results overview

Table 1: Baseline characteristics

Variable	PRP group (n=15)	Control group (n=15)	P-value	Test
Age, years				
Mean±SD	30.13 ± 7.73	32.67 ± 7.32		
Median (IQR)	32.00 (12.00)	35.00 (7.50)	0.364	t-test
Gender				
Female	6 (40%)	5 (33.33%)	1	Chi-square
Male	9 (60%)	10 (66.67%)		
Perforation Site				
Left	7 (46.67%)	7 (46.67%)	1	Chi-square
Right	8 (53.33%)	8 (53.33%)		
Perforation Size				
Large	8 (53.33%)	8 (53.33%)	0.125	Fisher
Medium	6 (40%)	2 (13.33%)		
Small	1 (6.67%)	5 (33.33%)		

Participant flow (CONSORT flow diagram)

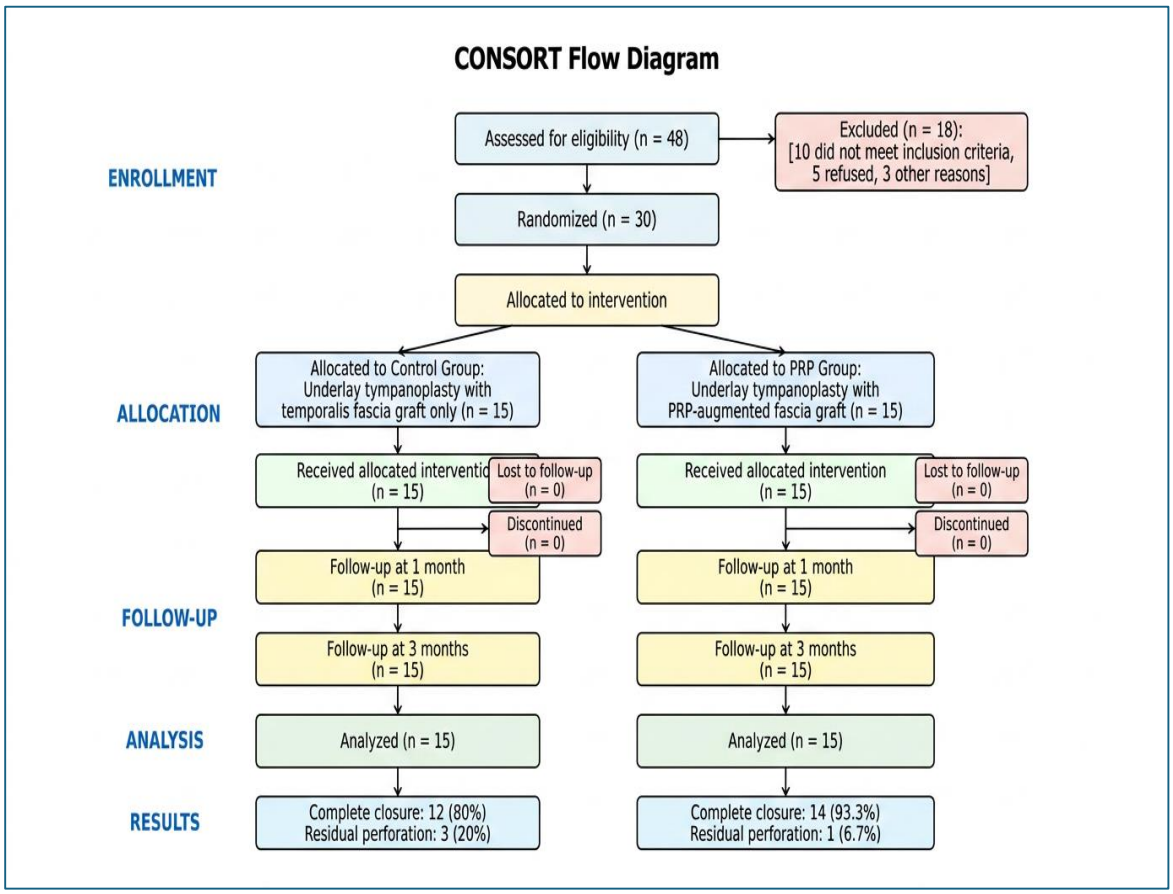

Figure 1 - CONSORT Flow Diagram

Adverse events

No major postoperative complications, graft lateralization, sensorineural hearing loss, or PRP-related adverse events were observed.

