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ORIGINAL ARTICLE

Comparison of Endoscopic Tympanoplasty with Microscopic Tympanoplasty in Anterior Tympanic Membrane Perforation

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Abstract

Background: ***Chronic otitis media is the most prevalent cause of tympanic membrane perforation. In these cases, tympanoplasty attempts to restore hearing mechanisms and close the perforation.***

Aim and objectives: ***To compare the functional and surgical results of microscopic and endoscopic tympanic membrane repair in patients with anterior tympanic membrane perforation.***

Subjects and Methods: ***Forty patients with anterior tympanic membrane perforations that required tympanoplasty (type-I) were included in this comparative prospective single-masked study. These patients were selected from patients reporting to the Otorhinolaryngology outpatient clinics at Al-Azhar University hospitals (Al-Hussein and Sayed Galal). Patients were divided randomly into two equal groups: Group A, which included (20 patients who were treated by microscopic tympanoplasty(type-I), and Group B, which included (20 patients who were treated by endoscopic tympanoplasty(type-I).***

Result; ***There was no statistically substantial variation between the two researched groups as regard age, sex, pre-operative Air-Bone gap, and the presence of an anterior canal wall hump. There was also no statistically substantial variation between the two groups as regards the degree of change in the pre-and postoperative air-bone gap (ABG), graft-taking rates at 1-month,3-month, and 6-month follow-ups, and postoperative complications. There was a statistically considerable variation between the researched groups regarding operation time, Intraoperative Blood Loss, the transition from pre-operative ABG to postoperative ABG, and the postoperative pain scale.***

Conclusion: ***We revealed that endoscopic tympanoplasty (type-I) is more beneficial for patients with anterior tympanic membrane perforation. It helps patients minimize injury and decreases operation time and postoperative pain.***

Keywords: Endoscopic Tympanoplasty; Microscopic Tympanoplasty; Anterior Tympanic Membrane; Perforation

1. Introduction

In cases of chronic otitis media, tympanoplasty attempts to restore hearing mechanisms and close the tympanic membrane perforation. [1]

It is technically more challenging to reach anterior perforations during surgical operations.[2]

Due to the anterior bony overhang and lack of vascularity, anterior tympanic membrane perforations-especially those at the anterior annulus-are challenging to repair using the underlay approach, and there is a risk that the graft may fall into the middle ear cavity. [3]

Conventional microscopic tympanoplasty (MT) uses an auxiliary incision and external auditory canal widening to improve visibility of the front portion of the eardrum. However, this traditional method is very painful and leaves surgical scars.

Since it was initially described in the 1990s as endoscopic ear surgery, Thomassin[4] has grown in popularity due to its smaller incisions and higher optical magnification. [5]

Improved views of the middle ear cavity's concealed regions, such as the facial recess, posterior and anterior epitympanic spaces, sinus tympani, and hypotympanum, may be obtained using endoscopy. [6]

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The microscope allows operating with two hands simultaneously and offers a stereoscopic image. However, its range of vision is limited, making it potentially insufficient for observing some locations at surgery, particularly in the anterior region of the eardrum. [7]

To minimize damage to soft tissues and bone drilling, the endoscopic approach improves surgical efficiency and lessens discomfort while providing an expanded surgical view with a small incision. [8]

It is not indispensable to expand the canal when using an endoscopic method in a convoluted EAC. [9]

This research aimed to contrast the functional and surgical results of microscopic and endoscopic tympanic membrane repair in patients with anterior tympanic membrane perforation.

2. Patients and methods

Forty patients with anterior tympanic membrane perforations that required tympanoplasty (type-I) were included in this comparative prospective study. These patients were selected from patients reporting to the Otorhinolaryngology (ORL) outpatient clinics at Al-Azhar University hospitals (Al-Hussein and Sayed Galal).

Patients were divided randomly into two equal groups: Group A included (20 patients who were treated by microscopic (post-auricular) tympanoplasty (type-I), and Group B included (20 patients who were treated by endoscopic (trans-canal) tympanoplasty (type-I).

All patients were subjected to Written consent, Full history taking including personal history, complaint, and ENT history, Examination included general and ENT (endoscopic & microscopic) Examination, Investigations included hearing evaluation (pure tone audiometry) and Routine laboratory investigations and Assessment of fitness for surgery.

2.1.Inclusion criteria:

Patients with medium-sized anterior tympanic membrane perforation, ages 10-50, and both genders.

2.2.Exclusion criteria:

Age: <10 years and >50 years, patients with uncontrolled systemic illness, mastoid lesions, attic lesions, middle ear bone erosion, previous history of ear surgery, and patients refusing surgery.

