Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

HEARING IMPROVEMENT AFTER TYPE 1 TYMPANOPLASTY IN CHRONIC OTITIS MEDIA- MUCOSAL TYPE DISEASE

B Y Praveen Kumar[1], Dr Sathish Kumar K N[2*], Dr Deepthi E[3]
[1]Professor, Department of ENT, Mysore Medical College and Research Institute.
[2*]Associate professor, department of ENT, Mysore Medical College and Research Institute.
[3]Junior resident, Mysore Medical College and Research Institute.
Corresponding Author: Dr Sathish Kumar K N
Email: sathishronanp@gmail.com

Abstract:

Aim: This is a study is to estimate hearing outcome after type 1 tympanoplasty using temporalis fascia as graft by underlay technique and to know about factors influencing outcome like age, gender, affected ear and size of the perforation. It is done by comparing our pre-operative and post-operative audiological results with that of previous studies.

Method: A total of 33 patients (34 ears) with CSOM who underwent type I tympanoplasty in the department of E.N.T, K.R. Hospital, Mysore were studied during the period of 18 months (January 2021 to June 2022). A detailed proforma was filled for each patient regard to personal details, clinical history, examination, investigations, surgical procedures and post-operative follow up visits. Audiological evaluation using pure tone audiometry was done pre operatively and at 6 and 12 weeks post operatively. Results are tabulated. Statistical analysis is done.

Results: In our study of 34 cases, graft take up is 91.17%, mean hearing gain is 12.6dB and mean air bone gap closure is 13.7dB. Incidence of cases is more in the age group of 21-30 years (32.4%). Graft take up and hearing gain in younger age group (93.75% &12.9dB), male patients (100% &13.5dB) are better but this finding is not statistically significant. Patients with normal contralateral ear (100% &14.35dB), perforation size <50% size (90% & 11.5dB) have better graft take up rate and hearing outcome, which are statistically significant.

Conclusion: The primary objective of surgery for CSOM is to eradicate infection and disease and make the ear safe and dry and second objective is to restore hearing. For central perforations with good cochlear reserve Type 1 tympanoplasty is good choice. Status of the opposite ear and size of the perforation have a significant role in the outcome of type I tympanoplasty.

Key words: CSOM, Type I Tympanoplasty, Hearing gain, Graft take up.

INTRODUCTION

Chronic otitis media (COM) is an inflammatory process in the middle-ear space that results in long term or more often, permanent changes in the tympanic membrane including atelectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development or cholesteatoma.[1] It refers to intractable pathology of greater than 3 months duration within the middle-ear system in the setting of a permanent tympanic membrane defect.[2] Active chronic otitis media, where there is inflammation and the production of pus and inactive chronic otitis

media, 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 chronic otitis media 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. Inactive mucosal chronic otitis media is the condition of the middle ear where the structure and often the hearing are impaired by the presence of a permanent tympanic membrane defect, but in which there is no active infection.[3]

According to the American Academy of Ophthalmology and Otolaryngology Subcommittee on Conservation of Hearing 1965 definition, tympanoplasty is "a procedure to eradicate disease in the middle ear and to reconstruct the hearing mechanism, with or without tympanic membrane grafting". Type 1 tympanoplasty is the most commonly performed tympanoplasty. Type 1 tympanoplasty refers to repair of tympanic membrane without altering the ossicular system. The procedure includes exploration of the middle ear to inspect and ensure normality of the ossicles. Tympanoplasty can be considered the final step in the surgical conquest of conductive hearing loss and represents the culmination of over 100 years of evolution of surgical procedures on the middle ear to improve hearing. The results of tympanoplasty are measured in terms of success or failure of graft-take and hearing improvement.[1]

This study is an effort to identify hearing outcome after type 1 tympanoplasty using temporalis fascia graft by underlay technique in chronic otitis media- mucosal type cases.

