



A Study of Evaluation of Hearing Loss in Tympanic Membrane Perforation and Hearing Outcome after Tympanoplasty

Authors

Dr V.P. Narve¹, Dr Vinay Gangwani^{2*}, Dr Varsha Tripathi³, Dr Deepak Parmar⁴

¹Professor, Department of ENT Jaya Arogya Hospital, Gwalior

^{2,3,4}Post Graduate Student, Department of ENT Jaya Arogya Hospital, Gwalior

*Corresponding Author

Dr Vinay Gangwani

Post Graduate Student, Department of ENT Jaya Arogya Hospital, Gwalior, India

Abstract

Aims and Objective: Assessment of effect of size, site, location of perforation on the degree of hearing loss. To evaluate improvement in hearing after tympanoplasty.

Methodology: This is the retrospective and prospective study of 100 patients that underwent tympanoplasty at tertiary care hospital between January 2106 to June 2018. The follow up period was 1 year.

Results: Most common type of perforation was medium type of perforation with incidence of 44%. Hearing loss was found to be maximum with large central perforation (49.7 ± 7.07 dB). Mean improvement gain after tympanoplasty was also maximum with large central perforation (15.67 dB).

Conclusion: The larger the size of perforation, the larger is the hearing loss. The location of perforation has significant effect on the degree of hearing loss with posterior quadrant perforations causing more hearing loss. Tympanoplasty is a beneficial procedure for hearing improvement and eradication of disease and there is significant improvement after tympanoplasty.

Introduction

Tympanic membrane is a membranous partition separating the external auditory meatus from the tympanic cavity, measuring 9-10 mm vertically and 8-9 mm horizontally¹. It plays a major role in middle ear transformer mechanism. Tympanic membrane perforation is caused by variety of causes, the most common being trauma and infections. Trauma (Barotrauma, temporal bone fracture), Infections (Acute otitis media, chronic otitis media, TB), Iatrogenic (ventilation tubes). Tympanic membrane perforation leads to varying degree of conductive hearing loss. So it is important to diagnose and treat tympanic membrane perforation as early as possible as

untreated tympanic membrane perforation leads to ongoing destructive changes in the middle ear, thus adding to further hearing loss.

Chronic otitis media is a long standing infection of the middle ear cleft characterized by persistent or recurrent aural discharge, deafness and perforation of tympanic membrane.COM often results in partial or total loss of the tympanic membrane (TM) and ossicles, leading to conductive hearing loss that can range in severity up to 60 dB. Incidence of COM is higher in developing countries like INDIA due to overcrowding, inadequate health facilities, poor hygiene, low socio-economic status, recurrent respiratory tract infections, poor nutrition &

pollution. Chronic otitis media can be managed in two ways, conservative and surgical management. The aim of middle ear surgery for hearing is reduction in the patient's hearing disability, not just closure of the airbone gap². Small perforations usually heal spontaneously but when the edges of the perforation are covered by stratified squamous epithelium, a perforation becomes permanent and does not heal spontaneously³.

Among the various causes of ear diseases, COM is a major global cause of hearing impairment and may have serious long term effects on language, auditory, cognitive development and educational progress. As per WHO, the prevalence of COM in Indian population is approximately 2% which is comparatively higher than that found in developed countries like that of USA and UK where the prevalence is <1%⁴. Majority of patients with COM do well with antimicrobial therapy but despite this there is a subset of the patients who develop serious intratemporal and intracranial complications from this otherwise self-limiting disease; and the mortality rate of these remains substantial ranging from 10–31%. The diagnosis of COM needs to be made earlier in order to prevent its long-term effects especially on hearing impairment

Several therapeutic practices and regimens have evolved to treat COM, but the surgical management –tympanoplasty– has remained the ultimate choice^{5,6}. Procedures such as grafting the tympanic membrane, alone, or in combination with ossiculoplasty (tympanoplasty with ossicular chain reconstruction), comprise the varying subtypes of tympanoplasty^{7,8}. Type-1 tympanoplasty is performed when there is tympanic membrane perforation without any ossicular damage⁹. Tympanoplasty type 1 can be nearly as straightforward as myringoplasty and for instance simply involve removal of a retracted membrane in the tympanic cavity or removal of adhesions around the ossicles but it can also be an extensive and time consuming procedure when combined with mastoidectomy procedures¹⁰. This study deals with evaluation of hearing loss in

tympanic membrane perforation and functional outcome in a series of patients who underwent tympanoplasty using temporalis fascia graft/grfts from other sites.

