

# Functional Results after Larynx-Preserving Treatment of Laryngeal Cancer. Suggestions for follow-up

## Authors' Contribution:

A – Study Design  
B – Data Collection  
C – Statistical Analysis  
D – Data Interpretation  
E – Manuscript Preparation  
F – Literature Search  
G – Funds Collection

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## ABSTRACT:

**Introduction:** Laryngeal cancer and its treatment are associated with both short- and long-term side effects, affecting laryngeal functions and having an impact on the quality of life.

**Material and methods:** Retrospective analysis of the medical records of patients receiving surgical or non-surgical, larynx-preserving treatment for laryngeal cancer.

**Results:** After termination of the treatment, the highest proportion of patients with bad voice quality was in the glottic carcinoma group (both in early and late phase), with swallowing dysfunction in the transglottic carcinoma group. Compared to the situation before the treatment, the proportion of patients with impaired voice quality (bad voice quality and loss of voice) initially decreased among all groups (except for supraglottic carcinomas), and during the first post-treatment year either increased or did not change. The proportion of patients with no swallowing dysfunction increased in the supraglottic, subglottic and transglottic carcinoma groups.

**Discussion:** We consider necessary the implementation of a standard pre- and post-treatment monitoring of the voice and swallowing function in the management of patients with laryngeal cancer.

## KEYWORDS:

dysphagia, dysphonia, functional results, laryngeal cancer, post-treatment follow-up

## INTRODUCTION

Cancer of the larynx is one of the most common malignancies of the head and neck [1]. In Slovakia there is an average of 310 newly diagnosed patients with laryngeal cancer each year [2]. Men are usually affected, the relative percentage of affected women is rising [3]. Tobacco use, alcohol consumption and their combinations are considered to be the most significant risk factors in its development. Dietary factors, asbestos, exposure and HPV (human papilloma virus) infection can also be involved in the pathogenesis of the disease [4–12]. The presence of symptoms such as hoarseness, dysphonia, dyspnea or impaired swallowing should indicate the suspicion of a malignant lesion. Depending on the site, clinical stage and other factors, radiotherapy, chemoradiotherapy and surgery are the main therapeutic modalities of choice [4, 13].

Apart from the desired effect – elimination of the tumour – every therapeutic modality is associated with the risk of adverse effects. The patients might be left with the burden of the sequelae due to the tissue destruction caused by both the tumour itself and the treatment. These sequelae have an impact on the functions of the larynx, which play an important role in the social life and are necessary for food and fluid intake and voice and speech formation [1, 14]. They may subsequently result into development of other negative

consequences, both in terms of physical health (increased risk of malnutrition, aspiration, weight loss) [15, 16] the psychosocial well-being, and decreased quality of life of the patients [4, 14, 17, 18].

In order to alleviate the burden of the negative effects of the treatment and to improve the quality of life of the patients, there are many options available for their treatment and rehabilitation. Before choosing one of them, it is important to detect the presence of these impairments and difficulties and perform their evaluation. Afterwards, it is possible to plan the subsequent management.

Thus, the objective of the present study is to analyze the presence of voice and swallowing dysfunctions in patients treated for laryngeal cancer with various treatment modalities and to suggest several steps to be implemented in the management of the patients with laryngeal cancer.

## MATERIAL AND METHODS

Retrospective analysis of a group of 99 patients with the diagnosis of laryngeal cancer with larynx preservation was performed. The cohort was divided into four groups according to the tumour location – glottic, supraglottic, subglottic and transglottic carcinomas.

All these patients were included based on the following criteria – they received intentionally curative treatment of the carcinoma in the selected period of time (2009–2013) at the Department of Otolaryngology and Head and Neck Surgery of the Medical Faculty and the University Hospital in Bratislava, went through post-treatment follow-up in the duration of at least 6 months, did not have recurrent/persisting tumour at the time of observation and did not undergo total laryngectomy as their primary treatment.

