(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 8, Issue 5 , Page No: 463-471
September-October 2025

IJMSCR

Outcomes Of Retrograge Mastoidectomy With Posterior Canal Wall Reconstruction

[1]Dr Saddaf Amin, [1]Dr Tariq Mahmood, [1]Dr. Heemani Bhardwaj, [1]Dr. Yavan Bhardwaj, [2]Dr. Padam Singh Jamwal,
[1,2]M.S ENT, [2]Professor
SMGS Hospital, Government Medical College Jammu, Jammu, Jammu and Kashmir, India

***Corresponding Author:**
Dr. Yavan Bhardwaj
Department of Otorhinolaryngology
SMGS Hospital, Government Medical College,
Jammu, Jammu and Kashmir, India, 180001

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Introduction: Chronic suppurative otitis media (CSOM) presents as recurrent or persistent discharge through a tympanic membrane perforation. It has been a matter of concern for otologists since since ages. It can be of mucosal (tubo-tympanic) or squamosal (attico-antral) type. The mainstay of the treatment of attico-antral disease of the middle ear cleft is mastoidectomy. Canal wall down mastoidectomy is associated with cavity problems while canal wall up mastoidectomy is associated with a very high rate of recidivism. Both the procedures had their own pros and cons which lead to the exploration of other surgical techniques to maximise the effectiveness of the treatment. Retrograde mastoidectomy is one such technique which has the advantages of both the canal wall up & canal wall down procedures.

Objective: The aim of the present study was to compare the pre & post-operative hearing results and to note the complications of retrograde mastoidectomy.

Materials and methods: The study included 30 patients with unsafe CSOM with or without cholesteatoma. In these patients, retrograde mastoidectomy was performed and the posterior canal wall reconstruction was done using conchal cartilage where required. We looked for the complications; pain, vertigo, nystagmus, tinnitus, facial palsy, headache, postoperative dizziness in the patients. The follow up was done weekly for first month, monthly for the next 2 months after surgery. Post-operative PTA was done at 1st month and 3rd month following surgery. The hearing results were compared in terms of post-operative average air bone gap (ABG) closure.

Results: In the present study the age group ranged from 13-53 with the mean age 27.4±11.4. The mean pre and post-operative ABG were 36.02±10.8 and 30.84±14.03, and the Mean pre and post-operative AC conduction were 49.34±12 and 42.13±15.02, which were statistically significant. The mean ABG closure in improved patients was 6.9±5.83. Postoperative graft was intact in 86.67% patients and residual perforation was found in only 3 out of 30 patients, i.e in 13.33% patients. No postoperative complications were found in majority of the patients (83.33%). In 3 (10%) discharge was seen, and in 2 (6.67%) patients granulations were seen postoperatively. All the patients came for regular follow up and none had residual disease at the end of the study period. Thus, the overall success rate was 100% in this study.

Conclusion: Retrograde or inside out mastoidectomy can be considered a better alternate in canal wall down procedures as it efficiently clears the disease from the middle ear cleft, leaving no postoperative cavity, which reduces the cavity problems, preserves the hearing and improves the quality of life in such patients.

Keywords: Mastoidectomy; .CSOM; Cholesteatoma; Recidivism; Atticotomy

Introduction

Chronic suppurative otitis media (CSOM) usually presents with intermittent or persistent purulent discharge through a perforated tympanic membrane. Acute or recurrent infections of the middle ear may result in permanent perforation of the tympanic membrane and irreversible inflammatory changes within mastoid and middle ear. Chronic suppurative otitis media (CSOM) can be classified as mucosal (safe) and squamous type (unsafe). Further, can be classified as active and inactive types. [2]

