Acta Scientific Otolaryngology

Volume 4 Issue 3 March 2022

Research Article

A Comparative Study on Effect of Different Approaches of Mastoidectomy Related to Recurrence and Hearing Improvement

Sushil G Jha[1] and S Balaji[2]*

[1]HOD, Department of ENT, Government Medical College, Bhavnagar Gujarat, India

[2]Former Resident, Department of ENT, Government Medical College Bhavnagar and Meenakshi Mission Hospital and Research Centre, Madurai, Tamilnadu, India

***Corresponding Author:** S Balaji, Former Resident, Department of ENT, Government Medical College Bhavnagar and Meenakshi Mission Hospital and Research Centre, Madurai, Tamilnadu, India.

DOI: 10.31080/ASOL.2022.04.0403

Received: January 26, 2022

Published: February 28, 2022

Abstract

Introduction: Hearing can be impaired by many conditions such as congenital, or due to trauma or infection or any abnormality in conductive pathway, of this infection in middle ear is one of the most common cause of hearing loss in developing countries. So any abnormality in tympanic membrane or middle ear conductive mechanism may cause Conductive type of hearing loss.

The diagnosis of chronic otitis media (COM) implies a permanent abnormality of the pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion.

Materials and Methods: A comparative retrospective study was conducted on the patients of unsafe type of chronic otitis media, who had undergone mastoid surgery.

Aim: Aim of this study is to compare the success rate of the different types of mastoid surgeries like modified radical mastoidectomy (canal wall down), intact canal wall mastoidectomy without posterior tympanotomy and intact canal wall mastoidectomy with posterior tympanotomy, in terms of eliminating cholesteatoma and to assess the postoperative hearing improvement in different kinds of surgeries.

Inclusion criteria: Patients having unsafe type of COM.

Exclusion criteria: Patients who were excluded for intact canal wall surgery were,

- Revision ICW cases
- More than 1/3rd destruction of posterior canal wall (Intra operative finding) 3.Patients who had severe to profound hearing loss due COM.

Conclusion: Intact canal wall masotidectomy with or without posterior tympanotomy were having better hearing results compared to modified radical mastoidectomy. The advantage of intact canal wall mastoidectomy with posterior tympanotomy are, minimal recurrence rate due to completely removal of disease, and better post op hearing threshold. But intact canal wall mastoidectomy with posterior tympanotomy is technically difficult, it requires good surgical skills. Modified radical mastoidectomy has inherent cavity problem, poor post op hearing as reconstruction with auto graft is difficult and requires lifelong follow up but has the advantage of less recurrence and technically easy to perform. In Intact canal wall mastoidectomy without posterior tympanotomy can give good hearing results as it allows hearing reconstruction and also offers a greater selection of hearing aids but complete eradication of disease might not be possible.

Keywords: Hearing; Chronic Otitis Media; Diagnosis

Introduction

The Hearing is the one of the most important means of social communication. Hearing can be impaired by many conditions such as congenital, or due to trauma or infection or any abnormality in conductive pathway, of this infection in middle ear is one of the most common cause of hearing loss in developing countries. So any abnormality in tympanic membrane or middle ear conductive mechanism may cause Conductive type of hearing loss.

The diagnosis of chronic otitis media (COM) implies a permanent abnormality of the pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion.

However, the distinction remains between active COM, where there is inflammation and the production of pus, and inactive COM, where this is not the case though there is the potential for the ear to become active at some time. A third clinical entity is healed COM where there are permanent abnormalities of the pars tensa, but the ear does not have the propensity to become active because the pars tensa is intact and there are no significant retractions of the pars tensa or flaccida.

'Healed COM' can also be the end result of successful surgery.

Broadly we classify the COM as SAFE type or TUBOTYMPANIC TYPE, or ATTICO ANTRAL type or UNSAFE TYPE. Here our main aim of surgery is to prevent spread of infection to CNS, secondly to give a safe ear, finally the hearing improvement.

Materials and Methods

A comparative retrospective study of 60 cases from June 2014 to January 2017 in the Department of Otorhinolaryngology, Govt Medical College Bhavnagar, Gujarat, was conducted on the patients of unsafe type of chronic otitis media, who had undergone mastoid surgery.

The patients with unsafe type of CSOM want to undergo mastoidectomy surgery. It can be either intact canal wall or canal wall down surgery. In Intact canal wall mastoid surgery, in few patient based on the extent of disease we performed post tymponatomy for better removal of cholesteatoma and preservation of hearing intra operatively we decided to perform post tympanotomy.

