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Microscopic Transcanal Approach for Tympanoplasty

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ABSTRACT

Background: Terminologically, the surgery for chronic otitis media (COM) called tympanoplasty indicates both the cleaning of the active disease or sequela within the tympanic cavity and hearing reconstruction by tympanic membrane repair and ossicular chain reconstruction. Three surgical approaches, namely retroauricular, endaural, and transcanal, were described as surgical methods under a microscope. In the literature, although there is much information and data about the retroauricular and endaural approaches, the documentation and data about the transcanal approach is very limited.

Methods: Microscopic transcanal tympanoplasty has been performed on 1095 cases of which the indications were COM, sequela of COM, and cholesteatoma limited to epitympanum since 2009. In cases without sufficient exposure of the anterior tympanic annulus, a retroauricular approach (15 cases) was performed. Tragal cartilage, temporalis fascia, and fat tissue were used as a graft materials.

Results: Myringoplasty was performed in 11 patients, type 1 tympanoplasty in 665 cases, type 2 tympanoplasty in 278 cases, type 3 in 121 cases, and type 4 in 5 cases. Graft intake ratio was 89.2% (970 cases) of the 1080 cases who were followed up. Graft intake was unsuccessful on 110 cases (10.8%). Of 36 cholesteatoma cases, recurrence was seen only in 2 cases (5.5%).

Conclusion: Microscopic transcanal approach for tympanoplasty is suitable in majority of cases. It leads to shorter operation times and faster postoperative healing period. However, it first requires to dominate the surgical anatomy of the temporal bone in detail. This can be obtained by dissections on cadavers, and further it necessitates experience with otologic surgery by retroauricular approaches.

Keywords: Chronic otitis media, ear surgery, transcanal approach, tympanoplasty

Introduction

Terminologically, tympanoplasty indicates both the cleaning of the active disease or sequela within the tympanic cavity due to chronic otitis media (COM) and hearing reconstruction by tympanic membrane repair and ossicular chain reconstruction. In general, retroauricular or endaural approaches have been preferred as surgical methods under microscopy.[1-5]

The transcanal approach under the microscope had also been defined in many classical otological surgery books.[1-5] It had been proposed for cases in which the pathology was limited to the hypotympanum, mesotympanum, and tympanic membrane, and where there was no anticipated need to reach to epitympanum and mastoid.

Surgical procedures which can be done with this approach are suggested as stapedectomy, labyrinthectomy, myringoplasty, ossiculoplasty, section of the posterior ampullary nerve, closure of perilymphatic fistula, biopsy of tumor masses, removal of glomus tympanicum tumors, section of Jacobson's nerve, section of tensor tympani tendon, and exploratory

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tympanotomy for unexplained conductive hearing loss.[2] However, the documentation and data about the transcanal approach is very limited in the literature.[6,7]

In this study, the long term experience of the author (A.A.) with this approach on a large amount of cases of COM will be presented.

Material and Methods

The study was approved by the Medical Sciences Ethics Committee of the Medical Faculty of Manisa Celal Bayar University (no.: 20.478.486/2578, April 9, 2024).

Microscopic transcanal tympanoplasty has been performed on 1095 cases since September 2009. The indication of cases included COM, sequela of COM, and cholesteatomatous COM limited to the epitympanum. The postoperative follow-up period has been changed from 2 months to 15 years among the patients. Fifteen cases were lost to follow-up. Hence, 1080 cases who were followed up were included in the retrospective analysis.

Demographic data for the cases of tympanoplasty types are demonstrated in Tables 1 and 2. There were 579 female and 501 male patients. In 515 cases, the right ear was operated on, while left ear was operated on in 565 cases. The mean age of the patients was 34.93 ± 15.32 (range: 6-75 years old).

Preoperative examination with an ear speculum under a microscope was performed, and when the surgical field was limited to see the anterior tympanic annulus, it was decided to perform a retroauricular approach (15 cases). Of these cases, 9 had a very prominent and protruding triangular Henle spine, 4 had protrusion of the anterior external auditory canal wall, and 2 had very thick tympanomastoid and tympanosquamous sutures, which limited surgical exposure of the anterior tympanic annulus when ear speculum was placed.