Squamosal or Unsafe type CSOM may be associated with cholesteatoma, and can cause damage to the surrounding structures and hearing. It has the tendency for progressive and independent growth at the expense of underlying bone, bone eroding properties and it can re-occur after removal. [1] It can only be eradicated by surgical resection. The primary aim of the cholesteatoma surgery is complete eradication of the disease with hearing restoration being a secondary concern. These days, hearing restoration and functional outcome of the cavity is also considered as equally important aims of the surgery, which is preferably performed as a single stage procedure. For cholesteatoma resection two principle techniques have been developed; Canal wall down mastoidectomy (CWDM) and Canal wall up mastoidectomy (CWUM).[3]

In Canal wall up mastoidectomy, the disease is removed and the posterior canal wall is left intact. The rate of recurrence is 20-40%. There is a risk of residual disease associated with this procedure but it avoids mastoid cavity problems. The canal wall down mastoidectomy involves complete removal of the mastoid air cells, aggressive saucerization of the cortical edges of the mastoid, complete removal of the superior and posterior canal walls and a wide meatoplasty. The advantages of canal wall down mastoidectomy include excellent exposure for removal of the disease and for post-operative monitoring of cavity. There are lesser chances of residual and recurrent disease. Canal wall down mastoidectomy has been the mainstay of treatment, however it also has certain downsides. It results in formation of a mastoid cavity which is unnatural and anatomically and physiologically unsatisfactory. The drawbacks include cavity problems, such as continuous ear discharge, accumulation of keratin debris, caloric induced vertigo, and difficulty in fitting a hearing aid. [2]. Therefore, otologists concluded that preservation of the posterior meatal wall increases the rate of recidivism whereas its removal is associated with cavity problems. [4]. Therefore, over the years; the techniques have evolved to enhance the benefits of the surgery and minimize the drawbacks.

Mastoid exploration by retrograde approach like anterior atticotomy, or the excision of the lateral wall of the attic, is comparitively more beneficial. During atticotomy, the attic is opened and the opening is then extended to the antrum and mastoid cells and it avoids unnecessary procedures, such as a wide (extended) mastoidectomy and provides better exposure of the sinus tympani, facial recess and hypotympanum. It avoids the complications involved with korner's septum, an anterior sigmoid sinus and a low-lying dura. [5] It permits preservation or partial reconstruction of the posterior canal wall depending upon extension of cholesteatoma. As and when required, the surgery can be extended to an open mastoid cavity which is then similar to the canal wall down technique. This technique also offers creation of a small, dry, self-cleaning cavity, also there is no need for meatoplasty [6].The advantage of both the canal wall up and canal wall down technique may be combined in this technique. It has low recurrence rate and residual disease. Thus, a compromise between the two techniques would be removal of a portion of canal wall for exposure and extirpation of the cholesteatoma, followed by reestablishment of the canal wall during the retrograde mastoidectomy. [8].

The present study was carried out in cases of chronic otitis media with or without cholesteatoma with an objective to identify the advantages of anteroposterior or retrograde approach with posterior canal wall reconstruction using cartilage graft as regards the recurrence / residual cholesteatoma, recurrence of retraction pocket formation, healing rate and hearing results with this approach in general. The magnitude of postoperative cavity problems if any was also observed.

Materials And Methods

The present prospective study was conducted in the Department of ENT& Head and Neck Surgery, in a tertiary care hospital from November 2019 to

Volume 8, Issue 5; September-October 2025; Page No 463-471

November 2020. The study was conducted after taking approval from Institutional Ethics Committee.

Inclusion Criteria: 1. Patients aged 13 years or more. 2. Patients diagnosed with chronic otitis media with or without cholesteatoma. 3. Patients willing to give consent.

Exclusion Criteria: 1. Patients less than 13 years age. 2. Patients having malignancy of the middle ear. 3. Patients suffering from otitis externa. 4. Patients with previous history of ear surgery. 5. Patients with sensorineural or mixed hearing loss. 6. Active infective focus in nose, throat or oral cavity.

