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Original Research Article

A comparative study of hearing outcome in cholesteatoma surgery canal wall up versus canal wall down mastoidectomy in 100 patients

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ABSTRACT

Introduction: Cholesteatoma is a well-demarcated sac of keratinizing squamous epithelium in the temporal bone, which is commonly characterized as “skin in the wrong place. The major goal of surgery for cholesteatoma is to make the ear safe and dry with increasing concern of the hearing outcome of patients. Two main surgical techniques employed are Canal Wall down (CWD) and Canal Wall up Mastoidectomy (CWU). In the current study, an attempt would be made to evaluate which technique would be better for achieving disease clearance with favorable hearing outcome and dry ear.

Aims and Objectives: 1. To evaluate the hearing results following CWU and CWD surgery in patient with cholesteatoma. 2. To decide surgical approach according to extension of disease.

Materials and Methods: This is a prospective study involving 100 patients with cholesteatoma who had undergone CWD and CWU surgery over the period of 3 years. The choice of mastoidectomy, CWD or CWU, was the decision of the surgeon, after completely evaluating the patient, preoperatively and intraoperatively. All cases were followed up & assessed by autoscopic examination & PTA for minimum of 3 months.

Results: In the CWD group, mean hearing gain, in 3 months was 12 ± 1.73 dB. In the CWU group, hearing gain in 3 month postoperative period was 18 ± 2.06 dB. Also the hearing gain between the two groups was compared and it was found to be statistically significant for the 3 months ($p=0.0002$) postoperatively; signifying that there was a comparable difference for CWU over CWD mastoidectomy in the matter of Hearing Gain. SNHL was also seen post operatively in both group. Total 3 (6%) patient in CWU had SNHL post operatively in comparison to 7(14%) patients in CWD.

Conclusion: From our study results, we think that CWU is superior to the CWD surgery in cases of cholesteatoma because of good post-operative hearing outcome as well as less complication and low morbidity. CWD surgery should be used in cases of extensive cholesteatoma, mental retardation, not sure about follow up and inadequate middle ear space cases.

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1. Introduction

Cholesteatoma is a well-demarcated sac noncancerous lesion derived from an abnormal growth of keratinizing squamous epithelium in the temporal bone, which is commonly characterized as “skin in the wrong place”. Cholesteatoma are the end stage of retractions of pars tensa

or flaccida that are not self-cleansing, retain epithelial debris and elicit a secondary, inflammatory mucosal reaction. This abnormal growth is locally invasive and capable of causing the destruction of structures in the middle ear cleft and surrounding structure. Cholesteatoma can be classified in two different types: congenital, which is specific to childhood, and acquired, which affects children as well as adults. Because of bone erosion, the lack

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of effective nonsurgical therapies, and the potentially fatal consequences of cholesteatoma underline the need for a comprehensive investigation of this condition. This study summarizes outcome in the surgical treatment of cholesteatoma.

Though the major goal of surgery of the middle ear cleft is to make the ear safe and dry by removal of disease; the increasing concern of the hearing outcome of patients have lead to surgeons resorting to techniques with maximum conservation of hearing and at the same time ensuring effective disease clearance. Two main surgical techniques employed in the treatment of cholesteatoma are Canal Wall Down Mastoidectomy (CWD) and Canal Wall Up Mastoidectomy (CWU).

There has been a never-ending debate on the comparison of the two types of mastoidectomy, CWD and CWU, for management of the cholesteatoma. An attempt has been made by the current study, to contribute to the available literature for the same and to compare the audio logical outcome of cholesteatoma patients with undergoing Canal Wall Down Mastoidectomy and Canal Wall Up Mastoidectomy.

2. Aims and Objectives

1. To evaluate the hearing results following CWU and CWD surgery in patient with cholesteatoma.
2. To decide surgical approach according to extension of disease.

3. Materials and Methods

This is a prospective study involving 100 patients with cholesteatoma who had undergone CWD mastoidectomy and CWU mastoidectomy over the period of three years.

