

The role of simple office-based surgery in small central tympanic membrane perforation

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Objective

The aim of this study was to evaluate the outcome of simple office-based surgery in small central tympanic membrane (TM) perforation.

Background

The purpose of closure of TM perforations is to restore the continuity of the TM in order to improve hearing and decrease the risk of middle ear infections. Rapid and cost-effective procedures like chemical cauterization and fat plug myringoplasty have been found to be effective in healing small central perforations with significant hearing improvement.

Patients and methods

Our prospective study was carried out on 40 patients aged more than 15 years with dry small central persistent perforation during the period spanning from April 2017 to March 2018, divided in two groups: group A (20 patients underwent fat graft myringoplasty) and group B (20 patients underwent chemical cautery of the edge of perforation).

Results

Our study included 26 male patients and 14 female patients; the mean age was 27.2 ±9.3 years. Our study showed a 70% success rate in the healing of TM perforation in group A while there was a 55% success rate in group B.

Conclusion

From our study, we found that the two procedures are easy to perform, reliable with a satisfactory outcome, simple, rapid, risk free, and also lessen the financial burden and morbidity on the patient.

Keywords:

cauterization, fat graft myringoplasty, tympanic membrane perforations

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Introduction

Tympanic membrane (TM) perforations may result from infection, trauma, or tympanostomy tube insertion. Although 88% of traumatic perforations heal without intervention, the rest of them become chronic and require surgical intervention. These nonhealing perforations typically require tympanoplasty for closure. Medical costs associated with tympanoplasty have recently obliged investigators to search for less expensive, simple nonsurgical methods [1,2].

Simple methods have some advantages: they do not require hospitalization, they are inexpensive, and the patient does not need to take leave from either work or school. The technique is simple and requires less time, including the time for anesthesia, no special equipment is needed, the anesthesia is limited to the surface of the eardrum and to the small-dose infiltration of the ear canal; hence, there is very little risk of systemic invasion by the anesthetic, and thus the method can be applied to the elderly with severe comorbid disease [3].

During the period spanning from the 17th to the 19th century, several methods have been attempted at closing the TM perforation. In 1876, Roosa used cauterizing agents to promote the healing of TM perforations, and he used a silver nitrate bead [4].

Fat graft myringoplasty (FGM) has been utilized since 1962 as a technique for repairing small TM perforations. FGM may be performed as an office-based procedure, under local anesthesia without violating the middle ear; hence it is extremely cost-effective and produces minimal discomfort to the patient, who is often disappointed due to the residual/recurrent TM perforation and is extremely reluctant to undergo a new surgical procedure [5].

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Patients and methods

Our prospective study was carried out on 40 patients aged more than 15 years with small dry persistent central TM perforation during the period spanning from April 2017 to March 2018, who were divided in two groups: group A comprised 20 patients who underwent FGM and group B comprised 20 patients who underwent chemical cautery of the edge of TM perforation.

Patients were collected from the outpatient clinic of the Otorhinolaryngology Department at Menoufia University Hospital and Shebin El-Kom Teaching Hospital according to the following inclusion and exclusion criteria:

- (1) Inclusion criteria were as follows: patients with small dry persistent central TM perforation with a size no more than 25% of the TM by visual assessment (small: <25% of total effective TM surface area; medium size: 25–50% of total effective TM surface area perforated; large: 50–75% of effective TM surface area perforated; and near total: 75–100% of effective TM surface area involved by the perforation) and patients more than 15 years of age and less than 50 years of age and who had no previous ear surgery.
- (2) Exclusion criteria were as follows: patients with active chronic suppurative otitis media, marginal perforations, nasopharyngeal pathology, eustachian tube dysfunction or active rhinosinusitis.

Preprocedure assessment

- (1) Full medical history including onset, course, duration, last attack, amount and color of otorrhea, hearing loss, tinnitus, and other complaints plus history of previous surgery or other system affection.
- (2) Clinical examinations including otological examination, site, size by visual assessment of perforation and any ear discharge or any abnormality of the external auditory canal were carried out. Nasal examination to detect any abnormality, for example, deviated nasal septum or rhinosinusitis.
- (3) Audiological assessment (pure tone audiometry and tympanometry).

Procedures

Fat graft myringoplasty

- (1) After Informing patients the technical details of FGM, its aims, and the possible surgical

alternatives, the concerned ear was prepared by betadine solution.

- (2) The osteocartilaginous junction of the external ear canal was infiltrated with 2 ml of 2% lidocaine with 1 : 100 000 epinephrine.
- (3) Thereafter, using a 0° otoendoscope, the edges of the TM perforation were removed with a sickle knife or a Rosen needle, and were then removed with a microforceps.
- (4) The skin of the posterior surface of the ear lobule was infiltrated with 0.5 ml of the same solution. A 5 mm skin incision was performed, and a skinless fat graft that was two to three times larger than the perforation was harvested, and the incision site was closed by 5/0 Prolene.
- (5) The harvested fat plug was then wedged like a dumb-bell through the perforation with one part of it in the middle ear and other lateral to the TM; thereafter, it was supported by a few pieces of gel foam from outside the patient's ear canal.

