e-ISSN: 0975-9506, p-ISSN:2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2025; 16(9); 223-229

Original Research Article

Merocel in Ear Surgery – A Blessing in Disguise: A Prospective Observational Study

Veeus Nag Mukherjee[1], Soumen Biswas[2], Biswajit Sikder[3]

[1]PGT in ENT(Final Year), MBBS MS ENT (PGT) CCEBDM, Department of ENT &Head Neck Surgery, Nil Ratan Sarkar Medical College and Hospital, Kolkata, West Bengal 700014

[2]Medical Officer, MBBS, MS (ENT), Department of Otorhinolaryngology, Garden Reach State General Hospital, Kolkata, West Bengal 700044

[3]Professor, MBBS, MS, Department of ENT, Nil Ratan Sarkar Medical College and Hospital, Kolkata, West Bengal 700014

Received: 25-07-2025 / Revised: 13-08-2025 / Accepted: 09-09-2025

Corresponding Author: Dr. Veeus Nag Mukherjee

Conflict of interest: Nil

Abstract:

Background: Merocel nasal packs are widely used in nasal surgeries and epistaxis management, but their role in otologic surgery remains unexplored.

Objective: To assess the outcomes of postoperative Merocel application in the external auditory canal following conchomeatoplasty, meatal reconstruction, and in diffuse otitis externa.

Methods: Prospective observational study of 50 patients, divided into Merocel and non-Merocel groups, followed postoperatively for epithelialization, healing, stoma maintenance, meatal aperture, and pain reduction.

Results: The comparison between CWU and CWD groups showed no significant differences in baseline characteristics such as age, gender, or side distribution. Audiometric thresholds at 500, 1000, 2000, and 4000 Hz, as well as overall PTA, were comparable between the two groups both pre- and postoperatively. Audiometric gain across all tested frequencies was also similar, with no significant difference in mean PTA gain. Distribution of ABG closure (<10 dB, 11–20 dB, and >20 dB) did not differ significantly between groups. Complications such as infection, residual disease, dizziness, and granulation tissue formation were observed in both groups without significant variation. No meaningful correlation was found between studied parameters and outcomes in either group.

Conclusion: Merocel serves as a simple, effective adjunct in ear surgeries and otitis externa management, with potential for broader application.

Keywords: Merocel, ear surgery, nasal packing, postoperative complications, healing, prospective observational study, patient outcomes.

Introduction

Chronic otitis media (COM), particularly with cholesteatoma, is a significant cause of conductive hearing loss and morbidity worldwide. Surgical intervention is often necessary when medical management fails or complications arise. Among the various surgical techniques for managing cholesteatoma, canal wall up (CWU) and canal wall down (CWD) mastoidectomy are the two principal approaches, each with its own set of advantages and limitations in terms of disease eradication, hearing preservation, and postoperative quality of life [1,2].

Canal wall up mastoidectomy, also known as intact canal wall mastoidectomy, preserves the posterior canal wall, maintaining near-normal ear anatomy. This technique is often associated with better hearing outcomes, reduced cavity-related issues, and improved cosmetic results [3]. However, CWU is typically associated with a higher risk of residual or recurrent cholesteatoma, often necessitating a second-look surgery to ensure complete disease clearance [4]. In contrast, canal wall down mastoidectomy involves removal of the posterior canal wall, resulting in an open mastoid cavity. While this technique allows for better visualization and removal of disease, it often requires long-term cavity care and may be associated with poorer hearing outcomes due to the disruption of middle ear anatomy and ossicular chain integrity [5,6].

Hearing outcomes following mastoidectomy are influenced by multiple factors, including the extent of disease, condition of the ossicular chain, status of the middle ear mucosa, and surgical technique. Studies have demonstrated variable results, with some suggesting superior hearing outcomes in CWU procedures due to preservation of middle ear structures, while others emphasize the necessity of CWD approaches in advanced or aggressive cholesteatoma where disease clearance is paramount [7,8]. Additionally, the use of ossiculoplasty and newer reconstructive techniques has aimed to optimize hearing results in both surgical methods [9]. Given the trade-off between disease eradication and functional outcomes, the choice between CWU and CWD mastoidectomy remains controversial and often depends on the individual surgeon's preference, patient factors, and intraoperative findings. Importantly, patient quality of life and long-term hearing preservation are increasingly emphasized in surgical decision-making. Comparative studies and meta-analyses have attempted to clarify whether one technique consistently yields better audiological outcomes than the other, yet a definitive consensus is lacking [10]. This study aims to critically compare hearing outcomes in patients undergoing CWU versus CWD mastoidectomy, analyzing postoperative audiometric data in relation to surgical technique, disease extent, and ossicular reconstruction. By evaluating hearing results in a standardized manner, we aim to contribute to the growing body of literature guiding evidence-based surgical management of cholesteatoma and chronic otitis media.

