Endoscopic Cartilage Tympanoplasty

ENDOSCOPIC CARTILAGE TYPANOPLASTY. OUR TECHNIQUE AND EXPERIENCE OF 157 CASES
Muhammad Atif Najam, Urwa Sarwar, Maqbool Raza*, Khalid Azam Khan**, Humaira Saleem, Najm u Saqib Niazi, Muhammad Rashid, Naeem Riaz***
Combined Military Hospital Kharian/National University of Medical Sciences (NUMS) Pakistan, *Combined Military Hospital Multan/National University of Medical Sciences (NUMS) Pakistan, **Combined Military Hospital Lahore/National University of Medical Sciences (NUMS) Pakistan, ***Pakistan Naval Ship Hafeez, Islamabad Pakistan

ABSTRACT

Objective: To assess the graft take rate and hearing gain in trans-canal endoscopic tympanoplasty
Study Design: Descriptive study.
Place and Duration of Study: Pakistan Naval Ship Hafeez, Islamabad Pakistan, form Dec 2015 to Jun 2018
Methodology: All patients with dry central perforations of >3 months history were included in the study. All Patients with perforations of pars tensa were booked for endoscopic cartilage tympanoplasty. All perforations were divided into four types small, medium, large and subtotal or total based on size of the tympanic membrane perforations. Small perforations involving <25% area of Pars Tensa. Medium perforation are Perforations involving 25-50% of Tympanic membrane. Large perforations include Perforations involving 50-75% of pars tensa. Subtotal or total perforations are defined as perforations with >75% perforation of the tympanic membranes. Wet Ears and perforations involving the Pars Flacida were excluded from the study. Preoperative Audiogram was carried out for all patients and A-B Gap were noted for all groups separately so as the demographic data including age and gender. Success was defined as complete closure of Tympanic membrane perforation at 3 months. All patients were operated with 0 Degree 3mm, 14cm rigid endoscope under general anesthesia.
Results: Mean age of patients was. 37 years and standard deviation was 12.34 (range 12-58 years). Out of total 157 cases 81 patients male were males (51%) and 76 patients were females (49%). Out of 157 ears operated 146 Perforations healed completely an overall success rate of 92%. Patients with small perforations had 100 percent success rate whereas near total or total perforations had 86% Success rate. Average preoperative A-B gap was 35 db and Average Postoperative A-B Gap was 15db. Ossicular discontinuity was noted in 34 (21.6%) cases and occlusion of ventilation including obstruction of eusthachian-tube opening was noted in 61 (38%) cases. Average Operative was 67 minutes. Incision scar was visible only in 2 patients 3 months after surgery.
Conclusion: Endoscopic trans canal cartilage tympanoplasty is scarless safe effective procedure with demonstrable tympanic membrane perforation closure rates and hearing gains in all patients with minimum complications. The Technique is single handed and has steep learning curve.

Keywords: Endoscopic ear surgery, Hearing loss, Pars tensa, Tragal cartilage, Tympanic membrane perforation.

INTRODUCTION

Tympanoplasty is defined as removing the disease from the middle ear and reconstructing the tympanic membrane with or without ossiculoplasty.¹ Microscopes are being used for tympanoplasty since the early 1900. The introduction of endoscopes in otological practice has revolutionized middle ear surgery by virtue of not only better visualization but also being able to surgically improve middle ear ventilation pathways that are usually cause of chronic middle ear infections leading to Tympanic membrane perforations.³ Wullstein divided tympanoplasty into five, types where type I is repair of tympanic membrane perforation only. Type II includes ossicular discontinuity tympanic membrane grafted over the incus. InType III Graft is placed directly over the stapes head. Type IV tympanoplasty includes placing the graft over foot plate of stapes. Type V includes repair of tympanic membrane with fixed foot plate of stapes. Various Grafts have been used for repairing the tympanic membrane of which temporalis fascia and tragal cartilage, are the most popular due to easy availability at the site of surgery along with low metabolic rate.² Two techniques have popularly been used in tympanoplasty namely on lay and underlay with equal success rates.³ Traditionally microscopes have been used for tympanoplasty and because of limited field of view and bony canal variations more invasive post aural exposures were used to repair anterior perforations.⁷ Muaz et al created a working group of endoscopic ear surgery

Correspondence: Dr Muhammad Atif Najam, ENT Department, Combined Military Hospital Kharian Pakistan


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1999 started using endoscopes as a single tool for treating middle ear diseases. Endoscopes have the advantage of wider field of view, superior exposure, evaluation and management of complex middle ear anatomy. Endoscopes have an added advantage of addressing the ventilation pathways during tympanoplasty which are difficult to visualize assess and treat with a limited field of view offered by microscopes.

