ORIGINAL ARTICLE

Fat graft myringoplasty: An office procedure for the repair of small perforations of the tympanic membrane

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OBJECTIVE: Perforations of the tympanic membrane are treated with various surgical techniques and materials, all of which have advantages and disadvantages. Although autologous temporalis fascia is most often used to repair a perforated tympanic membrane, a fat graft can also be used, and fat myringoplasty (FM) is a simple and cost-effective technique. The aim of our study was to determine the effectiveness of FM in tympanic membrane repair, particularly with respect to the size and site of the perforation. Suggestions for optimizing the outcome of FM with selection criteria and the careful choice of surgical technique are presented.

MATERIALS AND METHODS: Seventy-three patients (29 men and 44 women) in whom as much as one-quarter of the pars tensa had been perforated underwent FM as an office procedure. The outcome of that procedure in each subject was evaluated 1 week, 1 to 6 months, and 1 year after surgery.

RESULTS: One year after surgery, 80.8% of perforations were closed. The closure rates for small perforations were higher than those for large perforations (93.7% vs 70.7%), and posterior perforations had better closure rates (90.5%) than did anterior perforations (67.7%). The results of FM performed for revision tympanoplasty were poor (52.9%).

CONCLUSION: The results of our study emphasize the importance of carefully evaluating the remnant eardrum so that the actual size of the perforation can be determined. FM could be considered the treatment of choice for the repair of small posterior and inferior perforations of the tympanic membrane.

Myringoplasty, which is one of the most common otologic surgical procedures, involves the use of a graft to repair a tympanic membrane perforation. A variety of autografts, allografts, xenografts, and alloplasts (temporalis fascia, tragal perichondrium, bovine pericardium, etc) have been used for that purpose [1,2]. At present, the most frequently used graft is autologous temporalis fascia, which has been used in myringoplasty since the 1960s. Ringenberg [3] first reported the use of fat myringoplasty (FM). Several other authors have also reported their experiences with FM, and most of those investigators noted that the success of closure of the perforation ranged between 76% and 100% (Table 1). Imamoglu and colleagues [4] and Gold and Chaffoo [5] studied the effectiveness of FM in rats and guinea pigs, and the results of their research supported and validated the findings from similar studies in humans.

Authors	No. of Patients	Closure (%)
Ringenberg (3)	65	86.5
Terry and colleagues (10)	50	76
Gross and colleagues (12)	62	79.2
Deddens and colleagues (11)	28	89
Kaddour (8)	11	80
Mitchell and colleagues (13)	342	92
Liew and colleagues (14)	13	100
Ayache and colleagues (6)	45	91.1
Hagemann and Hausler (15)	44	91
Ozgursoy and Yorulmaz (9)	30	82.4
Landsberg and colleagues (16)	38	81.6
Our study	73	80.8

Table 1: Percentage of closure after fat myringoplasty

A review of the literature revealed that in studies of FM in human subjects, the clinical materials, the cause and size of the perforation, and the origin of the fat used varied extensively. Fat from the patient's ear lobe is usually used, although Ayache and colleagues [6] harvested the fat graft from the abdomen or the pretragal area, and De and colleagues [7] used fat from the area between the tragal and helical cartilages. Some authors [8,9] have also stressed the cost-effectiveness of performing FM as an office procedure.

The aims of our study were to evaluate the results of our experience with FM (especially with regard to the size, site, and cause of the perforation) and to identify the indications for the use of that procedure. The surgical technique used in FM is the subject of special focus

MATERIALS AND METHOD

This prospective study examined the success of FM procedures performed from September 2001 to April 2004 in 73 patients (29 men and 44 women; mean age, 48.1 years; age range, 13 to 82 years) with a tympanic perforation (size, up to one-quarter of the pars tensa) that resulted from any of a variety of causes (trauma, otitis media, prior tympanic surgery, grommet removal). The operations were performed as office procedures in the Otology and Neurology Department of the University of Rome "La Sapienza." Pure tone audiometry was performed preoperatively to exclude ossicular pathologic conditions (< 20 dB, 250 to 1000 Hz) and was repeated 6 months after surgery. The study subjects met the following inclusion criteria: no hyperplastic mucosa of the middle ear, no discharge from the ear, and no perforation less than 2 mm from the anulus (the distance was evaluated with a 2-mm hook). Alterations in the remaining tympanic membrane, such as atrophic or tympanosclerotic areas, were not considered exclusion criteria. Each patient underwent a careful preoperative otomicroscopic examination and was then assigned (according to the size of the perforation) to 1 of 2 groups: group A (48 patients with a small perforation; ie, less than one-eighth of the pars tensa) or group B (25 patients with a medium-size perforation; ie, from one-eighth to one-fourth of the pars tensa). The subjects in those 2 groups were then further assigned (according to the site of the perforation) to 1 of 4 subgroups: anterosuperior, anteroinferior, posterosuperior, or posteroinferior. The causes of the perforations are presented in Table 4.

