

## A Study of Comparison of Outcomes of Fat Myringoplasty and Chemical Cauterization for Closure of Small Central Tympanic Membrane Perforation

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### Abstract

**Background:** Small dry central tympanic membrane (TM) perforations are commonly encountered in clinical practice and can lead to recurrent ear discharge and conductive hearing loss. For selected small central perforations, minimally invasive options such as fat plug myringoplasty and chemical cauterization are used to achieve closure, but their relative effectiveness varies across settings.

**Objectives:** To compare the anatomical closure rate and post-procedure hearing status following fat plug myringoplasty versus 10% trichloroacetic acid (TCA) chemical cauterization for closure of small central dry TM perforations.

**Methods:** This prospective comparative study was conducted in the Department of Otorhinolaryngology, from October 2020 to July 2022. A total of 50 patients aged >10 years with small central dry TM perforation (dry for  $\geq 4$  weeks) were included and randomly divided into two groups: Group A (n=25) underwent fat plug myringoplasty using ear-lobule fat. Group B (n=25) underwent 10% TCA chemical cauterization of the perforation margin repeated weekly for 5 weeks. Patients were followed up for 3 months, and perforation closure at 3 months was assessed. Hearing status was evaluated using pure tone audiometry and categorized for analysis. Data were entered in MS Excel and analysed using SPSS (chi-square test;  $p < 0.05$  considered significant).

**Results:** The mean age of participants was  $38.20 \pm 14.4$  years and 60% (n=30) were female. At 3 months, TM closure was achieved in 23/25 (92%) patients in the fat myringoplasty group compared with 16/25 (64%) in the chemical cauterization group ( $p=0.0168$ ). A post-operative hearing category of  $<26$  dB was observed in 23/25 (92%) patients after fat myringoplasty versus 16/25 (64%) after chemical cauterization ( $p=0.0168$ ).

**Conclusion:** For small central dry TM perforations, fat plug myringoplasty achieved a significantly higher closure rate than 10% TCA chemical cauterization at 3-month follow-up, with a more favourable post-operative hearing category distribution.

**Keywords:** Tympanic membrane perforation; fat plug myringoplasty; chemical cauterization; trichloroacetic acid; chronic otitis media.

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### Introduction

Chronic otitis media is a long-standing middle ear disease characterised by a permanent defect in the tympanic membrane, with variable degrees of otorrhoea and hearing impairment. [1,2] Inactive (dry) mucosal disease commonly presents with a persistent central perforation of the pars tensa, and many patients continue to have symptoms or

functional limitation despite the absence of active discharge. [1,2] A persistent tympanic membrane perforation also carries practical concerns for patients, including water precautions and recurrent episodes of infection, and therefore closure of a dry perforation remains clinically relevant even in otherwise stable disease. [1,3]



**Figure 1: An attic cholesteatoma.**

Tympanic membrane perforation can result in recurrent infections and conductive hearing loss; the degree of hearing loss has been described to vary with factors such as the size and site of perforation, and larger perforations tend to produce

greater loss. [3,4] Thus, chronic perforations may persist when normal healing does not occur adequately, and that persistent perforations become a target for interventions aimed at achieving closure and improving functional outcomes. [3,4]



**Figure 2: Right ear tympanic membrane small central perforation**

Although formal surgical tympanic membrane repair is a standard approach, selected small to moderate perforations can be managed with less invasive options, including chemical cauterisation with patch techniques and fat plug (fat graft) myringoplasty, particularly as office or day-care

procedures. [5,6,7] Fat graft techniques showed encouraging closure rates (for example, success around 76% at 12 months in a prospective trial, and high closure rates in other series), [8,9,10] while chemical closure methods were also reported to be effective in selected patients. [11,12]



