

Comparative Study of Platelet Rich Plasma vs Fat Graft Myringoplasty in the Management of Small Traumatic Tympanic Membrane Perforations

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ABSTRACT

Background: Traumatic tympanic membrane (TM) perforation is a common ENT condition. Although most small perforations heal spontaneously, persistent perforations require intervention. Fat graft myringoplasty is a well-established technique, while Platelet-Rich Plasma (PRP), because of its high concentration of growth factors, may enhance tissue regeneration and accelerate healing.

Methods: This prospective comparative study included 60 patients aged 15–60 years with small traumatic tympanic membrane perforations who attended the Department of Otorhinolaryngology, Dr. B.S. Kushwah Institute of Medical Sciences, Kanpur. The diagnosis was established by otoscopic and otoendoscopic examination. Baseline hearing assessment was performed using pure tone audiometry (PTA). The patients were randomly allocated into two equal groups of 30 patients each. Group A underwent platelet-rich plasma (PRP) myringoplasty, whereas Group B underwent fat graft myringoplasty.

Results: Complete tympanic membrane closure was achieved in 93.3% of patients in the PRP group compared with 76.7% in the fat graft group ($p=0.041$). Both groups showed significant postoperative hearing improvement; however, the PRP group demonstrated greater hearing gain and better postoperative PTA thresholds ($p<0.05$). In addition, the overall postoperative complication rate was significantly lower in the PRP group than in the fat graft group (13.3% vs. 46.7%, $p=0.005$).

Conclusion: PRP is a safe, minimally invasive, and effective treatment for small traumatic tympanic membrane perforations and may be considered an alternative to fat graft myringoplasty.

Key-words: Fat Graft Myringoplasty, Hearing Loss, Platelet-Rich Plasma, Traumatic Tympanic Membrane Perforation, Tympanic membrane Healing

INTRODUCTION

Traumatic perforation of the TM is one of the most common otological conditions encountered in routine ENT practice. It may result from road traffic accidents, slap injuries, self-cleaning with cotton buds, blast injuries, instrumentation, and penetration by foreign bodies.^[1]

Although most small traumatic perforations heal spontaneously within a few weeks under conservative management, a proportion of patients develop persistent perforations, recurrent ear discharge, conductive hearing loss, tinnitus, and impaired quality of life, thereby necessitating surgical intervention.^[1,2] The primary objective of treatment is to achieve complete anatomical closure of the tympanic membrane while restoring hearing with minimal morbidity and maximum patient comfort.

Several surgical techniques have been described for the repair of small tympanic membrane perforations. Among these, fat graft myringoplasty has gained wide acceptance because it is a simple, minimally invasive,

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office-based procedure that can be performed under local anaesthesia with satisfactory graft uptake and hearing improvement.^[3] However, the procedure requires harvesting autologous fat from the ear lobule, which may increase operative time and is associated with donor-site morbidity. Furthermore, the healing process depends largely on graft survival, tissue integration, and neovascularization, which may delay complete epithelialization and closure of the perforation.^[3]

PRP has recently emerged as a promising biological material in regenerative medicine because of its high concentration of autologous platelets and multiple growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF- β), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), and insulin-like growth factor (IGF). These growth factors play a vital role in angiogenesis, fibroblast proliferation, collagen synthesis, epithelial regeneration, and tissue remodelling, thereby accelerating wound healing and improving tissue repair.^[4] Owing to these regenerative properties, PRP has been successfully used in various medical and surgical specialties and has recently attracted increasing attention as an adjunct in the management of tympanic membrane perforations.^[4,5]

Despite encouraging preliminary results, comparative clinical evidence evaluating the efficacy of PRP myringoplasty and conventional fat graft myringoplasty for traumatic tympanic membrane perforations remains limited, particularly in the Indian population.^[5,6] Most available studies have included small sample sizes or heterogeneous patient populations, making it difficult to establish the superiority of one technique over the other. Therefore, further prospective comparative studies are required to assess their anatomical and functional outcomes.

