



Comparative Analysis of Myringoplasty Outcomes Using Split versus Intact Tympanomeatal Flap Techniques.

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Abstract

Background: Repair of tympanic membrane perforations following chronic otitis media is done by Myringoplasty. Variations in tympanomeatal flap techniques, particularly intact and split flap approaches, can influence surgical exposure, graft uptake, and hearing outcomes. The current study was done to determine graft uptake and audiological outcomes of myringoplasty performed using intact versus split tympanomeatal flap techniques. **Methods:** This prospective observational study was done on 40 cases of chronic otitis media. They were allotted to two equal groups of 20 each. Group A underwent myringoplasty using an intact tympanomeatal flap. Group B underwent the split flap technique. Temporalis fascia graft was used in all cases by the underlay method. Graft uptake and hearing improvement, assessed by air-bone gap (ABG) closure on pure tone audiometry, were evaluated at 12 weeks postoperatively. **Results:** Baseline demographic and preoperative characteristics were comparable between the groups. The overall results of the study indicated that successful graft uptake was achieved in 90% of cases of Group A; similarly, the success rate was 95% in Group B cases. The differences between the two groups' success rates were not significant. The mean ABG closure was 15.7 ± 4.5 dB in Group A cases and 18.2 ± 5.1 dB in Group B cases, with no statistical differences. **Conclusion:** Intact and split tympanomeatal flap techniques were found to be equally effective. Both techniques provided comparable graft uptake and hearing outcomes in myringoplasty. The choice of technique is guided by the size of perforation and the surgeon's preference.

Keywords: Myringoplasty, Tympanomeatal Flap, Intact Flap, Split Flap, Graft Uptake, Hearing Outcome.



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INTRODUCTION

Chronic otitis media is the most frequently reported disorder across the globe, and it is one of the significant causes of preventable hearing loss in developing countries. Tympanic membrane perforation occurs due to chronic otitis media, and it results in recurrent ear discharge, conductive hearing loss, and reduced quality of life [1]. The surgical procedure aimed to repair tympanic membrane perforations without ossicular involvement is called Myringoplasty. It is the most commonly performed stand procedure to restore middle ear integrity and improve hearing outcome [1]. Over the years, many surgical techniques for myringoplasty have been described to maximize graft uptake, improve hearing, and produce minimal complications. In this commonly performed underlay technique for myringoplasty, the temporalis fascia is used because of its simplicity and favourable success rate [2].

However, there are technical variations in flap elevations where the use of an intact flap versus a split tympanomeatal flap has garnered attention because of beneficial surgical outcomes. The tympanomeatal flap creates an opening that gives access to the middle ear and helps to place the grafts in the course of the myringoplasty. In an intact tympanomeatal flap, the flap is lifted as one unit and preserves its blood supply. It is thought that this technique ensures the optimal blood circulation and improves graft recovery (3). Conversely, the split tympanomeatal flap is a method that entails division of the flap, typically to enhance surgical exposure to anterior or subtotal perforations. Advocates of the method believe that visualization improves the placement of grafts more accurately, and technical failure can be decreased, especially in difficult perforation sites (4).

Although both techniques are widely used, there is still controversy on which technique is more effective than the other. The rate of graft uptake is one of the primary indicators of the success of surgery and depends on several factors, such as the size and location of perforation, middle ear condition, surgical skills, and other flap designs (5). Some studies indicate that flap preservation can lower flap necrosis and postoperative lateralization of the graft (6). Other studies report similar

or even better results with the split flap approach in a few clinical conditions (7). Hearing improvement following myringoplasty is another important measure of outcome success. Tympanic membrane repair enhances sound conduction by re-establishing the effective vibratory surface as well as guarding the ossicular chain against repeated inflammation. In the past, the literature reveals that a successful graft uptake is normally associated with a substantial advancement in air-bone gap, irrespective of the flap technique employed (8).

