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Research Article

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COMPARATIVE EVALUATION OF THE FUNCTIONAL OUTCOMES AND QUALITY OF LIFE IN ENDOSCOPIC AND MICROSCOPIC TYMPANOPLASTY

ENDOSKOPİK VE MİKROSKOPİK TİMPANOPLASTİ YÖNTEMLERİNİN FONKSİYONEL SONUÇLAR VE YAŞAM KALİTESİ AÇISINDAN KARŞILAŞTIRMALI DEĞERLENDİRMESİ

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Abstract

Objective: This study aimed to compare endoscopic (Group 1) and microscopic (Group 2) tympanoplasty techniques in terms of surgical success, functional outcomes, postoperative pain, and quality of life.

Material and Methods: Forty-five patients who underwent tympanoplasty were retrospectively evaluated. Fifteen had endoscopic and 30 had microscopic surgery. Demographic data, surgical findings, tympanic membrane integrity, operative time, hearing thresholds, and quality of life scores were analysed. Quality of life was assessed using the Chronic Otitis Media Questionnaire-12 (COMQ-12) preoperatively and the Chronic Otitis Media Benefit Inventory (COMBI) at the 6th postoperative month. Pain was measured using the Visual Analog Scale (VAS) at the 1st hour and 1st day after surgery. Hearing outcomes were evaluated through air conduction (AC), bone conduction (BC), and air-bone gap (ABG) thresholds.

Results: There was no significant difference between the groups in operative time, membrane perforation, or membrane integrity at 6 months (Group 1: 100%, Group 2: 93.3%; p=0.54). Age differed significantly (p=0.039), while other demographics were similar. The quality of life scores (COMQ-12 and COMBI) showed no significant difference. However, postoperative VAS scores were significantly lower in the endoscopic group at both time points (p<0.001). Both groups showed significant hearing improvement, with no statistical difference. The mean postoperative ABG was 6.88 dB in Group 1 and 7.44 dB in Group 2 (p=0.02).

Öz

Amaç: Bu çalışmada, endoskopik (Grup 1) ve mikroskopik (Grup 2) timpanoplasti tekniklerinin cerrahi başarı, fonksiyonel sonuçlar, postoperatif ağrı ve yaşam kalitesi açısından karşılaştırılması amaçlanmıştır.

Gereç ve Yöntemler: Timpanoplasti uygulanan toplam 45 hasta retrospektif olarak incelendi. On beş hastaya endoskopik, 30 hastaya mikroskopik cerrahi uygulandı. Demografik veriler, cerrahi bulgular, timpanik membran bütünlüğü, ameliyat süresi, işitme eşikleri ve yaşam kalitesi skorları analiz edildi. Yaşam kalitesi, preoperatif dönemde COMQ-12 ve postoperatif 6. ayda COMBI anketleri ile değerlendirildi. Postoperatif ağrı düzeyleri, ameliyattan sonraki 1. saatte ve 1. günde Görsel Analog Skala (VAS) ile ölçüldü. İşitme sonuçları, hava yolu (AC), kemik yolu (BC) ve hava-kemik aralığı (ABG) ile değerlendirildi.

Bulgular: Ameliyat süresi, timpanik membran perforasyonu ve 6. aydaki membran bütünlüğü açısından gruplar arasında anlamlı fark yoktu (Grup 1: %100, Grup 2: %93,3; p=0,54). Yaş grupları arasında fark vardı (p=0,039), diğer demografik veriler benzerdi. Yaşam kalitesi skorları (COMQ-12 ve COMBI) açısından anlamlı fark saptanmadı. Ancak postoperatif VAS skorları her iki zaman noktasında endoskopik grupta anlamlı olarak daha düşüktü (p<0,001). Her iki grupta da işitme belirgin şekilde iyileşti, ancak gruplar arasında istatistiksel fark bulunmadı. Ortalama postoperatif ABG Grup 1'de 6,88 dB, Grup 2'de 7,44 dB idi (p=0,02).

Sonuç: Her iki teknik anatomik ve işitsel başarı açısından benzer sonuçlar vermiştir. Ancak endoskopik yaklaşım, postoperatif ağrıyı

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Conclusion: Both techniques yielded similar anatomical and auditory outcomes. However, the endoscopic approach reduced postoperative pain more effectively and may be preferred when patient comfort is a priority.

