

Outcome of Tympanoplasty Type - I by Underlay Technique

Ashfaque Ahmed Shaikh, Maisam Abbas Shiraz Onali, Salman Matiullah Shaikh
and Tariq Rafi

ABSTRACT

OBJECTIVE: To observe the factors influencing the success of type-I tympanoplasty by underlay technique, in closing tympanic membrane perforation of variable size and location with temporalis fascia graft.

DESIGN: Prospective study.

PLACE AND DURATION OF STUDY: Department of Otorhinolaryngology, Head & Neck Surgery, Jinnah Postgraduate Medical Centre, Karachi from April 2004 to November 2006.

PATIENT & METHODS: Hundred (100) consecutive patients of dry tympanic membrane perforation undergoing type-I tympanoplasty were included. Specific inclusion and exclusion criteria were set. Data were collected regarding age, gender, cause, site and size of tympanic membrane perforation, pre and postoperative audiogram results. The data were entered in a set per-forma and was analyzed using SPSS version 14.0

RESULTS: The male: female ratio was 2:3 with age varying from 18 to 40 years (mean age 31.2). Overall success rate was 81% (81 out of 100 perforations closed successfully). There was no significant effect of age, gender and size of perforation on closure. All patients with traumatic perforation had successful closure (100% with a p-value of <0.05). Out of the 100 patients tested, the mean air conduction threshold was 40db preoperatively and 28 db postoperatively, while the mean bone conduction threshold remained the same pre & postoperatively i.e. 15 db. On postoperative audiometric analysis air bone gap closed completely in 4 patients, 51 ears had a postoperative air-bone gap of 10 db or less, reduced up to 15db in 26 patients, while in the remaining 19 ears there was no uptake of graft .

CONCLUSION: Underlay technique for type-I tympanoplasty is an effective method for closure of uncomplicated tympanic membrane perforations. Patients with a traumatic perforation have a high success rate. Postoperatively these patients have record improvement in hearing on pure tone audiogram.

KEY WORDS: Tympanoplasty, tympanic membrane perforation, air conduction threshold, bone conduction threshold, air bone gap.

INTRODUCTION

Tympanoplasty is a surgical technique used to restore the anatomy and functions of middle ear. It is the procedure of choice for the treatment of inactive chronic otitis media. Its main goals are to eradicate middle ear disease and reconstruct the hearing mechanism, without mastoid surgery, with or without tympanic membrane grafting.¹ Success rate of tympanoplasty without mastoidectomy is at least as good for patients with Chronic Suppurative Otitis Media (CSOM) as it is for patients with perforation without prior otorrhea.² Successful closure of tympanic membrane following myringoplasty, is related to perforation size, grade of surgeon, surgical technique, graft material, previous myringoplasty and smoking history.³ Patients younger than 16 years had decreased graft uptake compared with adults.⁴ The two classical techniques that have developed are the underlay and overlay techniques first described by House⁵ and Shea⁶ respectively. Underlay technique is widely used as compared to the more challenging overlay technique reserved for sub-

total or anterior perforations. Autologous temporalis muscle fascia is now routinely the graft of choice for this procedure⁷. Factors which are commonly related to the successful outcome are size and site of perforation, duration of discharging ear and the associated pathology in the middle ear⁸. Hearing improvements after tympanoplasty are assessed by pure tone audiometry⁹. Mean hearing losses calculated by using the frequencies 500 HZ, 1000 HZ, 2000 HZ.¹⁰ Autologous temporalis fascia graft remains the preferred graft material for its superior tissue quality, its ready availability in the operative field, low BMR and excellent results in myringoplasty (Tympanoplasty).¹¹ A postauricular approach provides better access to the anterior margins of tympanic membrane¹². It is useful for medium to large perforation as well as anterior inferior perforation with or without alteration of annulus. Initially onlay technique was used by otologist, but with the passage of time, complications such as lateralization of graft, blunting of anterior angle etc were reported with this technique¹³. Since last 3 decade the

interest of the otologist all over the world have change from onlay to underlay technique with good results of over 92% have been reported with this technique¹⁴. In our attempt to study the outcome of type-I tympanoplasty and to observe factors influencing its success and failures, also to compare our results with other literature and to set references and outcome results for further studies on similar topics we conducted this study at the Department of Otolaryngology, Head and Neck Surgery, Jinnah Postgraduate Medical Centre, Karachi.

