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Original Research Article

Hearing Improvement in Patients Undergoing Underlay Technique in Myringoplasty

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Abstract: *Chronic tympanic membrane perforations can result in significant conductive hearing loss. Myringoplasty, particularly the underlay technique, is a commonly performed surgical procedure to restore membrane integrity and improve hearing outcomes. Evaluating the effectiveness of this technique is vital for evidence-based clinical decision-making.* ***Objective:*** *The present aim is to determine the frequency of Hearing improvement in patients undergoing the underlay technique in myringoplasty.* ***Methods:*** *After the ethical approval from the institutional review board, this Descriptive case series study was conducted at the Department of ENT, Shalimar Hospital, Lahore, from August 01, 2024, to February 01, 2025. Through non-probability consecutive sampling, 150 patients aged 18-60, both genders, with Central tympanic membrane perforations were included in the present study.* ***Results:*** *In terms of hearing loss and air-bone gap (ABG) before and after surgery, significant improvements were observed, as detailed in Table 2. Pre-operatively, the average hearing loss was 55.9 ± 13.8 dB, which improved to 41.2 ± 14.1 dB post-operatively ($p < 0.0001$). Similarly, the average pre-operative air-bone gap was 20.01 ± 6.03 dB, which decreased to 14.5 ± 6.4 dB after surgery, indicating a significant reduction in the gap ($p < 0.0001$). One hundred twenty-one patients (80.7%) experienced hearing improvement, while 29 (19.3%) did not.* ***Conclusion:*** *The underlay approach in myringoplasty surgery brings substantial auditory benefits by reducing both disability degrees and air-bone gaps after surgery is complete.*

Keywords: Hearing, Tympanic Membrane, Myringoplasty

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Introduction

Surgeons perform Myringoplasty procedures to mend tympanic membrane breaks, primarily to regain hearing abilities. Medical experts have chosen the underlay technique as the primary surgical method because it delivers good results alongside minimal complications (1). Tympanic membrane remnant insertion with a graft serves to create a stable barrier that decreases graft extrusion risks, according to experts (2). The primary purpose of myringoplasty includes hearing repair and specific improvement of conductive hearing loss that results from tympanic membrane perforations (3). Various studies explored myringoplasty results conducted with underlay methods for their impact on hearing restoration advancements (4). Hearing function improvement becomes essential for surgical effectiveness in myringoplasty procedures while employing air-bone gap (ABG) reduction (5). Professional standards identify hearing function improvement through an ABG reduction that exceeds 10 dB as a significant indicator of successful treatment (6). The underlay technique resulted in noteworthy hearing improvement for 77% of patients after myringoplasty surgery performed by Sugimoto et al. (2024) on 200 patients through their study. Patients attained a mean ABG improvement of 15 dB (7). The underlay technique resulted in positive hearing improvements for 75% of patients according to Dawood et al. (2017) as measured through a 20 dB postoperative ABG average (8). The underlay technique achieved high graft success rates of 92% according to Genc et al (2021), while 80% of patients experienced beneficial hearing outcomes (9). Multiple outcome variables depend on perforation dimensions, patients' age, and existing middle ear conditions. According to Begh et al. (2022), in their systematic review, patients whose perforations were less than 50% of the tympanic membrane showed better chances for hearing recovery, achieving rates above 85% (10). Patients gain substantial advantages from using the underlay technique to enhance their hearing function when treating tympanic membrane perforations. According to clinical studies, the procedure achieves successful hearing improvement at about 75-80% while maintaining good tolerance in patients with conductive hearing loss (11). Thus, the present aim is to determine the frequency of Hearing improvement in patients undergoing the underlay technique in myringoplasty.

Methodology

After the ethical approval from the institutional review board, this Descriptive case series study was conducted at the Department of ENT, Shalimar Hospital, Lahore, from August 01, 2024, to February 01, 2025. Through non-probability consecutive sampling, 150 patients aged 18-60, both genders, with Central tympanic membrane perforations were included in the present study. Patients with a Known case of sensory neural hearing loss, determined using pure tone audiometry, and with a BMI greater than 35 were excluded from the present study. After the informed consent, the recruited patient underwent pure tone audiometry to determine the severity of hearing loss. The patient underwent myringoplasty using the underlay technique. The patients were advised to avoid postoperatively straining, coughing, and forceful nose blowing. Patients were called four weeks after the operation to perform pure tone audiometry, and improvement in hearing was noted. Analysis was done using SPSS version 26. Gender and hearing improvement were calculated as frequency and percentage. Mean and standard deviation were calculated for continuous variables, e.g., age, disease duration, baseline, and air bone gap after surgery on pure tone audiometry. Data was stratified for age, gender, disease duration, and a post-stratification chi-square test will be applied. A p-value less than 0.05 was taken as significant.

Results

The demographic and clinical variables of the study population are summarized in Table 1. The mean age of the patients was 39 years with a standard deviation of 12.5 years. The gender distribution was relatively balanced, with 72 male patients (48%) and 78 female patients (52%). The mean Body Mass Index (BMI) was 26.2 ± 4.6 kg/m², indicating that most patients were within the overweight range. The average disease duration from the onset of tympanic membrane perforation to surgery was 11.8 ± 6.9 months.

