ORIGINAL ARTICLE

Transcanal Microscopic vs Endoscopic Type 1 Tympanoplasty in Dry Central Perforation: A Comparative Retrospective Study

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Abstract

Introduction: Type 1 tympanoplasty or myringoplasty is the repair of the perforated ear drum. Comparisons of microscopic and endoscopic techniques present in literature use different routes of access and cannot be compared head-on.

Objective: The objective of this study was to compare an endoscopic and a microscopic myringoplasty results when both are performed *via* the transcanal route.

Materials and methods: We present a retrospective study done at a single center to compare endoscopic and microscopic type 1 tympanoplasties, both done via the transcanal route. A total of 70 patients, 30 operated with endoscope and 40 with microscope, were included in the analysis. Patients of either sex, between 18 and 60 years of age, with a dry perforation, and air–bone gap of ≤30 dB were included.

Results: Perforations were completely closed in 93% of the endoscopic group and 92.5% in the microscopic group. The air–bone gap closure was 12.89 dB in the endoscopic and 11.97 dB in the microscopic group. There was no association between the site or size of the perforation and the failure of surgery. The time taken for surgery was also equivalent. The endoscope had the advantage of avoiding a canaloplasty and of looking into the hidden areas of the middle ear.

Conclusion: For transcanal, minimally invasive type 1 tympanoplasty, both techniques provide equivalent results. We recommend the use of an endoscope as the primary or an accessory tool for better visualization.

Keywords: Endoscopic approach, Microscope, Myringoplasty, Tympanoplasty.

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Introduction

The aim of tympanoplasty is to eradicate the disease from the middle ear and reconstruct the hearing mechanism. Wullstein in 1956 classified tympanoplasty into five types. Type 1 tympanoplasty or myringoplasty involves the repair of the perforated tympanic membrane when the middle ear chain is intact. It can be performed via end-aural, post-aural, or transcanal routes and the graft can be placed by overlay, interlay, or inlay techniques.

The microscope has been the workhorse of all otological surgeries and is still the preferred visualization tool for most surgeons. Microscopic ear surgery enables two-handed manipulation and binocular vision along with an excellent stereoscopic surgical view. With limited visual access to the hidden areas, such as the sinus tympani, hypotympanum, and epitympanum, the use of a microscope in the transcanal approach is limited and a post-auricular incision is preferred to obtain a wider view.

Endoscope-assisted microscopic surgery has been developed as El-Guindy[1] reported 36 cases of endoscopic myringoplasty, and McKennan[2] introduced endoscopy for the second look of ear surgery. Thomassin et al.[3] used an endoscope as an adjuvant in microscopic ear surgery.

The transcanal approach has the distinct advantage of a much smaller or hidden incision, minimum soft tissue dissection, and shorter duration of surgery. Since its advent, the endoscope has transformed the external auditory canal into the operative gateway. Transcanal endoscopic ear surgery permits a magnified, wide-angle vision at a high resolution, as well as the direct visualization of hidden areas.

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Previous studies have compared the results of microscopic surgery done via endaural or post-aural routes to endoscopic surgery via the transcanal route.[1–7] In this study, by performing both endoscopic and microscopic myringoplasties via the transcanal route, a symmetrical comparison was possible. The two arms were compared on the success of graft uptake, hearing improvement, and time duration of surgery. An analysis of the result outcome with both techniques in relation to the size and site of the perforation was also done.

Materials and Methods

Seventy patients were selected with single, central perforation, and the history of the dry ears without medication for a minimum

duration of one month. Patients in the age bracket of 18–60 years were included. Air–bone gap of ≤30 dB and sensorineural hearing (bone conduction) loss of ≤20 dB on pure tone audiometry (PTA) were set as hearing threshold limits. Patients with retraction pockets, adhesive or atrophic process, subtotal perforations, extensive tympanosclerosis, and those with traumatic perforations were excluded. Patients with a history of otogenic complications and active external ear canal disease, exostosis, or extremely narrow tortuous ear canals where a transcanal approach was not possible were also excluded.

All patients were evaluated in terms of history, examination, and relevant investigations. Ears examined for side, size, site and margins of perforation, middle ear mucosal status, and aural discharge. All patients were counseled regarding the procedure and anesthesia. Informed consent was taken. Pure tone audiometry for hearing level and impedance test for tubal patency was performed in all patients before surgery.

The perforation size was recorded at the time of surgery. The largest diameter was used to grade the perforations into small (<3 mm), medium (3–5), and large (>5 mm). The perforation sites were also categorized according to the predominant area involved as anterior, posterior, and inferior. Perforation of any size, which involved more than one segment, was classified as mixed.

Zeiss OPMI microscope and 2.9 mm and 4 mm 0° endoscopes without a holding device were used. Scopes (30°) were occasionally used to inspect the middle ear cavity in endoscopic surgeries.