The data were acquired from the outpatient and inpatient medical records and the presence of pre- and post-treatment dysphagia and dysphonia (2–4 weeks and 6–12 months in case of dysphonia and 6–12 months in case of dysphagia) was analyzed. The data were divided into several groups. The descriptions of the quality of voice before the treatment were divided into four groups – good voice quality, bad voice quality, loss of voice (aphonia) and no record of the voice quality. After the treatment, the data were divided into five groups – good voice quality, bad voice quality, loss of voice, present tracheostomy and no record of the voice quality. The data describing the swallowing function were divided into three groups both before and after the treatment – no swallowing dysfunction, swallowing dysfunction, no record of the quality of swallowing.

The study involved work with qualitative data, mostly of a descriptive character, as documented in the medical records. The data were not uniform and some patients missed the record of the quality of voice and swallowing.

## RESULTS

Out of 99 patients, 71 (71.72%) patients had a tumour located in the glottic area, 15 (15.15%) patients in supraglottic area, 4 (4.04%) patients in subglottic area and 9 (9.09%) patients had a transglottic carcinoma (Tab. I). Additional characteristics of the cohort (stage of the disease at the time of the diagnosis, treatment modality used) are also shown in Tab. I.

Diverse descriptions were used in the medical records to describe the quality of voice and deglutition (Tab. II., III.).

### Voice results

The comparison of the quality of voice in particular groups of patients related to the tumour location and to the time passed after the treatment is shown in Fig. 1.

The highest proportion of the patients with voice dysfunction (bad quality and loss of voice) before the treatment was in the glottic carcinoma group (97.19%).

Early after the treatment (2–4 weeks), the highest proportion of patients with voice dysfunction (bad quality and loss of voice), was again in the glottic carcinoma group (67.6%). Among patients with glottic and transglottic carcinoma, there was a decline in the proportion of patients with bad voice quality as compared to before the treatment (94.37% vs. 50.70% and 64% vs. 22.22% respectively). A decline was observed in the subglottic carcinoma group as well

but that group consisted of a small number of patients (87.5% vs. 50%). In the supraglottic carcinoma group there was a slight increase in the number of patients with bad voice quality early after the treatment (26.67% vs. 33.33%).

Later after the termination of the treatment (6–12 months), the highest proportion of patients with voice dysfunction (bad quality and loss of voice), was still in the glottic carcinoma group (66.20%). During the first post-treatment year, we observed in glottic, transglottic and supraglottic carcinoma groups an increase in the proportion of patients with bad voice quality (66.20%, 44.44%, 46.67% respectively) as compared to early after the treatment (50.7%, 22.22%, 33.33% respectively). In the subglottic carcinoma group the number of patients with bad voice quality did not change (50% vs. 50%).

In the group with glottic carcinoma the proportion of patients with good voice quality was progressively increasing during the whole time of observation (0% before the treatment, 2.82% and 12.68%, respectively, early and late after the termination of the treatment).

Loss of voice was observed only before and early after the treatment in glottic and transglottic carcinoma groups. Later and in other groups, there was no patient with aphonia.

Before the treatment, the association between the extend of the tumour and the quality of voice was also observed. Out of 75 patients with the early stage of the tumour, there was no patient with a good quality of voice, 90.67% with a bad quality, 2.67% experienced loss of voice and 6.67% of the patients missed the record of the quality of voice. Late stage of the tumour was present in 24 patients, 8.33% had a good quality of voice, 50% a bad quality, 4.17% lost their voice and 37.5% missed a record of the quality of voice.

### Swallowing results

The comparison of the quality of swallowing in the particular groups of patients related to the tumour location and to the time passed after the treatment is shown in Fig. 2. The highest proportion of the patients with swallowing dysfunction before the treatment was in the supraglottic carcinoma group (66.67%).

After the treatment, swallowing dysfunction was most commonly seen in patients with transglottic lesion (44.44%). As compared to the situation before the treatment, among patients with supraglottic carcinoma there was a decline in the proportion of patients with swallowing dysfunction (66.67% vs. 33.33%) after the treatment, and the proportion of patients with no swallowing dysfunction increased (26.67% vs. 60%). In the transglottic carcinoma group, the proportion of the patients with no swallowing dysfunction increased (22.22% vs. 55.56%) after the treatment and the proportion of patients with swallowing dysfunction did not change (44.44% vs. 44.44%).

