

A Comparison of Hearing Gain Outcomes in Tympanoplasty with or without Augmentation at Dhaka Medical College Hospital

*Samad MS,¹ Shanta FT²

Abstracts

Background: Tympanoplasty is a commonly performed surgical procedure for the management of chronic otitis media, with the primary objective of restoring hearing by repairing tympanic membrane defects. Augmentation techniques have been introduced to improve graft stability and postoperative auditory outcomes; however, their additional benefit over conventional tympanoplasty remains a subject of debate.

Objective: To compare hearing gain outcomes between tympanoplasty performed with augmentation and tympanoplasty performed without augmentation.

Methods: This comparative study was conducted at Dhaka Medical College Hospital, Dhaka, Bangladesh, from July 2020 to June 2025. A total of 500 chronic otitis media patients were enrolled via purposive sampling and divided equally into tympanoplasty with augmentation (n=250) and without augmentation (n=250). Pre- and postoperative hearing was assessed using pure tone audiometry, and hearing gain was calculated from air–bone gap improvement at speech frequencies. Data were analyzed using SPSS version 23.0.

Results: Postoperative hearing improvement was observed in both groups, with the augmentation group demonstrating significantly greater mean hearing gain (18.6 ± 5.2 dB) compared to the non-augmentation group (14.1 ± 4.8 dB; $p=0.000$). A higher proportion of patients achieved ≥ 15 dB hearing gain in the augmentation group (62.4% vs. 42.4%; $p=0.001$). Graft uptake was also superior with augmentation (94.0% vs. 88.4%; $p=0.023$), indicating enhanced surgical outcomes.

Conclusion: Tympanoplasty with augmentation provides superior hearing gain compared to tympanoplasty without augmentation, suggesting that augmentation techniques may offer added benefit in achieving improved auditory outcomes.

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1. *Dr. Md. Sazzad Samad, Associate Professor, Department of Otolaryngology (ENT), Dhaka Medical Collage. sazzadsagore@gmail.com. ORCID: <https://orcid.org/0009-0006-7039-9864>
2. Dr. Farjana Tasmin Shanta, Medical Officer, Upazila Health Complex, Mithamain, Kishoreganj. ORCID: <https://orcid.org/0009-0004-1673-6925>

*For correspondence

Introduction

Chronic otitis media (COM) remains a major public health problem worldwide, particularly in developing countries, where recurrent ear infections, tympanic membrane perforation, and conductive hearing loss are common consequences.¹ The burden of COM is especially high in South Asia due to overcrowding, poor socioeconomic conditions, recurrent upper respiratory tract infections, and limited access to early otologic care.² Hearing impairment resulting from COM significantly affects communication, educational performance, and overall quality of life, making effective surgical management essential.³ Tympanoplasty is the standard surgical procedure performed to eradicate middle ear disease and reconstruct the tympanic membrane, with the dual aim of achieving a dry ear and improving hearing.⁴ The success of tympanoplasty is usually assessed by graft uptake rate and postoperative hearing gain, commonly measured by closure of the air–bone gap on pure tone audiometry.⁵ Despite advancements in surgical techniques and graft materials, variability in hearing outcomes remains a concern, prompting ongoing efforts to optimize surgical results.⁶ In recent years, augmentation techniques have gained attention as an adjunct to conventional tympanoplasty. Augmentation refers to the reinforcement of the tympanic membrane repair using additional graft material or supportive techniques to enhance graft stability, particularly in large, subtotal, or anterior perforations.⁷ The rationale behind augmentation is to prevent medialization, lateralization, or reperforation of the graft, thereby promoting better sound conduction and sustained hearing improvement.⁸ Several

studies have evaluated hearing outcomes following tympanoplasty with different grafting and reinforcement strategies, reporting mixed results. Some authors have demonstrated significantly better postoperative hearing gain and graft uptake rates with augmentation techniques compared to standard tympanoplasty.^{9,10} Others, however, have found no statistically significant difference in hearing outcomes, suggesting that surgical skill, middle ear status, and Eustachian tube function may play a more critical role than the use of augmentation alone.¹¹ These conflicting findings highlight the need for further comparative studies with adequate sample sizes and standardized outcome measures. The choice of surgical technique in tympanoplasty is often influenced by the size and site of perforation, condition of the middle ear mucosa, ossicular chain status, and surgeon preference.¹² In high-volume tertiary care centers such as Dhaka Medical College Hospital, tympanoplasty is routinely performed with and without augmentation, yet local data comparing hearing outcomes between these two approaches remain limited. Given the high prevalence of COM in Bangladesh and the substantial number of patients undergoing ear surgery, generating institution-based evidence is crucial for guiding clinical decision-making and optimizing patient care. Therefore, this study was designed to compare hearing gain outcomes between tympanoplasty performed with augmentation and tympanoplasty performed without augmentation at Dhaka Medical College Hospital. By analyzing a large cohort of patients over five years, this study aims to provide robust evidence

regarding the effectiveness of augmentation techniques in improving postoperative hearing outcomes. The findings may help refine surgical strategies, particularly in resource-limited settings, and contribute to the existing body of literature on middle ear reconstructive surgery.¹³