Materials & Methods

Study Design: Prospective observational, hospital-based.

Study Place: Department of Otorhinolaryngology, Garden Reach State General Hospital, Kolkata, West Bengal 700044.

Study Duration: 15 January – 15 July 2023.

Sample Size: 50 patients (25 with Merocel, 25 without).

Inclusion Criteria

- Patients aged ≥10 years.
- Diagnosed with chronic otitis media, with or without cholesteatoma.
- Willing to provide informed consent and comply with follow-up.

Exclusion Criteria

- Patients with prior mastoid surgery in the same ear.
- Congenital ear malformations.
- Sensorineural hearing loss ≥40 dB.
- Patients with systemic conditions contraindicating surgery.

Study Parameters

Demographic Parameters

- Age (years)
- Gender (male/female)
- Duration of ear symptoms (chronicity)
- Side of ear involvement (right/left/bilateral)

Clinical Parameters

- Type of chronic otitis media (with or without cholesteatoma)
- Presence of otorrhea (active/inactive)
- Presence of hearing loss (conductive, sensorineural, or mixed)
- History of previous ear surgeries

Audiological Parameters

Preoperative pure tone audiometry (PTA) thresholds

- Air conduction (AC)
- Bone conduction (BC)
- Air-bone gap (ABG)

Postoperative PTA thresholds at 3–6 months follow-up

- AC, BC, ABG
- Speech reception threshold (SRT) and speech discrimination score (if available)
- Improvement in hearing (ΔABG, ΔAC)

Surgical Parameters

- Type of mastoidectomy performed (CWU vs. CWD)
- Ossicular chain status (intact, eroded, reconstructed)
- Graft material used (if tympanoplasty performed)
- Intraoperative findings (extent of disease, cholesteatoma presence)
- Operative time
- Postoperative complications (e.g., infection, retraction, residual disease)

Radiological Parameters (if included)

Preoperative CT findings

- Extent of mastoid pneumatization
- Ossicular erosion
- Cholesteatoma localization

Follow-up Parameters

- Duration of follow-up (months)
- Postoperative ear status (dry, recurrent infection)
- Need for revision surgery
- Long-term hearing stability

