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Original Research Article

Combined conchal cartilage islet-periosteum and posterior based pedicled flap obliteration: a comparison with unobliterated mastoid cavities

Arindam Das, Sandipta Mitra*, Sayan Hazra, Arunabha Sengupta

Department of Otorhinolaryngology and Head Neck Surgery, Institute of Post Graduate Medical Education and Research, Kolkata, India

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***Correspondence:**
Dr. Sandipta Mitra,
E-mail: onlysandipta@gmail.com

ABSTRACT

Background: Aim of the study was to compare the outcomes of a new technique of mastoid cavity obliteration with open mastoid cavity.
Methods: 90 patients diagnosed with chronic otitis media (active squamosal variety) and planned to undergo surgery between 2016-2018 were randomly assigned into two groups of 45 patients. One group underwent canal wall down matoidectomy followed by cavity obliteration with posteriorly based vascularised flap with mastoid cortex periosteum plus conchal cartilage composite graft and the other underwent the same surgery but without any obliteration. The two groups were compared in terms of cavity volume, discharge, epithelisation, wax formation, subjective sensation of vertigo and post-operative air-bone gap at 1 year.
Results: Cavity obliteration in post-canal wall down setting significantly reduced the post-operative cavity volume and need for cavity debridement with better epithelisation, less incidence of discharge, vertigo on caloric stimulation when compared to open cavity. The post-operative air-bone gap in obliterated cavities was better but not statistically significant.
Conclusion: Cavity obliteration has definite advantages over open cavity in terms of healing but no significant differences in long-term audiological outcomes.

Keywords: Mastoidectomy, Mastoid cavity, Canal wall down

INTRODUCTION

Chronic otitis media of active squamosal variety is often treated surgically by canal wall down mastoidectomy with an aim to achieve complete extirpation of the disease and hence a safe, dry ear. However, the otologist is often faced with distressing cavity problems such as persistent discharging or weeping mastoid cavity and inspissated wax or debris. Furthermore, a large, aesthetically displeasing meatoplasty, difficulties in use of hearing aids, dizziness on exposure to hot or cold water and life-long dependence on the otologist for cavity debridement can be worrisome for the patient as well.[1,2]

Herein comes the role of mastoid cavity obliteration. Popularized by Mosher in 1911, more than hundreds of cavity obliteration techniques have been devised by otologists since its inception.[3]

This study is aimed to compare the outcomes of canal wall down mastoidectomy with a combined approach obliteration technique and that without cavity obliteration.

METHODS

Patient selection and inclusion/exclusion criteria for this study included 90 patients with chronic otitis media of

active squamosal variety attending the institution between 2016-2018 were included in this randomised controlled study. The inclusion criteria were: Age ≤60 years, active squamosal variety of chronic otitis media, no evidence of intracranial or extracranial extratemporal complications, High-resolution computed tomography (HRCT) temporal bone showing features of cholesteatoma with destruction of ossicular chain.

Patients with active focus of infection in the nose, paranasal sinuses and throat and mixed hearing loss on pre-operative pure tone audiometry were not included in this study. The patients were randomly assigned into two groups-one undergoing canal wall down mastoidectomy with cavity obliteration with posteriorly based vascularised pedicled flap with mastoid cortex periosteum with conchal cartilage composite graft and the other without any cavity obliteration. The randomization sequence was generated by table of random numbers and allocation was concealed using sealed opaque envelopes.

Pre-operative otoendoscopy, pure tone audiometry, tympanometry and HRCT of temporal bone were done in all cases.

All the cases were done under general anaesthesia with 2% Lignocaine with Adrenaline (1:1,00,000) with the help of operating microscope via post-auricular trans canal approach. Temporalis fascia graft was harvested. The periosteum over the healthy mastoid cortex was collected and kept aside in normal saline solution. Meatotomy was done. Tympanomeatal flap was raised. Following exposure of the middle ear, ossicular chain status and diagnosis of cholesteatoma was confirmed. Drilling of the mastoid cortex was done. All diseased air cells were exenterated, the anatomical limits being tegmen plate superiorly, sinus plate posteriorly, sino-dural angle postero-superiorly and tip cells inferiorly. The cavity was exteriorised by removing the bridge and lowering facial ridge till level of lateral semi-circular canal. Complete clearance of disease was done from middle ear cleft including sinus tympani, anterior epitympanic space, protympanum and facial recess. After disease clearance was ensured, the volume of the resultant cavity was measured using normal saline. It was graded according to Sade's classification: small <1 ml, medium 1-2 ml, large >2 ml.[4]

Patients belonging to the cavity obliteration group were then subjected to obliteration of the resultant cavity with posteriorly based random, axial, vascularised pedicled flap for obliterating the tip cell and postero-inferior part of the cavity and conchal cartilage plus mastoid cortex periosteum composite graft for obliterating the deep recesses in supra-labyrinthine and peri-labyrinthine areas. The other group did not undergo any form of obliteration. Meatoplasty was done proportionate to the cavity size. Temporalis fascia graft was placed over the cavity by underlay technique. Ossicular chain reconstruction was done according to need. Gelfoam and antibiotic ointment-soaked ribbon gauze was used to pack the cavity. Post-auricular wound closed with non-absorbable sutures. Mastoid dressing applied. Infusion paracetamol was given for post-operative analgesia in all cases.

