

Outcome Assessment of Type I Tympanoplasty with Cortical Mastoidectomy using Temporalis Fascia Graft: A Retrospective Study

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Received: 11-10-2023 / Revised: 15-11-2023 / Accepted: 23-12-2023

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Conflict of interest: Nil

Abstract

Aim: The aim of this study was to evaluate the benefits of the tympanoplasty with cortical mastoidectomy using temporalis fascia with and without tragal cartilage support in terms of graft uptake and hearing improvement 6 months post procedure.

Methods: This retrospective study was conducted in the Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India from June 2020 to May 2021. 50 patients were carefully screened and selected from those who underwent cortical mastoidectomy with type I tympanoplasty for mucosal type of chronic otitis media quiescent stage with conductive hearing loss.

Results: In group A patients 32% were male (8) and 68% were female patients (17). In group B patients: 36% were male (9) and 64% were female (16) patients. In group A patients, the age wise distribution was 8 patients (32%) in 25 to 35 years, 7 patients (28%) in 35 to 45 years, 6 patients (24%) in 15 to 25 years, 4 patients (16%) in 45 to 55 years. In group B patients, the age wise distribution was 11 patients (44%) in 25 to 35 years, 8 patients (32%) in 35 to 45 years, 3 patients (12%) in 15 to 25 years, 3 patients (12%) in 45 to 55 years. In group A patients the duration of disease was around 6 months to 1 year in 13 patients (52%), 1 to 3 years in 8 patients (32%) and 3 to 5 years in 4 patients (16%). In group B patients the duration of disease was around 6 months to 1 year in 15 patients (60%), 1 to 3 years in 7 patients (28%) and 3 to 5 years in 3 patients (12%). In group A patients successful neo membrane was formed graft taken up in 23 patients (92%), unsuccessful in 2 patients (8%) whereas in group B patients successful neo membrane was formed in 24 patients (96%), failure noticed in 1 patients (4%). In group A patients, the hearing improvement taken into account with air bone gap closure of > 10 dB in 20 patients (80%), <10 dB in 5 patients (20%) whereas group B patients the hearing improvement with airborne gap closure is > 10 dB in 21 patients (84%), < 10 dB in 4 patients (16%).

Conclusion: It can be concluded that the post-operative closure rate of tympanic membrane was high and audiologic improvement was satisfactory with perichondrium cartilage island graft. It can be preferred in reconstruction of tympanic membrane in revision cases because of their resistance to poor feeding, recurring infections, and retractions.

Keywords: Chronic otitis media, Tympanoplasty, Cortical mastoidectomy

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Introduction

Chronic otitis media (COM) is a long standing infection of a part or whole of the middle ear cleft. Earlier acute otitis media, negative middle ear pressure or otitis media with effusion are the most likely causes to imply permanent abnormality of pars tensa or flaccid. As per WHO definition requires only 2 weeks of otorrhea, but otolaryngologists tend to adopt a longer duration, e.g. more than 3 months of active disease. It is one of the most common ear diseases encountered in developing countries because of poor socioeconomic standards, poor nutrition, lack of health education and unhygienic habits. [1]

In India, studies reported a prevalence ranging from 4.9 to 10.4%. In rural areas, prevalence is double that of in urban areas attributing it to unmanaged upper respiratory infections, low level of literacy and lack of health consciousness, along with contributing factors like malnutrition and swimming in dirty ponds. COM isolates, aerobic and anaerobic bacteria are involved, coexisting in half of cases. The most common aerobic isolates include *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Proteus* and *Klebsiella*. The most common anaerobic bacteria include *Bacteroides* and *Fusobacterium*. COM is considered a multifactorial disease resulting from a complex series of

interactions between environmental, bacterial, host and genetic risk factors. [2,3]

Chronic otitis media is any structural change in middle ear system associated with a permanent defect in tympanic membrane (TM). [4] TM perforation with no associated middle ear inflammation and discharge is classified as COM mucosal inactive. [5] The usual causes are infection, atelectasis, ventilation tube insertion, and trauma. [6] Children suffering from chronic suppurative otitis media of tubo tympanic type (CSOM-TT) with permanent perforation usually present with intermittent ear discharge of variable duration and hearing loss. [7] Myringoplasty is the repair of a tympanic membrane perforation without ossicular reconstruction. It is one of the various surgical techniques for the management of CSOM-TT disease. The operation aims at closure of the perforation with a tissue graft. [8]