Sample Size Estimation:

Sample size is calculated using the formula $n= (Z^2PQ)/ d^2$ where P is 94% with 95% confidence interval and absolute allowable error of 8%. The sample size comes to 33.8 which is rounded off to 34.

RESULTS

Background characteristics of patients

Our study included 34 ears (i.e. 33 patients) which underwent type 1 tympanoplasty. The age and sex and various factors influencing the audiological benefit in a successful type 1 tympanoplasty were analyzed after 6 weeks and 12 weeks and the results were analyzed based on the observations of the second follow up audiogram (after 12 weeks).

Age

Table 1: Percentage distribution of the sample according to age

Age in years	Number of patients	Percentage
<=20	5	14.7
21 - 30	11	32.4
31 - 40	9	26.5
41 - 50	9	26.5

In the present study the minimum age was 18 years and the maximum age was 45 years. Here maximum numbers of patients (11) were seen in the age group of 2130 years (32.4%). There were 9 patients (26.5%) in each, in the age group of 31-40 years and 41-50 years. 5 patients (14.7%) were below 20years of age.

The mean age was 32.1 ± 9.5 years.

Gender

Table 2: Percentage distribution of the sample according to gender

Gender	Number of patients	Percentage
Male	13	38.2
Female	21	61.8

In our study out of 34 cases 13 (38.2%) patients were males and 21(61.8%) were females, with the ratio of 1.61:1 in favor of females.

Affected ear

Table 3: Percentage distribution of the sample according to affected ear

Affected ear	Number of patients	Percentage
Left	14	41.2
Right	13	38.2
Both	7	20.6

In our study, 7 (20.6%) cases were bilaterally affected, Right ear was involved in 13(38.2%) cases and Left ear was involved in 14 (41.2%) cases.

Size of perforation

Table 4: Percentage distribution of the sample according to size of perforation

Size of perforation	Number of patients	Percentage
Small	5	14.7
Medium	25	73.5
Large	1	2.9
Subtotal	3	8.8

In our study 25 cases (73.5%) had medium size central perforation, 5 cases (14.7%) had small size central perforation, and 3 cases (8.8 %) had subtotal perforation and 1 case (2.9%) large size central perforation.

Graft status

Out of 34 cases, which had undergone Type 1 tympanoplasty in our hospital, there was graft up take in 31 cases (91.17%) and in 3 cases (8.82%) graft did not take up.

Table 5: Graft status

	Number of cases	**Percentage**
Graft up take	31	91.17
Graft failure	3	8.82

Hearing gain

In our study the mean pre-operative pure tone average was 41.1dB, mean postoperative pure tone average was 28.4dB, and the mean hearing gain is 12.7dB at the speech frequencies.

Table 6: Hearing gain (mean)

	Mean	SD	Mean hearing gain	p
Pre-operative pure tone average	41.1	8.7	**12.7**	p<0.01
Post-operative pure tone average	28.4	10.8		

Table 7: Air Bone Gap closure

	Mean	SD	Mean ABG closure	p
Pre op air-bone gap	28.8	7.3	**13.8**	p<0.01
Post op air-bone gap	15.0	8.4		

In our study the mean pre-operative air-bone gap was 28.8dB, mean postoperative air-bone gap was 15.0dB and the mean air bone gap closure is 13.8dB

Result in relation to Age distribution

Table 8: Age factor and outcome

	Age <=30	Age >30
Graft take up %	93.75	88.88
Hearing gain (dB)	12.9	12.4
ABG closure (dB)	12.8	14.6

In our study, 16 cases were 30 years of age or below. They showed graft take up of 93.75%, the mean hearing gain of 12.9dB and mean ABG closure of 12.8dB. 18 cases were above 30 years of age, showed graft take up of 88.88%, mean hearing gain of 12.4dB and mean ABG closure of 14.6dB.