All the surgeries were performed under local anesthesia, within the established principles of otologic surgery. The temporalis fascia graft was harvested with a temporal incision along the hairline. To harvest the tragal perichondrium, a curvilinear incision was made on the medial aspect of the tragus, removing the cartilage from its bed, and harvesting the perichondrium from both sides. The cartilage was then placed back. The grafts were dried and cut into the required shape and size. Next, the site and size of the perforation were recorded. The margins of perforation were freshened. The tympanomeatal flap was elevated, starting 3–4 mm lateral to the annulus and going 270°–360° around the canal. The middle ear was examined for any pathology and ossicular continuity, and mobility was confirmed. The graft was placed and tucked under the handle of the malleus. After repositioning the tympanomeatal flap, gel foam pieces followed by a medicated aural pack were placed. The graft incisions were sutured. A pressure dressing was applied where temporalis fascia was harvested. The duration of surgery was recorded. The aural pack was removed after 10 days. Ear examination was performed at each post-operative visit, and a hearing assessment was done after 3 months.

Results

The transcanal microscopic myringoplasty (TMM) and the transcanal endoscopic myringoplasty (TEM) groups were comparable in age and sex of the patients, size, and site of perforation (Table 1). More than two-thirds of patients were men. Age distribution was quite even, 47% were aged 35 years or less, and the rest were older. The average age in both groups was between 36 and 37 years. On examination, medium-sized perforations (3–5 mm in greatest dimension) were most seen. Perforations located anteriorly and those of mixed variety were the most common according to the site.

Temporalis facial graft was more commonly used in TMM, while tragal perichondrium use was more common in TEM, but there was no significant difference (p-value = 0.19, Table 2). In the initial part of the study, using temporalis fascia for TMM was the norm, which accounts for the higher number of patients in that category.

Table 1: Comparison of demographic factors and perforation characteristics

Demographic factors	*TMM (n = 40)*	*TEM (n = 30)*	*Total (n = 70)*
Sex			
Female	12	10	22 (31.4%)
Male	28	20	48 (68.6%)
Age			
≤35 years	19	14	33 (47.1%)
>35 years	21	16	37 (52.9%)
Average age (in years)	36.07	36.93	36.44
Perforation characteristics			
Side			
Left	15	16	31(44.3%)
Right	25	14	39 (55.7%)
Perforation size			
Small	9	4	13 (18.6%)
Medium	19	15	34 (48.6%)
Large	12	11	23 (32.8%)
Site of perforation			
Anterior	14	12	26 (37.1%)
Posterior	12	6	18 (25.7%)
Inferior	3	2	5 (7.1%)
Mixed	11	10	21 (30%)

Table 2: Type of graft used

Graft material			
Temporalis fascia	25	14	39
Tragal perichondrium	15	16	31

Table 3: Comparison of duration of surgery between the two groups

Duration of surgery	*TMM*	*TEM*	*Total*
Up to 60 min	22 (55%)	16 (53.33%)	38
60–90 min	15 (37.5%)	13 (43.33%)	28
>90 min	3 (7.5%)	1 (3.33%)	4

The duration of surgery was calculated from the time of local infiltration to aural packing. A little over half of all surgeries in both groups were completed within 60 minutes (Table 3).

The success of the surgery was defined in two parameters: the rate of closure of perforation and the improvement in air–bone gap. The perforation closure had similar results in both groups (Fig. 1). There was no association between the site or size of the perforation and the failure rate. The air–bone gap closure rate was 12.89 dB in the TEM group, which was higher than that in the TMM group (11.97 dB), but the difference was not significant (Fig. 1).

None of our patients had preoperative or postoperative complications. Since all the patients were operated on a day care basis, there were no differences in a hospital stay or resource consumption. The postoperative management was similar in all patients.

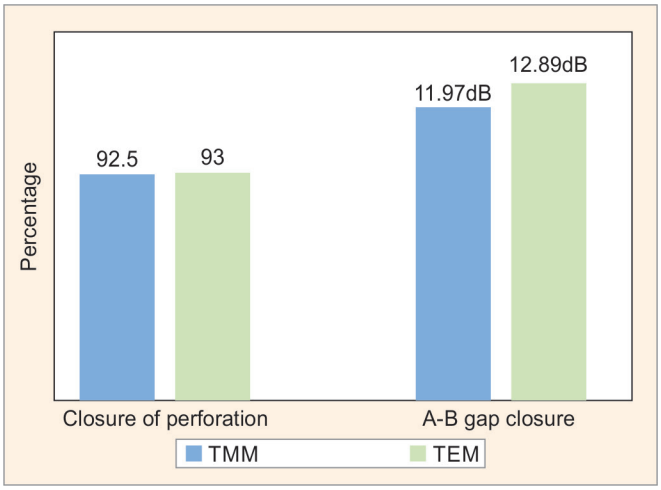

Fig. 1: Comparison of success in the closure of perforation and improvement of hearing

