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Comparison of Temporalis Fascia Graft Uptake in Patients with Large Tympanic Membrane Perforation Undergoing Type 1 Tympanoplasty

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Abstract **Original Research Article**

Background: Managing a large tympanic membrane perforation without middle ear disease involves reconstruction of tympanic membrane through tympanoplasty. Graft uptake may be highly influenced by the choice of either an endoscopic or microscopic modality. ***Objective:*** This study aimed at comparing graft uptake rates and hearing results for patients with large tympanic membrane perforations who received Type 1 tympanoplasty using temporalis fascia grafts via endoscopic and microscopic modalities. ***Methods:*** Sixty patients presenting with large-sized tympanic membrane perforations were divided into two different groups, Group A consisting of patients who underwent endoscopic tympanoplasty and Group B consisting of patients who underwent microscopic tympanoplasty. Intraoperative damage to chorda tympani nerve was monitored and post-operative pain was measuered by neumeric pain scale on 1st and 7th post-operative days. The graft uptake after 42 days of operation was analyzed and the hearing improvement was noted by using audiometric tests. The research took place at Sir Salimullah Medical College, Dhaka, Bangladesh, between July 2022 to June 2023. ***Results:*** Graft uptake in Group B was 90% while in Group A it was 83.33%. The average postoperative hearing gain in Group A and in Group B was 9.29 dB and 10 dB respectively. There has been no statistical significance found between the two techniques regarding graft uptake and hearing outcome but significant pain score was seen on 1st POD. ***Conclusion:*** Both the endoscopic and microscopic tympanoplasty techniques yielded similar graft uptake rates and hearing improvements in patients with large tympanic membrane perforations, thus the choice of technique should depend on surgeon preference rather than the expected outcome. More studies are needed in larger cohorts for the validation of these results.

Keywords: tympanic membrane perforation, tympanoplasty, graft uptake, endoscopic, microscopic, hearing improvement.

INTRODUCTION

More than 1.5 billion people- roughly 20% of the world's population- are affected by hearing loss and deafness. Of these, nearly 430 million people have disabling hearing loss [1]. Based on the present trend, this figure may reach 700 million by the year 2050 [WHO 2023]. This problem is seen in nearly 34 million children, of which as much as 60% is preventable [2]. The disabling hearing loss is affected by almost 9.6% of the population in Bangladesh, and COM is one of the major causes [3]. It is usually characterized by the inflammatory manifestations of the middle ear and mastoid cavity and most often results in persistent

discharge via the tympanic membrane perforation, thus negatively impacting speech, cognitive, educational, and psychological development among children [4]. Tympanoplasty is primarily aimed at repairing the perforation in the tympanic membrane and restoring hearing [5], which is amongst the most common surgical procedures for COM. It was first described by 1953 Wullstein and has since become an important procedure in managing middle ear pathologies, including COM and cholesteatoma [6]. Type 1 tympanoplasty or myringoplasty with the temporalis fascia as graft material is usually performed in patients with inactive mucosal COM, while preserving other middle ear structures [7]. Tympanoplasty, conventionally, has been performed using an operating microscope that gives excellent exposure, though access to certain areas of the middle ear can be limited. In current practice, there is a trend of increasing interest in the use of endoscopy for middle ear surgery as it may give improved exposure, high magnification, and angled views by enhancing visual exposure [8]. Further, endoscopic tympanoplasty may lead to reduced dissection in soft tissue, thereby improving graft uptake and healing aspects [9]. However, there is still scanty literature comparing the surgical results of endoscopic Type 1 tympanoplasty and microscopic tympanoplasty in relation to graft uptake in patients with large-sized tympanic membrane perforations [10]. The question addressed is very relevant to rural Bangladesh, where access to higher healthcare is severely limited. While effective, the method of microscopic tympanoplasty has a number of drawbacks in terms of high equipment costs and required maintenance [11]. However, the fact that endoscopes are so widely available, easy to afford, and portable makes them a very valuable tool in diagnostics and treatment [9]. The present paper is going to introduce the study of a comparison between endoscopic and microscopic Type 1 tympanoplasty in terms of feasibility and success rates with respect to graft uptake of the temporal fascia in patients with large perforations of the tympanic membrane. It further investigates postoperative outcomes to ascertain whether an endoscopic technique results in superior graft uptake compared to the traditional microscopic approach. This may, in turn, improve surgical decision-making and enhance patient outcomes.