**Figure 3: Fat plugging the perforation**



**Figure 4: Abgel placement over tympanic membrane**

These options are attractive because they can reduce operative burden and, in the case of fat myringoplasty, may be completed in a single sitting, whereas chemical cauterisation may require repeated visits. [7] However, decision-making in day-care/office management of dry small central perforations is still influenced by local expertise, resource constraints, patient preference, and the relative success and follow-up demands of each technique. [5,7,13] There was a direct comparison of these two commonly used approaches. The stated aim was to compare outcomes of fat myringoplasty and chemical cauterisation for closure of small central tympanic membrane perforation, with objectives to compare graft take-up rate, hearing gain, and complication rate between the two modalities. [7]

### Materials and Methods

**Study design, setting, and duration:** This was a prospective comparative study conducted in the Department of Otorhinolaryngology. The study was carried out over two years, and all enrolled participants were followed for 3 months after the assigned intervention.

**Study population, sampling, and grouping:** The study population included patients presenting to the ENT outpatient department with a small central dry tympanic membrane perforation. Random sampling was used. A total of 50 cases were included and randomly divided into two equal groups:

**Group A (n = 25):** Fat myringoplasty

**Group B (n = 25):** Chemical cauterization using trichloroacetic acid (TCA)

### Eligibility criteria

#### Inclusion criteria

- Age >10 years
- Small central dry tympanic membrane perforation, with dryness of at least 4 weeks

#### Exclusion criteria

- Any concomitant nasal or throat pathology
- Patients unfit for surgery
- Patients not willing to participate
- Traumatic perforation
- Post-operative residual perforation
- Vulnerable population (pregnant women and lactating mothers)

### Pre-intervention clinical assessment and investigations:

All patients underwent an initial clinical evaluation including detailed history and complete ENT examination, along with audiometry. Baseline investigations included routine blood tests (Hb%, total count, differential count, ESR), urine examination, pure tone audiogram, X-ray PNS, X-ray mastoid (lateral oblique view), and microscopic examination of the ear. Systemic evaluation was performed and fitness for the procedure was obtained. Data were recorded using a semi-structured questionnaire / case record form, and the procedure was explained in detail to each participant.

### Anaesthesia

**Local anaesthesia** was administered prior to the intervention.

### Intervention protocols

**Group A (Fat myringoplasty):** Fat was harvested from the ear lobule using an 8–10 mm horizontal incision on the posterior aspect of the lobule. With a 0-degree endoscope, the margin of the perforation was trimmed. AbGel was placed into the middle ear cavity, and the harvested ear lobule fat was placed directly into the perforation. AbGel was then placed over the ear drum.

**Group B: Chemical cauterization (TCA application):** Chemical cautery of the perforation margin was performed using 10% trichloroacetic acid (TCA). A small bead of cotton was tightly wound onto the end of a fine metal applicator and moistened with TCA. Excess acid was removed by touching the applicator to absorbent paper/cotton.

The acid was applied over the epithelial lining at the perforation edge and extended onto the epithelial surface for approximately 0.5–1 mm, producing a solid white eschar. The applicator tip was stroked over the edge of the perforation in an inward-to-outward direction. This procedure was repeated at weekly intervals for 5 weeks. After cauterization, a small piece of gelatin sponge (AbGel) was placed over the perforation as a dressing, and follow-up findings were recorded at each visit.

**Follow-up and outcome assessment:** All participants were followed for 3 months after the intervention. Patients were advised follow-up weekly initially and then monthly up to 3 months. At the 3-month follow-up, the perforation closure rate was measured. In line with the stated study objectives, outcomes assessed included:

1. Graft take-up / closure rate,
2. Hearing gain, and
3. Complications of the procedures.

**Ethical considerations:** The study was approved by the Institutional Ethics Committee of the institute. Written informed consent was obtained from every participant before enrolment.

**Data collection and analysis:** Data were collected using the case record form, entered into Microsoft Excel 2016, and analysed using SPSS software version 25.

