

Original Research Article

A study on the effect of grommet as partial ossicular replacement prosthesis in type III tympanoplasty in patients with chronic suppurative otitis media

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ABSTRACT

Background: Chronic otitis media (COM) with or without cholesteatoma causes ossicular erosion/ destruction which leads to conductive hearing loss. Ossiculoplasty is to reconstruct the hearing mechanism in ear after eliminating the disease from the middle ear. In our study we used ventilation tubes or grommet as partial ossicular replacement prosthesis (PORP) for the reconstruction of the ossicular chain especially when the stapes is mobile. The objective of the study is to assess the degree of hearing improvement by using grommet as PORP in type III tympanoplasty.

Methods: It was an observational study from July 2018 to July 2019. 20 patients with COM undergoing canal wall up or canal wall down mastoidectomy with intraoperative ossicular chain erosion with intact stapes suprastructure were included in this study. Post-operative hearing gain and graft uptake was assessed at 3rd month.

Results: Among these 20 patients 15 underwent canal wall up mastoidectomy with type III tympanoplasty and 5 underwent canal wall down procedure with type III tympanoplasty. Incus was eroded in 17 cases, malleus in 2 cases and malleus with incus eroded in 1 case. The pre op average airborne gap was 38 dB and mean improvement of 12 dB was observed at third month.

Conclusions: Grommet tube used as PORP is an effective alternative in the reconstruction of ossicular chain with good hearing improvement.

Keywords: COM, Ossiculoplasty, Grommet, PORP

INTRODUCTION

Chronic otitis media (COM) is a common otologic disease in India often associated with hearing impairment due to ossicular chain destruction or erosion.¹ Along with complete disease clearance, hearing preservation and/or improvement should be an important goal in tympanomastoidectomies to enhance the quality of life and productivity of patients.

The aim of ossiculoplasty is to reconstruct the hearing mechanism in ear after eliminating the disease from middle ear. The ossicular chain is reconstructed either

with patient's own modelled ossicles, cartilage graft or synthetic prosthesis.² Advantages of autologous materials are good biocompatibility, low extrusion rate, low cost and easy availability. Disadvantages being the uncertainty regarding the disease free state of remnant ossicle, resorption and need for surgical expertise and time for refashioning the prosthesis.³ The ideal prosthesis for ossicular reconstruction should be biocompatible, stable, safe and easily insertable and capable of yielding optimal sound transmission.⁴ The optimal results in ossicular reconstruction depend not only on the qualities of the prosthesis, but also on the environment in which it is placed and the surgical techniques used.⁵ In our study we used ventilation tubes/grommet as partial ossicular

replacement prosthesis (PORP) for reconstruction of the ossicular chain especially when stapes is mobile.

Objective

The objective of the study was to assess the degree of hearing improvement by using grommet as PORP in type III tympanoplasty.

METHODS

The observational study was designed during period of July 2018 to July 2019 at Sri Venkateshwara ENT Institute and Bowring and Lady Curzon Hospital attached to Bangalore Medical College and Research Institute, Bangalore.

Sample size of the study was 20 patients.

Inclusion criteria

Age group of 18 to 60 years of either sex willing to give written informed consent, patients of chronic otitis media with conductive hearing loss undergoing canal wall up or down mastoidectomy with intraoperative ossicular chain erosion with intact stapes suprastructure were included.

Exclusion criteria

Age below 18 years and above 60 years were excluded. Patients who were not willing to give written informed consent. Patients with erosion of stapes suprastructure, history of trauma, previous ear surgeries or revision cases and previous radiation treatment, granulomatous conditions of middle ear (tuberculosis or granulomatosis with polyangitis), patients of COM with aural polyp, patients with extra and intracranial complications of COM and sensory neural hearing loss were excluded.

Patients included in this study underwent canal wall up or down mastoidectomy with type III tympanoplasty using grommet for ossicular reconstruction. We used grommet of 0.9mm inner diameter made of Teflon. After taking informed written consent, preoperative PTA and all routine pre-operative investigations, patients were positioned on table, parts prepared, cleaned and draped.

