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Palisade vs. composite double island techniques in cartilage-supported myringoplasty

Vishal Sharma[1], Shiwani Rai[2], and Brijesh Sathian[3].

[1]Associate Professor & HOD, Department of Otorhinolaryngology & Head Neck Surgery, Manipal College of Medical Sciences & Teaching Hospital, Pokhara.
[2]Lecturer, Department of Otorhinolaryngology & Head Neck Surgery, Manipal College of Medical Sciences & Teaching Hospital, Pokhara.
[3]Assistant Professor, Department of Community Medicine, Manipal College of Medical Sciences & Teaching Hospital, Pokhara.

ABSTRACT

Temporalis fascia is prone to atrophy over time without support. Cartilage supported myringoplasty is a reliable technique for closure of tympanic membrane perforation, even under difficult conditions. Objective of the study was to compare the results of cartilage-supported myringoplasty between palisade and composite double island cartilage techniques. It was a prospective study done in Manipal Teaching Hospital, Pokhara; a tertiary referral centre. This study comprises of 46 patients who underwent cartilage-supported myringoplasty between January 2012 and December 2014. Only patients with large or subtotal central perforations were chosen. They were divided into 2 groups according to the surgical technique used. Group A: Cartilage palisades supporting tragal perichondrium graft. Group B: Perichondrium-cartilage composite double island graft harvested from tragal cartilage. Results in the 2 groups were assessed by comparing the closure of tympanic membrane perforation and change in the pre-operative to post-operative average air bone gap after 6 months. Statistical Package for Social Sciences (SPSS) version 16.0. Statistical significance was set at $p<0.05$. 76.2 % patients had an intact tympanic membrane graft in group A while 100% patients in group B ($p = 0.01$). A successful hearing outcome with a post-operative average air-bone gap of $\leq$ 10 dB was seen in 76.2% patients in group A and 72% patients in group B ($p = 1.0$). Cartilage-supported myringoplasty gives good results even in large and subtotal central perforations. Perichondrium-cartilage composite double island graft has a much better and statistically significant perforation closure rate compared to cartilage palisades technique especially for subtotal perforations. Hearing results for both techniques are similar with no statistically significant difference.

Keywords: cartilage-supported myringoplasty, composite double island, palisade

Corresponding author

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BACKGROUND

Unlike temporalis fascia, which is prone to atrophy [1], cartilage has proved to be a reliable material for closure of the tympanic membrane, even under difficult conditions. Cartilage is well incorporated with tympanic membrane layers, provides firm support to prevent retraction, is easy to work with and it can resist deformation from pressure variations. Cartilage has a very low metabolic rate and receives its nutrients by diffusion [2]. Cartilage maintains its rigid quality and resists reabsorption and retraction even in the cases of severe Eustachian tube dysfunction [3].

Indications for cartilage tympanoplasty are: [3]

1. Total and subtotal perforations.
2. Perforations with tympanosclerotic plaques.
3. Perforation with atrophic membranes.
4. Revision surgery for failed myringoplasty or tympanoplasty type I, II, III.
5. Anterior and inferior perforation with tubal discharge.
6. Retraction pockets.
7. Partially or completely atelectatic tympanic membranes.
8. Tympanic adherences.

Tragal cartilage was chosen in the current study owing to its relatively flat shape as opposed to the concave nature of conchal cartilage. Perichondrium-cartilage composite double island technique and cartilage palisade technique are the two of the many methods used to surgically prepare cartilage for cartilage-supported myringoplasty.

MATERIAL AND METHODS

This study comprises of 46 patients who underwent cartilage-supported myringoplasty performed at Manipal Teaching Hospital, Pokhara between January 2012 and December 2014. The study was performed after approval from the institutional review board at our hospital and taking written, informed consent from all the patients.

Inclusion criteria for the study

- Patient suffering from unilateral chronic suppurative otitis media, tubo-tympanic (mucosal) type with no ear discharge for at least 3 months.
- Presence of large size central perforation of tympanic membrane.
- Presence of subtotal size central perforation of tympanic membrane.
- Conductive hearing loss of $\leq$ 40 dB.
- Underwent cartilage-supported myringoplasty using cartilage palisades or composite double island technique.
- Minimum follow up period of 6 months after the surgery.
- Patient aged between 12-45 years to remove age bias.

Exclusion criteria for the study

- Presence of sensorineural & mixed hearing loss in operated ear before surgery.
- Revision myringoplasty or previous ear surgery in operated ear to remove the bias of revision surgery on the results.
- Active focus of infection in nose, paranasal sinuses or throat not responding to treatment.
- Presence of migrated squamous epithelium or cholesteatoma in middle ear.
- Patients with any congenital anomalies like cleft lip or cleft palate.