The choice of mastoidectomy, CWD or CWU, was the decision of the surgeon, after completely evaluating the patient, preoperatively and intraoperatively..

3.1. Inclusion criteria

Patients with active squamous type COM without any associated complications.

3.2. Exclusion criteria

1. COM with intracranial or extracranial complications.
2. Congenital cholesteatoma.
3. Revision surgery.
4. Patients not willing to participate in the study.

All the patients underwent a detailed clinical examination along with the following investigations:

1. Examination under microscope with tuning fork test
2. X-ray both mastoid schuller's view
3. HRCT Temporal bone

4. Aural swab for culture and sensitivity
5. Pure tone audiometry

Patients were followed up for at regular interval.

The treatment of cholesteatoma is aimed at removal of the disease and also eliminating the risk of complications, thereby producing a safe and dry ear. Hearing improvement by ossiculoplasty should remain at second priority. A number of surgical approaches for csom have been documented.

Depending on the fact whether postero-superior canal is removed or not,

1. Canal wall up mastoidectomy
2. Canal wall down mastoidectomy

Pre operative otoscopic images (Figures 1, 2, 3 and 4)

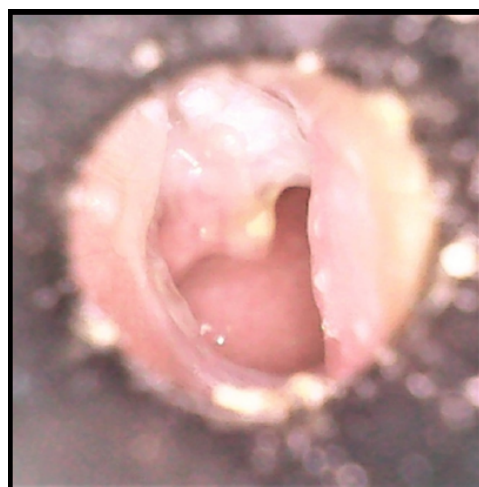


Fig. 1: Showing polyp arising from posterior wall of EAC in left ear.

Intraoperative images (Figures 5, 6, 7, 8, 9 and 10)

4. Discussion

In this three year of prospective single center comparative study, 100 patients with cholesteatoma were divided into two groups according to the type of mastoidectomy they had undergone; CWD and CWU. A comparison of the hearing outcome of the two surgical groups has been carried out.

This study comprised 100 cases, of which 57 were male and 43 were females. Males predominated slightly (57%) compared to females (43%) which is comparable to studies by Sadé et al.¹ and Jose Evandro Andrade Prudente de Aquino² et al.

In CWU group, most common presenting symptom was ear discharge (100%) followed by hearing loss present in 48(96%) patients, earache in 43 (86%), tinnitus and ear bleeding were present in 4 (8%) patients. In CWD group,



Fig. 2: Showing large perforation with attic cholesteatoma.

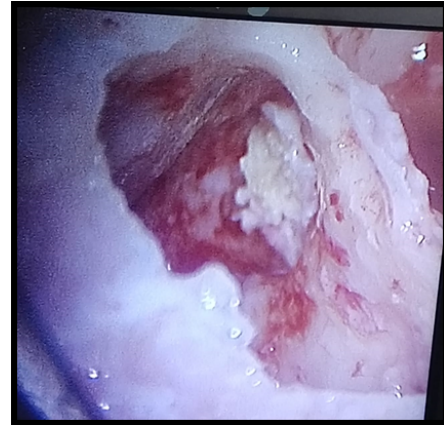


Fig. 5: Showing cholesteatoma in antrum with erosion posterior wall in right ear.



