Study of role of autologous versus homologous cartilage ossicular reconstruction

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Abstract:
Background: Chronic otitis media with ossicular discontinuity is most commonly faced otological condition which causes conductive hearing loss. It presents mostly with ear discharge and decreased hearing. The use of cartilage graft material in ossiculoplasty markedly improve the result in hearing. In this study we have used autologous (tragal/conchal) cartilage or homologous (septal) cartilage for ossiculoplasty and temporalis fascia graft for tympanoplasty.

Aims: Aim of the study was to compare and analyze the outcome of ossiculoplasty using autologous conchal/tragal cartilage and homologous septal cartilage in terms of hearing results and graft uptake rates.

Materials and method: The study was conducted in E.N.T. Department at S.C.L. Hospital, NHLMMC Ahmedabad. 50 patients were randomly selected and divided in 2 groups. 25 patients underwent homologous and 25 patients underwent autologous cartilage reconstruction. All patients underwent detailed ENT examination followed by audiological and radiological assessment of temporal bone, and those patients with evidence of ossicular erosion were subjected to ossiculoplasty with autologous cartilage and homologous cartilage randomly.

Results: Majority of the patients have central perforation and retraction pockets in middle ear pathology in both groups. Overall graft taken up rate was 96% in autologous while 92% in homologous ossiculoplasty. Our study shows hearing improvement up to 20-25 dB in 80% and 88% in autologous and homologous ossiculoplasty.

Conclusion: Both autologous and homologous cartilage have excellent outcomes and gives equivalent results irrespective of age or sex of the patient or middle ear pathology. In both the groups hearing improvement is similar. Subjective hearing is also improved. No post-op complications like wound infection, facial palsy, dead ear have occurred in either case.

Keywords: Ossicular reconstruction, Autologous cartilage, Homologous cartilage, Tympanoplasty

Introduction
Chronic otitis media with ossicular discontinuity or erosion is most common cause for conductive hearing loss and expected to improve by surgical management [1]. Many factors like ossicular status, ventilation of middle ear, extent of disease whereas other like surgical skill and technique and prosthesis material are responsible for outcome of ossiculoplasty [2,3]. Most commonly used graft is temporalis fascia, tragal perichondrium, fat, fascia lata. Since evaluation of technique various grafts have been used for ossiculoplasty like ossicles, cartilage, TORP/PORP, ceramic implants, titanium, hydroxyapatite, gold etc. [4]. In this study we have used autologous (tragal/conchal) cartilage or homologous (septal) cartilage for ossiculoplasty and temporalis fascia graft for tympanoplasty.

Aims and objectives
- To analyze and compare the outcome of ossicular reconstruction using autologous or homologous cartilage in hearing results.
- To compare graft taken up rate in autologous or homologous cartilage in ossicular reconstruction.

Materials and methods
Patients in age group between 10-65 years attending E.N.T. OPD at Shardaben General Hospital in Ahmedabad were included in study. Patients with chronic otitis media with conductive hearing loss with minimum definitive 30 dB air-bone gap were included in the study. Patients who suffered from complication of CSOM, acute suppurative otitis media, otosclerosis and with hearing loss less than 30 dB air bone gap in operating ear were excluded from study. All the patients were undergoing detailed ENT examination with audiological and
radiological assessment of temporal bone, and those who diagnosed with ossicular discontinuity or erosion were subjected to ossicular reconstruction with either autologous tragal/conchal cartilage (Group-A) or homologous septal cartilage (Group-B) randomly.

Compliance with ethical standards
All the authors declare that they have no conflict of interest. Ethical clearance was obtained from ethical committee for research on human subjects. All the subjects have given written informed consent on the standard consent form approved by the ethical committee.

Surgical Technique
After pre-op medication either sedation or general anesthesia given by post auricular route in all cases. Post-aural wide’s incision given and temporalis fascia graft harvested.

After evaluating middle ear status and ossicular chain randomly autologous (tragal/conchal) (Fig-1-4) or homologous (septal) cartilage harvested. Periosteum incision given and elevated. Septal cartilage procured from vomero-chondrine groove during septoplasty and preserved in 70% alcohol. (Fig—5-6) When it was needed for reconstruction, it was washed in saline and reshaped.