A thorough history, general physical and local examination was performed. A complete examination of the ear, along with nose, oral cavity, larynx and pharynx to rule out any foci of infection was done. Systemic diseases unrelated to the ear diseases were also ruled out. All the routine investigations were done. Tuning fork tests (using 256 Hz, 512 Hz and 1024 Hz frequency) were performed. Preoperative otologic evaluation (Otoscopy and Otomicroscopy) and basic audiologic assessment such as pure tone audiometry (PTA) were carried out. Imaging study like X-ray mastoid lateral oblique view (schuller's view), high resolution computed tomography (HRCT) of the temporal bone were also carried out where necessary. Informed and written consent was obtained from patients meeting the inclusion criteria after counselling them and their relatives regarding the nature of the disease and surgery. Surgical procedure was explained to them. All of them underwent retrograde mastoidectomy with primary ear canal reconstruction. The status of the ossicular chain and extent of the cholesteatoma was also recorded during the surgery. The same otologic examinations and measurements were repeated after operation in patients included in the study and were compared with the findings of preoperative measurements and examinations.

Surgical Technique

All the patients were operated under general/ local anaesthesia. Under all aseptic precautions patients were properly positioned. Povidone iodine was used to clean the auricle, post-auricular and pre-auricular areas and draping was done. Infiltration of adrenaline 1:100000 in normal saline (NS) and in 2% xylocaine in LA was done. Post-auricular incision was given at the upper attachment of pinna at around 12 o'clock position to the mastoid tip at 6o'clock postion approximately 1cm from the post-auricular groove. The subcutaneous tissue and the muscles of the pinna were cut using the knife. The posterior canal wall skin, 3mm below the spine of Henle. Tympanomeatal flap was raised, then the bony meatus was enlarged with a cutting burr to remove bone from the posterior and superior wall of the meatus at the isthmus and including the Henle's spine, so taking away the overhang and straightening the meatus before removing the outer attic wall. Then, the attic was enlarged with a 2mm burr and the lateral epitympanic wall was removed from the notch of rivinus until the diseased area was fully exposed. Rotating burr was kept away from the ossicles to avoid sensorineural hearing loss. The attic wall was removed with burr until a thin layer was left over the ossicles. The bone layer then was removed with the curette to expose the incus, malleus and stapes. Pathologies such as cholesteatoma, ossicular erosions, fixation of the ossicles, hypertrophied mucosa, polyps or parts of macerated or infilterated drum were exposed. Complete exposure of disease from attic, antrum and aditus was done depending upon extent of involvement without creating an unnecessary wide cavity. The cholesteatoma sac was followed and bone removal was determined by the extent of the disease. The procedure progressed in an anterior to posterior direction, exposing the cholestetoma thus creating atticotomy, atticoantrostomy and mastoidectomy following the cholesteatoma and removing as much bone as needed to create the smallest mastoid cavity as possible. The facial recess and sinus tympani were manipulated accordingly. Then reconstruction of the ossicles was done using remodelled autologous incus, malleus, cortical bone, conchal cartilage depending upon the requirement of the particular case after assuring the complete removal of the disease. For the posterior canal wall reconstruction conchal cartilage was used. An appropriate size of conchal cartilage was harvested. To accommodate the two sides of cartilage small grooves were drilled on anterior and posterior buttress at appropriate place. The cartilage piece was snuggly fitted into these grooves to avoid forward or backward displacement of cartilage. This maintained proper size and shape of canal. Reconstruction of the drum was done using temporalis fascia, conchal perichondrium or composite cartilage perichondrium

Volume 8, Issue 5; September-October 2025; Page No 463-471

graft from concha. Gel foam was kept and the incision was stitched back in two layers and a medicated external auditory pack was kept.

All patients were kept on antibiotics, analgesics and oral decongestants postoperatively for 7 days. We looked for pain, vertigo, nystagmus, tinnitus, facial palsy, headache, postoperative dizziness in the patient. Ear pack was removed on 3rd postoperative day and sutures were removed on 8th day postoperatively. Antibiotic ear drops were started on 8th postoperative day. Patients were advised to gently place a petroleum jelly smeared cotton ball in the operated ear while showering, to avoid blowing nose too hard for a few weeks and sneeze with mouth open. Patients were also advised to avoid strenuous exercise for few weeks.

