using ELS had lower total scores than the first two groups.

Keywords: Voice rehabilitation, V-RQOL, Total laryngectomy, Cervical suppuration

Introduction

The total ablation of the larynx is the primary modality of treatment for advanced stage laryngeal cancer, and also leads to the loss of voice, which is certainly the essential psychological element for the patient. This intervention has significant impact on the quality of life. Patient's speech rehabilitation after total laryngectomy is possible with three methods: esophageal speech (ES), tracheoesophageal speech (TES) and electrolaryngeal speech (ELS).

The mechanism of esophageal speech consists in producing an esophageal vocal sound through air flow that vibrates the neoglottis or superior esophageal sphincter. This neoglottis is constituted by the cricopharyngeal muscle and the inferior constrictor muscle of the pharynx. It's the larynx vibrator. Techniques used: swallowing, using the

natural mechanism that allows us to swallow the air; a blocking technique that uses pharyngeal pressure to drive air from the mouth and pharyngeal into the esophagus by blocking the mouth muscles; method of injected consonants.

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The Tracheoesophageal puncture (TEP) and prosthesis procedure is used for the producing a tracheoesophageal speech. During surgery, cricopharyngeal myotomy and implantation of a vocal prosthesis were performed. The phonatory implant allows passage of expired air from the trachea into the esophagus while the patient obstructs the tracheostomy.

The Electrolaryngeal speech (ELS) uses an artificial electronic device (electrolarynx) which allows patients with a laryngectomy to speak. The commonest disadvantages from its users is mechanical sound quality and the attention it attracts in public places (Casper & Colton 1993).

Social reinsertion after total laryngectomy requires precise preoperative information. The quality of life depends on the quality of speech re-education, on the possibilities of psychological adaptation of the patient to this disability, and on the possibility of satisfactory professional and family reintegration. A series of instruments have been developed in order to assess the quality of life of patients after total laryngectomy, including the Voice Handicap Index (VHI) and the Voice Related Quality of Life (V-RQOL) questionnaires.

The V-RQOL is a 10-item questionnaire, the advantage being that the patient is compliant to complete. These patient's self-report symptom specific scales can provide valuable information about functional abilities, social and emotional domains and related QOL (quality of life) issue.

The main driver for this study was the field observation in our activity with patients that have undergone total laryngectomy and speech rehabilitation. We noticed over time, that the patients with a voice prosthesis spoke much better and faster than those with an esophageal or electrolaryngeal voice. The primary aim was to study if patients who have a voice prosthesis integrate more easily into the community and are more satisfied with the qualities of the new voice, than those who speak through the esophageal voice or with the help of the electrolarynx. A secondary objective was to analyze the effect of the elapsed time after surgery and age on voice outcomes.

Material and Methods

This study was the retrospective review of the V-RQOL database of patients with total laryngectomy which used esophageal speech, tracheoesophageal speech and electrolaryngeal speech.

We have used Voice Related Quality of life (V-RQOL) questionnaire, a self-administered, 10-item quality of life instrument, measuring 2 domains: social-emotional and physical functioning. Each patient responded according to the suitability or closeness of each item (ranging from 1 = not a problem to 5 = the problem is "as bad as it can be") to his situation. The overall V-RQOL score ranges from 10 to 15 (excellent), 16 to 20 (very good), 21 to 25 (good), 26-30 (fair) and scores more than 30 and up to 50 is poor.

The database was collected during 3 years period between January 2018 to July 2020, for all eligible patients who had undergone total laryngectomy in Department of

Otolaryngology from two hospitals, Regional Institute of Oncology and Sf. Spiridon Hospital, both in Iasi, Romania.

The inclusion criteria: patients with total laryngectomy, even if they had postoperative complications (pharyngeal fistula or cervical suppuration given by the resistant germ) and who benefited from one of the 3 methods of vocal rehabilitation. No patient with flap / free flap reconstruction was included in our current analysis.

We preferred the V-RQOL instrument as it is easy for patients to complete and provides a good assessment of the vocal communication that influences the patient's daily life. Other information collected included details such as age and speech rehabilitation technique. It was recorded the elapsed time after surgery at the moment of the V-RQOL questionnaire completion. This database was used for our analysis after obtaining the proper Research Ethics Board approval.

Data was analyzed according to the raw scores (not processed according to standard algorithms score). Standard statistical techniques were used, including analysis of variance (ANOVA), in order to compare the total score in the context of three groups of patients. Statistical analysis was performed by the SPSS program for Windows. The ANOVA procedure was applied, respectively the Fisher test in order to evaluate the significant score differences between the groups in the total sample, then the Tukey test, to compare the score differences between each two groups. Pearson's correlation coefficient was calculated to analyze age and time association.

