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Does young otologists' method of initiation to tympanoplasty make a difference?

Genç otologların timpanoplastiye başlama yöntemi fark yaratır mı?

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ABSTRACT

Objectives: The study aimed to identify which surgical method will provide an easier initiation to tympanoplasty for young otolaryngology residents and which method will achieve more successful results.

Patients and Methods: The files of 58 patients who underwent type 1 tympanoplasty were retrospectively reviewed between September 2020 and September 2021. Patients were divided into two groups according to the surgical procedure as the microscopic (MT) and the endoscopic (ET) group. The ET group included 30 patients (16 females, 14 males; median age: 36.5 years range, 18 to 56 years), and the MT group included 28 patients (15 males, 13 females; median age: 29.5 years; range, 18 to 52 years). The two groups were compared in terms of pre- and postoperative audiometry results and graft success rates.

Results: There was no significant difference between the two groups in terms of pre- and postoperative air-bone conduction pure tone averages and air-bone gap ($p>0.05$). Air-bone gap gain was 13 dB in the ET group and 9.42 dB in the MT group, and this difference was statistically significant ($p<0.05$). The graft success rate was 86.7% in the ET group and 75% in the MT group, but there was no significant difference between the two groups ($p>0.05$).

Conclusion: Although the air-bone gap gain was better in the ET group in our study, it can be said that this difference was clinically negligible. We believe that conducting such a study with more surgeons and surgical cases may guide the otolaryngology residents to start type 1 tympanoplasty surgery.

Keywords: Endoscopic tympanoplasty, microscopic tympanoplasty, otolaryngology residents.

ÖZ

Amaç: Bu çalışmada amacımız genç kulak burun boğaz asistanlarının timpanoplasti ameliyatına başlarken hangi cerrahi yönteme daha kolay alışacağını ve hangi yöntemin daha başarılı sonuçlar elde edebileceğini belirlemektir.

Hastalar ve Yöntemler: Tip 1 timpanoplasti yapılan 58 hastanın dosyaları Eylül 2020 - Eylül 2021 tarihleri arasında retrospektif olarak tarandı. Hastalar yapılan cerrahi işleme göre mikroskopik (MT) ve endoskopik (ET) grup olarak iki gruba ayrıldı. Endoskopik gruba 30 hasta (16 kadın, 14 erkek; medyan yaş: 36.5 yıl; dağılım, 18-56 yıl) dahil edildi ve MT grubuna 28 hasta (15 erkek, 13 kadın; medyan yaş: 29.5 yıl; dağılım, 18-52 yıl) dahil edildi. İki grup ameliyat öncesi ve sonrası odyometri sonuçları ve greft başarı oranları açısından karşılaştırıldı.

Bulgular: İki grup arasında ameliyat öncesi ve sonrası hava-kemik iletim saf ses ortalamaları ve hava-kemik yolu farkı açısından anlamlı bir fark yoktu ($p>0.05$). Hava-kemik yolu fark kazancı ET grubunda 13 dB, MT grubunda 9.42 dB idi ve bu fark istatistiksel olarak anlamlıydı ($p<0.05$). Greft başarı oranı ET grubunda %86.7, MT grubunda %75 idi ancak iki grup arasında anlamlı fark yoktu ($p>0.05$).

Sonuç: Çalışmamızda hava-kemik yolu fark kazanımı ET grubunda daha iyi olmasına rağmen bu farkın klinik olarak ihmal edilebilir düzeyde olduğu söylenebilir. Bu tarz bir çalışmanın daha fazla cerrah ve cerrahi vaka ile yapılmasının kulak burun boğaz asistanlarının tip 1 timpanoplasti cerrahisine başlamada yol gösterici olabileceğini düşünmekteyiz.

Anahtar sözcükler: Endoskopik timpanoplasti, mikroskobik timpanoplasti, kulak burun boğaz asistanları.

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Tympanoplasty is one of the surgical procedures for the eradication of infection and repair of the eardrum in chronic otitis media.[1] Traditionally, middle ear surgery is performed under the guidance of a microscope, but in recent years, the endoscopic method has been a frequently preferred method by otolaryngologists. The endoscopic method, which was initially used for sinus surgeries in the field of otolaryngology, has gained a place in otology practice over time. While endoscopes were previously used in addition to microscopes during middle ear surgery, over time they began to be used as an independent tool.[2,3]

There are many publications in the literature comparing the endoscopic and microscopic methods in type 1 tympanoplasty surgery.[3-6] Many of these publications reported that both surgical methods achieved comparable results. In this respect, it has been demonstrated by many researchers that both surgical methods are successful. However, the question of which method will be easier for young otolaryngology residents to get used to when starting tympanoplasty surgery or which method will achieve more success is still unanswered. Hence, this study aimed to identify the surgical method with the easier introduction to tympanoplasty for young otolaryngology residents.

