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Possibility of deglutition function after laryngectomy: correlation analysis of physiological condition and consequences

Mogućnosti degluticijske funkcije nakon laringektomije: korelacijska analiza fiziološkog stanja i posljedica

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Summary

Objective: Surgical procedures on the larynx lead to some swallowing disorders of that may occur at any time during the postoperative period and can be present in all phases of swallowing. The aim of the study was to explore the prevalence of dysphagia after laryngectomy, the correlation and difference in dysphagia symptoms depending on the extent of the surgery.

Methods: The study included 40 laryngectomized subjects of both sexes, median age 63.50 years. Data were collected by a survey of respondents and questionnaire structured from three sets of closed-ended questions. The data were statistically processed in the statistical program SPSS (version 16.0, SPSS Inc., Chicago, IL, USA).

Results: The incidence of dysphagia is more often after partial laryngectomy with statistically significant differences in certain symptoms. A positive and statistically significant correlation was found between swallowing disorders and the consequences of oncological treatments. A negative and statistically significant correlation was found between swallowing disorders and the type of complications.

Conclusion: The results show that patients who had surgery have varying degrees of swallowing disorders. The ability to identify symptoms of dysphagia becomes increasingly important when developing appropriate interventions for this subgroup of laryngeal cancer patients.

Key words: dysphagia, laryngectomy, symptoms, swallowing

Sažetak

Cilj: Kirurški zahvati na grkljanu dovode do različitog stupnja disfunkcije gutanja koja se može pojaviti u bilo kojem trenutku tijekom postoperativnog razdoblja i može se manifestirati u svim fazama gutanja. Cilj studije bio je istražiti prevalenciju disfagije nakon laringektomije, te korelaciju i razliku u simptomima disfagije, ovisno o opsegu operacije.

Metode: Studija je obuhvatila 40 laringektomiranih ispitanika oba spola, medijana životne dobi 63,50 godina. Podaci su prikupljeni pregledom ispitanika i anketnim upitnikom koji je strukturiran iz tri seta zatvorenih pitanja. Podaci su statistički obrađeni u računalnom programu SPSS (verzija 16.0, SPSS Inc., Chicago, IL, SAD).

Rezultati: Pojavnost disfagije češća je nakon parcijalne laringektomije, uz statistički značajne razlike u određenim simptomima. Pronađena je pozitivna i statistički značajna povezanost između poremećaja gutanja i posljedica onkološkog liječenja. Pronađena je negativna i statistički značajna povezanost između poremećaja gutanja i određene vrste komplikacija.

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Zaključak: Rezultati pokazuju da bolesnici koji su operirani imaju različit stupanj poremećaja gutanja. Sposobnost prepoznavanja simptoma disfagije postaje sve važnija kako bi se omogućilo razvijanje odgovarajućih intervencija za ovu podskupinu bolesnika s karcinomom grkljana.

Ključne riječi: disfagija, laringektomija, simptomi, gutanje.

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Introduction

Surgical procedures on the larynx lead to some of the swallowing disorders that may occur at any time during the postoperative period and can be present in all phases of swallowing. The estimated prevalence of swallowing disorders after laryngectomy is 17–70% depending on the type of procedure and the patient's health condition.[1] Immediately after laryngectomy the patient uses a nasogastric tube for feeding during several days, and if the wound heals properly the nasogastric tube is removed after that period.[2,3] Longer or even permanent feeding through a nasogastric tube is used mainly by patients who aspirate food or liquids, and in whom peroral nutrition is not possible due to comorbidities and other medical complications. In these cases, a percutaneous gastrostomy is placed as a feeding solution. Symptoms of dysphagia include coughing, choking during eating or drinking, oral and nasal regurgitation, a subjective sensation of food being stuck in one's throat or chest, and persistent drooling of saliva. Dysphagia can lead to further problems. Some of the serious and common consequences of dysphagia are malnutrition and dehydration. One of the serious dysphagia complications is aspiration pneumonia, which is a lung infection that can develop after accidental inhalation of a small piece of food, or liquid. It causes irritation in the lungs or damages them.[4] To what extend protective mechanisms will be preserved or what the width of the gastrointestinal tract after laryngectomy will be is determined by local involvement of the tumour's sieve as well as subsequent oncological treatment.[5-7] Dysphagia after total laryngectomy is less common, and when it occurs, it is usually the result of oncological radiation treatment or is caused by a spasm of the cricopharyngeal muscle that results in the narrowing of the cervical esophagus.[8] Some patients also have difficulty with uncontrolled bolus and premature swallowing. After partial laryngectomy, the swallowing problems are created by loss of a part of the larynx' external muscles and lingual bone limited elevation to the root of the tongue.[9-11] The amount of aspiration depends on the preserved protective mechanisms and after horizontal laryngectomy aspiration is more pronounced.[11] In addition to manifesting aspiration accompanied by cough, silent aspiration of secretions is common and stagnation of secretions in the lungs can have aspiration pneumonia as a serious consequence. [12,13] Patients with dysphagia are cared by a multidisciplinary team composed of a head and neck surgeon, speech language pathologist, gastroenterologist, nutritionist, nurse and other specialists as needed.

