

## CARTILAGE TYMPANOPLASTY: A REVIEW ON ITS POSTOPERATIVE/FUNCTIONAL OUTCOMES ON HEARING

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### ABSTRACT

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#### INTRODUCTION

Cartilage graft tympanoplasty has a better success rate in the treatment of chronic otitis media if properly prepared pre-operatively and placed intraoperatively.

#### OBJECTIVE

To prepare cartilage graft from tragus and to compare preoperative and postoperative hearing.

#### METHODS

35 patients with chronic otitis media either tubotympanic or atticoantral, without intra/extracranial complications disease were made to undergo cartilage tympanoplasty. The study was conducted both retrospectively and prospectively.

#### RESULTS

In this technique, patients had an average improvement in hearing up to 10-12 dB. The mean postoperative period followup was 2-6 months.

#### CONCLUSION

If cartilage graft is properly prepared and placed, cartilage tympanoplasty appears to provide better success rates and hearing results.

#### KEYWORDS

Tragus, Cartilage Tympanoplasty, Tubotympanic, Atticoantral.

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**INTRODUCTION:** The aim of tympanoplasty is to close the tympanic membrane perforation, restore hearing and reconstruct a healthy middle ear cavity. In 1952, split thickness graft was used by Wullstein for repair of the tympanic membrane and published the results.<sup>[1]</sup> Zollner described his experiences with a similar graft.<sup>[2]</sup> Although tympanoplasty is a highly successful procedure in 70-90% of normally ventilated middle ears, the prognosis is poorer in cases with total dysfunction, adhesive processes, infection, tympanic fibrosis and defect of the entire tympanic membrane. Many autogenous, several allogeneous (homogeneous), and a few xenogeneous graft materials have been used for ear drum perforation closure and reconstruction of the middle ear and ear canal.<sup>[3]</sup> The major advantage of cartilage is its stiffness and bradytrophic metabolism, which make it particularly suitable for difficult conditions, such as subtotal perforations, adhesive otitis and

revision cases.<sup>[4,5]</sup> The aim of the present study was to prepare the cartilage graft material and to evaluate its effect on the success rate on functional outcomes on hearing. Cartilage graft has proven to be promising in closing TM perforations.

Cartilages are harvested from tragus, concha were used. Its rigidity in comparison to temporalis fascia, manages to prevent resorption, retraction, and re-perforation, despite continuous Eustachian tube dysfunction. It is less likely to cause an inflammatory reaction or an infection postoperatively. Many studies have proven that the middle ear tolerates cartilage very well showing long-lasting survival.

#### PATIENTS AND METHODS:

**A) Patient Population:** From September 2014 to August 2015, cartilage tympanoplasty was performed using tragal cartilage in 35 patients. (Out of which, 19 were male and 16 were female, age ranging from 12-60 years).

Of all the cases selected for the study to do cartilage tympanoplasty, all were primary procedures except for one case. Of the procedures done, 2 cases were with postero-superior retraction pockets, 2 cases were with attic cholesteatoma. Out of patients with mucosal disease, 27

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cases were inactive and 1 was active for which we did cortical mastoidectomy with cartilage tympanoplasty. Of the cases studied, 24 had bilateral ear disease and 11 had unilateral ear disease.

Type 1 tympanoplasty was performed for 31 patients, type 3 for one patient, type 1 with ossiculoplasty was performed for 1, revision intact canal wall with type 3 tympanoplasty was done for 1. All the cases were done in single centre, Upgraded Institute of Otorhinolaryngology, Chennai. The procedure was not done by a single surgeon. The following parameters were studied: graft take-up, change between pre and postop pure tone audiogram showing improvement in air bone gap, progression/regression of retraction.

If there is no perforation, retraction or lateralisation, it is labelled as successful graft uptake. The PTA-ABG for each audiogram was made out by calculating the mean air bone gap at 500, 1000, 2000 and 4000 Hz. Pre and postoperative audiograms were compared using 't' test.

Institutional ethical committee clearance and patient consent was obtained for the study.

**B) Preoperative Evaluation:** An audiogram is performed preoperatively at the following frequencies: 500, 1000, 2000 and 4000 Hz.

