

Original Research Article

A Clinical Study of Hearing Outcome after Type I Tympanoplasty

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Abstract

Introduction: This study was aimed to assess the hearing outcome after type I tympanoplasty using temporalis fascia graft, to assess the factors which influence the outcome and to evaluate the result of our study and to compare our data with similarly published study.

Materials and methods: The study was conducted at NSCB Medical College and Hospital, Jabalpur in the Department of Otorhinolaryngology after obtaining approval from the institutional ethics committee, from October 2014 till October 2015. Patients, aged 15 to 45 years, presenting with perforated tympanic membrane were consented. Audiological evaluation was done preoperatively, 1 month and 3 month after tympanoplasty.

Results: During the study period 45 type I Tympanoplasty were performed using temporalis fascia as graft, 24 males. 21 cases below the age of 26 years showed graft take up of 84% and the mean hearing gain of 11.37 dB. 77% of those belonging to low socioeconomic group showed graft take up of 76.9% with mean hearing gain of 12.03 dB and 88% of those belonging to high socio economic group showed graft take up of 87.5% with mean hearing gain of 11.14 dB. Out of 21 cases which had perforation size <50% 20 showed graft take up of 95.23% with mean hearing gain of 11.77 dB.

Conclusions: Graft uptake is independent of gender, age of the patient. Pre operative dry ear status is directly related to the outcome of surgery. Graft take up is better in perforation size less than 50% but hearing gain will be more in perforation size of more than 50%.

Key words

Hearing loss, Tympanoplasty, Graft, Outcome, Audiometry.

Introduction

Chronic suppurative otitis media is one of the major causes of tympanic membrane perforation in our country. The vast majority of perforation due to infection are small and heal spontaneously. Persistence of perforation can lead to recurrent infection of middle ear and a hearing loss of 30-40 dB [1]. Closure of perforation along with disease clearance was attempted since many years. Myringoplasty and tympanoplasty are descriptive terms defining surgical procedures that address pathology of the tympanic membrane and middle ear. Myringoplasty is an operative procedure used in the reconstruction of a perforation of the tympanic membrane. This assumes that the middle ear space; its mucosa, and the ossicular chain are healthy. Tympanoplasty implies reconstruction of the hearing mechanism and also deals with the pathology within the middle ear cleft; such as chronic infection; cholesteatoma or an ossicular chain problem. Tympanoplasty is the final step in the surgical conquest of conductive hearing loss and is the culmination of over 60 year of development of surgical procedures on the middle ear to improve hearing. Different technique and different graft materials are used like temporalis fascia; duramater; perichondrium and various factors influencing the outcome are studied [2].

Current tympanoplasty techniques primarily involves grafting with temporalis fascia. Tragal cartilage and perichondrium are also been rapidly used but with slightly lower success rates. Temporalis fascia contain collagen and mucopolysaccharides. These two components provide it with tensile strength and for this reason it does not get easily autolysed even in the presence of infection. The metabolic requirements of the fascia are also lower [3]. So, it has a higher success rate over other grafting materials. In our study, all type I tympanoplasties were done by postauricular approach, using temporalis fascia graft, by underlay technique.

Closure of perforation with hearing improvement and incidence of failures and complications are used as measure for evaluating the results. Through this study we aimed to assess the hearing outcome after type I tympanoplasty using temporalis fascia graft, to assess the factors which influence the outcome and to evaluate the result of our study and to compare our data with similarly published study.

Materials and methods

The present study was done in E.N.T. Department of N.S.C.B Medical College and Hospital Jabalpur. We included patients presenting to the outpatient department and fulfilling the below mentioned criteria.

Study design and patient population

We included patients of both sexes of age between 15 to 45 years of age presenting with perforated tympanic membrane due to chronic otitis media; trauma; recurrent middle ear infection; in which ossicular system are mobile and intact, had a dry ear and had eustachian tube function intact. We excluded patients with sensorineural hearing loss, chronic suppurative otitis media with atticofurrow type disease and those patients with disease causing disruption and damage to ossicular chain like middle ear atelectasis; middle ear tumors; congenital cholesteatoma etc. A detailed proforma was filled for each patient with regard to history; clinical examination; investigation; surgical procedures; postoperative period and follow up visit. Audiological evaluation (pure tone audiometry) was done preoperatively, 1 month and 3 month after surgery. Graft material used was autologous Temporalis fascia graft.