The follow up of the patients was done weekly for first month, monthly for the next 2 months after surgery and on each visit, otoscopic examination was done. Post-operative PTA was done at 1st month and 3rd month following surgery. The hearing results were compared in terms of post-operative average air bone gap (ABG) closure. The post-operative ABG closure was calculated by taking difference between pre-operative ABG and post-operative ABG at average frequencies of 500, 1000 and 2000 kHz. Post-operative ABG closure was divided into three categories <10 dB, 10-20 dB, >20 dB. Less than 20 dB was taken as successful hearing result. Otomicroscopic and radiological evaluations were done for postoperative follow up of patients with cholesteatoma, for the detection of recidivism.

Statistical Analysis

Data regarding, graft uptake rate, Air bone gap closure and complications were entered in Microsoft excel spread sheet and compared using statistical package for social science (SPSS) software. Appropriate statistical analytical tests were applied as per advice of Statistician.

Results

In the present study, 40.00% of the patients belonged to the age group <=20 years followed by 21-30 years (26.67%). Age group was 31-40 and >40 years of only 5 out of 30 patients (16.67%) each. Mean value of age (years) of the study subjects was 27.4 ± 11.4 with median (IQR) of 25(17.25-37). Out of 30 patients 17 (56.67%) of the patients were males and 13 (43.33%) of the patients were females.

In the present study, 50.00% of the patients had discharge with hearing impairment followed by discharge without hearing impairment (40.00%). 3 out of 30 patients (10.00%) had hearing impairment but not discharge. It is shown in table 1. In the present study, in all the patients, retrograde mastoidectomy was done. Intra-operative image of one of the patients with retrograde mastoidectomy has been shown in figure 1. In all these patients, reconstruction of the posterior canal wall was also done.

In the present study, in majority (43.33%) of the patients, type of tympanoplasty was type 3 followed by type 2B (30.00 %,). Intra-operative picture of one such patient has been shown in the figure 2. Type of tympanoplasty was 2A in only 8 out of 30 patients (26.67%). In the present study, in majority (90.00%) of the patients, material used for the PCWR was conchal cartilage, as shown in figure 2. Material used for the PCWR was conchal cartilage and tragal cartilage was used in only 3 out of 30 patients (10.00%), which has been shown in figure 3.

Mean value of pre-operative ABG(dB) and post-operative ABG(dB) of study subjects were 36.02 ± 10.8 and 30.84 ± 14.03 with median(IQR) of 36(28-42.75) and 29.15(18.95-40.875) respectively. Post-operatively ABG (dB) was significantly decreased as compared to pre-operative ABG (dB). (p value=0.0002). It is shown in table no 1.

Mean value of pre-operative AC threshold and post-operative AC threshold of study subjects were 49.34 ± 12 and 42.13 ± 15.01 with median (IQR) of 48.6(39.88-58.3) and 41.45(28.9-54.575) respectively. There was a significant reduction in AC threshold post-operatively as compared to pre-operative (p value<.0001). It is shown in table no 2.

In the present study, in majority (60.00%) of the patients, ABG gap closure (dB) was <=10 dB followed by 11-20 dB (23.33%). ABG gap closure (dB) was not improved in only 5 out of 30 patients (16.67%). It is shown in table no 3. Mean value of ABG closure (dB) in improved patients was 6.9 ± 5.83 with median (IQR) of 4.7(2.4-12).

In the present study, in majority (86.67%) of the patients, status of the graft on follow up was intact. Status of graft on follow up was residual perforation in only 4 out of 30 patients (13.33%). It is shown in table no 4.

Volume 8, Issue 5; September-October 2025; Page No 463-471

In the present study, in majority (83.33%) of the patients, there were no complications and in 10% discharge was seen. Granulations were seen in only 2 out of 30 patients (6.67%).

