

## Outcome of canal wall down mastoidectomy with Tympanoplasty

Nameirakpam Devakanta Singh<sup>1</sup>, Yumnam Tomba Singh<sup>1</sup>, Ningthoujam Kumarjit Singh<sup>2</sup>, Karam Monica<sup>2</sup>, Takhellambam Biram<sup>2</sup>, R. Jesline Joshua Jeyakaran<sup>3\*</sup>

<sup>1</sup>Associate Professor, Department of ENT, JNIMS, Porompat, India

<sup>2</sup>Assistant Professor, Department of ENT, JNIMS, Porompat, India

<sup>3</sup>S.R. Department of ENT, JNIMS, Porompat, India

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### Abstract

Chronic supportive otitis media is potentially serious disease because of their complications. In chronic cases complications are usually caused by progressive erosion of temporal bone thus increasing the risk of damage to facial nerve, labyrinth and the dura. With new surgical techniques, the complications and related mortality have been greatly reduced and furthermore the hearing threshold is also improved. The importance of this study is to achieve a stable hearing and to maintain the hearing mechanism as best as possible. The aim of the study is to assess the audiological and surgical outcome of canal wall down mastoidectomy with tympanoplasty. This study was conducted at Jawahar Lal Nehru Institute of Medical Sciences, Porompat, Imphal. The procedure and data collections of 50 patients were carried out for two years with effect from September 2018 to September 2020 and each case was followed up for 6 months. The data were entered and calculated statistically using SPSSv.20 software. The study shows significant hearing improvement in hearing post operatively. The mean air bone gap of 33.52 db reduced to 21.72 dB at 1 month post operatively and to 23.32 dB at 6 months post operatively (p= 0.00). In this study, 9 (18%) patients had wax in the cavity and were cleaned, graft retraction was seen in 3(6%) patients, vertigo was seen in 2(4%) and 1 patient had graft failure.

**Keywords:** Canal wall down mastoidectomy(CWDM), Tympanoplasty, Cholesteatoma, Decibel (dB), Pure Tone Audiometry (PTA) Airbone Gap (ABG).

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### Introduction

Otologists, over the years, experience challenges in treating the effects of chronic inflammation and cholesteatoma of the middle ear cleft. Surgical treatment i.e, the Tympanomastoid surgery is often required and is intended to eradicate the disease process and to help in the regression of middle ear cleft histopathological changes and to restore hearing mechanism[1].

Canal wall down mastoidectomy(CWDM) with tympanoplasty is an operation in which the posterior canal wall is taken down till the level of facial nerve and the floor of the mastoid cavity is continuous with the floor of the external canal whereas tympanoplasty is an operation performed to eradicate disease from the middle ear and to reconstruct, if possible the canal wall down mastoidectomy was considered to be the gold standard for the management of cholesteatoma for many years. Cholesteatoma management is typically surgical which aims to achieve a disease free and dry ear, but also to maintain the hearing mechanism as best as possible to reconstruct an affected hearing mechanism[2]. However its complication includes open cavity problems such as persistent otorrhea, keratin debris accumulation, caloric stimulation, inferior hearing and difficulty in fitting hearing aid. To resolve this issue, many surgeons have opted to lower the posterior canal wall to the level of the facial nerve for the management of cholesteatoma, followed by mastoid obliteration with reconstruction of posterior canal wall, ossicular chain and tympanic membrane. Several mastoid obliteration techniques have been used, such as muscle flaps, cortical

bone chips and hydroxyapatite. Mastoid obliteration provides a better quality of life as opposed to an unobliterated open cavity[3].

### Material and Methods

In this study a total of 50 patients above 15 years attending the ENT Department OPD of Jawahar Lal Nehru Institute of medical sciences, Porompat were carefully selected after thorough clinical and pre-operative evaluation. Patients with Squamosal chronic otitis media and extensive mucosal chronic otitis media (60% had cholesteatoma) requiring canal wall down were taken for the study. Patients with extensive cholesteatoma with moderate to profound sensorineural hearing loss, labyrinthitis and intracranial complications are excluded. Patients with systemic diseases are also excluded. The data were entered in personal computer using SPSSv.20 software and calculated using descriptive statistics like Mean, Standard Deviation, Proportion and Analytical Statistics like chi square, t- test or any other appropriate test were applied. A p- value of < 0.05 was considered to be statistically significant. Ethical clearance was also taken from the Institute ethics committee of JNIMS, Porompat, before conducting the study. All the patients after canal wall down mastoidectomy surgery were reconstructed using autologous ossicular remnants or tragal cartilage as strut in between temporalis fascia graft and stapes suprastructure. The autologous ossicular remnants and tragal cartilage are good autografts for tympanoplasty and they are good alternatives of synthetic grafts in terms of affordability and availability. The type of ossicular reconstruction done depends on the ossicular status. In our practice we used the classification described by Mirko Tos; Type 1: intact ossicular chain, straightforward myringoplasty, Type 2: defective long process of incus, interposition of an ossicle or prosthesis between the stapedial arch and malleus handle or eardrum, Type3: absent or defective stapedial arch, placement of collumella between

\*Correspondence

Dr. R. Jesline Joshua Jeyakaran

S.R. Department of ENT, JNIMS, Porompat, India.