The present prospective comparative study included 60 patients with small traumatic tympanic membrane perforations diagnosed by otoscopic and otoendoscopic examination in the Department of Otorhinolaryngology, Dr. B. S. Kushwaha Institute of Medical Sciences, Kanpur. Baseline hearing assessment was performed using PTA, and the majority of patients had mild conductive hearing loss of less than 40 dB. The patients were randomly allocated into two equal groups of 30 each. Group A underwent PRP myringoplasty using autologous PRP

prepared by the double-spin centrifugation technique, whereas Group B underwent conventional fat graft myringoplasty using autologous ear lobule fat. The study aimed to compare the anatomical closure rate, healing time, hearing improvement, and postoperative complications between the two techniques and to determine whether PRP could serve as a safe, effective, minimally invasive, and clinically superior alternative to fat graft myringoplasty in the management of small traumatic tympanic membrane perforations.^[7,8]

MATERIALS AND METHODS

Study Type and Setting- This prospective comparative study was conducted in the Department of Otorhinolaryngology, Dr. B. S. Kushwaha Institute of Medical Sciences, Kanpur, Uttar Pradesh, over a period of one year from April 2025 to March 2026. The study was undertaken to compare the anatomical and functional outcomes of PRP myringoplasty and fat graft myringoplasty in patients with small traumatic tympanic membrane perforations. Institutional Ethics Committee approval was obtained before commencement of the study, and written informed consent was obtained from all participants.

Inclusion Criteria

- Patients aged 18–60 years.
- Small traumatic tympanic membrane perforation ($\leq 25\%$ of the pars tensa).
- Dry ear for at least 4 weeks.
- Conductive hearing loss associated with traumatic tympanic membrane perforation.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria

- Active ear discharge or chronic suppurative otitis media.
- Marginal or large tympanic membrane perforations.
- Previous ear surgery.
- Cholesteatoma or ossicular chain pathology.
- Poorly controlled diabetes mellitus, bleeding disorders, anticoagulant therapy, or immunocompromised status.
- Patients unwilling to participate or unable to complete the follow-up period.

Study Groups and Procedure- A total of 60 patients with traumatic tympanic membrane perforations involving less than 25% of the pars tensa were enrolled after detailed clinical examination, otoscopic evaluation, otoendoscopic assessment, and pure tone audiometry. Patients were randomly allocated into two equal groups of 30 each. Group A underwent PRP myringoplasty, whereas Group B underwent fat graft myringoplasty. All patients were followed for 12 weeks. The primary outcome measure was complete tympanic membrane closure, while secondary outcome measures included hearing improvement, healing time, postoperative infection, graft uptake, and procedure-related complications.

For Group A, approximately 10–20 mL of autologous venous blood was collected under aseptic precautions, and PRP was prepared using the double-spin centrifugation technique. After microscopic freshening of the perforation margins, PRP was applied directly over the perforation, and the external auditory canal was packed with sterile Gelfoam soaked in PRP.

For Group B, fat graft myringoplasty was performed under local anaesthesia. A small piece of autologous fat was harvested from the ear lobule, and after freshening the perforation margins under microscopic guidance, the

graft was placed in an hourglass fashion across the perforation and supported with Gelfoam in the external auditory canal.

Statistical Analysis- Data were entered into Microsoft Excel and analysed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ standard deviation (SD) and compared using the independent Student's *t*-test. Categorical variables were expressed as frequencies and percentages and analysed using the Chi-square test or Fisher's exact test, wherever appropriate. A *p*-value of <0.05 was considered statistically significant.

RESULTS

A total of 60 patients with small traumatic tympanic membrane perforations were enrolled and equally allocated into two groups of 30 patients each. Group A underwent PRP myringoplasty, whereas Group B underwent fat graft myringoplasty. In Group A, there were 12 (40%) males and 18 (60%) females, while Group B comprised 16 (53.3%) males and 14 (46.7%) females. The gender distribution was comparable between the two groups (Table 1).

