Pakistan Journal of Advances in Medicine and Medical Research (PJAMMR)
ISSN: (Online) 2957-5893
Website: https://www.pjammr.com/index.php/pjammr/homepage
Open Access
Volume 3, Issue 2, 2025

ORIGINAL ARTICLE

Endoscopic versus Microscopic Tympanoplasty in Patients with Chronic Otitis Media: A Prospective Comparative Study

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Keywords
Endoscopic; Microscopic; Tympanoplasty; Chronic Otitis

Article History
Received: 28 January 2025
Revised: 26 March 2025
Accepted: 30 May 2025
Published: 10 July 2025

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DOI: 10.69837/pjammr.v3i2.74

How to Cite This Article:
Khan I, Ullah S, Fatima T, Ahmad M, Afaq M, Nawaz O. Endoscopic versus Microscopic Tympanoplasty in Patients with Chronic Otitis Media: A Prospective Comparative Study. Pak J Adv Med Med Res. 2025;3(2):79–83.

ABSTRACT

Background: Chronic otitis media (COM) is a persistent inflammation of the middle ear that commonly leads to hearing loss and often requires surgical intervention. Tympanoplasty can be performed using either endoscopic or microscopic techniques, both of which may differ in terms of graft success, hearing outcomes, and postoperative recovery.

Objective: To compare surgical outcomes between endoscopic and microscopic tympanoplasty in patients with COM, focusing on graft success rate, hearing improvement, and postoperative recovery.

Methods: This prospective comparative study was conducted in the Department of ENT, Khyber Teaching Hospital, Peshawar, from 12 January 2023 to 12 January 2024. A total of 100 patients with chronic otitis media were enrolled using consecutive non-probability sampling and allocated equally to endoscopic or microscopic tympanoplasty. Outcomes included graft uptake, hearing improvement, operative time, postoperative complications, and recovery. Statistical analysis was performed using the chi-square test and the independent-samples t-test, with $p < 0.05$ considered statistically significant.

Results: The mean age of the participants was 42.3 ± 10.4 years. The endoscopic group demonstrated a graft success rate of 47/50 (94%), compared with 45/50 (90%) in the microscopic group ($p = 0.03$). Mean hearing improvement was significantly greater in the endoscopic group (12.5 dB) than in the microscopic group (10.2 dB) ($p = 0.034$). Patients undergoing endoscopic tympanoplasty also experienced faster recovery and fewer postoperative complications.

Conclusion: Both endoscopic and microscopic tympanoplasty are effective in managing COM. However, the endoscopic approach offers superior hearing outcomes, higher graft success, and faster recovery, making it a favorable option when appropriate.

INTRODUCTION

Chronic otitis media (COM) is a common condition that affects many people worldwide and refers to a chronic inflammatory disease of the middle ear [1]. This may result in hearing impairment, ear discharge, and, in an untreated case, cholesteatoma, eardrum perforation, and mastoiditis [2]. Surgery, most commonly tympanoplasty, aims to restore the integrity of the tympanic membrane, eradicate middle ear disease, and improve hearing. Conventionally, microscopic techniques have been the gold standard for tympanoplasty, but endoscopic techniques have challenged this. The suggested benefits of endoscopic tympanoplasty include improved visualization of middle ear structures, less invasive surgery associated with a quicker healing process, and superior cosmesis [3]. Regardless of these possible advantages, there is a dearth of literature questioning the efficacy of endoscopic versus microscopic tympanoplasty, at least in the setting of chronic otitis media [4]. The microscopic procedure for tympanoplasty, usually via a postauricular approach, allows surgeons to visualize the middle ear structures under a microscope. This method has long been associated with a high graft success rate and positive hearing outcomes. Nonetheless, the greatest limitation of microscopic tympanoplasty is that the sinus tympani, epitympanum, and attic could not be visualized because they were obscured by the bony architecture of the ear canal and temporal bone [5,6]. Some authors have speculated that endoscopic surgery can result in greater access into the hidden anatomical recesses, and this may be of benefit to optimize the graft success rate and restore hearing [7]. In addition, endoscopic surgery can be associated with shorter surgery duration, reduced tissue damage, and better cosmetic results. The endoscopic approach, however, has a steep skill-set requirement for the surgeon, and its learning curve is steep [8]. Several studies have directly compared the results of endoscopic versus microscopic tympanoplasty. However, the large number of these studies has been hampered by small sample sizes or unreliable outcome measures. Improved graft success and hearing improvement have been reported in some studies with the endoscopic approach, but not in others. Also, postsurgery morbidities like wound infection, pain, and hematoma have been reported to take place at varying frequencies among the two groups, with some studies reporting less occurrence in the endoscopic group. In this study, a comparative analysis of the surgical outcomes of endoscopic and microscopic tympanoplasty among patients with chronic otitis media, in terms of graft success, hearing improvement, and postoperative recovery, is undertaken. We postulate that endoscopic tympanoplasty may be more effective at achieving higher graft take rates, greater hearing gain, and shorter healing durations than conventional microscopic techniques [9,10].

