Section: Otorhino Laryngology

Original Research Article

ROLE OF PERIOSTEUM AS A TYMPANIC MEMBRANE GRAFT IN TYMPANOPLASTY

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Abstract

Background: The aim of this study is to look at the possible outcome of tympanoplasty, a procedure performed to repair the tympanic membrane perforation using mastoid cortex periosteum and evaluate its results like graft uptake, improvement in hearing and complication within a period of 3 months following surgery. **Materials and Methods:** This is a prospective, non-controlled, non-randomized study that was conducted in our department of Oto-Rhino Laryngology between 2022- 2023. This study has a total of 50 study subjects, who are patients with COM attending ENT OPD selected based on inclusion and exclusion criteria. All patients in our study underwent tympanoplasty with or without cortical mastoidectomy using periosteum grafting and were followed up, to analyse the graft uptake and hearing outcome at the end of three months. **Result:** In our study, clinical and audiological assessment were done for all the cases at the end of three months post operatively. Out of 50 cases 46 patients showed intact neotympanum and 4 patients had residual perforation. Thus, successful graft uptake of 92% was achieved in our study. In 46 cases of successful anatomical closure, the mean pre operative Puretone average is 40.8±7.45 dB and the mean post operative Puretone average is 30.68±9 dB. **Conclusion:** The mastoid cortex periosteum with its anatomical and functional outcomes is comparable to temporalis fascia as it is of mesodermal origin with adequate tensile strength and elasticity, adequately available and can be harvested in the same incision. It is a better alternative to temporalis fascia especially in revision cases, where fascia was already used and its rigid nature makes it resistant to graft failure.

INTRODUCTION

Chronic otitis media is a common occurrence in children and adults in developing countries, usually presenting as persistent or intermittent ear discharge as a result of persistent tympanic membrane perforation, accompanied by varying degree of conductive hearing loss.

In the early years the aim of physicians was to primarily eradicate disease and save life of patient. The aim of otologists at present is to provide with maximal hearing to the patient along with eradication of disease. Tympanoplasty involves surgical reconstruction of perforated tympanic membrane and it serves to restore auditory function and to protect the middle ear against environmental insults.

Tympanoplasty is usually done using various autologous graft materials such as vein, fat, temporalis fascia, periosteum, fascia lata, perichondrium and cartilage for reconstructing the tympanic membrane.

The periosteum was mentioned in the literature as a suitable material to repair perforated ear drums [1]. In this study, the mastoid cortex periosteum is used for tympanic membrane grafting in tympanoplasty and the outcomes are analysed in terms of successful graft uptake and hearing gain in pure tone audiogram.

Aim: The aim of this study is to look at the potential outcome of Tympanoplasty using periosteum and evaluate its results and complication within a period of 3 months following surgery along with review of literature

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MATERIALS AND METHODS

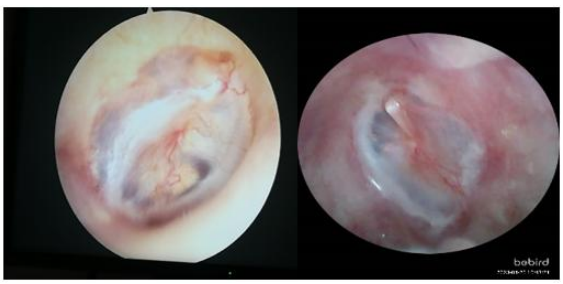
Study Design: This study is a cross sectional study which included 50 patients who came to our college with complaints of ear discharge, hearing loss and Tympanoplasty with or without cortical mastoidectomy performed there between 2022-23 for one year duration at Tirunelveli medical college and hospital after getting ethical committee approval (TVMC/IEC/20222407).

Patient data on age, gender, chief presenting complaints were recorded. All patients underwent otological examination for documenting perforation size, side, location and any evidence of polyps, granulations and edematous mucosa. Preoperative pure tone audiometry was done and the difference between pure tone average for air conduction and for bone conduction (PTA-ABG) were recorded for all cases. General examination, routine blood investigations and CT temporal bone were performed. After pre anaesthetic checkup, patient consent was taken for tympanoplasty. Advantages and complications of the surgery were explained. Wet ears were treated with preoperative topical ear drops and acetic acid wash.

Surgical Technique: Patients underwent tympanoplasty with or without cortical mastoidectomy under general or local anaesthesia. All the patients were operated by post aural approach. After dissecting the superficial layers, mastoid cortex periosteum was identified. Periosteum of adequate size from mastoid cortex was harvested. The harvested periosteum is used as a graft by underlay technique.

Post Operative Follow Up

All patients were treated with IV antibiotics for a week, followed by oral antibiotics, analgesics, and anti histaminics for another week post operatively. Mastoid bandage and sutures were removed on 7th post operative day. Patients were advised to avoid straining, water entry into ear and allergic foods. Patients were regularly followed up every two weeks in first month and once in a month till 3 months.