Table 1: Comparison of gender distribution between the groups

Gender	Group-A	Group-B	Total
Male	12	16	28
Female	18	14	32
Total	30	30	60

Complete tympanic membrane closure was achieved in 28 of 30 patients (93.3%) in the PRP group compared with 23 of 30 patients (76.7%) in the fat graft group. This

difference was statistically significant ($p=0.041$), indicating a higher anatomical success rate with PRP myringoplasty (Table 2).

Table 2: Comparison of closure of the tympanic membrane perforation between the groups

Tympanic membrane perforation	Group-A	Group-B	Total	p-value
Complete closure	28	23*	51	0.041
Persistent perforation	2	7*	9	
Total	30	30	60	

* $p<0.05$ significant

The mean time required for complete perforation closure was significantly shorter in the PRP group (16.80 ± 3.50 days) than in the fat graft group (24.90 ± 5.20 days). Most patients in the PRP group achieved complete

healing within 2–3 weeks, whereas closure in the fat graft group generally required 3–5 weeks, demonstrating significantly faster epithelialization with PRP (Table 3).

Table 3: Comparison of mean time required for perforation closure between the groups

Treatment Group	Group-A	Group-B
Time to complete closure (MEAN±SD)	2-3 weeks (14-21days)	3-5 weeks (21-35days)
Time to closure		
<2 Weeks	18	8
3 Weeks	9	12
4 weeks	3	7
>4 weeks	0	3
MEAN±SD	16.80±3.50	24.90±5.20*

**p*<0.05 significant

Both groups showed significant postoperative hearing improvement following treatment. The mean preoperative PTA was comparable between the groups (28.50 ± 5.20 dB in Group A vs. 29.10 ± 5.50 dB in Group B; *p*=0.68). However, the PRP group demonstrated

significantly better postoperative PTA thresholds (16.20 ± 3.80 dB vs. 18.80 ± 4.20 dB; *p*=0.02) and greater mean hearing gain (12.30 ± 3.50 dB vs. 10.30 ± 3.70 dB; *p*=0.03) than the fat graft group (Table 4).

Table 4: Comparison of mean hearing improvement assessed by Pure Tone Audiometry (air–bone gap) between the groups

Parameter	Group-A (MEAN±SD)	Group-B (MEAN±SD)	p-value
Preoperative PTA	28.50±5.20	29.10±5.50	0.68
Postoperative PTA	16.20±3.80	18.80±4.20*	0.02
Mean Hearing Gain	12.30±3.50	10.30±3.70*	0.03

**p*<0.05 significant

Postoperative complications were less frequent in the PRP group than in the fat graft group. Although individual complications, including infection, graft displacement, reperforation, and persistent perforation, did not differ significantly between the groups, the overall postoperative complication rate was significantly

lower in the PRP group (13.3% vs. 46.7%; *p*=0.005). These findings suggest that PRP myringoplasty is associated with lower postoperative morbidity and a more favourable postoperative recovery than fat graft myringoplasty (Table 5).

Table 5: Comparison of postoperative complications between the groups

Complication	Group-A (n=30)	Group-B (n=30)	p-value
Infection	1 (3.30)	3 (10.0)	0.30
Graft displacement	0 (0.0)	2 (6.7)	0.15
Reperforation	1 (3.30)	3 (10)	0.30
Persistent perforation	2 (6.70)	6 (20)	0.13
Any postoperative complication	4 (13.30)	14 (46.7)*	0.005

**p*<0.05 significant

DISCUSSION

The present prospective comparative study evaluated the efficacy of PRP myringoplasty and fat graft myringoplasty in the management of small traumatic tympanic membrane perforations. Both procedures achieved satisfactory anatomical closure and significant hearing improvement; however, PRP myringoplasty demonstrated superior clinical outcomes with respect to perforation closure rate, healing time, hearing gain, and postoperative complications.^[9-11]

