

Postoperative results and the effects of extended partial laryngectomy on the quality of life

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Ethics Committee Approval

The study was approved by Gaziantep University Clinical Research Ethics Committee on 21 March 2016 with the decision number 2016/90.

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Larynx cancers account for 2-5% of all malignancies worldwide. With early diagnosis, radiotherapy or a partial laryngectomy may help preserve voice and laryngeal functions and reduce morbidity. This study aimed to evaluate how laryngeal functions, voice, and life quality were affected in larynx cancer patients after partial and extended partial laryngectomy.

Methods: The patients who were diagnosed with larynx cancer and underwent partial (supraglottic laryngectomy (SGL), supracricoid laryngectomy (SCL)) or extended partial laryngectomy (extended supraglottic laryngectomy (ESGL) and extended supracricoid laryngectomy (ESCL)) between May 2010 and December 2015 in the otorhinolaryngology clinic of a Training and Research Hospital were included in this study. A questionnaire comprising three forms was filled in by these patients. Voice quality, duration of hospitalization, time until removal of the nasogastric tube, location of the tumor, time of decannulation, swallowing, and cough were compared with regards to the types of laryngectomies.

Results: Our study began with 102 patients who had a partial laryngectomy; however, twelve who eventually had to undergo a total laryngectomy were excluded. Of the remaining 90 patients, 67 filled out our questionnaire. Functional score (FS), social functional score (SFS), symptom score (SS), fatigue score (FAS), general health score (GHS), and swallowing symptoms score (HNSW) were calculated and compared. These scores did not differ with the types of laryngectomies. In terms of voice quality, there were significant differences between ESCL-SGL, SCL-SGL, ESGL-SGL groups ($P=0.001$, $P=0.004$, and $P=0.004$, respectively).

Conclusion: Despite numerous changes in swallowing physiology and larynx anatomy after partial and extended partial laryngectomy, swallowing function is restored, and the patients can lead a healthy life.

Keywords: Larynx cancer, Life quality, Voice

Introduction

Larynx cancers, which account for 2-5% of all malignancies worldwide and in the Turkish population, can be diagnosed early with the increasing use of endoscopy and stroboscopy. Good outcomes are expected for survival and quality of life with appropriate treatment. With early diagnosis, radiotherapy or a partial laryngectomy may help preserve voice and laryngeal functions, reduce morbidity, and increase the quality of social life. In advanced tumors, however, preserving laryngeal functions takes a backseat, and radical methods such as a total laryngectomy are employed [1, 2].

The traditional goal with cancer treatment is to eliminate the disease and prolong the patient's life. Today, treatments are aimed at reintegrating the patient back into social and economic life, strengthening their social bonds with society, and improving their quality of life so they feel happy about themselves and their lives. Quality of life includes all situations and factors that affect the individual. When planning cancer treatments, these factors should be well-considered and there should be an awareness about the impact of the disease and the treatment on people's lives. Many studies have been conducted to measure and evaluate the efficacy of these treatments [3-6].

After the World Health Organization defined health as "not only the absence of a disease or disability but also as a complete state of peace and well-being, physically, mentally and socially" in 1948, the concept of quality of life gained increasing importance in healthcare practice with a commensurate increase in research assessing health-related well-being [3]. The first studies for assessing the quality of life were published in 1973. In recent years, their number gradually increased, especially the cost-benefit analysis of novel programs and treatments [7, 8].

To measure the effects of treatment on quality of life, several multidimensional questionnaires, as well as questionnaires for the evaluation of head and neck cancers alone, were developed. We used EORTC QLQ-C30 (Quality of Life Questionnaire) and QLQ-H & N35 (Quality of Life Questionnaire for Head and Neck Cancer) developed by the European Organization for Research and Treatment of Cancer (EORTC) to evaluate the quality of life of cancer patients, along with a questionnaire developed in our clinic [9]. This study aims to compare the cancer stages of patients who underwent partial and extended partial laryngectomy for larynx cancer in our clinic, evaluate the surgical outcomes and their quality of life, and perform survival analysis.

Materials and methods

This study was conducted between May 2010 and December 2015 on 102 patients who underwent surgery and additional radiotherapy as needed for larynx cancer at the Training and Research Hospital, Otorhinolaryngology & Head and Neck Surgery Clinic.