The primary objective of doing a tympanoplasty is to reconstruct the diseased tympanic membrane with perforation in chronic suppurative otitis media (CSOM). A successful outcome is determined by an intact, mobile tympanic membrane with good hearing. [9] The most frequently used technique for repair of tympanic membrane perforation is underlay grafting of temporalis fascia. But in cases of subtotal perforations, atelectatic ear, retraction pocket or mastoid surgery long term results of temporalis fascia have been shown to be associated with increased failure rate. [10,11] To overcome this, cartilage grafts are used with good results. Cartilage being rigid tends to resist resorption, retraction and reperforation even in milieu of eustachian tube dysfunction and is more resistant to infection and negative middle ear pressure. Cartilage contributes minimally to an inflammatory tissue reaction and is well incorporated with tympanic membrane layers, providing firm support to prevent retraction. The greatest advantage of cartilage graft has been thought to be its very low metabolic rate.

The aim of this study was to evaluate the benefits of the tympanoplasty with cortical mastoidectomy using temporalis fascia with and without tragal cartilage support in terms of graft uptake and hearing improvement 6 months post procedure.

Materials and Methods

This retrospective study was conducted in the Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India from June 2020 to May 2021. 50 patients were carefully screened and selected from those who underwent cortical mastoidectomy with type I tympanoplasty for mucosal type of chronic otitis media quiescent stage with conductive hearing loss.

All patients aged from 15 to 55 years with a duration of disease from 6 months to 5 years with a minimum

of 3 weeks dry ear prior to surgery with intact ossicular chain, moderate size central perforation with mild to moderate conductive hearing loss, patent eustachian tube and post operatively followed up for a minimum of 6 months were included in the study.

All those patients with active ear discharge or cholesteatoma or ossicular discontinuity or sensorineural hearing loss or mixed hearing loss or chronic immunosuppressed status were excluded from the study.

Methodology

Using the selection criteria 50 patients were chosen and were divided into two groups .Group A consisted of 25 patients who underwent cortical mastoidectomy with type I tympanoplasty with temporalis fascia graft along with fashioned tragal cartilage without perichondrium and group B consisted of 25 patients who underwent cortical mastoidectomy with type I tympanoplasty with temporalis fascia graft alone.

A full clinical preoperative work up of history and Otological examination had been carried out. Focal sepsis in nose, para nasal sinuses and throat were ruled out. All the patients had undergone pre operative pure tone audiograms to know the type and degree of deafness and radiological imaging for size of mastoid antrum. Preoperative anaesthetic clearance for general anaesthesia and consent for the proposed surgical procedure were obtained. Informed and written consents were obtained for all patients.

Surgical Technique

All the sixty patients were operated under general anaesthesia using Carl Zeiss OPMI-pro microscope. Post-aural Wilde's incision was marked and made, temporalis fascia graft of size 2.5 x 3 cms harvested and kept for drying. "Reverse 7" periosteal incision made and flap elevated exposing the Henle's spine and the MacEvan's triangle. The mastoid cortex was exposed after placing suitable Mollison's and Jenson's retractors. Mastoid antrum was entered through MacEwen triangle with appropriate burrs. All accessible mastoid air cells were removed, cavity saucerized with smooth edges, Incus shadow demonstrated and aditus widened, patency between middle ear and mastoid confirmed with free flow of saline in either direction. In the group A patients, tragal cartilage was harvested ,refashioned to size, placed in saline and its wound sutured with 3-0 Ethylene. Permeatal lateral vascular Palva flap elevated. Posterior meatotomy completed and pinna retracted. Tympan meatal 12 to 6 o' clock flap marked and elevated. Ossicular chain integrity confirmed. Dried Temporalis fascia graft placed by underlay method which is then supported by refashioned tragal cartilage. In the group B patients

all the above steps were carried out but only temporalis fascia graft placed by underlay technique without using tragal cartilage. Medicated gel foam was used in all the patients. Standard post operative care for mastoid surgery was given to all sixty patients. Patients were discharged on the third post operative day with standard post-operative advice for ear surgeries.