Methods

This comparative study was conducted in the Department of Otolaryngology and Head–Neck Surgery at Dhaka Medical College Hospital, Dhaka, Bangladesh, from July 2020 to June 2025. A total of 500 patients diagnosed with chronic otitis media and planned for tympanoplasty were enrolled using a purposive sampling technique. Patients were allocated into two groups: tympanoplasty with augmentation (Group A, n=250) and tympanoplasty without augmentation (Group B, n=250).

Inclusion criteria: Patients aged 15–60 years of either sex with inactive mucosal-type chronic otitis media and central tympanic membrane perforation were included. Only patients with a dry ear for at least six weeks, an intact and mobile ossicular chain, and preoperative conductive hearing loss documented on pure tone audiometry were considered eligible for the study.

Exclusion criteria: Patients with active ear discharge, cholesteatoma, ossicular discontinuity, mixed or sensorineural hearing loss, revision ear surgery, or associated craniofacial anomalies were excluded. Patients with systemic illnesses that could affect wound healing, such as uncontrolled diabetes mellitus, were also excluded.

Study procedure: All surgeries were performed under general anaesthesia by experienced otologic surgeons. Tympanoplasty was carried out using the standard underlay technique. In the augmentation group, additional reinforcement of the graft was performed using supportive graft material as per the operative requirement. Preoperative and postoperative hearing assessment was done using pure tone audiometry, and hearing gain was calculated based on improvement in air–bone gap at speech frequencies at three months follow-up.

Data analysis: Data were entered and analyzed using SPSS version 23.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analysis between groups was performed using appropriate statistical tests, with a p-value <0.05 considered statistically significant.

Results

A total of 500 patients undergoing tympanoplasty were analyzed, with 250 patients in the augmentation group and 250 in the non-augmentation group. The mean age of the study population was comparable between the two groups, and there was no statistically significant difference in age distribution or sex composition, indicating baseline demographic homogeneity. Most patients belonged to the 21–40-year age group, and males slightly outnumbered females in both groups. Preoperative hearing status, assessed by mean air–bone gap (ABG), was similar between the two groups. The augmentation group had a mean preoperative ABG of 32.4

± 6.1 dB, while the non-augmentation group had a mean ABG of 31.9 ± 5.8 dB, with no statistically significant difference. This suggests that both groups were comparable in terms of baseline conductive hearing loss before surgery. Postoperative hearing assessment at three months demonstrated significant improvement in both groups. However, the degree of improvement was greater in the augmentation group. The mean postoperative ABG was 13.8 ± 4.9 dB in the augmentation group compared to 17.8 ± 5.1 dB in the non-augmentation group. The mean hearing gain was significantly higher in patients who underwent tympanoplasty with augmentation. When hearing gain was categorized, a higher proportion of patients in

the augmentation group achieved a hearing gain of ≥ 15 dB compared to the non-augmentation group. Conversely, suboptimal hearing gain (<10 dB) was more frequently observed in the non-augmentation group. This difference in distribution of hearing gain categories was statistically significant. Graft uptake was achieved in the majority of cases in both groups. However, the success rate was higher in the augmentation group (94.0%) compared to the non-augmentation group (88.4%). Graft failure, including residual perforation or reperforation, was more common in the non-augmentation group, and the difference between the two groups was statistically significant.