Inclusion criteria were as follows:

1. Patients diagnosed with SCC after preoperative biopsies
2. Those who underwent surgery as primary treatment
3. Patients followed up at our clinic
4. Patients who underwent postoperative radiotherapy as needed.

Our study was approved by Gaziantep University Clinical Research Ethics Committee on 21 March 2016 with the decision numbered 2016/90.

The preoperative and postoperative follow-up data of patients were recorded in our data collection system. Intraoperative data were recorded in our clinic's ledger of surgeries. Patients or their relatives were contacted via the telephone numbers in our records and called in for a medical examination. After routine examination, they were given detailed information about the study.

After filling out the patient information and consent forms, the patients proceeded to complete the form, consisting of the three following parts:

- 1) EORTC QLQ-C30 Version 3.0 Turkish, which is a quality-of-life scale for cancer patients (European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire) [4]
- 2) EORTC QLQ-H&N35 Turkish, which is a head and neck cancer scale (European Organization for Research and Treatment of Cancer, Questionnaire module to be used in Quality-of-Life assessments in Head and Neck Cancer) [4]
- 3) A questionnaire consisting of questions about the quality of life, designed in our clinic.

The basic demographic and clinical data of the patients were evaluated. The information was obtained from the patients and their files. The included parameters were age and gender of the patients, smoking habits, alcohol use, tumor sites, TNM and stage of the tumor, surgical treatments, postoperative complications, postoperative hospitalization, time until oral feeding, decannulation time, histopathological changes in the tumor and patients' medical histories.

Postoperative radiotherapy was recommended for the patients with a T4 tumor, bone/cartilage invasion, invasion of the soft tissues of the neck, perineural invasion, vascular invasion, multiple positive lymph nodes, extracapsular spread in the lymph node, and a subglottic extension of more than 10 mm in the anterior region and 5 mm in the posterior region [10-12].

Partial laryngectomy included supraglottic laryngectomy (SGL) and supracricoid laryngectomy (SCL), while extended partial laryngectomy comprised extended supraglottic laryngectomy (ESGL) and extended supracricoid laryngectomy (ESCL).

After the patient information and consent forms, the patients also filled out the three questionnaires for assessment and comparison of their life quality.

The EORTC QLQ-C30, Version 3.0 (European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire) is not a specific questionnaire for larynx cancer, but it is still a commonly used quality of life questionnaire for cancer patients worldwide [13].

The scale for head and neck cancer, EORTC QLQ-HN35 (European Organization for Research and Treatment of Cancer, Questionnaire module to be used in Quality-of-Life assessments in Head and Neck Cancer), was designed as an additional questionnaire to the EORTC QLQ C-30 to better assess the quality of life of patients with head and neck cancer [14, 15].

The questionnaire of 15 questions developed by our clinic included queries concerning the following: The decannulation process for patients who underwent laryngectomy, the duration until removal of the nasogastric feeding tube (NG), postoperative complications, postoperative voice quality, nasal obstructions, headaches, whether the patient coughed during oral feeding after the removal of the NG tube, post-nasal drips, length of hospitalization, wound site infections, whether the patient contracted a lung infection after surgery and impairment in their sense of smell.

Statistical analysis

Conformity to normal distribution of the numerical data was tested with the Shapiro–Wilk test. The Mann-Whitney test was used in the comparison of non-normally distributed variants between two groups, and the Kruskal Wallis test was used to compare the non-normally distributed variants between four groups. The relationship between categorical variables was assessed using the Chi-Square test. SPSS 22.0 package software was for analysis. $P < 0.05$ was considered statistically significant.

Results

A total of 102 patients treated in our clinic for larynx cancer between May 2010 and December 2015 were included in the study. The mean age of the patients was 56.1 (range 29-70) years. Ninety-four of the 102 patients were male and 8 were female. Of these, SGL was performed in 51 patients, SCL, in 24 patients, ESGL, in 19 patients and ESCL, in 8 patients (Table 1). These patients also underwent neck dissection. Only one patient who received preoperative radiotherapy did not have a neck dissection performed.