Materials & Methods

The study entitled to “A Study of Evaluation of Hearing Loss in Tympanic Membrane Perforation and Hearing Outcome after Tympanoplasty” conducted in the department of otorhinolaryngology & head and neck surgery, Jayarogya group of hospitals and gajra raja medical college Gwalior (M.P.) for a period of 1 and half year from January 2017 to June 2018 and the retrospective data was collected from January 2016 to December 2016. A total of 100 cases presenting with complaints of ear discharge, impaired hearing, ear pain in the ENT ward or opd were taken for study.

Study Design: retrospective and prospective study.

Inclusion Criteria

- Cases with safe CSOM.
- Patients with age between 10 years to 50 years.

Exclusion Criteria

- Patients younger than age 10 are excluded to eliminate the possibility of inaccuracies of audiological testing in children.
- Patients older than 50 years of age were excluded because of the increased incidence of presbycusis in this age group.
- Patients with active discharge.
- Traumatic perforation.
- Post ventilation tube insertion.
- Mixed hearing loss.
- Patients with presbycusis.
- Patients with history of familial hearing loss.
- Patients with history of prolonged exposure to noise and ototoxic drugs.
- Patients with history of head trauma.
- Patients not giving consent for the relevant investigation will be excluded from this study.

Results

1) Age distribution of patients

In our study maximum number of patients were from age group 20-40 years (53%), followed by 10-20 years (41%).

Table no. 1 : Age distribution of patients

Age group (in years)	Number of patients	Percentage
0 to 20 years	41	41%
20 to 40 years	53	53%
40 to 60 years	06	06%
>60 years	00	0%

2) Sex ratio of the patients

The total number of male and female patients in our study were 38 and 62 respectively.

Table no. 2: Sex ratio of the patients

Sex	Number of patients	Percentage
Male	38	38%
Female	62	62%
Total	100	100%

3) Duration of ear discharge

The duration of ear discharge range from 3months to 20 years with 30% of patients having ear discharge for 16 years to 20 years.

Table no. 3: Duration of ear discharge

Duration of ear discharge	Number of patients	Percentage
< 2 years	23	23%
3 to 5 years	18	18%
6 to 10 years	22	22%
11 to 15 years	07	07%
16 to 20 years	30	30%
Total	100	100%

4) Duration of impaired hearing

The duration of impaired hearing ranges from 2 months to 20 years with 44% having hearing impairment for less than 2 years.

Table no. 4: Duration of impaired hearing.

Duration of impaired hearing	Number of patients	Percentage
< 2 years	44	44%
3 to 5 years	30	30%
6 to 10 years	13	13%
11 to 15 years	02	02%
16 to 20 years	11	11%
Total	100	100%

5) Unilateral versus bilateral disease

Patients with unilateral disease were 53% and with bilateral ear disease were 47%.

Table no. 5: Unilateral v/s bilateral disease

Ear disease	Number of patients	Percentage
Unilateral	53	53%
Bilateral	47	47%

6) Types of perforation

In our study most common type of perforation encountered was medium central perforation being about 44%, followed by large central perforation (37%) and small central perforation (19%).

Table no. 6: Types of perforation

Perforation	Number of patients	Percentage
Small central	19	19%
Medium central	44	44%
Large central	37	37%

7) Hearing loss associated with size of perforation

Pre-operatively hearing loss was found to be maximum with the large central perforation i.e. 49.7dB ± 7.07dB followed by medium central perforation and small central perforation respectively.

Table no. 7: Hearing loss a/w type of perforation

Perforation	Number of patients	Average hearing loss in dB with standard deviation
Small central	19	37.34 ± 8.21
Medium central	44	43.98 ± 10.40
Large central	37	49.7 ± 7.07

8) Hearing loss associated with duration of ear discharge

More the duration of discharge is, more is the hearing loss.

