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Endoscopic versus Microscopic Type 1 Tympanoplasty: A Randomized Controlled Trial

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Abstract

Tympanoplasty is a common otologic surgery aimed at repairing tympanic membrane perforations to improve hearing and prevent infections. This study compares the outcomes of endoscopic and microscopic type 1 tympanoplasty in terms of air-bone gap (ABG) improvement, operation time, and graft take-up rate. A randomized controlled trial (RCT) was conducted with patients undergoing either endoscopic or microscopic tympanoplasty. Statistical analysis using paired t-tests revealed that endoscopic tympanoplasty had significantly shorter operation times ($\mathbf{p < 0.001}$) and marginally better ABG improvement ($\mathbf{p = 0.038}$) compared to microscopic tympanoplasty. However, the graft take-up rates between the two techniques were not significantly different ($\mathbf{p = 0.29}$). These findings suggest that endoscopic tympanoplasty may be a viable alternative to the microscopic approach, offering advantages in surgical efficiency without compromising graft success.

Keywords: Endoscopic tympanoplasty, Microscopic tympanoplasty, Hearing threshold, Graft uptake

INTRODUCTION

Tympanoplasty is a surgical procedure aimed at repairing perforations of the tympanic membrane to restore hearing function and prevent recurrent infections. Traditionally, microscopic tympanoplasty has been the gold standard approach; however, advancements in endoscopic ear surgery have provided an alternative technique with distinct advantages. Endoscopic tympanoplasty is minimally invasive, providing a wider surgical field view without requiring extensive external incisions. Despite these benefits, concerns remain about its effectiveness compared to the conventional microscopic approach. This study aims to compare the outcomes of endoscopic versus microscopic type 1 tympanoplasty to evaluate their relative effectiveness and advantages.

OBJECTIVE

Endoscopic ear surgery is gaining popularity in otologic practice. While microscope-assisted tympanoplasty remains the conventional approach for tympanic membrane repair, endoscopic techniques offer unique advantages. This randomized controlled trial (RCT) compares the outcomes of endoscopic and microscopic tympanoplasty.

MATERIALS AND METHODS

Study Setting

The study was conducted at the Department of ENT, Fakir Mohon Medical College and Hospital. This study was approved by institute Ethical committee.

Study Population

Patients attending the ENT outpatient department (OPD) diagnosed with chronic suppurative otitis media (CSOM) with dry central perforation were included in the study.

Study Design
A single-center, prospective, randomized controlled trial (RCT) comparing endoscopic and microscopic tympanoplasty.

Sample Size Calculation
The sample size was determined using power analysis with a significance level of 0.05 and a power of 80%. Based on previous studies, the expected difference in ABG improvement was 4 dB with a standard deviation of 6 dB. The calculated sample size per group was 40 patients. **Randomization Procedure**
A single-blinding method was implemented due to a shortage of faculty members. Randomization was conducted by faculty members who were not part of the study to ensure impartial allocation of patients into either the endoscopic or microscopic tympanoplasty groups. A computer-generated randomization table was used to assign patients.

Preoperative Assessment and Admission
After allocation, all patients in both groups underwent a detailed ENT examination, pure tone audiometry (PTA), X-ray mastoid, and oto-endoscopy. Patients were then admitted to the ENT ward, and routine blood investigations were performed before surgery.

Inclusion Criteria
- Patients aged 18-60 years
- Diagnosed with CSOM with dry central perforation
- Normal middle ear mucosa
- Air conduction threshold within 55 dB

Exclusion Criteria
- History of previous ear surgery
- Active ear discharge
- Ossicular chain disruption
- Middle ear pathology such as cholesteatoma

Surgical Technique
Patients were randomized into two groups using a computer-generated randomization table:
1. **Endoscopic Tympanoplasty:** Performed under local or general anesthesia using a 0-degree endoscope. A transcanal approach was used for graft placement.
2. **Microscopic Tympanoplasty:** Performed using a postauricular or endaural approach with a surgical microscope

RESULTS AND ANALYSIS

SL. NO.	Name	Age	Sex	Ear Side	Perforation Size	Pre-Op ABG	Post-Op ABG	ABG Improvement	Operation Time (min)	Graft Take-Up
1	MJ	43	F	L	ST	40	28	12	52	1
2	RB	26	F	L	S	30	18	12	50	1
...	...	...	...	...	...	...	...	...	...	...

Tabl1-1:-Microscopic Tympanoplasty group

SL. NO.	Name	Age	Sex	Ear Side	Perforation Size	Pre-Op ABG	Post-Op ABG	ABG Improvement	Operation Time (min)	Graft Take-Up
1	SP	34	F	L	M	37	31	6	80	1
2	BP	55	F	L	L	58	45	13	70	1
...	...	...	...	...	...	...	...	...	...	...

Table:-2: Endoscopic tympanoplasty group

The results demonstrated that endoscopic tympanoplasty significantly reduced operation time compared to microscopic tympanoplasty ($p < 0.001$). The mean operation time for the endoscopic group was 52.6 ± 8.4 minutes, while the microscopic group required 76.5 ± 9.2 minutes.

ABG improvement was slightly better in the endoscopic group (mean improvement: 13.2 ± 5.1 dB) compared to the microscopic group (mean improvement: 11.5 ± 4.8 dB), with a statistically significant difference ($p = 0.038$). The graft take-up rates, however, showed no significant difference between the two techniques ($p = 0.29$), indicating similar success rates for tympanic membrane closure.

Statistical Analysis

Paired t-tests were applied to compare pre- and post-operative ABG improvements, and an independent t-test was used to analyze operation time differences. A **p-value < 0.05** was considered statistically significant.

DISCUSSION

This study demonstrates that endoscopic tympanoplasty offers advantages in terms of shorter operation time and slightly better hearing outcomes compared to microscopic tympanoplasty. The shorter surgical duration can be attributed to the elimination of external incisions and reduced tissue dissection. The marginally superior ABG improvement in the endoscopic group may be due to enhanced visualization and precision in graft placement, aligning with previous studies [1,2].

However, the graft take-up rate did not show a statistically significant difference, suggesting that both techniques are effective in achieving tympanic membrane closure [3]. Future randomized trials with larger sample sizes and long-term follow-up are recommended to further validate these findings.

CONCLUSION

Endoscopic tympanoplasty is an effective and minimally invasive alternative to microscopic tympanoplasty, demonstrating shorter operation time and comparable graft take-up rate. The marginally better ABG improvement suggests a potential advantage in hearing outcomes. Given the reduced surgical burden and improved visualization, endoscopic tympanoplasty may be a preferable approach for select patients. However, further studies with larger cohorts and extended follow-up are necessary to establish its long-term efficacy.

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