Table 1: Demographic characteristics of the patients included in the study

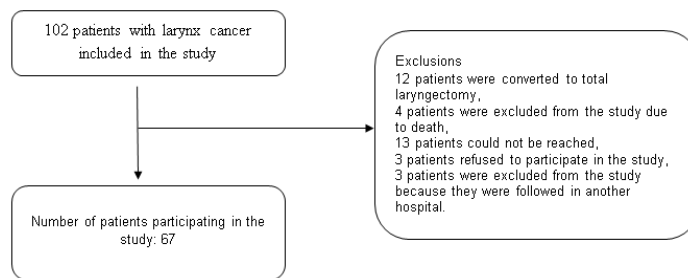
	Number (n)	Percentage (%)
Sex		
Female	8	7.84
Male	94	62.16
Distribution of patients by age group		
20-30	1	0.98
31-40	1	0.98
41-50	25	24.50
51-60	43	42.15
61-70	32	31.37
Types of laryngectomies		
SGL	51	50
SCL	24	23.52
ESGL	19	18.62
ESCL	8	7.84
Total	102	100

SGL: supraglottic laryngectomy, SCL: supracricoid laryngectomy, ESGL: extended supraglottic laryngectomy, ESCL: extended supracricoid laryngectomy.

Disease staging was performed postoperatively. Eighteen patients were assessed as stage I, 39 patients as stage II, 12 patients as stage III, 11 patients as stage IVa, and 7 patients as stage IVc.

Of 102 patients included in the study who underwent partial laryngectomy, 12 eventually underwent total laryngectomy and were excluded. Six of these patients underwent total laryngectomy due to relapse while the remaining had a total laryngectomy due to difficulties with aspiration and swallowing. Sixty-seven of the remaining 90 patients participated in our survey. Three of the twenty-three patients could not be evaluated due to being followed up at another hospital, 4 died, 13 could not be reached and 3 refused to participate in the survey (Figure 1). Of the sixty-seven patients interviewed, 33 had SGL, 12 had SCL, 15 had ESGL and 7 had ESCL (Table 2).

Figure 1: Flow diagram of the study



Sixty-seven patients were first divided into two groups, as those who had a partial and extended partial laryngectomy, and a further classification was made based on these groups. The functional score (FS), the social function score (SFS), the symptom score (SS), the fatigue score (FAS), the general health score (GHS), and the swallowing symptoms score (HNSW) were calculated and compared (Table 3).

Table 2: Data of patients who participated in the survey

	Number (n)	Percentage (%)
Patients Participating in the Survey		
Those who had partial laryngectomy	45	67.2
Those who had extended partial laryngectomy	22	32.8
Type of laryngectomy		
ESCL	7	10.4
ESGL	15	22.4
SCL	12	17.9
SGL	33	49.3
Lung infection		
Those who had the infection	12	17.9
Those who did not have an infection	55	82.1
Total	67	100

SGL: supraglottic laryngectomy, SCL: supracricoid laryngectomy, ESGL: extended supraglottic laryngectomy, ESCL: extended supracricoid laryngectomy

Table 3: Comparison of quality-of-life scores according to laryngectomy types

	Number (n)	FS mean (SD)	SFS mean (SD)	SS mean (SD)	FAS mean (SD)	GHS mean (SD)	HNSW mean (SD)
Those who had partial laryngectomy	45	79.24 (18.9)	81.48 (28.91)	21.70 (20.66)	31.31 (24.46)	55.74 (24.98)	29.62 (25.34)
Those who had extended partial laryngectomy	22	78.18 (20.01)	83.33 (26.72)	19.69 (17.91)	32.82 (26.22)	54.54 (16.81)	34.84 (22.36)
P1		0.881	0.865	0.857	0.912	0.813	0.236
P2		0.536	0.536	0.592	0.837	0.482	0.432
P3		0.623	0.784	0.938	0.926	0.324	0.530

FS: functional score, SFS: social functional score, SS: symptom score, FAS: fatigue score, GHS: general health score, HNSW: swallowing symptoms score, SD: standard deviation, P1: p values for partial laryngectomy and extended partial laryngectomy groups, P2: p values for extended supracricoid laryngectomy and supracricoid laryngectomy groups, P3: p values for extended supraglottic laryngectomy and supraglottic laryngectomy groups, $P < 0.05$ statistically significant

The FS ($P=0.881$), GHS ($P=0.813$), and all quality-of-life scores (Table 3) were similar between the groups who underwent partial and extended partial laryngectomy.