The surgical procedure in each patient was performed by senior otosurgeons. Atropine sulfate 0.5 mg and promethazine chlorhydrate 50 mg were administrated intramuscularly 30 minutes before surgery. The patient was then placed in the standard otosurgical position and was draped via sterile technique. The osteocartilaginous junction of the external ear canal was infiltrated with 2 mL of 2% lidocaine with 1:100 000 epinephrine. The edges of the perforation were excised with a

sickle knife and a Rosen needle and were removed with a microforceps. After that surgical phase, the dimensions of the perforation were reevaluated. The skin of the posterior surface of the ear lobule was infiltrated with 0.5 mL of the same solution without inducing swelling inside the fat tissue. A 5-mm incision was performed, and a skinless fat graft that was 2 to 3 times larger than the perforation and that had been shaped like an hourglass for better stabilization was selected. The fat graft was inserted through the perforation and was covered with a small piece of absorbable gelatin sponge (Gelfoam). Neither packing nor dressing was used. After surgery, the patient was instructed to instill 3 drops of neomycin into the ear canal daily for 1 week and to take oral antibiotics, the selection of which was based on each patient's sensitivity to specific allergens, for 6 days. All patients were discharged within 1 hour after surgery. The duration of surgery (the interval from the disinfection of the patient to the instillation of the postsurgically applied ear drops) was noted, and all patients were reexamined 1 week, 1 to 6 months, and 1 year after surgery.

RESULTS

In the first analysis, each surgical specimen was allocated to group A or group B, depending on the perforation size (which was evaluated again after the removal of the edges). In group A (small perforations), the number of patients decreased from 48 to 32, and in group B (larger perforations), the number of patients increased from 25 to 41 (Figure 1). In some patients in group B, the perforation was larger than a quadrant of the pars tensa

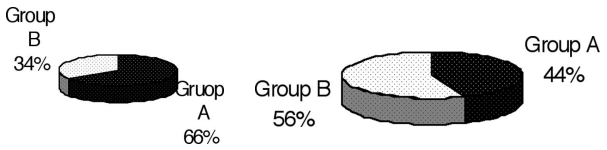

Figure-1a: Ears of the study subjects before the removal of the edges of the perforation. In group A, the perforation was smaller than one-eighth of the pars tensa. In group B, the perforation was up to one-fourth of the pars tensa in size.
Figure-1b: Ears of the study subjects after the removal of the edges of the perforation. In group A, the perforation was smaller than one-eighth of the pars tensa. In group B, the perforation was up to one-fourth of the pars tensa in size.

Figure 2 (A and B) shows the durations of surgery, which did not usually exceed 30 minutes. In 57 patients (78.1%), the duration of surgery was between 15 and 30 minutes.

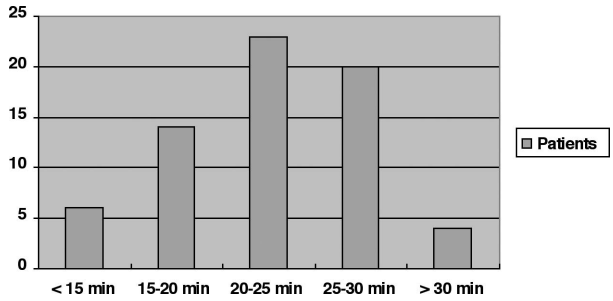

Figure-2: Duration of fat graft myringoplasty for the repair of a perforated tympanic membrane.

Most (80.8% overall; 93.7% of the patients in group A and 70.7% of the patients in group B) of the repaired perforations were still closed 1 year after surgery. (Table 2). The perforation size did not increase after surgery in any of our subjects, including those in whom the perforation remained open.

Perforation Size	No. of Patients	Closure (%)
Less than one-eighth of the pars tensa (group A)	32	93.7
Up to one-fourth of the pars tensa in size (group B)	41	70.7
Total	73	80.8

Table 2: Fat myringoplasty closure 1 year after surgery according to perforation size.