#### MATERIALS:

**Place of Study:** Rajiv Gandhi Govt. General Hospital, Chennai – 600003.

**Collaborating Department:** Upgraded Institute of Otorhinolaryngology.

**Study Design:** Prospective and retrospective Study.

**Study Period:** July 2014 to September 2015.

**Sample Size:** 35.

**Data Collection:** Patients attending UIORL.

#### Inclusion Criteria:

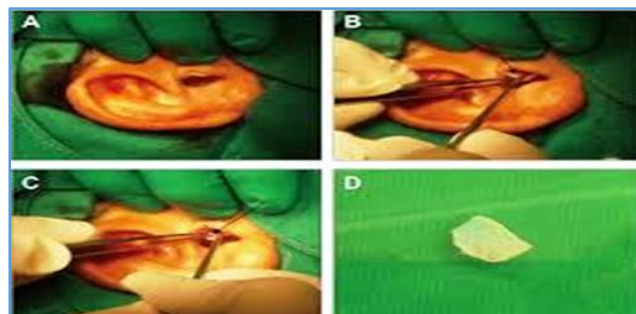
1. Type of disease (Tubotympanic/Atticoantral).
2. Age > 12 years, <60 years.

#### Exclusion Criteria:

1. COM with impending/overt complications.
2. COM with severe SNHL.
3. Age <12 years, >60 years.

**C) Surgical Procedure:** Cartilage is removed either

from the posterior aspect of the tragus or the concha by using sharp and blunt dissection. Sized to the dimensions of the tympanic membrane defect, the cartilage graft is stripped of its perichondrium, and sliced. At the upper portion of the cartilage graft, a wedge is removed to accommodate the handle of the malleus. Then, the middle ear is packed with Gelfoam, the cartilage graft is placed medial to the handle of the malleus and the tympanic sulcus. Lateral to the cartilage, an areolar tissue graft is placed, medial to the edges of the perforation and posteriorly onto the canal wall.



**Figure 1**



**Figure 2**

**D) Postoperative Evaluation:** An audiogram was repeated at least 3 months postoperatively. Followup examination of the graft was done at 3, 6, 12 months postoperatively.

#### STATISTICAL ANALYSIS:

| Paired Samples Statistics |                     |       |    |                |                 |
|---------------------------|---------------------|-------|----|----------------|-----------------|
|                           |                     | Mean  | N  | Std. Deviation | Std. Error Mean |
| Pair 1                    | PreOp Hearing Loss  | 39.00 | 35 | 7.526          | 1.272           |
|                           | PostOp Hearing Loss | 30.94 | 35 | 11.308         | 1.911           |

**Table 1**

| Paired Samples Test |  |                    |                   |                    |  |        |       |    |                    |
|---------------------|--|--------------------|-------------------|--------------------|--|--------|-------|----|--------------------|
|                     |  | Paired Differences |                   |                    |  |        | t     | df | Sig.<br>(2-tailed) |
|                     |  | Mean               | Std.<br>Deviation | Std.<br>Error Mean | 95% Confidence Interval<br>of the Difference |        |       |    |                    |
|                     |  |                    |                   |                    | Lower  | Upper  |       |    |                    |
| Pair 1              | PreOp Hearing Loss-<br>PostOp Hearing Loss | 8.057              | 6.366             | 1.076              | 5.870  | 10.244 | 7.488 | 34 | .000               |
| Table 2             |  |                    |                   |                    |  |        |       |    |                    |

**Table 2**

**DISCUSSION:** Yung et al<sup>[6]</sup> has conducted a study in 18 patients, of which cartilage uptake was 80% compared to 84.2% that of temporalis fascia; Mean hearing gain is 912.60 dB versus fascia 13.63 dB.

Cabra et al<sup>[7]</sup> has reported cartilage palisade technique and reported a higher morphological success in cartilage (82.3%) than fascia (64.4). Postoperative air bone gap for cartilage was 62.5% versus fascia 73.9%.

Dermir Pehlivan<sup>[8]</sup> did cartilage tympanoplasty and reported a higher graft intake in perichondrium (97.6%) versus cartilage only (78.95%) versus temporalis fascia (80.6%). No difference in hearing among groups.

Ulka et al<sup>[9]</sup> has reported 91.3% success rate of graft uptake in cartilage vs. fascia 88.2% and hearing gain of 12.3% in cartilage and 12.7% in fascia in cases of type 1 tympanoplasty.

Albirmawy et al<sup>[10]</sup> has reported a case series in type 1 tympanoplasty and all perforations where the morphological success rate in cartilage 95% vs. fascia 76.2%. Mean postoperative air bone gap 10.95+/-2.12 dB in cartilage versus 12.73+/-8.97 in fascia. No significant difference in hearing between two groups.