After securing the temporalis fascia and tympanomeatal flaps with underlay technique in both canal wall up and canal wall down procedures, the graft was gently elevating posteriorly and ossiculoplasty done according to ossicular chain status and graft repositioned back after checking cartilage stability. Antibiotic-soaked gel-foam kept in external canal and wound closed.

In case of partial erosion of IS Joint cartilage is placed medial to malleus and long process of incus (Fig.-7,8) whereas in necrosis of IS Joint and cartilage is placed between incus and stapes head which is showed schematcally (Fig.-9) and clinically (Fig-10-11).

Outcome measures
Patients were followed up weekly then every month up to 3 months. Graft uptake status was evaluated after 3 weeks. Audiometric evaluation was done 3 months post operatively. Graft taken up status and retraction pockets were examined by microscopically. No wound dehiscence, stitch abscess or persistent discharge was found postoperatively in either group

Results
A total of up to 50 patients included in the study, 25 patients underwent autologous ossiculoplasty and 25 patients underwent homologous reconstruction.

There was random selection in CSOM type. In this study 6 patients from autologous and 9 patients from homologous group presents with tubo-tympanic disease whereas 19 and 16 from either group presents with attico-antral disease (Fig-12).

Cartilage was used irrespective of middle ear pathology. Autologous cartilage was maximally (32%) used in Malleus, Incus & stapes suprastructure erosion followed by Incus & stapes erosion (20%) and Incus & Malleus erosion (20%). In 60% patients with only Incus erosion homologous cartilage was used followed by IS joint erosion in 16% and Malleus and Incus erosion in 12% of patients (Table-1).

Surgery was done according to pathology. All patients underwent tympanoplasty either alone or in combine approach with cortical or modified radical mastoidectomy. In autologous group maximum 10(40%) underwent MRM while in 7(28%) cortical mastoidectomy was done. In homologous group maximum 16(64%) underwent cortical mastoidectomy whereas in 5(20%) MRM was done. Tympanoplasty was done in 4(16%) patients in either group (Table-2).

In autologous group out of 25, 24(96%) patients had taken up the graft while in homologous group 23(92%) had graft taken up and rest patients had graft failed (Table-3).

In autologous group, 19(76%) out of 25 from atticoantral disease while 5(30%) from tubotympanic disease had taken up the graft. In homologous group 14(56%) from atticoantral disease while 9(36%) from tubotympanic disease had taken up the graft (Table-4).

After 3 months of hearing assessment there was no different in both groups. In autologous group almost 80% patients have improved minimum of 10 dB hearing and maximum of >10 dB hearing whereas in homologous group 88% patients shows the similar results. In autologous ossiculoplasty 20% and in homologous ossiculoplasty 12% patients have failed to improve the hearing and post-operatively their hearing got worsened. Meanwhile failure cases are those who had not taken up the graft (Fig-13 & Table-5).

Discussion
Ossicular deformity is most common cause of conductive hearing loss. Various methods and prosthesis have been used for ossicular reconstruction since decades.

Most of the patients had complaints of ear discharge with decreased hearing with minimum definite 20 dB air bone gap. Majority of patients had central perforation or retraction pockets with ossicular deformity.

In our study graft uptake rate was 96% in autologous group and 92% in homologous group and hearing improvement was 80% and 88% in respective groups. Another study done by Karan S. [5] showed 70% and 68% of hearing improvement in either group with 94% and 92% in respective groups.
Afzal VP et al, study showed 86.6% hearing improvement in both the groups with 97% of overall graft uptake rate. No post-op complications like wound infection, facial palsy, dead ear have occurred in either case.

