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Original Article

Determination of Factors That Impact Patient Satisfaction Following Tympanoplasty

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OBJECTIVE: The aim of this study was to assess the subjective evaluation of patients postoperatively about their hearing, otorrhea, and tinnitus by using a questionnaire and to determine factors affecting patient satisfaction following tympanoplasty.

MATERIALS and METHODS: Patients who underwent tympanoplasty with or without mastoidectomy due to chronic otitis media were included the study. Patients were called by telephone and invited to a control examination and to answer a questionnaire survey. Patients who came to the control examination were asked about any changes in their hearing and the presence or absence of tinnitus and otorrhea. The overall subjective satisfaction of the surgery was measured by visual analog scale (VAS).

RESULTS: One hundred forty-seven patients who underwent tympanoplasty with or without mastoidectomy with a mean age 33.32±11.27 were included the study. There were statistically significant differences between the patients whose grafts were successfully healed versus those not healed, according to VAS score ($p<0.001$). VAS score was significantly higher in patients whose tinnitus decreased or disappeared ($p=0.001$) and in patients whose otorrhea completely disappeared ($p=0.008$).

CONCLUSION: Postoperative patient satisfaction must be taken into consideration for the evaluation of the success of tympanoplasty surgery, in addition to objective criteria. Healing of the tympanic membrane, relief of tinnitus, hearing improvement, and relief from otorrhea were highly correlated with patient satisfaction.

KEY WORDS: Chronic otitis media, tympanoplasty, hearing, satisfaction, visual analog scale

INTRODUCTION

Chronic otitis media (COM) is a chronic inflammatory disease of the middle ear and mastoid. It generally results in total or partial loss of the tympanic membrane and ossicles [1, 2]. In addition to conductive hearing loss, COM can also leads to otorrhea, vertigo, and tinnitus. Typically, COM causes chronic purulent drainage through a perforated ear drum. It can also be associated with cholesteatoma. Currently, due to common use of antibiotics, the incidence of COM and potential complications has decreased. Nevertheless, especially for patients with cholesteatoma, surgery is still the main curative treatment strategy for COM.

Tympanoplasty with or without mastoidectomy aims to maintain a disease-free, safe, and dry ear, to improve hearing levels, and to prevent potentially life-threatening complications [3]. The success of tympanoplasty is determined by the evaluation of anatomic healing and by interpretation of audiological results obtained from pure tone audiometry [4]. But, these evaluations, based on anatomic and audiological criteria, do not always reflect patient satisfaction. Sometimes, patients may not be satisfied with the outcomes, even if the anatomic and audiological results are good and acceptable. Patients may not even notice when hearing gain is assessed as being sufficient postoperatively. The results of the surgery should satisfy both patients and surgeons at the same time. There have been a few studies in the literature investigating the subjective evaluation of patients who underwent COM surgery, in terms of postoperative hearing, tinnitus, and otorrhea. In this study, we aimed to assess the subjective evaluation of patients postoperatively about their hearing, otorrhea, and tinnitus by using a questionnaire and to determine factors affecting patient satisfaction following tympanoplasty.

MATERIALS and METHODS

Patients who underwent tympanoplasty with or without mastoidectomy due to COM in the Department of Otorhinolaryngology of Sakarya University Faculty of Medicine Training and Research Hospital between September 2009 and January 2013 were included in the study. Patients who were followed up for less than 6 months postoperatively and whose age was younger than 16 years were excluded from the study. The study protocol was approved by the Sakarya University Faculty of Medicine ethical committee

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(71522473.050.01.04/25). Informed consent was obtained from all of the patients. Charts of the patients were evaluated retrospectively. Patient characteristics, surgical techniques, pre- and postoperative hearing levels, and postoperative complications were noted. Grafted tympanic membranes were evaluated with an otologic microscope at the last follow-up postoperatively. The hearing results were measured using tonal audiometry. Hearing thresholds were calculated at 0.5, 1, 2, and 4 kHz, and pre- and postoperative results were compared. The air-bone gaps (ABGs) and pure tone averages (PTAs) were based on the means of 0.5, 1, 2, and 4 kHz frequencies. An intact graft without evidence of a perforation and lateralization was defined as anatomical success at the last follow-up examination after a minimum of 6 months.