Keywords Endoscopic tympanoplasty · microscopic tympanoplasty · COMQ-12 · COMBI · hearing outcomes · quality of life

azaltma açısından daha üstündür ve hasta konforunun ön planda tutulduğu durumlarda tercih edilebilir.

Anahtar Kelimeler Endoskopik timpanoplasti · mikroskopik timpanoplasti · COMQ-12 · COMBI · işitme sonuçları · yaşam kalitesi

INTRODUCTION

Tympanoplasty is a surgical procedure performed to repair tympanic membrane perforations and restore middle ear function. Traditionally, tympanoplasty is performed under an operating microscope, which is considered the standard approach because it provides high-resolution magnification, allows the surgeon to operate with both hands, and provides three-dimensional visualisation of the surgical field (1). However, this technique may have limitations in visualising the entire surgical field, especially when repairing anterior perforations, and may require additional procedures such as canalplasty (1, 2).

There has been a growing interest in endoscopic ear surgery over the past few years due to its wide-angle view and minimally invasive nature. Endoscopes provide a wider field of view, which allows for improved visualisation, especially in the anterior quadrants (3, 4). Moreover, tympanoplasty performed using an endoscopic approach allows the preservation of the natural anatomy of the external auditory canal and yields better cosmetic outcomes. Other reported advantages of endoscopic techniques include shorter operative time, reduced tissue trauma, and faster postoperative recovery (5, 6).

Several studies comparing endoscopic and microscopic tympanoplasty techniques have reported that both methods yield comparable graft success rates and auditory outcomes (7). However, some studies have indicated that the endoscopic approach may be associated with less postoperative pain and a shorter recovery period (4, 6). Despite these advantages, endoscopic ear surgery also presents technical limitations, including the necessity of one-handed manipulation, reduced depth perception, and a steeper learning curve (8).

The aim of this study was to compare the surgical success, hearing outcomes, and patient satisfaction of endoscopic and microscopic tympanoplasty procedures performed in our clinic. In particular, the effects of both techniques on postoperative pain and quality of life were investigated.

MATERIALS AND METHODS

This study was designed as a retrospective, comparative investigation based on the data of patients who underwent tympanoplasty surgery at our tertiary university hospital between 2022 and 2023. Approval for the study was recieved from the Istanbul Faculty of Medicine Clinical Research Ethics Committee, and written consent was obtained from all individuals participating in the research (Date: 17.07.2020, No: 18). The research was performed in full compliance with the ethical guidelines stated in the Declaration of Helsinki.

Patients who had a minimum follow-up period of six months and complete preoperative and postoperative audiological data were included in the study. Patients with missing data or concomitant major middle ear pathologies were excluded. A total of 45 eligible patients were divided into two groups according to the surgical technique used: Group 1 (n=15) endoscopic tympanoplasty and Group 2 (n=30) microscopic tympanoplasty.

All procedures were by a single experienced surgeon in accordance with a standardised surgical protocol. In Group 1, endoscopic tympanoplasty was conducted via a transcanal approach using a 0° rigid endoscope (4 mm, 18 cm); angled endoscopes were used when necessary. In Group 2, microscopic tympanoplasty was performed using the conventional microscopic approach through an endaural incision. In both groups, tragal cartilage was used as the graft material, and the underlay technique was used for graft placement.

Evaluation parameters

The following parameters were recorded: patient age, sex, operated side, size of tympanic membrane perforation, presence of anterior bony overhang, presence of canalplasty or tympanosclerosis, whether ossicular chain reconstruction (OCR) was performed, and duration of surgery. Tympanic membrane perforations were evaluated based solely on size (greater or less than 50% of the membrane). Anatomical localisation (e.g., anterior, posterior, central) was not systematically recorded or analysed.

Anatomical Success: Tympanic membrane integrity was evaluated by clinical examination and otoscopy at the 6th postoperative month.

Hearing Outcomes: Pure-tone audiometry was performed preoperatively and at the 6th month postoperatively. The air conduction (AC), bone conduction (BC), and air-bone gap

(ABG) thresholds were analysed in the 0.5–3 kHz frequency range.