Finally we broadly categorized the patients into three groups:

- Types of mastoidectomy approaches
- Modified radical mastoidectomy
- Intact canal wall mastoidectomy without posterior tympanotomy
- Intact canal wall mastoidectomy with posterior tympanotomy

Post operative disease recurrence and hearing loss are assessed for each patients and this study is to compare the degree of hearing loss and percentage of disease recurrence in the three different categories of patients as mentioned earlier.

Aim

Aim of this study is to compare the success rate of the different types of mastoid surgeries like modified radical mastoidectomy (canal wall down), intact canal wall mastoidectomy without posterior tympanotomy and intact canal wall mastoidectomy with posterior tympanotomy, in terms of eliminating cholesteatoma and to assess the postoperative hearing improvement in different kinds of surgeries.

Inclusion criteria

Patients having unsafe type of COM.

Exclusion criteria

Patients who were excluded for intact canal wall surgery were,

- Revision ICW cases
- More than 1/3rd destruction of posterior canal wall (Intra operative finding) 3.Patients who had severe to profound hearing loss due COM.

Bimaterials like TROP and PORP are used in some patients for ossicular reconstruction,they were excluded from the study.

All patients were asked to undergo routine history taking and complete ENT examination and Pure tone audiometry. A battery of investigations including routine blood investigations, urine examination were done for pre operative anaesthesia fitness, X ray both mastoid (schuller's view) and examination under microscope was done in all patients. Pus for culture and sensitivity, HRCT temporal bone were done in some selected cases.

In this study 28 patients had undergone intact canal wall mastoidectomy with posterior tympanotomy, 19 patients had undergone intact canal wall mastoidectomy without posterior tympanotomy and 13 patients had undergone modified radical mastoidectomy.

As mentioned earlier the main aim of surgery in unsafe ear is to give safe ear and to prevent spread of infection to CNS. Our first preference is to completely eradicate the disease during surgery followed by reconstruction of hearing.

Intraoperatively we found that it is difficult to remove disease from sites like sinus tympani and facial recess. Disease removal and reconstruction was done in a single stage. Ossicular sculpting and tragal cartilage were used for ossiculoplasty in some case of intact canal wall mastoidectomy with or without posterior tympanotomy.

Temporalis fascia grafting done in most of the cases. Biomaterials were not used. Post op care taken, patients were followed up to 18 months to know the recurrence rate and do hearing assessment.

Results and Observations

In this study 60 patients were enrolled. Post operative follow was done up to 18 months.

- Patients were evaluated for recurrence due to residual disease,
- Hearing improvement (assessed by tuning fork and PTA).

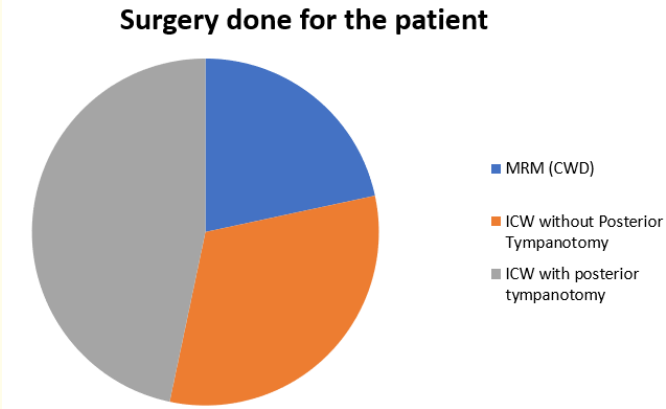

Figure 1

It is evident from the table that less than one third of the patients had undergone CWD surgery (21.6%) and about half of the patients had undergone Intact canal wall mastoidectomy with posterior Tympanotomy (46.6%) and rest of the patient had undergone Intact canal wall surgery without posterior tympanotomy (31.7%).

This table shows that most of the patient pre operatively had moderate (61.6%) and moderate to severe conductive hearing loss (23.7%), only few patients had Mild conductive hearing loss (15%).

In Modified radical mastoidectomy - No. of cases = 13.