Results

Our database included 45 patients (all men), who had undergone total laryngectomy for the laryngeal cancer with a mean age of 64 years and mean time postsurgery of 21 months. Patients were divided into 3 groups according to vocal rehabilitation: 18 ES, 10 TES, 17 ELS.

Groups Comparison

The average scores for the two components were very similar: social emotional component (13,2) and physical/functional component (13,06). For all scores, the standard deviation from the group mean is very small, suggesting a high homogeneity of individual scores, considering the overall sample of patients. Table 1 illustrates descriptive analysis of the total score (26,26) and score on the 2 components of our entire group (45 patients).

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Table 1. Descriptive statistics of the scores, for the entire sample of patients

	Total score	Social/emotional	Physical/ functional
N	45	45	45
Mean	26,2667	13,2000	13,0667
Std. Deviation	4,43334	3,52007	1,77610
Minimum	18,00	8,00	10,00
Maximum	34,00	19,00	17,00

Considering a 5% level of significance, for all three scores (total, social-emotional and physical-functioning), there were significant score differences between the three groups of patients (p-value < 0.05). This

showed empirical evidence that suggest that the score is significantly influenced by the group to which a patient belongs to (Table 2).

Table 2. ANOVA testing of the group mean differences

		Sum of Squares	df	Mean Square	F	p-value
Social Emotional Component	Between Groups	446,414	2	223,207	94,899	,000
	Within Groups	98,786	42	2,352		
	Total	545,200	44			
Physical Functioning Component	Between Groups	50,130	2	25,065	11,872	,000
	Within Groups	88,670	42	2,111		
	Total	138,800	44			
Total score	Between Groups	545,259	2	272,630	35,834	,000
	Within Groups	319,541	42	7,608		
	Total	864,800	44			

Comparing the groups, using the Turkey test (Table 3), at a 5% level there were significant differences, for all three scores, between almost all groups, excepting the TES and ELS groups, for the physical functioning component, for which the difference is not found to be significant. TES group had a significantly better outcome for social-emotional component (8,9 versus 16,9) compared with that of ELS group scores (p < .05). Overall, the TES group has better results on the 2 components than the ES and ELS groups (Table 3).

Table 3. Tukey multiple comparisons testing of the different groups

V-RQOL scores	Multiple pairwise comparisons								
	TES vs ELS			ES vs ELS			TES vs ES		
	TES	ELS	p-value	ES	ELS	p-value	TES	ES	p-value
Total (SD, range)	20.4 2.22, (18-24)	29.7 (2.82, 26-34)	<0.05*	26.27 (2.94, 21-31)	29.7 (2.82, 26-34)	<0.05*	20.4 2.22, (18-24)	26.27 (2.94, 21-31)	<0.05*
Social Emotional (SD, range)	8.9 (1.1, 8- 11)	16.9 (1.88, 14-19)	<0.05*	12.05 (1.34, 9-14)	16.9 (1.88, 14-19)	<0.05*	8.9 (1.1, 8- 11)	12.05 (1.34, 9-14)	<0.05*
Physical Functioning (SD, range)	11.5 (1.26, 10-14)	12.7 (1.14, 12-15)	>0.05	14.22 (1.76, 12-17)	12.7 (1.14, 12-15)	<0.05*	11.5 (1.26, 10-14)	14.22 (1.76, 12-17)	<0.05*

Note: For each group, the average score is presented; SD is the standard deviation from the group mean; range is the interval of the values in a group, the minimum and the maximum values being listed

* The groups are significantly different ($p < 0.05$)

The ANOVA procedure, respectively the Fisher test was applied to evaluate if, on the total sample, there were significant score differences between groups, then the Tukey test to compare the score differences between each two groups.

Correlation with Time after Surgery and Age

Regarding age, there were two significant correlations, with the total score and the socio-emotional component. The relationship between age and the total score was rather weak and positive ($r = 0.27$), meaning that the total score increases with age. The correlation between

age and the socio-emotional component was of average intensity and positive ($r = 0.4$), meaning that, overall, when age increases, so does the score for the socio-emotional component. For the physical functioning component, the correlation found was weak and not significant.

There was a moderate, positive and significant relationship between the time after surgery and each of the three scores given by the patients. As patients advance in age, they tend to give higher scores for the two components. Also, we noticed that time was more intensely correlated with the physical functioning component than with the socio-emotional one, meaning that the relationship has more consistency at a group level (Table 4).

Table 4. Correlation with age and time after surgery, for the entire sample

V-RQOL scores	Pearson correlation			
	Time after surgery		Age	
	r value	p-value	r value	p-value
Total	0.478	0.001**	0.27	0.073*
Social-emotional	0.353	0.018**	0.4	0.006**
Physical functioning	0.494	0.001**	-0.119	0.438

**Significant relationship between variables at 5% level; *Significant relationship between variables at 10% level

Discussions

The quality of life and the importance of communication after laryngeal removal in laryngeal cancer patients are essential for the integration of patients into the community. The establishment and decision of the treatment strategy for vocal rehabilitation must be taken within a team formed by the surgeon-patient-psychologist, while considering the socio-economic environment from which the patient comes.

