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CLINICAL OUTCOME OF FAT MYRINGOPLASTY IN SELECT DRY CENTRAL PERFORATIONS: A SIZE-BASED ANALYSIS

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ABSTRACT

Background: Fat graft myringoplasty (FGM) is a minimally invasive technique utilized for the closure of small to moderate tympanic membrane perforations, particularly in cases of chronic suppurative otitis media (CSOM). This technique employs autologous fat harvested typically from the ear lobule and is considered a simple, suture-less, and outpatient procedure. FGM is particularly advantageous due to its reduced operative time, minimal morbidity, and effective anatomical and functional outcomes.

Objective: To evaluate the efficacy of fat graft myringoplasty in terms of graft uptake and hearing improvement in patients with small central perforations of the tympanic membrane.

Methodology: The present prospective interventional study was conducted in the Department of ENT, Tertiary Care Hospital, over a period of 18 months from February 2017 to July 2018. A total of 50 patients aged 15–70 years, with dry, small to moderate-sized central tympanic membrane perforations, were enrolled. All patients underwent fat graft myringoplasty using autologous fat harvested from the ear lobule. The procedure was performed *via* a transcanal approach under local anesthesia. After freshening the perforation margins and topical preparation, the fat graft was inserted medial to the tympanic membrane remnant. The patients were followed up postoperatively on day 7, day 14, 1 month, 3 months, and 6 months for graft uptake and hearing assessment. Hearing was evaluated by Rinne tuning fork test and pure tone audiometry. All procedures were performed under supervision of experienced ENT surgeons.

Results: Among the 50 patients, 60% were male and 40% were female. The most affected age group was 31–40 years (36%). The overall graft uptake rate at six months was 88%, with only 12% graft failures. Audiological improvement was noted in 88% of cases, with a significant number showing Rinne conversion from negative to positive and 52% achieving hearing gain between 11–20 dB.

Conclusion: Our study concludes that fat graft myringoplasty is an effective, minimally invasive alternative to conventional myringoplasty techniques, with high graft uptake rate and significant hearing improvement, especially suitable for small central perforations in selected cases.

Keywords: Fat graft myringoplasty, tympanic membrane perforation, chronic suppurative otitis media, hearing improvement, graft uptake, ENT surgery.

INTRODUCTION

Tympanic membrane perforations, commonly arising from chronic otitis media, trauma, or iatrogenic causes, represent a significant cause of conductive hearing loss and recurrent middle ear infections. The disruption of the tympanic membrane's anatomical continuity results not only in compromised auditory function but also in increased vulnerability to otorrhea, discomfort, and impaired quality of

life due to communication barriers. Effective surgical repair of these perforations is therefore essential to restore hearing acuity and reestablish the protective function of the tympanic membrane against environmental contaminants and microbial invasion. The operative reconstruction of the tympanic membrane via myringoplasty has seen significant evolution, with the use of temporalis fascia to contemporary methods of tissue-conserving surgery, e.g. fat grafting. The trend is part of the overall change in otologic surgery, which is less invasive and cost effective with the best recovery and minimal surgical morbidity.1

The minimally invasive nature of the surgery, ease of performing, and the fact that it is applicable in an outpatient setting have made fat graft myringoplasty especially popular in the treatment of small to moderate central perforations.2 During fat graft myringoplasty, autologous fat is taken (usually earlobe or abdomen) and applied directly into the defect of the tympanic membrane. It is a biologically inert scaffold which allows the epithelial proliferation and closure of the defect using fat. The flexibility and the capability to fit the uneven shapes of perforations increase the effectiveness of sealing. Moreover, this technique does not require big incisions or general anesthesia, which is a significant benefit in aged patients, children and individuals with systemic comorbid diseases. 3

The biocompatibility of fat grafts and how it easily integrates with host tissue has been proven over and over again in clinical studies. A seminal longitudinal study demonstrated that fat graft myringoplasty has long-term success in tympanic membrane closure and great improvement in auditory results with little to no adverse events.4 Also, fat harvesting has insignificant donor site morbidity which further supports its safety record and its popularity among otologic surgeons.5 Comparative studies have shown that fat graft myringoplasty may yield results comparable to temporalis fascia graft closure in particular types of perforation such as small perforations, posterior perforations, and dry central perforations.

Although temporalis fascia tympanoplasty is regarded as the gold standard of large or anterior perforations, it frequently requires greater surgical access via endaural or postauricular approach and general anesthesia as compared to fat myringoplasty, which can be conducted through transcanal access, completely obviating external incisions and significantly decreasing the complexity of the operation.9 This factor makes the procedure especially useful in resource-limited environments and complies with the principles of enhanced recovery after surgery (ERAS), facilitating increased patient turnover and decreased health care spending.