We share our experience of 157 endoscopic cartilage tympanoplasty by far largest series on the subject from Pakistan. We present our technique, success rate, hearing results and ossicular and ventilation abnormalities encountered during surgery. Tragal cartilage was preferred graft because of its availability in adequate quantity from the operative field, natural concavity for reconstructing the tympanic membrane and incision on medial unexposed site of tragus.

**METHODOLOGY**

This Descriptive study was carried out at Pakistan Naval Ship Hafeez Islamabad, from December 2015 to June 2018. A total of 157 cases of endoscopic cartilage tympanoplasty were included in the study.

**Inclusion Criteria:** Patients of both genders over 12 years fit for general anaesthesia were included in the study. All cases with dry perforation in the pars tensa were included in the study. The patients were categorized into 4 groups based on size of perforation. Group A included patients with small sized perforation involving up to 25 percent of pars tensa. Patients in group B had medium sized perforation involving 25-50% pars tensa. Group C had 50-75 perforation in the pars tensa and group D had near total perforation with only rim of pars tensa intact. Preoperative Audiogram was done for all cases and A-B Gap noted.

**Exclusion Criteria:** All cases with active discharge, involvement of pars flacida were excluded from the study. Endoscopic tympanoplasty was performed using a 0 Degree 3mm 14 cm rigid endoscope with 3chip Camera and medical grade monitor. Tragal cartilage was harvested using a 2-3 cm incision on the medial side of tragus. Skin elevated on both sides of the cartilage. Adequate sized cartilage was harvested sparing a superior rim of cartilage to prevent cosmetic deformity at the tragus. Cartilage was harvested with perichondrium on both sides. Perichondrium on the lateral side was stripped of and prepared as a separate graft. Incision was closed with 5/0 prolene sutures. 1% Lignocaine with adrenaline Local anaesthesia was infiltrated at 6° clock and 12° clock position at the junction of cartilaginous and bony canal with and insulin syringe under endoscopic vision. Margins of perforation freshened with sharp curved needle. Canal incision was made 5mm from the bony annulus from 6-12° clock position. Tympanomeatal flap was elevated with help of Rosen knife. Fibrous annulus and chorda tympani identified and middle ear mucosa incised using curved needle. Tympanomeatal flap lifted of the handle of malleus and flap reflected superiorly. Four quadrant middle ear examination done with 0 and 30 degree endoscopes. Opening of eustachian tube, processus cochleiformis, anterior and posterior ventilation pathways, sinus tympani and ossicles examined. Ossicular status and mobility noted. Middle ear bed was prepared with gelfoam and full thickness tragal cartilage cut to appropriate size with sculptured groove for handle of malleus placed via underlay technique the side of cartilage denuded of perichondrium facing laterally. Perichondrium graft placed over the cartilage. Tympanomeatal flap repositioned and external auditory canal filled with gelfoam and packed with small bismuths examined Fat from ear lobule was harvested from a small posterior incision for sealing the stapedotomy and wound was closed with 5/0 prolene sutures. Transcanal approach was used for all cases. Canal incisions were made at 12-6° clock and tympanomeatal flap was elevated chorda tympani was identified middle ear entry was made. Posterior bone removal was done with a curette or micro drill. Pyramidal process, Stapedius tendon, facial nerve stapes supra structure and foot plate was exposed. Stapedius tendon was divided with micro scissors (Figure-1). Incudo-stapedial joint was divided with joint knife. Crurotomy and stapedotomy was done with 0.7mm diamond burr using a stapes drill (Figure-2). Footplate distance from the incus was measured and appropriate size Teflon piston 0.6mm diameter was placed in the stapedotomy (Figure-3). Piston position and mobility was confirmed with bending sign (Figure-4) and round window reflex. Fat graft was placed around the piston to seal stapedotomy (Figure-5). Tympanomeatal flap was repositioned and spongostan was filled in the external auditory canal. Operative time was noted from start of transcanalectomy’s to repositioning of tympanomeatal flap. and Postoperative facial nerve function and nystagmus was documented. Post operative follow up was done after 2, 4 and 12 weeks. Postoperative audiogram was carried out at 12 weeks along with confirmation of graft take and rejection. Ossicular and middle ear ventilation pathway abnormalities noted along with total operative time. Ossiculoplasty was done in all patients with ossicular discontinuity. Remanent incus or teflon
prosthesis were used for ossiculoplasty. Presence of visible scar with naked eye at 3 months was also noted. All data was entered in SPSS and mean was calculated for Age, Gender, A-B Gap, operative time, success of graft uptake middle ear abnormalities and visible scar was calculated.

Figure-1: TM perforation with 6-12\textdegree clock incision marked.

Figure-2: Malleus denuded and ossicular integrity checked.

Figure-3: Cartilage graft placed with slit for malleus.

Figure-4: Perichondrium graft placed and tympanomeatal flap repositioned.

Figure-5: Healed Tympanic membranes in three of our patients.

Figure-6: Intraoperative incudo-stapedial discontinuity.