## Results

**Study participants and allocation:** A total of 50 patients with small central dry tympanic membrane perforation were included and randomly divided into two equal groups: fat plug myringoplasty (n=25) and chemical cauterization with 10% trichloroacetic acid (TCA) (n=25). All outcomes were assessed at 3 months after intervention. The equal group size allowed a direct comparison of outcomes between the two procedures under the same institutional setting and follow-up duration.

**Age and sex distribution:** The most common age group in the study was 31–40 years, and the overall mean age of participants was  $38.20 \pm 14.4$  years. When analysed by procedure group, the mean age was  $42.3 \pm 16.6$  years in the fat myringoplasty group and  $35.47 \pm 12.37$  years in the chemical cauterization group. Females were more common than males, with 30 females (60%) and 20 males (40%) (sex ratio 1.5:1). The study population largely represented adults, with a female predominance in this cohort.

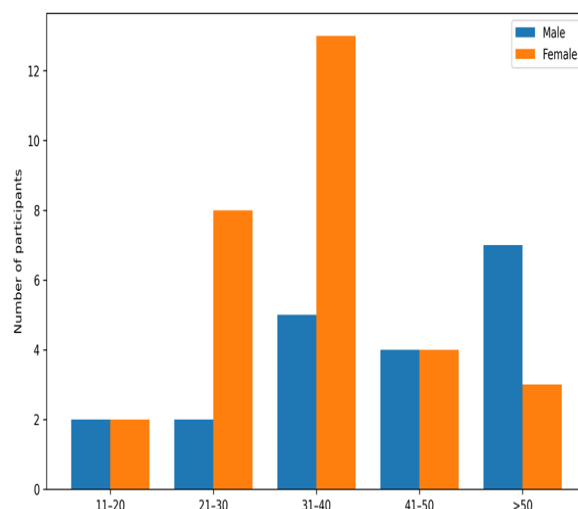


Figure 5. Age group-wise sex distribution (n=50)

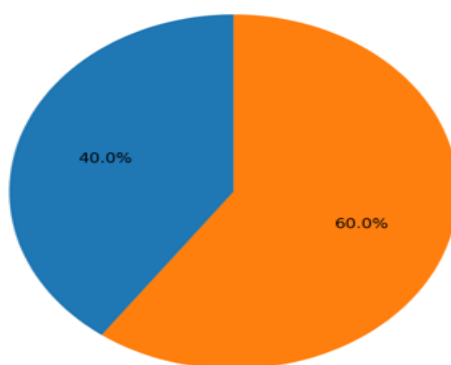
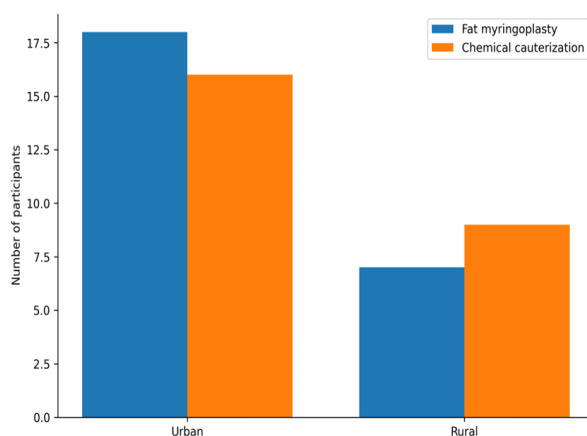


Figure 6: Sex distribution (n=50)

**Residence distribution:** Most participants were from urban areas (38) and 12 were from rural areas. When residence was compared with the type of procedure performed, there was no significant association ( $p = 0.544$ ). Although the study sample