2.3.Surgical technique:

All surgeries were done under general anesthesia.

Group A: Microscopic post-auricular approach

The same surgeon did all the patients. In this group, patients were operated UGA, sterilized, and placed in a supine posture with their heads turned to the opposing side. Adrenaline (1/200,000) was injected locally, a post-auricular incision of 0.5 cm from the post-auricular sulcus was done, and a temporalis fascia graft was harvested.

An anteriorly based mucoperiosteal flap was elevated, and an incision was made on the posterior meatal skin. Through this incision, the margins of the T.M. perforation were refreshed using the microscope, the tympanometry flap was elevated, the anterior ear canal was incised, and an anterior meatal tunnel was created. The graft was positioned medially to the T.M. remnant. The anterior tab of the graft was hooked into the tunnel (beneath the anterior flap and the annulus) using a right-angle hook. After that, absorbable gelatin sponges were inserted into the middle ear cavity. The annulus was put back into the sulcus after carefully repositioning the anterior and posterior tympanometry flaps. Next, Gel foam was filled into the external auditory canal; absorbable sutures were used to seal the mucoperiosteal flap, and layers of closure were applied to the skin incision.

Group B: Endoscopic transcanal approach

Patients were operated UGA, sterilized, and placed in a supine posture with their heads turned to the opposing side. Epinephrine was gently injected into the four quadrants of the external auditory canal at a ratio of 1: 200,000 (1-2 ml). The standard transcanal approach was used with 0-degree rigid endoscopes (2.7 mm and 4 mm diameter). The perforation edge was de-epithelized.

A supra-auricular incision (small incision 1 cm at the hairline just above the ear) was made for harvesting temporalis fascia graft, an incision of the anterior ear canal, creation of anterior meatal tunnel, an incision in the posterior canal wall, the elevation of posterior tympanometry flap, position of the graft medially to the T.M. remnant were done. The anterior tab of the graft was hooked into the tunnel (beneath the anterior flap and the annulus), and then absorbable gelatin sponges were placed into the middle ear cavity.

The annulus was put back into the sulcus after carefully repositioning the anterior and posterior tympanometry flaps. Ultimately, the supra-auricular incision was sutured, and a thin layer of gelatin sponge containing antibiotic ointment was inserted into the external auditory canal (EAC).

2.4.Postoperative follow-up:

During hospitalization, antibiotics (I.V.), Anti-inflammatory drugs (I.M.), oral decongestants, and antihistaminics were administered. Patients were allowed to return home within 2-3 days and were called for regular follow-up.

The postoperative pain scale was assessed after surgery using a Visual analog scale.

(VAS) that measures pain intensity by asking the patients to rate their current pain level from 0 to 10, as 0(no pain) and 10(maximum pain

possibly).

Outcome assessment: The primary outcome was the graft-taking rate, which was detected by Examination by 0 endoscopes 1, 3, and 6 months after surgery.

The secondary outcomes included evaluating hearing via PTA and calculating ABG three months after the surgery. After-surgery complications were evaluated as infection, anterior blunting, reperforation, hearing impairment, canal stenosis, and loss of taste.

2.5.Ethical consideration: The study considered ethical principles and informed consent was obtained from the patients.

Data management and Statistical Analysis: The statistical package of Special Science (SPSS) version 25 was utilized to gather, tabulate, and statistically analyze all of the data in the following ways: Coding and editing, entering data on a computer, The standard deviation (mean ± S.D.) was utilized for presenting quantitative data, whereas frequencies and relative percentages were utilized to express qualitative data. Shapiro-Wilk's test was utilized to check whether the data had a normal distribution. Other relevant statistical tests of significance that were applied to the data were the Independent t-test, Mann-Whitney test, paired t-test, Chi-square test (x2), and Fisher exact. Additionally, every statistical comparison was two-tailed, with a significance level of p-value ≤ 0.05 signifying a substantial variation, p-value <0.001 indicating a very substantial variation, and p-value > 0.05 signifying a non-significant variation.

Case 1: A female patient 35 years old with left-sided anteriorly perforated drum underwent microscopic tympanoplasty.

A B

Figure 1. (A): Pre-operative and (B): Six months post-operative

Case 2: Male patient 39 years old with right sided anteriorly perforated drum underwent endoscopic tympanoplasty.

A B

Figure 2. (A): Pre-operative and (B): Six months post-operativeFigure

3. Results

Table 1. comparison of clinical and demographic data between two groups.