In the glottic carcinoma group, the proportions before and after the treatment did not greatly change, and most of the patients (67.61%) had no swallowing dysfunction. Among the patients with subglottic lesion, the number of patients with no swallowing dysfunction increased after the treatment (25% vs. 50%), but that group consisted

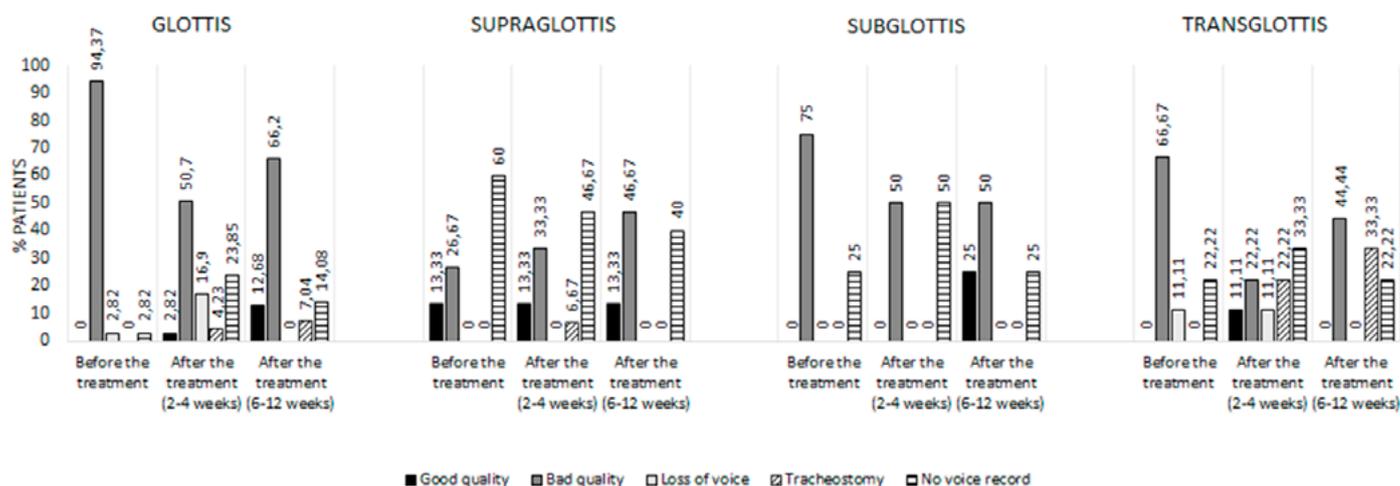


Fig. 1. Comparison of the quality of voice in the analyzed groups of patients.