In the present study, recidivism was not seen in any patient.

Discussion

Retrograde mastoidectomy offers the benefits of both canal wall up and canal wall down mastoidectomy procedures. It can solve cavity problems associated with canal wall down mastoidectomy; and recidivisim associated with canal wall up mastoidectomy. It requires comparatively shorter anaesthesia, and allows quicker postoperative recovery, especially if the mastoid cells are free of disease. [9].

Donald P et al. [10] reported a success rate of 73.2% in the first and 72.1% in the second postoperative year after the use of transmeatal atticotomy in cholesteatoma surgery. A dry central perforation was reported in 9.7%, which is slightly better than re-perforation rate in the present study which is 13.33%. East DM. [11] reported a recurrence rate of 3% in ears operated on by atticotomy. Abramson M et al. [12] reported a recurrent cholesteatoma rate of 17% when used atticoantrostomy and reconstructed the scutum, whereas with the use of Intact canal wall technique, the rate of recurrence was 35%. The most common disadvantage of the anterior atticoantrostomy technique is postoperative retraction and retraction pocket formation. [13]. In order to eliminate this problem, Sakai M et al. [13] proposed the use of an autogenous cortical bone graft instead of tragal cartilage. In the present study no cases of retraction occurred that is even lesser than that reported in the literature till date. In patients who undergo reconstruction with tragal or conchal cartilage, we recommend supporting the graft with a periosteal flap from the posterior side to prevent displacement, to increase vascularization of the graft, and to provide resistance against retraction. Another advantage of anterior atticoantrostomy is that it allows access to the cholesteatoma to wherever it extends. In particular, in cholesteatoma, which extends under the head of the malleus or the incus, it prevents residues and recurrences through the removal of these ossicular elements. In addition, if the cholesteatoma is limited to the attic, this technique avoids unnecessary opening of the posterior mastoid cells. [7]. Autologous cartilage has some advantages, such as ready availability in the surgical field, ease of shaping, and no extra cost. [14]. Cartilage is resistant to negative middle ear pressure, increases stability, and minimizes postoperative adhesions. It has low metabolic rate and receive nutrients by diffusion. [15]. Thus, autologous conchal cartilage was used in our study mainly for the posterior auditory canal reconstruction.

In the present study, the mean age of presentation was 27.4+/-11.4 years which is comparable to study carried out by Dornhoffer JL. [8], Cetinkaya EA et al. [16], Venkatarajamma K et al. [17] in which mean ages were 29.34, 25.7 and 22.34 years respectively. In contrast, the mean age of presentation in the study conducted by Uyar Y et al. [7] was 34.8+/-9.8 years. Maximum number of patients were in the age group of < 20 years that was about 40% of the study population and the range was 13-53 which is comparable to the study conducted by Chamoli P et al. [18]. Venkatarajamma K et al. [17] also reported that maximum number of patients were in the age group 11-20 (<20) years, which constituted 42% of the study population whereas, in the studies conducted by Dornhoffer JL. [8] patients were in the age range of 6-73 years.

In the present study there was a male preponderance with a total number of males being 17 (56.67%) and females 13(43.33%), which is comparable to the study conducted by Cetinkaya EA et al. [16] where there was a male preponderance. In contrast, Kalcioglu MT et al. [19] reported a female preponderance with a total no of females being 19(54%) and males being 16(46%) in number.

In the present study, otorrhoea was the most common complaint which was seen in almost all the cases and the second most common symptom was hearing loss, otorrhoea alone was found in 40% of the patients, and otorrhoea with hearing impairment was found in 50% of the patients, and hearing impairment alone was found in 10% of the patients. Our study was comparable with the study conducted by Chamoli P et al. [18] In contrast, Edelstein et al. [20] noted hearing loss in 85% and otorrhoea in 73% of the cases.

