Hearing Outcome After Type I Tympanoplasty: A Retrospective Study

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Abstract The purpose of this retrospective study was to evaluate the hearing outcomes using temporalis fascia graft for tympanic membrane reconstruction in type 1 tympanoplasty. It included 100 patients with tubotympanic type of chronic suppurative otitis media requiring only tympanic membrane reconstruction. Patients requiring ossicular reconstruction or with attic antral disease were excluded. Patients were assessed after 3, 6 months and 1 year for graft status and hearing outcome. Hearing evaluation was done using tuning fork tests and pure tone audiometry. In total, 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 dBs and the mean air bone gap reduction was 11.94 dBs. This reduction was statistically significant when compared to the pre operative hearing conditions.

Keywords Type 1 tympanoplasty · Temporalis fascia · Underlay technique · Post aural approach

Introduction

Chronic suppurative 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. Chronic tubotympanic suppurative 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 airborne gap [1]. 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 spontaneously [2].

Procedures such as grafting the tympanic membrane, alone, or in combination with ossiculoplasty (tympanoplasty with ossicular chain reconstruction), comprise the varying subtypes of tympanoplasty [3, 4]. Type-1 tympanoplasty is performed when there is tympanic membrane perforation without any ossicular damage [5]. 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 procedures [6]. The incidence of chronic tubotympanic suppurative otitis media is high in developing countries because of poor socioeconomic standards, poor nutrition and lack of health education. It is an important cause of hearing impairment [7]. More and more attention has been focused on the effectiveness of treatment modalities in relation to the costs. Evaluation of treatment results in reconstructive middle ear surgery with special regard to quality of life aspects is, therefore, of increasing importance. This study deals with functional outcome in a series of patients who underwent type-1 tympanoplasty with underlay technique using temporalis fascia graft.

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Materials and Method

The study was a retrospective study involving all patients who underwent Type I tympanoplasty in ENT Department, People's College of Medical Sciences and Research Centre for perforation of the tympanic membrane during the period from Jan 2009 until Dec 2012.

All patients were assessed pre-operatively by detailed history and clinical examination. The patients with tubo-tympanic disease and dry central perforations were selected. Patients with history of nasal allergy, other nasal diseases, throat problems or any systemic disease were appropriately treated before taking for ear surgery. Tympanosclerosis and condition of the middle ear mucosa was noted; cholesteatoma cases were excluded from the study. The type, size and location of the perforations were recorded. The patency of Eustachian tube was assessed. Hearing assessment was initially performed clinically by tuning fork tests and then by Pure tones Audiometry. Ossicular chain integrity was speculated by pre operative A–B gap on audiometry and then it was checked per operatively when the tympanum was opened. X-ray of the Mastoids was performed in all patients. All cases were operated through post aural approach using temporalis fascia by underlay technique under local anesthesia except a few apprehensive patients which were operated under general anesthesia.

Patients were followed at regular intervals i.e. at 6 weeks, 3, 6 months and 1 year post-operatively. Status of the graft, along with any evidence of complications was noted. Hearing assessment was made with tuning forks and confirmed with pure tone audiometry and compared with the pre-operative state at 6 weeks, 3, 6 months and 1 year final post operative PTA done at 1 year. An intact graft at the end of the 1 year postoperatively was considered a success and a minimum hearing improvement of 10 dB in two consecutive frequencies was regarded as audiological success. In patients with pin point perforation after surgery, cauterization with tricarboxylic acid (TCA) was done. Results were tabulated and statistically analyzed.

Statistical Methods

The collected data were tabulated and statistical analysis was done by estimating rates, means and standard deviations using statistical software package SPSS 20.0.

Results

A total of 100 cases were included, of these 41 were males and 59 were females. The age range was from 13 to 55 years and mean age was 27.17 years (Fig. 1).

Fig. 1 Distribution of cases according to age ($n = 100$)

The study comprised of 48 % cases of unilateral left sided disease, 34 % of unilateral right sided disease and 18 % cases of bilateral disease.

Our study showed an overall success rate of 88 % as far as the graft uptake was concerned, i.e. out of 100 cases, in 88 cases the perforation was closed on examination at the interval of 1 year. Overall, the procedure failed in 6 (6 %) cases; there was residual pin point perforation of tympanic membrane in 11 (11 %) cases, few were healed spontaneously and for the rest cauterization was done with TCA. Small central perforation in 6 (6 %) cases and were advised re-surgery. The post operative residual pin point perforation had no co-relation with the pre operative size of the perforation which included large as well as the sub total perforations (Fig. 2).