E-mail: [Joshua06@gmail.com](mailto:Joshua06@gmail.com)

footplate and malleus handle or eardrum, Type 4: Sound protection of round windows with a graft, and formation of an airspace in the hypotympanum with absent ossicle and intact and mobile stapes footplate, Type 5A: fenestration of the lateral semicircular canal in cases with no ossicles and a fixed stapes footplate, Type 5B: platinectomy, the oval window niche is filled with fatty tissue or

fibrous tissue[4]. Cavity obliteration technique was used with pedicled flap and meatoplasty was done in all the patients. The pre-operative audiometry was compared with audiometric outcome after 1 month and 6 months of surgery. The status of the graft and recurrence of the disease are noted.

**Results**

**Table 1: Distribution based on age group (n=50)**

Age groups	No of patients
17-29 years	15
30-44 years	21
45-59 years	13
60-69 years	1
Above 70 years	0

Table 1 shows that a total of 50 patients underwent CWDM with tympanoplasty. The age group ranged from 17 years to 60 years. The mean (SD) age was 37.04+-11.33 years. Majority of them belonged to 30-44 years (42%) and least belonged to 60-69 years (2%). Out of

50 patients studied, 28(56%) patients were males and females were 22(44%) and most common presenting age group is 30-44 years (42%).

**Table 2: Distribution of Mean Air Bone gap pre operative and post operative with various frequencies.**

Frequency	Pre OP/Post OP Readings	Mean ABG	Standard Deviation	Significance (P value)
500 HZ	Pre Op	41.8	4.1335	0.000
	Post Op 1 month	28	4.6291	
	Post Op 6 months	28.7	4.2630	
1 K HZ	Pre Op	33.8	4.2330	0.000
	Post Op 1 month	23.1	3.6267	
	Post Op 6 months	24.4	3.7307	
2K HZ	Pre Op	25.8	3.9590	0.000
	Post Op 1 month	15.9	3.3028	
	Post Op 6 months	17.4	4.5446	
3 K HZ	Pre Op	32.7	3.9396	0.000
	Post Op 1 month	19.9	3.7102	
	Post Op 6 months	22.8	3.3746	

In Table 2 shows that all the patients had improvement in mean air bone gap post operatively for frequencies 500Hz, 1Kz, 2K Hz and 3K Hz and was found to be statistically significant (p= 0.000)

**Table 3: Distribution of mean air bone gap of patients pre and post operatively.**

Air Bone Gap	Mean	Standard Deviation	P Value
Pre OP	33.52	3.4040	0.000
Post OP 1 month	21.72	3.1832	0.000
Post OP 6 months	23.32	2.8971	0.000

From the above table we can inferred that the patients who underwent CWDM with tympanoplasty had improvement in their

mean air bone gap post operatively and are found to be statistically significant(p=0.000).

**Table 4: Distribution of mean air bone gap based on Mirko Tos Tympanoplasty (n=50).**

CWDM with Tympanoplasty type	No. of cases with CWDM according to Tympanoplasty type	Pre op ABG	Post op ABG at 1 month	Post op ABG at 6 months
Mirko tos type 2 tympanoplasty	26	32.07 dB	20.14 dB	22.6 dB
Mirko tos type 3 tympanoplasty	24	35.1 dB	23.44 dB	24.48 dB

In table 4 shows that 26 patients (52%) underwent CWDM with Mirko tos type 2 tympanoplasty and 24 patients (48%) underwent CWDM with type 3 Mirko tos tympanoplasty, their mean air bone gap post operatively at 1month and 6 months were 20.14 dB and

22.26 dB respectively. 24 patients underwent CWDM with type 3 Mirko Tos tympanoplasty and their mean air bone gap post operatively at 1 month and 6 months were 23.44 dB and 24.48 dB.

**Table 5: Distribution of mean air bone closure**

Air bone closure (gain) :	Mean values
Pre-operative 1 month	11.8 dB
Post-operative 6 months	10.2 dB

In table 5 shows that the mean air bone gain at 1 month post operative was 11.8 dB and at 6 months post-operatively was 10.2 dB.

**Table 6: Distribution of air bone gap gain at 1 month post operatively and at 6 months post operatively (n=50).**

Gain in Decibels	ABG gain 1 month post operatively	ABG gain 6 months post operatively
0 to 5 dB	0	1
6 to 10 dB	15	28

11 to 15 db	33	20
16 to 20 db	2	1
21 and above	0	0

At 1 month post operatively, 33 patients(66%) had an air bone gap improvement of 11-15 dB followed by 15 patients (30%) had 6-10 dB and 2 patients (4%) had improvement in air bone gap respectively. 28 patients (56%) had air bone gap improvement of 6-

10 dB post operatively at 6 months followed by 20 patients (40%) had 11-15 dB and 1 patient(2%) had 16 to 20 dB. 1 patient had less than 5 dB closure due to graft uptake failure.