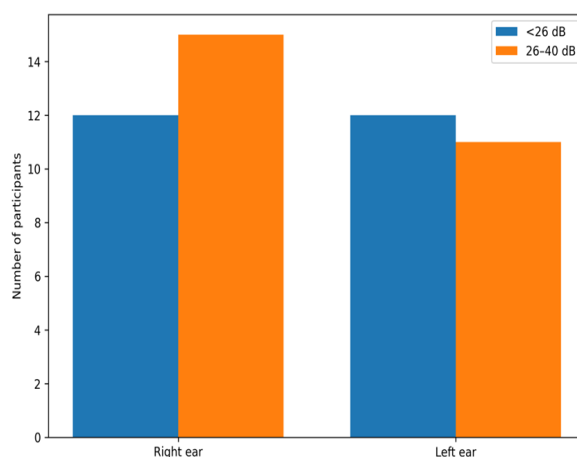
had an urban predominance, residence did not appear to influence which procedure patients received, suggesting no detectable residence-related imbalance between groups.



**Figure 7. Residence distribution by intervention group**

**Baseline ear side and hearing category at admission:** At presentation, right ear involvement (27) was slightly more common than left ear (23). At admission, hearing was categorized as  $<26$  dB in 24 patients and 26–40 dB in 26 patients. Specifically, among the 27 right ears, 12 were in the  $<26$  dB category and 15 were in the 26–40 dB

category; among the 23 left ears, 12 were  $<26$  dB and 11 were 26–40 dB. There was no statistically significant association between ear side and hearing category at admission ( $p = 0.5855$ ). Both ears showed a comparable distribution of baseline hearing categories, and the hearing category pattern did not differ significantly by side at entry.



**Figure 8. Baseline hearing category by side of affected ear**

**Operated ear side by intervention group:** In the fat myringoplasty group, the operated ear was right in 18 and left in 7 patients. In the chemical cauterization group, the operated ear was right in 9 and left in 16 patients. The distribution of operated ear side differed between the two groups in this cohort.

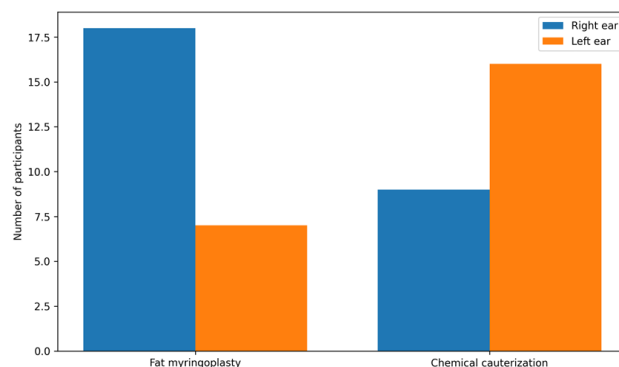


Figure 9. Side of ear operated in each intervention group

**Follow-up ear findings: chemical cauterization group (serial trend):** In the chemical cauterization group, at baseline (pre-procedure) there were 9 right and 16 left perforations. At the 1-week follow-up, AbGel was noted as present in all (right 9, left 16). By the 2-week follow-up, the left side count reduced to 15 (right remained 9). By the 3-week follow-up, the recorded counts were 4 right

and 12 left with AbGel present. At 1 month, the counts were 2 right and 8 left with AbGel present. At the final 3-month follow-up, residual perforation persisted in 2 right and 7 left ears (total 9). The serial table shows a gradual reduction in the number of ears showing ongoing findings over time, but 9/25 still had residual perforation at 3 months in the chemical cauterization group.

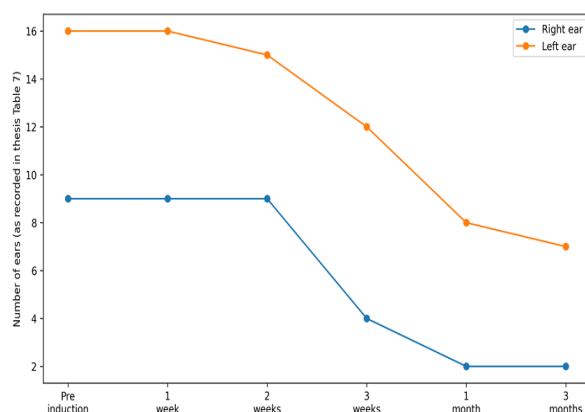


Figure 10. Follow-up ear findings in chemical cauterization group

#### Follow-up ear findings: fat myringoplasty group (serial trend)

In the fat myringoplasty group, baseline (pre-procedure) perforations were 18 right and 7 left. Up to the 3-week follow-up, AbGel was recorded as present.