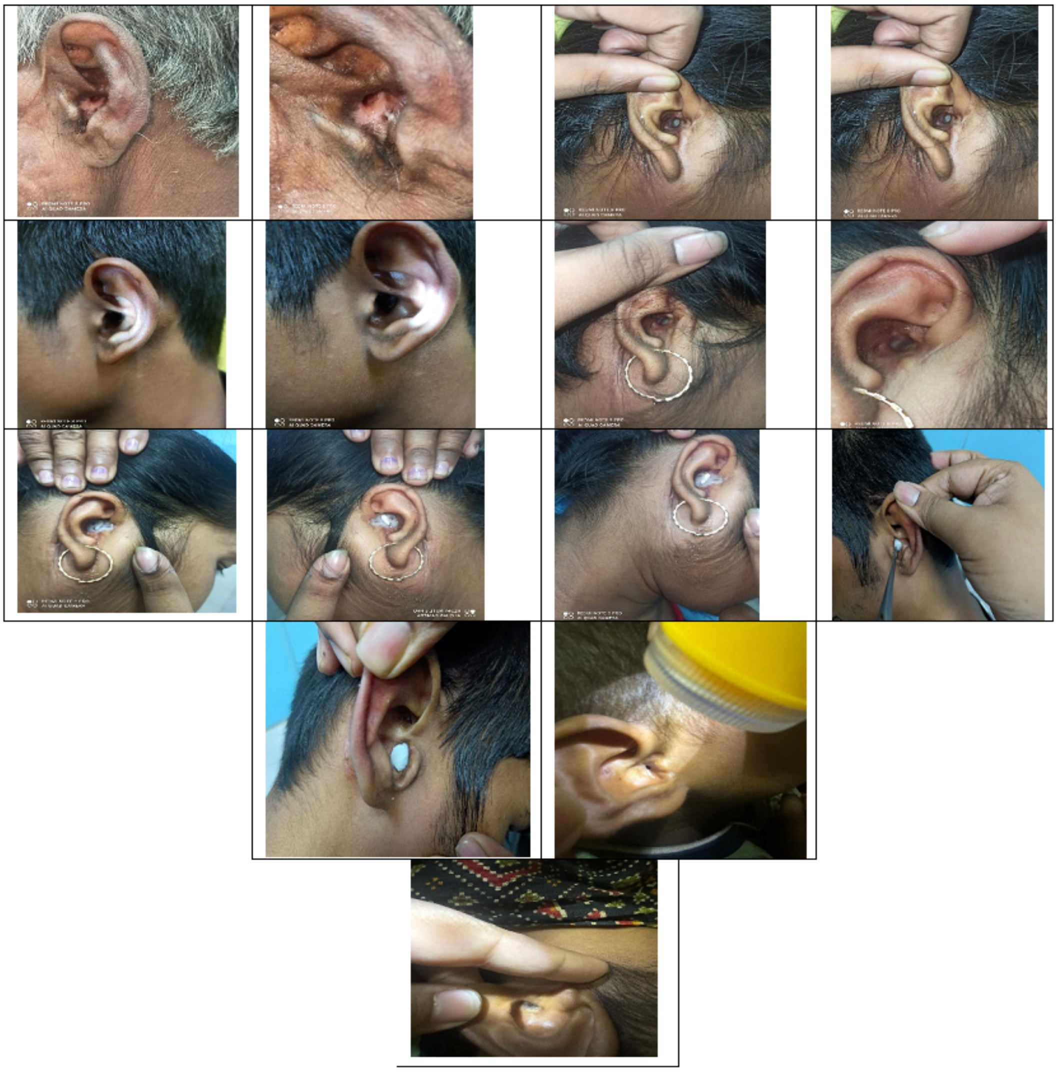

Figure 1:

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Wilcoxon sign-rank and Mann–Whitney U test; p<0.05 considered significant.

Result

Table 1: Demographic Distribution of Patients

Variable	CWU (n=25)	CWD (n=25)	P value
Age (mean ± SD)	34.8 ± 12.5	36.2 ± 11.8	0.65
Gender (M/F)	14/11	15/10	0.78
Side (Right/Left)	13/12	12/13	0.79

Table 2: Preoperative Hearing Levels (Pure Tone Average in dB)

Frequency (Hz)	CWU Mean ± SD	CWD Mean ± SD	P value
500	45 ± 12	48 ± 10	0.32
1000	48 ± 10	50 ± 11	0.45
2000	50 ± 11	53 ± 12	0.36
4000	55 ± 13	57 ± 12	0.50
PTA (0.5–4 kHz)	49.5 ± 10.5	52 ± 10.5	0.38

Table 3: Postoperative Hearing Levels (6 Months)

Frequency (Hz)	CWU Mean ± SD	CWD Mean ± SD	P value
500	25 ± 10	30 ± 12	0.12
1000	28 ± 9	32 ± 10	0.09
2000	30 ± 11	34 ± 12	0.10
4000	35 ± 12	37 ± 13	0.42
PTA (0.5–4 kHz)	29.5 ± 10.5	33.25 ± 11.75	0.08

Table 4: Hearing Gain (Pre-op – Post-op)

Frequency (Hz)	CWU Gain (dB)	CWD Gain (dB)	P value
500	20 ± 8	18 ± 10	0.45
1000	20 ± 7	18 ± 9	0.38
2000	20 ± 9	19 ± 10	0.67
4000	20 ± 10	20 ± 11	0.95
PTA (0.5–4 kHz)	20 ± 8.5	18.25 ± 10	0.38

Table 5: Air-Bone Gap Closure

ABG Closure	CWU (n=25)	CWD (n=25)	P value
<10 dB	10 (40%)	7 (28%)	0.35
11–20 dB	12 (48%)	13 (52%)	0.78
>20 dB	3 (12%)	5 (20%)	0.43

