

Original Research Article

A comparative study of preoperative and postoperative hearing after type I tympanoplasty using temporalis fascia graft at Dr. B. R. Ambedkar Medical College, Bengaluru

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ABSTRACT

Background: The objective of the study was to identify the factors which significantly influence type 1 tympanoplasty success.

Methods: A prospective study was performed on 30 patients who underwent type 1 tympanoplasty via underlay technique using temporalis fascia graft from December 2017 to September 2019 in a teaching hospital. Outcome measures were graft uptake rate and hearing gain. The factors assessed were the age and sex, preoperative condition of the ipsilateral and contralateral ears, perforation size, presence of tympanosclerosis, and whether simultaneous cortical mastoidectomy was performed.

Results: None of the factors proved to have a significant influence on tympanic membrane closure or hearing gain.

Conclusions: The success rate of a type 1 tympanoplasty is dependent on the skills of the surgeon and the type of graft used. Age, sex, laterality of the disease, duration of dry ear, size of the perforation, presence of tympanosclerosis and simultaneous cortical mastoidectomy have no bearing on hearing gain.

Keywords: Conductive hearing loss, Tympanoplasty, Myringoplasty, Fascia, Myringosclerosis, Audiometry

INTRODUCTION

Global burden of illness from chronic suppurative otitis media (CSOM) involves 65-330 million individuals with otorrhoea. 60% of them (39-200 million) suffer from significant hearing impairment. CSOM accounts for 28,000 deaths and a disease burden of over 2 million DALYs (disability-adjusted life year).¹

Conductive hearing loss is the most common pattern of hearing loss in CSOM with deficits varying between 20 to 60 dB.

The degree of hearing loss is determined by the size and site of the tympanic membrane perforation, ossicular

damage, and the presence of granulation tissue or cholesteatoma.²

Spontaneous healing of chronic tympanic membrane perforations is uncommon. Surgical intervention is the treatment of choice to effect closure of the perforation.³ Tympanoplasty is a surgical procedure designed to reconstruct the sound transmission mechanism of the middle ear. This procedure can be combined with either an intact canal wall or a canal-wall-down mastoidectomy to eradicate disease from the mastoid area.⁴

The objective of the study was to identify the factors which significantly influence type 1 tympanoplasty success.

METHODS

A prospective, observational single centre study was conducted in the Department of ENT & Head and Neck Surgery, Dr. B.R. Ambedkar Medical College and Hospital from December 2017 to September 2019. A total of 30 patients with chronic otitis media (COM) who underwent type I tympanoplasty via underlay technique using temporalis fascia graft with/without cortical mastoidectomy were studied.

Inclusion criteria included patients of both sexes aged between 15 and 45 years presenting with perforated tympanic membrane due to chronic otitis media, trauma, recurrent middle ear infection, in whom ossicular systems are mobile and intact, ear was dry and eustachian tube function was intact.

Patients with sensorineural hearing loss (SNHL) or mixed hearing loss, COM - squamous disease, and disease causing disruption and damage to ossicular chain like tympanosclerosis, middle ear atelectasis, middle ear tumours, congenital cholesteatoma etc., were excluded from the study.

A detailed pro forma was filled for each patient with regard to history, complete general physical, systemic and ENT examination. In all the patients, routine blood examinations, examination under microscope and pure tone audiometry were done.

All the cases were operated by senior consultants. A mastoid dressing was applied and was kept for 1 week post operatively. Local antibiotic drops and antihistamines were advised in all cases. Follow up with audiometric evaluation was conducted in the 1st, 3rd and 6th month and the results were compared with preoperative results to establish betterment of hearing threshold. The hearing outcome was analysed based on the observations of the third follow-up audiogram (after 6 months).

Potential influencing factors were age and sex of the patient, preoperative condition of the ipsilateral middle ear (inactive or active chronic otitis media); preoperative condition of the contralateral middle ear (normal, or inactive or active chronic otitis media); perforation size (less than or more than 50 per cent of the tympanic membrane); presence of tympanosclerotic patches and simultaneous cortical mastoidectomy. The indication for a cortical mastoidectomy was type 1 tympanoplasty in the presence of an actively discharging ear or an ear dry for less than six months.

Statistical analysis

Data was tabulated and charted using Microsoft Excel 2010. Descriptive analysis of quantitative variables (age, pre- and postoperative hearing levels, and hearing gain) was done using mean and standard deviation.

Comparisons within each group between pre- and postoperative results were made with T-test calculator for 2 independent Means and Chi-square calculator for 2x2 Contingency Table. Statistical significance was set at a p value of less than 0.05.

RESULTS

A total of 30 procedures were included, involving 20 without cortical mastoidectomy and 10 with cortical mastoidectomy (Table 1).

Table 1: Factors affecting outcome.