**Conclusion**

Various grafting materials are used for ossiculoplasty have different outcomes. The choice of graft affects not only the outcome of surgery, but also determines the complexity of the procedure and time taken for the same. Factors responsible for success of surgery are good cartilage placement technique, selection of patients, considering anatomical factors and care to prevent post-operative infection. Both autologous and homologous cartilage have excellent outcomes and gives equivalent results irrespective of age or sex of the patient or middle ear pathology. In both the groups hearing improvement is similar. Subjective hearing is also improved. It is up to surgeons to choose the graft material for ossiculoplasty as both have similar post-op results.

**Bibliography**

6. Afzal VP (2010); Hearing results following canal wall down mastoidectomy in attico-antral disease. RGHU.

**TABLE-1: STATUS OF OSSICULAR CHAIN INTRAOPERATIVELY**

<table>
<thead>
<tr>
<th>Erosion of ossicle</th>
<th>Autologous</th>
<th>Homologous</th>
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<tbody>
<tr>
<td>Only Incus erosion</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Only Stapes suprastructure erosion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Malleus &amp; Incus erosion</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Incus &amp; Stapes suprastructure erosion</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Malleus, Incus, Stapes suprastructure erosion</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>IS Joint dislocation</td>
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<td>4</td>
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**TABLE-2: TYPES OF SURGERY**

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<tr>
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<tr>
<td>Cortical mastoidectomy</td>
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<td>16</td>
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<tr>
<td>With tympanoplasty</td>
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**TABLE-3: GRAFT UPTAKE STATUS**

<table>
<thead>
<tr>
<th>Graft Status</th>
<th>Autologous</th>
<th>Percentage (%)</th>
<th>Homologous</th>
<th>Percentage (%)</th>
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<tbody>
<tr>
<td>Gift taken-up</td>
<td>24</td>
<td>96</td>
<td>23</td>
<td>92</td>
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<tr>
<td>Gift failure</td>
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**TABLE-4: GRAFT UPTAKE STATUS IN DIFFERENT CSOM TYPE**

<table>
<thead>
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<th>CSOM Type</th>
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<th>Percentage (%)</th>
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<tr>
<td>Tubo-tympanic</td>
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<td>30</td>
<td>9</td>
<td>36</td>
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<tr>
<td>Attico-antral</td>
<td>19</td>
<td>76</td>
<td>14</td>
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**TABLE-5: PRE- AND POST-OP PTA COMPARISION AFTER 3 MONTHS**

<table>
<thead>
<tr>
<th>Hearing status</th>
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<th>Homologous</th>
<th>Percentage (%)</th>
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<tr>
<td>Improved</td>
<td>8</td>
<td>32</td>
<td>6</td>
<td>24</td>
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<tr>
<td>Less than 10 dB</td>
<td>12</td>
<td>48</td>
<td>16</td>
<td>64</td>
</tr>
<tr>
<td>----------------</td>
<td>----</td>
<td>----</td>
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<td>----</td>
</tr>
<tr>
<td>Improved &gt; 10 dB</td>
<td>3</td>
<td>12</td>
<td>1</td>
<td>4</td>
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<tr>
<td>Worsened &lt; 10 dB</td>
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<td>2</td>
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</tr>
<tr>
<td>Worsened &gt; 10 dB</td>
<td>2</td>
<td>8</td>
<td>2</td>
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Fig -1: Tragal cartilage harvesting

Fig -2: Tragal Cartilage
Fig. 3: Conchal cartilage Harvesting
Fig. 4: Conchal cartilage

Fig. 5: 70% Alcohol
Fig-6: Septal Cartilage
Fig. 7: Limited partial erosion in incudostapedial joint. M handle of malleus
Fig. 8: Cartilage is placed medial to the handle of the malleus (M) and lateral to long process of the incus.

Fig 9: Necrosis of IS Joint and cartilage is placed between incus and stapes head.
Figure 34: In middle ear, notice the incudostapedial joint (black arrow) connected to the stapes (S) with the stapedial tendon (ST).
FIGURE 35: Trimming the necrotic part of long process of incus with microsurgical scissors.
Figure -10: Erosion of IS Joint

Figure -11: Cartilage placed between malleus and stapes head
Fig – 12: Cartilage used in CSOM types

Fig – 13: Pre- and Post-op PTA comparison after 3 months
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