Nevertheless, minor differences in the aeration of the middle ear and graft placement in techniques could be the determinants of audiological outcomes over the long term (9). Restoration of the tympanic membrane improves sound conduction because it re-establishes the effective vibratory surface, also protecting the ossicular chain from chronic inflammation. Few studies have indicated that successful graft uptake generally correlates with significant improvement in air-bone gap irrespective of the flap technique used (8). Moreover, there may be differences in middle ear aeration and graft positioning between techniques, which may influence long-term audiological outcome [9].

Contemporarily, there is increased use of evidence-based surgical practice for this condition. It is essential to critically evaluate and compare commonly used techniques to guide clinical decision-making. A comparison of split versus intact tympanomeatal flap techniques may help identify measurable advantages offered by one technique over the other in terms of graft success, hearing outcomes, and complication rates. Such comparative analyses are particularly relevant in resource-limited settings, where optimizing surgical success is important. Based on this background, the current study was done to determine the outcomes of myringoplasty performed using split and intact tympanomeatal flap techniques, focusing on graft uptake and hearing improvement. Results of such a study will contribute to the existing body of evidence in otologic literature and help surgeons in selecting the most appropriate technique of tympanic membrane repair.

MATERIALS AND METHODS

This prospective, comparative clinical study was conducted to evaluate the outcomes of myringoplasty using two different tympanomeatal flap techniques: split flap and intact flap in the department of Otolaryngology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion Criteria

1. Cases of chronic otitis media (Tubotympanic Type)
2. Aged 18 – 50 years
3. Dry ear for a period of at least 4 weeks.
4. Existing central tympanic membrane perforation
5. Normal ossicular chain mobility in preoperative evaluation
6. Signed written informed consent

Exclusion Criteria

1. Ossicular chain discontinuity of fixation
2. Active ear discharge
3. Attic canal disease or cholesteatoma
4. Sensorineural hearing loss
5. Revision myringoplasty
6. Those with a pathology of the nasopharynx that affects eustachian tube functions.

Based on the inclusion and exclusion criteria, a total of 40 patients diagnosed with chronic otitis media (tubotympanic type) with dry central tympanic membrane perforation were included in the study. All patients were selected from the outpatient and inpatient departments of Otorhinolaryngology presenting to our hospital. The sample collection was by the convenience sampling method, allocation was done by alternate method, with successive cases diagnosed with chronic otitis media (mucosal type) being taken for the study.

The study cases were divided into two equal groups of n=20 each for comparison of results. Group A (n=20) were patients undergoing myringoplasty using the intact tympanomeatal flap technique. Group B (n=20) were patients undergoing myringoplasty using the split tympanomeatal flap technique.

Preoperative Evaluation: All patients underwent detailed otoscopic and microscopic ear examination to assess the size and site of perforation as per protocol. Pure tone audiometry (PTA) was performed preoperatively to evaluate hearing thresholds and air-bone gap. The patients were subjected to routine hematological tests, and an anesthetic fitness evaluation was done before the surgery.

Surgical Technique: All surgeries were performed under general anesthesia using a postauricular or preauricular approach. Temporalis fascia was used as the graft material in all cases and placed by the underlay technique. In Group A, the tympanomeatal flap was elevated as a single intact flap to access the middle ear and support graft placement. In Group B, the tympanomeatal flap was split to improve exposure, particularly for anterior perforations, and the graft was positioned accordingly.

Postoperative management and follow-up: All patients received standard postoperative care, including antibiotics, analgesics, and ear precautions. Patients were followed up at 1 week, 4 weeks, and 12 weeks postoperatively.

Outcome Evaluation: The primary outcome measure was graft uptake, assessed otoscopically at 12 weeks postoperatively. Secondary outcome measures included hearing improvement, evaluated by postoperative pure tone audiometry and comparison of pre- and postoperative air-bone gap.

