

COMPARISON OF SWALLOWING IN DIFFERENT TYPES OF PARTIAL LARYNGECTOMIES

FARKLI PARSİYEL LARENJEKTOMİ TEKNİKLERİNDE YUTMANIN KARŞILAŞTIRILMASI

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ABSTRACT

Objective: We designed this study to assess and compare the effects of different partial laryngectomy (PL) techniques on swallowing.

Material and Methods: Ten patients had laryngofissure with cordectomy, ten had frontal anterior laryngectomy with epiglottic reconstruction (FAL), ten had frontolateral laryngectomy (FLL), ten had cricohyoidopexy (CHP), ten had cricohyoidoepiglottopexy (CHEP), and ten had supraglottic laryngectomy. Swallowing was assessed with flexible endoscopy.

Results: Mild or moderate dysphagia for solid foods was discovered significantly more often in CHP patients compared to FLL and FAL ($p<0.05$) patients. Dysphagia discoveries for semi-solid and liquid food didn't significantly differ among PL's ($p>0.05$). Compared to other PLs, the penetration-aspiration test with 10 ml of water was distinctly lower in cordectomy and FLL patients ($p<0.05$).

Conclusion: Penetration and aspiration with 10 ml of water was marked lower in cordectomy and FLL patients matched to other PL patients. With studies involving more patients, it will be possible to increase the evidence value of our results.

Keywords: Partial laryngectomy, fiberoptic endoscopic evaluation of swallowing (FEES), deglutition disorders, dysphagia

ÖZET

Amaç: Bu çalışma, farklı parsiyel larenjektomi (PL) tekniklerinin yutma üzerindeki etkilerini değerlendirmek ve karşılaştırmak amacıyla tasarlandı.

Gereç ve Yöntemler: On hastada kordektomi ile laringofissür, onunda epiglotik rekonstrüksiyon (FAL) ile frontal anterior larenjektomi, on hastada frontolateral larenjektomi (FLL), on hastada krikohyoidopeksi (CHP), on hastada krikohyoidoepiglottopexi (CHEP) ve diğer onunda supraglottik larenjektomi operasyonu yapılmıştı. Yutma fleksible endoskopi ile değerlendirildi.

Bulgular: Katı yiyecekler için hafif veya orta derecede disfaji, CHP hastalarında FLL ve FAL hastalarına kıyasla anlamlı olarak daha sık olduğu bulundu ($p<0,05$). Yarı katı ve sıvı gıdalar için disfaji araştırmasında, PL'ler arasında önemli ölçüde farklılık gösterilmedi ($p>0,05$). Diğer PL'lere kıyasla, 10 ml su ile penetrasyon-aspirasyon testi, kordektomi ve FLL hastalarında belirgin şekilde daha düşüktü ($p<0,05$).

Sonuç: Kordektomi ve FLL hastalarında diğer PL hastalarına göre 10 ml su ile penetrasyon ve aspirasyon testi, daha düşüktü. Daha fazla hastayı içeren çalışmalar sayesinde vermiş olduğumuz sonuçların kanıt değerinin artırılması mümkün olacaktır.

Anahtar Kelimeler: Parsiyel larenjektomi, fiberoptik endoskopik yutma değerlendirmesi (FEYD), yutma bozuklukları, disfaji

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INTRODUCTION

Laryngeal cancer is the most common malignancy of head and neck cancer in terms of frequency (1). Partial laryngectomy (PL) is indicated in the early stages and in some of the advanced stages of laryngeal cancer. PL has the advantage of preserving laryngeal functions, having lower morbidity, and increasing quality of life. However, swallowing dysfunction following PL is an important issue in some patients and may require a considerable amount of care and rehabilitation (2). The evaluation and treatment plan for swallowing difficulties has to be completed as soon as possible (3). Swallowing function, physiology, and aspiration can be effectively evaluated with fiberoptic endoscopic evaluation of swallowing (FEES). By assessing swallowing functions and implementing rehabilitation plans, patients could start a normal diet and potential complications such chronic aspiration, malnutrition, and dehydration could be prevented (3).

Objective evaluation and comparison of the effects of different PL techniques on swallowing functions is the purpose of this study.

