

Assessment of Performance of Cartilage graft in the Management of Chronic Suppurative Otitis Media: A Prospective Study

P Veeranjanyulu¹, Dwarampudi V S V B Reddy²

ABSTRACT

Introduction: Chronic otitis media (COM) is a long standing infection of a part or whole of the middle ear cleft. 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. Perforation of the tympanic membrane(TM) is sequelae of otitis media and primarily results from middle-ear infection, trauma or iatrogenic causes. The major advantage of cartilage graft is the stiffness and bradytrophic metabolism. Hence, the aim of the present study was to assess the tolerance, durability and performance of the graft with various thickness and effectiveness and also to study the acoustic transfer characteristics of cartilage plates.

Material and Methods: This was a prospective study done in the Department of ENT, GSL Medical College, Rajahmundry from September 2016 to August 2018. Patients who were 15-60 years of age, with total and subtotal perforations, perforations with tympanosclerotic plaques, Perforation with atrophic membranes, Revision surgery for failed myringoplasty or tympanoplasty were selected for the study. Materials used were tragal and chonchal cartilage along with an underlay type I tympanoplasty (primary or revision), using temporalis fascia, tragal cartilage of two different thicknesses was also performed.

Results: The graft survival rate with cartilage tympanoplasty is extremely satisfactory (95.2%). There was no significant difference observed between the graft survival and type of cartilage used. Hence, both tragal and conchal cartilage can be used without any predisposition. The hearing results were better with cartilage tympanoplasty post-operatively (mean hearing gain 10.57dB).

Conclusion: Cartilage is a valuable material for repairing a retracted tympanic membrane because of its stiffness, and cartilage will resist retraction.

Keywords: Tympanic Membrane, Graft Material, Tympanoplasty, Otitis Media

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 flaccida. As per WHO definition requires only 2 weeks of otorrhoea, 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}

Hearing is a sense that enables man to establish contact with his fellows via speech to experience life more fully. Deafness in varying degree of severity is a big impediment to the integration of a person into the social structure. In early centuries, ear infection with complication was a life threatening condition. In the early years the aim of physicians was to primarily eradicate disease and save life of the patient, but with time the otology surgery have attained a state of art. The introduction of antibiotics and operative microscope in the surgical field were revolutionary advances in control of ear disease.⁴

Perforation of the tympanic membrane (TM) is a sequelae of otitis media and primarily results from middle-ear infection, trauma or iatrogenic causes. The provision of a dry ear was the main concern in the search to improve hearing along with closure of the ear drum. The development of tympanoplasty techniques were led by incidental and inspirational contributions from surgeons over the world.⁵

The goal of successful tympanoplasty is to create a mobile tympanic membrane (TM) or graft with aerated, mucosa lined middle ear space and a sound conduction mechanism

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between the mobile membrane and the inner ear fluids. Since the earliest attempts at tympanic membrane perforation closure, various graft materials have been used for reconstruction.⁶

Recently, the most commonly used graft material is temporal muscle fascia and it provides nearly 90% closure rates for TM perforation. But in case of advanced middle-ear pathologies, revision surgery, atelectasis, Eustachian tube disorders and larger perforations, healing of TM has much poorer prognosis regardless of the surgical technique used.⁷ The use of cartilage for tympanic membrane(TM) reconstruction is not a recent idea; many of tympanoplasty techniques using cartilage have been described. The major advantage of cartilage graft is the stiffness and bradytrophic metabolism. From the previous literature, it was found that according to Zhang, Tos and Yung et al the rigidity of the cartilage prevents resorption, reperforation and retraction, even in the conditions of continuous eustachian tube dysfunction.^{8,9}

Temporalis fascia grafts were being used to reconstruct the tympanic membrane (TM). However, the long-term outcome was not ideal, especially for large perforations. Hence, a new technique for tympanic membrane reconstruction using a sliced tragal cartilage perichondrium composite graft is being used. To avoid the possibility of a thick cartilage graft interfering with sound conduction, sliced cartilage is preferred.^{10,11} Hence, the aim of the present study was to assess the tolerance, durability and performance of the graft with various thickness and effectiveness and also to study the acoustic transfer characteristics of cartilage plates.