	MICROSCOPIC -A- (N = 20)	ENDOSCOPIC -B- (N = 20)	P VALUE
AGE (YEARS)			
MEAN ± SD	31.8 ± 8.3	30.7 ± 8.4	0.65
RANGE	20-48	18-47	
SEX			
MALE	8 (40%)	13 (65%)	0.113
FEMALE	12 (60%)	7 (35%)	
PERSPECTIVE AIR-BONE GAP			
MEDIAN (MIN – MAX)	25 (20-35)	30(18-47)	0.841
MEAN ± SD	25.3 ± 4.5	25.7 ± 5	

Between the two groups under study, there was no statistically substantial variation with regard to age (p = 0.65), sex (p = 0.113), or perspective Air-Bone GAP (p = 0.841).

Table 2. Comparing two groups with respect to operational aspects

	MICROSCOPIC -A- (N = 20)	ENDOSCOPIC -B- (N = 20)	P VALUE
OPERATION TIME (MIN)			
MEAN ± SD	98 ± 11.5	68.8 ± 65	<0.001
MEDIAN (MIN – MAX)	95 (78 – 128)	69 (57 – 85)	
INTRA OPERATIVE BLOOD LOSS (ML)			
MEAN ± SD	21.1 ± 2.5	9.2 ± 3.1	<0.001
MEDIAN (MIN – MAX)	20 (15-30)	9(5-15)	

The operation time was substantially longer in the microscopic group (Group A) in comparison to the Endoscopic group (Group B) and Intraoperative blood loss was notably greater in the microscopic group compared to the Endoscopic group demonstrating statistical significance with p < 0.001 for both.

Table 3. Comparison between pre- and post-operative ABG

	PRE-OPERATIVE (N = 20)	POST-OPERATIVE (N = 20)	P VALUE
MICROSCOPIC GROUP			
MEAN ± SD	25.3 ± 4.5	11.6 ± 7.1	0.0001
MEDIAN (MIN – MAX)	25 (20-35)	10 (5 – 25)	
ENDOSCOPIC GROUP			
MEAN ± SD	25.7 ±5	8.7 ± 6	0.0001
MEDIAN (MIN – MAX)	30 (18 – 47)	5 (0 – 25)	
P VALUE	0.792	0.171	

In the Microscopic group and Endoscopic group, a significant decrease was observed in the transition from pre-operative ABG to post-operative ABG (p = 0. 0001). However, there was no statistical divergence in the degree of change in pre - and postoperative ABG between the two groups. As the p-value for the Preoperative ABG was 0.792, and for the Postoperative ABG, it was 0.171.

Table 4. Comparing two groups in terms of potential outcomes

	MICROSCOPIC♀ -A- (N = 20)	ENDOSCOPIC -B- (N = 20)	P VALUE
PAIN SCALE			
MEAN ± SD	6.7 ± 2.5	2.4 ± 1.5	<0.0001
MEDIAN (MIN – MAX)	6 (4 -10)	2(0-4)	
POST OPERATION ABG			
MEAN ± SD	11.6 ± 7.1	8.7 ± 6	0.171
MEDIAN (MIN – MAX)	10 (5 – 25)	5 (0 – 25)	
GRAFT TAKING			
1 MONTH FOLLOW UP			
NOT TAKEN	6 (30%)	4 (20%)	0.470
TAKEN	14 (70%)	16 (80%)	
3 MONTH FOLLOW UP			
NOT TAKEN	3 (15%)	2 (10%)	0.636
TAKEN	17 (85%)	18 (90%)	
6 MONTH FOLLOW UP			
NOT TAKEN	3 (15%)	2 (10%)	0.636
TAKEN	17 (85%)	18 (90%)	
COMPLICATION			
NO	16 (80%)	20 (100%)	0.106
YES	4 (20%)	0 (0%)	

Regarding the postoperative pain scale, there was a high substantial variation between the two groups under study. Regarding post-operative air-bone gap (ABG), graft taking rates at 1, 3, and 6-month follow-ups, and intra- or post-operative problems, no statistically substantial variations were seen, and the Endoscopic group did not have complications.