Factor	Number	Graft uptake (%)	Hearing gain (dB)
Age group (in year)			
15-28	15	93	16.18±6.13
29-45	15	93	14.75±8.25
P value		0.46	0.59
Sex			
Male	9	100	15.9±3.62
Female	21	90	15.28±8.33
P value			0.83
Ear affected			
Unilateral	22	100	16.16±6.68
Bilateral	8	75	13.55±8.6
P value			0.39
Duration of dry ear			
≤6 months	24	92	14.56±7.59
>6 months/ no discharge	6	100	19.1±3.77
P value			0.17
Size of the perforation			
≤50%	20	95	14.48±5.38
>50%	10	90	17.44±9.93
P value		0.60	0.29
Tympanosclerotic patch			
Present	4	100	14.68±5.46
Absent	26	92	15.59±7.49
P value			0.81
Cortical mastoidectomy			
Done	10	100	18.38±6.92
Not done	20	90	14.01±7.02
P value			0.11

Patients under the age of 15 years were not included in this study. Upper age limit was set at 45 years as many patients above this age showed mixed hearing loss. In this study, prevalence of COM was equal in those between the age of 15 and 28 years and in those between the age of 29 and 45 years. Mean age of presentation was 28.67±8.56 years. Out of our 30 patients, 21 were female and the others were males, giving us a prevalence ratio of 2.3:1 in favour of the female. Age and sex of the patient did not have any bearing on graft uptake or hearing gain.

The effect of unilateral or bilateral COM on graft take up rate and hearing gain was evaluated. A total of 22 unilateral cases and 8 bilateral cases were included in the study. The success rate for unilateral disease was found to be 100%, whereas for bilateral disease it was 75%. Presence of bilateral ear disease at the time of type 1 tympanoplasty did not seem to have an influence on the graft take up or hearing gain.

Our study had 4 patients (13%) with dry ear for less than one month, 20 (67%) for 1-6 months, and 4 (13%) for more than 6 months. 2 patients (7%) had no history of ear discharge. Graft uptake was 100% in ears that had been dry for more than 6 months or had no history of ear discharge with higher hearing gain (19.1 dB) as opposed to the ears that had been dry for less than 6 months (92% graft uptake, 14.56 dB hearing gain). Even though hearing was better in those ears that were dry for more than 6 months, the results were not statistically significant.

The effect of perforation size on graft uptake and hearing gain was also evaluated. 20 cases had perforations involving ≤50% of the tympanic membrane and 10 cases >50%. Graft uptake was 95% in perforations ≤50% and 90% in perforations >50%. Hearing gain though better in the larger perforations, was not statistically better.

In our study tympanosclerotic patch over the tympanic membrane was present in 4 (13%) cases and in the rest of the 26 (87%) cases it was absent. The graft was successfully taken up (100%) in all the 4 ears that had tympanosclerotic patches. However, the graft failed to take up in 2 ears out of the 26 ears (92% uptake rate) that had no tympanosclerotic patch. The hearing gain was 15.59 dB in patients without tympanosclerosis and 14.68 dB in patients with tympanosclerosis, which even though numerically better was statistically not significant, indicating no major role in hearing gain.

Cortical mastoidectomy was performed in 10 out of the 30 ears that were operated. All of these cases showed graft up take with a mean hearing gain of 18.38 dB. The other 10 cases had a 90% graft up take and a mean hearing gain of 14.01 dB. There was no relationship between simultaneous cortical mastoidectomy and graft take rate or hearing gain.

Table 2: Graft uptake.

Graft uptake	No. of cases	Percentage
Taken up	28	93
Not taken up	2	7
Total	30	100

We had an overall graft success take rate of 93% (Table 2, Figure 1). The mean preoperative hearing loss was 33.84 dB, mean postoperative hearing was 18.38 dB, and the mean hearing gain was 15.47 dB (Table 3). With

$p < 0.00001$, postoperative hearing is significantly better than preoperative hearing at $p < 0.05$.

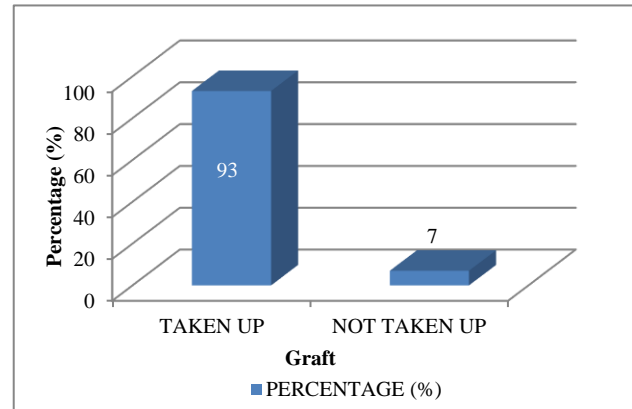


Figure 1: Graft uptake.

Table 1: Hearing gain.