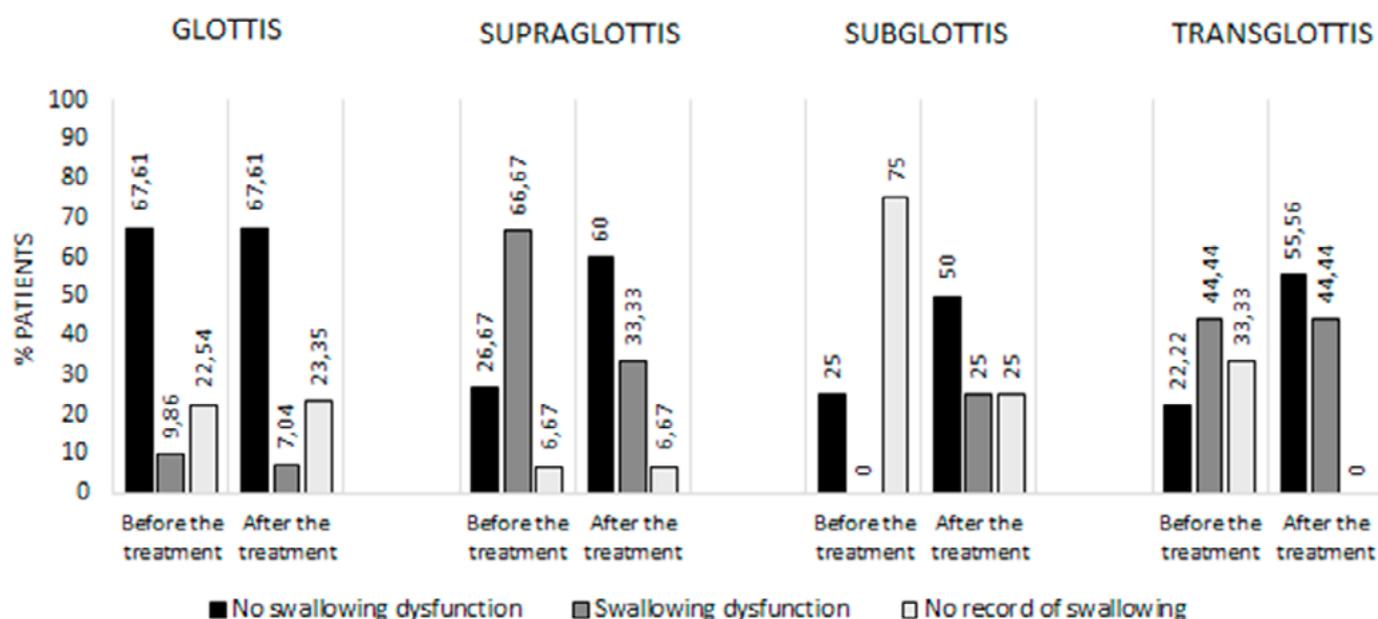


Fig. 2. Comparison of the quality of swallowing in the analyzed groups of patients.

of a low number of patients, while a high number of patients was missing the record of the swallowing function (75% vs. 25%).

## DISCUSSION

Laryngeal cancer and its treatment are associated with both short- and long-term side effects, affecting laryngeal functions and leading to a decreased quality of life [1, 14, 17, 18]. One of the objectives of this study was to analyze the presence of voice and swallowing dysfunctions in patients treated for laryngeal cancer with various larynx-preserving treatment modalities. It must be noted that no focused treatment was given to the patients with respect of the management of voice and swallowing function.

Voice impairment was most frequent in the glottic carcinoma group, both before and after the treatment. The dysfunction of

swallowing was less common in this group of patients. This tendency may be explained by the location in the glottic area and affection of the vocal cords being an important component of voice production. On the other hand, the highest proportion of the patients with swallowing dysfunction appeared to be in the supraglottic carcinoma group before the treatment and in the transglottic carcinoma group after the treatment. The association of the supraglottic tumours with swallowing problems could be related to the location of the tumour at the time of diagnosis close to the swallowing route. Post-therapeutic dysphagia in patients with transglottic cancer is likely due to both the extent of the lesion and the need for aggressive therapy. The observation of the stage of the tumour and the quality of voice in our cohort of patients showed that even early stages of the tumour cause an impairment of the voice quality. To assess the impact of the extend of the tumour on the stage of the voice disorder, a quantitative analysis of the quality of voice is necessary.

Tab. I. Group characteristics.

LOCATION	N	STAGE				TREATMENT							
		Early		Late		Surgery		RT		CRT		Surgery+RT/CRT	
		N	%	N	%	N	%	N	%	N	%	N	%
Glottic	71	61	85.92	10	14.08	57	80.28	7	9.86	6	8.45	1	1.4
Supraglottic	15	6	40	9	60	7	46.67	0	0	4	26.67	4	26.67
Subglottic	4	4	100	0	0	0	0	2	50	1	25	1	25
Transglottic	9	4	44.44	5	55.56	1	11.11	2	22.22	5	55.56	1	11.11

Early stage = stage I, II; Late stage = stage III, IV based on TNM, Classification N – number of patients, RT – radiotherapy, CRT – chemoradiotherapy

Tab. II. Descriptions of the quality of swallowing after the treatment.

DESCRIPTION OF	
NO SWALLOWING DYSFUNCTION	SWALLOWING DYSFUNCTION
No problems/difficulties with swallowing; free/good/normal swallowing; good/normal alimentation; alimentation without restrictions; can eat everything	Choking; intermittent pain; need of washing down; difficulty with swallowing; dryness in the throat; need of a soft diet

Tab. III. Descriptions of the quality of voice after the treatment.