New developments have aimed at enhancing success of fat grafting by adding biological adjuvants, like platelet-rich plasma (PRP). The preliminary results are that PRP can potentially improve graft incorporation and epithelial repair, but additional high-quality randomized studies are required to determine its clinical effectiveness.10 Moreover, the success of surgery depends on the size, location, and cause of perforation. Small central and posterior defects have always had a higher rate of closure and good graft attachment compared to anterior and marginal perforation which are more difficult to manage due to anatomical factors.11

The efficacy of fat-plug myringoplasty as a primary method of repairing uncomplicated perforations of the tympanic membrane has gained support in a growing body of literature, including systematic reviews and meta-analyses.12 However, the surgical outcome depends on various factors in addition to the choice of graft material, such as the technical skills of the surgeon, preoperative infection control, or morphology of the perforation.13 This knowledge explains the importance of personalized treatment planning, careful surgical performance, and intensive postoperative follow-up.

Considering that the current demands targeted at safe, efficient and minimal invasive surgical methods move on in a positive direction, fat graft myringoplasty offers a promising and successful alternative to more classical methods. It offers a feasible solution that balances clinical performance with patient-centered care, particularly in groups in which the goal of reducing procedural risk is of utmost importance. The current research aims to advance the current body of literature by assessing the clinical outcome of fat graft myringoplasty in dry central perforations and stratify them by the size of the perforation to further understand the therapeutic potential of the modality in various anatomical settings.

Research Objectives

With changes in the otologic surgery environment, there is an increasing demand of less invasive methods that can offer successful repair of the tympanic membrane with less surgical morbidity and improved patient healing. Fat graft myringoplasty has been found as an attractive alternative to conventional tympanoplasty in small to moderate sized central perforation. Although there has been an upward trend in its use, there is very little good quality evidence that explores the effects of perforation size on clinical outcomes. This research aims to fill this gap by critically reviewing anatomical closure rates and hearing gain after fat graft myringoplasty in a systematic way and comparing the effectiveness of the surgery with size of perforation.

The specific objectives of this study are:

1. To assess the anatomical success rate of fat graft myringoplasty in achieving tympanic membrane closure in patients with dry central perforations.
2. To evaluate the functional hearing improvement following fat graft myringoplasty by comparing preoperative and postoperative audiometric outcomes.
3. To compare the clinical outcomes based on perforation size, specifically analyzing differences in graft uptake and hearing restoration between small and moderate central perforations.

MATERIAL AND METHODS

The study was a prospective interventional clinical trial conducted in the Department of ENT, Tertiary Care Hospital, during a period of 18 months, between February 2017 and July 2018. The aim of the study was to assess anatomical and functional results of fat graft myringoplasty (FGM) in patients with dry central tympanic membrane perforations. These results were particularly examined on the perforation size. The purpose of the study was to determine the long-term evidence on the success rate of the procedure which is minimally invasive surgical technique. Ethical clearance was appropriately granted by the institutional review board (anonymized approval number to protect confidentiality) and all the patients were explained about the study details in their native language following which the written informed consent was obtained. All the processes were conducted according to the Declaration of Helsinki and to the guidelines of clinical research.

Study Design and Setting:

The research followed a single-center, single-arm interventional design, conducted entirely at the Department of ENT, Tertiary Care Hospital. The infrastructure included modern surgical facilities, digital audiometry, otomicroscopy, and endoscopic systems necessary for comprehensive preoperative, operative, and postoperative management. The period of data collection and follow-up ranged from February 2017 to July 2018.

Participants:

Fifty consecutive patients who met predefined inclusion and exclusion criteria were enrolled using non-randomized, purposive sampling. Patients were aged between 15 and 70 years and had confirmed diagnoses of small to moderate size perforations (approximately 30% of the tympanic membrane) in the pars tensa region associated with inactive chronic otitis media (COM) of the tubo-tympanic type. The male-to-female ratio was 30:20. Eligibility was determined based on absence of otologic complications, normal middle ear mucosa, and a non-reactive xylocaine sensitivity test. Patients with history of atticoantral disease, subtotal/large perforations, sensorineural hearing loss, prior surgeries, or comorbid systemic illnesses such as ischemic heart disease, cerebrovascular accidents, renal or hepatic disorders were excluded from the study.

Surgical Procedure:

Local anaesthesia was done with 2 percent lignocaine with and without adrenaline, depending on the area of infiltration, in all the surgeries. Following ear lobule infiltration, about two times more volumes of the autologous fat compared to the area of the tympanic membrane perforation was collected. It was performed transcanally under an operating microscope KARL-KAPS. Microsurgical

instruments were used to re-fresh the margins of the perforation with a sickle knife or a curved pick, then gelfoam was placed in the middle ear. The fat graft was put in the form of dumbbell so that it could fit closely and also gelfoam was packed in the external auditory canal (EAC). It was haemostasised and a sterile dressing was done. The patients were observed in the 4-6 hours after the surgery and released in stable conditions.

