Nasal septal perichondrium versus temporalis fascia in transmeatal myringoplasty

Moustafa Hammad, Mohammed Gomaa *

Department of Otolaryngology, El-Minia University, Egypt

Received 25 December 2010; accepted 27 March 2011
Available online 23 June 2011

Abstract

Objective: The aim of this study was to compare between nasal sepal perichondrium and temporalis fascia in surgical repair of tympanic membrane perforation.

Patients and methods: A prospective study was done on 40 patients from the out-patient clinics of otorhinolaryngology department of El-Minia University Hospital with ages ranging between 18 and 54. All patients had a persistent, symptomatic tympanic membrane perforation, and 20 patients out of 40 had nasal obstruction due to nasal septal deviation. All patients were scheduled for myringoplasty by a transmeatal approach in combination with septoplasty – for the patients with deviated nasal septum – under general anesthesia. In 20 patients, nasal septal perichondrium was taken and used as a graft for transmeatal myringoplasty. In the remainder 20 patients, myringoplasty was done by using temporalis fascia as a graft.

Results: Sixteen out of 20 patients (80%) nasal septal perichondrium grafts were successfully uptaken. In temporalis fascia group, 17 out of 20 (85%) perforations had been successfully closed. As regards hearing, all patients of both groups had more than 5 dB HL improvement in conductive...
hearing thresholds of at least three frequencies. An overall success rate of 92% was recorded in terms of hearing improvement. No significant differences were present between both groups as regards healing and hearing improvement.

**Conclusion:** In patients with simultaneous myringoplasty and septoplasty nasal septal perichondrium was better to be used as a graft material for repair of tympanic membrane perforation to avoid the post-auricular incision to obtain temporalis fascia. In addition, nasal septal perichondrium has other advantages, it is easily accessible, cost-effective, time saving and is sufficiently large.

© 2011 Egyptian Society of Ear, Nose, Throat and Allied Sciences.
Production and hosting by Elsevier B.V. All rights reserved.

1. **Introduction**

When tympanoplasty is to be performed on a patient suffering from chronic otitis media, in general potential interactions between middle ear mucosa, Eustachian tube (ET) function, and the nose are considered. It is noted that poor tubal function goes along with a diminished success rate of tympanoplasty and pathological findings in the nose are often said to be responsible for inadequate tubal function. Consequently, surgery of the nose is preferred to be performed before tympanoplasty if septal deviation is observed on a patient with chronic otitis media.1

One of the main factors affecting the success of myringoplasty is the type of the graft that is used. In modern otology, autografts, including many body tissues like fascia of the temporalis muscle, perichondrium, and cartilage are most commonly used in tympanoplasty as a transplant for covering tympanic membrane defects. All of these grafts are not only easily harvested and inexpensive, but also they have excellent properties of regeneration, and do not involve any immunological problems.2,3 Up to now, many attempts have been made to investigate the most ideal graft for optimal repair of the tympanic membrane perforation. For the same purpose, we describe our experience of using nasal septal perichondrium in myringoplasty. Myringoplasty with septoplasty, in accordance with the principles of minimally invasive surgery, was done at the same session, and the results of myringoplasty in terms of graft uptake and hearing improvement were evaluated postoperatively.

2. **Patients and methods**

This prospective study was performed between March 2006 and January 2009, in otolaryngology department in El-Minia University Hospital and the study group consisted of 40 adult patients with tympanic membrane (TM) perforation without otorrhea. The study protocol was approved by the Local Ethics Committee and informed consent of each patient was obtained before surgery. All of the patients had a persistent, symptomatic TM perforation due to chronic otitis media (COM), and symptoms of nasal obstruction at the same time in only 20 patients. TM perforations were dry at least for the last 3 months. Each patient was assessed with clinical examination and transnasal endoscopic examination, and then the Eustachian tube was examined. To establish the site and size of the perforation, the TM and the tympanic cavity were examined carefully by microscope. The classification of TM perforations according to Tos4 namely anterior, inferior, posterior, and total or subtotal perforations was used. TM perforations with diameters that are less than 3 mm, and TM perforations with diameters in between 3 and 6 mm were regarded as small and medium in size, respectively. A pure tone audiogram was performed preoperatively just a couple of days before the operation. Threshold measurements were performed in a sound proof room that satisfied ISO/DIS 8253 requirements. Audiologic tests were applied by using Interacoustics AC-40 clinical audiometer for the conventional pure tone audiometry for frequency ranges 0.25–8 kHz.