DESCRIPTION OF		
GOOD VOICE QUALITY	BAD VOICE QUALITY	LOSS OF VOICE
good/quite good/clear/resonant voice	Dysphonia/dysphonic voice; hoarseness/hoarse voice; moderately hoarse/weaker/fatigable/husky voice; severe dysphonia; dysphonia to aphonia; bad/worse voice; fluctuating voice quality; the voice is shaking	aphonia/aphonic voice; does not have voice

While analyzing the data obtained from the medical records of the selected groups of patients, we encountered a few issues limiting the scientific value of the work. One of them was the inhomogeneity of medical records as regards the quality of voice and swallowing. There was no uniform assessment and recording method, mostly because currently there are no national guidelines for the diagnosis and treatment of the functional sequelae associated with the treatment of laryngeal cancer in the Slovak republic. The data were mostly descriptive and based on clinician's observation of the patient during the examination and did not quantify the degree of the impairment. Another limitation, closely related to the situation mentioned above, was missing data of interest in the pre- and post-treatment medical records of some patients. The assessment/recording of the voice and swallowing quality was not carried out routinely in all patients. All these limitations may have an impact on the results of this study and have led to difficulties with the evaluation of the final results. The number of patients in the compared groups (based on tumour location) was not equal, which could lead to another bias in the comparison.

As the presence of post-treatment dysphagia and dysphonia affects the quality of life of the patients in a negative way and it can be improved with a good management, another aim of the study was to review relevant literature to find various opinions on the management process. According to diverse authors, it is important to provide patients with laryngeal/head and neck cancer (HNC) with management by a multidisciplinary team [4, 19–21]. The post-therapeutic follow-up of the patients should, apart from other objec-

tives, assess acute and chronic treatment-related side effects, guide the rehabilitation process and limit the functional loss [22–26].

Literature describes various follow-up strategies after completing the treatment. A common characteristic of many of them is the need to evaluate the state of voice and swallowing functions before and after the treatment of HNC and a routine post-therapeutic follow-up and rehabilitation of the identified functional impairment [19–21, 23, 24].

### Suggestion for a follow-up of the voice and swallowing functions in patients treated for laryngeal cancer

Based on the literature review and the results of our study, we suggest introducing a routine voice and swallowing function evaluation as an essential part in both the pre-treatment examination and the post-treatment follow-up in patients with laryngeal cancer [19–21, 23, 24]. We consider it necessary to examine/consult every laryngeal cancer patient by a multidisciplinary team. This team should, besides other specialists, include a speech and language therapist/phoniatrician, specialized in HNC, co-responsible for the management of the functional part of the treatment (voice and swallowing).

During the treatment and the post-treatment follow-up, it is important to monitor the weight and its changes. We suggest including in both pre- and post-treatment medical records a simple evaluation of the voice and swallowing function (normal or abnormal voice quality; presence or absence of swallowing dysfunction). In case of swallowing dysfunction we suggest adding a more detailed description (aspiration, pain, food regurgitation etc.). Next, in patients with identified abnormal voice quality/swallowing function, a more detailed examination should be carried out by a speech-language therapist/phoniatrician to identify the degree of the impairment. The method of evaluation of the functions should be simple, time-efficient and easy to perform. The VHI-10 questionnaire for voice evaluation and EAT-10 for evaluation of swallowing can be taken into consideration. Both of them are currently being validated for the Slovak language. Other options for voice evaluation could be e.g. the GRBAS scale or MPT (maximum phonation time).

As this study presented a retrospective analysis with all its limitations (missing data of interest, data inhomogeneity, qualitative character of the data), there is a need for a further prospective study regarding the quality of voice and swallowing in patients treated for laryngeal cancer. It is essential to compare the functional results

in different treatment groups, which was not performed in this study due to its descriptive character. It is necessary to further cooperate with speech and language therapists and phoniatrists in order to meet a consensus on the most suitable method for voice and swallowing function evaluation in patients treated for laryngeal cancer.

## CONCLUSIONS

The following conclusions were drawn based on our study:

- Follow-up medical records are incomplete regarding functional outcomes of the laryngeal cancer treatment (30.30% – no record on the voice quality early after the treatment, 19.19% – no record on the voice quality late after the treatment, 20.20% – no record on the quality of swallowing);

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