Inclusion Criteria

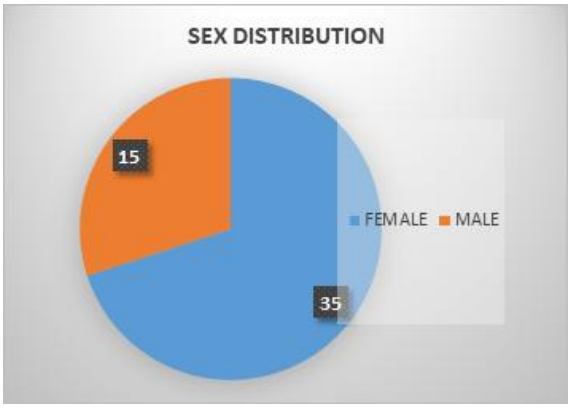
- Chronic otitis media – mucosal type with conductive hearing loss without any complications
- Patients who give consent for surgical procedure and willing for follow up

Exclusion Criteria

- Chronic otitis media – squamosal type
- Adhesive otitis media
- Mixed or sensory neural hearing loss
- Revision cases
- Patients who are not willing to participate in the study

RESULTS

In this study population of 50 cases, 15 were males and 35 were females.



In The age range was 15 to 70 years with mean of 35.74 years. Maximum cases of chronic otitis media were found in 3rd and 4th decades.

Age in years	No of patients	Percentage
10 – 20	8	16%
21 – 40	24	48%
41 – 60	16	32%
>60	2	4%

Ear discharge was the most common chief complaint, present in 49 (98%) patients followed by hard of hearing present in 47 (94%) patients. The other symptoms were ear pain and tinnitus.

In this study group, majority had pre operative hearing loss in the range of 26-40 dB representing mild hearing loss, present in 31 (62%) patients. 19 (38%) patients had hearing loss in the range of 41-55 dB representing moderate hearing loss. The mean pre operative hearing loss is 40.8±7.45 dB in this study.

Preoperative hearing assessment

Puretone average

Hearing Loss (in dBs)	No of cases
16 – 25	-
26 – 40	31
41 – 55	19
56 – 70	-
71 – 90	-
>90	-

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PTA air bone gap less than 30 dB seen in 32 (64%) patients and 18 (36%) patients had PTA air bone gap more than 30 dB. The mean PTA air bone gap of the study group was 28.91±8.75 dB.

Out of 50 patients, 46 (92%) patients underwent cortical mastoidectomy with Type I Tympanoplasty and 4 (8%) patients underwent cortical mastoidectomy with type II Tympanoplasty.

In this study group, 46 (92%) patients had intact ossicular chain and 4 (8%) patients had defective ossicular chain with absent or eroded incus.

In this study group 16 (32%) patients had well pneumatised mastoid and rest of the group had diseased mastoid. Among them 9 (18%) had sclerosed mastoid and 25 (50%) patients showed polypoidal mucosa, granulation tissue and glue within middle ear and mastoid.

At the end of three months after tympanoplasty, the patients were examined. 46 patients had intact neotympanum implying successful graft uptake. 4 patients had residual perforation at the end of 3 months were considered failed cases of tympanoplasty.

Among the 4 patients with failed uptake, 3 patients had large posterior perforation while one patient had medium perforation in anterior quadrant. Among 34 patients with diseased middle ear and mastoid, 3 patients had failed graft uptake and among 16 patients with normal middle ear and mastoid mucosa, 1 patient had failed graft uptake.

Post Operative Hearing Assessment

Post operative hearing assessment was done for 46 cases in whom graft uptake was successful at the end of 3 months post operative period.

Post Operative Puretone Average

Post OP PTA (in dBs)	No of cases
16 – 25	14
26 – 40	26
41 – 55	6

Among 46 cases with successful uptake 14 (30.43%) patients had <25 dB, 26 patients had in the range of 26-40 dB and 6 patients had >40 dB. The mean post operative puretone average is 30.68±9.03 dB.

In the study group of 46 cases of successful anatomical closure, the mean pre operative pure tone average is 40.8±7.45 dB and the mean post operative pure tone average is 30.68±9 dB. Mean difference between pre and post operative values is 10.1±8.24 dB which is statistically significant with p value <0.001 (T-test).

DISCUSSION

Chronic otitis media is used to describe any inflammatory disease of middle ear cleft presenting with a worrisome ear discharge and a perforation in tympanic membrane. Surgical management is needed when the perforation fails to heal by conservative therapy. Tympanoplasty is the procedure to repair the tympanic membrane perforation thus improving hearing by restoring vibratory area of tympanic membrane, and by offering round window protection. It also prevents exposure of middle ear to external infections.[1]

The evolution of tympanoplasty is based on biological tissues of mesodermal origin containing collagen matrix, that acts as a scaffold in sealing the perforation. Temporalis fascia is the most preferred graft among otologists due to its anatomic proximity, translucency, very low metabolic requirements making it an ideal template for grafting.