PATIENTS AND METHODS

In this study, conducted at the Konya City Hospital between September 2020 and September 2021, the files of 58 patients who underwent type 1 tympanoplasty in two different centers were reviewed retrospectively. The patients were divided into two groups according to the surgical procedure performed. In one center, all surgical procedures were performed with the microscopic (MT group) method, while in the other center, they were performed with the endoscopic (ET group) method. The ET group included 30 patients (16 females, 14 males; median age: 36.5 years range, 18 to 56 years), and the MT group included 28 patients (15 males, 13 females; median age: 29.5 years; range, 18 to 52 years). Temporal bone computed tomography was applied to each patient before surgery. Age, sex, tympanic membrane perforation side and size, and preoperative and postoperative (sixth month) pure tone audiometry test results data of the patients were recorded. The results of the two groups was compared in two respects: *(i)* successful tympanic membrane healing (closure), indicating the graft success rate; *(ii)* the degree of improvement of hearing function, including the pre- and postoperative air-bone gap (ABG) and average hearing gain. Those who were operated on for cholestetaoma, cholesterol granuloma, and retraction pocket, those who underwent mastoidectomy, underwent butterfly myringoplasty with fat, had ossicular chain repair, and had comorbidities, and those who smoked were excluded from the study.

Audiological examination

Pure tone average (PTA) was obtained by considering hearing thresholds between 500 and 4,000 Hz in the audiometry test performed preoperatively and postoperatively (minimum six months). Preoperative and postoperative air and bone conduction thresholds and ABG were recorded.

Surgical procedure

In our country, otolaryngology training lasts for five years, and in this study, the first 10 tympanoplasty surgeries performed by otolaryngology residents who are in the fourth and fifth years of their education were considered. In both centers, all operations were performed by three different otolaryngology residents under the supervision of a senior surgeon. Thinned tragal perichondrium island graft was used in all patients. The graft was placed lateral to the handle of the malleus and medial to the tympanic membrane using the over-underlay technique. The size of the perforation in the tympanic membrane was expressed as a percentage (%) of the perforation over the entire membrane.

Microscopic technique

Local anesthetic containing epinephrine at a concentration of 1/100,000 was injected into the tragal region and posterior auricle. In the MT group, surgery was performed with a postauricular incision, the periosteum was elevated after a curvilinear incision made approximately 5 mm behind the ear crease. The skin of the external auditory canal was elevated posteriorly, an incision was made, and the tympanic membrane was exposed. After refreshing the edges of the perforation, the posterior tympanomeatal flap was raised, and the middle ear was entered. Then, middle ear mucosa and ossicular chain motility were checked. The graft was placed as indicated and supported with spongostan from the middle ear. Afterward, the tympanometal flap was placed in its anatomical position and supported with spongostan from the external auditory canal.

Endoscopic technique

Rigid endoscopes with a diameter of 2.7 and 4 mm were used in endoscopic surgery (Karl Storz, Tuttlingen, Germany). After endoscopic evaluation of the tympanic membrane and middle ear, a local anesthetic containing 1/100,000 epinephrine was applied to the posterior wall

of the external auditory canal and tragus. A circular incision was made 4 to 6 mm lateral to the annulus on the posterior skin of the external auditory canal. The posterior tympanomeatal flap was raised, exposing the middle ear. Then, middle ear mucosa and ossicular chain motility were checked. The graft was placed as indicated and supported with spongostan from the middle ear. Afterward, the tympanometal flap was placed in its anatomical position and supported with spongostan from the external auditory canal.

Statistical analysis

The data were analyzed using IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive statistical methods were used in the analysis of the data. Normality tests including Kolmogorov-Smirnov and Shapiro-Wilk tests, was used to determine the distribution of data. Normally distributed data were expressed as mean ± standard deviation, and nonnormally distributed data were expressed as median (interquartile range). Categorical variables were specified as number (n) and percentage (%). The comparison of the numerical data between groups was performed with either the independent Samples t-test or the Mann-Whitney U test, where appropriate. The chi-square test and Fisher exact test were used to compare categorical variables. A p value <0.05 was considered statistically significant.

