International Journal of Otorhinolaryngology and Head and Neck Surgery
Selvan VS et al. Int J Otorhinolaryngol Head Neck Surg. 2017 Jul;3(3):650-655
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20173041

A comprehensive study on cartilage tympanoplasty in adhesive otitis media

V. Saravana Selvan[1]*, C. Karuppasamy[2]

Department of ENT, [1]Government Stanley Medical College, Chennai, [2]Government Tirunelveli Medical College, Tirunelveli, Tamil Nadu, India

Received: 02 April 2017
Revised: 08 May 2017
Accepted: 09 May 2017

***Correspondence:**
Dr. V. Saravana Selvan,
E-mail: anavaras81@gmail.com

ABSTRACT

Background: The surgical management of adhesive otitis media is debatable. Adhesive otitis media progressing to cholesteatoma cannot be predicted, and hearing remains normal until later in the disease course. Hence surgery is done only when there is hearing loss or frank cholesteatoma develops, where an extensive surgery may be needed. Earlier intervention is often avoided due to near normal hearing levels at this stage in some cases. Aim of the study was to hearing results and intactness of neotympanum who have undergone cartilage tympanoplasty with or without ossicular reconstruction are reported for patients with adhesive otitis media

Methods: This is an open labelled randomised study conducted in Madras Medical College after getting approval from the Institutional Ethical Committee. The study was conducted during the period of November 2011 to April 2013. A total of thirty patients (thirty one ears) aged thirteen-forty eight years underwent cartilage tympanoplasty with or without ossicular reconstruction. Tympanotomy was followed by cartilage reconstruction of the tympanic membrane, with ossicular reconstruction if there is any ossicular discontinuity

Results: The outcome measures were post-operative pure tone average, air-bone gap for three frequencies (five hundred, thousand, two thousand hertz) compared to pre-operative levels. There was a statistically significant improvement in hearing. Neotympanum was found to be stable significantly during follow up.

Conclusions: Therefore cartilage tympanoplasty with or without ossiculoplasty is effective for adhesive otitis media.

Keywords: Cartilage, Tympanoplasty, Adhesive otitis media

INTRODUCTION

The management of the atelectatic ear continues to be one of the most controversial issues facing the otolaryngologist. It is difficult to elucidate and predict the natural history of this disease and effectively predict those cases that will develop cholesteatoma. The controversy is augmented by the fact that, early in the course of the disease, and even in the presence of incus erosion, hearing loss is frequently minimal and the patient, for the most part, asymptomatic.[1]

Should a procedure such as cartilage tympanoplasty be performed early in the disease when the hearing is often normal as a prophylactic measure, or later in the disease after the development of hearing loss or frank cholesteatoma? With early intervention, before the development of cholesteatoma, the structural abnormalities in the ear drum and middle ear space are technically easier to correct, and adhesion formation is minimized. The main disadvantage lies in the possibility of performing an unnecessary surgery in an ear that potentially would have remained stable with time.

Likewise, the possibility of making the hearing worse with early intervention in an otherwise functional ear must take into consideration. On the other hand, if the surgeon waits until the eardrum retraction has turned into cholesteatoma or significant hearing has occurred, there is no question of surgical necessity. However, with this approach, the patient is put at increased risk for much more extensive, and often multiple, surgical interventions.

Aims and objectives

- To analyse the intactness of tympanic membrane and stability of tympanic membrane reconstructed by cartilage.
- To analyse the hearing results after the procedure.

METHODS

This is an open labelled randomised study conducted in Madras Medical College after getting approval from the Institutional Ethical Committee. The study was conducted during the period of November 2011to April 2013.

We have confined our results to patients with sade type four retractions undergoing surgical intervention. Thirty patients (thirty one ears) were enrolled in this study. All patients underwent following investigations: endoscopic examination on table, pure tone audiometry diagnostic nasal endoscopy, x-ray both mastoids – lateral oblique view, HRCT temporal bones, and routine blood investigations. After getting anaesthetic fitness patients were posted for surgery. Surgeries were mostly done under local anaesthesia. For uncoopertive patients and in children, surgery was done under general anesthesia. Patients underwent treatment for sino nasal disease and adenoid hypertrophy as required. Topical nasal steroids and valsalva were initiated even before surgery. After surgery all patients were advised to attend OPD once every week till the healing of neotympanum was observed. Anti-histamines were given for one month and audiogram was done after complete healing mostly at the end of first month, third month and sixth month. All cases with Sade grade four retraction of pars tensa were included. All age group, both genders were included. Patients with cholesteatoma, mixed hearing loss and with other comorbid conditions were excluded.