Chemical cautery of the edges of the perforation

- (1) Patients were properly explained about the procedure and the possible outcome, and written and informed consent was taken.
- (2) A cotton ball soaked in 4% xylocaine was applied in the external auditory canal.
- (3) Using a 0° otoendoscope, the edges of the TM perforations were cauterized by using silver nitrate stick.
- (4) After the procedure, part of the gel foam was placed over the perforation.

Postprocedure care

- (1) A course of systemic antibiotic was given in the postoperative period.
- (2) Clinical and audiological assessment were performed after 4, 8, and 12 weeks.

Statistical analysis

Statistical analysis was carried out with the use of Microsoft Excel 2016. The data were collected as mean±SD; Student's *t* test was utilized for comparing quantitative values, χ^2 test, and Fisher's exact test for qualitative values; *P* value was considered significant if less than 0.05, highly significant if less than 0.001, and nonsignificant if more than 0.05.

Results

This study was conducted on 40 patients of whom 26 (65%) were male individuals and 14 (35%) were female

individuals with an average age 27.2 ± 9.3 years. Of 40 patients, nine (22.5%) had perforation due to traumatic etiology, and 31 (77.5%) patients had perforation due to pathological etiology; 17 (42.5%) of the cases had perforation of the right TM and 23 (57.5%) had perforation of the left TM; 19 (47.5%) patients had anteroinferior TM perforation, and 21 (52.5%) had posteroinferior TM perforation (Table 1).

In group A (who underwent FGM), the mean preprocedure air-bone gap (ABG) was 30.5 ± 5.2 dB and the mean postprocedure ABG was 19.2 ± 5.6 dB; there was a mean ABG gain of 11.3 ± 6 dB, which was found to be statistically highly significant ($P > 0.001$). Of 20 patients, complete healing of the TM perforation had occurred in 14 (70% success rate) patients (Tables 2 and 3).

In group B (who underwent chemical cautery of the edges of TM perforation), the mean preprocedure ABG was 27.5 ± 5.9 dB and the mean postprocedure ABG was 15.8 ± 5.4 dB; there was a mean gain of 11.7 ± 8.5 dB, which was found to be statistically highly significant ($P < 0.001$). Of 20 patients, complete healing of TM perforation had occurred in 11 (55% success rate) patients (Tables 2 and 3).

Discussion

The purpose of closing the TM perforation is to restore the continuity of the TM, aiming to improve hearing and decrease the incidence of middle ear infections [6].

Table 1 Criteria of tympanic membrane perforations

Criteria of tympanic membrane perforation	Number of patients=40 [n (%)]
Etiology	
Traumatic	9 (22.5)
Pathological	31 (77.5)
Side	
Right	17 (42.5)
Left	23 (57.5)
Site	
Anteroinferior	19 (47.5)
Posteroinferior	21 (52.5)

Despite the safety and high success of myringoplasty, it carries some risks such as bleeding, infections, and possible ossicular chain injury. Furthermore, surgery is not accessible to all patients due to its costs and availability [7].

Minimally invasive and cost-effective procedures like chemical cauterization and FGM have been found to be effective in the treatment of small central perforations with significant hearing improvement [8].

Our study was carried out on 40 patients with small central TM perforation. Of 40 patients, 20 underwent FGM (group A) and 20 underwent chemical cauterization (group B). The mean age group of the patients was 27.2 ± 9.3 years; 65% of patients were male individuals, and 35% were female individuals.

We found out that 22.5% of cases had perforation due to traumatic etiology, and 77.5% of cases had perforation due to pathological etiology.

This study showed that the mean preprocedure ABG was 30.5 ± 5.2 dB, and the mean postprocedure ABG was 19.2 ± 5.6 dB in group A (FGM); there was a mean gain of 11.3 ± 6 dB, and there was 70% (14 out of 20) success in the healing of TM perforation, with only six cases with residual perforation. The failure rate in our study with group A was 30% due to infection, detached fat graft and dehiscence due to undersized grafts. In 2013, Debnath and Khanna detected that, in the group that underwent fat plug myringoplasty, the mean preoperative ABG was 33.83 ± 4.41 dB, and, after the procedure, the mean ABG was 17.83 ± 2.84 dB, which was found to be statistically

Table 2 Success rate among the studied groups

Success rate	Number of patients=40 [n (%)]
Group A (N=20)	
Healed	14 (70)
Residual perforation	6 (30)
Group B (N=20)	
Healed	11 (55)
Residual perforation	9 (45)

Table 3 Preprocedure and postprocedure air-bone gap and air-bone gap gain in each of the studied groups