PATIENT AND METHODS

This is a prospective study carried out for 100 consecutive cases of type-I tympanoplasty during the period ranging from April 2004 to November 2006 at The Jinnah Postgraduate Medical Centre, Karachi. Majority of the patients belonged to the urban population. Well defined inclusion criteria were set which included (1) patients belonging to both genders with ages ranging from 18 to 40 years (2) having a dry tympanic membrane perforation for last 6 weeks duration (3) with a good cochlear reserve and (4) no evidence of cholesteatoma, granulation or active disease in the middle ear. Patients with active ear discharge, frequently or recently discharging ear (history of ear discharge of less than 6 weeks) were excluded. Also patients with upper respiratory tract pathologies including deviated nasal septum, sinusitis, chronic tonsillitis or pharyngitis were excluded. Patients with deformities of external auditory canal were also not included. Patients with unilateral hearing and having discharge in the same ear were also omitted from the study. All patients with contraindication to general anesthesia or having other comorbidities were excluded. All patients were clinically examined to assess the site and size of perforation of tympanic membrane and to rule out cholesteatoma, granulations or active disease. Perforation was allocated site according to the division of pars tensa into four quadrants i.e. antero-superior and inferior & postero-superior and inferior quadrants. Small sized perforations occupied only one quadrant where as medium sized perforations were located to 2-3 quadrants and large perforations had a share in all the four quadrants. Large perforations occupying almost the whole of tympanic membrane except for a thin rim at the periphery were labeled as subtotal. Examination of nose and throat was done to rule out other ENT problems like deviated nasal septum, nasal polyp and inferior turbinate hypertrophy. Pure tone audiometry was done in all patients. Our patients underwent type-I tympanoplasty using temporalis fascia graft for reconstruction of the tympanic membrane. For all patients post aural approach was carried out and the grafts were placed by underlay technique. Postoperatively all patients received antibiotics for a minimum of

7 days. Ear packing (BIPP pack) was removed after 2 weeks and the patients were followed up weekly and otoscopy was performed to evaluate the anatomical outcome. We took into account the presence of a healed tympanic membrane or a residual perforation. Patients were again followed up, after 3 months of surgery when the ear was examined and audiogram was performed. Postoperative results were evaluated with respect to functional outcome. The data were entered in to a set up Performa and was evaluated using the statistical package for social sciences (SPSS version 14.0). Appropriate statistical tests were applied to the information provided and the results were considered significant if the p-value was less than or equal to 0.05

RESULTS

Out of the 100 patients, there were 67 males and 33 females. The age range was 18-40 years with a mean age of 31.2 years. Both the right and left ears were nearly equally affected (right ear 51 perforations, left ear 49 perforations). The main cause of perforation was chronic suppurative otitis media (88 patients) whereas in 12 patients the perforation was due to trauma. Most of the patients had a large central perforation (48), whereas 32 patients had a medium sized perforation and 20 patients had a subtotal perforation (**Table I**). On univariate analysis age, gender and size of perforation had no significant effect on the outcome or success of graft uptake; however an association was seen with the cause of perforation. Out of 88 patients having tympanic membrane perforation due to chronic suppurative otitis media 69 had a successful uptake (78.4%) where as all 12 patients with traumatic perforation had successful closure i.e. 100% (**Table II**). This was statistically significant (p-value <0.05). Patients with a medium sized perforation did better than those with a large or subtotal perforation having success rate of (28 out of 32 healed) 87.5%, (39 out of 48 healed) 81.2% and (14 out of 20 healed) 70% respectively. These values were not significant on comparison. The preoperative and postoperative air and bone conduction thresholds were obtained at speech frequencies, of 500 HZ, 1000 HZ and 2000 HZ. In 81 cases with successful graft uptake, the mean air conduction threshold at the speech frequencies was 40db preoperatively and 28 db postoperatively, while the mean bone conduction threshold remained the same pre & postoperatively i.e. 15 dB results are shown in **Table III**. On postoperative audiometric analysis 51 ears had a postoperative air – bone gap of 10 db or less, air bone gap closed completely in 4 patients, reduced up to 15db in 26 patients, while in the remaining 19 ears there was no uptake of graft. The mean air bone gap closure of 12db was achieved. Results are shown in **Figure I**.