Patients were called by telephone and invited to a control examination to complete a questionnaire. Patients who came to the control examination were asked about any changes in their hearing and the presence or absence of tinnitus, otorrhea, and vertigo. The hearing changes of patients were determined by selecting one of the four degrees, such as "very improved," "little improved," "unchanged," and "little deteriorated." The complete subjective satisfaction from surgery was measured using a visual analog scale (VAS), ranging from 0 (unsatisfied) to 10 (satisfied).

Statistical Analysis

The Kolmogorov-Smirnov test was used to evaluate whether the distribution of variables was normal. Accordingly, it was seen that all variables displayed a normal distribution. Therefore, two independent-samples t-tests or one-way analysis of variance (ANOVA) was used to compare continuous variables between/among groups. When the ANOVA result was significant, the Tukey test was used in the paired comparison according to Levene variance homogeneity. Continuous variables are presented as mean±standard deviation. Categorical variables were compared using chi-square tests. Categorical variables are presented as count (n) and percentage (%). Kendal's tau-b (τ_B) coefficient was used for the determination of the concordance between decreases in PTA and subjective hearing improvement. A p-value <0.05 was considered significant. Statistical analyses were performed using IBM the Statistical Package for Social Sciences (SPSS) Statistics 20 (SPSS Inc., an IBM Co., Somers, NY, USA)

An ordinal logistic regression model was implemented to determine the various independent factors associated with hearing improvement senses of patients at post-operative COM surgery. Ordinal regression analysis is a method used to identify the effect of one or more independent variables on more than two sequential categorically structured dependent variables. In this study, ordinal logistic regression was used with a proportional odds model. The significance of β coefficients was tested using Wald statistics. Ordinal logistic regression analysis was performed using R statistical software (R Commander, ver. 2.0-0).

RESULTS

One hundred forty-seven patients who underwent tympanoplasty with or without mastoidectomy with a mean age of 33.32±11.27 were included in the study. Of the 147 patients, 62 were male and 85 were female. Type 1 tympanoplasty was performed in 107 (72.8%) patients, type 2 tympanoplasty was performed in 32 (21.8%) patients, and type 3 tympanoplasty was performed in 8 (5.4%) patients. Cholesteatoma was observed in 20 (13.6%) patients. In 22 patients, canal wall up (CWU) mastoidectomy was performed, and in 13 patients, canal wall down (CWD) mastoidectomy was performed. Closure of tympanic membrane perforation was achieved in 136 (92.5%) patients. The mean time between the surgery and interview was 17.2±6.8 (7-36) months. Tinnitus was present before the surgery in 48 (32.7%) patients. It decreased in 20 patients and completely disappeared in 8 patients following the surgery. Twenty of 48 patients thought that their tinnitus symptoms did not change. Regarding otorrhea, 123 of the patients had otorrhea before the operation. Of the 123 patients, 114 thought that their otorrhea completely disappeared. In 9 patients, otorrhea remained, but the severity and frequency decreased after the surgery. There were statistically significant differences between the patients whose grafts were successfully healed versus those not healed, according to VAS score ($p<0.001$). VAS score was significantly higher in patients whose tinnitus decreased or disappeared ($p=0.001$) and in patients for whom otorrhea completely disappeared ($p=0.008$). There were statistically significant differences between the patients whose decrease in PTA was: no change, 0-10 dB, 10-20 dB, and >20 dB, according to VAS score ($p<0.001$). There was a statistically significant concordance between the decrease in PTA and hearing improvement (according to patients) ($\tau_B=0.768$, $p<0.001$) (Table 1).

The mean pre- and postoperative PTAs were 42.14±12.7 dB and 29.98±16.31 dB, with a statistically significant difference ($p<0.001$). According to PTA, the mean audiological improvement was 12.16±12.57 dB. In 37 (25.2%) patients, >20 dB of improvement was obtained, 10-20 dB of improvement was obtained in 54 (36.7%) patients, and <10 dB of improvement was obtained in 29 (19.7%) patients, whereas audiologic improvement was not obtained in 27 (18.4%) patients. The mean pre- and postoperative ABGs were 31.15±10.09 dB and 21.1±11.96 dB, respectively. The difference between mean pre- and postoperative ABG was found to be statistically significant. ($p<0.001$) The improvement of the mean ABG was 10.05±12.94 dB in all patients. Forty patients thought that their hearing was greatly improved, 43 patients thought their hearing was somewhat improved, and 7 patients thought that their hearing deteriorated a little following surgery, whereas 57 thought their hearing did not change.