Fig. 3: Showing posterior half retraction in pars tensa with cholesteatoma flakes

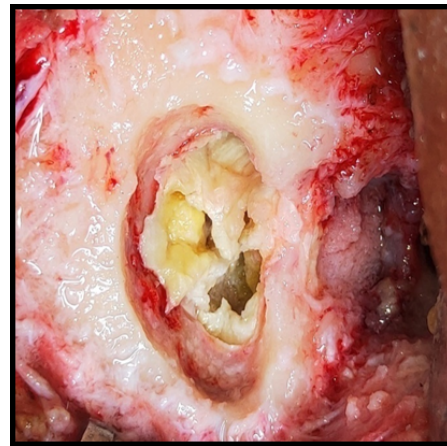


Fig. 6: Showing cholesteatoma in antrum, aditus.

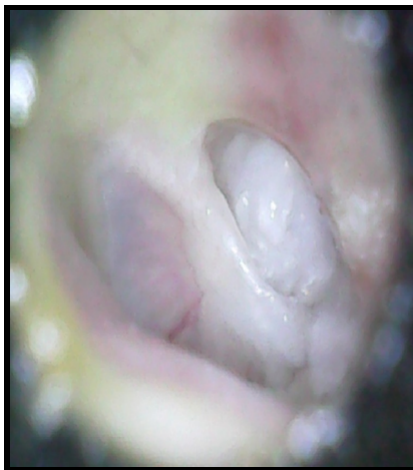


Fig. 4: Showing attic retraction pocket with cholesteatoma flakes, SCUTUM eroded.

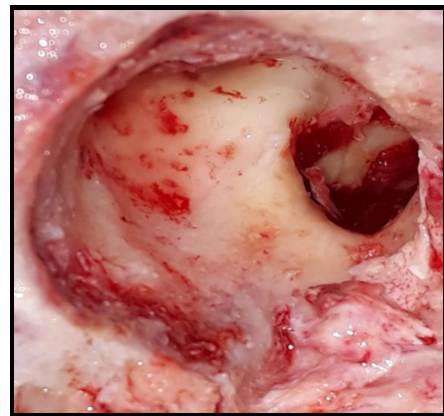


Fig. 7: Showing cartilage reconstruction in middle ear after canal wall up surgery in right side



Fig. 8: Showing cartilage reconstruction in middle ear after canal wall down surgery on right side.

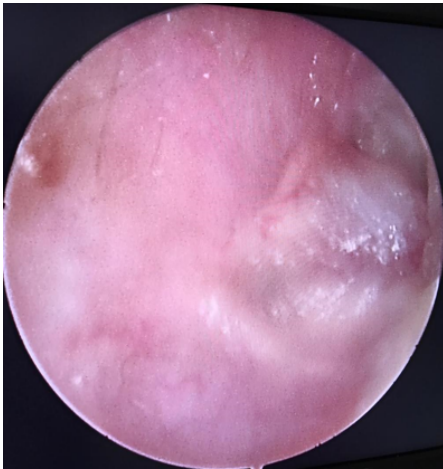


Fig. 9: Post operated image of canal wall up masoidectomy patient after 3 month.

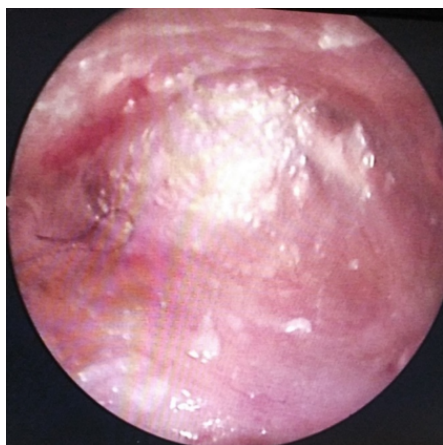


Fig. 10: Post operated image of canal wall down masoidectomy patient after 3 month.

most common presenting symptoms were ear discharge and earache in 50 (100%) patients followed by hearing loss present in 49(98%) patients, ear bleeding in 11(22%) patients, and headache in 3 (6%) patients. Tinnitus and vertigo were present in 2(4%) patients.

