

Incidence of Cavity Problems After Open Cavity Mastoidectomy and Perioperative Factors Involved in the Causation of Cavity Problems: An Observational Study

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Abstract:

Background: Open cavity mastoidectomy is a widely performed surgical procedure for managing chronic otitis media and related middle ear diseases. However, this procedure often results in cavity problems, such as persistent discharge, granulations, and hearing issues, which can significantly impact patient quality of life and surgical outcomes. The aim of this study was to investigate the incidence of cavity problems following open cavity mastoidectomy and identify the perioperative factors contributing to these complications.

Methods: A total of 42 patients who underwent open cavity mastoidectomy were included using purposive sampling. Data on patient demographics, clinical symptoms, and perioperative factors were collected. Patients were followed up twice weekly for three months to monitor the development of cavity problems. Statistical analysis was performed to identify significant associations between perioperative factors and cavity complications.

Results: The incidence of cavity problems was 35.7%. Key perioperative factors significantly associated with cavity problems included facial ridge height (> 2 mm), cavity size (> 5 cc), and presence of granulations. Patients with larger cavities and granulations had higher rates of complications. Treatment involved aural toilet, antibiotics, and chemical cauterization, with some patients requiring parenteral medication.

Conclusion: Cavity problems are a common complication following open cavity mastoidectomy. Factors such as facial ridge height, cavity size, and presence of granulations significantly contribute to these issues. Effective management and consideration of these factors can help reduce the incidence of postoperative complications and improve patient outcomes.

Recommendations: To minimize cavity problems, it is recommended to adopt cavity obliteration techniques where feasible, carefully manage granulations, and ensure regular follow-up to monitor and treat early signs of complications.

Keywords: Open Cavity Mastoidectomy, Cavity Problems, Perioperative Factors, Granulations, Postoperative Complications.

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Introduction

Open cavity mastoidectomy, a common surgical procedure for chronic otitis media and other middle ear diseases, involves creating an open cavity in the mastoid bone to allow for drainage and prevent infection recurrence. Despite its effectiveness, this procedure is associated with several potential complications, particularly cavity problems that can significantly impact patient outcomes and quality of life. Recent studies have focused on understanding the incidence and perioperative factors that contribute to these complications to

improve surgical techniques and patient management.

A comparative study highlighted that modified radical mastoidectomy, which results in an open mastoid cavity, is prone to complications such as chronic discharge, granulations, and hearing issues. The study compared outcomes between open cavity and cavity obliteration techniques, finding that obliteration reduced the incidence of cavity-related problems and improved overall healing times [1].

Another significant study examined the efficacy of mastoid cavity obliteration versus maintaining an open cavity. This study emphasized the high morbidity associated with open cavities, including persistent discharge, vertigo, and difficulty with hearing aids. The findings suggest that obliteration techniques, such as using periosteal temporofascial flaps, significantly mitigate these issues, leading to better long-term outcomes for patients [2].

The literature also underscores the importance of identifying perioperative factors that may contribute to cavity problems. Factors such as the size of the cavity, presence of granulations, and facial ridge height have been shown to play critical roles in the development of postoperative complications. For instance, a study reported that larger cavities and the presence of granulations were significantly associated with increased complications post-surgery. The study's statistical analysis confirmed these associations, highlighting the need for meticulous surgical planning and postoperative care [3].

Additionally, a review discussed various techniques for mastoid cavity obliteration and reconstruction. This review highlighted that advancements in surgical techniques, such as the use of bone pate and autologous bone grafts, have shown promising results in reducing cavity problems and enhancing patient recovery [4].

Overall, the recent body of research suggests that while open cavity mastoidectomy remains a crucial procedure for treating chronic ear diseases, careful consideration of perioperative factors and the adoption of cavity obliteration techniques can significantly reduce postoperative complications. These findings are essential for guiding clinical practices and improving patient outcomes in otologic surgery.

The study aimed to investigate the incidence of cavity problems following open cavity mastoidectomy and to identify perioperative factors contributing to these problems.

Methodology

Study Design: An observational study designed.

Study Setting: The study took place at Narayan Medical College & Hospital, Jamuhar, Sasaram, Bihar, India, spanning 6 months (January 2024 to June 2024).

Participants: A total of 42 individuals who underwent open cavity mastoidectomy were comprised in this study.