In the study 3 cases showed retraction pocket, 4 showed tympanosclerotic patch over it and 10 showed sagging of the graft at the end of 1 year follow up (Table 1).

In the study anterior as well as posterior quadrant perforations yield similar results. Mean pre operative air conduction was 38.47 ± 11.25 dBs whereas Mean post operative air conduction was 23.92 ± 13.80 dBs. Mean air

Fig. 2 Condition of ear at 1 year ($n = 100$)

Table 1 Clinical appearance of graft at 1 year ($n = 88$)

Condition of graft	Number
Normal	71
Tympanosclerotic patch	4
Retraction pocket	3
Mild retraction	10

Table 2 Pre & Post operative mean and gain in air conduction, bone conduction & air bone gap ($n = 88$)

	Pre operative	Post operative 1 year	Gain	P value
Air conduction	38.47 $\pm$ 11.25	23.92 $\pm$ 13.80	14.55 $\pm$ 9.40	
Bone conduction	14.74 $\pm$ 7.21	12.32 $\pm$ 9.73	2.42 $\pm$ 4.06	
Air bone gap	23.55 $\pm$ 7.56	11.60 $\pm$ 7.70	11.94 $\pm$ 7.88	0.0001

bone gap pre operatively was 23.55 $\pm$ 7.56 dBs and post operatively was 11.60 $\pm$ 7.70 dBs (Table 2).

The air bone gap closure achieved is 0.0001 highly significant.

The mean gain in air conduction achieved is 14.55 $\pm$ 9.40 dBs. The mean gain in bone conduction is 2.42 $\pm$ 4.06 dBs whereas the mean gain in air bone gap is 11.94 $\pm$ 7.88 dBs (Table 2).

Discussion

Tympanoplasty is considered to be a simple, easy-to-complete otologic surgery, with good success rate both anatomically and functionally. However, failures do occur. The main aim of this procedure is to prevent recurrent infection of the middle ear, to improve hearing, and minimize after care [8].

Many studies have been carried out in the past regarding structural and functional outcome following type-I tympanoplasty utilizing temporalis fascia with underlay technique. The quoted success rate in various studies ranges from 80 to 95 % [9–12]. Pelva reported 97 % success of tympanic membrane repair and air-bone gap of <20 dB in 69 % of the cases undergoing type-I tympanoplasty [13]. Regarding anatomical outcome our graft uptake rate, with complete closure and healing of the tympanic membrane was 88 %. These results are comparable to the results of other published studies.

Considering the functional outcome, one author reported approximately an 80 % success rate at 5 years to within 10 dB. He recommended aiming for a final air-conduction threshold <30 dB or within 15 dB of the other ear for the

patient to benefit from binaural hearing and sound localization [10]. The largest study to date on overlay and underlay grafting was performed by Rizer, improvement in hearing (closure of air-bone gap to within 10 dB) was seen in 84.9 % cases of the underlay group [6]. Our study was based on the experience with underlay technique only and overall improvement in hearing was seen in 90 % of cases with notable reduction in air-bone gap and out of these cases 88.89 % cases had air-bone gap to within 15 dB, at the end of one year. Hearing deterioration was seen in 10 cases due to graft rejection and infections leading to re-perforation.

Recently various new other tissues have proved to be good grafting materials. Many studies have been conducted to compare the hearing results of patients with cartilage tympanoplasty, using perichondrium and it was concluded that hearing results after cartilage tympanoplasty are comparable to temporalis fascia and perichondrium [14–16], but results of cartilage tympanoplasty were not good by some authors [17]. Recently in many studies alloderm and human amniotic membrane have also proved to be an effective TM graft when used in type I tympanoplasty [18–20]. Still temporalis fascia graft is most widely used because of easy of availability, good post operative results and morphological similarity with the tympanic membrane.

Various complications regarding type-I tympanoplasty have been mentioned in the literature, among these infection, residual perforation, dislodgement of graft, retraction pockets and damage to chorda tympani are the common ones [21]. Postoperative infections can lead to graft failure. In our study the graft failure was seen in 6 %. Other complications like sensory neural hearing loss, vertigo, damage to facial nerve, chondritis and meatal stenosis were not seen. In this study we observed that type-I tympanoplasty using temporalis fascia with underlay technique is a reliable and preferred procedure because of less complications and better anatomical and functional results. In another study by Singh M. underlay technique was judged to be better because of its technical ease, better assessment of ossicular chain integrity and mobility, less time consumption, earlier healing of graft, hearing gain in more patients and fewer minor complications [22].