The patients who underwent laryngectomy were compared in terms of the food they consumed and their cough severity. They were asked to respond to questions concerning the relationship between the food they consumed, both solid and liquid, and their coughing using the options "yes", "no", "sometimes". Solid and liquid foods were evaluated separately according to the different types of laryngectomy surgeries performed on the patients. The groups were similar in terms of cough severity during solid ($P=0.053$) and liquid ($P=0.308$) food consumption (Table 4).

Twelve patients had one or more lung infections and received treatment because of aspiration during eating and drinking. Patients who had a partial laryngectomy and a lung infection due to the food they consumed were compared based on different types of laryngectomy surgeries they had undergone, and no statistically significant differences were found ($P=0.505$) (Table 4).

Table 4: Relationship between foods and coughing

		Types of laryngectomies				P-value
		ESCL	ESGL	SCL	SGL	
Relationship between solid food and coughing	Sometimes	1	4	3	15	0.053
	Yes	3	7	3	3	
	No	3	3	6	15	
Relationship between liquid food and coughing	Sometimes	3	3	5	16	0.308
	Yes	3	9	4	8	
	No	1	2	3	9	
Lung infection	Those who had the infection	2	1	2	7	0.505
	Those who did not have an infection	5	14	10	26	
	Total number of patients	7	15	12	33	

SGL: supraglottic laryngectomy, SCL: supracricoid laryngectomy, ESGL: extended supraglottic laryngectomy, ESCL: extended supracricoid laryngectomy. *P*<0.05 statistically significant

In the survey, patients were asked to appoint scores on a scale of 1 to 7 to determine voice quality, where 1 point indicated "very bad", and 7 points indicated "perfect". The mean voice quality score was higher in patients who underwent SGL compared to the others (SGL mean score: 4.6). The mean score was lower in patients who underwent an extended laryngectomy compared to the other group (mean scores respectively ESGL: 3.4, SCL: 3.2, ESCL: 2.7).

Significant differences were found between the ESCL-SGL, SCL-SGL, and ESGL-SGL groups in terms of voice quality scores (*P*=0.001, *P*=0.004, *P*=0.004, respectively). This was attributed to the preservation of both vocal cords in SGL.

Based on different types of laryngectomy surgeries, the patients were compared about decannulation time and the length of time elapsed until the removal of the NG tube. The decannulation time and duration until NG tube removal were insignificantly longer in patients who underwent ESCL compared to patients who had other types of laryngectomies (Table 5).

Table 5: Decannulation time and length of time spent with an NG tube

	Types of laryngectomies				P-value
	ESCL	ESGL	SCL	SGL	
Decannulation time (day)	16.85	15.27	16.25	15.15	0.422
Length of time spent with an NG tube (day)	39	38.07	37.45	35.06	0.991

SGL: supraglottic laryngectomy, SCL: supracricoid laryngectomy, ESGL: extended supraglottic laryngectomy, ESCL: extended supracricoid laryngectomy, NG: nasogastric tube, *P*<0.05 statistically significant.

Discussion

In this study, we evaluated the surgical results of 102 patients who underwent partial laryngectomy for larynx cancer, and the quality of life of 67. The mean age of the patients was 56.1 years (29-70 years). The scores were similar to those reported in most studies [12, 16, 17] but less than some [18]. In recent years, the number of younger patients admitted to our clinic increased. While the rate of females in our study was 7.8%, those reported by Portal et al. [19] and Gok et al. [20] were 3.2% and 4.0%, respectively.

Park et al. evaluated the functional outcomes of 116 patients who underwent partial laryngectomy due to larynx cancer between 2009-2013 [21]. The patients were followed up over at least 12 months and divided into two groups, SCL (n=84) and ESCL (n=32), according to arytenoid resection. Among those that underwent SCL and ESCL, the mean decannulation times were 16.83 days and 23.27 days, respectively, while the time passed until NG tube removal was 24.19 days and 27.33 days, respectively. The two groups were similar in terms of eating routines after NG tube removal and significantly different

with regards to decannulation time and rate of aspiration pneumonia. We also found no differences between our ESCL and SCL groups in terms of eating routines. This study supports our findings.