MATERIAL AND METHODS

This was a prospective study done in the Department of ENT, GSL Medical College, Rajahmundry from September 2016 to August 2018. Patients attending (or) referred to the department of ENT, GSL Medical College, Rajahmundry during the period of September 2016 to August 2018, with symptoms and signs of CSOM with discharge, hearing loss, CSOM with perforation of tympanic membrane(TM), previous otologic surgery, either primary presentation or post tympanoplasty. Patients who were 15-60 years of age, with total and subtotal perforations, perforations with tympanosclerotic plaques, Perforation with atrophic membranes, Revision surgery for failed myringoplasty or tympanoplasty, Anterior and inferior perforation with tubal discharge, Retraction pockets, Partially completely atelectatic tympanic membranes, Adherent otitis media and revision surgery for failed tympanoplasties of type2 and type3 as well as tympanomastoidectomies.

Patients who does not gave informed written consent, with severe sensory neural hearing loss (SNHL), Patients suffering from malignancy, Patients suffering from severe DM and HTN and renal diseases, Tuberculous patients on ATT, Patients who had failure of cartilage tympanoplasty, Certain occupations like fishermen and Patients suffering from persistent and uncontrollable sinonasal allergy were excluded from the study.

Materials used were tragal and chonchal cartilage along with an underlay type I tympanoplasty (primary or revision), using temporalis fascia, tragal cartilage of two different thicknesses was performed. Full thickness tragal cartilage of 1mm and partial thickness tragal cartilage of 0.5mm was used in this study. The techniques used for cartilage tympanoplasty were as follows:

1. Inlay butterfly graft
2. Perichondrium/cartilage island flap
3. Palisade flap
4. Cartilage shield tympanoplasty

SURGICAL TECHNIQUE

1. Preparation
 - Preparation of the surgical part was done by shaving of hair of the post auricular region by margin of about an inch.
 - Vital parameters were recorded.
 - Preoperative dose of antibiotic was given.
 - Xylocaine test dose - 0.1 ml of 2% xylocaine is given intradermally.
 - Inj Tetanus Toxoid 0.5ml is given intramuscularly
2. Position of the patient - The patient was placed in supine with the face turned to other side and the ear to be operated is up, with the head slightly elevated. The patient was draped in the usual sterile manner.
3. Anaesthesia- local or general. Local infiltration was done with 1% lignocaine with 1:1,00,000 adrenaline. The tympanic branches of the auriculo-temporal nerve to the anterior meatal wall and tympanic membrane(TM) are blocked by the injection of 1 or 2 ml of 2% lignocaine with 1:1,00,000 adrenaline solution into the anterior meatal wall at the junction of the cartilaginous and osseous meatus.

The auricular branches of this nerve to the upper part of the auricle and skin above the meatus are blocked by injection of 1 ml of solution into the incisura terminalis. The branches of the great auricular nerve to the auricle and meatus are blocked by injection of 1 ml of solution at several points behind the auricle over the mastoid process. The auricular branch of the vagus nerve is blocked by injection of the periosteum of the anterior surface of the mastoid process and of the skin of the floor of the meatus.

Harvesting Tragal Cartilage

Tragal cartilage was harvested through a skin incision on the medial side of the tragus. The lateral 2-mm portion of the tragal cartilage was left intact in the dome of the tragus for cosmeses. The cartilage, with attached perichondrium, was dissected medially from the overlying skin and soft tissue by spreading a pair of sharp scissors in a plane that is easily developed superficial to the perichondrium on both sides. At this point, in order to maximize the length of harvested cartilage, it is necessary to make an inferior cut as low as possible. The cartilage was then grasped and retracted inferiorly, which delivers the superior portion from the incisura area.

