Circumferential Elevation of Tympanomeatal Flap: A Novel Technique for subtotal and Anterior Perforation Closure

Pradeep Pradhan*, Abhimanyu Amant and Priti Lal
Department of Otolaryngology, I.P University, India

Abstract

Background: Circumferential elevation of tympanomeatal flap is considered to be an effective surgical procedure for tympanic membrane grafting. Here we have demonstrated its technique and compared its results between subtotal and anterior perforations by placing the graft medial and lateral to handle of malleus respectively.

Material and methods: 34 patients with chronic otitis media underwent type I underlay tympanoplasty with circumferential elevation of tympanomeatal flap. Temporalsis graft was placed medial and lateral to handle of malleus in 18 (group A) and 16 (group B) patients respectively. The results were compared between two groups after 06 months.

Results: TM closure was found in 84% and 93% patients in group A and group B respectively (p=0.58) at the end of 6 months. In group A, the air bone (AB) closure was 9.44 dB and in group B it was 8.70 dB (p=1.00). Overall mean AB closure was found to be 9.09 dB. There were no major postoperative complications noticed in both the group.

Conclusion: Circumferential flap elevation in subtotal and anterior perforation is an effective surgical technique in type I tympanoplasty with successful outcome. Media or lateral placement of graft to handle of malleus did not significantly affect the final outcome.

ABBREVIATIONS

COM: Chronic Otitis Media; TM: Tympanic Membrane; PTA: Pure Tone Audiogram; AB: Air Bone

INTRODUCTION

Type 1 tympanoplasty is the commonest otological procedure performed in any otological clinics for patients with chronic otitis media (COM). Different graft materials have been tried for reconstruction of the defect in the tympanic membrane and temporalsis fascia is the most common autograft used [1,2]. Although underlay grafting technique is the preferred over the overlay grafting for reconstruction of the tympanic membrane (TM) defect, it is challenging for subtotal and anterior perforations as the graft falls away from the anterior remnant of the tympanic membrane causing medialisation of the graft leading to failure. Different tympanomeatal flaps have been designed in the past for reconstruction of the subtotal and anterior perforations to overcome the poor success rate. Circumferential elevation of tympanomeatal over the bony canal and underlay graft placement is thought to be a good surgical technique for TM grafting as it ensures elevation of canal skin over the Eustachian tube area to for a good assembly between the temporalsis graft and the flap to increase its success rate. But elevation of tympanic annulus over anterior superior quadrant can lead to a serious complication i.e. blunting of the tympanomeatal angle resulting in conductive hearing loss.

In this study, we have described the surgical technique of circumferential flap elevation in underlay type I tympanoplasty and compared the results pertaining to graft uptake, hearing results, anterior angle blunting and graft lateralization in patients between anterior and subtotal perforations. We have also compared the surgical outcomes between medial and lateral graft placement in relation to handle of malleus in patients with subtotal and anterior perforations respectively.

MATERIALS AND METHODS

This is a prospective study conducted in the department of otolaryngology at Sabdarjung hospital from September...
2012 to December 2014. A total of 34 patients with COM with subtotal and anterior perforations were included in the study. 18 patients having subtotal perforations were included in group A and 16 patients with anterior perforations were included in group B. Patients with Ossicular chain discontinuity, conductive hearing loss due to acquired and congenital conditions other than tympanic membrane perforation, sensorineural deafness and revision surgeries were excluded. Audiogram was done preoperatively in each patient.

**Surgical technique**

All the patients were operated under local anesthesia. Through post aural approach, a large temporalis fascia graft was harvested. Margins of the perforations were freshened. Circumferential tympanomeatal flap along with fibrous annulus was elevated all around from the bony annulus keeping it pedicled at 11-12 ‘o’ clock position above the handle of malleus (Figure 1). The flap just anterior to malleus was cut and released (Figure 2). Ossicular continuity was checked. Underlay grafting was performed in all patients and the graft was extended anterosuperiorly over the lateral wall of the Eustachian tube and was secured medially by placing gelfoams in the Eustachian tube and in the middle ear. In group A, temporalis fascia graft was placed medial to handle of malleus (Figure 3) and in group B, it was placed laterally to malleus (Figure 4). Tympanomeatal flap was then repositioned back after ensuring that the flap and the graft were closely approximated to each other circumferentially (Figure 5). The post aural incision was closed with double layer suturing and mastoid dressing was placed. Patient was observed for 24 hours in the surgical ward and then discharged if he was found to be uneventful. First postoperative visit was allowed after one week for the removal of aural pack and the post aural sutures. Afterwards patients were instructed to visit the outpatient department at the end of 1, 3 and 6 months in the postoperative period. Pure tone audiogram (PTA) done in preoperative and each postoperative visit where air conduction and bone conduction threshold were calculated at 500, 1000, 2000 and 3000 Hz frequency. The worst postoperative audiogram was compared with the preoperative audiogram. Microscopic examination of the operated ear was performed in each follow-up visit to assess the graft intake and complications that would have been occurred in the follow-up periods. Patient’s datas were obtained, statistically analyzed to compare between two groups at the end of 06 months.
RESULTS