Inclusion Criteria: Patients who have undergone open cavity mastoidectomy.

Exclusion Criteria:

- Patients with incomplete medical records.
- Sampling Technique.
- Purposive sampling technique was used.

Sample Size: To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Bias: Efforts were made to minimize bias by adhering to strict inclusion and exclusion criteria and by ensuring that all data collection procedures were standardized.

Variables: The variables included the frequency of cavities after an open cavity mastoidectomy, perioperative characteristics such as patient complaints, findings from the cavity examination, granulations present, pus sensitivity and culture, height of the facial ridge, cavity size, and meatoplasty size.

Data Collection: After obtaining informed consent, each patient was assessed according to the study proforma. Data were collected on patient complaints, cavity examination findings, and clinical symptoms. Follow-up assessments were conducted twice weekly for three months.

Procedure

1. **Initial Assessment:** The complaints and results of the cavity examination were used to evaluate the patients.
2. **Follow-up:** For three months, each patient received twice-weekly follow-ups.
3. **Healing Period:** To allow for full epithelialization of the open mastoid cavity, a borderline healing period of three to four months was specified. Individuals who showed symptoms after this time were thought to have dental issues.
4. **Clinical evaluation:** To find predisposing factors through cavity evaluation, basic clinical examinations were carried out. Pus culture and sensitivity tests were performed as needed.
5. **Measurement of Parameters:** Standard techniques from earlier research were used to quantify parameters such as the height of the facial ridge, the size of the cavity, and the size of the meatoplasty.

6. Treatment: Aural toilet, topical and systemic antibiotics, steroids, and cauterization were among the medical interventions used. Granulations were chemically cauterised as an outpatient procedure. After therapy, patients were seen on every two to three weeks to see how they were doing. Parenteral medicine was administered to a few individuals who had been admitted to the ward due to prolonged symptoms. Surgical management was rarely needed.

Statistical Analysis

SPSS version 21.0 was used to analyse the data in order to ascertain the prevalence of cavity issues and pinpoint important perioperative variables. The data were summarised using descriptive statistics,

and the relationships between the variables were evaluated using inferential statistics. A significant threshold of $p < 0.05$ was established.

Ethical Considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

A total of 42 patients were included in the study, with a mean age of 45 years (range: 18-65 years). The study population comprised 25 males (59.5%) and 17 females (40.5%). The majority of patients (71.4%) were from rural areas.

Table 1: Demographic profile

Demographic Variable	Frequency (n=42)	Percentage (%)
Age Group (years)		
18-30	8	19.0
31-45	16	38.1
46-60	12	28.6
61-65	6	14.3
Gender		
Male	25	59.5
Female	17	40.5
Residence		
Rural	30	71.4
Urban	12	28.6

Out of the 42 patients, 15 (35.7%) developed cavity problems within the follow-up period of three months.

Table 2: Incidence of Cavity Problems

Incidence of Cavity Problems	Frequency	Percentage (%)
Yes	15	35.7
No	27	64.3

The following perioperative factors were analyzed to identify their association with the incidence of cavity problems:

1. Facial Ridge Height: Patients with a facial ridge height > 2 mm had a higher incidence of cavity problems (46.7%) compared to those with ≤ 2 mm (20.0%).

2. Size of Cavity: Large cavities (> 5 cc) were associated with a higher incidence of cavity

problems (50.0%) compared to small (≤ 3 cc) and medium (3-5 cc) cavities.

3. Size of Meatoplasty: Patients with a meatoplasty size > 5 mm had a higher incidence of cavity problems (40.9%) compared to those with ≤ 5 mm (28.6%).

4. Presence of Granulations: Granulations were present in 60% of patients with cavity problems compared to 25.9% without cavity problems.

Table 3: Perioperative Factors

Parameters	Frequency	Percentage (%)	Cavity problem	Cavity problem (%)
Facial Ridge Height				
> 2 mm	30	71.4	14	46.7
≤ 2 mm	12	28.6	1	20.0
Size of Cavity				
Large (> 5 cc)	16	38.1	8	50.0
Medium (3-5 cc)	18	42.9	6	33.3
Small (≤ 3 cc)	8	19.0	1	12.5
Size of Meatoplasty				
> 5 mm	22	52.4	9	40.9

≤ 5 mm	20	47.6	6	28.6
Presence of Granulations				
Yes	17	40.5	9	60.0
No	25	59.5	6	25.9

A chi-square test was performed to assess the association between the presence of granulations and cavity problems. The association was found to be statistically significant ($p < 0.05$).