MATERIAL AND METHODS

This study was done between July 2012 and February 2013. Sixty patients operated for laryngeal carcinoma were included in the study. Ten had laryngofissure with cordectomy, ten had frontal anterior laryngectomy with epiglottic reconstruction (FAL), ten had frontolateral laryngectomy (FLL), ten had cricohyoidopexy (CHP), ten had cricohyoidoepiglottopexy (CHEP) and ten had supraglottic laryngectomy. All of the patients were informed about the study and their informed consent was gained. This research was submitted to the Institutional Review Board and approved (Date: 14.09.2012, No: 12-7/80). Our study was completed within the framework of international ethical standards and the World Health Organization Helsinki Declaration.

Patient selection

Sixty patients, who underwent PL at least six months ago for histopathologically proven laryngeal cancer, were included in the study. Patients having symptoms of aspiration (coughing) and swallowing difficulties (dysphagia) were included. Patients with tumor recurrence, previous radiotherapy, and head and neck surgery other than PL were excluded from the study.

Instrumentation

Sociodemographic data was collected from patient records. Endoscopic assessment was carried out in an upright-seated position without using topical anesthesia to the nasal cavity. A video was recorded for each individual patient. We used a flexible nasopharyngoscope camera (KAY PENTAX Ltd, Montvale, NJ, USA) during the procedures.

Procedure

The test procedure comprised two administrations of 3 ml, 5 ml, and 10 ml of water stained with food dye (green) via an injector. Likewise, swallowing tests were completed with two administrations of one dessert spoonful of yoghurt (5 ml) colored with food dye and fish crackers. Premature spillage, retention-pooling, penetration, aspiration and reflex coughing were scored (from 1 to 5) with the scoring system established by Topaloglu et al. (Table 1) (4). An otolaryngologist and a physical therapy and rehabilitation specialist were present for the duration of each procedure and all procedures were video-recorded. As in our previously published study in different patient groups, the total test results were blindly evaluated by the same physician and unchanged otolaryngologist, who were focused and specialized in this field, regardless of the treatment procedures (5).

Statistical analysis

Computer software (SPSS version 22.0, SPSS Inc. Chicago, IL, USA) was conducted for statistical analysis. Comparison of categorical data was made with chi-square (X²) exact tests. According to the distribution pattern of the data, Wilcoxon and Mann-Whitney U tests were used in

Table 1: Swallowing grading scale developed by Topaloglu et al.

Points	Premature spillage of material	Retention/pooling of material and/or secretion	Penetration-aspiration reflex cough
1	Severe	Severe retention/pooling	Entrance of material into trachea; no reflex cough
2	Marked	Marked retention/pooling	Entrance of material into trachea; with reflex cough
3	Moderate	Mild retention/pooling	Entrance of material into larynx; remaining above the trachea no reflex cough
4	Mild	Coating residue/secretion	Entrance of material into larynx; remaining above the trachea with reflex cough forming
5	None	No retention/pooling	No entrance of material into larynx or trachea; no reflex cough

the analysis of nonparametric variables, and independent, and paired sample t-tests were used in the analysis of parametric variables. Determining the distribution pattern of the data was provided by the Shapiro-Wilk test. The distribution of the groups in our study was non-parametric. Considering the distribution of the data, Pearson or Spearman correlation analysis was used. Data was expressed as "median, interquartile range (IQR)". A p value of <0.05 was considered statistically significant.

RESULTS

Sixty patients treated with PL were involved in the study. Five (8.3%) of the patients were female and 55 (91.7%) were male, with a mean age of 59.87±7.93 years (range 33-79 years).

Forty-four (73.3%) patients reported coughing, two (3.3%) reported coughing and dysphagia, and 14 (23.3%) reported only dysphagia. The type of PL present in the patient and their symptoms were not statistically correlated (p>0.05). The presence and frequency of the subjective symptoms (difficulty in bolus control, need to clear throat, food gets stuck, choking) are presented in Table 2. Subjective symptoms and the type of PL were not statistically correlated (p>0.05).

Dysphagia for solid, semi-solid, and liquid food was evaluated and the data (according to the types of PL) is presented in Table 3. Mild or moderate dysphagia for solid foods was significantly more prevalent in CHP patients compared to FLL and FAL (p<0.05) patients. Dysphagia for semi-solid and liquid food did not significantly differ among different PLs (p>0.05).