Surgical Technique

All the operations were carried out under general anesthesia. The first step is revivation of the tympanic membrane perforation with a pick (Figure 1). Later, vertical and medial tympanomeatal flap incisions are made through an ear speculum (Figure 2). Next, the tympanomeatal flap is elevated through the malleus manibrium (Figure 3). Lastly, tragal cartilage graft material is placed using the over-underlay technique (Figure 4). The first postoperative examination of the graft's success has been done at 2 months (Figure 5).

Pearson chi-square and Fisher exact test were used for statistical analysis of graft success rates in total cases and in each different tympanoplasty type.

Table 1. Demographic Data for the Cases of Tympanoplasty

Otologic Procedure	Number of Cases	Age		Sex	
		Mean ± SD	Range	F	M
Myringoplasty	11	37.27 ± 13.32	16-56	10	1
Type 1 tymp	665	35.05 ± 15.52	6-75	360	305
Type 2 tymp	278	35.43 ± 15.20	8-68	146	132
Type 3 tymp	121	32.92 ± 14.55	10-67	60	61
Type 4 tymp	5	34.20 ± 19.33	11-56	3	2
Total	**1080**	**34.93 ± 15.32**	**6-75**	**579**	**501**

Results

Distribution of the diagnosis of the cases was demonstrated in Table 2. The cholesteatoma cases limited to the epitympanum were 36 (3.3%). The rest of the cases included those with COM not necessitating mastoidectomy. Cholesteatoma recurred in 2 cases (5.5%). It recurred 11 years after the primary type 3 tympanoplasty in 1 case, and 1.5 years after the primary type 3 tympanoplasty in another case.

Distribution of the tympanoplasty types was myringoplasty (11 cases), type 1 (665 cases), type 2 (278 cases), type 3 (121 cases), and type 4 (5 cases) (Table 1).

The microscopic evaluation of the graft success was noted at the last postoperative examination of the patient. Graft intake ratio was 89.8% (970 cases) of the 1080 cases who were followed up (Table 3). Graft intake was unsuccessful on 110 cases (10.2%).

Among the 660 cases with a follow-up period of less than 1 year, the graft success rate was 91.8%, while among the 420 cases with a follow-up period longer than 1 year, it was 86.7% (Table 3). The difference between the 2 groups was found to be statistically significant ($P = .006$). It seems that this is due to significant difference in the number of cases in each follow-up group. Six hundred six of 970 cases with an intact graft (62.5%) have a follow-up of less than 1 year, while 364 cases (37.5%) have a follow-up longer than 1 year (Table 3).

The graft success rate according to types of operation is demonstrated in Table 4. Regarding the tympanoplasty types, the graft success rate in cases with 2 different follow-up groups was statistically meaningful only in type 1 tympanoplasty cases ($P = .001$).

Among the unsuccessful cases, it was observed that in the majority of the cases, the reperforation was of very limited size, as an untouchable graft material at the junction of the anterior tympanic annulus (Figure 6).

Discussion

Microscopic transcanal approach was previously termed as endaural approach with an ear speculum or internal endaural (transmeatal) approach.[1,2] Later, the term transcanal approach has been accepted by many surgeons.[3-7] Although the microscopic transcanal approach was defined very long time ago, there are few reports on the surgical

MAIN POINTS

- *Microscopic transcanal approach can be used for any type of tympanoplasty, and for removal of attic cholesteatoma limited to epytympanum.*
- *By this approach, less skin incisions are made leading to shorter surgical time, and to faster postoperative healing.*
- *As surgical experience has increased, it is also possible to expose the epytympanum and anterior tympanic membrane by curretting the scutum and the anterior wall of external ear canal, respectively.*
- *It is possible to obtain high surgical success rate similar to classical approaches and endoscopic approach. The main advantage upon endoscopic one is using both hands. Whenever needed, an endoscope can also be safely used through a fixed speculum.*
- *Before starting to perform the transcanal approach, it is essential to learn surgical anatomy on temporal bone dissections, and to have sufficient surgical experience by retroauricular approach.*

Table 2. Otologic Diagnosis of the Patients According to the Types of Tympanoplasty