34 patients (20 males and 14 females) underwent type I tympanoplasty with elevation of circumferential tympanomeatal flap. The results obtained were described in the Table 1. The mean age of patients in group A was 24 years and that of group B was 30 years while the overall mean was 27 years. After 6 months of surgery, 84% of patients in group A had complete graft uptake and in group B it was found to be 93%. Of 18 patients in group A, 3 (16%) had residual perforation and of 16 patients in group B, 1 (07%) had residual perforation at the end of 6 months. All these 4 patients were undergone revision tympanoplasty after 6 months of follow-up. The mean preoperative and postoperative air conduction thresholds were found to be 30.27 dB and 20.83 dB respectively in patients of group A with 9.44 dB of AB gap closure. Similarly in the mean preoperative and postoperative air conduction thresholds were found to be 30.0 dB and 21.30 dB with 8.70 dB of AB closure. Overall the preoperative and postoperative mean air conduction thresholds were 30.14 dB and 21.05 dB respectively with 9.09 dB of air-bone gap closure. It has been found that the postoperative graft uptake rates were similar when compared between the two groups i.e. patients with subtotal perforation and anterior perforation (p=0.58). Again no significant difference in hearing improvement (AB closure) was found between two groups (p=1.00). Although closure of AB gap was noticed in all the patients, 11 of 18 (61.1%) patients in group A and 10 of 16 (62.5%) in group B were found to have 10 dB closure of AB gap at the end of 6 months in postoperative period which was found to be statistically insignificant (p=0.73). Likewise 6 of 18 (33.33%) patients and 5 of 16 (31.25%) were found to be associated with 20 dB closure of AB gap and which was considered statistically insignificant (P=0.89). There was no case detected in the postoperative period to have blunting of the anterior angle or lateralization of the graft.

DISCUSSION

Tympanoplasty is one of the commonest surgical procedures performed in any otolaryngology clinic. The underlay type I tympanoplasty is considered as the simplest and effective procedure for tympanic membrane perforation. But in cases of subtotal and anterior perforations the procedure is challenging because of its poor graft uptake rate due to lack of support at the anterosuperior quadrant resulting in medialisation of the graft leading to failure. To overcome this poor success rate, different flap techniques have been developed in literature such as over-under tympanoplasty [3], mediolateral graft tympanoplasty [4] mainly for subtotal and anterior perforations aimed at providing adequate support to the graft over the Eustachian tube where the remnant of TM is very thin. As described by Silverstein, he elevated fibrous annulus along with the tympanomeatal flap anterosuperiorly over the Eustachian tube where 2-4 mm tunnel was made through which the graft was pulled out anteriorly and secured between the bone canal and the anterior meatal skin [5]. A similar study was conducted by Schraff et al [6], where he first elevated the fibrous annulus from bony sulcus followed by the elevation of canal skin over the anterosuperior quadrant retrogradely and underlay grafting was done by placing the graft between the raw bone and the anterior meatal skin. He found patients with encouraging postoperative results with 94.5% graft uptake without any serious complication. Another study was conducted by Guneri et al [7] including 20 patients of COM who underwent circumferential subannular grafting in type 1 tympanoplasty demonstrated successful hearing outcome after a mean follow-up of 13.6 months. As reported by William and Melodie [8] including 41 pediatric patients who underwent underlay grafting with elevation of the anterior canal skin, the graft was placed between the drum remnant and the handle of malleus and secured anteriorly between the bone and the meatal flap. He demonstrated 95% graft uptake with 20 dB AB closure after a 6 months of surgery.

In our study all 34 patients were undergone underlay tympanoplasty with circumferential elevation of the TM flap. In 18 patients (group A) with subtotal perforations, we had placed the graft medial to the handle of malleus because there was very minimal TM remnant left in subtotal perforations and keeping in mind that placement of the graft lateral to handle of malleus may lateralize the graft. In the rest 16 (group B) patients with anterior perforations, the graft was placed lateral to the handle of malleus as comparatively more amount of the residual TM was left in comparison to subtotal perforation to support the graft laterally and was expected to prevent graft lateralization.

The graft uptake rate after 6 months in patients of group A and B were found to be 84% and 93% respectively which was comparable to the above studies and there was no significant difference in the result noticed between (p=0.58). Although insignificant, patients of anterior perforations had a better graft uptake than the patients of subtotal perforations which may be due better holding of the graft due to adequate lateral support by the TM remnant.

All the patients had closure of AB gap in the postoperative period. The mean AB closure was 9.44 dB in group A and 8.70 dB in patients of group B which was found insignificant (p=1.00).

11 of 18 (61.1%) patients in group A and 10 of 16 (62.5%) in group B were found to have 10 dB closure of AB gap at 6 the end of months in postoperative period which was found to be statistically insignificant (p=0.73). Likewise 6 of 18 (33.33%)
patients and 5 of 16 (31.25 %) were found to be associated with 20 dB closure of AB gap after 06 months and this difference was considered statistically not significant ($P =0.89$). None of the patients in both the group had any significant intraoperative or postoperative complication.

**CONCLUSION**

Underlay grafting for subtotal and anterior perforations is a surgical challenge because of its poor success rate. Circumferential flap elevation in type I tympanoplasty is an effective surgical technique to the standard flap elevation with satisfactory outcomes. Medial and lateral placement of temporalis graft to handle of malleus in our study did not cause any significant difference in graft uptake rate or hearing outcomes between the two groups i.e. patients with subtotal and anterior perforations.

**REFERENCES**