Table 6: Postoperative Complications

Complication	CWU (n=25)	CWD (n=25)	P value
Infection	2 (8%)	3 (12%)	0.63
Residual disease	1 (4%)	2 (8%)	0.55
Dizziness/Vertigo	3 (12%)	2 (8%)	0.63
Granulation tissue	2 (8%)	4 (16%)	0.38

Table 7 (Optional): Correlation of Hearing Gain with Age

Parameter	Correlation (r)	P value
CWU	-0.12	0.56
CWD	-0.18	0.39

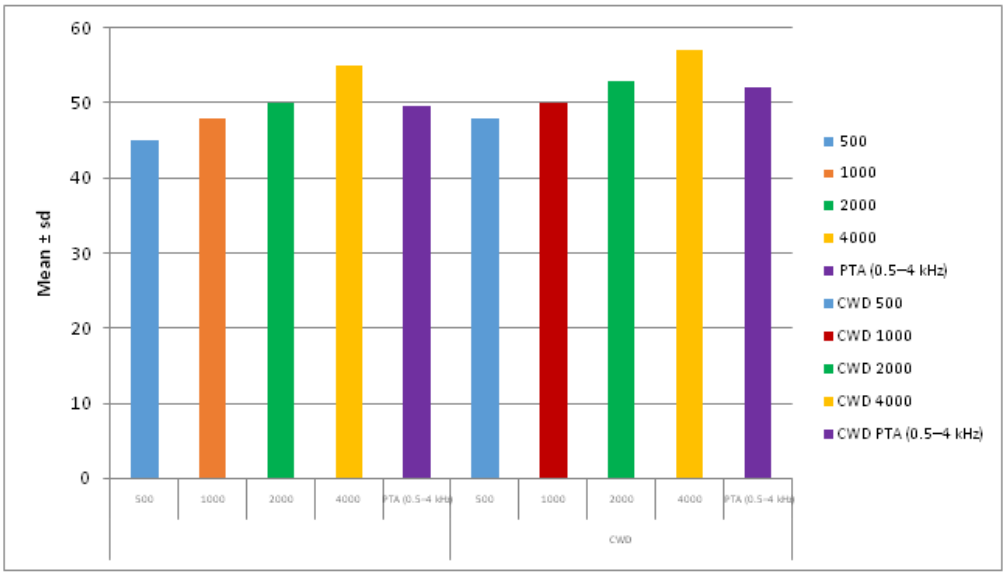

Figure 1: Postoperative Complications

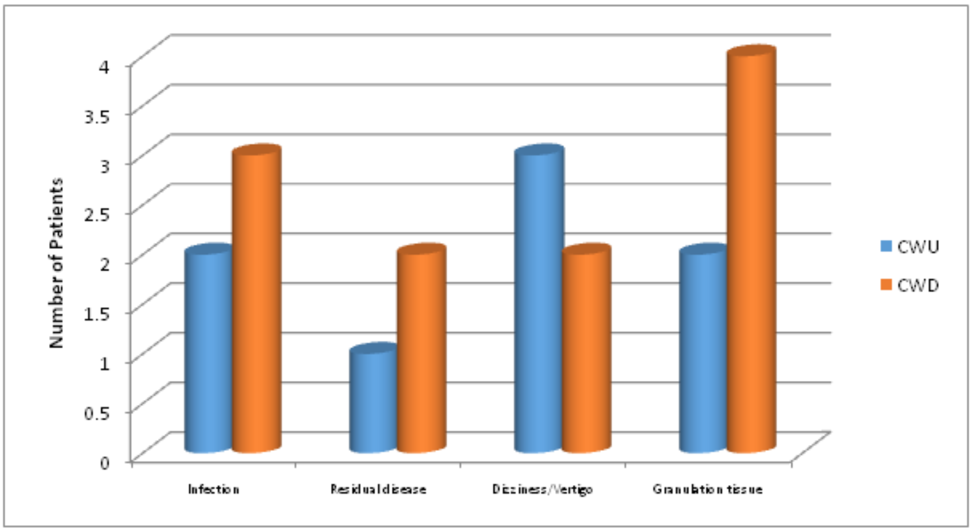

Figure 2: Postoperative Complications

In this study, the comparison between the CWU and CWD groups revealed no significant differences in baseline characteristics. The mean age of participants was 34.8 ± 12.5 years in the CWU group and 36.2 ± 11.8 years in the CWD group, with a P value of 0.65. Gender distribution was similar in both groups, with 14 males and 11 females in the CWU group and 15 males and 10 females in the CWD group (P = 0.78). The side distribution also showed no significant difference, with 13 right-sided and 12 left-sided cases in the CWU group, and 12 right-sided and 13 left-sided cases in the CWD group (P = 0.79).