		Side		Diagnosis		
Otologic Procedure	**Number of Cases**	**R**	**L**	**COM**	**COM Sequela**	**Cholesteatoma**
Myringoplasty	11	5	6	–	11	–
Type 1 tymp	665	334	331	442	223	–
Type 2 tymp	278	122	156	158	106	14
Type 3 tymp	121	52	69	76	24	21
Type 4 tymp	5	2	3	3	1	1
Total	**1080**	**515**	**565**	**679**	**365**	**36**

experience with this method in the literature.[6,7] Recently, the endoscopic transcanal approach has gained popularity.[8,9] The reports comparing the endoscopic and microscopic approaches define only the retroauricular approach as a microscopic approach and no mention about the microscopic transcanal approach for tympanoplasty.[8,9]

Microscopic transcanal approach for tympanoplasty has several advantages over retroauricular and endaural approaches.[6,7] First, skin incisions are only required to create tympanomeatal flap (Figures 2 and 3). This leads to a faster postoperative wound healing period. In addition, it also results in a faster operation time. A recent common belief is that such advantages are specific for only endoscopic transcanal approach.[8,9] This opinion seems to originate from the fact that such reports do not have sufficient data to compare the endoscopic transcanal approach with the microscopic transcanal approach due to the lack of data about the experience with the microscopic transcanal approach in the literature.

Furthermore, with a microscopic transcanal approach, it is clear that it is possible to work using both hands, which may be difficult when an endoscope is used through the ear canal, and to have better depth perception in the surgical area, which is frequently emphasized as a disadvantage of the endoscopic transcanal surgery.[8,9]

Classically, it is stated that the microscopic transcanal approach is limited to patients with wide ear canals and small, posteriorly placed tympanic membrane defects, which means it is suitable only for type-1 tympanoplasties.[9] However, our experience shows that surgical exposure in microscopic transcanal tympanoplasty is generally sufficient. The presence of a protruding Henle spine, anterior canal wall protrusion, and large tympanomastoid and tympanosquamous sutures may make the surgical exposure very limited. In such cases, the retroauricular approach can be preferred. The number of such cases is very limited. Within the last 15 years, in only 15 cases it

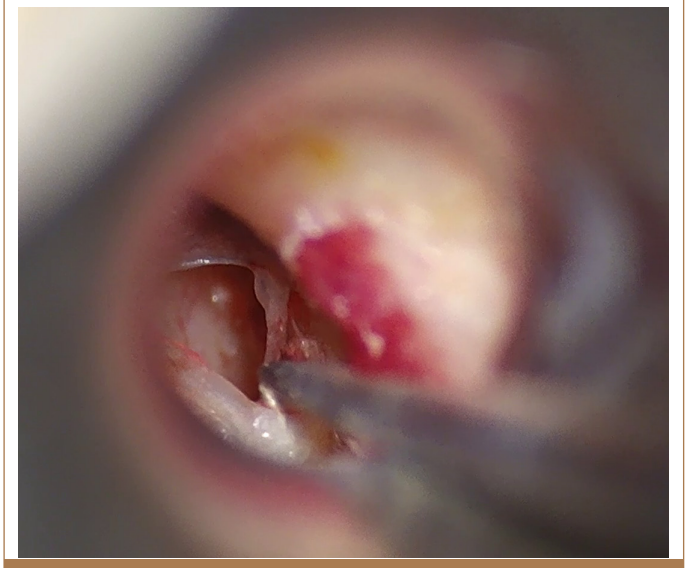

Figure 1. Perforation of the tympanic membrane at the anteroinferior quadrant (right ear). Revivation of the perforation edges is performed through an ear speculum.