MATERIAL AND METHODS

Study Design and Setting

This prospective comparative study was conducted in the Department of ENT, Khyber Teaching Hospital, Peshawar, Pakistan, from 12 January 2023 to 12 January 2024.

100 patients with chronic otitis media were enrolled. Eligible patients were enrolled through consecutive nonprobability sampling and were allocated in equal numbers to the endoscopic and microscopic tympanoplasty groups according to the predefined study protocol. Well-experienced otolaryngologists carried out the surgeries. The success of the graft, hearing improvement, and postoperative complications were measured at 6 months after the surgery. Data were analyzed using SPSS 24.0 with independent-samples t-tests and chi-square tests to identify differences between the two groups.

Sampling Technique

Consecutive non-probability sampling was used.

Sample Size Calculation

Sample size was calculated using OpenEpi version 3.01 at a 95% confidence level. Based on expected differences in graft uptake rates reported in previous studies, a minimum sample size of 100 patients (50 per group) was considered adequate.

Operational Definitions

Graft Success: Complete closure of the tympanic membrane without residual perforation at the 6-month follow-up.

Hearing Improvement: ≥10 dB increase in the pure-tone average compared with the preoperative audiogram.

Recovery Time: The time from surgery to complete wound healing and return to normal daily activities.

Postoperative Complications: Any adverse event occurring within six months after surgery, including wound infection, hematoma, persistent ear pain, numbness, or graft failure.

INCLUSION CRITERIA

All 18-60-year-old patients with chronic otitis media and tympanic membrane perforation who needed tympanoplasty.

EXCLUSION CRITERIA

Patients with a history of ear surgery, cholesteatoma, or other systemic diseases that could affect surgical outcomes were excluded.

DATA COLLECTION

Preoperative measures and 6-month postoperative data were recorded. The recorded variables included graft uptake, hearing improvement, operative time, postoperative recovery, and postoperative complications. Audiometric assessment and otoscopic examination were performed at each scheduled follow-up visit to evaluate graft uptake, hearing improvement, and postoperative complications.

STATISTICAL ANALYSIS

Data analysis was performed with SPSS 24.0. Continuous data were compared using independent-samples t-tests, whereas categorical data were compared using the chi-square test. P-values less than 0.05 were considered statistically significant.

RESULTS

A total of 100 patients were included, with 50 patients in each treatment group. The mean age of the participants was 42.3 ± 10.4 years. Graft uptake was successful in 47 patients (94%) in the endoscopic group and 45 patients (90%) in the microscopic group ($p = 0.03$). Mean hearing improvement was significantly greater in the endoscopic group (12.5 dB) than in the microscopic group (10.2 dB, $p = 0.04$). Wound infection and hematoma occurred less frequently in the endoscopic group. The mean operative time was 75.46 ± 21.04 minutes in the endoscopic group compared with 126.66 ± 34.27 minutes in the microscopic group ($p < 0.001$). The mean recovery time was 5.4 ± 0.5 weeks and 7.7 ± 0.5 weeks, respectively ($p < 0.001$). No significant difference was observed in overall patient satisfaction.