The 40 patients of the study were classified into 2 groups:

**Group A (20 patients):** In this group, grafting of TM perforations were done by nasal septal perichondrium obtained from the same patients while doing the septoplasty.

**Group B (20 patients):** In this group, grafting of TM perforations were done by temporalis fascia.

2.1. **Nasal septal perichondrium**

While septoplasty was being performed, the nasal septal perichondrial graft was taken. While elevating the mucoperichondrium, the perichondrium was left and then this remaining part was elevated from the cartilage and dissected (Figs. 1–3).

**Figure 1** Nasal septal prichondrium taken from left nasal side of a male patient.
2.2. Transmeatal myringoplasty

Later myringoplasty was performed through a posterior transmeatal approach with a Rosen incision, using underlay technique. The technique was used in patients only when the width of the external canal was sufficient to make surgery in a fashion of transcanal tympanotomy. First, the edges of the perforation were freshened and then the formation of a posterior tympanomeatal flap and the detachment of the tympanic remnant from the posterior part of the Rivinus notch and from the malleus handle were performed. In group A ($n = 20$), a sheet of nasal septal perichondrium, trimmed to a size roughly 2 mm larger in diameter than the perforation, was placed through the tympanomeatal flap under the ear drum remnant and positioned over the malleus handle in order to gain better stability for the graft. In group B ($n = 20$), temporalis fascia was used instead of nasal septal perichondrium for grafting of TM and the graft was placed by the same method. The tympanic cavity was filled with sponge gel, followed by the placement of the sponge gel balls placed over the tympanic membrane, and lastly the external ear canal was dressed appropriately.

2.3. Follow-up

Patients were seen within 2–5 days for removal of the silastic nasal splints and within 10 days post-operatively for removal of the external ear canal dressings in the out-patients departments. Regular follow-ups of the patients were done monthly. Mostly, 3 months after the operations, pure tone audiograms were recorded and the main outcome measures were as follows: (1) graft survival, (2) hearing gain and closure of the air-bone gaps (ABG), and (3) presence or absence of discharge. An intact graft at the end of the third month and the mean hearing improvement more than 5 dB HL in three consecutive frequencies in the range of 0.5, 1, 2, and 4 kHz in tonal audiometry were considered as a success.

The statistical analysis was carried out using SPSS 10.0 statistical package programme. The mean values and standard deviations of the age, pre- and postoperative air bone gaps were calculated. Comparisons of the audiometric changes between pre- and postoperative ABGs in the whole study population and in the two groups were done by the paired samples $t$ test and Wilcoxon Signed Ranks tests. $P < 0.05$ was considered meaningful.

3. Results

There were 16 male and 24 female patients aged between 18 and 53 with a mean of 35.96 ± 12.8. There were 19 left and 21 right TM perforations. All the TM perforations that are observed were sized between 2 and 5 mm roughly in diameter, and all of them were limited to posterior and inferior quadrants. There were 15 small and 25 medium size perforations at the inferior and posterior quadrants. Due to the absence of anterior and superior perforations, it was impossible to compare TM perforations of all of 4 quadrants with each other. None of the patients had ear surgery before on the same ear, and there were no tympanic cavity or ossicular chain defects at the time of the operation. All of the middle ear mucosa was normal and there were no discharges at least for the last 3 months before the operations. Twenty patients had septal deviations, which obstruct the nasal passages moderately. There were no postoperative complications, and all of the nasal septal mucosa was healthy at the follow-up visits.