Patient Satisfaction and Quality of Life (QoL): Quality of life was assessed using the Chronic Otitis Media Questionnaire-12 (COMQ-12) in the preoperative period and the Chronic Otitis Media Benefit Inventory (COMBI) at the 6th postoperative month.

Pain Assessment: Postoperative ear pain was evaluated using the Visual Analog Scale (VAS) at the 1st hour and on the 1st day after surgery.

Statistical analysis

The sample size was determined a priori using G*Power (University of Düsseldorf, Düsseldorf). Assuming a two-tailed test with α=0.05, 80% power to detect a mean COMBI score difference of 5, and a 2:1 allocation ratio (microscopic: endoscopic tympanoplasty), the required sample sizes were 27 and 13, respectively. Allowing for potential dropouts, we enrolled 45 patients (30 microscopic, 15 endoscopic).

Continuous variables were tested for normality using the Shapiro–Wilk test and are presented as mean±SD or median (first to third quartile), as appropriate. Between-group comparisons of normally distributed data were performed with Student's t-test, whereas non-normally distributed data were analysed using the Mann–Whitney U test (between groups) and the Wilcoxon signed-rank test (within groups). Categorical variables are expressed as numbers (%) and compared using the χ^2 test or Fisher's exact test, as appropriate. All analyses were conducted in IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY) which was used for data analysis. A p-value of <0.05 was considered statistically significant for all analyses

RESULTS

A total of 45 patients were enrolled in the study. Fifteen patients were allocated to group 1, while 30 patients were allocated to group 2. The average age of the patients was 31.44±10.83 (range: 13-59) years. Twenty-eight (62.2%) patients were female, while 17 (37.8%) were male. No statistically significant differences were found between the groups regarding sex distribution, operated side, perforation rate, presence of anterior bony overhang, need for canalplasty, or presence of tympanosclerosis (p>0.05). Only the ages of patients between the groups showed statistical significance. Group 1 was 7.03 (CI:95%, 0.39-13.68) years older than group 2, p=0.039. A comparison of the demographic data, operative findings, and surgical success rate between the groups is given in Table 1.

There was no statistically significant difference in operative time between the two groups (Group 1: 55 min [50–65], Group 2: 57.5 min [53.75–60]; p=0.75).

Table 1. Demographic and operative findings

	Group 1 (n = 15)	Group 2 (n = 30)	p
Demographics			
Age* mean±SD	36.13±8.88	29.1±11.1	**0.039**
Gender			0.38
Male, n (%)	7 (46.7)	10 (33.3)	
Female, n (%)	8 (53.3)	20 (66.7)	
Operative findings			
Side of the Operation			0.39
Right, n (%)	7 (46.7)	18 (60)	
Left, n (%)	8 (53.3)	12 (40)	
TM perforation			0.67
<50%, n (%)	8 (53.3)	18 (60)	
>50%, n (%)	7 (46.7)	12 (40)	
Anterior bony overhang, n (%)	5 (33.3)	6 (20)	0.46
Canalplasty, n (%)	0 (0)	5 (16.7)	0.15
Tympanosclerosis, n (%)	0 (0)	6 (20)	0.16
OCR, n (%)	3 (20)	2 (6.7)	0.31
Duration of surgery* median (first to third quartile)	55 (50-65)	57.5 (53.75-60)	0.75
Surgical success rate	15 (100%)	28 (93.3%)	0.54

*Student's t-test was used and data were presented as mean±SD. *Mann-Whitney U test was used and data were presented as median (first to third quartile). Other comparisons were made with chi-square test or Fischer's exact test, and data were presented as number (percentage). TM: tympanic membrane, OCR: ossicular chain reconstruction, SD: standard deviation, n: Number. p<0.05 demonstrated statistical significance compared with the control group.

Anatomical success was observed in 100% of the patients in Group 1 and 93.3% in Group 2. There was no significant difference in anatomical surgical outcomes (tympanic membrane integrity) between the groups (p=0.54). Only two patients in Group 2 had a small tympanic membrane perforation with a medialized graft at the sixth postoperative month. All other patients had an intact tympanic membrane at the 6th month.

When assessed in terms of QoL and pain scores, no difference was observed in either preoperative (COMQ-12) or postoperative (COMBI) QoL scores between the groups. (respectively p=0.191 ve p=0.743). However, the postoperative VAS scores, which evaluate ear pain, were significantly lower in group 1.