METHODOLOGY

This prospective cohort study was conducted from July 2022 to June 2023 in the Department of Otolaryngology-Head & Neck Surgery, Sir Salimullah Medical College Mitford Hospital. The population studied included patients who were diagnosed with a large perforation of the tympanic membrane requiring Type 1 tympanoplasty. Participants were selected using very strict criteria: an age range between 15 and 55, a patent eustachian tube that was previously confirmed by impedance audiometry, and hearing loss in the range of 20-55 dB. Sensorineural or mixed hearing loss, active ear disease, previous revision surgeries, narrow ear canals, and chronic respiratory conditions such as bronchial asthma or COPD had been excluded. Using purposive sampling, subjects were divided into two groups wherein odd-numbered patients underwent the endoscopic procedure, and even-numbered patients had the microscopic procedure. The sample size was 60 in number dividing them into two groups resulting in each group consisting of 30 patients. The informed consent was taken from all–patients or their guardians. History taking in detail, clinical examination, and preoperative pure tone audiometry were done on all the patients to ascertain the hearing status. Intraoperative recordings included monitoring for injury to chorda tympani nerve. Further assessments were made on day one and day seven postoperatively using the pain scale. The follow-up was scheduled after six weeks from the date of the operation to see the graft uptake and status of hearing. All surgeries were carried out by qualified otolaryngologists under general anesthesia with endotracheal intubation. Graft material for doing the tympanoplasty was temporalis fascia. The endoscopic group received a transcanal approach while the microscopic group received a postauricular approach, placing grafts using the underlay technique. Results were expressed as mean ± SD or percentage. $p < 0.05$* was considered significant, and it was calculated by chi-square tests in respect to qualitative data, and independent t-tests were performed in relation to the hearing status.

RESULT

The sample size of the current study included sixty patients with big-sized tympanic membrane perforations; they were then divided into two groups, Group A-endoscopic tympanoplasty and Group B-microscopic tympanoplasty. In Group A, right-sided perforations consisted of 14 patients, which was 46.67%, while in Group B, there were 17 patients amounting to 56.67-While comparing the results between both groups, 83.33% (25 of 30 patients) in Group A and 90% (27 of 30 patients) in Group B had successful graft uptake at 42 days postoperatively, as represented. The hearing gain in Group A and B was 9.29 and 10 dB respectively which was statistically insignificant. The complication rate in Group A was 3.33%, while it was 10% in Group B, with no statistically significant difference. In this respect, on the first postoperative day, pain assessment gave results of 4.3 ± 0.87 in Group A and 6.1 ± 0.81 in Group B; the difference was statistically significant ($p < 0.05$). By the seventh postoperative day, pain scores were equalized at 4.2 ± 0.76 for Group A versus 4.4 ± 1.00 for Group B ($p > 0.05$). Thus, summarizing, both the approaches demonstrated similar results with respect to graft uptake, hearing gains, and complications; however, the endoscopic approach produced a significantly lower immediate postoperative pain level.

Table I: Graft Status in Group A and Group B (N=60)

Intervention	Uptaken	Failed	Total	Graft Success Percentage	Graft Failed Percentage	χ^2	P-value
Group A (Endoscopic Myringoplasty)	25	5	30	83.33%	16.67%	0.58	0.45
Group B (Microscopic Myringoplasty)	27	3	30	90%	10.0%		

Table II: Post-Operative Hearing Gain Comparison in-Large Perforation (N=60)

Group	Number of Patients	Summation of Pre- and Post-Operative A-B Gap	Mean ± SD	t Value	df	p Value
A	30	278.57	9.29±1.89	0.91	11	>0.05
B	30	300	10±0			

Table III: Hearing Status Before Operation in Group A (N=60)