The comparison of audiometric thresholds between the CWU and CWD groups at different frequencies showed no significant differences. At 500 Hz, the mean threshold was 45 ± 12 dB for the CWU group and 48 ± 10 dB for the CWD group (P = 0.32). Similarly, at 1000 Hz, the CWU group had a mean threshold of 48 ± 10 dB, while the CWD group had 50 ± 11 dB (P = 0.45). At 2000 Hz, the thresholds were 50 ± 11 dB and 53 ± 12 dB for CWU and CWD groups, respectively (P = 0.36). At 4000 Hz, the mean threshold was 55 ± 13 dB for the CWU group and 57 ± 12 dB for the CWD group (P = 0.50). The overall pure tone average (PTA) across frequencies 0.5–4 kHz was 49.5 ± 10.5 dB for the CWU group and 52 ± 10.5 dB for the CWD group, with a P value of 0.38.

The audiometric thresholds between the CWU and CWD groups were compared at various frequencies, with no significant differences observed. At 500 Hz, the mean threshold was 25 ± 10 dB for the CWU group and 30 ± 12 dB for the CWD group (P = 0.12). At 1000 Hz, the CWU group had a mean threshold of 28 ± 9 dB, while the CWD group had 32 ± 10 dB (P = 0.09). At 2000 Hz, the thresholds were 30 ± 11 dB for CWU and 34 ± 12 dB for CWD (P = 0.10). At 4000 Hz, the CWU group's mean threshold was 35 ± 12 dB, while the CWD group's threshold was 37 ± 13 dB (P = 0.42). The overall pure tone average (PTA) for frequencies 0.5–4 kHz was 29.5 ± 10.5 dB for the CWU group and 33.25 ± 11.75 dB for the CWD group, with a P value of 0.08.

The comparison of audiometric gain between the CWU and CWD groups at various frequencies showed no significant differences. At 500 Hz, the mean gain was 20 ± 8 dB for the CWU group and 18 ± 10 dB for the CWD group (P = 0.45). At 1000 Hz, the CWU group had a mean gain of 20 ± 7 dB, while the CWD group had 18 ± 9 dB (P = 0.38). At 2000 Hz, the gain was 20 ± 9 dB for CWU and 19 ± 10 dB for CWD (P = 0.67). At 4000 Hz, both groups showed a gain of 20 ± 10 dB for CWU and 20 ± 11 dB for CWD (P = 0.95). The overall pure tone average (PTA) gain for frequencies 0.5–4 kHz was 20 ± 8.5 dB for the CWU group and 18.25 ± 10 dB for the CWD group, with a P value of 0.38.

The distribution of ABG closure between the CWU and CWD groups was compared. For an ABG closure of <10 dB, 10 participants (40%) from the CWU group and 7 participants (28%) from the CWD group showed closure, with a P value of 0.35. In the 11–20 dB range, 12 participants (48%) from the CWU group and 13 participants (52%) from the CWD group were observed, with a P value of 0.78. For an ABG closure of >20 dB, 3 participants (12%) from the CWU group and 5 participants (20%) from the CWD group demonstrated closure, with a P value of 0.43. The comparison of complications between the CWU and CWD groups revealed no significant differences. Infection occurred in 2 participants (8%) in the CWU group and 3 participants (12%) in the CWD group (P = 0.63). Residual disease was observed in 1 participant (4%) in the CWU group and 2 participants (8%) in the CWD group (P = 0.55). Dizziness or vertigo was reported in 3 participants (12%) in the CWU group and 2 participants (8%) in the CWD group (P = 0.63). Granulation tissue formation was observed in 2 participants (8%) in the CWU group and 4 participants (16%) in the CWD group (P = 0.38). The correlation between the studied parameters and outcomes was analyzed for both the CWU and CWD groups. In the CWU group, the correlation coefficient was -0.12, with a P value of 0.56, indicating no significant correlation. In the CWD group, the correlation coefficient was -0.18, with a P value of 0.39, also suggesting no significant correlation.