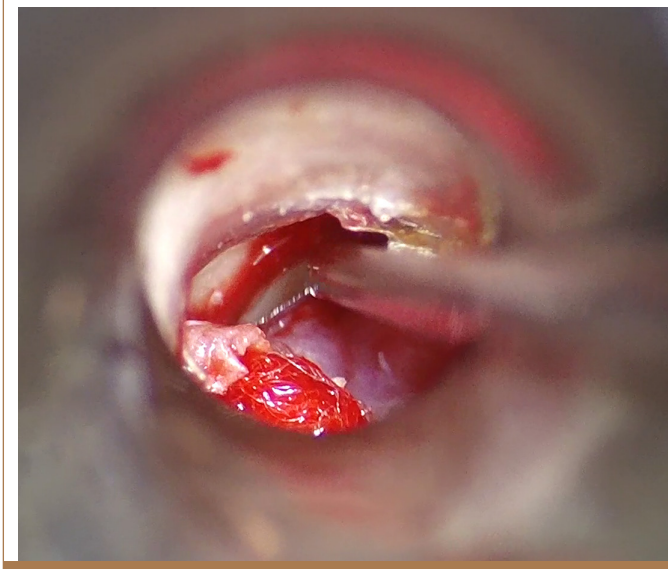

Figure 2. Vertical and horizontal incisions for the tympanomeatal flap.

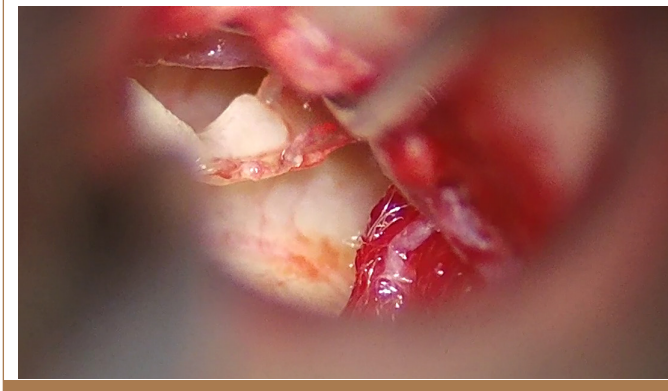

Figure 3. Elevation of the tympanomeatal flap and tympanic membrane remnant over the malleus manibrium.

Figure 4. Placement of the cartilage graft.

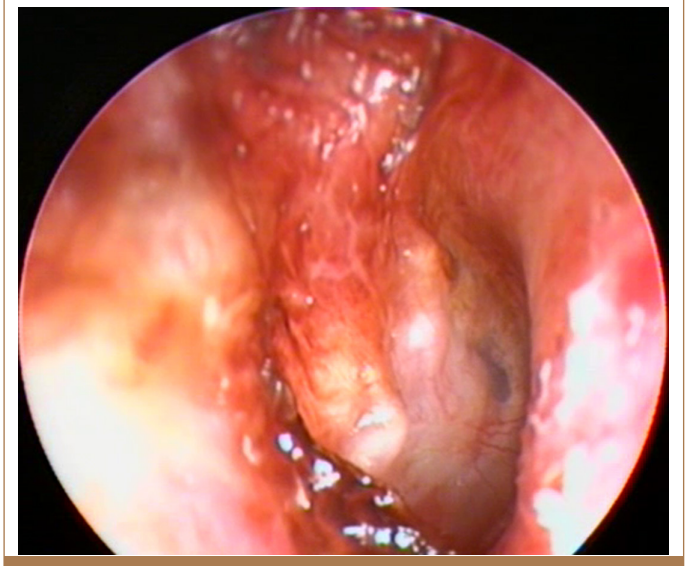

Figure 5. Postoperative visualization of the graft material at the second month.

Table 3. Graft Success Rate for All Types of Tympanoplasty

	Number of Cases	Graft Intact	Graft Perforated
Postop <1 year	660	606 (91.8%)	54 (8.2%)
Postop >1 year	420	364 (86.7%)	56 (13.3%)
Total	1080	970 (89.8%)	110 (10.2%)