Table 5. Six-month correlation between anterior canal wall hump, graft taking, and operation time in each group

	ABSENT (N = 14)	PRESENT (N = 6)	P VALUE
MICROSCOPIC (N = 20)			
OPERATION TIME			
MEAN ± SD	97.6 ± 9.5	102.2 ± 13.5	0.393
MEDIAN (MIN – MAX)	94.5(80-120)	98 (85-128)	
GRAFT TAKING (6 OMNTHS)			
NOT TAKEN	0 (0%)	3 (50%)	0.005
TAKEN	14 (100%)	3 (50%)	
ENDOSCOPIC (N = 20)			
OPERATION TIME			
MEAN ± SD	65.4 ± 6.4	75.1 ± 6.2	0.006
MEDIAN (MIN – MAX)	67 (57 - 82)	68 (65 – 81	
GRAFT TAKING (6 MONTHS)			
NOT TAKEN	0 (0%)	2 (34%)	0.024
TAKEN	14 (100%)	4 (66%)	

In the Microscopic group, the presence or absence of an anterior canal wall hump did not yield a statistically significant difference in operation time with a p-value of 0.393. However, the impact of this hump on graft success after 6 months was highly significant, with a substantial 50% graft failure rate in cases with present hump, in stark contrast to a 0% graft failure rate when absent, signifying a p-value of 0.005. In the Endoscopic group, the operation time significantly differed between cases with absent and present humps .For graft taking rates at 6 months, there was a significance difference, with a 34% graft failure rate in cases with present hump compared to a 0% failure rate when absent, indicated by a p-value of 0.024. Thus, at six months, there was a statistical substantial correlation (p=0.005 and p=0.024, respectively) between anterior canal wall hump and the graft taking rate in both groups.

4. Discussion

The current thesis showed no substantial variation in age, sex, and preoperative air-bone gap between both groups (P > 0.05). In group A, the mean age was 31.8 ± 8.3 years (range: 20-48) years, 40% were males and 60% were females, and the preoperative air-bone gap had a median of 25 and a mean of 25.3 ± 4.5. While in group B mean age was 30.7 ± 8.4 years (range: 18-47),

65% were males, and 35% were females, and the preoperative air-bone gap had a median of 30 and a mean of 25.7 ± 5.

In the same line, Zhang et al.aimed to contrast ET and MT's functional and surgical results for anterior tympanic membrane perforation. The study included 42 Patients who were classified into the ET group (n = 22) with a mean age of 44.05 ± 13.53 years; 7 (31.8%) were male and 15 (68.2%) were female, and the MT group (n = 20) with mean age 47.14 ± 14.33 years, 5 (25%) male and 15 (75%) were female. The two groups' mean ages and genders did not vary significantly (p-values, respectively, were 0.436 and 0.211). [10]

Regarding the operative details, the operation time was substantially longer in the Microscopic group (Group A) with a mean of 98 ± 11.5 minutes in comparison to the Endoscopic group (Group B) with a mean of 68.8 ± 6.5 minutes, demonstrating statistical significance with $p < 0.001$. Intraoperative blood loss was notably greater in the Microscopic group (21.1 ± 2.5 mL) compared to the Endoscopic group (9.2 ± 3.1 mL), also showing statistical significance with $p < 0.001$.

Along with our findings were the results of Zhang et al., who found that the operation time of the ET group was significantly shorter than that of the MT group (61.23 ± 11.68 min vs. 78.65 ± 11.79 min, p = 0.034). [10]

Kim et al. found that The ET group had a shorter hospital stay and operation duration than the MT group ($p < 0.05$).[11]

Our findings observed that there was a highly considerable improvement of ABG postoperatively in both groups ($p< 0.0001$). However, when comparing the extent of change in pre-and postoperative ABG between the two groups, no significant differences were identified; the p-value for the Preoperative ABG was 0.792, and for the Postoperative ABG, it was 0.171, suggesting no statistical divergence in the degree of change in pre-and postoperative ABG between the two groups.

Similarly, Hanna et al. reported a substantial decrease in ABG after ET was noted. [12]

In line with our results, Zhang et al. noted no significant difference in pre-and postoperative ABG between the two groups, as the p-value for the Preoperative ABG was 0.526. For the Postoperative ABG, it was 0.257. There was considerable improvement in ABG postoperatively in both groups, as in the ET group, the pre- and postoperative significantly improved (p = 0.016). The values in the MT group also represented a significant improvement (p = 0.004). [10]

Regarding the postoperative outcomes, Group A exhibited significantly higher pain scale scores (6.7 ± 2.5) than Group B (2.4 ± 1.5), $p < 0.0001$. Concerning the postoperative air-bone gap (ABG), no significant disparity emerged between Group A (11.6 ± 7.1) and Group B (8.7 ± 6), p=0.171. Likewise, there were no statistically considerable variations between the two groups when looking at graft-taking rates at the 1, 3, and 6-month follow-ups (p=0.636). Furthermore, there was no discernible difference in sequelae between the two groups.