Infiltration given in post auricular region and a post auricular incision is made about 3 mm behind the post auricular crease using a No.15 scalpel blade. Temporalis fascia graft is harvested and teased out to a thin layer. Middle ear is exposed using a T-shaped incision made through the subcutaneous tissue & periosteum to the bone overlying the mastoid and linea temporalis exposing Mc Ewen's triangle. Lempert's elevator is used to mobilize the periosteum to the level of the ear canal. Posterior meatotomy done.

Drilling commenced in the region of Mc Ewen's triangle. Canal wall down Mastoidectomy done depending on the

extent of the disease. Disease clearance done from the involved areas. Ossicular chain status analyzed and mobility of stapes suprastructure noted. The graft is positioned to cover the annulus and denuded bone of the meatus with a minimum overlap of 5mm all around to avoid blunting. The conical aspect of the tympanic membrane must be restored.

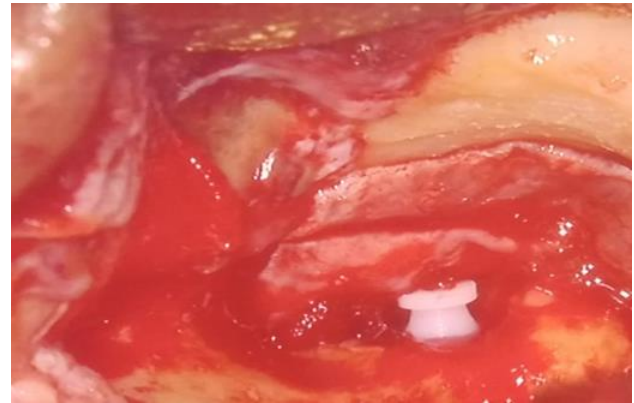


Figure 1: Grommet placed over the stapes head.

For ossicular reconstruction we used grommet of 0.9 mm inner diameter made of Teflon. It was placed between mobile stapes suprastructure and grafted tympanic membrane (Figure 1). The post aurial incision is closed by mattress sutures using 3-0 ethilon in a single layer. Finally, the external auditory canal is packed with medicated gel foam and mastoid dressing is applied.

Antibiotic, analgesics and antihistamines are administered for 14 days. Mastoid dressing changed to post aurial dressing on second postoperative day. External auditory canal pack was removed after 1 week in canal wall down mastoidectomy and after 3 weeks in canal wall up mastoidectomy following which antibiotic ear drops are advised for 3 weeks, three times a day. Neotympanum was inspected, patients were told to follow-up regularly at weekly intervals to note the graft take up for 3months. PTA done at 3rd month. The data obtained was analysed using Microsoft excel.

RESULTS

Among these 20 patients 15 underwent canal wall up mastoidectomy with type III tympanoplasty and 5 underwent canal wall down procedure with type III tympanoplasty. Incus was eroded in 18 cases and malleus in 3 cases. The pre op average airborne gap was 38 dB and mean improvement of 12 dB was observed at third month.

In our study among 20 patients 13 were male and 7 were female (Figure 2).

Most common age group in our study were between 31 to 45 years (Figure 3).

With regard to graft uptake out of 20 patients 17 had good graft uptake and there were two cases of residual perforation and 1 case of medialisation of graft (Figure 4).

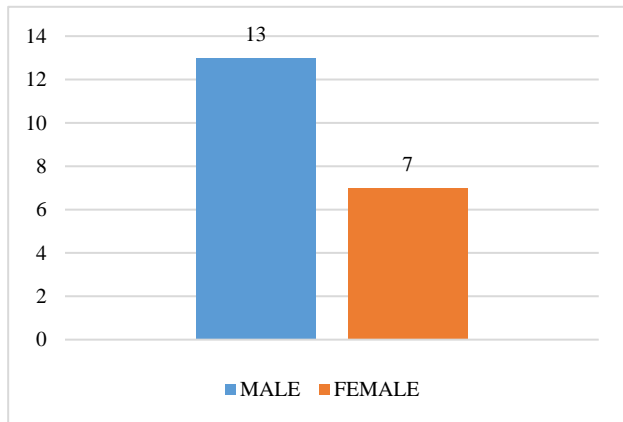


Figure 2: Gender distribution.

hearing gain of 10 to 15 dB. In CWD out of 5 patients, 2 patients had an average postoperative hearing gain of <5 dB and 3 patients had an average postoperative hearing gain of 5 to 10 dB (Figure 5).