Patients were followed up in the ENT out-patient on 7th post -operative day for sutures and pack removal, then every fortnightly until the 6th month for postoperative pure tone audiogram which is done on

the 100th post operative day and postoperative neo membrane documentation.

Statistical Analysis

Data collected was tabulated in an excel sheet. The means and standard deviations of the measurements were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Student's paired t test was applied to the collected data to analyze the gain in hearing at various prespecified intervals with confidence interval set at 99.99% with $p < 0.01$ considered significant.

Results

Table 1: Demographic details

Gender	Group A	Group B
Male	8 (32)	9 (36)
Female	17 (68)	16 (64)
Age groups in years		
15-24	6 (24)	3 (12)
25-34	8 (32)	11 (44)
35-44	7 (28)	8 (32)
45-55	4 (16)	3 (12)

In group A patients 32% were male (8) and 68% were female patients (17). In group B patients: 36% were male (9) and 64% were female (16) patients. In group A patients, the age wise distribution was 8 patients (32%) in 25 to 35 years, 7 patients (28%) in 35 to 45 years, 6 patients (24%) in 15 to 25 years, 4

patients (16%) in 45 to 55 years. In group B patients, the age wise distribution was 11 patients (44%) in 25 to 35 years, 8 patients (32%) in 35 to 45 years, 3 patients (12%) in 15 to 25 years, 3 patients (12%) in 45 to 55 years.

Table 2: Duration of the disease

Duration of the disease	Group A	Group B
6 Months-1 Year	13 (52%)	15 (60)
1 Year – 3 Years	8 (32)	7 (28)
3 Years- 5 Years	4 (16)	3 (12)

In group A patients the duration of disease was around 6 months to 1 year in 13 patients (52%), 1 to 3 years in 8 patients (32%) and 3 to 5 years in 4 patients (16%). In group B patients the duration of disease was around 6 months to 1 year in 15 patients (60%), 1 to 3 years in 7 patients (28%) and 3 to 5 years in 3 patients (12%).

Table 3: Condition of graft after 6 months post-operative time

Condition of graft	Group A	Group B
Graft uptake	23 (92)	24 (96)
Graft failure	2 (8)	1 (4)
Hearing improvement		
>10 dB	20 (80)	21 (84)
<10 Db	5 (20)	4 (16)

In group A patients successful neo membrane was formed graft taken up in 23 patients (92%), unsuccessful in 2 patients (8%) whereas in group B patients successful neo membrane was formed in 24 patients (96%), failure noticed in 1 patients (4%). In group A patients, the hearing improvement taken

into account with air bone gap closure of > 10 dB in 20 patients (80%), <10 dB in 5 patients (20%) whereas group B patients the hearing improvement with airborne gap closure is > 10 dB in 21 patients (84%), < 10 dB in 4 patients (16%).

Table 4: Outcome of hearing post operatively

Group	Mean pre-operative AB GAP	Mean post-operative AB GAP	Mean post-operative hearing gain %age
A	17.56	10.50	72%
B	17.76	10.20	75%

In our present study, group A of tragal cartilage supported graft showed mean pre operative PTA - ABG of 17.56, mean post operative PTA - ABG of 10.50 and mean hearing gain of 72%. Group B of temporalis fascia graft showed mean pre operative PTA - ABG of 17.76, mean post operative PTA - ABG of 10.20 and mean hearing gain of 75%.