**TABLE I:
BASELINE CHARACTERISTICS**

Sex (n=100)	
Males	67 (67%)
Females	33 (33%)
Age (n=100)	
18-24 years	32 (32%)
25-40 years	68 (68%)
Causes of perforation	
Trauma	12 (12%)
CSOM*	88 (88%)
Size of perforation	
Medium	32 (32%)
Large	48 (48%)
Sub-total	20 (20%)

* Chronic suppurative otitis media

**TABLE II:
HEALING RATE WITH RESPECT TO CAUSE OF PERFORATION**

Cause	Healed	Non-healed
Trauma	12 (100%)	0
CSOM	69 (78.4%)	19 (21.6%)

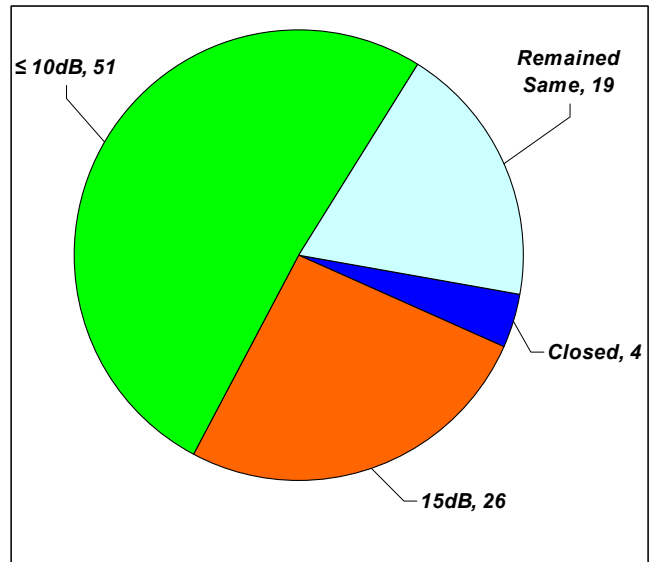
**TABLE III:
COMPARISON OF PRE AND POSTOPERATIVE RESULTS (n=100)**

Audiometric Test	Preoperative	Postoperative
Mean air conduction threshold	40dB	28dB
Mean bone conduction threshold	15dB	15dB
Mean air bone gap	25dB	12dB

DISCUSSION

The main objectives of study regarding type-I tympanoplasty are to eradicate the disease, to repair the tympanic membrane, to observe factors influencing the outcome and to minimize the occurring of complications. The anatomical and functional results in this series of 100 type-I tympanoplasties are: In 81 ears (81%) the tympanic membrane closed, while the procedure failed in 19 ear (19%) resulting in the residual perforation of tympanic membrane. On postoperative

**FIGURE I:
POSTOPERATIVE AIR BONE GAP**



audiometric analysis 51 ears had a postoperative air – bone gap of 10 db or less, air bone gap closed completely in 4 patients, reduced up to 15db in 26 patients, while in the remaining 19 ears there was no uptake of graft. The mean air bone gap closure of 12db was achieved in 81 patients (81%) in our study. Rizer (1997)¹⁵ in a retrospective study of tympanoplasty with underlay technique using temporalis fascia reported 88.8% tympanic membrane perforation closure rate. Aming A. Seraj and M.S. Atha Ullah¹⁶ reported 82.9% success rate for type-I tympanoplasty. It was retrospective study of 217 patients operated as type-I tympanoplasty using temporalis fascia as graft material with underlay techniques. Pelva¹⁷ reported 97% success of tympanic membrane repair and air bone gap of less than 20dB in 69% of the cases undergoing tympanoplasty. Ogisi¹⁸ reported 66.6% success of tympanic membrane repair and hearing improvement in 77% of the cases undergoing tympanoplasty type-I. In one study of inferior based flap in myringoplasty, the graft success rate was 92%. In this study 124 patients were operated using the modification of Fisher’s inferior based flap technique. Both overlay and underlay techniques were carried out.¹⁹ Several poor prognostic factors have been identified in the studies: Age less than 8 years was found to be a poor prognostic factor by Black et al²⁰ and MacDonald et al²¹. Reasons cited for poor results are: immaturity of Eustachian tube function,²¹ high incidence of recurrent upper airway infections and the surgical difficulty presented by a narrow external auditory canal in children.²² It has also been argued that a perforation may serve the same function as ventilation tube.²³ The size of the perforation was found to be a