Bron et al. conducted a study to evaluate the effect of arytenoid resection on patients who underwent SCL and reported that arytenoid resection does not cause any significant difference regarding the time a patient spends with an NG tube. They concluded that a simple resection of the arytenoid does not impact swallowing in the early postoperative phase [22].

Akbas et al. evaluated the functional outcomes of 46 patients who underwent supracricoid laryngectomy. The mean decannulation time was 20 days in the group where both arytenoids were preserved, and 41 days in the group that had just one arytenoid resected. The mean time spent with an NG tube was 21 days (9-60 days) in the group where both arytenoids were preserved; while it was 40 days in the group who had one arytenoid resection [23]. In the study of Yuce et al., the decannulation time was 40.2 days in the patient group with a single arytenoid and 20.8 days in the patient group with both arytenoids preserved. The length of time spent with an NG tube was 18.4 days in the patient group with a single arytenoid and 8.8 days in the patient group with both arytenoids preserved. In this study, the differences between the two groups were statistically significant [24]. We found no significant differences between our SCL and ESCL patients in terms of decannulation time and time until NG tube removal.

In partial laryngectomies, aspiration-related complications are one of the most important postoperative complications. A possible incidence of aspiration delays decannulation and the transition to oral feeding, resulting in an extension of hospitalization times and cost increase [25-27]. Başerer et al. [28] found postoperative aspiration rates affecting oral nutrition to be 6% while it was 5% according to Oz F. et al. [29]. Uluşan et al. [30] have shown that the incidence of aspiration goes up in cases where the FEV1 value (Forced Expiratory Volume in 1 second) lies below 75% in a lung function test. Therefore, in patients scheduled to undergo a laryngectomy, preoperative PFTs (Pulmonary Function Test) and seeking the opinion of a chest diseases specialist are recommended.

Mc Connel et al. analyzed the swallowing function in patients after supraglottic laryngectomy and found three aspiration-causing factors. These are decreased and delayed laryngeal elevation and weak laryngeal-lingual approximation [31]. Since a standard supraglottic laryngectomy performed during the resection of a supraglottic carcinoma protects the arytenoids and vocal cords, the larynx can perform its protective function. However, some patients lose their epiglottis, and arytenoids and vocal cords need to do additional work to cover the laryngeal sphincter. The possible complications after a supraglottic laryngectomy are chronic aspiration due to glottis insufficiency, hyposensitivity caused by incision of the superior laryngeal nerve, and insufficient elevation of the larynx to the root of the tongue. After an extended supraglottic laryngectomy, which includes part of the root of the tongue, the arytenoid cartilage, the aryepiglottic fold, and/or the piriform sinus, and swallowing problems intensify, and aspiration problems may

arise. Resection of the root of the tongue can damage the 12th cranial nerve and cause hypomobility of the root of the tongue which can impair the root of the tongue's ability to pull backward [32]. In our study, coughing after solid and liquid food intake was higher in patients who had ESGL and ESCL than in those who had SGL and SCL. These patients also took longer to switch to oral feeding in the post-operative period. Patients were thought to tolerate this condition over time.

In a study conducted by Gallo et al. [33], prognostic factors in pneumonia developing after supraglottic and supracricoid laryngectomy were investigated. In a series of 416 cases, pneumonia occurred in 73. Three of these patients died of respiratory arrest and sepsis. Of the 73 patients, 26 had early-stage pneumonia and 44 had late-stage pneumonia. The number of cigarettes smoked, body mass index, lung diseases before surgery, age, gender, preoperative blood gas values, tumor stage, and type of surgery were assessed as potential risk factors for postoperative pneumonia. In the study, a stage III-IV disease, a history of lung diseases, a preoperative hemoglobin level of less than 14, and a preoperative pO₂ level of less than 90 in the blood gas had prognostic significance. Early postoperative pneumonia was associated with patients over 60 years of age and those with a body mass index >30 kg/m². Forty-two of 70 patients who had pneumonia had growth in their sputum culture. The most isolated pathogen was *Staphylococcus aureus*. More than one species was isolated in 22 patients. In the culture analysis, no significant differences were found between the groups in terms of microorganisms [33]. In this study, the incidence of pneumonia in the postoperative period was 16.8%, which was similar to the finding in our study (17.9%).