**Table 7: Distribution of air bone gap (n =50)**

Air bone gap (n=50)	0 to 10 dB	11 to 20 dB	21 to 30 dB	31 to 40 dB	41 to 50 dB
Pre OP	0	0	2	45	3
Post OP at 1 month	0	16	33	1	0
Post OP at 6 months	0	2	47	1	0

Table 7 shows that Pre-operatively 45 patients (90%) had mean air bone gap between 31 to 40 dB. Post operatively at 1 month 33 patients (66%) had 21 to 30 dB air bone gap followed by 16 patients

(32%) had 11 to 20 dB air bone gap. Post-operatively at 6 months 47 patients (94%) had air bone gap of 21 to 30 dB.

**Table 8: Distributions of complications post operatively**

Complications	Total	Percentage
Haematoma	1	2
Facial nerve palsy	0	0
Vertigo	2	4
Wax	9	18
Graft failure	1	2
Labrynthitis	0	0
TM retraction	3	6
Recurrence	0	0
Persistent discharge	0	0

Table 8 shows that 1 patient (2%) had haematoma at area of temporalis fascia graft and was managed conservatively. 2(4%) patients complained of vertigo, they improved with medications. 9 (18%) patients had wax in the cavity and was cleaned. 1 patients had graft failure. Graft retraction was seen in 3(6%) patients. No patients had labyrinthitis, recurrence or persistent discharge during the study period.

**Discussion**

Out of the 50 patients studied, 28(56%) patients were males and 22(44%) were females and the most common presenting age group is 30-44 years (42%). Similar results of age and male predominance was seen in studies done by Qotb M et al<sup>3</sup>, Karamert et al<sup>5</sup> and Demir E et al[6].All the patients had significant improvement in air bone gap post operatively. The findings of pre-operative ABG mean and post-operative ABG mean at 1 month and 6 months for each frequency (500 Hz,1K Hz,2 K Hz and 3 K Hz) shows statistically significant values (p = 0.000).The mean air bone gap pre-operatively was 33.52 dB, post-operative mean air bone gap at 1 month was 21.72 dB, and mean post- operative air bone gap at 6 months was 23.32dB. It was found to be statistically significant (p=0.000). Shresta et al<sup>7</sup> had similar results with mean pre op and post op air bone gap of 37.8 dB and 29.8 dB respectively. In another study Qotb M et al<sup>3</sup> had mean pre op ABG of 35.9 dB and post op ABG of 33.9 dB respectively. Berenholz LP et al<sup>8</sup> in his study recorded mean pre op ABG of 29.55 dB and post op ABG of 17.82 dB. All the studies showed significant improvement in air bone gap post operatively.

Regarding the audiological outcome based on tympanoplasty type, did not demonstrate any significant difference between type 2 and 3 tympanoplasty. The mean air bone gap at 1 month for type 2 and type 3 were 20.14 dB and 23.44 dB respectively and mean air bone gap at 6 months was 22.6 dB and 24.48 dB respectively. Patients with intact stapes had better pre operative mean air bone gap values compared to those with eroded or absent stapes and this continues post operatively. Similar results were seen in studies done by Abdullah AS et al, Mukherjee P et al and Siddappa PN et al that in patients with intact stapes supra-structure had better hearing results compared to those with eroded or absent stapes supra-structure[9-11]. The mean ABG closure post operatively at 1 month was 11.8 dB and post-operatively was 10-2 dB. Similar results were obtained in a study of Berenholz LP et al[8] with mean ABG closure at 1month -

11.37 dB and at 1 year- 9.87 dB. In another study by Stankovich MD loss of 2 dB was encountered in long term follow up and in study by Edfelt L et al[12,13] had 1 dB loss in long term.The distribution of air bone gap shows that pre operatively 96% (48) of patients had mean air bone gap above 30 dB and post operatively at 6 months 94% (47) of patients had air bone gap of 21 to 30 dB. Similar results were obtained in study by Kim MB et al[14] had 83% of patient having post op ABG less than 30 dB. The most common complaint post operatively was wax and crusts in cavity (18%). Graft retraction was seen in 6% of cases. In a study by Khalil HS et al[15] the commonest problem faced by patients was wax and crust in the cavity. In another study by Qotb M et al[2] encountered 12% of patients having graft retraction post operatively. In this study no patient reported with facial nerve paralysis, labyrinthitis, recurrence or persistent discharge post operatively.

**Conclusion**

The present study shows that with a proper canal wall mastoidectomy with tympanoplasty , it is possible to obtain good and stable long term hearing result . There is significant improvement in hearing after the canal wall down mastoidectomy with tympanoplasty. Canal wall down mastoidectomy is an effective technique for eradication of advanced chronic otitis media or cholesteatoma. Under the hands of expert surgeon canal wall down mastoidectomy is a very safe procedure with least complications and almost nil recurrence post operatively.

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