Table no. 8: Hearing loss a/w duration of ear discharge

Duration of ear discharge	Number of patients	Average hearing loss in dB with standard deviation
Less than 2 years	44	37.64 ± 6.35
3 to 5 years	30	46.22 ± 10.70
6 to 10 years	13	46.98 ± 10.69
11 to 15 years	02	47.6 ± 9.76
16 to 20 years	11	45.2 ± 12.55

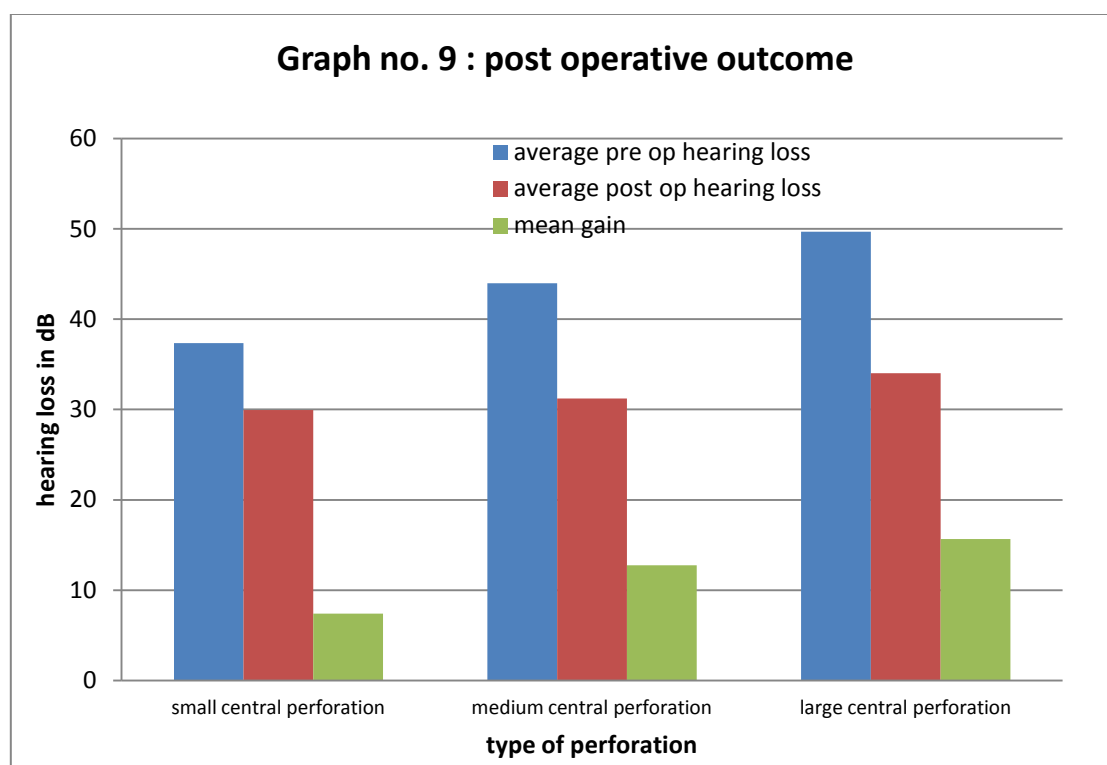
9) Post operative outcome

Outcome following tympanoplasty was measured in terms of Post-operative Audiometry done 4-6 months after surgery, which showed significant improvement in average hearing

thresholds. Mean improvement gain of observed in patients operated for large central perforation, medium central perforation, small central perforation are 15.67dB, 12.75dB, and 7.39dB respectively with individual p value= 0.00.

Table no. 9 : Post-operative outcome

Type of perforation	Pre operative PTA with standard deviation	Post operative PTA with standard deviation	Mean gain in dB	P value
Small central perforation	37.34 ± 8.21	29.95 ± 7.32	7.39	0.00
Medium central perforation	43.98 ± 10.40	31.23 ± 8.75	12.75	0.00
Large central perforation	49.7 ± 7.07	34.03 ± 7.74	15.67	0.00



Discussion

COM is one of the commonest conditions, which the Otorhinolaryngologists encounter in day to day practice. The tubotympanic type of COM usually presents with perforation of tympanic membrane with normal ossicular chain. The delicate ossicle with poor blood supply is more susceptible to be eroded by the middle ear disease like COM both in atticoantral as well as tubotympanic type as reported by various authors and in our study too.