Type of Mastoidectomy Approaches	Frequency	Percent
Modified Radiacal Mastoidectomy	13	21.7
Intact Canal Wall Mastoidectomy with Post Tympanotomy	28	46.6
Intact Canal Wall Mastoidectomy Without Post Tympanotomy	19	31.7
Total	60	100.0

Table 1

Pre op hearing status		Post op hearing status	
Hearing loss	**No. of pts (n = 13)**	**Hearing loss**	**No. of pts (n = 13)**
Mild	2	Mild	0
Moderate	4	Moderate	6
Moderately severe	7	Moderately severe	0
Severe	0	severe	7

Table 2

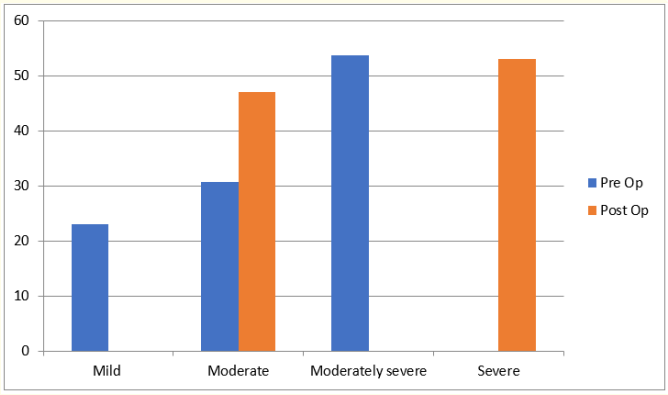

Figure 2

Hearing assesment after modified radical mastoidectomy surgery

This table shows that there is no hearing improvement in canal wall down surgery patients, but we also want to note that most of them have moderately severe CHL even before the surgery due to the disease process and so only they had undergone CWD procedure.

So this hearing loss is statistically significant so it is evident that modified radical mastoid surgery has poor post operative hearing outcome.

Type of Mastoidectomy			Post Op Hearing loss (in db)			Total	P-Value
			Mild	Moderate	Severe		
Modified Radiacal Mastoidectomy	Pre op hearing loss (in db)	Mild	0	2	0	2	0.022 Sig
			0.0%	33.3%	0.0%	15.4%	
		Moderate	0	4	2	6	
			0.0%	66.7%	28.6%	46.2%	
		Severe	0	0	5	5	
			0.0%	0.0%	71.4%	38.5%	
	Total		0	6	7	13	
	0.0%		100.0%	100.0%	100.0%		

Table 3

In Intact canal wall mastoidectomy without posterior tympanotomy - No. of cases 19.

Pre op hearing loss		Post op hearing loss	
Hearing loss	No. of pts (n = 19)	Hearing loss	No. of pts (n = 19)
Mild	3	Mild	11
Moderate	11	Moderate	8
Moderately severe	5	Moderately severe	0
Severe	0		0

Table 4

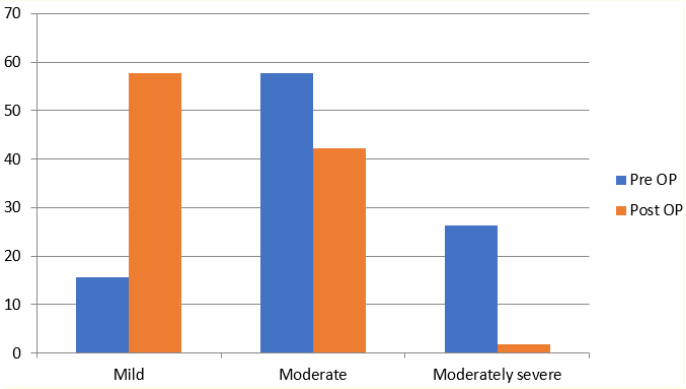

Figure 3

Hearing assesment after intact canal wall surgery without posterior tympanotomy

This table shows Hearing assessment after intact canal wall mastoidectomy without posterior tympanotomy, more than half of the people have moderate conductive hearing loss and there is a very good improvement in hearing after the surgery. This may be due to two reasons, firstly patient presented with early stage of the disease and secondly it is not a radical surgery as disease is not that much extensive and destructive.

This shows that hearing loss or gain statistically significant, so intact canal wall mastoid surgery without post tympanotomy has significant hearing outcome.

Type of Mastoidectomy			Post Op Hearing loss (in db)			Total	P-Value
			Mild	Moderate	Severe		
Intact Canal Wall Mastoidectomy Without Post Tympanotomy	Pre op hearing loss (in db)	Mild	3	0	0	3	0.041 Sig
			27.3%	0.0%	0.05	15.8%	
		Moderate	8	5	0	13	
			72.7%	62.5%	0.05	68.4%	
		Severe	0	3	0	3	
			0.0%	37.5%	0.05	15.8%	
	Total		11	8	0	19	
			100.0%	0.0%	100.0%	100.0%	

Table 5

Intact canal wall mastoidectomy with post tympanotmy (n = 28).