Statistical analysis included the data was analysed by SPSS (version 24.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data has been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Paired t-test was used for normally distributed data. P value ≤0.05 was considered to be statistically significant. The parameters studied were intra-operative and post-operative cavity volume measured with normal saline in millilitres, discharge in terms of Merchant et al grading, post-operative epithelisation, wax formation measured in terms of number of monthly debridement required in a twelve-month follow-up period, subjective vertigo experienced and post-operative air-bone gap in decibels at 1 year. Both the pre- and post-operative air-bone gaps were measured at 500, 1000, 2000 and 3000 Hz.

RESULTS

61.1% (55/90) of the patients were male and the rest were female. The mean age (mean ± SD) of the patients was 32±4.5 years with minimum age being 12 years and maximum 60 years.

The mean cavity volume (mean ± SD) measured intra-operatively with normal saline was 2.84±0.83 ml in patients 'with obliteration' and 2.87±0.8 ml in patients 'without obliteration'. The difference between two groups was statistically insignificant (p value>0.05). Mean post-operative cavity volume (mean ± SD) in the 'with obliteration' group was 1.38 ± 0.52 ml and that in the 'without obliteration' was 2.78±0.85 ml. The difference in mean between the two groups was statistically significant (p value <0.00001).

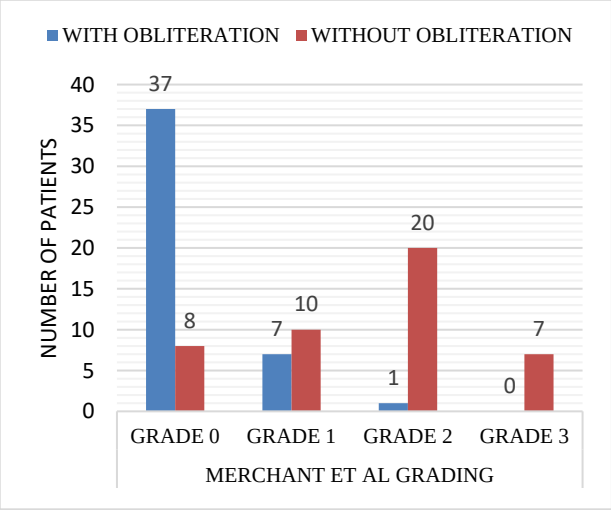

Figure 1: Merchant et al grading for assessment of post-operative discharging cavity.

Merchant et al scoring system was used to assess the post-operative cavity for discharge. 82.2% patients 'with obliteration' belonged to grade 0 and none of the patients had grade 3, whereas, amongst patients 'without obliteration', 44.4% belonged to grade 2 and 15.5% belonged to grade 3 (Figure 1).

All patients 'with obliteration' were noted to have epithelised cavity at the end of 6 months. In patients 'without obliteration', 86.6% patients had epithelised cavity at the end of 6 months.

Wax formation in the post-operated cavity was assessed in terms of number of monthly cavities debridement required over a twelve-month follow-up period. It was observed that the median cavity debridement for wax removal was 1 (range 0-3) in patients 'with obliteration' and 4 (range 1-10) in patients 'without obliteration'. This was found to be statistically significant (p value<0.00001) (Figure 2).

Subjective sensation of vertigo was recorded in all patients. It was found that 24.4% (11/45) of patients 'without obliteration' experienced vertigo whereas, none of the patients 'with obliteration' experienced vertigo post-operatively.

The mean pre-operative air-bone gap (mean ± SD) in patients 'with obliteration' group was 37.27±6.48 dB and that in 'without obliteration' group was 37±6.5 dB. The difference between two groups was found to be statistically insignificant. The mean post-operative air-bone gap (mean ± SD) was found to be 24.82±8.5 dB and 28.37±8.9 dB in groups 'with obliteration' and 'without obliteration' respectively. The p value was found to be 0.05703. The result is not significant at p<0.05.