In the present study 43.33% patients were operated with type 3 tympanoplasty, 30.00% were operated with type 2b tympanoplasty and 26.67% were operated by type 2a tympanoplasty. In a study conducted by Roth TN et al. [21] maximum number of

Volume 8, Issue 5; September-October 2025; Page No 463-471

patients were operated with type 3 tympanoplasty which is also similar to a study conducted by Hatano M et al. [22]

The graft uptake rate in the present study was 86.6% and residual perforation was seen in 4 (13.33%) of the patients. Results are comparable with the studies conducted by Qotb M et al. [23], Uyar Y et al. [7], where the residual perforation was seen in 4(5.6%) & 3(3.8%) of the patients respectively. In studies conducted by Manrique R et al. [24], Shewel Y et al. [4] the rate of success was 83.3 and 90% respectively and the residual perforation was seen in 2(4.8%)

According to American Academy of Otolaryngology head and neck surgery guidelines, successful hearing result is the one with the postoperative Airborne Gap up to less than 20 db. Our results were analysed with respect to above guidelines and it was observed that the mean ABG closure was 6.9+/-5.83 db. ABG closure was <10 in 60% of the patients, within 11-20 in 23.33% and was not improved in 5(16.67%). The present study was comparable with the studies conducted by Kuo CY et al. [25], and Manrique R et al. [24] where the mean ABG closure was 6.96 db, 4.5+/-16.9 db, In the studies conducted by Kuo CL et al. [26] and Roth TN et al. [21] the mean ABG closure was 12.35 db and 12 db respectively.

In the present study the mean preoperative AC threshold was 49.34+/-12 db and the mean postoperative AC threshold was 42.13+/- 15.01 db which was found to be statistically significant with a P value of <0.0001. Our results were comparable with the studies conducted by Kuo CY et al. [25] and Chamoli P et al. [18] where the preoperative mean AC threshold was 54.28 db and 43.88 db while the mean postoperative AC threshold was 48.58 db and 39.23 db and the p values being <0.001 and <0.01 respectively. In contrast to the present study Manrique R et al. [24] conducted a study where the preoperative and postoperative mean AC threshold were 41.04 db and 51.5 db.

The mean preoperative and postoperative ABG were 38+/-10 db and 28+/-10 db which was statistically significant with a p value of <0.0001. Also, no complications were found in 83.33% of the patients and discharge was found in 3(10%) of the cases, granulations were found in 2 (6.67%) of the cases. The findings were similar to the studies conducted by Ravikumar C et al. [2], Manrique R et al. [24] and Chamoli P et al. [18]. No recidivism was found, no cases of retraction pocket formation, also there were no complications such as injury to the dura, sigmoid sinus, lateral semicircular canal, inner ear trauma (SNHL induced by the surgery).

All the patients came for regular follow up and none had residual disease at the end of the study period. Thus, the overall success rate was 100% in this study.

Conclusion

The retrograde mastoidectomy procedure has proven to be effective for cholesteatoma removal and functional reconstruction of the ear as it allows a partial or complete removal of the posterior canal wall according to the extension of the disease. Retrograde or inside out mastoidectomy with posterior canal wall reconstruction can be considered a better alternative in canal wall down procedures as it efficiently clears the disease, leaving no postoperative cavity. This technique, hence, averts the cavity problems, preserves the functional outcome, and improves the quality of life in such patients.

References

1. DrA.S.ArunaKumari. “Efficacy of Canal Wall down Mastoidectomy In Surgical Treatment Of Cholesteatoma And Its Outcome. ” IOSR Journal of Dental and Medical Sciences (IOSRJDMS), vol. 17, no. 11, 2018, pp 15-23..
2. Ravikumar C, Priyatharisini K, Kanitha MS, Pandian DR, Anandan H. A Study of Canal Wall down Mastoidectomy with Soft-wall Reconstruction. Int J Sci Stud 2018;5(12):43-46.
3. Minovi A, Dombrowski T, Shahpasand S, Dazert S. (2015) Audiometric Results of Open Cavity Tympanomastoidectomy in Advanced Attic Cholesteatoma. ORL 77:180-189.
4. Shewel, Y., Abougabal, A. Retrograde mastoidectomy with canal wall reconstruction with bone graft in acquired cholesteatoma. Egypt J Otolaryngol 36, 11 (2020).
5. Uyar Y, Salturk Z, Yilmazer AB. (2018) Anterior atticotomy technique in otology: A review article. Tr-ENT 28(23):145-153.
6. Nikolopoulos TP, Gerbesiotis P. (2009) Surgical management of cholesteatoma: The two main options and a third way atticotomy / limited mastoidectomy. International Journal of Pediatric Otorhinology 73:1222-1227.