Surgical technique

Endoscope assisted transcanal or microscope assisted post aural approaches were used. The atelectatic eardrum is carefully elevated off the promontory and middle ear structures, without violating the mucosa if possible. Redundant tympanic membrane is removed, and the ossicular chain is inspected. If good movement exists between the incus and stapes we proceeded with cartilage tympanoplasty. The incus is removed if the lenticular process shows erosion. For ossicular reconstruction, we used the incus interposition technique. A cartilage shield technique is used to reconstruct tympanic membrane using cartilage harvested from the tragal cymba /concha. For transcanal approach we used tragal cartilage. For post aural approach conchal and cymbaconchal cartilage were used.

The cartilage graft is stripped of its perichondrium on one side, sized to the dimensions of the tympanic membrane defect, and thinned. A wedge is removed at the upper portion of the graft to accommodate the malleus handle. After the middle ear is packed with gel foam, the cartilage graft is placed medial to the manubrium and the tympanic sulcus such that perichondrial side is towards tympanic membrane. Temporalis fascia graft is placed over the cartilage.

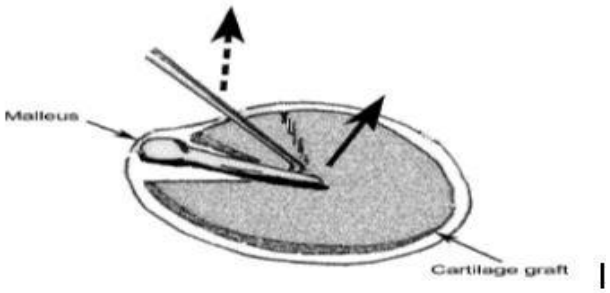

Figure 1: Placement of cartilage.

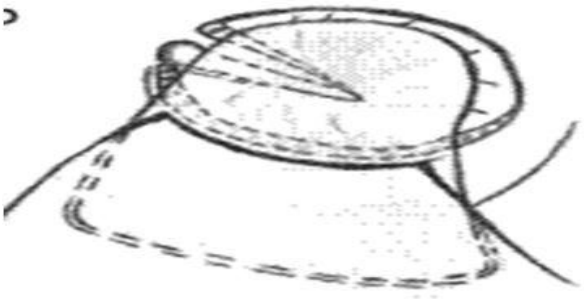

Figure 2: Placement of temporalis fascia graft.

Mastoidectomy is not routinely included in the surgical regimen performed at this institution but to visualise the retraction pockets we drilled some part of posterior canal wall.

In cases of medialised malleus we cut the tensor tympani or tip of the malleus to lateralize it and thereby increase the mesotympanic space. For reporting about middle ear status we used middle ear risk index reporting system (MERI).

Post-op care

After 1-2 weeks of surgery we remove gel foam by gentle suction. After second week we start antibiotic with

steroid ear drops for 4 days thrice daily. After 6-8weeks we do first post op audiogram. We Follow up the patients for 6 months.

Figure 3: One of our case of adhesive otitis media.

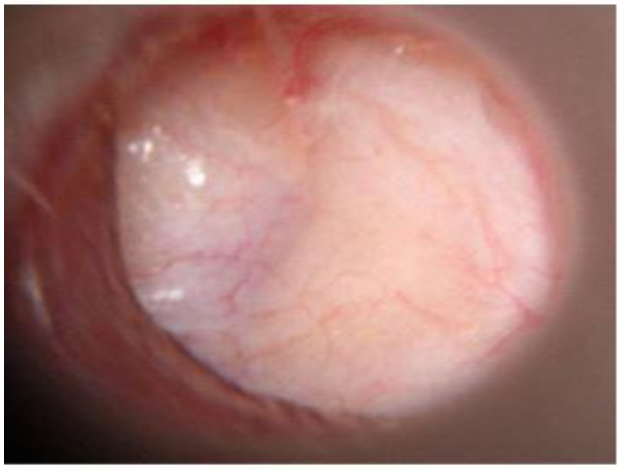

Figure 4: Post-operative picture at first month showing vascularity over the cartilage.