Pre op hearing loss		Post op hearing loss	
Hearing loss	No. of pts (n = 28)	Hearing loss	No. of pts (n = 28)
Mild	4	Mild	16
Moderate	22	Moderate	12
Moderately severe	2	Moderately severe	0
Severe	0	severe	0

Table 6

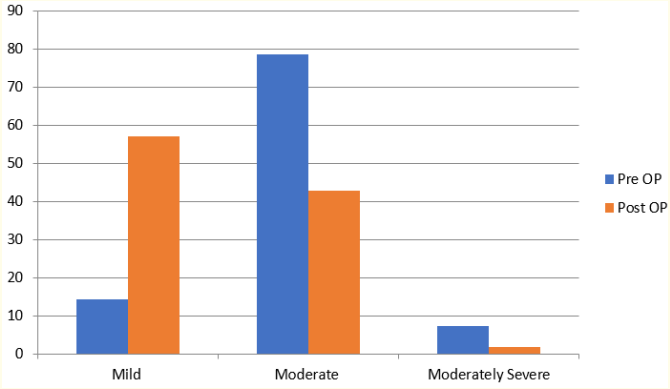

Figure 4

Hearing assesment after intact canal wall mastoidectomy with posterior tympanotomy

This table shows most of the patient who undergone intact canal wall mastoid surgery with posterior tympanotomy had Moderate conductive hearing loss and post operative hearing is improved in most of the patients and none of them had a moderately severe/ severe conductive hearing loss.

However we come to know that the hearing loss or improvement is non significant.

This table shows that most of the patients with unsafe COM had Cholesteatoma in attic and sinus tympani regions which is very difficult to remove.

Type of Mastoidectomy			Post Op Hearing loss (in db)			Total	P-Value
			Mild	Moderate	Severe		
Intact Canal Wall Mastoidectomy with Post Tympanotomy	Pre op hearing loss (in db)	Mild	5	0	0	5	0.063 NS
			31.3%	0.0%	0.05	17.9%	
		Moderate	11	11	0	22	
			68.8%	91.7%	0.05	78.6%	
		Severe	0	1	0	1	
			0.0%	8.3%	0.05	3.6%	
	Total		16	12	0	28	
			100.0%	0.0%	100.0%	100.0%	

Table 7

Intra operative disease site	No. of patients
In sinus tympani	49
In facial recess	43
In Attic	52

Table 8

Post-operative recurrence of disease

Types of approaches of mastoidectomy	Total no. of patients (n = 60)	Pts having post op recurrence of disease
Modified radical mastoidectomy	13	0
Intact canal wall mastoidectomy without posterior tympanotomy	19	6
Intact canal wall mastoidectomy with posterior tympanotomy	28	0

Table 9

Recurrence after surgery

From this table it is very evident that recurrence is very high if we do intact canal wall surgery without doing post tympanotomy and it is statistically significant.

We observed that in randomly selected 60 cases of COM, we got better result with intact canal wall mastoidectomy with posterior tympanotomy in terms of both recurrence of disease and post op hearing improvement which is non significant. Patient who were operated with intact canal masoidectomy without posterior tympanotomy were having good post op hearing but had high recurrence rate which might be because of residual disease in poorly accessible areas like sinus tympani and facial recess, where complete disease removal might not be possible. The patients who were operated with modified radical mastoidectomy had minimal or no recurrence rate but had significant post op hearing loss as reconstruction was difficult with autograft, these patients also had inherent cavity problem which needs a lifelong follow up.

Type of Mastoidectomy	Post Op Recurrence		Total	P-Value
	Yes	No		
Modified Radiacal Mastoidectomy	0	13	13	0.022 Sig
	0.0%	24.1%	21.7%	
Intact Canal Wall Mastoidectomy with Post Tympanotomy	6	22	28	
	100.0%	40.7%	46.7%	
Intact Canal Wall Mastoidectomy Without Post Tympanotomy	0	19	19	
	0.0%	35.2%	31.7%	

Table 10

Discussion

The choice for preserving or removing the posterior canal wall of the EAC [3], i.e., CWU versus CWD mastoidectomy, has been extensively debated. An open cavity is having advantage of lower rate of disease recurrence [4] but having disadvantage [5-7] of big cavity and hearing loss it is usually combined with wide meatoplasty which is not cosmetically acceptable by few people. Hearing outcome is better in CWU mastoidectomy when compared to CWD. Toner and Smyth [8] reported better hearing outcomes after one year of surgery in intact canal wall surgery patients when compared with canal wall down surgery patients.

