Section: ENT

Original Research Article

COMPARING THE QUALITY OF LIFE AND SURGICAL OUT COME IN OPEN MASTOID CAVITY AND MASTOID CAVITY OBLITERATION IN CANAL WALL DOWN MASTOIDECTOMY

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ABSTRACT

Background: Canal wall down mastoidectomy is a surgical procedure aimed at eradicating middle ear disease. The large, open mastoid cavity left behind often leads to various complications. To mitigate these issues, mastoid cavity obliteration has been developed. This technique, using either biological or synthetic materials, has proven effective in reducing complications associated with the open mastoid cavity. Synthetic materials for mastoid obliteration have emerged as a valuable and safe option for patients undergoing canal wall down mastoidectomy.

Materials and Methods: Study Design: This prospective study was conducted in the Department of Otorhinolaryngology Great eastern Medical School and hospital Ragolu Srikakulam. The sample comprised 30 patients, divided into two groups: 15 underwent Modified Radical Mastoidectomy with obliteration (Group A), and 15 underwent Modified Radical Mastoidectomy without obliteration (Group B). The study design was a single-center, longitudinal, prospective, parallel, two-group follow-up study. Statistical analysis was performed using Fischer's Exact Test. The study period spanned from March 2021 to February 2022.

Results: The study demonstrated that patients in Group A, who had undergone mastoidectomy with obliteration, experienced a significantly lower incidence of pain, discharge, giddiness, and wax formation compared to those in Group B, who had not undergone obliteration. At the end of the 3-month follow-up period, healing of the cavity, as indicated by epithelialization, was notably better in the obliterated cavities. Additionally, patients with obliterated mastoid cavities required less frequent cavity care, experienced reduced dependence on medical supervision, and had fewer outpatient visits.

Conclusion: Mastoid cavity obliteration significantly reduces post-operative complications and improves healing outcomes compared to non-obliterated cavities. The technique also lessens the need for ongoing cavity care and medical visits, making it a beneficial approach for patients undergoing canal wall down mastoidectomy.

Keywords: Mastoid Cavity, Mastoidectomy.

INTRODUCTION

A persistently discharging ear has long been a significant concern for Otorhinolaryngologist in India and other developing countries due to its high rate of morbidity and ongoing challenges. The population suffering from chronic ear disease in India is up to 6%.[1] The pathological processes that lead to complications in CSOM are cholesteatoma, bone eroding properties of granulation tissue and infection. Since there is no straightforward way to completely eradicate chronic ear disease, timely and appropriate intervention by an otologist is crucial. Such professional care can significantly aid in

preventing further complications and managing the condition effectively. Early and expert treatment not only helps in alleviating symptoms but also plays a critical role in reducing the risk of long-term damage and improving overall quality of life for those affected.[2] The surgical options available for the middle ear disease are canal wall down mastoidectomy and intact canal wall mastoidectomy.

The most commonly used surgical technique is canal wall down mastoidectomy. This technique leads to formation of large open mastoid cavity. Patients with an open mastoid cavity following surgery often face several challenges. Common issues include persistent drainage and infections, which require ongoing medical management. Exposure to water can lead to infections and complicate activities like swimming or showering. Regular oto-microscopic cleaning of the cavity is needed to remove debris and prevent infections, necessitating frequent specialist visits.[3] Additionally, changes in temperature from water or air exposure can induce vertigo, and variations in atmospheric pressure can also trigger dizziness. For those with hearing loss, traditional hearing aids may be ineffective due to the open mastoid cavity, complicating auditory rehabilitation.

The popularity of intact canal wall mastoidectomy is largely due to its advantages, which include eliminating the need for frequent cleaning of the mastoid bowl, avoiding water intolerance and calorically induced vertigo, and simplifying the fitting and use of hearing aids.[3]

Although intact canal wall mastoidectomy avoids certain complications, such as the need for frequent mastoid bowl cleanings, water intolerance, calorically induced vertigo, and difficulties with hearing aid use, it does not always result in complete disease clearance. This technique can be less effective in fully eradicating the disease compared to other surgical approaches.