Sakagami M *et al* observed that chronic otitis media as the main cause of hearing loss, in which

82 out of 91 cases were with chronic otitis media had an tympanic membrane perforation with intact ossicular chain. Therefore the main cause of hearing loss was tympanic membrane perforation and not the other ossicular pathology.

100 patients of tubotympanic type of COM were included in our study. Maximum numbers of patients 53% were found in the age group of 20 to 40 years. Rout *et al*¹¹ in their study observed that maximum number of patients 64 cases were in the age group of 20-30 years. Varshney *et al*¹² observed that the most commonly affected age group was between 16-25 years.

In our study, the male to female ratio was 1:1.63. In the conducted by Kashyap *et al*¹³, out of the 100 patients 30 were males and 70 were females. The duration of ear discharge ranged from 2 months to 20 years, with 30 cases having duration in the range of 16-20 years.

The duration of hearing loss ranges from 2 months to 20 years, with 44 cases having duration less than 2 years. The duration of hearing loss was in all cases found to be lesser the duration of ear discharge. This may be attributable to difficulty in appreciating minor degrees of hearing loss by the patient. The hearing loss would be noticed only when the disease has progressed sufficiently to cause a significant impairment of hearing by perforation or ossicular destruction. Similar findings were observed in the study conducted by Sakagami M *et al*, Varshney *et al*¹²

Unilateral disease was observed in 53 cases and bilateral disease was seen in 47 cases.

The most common type of perforation encountered in our study was medium central perforation in 44% of cases followed by large central perforation in 37% of cases. Sharma *et al*¹⁴ observed the most common type of perforation was central with an incidence of 69.77%. Kamal *et al*¹⁵ found an incidence of central perforation in COM of 93% in their study population of 203.

In our study, the average hearing loss was found to be maximum with large perforation that is 49.7 ± 7.07 dB, followed by medium central perforation that is 43.98 ± 10.40 dB. Studies conducted by Teja D.D. *et al*¹⁶, Gudepu *et al*¹⁷, Walter P *et al*, Vose SE *et al*, Ahmed SW *et al*, Ibekwe TS *et al*, Oluwole M *et al*, Mehta RP *et al* showed that with increasing size of perforation hearing loss increases.

In our study mean improvement gain of observed in patients operated for large central perforation, medium central perforation, small central perforation are 15.67dB, 12.75dB, and 7.39dB respectively with individual p value= 0.00.

Mean hearing improvement of 8.0 dB was observed in 281 cases of tympanoplasty in a study conducted by Palva and Ramsay *et al*¹⁸ in 1995.

In a study conducted by Lee *et al*¹⁵ in 2002; 261 cases of tympanoplasties were followed up and their mean improvement hearing gain was observed to be 8.1 dB.

In a study conducted by Batni G and Goyal R *et al* in 2014⁴⁸, 88 out of 100 patients had intact and completely healed grafts at 1 year postoperatively (success rate of 88 %). The Hearing gain achieved was 14.55 dB and the mean air bone gap reduction was 11.94 dB. This reduction was statistically significant when compared to the pre-operative hearing conditions.

Conclusion

COM is a well-known disease presenting with ear discharge and hearing loss. Hearing loss can occur because of perforation as well as with ossicular pathology.

In most cases, ossicular pathologies are late to occur if perforation are not timely care off and treated.

The larger the perforation, greater is the hearing loss in decibels. Large central perforations involving all the 4 quadrants results in more degree of hearing loss.

Duration of ear discharge also have significant effect on the magnitude of hearing loss, the longer the duration of ear discharge the greater is the hearing loss.

Tympanoplasty is a beneficial procedure for hearing improvement and the eradication of the disease. It provide a dry ear and improvement in hearing. Mean improvement gain in hearing observed in patients operated for large central perforation, medium central perforation and small central perforations are 15.67 dB, 12.75 dB, 7.39 dB respectively. Socially, adequate hearing has been obtained in a significant percentage of cases and the results are comparable to those of other authors.

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