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Clinical and Audiological Outcomes of Ossiculoplasty in Chronic Otitis Media: A Prospective Study

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ABSTRACT

Background: Chronic Otitis Media (COM) is a long-standing inflammatory disorder of the middle ear and remains a leading cause of hearing loss, particularly in developing regions. Destruction of the ossicular chain most commonly involving the incus impairs the normal transmission of sound. Ossiculoplasty is performed to restore this mechanism by reconstructing the ossicular chain using either autologous graft materials or synthetic prostheses such as PORP and TORP.

Methods: This prospective interventional study included 50 patients with COM conducted at the Department of ENT, PMCH Udaipur, from May 2024 to November 2025. Patients aged 15–70 years with air–bone gap (ABG) >25 dB were included. Ossiculoplasty was performed using tragal or conchal cartilage, PORP, or TORP. Hearing outcomes were assessed using pure tone audiometry. ABG gain was evaluated after 3 months and graft uptake was also analyzed.

Results: Most patients were aged 21–30 years (28%) with male predominance (56%). Incus erosion was most common (90%). Tragal cartilage (32%) and PORP (28%) were frequently used. Mean ABG improved significantly from 33.5±6.8 dB to 14.2±6.0 dB p<0.001), with a mean gain of 19.3 dB. TORP showed maximum gain (23.8 dB). Graft uptake was 92%, with minimal complications.

Conclusion: Ossiculoplasty is a safe and effective procedure for hearing restoration in COM, with high success rates and low complications. Appropriate graft selection improves surgical outcomes.

Key-words: Chronic Otitis Media, Cartilage Graft.Ossiculoplasty, PORP, TORP

INTRODUCTION

Chronic Otitis Media (COM) is a chronic inflammatory disorder of the middle ear cleft and remains a major cause of preventable hearing loss, particularly in developing countries. It is commonly associated with recurrent or persistent infections, leading to irreversible damage to the tympanic membrane and ossicular chain, thereby impairing sound conduction [1].

Conductive hearing loss is a frequent sequela, reported in up to 62–80% of cases, largely due to ossicular discontinuity [2]. Ossicular erosion occurs as a result of chronic inflammation and enzymatic bone resorption, especially in the presence of Cholesteatoma. The long process of the incus is most commonly affected, followed by other ossicles due to their anatomical vulnerability [3]. Restoration of hearing in such cases requires surgical intervention. The primary goal of surgery in COM is the eradication of disease and the reconstruction of the sound-conducting mechanism. Ossiculoplasty involves re-establishing continuity between the tympanic membrane and the oval window using suitable graft materials [4,5].

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Various materials have been employed, including autologous grafts and alloplastic prostheses such as Partial Ossicular Replacement Prosthesis (PORP) and Total Ossicular Replacement Prosthesis (TORP) [5]. Autologous cartilage, particularly tragal and conchal cartilage, is widely used due to its excellent biocompatibility, low extrusion rates, and resistance to resorption [6,7]. Despite multiple options, the ideal reconstructive material remains controversial. This study aims to evaluate and compare hearing outcomes using autologous cartilage grafts and prosthetic materials in patients with COM.

MATERIALS AND METHODS

Study Design and Setting- This prospective interventional study was conducted in the Department of ENT at Pacific Medical College and Hospital, Udaipur, from May 2024 to November 2025, after obtaining Institutional Ethics Committee approval.

Study Population and Sampling- A total of 50 patients diagnosed with Chronic Otitis Media (COM) were included using convenient sampling.

Inclusion Criteria

- Patients aged 15–70 years
- Diagnosed cases of COM
- Air–bone gap (ABG) >25 dB

Exclusion Criteria

- Patients below 15 years or above 70 years
- Patients with sensorineural hearing loss
- Conductive hearing loss due to causes other than COM

Preoperative Evaluation- All patients underwent:

- Detailed clinical history and ENT examination
- Audiological assessment using pure tone audiometry (PTA) to determine baseline hearing and ABG
- Radiological evaluation with high-resolution computed tomography (HRCT) of the temporal bone to assess middle ear pathology and ossicular status
- Routine preoperative investigations and pre-anaesthetic evaluation

Surgical Procedure- All patients underwent ossiculoplasty under general anaesthesia or local anaesthesia with sedation, depending on the need for additional procedures. Surgery was performed via transcanal or postauricular approach.