Postoperative Management and Follow-Up:
All patients received a 7-day course of oral antibiotics, antihistamines, and multivitamins after the surgery. Antibiotic course was prolonged in patients with the early signs of infection. Even in the incidences where postoperative complications occurred, i.e. when patients experienced unnecessary pain, or when they bled so much, they were observed even after 3-4 extra days. Follow ups were done regularly at 1, 2, 4 and 6 weeks as well as 3 and 6 months after surgery. Otomicroscopic investigation was done on each follow-up to determine graft absorption and closure of the perforations. At 3- and 6-months pure tone audiometry (PTA) was used to measure hearing. As well, at their last follow-up visit, patients were requested to fill in the Chronic Ear Survey questionnaire to give subjective information concerning symptom resolution.

Outcome Measures:
The anatomical success (complete closure of the tympanic membrane perforation with the intact and mobile graft confirmed with otomicroscopy) was chosen as the primary outcome of interest. The second outcome was the functional success evaluated by improvement of air conduction thresholds and reduction of air-bone gap in terms of PTA. The postoperative complications like infection, pain, tinnitus or graft displacement were also noted.

Statistical Analysis:
Sample size was calculated using the standard statistical formula for estimating proportions:
$n = (Z\alpha)^2 \times p \times q / l^2$, where $Z\alpha = 1.96$ for a 95% confidence level, p represents the expected proportion of successful graft uptake based on prior published data, q is the complement $(1 - p)$, and l denotes the margin of error or absolute precision. This formula provided the rationale to include 50 patients in order to achieve statistical power sufficient for meaningful interpretation. All collected data were meticulously documented using Microsoft Excel and subsequently subjected to statistical evaluation using IBM SPSS Statistics version 25.0. Descriptive statistics were used to summarize categorical variables such as graft uptake success and the incidence of complications, expressed as frequencies and percentages. Inferential statistics involved application of the Chi-square test or Fisher's exact test, where assumptions of the Chi-square test were violated. For continuous variables, such as hearing thresholds recorded preoperatively and postoperatively through pure tone audiometry (PTA), statistical comparison was carried out using the paired t-test for data with normal distribution. In cases where normality assumptions were not met, the Wilcoxon signed-rank test was employed. Statistical significance was inferred at a p-value threshold of less than 0.05.

Results
This prospective interventional clinical study was conducted in the Department of ENT, Tertiary Care Hospital, involving 50 patients between the ages of 15 and 70 years, operated from February 2017 to July 2018. The data has been meticulously analyzed and presented below.

Demographic and Clinical Distribution
An in-depth analysis of the demographic and clinical parameters was undertaken to comprehensively characterize the patient population subjected to fat graft myringoplasty. This evaluation involved stratification by age, sex, laterality of ear involvement, and the type of otorrhea observed prior to surgery. The goal of this detailed profiling was to identify any patterns or associations that may influence surgical outcomes and to ensure that the study cohort was representative of typical clinical presentations in tubotympanic chronic otitis media. Such granular insights are pivotal in

substantiating the reliability and generalizability of the surgical technique under investigation, especially within the framework of evidence-based otologic practice.

Table 1: Age and Sex-wise Distribution

Age in Years	Male	Female	Total	Percentage
< 30	6	4	10	20%
31 – 40	10	8	18	36%
41 – 50	7	5	12	24%
51 – 60	2	1	3	6%
61 – 70	5	2	7	14%
Total	**30**	**20**	**50**	**100%**
χ^2 (Age) = 12.6, p = 0.013; χ^2 (Sex) = 2, p = 0.157				

The majority of patients belonged to the 31– 40year age group (36%), highlighting a peak incidence of tympanic membrane perforation in early middle age. Males constituted 60% of the study population, although this sex-based difference was statistically insignificant (p = 0.157). The age distribution, however, showed statistical significance (p = 0.013), suggesting a meaningful association between age and procedure eligibility or disease prevalence, as presented in **Table 1**.