Result in relation to gender distribution

Table 9: Gender factor and outcome

	Male	Female
Graft take up %	100	91.17
Hearing gain (dB)	13.5	12.1
ABG closure (dB)	14.9	13.0

In our study, there were 13 male patients, they showed graft take up of 100%, the mean hearing gain of 13.5dB and mean ABG closure of 14.9dB. 21 patients were females, showed graft take up of 91.17%, mean hearing gain of 12.1dB and mean ABG closure of 13.0dB.

Results in relation to affected ear

Table 10: Ear affected and outcome

	Unilateral	Bilateral
Graft take up %	100	57.14

Hearing gain (dB)	14.35	6.1
ABG closure (dB)	15.3	7.3

There were 27 unilateral ear disease cases (14 left and 13 right), they showed 100% graft up take, 14.35dB hearing gain and 15.3dB ABG closure.7 cases had bilateral ear disease. In this group graft take up was 57.14%, hearing gain was 6.1dB and ABG closure was 7.3dB

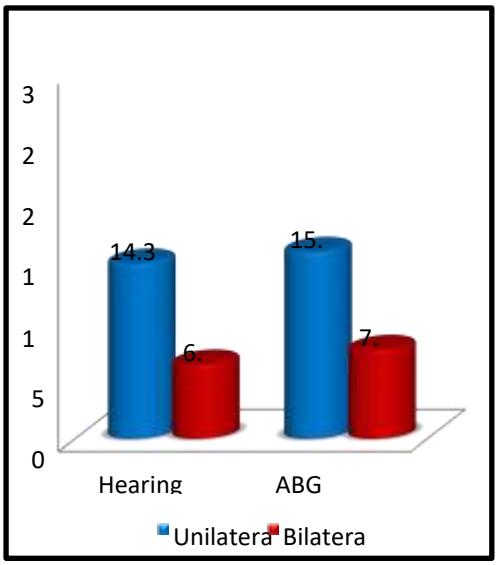

Figure: Ear affected and hearing outcome

Results in relation to size of the perforation

Table 11: Size of perforation and outcome

	Perforation size < 50%	**Perforation size > 50%**
Graft take up %	90	25
Hearing gain (dB)	11.5	7.0
ABG closure (dB)	13.15	7.5

In our study 25 cases (73.5%) had medium size central perforation, 5 cases (14.7%) had small size central perforation, and 3 cases (8.8 %) had subtotal perforation and 1 case (2.9%) large size central perforation. They were categorized to 2 groups to evaluate outcome in relation to size of perforation, first one where size of perforation is <50% and second was size of perforation >50%. 30 patients had perforation size <50% and 4 patients had perforation size >50%.

In first group had 90% graft up take, 11.5dB hearing gain and 13.15dB ABG closure and in second group graft take up was 25%, hearing gain was 7.0dB and ABG closure was 7.5dB.

DISCUSSION

The present was study conducted in Krishna Rajendra Hospital attached to Mysore medical college and Research institute, Mysore, during a period of 18 months, between January 2021 to June 2022.

The discussion is done under the following headings:

- Post-operative Graft status
- Post-operative hearing gain

- Age distribution
- Gender distribution
- Affected ear
- Size of the perforation

•Post-operative Graft status

Michael E Glasscock did his study of post auricular undersurface tympanic membrane grafting in 1982. There were 1556 ears grafted with areolar tissue, temporalis fascia or perichondrium. The graft take up rate was 93%.[7]

Batni G and Goyal R did a retrospective study on hearing outcome after type 1 tympanoplasty in 2014. It included 100 patients with tubotympanic type of chronic otitis media who underwent type 1 tympanoplasty. They reported a graft uptake rate of 88% at the end of 1 year follow up.[10]

In our study of 34 cases of type 1 tympanoplasty, 31 cases showed successful graft take up. The percentage of graft take up is 91.17% which nearly correlates with the quoted literature which shows a range of 80% to 98%. All 3 failure cases were because of post-operative infection and poor personal hygiene of the patients.