In the present study, complete closure of the tympanic membrane was achieved in 93.3% of patients treated with PRP compared with 76.7% in the fat graft group ($p=0.041$). These findings are consistent with previous studies reporting that PRP enhances tympanic membrane healing through the release of PDGF, TGF- β , VEGF, and other bioactive mediators that stimulate angiogenesis, fibroblast proliferation, collagen synthesis, and epithelial regeneration.^[12-15]

The mean healing time was significantly shorter in the PRP group (16.8 ± 3.5 days) than in the fat graft group (24.9 ± 5.2 days). Similar observations have been reported by previous investigators, who demonstrated that PRP accelerates epithelialization and tissue repair, resulting in earlier closure of tympanic membrane perforations.^[12,13,16] In contrast, fat graft myringoplasty depends on graft survival, neovascularization, and tissue integration before complete healing, which may explain its relatively longer healing period.^[9,10]

Both groups showed significant postoperative hearing improvement; however, the PRP group achieved greater mean hearing gain (12.3 ± 3.5 dB) than the fat graft group (10.3 ± 3.7 dB). The superior postoperative pure tone audiometry thresholds observed in the PRP group may be attributed to earlier perforation closure and faster restoration of tympanic membrane integrity. These findings are in agreement with previously published studies demonstrating better functional hearing outcomes following PRP-assisted myringoplasty.^[12,14,17]

Postoperative complications were fewer in the PRP group. Although individual complications, including infection, graft displacement, re-perforation, and persistent perforation, did not differ significantly between the groups, the overall postoperative complication rate was significantly lower in the PRP group (13.3% vs. 46.7%; $p=0.005$). Similar findings have

been reported in previous studies suggesting that PRP reduces postoperative inflammation, promotes tissue regeneration, and minimizes postoperative morbidity.^[13,15,18]

Fat graft myringoplasty remains an established and reliable technique for the repair of small tympanic membrane perforations, with reported success rates ranging from 75% to 90%.^[9-11] Nevertheless, the procedure requires harvesting adipose tissue from the ear lobule, which increases operative time and may result in donor-site morbidity. In contrast, PRP is an autologous biological material that is easy to prepare, inexpensive, minimally invasive, and free from donor-site complications, making it an attractive alternative for the management of small traumatic tympanic membrane perforations.^[12,13,16]

The present study has certain limitations, including its relatively small sample size, single-centre design, and short follow-up period of 12 weeks. Therefore, larger multicentric randomized controlled trials with longer follow-up are warranted to validate these findings and establish the long-term efficacy and safety of PRP myringoplasty.^[19,20]

Overall, the findings of the present study suggest that PRP myringoplasty is a safe, effective, minimally invasive, and cost-effective treatment option for small traumatic tympanic membrane perforations. Compared with fat graft myringoplasty, PRP provides higher tympanic membrane closure rates, faster healing, greater hearing improvement, and fewer postoperative complications, supporting its potential role as a preferred treatment modality in appropriately selected patients.^[12-15]

CONCLUSIONS

The present study demonstrated that PRP myringoplasty is a safe, minimally invasive, and effective treatment modality for small traumatic tympanic membrane perforations. Compared with fat graft myringoplasty, PRP achieved a higher tympanic membrane closure rate, significantly shorter healing time, greater postoperative hearing improvement, and a lower incidence of postoperative complications. The autologous nature of PRP, ease of preparation, low cost, and absence of donor-site morbidity make it an attractive biological alternative for tympanic membrane repair. These findings suggest that PRP may improve both anatomical and functional outcomes while reducing patient

morbidity. However, further multicentric randomized controlled studies involving larger sample sizes and longer follow-up periods are necessary to confirm these findings, establish standardized PRP preparation protocols, evaluate long-term graft durability and hearing outcomes, and determine its cost-effectiveness before PRP myringoplasty can be recommended as a routine first-line treatment for appropriately selected patients with traumatic tympanic membrane perforations.

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