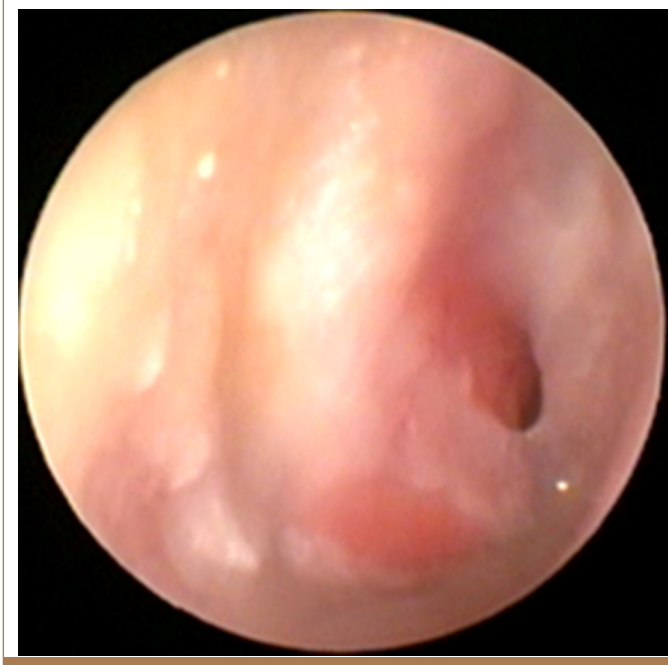

Figure 6. Postoperative small perforation at the anterior quadrant of the graft (right ear).

was decided to change the surgical procedure to the retroauricular approach.

In addition, it must be emphasized that as surgical experience has developed, it is possible to expose the epitympanum by curetting the scutum and to expose the surgical exposure of the anterior tympanic membrane by curetting the anterior wall through an ear speculum. This leads to better management of the whole tympanic membrane pathology and makes it easier to place the graft material safely, which increases the graft success rate of the surgery. The graft success rate in this study was 89.8%. Huang et al[6] reported the graft success rate with the transcanal microscopic approach as 97.1% at 3 months after type 1 tympanoplasty in 35 cases.We previously reported the graft success rate as 90.3% in 134 cases with type 2 tympanoplasty.[7] In this study, we found the graft success rate to be 93.9% in 278 cases with type 2 tympanoplasty.

In this study, when the cases with unsuccessful graft intake (10.2%) are examined, it was observed that in the majority of the cases, perforation was indeed minimal and due to failure of contact between the graft material and the tympanic membrane remnant (Figure 6).

Although previous reports state that the transcanal approach is used mainly to repair tympanic membrane perforation in COM

Table 4. Graft Success Rate According to the Tympanoplasty Types

Otologic Procedure	Number of Cases	Post Op <1 Year		Post Op >1 Year		Total	
		Graft Intact	Graft Perforated	Graft Intact	Graft Perforated	Graft Intact	Graft Perforated
Myringoplasty	11	6 (85.7%)	1 (14.3%)	3 (75%)	1 (25%)	9 (81.8%)	2 (18.2%)
Type 1 tymp	665	405 (91.8%)	36 (8.2%)	187 (83.5%)	37 (16.5)	592 (89%)	73 (11%)
Type 2 tymp	278	135 (93.8%)	9 (6.2%)	126 (94%)	8 (6.0%)	261 (93.9%)	17 (6.1%)
Type 3 tymp	121	59 (88.1%)	8 (11.9%)	44 (81.5%)	10 (18.5)	103 (85.1%)	18 (14.9%)
Type 4 tymp	5	1 (100%)	–	4 (100%)	–	5 (100%)	

patients.[8,9] Through microscopic transcanal approach, ossiculoplasty can also be done together with tympanic membrane repair.[7] In this study, type 2 and type 3 tympanoplasties have been performed in a significant number of the cases, 278 and 121, respectively (Table 4).

Furthermore, it is possible to use microscopic transcanal tympanoplasty in cases of mucosal pathology filling the middle ear, including epitympanum. It can be used in cases of retraction pockets and limited cholesteatoma. There are some debates on whether mastoidectomy is necessary in such cases.[10,11] Similar to Balyan et al[10] it has been observed that it is possible to have a high graft intake ratio with transcanal tympanoplasty without mastoidectomy. In this study, cholesteatoma limited to epitympanum were removed in 36 cases, and there were only 2 recurrences postoperatively.

In conclusion, the microscopic transcanal approach through an ear speculum for tympanoplasty is suitable in majority of cases. However, it first requires to dominate the surgical anatomy of the temporal bone in detail. This can be obtained by dissections on cadavers, and further it necessitates experience with otologic surgery by retroauricular approaches.

Data Availability Statement: *The data that support the findings of this study are available on request from the corresponding author.*

Ethics Committee Approval: *This study was approved by the Medical Sciences Ethics Committee of the Medical Faculty of Manisa Celal Bayar University (no:20.478.486/2578, April 9, 2024).*

Informed Consent: *N/A.*

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Declaration of Interests: *The author has no conflict of interest to declare.*

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