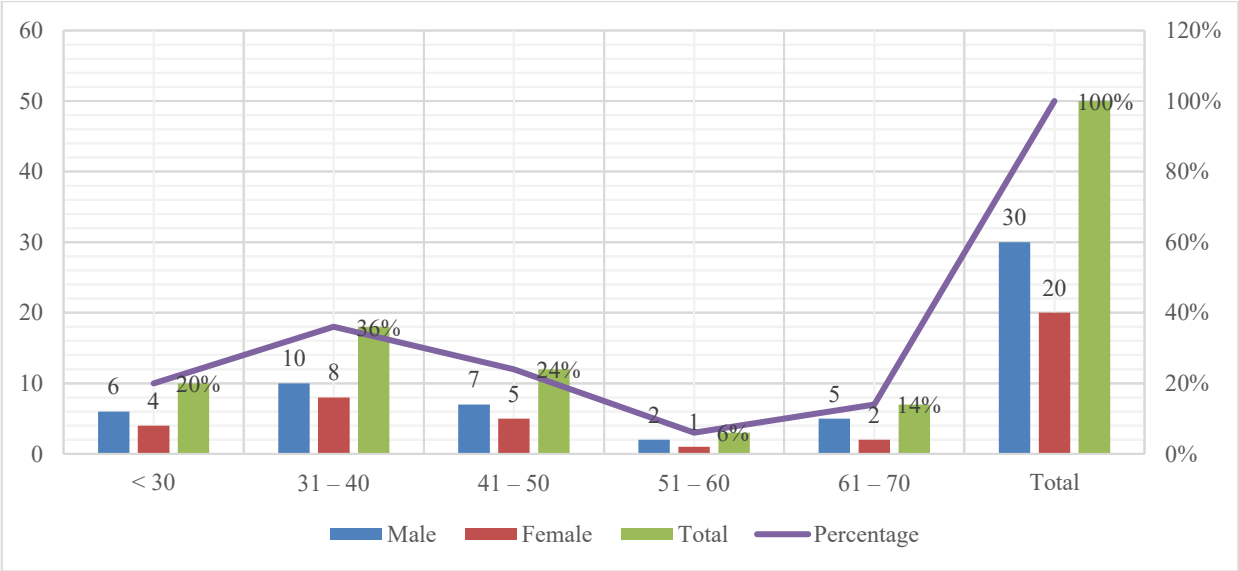

Figure 1: Age and Gender Distribution of Patients Undergoing Fat Graft Myringoplasty

Figure 1 illustrates the age and gender distribution of 50 patients who underwent fat graft myringoplasty, corresponding to Table 1. The majority (36%) were aged 31–40 years, followed by 24% in the 41–50 group. Males constituted 60% of the cohort, while females accounted for 40%. Although males were more frequent, the sex distribution was statistically insignificant (p = 0.157). However, the age distribution showed a significant trend (p = 0.013), indicating higher procedure prevalence in younger adults.

Table 2: Ear Side and Discharge Type

Parameter	Right Ear	Left Ear	Mucoid	Mucopurulent
Number of Cases	31	19	30	20
Percentage	62%	38%	60%	40%
χ^2 (Side) = 2.88, p = 0.09; χ^2 (Discharge) = 2, p = 0.157				

In this study, 62% of the surgical interventions were performed on the right ear and 38% on the left. Although right-sided involvement appeared more frequent, the difference was statistically

insignificant ($\chi^2 = 2.88$, $p = 0.09$). Regarding the nature of discharge, 60% of patients exhibited mucoid discharge, while 40% had mucopurulent types, with no significant association noted ($\chi^2 = 2$, $p = 0.157$), as outlined in **Table 2**.

Site of Tympanic Membrane Perforation

A detailed evaluation of the specific quadrant of tympanic membrane involvement was undertaken to determine not only the surgical accessibility but also its association with anatomical success and healing rates. Identifying the quadrant-specific distribution of perforations—such as anteroinferior (AI), anterosuperior (AS), posteroinferior (PI), and posterosuperior (PS)—aids in understanding the anatomical feasibility of fat graft insertion, ease of endoscopic visualization, and post-surgical recovery trends. This analysis offers critical insight into how perforation site may affect operative strategy and graft success, thereby refining patient selection and surgical planning protocols for fat myringoplasty in cases of chronic otitis media.

Table 3: Site of Perforation

Quadrant Involved	Number of Cases	Percentage
Anteroinferior (AI)	20	40%
Anterosuperior (AS)	15	30%
Posteroinferior (PI)	12	24%
Posterosuperior (PS)	3	6%
Total	**50**	**100%**
$\chi^2 = 12.24$, $p = 0.007$		

Anatomical distribution of perforations of tympanic membrane showed that 40 percent of the cases were anteroinferior (AI) quadrant and 30 percent were anterosuperior (AS) quadrant. The Posteroinferior (PI) quadrants and posterosuperior (PS) quadrants were 24% and 6%, respectively. This distribution in the quadrant was statistically significant (2 = 12.24, p = 0.007), which means that the pattern of distribution of perforation sites was not random but probably related to the pathology of disease or anatomical predisposition (see Table 3).