3.1. Myringoplasty success rate

The success rate was defined by successful graft uptake. In the nasal septal perichondrium group, 16 out of 20 (80%) grafts were successfully uptaken, 4 perforations failed to close with central necrosis due to infection. In temporalis fascia group, 17 out of 20 (85%) grafts had been successfully uptaken, only one perforation failed to close with central necrosis due to infection. No significant difference was found between both groups as regards the success rate (Table 1).
3.2. Myringoplasty details and complications

The operating time in the nasal septal perichondrium group ranged from 15 to 20 min (with mean value 16.2 ± 2.65) and that of the temporalis fascia group ranged from 30 to 45 min (with mean value 34.6 ± 4.2). A significant difference was found between both groups (Table 2).

Postoperative graft infection with central necrosis occurred in 7 cases in nasal septal perichondrium group (20%) and 3 in temporalis fascia group (15%).

3.3. Hearing results

The mean preoperative air conduction thresholds at 250–8000 Hz was 17.8 dB for the nasal septal perichondrium group and 16.5 dB for the temporalis fascia group. The mean preoperative air-bone gap (ABG) was 26.1 and 25.8 dB for the nasal septal perichondrium group and the temporalis fascia group, respectively.

After operation, the hearing gain for the average air conduction thresholds at 250–8000 Hz was 13.3 and 13.4 dB for nasal septal perichondrium and temporalis fascia groups, respectively. The mean postoperative air-bone gap, calculated as the difference between postoperative air and bone conduction (500–4000 Hz), was nearly equal in both groups (Table 3), with no significant difference. Closure of air-bone gap to within 10 dB was achieved in 15% of patients in nasal septal perichondrium group as compared to 20% of patients in temporalis fascia group with no significant difference between both groups (Table 4).

4. Discussion

For decades, it is known that ET dysfunction occurs in patients with deviation of the nasal septum frequently and septoplasty before tympanoplasty is recommended in cases of severe nasal pathology. In their study, Maier and Krebs, declared that tympanoplasty could be performed after several months following septoplasty if it really necessitates, although they had observed no positive effect of septoplasty to the tubal function. Conversely, in another study investigating the effect of nasal surgery on ET function and middle ear ventilation, postoperative tubal function tests were found significantly better than preoperative ones, and the majority (95%) of the patients that were examined in the study reported a postoperative improvement of ear fullness sensation 1 month after the surgery. In the past, when classical intranasal packings were being used, nasal surgery would have had negative effects on ET functions, but nowadays most surgeons prefer nasal septal suturing or nasal septal splints which do not worsen ET functions. In a study comparing the intranasal packing and nasal septal suturing, although a statistically significant increase in the middle ear pressure was observed in the first group, there was not any improvement in the second group. During myringoplasty, due to the fact that the middle ear cavity is fulfilled with the sponge gel balls which do not dissolve by and large before the first month, the patients may suffer normally some degree of fullness. In our study, because of patients subjectively had no ear complaints related with septoplasty, we may conclude that myringoplasty with septoplasty should be performed simultaneously. The ideal graft material for the management of TM perforation should be thin, elastic, intact, and free on each surface. The perichondrium has been successfully used in tympanoplasty for approximately half a century. In 1964, Goodhill et al. introduced the use of tragal perichondrium together with tragal cartilage and Salen was the first who used nasal septal cartilage as a graft material. Autologous nasal mucosa was noted as it is prepared easily and can be used as a transplant for covering tympanic membrane defects. Perichondrium, which surrounds almost all cartilaginous structures of the head and neck, is a well-known reservoir for mesenchymal stem cells and is capable of sealing