Statistical Analysis: All the available data were segregated, refined, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 26 in Windows format. Continuous variables: Mean $\pm$ SD; compared using Independent Student's t-test. Categorical variables: Frequency (%); compared using Chi-square test was used the values of $p < 0.05$ were considered statistically significant.

RESULTS

Baseline Demographic and Preoperative Characteristics of the cohort are given in Table 1. A critical analysis of the table showed that for Group A (intact tympanomeatal flap), the mean age was 34.6 ± 8.2 years. Similarly, for Group B (split tympanomeatal flap), the mean age was 32.9 ± 9.1 years. There were no statistically significant differences between the two as far as age is concerned. Similarly, the gender distribution in the cases was similar, with males accounting for 55% of cases in Group A and 45% of cases in Group B, although the differences were not significant. The laterality of involvement showed right ear involvement in 60% of Group A and 50% of Group B, with no statistical differences ($p = 0.507$). The size of perforation showed that small perforations were present in 25% of Group A and 30% of Group B. Medium perforations were present in 50% and 45% of cases, and similarly, large perforations were present in 25% of cases in both groups with insignificant p values. The preoperative (ABG) was similar between the groups, with a mean preoperative ABG of 28.4 ± 4.1 dB in Group A and 29.1 ± 3.8 dB in Group B. These findings showed that both groups were well matched for comparison, and there were no confounding factors that could have affected the outcomes based on demography.

Table 1: Baseline Demographic and Preoperative Characteristics

Characteristic	Group A (Intact Flap) n=20	Group B (Spit Flap) n=20	P value
Age (years), Mean $\pm$ SD	34.6 ± 8.2	32.9 ± 9.1	0.534
Gender, n (%)			
Male	11 (55%)	9 (45%)	0.321
Female	9 (45%)	11 (55%)	
Side of Ear, n (%)			
Right	12 (60%)	10 (50%)	0.507
Left	8 (40%)	10 (50%)	
Size of Perforation, n (%)			
Small (<25%)	5 (25%)	6 (30%)	0.841
Medium (25-50%)	10 (50%)	9 (45%)	
Large (>50%)	5 (25%)	5 (25%)	
Preoperative ABG (dB), Mean SD	28.4 ± 4.1	29.1 ± 3.8	0.646

Table 2 shows the primary surgical outcome of graft uptake at 12 weeks postoperatively. Successful graft uptake was achieved in 18 patients (90.0%) in Group A and 19 patients (95.0%) in Group B. Graft failure was observed in 2 patients (10.0%) in Group A and 1 patient (5.0%) in Group B. The difference in graft uptake rates between the two groups was not statistically significant ($p = 0.548$), indicating comparable surgical success with both tympanomeatal flap techniques.

Table 2: Primary Surgical Outcome Graft Uptake at 12 Weeks

Outcome	Group A (Intact Flap) n=20	Group B (Spit Flap) n=20	P value
Successful Graft Uptake, n (%)	18 (90.0%)	19 (95.0%)	0.548
Graft Failure, n (%)	2 (10.0%)	1 (5.0%)	

Audiological outcomes and hearing improvement in two groups of cases are presented in Table 3. The mean postoperative ABG was 12.7 ± 5.2 dB in Group A and 10.9 ± 4.8 dB in Group B, with no statistically significant difference between the groups (as p values were greater than 0.05). Mean ABG closure, reflecting hearing improvement, was 15.7 ± 4.5 dB in Group A and 18.2 ± 5.1 dB in Group B. Although Group B demonstrated greater mean ABG closure, the difference did not reach the level of statistical significance ($p = 0.098$). Hearing success, defined as a postoperative ABG of 20 dB or less, was achieved in 85.0% of patients in Group A and 95.0% of patients in Group B. This difference was also not statistically significant ($p = 0.296$). Overall, both surgical techniques resulted in substantial and comparable hearing improvement.