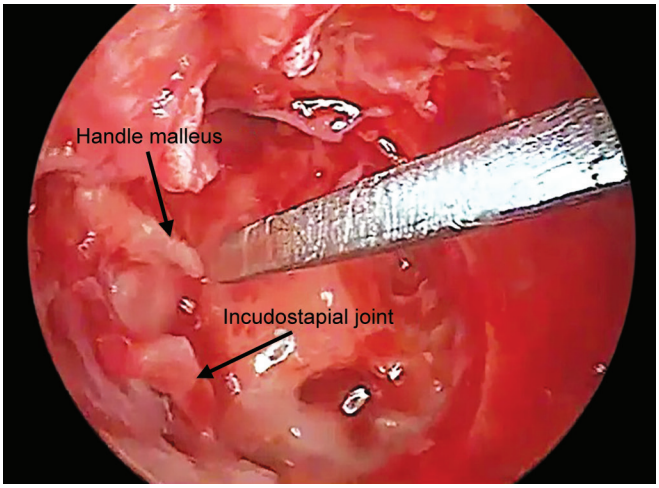

Fig. 3: Middle ear and ossicular chain inspection during endoscopic surgery

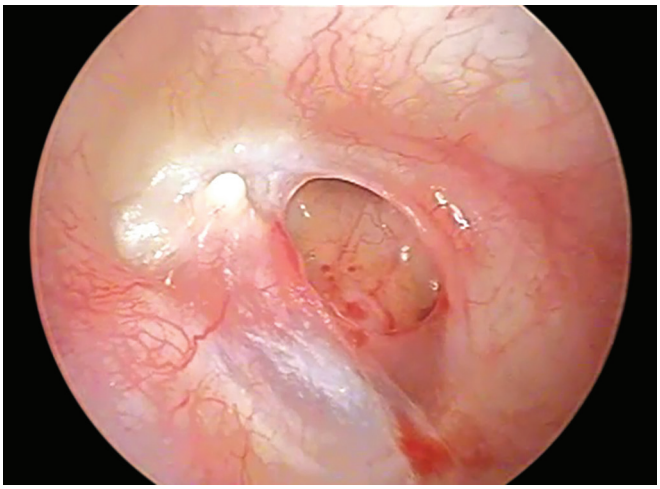

Fig. 2: Endoscopic visualization of the complete tympanic membrane

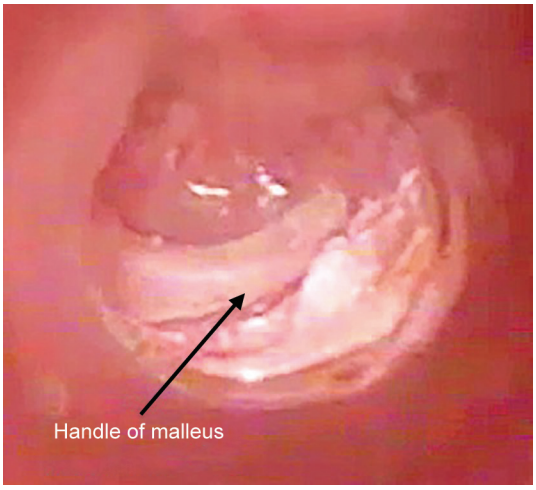

Fig. 4: Limited view with a microscope

The surgeons were well versed with the microscopic techniques, and in the initial phase there was some difficulty with an endoscope, predominantly due to the availability of just one hand for instrumentation. There was also a tendency to select wider and straighter ear canals for endoscopic procedures. For these reasons, the first few cases operated with the endoscope were not included in the study.

The endoscope allowed an unobstructed view of the tympanic membrane (Fig. 2) and had a clear advantage while inspecting the middle ear (Fig. 3). In comparison, the microscopic view is limited (Fig. 4) and difficult to assess the middle ear (Fig. 5). Angled endoscopes were employed to visualize the hidden areas if deemed necessary. Although none of these examinations yielded findings, which required us to modify the surgery, we find it to be a valuable step toward the goal of the surgery.