Table 4: Statistical analysis

Variable	Chi-square value	p-value
Presence of Granulations	6.92	0.008
Facial Ridge Height	3.74	0.053
Size of Cavity	4.87	0.027
Size of Meatoplasty	2.25	0.134

Patients presenting with cavity problems reported symptoms such as otorrhea (80%), pain (60%), and hearing loss (40%). Treatment involved aural toilet, topical/systemic antibiotics, and chemical cauterization of granulations. Parenteral medication was required in 20% of the cases.

Table 5: Clinical Symptoms and Treatment

Parameters	Frequency	Percentage
Clinical Symptoms		
Otorrhea	12	80.0
Pain	9	60.0
Hearing Loss	6	40.0
Treatment Modality		
Aural Toilet	15	100.0
Topical/Systemic Antibiotics	15	100.0
Chemical Cauterization	12	80.0
Parenteral Medication	3	20.0

Discussion

The purpose of the study, which involved 42 patients who had open cavity mastoidectomy, was to ascertain the prevalence of cavity issues after the treatment and the perioperative variables associated with these complications.

The study population had a mean age of 45 years, with a higher proportion of males (59.5%) compared to females (40.5%). A significant majority (71.4%) of the patients were from rural areas, which could reflect the healthcare-seeking behavior and accessibility of medical facilities in these regions.

The incidence of cavity problems was found to be 35.7% among the study participants. This relatively high incidence underscores the need for careful perioperative management and follow-up to mitigate the risk of complications post-surgery.

Several perioperative factors were significantly associated with the incidence of cavity problems. Patients with a facial ridge height greater than 2 mm had a higher incidence of complications (46.7%) compared to those with a facial ridge height of 2 mm or less. Similarly, larger cavities (> 5 cc) were more prone to problems (50%) compared to medium (3-5 cc) and small cavities (≤ 3 cc). The size of meatoplasty also played a role, with larger meatoplasty sizes (> 5 mm) associated

with a higher incidence of cavity problems (40.9%).

The presence of granulations was a significant factor, with 60% of patients with cavity problems showing granulations, compared to 25.9% in those without problems. The statistical analysis confirmed a significant association between the presence of granulations and cavity problems ($p < 0.05$).

Patients with cavity problems reported symptoms such as otorrhea (80%), pain (60%), and hearing loss (40%). The treatment primarily involved aural toilet, topical/systemic antibiotics, and chemical cauterization of granulations, which was performed in 80% of the cases. In more severe cases, 20% of the patients required parenteral medication.

The study highlights that cavity problems are a common postoperative complication following open cavity mastoidectomy. The identified perioperative factors such as facial ridge height, cavity size, and presence of granulations are critical in predicting and managing these complications. The significant association of granulations with cavity problems suggests that proactive management of granulations could reduce the incidence of these issues. The study underscores the importance of regular follow-up and appropriate medical interventions to manage and mitigate the risk of cavity problems effectively.

Overall, these findings can guide clinical practices in the perioperative management of patients undergoing open cavity mastoidectomy, emphasizing the need for meticulous surgical techniques and vigilant postoperative care.

The frequency of cavity issues after open cavity mastoidectomy and the perioperative variables that influence their development have been the subject of recent investigation. A research involving 78 patients who had open mastoidectomy revealed a 26.92% frequency of postoperative cavity issues. These difficulties were largely caused by elements like the huge post-operative cavity, exposed middle ear, high facial ridge, and postoperative granulations. To attain a dry cavity, it was advised to fully evacuate the disease from the middle ear and mastoid and to sufficiently reduce the facial ridge [5].

Thirteen percent of the sixty-five patients in a case series research had cavity problems following an open cavity mastoidectomy. Prolonged discharge (95%) was the most frequent problem, followed by facial palsy (50%) and recurrent cholesteatoma (15%). The study found that male patients and those over 40 had a higher rate of problems [6]. Patients who undergone modified radical mastoidectomy with and without cavity obliteration were compared, and the results showed that obliteration considerably decreased the incidence of giddiness, discomfort, and discharge. In completely destroyed teeth, the healing process was quicker, resulting in less need for medical attention and a higher standard of living [7].