1st postoperative hour: The median VAS score was 5 (IQR: 3–5) in Group 1 and 7 (IQR: 7–8) in Group 2.

1st postoperative day: The median VAS score was 5 (IQR: 4–6) in Group 1 and 8 (IQR: 7–8.25) in Group 2.

The differences at both time points were statistically significant (p<0.001). Detailed scores and p-values are provided in Table 2.

Table 2. Preoperative and postoperative quality of life and pain assessment

	Group 1 (n = 15)	Group 2 (n = 30)	p
COMQ-12 score* mean±SD	31.47±8.99	27.73±8.84	0.191
VAS Score for pain (Postop. 1h)⁺ median (first to third quartile)	5 (3-5)	7 (7-8)	**<0.001**
VAS Score for pain (Postop. 1d)⁺ median (first to third quartile)	5 (4-6)	8 (7-8.25)	**<0.001**
COMBI Score* mean±SD	45.33±3.58	45.93±6.54	0.743

*Student's t-test was used and data were presented as mean±SD. ±;Mann-Whitney U test was used and data were presented as median (first to third quartile). p<0.05 demonstrated statistical significance compared to the control group. SD: Standard deviation, COMQ-12: Chronic otitis media questionnaire-12, COMBI: Chronic otitis media benefit inventory, VAS: Visual analog scale, n: Number.

In terms of audiological outcomes, a significant improvement in both $AC_{0,5\text{-}3\ kHz}$ and $ABG_{0,5\text{-}3\ kHz}$ was obtained six months after the surgery in groups 1 and 2, with no significant change in $BC_{0,5\text{-}3\ kHz}$ thresholds. Furthermore, no statistically significant difference was observed in both preoperative and postoperative median $AC_{0,5\text{-}3\ kHz}$ and median $BC_{0,5\text{-}3\ kHz}$ thresholds between the groups. Values are given in Table 3.

Table 3. Audiological outcomes: preoperative and postoperative comparisons

	Group 1 (n = 15) Median (first to third quartile)	Group 2 (n = 30) Median (first to third quartile)	p
Preoperative			
$AC_{0,5\text{-}3kHz}$	23.13 (22.19-31.56)	27.5 (24.38-32.5)	0.202
$BC_{0,5\text{-}3kHz}$	10.63 (5.38-11.25)	5.94 (0.63-10)	0.072
ABG	17 (12.5-22.19)	23.44 (16.88-28.75)	**0.025**
Postoperative 6th month			
$AC_{0,5\text{-}3kHz}$	11.88 (7.94-14.38)	14.38 (9.38-18.75)	0.273
$BC_{0,5\text{-}3kHz}$	5.5 (5-9.75)	6.25 (0.63-10)	0.447
ABG	6.88 (2.19-7.75)	7.44 (5-10)	**0.02**
p-value⁺ ($AC_{0,5\text{-}3\ kHz}$ and ABG)	**0.01**	**<0.001**	

*Mann-Whitney U test was used for between-group comparisons. ⁺The Wilcoxon signed-rank test was used for within-group comparisons. All data are presented as the median (first to third quartile). p<0.05 demonstrated statistical significance compared with the control group. AC: Air conduction, BC: bone conduction, ABG: air-bone gap, n: Number.

DISCUSSION

In this study, the endoscopic and microscopic tympanoplasty techniques were compared in terms of surgical success, audiological outcomes, and patient satisfaction. Our findings indicate that while both techniques provide comparable anatomical and audiological outcomes, the endoscopic approach offers advantages in terms of patient comfort and reduced postoperative pain.

Anatomical success and hearing outcomes

In our study, the graft uptake rates were 100% in Group 1 and 93.3% in Group 2, with no statistically significant difference between the groups. These rates are consistent with those of previous studies. Large-scale meta-analyses conducted by Pap et al. and Crotty et al. have also reported comparable anatomical success rates for both techniques, with no clear superiority of one approach over the other in terms of graft integration (4, 7).