Figure-7: Preoperative and postoperative audiogram in a patient with ossicular reconstruction.
RESULTS

Total 157 patients were included in the study. Mean age of patients was 37 years and standard deviation was 12.34 (range 12-58 years). Out of 81 were males and 76 females. Among the 157 patients operated 17 (10.82%) had small, 42 (26.75%) medium, 69 (43.9%) large and 29 (18.4%) had subtotal or near total tympanic membrane perforation. Preoperative Average Air bone gap was 35 db. Tympanic membrane closure rate was 17 (100%) for small, 40 (95%) for medium, 64 (92%) for large and 25 (86%) for near total and total perforations. Over all 146 (93%) patients had complete tympanic membrane closure seen in our series. Out of 39 (24.8%) patients had ossicular discontinuity out which 23 (14.64%) patients had necrosis of long process of incus, 10 (6.3%) patients had necrosis of supra-structure of stapes and 6 (3.8%) patients had necrosis of handle of malleus. Four (2.57%) patients had sclerosis involving the stapes suprastructure, incus and foot plate. A total of 49 (31%) patients had blockage in the ventilation pathways. The Ventilation pathway pathologies included granulations in the anterior and posterior isthmuses and fibrous bands obstructing the eustachian tube ope-ning. Postoperative average A-B gap was 13 db. Of 72% patients had >20 db of A-B Gap reduction, 18% patients had 12-15 db of A-B Gap closure where as 10% patients had <10 db of A-B Gap reduc-tion. Mean operative time was 62 minutes.

DISCUSSION

Traditionally tympanoplasties have been performed with microscopes.2 Endoscopes is the latest tool for surgical management of middle ear pathologies. Endoscopic tympanoplasty has rapidly gained popularity among ENT surgeons because of better visualization of middle ear anatomy, completely trans-canal approach, no need for canaloplasty in most cases and avoidance of endaural and post-aural incisions. Tragal cartilage is a robust graft for middle ear reconstruction. Initially was reserved for total perforations and revision surgeries but currently its being used for primary tympanoplasties for its better take rates and hearing gains.9 Tragal cartilage is a favored graft for endosco-pic ear surgeons for the reason its easy to handle with a single hand technique and readily available in operative site along with better cosmetic result. Success rate of endoscopic tympanoplasty has been reported between 90-98% depending on the size and site of perforations.10 Our study has reported an overall success rate of 92% with 100% success rate for small perforations and 86% for total perforations. Our results are similar to quoted by choi et al,11 and Nausheen et al, in their studies.12 The mean operative time for endoscopic ear surgery has been reported between 50-65 minutes.13-14 Operative time in our study was 62 minutes. Tragal cartilage is associated with good hearing results. Many studies have quoted significant hearing gains with full thickness tragal cartilage owing to its natural curvature for use in middle ear and average 5mm thickness.15 Our study also has shown 90% patients having more than 12 db A-B gap closure suggesting a perceptible hearing gain. Vershney et al16 reported 7.7% incidence of ossicular injury in mucosal type of chronic suppura-tive otitis media. In our study 24.8% patients had ossic-u lar discontinuity of which commonest was necrosis of long process of incus similar to reported by vershney et al.16 Middle ear ventilation has been described in detail by tarabichi and marchioni,17-18 and addressing the ventilation pathways is mandatory for a successful middle ear surgery. In 31% of our patients we noticed an obstruction in the ventilation pathways of the

Table: Perforation closure and hearing gain.

<table>
<thead>
<tr>
<th>Size of Perforation</th>
<th>Total Cases</th>
<th>Males</th>
<th>Females</th>
<th>Complete Closure</th>
<th>Average Pre-Operative A-B Gap</th>
<th>Average Post Operative A-B Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>17</td>
<td>11</td>
<td>6</td>
<td>17(100%)</td>
<td>10 db</td>
<td>08 db</td>
</tr>
<tr>
<td>Medium</td>
<td>42</td>
<td>22</td>
<td>20</td>
<td>40(95%)</td>
<td>15 db</td>
<td>10 db</td>
</tr>
<tr>
<td>Large</td>
<td>69</td>
<td>35</td>
<td>34</td>
<td>64(92%)</td>
<td>25 db</td>
<td>10 db</td>
</tr>
<tr>
<td>Total/Near Total</td>
<td>29</td>
<td>13</td>
<td>16</td>
<td>25(86%)</td>
<td>30 db</td>
<td>15 db</td>
</tr>
</tbody>
</table>

p

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time minimal scar. Endoscopic ear surgery has evolved as future of otological surgical practice.

Conflict of Interest: None.

Authors’ Contribution
MAN: Operating surgeon, data collection, US: Data collection, data entry, discussion writing, MR: Data collection, KAK: Data collection and results, US: Data collection, data entry, discussion writing, NN: Results compilation, MR: Discussion and results compilation.

REFERENCES