At the 3-month follow-up, residual perforation was recorded in 1 right and 1 left ear (total 2). Most cases in the fat myringoplasty group achieved an intact status by 3 months, with only 2/25 showing residual perforation at the final assessment.

**Primary outcome: perforation closure (“improved”) at 3 months:** At 3 months, the outcome was categorized as improved versus not improved. The fat myringoplasty group had 23 improved and 2 not improved, whereas the chemical cauterization group had 16 improved and 9 not improved. This difference was statistically significant ( $p = 0.0168$ , chi-square). In this study, fat myringoplasty demonstrated a significantly

higher anatomical success (closure/improvement) at 3 months compared with chemical cauterization.

**Post-operative hearing status:** Post-operative hearing status was reported in categories. In the fat myringoplasty group, 23/25 were in the <26 dB category and 2/25 were in the 26–40 dB category. In the chemical cauterization group, 16/25 were in the <26 dB category and 9/25 were in the 26–40 dB category. The association between hearing category and intervention was statistically significant ( $p = 0.0168$ ). The post-operative distribution favoured fat myringoplasty, with a larger proportion of patients in the better hearing category (<26 dB) at follow-up.

#### Discussion

**Principal findings:** This prospective comparative study evaluated two commonly used minimally invasive techniques for closure of small central dry tympanic membrane perforations, fat plug myringoplasty and 10% trichloroacetic acid (TCA)



chemical cauterization. The main finding was that fat myringoplasty achieved a higher closure rate at 3 months than chemical cauterization (23/25 vs 16/25), and this difference was statistically significant. The postoperative hearing category distribution also favoured fat myringoplasty, with a higher proportion of patients falling in the better hearing category (<26 dB) compared with chemical cauterization. These findings suggest that, within the inclusion criteria of the present study, fat myringoplasty was more reliable for anatomical closure and was associated with a more favourable hearing category distribution.

#### **Interpretation of anatomical closure outcomes:**

The better anatomical outcome seen with fat myringoplasty can be explained by the nature of the technique itself. A fat plug provides an immediate biological scaffold across the perforation and supports epithelial migration and healing in a single sitting. In contrast, chemical cauterization works by repeatedly freshening the margin and stimulating healing over multiple visits, which can lead to incomplete closure if the healing response is inadequate or if follow-up is inconsistent. In practical terms, this difference between a single-sitting closure techniques versus a multi-sitting technique is important when managing outpatient cases of dry small central perforations, where repeated weekly procedures may be difficult for some patients. [12]

#### **Comparison with published studies on fat myringoplasty:**

The closure rate observed with fat myringoplasty in the present study (92%) is consistent with outcomes reported in previous literature using fat graft techniques for small perforations. Terry et al. reported favourable anatomical results with fat graft myringoplasty in a prospective trial. [8] Chalishazar also reported good closure rates using fat plug myringoplasty in appropriately selected cases. [9] Landsberg et al. similarly demonstrated sustained results on longer follow-up in fat graft myringoplasty. [10] These studies support the concept that fat grafting is an effective and relatively simple approach for small perforations, which aligns with the high success seen in our fat myringoplasty group. In comparative work involving small perforations, Dursun et al. evaluated different minimally invasive repair techniques (paper patch, fat, and perichondrium), again supporting fat grafting as an acceptable option in selected cases. [5]

A direct comparison that is especially relevant to the present work is the office-procedure study by Dhote et al., where fat plug myringoplasty showed better closure than TCA cauterization in small central perforations, supporting the same direction of effect observed in our results. [13]