The goals of surgical management for chronic otitis media are to eradicate the disease, restore hearing, and, when possible, maintain or restore a normal anatomical configuration. Before the mid-1950s, achieving the first two goals typically involved removing the posterior wall of the external auditory canal, resulting in either a radical or modified radical mastoidectomy cavity. Today, many otologic surgeons favor intact canal wall mastoidectomy combined with tympanoplasty, unless extensive disease necessitates canal wall removal. While canal wall down mastoidectomy can ensure complete disease clearance, it often comes with the drawbacks of postoperative cavity problems and significant hearing loss.[4] To address these issues, mastoid obliteration is frequently employed in canal wall down procedures for cholesteatoma. This technique aims to enhance tympanic aeration and reduce the risk of cholesteatoma recurrence.

The main advantages of mastoid cavity obliteration include reducing the nitrogen-absorbing mucosa in the cavity, which helps prevent the recurrence of retraction in patients with Eustachian tube dysfunction, and eliminating dead space that could otherwise accumulate squamous epithelium and lead to infections. The goal is to create a smaller, self-cleaning cavity that is easier to maintain.

Both autologous and synthetic materials have been used for mastoid cavity obliteration, including free grafts, fat, cartilage, bone chips, bone pâté, hydroxyapatite, and periostio-muscular flaps. In this study, we used bone pâté and cartilage for obliteration. The aim of the study is to compare the postoperative outcomes of canal wall down mastoidectomy with and without obliteration in patients with atticoantral or postero-superior marginal pathology associated with chronic suppurative otitis media.[5]

MATERIALS AND METHODS

Study Design: Prospective study

Study Area: The department of Otorhinolaryngology Great Eastern Medical School and hospital Ragolu Srikakulam

Study Period: March 2021- February 2022

Study Data: ENT OPD and undergoing surgeries.

Sample Size and Sampling Procedure

The study included a total of 30 patients undergoing surgery. Among these, 15 patients underwent Modified Radical Mastoidectomy with obliteration (Group A), and the remaining 15 patients underwent Modified Radical Mastoidectomy without obliteration (Group B).

For the sampling procedure, a pre-designed proforma was used to collect relevant information from each patient, selected according to established inclusion and exclusion criteria. The patients were divided into two groups based on their surgical treatment: Group A received mastoidectomy with obliteration, while Group B had mastoidectomy without obliteration.

All procedures involving human participants adhered to the ethical standards set by the institutional and/or national research committees, and were conducted in accordance with the 1964 Helsinki Declaration and its subsequent amendments, or comparable ethical standards. Informed consent was obtained from all participants included in the study.

Statistical Analysis: Fisher's Exact Test

Inclusion Criteria

This study included patients with unsafe chronic suppurative otitis media (CSOM), those undergoing canal wall down mastoidectomy, and individuals of all ages and sexes.

Exclusion Criteria

The study excluded patients with safe CSOM, those with malignancies, and individuals who did not consent to participate.

RESULTS

In this study, we analyzed 30 cases of attico-antral chronic suppurative otitis media (CSOM), dividing them into two distinct groups for comparison. Group A underwent canal wall down mastoidectomy with mastoid cavity obliteration, while Group B received canal wall down mastoidectomy without obliteration. The aim was to evaluate and compare the outcomes of these two surgical approaches.

To ensure a thorough comparison, we examined the postoperative results of both groups. This involved objectively assessing the mastoid cavities for epithelialization, which is the process of the cavity lining becoming covered with new skin cells, and for any accumulation of waxy debris. Additionally, we gathered patient-reported data on postoperative symptoms, including any pain, dizziness (giddiness), and discharge from the ear. This comprehensive evaluation aimed to provide insights into the efficacy and potential advantages of incorporating cavity obliteration in canal wall down mastoidectomy.

Age Distribution

The study included patients across all age groups. The largest age group was 20-30 years, which comprised 12 patients (40%). This was followed by the 0-20 years age group, with 11 patients (36.6%). The third most prevalent age group was 31-40 years, which included 8 patients (26.6%). The statistical analysis of age distribution yielded a p-value of 0.897871, indicating that the differences observed among age groups are statistically insignificant.

Audiological Examination

The audiological examination revealed a range of hearing loss severities among the patients. Specifically, 6 patients (20%) experienced mild hearing loss, defined as a loss of 26-40 dB. A larger group, 15 patients (50%), had moderate hearing loss, characterized by a loss of 41-60 dB. Seven patients (23.3%) were classified with severe hearing loss, and 2 patients (6.67%) had profound hearing loss, exceeding 81 dB.

Statistical analysis comparing these hearing loss severities between the two study groups showed no significant difference, with a p-value of 0.542725.