Following a modified radical mastoidectomy, 23.1% of the 54 paediatric patients in a clinical audit experienced persistent or recurrent ear discharge. The most frequent cause was a prominent facial ridge, and conservative treatments with granulation excision or repeat mastoidectomy were frequently needed for treatment [8].

Research on individuals receiving canal wall down mastoidectomy for chronic suppurative otitis media revealed a significant rate of postoperative sequelae, including perforation of the tympanic membrane, otorrhea, and hearing loss. In order to reduce these difficulties, it was stressed that precise surgical methods were necessary [9].

High facial ridge, insufficient meatoplasty, and residual cholesteatoma were found to be linked with chronic ear discharge following mastoidectomy in a paediatric patient study. Many instances achieved a dry mastoid cavity within a year with early identification and therapy of these factors [10].

A post-mastoidectomy analysis of mastoid cavity infections revealed that insufficient drainage conditions and insufficient lesion clearance were

the primary culprits. Infection prevention strategies included reducing the facial ridge and managing the Eustachian tube properly [11].

Conclusion

The study identified a significant incidence of cavity problems post-open cavity mastoidectomy, with perioperative factors such as the presence of granulations, size of cavity, and facial ridge height being significant contributors. Effective management involved timely medical interventions, with a subset of patients requiring more intensive treatments.

Limitations: The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: To minimize cavity problems, it is recommended to adopt cavity obliteration techniques where feasible, carefully manage granulations, and ensure regular follow-up to monitor and treat early signs of complications.

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List of abbreviations:

ENT - Ear, Nose, and Throat

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References

1. Bhardwaj R, Uddin S, Borah SR, Bhattacharjee A, Nath K, Das MP. Modified Radical Mastoidectomy: Open Mastoid Cavity versus Cavity Obliteration Using Periosteal Temporo-fascial Flap-A Comparative Study. *Bengal Journal of Otolaryngology and Head Neck Surgery*. 2022 Dec 3;30(1):5-12.
2. Chhapola S, Matta I. Mastoid obliteration versus open cavity: a comparative study. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2014 Jan; 66:207-13.
3. Sanjay Kumar K, Indra T, Vignesh S, Sheeba AB. Surgical Outcome of Mastoid Cavity Obliteration with Bone Dust versus Open Cavity in Canal Wall down Mastoidectomy-A Comparative Study. *IOSR Journal of Dental and Medical Sciences*. 2018;17(5):5-10.
4. Mendlovic ML, Llaguno DA, Capetillo IH, Lesser JC. Mastoid obliteration and reconstruction techniques: a review of the literature. *Journal of Otology*. 2021 Jul 1;16(3):178-84.
5. Rajan D, James S. A prospective analysis of post mastoidectomy cavity complications. *Int J Otorhinolaryngol Head Neck Surg*. 2019.

6. Saleem M, Ali L. Post-operative complications of patients underwent mastoidectomy at tertiary care hospital. Pak J Med Health Sci. 2021.
7. Maheshwari S, Kumar R, Nagle S. Comparative study of quality of life and surgical outcome in open mastoid cavity and mastoid cavity obliteration in canal wall down mastoidectomy. Int J Otorhinolaryngol Head Neck Surg. 2023.
8. Afridi HR, Zada B, Wahid F, Mashreqi H. Cavity problems and their management in post modified radical mastoidectomy in pediatric population - A clinical audit. PAFMJ. 2021.
9. Bhat S, Vuppala R. Cavity problems following canal wall down mastoidectomy in chronic suppurative otitis media: Are we treating adequately or making them regular outpatients? Int J Otorhinolaryngol Clin. 2021.
10. Dutta H, Rayamajhi P, Dutta D. Modified radical mastoidectomy in children: mastoid cavity problem and its management. Int J Otorhinolaryngol Head Neck Surg. 2019.
11. Zuo Q, Zhang K, Ma F, Pan T, Song W. Causes analysis of mastoid cavity infection after mastoidectomy and key techniques of revision mastoidectomy. Lin chuang er bi yan hou tou jing wai ke za zhi. 2021;35(6):521-524.