Premature spillage, residue-secretion, and penetration-aspiration scores were evaluated with fiberoptic endoscopy. Scores for different types of PL are presented in Table 4. Penetration-aspiration with 10 ml water was meaningfully lower in cordectomy and FLL patients compared to supraglottic laryngectomy, CHP and CHEP patients (p<0.05). Other scores had no significant difference among the groups (Table 4) (p>0.05).

DISCUSSION

There are many reports assessing the swallowing function in a certain type of PL (6-12). While some researchers evaluated swallowing function with N/G tube removal time or gastrostomy tube removal rates in previous reports, others used quality of life measures (9, 12-15). Videofluoroscopy is also a widely used technique for the evaluation of swallowing (7, 8, 12, 16). However, a study,

Table 2: Operation types and subjective complaints

Complaint		Operation type						p
		Supraglottic laryngectomy	Cordectomy	CHP	CHEP	FLL	FAL	
Cough	N (%)	7 (70%)	8 (80%)	8 (80%)	8 (80%)	7 (70%)	6 (60%)	p>0.05
Cough, dysphagia	N (%)	0 (0%)	0 (0%)	2 (20%)	0 (0%)	0 (0%)	0 (0%)	
Dysphagia	N (%)	3 (30%)	2 (20%)	0 (0%)	2 (20%)	3 (30%)	4 (40%)	
Difficulty in bolus control	Not present (N;%)	9 (90%)	9 (90%)	9 (90%)	8 (80%)	10 (100%)	10 (100%)	p>0.05
	Present (N;%)	1 (10%)	1 (10%)	1 (10%)	2 (20%)	0 (0%)	0 (0%)	
Need to clear throat	Not present (N;%)	4 (40%)	7 (70%)	4 (40%)	8 (80%)	8 (80%)	7 (70%)	p>0.05
	Present (N;%)	6 (60%)	3 (30%)	6 (60%)	2 (20%)	2 (20%)	3 (30%)	
Sensation of a lump in the throat	Not present (N;%)	6 (60%)	7 (70%)	5 (50%)	7 (70%)	6 (60%)	5 (50%)	p>0.05
	Present (N;%)	4 (40%)	3 (30%)	5 (50%)	3 (30%)	4 (40%)	5 (50%)	
Sense of choking	Not present (N;%)	7 (70%)	8 (80%)	6 (60%)	9 (90%)	10 (100%)	10 (100%)	p>0.05
	Present (N;%)	3 (30%)	2 (20%)	4 (40%)	1 (10%)	0 (0%)	0 (0%)	

CHP: Cricohyoidopexy; CHEP: Cricohyoidoepiglottopexy; FLL: Frontolateral laryngectomy; FAL: Frontal anterior laryngectomy

Table 3: Dysphagia table

Operation type			Supraglottic laryngectomy	Cordectomy	CHP	CHEP	FLL	FAL	Total
Dysphagia to solid food	Not present	n	8	7	5	7	9	9	45
		%	80	70	50	70	90	90	75
	Mild or moderate	n	2	3	2	3	1	1	12
		%	20	30	20	30	10	10	20
	Severe	n	0	0	3	0	0	0	3
		%	0	0	30	0	0	0	5
Total	n	10	10	10	10	10	10	60	
	%	100	100	100	100	100	100	100	
Dysphagia to semisolid food	Not present	n	6	8	6	8	10	9	47
		%	60	80	60	80	100	90	78.3
	Mild or moderate	n	4	2	4	2	0	1	13
		%	40	20	40	20	0	10	21.7
	Severe	n	0	0	0	0	0	0	0
		%	0	0	0	0	0	0	0
Total	n	10	10	10	10	10	10	60	
	%	100	100	100	100	100	100	100	
Dysphagia to liquid food	Not present	n	5	10	8	4	8	8	43
		%	50	100	80	40	80	80	71.7
	Mild or moderate	n	4	0	2	6	2	2	16
		%	40	0	20	60	20	20	26.7
	Severe	n	1	0	0	0	0	0	1
		%	10	0	0	0	0	0	1.7
Total	n	10	10	10	10	10	10	60	
	%	100	100	100	100	100	100	100	