Al Lackany and Sarkis<sup>[11]</sup> has reported a graft success rate of 92.3% composite graft, 88% perichondrium and 80% fascia, statistically different only for total perforations in case of type 1 tympanoplasty. Better postoperative air bone gap with perichondrium and composite graft in total and subtotal perforations with intact ossicular chain.

Gerber et al<sup>[12]</sup> conducted a study comparing cartilage and fascia tympanoplasties in cases of medium sized perforation with intact ossicular chain and concluded that hearing results were comparable in case of medium sized perforations.

Dornhoffer et al<sup>[13]</sup> conducted study in cases of perforation involving more than 25% with fascia/perichondrium with cartilage tympanoplasties and concluded that the amount of cartilage used for reconstruction does not adversely affect hearing.

Coulinger et al<sup>[14]</sup> conducted study in children comparing inlay butterfly graft and underlay fascia graft in children and concluded that there is no post op hearing in both groups.

Gierek et al<sup>[15]</sup> made a comparative study with cartilage perichondrium composite graft and fascia and observed that there is no significant hearing difference in both groups.

**Fate of Cartilage after Cartilage Tympanoplasty:** The fate of cartilage after cartilage tympanoplasty was investigated by Yamamoto et al., 6 months postoperatively. There was no evidence of any FB reaction or marked changes in histology of matrix, but the chondrocytes showed degenerative changes. After 6 months, there was fibrous connective tissue replacement and resorption of the cartilage partially. Stiffness of the cartilage was maintained after 6 months for implanted homologous cartilage grafts.

After the primary procedure, there were slight changes in the chondrocytes following two and eight years and no changes in the matrix histologically.

Hitarj<sup>[16]</sup> conducted a four-year study collecting the autologous cartilages during revision surgery and found that chondrocytes which were dead were replaced by the amorphous cartilage material or fibrous tissue.

#### SUMMARY AND CONCLUSION:

1. For reconstruction of the tympanic membrane, cartilage tympanoplasty is a safe and reliable technique.
2. Tragal cartilage with perichondrium is a good material for grafting in reconstructive tympanoplasty.
3. Results are better when reconstruction is performed in dry ear rather than wet ear.
4. Excellent graft take up in cases of myringoplasty and ossiculoplasty.
5. Cartilage can be used in patients with bilateral ear disease, smokers, poor Eustachian tube function, anterior perforations, wet ears and also in revision cases.
6. Results are better when tympanoplasty is performed in dry rather than wet ears.
7. Our study has shown improvement hearing up to 10-12 dB.
8. Results obtained are good as the cartilage stabilisation is good due to thinning of the cartilage.
9. Cartilage resists constant negative middle ear pressure and can withstand longstanding Eustachian tube dysfunction. Hence results are good.