The aim of the study was to explore the prevalence of dysphagia after laryngectomy, the correlation and the difference in dysphagia symptoms depending on the extent of surgery.

Subjects and methods

The research was conducted at the Department of Otorhinolaryngology, Head and Neck Surgery of Osijek University Hospital Centre after the approval of the Ethics Committee of the Osijek University Hospital Centre during part of 2019 and 2020. All respondents were informed in a timely manner about the conduct of the research and gave their written consent.

The study included 40 laryngectomized subjects of both sexes 37 (92.50%) men and 3 (7.50%) women, median age 63.50 years. The criteria for the inclusion of the subjects in the study were: the performance of total or partial laryngectomy due to malignancy, orderly neurological and neurosurgical status, and orderly thyroid function. The exclusion criteria from the study were: existence of dysphagia of neurogenic etiology, performed cordectomy and performed extended surgical procedures (commando surgery, pharyngolaryngectomy), thyroid disease, previous neck trauma. The subjects were divided into two groups depending on the type of laryngectomy. The first group consisted of 25 totally laryngectomized subjects, and the second group consisted of 15 partially laryngectomized subjects. In the second group of a total of 15 subjects, 9 (60%) had horizontal partial laryngectomy and 6 (40%) subjects had horizontal vertical laryngectomy. In total, twenty-two variables were analyzed. The arithmetic mean of the time period elapsed since surgery, taking both groups into account, was 2.4 years. In the first group, it was 2.3 years, while in the second it was 2.5 years. Successful swallowing rehabilitation was performed in 10 (40%) subjects from the first group and 10 (66.7%) subjects from the second group, while during the study in 15 (60%) subjects from the first group

and 5 (33.3%) from the second group rehabilitation was underway. Data were collected by a survey of respondents and questionnaire constructed for the purpose of this research. The survey questionnaire was structured from three sets of closed-ended questions for easier statistical processing. The first set of questions concerned demographic data; the second set of questions concerned the type of surgery and the consequences of oncology treatment; the third set of questions related to complications after surgery.

The data obtained by the questionnaire were statistically processed in the statistical program SPSS (version 16.0, SPSS Inc., Chicago, IL, USA). Categorical data are presented in absolute and relative frequencies. Numerical data are described by the median and limits of the interquartile range since the distribution did not follow the normal one. The normality of the distribution of numerical variables was tested with the Kolmogorov-Smirnov test. Differences of abnormally distributed numerical variables between independent groups were tested by the Mann-Whitney U test. The correlation of numerical variables was evaluated with Spearman's correlation coefficient ro. All p values are two-sided. The significance level was set at 0.05.

Results

The incidence of dysphagia is more often after partial laryngectomy (26.7%). Table 1 shows statistically significant differences in disturbances with the sense of flair (p=0.016), the appearance of aspiration (p=0.008), oral and nasal regurgitation (p=0.000) and consumption of tobacco products (p=0.013) between partially and totally laryngectomized subjects. Other differences found were not statistically significant.

