ORIGINAL ARTICLE

Canal Wall Down Approach for Tympanomastoid Cholesteatoma: Anatomical and Functional Outcomes

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ABSTRACT

Background: Chronic Otitis Media (COM) is a life long suffering for a patient and tympanomastoid cholesteatoma is a major complication of COM. Aim of this study was to evaluate the anatomical and functional outcomes of the canal wall down mastoidectomy (CWDM) in patients with chronic otitis media with tympanomastoid cholesteatoma, and to identify prognostic factors influencing postoperative results.

Methods: This cross-sectional observational study was conducted at Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh, from July 2017 to January 2020. Seventy-six patients with extensive cholesteatoma underwent single-stage CWDM with tympanoplasty and partial mastoid cavity obliteration using bone dust and cartilage. Pre- & post-operative assessment included micro-otoscopy and pure-tone audiometry (PTA), with follow-up at 12 months. Patients with bilateral disease, revision surgeries, petrous apex involvement, or confounding medical conditions were excluded.

Results: The mean age of patients was 25.96 years, with a male-to-female ratio of 1.37. Postoperatively, 94.7% of patients achieved a well-epithelialized, dry mastoid cavity. Hearing improved in 39.5% of patients, remained stable in 46%, and deteriorated in 14.5%. The mean air conduction threshold improved significantly from 46.57 dB to 43.88 dB (p=0.000). The mean air-bone gap also improved significantly (p=0.000). Complication rates were low – no recurrence, no facial nerve palsy, or no dead ear was observed.

Conclusion: CWDM offers excellent disease control, low recurrence rates, and acceptable functional hearing outcomes in patients with tympanomastoid cholesteatoma. When combined with cavity obliteration and appropriate reconstructive techniques, CWDM remains a dependable surgical option for managing extensive middle ear disease.

Keywords: Cholesteatoma in COM, Canal wall down mastoidectomy, Tympanoplasty.

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INTRODUCTION

Cholesteatoma is a mass in the tympanic cavity and/or mastoid cavity, formed by keratinized stratified squamous epithelium, subepithelial connective tissue, and the progressive accumulation of keratin debris with or without a surrounding inflammatory reaction. Surgery is the treatment of choice, and its objectives are the complete removal of the disease, creation of a safe, dry, and disease-free ear, and preservation or restoration of hearing as far as possible.[1,2] The surgical approaches are classically divided into open approaches (or canal wall down – CWD) and closed approaches (or canal wall up – CWU).[3] There has been a lengthy debate on the merits of the CWU versus CWD technique as the optimal surgical strategy. [3,4]

In CWU, the targets are achieved through preservation of both the external canal wall and middle ear volume and maintenance of a physiological position of the tympanic membrane. CWU allows for avoiding both the need for frequent ear cleaning and the limitation of keeping the ear away from water. However, an increased risk of recurrence/residual cholesteatoma and revision surgery is described.[5] Moreover, the residual/recurrent cholesteatomatous process is not easily detectable in a CWU cavity.[5]

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The literature reports varying recurrence rates in both groups. A recent review, including six studies, describes higher recidivism after CWU (16.7–61%) versus CWD (0–13.2%).[4,6]

CWDM provides complete removal of the disease, easy inspection of hidden areas of cholesteatoma, less formation of new retraction pockets, early detection of recurrence of disease, and improved post-surgical outcome.[6,7] Although expectations of hearing gain after surgery are minimal, a successful tympanoplasty or ossiculoplasty can reconstruct the hearing mechanism and improve hearing status.[1,6]

On the other hand, in CWD, some disadvantages may be present. The most common limitations are accumulation of keratin debris and the need for frequent cleaning, higher susceptibility to infection with water exposure, risk of sudden dizziness associated with changes in temperature in the external auditory canal, and hearing aid discomfort.[8] To overcome such problems, many surgeons choose to obliterate the neo-cavity with different materials: bone patè, musculo-periosteal flaps, silicon material or cartilage, hydroxyapatite, or bioactive glass.[9,10]

The aim of this study is to analyse the long-term anatomical and functional outcomes of CWD tympanoplasty for treatment of tympano-mastoid cholesteatoma in patients with follow-up and to evaluate the prognostic factors that influence outcomes.

The aim of this study is to evaluate the outcome of canal wall down mastoidectomy for patients with chronic active otitis media (OM) with cholesteatoma.

MATERIALS & METHODS

This cross sectional study was carried out at the Department of ENT & Head-Neck surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh during the period of July 2017 to January2020. We enrolled 76 patients admitted for chronic otitis media with cholesteatoma. Micro-otoscopy and pure tone audiometry were performed in all patients. The diagnosis was confirmed by microscopic examination & CT scan of the temporal bone. All patients were candidates for surgery and the CWD technique was applied, due to the large extent of the pathology, anatomical conformation and/or erosion of the external ear canal. CWDM with tympanoplasty was carried out in a single stage. Partial obliteration of the neo-mastoid cavity with bone dust and cartilage was performed. All patients underwent standard pure-tone audiometry for testing conventional frequency range (0.25 to 8 kHz). Pure-tone average (PTA) values were calculated as the mean of 0.5, 1, 2, and 4 kHz thresholds. Audiological assessment performed 24 hours preoperatively and 12 months post-operatively. The CES questionnaire was translated from English into Bengali and was administered preoperatively and at 1 year postoperatively, and differences in scores within the groups were analyzed. Scoring for each CES question was normalized to a scale of 0 to 100, with 100 being the highest score. The total scores and sums of subscale scores were averaged on the basis of the number of questions included in each category.