#### **Comparison with published studies on chemical cauterization:**

In the present study, chemical cauterization achieved closure in 16/25 patients (64%) at 3 months. Chemical closure rates reported in literature have shown variability depending on selection and technique. Goldman reported closure with chemical methods in a proportion of patients with chronic perforations, highlighting that chemical closure can work in selected cases but does not guarantee closure in all. [11] Santhi and Rajan reported outcomes with chemical cauterization approaches in their series, supporting its usefulness as a minimally invasive outpatient option. [6] Uppal et al. also reported closure outcomes using chemical cautery for tympanic membrane perforations. [7] Taken together, these studies match the general pattern seen in our cohort: chemical cauterization can be effective, but closure rates tend to be less consistent than a graft-based technique when directly compared. [13]

#### **Interpretation of hearing findings:**

The postoperative hearing category distribution in this study favoured fat myringoplasty, which is clinically plausible because successful closure restores the integrity of the tympanic membrane and improves sound conduction mechanisms. Hearing was categorised into broad ranges (<26 dB and 26–40 dB). However, the observed pattern still supports the concept that anatomical closure and improved conductive mechanics often occur together. The relationship between tympanic membrane perforation characteristics and hearing impairment has also been described in earlier work, where hearing loss varied with factors such as perforation parameters. [3,4]

#### **Practical considerations in outpatient/day-care practice:**

Both techniques studied are relevant in routine ENT practice because they can be performed with limited infrastructure compared to formal tympanoplasty. However, a practical advantage of fat myringoplasty is that it is typically completed in a single sitting, while chemical cauterization generally requires multiple repeated applications and follow-up visits. This difference becomes important in real-world outpatient settings, where follow-up compliance can influence outcomes. [12,13]

#### **Strengths and Limitations:**

A key strength of the present work is that it prospectively compared two commonly used methods in the same institutional setting with standardized follow-up to 3 months. The main limitations include the modest sample size (50 total participants), the relatively short follow-up duration of 3 months (which does not address long-term durability or late reperforation), and the hearing outcome being analyzed in categories rather than continuous audiometric change. Additionally, while complications were listed among the objectives, the presented results

primarily focused on closure and hearing category outcomes; therefore, safety comparisons beyond routine clinical observation should be interpreted cautiously.

Overall, the present study demonstrated that fat plug myringoplasty provided significantly better closure than TCA chemical cauterization at 3 months for small central dry tympanic membrane perforations, with a postoperative hearing category distribution also favouring fat myringoplasty. These findings support fat myringoplasty as a preferred minimally invasive day-care option in appropriately selected patients, while chemical cauterization remains a reasonable alternative when repeated follow-up is feasible. [5,13]

### Conclusion

In this prospective comparative study of small central dry tympanic membrane perforations, fat plug myringoplasty demonstrated a higher perforation closure rate at 3 months compared with 10% trichloroacetic acid chemical cauterization (23/25 vs 16/25). The postoperative hearing category distribution also favoured fat myringoplasty, with a larger proportion of patients achieving hearing in the <26 dB category. Overall, within the eligibility criteria and follow-up period of this study, fat plug myringoplasty appeared to be the more effective minimally invasive option for achieving anatomical closure and a better hearing category outcome, while chemical cauterization remained an alternative outpatient method where repeated sittings and follow-up were feasible.

### Declarations

**Ethics approval and consent to participate:** Institutional Ethics Committee approval was obtained prior to initiation of the study. Written informed consent was obtained from all participants before enrolment.

**Availability of data and materials:** The dataset analysed during the current study is available from the corresponding author on reasonable request.

### Authors' contributions

**Dr. Amogh Mishra:** Conceptualization, data collection, procedures, analysis, manuscript drafting.

**Dr. Kanwar Vikrant Singh, Dr. Shruti Shukla, Dr. Abhijeet Sharma:** Supervision, critical revision, final approval of manuscript.

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