A tympanomeatal flap was elevated to expose the middle ear and ossicular chain. Intraoperative assessment included ossicular status and stapes footplate mobility. Ossiculoplasty was performed either alone or in combination with tympanomastoidectomy, depending on the extent of the disease.

Reconstruction Technique- Reconstruction was performed using:

- Autologous grafts (ossicles or cartilage such as tragal or conchal cartilage)
- Alloplastic prostheses, including Partial Ossicular Replacement Prosthesis (PORP) and Total Ossicular Replacement Prosthesis (TORP) (Fig. 1).

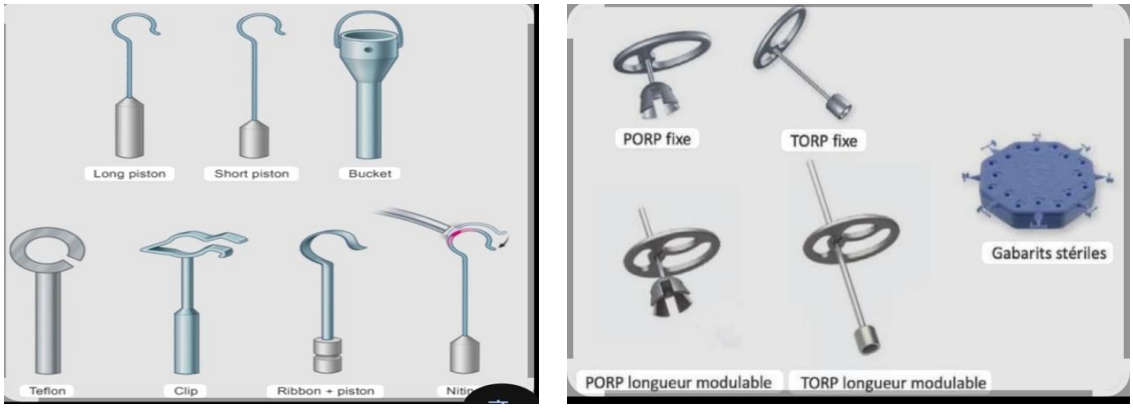

Fig. 1: Different Types of Prosthesis

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PORP was used when the stapes suprastructure was intact, whereas TORP was used when only a mobile footplate was present. Cartilage grafts were placed acapsap oshieldsld over prostheses to prevent extrusion. The prosthesis was trimmed and positioned to maintain continuity between the tympanic membrane and stapes/footplate, ensuring stability and optimal alignment. A gelatin sponge soaked in an antibiotic solution was used for support, and the tympanomeatal flap was repositioned.

Postoperative Care and Follow-Up- A mastoid dressing was applied for 24–48 hours. Patients were advised of precautions for dry ear and were followed up regularly. Final assessment was performed at 3 months postoperatively.

Outcome Measures

- **Intraoperative findings:** Ossicular status and type of reconstruction
- **Postoperative outcomes:** ABG gain and graft uptake

Statistical Analysis- Data were analysed using IBM SPSS version 26. Preoperative and postoperative ABG values were compared using a paired t-test. A p-value <0.05 was considered statistically significant.

Ethics and Consent- Ethical approval was obtained from the institutional ethics committee, and informed consent was taken from all patients.

RESULTS

This study evaluated 50 patients with Chronic Otitis Media undergoing ossiculoplasty, analyzing clinical profile, intraoperative findings, reconstruction techniques, and outcomes. The majority of patients were in the 21–30-year age group (28%), followed by the 31–40-year age group (24%). Patients aged 41–50 and 11–20 years accounted for 18% and 16%, respectively, while older age groups (51–70 years) constituted 14%. There was a slight male predominance (56%) compared to females (44%). All patients presented with ear discharge and hearing loss, while tinnitus was reported in 16% of cases. Central tympanic membrane perforation was most common (60%), followed by attic (16%), and marginal and subtotal perforations (12% each). Bilateral disease was observed in 38% of patients, with left-sided involvement (34%) slightly higher than right-sided (28%) (Table 1).