A-B Gap	No. of Patients	Percentage (%)
<10 dB	3	10
11-20 dB	5	16.66
21-30 dB	15	50
31-40 dB	7	23.33

Table IV: Hearing Status After Operation in Group A (N=60)

A-B Gap	No. of Patients	Percentage (%)
<10 dB	7	23.33
11-20 dB	18	60
21-30 dB	4	13.33
31-40 dB	3	10

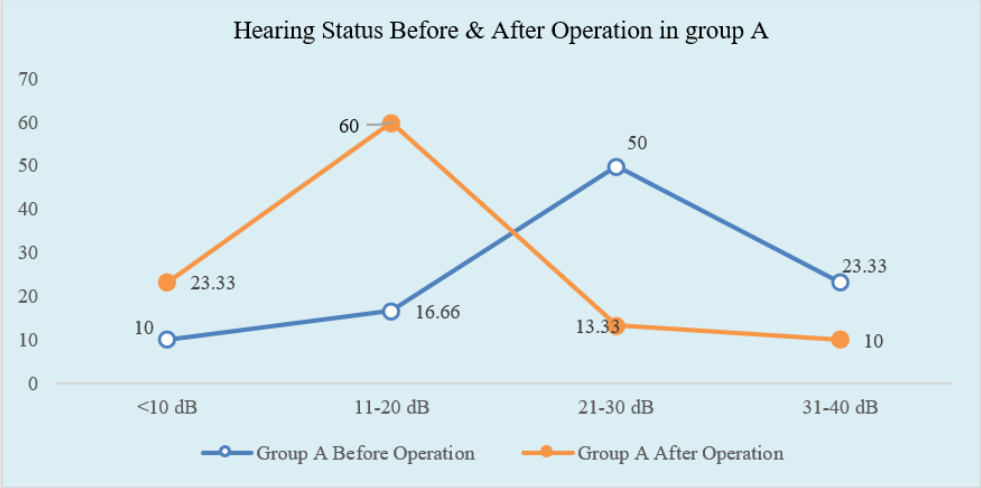

Figure III: Line chart showed before & after operation hearing status in group A patient (N=60)

Table V: Hearing Status Before Operation in Group B (N=60)

A-B Gap	No. of Patients	Percentage (%)
<10 dB	3	10
11-20 dB	10	33.33
21-30 dB	10	33.33
31-40 dB	7	23.33

Table VI: Hearing Status After Operation in Group B (N=60)

A-B Gap	No. of Patients	Percentage (%)
<10 dB	4	13.33
11-20 dB	9	30
21-30 dB	15	50
31-40 dB	2	6.66

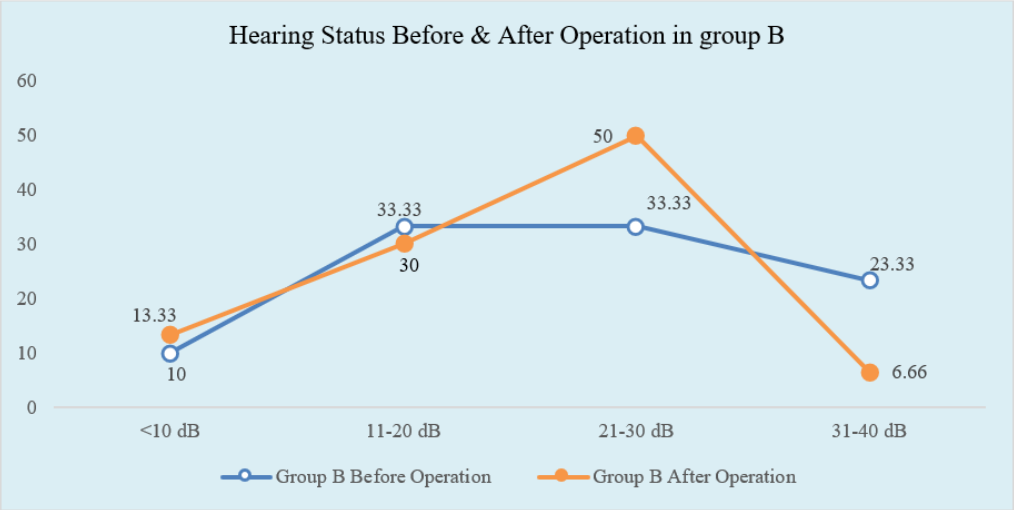

Figure IV: Line chart showed before & after operation hearing status in group A of patients (N=60)