Volume 8, Issue 5; September-October 2025; Page No 463-471

7. Uyar Y, Ozturk K, Keles B, Arbag H, Ulku CH. (2006) Anterior atticoantrostomy for cholesteatoma surgery. Annals of Otology, Rhinology &Laryngology 115(2):150-155.
8. Dornhoffer JL. (2000) Retrograde mastoidectomy with canal wall reconstruction: a single stage technique for cholesteatoma removal. Ann Otol Rhinol Laryngol 109:1033-1039.
9. Nadol, J.B. and Schuknecht, H.F. (1993) Surgery of the Ear and Temporal Bone. 1th Edition, Raven Press, New York: 111-116.
10. Donald P, McCabe BF, Loevy SS. Atticotomy: a neglected otosurgical technique. Ann Otol Rhinol Laryngol. 1974 Sep-Oct;83(5):652-62.
11. East DM. (1998) Atticotomy with reconstruction for limited cholesteatoma. Clin Otolaryngol Allied Sci 23:248-252.
12. Abramson M, Lachenbsuch P, Press B, McCabe B. (1977) Results of conservative surgery for middle ear cholesteatoma. Laryngoscope 87:1281-1287.
13. Sakai M, Shinkawa A, Miyake H, Fuiji K. (1986) Reconstruction of scutum defects (scutumplasty) for attic cholesteatoma. Am J Otol 7:188-192.
14. Chhapola S, Matta I. (2014) Mastoid obliteration versus open cavity: a comparative study. Indian J Otolaryngol Head Neck Surg 66(1):207-213.
15. Beutner D, Helmstaedter V, Stumpf R et al. (2010) Impact of partial mastoid obliteration on caloric vestibular function in canal wall down mastoidectomy. Otol Neurotol 31:1399-1403.
16. : Çetinkaya EA, Çukurova ‹, Olgun L, Kabakç› R. Long-term outcomes of functional surgery for attic cholesteatoma. ENT Updates 2016;6(1):29–33.
17. Venkatarajamma K, Oshyam S. (2015) Cholesteatoma by inside out canal wall down techniques in government tertiary care hospitals. International Journal of General Medicine and Pharmacy 4:27-40.
18. Chamoli P, Singh CV, Radia S, Shah AK. (2018) Functional and anatomical results of inside out approach for cholesteatoma surgery. Int J Otolaryngology Head Neck Surg 4:481-489.
19. Kalicioglu MT, Ozerk A, Egilmez OK et al. (2019) Mastoid Cavity Obliteration with Cartilage Graft; Evaluation of 35 Patients. Medeniyet Med J 34:360-367.
20. Edelstein DR, Parisier SC, Ahuja GS et al. (1988) Cholesteatoma in the pediatric age group. Ann Otol Rhinol Laryngol 97:23-29.
21. Roth TN, Haeusler R. (2008) Inside out technique cholesteatoma surgery: a retrospective long term analysis of 604 operated ears between 1992 and 2006. Otology & Neurotology 30:59-63.
22. Hatano M, Ito M, Yoshizaki T. (2010) Retrograde mastoidectomy on demand with soft wall reconstruction in pediatric cholesteatoma. Acta Oto Laryngologica 130:1113-1118.
23. Qotb M, Fawzy T, Ragab W. (2017) Single Stage Canal Wall Down Mastoidectomy with Reconstruction of the Canal Wall: 5 years' experience in Fayoum Province, Egypt. J Int Adv Otol 13(2):181-185.
24. Manrique R, Sanhueza I, Manrique M. (2013) Attic exposure antrum exclusion as an on demand surgical technique for cholesteatoma. Acta Otorrinolaringol 64:22-30.
25. Kuo CY, Huang BR, Chen HC et al. (2015) Surgical results of retrograde mastoidectomy with primary reconstruction of the ear canal and mastoid cavity. BioMED Research International 517035.
26. Kuo CL, Shiao AS, Liao WH, Ho CY, Lien CF. (2012) Can long-term hearing preservation be expected in Children following Cholesteatoma Surgery? Results from a 14- year- Long Study of Atticotomy- Limited Mastoidectomy with Cartilage Reconstruction. Audiol Neurotol 17(6):386-394.