	ABG Mean \pm SD	ABG gain	t test	P value
Group A (N=20)				
Preprocedure ABG	30.5 ± 5.2	11.3 ± 6	9.704	0.0001 (HS)
Postprocedure ABG	19.2 ± 5.6			
Group B (N=20)				
Preprocedure ABG	27.5 ± 5.9	11.7 ± 8.5	9.320	0.0001 (HS)
Postprocedure ABG	15.8 ± 5.4			

ABG, air-bone gap. NS, nonsignificant ($P > 0.05$); S, significant ($P \leq 0.05$); HS, highly significant ($P \leq 0.001$).

significant ($P=0.01$). There was a mean gain in his study of about 16 ± 4.02 dB. Of 33 patients who underwent fat plug myringoplasty, three patients had residual perforations. The success rate was found to be 90.9% [6].

In 2014, Sharma and colleagues carried out a study on 20 patients; the mean preoperative ABG was 22.90 ± 6.543 dB, and they found out that the mean postoperative ABG was $21.80\text{ dB}\pm 6.288$ dB. The overall successful graft uptake rate was found to be 80% [1].

Fifty patients who underwent FGM by Mukherjee and Paul were included in his study. Their preoperative mean ABG was 23.6 dB. Postoperative mean ABG was found to be 16.4 dB. The average hearing gain was 7.2 dB. The overall successful graft uptake rate was found to be 84% (42 patients) [8].

Landsberg *et al.* performed FGM on 38 perforations and found successful closure in 81.6%. They also described a significant improvement in speech reception threshold (18.5 ± 7.7 dB) [9].

Fiorino and Barbieri recorded a slight insignificant improvement in hearing in their 31 patients postoperatively, the mean ABG gain of 1.1 dB postoperatively. A difference of 1.1 dB was found to be statistically insignificant ($P=0.077$) [10].

Chalishazar [11] described closure of TM perforation in 90% cases by FGM.

Our study showed that the mean preprocedure ABG was 27.5 ± 5.9 dB, and the mean postprocedure ABG was 15.8 ± 5.4 dB in group B (chemical cauterization of the edges of TM perforation); there was a mean ABG gain of about 11.7 ± 8.5 dB, and there was 55% (11 out of 20) success in healing of the TM perforation, with nine cases with residual perforation on follow-up of cases. Debnath and Khanna detected that in the group of patients who underwent chemical cauterization, the mean preoperative ABG was 24.66 ± 3.69 dB, and, after the procedure, the mean ABG was 16 ± 2.03 dB, which was found to be statistically significant ($P=0.01$.) There was a mean gain in his study of about 8.66 ± 3.69 dB. Of 36 patients who underwent chemical cauterization, six patients had residual perforations. The success rate was found to be 83.33% [6].

Makwana and colleagues found that, of the 60 patients, in 45, the perforation was completely healed (75% success rate); in the rest, the size of the perforation was reduced. Average pretreatment ABG was 21.5 dB,

and average ABG was 12.2 dB with an average hearing improvement of 9.3 dB [12].

Bhadouriya *et al.* [2] performed chemical cauterization for 70 perforations; 51 (73%) perforations healed, and 19 (27%) did not heal.

Goldman [13] found that 18 of the 28 (64%) patients treated by chemical means experienced closure of their TM perforations.

Singh *et al.* [14] found that 100 cases of varying age groups and both sexes presenting with small-sized to medium-sized (up to 5 mm) dry central TM perforations were enrolled for the study. Of 100 cauterized perforations, 76% were closed.

Fiorino and Barbieri described various causes of failure in FGM. Immediate failures were due to technical difficulties such as anterior perforations, inadequate graft support, poor vascular supply, or infection and delayed failures due to atrophic TM, infections or Eustachian tube dysfunction with a change in the TM structure [10].

Hegazy [15] described technical operative points during fat grafting, that is, graft size in relation with the perforation, the degree of the lateral bulge in the fat plug and moistening of the lateral side of the graft are important factors for success in the fat-grafting procedure.

Our result in chemical cautery was a 55% success rate that was in discrepancy with other results; this could be due to the fact that we applied the chemical cauterization for just one time. However, other studies like Debnath in 2013 showed multiple application of the chemical substance up to four times. Moreover, Makwana and colleagues in 2016 showed a 75% success rate with an average of 2.53 applications and Bhadouriya and colleagues in 2012 showed a success rate of 73% with an average of 3.6 applications [2,6,12].

Moreover, Singh *et al.* [14] found that of 100 cauterized perforations, 76% were closed with an average of 4.1 applications (range, 1–7 applications).

Conclusion

A reliable TM closure rate in small central perforations was achieved with FGM and chemical cauterization with local anesthesia in an office setting with a good amount of success. These two procedures are easy to perform and reliable with a satisfactory outcome; they

are virtually simple, rapid, risk free and also lessen the financial burden and morbidity on the patient.

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Conflicts of interest

There are no conflicts of interest.

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