Table 1. Significance of differences according to parameters between groups
Tablica 1. Značajnost razlika između grupa prema parametrima

	Median (interquartile range) *Median (interkvartilni raspon*)	Median (interquartile range) *Median (interkvartilni raspon)*	*p-value *p-vrijednost*
Parameter / *Parametar*	Group 1 / *Grupa 1*	Group 2 / *Grupa 2*	
Oncological therapy *Onkološko liječenje*	3 (1-4)	3 (1-4)	0,598
Existence of complications *Postojanje komplikacija*	2 (1-2)	2 (1-2)	0,420
Swelling *Edem*	1 (1-6)	1 (1-6)	0,496
Skin inflammation *Upala kože*	2 (1-4)	2 (1-4)	0,065
Help dependence *Ovisnost o pomoći*	3 (1-3)	2 (1-3)	0,096
Weight loss *Gubitak težine*	1 (1-2)	2 (1-2)	0,257
Teeth problems *Problemi sa zubima*	2 (1-3)	2 (1-3)	0,738
Malnutrition *Pothranjenost*	4 (1-4)	4 (1-4)	0,64
Food consistency adaptation *Prilagodba prehrane*	2 (1-3)	3 (1-3)	0,951
Meal duration *Trajanje obroka*	1 (1-3)	1 (1-3)	0,436
Odinophagia *Odinofagija*	1 (1-4)	1 (1-4)	0,451
Swallowing dysfunction *Degluticijska disfunkcija*	1 (1-2)	2 (1-2)	0,107
Dysfunction of taste Smetnje okusa	1 (1-3)	1 (1-3)	0,119

Dysfunction of flair *Smetnje njuha*	1 (1-3)	1 (1-3)	0,016
Dry skin and mucosa *Suha koža i sluznica*	1 (1-3)	1 (1-3)	0,259
Salivation problems *Problemi salivacije*	2 (1-3)	2 (1-3)	0,359
Aspiration *Aspiracija*	2 (1-2)	1 (1-2)	0,008
Cough irritation *Nadražaj na kašalj*	2 (1-3)	2 (1-3)	0,280
Aspiration pneumonia *Aspiracijaska pneumonija*	2 (1-2)	2 (1-2)	0,284
Nasal regurgitation *Nazalna regurgitacija*	2 (1-2)	2 (1-2)	0,000
Alcohol consumption *Konzumacija alkohola*	2 (1-2)	2 (1-2)	0,629
Cigarette consumption *Konzumacija cigareta*	2 (1-2)	2 (1-2)	0,013

* *Mann Whitney U test*

A positive and statistically significant correlation was found between swallowing disorders and the consequences of oncological treatment (ρ=0.375, p=0.017) and between swallowing disorders and dietary adjustments, i.e. food consistency adjustments (ρ=0.505, p=0.001), meal duration (ρ=0.704, p=0.001), mucosal and skin dehydration (ρ=0.569, p<0.000) and between swallowing disorders and aspiration pneumonia (ρ=0.510, p=0.001). A complete and positive, statistically significant correlation was found between swallowing disorders and disturbance of taste sensation (ρ=1, p<0.000). A negative and statistically significant correlation was found between swallowing disorders and presence of swelling (ρ=-0.360, p=0.023), weight loss (ρ=-0.318, p=0.045), the appearance of odynophagia (ρ=-0.614, p=0.001), and a reduction in sense of flair (ρ=-0.658, p=0.001). The rest of the correlations found between the parameters were not statistically significant (Table 2).

Table 2. Spearman's estimate of the correlation of swallowing disorders with other parameters
Tablica 2. Spearmanova ocjena korelacije između degluticijske disfunkcije i ostalih parametara

Parameter / *Parametar*	Swallowing dysfunction / *Degluticijska disfunkcija*	
	Coefficient ρ *Koeficijent ρ*	*p-value *p-vrijednost*
Oncological therapy / *Onkološko liječenje*	-0,005	0,978
Existence of complications / *Postojanje komplikacija*	0,375	0,017
Swelling / *Edem*	-0,360	0,023
Skin inflammation / *Upala kože*	0,014	0,930
Help dependence / *Ovisnost o pomoći*	-0,020	0,902
Weight loss / *Gubitak težine*	-0,318	0,045
Teeth problems / *Problemi sa zubima*	-0,056	0,731
Malnutrition / *Pothranjenost*	0,142	0,383
Food consistency adaptation / *Prilagodba prehrane*	0,505	0,001
Meal duration / *Trajanje obroka*	0,704	0,001
Odinophagia / *Odinofagija*	-0,614	0,001
Dysfunction of taste / *Smetnje okusa*	1	-
Dysfunction of flair / *Smetnje njuha*	-0,658	0,001
Dry skin and mucosa / *Suha koža i sluznica*	0,569	0,000
Salivation problems / *Problemi salivacije*	0,125	0,442