Table 1

PRE OPERATIVE HEARING LOSS	GROUP A	GROUP B	TOTAL
MILD	3 (20%)	3 (20%)	6 (40%)
MODERATE	7 (46.6%)	8 (53.3%)	15 (100%)
SEVERE	3 (20%)	4 (26.6%)	7 (46.6%)
PROFOUND	2 (13.3%)	0	2 (13.3%)
TOTAL	15	15	30

Laterality

In this study, surgery was performed on 15 patients for the right side and 15 patients for the left side. Within Group A, 8 patients underwent surgery on the right side, while 7 patients had the left side operated on. In Group B, 7 patients had surgery on the right side, and 8 patients had the left side operated on. The statistical analysis showed a p-value of 1, indicating that the distribution of surgical procedures between the right and left sides is statistically insignificant.

Pain

Table 2

PAIN 0N	GROUP A	GROUP B
POST OP DAY 15	12	7
POST OP DAY 21	5	5
POST OP DAY 45	1	2
POST OP DAY 90	0	1
P VALUE		0.8141

In our study, pain complaints were assessed at various follow-up points. On day 15, 7 patients (46.6%) in Group B reported pain, compared to 12 patients (80%) in Group A. By day 21, 5 patients (33.3%) in both groups reported pain. On day 45, only 1 patient (6.66%) in each group A and 2 patients in group B (13.3%) complained of pain. No patients in Group A reported pain on day 90, while 1 patients (6.6%) in Group B did. At the end of the study period, the statistical analysis yielded a p-value of 0.8141 , indicating that the differences in pain levels between the two groups are statistically insignificant. Despite this statistical insignificance, it is noted that a higher proportion of patients in both groups experienced pain during the first 30 days.

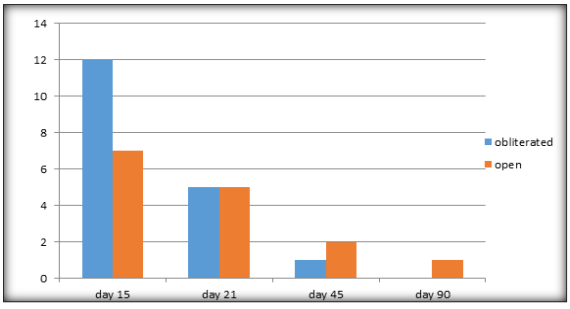

Figure 1

Discharge

In our study, discharge was evaluated at different follow-up intervals. On day 15, all 15 patients (100%) in Group B reported discharge, while 12 patients (80%) in Group A experienced discharge. By day 21, discharge persisted in all 15 patients (100%) in Group B and in 12 patients (80%) in Group A. On day 45, 11 patients (73.3%) in Group B and 4 patients (26.6%) in Group A reported discharge. The p-value for this time point was 0.02198, indicating a significant difference between the groups. By day 90, 6 patients (40%) in Group B and 1 patients (6.66%) in Group A reported discharge. The p-value at this follow-up was 0.02495, which is statistically significant.

Table 3

DISCHARGE 0N	GROUP A	GROUP B
POST OP DAY 15	12	15
POST OP DAY 21	12	15
POST OP DAY 45	4	11
POST OP DAY 90	1	6
P VALUE		0.02495

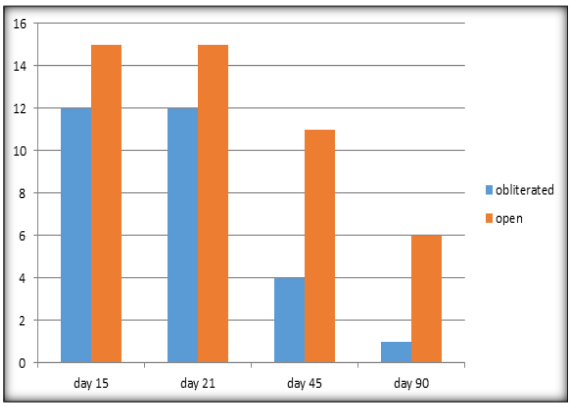

Figure 2

Giddiness

In our study, complaints of giddiness were recorded at various follow-up intervals. On day 15, 6 patients (40%) in Group B reported experiencing giddiness, compared to 3 patients (20%) in Group A. By day 21, the incidence of giddiness was with 2 patients (13.33%) in Group A and 3 patients in Group B (20%) . On day 45, giddiness was reported by 1 patient (6.66%) in group A and 2 patients in group B (13.3%). By the end of the study, on day 90, no patients reported giddiness. The statistical analysis yielded a p-value of 0.2495, indicating that the differences observed are statistically insignificant.