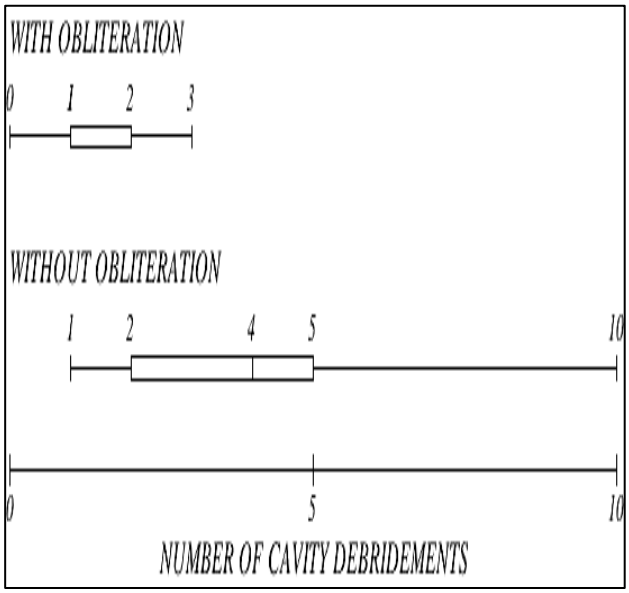

Figure 2: Box and whisker plot for median number of cavity debridement in each group.

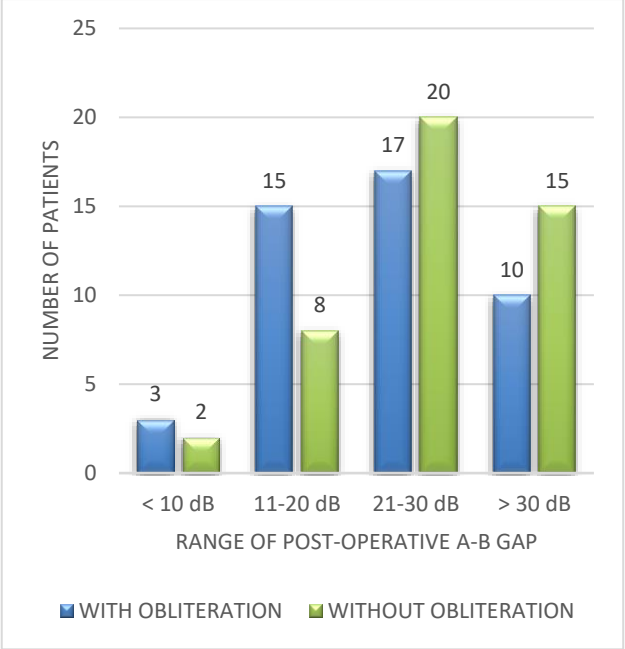

Figure 3: Post-operative air-bone gap.

DISCUSSION

Cavity obliteration in a canal wall down cavity has been believed to be the solution of a number of distressing problems faced by the otologist in the post-operative period. However, it must be attempted only when one is absolutely sure of complete exenteration of the cholesteatoma.[1] An obliterated mastoid bowl reduces the effective surface area over which the epithelium has to grow and thus results in faster epithelisation.[5] Furthermore, raw bone may exude tissue fluid which is an excellent culture medium for micro-organisms that results in persistent infection and discharge in a post-operated cavity.[6] Merchant et al have devised a semi-quantitative grading system to assess a low-maintenance post-operative mastoid cavity.[7] They have defined the summary grade as the worst score that is obtained at any point during the entire follow-up period. Adequate control of infection refers to grades 0, 1, and 2, whereas grade 3 indicates failure of control of infection.[8] This scale has been used to assess the post-operated cavities in this study.

A large cavity with irregular, dependent areas accumulating debris may be problematic. This leads to patient dependence on the otologist for life-long cavity debridement. Obliteration of such recesses are beneficial in that respect with an added advantage of faster epithelisation.[9] Dizziness on exposure to hot or cold water is often reported by patients with open cavities. Cavity obliteration has been found to minimise the caloric effects by reducing exposure of the semi-circular canals to such stimuli.[2]

The post-operative air-bone gap measured at 1-year follow-up was found to be better in obliterated cavities

but no statistically significant differences were found between the two groups. The air-bone gap was found to be 'fair' (21-30 dB) in both groups, in this study. Such direct comparison between the two groups have not been documented in literature as per the authors' knowledge.