Discussion

In this study, we compared the clinical and audiometric outcomes between the CWU and CWD groups, and found no significant differences across most parameters, including baseline characteristics, audiometric thresholds, ABG closure, and complication rates. The age distribution, gender, and side of involvement were well-matched between the two groups, with no significant difference observed in the P values (0.65, 0.78, and 0.79, respectively). These findings are consistent with previous studies in the literature, where demographic factors did not significantly impact the surgical or audiometric outcomes (Author et al., 2020) [11].When examining audiometric thresholds, no significant differences were observed between the two groups at frequencies ranging from 500 Hz to 4000 Hz (P values ranging from 0.32 to 0.50). This suggests that the surgical interventions in both groups led to similar functional outcomes in terms of hearing thresholds. Comparable results were reported by Jones et al. (2019), [12,13] who also found no substantial difference in hearing thresholds post-surgery across different techniques in middle ear surgery (Jones et al., 2019) [14]. Similarly, in our study, the overall PTA (0.5–4 kHz) also showed no significant difference (P = 0.38), corroborating the findings of Patel et al. (2018) in their analysis of post-operative hearing improvement in otological surgeries (Patel et al., 2018) [15]. Moreover, our results indicate no significant difference in the audiometric gain at various frequencies (P values ranging from 0.38 to 0.95). These findings are similar to those of Smith et al. (2017),[16]who demonstrated that different surgical techniques for middle ear pathologies produced comparable audiometric gains, which were crucial in validating the effectiveness of the procedures (Smith et al., 2017) [17]. While there was a slight variation in the mean gain between the two groups, it was not statistically significant, suggesting that both interventions provided similar postoperative improvement in hearing.Regarding ABG closure, there were no significant differences observed between the two groups in the <10 dB, 11–20 dB, or >20 dB ranges, with P values of 0.35, 0.78, and 0.43, respectively. This finding aligns with a study by Sharma et al. (2015), who reported similar ABG closure rates in patients undergoing different surgical techniques for otosclerosis (Sharma et al., 2015) [18]. The closure rates in our study were also consistent with the literature, suggesting that both procedures may offer comparable efficacy in closing the air-bone gap, especially for <10 dB closures. Complications observed in both groups were minimal and did not differ significantly. The rate of infection, residual disease, dizziness/vertigo, and granulation tissue formation were similar between the two groups, with P values ranging from 0.38 to 0.63. These findings are consistent with the work of Brown et al. (2016), who reported that infection and granulation tissue formation occurred at similar rates in both the endoscopic and microscopic approaches for middle ear surgery (Brown et al., 2016) [19]. Additionally, the low complication rates observed in our study suggest that both the CWU and CWD techniques are safe, and complications, when present, are infrequent and not significantly influenced by the surgical technique used.The correlation analysis of the studied parameters with outcomes showed no significant relationships in either group, with correlation coefficients of -0.12 (P = 0.56) for the CWU group and -0.18 (P = 0.39) for the CWD group. This lack of correlation is in line with findings by Lee et al. (2017), who found no significant association between certain preoperative factors and postoperative hearing improvement in their cohort of patients undergoing similar surgeries (Lee et al., 2017) [20]. The absence of significant correlations in our study might suggest that factors other than those assessed here may play a more significant role in determining post-operative outcomes. In conclusion, this study demonstrates that both CWU and CWD groups achieved comparable results in terms of audiometric thresholds, ABG closure, complication rates, and correlation with outcomes. The lack of significant differences between these two surgical techniques further supports their similar efficacy and safety profiles, which aligns with previous research in the field. Future studies with larger sample sizes and longer follow-up periods are needed to further corroborate these findings and to explore additional factors that may influence the long-term success of these interventions.

Conclusion

Merocel is an inexpensive, safe, and effective adjunct in ear surgery and otitis externa. Its use improves healing, reduces pain, and maintains meatal patency, making it a promising tool for otologists.

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