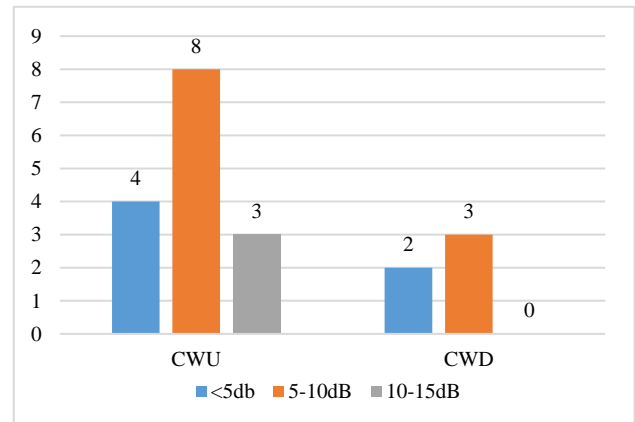


Figure 5: Postoperative hearing gain.

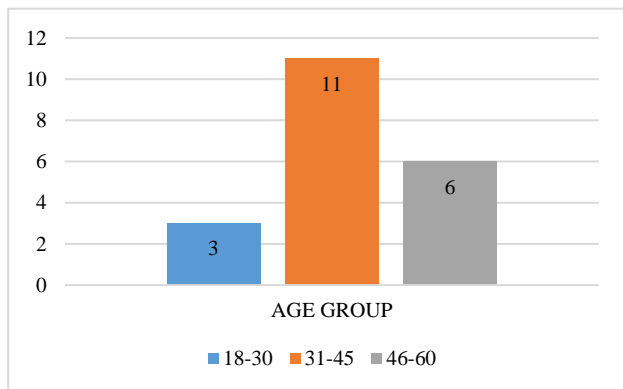


Figure 3: Age distribution.

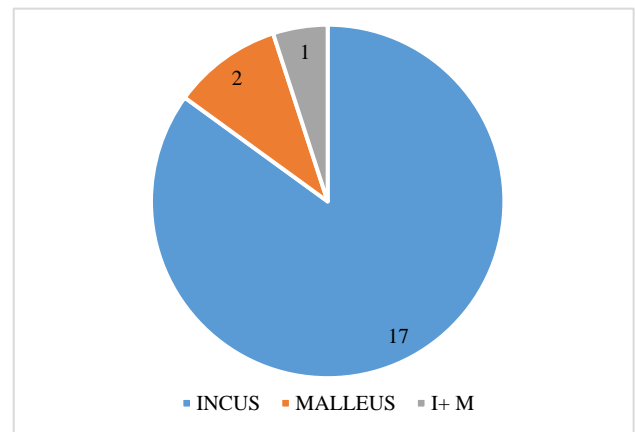


Figure 6: Intraoperative ossicular status.

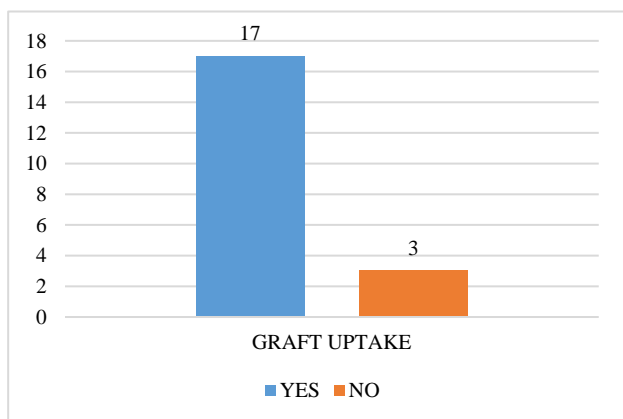


Figure 4: Postoperative graft uptake.

In our study 15 patients underwent canal wall up (CWU) mastoidectomy and 5 patients underwent canal down mastoidectomy (CWD). In CWU out of 15 patients, 4 patients had an average postoperative hearing gain of <5 dB, 8 patients had an average postoperative hearing gain of 5 to 10 dB and 3 patients had an average postoperative

hearing gain of 10 to 15 dB. In CWD out of 5 patients, 2 patients had an average postoperative hearing gain of <5 dB and 3 patients had an average postoperative hearing gain of 5 to 10 dB (Figure 5).