The superior portion was then dissected out while retracting,

which produces a large piece of cartilage. The cartilage was then widely exposed on both its lateral and medial surfaces and then harvested with its attached perichondrium, the donor site. The cartilage graft was prepared by elevating the perichondrium over the convex surface of the tragal cartilage graft while maintaining its attachment to the concave surface (the thinner perichondrium). The cartilage was trimmed to fit the size and shape of the tympanic membrane defect using a slicer thickness of 0.5 mm cartilage was done.

STATISTICAL ANALYSIS

The data was entered in the excel spread sheet and statistical analysis was performed using SPSS 19 version. The descriptive analysis was calculated using percentage. The results were tabulated in the form of tables and graphs.

RESULTS

In the present study, Table no. 1 shows that out of all 42 cases, 14 were males and 28 were females. The age of the subjects ranged from 16-50 years. Majority of the subjects were from 21-30 years (40.47%) followed by 11-20 years (28.57%) and 31-40 years (21.42%). Very few subjects were from the age ranged from 41-50 years (9.52%) (Table no. 2). Table no. 3 shows that the most common side affected was right side of ear among 29 cases i.e. (69.04%) followed by left side among 13 cases (30.95%). It was found that 35 subjects were most commonly affected with both ear

discharge and hearing loss (83.33%). Also, only 5 cases were found to be affected with ear discharge only (11.90%). About 4.76% i.e.2 cases were found to be affected with hearing loss only (Table no. 4).

Graph no.1 shows the hearing improvement among the study subjects. The majority of cases were found to be 23 cases which showed significant improvement (54.76%) with range of hearing 10-15 dB followed by range of hearing 5-10 dB



Figure-1: shows the harvesting of tragal cartilage

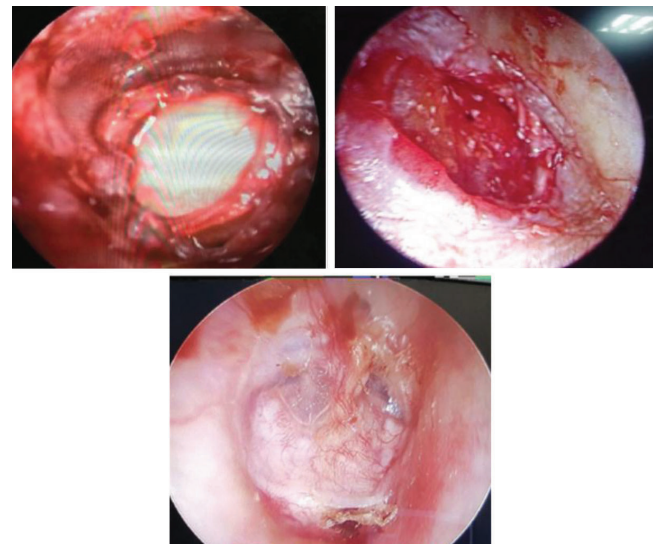


Figure-2: shows the intra-operative images of cartilage and temporalis fascia graft after placement of graft and healed tympanic membrane at 12 weeks post-operative period

Gender	Number of cases	Percentage
Males	14	33.33%
Females	28	66.66%
Total	42	100%

Table-1: Shows the distribution of data based on gender among the study subjects

Age	Number of cases	Percentage
11-20 years	12	28.57%
21-30 years	17	40.47%
31-40 years	9	21.42%
41-50 years	4	9.52%

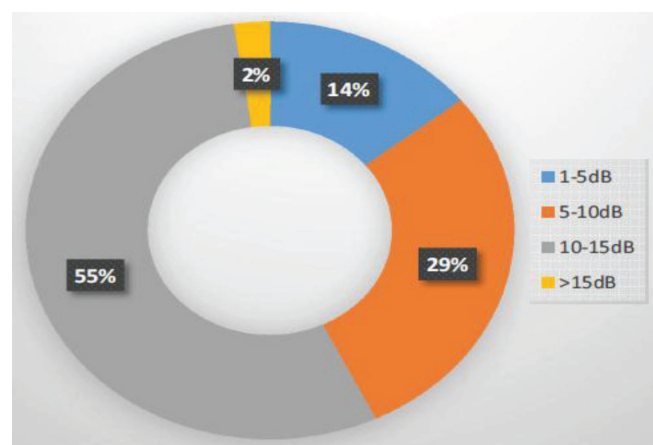
Table-2: Shows the distribution of data based on age among the study subjects