Originally 50 patients were enrolled for this study. The patients were randomly chosen for 2 different techniques of cartilage-supported myringoplasty. Accordingly they were divided into 2 groups: A. Cartilage palisades method. B. Perichondrium-cartilage composite double island method. However 4 patients were

excluded later as they did not come for follow-up. Thus, 46 patients were left in the study with 21 in group A and 25 in group B.

Surgical technique

All surgeries were done under general anesthesia. In all patients the tympanic membrane perforation margin was freshened with a sickle knife and its undersurface was scored with a circular knife. Rosen's permeatal incision was made on posterior canal wall from 12 o'clock to 6 o'clock position. Tympano-meatal flap was elevated using the circular knife for performing underlay myringoplasty. A thin slice of gel foam was put in the middle ear to support the cartilage. Tragal cartilage along with its perichondrium was harvested. For the palisade technique, perichondrium on one side of the cartilage was elevated and separated to be used as a graft. The cartilage with attached perichondrium on one side was then cut into 9-10 slices (Figure 1). Full thickness tragal cartilage palisades with attached perichondrium on the canal facing side were placed in the middle ear in an overlapping fashion. Absence of perichondrium on the side facing middle ear prevents adhesions with the middle ear mucosa or ossicles. No attempt was made to make the cartilage thin as we do not have a cartilage slicer and an attempt to thin the cartilage with a scalpel knife caused twisting of the cartilage. The perichondrium graft was placed over the cartilage palisades plus handle of malleus and then under the elevated tympanomeatal flap on the posterior canal wall. For the composite double island technique, perichondrium was elevated on one side of the cartilage but not separated. A 2 mm central longitudinal strip of cartilage was removed to accommodate the handle of malleus and create the perichondrium-cartilage composite double island graft (Figure 2). The creation of cartilage double islands in this manner enables the reconstructed TM to bend into a normal conical shape. An additional triangular piece of cartilage was removed from the posterior-superior quadrant to accommodate the incus. This perichondrium-cartilage composite double island graft was then placed in the middle ear with cartilages facing inside, with the perichondrial graft placed posteriorly under the elevated tympanomeatal flap. In both groups, packing of external auditory canal was done with gel foam pieces followed by closing of incision and application of mastoid dressing.

Figure 1: Tragal perichondrium + cartilage palisades

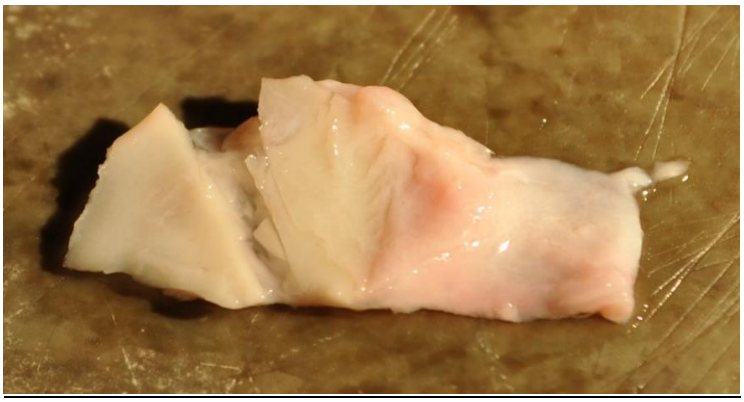

Figure 2: Perichondrium-cartilage composite double island graft

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After hospital discharge, the patients were reviewed in the OPD at 1 week, 2 weeks, 4 weeks, 3 months and 6 months. During these visits, assessment was done by otoscopic examination. The hearing assessment was performed at the 6-month visit. Results in the 2 groups were assessed at 6 months by comparing the closure of tympanic membrane perforation and post-operative average air-bone gap. Average air-bone gap was calculated during pure tone audiometry by the difference in the mean thresholds of air conduction and bone conduction at 500, 1000 and 2000 Hz. An intact tympanic membrane in normal position and $\leq$ 10 dB air-bone gap were considered as successful outcome. All results were analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. Statistical significance was set at a 2-sided p value <0.05.

RESULTS

Of the 46 patients in our study, 18 were males and 28 were females. The mean age was 23.91 years (sample standard deviation 8.83). The mean follow-up was 9.23 months for the palisade group and 9.6 months for the composite double island group. The results of graft uptake at 6 months after surgery are shown in table 1. 76.2 % patients had an intact tympanic membrane graft in group A while 100% patients in group B. Thus the success rate in group B was much better and this finding was statistically significant (P value = 0.01). The overall perforation closure in 46 patients was 89.1%. All the 5 cases of residual perforation in group A were patients who had subtotal perforation. The residual perforations were closed by 20% silver nitrate chemical cautery and no revision surgery was required.