prognostic factor by Ophir et al.²⁴ The status of the contra lateral ear was found to be a prognostic factory by Koch et al,²³ but not by Chandrasekhar et al.²⁵ A wet ear at surgery was a poor prognostic factor for Lau and Tos²⁶ but did not influence the results in the study carried out by Francois et al.²⁷ Gersdorff²⁸, Gerard²⁹ reported that the underlay or overlay position of the graft does not significantly influence the rate of postoperative perforation or complication. In a study published in 2006, Angeli³⁰ mentioned the success rate of tympanoplasty up to 91% predicting the condition of handle of malleus (involved or free of disease) and the air bone gap to be a prognostic factor. In our study the major negative factors were history of middle ear infection, no other obvious factor or complication detected. Regarding the anatomical and functional (audiological) outcome our study showed an excellent up take rate. The factors influencing outcome in our study were the cause of perforation (infection). To obtain excellent results, surgical indications have to be extremely rigorous as with surgical techniques.³¹ So in order to have better results in tympanoplasty, proper case selection, with skill and ability to handle the tissues gently are the main factors. Post-operative management including care, antibiotic is also play a key role in obtaining good results.

CONCLUSION

We observe an excellent result for type-I tympanoplasty by Underlay technique in cases of uncomplicated tympanic membrane perforations and therefore it is an effective method for closure of such perforations. Post operatively majority of our patients had improved hearing on audiogram. The factors which influenced outcome in our series of patients where the history of traumatic perforation .we observes a high success rate which is comparable to the international literature.

REFERENCES

1. Aslam MA, Aslam MJ. Peadiatric Tympanoplasty: Anatomical and Functional results. Pak Armed Force Med J 2006; 56(3): 276-9.
2. Webb BD, Chang CV. Efficacy of tympanoplasty without mastoidectomy for chronic suppurative otitis media. Arch Otolaryngol Head Neck Surg 2008 Nov;134(11):1155-8.
3. Wasson JD, Papadimitriou CE, Pau H. Myringoplasty: impact of perforation size on closure and audiological improvement. J Laryngol Otol 2009 Jan; 12:1-5.
4. Sarkar S, Roychoudhury A, Roychaudhuri BK. Tympanoplasty in children. Eur Arch Otorhinolaryngol 2009;266(5):627-33.
5. House WF. Myringoplasty. Arch Otolaryngol 1960;71: 399-404.
6. Shea JJ Jr. Vein graft closure of ear drum perforation. J Laryngol Otol 1960;74: 358-62.
7. Glasscock ME, House WF. Homograft reconstruction of the middle ear. Laryngoscope 1968;78: 1219-1225.
8. Ashfaq M, Aasim MU, Khan N. Mringoplasty: Anatomical and functional results. Pak Armed Force Med J 2004;54(2):155-8.
9. Baba S, Yagi T, Fujikura T. Subjective evaluation and overall satisfaction after tympanoplasty for chronic simple suppurative otitis media. J Nippon Med Sch 2004 Feb;71(1):17-24
10. Hibbert J, Scott-Brown WG, eds. Scott Brown's Otolaryngology 6th edition. UK, Butterworth-Heinemann, 1997.
11. Khan N, Pal MB. Incidence of complications in temporal bone due to Cholesteatoma. PPMJ 1999; 10: 109-111.
12. Ibekwe TS, Nwaorgu OG, Adeosun AA, Kokong DD, Lawal HO, Okundia PO, et al. Assessment of the size of tempanic membrane perforations: a comparison of clinical estimations with video otoscopic calculations. Ear Nose Throat J 2008;87 (10):567-9.
13. Benecke JE. Myringoplasty: the lateral graft technique with fascia: Acta Otorhinolaryngol Belg 1995;49(2):2001.
14. Black JH, Warnald PJ. Myringoplasty effects on hearing and contribution factors. Afr Med J 1995;85(1):41.
15. Rizer FM. Overlay versus underlay tympanoplasty. Part II: the study. Laryngoscope 1997; 107: 26-36.
16. Seraj AA, Attaullah MS. Tympanoplasty, review of 234 cases in a residency program. Pakistan J Otolaryngology 1991; 7: 43-7.
17. Tauno P. Surgical treatment of chronic middle ear disease: Myringoplasty and tympanoplasty. Acta Otolaryngol (Stockh) 1987; 104: 279-84.
18. Ogisi FO, Adobamen P. Type-I tymanoplasty in benign: 10 years review. Niger Postgrad Med J 2004; 11 (2): 84-7.
19. Ogale SB, Bhaya MH, Verma S, Sheode JH. Inferior based flap in myringoplasty. Pakistan J Otolaryngology 1992; 8:13-5.
20. Black JH. An analysis of the results of myringoplasty in children. Int J Pediatr Otolaryngol 1995; 31: 95-100.
21. MacDonald RR, Lusk RP, Muntz HR. Fascia form myringoplasty in children. Arch Otolaryngol Head Neck Surg 1994; 120:138-43.
22. Bluestone CD, Cantekin EJ, Douglas GS. The Eustachian tube function related to the results of tympanoplasty in children. Laryngoscope 89:450-58.