RESULTS

There was no significant difference between the two groups in terms of sex and mean age (p>0.05). In the ET group, each surgeon performed 10 operations, while in the MT group, two surgeons each performed nine operations, and one surgeon performed 10 operations. In the ET group, 14 patients were operated on the left ear, and 16 patients

Table 1
Distribution of patients parameters by groups

	ET group				MT group				
Parameters	n	%	Median	IQR	n	%	Median	IQR	p
Age (year)			36.5	18.75			29.5	15.25	0.599
Sex									0.237
Female	16				13				
Male	14				15				
Ear									0.425
Left	14				16				
Right	16				12				
Perforation size		62.5		46.25		60		43.75	0.287

ET: Endoscopic; MT: Microscopic; IQR: Interquartile range.

Table 2
Preoperative and postoperative pure tone averages and graft success rates by groups

	ET group					MT group					
Parameters	n	%	Mean±SD	Median	IQR	n	%	Mean±SD	Median	IQR	p
Preoperative air conduction			39.6±7.5					36±6.3			0.052
Postoperative air conduction			25.1±6.9					22.8±5.7			0.171
Preoperative bone conduction				14.5	11.0				13.0	6.0	0.371
Postoperative bone conduction				11.0	8.50				10.0	5.0	0.150
Preoperative ABG			23.8±6.94					20.9±4.9			0.070
Postoperative ABG				10.0	8.50				11.5	6.75	0.826
ABG improvement				13.0	7.25				9.42	10.0	0.020
Graft success (%)	26/30	86.7				21/28	75				0.320

ET: Endoscopic; MT: Microscopic; SD: Standard deviation; ABG: Air-bone gap.

were operated on the right ear. In the MT group, 16 patients were operated on the left ear, and 12 patients were operated on the right ear. Tympanic membrane perforation size ratio was 62.5% in the ET group, while it was 60% in the MT group. There was no significant difference between the two groups in terms of tympanic membrane perforation size ($p>0.05$, Table 1).

The preoperative and postoperative audiometry test results of the groups are shown in Table 2. The preoperative air conduction PTA of the ET group was 39.6 dB, while it was 36 dB in the MT group. The preoperative bone conduction PTA of the ET group was 14.5 dB, while it was 13 dB in the MT group. The postoperative air conduction PTA of the ET group was 25.1 dB, while it was 22.8 dB in the MT group. Postoperative bone conduction PTA in the ET group was 11 dB, while it was 10 dB in the MT group. While the preoperative ABG was 23.8 dB in the ET group, it was 20.9 dB in the MT group. Postoperative ABG was 10 dB in the ET group and 11.5 dB in the MT group. There was no significant difference between the two groups in terms of pre- and postoperative air-bone conduction PTA and ABG ($p>0.05$). Air-bone gap gain was 13 dB in the ET group and 9.42 dB in the MT group, and this difference was statistically significant ($p<0.05$). The graft success rate was 86.7% in the ET group and 75% in the MT group. In this respect, there was no significant difference between the two groups ($p>0.05$).

DISCUSSION

Since the 1950s, microscopic tympanoplasty has been a standard method for repairing a perforated eardrum.[1] Endoscopes have been used by otolaryngologists since 1960.[1] Endoscopes, which were initially used only for diagnostic purposes and as an aid to the microscope in cholesteatoma surgery, have been widely used in otological surgical procedures, such as myringoplasty, tympanoplasty, and stapedotomy, which are classically performed with a microscope, in the last two decades.[7,8] Therefore, over the years, some changes have occurred in our surgical and educational habits. While otolaryngologists with a certain experience, including the corresponding author of this article, learned and practiced otological surgeries with the microscope, otolaryngology residents who are training at present may begin otological surgeries with both microscopic and endoscopic methods. Therefore, it can be said that we are experiencing a transition period in otologic surgery training in this regard. For this reason, we aimed to examine the surgical results of otolaryngology residents who started type 1 tympanoplasty with two different methods (endoscopic or microscopic) and to reveal which method would lead to better results in the introduction to this surgery. In this way, we aimed to find the best method that would minimize the initial concerns and hesitations of otolaryngology residents who do not have enough experience.