The mean age of patients greatly improved postoperative hearing status was statistically greater than those with no change and little improvement ($p=0.009$). The graft success ratio of patients with greatly improved and little improved postoperative hearing status was statistically greater than no change ($p=0.004$). There were statistically significant differences for PTA and ABG among patients with greatly improved, little improved, and no change of hearing ($p<0.001$ and $p<0.001$, respectively). According to the subjective evaluation of hearing, there was a statistically significant difference in VAS scores of the patients. VAS score was significantly higher in patients whose hearing was improved ($p<0.001$) (Table 2). According to the ordinal logistic regression model, improvement in hearing showed a 1/0.224=4.46 fold decrease with mastoidectomy (CWU); on the other hand, it showed a 59.92-fold increase when the decrease in PTA was ≥10 dB and a 9.48-fold increase when VAS was ≥7 (Table 3).

Table 1. Distributions of the patient characteristics and results of the comparisons according to VAS

		n (%)	VAS	p
Gender	Male	62 (42.2)	7 [6-8]	0.937
	Female	85 (57.8)	7 [6-8]	
Surgery type	Type I	107 (72.8)	7 [7-8]	0.557
	Type II	32 (21.8)	7 [6-8]	
	Type III	8 (5.4)	6.5 [6-8.5]	
Cholesteatoma	No	127 (86.4)	7 [6-8]	0.202
	Yes	20 (13.6)	7 [6-7.75]	
Mastoidectomy	No	112 (76.2)	7 [7-8]	0.061
	CWU	22 (15)	6.5 [6-7]	
	CWD	13 (8.8)	7 [6-8]	
Closure of tympanic membrane perforation	Successful	136 (92.5)	7 [6.25-8]	<0.001
	Unsuccessful	11 (7.5)	6 [5-6]	
Hearing improving	Greatly improved	40 (27.2)	8 [8-9]	<0.001
	Little improved	43 (29.2)	7 [7-8]	
	No change	57 (38.8)	6 [6-7]	
	Slightly deteriorated	7 (4.8)	6 [5-6]	
Pre-op tinnitus	No	99 (67.3)	7 [6-8]	0.836
	Yes	48 (32.7)	7 [6-8]	
Changes in tinnitus	Disappeared	8 (16.7)	8 [7.25-9]	0.001
	Decreased	20 (41.7)	8 [7-8]	
	No change	20 (41.7)	6 [6-7]	
Decrease of PTA	No decrease	27 (18.4)	6 [5-6]	<0.001
	0-10-dB Decrease	29 (19.7)	6.5 [6-7]	
	10-20-dB Decrease	54 (36.7)	7 [6-8]	
	>20-dB Decrease	37 (25.2)	8 [8-9]	
Pre-op otorrhea	No	24 (16.3)	7 [7-8]	0.462
	Yes	123 (83.7)	7 [6-8]	
Changes of otorrhea	Completely disappeared	114 (92.7)	7 [6-8]	0.008
	Severity and frequency decreased	9 (7.3)	6 [6-6.5]	

Visual analog scale (VAS) is shown as median [interquartile range]
CWU: canal wall up; CWD: canal wall down; PTA: pure tone average

DISCUSSION

Tympanoplasty is a pretty successful treatment technique in the control of infection and prevention of repeated disease. The success of treatment after tympanoplasty is determined in terms of graft uptake and improvement in hearing. Hearing outcomes following tympanoplasty can be assessed with pure tone audiometry, by comparing pre- and postoperative results [4, 5]. In order to assess the hearing changes, closure of ABG and/or improvement in air conduction threshold is usually used. On the other hand, the assessment based on pure tone audiological (PTA) criteria does not show the satisfaction of patients who underwent tympanoplasty.

Although many studies have evaluated the success of COM surgery by comparing objective findings in the literature, there are few reports on subjective hearing improvement after middle ear surgery. Aihara et al. [6] investigated hearing level, ear symptoms, and satisfaction with surgery outcomes for 212 patients who underwent tympanoplasty in a study using a questionnaire-based survey. They observed hearing improvement in 89% of the patients by evaluating with pure tone audiometry, but only 63.2% of them were aware of the hearing improvement. Yuen et al. [7] noted that there was a dissociation between the evaluation by pure tone audiometry and patient satisfaction. They recommended using not only pure tone audiometry but also a subjective evaluation of patients for the assessment of postoperative hearing improvement. Baba et al. [4] reported that PTA and VAS scores of patients who defined their hearing as "improved" displayed a good correlation. They considered that an approach using both objective criteria and the patient's perspective in the evaluation of postoperative hearing, especially using VAS, was particularly helpful. In another study, Baba et al. [8] obtained a 90-mm or more VAS