Table VII: Complications of Surgery (N=60)

Complication	Chorda Tympani Injury	Wound Infection	χ^2 Value	p Value
Endoscopic Myringoplasty	1	1	0.38	0.54
Microscopic Myringoplasty	0	1		

Table VIII: Mean pain score between Group A and B at 1st POD

Group	Pain score (mean ± SD)	t test score	p value
Group A	4.2±0.76	8.25	> 0.05
Group B	6.1 +0.81		

Mean pain score of Group A was significantly shorter than Group B based on inde- pendent t test (p value<0.05) which is statistically significant.

Table IX: Mean pain score between two groups at 7th POD

Group	Pain score (mean ± SD)	t test score	p value
Group A	4.3±0.87	0.91	> 0.05
Group B	4.4 ±1.00		

Mean pain score of Group A and Group B was closed. Based on independent t test (p value>0.05) which is statistically not significant.

DISCUSSION

This study examined the outcome of the uptake of the temporalis fascia graft in patients in the age group of 15-55 years with large-sized tympanic membrane perforation following Type 1 tympanoplasty. Patients were divided into two groups based on the grafting method: odd-numbered patients were subjected to endoscopic tympanoplasty, while even-numbered ones underwent microscopic tympanoplasty. The mean age was 26.5 and 29.8 years for the endoscopic and microscopic groups, respectively; this is understandable since the prevalence of tympanic membrane perforation is greater among younger age groups. Most of the patients came from urban areas, indicating that the access to health facilities was good. However, the patients were relatively fewer from the slum areas, and it is agreed by Adoga *et al.*, 2010 as the latter stated that health is related to the socioeconomic status of a person [12]. In the present analysis, the predominance of right-sided perforations was 1.4:1.0; medium-sized perforations were also the most common, corroborating the existing literature. The graft uptake rate, generally, was remarkable: 90% in the microscopic group and 83.33% in the endoscopic group. While these findings disagree with some studies that reported higher graft uptake following endoscopic tympanoplasty. In microscopic procedure surgeons had enough space for instrumentation to clear the perforation margin and placement of temporalis fascia. That's why graft uptake success rate is slightly higher in Microscopic group but it was not statistically significant. The $\chi 2$ test showed no significant difference in graft uptake between groups, indicating that the outcome depends on patients. Postoperative hearing evaluations showed ~~significant~~ promising hearing gain in both groups, though which was not statistically significant differences among the groups in agreement with Kawale *et al.*, (2023) [13]. Both surgical techniques yielded hearing gain, thus proving necessity of reconstruction of tympanic membrane perforation. The postoperative complications

in the endoscopic group were fewer, hence indicating that there is a trend toward fewer postoperative complications with endoscopic procedures. Similarly, the pain scores were significantly reduced in the endoscopic group, further indicating less tissue trauma. In brief, both endoscopic and microscopic tympanoplasty methods had good graft uptake and improvement in hearing. However, overall graft uptake was marginally better in the microscopic group. Again, the endoscopic approach had the advantages of lower complication rates and pain scores. Longer follow-up and larger sample size studies are necessary to confirm these findings.

LIMITATIONS

Certain limitations of this study that may not allow generalization of findings are the small sample size and a single-center design. Variability in surgical techniques and short-term follow-up further limits the assessment of temporal outcomes. Future studies need to be done with larger, multiple centers and longer follow-ups to authenticate this study.

CONCLUSION

This study compared graft uptake in patients with large tympanic membrane perforations who underwent Type 1 tympanoplasty using temporalis fascia grafts. Both endoscopic and microscopic techniques had meaningful graft success rates and improvement in hearing post-operatively, thus indicating the choice of the surgical approach based on a surgeon's preference and not an anticipated outcome

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