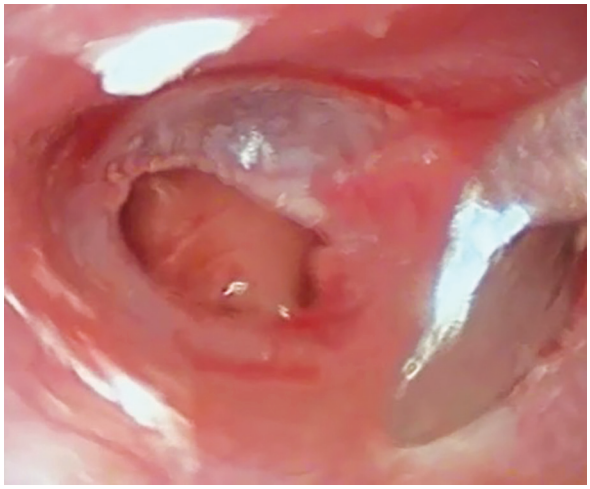

Fig. 5: Middle ear assessment under a microscope

Discussion

Traditionally, myringoplasty or tympanoplasty type 1 is performed with an operative microscope. El-Guindy[1] in 1992 was the first to publish a series on endoscopic myringoplasty although it was Thomassin et al.[3] who reported the use of endoscopic guided surgery to look at hidden areas during cholesteatoma surgery in 1987. McKennan[2] and Youssef and Poe[8] reported the second look mastoidoscopy to rule out residual cholesteatoma.

The endoscopic technique offers a new perspective to understand anatomy, pathology, and operative techniques. A review of endoscopic ear surgeries demonstrated that there has been an increase in publications in recent years, which reflects acceptance and comfort with the endoscope. Primary indications identified for endoscopic ear surgeries included cholesteatoma removal and myringoplasty. Enough evidence is found in the literature on the benefit of observational use of the endoscope in ear surgery, and the feasibility of endoscope as a microscope replacement has also been studied.[9]

Transcanal tympanoplasty leaves a small or no visible incision. There is a little change in ear anatomy, and it can be done in a short time. It is ideal for the repair of tympanic membrane perforations without chronic inflammation or cholesteatoma and/or necrosis of the ossicles.

Comparing endoscopic and microscopic myringoplasty/type 1 tympanoplasty based on the success of closure of perforation, some authors had better results with a microscope[4,6,10,11] and others with an endoscope,[7,12] but these results were statistically insignificant. On comparing the air–bone gap closure, Jyothi et al.[6] reported a significant difference in the favor of the microscopic procedure done via the postaural route. Other authors[5,10,11] also reported better air bone gap (ABG) closure with a microscope, but Ohki et al.[12] had better results with the endoscope. In our study, the success rates were only marginally in the favor of the endoscopic technique for perforation repair and for ABG closure.

Almost all the studies performed transcanal endoscopic and postaural/endaural microscopic surgery and this reflected in the time taken for surgery. Microscopic procedures were thus longer in nearly all the studies.[5,6,10–12] In our study, all the surgeries were done via the transcanal route and the time taken was similar in both procedures. In cases where the drilling of the canal wall was necessary with the microscope, the surgeries were prolonged. None of the endoscopic procedures required bone removal.

Maran et al.[10] reported that the microscope provided a better result with large perforations. This result was replicated in this or other studies.[8,9] A meta-analysis on endoscopic vs microscopic type 1 tympanoplasties by Pap et al.[13] found surgical outcomes of endoscopic comparable to the microscopic type 1 tympanoplasty. Moreover, microscopic surgery was associated with a postaural scar and the need for canaloplasty, and these were the areas where the endoscope scored over the microscope.

The microscope provides better depth perception and the freedom to use both hands but gives a linear view through the ear canal and the deep recesses stay hidden. An endoscope, on the contrary, bypasses the ear canal tunneling effect and provides a much wider view. The rotational movements of angled scopes provide a panoramic view of the hidden areas of the middle ear cleft. The tubal orifice, incudostapedial joint, oval, and round window niches can be seen easily with an endoscope. When an external ear canal is narrow and tortuous and/or the anterior canal wall bony overhang is present, canaloplasty needs to be carried out in microscopic but not in endoscopic surgery. Microscopes also require adjustment and patient head rotation during surgery, while forward and reverse movements of the endoscope can easily produce close-up and angled images when necessary. With the advent of endoscope holders and high-definition systems and factoring in the lower cost of setting up an endoscopic facility with a wider utility in otorhinolaryngology practice, the scope of using an endoscope in ear surgery has increased manifold.

Conclusion

Endoscopic ear surgery follows the same basic principles as microscopic surgery. The graft uptake rate, hearing improvement, and time taken for surgery with an endoscope are comparable with those of microscopic myringoplasty. The endoscope is valuable in overcoming anatomical obstructions without canaloplasty and in visualizing the hidden areas of the middle. At the same time, there is a steeper learning curve, the inconvenience of frequent cleaning of the endoscope tip and only one hand being available for manipulations, which can be eased with the use of an endoscope holder. Considering better visualization via a minimal access approach and equivalent results to microscopic surgery, we recommend the use of an endoscope for type 1 tympanoplasties as a primary tool or an accessory tool to the microscope.

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