Woisard et al. [34, 35] examined the swallowing functions of patients who had supraglottic and supracricoid laryngectomies. It was concluded that edema in arytenoids may contribute to laryngeal occlusion and that food accumulating around the arytenoid may increase the risk of aspiration.

Philippe et al. conducted a study showing the postoperative functional results in 190 patients who had a supracricoid partial laryngectomy with cricohyoidopexy [36]. Normal swallowing was achieved in the first postoperative month in 68.1% of the patients (128/188). Grade 1-2 aspiration was observed in 23.4% (44/188) between the 1st and 4th months. Grade 1-2 aspiration was treated in conjunction with physiotherapy and swallowing rehabilitation. Grade 1-2 aspiration was reported to occur due to old age, repositioning of the piriform sinuses and inferior constrictor muscles, disarticulation of the arytenoid cartilage, and extended insertion of the tracheostomy tube. Pneumonia due to aspiration (grade 3 aspiration) was seen in 8.5% (16/188) of the patients. Aspiration-induced pneumonia was treated by antibiotics and physiotherapy in 13 patients, collagen injection in 1 patient, and temporary gastrectomy in 2 patients. At the end of the first postoperative year, the rate of permanent gastrostomy placement and total laryngectomy due to aspiration was 0.5% (1/188) and 98.4% of the patients (187/190) regained their normal swallowing functions without a gastrostomy. In this study, the early removal of the tracheostomy tube led to the rapid mobilization of the arytenoid cartilage, maintenance of the cough reflex, and prevention of pulmonary infections. It has been argued that early

decannulation improves swallowing because the tracheostomy tube reduces laryngeal elevation during swallowing, affecting the sensitivity of the mechanical laryngeal receptors.

Limitations

The small size of our patient group may be a limitation of our study. Future studies with a larger group of patients might well establish the exact relationship of laryngectomy results.

Conclusions

A comparison of the cited studies and the current study reveals that due to the numerous changes in swallowing physiology and anatomy following partial laryngectomies and extended partial laryngectomies, restoration of the swallowing function can also take a long time in some patients. Even in such cases, it can be argued that patients regain most of their swallowing functions and can continue to lead healthy lives.