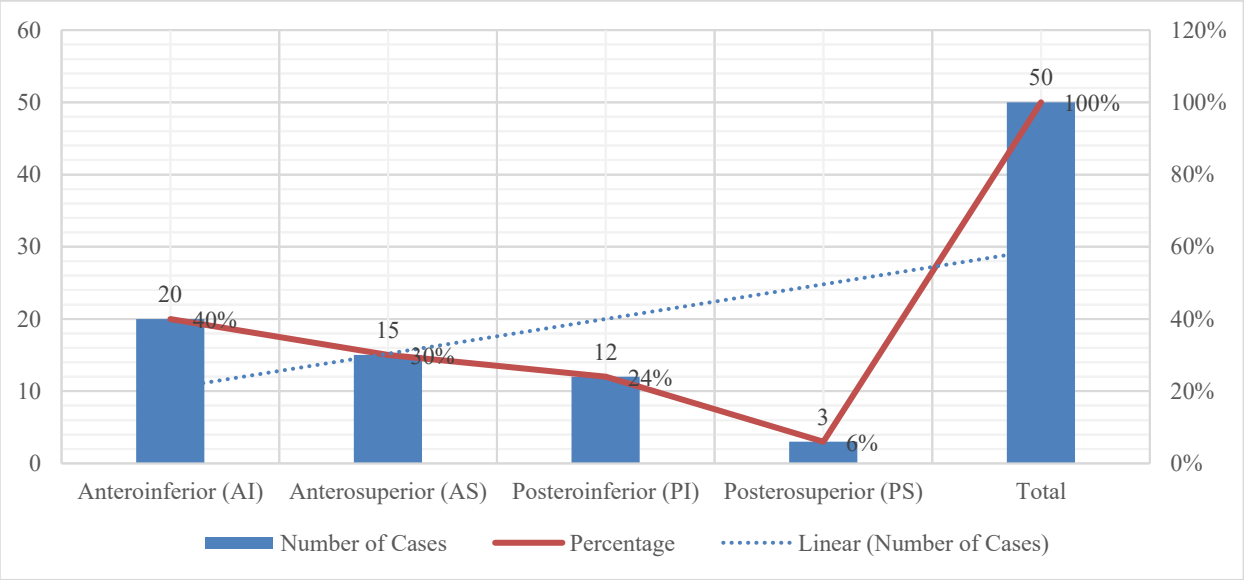

Figure 2 represents the quadrant-wise distribution of tympanic membrane perforations, corresponding to Table 3. The anteroinferior (AI) quadrant was most commonly involved (40%), followed by the anterosuperior (AS) at 30%, posteroinferior (PI) at 24%, and posterosuperior (PS) at only 6%. The distribution reveals a notable anatomical pattern, with the majority of perforations occurring in the anterior quadrants. This distribution was statistically significant ($\chi^2 = 12.24$, $p =$

0.007), emphasizing potential vulnerability of anterior quadrants to perforation in tubotympanic COM.

Rinne's Test Outcomes

Rinne's tuning fork test results were systematically assessed both preoperatively and postoperatively to evaluate shifts in auditory perception, particularly the transition from bone to air conduction, which is a critical indicator of middle ear function restoration. The presence of a negative Rinne test preoperatively across all patients reflected conductive hearing loss, while postoperative assessments were aimed at detecting conversion to positive Rinne, signifying improved air conduction and successful surgical intervention. This diagnostic measure is pivotal in confirming the functional efficacy of fat graft myringoplasty in rehabilitating hearing.

Table 4: Pre and Postoperative Rinne Test

Rinne Result	Pre-op Cases	Post-op Cases	Pre-op %	Post-op %
Negative	50	6	100%	12%
Positive	0	44	0%	88%
Total	**50**	**50**	**100%**	**100%**
χ^2 (Post-op) = 28.88, p = 0.0001				

The Rinne test outcomes demonstrated a significant audiological improvement postoperatively. Prior to surgery, all 50 patients (100%) exhibited negative Rinne results, confirming conductive hearing loss. However, at six months post-surgery, 88% of patients (n = 44) showed conversion to a positive Rinne, indicating effective restoration of air conduction. Only 12% remained negative. This change was statistically significant (χ^2 = 28.88, p = 0.0001), strongly supporting the efficacy of fat graft myringoplasty in improving auditory function, as shown in **Table 4**.

Pure Tone Audiometry (PTA) and Hearing Gain

The effectiveness of fat graft myringoplasty in enhancing auditory outcomes was thoroughly assessed using pure tone audiometry (PTA), which served as the primary objective audiological evaluation tool. Preoperative PTA values were meticulously recorded to establish baseline hearing thresholds across frequencies. Postoperative PTA readings were then compared at the six-month follow-up mark to quantify the degree of hearing improvement. Audiological gain was computed as the difference between pre- and post-operative PTA thresholds, categorizing patients based on decibel (dB) improvement. This systematic approach enabled the evaluation of the intervention's functional success in restoring air conduction, corroborated by statistically significant improvements in audiometric scores, thereby supporting the efficacy of fat graft myringoplasty as a rehabilitative surgical procedure for tympanic membrane perforations.

Table 5: PTA and Audiological Gain

Category	21–30 dB	31–40 dB	41–50 dB	0–10 dB	11–20 dB	21–30 dB	Total
Preoperative PTA	10	38	2	-	-	-	**50**
Postoperative PTA	14	29	7	-	-	-	**50**
Audiological Gain	-	-	-	22	26	2	**50**
χ^2 (Pre-op PTA) = 42.88, p = 0.0001							
χ^2 (Post-op PTA) = 15.16, p = 0.001							
χ^2 (Gain) = 19.84, p < 0.0001							

Preoperative pure tone audiometry (PTA) revealed that the majority of patients (76%) had hearing thresholds between 31–40 dB, while 20% ranged between 21–30 dB and 4% had values in the 41–

50 dB range. Postoperatively, 28% of patients improved to the 21–30 dB range, 58% remained within 31–40 dB, and only 14% showed 41–50 dB thresholds. Audiological gain analysis demonstrated that 52% achieved an 11–20 dB improvement, while 44% showed 0–10 dB gain and 4% had gains above 20 dB. All these changes were statistically significant ($p < 0.05$), confirming meaningful auditory recovery post-intervention as presented in **Table 5**.