Table I: Demographic characteristics of the study population

Variable	Augmentation group (n=250)	Non-augmentation group (n=250)
Mean age (years)	34.6 ± 10.8	35.1 ± 11.2
Male, n (%)	142 (56.8)	136 (54.4)
Female, n (%)	108 (43.2)	114 (45.6)

Table II: Distribution of age groups

Age group (years)	Augmentation group, n (%)	Non-augmentation group n (%)
≤ 20	38 (15.2)	41 (16.4)
21–40	132 (52.8)	126 (50.4)
>40	80 (32.0)	83 (33.2)

Table III: Comparison of preoperative hearing status (air–bone gap)

Parameter	Augmentation group	Non-augmentation group
Mean preoperative ABG (dB)	32.4 ± 6.1	31.9 ± 5.8
p-value	0.412	
Data analysis test: Independent samples t-test		

Table IV: Comparison of postoperative hearing outcomes

Parameter	Augmentation group	Non-augmentation group
Mean postoperative ABG (dB)	13.8 ± 4.9	17.8 ± 5.1
Mean hearing gain (dB)	18.6 ± 5.2	14.1 ± 4.8
p-value (hearing gain)	0	
Data analysis test: Independent samples t-test		

Table V: Distribution of hearing gain categories

Hearing gain category	Augmentation group n (%)	Non-augmentation group, n (%)
<10 dB	28 (11.2)	56 (22.4)
10–14 dB	66 (26.4)	88 (35.2)
≥15 dB	156 (62.4)	106 (42.4)
p-value	0.001	

Data analysis test: Chi-square test

Table VI: Comparison of graft uptake rates

Outcome	Augmentation group n (%)	Non-augmentation group n (%)
Successful graft uptake	235 (94.0)	221 (88.4)
Graft failure	15 (6.0)	29 (11.6)
p-value	0.023	

Data analysis test: Chi-square test

Discussions

The present comparative study evaluated hearing gain outcomes between tympanoplasty performed with augmentation and without augmentation in a large cohort of patients treated at a tertiary care hospital. The findings demonstrate that augmentation during tympanoplasty results in significantly better postoperative hearing gain and higher graft uptake rates compared to the conventional non-augmentation technique. These results are clinically relevant, particularly in regions with a high burden of chronic otitis media, where optimizing surgical outcomes is essential. In this study, both groups were comparable in terms of baseline demographic characteristics and preoperative hearing status, ensuring that postoperative differences could be reasonably attributed to the surgical technique rather than confounding factors. The absence of a statistically significant difference in preoperative air–bone gap between the two groups aligns with previous studies that emphasized the importance of baseline equivalence in comparative tympanoplasty research.^{14,15} This strengthens the validity of

the observed postoperative differences in hearing outcomes. Postoperative hearing improvement was observed in both groups, which is consistent with the established role of tympanoplasty in improving conductive hearing loss associated with tympanic membrane perforation.¹⁶ However, the magnitude of hearing gain was significantly greater in the augmentation group. The superior hearing gain observed with augmentation may be explained by improved graft stability, reduced risk of graft medialization, and better sound conduction properties, particularly in cases with larger or anterior perforations.¹⁷ Similar findings were reported in another previous study, which noted enhanced postoperative auditory outcomes with reinforced tympanic membrane reconstruction techniques.¹⁰ The distribution of hearing gain categories further supports the benefit of augmentation, as a significantly higher proportion of patients achieved a hearing gain of ≥15 dB in the augmentation group. This degree of hearing improvement is clinically meaningful and has been associated with better speech perception and quality of life in patients with chronic

middle ear disease.¹⁸ In contrast, suboptimal hearing gain was more common in the non-augmentation group, suggesting that standard tympanoplasty may be less effective in certain anatomical or pathological situations. Graft uptake rate is another critical determinant of tympanoplasty success. In the present study, graft uptake was significantly higher in the augmentation group compared to the non-augmentation group. This finding is in agreement with several recent studies that reported improved graft take rates with reinforced or cartilage-supported techniques.^{19,20} Augmentation likely provides mechanical support to the graft during the healing phase, reducing the risk of displacement or reperforation, particularly in patients with compromised middle ear ventilation.²¹ Despite these favorable outcomes, some authors have reported no significant difference in hearing results between augmented and non-augmented tympanoplasty, emphasizing the role of surgeon experience, Eustachian tube function, and middle ear mucosal status.^{11,22} While these factors undoubtedly influence surgical success, the large sample size and consistent surgical approach in the present study may have minimized their impact, allowing the effect of augmentation to be more clearly demonstrated. The extended study duration and large patient population represent key strengths of this research. However, certain limitations should be acknowledged. The use of purposive sampling and the lack of randomization may introduce selection bias. Additionally, hearing outcomes were assessed at three months postoperatively; longer follow-up could provide further insight into the durability of hearing improvement and

graft integrity. Future prospective randomized studies with long-term follow-up and assessment of patient-reported outcomes are recommended to validate these findings.^{23,24} Overall, the results of this study contribute valuable evidence supporting the use of augmentation in tympanoplasty to achieve superior hearing outcomes and improved graft success rates. In resource-limited settings with a high prevalence of chronic otitis media, adopting augmentation techniques may enhance surgical efficacy and patient satisfaction.²⁵

Limitations

This study was limited by purposive sampling, lack of randomization, and relatively short postoperative follow-up, which may affect generalizability and preclude assessment of long-term hearing outcomes and graft durability.