Various vocal rehabilitation techniques have been developed in recent years (various types of voice prosthesis, laryngophones). In various studies, it has been observed that physicians and patients evaluate dysphonia differently. This finding is essential and the evaluation of patients and their perception should guide the choice of the type of intervention and the success of any vocal rehabilitation option.

In our study the scores were better for TES than for ES and ELS. There were no statistically significant differences in the functional component between the TES and ELS group. This suggests that the way the patients who use electrolaryngeal speech consider their functional quality of life may be comparable to the perception of patients using tracheoesophageal speech. This may also be due to the fact that the average age of patients in the ELS group was higher (older age) and they could have lower overall expectations.

In the present study the TES group had good scores for the social-emotional component compared to the ES and ELS group. However, the functional perception (physical functioning) did not register major statistical differences between the 3 groups.

The physical functioning component had good scores in the evaluation of V-RQOL, this being due to the patient's perception of his quality of life or even a low level of expectations. This perception is more common in older patients.

Mignano et al² considered the psychological support very important for patients with total laryngectomy, having a first role in vocal reeducation after surgery. Emphasis was placed on pacing laryngectomized group meetings in which the patient acquires (self-confidence) to perceive his new voice and in time, gain confidence, and the feeling of a life improvement. The group leader is able to provide information about voice sensations which can help with the acceptance of an laryngeal voice, more easily than a person who has not experienced a laryngectomy.

Roger et al³ looked into the voice-related quality of life in patients with 3 different post laryngectomy voice rehabilitation methods. They used V-RQOL and the results showed that patients using TES had similar V-RQOL outcomes compared to ES, and both performed significantly better than ELS. For ELS, total V-RQOL score was better with longer time after surgery and older age.

Allegra et al⁴ performed acoustic analysis on patients using tracheoesophageal speech and esophageal speech. They used the following questionnaires: Voice Handicap Index (VHI), V-RQOL and Voice Performance Questionnaires. They found a difference between ES and TES patients on all acoustic parameters and TES correlated

with better total scores compared with ES. The differences in the total scores on the VHI, V-RQOL were not statistically significant.

In our study, from the total group, there were 5 patients who had postoperative complications (pharyngo-cutaneous fistula). They had cervical suppuration with resistant methicillin-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa* identified by secretion sampling and bacteriological examination. These patients required drug treatment according to the antibiogram and surgery per second. Of the 5 patients, 2 received TES vocal rehabilitation and 2 ELS patients (due to mucosal sclerotic scars). The treatment of cervical suppuration consisted in wide opening of the operative wound, the drainage of the cervical spaces with daily toilet until the negation of the secretions and the closing of the pharynx. In one of the patients, the esophageal flange of the voice prosthesis came out and it was necessary to remove the voice prosthesis and the patient was rehabilitated vocally by esophageal speech (it was introduced in the ES group). In the other patient with the voice prosthesis, the tracheo-esophageal tract widened and a ring was mounted around the prosthesis to avoid leakage (the patient was introduced in the TES group).

Bozzo et al¹² emphasized in their study the importance of choosing the correct length of the voice prosthesis, especially in patients undergoing radiotherapy because the risk of suppurative complications (mediastinitis) increases. Immediate surgical drainage is needed to avoid severe chronic dysphagia with impaired vocal rehabilitation due to creation of an esophageal post scarring stricture.

One limitation of our study is that we did not make a distinction between patients who underwent radiotherapy and those who did not require radiotherapy. Given the consequences due to radiotherapy (tissue fibrosis), vocal rehabilitation is difficult and the results are uncertain. A possible explanation for patients who gave unsatisfactory scores may be that they underwent radiation therapy and this affected their vocal rehabilitation.

Conclusion

Vocal rehabilitation after total laryngectomy must be approached in a multidisciplinary team (surgeon, psychologist, phoniatrician) to consider the patient's specificities, consisting of personality traits, relationship needs, socioeconomic status. These are the basis for choosing the most appropriate method of vocal rehabilitation to obtain a better quality of life.

Although TES is now considered the gold standard in laryngectomized patients, this study showed low differences in total V-RQOL scores between the TES and ES groups. Thus, our results indicate that when feasible and timely, ES is a viable option that should be considered by surgeons. The option of vocal rehabilitation in patients who have had postoperative complications of cervical or mediastinal suppuration with resistant germs by acquiring ES can be a topic to address in a future study.

Conflict of Interest

Authors have no conflict of interest to disclose

Ethical issues

The study was approved by the Ethics Commission of the University of Medicine and Pharmacy "Grigore T. Popa" Iasi

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