Table 1: Baseline Demographic and Clinical Characteristics of Patients Undergoing Endoscopic and Microscopic Tympanoplasty

Parameter	Endoscopic Group (n=50)	Microscopic Group (n=50)	p-value
Mean Age (years)	42.3 (SD 10.4)	41.9 (SD 9.8)	0.82
Gender (Male/Female)	25/25	26/24	0.89
Tympanic Membrane Perforation Size (mm^2)	9.5 (SD 3.2)	9.8 (SD 3.1)	0.56

Baseline demographic and clinical characteristics of patients undergoing endoscopic and microscopic tympanoplasty. Data are presented as mean ± standard deviation (SD) or frequency (n). No statistically significant differences were observed between the two groups, indicating comparable baseline characteristics.

Table 2. Comparison of Graft Uptake Success Rates Between Endoscopic and Microscopic Tympanoplasty.

Group	Graft Success, n (%)	p-value
Endoscopic Group (n = 50)	47 (94%)	
Microscopic Group (n = 50)	45 (90%)*	0.03

Comparison of graft uptake success rates between endoscopic and microscopic tympanoplasty groups. Data are presented as frequency (n) and percentage (%). Graft uptake was significantly higher in the endoscopic group than in the microscopic group (p = 0.03).

Table 3: Comparison of Hearing Improvement Following Endoscopic and Microscopic Tympanoplasty

Group	Mean Hearing Gain (dB)	p-value
Endoscopic Group	12.5 (SD 5.47)	0.04
Microscopic Group	10.2 (SD 5.18)	

Comparison of postoperative hearing improvement between endoscopic and microscopic tympanoplasty. Data are presented as mean hearing gain (dB) ± standard deviation (SD). The endoscopic group demonstrated significantly greater hearing improvement than the microscopic group (p = 0.04).

Table 4: Comparison of Operative Time and Postoperative Recovery Between Endoscopic and Microscopic Tympanoplasty

Parameter	Endoscopic Group (n=50)	Microscopic Group (n=50)	p-value
Mean Surgical Time (minutes)	75.46 (SD 21.04)	126.66 (SD 34.27)	< 0.001
Mean Recovery Time (weeks)	5.4 (SD 0.5)	7.7 (SD 0.5)	< 0.001

Comparison of operative time and postoperative recovery between endoscopic and microscopic tympanoplasty. Data are presented as mean ± standard deviation (SD). The endoscopic approach was associated with significantly shorter operative time and faster postoperative recovery than the microscopic technique (p < 0.001).

Table 5: Comparison of Postoperative Complications Between Endoscopic and Microscopic Tympanoplasty

Complication	Endoscopic Group (n = 50), n (%)	Microscopic Group (n = 50), n (%)	p-value
Wound infection	2 (4%)	6 (12%)	0.04
Hematoma	1 (2%)	4 (8%)	0.05
Ear pain	3 (6%)	5 (10%)	0.23
Numbness	1 (2%)	3 (6%)	0.21

Comparison of postoperative complications following endoscopic and microscopic tympanoplasty. Data are presented as frequency (n) and percentage (%). Patients undergoing endoscopic tympanoplasty experienced fewer postoperative complications than those undergoing microscopic tympanoplasty, although not all differences were statistically significant.