Table 1: Comparison of Different Graft/Prosthesis Materials Based on Hearing Outcomes and Surgical Success

Graft / Prosthesis Type	Number (n)	Percentage(%)	Mean ABG Gain (dB)	Graft Uptake (n)	Failure (n)
Tragal Cartilage	16	32	16.6	16	0
Conchal Cartilage	10	20	15.9	9	1
PORP	14	28	20.1	13	1
TORP	10	20	23.8	8	2
Total	50	100		46	4

Ossicular erosion was noted in all cases, with incus involvement in 90%, malleus erosion in 28%, and absence of stapes suprastructure in 20%. Mastoid sclerosis was present in 60% of cases, while Cholesteatoma was seen in 8%. Tragal cartilage was the most commonly used graft material (32%), followed by Partial Ossicular Replacement Prosthesis (PORP) (28%), while conchal cartilage and Total Ossicular Replacement Prosthesis (TORP) were used in 20% each. The mean preoperative air–bone gap (ABG) of 33.5 ± 6.8 dB improved significantly to 14.2±6.0 dB postoperatively, with a mean gain of 19.3 dB (p<0.001). Among reconstruction materials, TORP showed the highest mean gain (23.8 dB), followed by PORP (20.1 dB), conchal cartilage (16.6 dB), and tragal cartilage (15.9 dB) (Table 2, Fig. 1).

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Table 2: Comparison of Preoperative and Postoperative Air–Bone Gap (ABG)

Parameter	Pre-op ABG (Mean ± SD)	Post-op ABG (Mean ± SD)	Mean Gain
Overall	33.5 ± 6.8	14.2 ± 6.0	19.3 dB

p<0.001

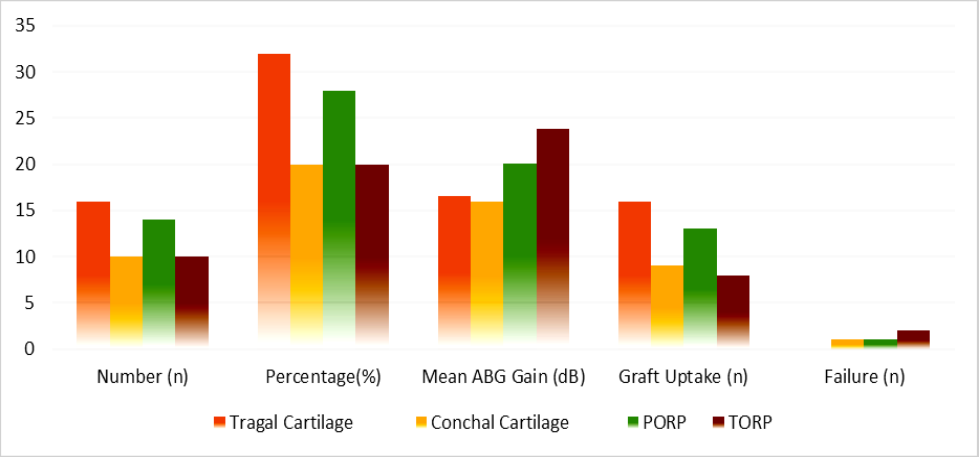

Fig. 1: Different types of prosthesis and their outcome

DISCUSSION

The present study evaluated the clinical profile, intraoperative findings, reconstruction techniques, and hearing outcomes following ossiculoplasty in patients with Chronic Otitis Media (COM). The findings highlight important demographic trends, disease characteristics, and surgical outcomes, and show a strong correlation with the existing literature. The majority of patients were in the 21–30 years age group (28%), followed by the 31–40 years age group (24%), indicating that ossiculoplasty is most commonly performed in young and middle-aged adults. A similar age distribution has been reported by Pandey et al. and Sharma et al., in which the maximum cases were observed in the second and third decades [8,9]. Lakshmipathiraju *et al.* also reported that nearly half of the patients were aged 20-35 years [10]. This trend may be explained by the progressive nature of COM, where chronic infection leads to ossicular damage over time, necessitating surgical intervention. Younger individuals are more likely to seek treatment due to functional impairment, whereas elderly patients may have lower surgical acceptance.

A slight male predominance (56%) was observed compared with females (44%), consistent with findings by Pandey *et al.,* Sharma *et al*., and Lakshmipathiraju *et al*. [8–10]. This may be attributed to greater exposure of males to environmental and occupational risk factors, although the difference is not significant, suggesting that COM affects both genders almost equally. All patients presented with ear discharge and hearing loss (100%), reaffirming these as the hallmark symptoms of COM. Tinnitus was present in 16% of cases, indicating possible cochlear involvement in long-standing disease. Similar clinical presentations have been consistently reported in previous studies [8–10].