Table 4

GIDDINESS 0N	GROUP A	GROUP B
POST OP DAY 15	3	6
POST OP DAY 21	2	3
POST OP DAY 45	1	2
POST OP DAY 90	0	0
P VALUE		0.2495

Wax

At the 90-day follow-up, 1 patient (6.66%) in Group A and 4 patients (26.6%) in Group B had waxy debris. The statistical analysis showed a p-value of 0.1891, indicating that the difference between the groups is statistically insignificant.

Table 5

WAX 0N	GROUP A	GROUP B
POST OP DAY 15	0	0
POST OP DAY 21	0	0
POST OP DAY 45	0	4
POST OP DAY 90	1	4
P VALUE		0.1891

Epithelialization

The average time required for epithelialization was 5 weeks in Group A and 16 weeks in Group B. By the end of the study on day 90, complete epithelialization was achieved in 11 cavities (73.3%) in Group A, compared to 5 cavities (33.3%) in Group B. The p-value for this comparison was 0.4175, which is statistically insignificant.

Table 6

EPITHELIAZATION 0N	GROUP A	GROUP B
POST OP DAY 15	0	0
POST OP DAY 21	0	0
POST OP DAY 45	5	1
POST OP DAY 90	11	5
P VALUE		0.4175

DISCUSSIONS

Our study included patients from all age groups. The largest cohort was in the 20-30 years age group, comprising 12 patients (40%), followed by 10 patients (36.6%) in the 0-20 years group. The third most common age group was 31-40 years, with 8 patients (26.6%).

In comparison, Ramsey et al. included patients ranging from 4 to 84 years, with a mean age of 39 years. 21 Similarly, Singh et al. studied 88 patients, with the majority (59%, n=52) in the 12-20 years age group. 25 Chhapola et al. found that in their study of 60 patients, the majority were in the 11-20 years age group, followed by 27.5% in the 21-30 years range, 25% over 30 years, and 10% under 10 years. 27 Shah et al. studied 100 patients with ages ranging from 7 to 68 years, with 60% (n=60) in the 11-30 years age group, and a mean age of 28.34 years.[28]

Laterality

In our study, 15 patients underwent surgery on the right side, and 15 on the left side. Within Group A, 8 patients had the right side operated on, while 7 patients had the left side treated. In Group B, 7 patients had the right side operated on, and 8 had the left side. Additionally, 2 patients presented with bilateral cases; in these instances, the ear with more extensive pathology, as indicated by HRCT temporal bone imaging, was operated on first, followed by the second ear.

In contrast, Ramsey et al. reported 26 left-sided and 34 right-sided operations. Beutner et al. performed surgery on 7 left ears and 11 right ears. Sun et al. included 23 left ears, 19 right ears, and 3 bilateral cases. 23 Overall, no significant right or left dominance was observed in the comparable studies.

Pain

In our study, pain was assessed at various follow-up points. On day 15, 7 patients (46.6%) in Group B reported pain, compared to 12 patients (80%) in Group A. By day 21, the incidence of pain decreased, with 5 patients (33.3%) in both groups reporting discomfort. On day 45, pain was reported by 1 patient (6.66%) in group A and 2 (13.3%) patients in group B. By day 90, no patients in Group A reported pain, while 1 patient (6.66%) in Group B did.

In comparison, Chhapola et al. observed that on postoperative day 30, 12 patients (60%) in the control group experienced pain, whereas only 8 patients (40%) in the case group reported pain. On day 45, pain was reported by 1 patient (40%) in the case group and 2 patients (10%) in the control group. 27 Similarly, Deshmukh et al. found that on postoperative day 30, 40% of patients in the control group experienced pain, while only 20% in the case group reported pain.[29]

Discharge

In our study, discharge was monitored at several follow-up points. On day 15, all 15 patients (100%) in Group B reported discharge, compared to 12 patients (80%) in Group A. By day 21, discharge persisted in all 15 patients (100%) in Group B and in 12 patients (80%) in Group A. On day 45, 11 patients (73.3%) in Group B and 4 patients (26.6%) in Group A complained of discharge. This difference was statistically significant, with a p-value of 0.02198. By day 90, 6 patients (40%) in Group B and 1 patients (6.66%) in Group A reported discharge.