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The success rate in both groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success rate</td>
<td>Nasal septal perichondrium group (n = 20)</td>
</tr>
<tr>
<td>Number of successful grafts</td>
<td>16/20</td>
</tr>
<tr>
<td>Central necrosis</td>
<td>4/20</td>
</tr>
<tr>
<td>Success rate</td>
<td>80%</td>
</tr>
<tr>
<td>$P$ value</td>
<td>$&gt;0.05.$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>The mean myringoplasty operating time in both groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The operating time (min)</td>
<td>Nasal septal perichondrium group (n = 20)</td>
</tr>
<tr>
<td>Range</td>
<td>15–20</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>16.2 ± 2.65</td>
</tr>
<tr>
<td>$P$ value</td>
<td>$&lt;0.001.$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Mean values of pre- and postoperative air-bone gap (ABG) in both groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-bone gap</td>
<td>Nasal septal perichondrium group (n = 20)</td>
</tr>
<tr>
<td>Preoperative</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>26.1</td>
</tr>
<tr>
<td>SD</td>
<td>0.8</td>
</tr>
<tr>
<td>Postoperative</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>13.0</td>
</tr>
<tr>
<td>SD</td>
<td>0.71</td>
</tr>
</tbody>
</table>
defects with dividing cells. Hence, septal perichondrium being a part of elastic cartilage can afford all these prerequisites. After 3 months of operations all of the septal mucosa and TMs, except two of them, were microscopically intact and well in the structural continuity in our study. There was a statistically significant reduction in the mean of ABGs following myringoplasty, and there were only three ears, which had minimal perforation. The mean hearing improvement in conductive hearing thresholds postoperatively (at 0.5, 1, 2, and 4 kHz) was 11.52 dB HL, which compares favorably with other series. Nasal septal perichondrium has several advantages; it is easily accessible when performing septoplasty and sufficiently large for almost total perforation of TM and has a good chance of postoperative survival. The comparison of perichondrium and cartilage grafts for reconstructing the tympanic membrane showed that there was no significant difference between them. We have observed that the nasal septal perichondrium is very thin and transparent, and survive easily, besides it becomes very strong and transparent after healing (Fig. 3. The septal perichondrium is made up of a homogeneous dense layer containing collagen and elastic fibers, and its thickness is approximately 150–200 μm. The collagen of type I and II are not present in the perichondrium. It was noted that the age of the patient, the site and size of the perforation, the status of the middle ear mucosa, function of the Eustachian tube, smoking, the type of anesthesia, the surgical technique, and the type of grafts were significantly related to the outcome of the operation. The principal postoperative failures in tympanoplasty are reperforation of the eardrum, formation of retracted pockets, iatrogenic cholesteatomas, anterior blunting, lateralization, and thickening of the graft. Of them all, the most frequent failure in myringoplasty was reported as reperforation. In the literature, while some authors have suggested that the size of the perforation affect the success rate of tympanoplasty, others have reported conversely. There has been a long debate over whether myringoplasty should be offered to patients to improve hearing and it was noted that myringoplasty alone is not good operation to improve hearing. Success rate of different myringoplasty operations in terms of audiologic improvement and graft uptake were quoted as 57.4–97% approximately. Postoperative hearing loss was not observed in any cases. We did not see any formation of retracted pockets in our cases, and we believe that the structural power of the perichondrium prevents the autograft subsiding into the middle ear. The site and size of perforation were noted as playing no particular role in either graft uptake or in hearing improvement. In contrast, the site of the perforation was noted as having a significant effect on outcome because anterior perforations had less success rate than that of the posterior ones. In our study, because the tympanic membrane perforations were located in posterior and inferior locations, much improvement in conductive hearing loss should be expected. Closure of small perforations result in greater hearing improvement in conductive hearing loss should be expected. In our study, because the tympanic membrane perforations were located in posterior and inferior locations, much improvement in conductive hearing loss should be expected. Closure of small perforations result in greater hearing improvement following myringoplasty. In the analysis of our results, graft survival and the long-term results of improvement in hearing are satisfactory.

References