Figure 5: Post-operative picture of another patient after 1 month. Here we used a smaller sized cartilage.

Data collection

Patients were included when pre- and post-operative audiograms were available, with at least a 6 month follow-up after surgical intervention.

After the patient's inclusion in the study, the following information was extracted from his or her chart: sex, age, surgical indication, type of ossicular reconstruction, pre- and post-operative audiograms, post-operative findings, and length of follow-up. Three - frequency (five hundred, thousand, two thousand hertz) pure tone averages (PTA) & air-bone gaps (ABG) were calculated. The air and bone conduction scores obtained at the most recent follow-up were used to compute the post-operative results. Statistical comparison between the pre- and postoperative audiograms was performed using the student's t-test.

RESULTS

Table 1: Age.

	N	Minimum	Maximum	Mean	SD
Age	31	13	48	28.77	10.115

Table 2: Sex.

	Frequency	Percent
Valid Male	19	61.3
Female	12	38.7
Total	31	100

Table 3: Pre- operative PTA vs. post- operative PTA.

	Mean	SD	Significance
Pair PTA-pre op	47.74	11.582	0.00
1 PTA-3 months	26.45	4.877	
Pair PTA- pre op	47.74	11.582	0.00
2 PTA-6 months	26.55	5.603	
Pair PTA-3 months	26.45	4.877	0.878
3 PTA-6 months	26.55	5.603	

Table 4: Pre- operative ABG vs. post- operative ABG.

	Mean	SD	Significance
Pair ABG-Pre OP	32.45	11.863	0.00
1 ABG-3 months	15.23	2.825	
Pair ABG- Pre OP	32.45	11.863	0.00
2 ABG-6 months	15.48	3.548	
Pair ABG-3 months	15.23	2.825	0.60
3 ABG-6 months	15.48	3.548	

A total of thirty patients (representing thirty one ears) underwent surgery using cartilage tympanoplasty techniques for adhesive otitis media. The average age was twenty eight years, with a range of thirteen to forty eight years. Twelve patients were female, and nineteen were male. The follow-up period was six months.

Table 5: Intactness of TM-Post OP3.

	Frequency	Percent
Valid Yes	30	96.8
No	1	3.2
Total	31	100

Table 6: Intactness of TM-Post OP6.

	Frequency	Percent
Valid Yes	29	93.5
No	2	6.5
Total	31	100

Of the surgeries performed, nineteen were Type I cartilage tympanoplasties and twelve were cartilage tympanoplasties with ossicular reconstruction. All the patients had sclerosed mastoid in their x-ray mastoids ossicles were intact in nineteen ears where we did cartilage tympanoplasty Type I and twelve ears were without intact ossicular continuity where we did cartilage tympanoplasty with ossiculoplasty. Commonest ossicle found to be eroded was lenticular process of incus followed by the stapes head. Malleus was found to be retracted where we cut the tensor tympani muscle or cut the tip of the malleus to lateralize it. We did the ossicular reconstruction using incus interposition technique. All the ears falls in MERI mild category (score1-3). Commonest etiology for adhesive otitis media in my study was allergy (35.5%) followed by smoking (16.1%).mean pre op pta was 47.74±11.582db.post op pta at 3rd month is 26.45±4.877 db and at 6th month post op pta is 26.55±5.603 db.

There was significant improvement between pre-op and post-op PTA for both 3rd and 6th month (p is.000<0.05). But no significant difference between 3rd & 6th month. Pre-op ABG is 32.45±11.863 db and post op ABG at 3 and 6 months are 15.23±2.825 db and 15.48±3.548 db respectively. There was a significant difference between pre op &post op values. Average ABG closure was 16.97 db. At the end of 6 months two cases had residual perforation. Our success rate was 93.5%.

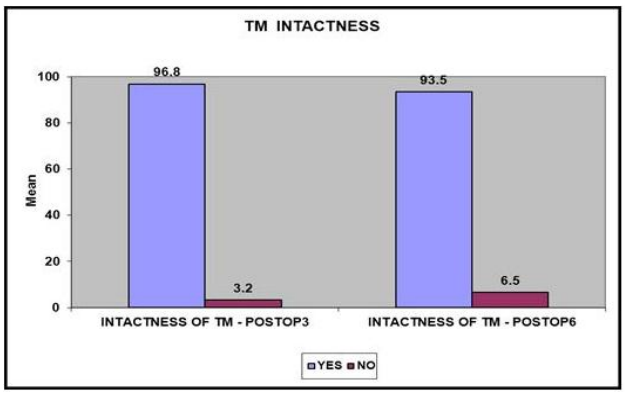

Figure 6: Mean deviation of intactness of tympanic membrane.