DISCUSSION

COM is associated with conductive hearing loss from tympanic membrane perforation and in some cases ossicular discontinuity or fixation warranting ossiculoplasty for hearing improvement. Incus is the most common ossicle affected in COM due to its delicate anatomy and blood supply. The aim of ossiculoplasty is to achieve a stable connection between the tympanic membrane and the mobile stapes footplate. Type III tympanoplasty involves placement of ossicular prosthesis between the stapes superstructure (IIIa) or stapes footplate (IIIb) and the graft.

Ossicular grafts and prosthesis must couple well at their ends to bone or soft tissue, but must remain suspended in

air elsewhere in order to transmit sound effectively. Additionally, ossicular implants are subject to resorption from persistent or recurrent infection and extrusion from negative pressure and tubal insufficiency. In case of homograft and synthetic prosthesis, they are potentially prone for immune-mediated rejection.

A wide variety of autografts, homografts, synthetic ossicular grafts, and prostheses have been employed for reconstructing the ossicular chain. With a number of prosthesis being available, comparisons become inevitable. The ideal prosthesis for ossiculoplasty should be compatible, stable, safe, readily available, easily insertable, and capable of yielding optimal sound transmission. In our study we used grommet made of teflon with internal diameter of 0.9 mm.

In our study the mean age group of patients was 31 to 45 years which is similar to the study by Chavan et al, a retrospective study on 50 patients who underwent ossiculoplasty in the Department of ENT at a tertiary care hospital that had mean age in the 3rd decade.⁶

In our study out of 20 patients 13 were male and 7 female which is comparable to the study by Chavan et al a prospective study on 80 patients who underwent various type of ossiculoplasties wherein male preponderance was observed.⁷

In our study, the long process of incus was eroded in 17 out of 20 cases and malleus was eroded in 2 out of 20 cases and malleus with incus eroded in 1 case, which is comparable to the study by Chavan et al in which long process of incus was the most susceptible part of the ossicular chain, affected due to the disease process in 74 patients, followed by the stapes in 29 patients with the malleus being the most resistant amongst the three, being affected in only 10 cases. This correlates with the precarious blood supply to the long process of incus that results in the incus being the most susceptible ossicle for erosion.⁷

In our study, graft uptake was 85%, as 2(10%) patients had residual perforation and 1 patient (5%) had medialisation of graft and none of the grafted ears exhibited graft lateralization, or epithelial pearls.

Hearing was assessed by a pre-operative audiometric evaluation. Post-operative audiometry was done after 3 months and the difference calculated. In a retrospective study conducted by Naragund et al, average postoperative ABG closure of less than 20 dB was observed in seven cases with autologous incus and 4 cases with titanium prosthesis.⁸

Jha et al in 2007 to 2009 performed a study of ossiculoplasty outcome after 2 and 5 months of operation in relation to air bone gap and suggested the success rate among cartilage was 57%, incus was 58% and plastic PORP was 40%.⁹

In a study by Wiatr et al, the use of ventilation tubes to reconstruct the continuity of ossicular chain resulted in statistically significant change of the average value of ABG ($p=0.046$) as early as after 6 months following otosurgery.¹⁰

In our study 15 patients underwent canal wall up (CWU) mastoidectomy and 5 patients underwent canal down mastoidectomy (CWD). In CWU out of 15 patients, 4 patients (26%) had an average postoperative hearing gain of <5 dB, 8 patients (53.3%) had an average postoperative hearing gain of 5 to 10 dB and 3 patients (20%) had an average postoperative hearing gain of 10-15 dB. In CWD out of 5 patients, 2 patients (40%) had an average postoperative hearing gain of <5 dB and 3 patients had an average postoperative hearing gain of 5 to 10 dB.

CONCLUSION

Grommet tube used as PORP is an effective alternative in the reconstruction of ossicular chain with good hearing improvement. The shape and size allows grommet to be correctly fixed onto to the head of stapes making the extrusion rates comparatively lower. Cost effectiveness and comparable hearing gain make it as an alternative for PORP in type III tympanoplasty.

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Conflict of interest: None declared

Ethical approval: Not required

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