Data collection and analysis

All patients in the study were clinically evaluated by taking detailed history and clinical examination including tuning fork test (TFT); as per the proforma. In the patient who presented with active ear discharge, appropriate antibiotic was given to make the disease inactive. Dry aural toilet was done to remove debris from ear canal.

Status of tympanic membrane perforation was evaluated by otoscopy. Septic foci in the nose or throat were treated at the outpatient if present. PTA was done as per Hughson Westlake Method. Cases were then diagnosed and surgical plan of management was formulated. Routine investigations like hemoglobin, bleeding time, clotting time, urine analysis, random blood sugar, blood urea, viral antigens were done. Patients were followed up at 1 month and 3 month postoperatively. In each visit patient's ear was examined with otoscope using sterile measures and TFT and audiometry was done to know the degree of hearing improvement. The collected data were tabulated in the Microsoft excel sheet and imported in SPSS software to perform the analysis.

Results

The present study was done in Department of Otorhinolaryngology and Head-Neck Surgery NSCB Medical College, Jabalpur from October 2014 till October 2015. During this period 45 type I Tympanoplasties were performed using temporalis fascia as graft. The age and sex incidence and various factors influencing the audiological benefit and surgical outcome in successful type I tympanoplasty were analyzed after 1 month and 3 months of surgery and the results were analyzed based on the observations of the second follow-up audiogram (after 3 months). Patients under 15 years of age were not included in this study. Upper age limit was 45 years as many patients above this age showed mixed hearing loss. In this study, maximum number of patients (16) were seen in the age group of 20-29 years (35.5%). There were 12 patients (26.6%) in the age group of 15-19 years, 15 patients (33.3%) in 30-39 years and 2 patients (4.4%) in the age group of 40-45 years (**Table - 1**). In our study of 45 cases, 24 (53.3%) were male and 21 (46.66%) were female, with the ratio of 1.14: 1 in favor of male. In our study of 45 cases, 13 cases (28.8%) belonged to low socioeconomic group, 24 case (53.3%) belonged to middle class group and 8 cases (17.7%) belonged to high socioeconomic group. In our

study 26 cases had dry ear preoperatively for less than 6 weeks (57.77%) and 19 cases had dry ear for more than 6 weeks (42.22%). In our study, 3 cases (6.6%) had small size perforation, 19 cases (42.22%) had medium size perforation, 17 cases (37.7%) had large perforation and 6 cases (13.33%) had subtotal perforation.

Table – 1: Characteristics of patients involved in the study.

Variable	n
Age distribution	
15-19 years	12
20-29 years	16
30-39 years	15
40-45 years	2
Gender	
Males	24
Females	21
Socioeconomic status	
Low	13
Middle	24
High	8
Side of ear involved	
Right ear	8
Left ear	13
Bilateral	24
Duration of dry ear	
Less than 6 weeks	26
More than 6 weeks	19
Perforation size	
Small	3
Medium	19
Large	17
Subtotal	6
X-ray finding	
Pneumatic	23
Sclerotic	22
Diploic	0

In our study there were 25 cases below 26 years of age in which 21 cases showed graft take up of 84% and the mean hearing gain of 11.37 dB and 20 cases were 26 years and above showed graft take up of 90% and mean hearing gain of 12.53 dB (**Table - 2**). In our study there were 24 male

in which 20 showed graft take up (83.33%) with mean hearing gain of 12 dB and 21 cases were female in which 19 showed graft take up (90.4%) with mean hearing gain of 11.71 dB. Out of 13 cases which belong to low socioeconomic group 10 cases showed Graft take up (76.9%) with mean hearing gain of 12.03 dB, 24 cases belonged to middle class in which 22 cases showed graft take up (91.6%) with mean hearing gain of 12.05 dB and 8 cases belonged to high socio economic group in which 7 cases showed graft take up (87.5%) with mean hearing gain of 11.14 dB. Out of 26 cases who had dry

ear for less than 6 weeks 21 cases showed graft take up (80.76%) with mean hearing gain of 11.06 dB and 19 cases who had dry ear for more than 6 weeks, 18 cases showed graft take up (94.73%) with mean hearing gain of 13.01 dB. Out of 21 cases which had perforation size involving less than 50% of tympanic membrane, 20 cases showed graft take up (95.23%) with mean hearing gain of 11.77 dB and out of 24 cases which had perforation size involving more than 50% of tympanic membrane, 19 cases (79.16%) showed graft take up with mean hearing gain of (11.98 dB).