Even with advancement and newer graft materials [14–20], temporalis fascia remains a widely used graft by many surgeons which yields good take up rates and acceptable hearing results as in this study.

References

1. Browning GG et al Scott-brown's otorhinolaryngology head and neck surgery, 7th edn. 3:3421

2. Khan NA (1992) Repair of traumatic perforation of tympanic membranes by a new technique. *Pak J Otolaryngol* 8:177–179
3. Javed M, Khan S, Ullah H, Shah J (2000) Onlay versus underlay myringoplasty, audiological results. *Pak J Otolaryngol* 16:59–60
4. Vrabec JT, Deskin RW, Grady JJ (1999) Meta-analysis of pediatric tympanoplasty. *Arch Otolaryngol* 125(5):530–534
5. Ashfaq M, Aasim MU, Khan N (2004) Myringoplasty: anatomical and functional results. *Pak Armed Forces Med J* 54(2): 155–158
6. Meyer AG, Albers FW et al (1997) Validation of hearing results in tympanoplasty. In: Huettenbrink (ed) *Middle ear mechanics in researches and otosurgery*. p 147–150
7. Rizer FM (1997) Overlay versus underlay tympanoplasty. Part I: historical review of the literature. *Laryngoscope* 107((12) suppl 84):1–25
8. Jalisi M, Khalid I, Khalid AA (1997) The human amniotic membrane graft material in tympanoplasty. *Pak J Otolaryngol* 13:11–12
9. Ogale SB, Bhaya MH, Verma S, Sheode JH (1992) Inferior based flap in myringoplasty. *Pak J Otolaryngol* 8:1315
10. Smyth GDL (1992) Toynbee memorial lecture 1992: facts and fantasies in modern otology: the ear doctor's dilemma. *J Laryngol Otol* 106:591–596
11. Aslam N, Iqbal J, Mehmood K (2001) Type I tympanoplasty underlay technique and results. *Proc Shaikh Zayed Postgrad Med Inst* 15(2):77–80
12. Fadl FA (2003) Outcome of type-I tympanoplasty. *Saudi Med J* 24(1):58–61
13. Palva T (1987) Myringoplasty and tympanoplasty. *Acta Otolaryngol* 104:279–284
14. Gerber, Dornhoffer et al (2000) Hearing results after primary cartilage tympanoplasty. *Laryngoscope* 111(12):1994–1999
15. Gierek T, Slaska-Kaspera A, Majzel K, Klimczak-Golab L (2004) Results of myringoplasty and type I tympanoplasty with the use of fascia, cartilage and perichondrium grafts. *Otolaryngol Pol* 58:529–533
16. Wielgosz R, Mroczkowski E (2006) Assessment of the hearing results in tympanoplasties with the use of palisade-technique. *Otolaryngol Pol* 60:901–905
17. Effat KG (2005) Results of inlay cartilage myringoplasty in terms of closure of central tympanic membrane perforations. *J Laryngol Otol* 119(8):611–613
18. Vos JD, Latev MD, Labadie RF, Cohen SM, Werkhaven JA, Haynes DS (2005) Use of Allo Derm in type I tympanoplasty: a comparison with native tissue grafts. *Laryngoscope* 115:1599–1602
19. Fishman AJ, Huang TC, Kanowitz SJ (2005) Total tympanic membrane reconstruction: Allo Derm versus temporalis fascia. *Otolaryngol Head Neck Surg* 132(6):906–915
20. Harvinder S, Hassan S, Sidek DS, Hamzah M, Samsudin AR, Philip R (2005) Underlay myringoplasty: comparison of human amniotic membrane to temporalis fascia graft. *Med J Malays* 60(5):585–589
21. Emir H, Ceylan K, Kizilkaya Z, Gocmen H, Uzunkulaoglu H, Samim E (2007) Success is a matter of experience: type I tympanoplasty: influencing factors on type I tympanoplasty. *Eur Arch Otorhinolaryngol* 264(6):595–599
22. Singh M, Rai A, Bandyopadhyay S, Gupta SC (2003) Comparative study of the underlay and overlay techniques of myringoplasty in large and subtotal perforations of the tympanic membrane. *J Laryngol Otol* 117(6):444–448