•Post-operative hearing gain

Albera et al (2006) in their study of 212 cases found that the mean preoperative air conduction average was 37 dB and mean air-bone gap was 16dB while the mean post-operative air conduction average was 27 dB and mean air bone gap was 8dB, thus average air conduction improvement was 10 dB and mean reduction in air bone gap was 8dB.[24]

The most likely explanation for lack of complete success from a hearing stand point is that in most cases of CSOM, even though ossicular chain may appear normal, there are adhesions and scar tissue in the middle ear that prevents total restoration of hearing (Sheehy et al 1980). It substantiates the possibility that the larger the preoperative conductive deficit, the less likely the patient is to obtain an ideal hearing result.[26]

In our study of 34 cases, based on second follow up (12 weeks) we calculated the hearing gain when compared to pre-operative hearing loss. Out of 34 cases, 31 cases were successful in terms of both hearing gain and graft take up. The preoperative mean pure tone average was 41.1dB and the mean pure tone average after 12 weeks post-operative period was 28.4dB. Thus the mean hearing gain in our study is 12.7dB. The mean pre-operative air bone gap was 28.8dB and mean post-operative air bone gap was 15.0dB, so air bone gap reduction was 13.8dB. This correlates well with the quoted literature.

•Age distribution

Michael Glasscock et al. (1982) reported in their study of 1556 tympanic membrane grafting that there was no difference in take rate of graft based upon age of the patient.[7]

In our study of 34 cases age below 18 years and above 50 years are not considered.

According to the available literature, unless there is cholesteatoma or a bilateral tympanic membrane perforation with conductive hearing loss, tympanoplasty in children can be delayed until the age of 10-15yrs, when Eustachian tube function is usually better and a satisfactory outcome is more likely.

Distribution of age showed maximum number of cases in the age group between 21-30 years in contrast to study done by Ortegren where most of the cases are above 30yrs. It purely depends on the age group from which we select maximum number of cases and statistically it is not significant.[4]

To know the age factor in the outcome of the surgery, we divided the sample into 2 groups: age of 30 years and below and above age of 30 years. The hearing results in patients of age 30 years and below (12.9dB of hearing gain, 12.8dB of ABG closure and 93.75% graft take up) are compared with patients above age 30 years (12.4dB of hearing gain, 14.6dB of ABG closure and 88.88% graft take up). The graft take up and hearing gain was more in age of 30 years and below. As described by many studies graft take up is more in younger age groups but if the cochlear reserve is good then same outcome can be achieved in elderly people also. But both the values are statistically not significant (p is >0.05) indicating that there is no significant relation between age factor and outcome of type I tympanoplasty.

•Gender distribution

Caye–Thomasen et al. (2007) in their study of 26 cases, male to female ratio was 1.36.[25]

In our study male to female ratio is 1:1.61. Graft take up rate is more in male (100%) compared to female (91.17%). Hearing gain is also slightly more in males (13.5dB) compared to females (12.1dB) but both these results are not significant statistically.

As per the available literature there is no difference in outcome of surgery solely on the basis of gender.[3]

•Affected ear

But study on pediatric tympanoplasty by Chandrasekhar et al (1995)[30] showed that status of contralateral ear was not associated with successful outcome.

William O. Collins, MD et al (2003)in his study on pediatric tympanoplasty noted that the presence of perforation, high negative pressure, atelectasis, and OME in the contralateral ear was associated with a less successful outcome for obtaining adequate middle ear aeration.

In our study of 34 cases, 13 cases (38.2%) had right ear disease, 14 cases (41.2%) had left ear disease and 7 cases (20.6%) were having bilateral disease. Here the graft take up, hearing gain and ABG closure were 100%, 14.35dB and 15.3dB respectively when the contralateral ear was normal and 57.14% , 6.1dB and 7.3dB when contralateral ear is diseased. It was found to be significant statistically (p value is <0.001). Thus the status of the contralateral ear can be considered as one of the prognostic factor indicating the role of Eustachian tube function in tympanoplasty.