References

- Kaya S. Larenks Hastalıkları. Ankara: Bilimsel Tıp Yay; Ocak 2002;539-716.
- Özlügedik S, Ünal A. Bas boyun kanserlerinde epidemiyoloji ve risk faktörleri. KBB Bas Boyun Cerrahisi'nde Güncel Yaklaşım. 2005;1:51-6.
- Testa MA, Simonson DC. Assessment of quality-of-life outcomes. N Engl J Med. 1996 Mar 28;334(13):835-40. doi: 10.1056/NEJM199603283341306. PMID: 8596551.
- QL Coordinator Quality of Life Unit, EORTC Data Center, Avenue E. Mounier 83 - B11, 1200 Brussels, Belgium, Email: abo@eortc.be
- Long SA, D'Antonio LL, Robinson EB, Zimmerman G, Petti G, Chonkich G. Factors related to quality of life and functional status in 50 patients with head and neck cancer. Laryngoscope. 1996 Sep;106(9 Pt 1):1084-8. doi: 10.1097/00005537-199609000-00008. PMID: 8822710.
- Smith JC, Johnson JT, Cognetti DM, Landsittel DP, Gooding WE, Cano ER, et al. Quality of life, functional outcome, and costs of early glottic cancer. Laryngoscope. 2003 Jan;113(1):68-76. doi: 10.1097/00005537-200301000-00013. PMID: 12514385.
- Carr AJ, Higginson IJ. Are quality of life measures patient centred? BMJ. 2001 Jun 2;322(7298):1357-60. doi: 10.1136/bmj.322.7298.1357. PMID: 11387189; PMCID: PMC1120435.
- Jenney ME, Campbell S. Measuring quality of life. Arch Dis Child. 1997 Oct;77(4):347-50. doi: 10.1136/adc.77.4.347. PMID: 9389243; PMCID: PMC1717359.
- Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Dues NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. J Natl Cancer Inst. 1993 Mar 3;85(5):365-76. doi: 10.1093/jnci/85.5.365. PMID: 8433390.
- Hinerman RW, Morris CG, Amdur RJ, Lansford CD, Werning JW, Villaret DB, et al. Surgery and Postoperative Radiotherapy for Squamous Cell Carcinoma of the Larynx and Pharynx. Am J Clin Oncol. 2006 Dec;29(6):613-21. doi: 10.1097/JCO.0000000000000000. PMID: 1618666.
- Huang DT, Johnson CR, Schmidt-Ullrich R, Grimes M. Postoperative radiotherapy in head and neck carcinoma with extracapsular lymph node extension and/or positive resection margins: a comparative study. Int J Radiat Oncol Biol Phys. 1992;23(4):737-42. doi: 10.1016/0360-3016(92)90646-y. PMID: 1618666.
- Aslan I, Baserer N, Yazicioglu E, Oysu C, Tinaz M, Kiyak E, et al. Neartotal laryngectomy for laryngeal carcinomas with subglottic extension. Arch Otolaryngol Head Neck Surg. 2002;128:177-80.
- Bjordal K, de Graeff A, Fayers PM, Hammerlid E, van Pottelsberghe C, Curran D, et al. A 12 country field study of the EORTC QLQ-C30 (version 3.0) and the head and neck cancer specific module (EORTC QLQ-H&N35) in head and neck patients. EORTC Quality of Life Group. Eur J Cancer. 2000 Sep;36(14):1796-807. doi: 10.1016/s0959-8049(00)00186-6. PMID: 10974628.
- Bjordal K, Ahlner EM, Tollesen E, Jensen AB, Razavi D, Maher EJ, et al. Development of a European Organization for research and Treatment of Cancer (EORTC) questionnaire module to be used in quality of life assessments in head and neck cancer. Acta Oncol 1994;33:879-85.
- Bjordal K, Hammerlid E, Ahlner-Elmqvist M, de Graeff A, Boysen M, Evensen JF, et al. Quality of life in head and neck cancer patients: validation of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-H&N35. J Clin Oncol. 1999 Mar;17(3):1008-19. doi: 10.1200/JCO.1999.17.3.1008. PMID: 10071296.
- Erdamar B, Sütoglu Y, Kiyak E, Sunay T, Katircioğlu S, Güven M, et al. Cerrahi tedavi uygulanan larenks kanserli hastaların uzun dönemde yaşam kalitelerinin değerlendirilmesi. KBB İhtisas Dergisi 2001;8:219-25.
- İnal E, Kemaloglu Y, Bayramoğlu I, Yeğin H. Larenks kanseri olgularımızın retrospektif analizi. Kulak Burun Boğaz ve Baş Boyun Cerrahisi Dergisi, 1993;1:23-8.
- Müller R, Paneff J, Köllner V, Koch R. Quality of life of patients with laryngeal carcinoma: a post-treatment study. Eur Arch Otorhinolaryngol. 2001 Aug;258(6):276-80. doi: 10.1007/s004050100356. PMID: 11583465.
- Molina JM, Fernandez-Crehuet MJ, Caballero J, Gutierrez BM, Gomez GE, Fernandez-Crehuet NJ. Quality of life in patients treated for early laryngeal cancer, in healthy people and in those with other associated pathologies Acta Otorrinolaryngol Esp. 2004;55:381-6.
- Gök Ü, Karlıdağ T, Kaygusuz İ, Yağcı Ş. Parsiyel Larenjektomi Sonrası fonksiyonel Sonuçlarımız. Türkiye Klinikleri KBB Dergisi 2003;3:4-8.
- Jun-Ook P, Young-Hoon J, Kwang-Jae C, Nam-Gyun K, Min-Sik K. Functional and Oncologic Results of Extended Supracricoid Partial Laryngectomy. Arch Otolaryngol Head Neck Surg. 2011;137:1124-29.
- Bron L, Brossard E, Monnier P, Pasche P. Supracricoid partial laryngectomy with cricohyoidopexy and cricohyoidopexy for glottic and supraglottic carcinomas. Laryngoscope. 2000 Apr;110(4):627-34. doi: 10.1097/00005537-200004000-00017. PMID: 10764009.
- Akbas Y, Demireller A. Oncologic and functional results of supracricoid partial laryngectomy with cricohyoidopexy. Otolaryngol Head Neck Surg. 2005 May;132(5):783-7. doi: 10.1016/j.otohns.2005.01.030. PMID: 15886635.
- Yuce I, Cagli S, Bayram A, Karasu F, Sati I, Guney E. The effect of arytenoid resection on functional results of cricohyoidopexy. Otolaryngol Head Neck Surg. 2009;141:272-5.
- Sevilla MA, Rodrigo JP, Llorente JL, Cabanillas R, López F, Suárez C. Supraglottic laryngectomy: analysis of 267 cases. Eur Arch Otorhinolaryngol. 2008 Jan;265(1):11-6. doi: 10.1007/s00405-007-0415-9. Epub 2007 Aug 8. PMID: 17684753.