Surgical Outcomes and Postoperative Complications

The final outcome of the surgical intervention was rigorously evaluated by analyzing both the anatomical integrity of the graft and the incidence of postoperative complications. Graft uptake was assessed by direct otomicroscopic examination, verifying successful integration and closure of the tympanic membrane without residual perforation. Concurrently, postoperative complications were monitored, including occurrences of persistent ear discharge and residual membrane defects, to determine any adverse surgical sequelae. These metrics provided a dual lens—functional and anatomical—through which the overall effectiveness and reliability of fat graft myringoplasty were validated in the cohort under study.

Table 6: Graft Uptake and Complications

Outcome/Complication	Number of Cases	Percentage
Graft Taken	44	88%
Graft Failure	6	12%
Nil Complications	44	88%
Ear Discharge	2	4%
Residual Perforation	4	8%
Total	**50**	**100%**
χ^2 (Graft) = 28.88, $p < 0.0001$; χ^2 (Complications) = 67.36, $p < 0.0001$		

The clinical efficacy of fat graft myringoplasty was substantiated through robust anatomical and functional outcomes at the six-month follow-up interval. A substantial proportion of patients (88%) achieved complete graft integration, reflecting a high degree of surgical precision and biological compatibility of the autologous fat graft material. Conversely, graft failure was documented in 12% of cases, predominantly due to persistent tympanic membrane perforations or postoperative otorrhea. Complication profiling revealed a favorable safety margin, with 88% of subjects experiencing no adverse effects. However, a minority presented with postoperative complications: 4% exhibited recurrent ear discharge and 8% developed residual perforations. These findings, all statistically significant ($\chi^2 = 28.88$ for graft uptake; $\chi^2 = 67.36$ for complications; $p < 0.0001$), underscore the procedural reliability and minimal morbidity associated with fat graft myringoplasty in selected patients, as detailed in **Table 6**.

DISCUSSION

The prospective clinical investigation has illuminated the anatomical and functional efficacy of fat graft myringoplasty in treating small to moderate central tympanic membrane perforations among a carefully selected patient cohort aged between 15 and 70 years. The demographic analysis indicated a peak occurrence of perforations in individuals aged 31–40 years, accounting for 36% of cases, highlighting a greater prevalence in early middle-aged adults. This observation aligns with epidemiological data that suggest a higher rate of healthcare utilization and environmental exposure to otologic risk factors in this age group. Although a greater number of males underwent the procedure, the sex distribution was statistically insignificant. This neutrality implies that gender does not significantly influence the predisposition to or outcome of fat graft repair. The finding that most perforations occurred in the anteroinferior quadrant (40%) supports the hypothesis that this region is structurally more vulnerable and more commonly implicated in chronic otitis media. These anatomical trends are consistent with previously published reports that emphasize quadrant-specific vulnerability to infectious and iatrogenic perforations.14

The functional outcomes measured through Rinne's tuning fork test and pure tone audiometry (PTA) further corroborated the therapeutic value of fat grafting. Postoperatively, 88% of patients demonstrated a conversion to positive Rinne's test, denoting significant recovery of air conduction. PTA values post-surgery revealed that the majority of patients improved within the 21–30 dB range, and 52% achieved an audiological gain of 11–20 dB. These results are statistically significant and mirror findings from larger multicentric studies that have established the viability of fat grafting as an effective hearing restoration technique.15 Such improvements underscore the procedure's capacity to not only close perforations anatomically but also restore auditory function effectively. When benchmarked against existing literature, the present study's outcomes compare favorably with those of alternative grafting techniques. For instance, endoscopic cartilage myringoplasty, although superior in structural integrity, often involves greater technical complexity and surgical time. Fat grafting, by contrast, offers comparable closure rates, particularly for small and central perforations, while maintaining a minimally invasive profile.16 This characteristic makes it an appealing choice in outpatient or resource-limited environments. The anatomical success rate of 88% reported in this study matches the success rates documented in previous endoscopic and microscopic fat graft trials.17 These parallels reinforce the reproducibility of the technique and affirm its place in contemporary otologic surgery.