| Sl. No | Name         | Age/Sex | IP NO  | Diagnosis                             | Laterality          | Name of surgery  | PreOp Hearing Loss | PostOp Hearing Loss |
|--------|--------------|---------|--------|---------------------------------------|---------------------|--|--------------------|---------------------|
| 1      | Rashi Kumar  | 20/M    | 97350  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 35 dB              | 25 dB               |
| 2      | Indumathy    | 21/F    | 91977  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 38 dB              | 30 dB               |
| 3      | Shanthi      | 48/F    | 11675  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 30 dB              | 18 dB               |
| 4      | Rajamma      | 30/F    | 47301  | Right COM                             | Unilateral          | Type 1 Tympanoplasty                                   | 40 dB              | 25 dB               |
| 5      | Chandra      | 33/F    | 41655  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 36 dB              | 25 dB               |
| 6      | Thambachari  | 59/M    | 41863  | Left COM with PSRP                    | Unilateral          | Type 1 Tympanoplasty                                   | 33 dB              | 20 dB               |
| 7      | Moesh        | 34/M    | 35263  | Bilateral COM with CP                 | Bilateral           | Type 1 Tympanoplasty                                   | 35 dB              | 25 dB               |
| 8      | Kamala       | 33/F    | 40573  | CP bilateral COM with CP              | Bilateral right ear | Type 1 Tympanoplasty                                   | 38 dB              | 29 dB               |
| 9      | Jeyaseelan   | 59/M    | 40530  | Left COM with CP                      | Unilateral          | Type 1 Tympanoplasty                                   | 40 dB              | 26 dB               |
| 10     | Keerthana    | 14/F    | 46880  | Right COM with CP                     | Unilateral          | Type 1 Tympanoplasty                                   | 35 dB              | 25 dB               |
| 11     | Vishal       | 21/M    | 87606  | Left COM with attic cholesteatoma     | Unilateral          | Inside out mastoidectomy with cartilage tympanoplasty  | 43 dB              | 45 dB               |
| 12     | Chinnammal   | 41/F    | 19644  | Right COM with active mucosal disease | Unilateral          | Cortical mastoidectomy with type 1 Tympanoplasty       | 45 dB              | 45 dB               |
| 13     | Vimala       | 37/F    | 125465 | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 33 dB              | 20 dB               |
| 14     | Prakash      | 29/M    | 113603 | Bilateral COM with PSRP               | Unilateral          | Left atticotomy with cartilage tympanoplasty           | 30 dB              | 30 dB               |
| 15     | Thirumoorthy | 24/M    | 108095 | Bilateral COM                         | Bilateral           | Right cortical mastoidectomy with type 1 tympanoplasty | 36 dB              | 25 dB               |
| 16     | Ganesh       | 26/M    | 48664  | Left COM with attic CHOL              | Unilateral          | Inside out mastoidectomy with cartilage tympanoplasty  | 30 dB              | 25 dB               |
| 17     | Balamurugan  | 50/M    | 49936  | Right COM                             | Unilateral          | Type 1 Tympanoplasty                                   | 35 dB              | 20 dB               |
| 18     | Rajiv Gandhi | 26/M    | 43152  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 40 dB              | 27 dB               |
| 19     | Madurai      | 35/M    | 28910  | Left COM                              | Unilateral          | Type 1 Tympanoplasty                                   | 43 dB              | 30 dB               |
| 20     | Indira       | 40/F    | 23465  | Bilateral COM                         | Bilateral           | Cortical mastoidectomy with type 3 tympanoplasty       | 33 dB              | 20 dB               |

|                |             |      |        |               |            |  |       |       |
|----------------|-------------|------|--------|---------------|------------|--|-------|-------|
| 21             | Paiyalal    | 27/M | 18498  | Left COM      | Unilateral | Type 1 Tympanoplasty   | 35 dB | 22 dB |
| 22             | Eagavalli   | 30/F | 4516   | Bilateral COM | Bilateral  | Type 1 Tympanoplasty   | 38 dB | 30 dB |
| 23             | Kumari      | 33/F | 1239   | Left COM      | Unilateral | Type 1 Tympanoplasty   | 35 dB | 40 dB |
| 24             | Jayalakshmi | 15/F | 1426   | Left COM      | Unilateral | Type 1 Tympanoplasty   | 40 dB | 30 dB |
| 25             | Kumar       | 25/M | 304181 | Right COM     | Unilateral | Type 1 Tympanoplasty   | 30 dB | 21 dB |
| 26             | Siva        | 34/M | 17539  | Right COM     | Unilateral | Type 1 Tympanoplasty   | 32 dB | 20 dB |
| 27             | Suriya      | 15/M | 10281  | Left COM      | Unilateral | Type 1 Tympanoplasty   | 37 dB | 25 dB |
| 28             | Munuswamy   | 25/M | 28216  | Right COM     | Unilateral | Type 1 Tympanoplasty   | 43 dB | 30 dB |
| 29             | Sivagamy    | 66/F | 71483  | Bilateral COM | Bilateral  | Type 1 tympanoplasty   | 55 dB | 41 dB |
| 30             | Andal       | 57/F | 76207  | Bilateral COM | Bilateral  | Type 1 tympanoplasty   | 58 dB | 60 dB |
| 31             | Arul        | 35/M | 92097  | Bilateral COM | Bilateral  | Type 1 tympanoplasty right   | 55 dB | 48 dB |
| 32             | Suganthi    | 13/F | 88580  | Left COM      | Unilateral | Type 2 tympanoplasty   | 35 dB | 38 dB |
| 33             | Johnson     | 20/M | 85902  | Right COM     | Unilateral | Cortical mastoidectomy with type 1 tympanoplasty                   | 40 dB | 30 dB |
| 34             | Sangeetha   | 24/F | 81243  | Right COM     | Unilateral | Revision intact canal wall mastoidectomy with type 3 tympanoplasty | 50 dB | 56 dB |
| 35             | Kumar       | 38/M | 93007  | Left COM      | Unilateral | Type 1 tympanoplasty   | 54 dB | 57 dB |
| <b>Table 3</b> |             |      |        |               |            |  |       |       |

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