Preservation of the canal wall is preferred in our practice. The decision to remove the wall is most often made during surgery. When more than 1/3rd of posterior ear canal wall is destroyed by the disease, we prefer to remove it and go for modified radical mastoidectomy. Patients who had undergone intact canal wall mastoidectomy with posterior tympantomy had no recurrence compared to ICW without posterior tympanotomy. In patients of intact canal wall mastoidectomy with posterior tympantomy regular follow up was not required beyond a certain period. Although recurrence was also less in modified radical mastoidectomy but post op hearing status was very poor as compared to ICW mastoidectomy with or without posterior tympanotomy and they also need a life lonf followup. Mahadevaiah., *et al.* [9] study revealed that postoperative mean air conduction was 41.5 dB and mean air-bone gap was 21.1 dB. Stankovic., *et al*. [10] observed mean air-bone gap of 14.6 dB.

In a canal wall-down mastoidectomy, the bony tympanic annulus and much of the ear is removed, and the tympanic membrane graft is placed onto the facial ridge and medial attic wall. This results in a significant reduction in the size of the residual middle-ear air. However, as long as this airspace is greater than or equal to 0.5 cc, the resultant loss of sound transmission should be less than 10 dB. Since the average volume of the tympanic cavity is 0.5 to 1.0 cc, a canal wall down procedure should create no significant acoustic detriment, so long as the middle ear is aerated [11].

Conclusion

Intact canal wall masotidectomy with or without posterior tympanotomy were having better hearing results compared to modified radical mastoidectomy. The advantage [12] of intact canal wall mastoidectomy with posterior tympanotomy are, minimal recurrence rate due to completely removal of disease, and better post op hearing thresholds (non significant). In these patients preservation of a normal external auditory canal can allow use of hearing aids more conveniently and the absence of a mastoid cavity that results in reduced postoperative convalescence and less follow up. But intact canal wall mastoidectomy with posterior tympanotomy is technically difficult, it requires good surgical skills. Modified radical masoidectomy has inherent cavity problem, poor post op hearing as reconstruction with auto graft is difficult and requires lifelong follow up but has the advantage of less recurrence and technically easy to perform. In Intact canal wall mastoidectomy without posterior tympanotomy can give good hearing results as it allows hearing reconstruction and also offers a greater selection of hearing aids but complete eradication of disease might not be possible because of poor accessibility of hidden areas like facial recess, sinus tympani, which may cause recurrence.

Bibliography

1. Browning GG. "Chapter 3. Aetiopathology of inflammatory conditions of the external and middle ear". In: Kerr AG (ed.). Scott-Brown's Otolaryngology, 6th edn. London: Arnold, 3 (1997).

2. Scott Brown Ch. 6th edition, ch 237c part 19, page no 3432.

3. Shambaug 7th edition, ch 30, pg no 504.

4. Palva T. "Surgical treatment of chronic middle ear disease". II. Canal wall up and canal wall down procedures". *Acta Oto-Laryngologica* 104 (1987): 487-494.

5. Lindroos R. "Surgery for chronic ear disease in a non university hospital: open cavity, obliteration and intact canal wall techniques". *Clinical Otolaryngology and Allied Sciences* 16 (1991): 252-256.

6. Harkness P., *et al*. "Mastoidectomy audit: results of the Royal College of surgeons of England comparative audit of ENT surgery". *Clinical Otolaryngology and Allied Sciences* 20 (1995): 89-94.

7. Merchant SN., *et al*. "Efficacy of tympanomastoid surgery for control of infection in active COM". *Laryngoscope* 107 (1997): 872-877.

8. Toner JG and Smyth GD. "Surgical treatment of cholesteatoma: A comparison of three techniques". *American Journal of Otolaryngology* ll.4 (1990): 247-249.

9. Mahadevaiah A. "Modified intact canal wall mastoidectomy – long term results in hearing and healing". *Indian Journal of Otolaryngology and Head and Neck Surgery* 60 (2008): 317-323.

10. Stankovic Milan. "Audiologic Results of Surgery for Cholesteatoma: Short- and Long-Term Follow-Up of Influential Factors". *Otology and Neurotology* 29 (2008): 933.

11. Shaumbaug ear surgery, 6th edition ch number 3, page no 67.

12. Scott Brown, 6th edition, ch 237c part 19, page no 3433.