The quadrant-specific analysis demonstrated a statistically significant association between perforation site and surgical outcomes, with the anteroinferior quadrant being the most frequently involved. Given that anterior quadrants pose greater challenges for graft placement and visualization, the high uptake rate in this region is particularly encouraging. This is further supported by recent innovations in endoscopic transcanal approaches, which allow enhanced visualization and maneuverability, thereby facilitating successful graft deployment even in anatomically difficult zones.18 The present study did not utilize platelet-rich plasma (PRP), yet comparative studies have found only modest improvements with PRP augmentation, suggesting that standard fat grafting remains highly effective in achieving closure and function.19 The low complication rate reported in this study further supports the safety profile of fat myringoplasty. A total of 88% of patients experienced no complications postoperatively. Only 12% encountered issues such as residual perforations or recurrent discharge. These figures mirror global data that highlight the low morbidity associated with fat plug techniques, particularly when executed with strict aseptic measures and under endoscopic or microscopic guidance.20 These advantages are magnified in elderly or comorbid patients, who benefit from shorter procedure times and reduced surgical stress.21 In contrast to cartilage grafts, which are bulkier and may alter the vibratory characteristics of the tympanic membrane, fat grafts offer a more compliant medium with favorable acoustic properties, especially in limited perforation areas. Studies comparing these graft types have concluded that while cartilage offers superior durability in larger perforations, fat grafting yields equal or superior results in small central lesions.22 Therefore, patient selection based on perforation characteristics is paramount in optimizing outcomes. The simplicity of the fat grafting procedure also facilitates its use in office-based settings, a point supported by several trials comparing outcomes of minor surgical interventions for TM repair.23 The ability to perform fat myringoplasty under local anesthesia with minimal equipment requirements underscores its accessibility and potential for broader implementation, particularly in low-resource settings. Additionally, the minimal donor site morbidity associated with fat harvesting—typically from the earlobe—ensures patient comfort and minimizes recovery time, enhancing overall procedural satisfaction.24 From a technical standpoint, the consistent closure rates and hearing improvements observed in this study suggest that fat graft myringoplasty maintains a stable success profile across different age groups and perforation types. This stability is instrumental in integrating the technique into standardized clinical protocols, especially for tubotympanic type chronic otitis media with dry, central perforations. Furthermore, the statistical significance observed in audiological gain ($p < 0.0001$) and graft uptake ($p < 0.0001$) strongly substantiates the robustness of the outcomes and adds to the growing evidence base advocating fat grafting as a reliable intervention. Despite its advantages, certain limitations must be acknowledged. The study's relatively short follow-up duration of six months restricts insights into

long-term graft integrity and late-onset complications. Moreover, the absence of adjunct therapies such as PRP or stem cell-enhanced scaffolds limits comparative interpretation with evolving biological treatments. Future research may benefit from longer observational periods, multicentric cohort recruitment, and head-to-head comparisons with cartilage or synthetic grafts using randomized controlled designs. The study contributes valuable evidence supporting the clinical utility of fat graft myringoplasty, particularly when patient selection is judicious and surgical execution meticulous. The technique's high anatomical closure rate, excellent functional recovery, and low complication profile render it an attractive option in the surgical armamentarium for tympanic membrane repair. Its alignment with modern surgical principles of minimally invasive, patient-centered, and cost-effective care ensures its relevance in both high- and low-resource environments. Thus, the findings of this study advocate for the continued adoption and refinement of fat graft myringoplasty in selected cases, supported by rigorous preoperative evaluation and postoperative monitoring to optimize outcomes.

CONCLUSION

The prospective clinical study validates the effectiveness of fat graft myringoplasty as a minimally invasive and functionally successful technique for the repair of small to moderate tympanic membrane perforations. With a high graft uptake rate of 88% and significant audiological improvement—marked by an 88% transition from negative to positive Rinne and a mean hearing gain predominantly within the 11–20 dB range—the procedure demonstrates both anatomical and functional efficacy. The fact that the technique is simple, less time-consuming in the operating room, and does not require the use of general anesthesia predisposes the method to outpatient care and resource-limited settings. The pattern of the perforation sites (mainly in the anteroinferior and anterosuperior quadrants) was significantly correlated with the outcome of the surgery, which leads to the idea that the location of perforation should also be considered in the surgical planning. Moreover, there were low rates of complications, as 88% of the patients had no postoperative morbidity, which highlights the safety of the procedure. Fat graft myringoplasty has unique benefits over more invasive typanoplasty procedures using temporalis fascia or cartilage grafts in regard to ease of surgery, minimal patient morbidity and expedited convalescence. The evidence is congruent and complements the literature, which makes it a desirable method in a case of chronic otitis media with the dry and central perforations. Despite the current study being well-supported in its evidence of short-term efficacy, long-term comparative studies as well as randomized trials in the future are needed to determine the durability of the results. Future studies into the nature of biological adjuncts, the mechanisms of graft incorporation, and predictors of success based on individual patients will make the procedures more precise and successful. To sum up, it can be stated that fat graft myringoplasty is a safe, efficient, and cost-effective procedure with promising anatomical closure and auditory rehabilitation in the selected patients. It can be regarded as an effective primary treatment that could be implemented in contemporary surgical management of some tympanic membrane perforations.