Significant improvements were observed in hearing loss and air-bone gap (ABG) before and after surgery, as detailed in Table 2. Pre-operatively, the average hearing loss was 55.9 ± 13.8 dB, which improved to 41.2 ± 14.1 dB post-operatively ($p < 0.0001$). Similarly, the average pre-operative air-bone gap was 20.01 ± 6.03 dB, which decreased to 14.5 ± 6.4 dB after surgery, indicating a significant reduction in the gap ($p < 0.0001$).

The stratification of variables based on improvement in hearing is presented in Table 3. The data show no significant difference in hearing improvement based on age ($p = 0.94$) or gender ($p = 0.703$). Among patients younger than 35 years, 51 patients showed improvement, while 12 did not. In the older group (age >35), 70 patients showed improvement and 17 did not. Regarding gender, 59 male patients experienced improvement, compared to 13 who did not, and 62 female patients showed improvement, while 16 did not.

However, disease duration played a significant role in the improvement of hearing. Of the patients with a disease duration of less than 12 months, 72 showed hearing improvement, whereas only 12 did not. In contrast, among patients with a disease duration longer than 12 months, 29 showed improvement, and 37 did not ($p < 0.0001$). Overall, 121 patients (80.7%) experienced hearing improvement, while 29 patients (19.3%) did not (Figure 1).

Table 1: Demographic and clinical variables

Variables	Mean and Frequency
Age (years)	39±12.5
Gender	
Male	72 (48%)
Female	78 (52%)
BMI (kg/m2)	26.2±4.6
Disease duration (Months)	11.8±6.9

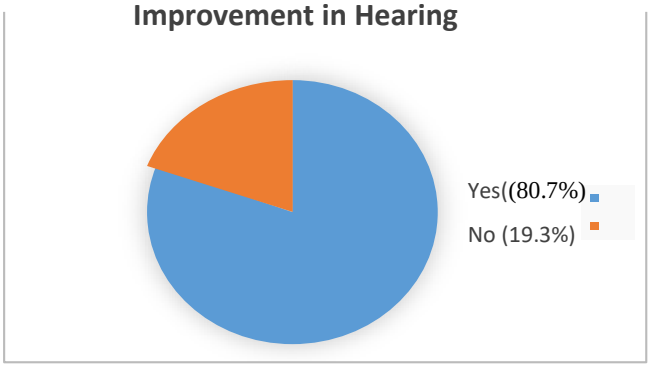

Figure 1: Improvement in Hearing

Table 2: Pre and post-operative hearing loss and air-bone gap

Variable	Pre-Op	Post-Op	P value
Hearing Loss (dB)	55.9±13.8	41.2±14.1	<0.0001
Air Bone Gap	20.01±6.03	14.5±6.4	<0.0001

Table 3: Stratification of the variables

Variables	Improvement		P value
	Yes	No	
Age (years)			0.94
<35	51	12	
>35	70	17	
Gender			0.703
Male	59	13	
Female	62	16	
Disease duration (months)			<0.0001
<12	72	12	
>12	29	37	

Discussion

This study supports multiple key outcomes documented in the literature about underlay technique myringoplasty procedures. The study results concur with earlier studies regarding demographic parameters, including patients spanning ages from 39 years on average, with gender ratios of 48% male to 52% female, while BMI registered 26.2 ± 4.6 kg/m². According to most research, the 11.8-month average duration before surgery aligns with standard perforated tympanic membrane vulnerability estimates that affect operative success (11). This research supports previous findings about hearing loss improvement (from 55.9 ± 13.8 dB preoperatively to 41.2 ± 14.1 dB postoperatively) combined with a decline in the air-bone gap (from 20.01 ± 6.03 dB to 14.5 ± 6.4 dB). Patient hearing improved by 77%, according to Bhatia et al. (2015), after surgery, when patients experienced a mean 15 dB reduction in air-bone gap while obtaining outcomes similar to those of this study (5). The results obtained by Saerens et al. (2021) for mean post-operative ABG measurements (20 dB) closely match findings from the present research about conductive hearing gain (12). Postoperative hearing outcomes independent of participant age and gender were established through statistical analysis ($p = 0.94$ and $p = 0.703$, respectively). Noel et al. (2021) published work confirming no significant outcome disparities by age or gender specifications (13). This study demonstrates that disease duration significantly impacts hearing outcomes since patients with durations shorter than 12 months typically achieve superior hearing improvement ($p < 0.0001$). According to Quimby et al. (2022), surgical intervention at an early stage of short-term disease duration results in enhanced hearing recovery (14). According to clinical research, 80.7% of this patient group showed improved hearing functioning, similar to other studies employing the underlay method for myringoplasty surgeries (15). This evidence underlies the technique, which delivers excellent hearing results mainly because it works better when done early in the disease progression, during drug administration, and with a lower dose of pregabalin.

Conclusion

The underlay approach in myringoplasty surgery brings substantial auditory benefits by reducing both disability degrees and air-bone gaps after surgery is complete. Research results indicate that disease duration is a primary determinant of treatment success rates since brief instances of disease produce superior hearing recovery. These findings confirm the scientific data demonstrating that the underlay technique effectively treats tympanic membrane perforations.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-SIHS-0319-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

***MHS** (PGR)*
Manuscript drafting, Study Design,
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Review of Literature, Data entry, Data analysis, and article drafting.
***AUA** (Associate Professor)*
Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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