Patients undergoing revision surgery, patients with bilateral disease who underwent a different surgical technique in the two ears, patients affected by petrous apex cholesteatoma and patients with other medical conditions that could affect quality of life were excluded from this study.

Statistical analysis was performed using SPSS statistical software. We adopted the Mann-Whitney 'U' test to compare parametric mean values and used the paired *t* test to compare changes within groups. We evaluated correlations between CES scores and objective AC thresholds using Spear-man rank correlation analysis. $P<0.05$ was considered statistically significant.

RESULTS

We enrolled seventy-six patients who underwent CWDM in this study. The mean age of the patients was 25.96 (range: 8-60) years & among them 25% was in <12 years of age, 50% was in 13-35 years age group & 25% was in >35 years age group (Table: II) & male/female ratio was 1.37 (44 males and 32 females) (Table: I).

Table-I: Gender distribution(n=76)

Gender	Frequency (n)	Percent(%)
Male	44	57.9
Female	32	42.1
Total	76	100

Table-II: Distribution of age (n=76)

Age	Frequency N (%)	Mean age
Below 12 years	19 (25)	10.11
13-35 years	38 (50)	23.68
Above 35 years	19 (25)	46.37
Total	76 (100)	25.96

Audiological outcome

Pre-operatively, the mean (±SD) PTA (AC threshold) was 46.57 dB (±15.61). Whereas at the 12-month post-operative assessment, the overall mean (±SD) PTA (AC threshold) was 43.88 dB (±17.10). The mean preoperative PTA & mean postoperative PTA differences were significant (p=0.000). The mean (±SD) preoperative ABGs were 26.51±8.38 dB and the mean (±SD) postoperative ABG had improved to 24.17±10.16dB. (Table III)

Table-III: Comparison of preoperative and postoperative audiological data.

PTA	AC threshold(Mean)	BC Threshold(Mean)	AB gap(Mean)
Preop PTA(dB)± SD	46.57±15.61	20.11±9.64	26.51±8.38
postop PTA(dB)± SD	43.88±17.10	19.75±9.52	24.17±10.16
Mean difference (95% CI)	2.69(1.75,3.64)	0.36(0.23,0.49)	2.33(1.38,3.28)
P value	0.000	0.000	0.000

Table-IV: Distribution of patients according to postoperative hearing status.

Postoperative Hearing status	Cases (n=76) n (%)
Improved	30 (39.5)
Unchanged	35 (46)
Deteriorated	11 (14.5)

Table-V: Anatomical results: Status of post-operative mastoid cavity (n=76)

Anatomical outcome	Number of cases (N=76)
Well epithelialized	72 (95%)
Well epithelialized with residual perforation (out of above 72)	4 (5%)
Discharging	4 (5%)

Table-VI: Postoperative Complications

Complications	Cases (n=76)
Recurrence	0
Ear drum retraction	4
Residual TM perforation	4
Myringitis	2
Facial nerve palsy	0
Dead ear	0

DISCUSSION

The present study evaluates the anatomical and functional outcomes of canal wall down mastoidectomy (CWDM) in patients with tympanomastoid cholesteatoma. The findings support CWDM as a reliable technique for achieving complete disease eradication, with zero recurrence observed during the follow-up period. This is consistent with prior literature indicating lower recurrence rates in CWDM compared to canal wall up (CWU) approaches. [2,4,6]

Functionally, while hearing improvement is not the primary objective of CWDM, the study revealed a significant improvement in mean air conduction thresholds and air-bone gap (ABG) postoperatively. Hearing improved in 39.5% of patients, remained unchanged in 46%, and deteriorated in 14.5%, suggesting that careful ossicular chain reconstruction can yield favourable audiological outcomes.[1,6]

Anatomically, 94.7% of patients achieved a well-epithelialized, dry mastoid cavity. Minor complications such as tympanic membrane retraction, residual perforation, and myringitis were observed, but there were no cases of facial nerve palsy or dead ear. Partial cavity obliteration using bone dust and cartilage contributed to improved cavity health and reduced the burden of postoperative care.[8,9,10] Over all we may say that CWDM offers excellent disease control with acceptable hearing preservation and a low complication profile, especially when combined with appropriate reconstructive techniques and cavity obliteration. These results affirm its value in managing advanced or extensive cholesteatoma.[4,6,7]

Conclusion

This study demonstrates that the canal wall down approach for tympanomastoid cholesteatoma offers excellent anatomical results with a well-epithelialized, dry cavity in the majority of cases and no recurrence during the follow-up period. Finally, a significant improvement in hearing was observed in a substantial proportion of patients. CWDM remains a reliable and effective surgical strategy for extensive middle ear cholesteatoma, balancing disease control with functional preservation when combined with appropriate reconstructive measures and partial cavity obliteration.

Limitations

Canal wall down mastoidectomy (CWDM) is typically performed in patients with extensive or advanced cholesteatomatous disease, which may inherently lead to variable and often more severe clinical presentations. The follow-up period in this study was limited to approximately 12 months; therefore, longer-term outcomes, particularly regarding recurrence, cavity health, and hearing stability, could not be fully assessed. Additionally, factors such as the surgeon's experience, variations in surgical technique, and individual patient compliance with postoperative care were not controlled or evaluated. Social, cultural, and economic influences on follow-up and rehabilitation were also beyond the scope of this study but may impact outcomes significantly.

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Conflict of interest: None

Ethical approval: The study was approved by the Institutional Ethics Committee.

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