Also, this result was close to those obtained by Zhang et al., who reported that the pain scale score of the ET group 24 hours after surgery was significantly lower than that of the MT group (0.86 ± 0.64 vs. 2.40 ± 1.14, p = 0.029). It was reported that, with the postoperative air-bone gap (ABG), no significant disparity emerged between the two groups, with p=0.257. No significant difference was presented in the grafting success rate between the two groups (95.5% vs. 95.0%, p = 0.412). [10]

Our findings were from a previous study by Abtahi et al., which revealed that Following surgery, individuals in the ET group reported far less discomfort than those in the MT group. Because there was no further incision made and the EAC was widened using an endoscopic approach, the decreased pain levels of the ET group were thought to be associated with minimally invasive surgery. In a similar context, the procedure involving the ET group took less time. [6]

In the Microscopic group, the presence or absence of an anterior canal wall hump did not yield statistically substantial variations in operation time. However, the impact of this hump on graft success after six months was significant when the hump was present in comparison to its absence. Anterior canal wall hump was statistically strongly correlated with the graft-taking rate in both groups after six months (p=0.005 and p=0.024, respectively), and the operation time was substantially shorter in instances with nonexistent humps than present humps in the Endoscopic group.

In another study, Gülşen et al. noted that There was no significant relationship between anterior canal wall protrusion (ACWP) and graft success rates in either the endoscopic (p=0.685) or microscopic (p=0.894) group. Regarding operative time, there was no statistically significant difference between patients with and without ACWP (p=0.124)) in the endoscopic group. However, the mean operative time of patients with ACWP in the microscopic group was significantly longer than patients without ACWP ($p<0.001$). [13]

4. Conclusion

We revealed that patients with anterior tympanic membrane perforations benefit more

from endoscopic tympanoplasty since it minimizes damage, shortens the duration of the procedure, and eases postoperative discomfort.

Disclosure

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References

1. Isaacson B. Anatomy and Surgical Approach of the Ear and Temporal Bone. Head Neck Pathol. 2018;12(3):321-327.
2. Hsu YC, Kuo CL, Huang TC. A retrospective comparative study of endoscopic and microscopic Tympanoplasty. J Otolaryngol Head Neck Surg. 2018;47(1):44.
3. Shim DB, Kim HJ, Kim MJ, Moon IS. Three-point fix tympanoplasty. Acta Otolaryngol. 2015;135(5):429-434.
4. Thomassin JM, Duchon-Doris JM, Emram B, Rud C, Conciatori J, Vilcoq P. Otochirurgie endoscopique. Premier bilan [Endoscopic ear surgery. Initial evaluation]. Ann Otolaryngol Chir Cervicofac. 1990;107(8):564-570.
5. Marchioni D, Alicandri-Ciufelli M, Piccinini A, Genovese E, Presutti L. Inferior retrotympanum revisited: an endoscopic anatomic study. Laryngoscope. 2010;120(9):1880-1886.
6. Abtahi SH, Abootalebian F, Rogha M, Berjis N. The value of otoendoscopy in the management of middle ear cholesteatoma. J Res Med Sci. 2015;20(12):1182-1185.
7. Akyigit A, Sakallıoglu O, Karlidag T. Endoscopic tympanoplasty. J Otol. 2017;12(2):62-67.
8. Choi N, Noh Y, Park W, et al. Comparison of Endoscopic Tympanoplasty to Microscopic Tympanoplasty. Clin Exp Otorhinolaryngol. 2017;10(1):44-49.
9. Emre IE, Cingi C, Bayar Muluk N, Nogueira JF. Endoscopic ear surgery. J Otol. 2020;15(1):27-32.
10. ZHANG, Jingna; HU, Sunhong. Comparison of endoscopic tympanoplasty to microscopic tympanoplasty in anterior tympanic membrane perforation. Laparoscopic, Endoscopic and Robotic Surgery, 2020, 3.3: 70-73.
11. Kim DJ, Lee HM, Choi SW, Oh SJ, Kong SK, Lee IW. Comparative study of endoscopic and microscopic tympanoplasty performed by a single experienced surgeon. Am J Otolaryngol. 2021;42(1):102788.
12. Hanna BM, Kivekäs I, Wu YH, et al. Minimally invasive functional approach for cholesteatoma surgery. Laryngoscope. 2014;124(10):2386-2392.
13. Gülşen S, Arıcı M. Endoscopic transcanal versus conventional microscopic tympanoplasty in treatment of anterior tympanic membrane perforations. Eur Arch Otorhinolaryngol. 2019;276(12):3327-3333.