Both surgical methods preferred for tympanoplasty have their own advantages and disadvantages. Although small perforations can be performed with transcanal and endaural incisions in the microscopic method, a postauricular incision is generally used for large perforations. Therefore, the microscopic method is more invasive than the endoscopic method, and sometimes the curved structure of the external ear canal and bony prominences may distort the exploration. In such cases, canaloplasty may be required. However, in the microscopic method, we have the opportunity to use both hands, and the sense of depth is better in this method. The endoscopic method is less invasive as the surgeon begins the operation from the transcanal tympanometal flap removal stage. In addition, endoscopes provide a wider and angled view of thin and deep structures in the middle ear. However, since the surgeon can use only one hand with this method, good hemostasis must be ensured, otherwise the surgeon's manipulations may be limited. In addition, the sense of depth is worse as it presents a two-dimensional image.[2,9] In a meta-analysis, it was stated that endoscopic ear surgery would be a good alternative to microscopic ear surgery in terms of graft success rates and hearing results in patients who underwent tympanoplasty and myringoplasty.[10]

When the publications comparing the microscopic and endoscopic method in tympanoplasty operations are reviewed, it is seen that these are generally publications that compare the operations performed with the endoscopic method by a surgeon who previously operated with the microscopic method and that examine the adaptation period. In a study dealing with operations performed by a single surgeon, patients were divided into three groups: the MT group, early ET group, and late ET group.[11] In this study, it was reported that there was no significant difference between the groups in terms of tympanic membrane closure rate and ABG healing, indicating that similar and good results can be obtained when a surgeon adapts to endoscopic tympanoplasty and teaches it to his residents. On the other hand, our study differs from the previous studies in terms of its setup. When comparing the two surgical methods, we formed the groups from more than one surgeon to minimize individual differences. In addition, practicing one surgical method (endoscopic or microscopic) can make it easier to adapt to the other surgical method.

Therefore, our groups consisted of native surgeons who trained in only one surgical method.

Doğan and Bayraktar[12] divided their patients into four groups as early, middle, late endoscopic, and microscopic, and they stated that there was no significant difference between the groups in terms of hearing and graft success and that a surgeon who had previously received microscopic training should perform an average of 60 cases to master the endoscopic method. In another study in which endoscopic tympanoplasty operations were performed by a young surgeon, it was found that the graft success rate was 94%, and there was a significant improvement in preoperative and postoperative PTA.[13] In this study, although there was no significant difference between the groups in terms of graft success, the graft success rate was higher in the ET group. This can be explained by the fact that the microscopic method requires more surgical steps and the tympanic membrane can be viewed more easily in the endoscopic method. Therefore, in inexperienced hands, small continued openings around the perforation can be detected more easily by the endoscopic method after graft placement, and the necessary corrections can be made. In a study examining the learning curve of endoscopic tympanoplasty, it was reported that a significant improvement was achieved in the first 50 patients in terms of graft success, and the average operation time improved after the 150th patient.[9] Therefore, perhaps we should have formed groups with more cases in this study. Monteiro et al.[14] compared the first 25 endoscopic cases of a surgeon who previously performed with the microscopic method and the first 25 cases of another surgeon who first learned this surgery with the direct endoscopic method. The authors stated that there was no significant difference between the two groups in terms of operative time and ABG healing, and stated that endoscopic tympanoplasty showed comparable results and learning curves in both methods, regardless of previous microscope experience. In a study that analyzed transcanal myringoplasty patients of a young surgeon who had just completed his residency, it was stated that endoscopic transcanal myringoplasty is safe even in the hands of young surgeons who are just starting out, and surgeons can consider the endoscopic method early in their careers without fear of a learning curve.[15] In our study, there was no significant difference between the two groups in terms of pure tone audiometry values and perforation size. Therefore, both groups were homogeneous regarding patient profile. Although there was no significant difference between the two surgical methods in postoperative PTA values and ABG, ABG gain was significantly higher in the ET group. This may be related to the higher graft success rate in the ET group. Therefore, in light of our findings, it can be said that the ET group achieved more successful surgical results than the MT group in this study.

The main limitation of this study is its retrospective nature. Prospective studies in this area may yield more accurate results. In addition, we think that increasing the number of surgeons and cases in surgical groups will minimize the differences arising from individuals.

In conclusion, the ABG gain of the ET group was higher than that of the MT group in type 1 tympanoplasty. In addition, although not significant, the graft success rate of the ET group was higher than the MT group. It may be easier for young otorhinolaryngology residents to get used to type 1 tympanoplasty surgery with the endoscopic method. Therefore, we believe that starting otologic surgeries with the endoscopic method in this population and combining them with the microscopic method over time may yield better surgical results.

Ethics Committee Approval: The study protocol was approved by the Necmettin Erbakan University Ethics Committee (date: 01.11.2021, no: 2021-3476). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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