REFERENCES

1. Mahajan R, Mahajan N, Kour B. Fat graft myringoplasty: A clinical study and review of literature. Indian J Med Sci. 2021 Dec 23;73(3):340-2.
2. Han JS, Han JJ, Park JM, Seo JH, Park KH. The long-term stability of fat-graft myringoplasty in the closure of tympanic membrane perforations and hearing restoration. ORL. 2021 Mar 16;83(2):85-92.
3. Alkalabi AA, Al-Ani RM. The Efficiency of Endoscopic Fat Myringoplasty under Local Anesthesia. Prensa Med Argent. 2020:S1-012.
4. Knutsson J, Kahlin A, von Unge M. Clinical and audiological short-term and long-term outcomes of fat graft myringoplasty. Acta Otolaryngol. 2017 Sep 2;137(9):940-4.
5. Ambani KP, Gangwani RW, Bhavya BM, Vakharia SD, Katarkar AU. A comparative study between fat myringoplasty and temporalis fascia tympanoplasty in moderate to large central

perforation of pars tensa of tympanic membrane. Int J Otorhinolaryngol Head Neck Surg. 2017 Oct;3(4):997.
6. Lyngdoh NC, Saha R, Kamgo L, Khumanthem G, Ahmed N. Platelet Rich Plasma Enriched Fat Myringoplasty: An Office Procedure for Repairing Small Tympanic Membrane Perforations.
7. Diaz AR, Reina COC, Plaza G, Posadas ER, Arevalo FV, Iriarte MTG. Long-term follow-up after fat graft myringoplasty: Do size and location matter? Ear Nose Throat J. 2021;100(3 Suppl):229S-234S.
8. Lee DY, Kim YH. Can fat-plug myringoplasty be a good alternative to formal myringoplasty? A systematic review and meta-analysis. Otol Neurotol. 2018 Apr 1;39(4):403-9.
9. Beckmann S, Anschuetz L. Minimally invasive tympanoplasty: review of outcomes and technical refinements. Oper Tech Otolaryngol Head Neck Surg. 2021 Jun 1;32(2):143-9.
10. Fouad YA, Abdelhady M, El-Anwar M, Merwad E. Topical platelet rich plasma versus hyaluronic acid during fat graft myringoplasty. Am J Otolaryngol. 2018 Nov 1;39(6):741-5.
11. Karabulut B, Mutlu F, Sahin S, Cirik AA. Anatomical and functional long-term results of endoscopic butterfly inlay myringoplasty. Eur Arch Otorhinolaryngol. 2018 Nov;275:2653-8.
12. Panchal AJ, Kumar R, Desai M. Analysis of hearing improvement following fat graft myringoplasty. Int J Otorhinolaryngol Head Neck Surg. 2019 Jan;5(1):96.
13. Beckmann S, Anschuetz L. Minimally invasive tympanoplasty: review of outcomes and technical refinements. Oper Tech Otolaryngol Head Neck Surg. 2021;32(2):143-149.
14. Ridge SE, Shetty KR, Lee DJ. Current trends and applications in endoscopy for otology and neurotology. World Journal of Otorhinolaryngology-Head and Neck Surgery. 2021 Apr 1;7(02):101-8.
15. Zhu XH, Zhang YL, Xue RY, Xie MY, Tang Q, Yang H. Predictors of anatomical and functional outcomes following tympanoplasty: a retrospective study of 413 procedures. Laryngoscope Investigative Otolaryngology. 2021 Dec;6(6):1421-8.
16. Lou Z, Li X. A comparative study of endoscopic cartilage myringoplasty used to treat wet and dry ears with mucosal-type chronic otitis media. The Journal of Laryngology & Otology. 2020 Sep;134(9):773-8.
17. Huang J, Shi Y, Wu L, Lv C, Hu Y, Shen Y. Comparative efficacy of platelet-rich plasma applied in myringoplasty: A systematic review and meta-analysis. Plos one. 2021 Jan 25;16(1):e0245968.
18. Tseng CC, Lai MT, Wu CC, Yuan SP, Ding YF. Endoscopic transcanal myringoplasty for anterior perforations of the tympanic membrane. JAMA Otolaryngology–Head & Neck Surgery. 2016 Nov 1;142(11):1088-93.
19. Mandour MF, Elsheikh MN, Khalil MF. Platelet-rich plasma fat graft versus cartilage perichondrium for repair of medium-size tympanic membrane perforations. Otolaryngology–Head and Neck Surgery. 2019 Jan;160(1):116-21.
20. Park KS, Kim JS, Sung CM, Cho HH, Kim HC. Factors affecting fat myringoplasty in elderly patients with chronic otitis media: A case control study. European Journal of Medical Research. 2024 Oct 3;29(1):481.
21. Schwam ZG, Cosetti MK. Endoscopic myringoplasty and type I tympanoplasty. Otolaryngologic Clinics of North America. 2021 Feb 1;54(1):75-88.
22. Mourya A, Jain L, Jadia S, Qureshi S. A comparative study of various office procedures for the management of small to medium size tympanic membrane perforations. Indian Journal of Otolaryngology and Head & Neck Surgery. 2018 Sep;70:351-4.
23. Dhanapala N, Ramya B, Sudarshan Reddy L. A Comparative Study of the Efficacy of Fat Plug Myringoplasty and Conventional Myringoplasty in Chronic Suppurative Otitis Media with Small Central Perforation. Indian Journal of Otolaryngology and Head & Neck Surgery. 2019 Nov;71(Suppl 2):1197-201.
24. Salvador P, Gomes P, Silva F, Fonseca R. Type I tympanoplasty: surgical success and prognostic factors. Acta Otorrinolaringologica (English Edition). 2021 May 1;72(3):182-9.