26. Laccourreye O, Brasnu D, Merite-Drancy A, Cauchois R, Chabardes E, Ménard M, Laccourreye H. Cricohyoidopexy in selected infrahyoid epiglottic carcinomas presenting with pathological preepiglottic space invasion. *Arch Otolaryngol Head Neck Surg.* 1993 Aug;119(8):881-6. doi: 10.1001/archotol.1993.01880200087012. PMID: 8343251.
27. Orús C, León X, Vega M, Quer M. Initial treatment of the early stages (I, II) of supraglottic squamous cell carcinoma: partial laryngectomy versus radiotherapy. *Eur Arch Otorhinolaryngol.* 2000 Nov;257(9):512-6. doi: 10.1007/s004050000276. PMID: 11131380.
28. Baserer N, Kiyak E, Oysu Ç, Aslan I, Yazıcıoğlu E, Biliciler N et al. Larenks karsinomunda fonasyon teknikleri. *Kulak Burun Bogaz İhtis Der* 1996;3:674-7.
29. Öz F, Sekercioğlu N, Toprak M. T3 evresindeki transglottik kanserlerde geniş parsiyel larenjektomi. CTF KBB Anabilim Dalı X Akademik Haftası Uluslararası Nöro-Otolojik Cerrahi Simpozyumu Tutanakları 1988:231-2.
30. Ulsan M, Başaran B, Orhan KS, Comoğlu S, Yıldırım K, Kiyak OE. Oncologic and functional outcomes of open surgery in early supraglottic tumors: is it still a valid technique? *Kulak Burun Bogaz İhtis Der* 2012;22:129-35.
31. McConnel FM, Mendelsohn MS, Logemann JA. Manofluorography of deglutition after supraglottic laryngectomy. *Head Neck Surg.* 1987 Jan-Feb;9(3):142-50. doi: 10.1002/hed.2890090303. PMID: 3623944.
32. Tuncay A, Titiz A, Özcan M. Parsiyel larenjektomi sonrası yutma fizyolojisindeki değişimler. *Ankara Numune Eğitim ve Araştırma Hastanesi 1. KBB Kliniği Derleme*
33. Gallo O, Deganello A, Gitti G, Santoro R, Senesi M, Scala J, et al. Prognostic role of pneumonia in supracricoid and supraglottic laryngectomies. *Oral Oncology* 2009;45, 30– 8.
34. Woisard V, Puech M, Yardeni E, Serrano E, Pessey JJ. Deglutition after supracricoid laryngectomy: compensatory mechanisms and sequelae. *Dysphagia.* 1996 Fall;11(4):265-9. doi: 10.1007/BF00265213. PMID: 8870355.
35. Woisard V, Serrano E, Yardeni E, Puech M, Pessey JJ. Deglutition after supra-glottic laryngectomy. *J Otolaryngol.* 1993 Aug;22(4):278-83. PMID: 8230379.
36. Naudo P, Laccourreye O, Weinstein G, Jouffre V, Laccourreye H, Brasnu D. Complications and functional outcome after supracricoid partial laryngectomy with cricohyoidoepiglottopexy. *Otolaryngol Head Neck Surg.* 1998 Jan;118(1):124-9. doi: 10.1016/S0194-5998(98)70388-2. PMID: 9450842.

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