Table 3: Audiological Outcomes and Hearing Improvement

Audiometric Parameter	Group A (Intact Flap) n=20	Group B (Split Flap) n=20	P value
Postoperative ABG (dB), Mean $\pm$ SD	12. $\pm$ 5.2	10.9 $\pm$ 4.8	0.245
Mean ABG Closure (dB), Mean $\pm$ SD	15.7 $\pm$ 4.5	18.2 $\pm$ 5.1	0.098
*Hearing Success (Post-op ABG $\leq$ 20 dB), n (%)	17 (85.0%)	19 (95.0%)	0.296
*Hearing success is defined as a postoperative Air-Bone Gap (ABG) of 20 dB or less			

DISCUSSION

The current study was done for comparison of surgical and audiological results of myringoplasty performed using intact and split tympanomeatal flap techniques. The results show that the two methods had high graft uptake rates and significant hearing gain, although the differences between the two groups were not statistically significant. This implies that the two methods are useful and effective in repairing the tympanic membrane of patients with chronic otitis media. The baseline demographic and preoperative features of the two groups, such as age, gender, side of ear involvement, perforation size, and preoperative air bone gap (ABG) differences between groups, were not significant.

This showed that homogeneity allows strengthening the validity of the results comparison and reducing the impact of confounders. To ascertain that the difference in outcomes is due to surgical technique and not patient-related factors, similar baseline matching has been highlighted as a fundamental requirement in similar comparative otologic studies (6). The initial sign of success in surgery in myringoplasty is determined by graft uptake. In the current research, graft uptake was high in both groups, with a 90% success rate in the intact flap group and 95% in the split flap group, without any statistically significant difference. These findings are in line with other studies that have been carried out on this topic and reported a range of graft success rates of 85-95% regardless of the flap design (2,6). It is suggested that preservation of vascularity with the intact flap technique helps to maintain graft nourishment. The split flap technique offers better exposure, which helps to place grafts accurately, especially in anterior or large perforations (4,10).

The similar results that were achieved imply that both mechanisms are sufficient to attain successful healing of the tympanic membrane. The results of this study showed that there was a significant improvement in audiological outcome in the two groups. Mean postoperative ABG was decreased to close to normal levels, and in the two techniques, the mean ABG closure was greater than 15 dB. Although the split flap group showed slightly greater ABG closure and a higher proportion of hearing success, the differences were not statistically significant. The same results have been shown in previous studies wherein hearing improvement post-myringoplasty was clarified to be largely dependent on successful graft uptake and middle ear status as opposed to the particular method of flap elevation (8,11). The marginally improved audiological results of the split flap group might be explained by the improved visualization and better graft positioning, especially in the anterior quadrant of the tympanic membrane. The Anterior perforation has long been known to have a low success rate because it is difficult to access and would support the grafts less (10).

The process of enhancing exposure, including the use of split flap elevation, can thus have viable benefits in a few situations, although the overall results are similar. The absence of significant differences between the two methods indicates that the preferences of the surgeon, the nature of the perforation, and the demands during the operations could be the factors determining the selection of the flap design more than the issues of efficacy. This is especially applicable in the daily clinical practice when flexibility of the method is usually necessary. Existing literature also confirms the opinions that the surgical experience and the careful technique are more important factors than the approach to the flap elevation (5,12). The current research has limitations because of the small sample size and short duration of follow-up. There was no evaluation of the long-term results, such as delayed graft failure, middle ear aeration, and sustained hearing improvement. Further

multicentric research on larger cohorts with longer-term follow-up can be used to determine long-term differences in outcomes.

CONCLUSION

The present study shows that both intact and split tympanomeatal flap techniques of myringoplasty are effective in producing high graft uptake rates and significant hearing improvement. We found that no statistically significant differences were present in the two techniques with respect to graft uptake and audiological outcome. These findings indicate that the choice of surgical technique may be individualized based on the perforation characteristics and the surgeons' preference without affecting the outcome. The two methods provide satisfactory and reliable results with regard to the management of perforations of the tympanic membrane associated with chronic otitis media.

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