Side of Ear	Number of cases	Percentage
Right side	29	69.4%
Left Side	13	30.95%
Total	42	100.0%

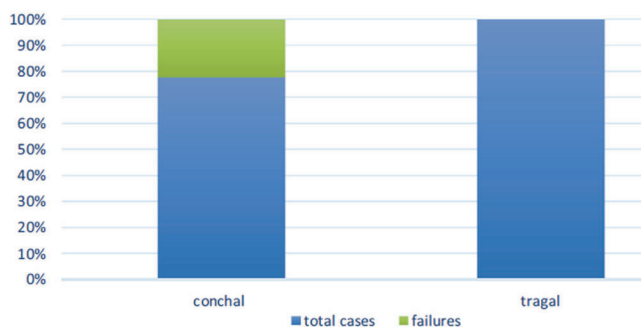
Table-3 Shows the distribution of data based on the ear affected among the study subjects

Clinical Presentation	Number of cases	Percentage
Ear discharge only	5	11.90%
Hearing loss only	2	4.76%
Ear discharge+ Hearing loss	35	83.33%

Table-4: Shows the distribution of data based on clinical presentation among the study subjects



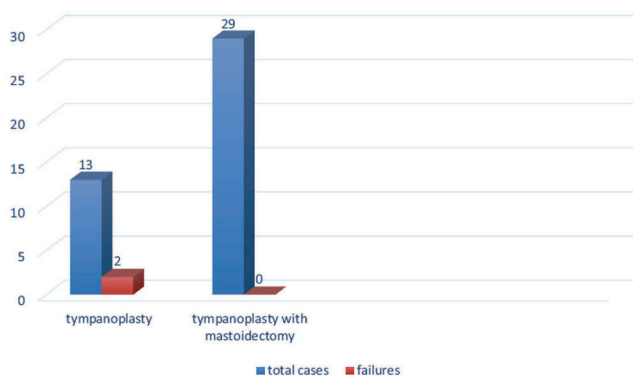
Graph-1: shows the distribution of data based on hearing improvement among the study subjects



Graph-2: shows the distribution of data based on graft material and graft failure among the study subjects



Graph-3: shows the distribution of data based on post-operative graft status among the study subjects



Graph-4: shows the distribution of data based on relation with surgery and graft failures among the study subjects

in 12 cases (28.57%). No improvement was seen in 6 cases (14.28%) with range of hearing <5 dB. Only 1 case showed good improvement with range of hearing >15 dB.

Graph no.2 shows the relation between graft material and graft failure among the revision cases, it was found that out of 12 cases, 2 cases had failure (16.66%), conchal cartilage was used as a graft material in 7 cases out of which 2 cases had failure (28.57%). Tragal cartilage was used in 5 cases which showed no failures.

Graph no.3 shows the post-operative graft status among 42 cases, out of which only 2 cases showed graft failure. The successful graft uptake at 6 weeks post-operatively was seen in 37 cases and at 12 weeks post-operatively was seen in 40 years. Pus was seen in 5 cases at 6 weeks post-operatively and at 12 weeks post-operatively seen in 2 cases. Monthly follow-up revealed persistence of disease i.e. discharge.

Graph no. 4 shows the distribution of data based on relation with surgery and graft failures. It was found that out of 42 cases, only 2 cases (4.76) were failed, 13 cases underwent tympanoplasty in which 2 cases failed (15.38%), 29 cases underwent tympanoplasty with mastoidectomy in which no failure occurred.