Discussion

Chronic otitis media (COM) is a common ear disease all over the world. It is seen mostly among the patients in low socio economic group with poor nutrition and lack of health education. [12] COM is an inflammation of mucoperiosteal lining of middle ear cleft. Mucosal COM presents with recurrent mucopurulent ear discharge through the tympanic membrane perforation. [13] Hearing impairment is mild to moderate of conductive type depending on the size of perforation and integrity of ossicular chain. [14] Medical management consists of aural toileting, topical antibiotics, antihistaminic and systemic antibiotics as and when needed. Persistence of ear discharge after adequately clearing focal sepsis suggests a mastoid reservoir. [15]

In group A patients 32% were male (8) and 68% were female patients (17). In group B patients: 36% were male (9) and 64% were female (16) patients. In group A patients, the age wise distribution was 8 patients (32%) in 25 to 35 years, 7 patients (28%) in 35 to 45 years, 6 patients (24%) in 15 to 25 years, 4 patients (16%) in 45 to 55 years. In group B patients, the age wise distribution was 11 patients (44%) in 25 to 35 years, 8 patients (32%) in 35 to 45 years, 3 patients (12%) in 15 to 25 years, 3 patients (12%) in 45 to 55 years. Various factors like age of the patient, the size and site of perforation, status of middle ear mucosa, surgical experience have all been cited as factors which may influence the surgical outcome. [16]

In group A patients, the hearing improvement taken into account with air bone gap closure of > 10 dB in 20 patients (80%), <10 dB in 5 patients (20%) whereas group B patients the hearing improvement with airborne gap closure is > 10 dB in 21 patients (84%), < 10 dB in 4 patients (16%). The perceived benefits of cartilage tympanoplasty is to prevent retraction pockets at the grafted sites even though many otolaryngologists accept that this technique may not deal with causal factors involved in the retraction process. There are many concerns that the stiffness and mass of cartilage graft may adversely affect hearing have not been substantiated in clinical

reports so far but according to a study by Ramalingam et al⁹ use of 1mm thickness conchal cartilage graft gives a similar outcome to that of a temporalis fascia graft without altering the compliance of the hearing Temporalis apparatus. A study by Onal et al, have also shown better graft uptake in small sized perforations as compared with large perforation. [17] This is probably because of the larger bed that is provided for the graft and there is a good opportunity for the graft to be taken in cases of small and medium sized perforations. [18] The stiffness and mechanical stability of the cartilage graft have obvious benefits in reducing the retractions of tympanic membrane. Cartilage receives its nutrition by diffusion; it is very easy to work with because it is pliable and resists deformation from pressure variations and become well incorporated in the tympanic membrane. [19]

In group A patients the duration of disease was around 6 months to 1 year in 13 patients (52%), 1 to 3 years in 8 patients (32%) and 3 to 5 years in 4 patients (16%). In group B patients the duration of disease was around 6 months to 1 year in 15 patients (60%), 1 to 3 years in 7 patients (28%) and 3 to 5 years in 3 patients (12%). In group A patients successful neo membrane was formed graft taken up in 23 patients (92%), unsuccessful in 2 patients (8%) whereas in group B patients successful neo membrane was formed in 24 patients (96%), failure noticed in 1 patients (4%). Our studies were similar to the studies conducted by the following researchers. The graft uptake rate in myringoplasty by tragal cartilage with simple mastoidectomy in the study conducted by Ahmed Gamal Khafagy et al and Gun T et al was 88%. [20,21] In our present study, group A of tragal cartilage supported graft showed mean pre operative PTA - ABG of 17.56, mean post operative PTA - ABG of 10.50 and mean hearing gain of 72%. Group B of temporalis fascia graft showed mean pre operative PTA - ABG of 17.76, mean post operative PTA - ABG of 10.20 and mean hearing gain of 75%. Our studies were similar to the studies conducted by Ahmed Gamal Khafagy for cartilage graft was 0.0843, [20] for temporalis fascia graft by Shalini Singh Sisodia et al [22] was 10.37 -+ 2.95 by Krishnan et al was 75% hearing gain. [23]

Conclusion

It can be concluded that the post-operative closure rate of tympanic membrane was high and audiologic improvement was satisfactory with perichondrium cartilage island graft. It can be preferred in

reconstruction of tympanic membrane in revision cases because of their resistance to poor feeding, recurring infections, and retractions. Even-though tympanoplasty with cortical mastoidectomy gives an overall improvement in terms of graft uptake and hearing, between the two types of grafting strategies used in tympanoplasties there was no significant difference.

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