The primary surgical goal while treating cholesteatoma is complete exenterating of disease. Secondary aim is to improve the hearing to the extent possible with proper ossiculoplasty. The choice of treatment should ideally be one which completely clears the disease and simultaneously reconstructs the hearing apparatus in a single stage.

5. Evaluation of The Hearing Outcome

5.1. Comparison of the Hearing Gain between the CWD and CWU groups

In the CWD group, mean hearing gain, in 3 months was 12 ± 1.73 dB. In the CWU group, hearing gain in 3 month postoperative period was 18 ± 2.06 dB. From these observations, it is evident that the hearing gain was appreciable in 3 months postoperative period. Also the hearing gain between the two groups was compared and it was found to be statistically significant for the 3 months ($p=0.0002$) postoperatively; signifying that there was a comparable difference for CWU mastoidectomy over CWD mastoidectomy in the matter of Hearing Gain. The better hearing gain in the CWU group is easily attributable to the maximum preservation of the middle ear cleft anatomy and posterior canal wall also leading to better reconstructive outcome.

Similarly, in the study by Osborn et al, CWU patients had better postoperative hearing (median AB gap, 38 dB vs. 51 dB, $P = .004$) and greater hearing improvement (median hearing gain, 7 dB vs 0 dB, $P = .004$) than the CWD group.³

Varshney et al (2009) compared the hearing results by CWUM versus CWDM and found postoperative hearing gain in both groups similar with the hearing results of both these groups in our study. Hearing gain in CWUM and CWDM at 3 months was 19.37 dB and 11 dB thus concluding that the hearing results in CWUM is better than in CWDM.⁴

The choice of surgery may also significantly affect hearing outcomes. The hearing results of patients who received CWD tend to be worse than those who undergo CWU due to impairment of resonance in the middle ear.^{5,6} Placement of a graft or prosthetic device in the middle ear may be also difficult for patients with CWD, given the altered middle ear space.

Similarly, patients with CWD are limited in their choice of hearing aids, due to the enlarged ear cavity. Traditional hearing aids may be unsuitable in cases where the middle ear cannot be reconstructed or in cases of chronically draining ears.⁷ the canal wall-down procedure i.e., radical or modified radical tympanomastoidectomy

results in significant reduction in the size of residual middle ear air space.⁸

It is generally thought that surgeries that provide greater exposure -CWD, have less recurrence. Studies by Sheehy et al, Gristwood et al and Sana et al had 20% to 25% incidence of recurrence with CWU surgery^{9–11} and slightly higher than the 14.6% incidence with the CWD surgery.

SNHL was also seen post operatively in both groups. Total 3 (6%) patients in CWU had SNHL post operatively in comparison to 7 (14%) patients in CWD. Probable causes of post-operative hearing loss in a patient undergoing cholesteatoma surgery are, noise due to drills, continuous suction irrigation, vibrations, inner ear injury, manipulation of ossicles and a few unknown reasons.¹²

If the cholesteatoma has significantly destroyed the posterior canal wall preoperatively or the mastoid is much contracted or there is unsuspected canal wall destruction intraoperatively, we should not hesitate to take the canal wall down. We think that the open cavity technique is superior to the closed cavity technique in cases of treatment of large cholesteatomas. However we would prefer not to create an unnecessary cavity and when we encounter a small cholesteatoma confined to the middle ear we prefer the intact canal wall technique.

It is impossible to advise a single standard technique for any cholesteatoma. It is important to remove all disease and follow up all cases of cholesteatoma regardless of method of surgery.

6. Conclusion

From our study results, we think that CWU is superior to the CWD surgery in cases of cholesteatoma because of good post-operative hearing outcome as well as less complication and low morbidity. However we would prefer not to cause an unnecessary cavity in small limited cholesteatoma with well defined sac. CWD surgery should be used in cases of extensive cholesteatoma, mental retardation, not sure about follow up and inadequate middle ear space cases.

7. Conflicts of Interest

None.

8. Source of Funding

None.

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