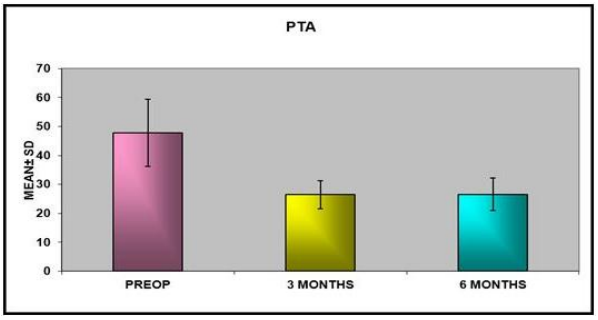

Figure 7: Mean deviation of Post OP PTA.

Among the cartilages, we used conchal in fifteen ears and tragus in fourteen ears and cymba concha in two cases. Grade 2 retraction was commonly present in the other ear during surgery. Mean post op PTA at 6 months in cartilage tympanoplasty was 23.42 ± 3.271 db.

In cartilage tympanoplasty with ossiculoplasty it was 31.50 ± 4.945db.mean ABG was 13.95 ± 1.649 db in cartilage tympanoplasty alone and 17.92 ±4.400 db in cartilage tympanoplasty with ossiculoplasty. Thus a statistically significant improvement in hearing was seen in patients undergoing Type I tympanoplasties and in those receiving ossicular reconstruction ($p<0.05$). Interestingly, there was no significant difference in hearing results between these two groups. In the cases where only cartilage tympanoplasty alone done post op PTA at 6 months for tragal is 22.80 ±3.490 db conchal 24.29 ±2.870db cymba 23.50 ±4.950db &for ABG tragus 13.30 ± 1.767 conchal 14.86 ± 1.345 and cymba 14 db which shows tragus slightly better than other two in hearing improvement which is not that significant.

Allergy followed by smoking was the commonest etiology identified for eustachian tube dysfunction in my study. When hearing outcomes of the patients whose identified etiology was treated to those with untreated etiology, there was no statistically significant difference of the hearing outcome. Among the two patients who had perforation at the end of 6th month one had allergic etiology and the other patient was a chronic smoker.

There were no serious complications seen in any patient. All patients who had bony curetting of postero superior meatal wall had an intact taste sensory perception. All ears showed intact grafts except 2 patient's at the most recent follow-up. There were no significant retractions. Small, local retractions around the edge of the cartilage graft were seen in two ears. These have remained stable and are believed to be clinically insignificant. All patients had significant hearing improvement. No patient required ventilation tubes for persistent effusion in the post-operative period.

DISCUSSION

The prevalence of *pars tensa* retractions with significant abnormalities, such as atrophy, is reported to be between

0.7% and 10%.[2] Progression of the disease, with cholesteatoma formation, has been reported to occur in 1% to 55% of patients after 1 to 15 year follow-ups in an at-risk group of patients.[3]

Several staging systems have been developed, and each has its advantages and disadvantages. A three grade staging system described by charachon, et al is based on the presence and absence of adhesions, as determined by pneumatic otoscopy as well as by the ability to inspect the depth of retraction.[5] The Type V designation in sade's system suggests that perforation is the natural progression of the atelectatic ear. However, this is not necessarily the case as mesotympanic cholesteatoma is frequently the end-point of a deep retraction pocket. From the standpoint of describing the natural progression of the disease, it seemed logical to omit the presence of perforation in the staging system. Type V was therefore not included in our staging system.

The management protocol used in our Institute is fairly aggressive surgically. Most would not argue with the logic of surgical intervention in a sade type IV retraction due to the inability to rule out incipient cholesteatoma.