Mean preoperative hearing (dB) (mean±SD)	Mean postoperative hearing (dB) (mean±SD)	Mean postoperative hearing gain (dB) (mean±SD)
33.84±8.88	18.38±5.81	15.47±7.18

DISCUSSION

It is essential to identify the factors that affect the success rates of tympanoplasty, such as factors related to disease, patients, graft materials and surgical techniques.

The graft success rate of 93% achieved in this study is comparable with other studies. Glasscock et al in his study of postauricular under surface tympanic membrane grafting, showed the graft take rate with autograft fascia to be 92.8%.⁵ Similar results were published by Thakur et al who reported a graft uptake rate of 92.05% in 139 out of 151 ears that underwent type 1 tympanoplasty using temporalis fascia graft.⁶ Arora et al published a study on comparison between type 1 tympanoplasty by cartilage palisade and temporalis fascia technique.⁷ With temporalis fascia technique, the number of successful graft uptakes was similar to ours, with 27 cases out of 30 (90%) showing successful graft uptake.

Our 2 cases that failed to take up the graft were possibly because of unreported/untreated postoperative infection as the patients were non-compliant with follow-up.

The mean preoperative hearing loss was 33.84 dB, mean postoperative hearing was 18.38 dB, and the mean hearing gain was 15.47 dB. With $p < 0.00001$, postoperative hearing is significantly better than preoperative hearing at $p < 0.05$. Singh et al reported an average hearing gain of 14 dB postoperatively.⁸ Majeed and Ahamed et al in a “Comparative study between temporalis fascia and tragal perichondrium in

myringoplasty” found that the patients who underwent temporalis fascia grafting (86.13%) had a gain of 15 dB.⁹ Harkare et al in a comparative study of different tissues used for tympanic membrane grafting found that a mean gain in hearing (14 dB) was observed maximum in group-I (temporalis fascia).¹⁰

None of the factors assessed in this study had a significant influence on perforation closure or hearing gain.

This study found no significant relationship between age of the patient or sex of the patient and either closure rate or hearing gain. In agreement with this, Adkins et al found the age of the patient to have no effect on success of tympanoplasty.¹¹ Similarly, Fadl et al, in his study, found age factor to have no influence on graft success.¹² Non-influence of gender was also reported by Thakur et al, as well as by Stekelenburg et al and by Salviz et al.^{6,13,14}

This study demonstrated that bilateral disease does not influence closure rate or hearing gain. Even though the hearing gain was better in unilaterally affected ears, it was not statistically significant. These results are consistent with studies by Albera et al, who carried out bilateral myringoplasties at the same time, and Carr et al, who demonstrated that the condition of the contralateral ear has no impact on closure rate or hearing gain.^{15,16}

Our study found no relationship between duration of dry ear and graft uptake or hearing gain. In agreement with this, Carr et al, Onal et al and Albera et al demonstrated no difference in closure rates between discharging and dry ears.¹⁵⁻¹⁷ Balyan et al and Mishiro et al found no statistically significant difference between graft success rate in discharging ears and dry ears.^{18,19}

In this study, graft uptake was 95% in perforations \leq 50% and 90% in perforations $>$ 50%. Hearing gain though better in the larger perforations, was not statistically better. Comparable reports were published by Jain et al, who reported that graft take up is better in perforation size less than 50% but hearing gain was more in perforation size of more than 50%.²⁰ Wasson et al after investigating the impact of perforation size and other variables on the success of myringoplasty concluded that perforation size was not a statistically significant determinant factor for successful myringoplasty.²¹

We found that the presence of tympanosclerosis had no bearing on graft up take rate or postoperative hearing gain. This concurs with Wielinga et al who evaluated the influence of tympanosclerosis in 555 myringoplasties and concluded that there is no relation between presence and absence of it in the final result, even if it is diffuse.²² Stekelenburg et al also did not find tympanosclerosis to influence success rates of myringoplasty in daily practice.¹³

This study revealed no relationship between simultaneous cortical mastoidectomy and graft take rate or hearing gain. Albu et al, demonstrated that cortical mastoidectomy has no significant effect on graft take rate.²³ McGrew et al demonstrated that concomitant mastoidectomy was not necessary for successful perforation repair, although it did reduce the number of patients requiring future procedures and slowed disease progression.²⁴ Carr et al also concluded that there was no relationship between simultaneous cortical mastoidectomy and graft take rate or hearing gain.¹⁶

CONCLUSION

Type 1 tympanoplasty is a beneficial procedure for hearing improvement. The success rate of a type 1 tympanoplasty is dependent on the skills of the surgeon and the type of graft used. The outcome of type 1 tympanoplasty does not depend on age, sex, ear affected and duration of dry ear, size of the perforation or presence of tympanosclerotic patch. Simultaneous cortical mastoidectomy is also not necessary for successful perforation repair.

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