The mastoid cortex periosteum is very similar to temporalis fascia, to make it as an alternate grafting material. Chiossone in his study "periosteal grafting in tympanoplasty",[2] described several advantages of periosteum as a grafting material. Periosteum, being mesenchymal in origin is structurally similar to middle fibrous layer of tympanic membrane. It is very pliable, thus easy to handle due to its elasticity and consistency. Similar to temporalis fascia, it has very low metabolic requirement, thus it can tolerate the initial period after transplantation. It is a locally available tissue in adequate amount and it can be easily harvested.[3]

In this study describing periosteal graft tympanoplasty, persistent residual perforation was the most common complication followed by failure of hearing improvement in late post operative period. Failures may be due to upper respiratory tract infection in peri operative period, smoking, difficulties during surgery in case of anterior and subtotal perforations.[4]

In this study, age range was 15-70 years with mean age of 35.74 years, which was consistent with the study conducted by Dinc ASK, Cayonu M, Boynuegri S, Sahin MM, Paksoy B, Eryilmaz A3 whose results showed mean age of 35±15.3 years (6-66). Maximum cases of COM were found in third and fourth decades of life in our study. However, the study conducted by Mostafa ElTaher, Yosry Othman, Ibrahim Mohammed and Khaled Ali [4] the ages of the patients at the time of tympanoplasty ranged from 10 years to 49 years, with a mean of 26.93 years.

In our study 70% of cases were females and 30% of cases were males, which shows predilection of chronic otitis media in females. This was comparable

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to the study by Mohamed M. Elmoursy and Mahmoud M. Elbahrawy,[5] which showed female predilection of 70% and the rest 30% of cases being males. However, Gupta et al,[6] found that the majority of patients were males. Also, in a study done by Konstantinidis et al,[7] male preponderance in the subjects was noticed.

In our study, pre operative audiological assessment of 50 cases showed mean hearing loss of 40.8±7.45 dB which was in consistency with the study conducted by Dinc ASK, Cayonu M, Boynuegri S, Sahin MM, Paksoy B, Eryilmaz A [3] whose results showed 40±14 dB as mean pre operative hearing loss in patients with tubotympanic COM.

35 patients had PTA air bone gap of less than 20 dB and 11 patients had PTA air bone gap of more than 20 dB. The mean post operative PTA - ABG was 19.13±9.32 dB.

In our study, clinical and audiological assessment were done for all the cases at the end of three months post operatively. Out of 50 cases 46 patients showed intact neotympanum and 4 patients had residual perforation. Thus, successful graft uptake of 92% was achieved in our study, which is in consistency with the study done by Ahmed Mahmoud ElBatawi, Mostafa A ElTaher, Mohamed Abd Elmottaleb Sabaa which produced a successful graft uptake of 93% with periosteum graft for tympanic membrane grafting.[8] The temporalis fascia, the most preferred graft material achieves a success rate of ~ 93% to 97% in primary myringoplasty and cartilage grafts achieve ~ 92% success rate.[9] The study conducted by Rao SSP, Prasad TVSSNL, Veeraswamy N, et al,[10] demonstrated 96% Successful graft uptake with periosteum.

In this study, the functional audiological outcome was calculated only for 46 patients with anatomical success of graft uptake. The mean post operative PTA was 30.68±9 dB in this study. The difference between pre operative and post operative pure tone average was 10.1±8.24 dB (p-value < 0.001), which was statistically significant. This is in consistency with the study conducted by El Batawi et al [8] in which the mean difference between pre operative and post operative hearing was 11±5 dB and the study conducted by El Taher et al2 in which the mean improvement in hearing was ~ 11 dB.

CONCLUSION

An intact functional tympanic membrane at the end of tympanoplasty depends heavily on the ideal material used for grafting tympanic membrane perforation.

In this study the mastoid cortex periosteum was successfully used as a grafting material in tympanoplasty. Results of graft uptake and hearing gain were comparable to other autologous grafts.

Periosteum is of mesodermal origin, thus eliminates the risk of iatrogenic cholesteatoma. It is easily accessible and can be adequately harvested through post aural approach. The rigidity of periosteal graft makes it stable and resistant to negative middle ear pressure. It is well tolerated, resistant to resorption and provides excellent scaffolding with high graft take up. The periosteum thickness offers the best balance between the stability and the acoustic sensitivity.

Temporalis fascia is the ideal grafting material in routine tympanoplasty procedures with successful graft uptake and air-bone gap closure. The mastoid cortex periosteum with its anatomical and functional outcomes is comparable to temporalis fascia as it is of mesodermal origin with adequate tensile strength and elasticity, adequately available and can be harvested in the same incision. It is a better alternative to fascia especially in revision cases, where fascia was already used and its rigid nature makes it resistant to graft failure.

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