Outcome measures

This study compared the outcomes of underlay fascial tympanoplasty assisted with PRP to conventional underlay fascial tympanoplasty. The two groups were comparable in terms of baseline characteristics, including age, gender, perforation site, and perforation size. While the PRP group had a slightly younger mean age and a higher proportion of medium-sized perforations, these differences were not statistically significant.

Closure of the tympanic membrane

The results of the current study showed that the tympanic membrane healing rates were high in both groups, with complete closure observed in 93.3% of patients in the PRP group and 80% in the control group at both 1 and 3 months postoperatively. Although the difference did not reach statistical significance, the higher closure rate in the PRP group suggests a potentially beneficial role of PRP in enhancing healing, consistent with PRP's known regenerative properties. However, the small sample size may have limited the power to detect a statistically significant difference.

In agreement with our findings, Huang et al. (2021) conducted a review of published articles on the subject, reporting 93.4% of complete closure cases in patients who received PRP after surgery compared to 78.6% in patients who had surgery alone, with a low incidence of complications.

Graft rejection was described in one case where a surgical repair failed. In the same study, PRP bactericidal capabilities were postulated since four cases in the control group had postoperative infections but none of those with PRP application (El-Anwar et al., 2015). Navarrete Alvaro et al. (2011) reported using PRP as an adjuvant in tympanoplasty, resulting in complete closure of tympanic membrane perforations. Sankaranarayanan et al. (Kumar, 2014) discovered that a PRP clot applied during tympanoplasty decreased transplant displacement. In a 32-patient research, PRP formulations were found to help in healing of acute tympanic membrane perforations (Habesoglu et al., 2014).

Elbary et al. (2018) found that employing titanium mesh and PRP combined with bone material to reconstruct the posterior meatal wall after canal wall-down mastoidectomy for middle ear cholesteatoma was effective. PRP, continuous hyperbaric oxygen, and polydeoxyribonucleotide were employed in a unilateral total ear amputation. It has been established that PRP can successfully salvage practically the whole auricle (Lee et al., 2017). Vozel et al. (2021) confirmed in a randomized controlled clinical trial that autologous PRP is an effective treatment modality for chronic postoperative temporal bone cavity inflammation in patients whose disease could not be treated surgically to maintain serviceable hearing loss and a reasonable disease-related quality of life.

Audiological improvements

The results of our current study demonstrated that both groups showed significant improvements in hearing over time, as reflected by reductions in AC thresholds and air-bone gaps ABG. Repeated-measures ANOVA confirmed a strong effect of time on AC, BC, and ABG in both groups, indicating that tympanoplasty—regardless of technique—effectively restored auditory function. Importantly, the PRP group demonstrated a more favorable trend, particularly in ABG improvement, which was significantly better at 3 months compared to the control group (13.9 dB vs. 20.7 dB; $p = 0.026$). This suggests enhanced ossicular chain function and better conductive hearing outcomes with PRP.

Interestingly, BC thresholds showed a transient increase in the PRP group at 1 month, possibly due to temporary middle ear inflammation or measurement variability. However, BC values normalized by 3 months, and no long-term adverse impact was observed. The control group, on the other hand, showed stable BC values throughout the follow-up. Post-hoc comparisons also supported these trends. While AC improvements were not statistically different between groups, the PRP group consistently showed lower mean thresholds at each time point. This indicates a more pronounced, though not statistically significant, benefit of PRP in auditory recovery.