23. Koch WM, Friedman EM, Mchill TJI, Healy GB. Tympanoplasty in children: The beston children's hospital experience. Arch Otolaryngol Head Surg 1990; 116: 35-40.
24. Ophir D, Porat M, Marshak G. Myringoplasty in pediatric population. Arch Otolaryngol Head Neck Surg 1987; 113:1288-90.
25. Chandrasekhar SS, House JW, Devan U. Pediatric tympanoplasty: A 10 years experience. Arch Otolaryngol Head Neck Surg 1995; 121: 873-8.
26. Lau T, Tos M. Tympanoplasty in children an analysis of results. Am J Otol 1986; 7: 55-9.
27. Francois M, Juvanon JM, Contencin P, Bobin S, Manach Y, Naray P. Myringoplastic chez fenfant. Ann Otolaryngol (Paris) 1985; 102: 321-7.
28. Gersdorff M, Gerard JM, Thill MP. Overlay verses underlay tympanoplasty: Comparative study of 122 cases. Rev Laryngol Otol Rhinol (Bord) 2003; 124 (1):15-22.
29. Gerard JM, Thill MP, Gersodorff M. The art of tympanoplasty and its clinical illustration. Ann Otolaryngol Chir Cervicofac 2003; 120 (2): 83-93.
30. Angeli SI, Kulak JL, Guzmán J. Lateral Tympanoplasty for total or near-total perforations: prognostic factors. Laryngoscope 2006;116(9):1594-9.
31. Yigit O, Alkan S, Topuz E , Uslu B , Usal O, Dadas B. Short-term evaluation of over-under myringoplasty technique. Eur Arch Otorhinolaryngol 2005; 262(5):400-3.



AUTHOR AFFILIATION:

Dr. Ashfaque Ahmed Shaikh (*Corresponding Author*)

Medical Officer, Department of ENT and Head & Neck Surgery
Dow University of Health Sciences & Civil Hospital
Karachi, Sindh-Pakistan.
Email: shaikhashfaque@live.com

Dr. Maisam Abbas Shiraz Onali

Resident-FCPS, Department of ENT and Head & Neck Surgery
Dow University of Health Sciences & Civil Hospital
Karachi, Sindh-Pakistan.

Dr Salman Matiullah Shaikh

Associate Professor, Department of ENT and Head & Neck Surgery
Dow University of Health Sciences & Civil Hospital
Karachi, Sindh-Pakistan.

Prof. Tariq Rafi

Professor, Department of ENT and Head & Neck Surgery
Jinnah Postgraduate Medical Centre
Karachi, Sindh-Pakistan.