Table 1: Tympanic membrane graft status at 6 months

Tympanic membrane graft status at 6 months	Cartilage palisades		Composite double island	
	Number of cases	%	Number of cases	%
Intact	16	76.2	25	100
Residual perforation	5	23.8	0	0
Total	21	100	25	100
P value by Chi-square (Fisher's exact) test = 0.015				

Table 2: Mean gain in average air-bone gap 6 months after surgery

	Sample size	Mean gain in average air-bone gap (dB)	Sample standard deviation
Cartilage palisades	21	19.28	4.73
Composite double island	25	18.52	3.66
P value by independent samples T-test = 0.549			

Table 3: Post-operative average air-bone gap categories at 6 months

Post-operative average air-bone gap category	Cartilage palisades		Composite double island	
	Number of cases	%	Number of cases	%
$\leq$10 dB	16	76.2	18	72
11-20 dB	5	23.8	7	28
Total	21	100	25	100
P value by Chi-square (Fisher's exact) test = 1.00				

The mean gain in average air-bone gap 6 months after surgery in groups A and B were 19.28 dB and 18.52 dB respectively (P = 0.54) as shown in table 2. Table 3 shows the post-operative average air-bone gap categories at 6 months. A successful hearing outcome with a post-operative average air-bone gap of $\leq$ 10 dB was seen in 76.2% patients in group A and 72% patients in group B. (P value = 1.0). Thus the comparative hearing results between the 2 groups, as shown in tables 2 and 3, were similar though this finding was not statistically significant. The overall successful hearing result in 46 patients was 73.9%. There was no case of mixed hearing loss, sensorineural hearing loss or dead ear as a result of surgery.

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DISCUSSION

The cartilage palisades technique in reconstructive middle ear surgery was introduced by Heermann[4] in 1970. Cartilage strips with perichondrium preserved on the outer surface were placed parallel to the malleus until the middle-ear cavity was covered. Overbosch[5] described a microslice technique using septal cartilage to improve the acoustic properties of the reconstructed tympanic membrane. Murbe et al[6] also described a modified cartilage plate technique, with several thin cartilage slices overlapping at their edges, like the petals of a tulip blossom. The cartilage part of the composite cartilage perichondrial graft has been cut into the shape of a shield[7], single double island cartilage-mat[8] wheel[9], coin with butterfly edges[10], crowncork [11] and double islands[12] by authors before. Mirko Tos[3] described 23 cartilage tympanoplasty methods and proposed a classification with six main groups.

Simple myringoplasty (without using cartilage) results at our hospital over the past 3 years for medium and large size central perforations are 81.1% for perforation closure and 77% for post-operative pure tone average $\leq$ 10 dB. This has been reported in a different study that has been sent for publication. The same results for cartilage-supported myringoplasty in large and subtotal perforations are 89.1% and 73.9% respectively in this study. Thus the use of cartilage has not significantly reduced the hearing results in reconstruction of tympanic membrane perforation.

This study compares the cartilage palisades and composite double island techniques for cartilage-supported myringoplasty. 76.2 % patients had an intact tympanic membrane graft in palisade group while 100% patients in composite double island group in this series. A successful hearing outcome with a post-operative average air-bone gap of $\leq$ 10 dB was seen in 76.2% patients in palisade group and 72% patients in composite double island group in this series. Dornhoff[12] reported no significant differences in gains in auditory function in patients who had a cartilage-perichondrium grafting compared with patients who had grafts of perichondrium alone. Following perichondrium-cartilage composite graft tympanoplasty, Levinson[13] reported that 65% of his patients had closure of the air-bone gap to within 10 dB and 86% to within 20 dB. Milewski[14] reported use of perichondrium-cartilage composite grafts in 197 type 1 tympanoplastic procedures. Closure of the eardrum perforation was successful in 92% procedures. An air-bone gap of less than or equal to 30 dB was obtained in 92.4% procedures. Khan et al[15] reported shield cartilage supported myringoplasty using sliced tragal cartilage–perichondrium composite graft with an overall success rate of 98.20% in terms of perforation closure and air bone gap closure within 7.06 ± 3.39 dB.

Gierek et al[16] performed myringoplasty and myringoplasty in 112 cases with cartilage and 30 cases with temporalis fascia alone. They observed that there was no significant hearing difference between the two groups. Couloigner et al[17] reported 59 cartilage graft tympanoplasties and 20 temporalis fascia tympanoplasties with no postoperative hearing difference between the two groups.

CONCLUSIONS

Cartilage-supported myringoplasty gives good results even in large and subtotal central perforations. Perichondrium-cartilage composite double island graft has a much better and statistically significant perforation closure rate compared to cartilage palisades technique especially for subtotal perforations. Hearing results for both techniques are similar with no statistically significant difference.

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