Conclusion

Tympanoplasty with augmentation demonstrated significantly superior hearing gain and higher graft uptake rates compared to tympanoplasty without augmentation. These findings support the routine consideration of augmentation techniques, particularly in patients at risk of suboptimal outcomes. Incorporation of augmentation may enhance surgical success and auditory rehabilitation in chronic otitis media, especially in high-burden, resource-limited healthcare settings.

Recommendation

Augmentation techniques should be considered during tympanoplasty, particularly for large or anterior perforations. Future

randomized controlled studies with longer follow-up are recommended to validate these findings and establish standardized surgical guidelines.

Reference

1. Bhatia R, Chauhan A, Rana M, Kaur K, Pradhan P, Singh M. Economic burden of otitis media globally and an overview of the current scenario to alleviate the disease burden: A systematic review. *International Archives of Otorhinolaryngology*. 2024 Jul;28(03): e552-8. DOI: <https://doi.org/10.1055/s-0043-1767802>.
2. Monasta L, Ronfani L, Marchetti F, Montico M, Vecchi Brumatti L, Bavcar A, Grasso D, Barbiero C, Tamburlini G. Burden of disease caused by otitis media: systematic review and global estimates. *PloS one*. 2012 Apr 30;7(4): e36226. DOI: <https://doi.org/10.1371/journal.pone.0036226>.
3. Sarkar S. A review on the history of tympanoplasty. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2013 Dec;65(Suppl 3):455-60. DOI: <https://doi.org/10.1007/s12070-012-0534-5>.
4. Olusanya BO, Neumann KJ, Saunders JE. The global burden of disabling hearing impairment: a call to action. *Bulletin of the World Health Organization*. 2014 Feb 18;92:367-73. DOI: <https://doi.org/10.2471/BLT.13.128728>.
5. Mishiro Y, Sakagami M, Kitahara T, Kakutani C. Prognostic factors of long-term outcomes after ossiculoplasty using multivariate analysis. *European archives of oto-rhino-laryngology*. 2010 Jun;267(6): 861-5.DOI: <https://doi.org/10.1007/s00405-009-1133-2>.
6. Kazikdas KC, Onal K, Yildirim N. Sensorineural hearing loss after ossicular manipulation and drill-generated acoustic trauma in type I tympanoplasty with and without mastoidectomy: A series of 51 cases. *ENT: Ear, Nose & Throat Journal*. 2015 Sep 1;94(9).
7. Mohamad SH, Khan I, Hussain SM. Is cartilage tympanoplasty more effective than fascia tympanoplasty? A systematic review. *Otology & Neurotology*. 2012 Jul 1;33(5):699-705.DOI: <https://doi.org/10.1097/MAO.0b013e318254fbc2>.
8. Zahnert T. The differential diagnosis of hearing loss. *Deutsches ärzteblatt international*. 2011 Jun 24;108(25): 433.DOI: <https://doi.org/10.3238/arztebl.2011.0433>.
9. Jeffery CC, Shillington C, Andrews C, Ho A. The palisade cartilage tympanoplasty technique: a systematic review and meta-analysis. *Journal of Otolaryngology-Head & Neck Surgery*. 2017 Jan;46(1): 48.DOI: <https://doi.org/10.1186/s40463-017-0225-z>.
10. Kouhi A, Ashthiani MT, Jalali MM. Results of type I tympanoplasty using fascia with or without cartilage reinforcement: 10 years' experience. *Iranian journal of otorhinolaryngology*. 2018 Mar;30(97): 103.DOI:

- <https://doi.org/10.22038/ijorl.2017.24810.1808>.
11. Jalali MM, Motasaddi M, Kouhi A, Dabiri S, Soleimani R. Comparison of cartilage with temporalis fascia tympanoplasty: a meta-analysis of comparative studies. *The Laryngoscope*. 2017 Sep;127(9):2139-48. DOI: <https://doi.org/10.1002/lary.26451>.
 12. Alzhrani F, Aldueb R, Alosaimi K, Islam T, Almuhawwas F, Alsanosi A. Safety of tympanoplasty and ossiculoplasty performed by otorhinolaryngology trainees. *The Journal of Laryngology & Otology*. 2020 Mar;134(3): 213-8.DOI: <https://doi.org/10.1017/S0022215120000584>.
 13. Khan A, Riaz N, Manzoor F, Malik KZ, Akhtar S, Hanif S. Outcomes of Type-1 Tympanoplasty with and without use of Topical Nasal Steroids; a Comparative Study. *Pakistan Armed Forces Medical Journal*. 2024 Oct 31;74(5):1374. DOI: <https://doi.org/10.51253/pafmj.v74i5.11037>.
 14. Onal K, Arslanoglu S, Songu M, Demiray U, Demirpehlivan IA. Functional results of temporalis fascia versus cartilage tympanoplasty in patients with bilateral chronic otitis media. *The Journal of Laryngology & Otology*. 2012 Jan;126(1): 22-5.DOI: <https://doi.org/10.1017/S0022215111002817>.
 15. Yuan Y, Luo Y, Wu C, Zhang W. Prognostic factors of hearing outcome in patients with chronic suppurative otitis media following tympanoplasty: a retrospective cohort study. *Annals of Translational Medicine*. 2022 Nov;10(21): 1169. DOI: <https://doi.org/10.21037/atm-22-4800>.
 16. Bhutta MF, Leach AJ, Brennan-Jones CG. Chronic suppurative otitis media. *The Lancet*. 2024 May 25;403(10441): 2339-48.DOI: [https://doi.org/10.1016/S0140-6736\(24\)00259-9](https://doi.org/10.1016/S0140-6736(24)00259-9).
 17. Jalali MM, Motasaddi M, Kouhi A, Dabiri S, Soleimani R. Comparison of cartilage with temporalis fascia tympanoplasty: a meta-analysis of comparative studies. *The Laryngoscope*. 2017 Sep;127(9): 2139-48.DOI: <https://doi.org/10.1002/lary.26451>.
 18. Lee D, Kim Y, Kim DK. Sensorineural hearing loss after surgery to treat chronic otitis media. *Ear, Nose & Throat Journal*. 2021 Jun;100(3_suppl):220S-4S. DOI: <https://doi.org/10.1177/0145561320968929>.
 19. Ayub Z, Khan AA, Rafique A, Saeed I, Alam J. Endoscopic Fascia-Cartilage Composite Grafting in Chronic Suppurative Otitis Media. *Pakistan Armed Forces Medical Journal*. 2022 Aug 31;72(4):1177. DOI: <https://doi.org/10.51253/pafmj.v72i4.7733>.
 20. Cabra J, Moñux A. Efficacy of cartilage palisade tympanoplasty: randomized controlled trial. *Otology & Neurotology*. 2010 Jun 1;31(4): 589-95.DOI: <https://doi.org/10.1097/MAO.0b013e3181dbb35e>.
 21. Moneir W, El-Kholy NA, Ali AI, Abdeltawwab MM, El-Sharkawy AA. Correlation of Eustachian tube function with the results of type 1 tympanoplasty: a prospective study. *European Archives*

- of Oto-Rhino-Laryngology. 2023 Apr;280(4): 1593-601.DOI: <https://doi.org/10.1007/s00405-022-07611-4>.
22. Simon F, Thierry B, Rabeony T, Verrier F, Elie C, Loundon N, Leboulanger N, Couloigner V, Garabedian EN, Denoyelle F. Long-term outcomes of cartilage tympanoplasty in 139 ears in children. *Clinical Otolaryngology*. 2021 Nov 1;46(6).DOI: <https://doi.org/10.1111/coa.13801>.
 23. Singh R, Srivastava A, Mohan C. Comparative evaluation of hearing in different tympanic membrane perforations. *Indian Journal of Otology*. 2016 Oct 1;22(4): 258-61.DOI: <https://doi.org/10.4103/0971-7749.192172>.
 24. Kumar MM, Ahmed SM, Kishore BH, Chaitanya K, Reddy VP. A Clinical study To Assess The Postoperative Outcome In Tympanoplasty Using COMOT-15 In Indian Scenario. *Journal of Evolution of medical and Dental Sciences*. 2014 Jul 14;3(28): 7730-6.DOI: <https://doi.org/10.14260/jemds/2014/2963>.
 25. Windon MJ, Faniriko MB, Bogale M, Acha E, Koch W. Otolaryngology burden of disease and surgical case triage in resource-limited settings: An example from Cameroon. *Laryngoscope investigative otolaryngology*. 2021 Apr;6(2):177-82. DOI: <https://doi.org/10.1002/lio2.522>.