Table – 2: Surgical outcomes in the patients included in the study.

Variable	Graft taken up	Hearing gain (dB)
Less than 26 years of age	84%	11.37
More than 26 years of age	90%	12.53
Male	83.33%	12
Female	90.4%	11.71
Low socioeconomic status	76.9%	12.03
Middle socioeconomic status	91.6%	12.05
High socioeconomic status	87.5%	11.14
Unilateral ear involvement	95.23%	12.35
Bilateral ear involvement	79.16%	19.48
Dry ear for less than 6 weeks	80.76%	11.06
Dry ear for more than 6 weeks	94.73%	13.01
Size of perforation less than 50%	95.23%	11.77
Size of perforation more than 50%	79.16%	11.98
X-ray finding of pneumatic changes	91.3%	13.15
X-ray findings of sclerotic changes	81.81%	10.56

Out of 45 cases, which had undergone type I tympanoplasty in our hospital, were followed at 1 month and 3 month postoperatively, there was graft take up in 39 cases (86.66%) and in 6 cases (13.33%) graft did not take up. In our study, the mean pre-operative air-bone gap was 34.77 dB, mean post-operative air bone gap at 1 month was 25.57 dB and mean post-operative air bone gap at 3 months was 22.88 dB. As maximum improvement of hearing may take 3 to 6 months after surgery, taking into account mean post operative pure tone average at 3 months, the mean hearing gain is 11.89 dB.

Discussion

The present study was carried out in the Department of Otorhinolaryngology and Head Neck surgery, N.S.C.B Medical College, Jabalpur between October 2014 and October 2015 (12 month). The study was done on 45 cases who underwent type I tympanoplasty operation after fulfilling all the prerequisites for the operation.

In Ortegren's study the hearing improvements in the various group below 30 years were obviously very much alike [4]. Hearing results were worse in the above 30 years age group, compared to

young age group and in his study the maximum number of the patients were in the age group of > 30 years (42.5%). In our study of 45 cases age below 15 years and above 45 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 15 years, 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 20-29 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.

The mean age of our study sample was 26 years. To know the age factor in the outcome of the surgery we divided the sample into age below 26 years and age of 26 years and above. The hearing results in patients below 26 years (11.37 dB of hearing gain and 84% graft take up) are compared with patients of age 26 yrs and above (12.53 dB of hearing gain and 90% graft take up). The graft take up and hearing gain was slightly more in age group of 26 years and above. As described by many studies graft take up may be 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 value are not significant indicating that there is no significant relation between age factor and outcome of type I tympanoplasty.

It has been reported that there are more failures in women than men with regard to graft take up rates [5]. In our study male to female ratio is 1.14:1. Graft take up rate is slightly more in female 90.4% compare to male 83.33%. Hearing gain is slightly less in female (11.71 dB) compare to male (12 dB) but both these results are not significant. Gerdooff M, et al. studied that long term results of tympanic membrane repair in adults and children and found that state of middle ear at the time of operation influences surgical outcome; wet ears have a higher rate of

reperforation [6]. Gibb AG, Chang SK in their study of 206 cases of underlay myringoplasties, found that the uptake rate of 91.4% for dry ears and 80.9% for wet ear [7]. In our study of 45 cases, 26 cases had dry ear preoperatively for less than 6 weeks of which 80.76% has graft uptake, while 19 cases had dry ear preoperatively for more than 6 week which had a graft take up rate of 94.73% which correlates with the quoted literature. The hearing gain is 11.06 dB in patients who had dry ear preoperatively for less than 6 week and 13.01 dB in patients who had dry ear for more than 6 week indicating the role of dry ear as one of the prognostic factor for successful tympanoplasty. Dry ear for long duration indicates disease free middle ear cleft which directly affects the surgical outcome. So the outcome of the surgery will be better if the operating ear is dry for long duration.