In comparison, Chhapola et al. found that three months post-surgery, 16 out of 20 patients (80%) in their study had a dry cavity, while 4 patients (20%) still had ear discharge. In their control group, 12 out of 20 patients (60%) had a dry cavity, and 6 patients (30%) continued to have discharge. 27 Similarly, Deshmukh et al. reported that three months after surgery, 16 out of 20 patients (80%) had a dry cavity, while 4 patients (20%) still had discharge, with 12 out of 20 control patients (60%) achieving a dry cavity and 6 patients (30%) still experiencing discharge.[29]

Giddiness

Regarding giddiness, our study showed that on day 15, 6 patients (40%) in Group B reported symptoms, whereas 3 patients (20%) in Group A experienced giddiness. By day 21, 2 patients (13.33%) in group A and 3 (20%) patients in group B reported giddiness. On day 45, 1 patient (6.66%) in group A and 2 patients in group B (13.3%) reported giddiness. By day 90, no patients in either group reported giddiness.

In contrast, Chhapola et al. found that only 1 patient (5%) in the control group experienced giddiness, while no patients in the case group reported such symptoms.

Epithelialization

In our study, the average time required for epithelialization was 5 weeks in Group A and 16 weeks in Group B. By the end of the study on day 90, 11 cavities (73.3%) in Group A had achieved complete epithelialization, compared to 5 cavities (33.3%) in Group B.

Chhapola et al. reported that at the end of a 6-month study period, 18 out of 20 cases (90%) with obliteration achieved complete epithelialization, whereas 14 out of 20 cases (70%) with open cavities did so. 27 Deshmukh et al. found that epithelialization occurred in 60% of cases where cartilage and flaps were used for obliteration. In contrast, epithelialization was seen in 40% of cases where bone dust was used. Furthermore, 80% of patients achieved epithelialization with cartilage and flaps, while 100% of patients demonstrated epithelialization when bone dust was used for obliteration.[29]

Wax

In our study, at the 90-day follow-up, 1 patient (6.66%) in Group A had waxy debris, while 4 patients (26.6%) in Group B had similar findings. Chhapola et al. observed that at the end of their study period, 2 patients (10%) in the control group

presented with wax. 27 Similarly, Deshmukh et al. reported that only 2 patients in the control group had waxy debris by the end of their study.[29]

Limitations

Our study has several limitations. We excluded patients with multiple prior surgeries, which may affect the applicability of our results to those with a history of recurrent procedures. Additionally, we only used bone dust and cartilage for mastoid cavity obliteration, without considering other materials or techniques.

Patients with mucosal type chronic suppurative otitis media (CSOM) and those with malignancies were not included, potentially limiting the generalizability of our findings. The study also focused on individuals under 40 years of age, which may not reflect outcomes in older patients. Furthermore, the follow-up period was only 3 months, restricting our ability to evaluate long-term results.

These limitations should be considered when interpreting our findings, and future research should address these factors for a more comprehensive understanding of the interventions.

CONCLUSION

Obliterating the mastoid cavity results in a smaller surface area, which facilitates quicker and easier epithelialization and reduces the likelihood of developing cavity granulations. A smaller cavity is more likely to retain its epithelial migratory potential and self-clean more effectively. The exposed bone after mastoidectomy secretes tissue fluid, creating a medium conducive to bacterial growth. Covering the bony walls with obliteration material lessens this secretion and consequently lowers the risk of infection.

Patients with an open cavity and exposed lateral semicircular canal often experience vertigo during activities like swimming or exposure to cold air. Hearing aids are generally better tolerated in an obliterated cavity compared to an open one.

The use of cartilage with bone pate for obliteration offers several advantages. The fascial component of the cartilage can effectively seal tympanic membrane perforations, while the periosteum component aids in cavity obliteration. The pliability of the cartilage flap allows it to conform to all areas of the mastoid cavity, and its good vascular supply supports better healing. Bone pate helps prevent flap shrinkage and maintains cavity volume.

Our study concludes that obliterated cavities show a marked reduction in pain, discharge, giddiness, and wax formation compared to open cavities. Epithelialization was notably better in obliterated cavities after 3 months. Additionally, patients with obliterated cavities required less frequent cavity care, leading to reduced dependence on medical supervision, fewer outpatient visits, and lower medical treatment needs, thus alleviating pressure on hospital resources. In Group A, the mastoid cavity was obliterated using bone pate and cartilage, whereas Group B patients had their cavities packed with povidone-iodine-soaked gel foam.

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