Innumerable techniques of obliteration have been described in literature.[11] Each have their own advantages and limitations. In this study, have chosen a technique that is easy, less time-consuming, ensures effective epithelisation to achieve a dry healed cavity and at the same time compared the outcomes with non-obliterated cavities. Chosen a random, axial, posteriorly based vascularised pedicled flap for obliteration of the tip cell and postero-inferior part of the cavity and composite mastoid cortex periosteum with conchal cartilage for obliteration of the rest. The rationale of such a combination is that a pedicled flap ensures a robust blood supply over which epithelisation can take place effectively. At the same time, such a flap can be readily harvested and easily swung in position for immaculate obliteration of the said area (Figure 4). However, in other areas such as the supra-labyrinthine, peri-labyrinthine and retro facial, conchal cartilage plus periosteum serves as a better option for filling up the deep crevices as it takes the shape of these areas more effectively and retains its shape unlike bone which has the tendency to get resorbed (Figure 5).[12] Dornhoffer has described the use of cartilage for obliteration of these critical areas in his study.[13] A large unsightly meatoplasty that inevitably accompanies a large mastoid cavity is cosmetically displeasing and clearly not favoured by patients.

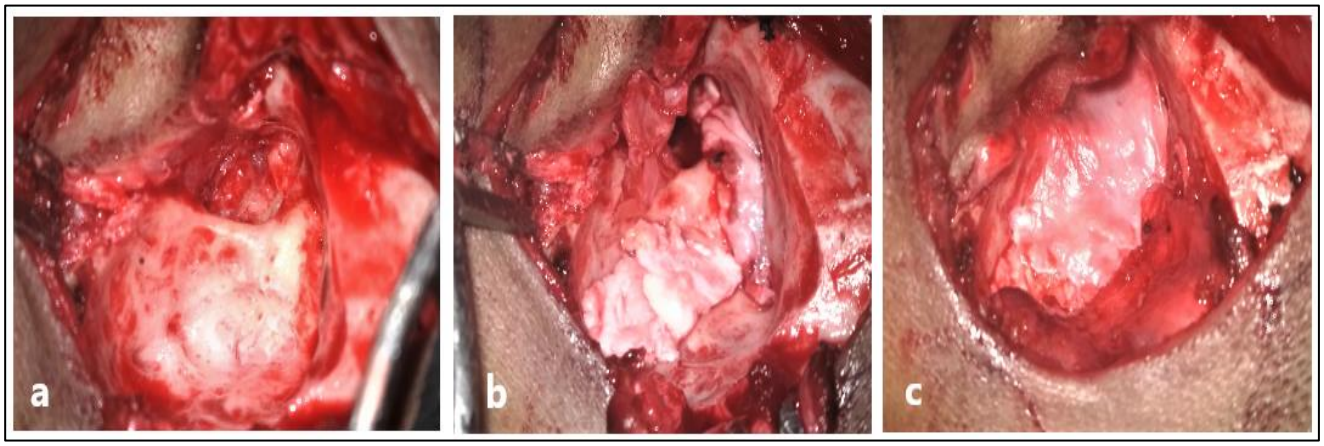

Figure 4: (A) Resultant cavity in left ear after complete disease clearance. (B) Obliteration with conchal cartilage and mastoid cortex periosteum. (C) Final look of obliterated cavity with temporalis fascia grafting (note the posteriorly based flap draping the tip cell and postero-inferior area).

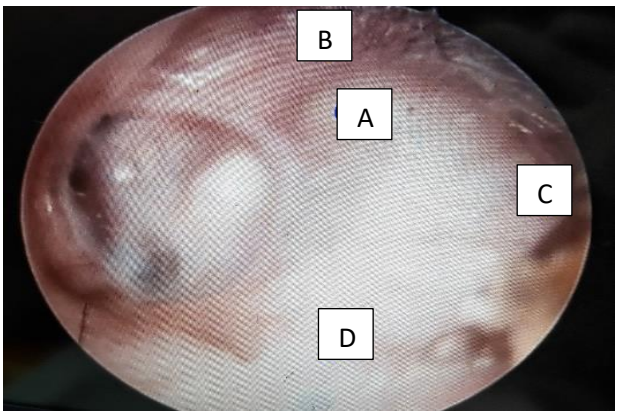

Figure 5: Well-epithelised obliterated left mastoid cavity at one-year follow-up. (A) Lateral semi-circular canal. (B) Supra-labyrinthine cell area. (C) Sino-dural angle. (D) Tip cell area.

There are certain limitations of this study that include limited sample size, short follow-up period and analysis of a single technique of obliteration. Hence, certain differences may not appear significant even if they do exist. This calls for larger, multi-centric trials for more in-depth analyses of the techniques and their advantages in the long run.

CONCLUSION

Cavity obliteration in post-canal wall down setting significantly reduces the post-operative cavity volume and need for cavity debridement with better epithelisation, less incidence of discharge, vertigo on caloric stimulation when compared to open cavity. The long-term post-operative air-bone gap in obliterated cavities is better but not statistically significant.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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