If retraction is down to the promontory, progression occurs from this point, especially if adhesions are present posteriorly, the resulting mesotympanic cholesteatoma will ultimately involve the sinus tympani and facial recess areas, the two most difficult areas for cholesteatoma eradication. Involvement of the sinus tympani almost guarantees the need for staged surgery, as no surgical technique for cholesteatoma removal, even canal-wall-down surgery, adequately deals with this area. The second reason involves hearing loss. With Type II retraction, or myringo-incudo-stapediopexy, the mechanical advantage produced by the lever action of the incus is certainly reduced, but the acoustic gain offered by this mechanism in the normal ear is minimal, so the resulting hearing loss is negligible.[6] With Type III retraction, the effective surface area of the vibrating tympanic membrane is reduced by its contact to the promontory. In the normal ear, the hearing gain is produced

by the ratio of the surface area of the tympanic membrane to the oval window is significant, so the resulting hearing loss in the Type III retraction is notable.[6] While this degree of hearing loss may not be, in and of itself, an indication for surgery, it is testimony to the importance of the ratio of the surface area of the tympanic membrane to the oval window. The hearing gain afforded by surgery in these cases reinforces the aggressive surgical treatment of the Type IV retraction.

The surgical technique used here appears to offer a viable alternative in the management of Type IV atelectatic ears. The ultimate hearing results were quite encouraging, and hearing was either maintained or improved. Even patients undergoing only a Type I tympanoplasty, with no reconstruction, showed better overall improvement of hearing. Certainly, this group of patients was most at risk for having a detrimental surgical result with regards to hearing as the hearing loss in this subset of patients was frequently mild preoperatively.[7]

Our hearing results compares favorably to those reported by other authors.

A final comment concerns our graft material cartilage appears to be an ideal graft material in the atelectatic middle ear as it offers rigorous reconstruction with little or no detrimental effect on hearing when compared to more traditional materials, such as fascia or perichondrium.[4] It has been shown in both experimental and clinical studies that cartilage is well tolerated by the middle ear, and long-term survival is the norm.[8] Although it is similar to fascia in that it is mesenchymal tissue, its more rigid quality tends to resist resorption and retraction, even in the milieu of continued eustachian tube dysfunction.[9] One distinct disadvantage of cartilage, however, is that it is difficult to intubate the ear in the post-operative period should that be necessary. Interestingly, although eustachian tube dysfunction is felt to be the underlying cause of the atelectatic ear, myringotomy and pressure equalizing tube insertion was not needed in this group. If the patient is able to perform the valsalva maneuver pre-operatively, the need for subsequent intubation is lesser, compared to the patient unable to perform the maneuver.

Limitations of the study

1) Smaller sample size
2) This sample population does not represent the true population.
3) Follow up period is only 6 months.

CONCLUSION

Management of adhesive otitis media with cartilage perichondrium tympanoplasty with or without ossiculoplasty is a proven modality of treatment with successful results. Cartilage gives a tensile strength to the tympanic membrane which prevents further retractions inspite of the continuing eustachian tube dysfunction and thus prevents cholesteatoma formation without compromising on hearing.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Elden, Lisa M, Kenneth M. Grundfast, Gilbert Vezina. Accuracy and usefulness of radiographic assessment of cervical neck infections in children. J Otolaryngol Head Neck Surg. 2001;30(2):82.

2. Prevalence and Progression of Sequelae following Secretory Otitis
3. Tos M, Hvid G, Stangerup SE, Andreassen UK. Prevalence and progression of sequelae following secretory otitis. Annals Otol Rhinol Laryngol. 1990;99(7):36-38.
4. Dornhoffer, John L. Hearing results with cartilage tympanoplasty. Laryngoscope. 1997;107(8):1094-9.
5. Sheehy, James L, Michael E. Glasscock. Tympanic membrane grafting with temporalis fascia. Arch Otolaryngol. 1967;86(4):391-402.
6. Paparella MM, Jung TT. Experience with tympanoplasty for atelectatic ears. Laryngoscope. 1981;91(9):1472-7.
7. Peer LA. The fate of living and dead cartilage transplanted in humans. Surg Gynecol Obstet. 1939;68:603-10.
8. Milewski C. Composite graft tympanoplasty in the treatment of ears with advanced middle ear pathol. Laryngoscope. 1993;103(12):1352-6.
9. Glasscock ME 3rd, Jackson CG, Nissen AJ, Schwaber MK. Postauricular undersurface tympanic membrane grafting:A follow-up report. The Laryngoscope. 1982;92(7):718-27.

Cite this article as: Selvan VS, Karuppasamy C. A comprehensive study on cartilage tympanoplasty in adhesive otitis media. Int J Otorhinolaryngol Head Neck Surg 2017;3:650-5.