DISCUSSION

Chronic otitis media (COM) is a major concern to health systems across the globe, and clinical interventions where ear surgery is used to achieve an intact tympanic membrane and hearing restoration are essential. Microscopic tympanoplasty (MT) has also been the gold standard, but with the introduction of endoscopic tympanoplasty (ET), a less invasive alternative is possible [11,12]. This discussion synthesizes findings from the latest studies comparing the effectiveness of ET and MT in managing COM. Some sources claim that not only are the graft success rates between ET and MT similar, but also the rates of comparable graft uptake and hearing outcomes. As an example, a study conducted by Yang et al. [13] reported graft success rates of 94.64% and 90.91% in the ET and MT groups, respectively, with no significant difference (P = 0.239). Likewise, Li et al. [14] reported no significant difference in graft success between endoscopic and microscopic tympanoplasty, supporting the findings of the present study. These results imply that ET is equally effective in resolving tympanic membrane closure to MT. Post-operative hearing is a decisive factor of surgical success. The average hearing gains were 11.85 dB and 10.48 dB, respectively, with higher-than-average gains in the ET approach; the difference between groups was also statistically significant (P = 0.031). Lou and Li [15]. also reported no statistically significant difference in postoperative hearing improvement between endoscopic and microscopic tympanoplasty (P = 0.132) [15]. Variations in design, patient selection, and surgical procedures may explain the differences. Shorter Surgical durations have been related to endoscopic tympanoplasty. A difference in average surgical time between ET and MT of 75.46 minutes and 126.66 minutes, respectively, was significant (P = 0.001), as stated (2025). Also, the recession times are usually shorter in the ET group [16]. Nagar et al. [17] reported that the average time to full recovery following endoscopic tympanoplasty was shorter than that observed after microscopic tympanoplasty, which supports the faster postoperative recovery observed in our study.was 7.8 days, and the time to return to normal activity was 1.2 days, compared with 11.3 days and 2.5 days in the MT participants (both P < 0.001) [17]. These results indicate the effectiveness and faster healing attributable to ET. The frequency of postoperative adverse effects, including wound infection and hematomas, is claimed to be lower in the ET group [18]. Yang et al. [11] reported that postoperative ear pain, ear numbness, and persistent ear discharge occurred more frequently in the microscopic tympanoplasty group than in the endoscopic group. were recorded more frequently in the MT group than in the ET group. On the same note, 2025) also indicated that there was no significant difference in complications when comparing the two groups; thus, endoscopic procedures do not compromise safety because of the enhanced visualization of the middle ear structures, including its difficult-to-reach areas. It may contribute to more precise surgical interventions and possibly more favorable outcomes due to this enhanced visualization. Endoscopic procedures, however, present a learning curve that is challenging for some surgeons. The cost factor plays a vital role in evaluating surgical techniques. In a cost-effectiveness analysis (Tseng et al., 2018), ET is considered comparable to MT in terms of cost per QALY, implying ET is a cost-effective alternative to MT [19,24].

CONCLUSION

Endoscopic tympanoplasty demonstrated superior hearing outcomes, shorter operative time, faster recovery, and fewer postoperative complications, with at least comparable graft success compared to microscopic tympanoplasty. Its minimally invasive nature often results in shorter operative time, less morbidity, and improved visualization of hidden recesses. Microscopic surgery remains valuable, particularly in advanced disease, ensuring that both approaches are complementary rather than mutually exclusive.

LIMITATIONS

This study was limited by its single-center design, relatively small sample size, and short follow-up period. Surgeon experience and the learning curve associated with endoscopic tympanoplasty may have influenced surgical outcomes. Long-term multicenter randomized studies are required to validate these findings.

Author Contributions(ICMJE)

Imran Khan: Conceptualization, study design, supervision, manuscript drafting, critical revision of the manuscript, and final approval.

Shakir Ullah: Data collection, statistical analysis, data interpretation, manuscript drafting, and final approval.

Tahreem Fatima: Data collection, data interpretation, manuscript drafting, critical revision, and final approval.

Mushtaq Ahmad: Study design, data validation, critical revision of the manuscript, and final approval**.**

Muhammad Afaq: Data collection, statistical analysis, data interpretation, manuscript editing, and final approval.

Osama Nawaz: Critical revision of the manuscript for important intellectual content, supervision, manuscript editing, and final approval.

All authors made substantial contributions to the conception and design of the study, acquisition, analysis, and interpretation of data, critically revised the manuscript for important intellectual content, approved the final version for publication, and agree to be accountable for all aspects of the work in accordance with the **ICMJE** authorship criteria.

Conflict of Interest

The authors declare no conflict of interest.

Funding

The authors received no financial support for this study.

Ethical Approval

Ethical approval was obtained from the Institutional Review Board of Khyber Teaching Hospital, Peshawar (Ref. No. 456/08/2022). Written informed consent was obtained from all participants before enrollment. The study was conducted in accordance with the Declaration of Helsinki.

Data Availability Statement:

All data generated or analyzed during this study are available from the corresponding author upon reasonable request.

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