Holmquist reported success rate of 70% with well-pneumatized mastoid air cells as compared to 57% with poorly pneumatized mastoid air cells [8]. Jackler and Schindler found a strong correlation between mastoid pneumatization and results of type I tympanoplasty and suggested that the patients with large (pneumatic) mastoid had higher successful results in comparison with patients with smaller (sclerotic) mastoid [9]. In our study of 45 cases, we found that 22 cases (48.8%) had sclerotic mastoid, with a success rate of (81.8%) and hearing gain of 10.56 dB in comparison to 23 cases (51.11%) had well pneumatic mastoid on X-ray, with a success rate of 91.3% and hearing gain of 13.15 dB which correlates well with the observation of the quoted literature.

Brown C, et al. in their study of 193 cases, the mean pre operative air conduction average was 35 dB while the mean postoperative air conduction average was 25 dB, thus average air conduction improvement was 10dB. The most likely explanation for lack of complete success from a hearing standpoint is that in most cases of CSOM even though ossicular chain may appear normal there is some factor of scar tissue that prevents total restoration of hearing. Alan G

Gibb and Sing Kait Chang proposed the following reasons for worsening of hearing loss [7]. They stated that a conductive loss can result from damage to the ossicular chain, sensorineural hearing loss appearing for the first time post operatively generally iatrogenic and the result of some technical error at operation.

Gibb, et al. found that the persistent conductive hearing loss can result from underlay technique if the handle of malleus is severely retracted especially if it is touching or adherent to the promontory, difficulties arise due to possible reduction in the depth of the tympanic cavity when the graft is placed medial to the malleus handle to overcome this problem, they suggested that one could leave the malleus in its original retracted position and a split graft be pulled upon each side of malleus handle and tucked behind its upper part or amputate 2-3 mm from the tip of handle [7]. In our study of 45 cases, based on second follow up (3 months) we calculated the amount of hearing gain when compared to pre operative hearing loss. Out of 45 cases, 39 cases were successful in terms of both hearing gain and graft take up. Only small percentage of cases showed no change in pre operative and post operative pure tone average. The pre operative mean pure tone average was 34.77 dB and the mean pure tone average after 3 months of post operative period was 22.88 dB. Thus the mean hearing gain in our study is 11.89 dB. This correlates well with the quoted literature.

Gibb, et al. in their study of 206 cases of type I tympanoplasty employing the underlay technique with temporal fascia reported a graft take rate of 89.3% [7]. Jackler and Schindler in their study of 48 cases reported a graft take rate of 85.4% [9]. Glasscock, et al. in his study of postauricular undersurface tympanic membrane grafting, showed the graft take rate with fascia to be 93% [10]. Albera R, et al. in their study of 212 patients, found a graft take rate of 86% (182 cases) [11]. Gaurav Batni and Rashmi Goyal (2015) in their study of 100 cases found graft uptake rate of 88% [12]. In our study of 45 cases of type I tympanoplasty, 39 cases showed

successful graft take up. The percentage of graft take up is 86.66% which very well nearly correlates with the quoted literature. Out of 6 failure cases, 5 cases were because of infection and poor hygiene and one case was due to faulty technique correlating well with the quoted literatures.

Conclusion

Type I Tympanoplasty is a procedure of simple repair of tympanic membrane, its ultimate goals being-permanent restoration of hearing and prevention of recurrent attacks of otorrhoea and its complications. Our study has shown that the outcome of type 1 tympanoplasty does not depend on age and sex of the patient, lower socioeconomic status patients have higher incidence and poorer graft uptake due to their poor hygienic habits & due to lack of proper nutrition which causes decrease in their immunity, hence increasing the chances of recurrent infection. We also demonstrated that pre operative dry ear status is directly related to the outcome of surgery. Graft take up is better in perforation size less than 50% when compare to perforation size more than 50% but hearing gain will be more in perforation size of more than 50% because the patient is having more preoperative hearing deficits in large perforations. In this study, we have seen that temporalis fascia has proven to be a very good material for grafting because of its low metabolic needs and high collagen content. Hence it closes the perforation in high percentage of cases with good tensile strength.

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