Aspiration / *Aspiracija*	-0,280	0,080
Cough irritation / *Nadražaj za kašalj*	0,230	0,153
Aspiration pneumonia / *Aspiracijska pneumonija*	0,510	0,001
Nasal regurgitation / *Nazalna regurgitacija*	0,130	0,423
Alcohol consumption / *Konzumacija alkohola*	0,095	0,560
Cigarette consumption / *Konzumacija cigareta*	0,125	0,442

***** *Spearman's coefficient of correlation*

Discussion

Given the qualitative difference in the surgical approach and the scope of the operation in total laryngectomy in relation to partial laryngectomy, the results obtained in the difference between the examined parameters are logical and similar to the results of previous studies. An American study showed that 16% of laryngectomized patients had severe dysphagia[3] and, according to the results of an Australian study, the prevalence of dysphagia was 72%, which resulted in significant changes in diet and had an impact on their social activities.[1] English researchers examined the swallowing function after laryngectomy with videofluoroscopy and fiberoptic endoscopic evaluation of swallowing to show food residue in the neopharynx, on the vocal cords and in the upper esophagus. The presence of food residue is an important indicator of dysphagia. This symptom causes swallowing with latency, which is why a laryngectomised person must swallow multiple times for successful deglutation.[14] Maclean et al. and McConnel et al. have described poor pharyngeal clearance post laryngectomy resulting in higher retention of food residue, and consequently, in longer meal duration.[15,16]

In a study by Pauloski and Nasir, the taste sensation of the tongue was measured, and subsequently related to swallowing kinematics. It was found that a response bias for sour taste was significantly correlated with pharyngeal delay time, highlighting oral sensory contributions to swallow motor dysfunctions.[17] Although it has been suspected that pharyngeal congestion stems from sensory impairment, this study was conducted on a too small sample of subjects to bring general conclusions. On the other side, it is thought that taste sensation can activate the central pattern generator for swallowing due to afferent fibers of the facial nerve via the tympani chord in the nucleus tractus solitarius.[18-20] Among those suffering from dysphagia, the prevalence of dehydration ranges from 44% to 75%.[21] Bennett et al. showed that laboratory parameters indicated dehydration in 48% of elderly people, but proper assessment of dehydration was documented only in 26%[22] in the form of imbalance of fluid and electrolyte in persons[23]. The status of hydration should be reassessed regularly until corrected, and then regularly monitored. The first measure to replace fluid loss should be offering thickened liquids or food with high fluid content, whereas sodium-containing food and liquids must be avoided, and the enteral liquid administration via feeding tube may be appropriate in cases of severe dysphagia.[24] The results of the epidemiological study show that the prevalence of swallowing disorders is 38%. Most people with dysphagia described the sudden onset of chronic problems that lasted for at least 4 weeks. Three primary symptoms have been registered that are uniquely associated with swallowing disorder: taking a long time to eat, coughing or choking before, during, or after a meal, and a feeling of food being stuck in the throat.[25]

The results of this study and previous publications show that all patients who had surgery have certain swallowing disorders, but of varying degrees. Likewise, some physiological consequences of treatment and symptoms are certain factors that significantly contribute to the occurrence of dysphagia, even after a total laryngectomy in which the airway is surgically secured.

Conclusion

The results of this study show that patients who had surgery have varying degrees of swallowing disorders. The ability to identify the symptoms of dysphagia becomes increasingly important when developing appropriate interventions for this subgroup of laryngeal cancer patients.

It is relevant to monitor vital parameters, identify acute conditions and clinical signs that may lead to symptoms of dysphagia or dysphagia itself. Also, it should be kept in mind that dysphagia has secondary psychosocial consequences, not just health consequences. Therefore, it is important that medical staff dealing with dysphagia patients create a nutrition intake plan tailored to the needs and condition of each patient. In order to be successfully treated, people with dysphagia need to be cared for by a multidisciplinary team of professionals.

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