Table 2. Comparison of patient characteristics by hearing improvement status

		Hearing Improving			
		No Change or Slightly deteriorated (n=64)	Little Improved (n=43)	Greatly Improved (n=40)	p
Age (year)		35.31±12.2	34.65±10.89	28.7±8.79 [a,b]	0.009
Gender	Male	28 (43.8)	16 (37.2)	18 (45)	0.730
	Female	36 (56.3)	27 (62.8)	22 (55)	
Surgery type	Type I	43 (67.2)	34 (79.1)	30 (75)	0.575
	Type II	17 (26.6)	8 (18.6)	7 (17.5)	
	Type III	4 (6.3)	1 (2.3)	3 (7.5)	
Cholesteatoma	No	52 (81.3)	40 (93)	35 (87.5)	0.212
	Yes	12 (18.8)	3 (7)	5 (12.5)	
Mastoidectomy	No	42 (65.6)	38 (88.4)	32 (80)	0.071
	CWU	15 (23.4)	3 (7)	4 (10)	
	CWD	7 (10.9)	2 (4.7)	4 (10)	
Closure of tympanic membrane perforation	Unsuccessful	10 (15.6)	0 a	1 (2.5) [a]	0.004
	Successful	54 (84.4)	43 (100)	39 (97.5)	
Pre-op tinnitus	No	41 (64.1)	32 (74.4)	26 (65)	0.499
	Yes	23 (35.9)	11 (25.6)	14 (35)	
Changes of tinnitus	Disappeared	2 (8.7)	0	6 (42,9)	<0.001
	Decreased	5 (21.7)	7 (63.6)	8 (57.1)	
	No change	16 (69.6)	4 (36.4)	0	
Pre-op otorrhea	No	9 (14.1)	8 (18.6)	7 (17.5)	0.801
	Yes	55 (85.9)	35 (81.4)	33 (82.5)	
Changes of otorrhea	Completely disappeared	48 (87.3)	34 (97.1)	32 (97)	0.117
	Severity and frequency decreased	7 (12.7)	1 (2.9)	1 (3)	
Pre-op PTA	41.72±14.22	41.6±12.39	43.4±10.46	0.766	
Post-op PTA	40.28±16.95	25.58±10.63 [a]	18.23±8.54 [a,b]	<0.001	
Decrease of PTA	1.44±8.43	16.02±5.85 [a]	25.18±7.83 [a,b]	<0.001	
Decrease of PTA	<10-dB Decrease	53 (82.8)	3 (7.0)	0	<0.001
	≥10-dB Decrease	11 (17.2)	40 (93.0)	40 (100)	
Pre-op ABG	28.81±9.8	29.67±9.66	36.48±9.2 [a,b]	<0.001	
Post-op ABG	28.72±12.77	16.72±7.41 [a]	13.63±6.25 [a]	<0.001	
Decrease of ABG	0.09±9.71	12.95±7.7 [a]	22.85±8.4 [a,b]	<0.001	
VAS	6 [1]	7 [1] [a]	8 [1] [a,b]	<0.001	

Data were shown as mean ±standard deviation, median [interquartile range], and n (%)

According to multiple comparison test, athere was a statistically significant difference from the patients with no change of hearing; bthere was a statistically significant difference from the patients with little improvement in hearing

CWU: canal wall up; CWD: canal wall down; PTA: pure tone average; ABG: air-bone gap

value in those whose hearing was "much improved," regardless of their hearing level before the operation, and reported that subjective hearing gain after the operation coincided with satisfaction with the surgery. A PTA ≥10 dB improvement was obtained in 91 (61.9%) patients in our study. Similarly, 83 patients were aware of their hearing improvement. There was therefore a concordance between objective and subjective evaluation of hearing improvement for patients following surgery. Concerning the relation between hearing improvement and satisfaction, higher VAS values were obtained from the patients whose hearing improved, as expected.