In our study, postoperative hearing improvement was observed in both the PRP and control groups. The average hearing gain (preoperative ABG – postoperative month-3 ABG) in the PRP group was 15.6 dB, compared to 11.6 dB in the control group. These findings are consistent with those reported in earlier studies where PRP-treated patients showed average gains ranging from 10.3 to 18.62 dB, while control groups showed gains between 7.23 and 15.64 dB (Anwar et al., 2020; Fouad et al., 2018; Ersözlü & Gultekin, 2020). For instance, Yadav et al. (2018) reported a gain of 18.62 dB in the PRP group versus 13.15 dB in the control group. Similarly, El-Anwar et al. (2015) found a mean gain of 10.5 dB in the PRP group versus 7.43 dB in controls.

In terms of functional success, defined as ABG gain >10 dB, our study achieved a success rate of 73.3% in the PRP group and 60% in the control group, aligning with prior reports where the improvement rates ranged from 65.6% to 90% in PRP-treated patients and 40.6% to 77.1% in controls (Anwar et al., 2020; Fouad et al., 2018; Ersözlü & Gultekin, 2020). For example, Anwar et al. (2020) reported success rates of 88.6% in the PRP group and 77.1% in the control group.

Although our findings demonstrated significant improvement between pre- and postoperative ABG values within each group, no statistically significant difference was noted between the PRP and control groups in terms of hearing gain, which is also in agreement with previous systematic reviews [e.g., Ersözlü & Gultekin (2020), Fouad et al. (2018)]. This may reflect variability in frequency selection, surgical techniques, or small sample sizes that limit statistical power.

The biological mechanisms underlying PRP's effects on tympanic membrane healing are multifactorial. PRP releases a concentrated cocktail of growth factors including platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor-beta (TGF-β), which collectively stimulate fibroblast proliferation, promote angiogenesis, and accelerate both epithelial migration and stromal remodeling. These processes are critical for successful graft integration and TM regeneration. Additionally, PRP's adhesive properties may help stabilize the graft during the early postoperative period, while its anti-inflammatory effects could reduce cytokine-mediated tissue damage. The transient elevation in bone conduction thresholds observed in the PRP group at 1 month may reflect an initial inflammatory response to these growth factors, which subsequently resolves as healing progresses.

The predominantly non-significant between-group comparisons in the present study likely reflect the limited statistical power conferred by the relatively small sample size (n=15 per group) rather than true equivalence between treatments. With an observed closure rate difference of 13.3% (93.3% vs. 80%) and a functional success difference of 13.3% (73.3% vs. 60%), a substantially larger sample would be required to achieve adequate power. Furthermore, the 3-month follow-up period may have been insufficient to capture the full extent of audiological recovery, as ongoing remodeling of the tympanic membrane and middle ear mechanics can continue beyond this timeframe. Variability in perforation size distribution, despite randomization, and the single-center design may have also contributed to the observed variability in outcomes.

The present study provides confirmatory rather than novel evidence regarding PRP augmentation in tympanoplasty, as several randomized controlled trials and systematic reviews have previously investigated this adjunct. The specific contributions of the current study include: (1) its prospective randomized design conducted within an Egyptian patient population that has been underrepresented in the existing literature; (2) detailed repeated-measures audiological outcome data (AC, BC, and ABG at three time points) analyzed using rigorous statistical methodology (R

version 4.5.1, mixed-design repeated-measures ANOVA with sphericity corrections, generalized eta-squared effect sizes, and Bonferroni-adjusted post-hoc comparisons); and (3) explicit reporting of primary and secondary outcomes with blinding of the audiologist to group allocation. These elements add to the geographic and methodological diversity of the evidence base, although they do not establish a new therapeutic paradigm.

Taken together, our results reinforce the trend that PRP, when combined with autologous graft materials, contributes to clinically meaningful hearing improvements, even if the statistical differences between treatment groups remain inconsistent across studies.