CHP: Cricohyoidopexy; CHEP: Cricohyoidoepiglottopexy; FLL: Frontolateral laryngectomy; FAL: Frontal anterior laryngectomy

Table 4: P values regarding different laryngectomy types and swallowing scores

	Premature spillage	Residue, secretion	Penetration, aspiration, reflex cough
	p value	p value	p value
3 ml water	.539	.294	.097
5 ml water	.490	.471	.163
10 ml water	.305	.614	.024
5 ml yoghurt	.385	.303	.083
Fish cracker	.540	.314	.066

that compared swallowing functions in different types of PL with FEES, is missing. A study conducted by Alicandri-Ciufelli et al. compared swallowing functions of supraglottic laryngectomy and supracricoid partial laryngectomy (SCPL) patients with FEES (12). Other studies usually evaluated swallowing in only one type of PL or compared supracricoid laryngectomy with total laryngectomy (12,16). Alicandri-Ciufelli et al. found no statistically significant difference between supraglottic laryngectomy and supracricoid laryngectomy patients regarding swallowing functions evaluated with FEES (12). They also evaluated cases with both preserved arytenoids, radiotherapy, different ages, and a different time interval after surgery, and it was concluded that only radiotherapy had a significant negative effect on supracricoid laryngectomy patients with FEES (4). Premature spillage, residue-se-

cretion, and penetration-aspiration scores were higher in patients with both arytenoids preserved and in patients that did not receive radiotherapy, but this difference was not statistically significant (4). Because patients with a history of radiotherapy were excluded and both arytenoids were preserved in all patients, these were not evaluated in this study.

Another important step in preserving the swallowing function is to preserve the superior laryngeal nerve. If this nerve is damaged, the cricopharyngeal sphincter and the cough reflex will be negatively affected and the patient won't be able to recognize aspiration (3, 17, 18). This may hamper subsequent swallowing rehabilitation and may extend adaptation time. All effort should be taken to preserve both superior laryngeal nerves in laryngeal conservation surgery.

Zacharek et al. evaluated the swallowing function of 10 supracricoid laryngectomy patients with FEES and modified barium swallow studies (19). They reported swallowing difficulties in all patients. Supraglottic sensory loss secondary to unilateral or bilateral damaged superior laryngeal nerve, changed base of tongue/vallecular anatomy after extraction of epiglottis, physiologic insufficiency of the neoglottal valve, or a combination of these three mechanisms were the proposed mechanisms for swallowing difficulties (15, 18). All of the patients in this study tolerated oral food intake and were decanulated. None of the patients developed aspiration pneumonia. These findings show that all patients should have a sufficient cough reflex to protect their lungs from aspiration pneumonia and an active tracheopulmonary mucociliary clearance system. In addition, these studies emphasize the importance of adequate respiratory function in patients undergoing SCPL. In a study evaluating the swallowing function of 116 SCPL patients, 45 patients that had aspiration in videofluoroscopic study were assessed with high-resolution computed tomography and no statistically noteworthy difference was established among these patients and control groups regarding the radiographic images (19).

This is the first research to compare swallowing functions of different types of PL with FEES. A limited number of patients and inadequate randomization are the limitations of this study. Objective evaluation of swallowing in PL patients provides valuable data and feedback for both the doctor and the patient.

CONCLUSION

In conclusion, penetration and aspiration with 10 ml of water was meaningfully lower in cordectomy and FLL patients compared to supraglottic laryngectomy, CHP, and CHEP patients. This study is important because it is the first study, which evaluated swallowing objectively in patients

who underwent six different PL. The most important result of this study, regardless of which PL technique is applied, is that aspiration problems are not caused, other than high-volume water ingestion, after the 6th postoperative month in patients, who have preserved both arytenoids and have not applied radiotherapy. We think that we can reduce the concern of surgeons with this objective study about swallowing that will occur as a result of the PL technique preference. Further studies with larger patient groups are warranted to obtain more reliable results.

Informed Consent: Written consent was obtained from the participants.

Ethics Committee Approval: This study was approved by the Clinical Research Ethical Committee of the Ege University School of Medicine (Date: 14.09.2012, No: 12-7/80).

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