Central perforation was the most common type observed (60%), followed by attic (16%), marginal (12%), and subtotal perforations (12%). This pattern is consistent with earlier studies showing that central perforations predominated [8–10], suggesting that mucosal COM is more common than squamosal disease in patients undergoing ossiculoplasty. Although cholesteatoma was present in only 8% of cases, it remains clinically important due to its destructive potential.

Bilateral disease was seen in 38% of patients, followed by left-sided (34%) and right-sided involvement (28%). These findings are comparable to those of Kelkar *et al*., who also reported a higher proportion of bilateral cases [11]. However, other studies, like those by van den Bogaard *et al.* have shown predoa Bilateral involvement can result in greater hearing disability and may influence overall outcomes.

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Radiological evaluation with HRCT revealed ossicular erosion in all cases (100%) and mastoid sclerosis in 60%, while cholesteatoma was seen in 8%. These findings are consistent with the literature, which reports that ossicular erosion and mastoid sclerosis are common in chronic ear disease [11,12]. The relatively low incidence of cholesteatoma is also comparable to findings by Yung *et al.* [13]. HRCT plays an essential role in preoperative planning and correlates well with intraoperative findings.

Intraoperatively, the incus was the most commonly eroded ossicle (90%), followed by the malleus (28%), while the absence of the stapes suprastructure was noted in 20%. This pattern is well documented, as the long process of the incus is particularly vulnerable to necrosis due to poor blood supply. Similar observations have been reported by Lahlou et al. and O'Connell *et al.* [14,15]. Ossicular status plays a key role in determining the type of reconstruction and final hearing outcome.

Regarding reconstruction, tragal cartilage was the most commonly used graft material (32%), followed by PORP (28%), while conchal cartilage and TORP were used in 20% each. The preference for autologous cartilage may be due to its biocompatibility, low cost, and minimal risk of extrusion. Previous studies have shown comparable outcomes between autologous grafts and synthetic prostheses [16,17]. The choice of prosthesis is largely determined by ossicular status: PORP is used when the stapes suprastructure is intact, and TORP when only the footplate is present.

A significant improvement in hearing was observed, with mean ABG decreasing from 33.5±6.8 dB preoperatively to 14.2±6.0 dB postoperatively, resulting in a mean gain of 19.3 dB ($p<0.001$). These results are comparable to those of Lamba *et al*. and Chavan *et al*., who reported ABG gains of 14–20 dB [16,17]. Chaudhary *et al.* also reported similar outcomes with ABG closure ranging from 15 to 22 dB [18], confirming the effectiveness of ossiculoplasty.

Among reconstruction materials, TORP showed the highest mean ABG gain (23.8 dB), followed by PORP (20.1 dB), conchal cartilage (16.6 dB), and tragal cartilage (15.9 dB). This trend is consistent with previous studies that found TORP provided superior hearing gain [14,16]. However, cartilage grafts provided stable, reliable results, especially in compromised middle ear conditions.

The overall graft uptake rate was 92%, with a failure rate of 8%, which is comparable to reported rates of 85–92% in the literature [8,16]. Outcomes were influenced by factors including ossicular status, middle-ear condition, and surgical technique. Patients with intact stapes and healthier middle ear mucosa demonstrated better results. No significant difference was observed among graft materials, indicating that both autologous and prosthetic materials are effective when used appropriately.

Overall, the findings confirm that ossiculoplasty is a safe and effective procedure for hearing restoration in COM. Significant improvements in ABG, high graft uptake rates, and low complication rates highlight the success of modern ossicular reconstruction. Proper selection of graft material based on intraoperative findings and middle ear status is essential for achieving optimal outcomes.

CONCLUSIONS

In conclusion, ossiculoplasty is a reliable and effective procedure for hearing restoration in patients with Chronic Otitis Media. Ossicular disruption, particularly of the incus, is a consistent finding, and preservation of the stapes is associated with improved outcomes. Both autologous grafts and prosthetic materials provide significant hearing gain; cartilage grafts are cost-effective with low extrusion rates, while PORP and TORP yield superior hearing results. High graft uptake, satisfactory functional outcomes, and minimal complications highlight the procedure's safety and efficacy. Thus, ossiculoplasty remains a standard, predictable, and clinically valuable intervention in middle ear reconstruction.

CONTRIBUTION OF AUTHORS

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Final approval- Shiv Shanker Kaushik, Richa Gupta

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