In terms of hearing outcomes, our study demonstrated significant improvements in both ABG and AC thresholds in both groups. However, no statistically significant difference was observed between the groups. These findings are consistent with the results of a meta-analysis by Crotty et al., which also reported no significant difference in postoperative ABG values between endoscopic and microscopic tympanoplasty techniques in terms of hearing success (7). Similarly, Tseng et al. reported a mean improvement in the ABG of −2.73 dB with the endoscopic technique; however, this difference was not statistically significant (9). The majority of studies in the literature have reached a common conclusion that hearing gains are comparable between endoscopic and microscopic tympanoplasty (4, 6, 7, 10-12).

Surgical duration and technical challenges

In our study, no significant difference was observed between the groups in terms of operative time. However, the literature presents conflicting results on this matter. Several studies and meta-analyses have suggested that the endoscopic technique may reduce the operative time, attributing this to a more direct transcanal approach and the elimination of additional procedures such as canalplasty (1, 7, 13, 14). One of the key factors contributing to the shorter operative time observed with the endoscopic approach is the elimination of additional procedures such as endaural or retroauricular incisions, which are often required in microscopic tympanoplasty to enhance visualisation. In contrast, the transcanal approach used in endoscopic surgery allows for a wider field of view without the need for such incisions.

However, endoscopic tympanoplasty is a technically demanding procedure that requires considerable surgical experience. It has been reported that the initial learning curve may lead to variability in operative time, particularly in the early stages of a surgeon's training. The one-handed technique and the lack of depth perception inherent to endoscopic surgery are known to pose technical challenges. Additionally, the presence of intraoperative bleeding may obscure the endoscopic view, necessitating frequent lens cleaning, which can prolong the duration of surgery (1, 15). However, similar to our study, Shakya et al. reported that although the operation time was slightly shorter with the endoscopic approach, there was no significant difference (16).

Postoperative pain and comfort for the patient

In our study, the VAS scores were significantly lower in the endoscopic group. There are many studies in the literature that support this finding. Choi et al. compared endoscopic and microscopic tympanoplasty data and reported that postoperative pain was similar between groups on day 1, but significantly less in the ET group 1 day later (10). Similarly, in a study by Kallyadan et al. involving 209 patients, postoperative day 1 VAS scores were significantly lower in the endoscopic tympanoplasty group (5.48±1.26) compared to the microscopic group (6.92±0.91), indicating superior early postoperative comfort in the endoscopic approach (11). This difference may be due to the minimal soft tissue dissection involved in endoscopic tympanoplasty, which results in reduced postoperative pain, whereas the microscopic technique typically requires skin incision and tissue retraction, which may result in increased pain.

In a study specifically focusing on the paediatric population, Nassif et al. reported that endoscopic tympanoplasty offered anatomical and auditory outcomes comparable to the microscopic technique, while providing significantly greater postoperative comfort in children (12).

In the literature, a study comparing endoscopic and microscopic tympanoplasty in terms of patient satisfaction, quality of life, and symptom scores has been reported. Pap et al. evaluated 53 patients using a 16-item QoL questionnaire developed by the researchers. They found that both techniques provided comparable outcomes regarding patient satisfaction and QoL, while the endoscopic approach offered potential advantages in terms of faster recovery and better cosmetic results (17). To the best of our knowledge, no study in the literature has used the COMQ-12 and COMBI questionnaires to objectively evaluate patient satisfaction and quality of life in a comparison of endoscopic and microscopic tympanoplasty techniques. In our study, no significant difference was found between the endoscopic and microscopic groups in terms of patient satisfaction and quality of life. However, various studies have shown that factors such as better cosmetic outcomes and faster recovery make the endoscopic approach more comfortable for patients. In particular, the transcanal approach eliminates the need for a postauricular incision, thereby accelerating the healing process and facilitating an earlier return to daily life.

The primary limitations of this study are its retrospective design and relatively small sample size. In addition, long-term follow-up data were not available. Therefore, larger-scale, multicenter, and prospective studies are necessary to validate and expand upon these findings.

CONCLUSION

Endoscopic and microscopic tympanoplasty techniques give similar results in terms of anatomical and auditory success. However, the endoscopic approach stands out as a superior technique in terms of low postoperative pain level, faster healing process, cosmetic advantages, and patient comfort. Preferring this method in appropriate cases may increase patient satisfaction.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Bioethics Committee of İstanbul University İstanbul Faculty of Medicine (Date: 17.07.2020, No: 18).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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