Figure 1: posterior canal wall reconstruction and remodelled incus over stapes footplate.

Volume 8, Issue 5; September-October 2025; Page No 463-471

Figure 2: posterior canal wall reconstruction with conchal cartilage.

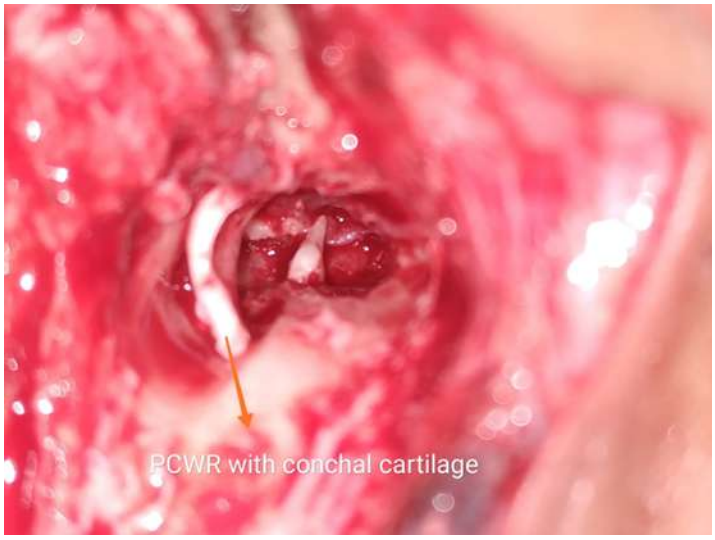

Table 1:- Comparison of pre-operative and post-operative ABG (dB) of the study subjects.

ABG(dB)	Mean ± SD	Median (25th-75th percentile)	Range	P value	Test performed
Pre-operative ABG(dB)	36.02 ± 10.8	36(28-42.75)	16.6-56.6	0.0002	Paired t test; t value = 4.297

Volume 8, Issue 5; September-October 2025; Page No 463-471

Post-operative ABG(dB)	30.84 ± 14.03	29.15(18.95-40.875)	11.6-58		

Table 2:- Comparison of pre-operative and post-operative AC threshold of the study subjects.

AC threshold	Mean ± SD	Median (25th-75th percentile)	Range	P value	Test performed
Pre-operative AC threshold	49.34 ± 12	48.6(39.88-58.3)	28.6-69.6	<.0001	Paired t test; t value = 5.413
Post-operative AC threshold	42.13 ± 15.01	41.45(28.9-54.575)	21.6-71.6		

Table 3:- Distribution of ABG gap closure (dB) of the study subjects.

ABG gap closure(dB)	Frequency	Percentage
<=10 dB	18	60.00%
11-20 dB	7	23.33%
Not improved	5	16.67%
Total	30	100.00%

Table 4:- Distribution of status of graft of the study subjects.

Status of graft on follow up	Frequency	Percentage
Intact	26	86.67%
Residual perforation	4	13.33%
Total	30	100.00%

Volume 8, Issue 5; September-October 2025; Page No 463-471