•Size of the perforation

Alan G Gibb & Sing Kait Chang in their study which included 365 myringoplasties found that success rate in repairing perforation is not affected by the size of the defect provided that careful technique is used.[22]

Adkin et al (1984) in their study observed that failure rate was higher with large perforation. In this study 22 patients had a perforation greater than 50% and 49 patients had perforation less than 50%. 7 out of 8 failures occurred in first group and only one

failure occurred in latter group. They proposed that the two factors which adversely influenced the success rate were the presence of a near total or total perforation and the presence of bilateral perforations.[12]

In our study of 34 cases, 5 cases (14.7%) had small size perforation, 25 cases (73.5%) had medium size perforation, 1 case (2.9 %) had large size perforation and 3 cases (8.8%) had subtotal perforation. Graft take up rate was 90% and 25% respectively in ears with perforation size <50% and perforation size >50%. Hearing gain was 11.5dB and 7.9dB respectively in ears with perforation size <50% and perforation size >50%. ABG closure was 13.15dB and 7.5dB respectively in ears with perforation size <50% and perforation size >50%. Perforation size of more than 50% had poorer graft take up rate, hearing gain and ABG closure. This finding is statistically significant (p value <0.008).

CONCLUSION

- The outcome of Type 1 tympanoplasty does not depend on age and gender factors
- Status of the contralateral ear is an important prognostic factor indicating the role of Eustachian tube in the successful outcome of the surgery.
- Graft take up and hearing gain is better in perforation size less than 50% when compare to perforation size more than 50.
- Post-operative infection is the most common causes for the graft failure.
- Success of Type 1 tympanoplasty is better in restoring hearing in uncomplicated chronic otitis media with good cochlear reserve, provided regular postoperative care is done.

REFERENCES

1. Aina J, Gulya LB, Minor DS. Glasscock-Shambaugh Surgery of the ear. 6th ed. People's Medical Publishing House• USA.
2. Wackym A, Snow JB. Ballenger's Otorhinolaryngology: head and neck surgery. Shelton;
3. John C, Watkinson RW. Scott-Brown's Otorhinolaryngology Head and Neck Surgery. Vol. 2. CRC Press Taylor & Francis Group; 1484.
4. Glasscock ME, Jackson CG, Nissen AJ, Schwaber MK. Post-auricular undersurface tympanic membrane grafting: A follow-up report. Laryngoscope. 1982;92(7):718–27.
5. Batni G, Goyal R. Hearing outcome after type 1 tympanoplasty: A retrospective study. Indian journal of Otorhinolaryngology head and neck surgery. 2015;67:39–42.
6. Albera R, Ferrero V, Lacilla M, Canale A. Tympanic reperforation in myringoplasty: evaluation of prognostic factors. Ann OtolRhinolLaryngol [Internet]. 2006;115(12):875–9. Available from: http://dx.doi.org/10.1177/000348940611501202
7. Sheehy JL, Anderson RG. Myringoplasty. A review of 472 cases: A review of 472 cases. Ann OtolRhinolLaryngol [Internet]. 1980;89(4 Pt 1):331–4. Available from: http://dx.doi.org/10.1177/000348948008900407
8. Ortegren. Myringoplasty. actaotolaryn, 1961: Suppl: 193, 1-41.
9. TorfinnurRubek Nielsen M. Bilateral Myringoplasty in Chronic Otitis Media. The Laryngoscope. 2007;117:903–6.

10. Sujana S, Md; John W. Pediatric TympanoplastyA 10-Year Experience. Arch Otolaryngol Head Neck Surg. 1995;121:873–8.
11. Gibb and sing-kiatchang. Myringoplasty (A review of 365 operations). The Journal of Laryngology and Otology. 1982;96:915–30.
12. Warren Y. Type 1 tympanoplasty: Influencing factors. Laryngoscope. 1984;94.