Tinnitus, with an incidence of 43%, is another common problem for patients with COM [9]. It often results in severe patient nuisance for some patients with COM. Improvement of tinnitus after middle ear surgery has been rarely investigated in the literature. Lima et al. [10] evaluated 23 patients with tinnitus who underwent tympanoplasty

Table 3. Ordinal logistic regression model for hearing improvement

		β	SE of β	Wald	p	OR	95% C.I. for OR
Threshold (Hearing) *	Little Improvement	-7.406	2.047	14.654	<0.001		
	Great Improvement	-5.163	1.983	6.701	0.010		
Location	Age ≤30	0.696	0.416	2.806	0.094	2.006	0.889-4.531
	Gender (Male)	0.272	0.405	0.453	0.501	1.313	0.594-2.901
	Cholesteatoma (No)	-0.444	1.096	0.164	0.685	1.559	0.182-13.37
	Mastoidectomy (CWU)	1.496	0.744	4.043	0.044	0.224	0.052-0.962
	Mastoidectomy (CWD)	0.770	1.215	0.402	0.526	2.160	0.2-23.359
	Closure of tympanic membrane perforation (Successful)	-1.707	1.758	0.942	0.332	5.512	0.176-172.777
	Pre-op tinnitus (No)	0.266	0.452	0.348	0.555	1.305	0.538-3.165
	Pre-op otorrhea (No)	0.032	0.501	0.004	0.949	1.033	0.387-2.759
	Decrease of PTA ≥10 dB	4.093	0.683	35.950	<0.001	59.919	15.721-228.378
	VAS ≥7	2.249	0.727	9.582	0.002	9.478	2.282-39.37

*: No change of the hearing improving as a reference category, β: regression coefficient, SE: standard error, OR: odds ratio: CI: confidence interval

CWU: canal wall up; CWD: canal wall down; PTA: pure tone average

and found that 83% of the patients had improvement or elimination of tinnitus after surgery. However, they failed to display a correlation between hearing improvement and tinnitus. Kim et al. [9] noted that tinnitus handicap inventory scores were reduced in 82% of patients following middle ear surgery. They found that most of the patients experienced improvement in tinnitus symptoms, such as loudness, nuisance, cognizance, and life effect of tinnitus. Baba et al. [8] reported that 66% of patients had both improvement in COM symptoms and improvement or elimination of tinnitus following middle ear surgery. The mechanism of the inception of tinnitus as a complication of COM is still unknown. However, after tympanoplasty, recovery from tinnitus attributable to the conductive system of the middle ear may be expected. In our study, a very close relationship was detected between tinnitus recovery and hearing improvement. Improvement or elimination of tinnitus had a great effect on patient satisfaction and subjective evaluation measured with VAS.

One of the primary objectives of tympanoplasty is to avoid otorrhea and to create a dry middle ear. Patients with COM complain especially of hearing loss and otorrhea. They usually expect recovery of these symptoms following middle ear surgery. Although hearing gain is evaluated by objective methods, there is no objective measurement for the assessment of otorrhea. Subjective evaluation of patients using VAS can be used for this purpose. In our study, we noted that recovery of otorrhea had a great effect on patient satisfaction measured with VAS, as well as hearing improvement.

Concerning the relation between patient characteristics and hearing improvement, we detected that gender, surgery type, cholesteatoma, mastoidectomy, and otorrhea had no effect on hearing improving status after surgery. We also noted that patient characteristics, except changes in otorrhea, did not affect the patients' subjective evaluation and satisfaction measured with VAS. Interestingly, there was no significant difference between the patients with or without cholesteatoma in terms of satisfaction following surgery, although hearing improvement was poor in the patients with cholesteatoma. We thought that it was because of the patients' expectations from surgery. In advanced cases, such as cholesteatoma, recovery from disease and relief from otorrhea are much more important than hearing improvement for patients. Generally, these patients have poor expectations for hearing improvement prior the surgery. We also noted that the type of mastoidectomy had no significant impact on patients' satisfaction following tympanoplasty. Patient satisfaction from surgery is a complex issue. Many factors, including hearing level of the contralateral ear, status of disease, and patient expectations from surgery, have an impact on patient satisfaction. But, we think that if a dry, disease-free middle ear can at least be maintained, patients probably will be satisfied following tympanoplasty, especially in advanced cases.

In conclusion, in otology, the evaluation of the success of surgery based on the patient's perspective is significant. Postoperative patient satisfaction must be taken into consideration for the evaluation of the success of tympanoplasty surgery, in addition to objective criteria. Healing of the tympanic membrane, relief of tinnitus, hearing improvement, and relief from otorrhea were highly correlated with patient satisfaction. VAS can be used for assessing patient satisfaction following middle ear surgery.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Sakarya University Faculty of Medicine (71522473.050.01.04/25).

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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