DISCUSSION

In the present study, among 42 patients 17 (40%) patients were between 21 and 30 years. The minimum age was 16 years and maximum was 50 years. According to a study conducted by S. Varshney et al study, it was found that the most commonly affected age group was between 16 and 25 years. Similarly various other studies also reported COM in the same age group. The early presentation may be due to increased awareness to health issues and difficulty in hearing, affecting the work efficiency leading patients and parents to seek early medical intervention.¹²

Among the total subjects, there were 14 males and 28 females in the study. Other studies did not show any significant difference occurrence of disease based on gender distribution. In the present study, right ear was affected in 29 subjects (69.04%) and remaining in left side 13 subjects (30%). Similar studies did not reveal any significance in laterality of the disease based on gender as well as age. 5 (11%) subjects had active disease in the present study. Patients with active disease in cartilage group had successful graft survival when compared to dry ear. Good vascularization or angiogenesis of the graft material is one of the most important physiological factors for successful grafting.

A histopathological study was conducted by Vijendra et al which stated that the tympanic membrane of wet ears showed preservation of all layers of the epithelium, a higher number of inflammatory cells, and abundant blood vessels, while in totally dry ears, the tympanic membrane showed a single layer of epithelium, as well as scant or absent inflammatory cells and blood vessels. Due to above findings, they inferred that graft failure is more in totally dry perforations, and they recommended conversion of all tympanic membrane perforations in dry ears into subtotal perforations to remove the atrophic and avascular portion of the ear drum.¹³

In this study, 27(64.28%) subjects had large size perforation, 15(35.71%) subjects had sub-total perforations. The graft survival was maximum for large perforations followed by subtotal perforations. Large perforations have a better chance of closure than subtotal perforations. This is probably because a larger bed is provided for the graft.

A study was done by S.Vaidya et al, which noted that residual perforations were more in 42 to 55 mm² size (subtotal) perforations, where all four quadrants were involved. Hearing thresholds and graft survival were assessed at 6 weeks, 12 weeks and 6 months and 1 year of surgery.¹⁴

In a study done by Prasad et al which had also used 6 weeks as the minimum post-operative follow up period after myringoplasty, the optimum time required for complete healing and good hearing results. A study was conducted by Brown et al which used minimum of 4 weeks from the date

of operation to assess the results.^{15,16}

In the present study, successful graft survival in cartilage at 6-12 weeks postoperatively was seen in 37 (86.5%) subjects and failure in 5 (13.5%). The subjects were followed up for 12 months and the graft survival was assessed. In the cartilage group, when followed from 6 weeks to 12 months, we observed that intact tympanic membrane(TM) was seen in 40 subjects (95%). The type of failure seen in the present study, in cartilage graft, is displacement of graft leading to reoperation. There was neither medialisation, nor anterior blunting, which is in consistent with the study done by Gamra OB et al, in which no retraction or lateralization of graft was observed in an average follow-up of 2 years.¹⁷

The main advantage of cartilage tympanoplasty is that epithelisation will continue over the cartilage surface. The other advantage is that, this technique avoids synechia formation between the graft and promontory. Hence, there is no need to use a gelfoam in the middle ear to support the graft. Cartilage being of rigid quality, its resistance to infection and retraction forms the basis for using it as a grafting material. A study was conducted by Sandeep B et al to assess hearing results after cartilage tympanoplasty in cases of tympanic perforation. Mean post-operative air bone gap of 13.7dB was found correlates with our result at the end of one year. Graft survival rate were correlating with our study. Even in the present study, out of 42 cases of cartilage tympanoplasty conchal cartilage was used in 29 cases and tragal cartilage in 13 cases. It was found that there is no significant difference in the graft survival rate in both the groups.¹⁸

CONCLUSION

Cartilage is a valuable material for repairing a retracted tympanic membrane because of its stiffness, cartilage will resist retraction. The major drawback of cartilage is that it is opaque and may mask residual disease.

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