In a second arm of the study, the site and size of the perforations were correlated with the success of the surgical technique. Posterior perforations had an overall closure rate of 90.5% (38/42), and in anterior perforations, the overall closure rate was 67.7% (21/31). We found a closure rate of 83.3% in anterior perforations and 100% in posterior perforations in group A patients, and in group B patients, 52.8% of anterior perforations and 81.8% of posterior perforations were closed (Table 3).

Perforation Size	Closure		
	No. of Patients, Group A (%)	No. of Patients, Group B (%)	No. of Patients, Total (%)
Anterosuperior	2/3 (67)	4/6 (67)	6/9 (67)
Anteroinferior	8/9 (89)	7/13 (54)	15/22 (68)
Posterosuperior	7/7 (100)	3/4 (75)	10/11 (91)
Posteroinferior	13/13 (100)	15/18 (83)	28/31 (90)

Table 3: Outcome of fat myringoplasty according to perforation site and size.

The causes of the perforations and surgical outcomes are shown in Table 4. Except for revision surgery, closure was achieved in more than 80% of the repairs. The worst results occurred after tympanoplasty revision surgery (52.9%) and the closure of large perforations (40%). Some patients experienced the following symptoms during the first week after surgery: pseudosecretions from the ear canal (44%), ear fullness (22%), low-tone temporary tinnitus (16%), or a fibrous nodule of the ear lobe (13%). Postoperative pure tone audiometry was performed to exclude any hearing deterioration caused by FM

DISCUSSION

We investigated the effects of the size, site, and status of the remnant membrane and the cause of its perforation on surgical outcome. A review of the literature revealed good overall results for FM but consistent data about the various clinical materials and criteria used for the evaluation and selection of patients could be not found. The size of the perforation was determined by several parameters: the percentage of the pars tensa involved [3,10,11], the number of involved quarters of the tympanic membrane [6], the diameter of the perforation [12], and the gross dimension of the perforation [7]. A few published investigators [11-16] performed FM only in children, and only a few authors [9,11,14] used FM in revision surgery.

The size of the perforation is the main criterion used by many investigators to select candidates for FM. According to Kaddour [8], the size of the perforation should not exceed 30% of the size of the eardrum (closure rate, 80%). Terry and colleagues [10], who performed FM to correct perforations of various sizes, cited a closure rate of 79.4% if the perforation accounted for less than 50% of tympanic membrane and 57.1% if the perforation was larger than that size.

We found a low closure rate for anterior perforations (67.7% with no statistically significant difference between groups A and B), and to our knowledge, similar data have not been reported in the literature. However, posterior perforations demonstrated an overall closure rate of 90,5%, and 100% of the patients in group A had a siccessful result. In an experimental study using guinea pigs, Gold and Chaffoo [5] did not find a statistically significant difference in the healing rate of anterior as opposed to posterior perforations, but all perforations in their study were traumatic and had not been caused by chronic otitis (a well known cause of eardrum alteration).

Poor results from the repair of an anterior perforation may occur because the anterior edge of the perforation is usually partially obscured by the bulging of the anterior ear canal. As a result, the scarred margins may not be adequately refreshed. In such cases, Ayache and colleagues [6] suggest the use of otoendoscopy for better visualization of the anterior margin.

We found that the success of closure was correlated with the cause of the perforation (Table 4). In patients (including those who underwent poststapes surgery) whose perforation was caused by a traumatic injury, the percentage of closure was high (perhaps because of the normal vascular supply to the eardrum in those individuals). However, the poor results of tympanoplasty revision could have been caused by any of several complications that developed after the initial surgery, such as a Eustachian tube problem, a middle ear infection, poor vascular supply in the remnant

Causes of Perforation	Closure		
	No. of Patients, Group A (%)	No. of Patients, Group B (%)	No. of Patients, Total (%)
Otitis media	15/17 (88)	22/26 (85)	37/43 (86)
Tympanoplasty revision	5/7 (71)	4/10 (40)	9/17 (53)
Fat myringoplasty revision *	3/3 (100)	2/3 (67)	5/6 (83)
Trauma	3/3 (100)	1/2 (50)	4/5 (80)
Poststapes surgery	1/1 (100)	_	1/1 (100)
Grommet removal	1/1 (100)	_	1/1 (100)

Table 4: Causes of perforations in the study subjects
*Patients treated with fat myringoplasty before this study.

eardrum, etc. Despite those poor results in that group of patients, we suggest that FM be considered for the treatment of reperforation in patients who have undergone at least 1 formal tympanoplasty or for those who are not compliant (eg, a patient who refuses to return to the operating theater).

We studied perforations that were no larger than a quadrant of the pars tensa (a size measured before the removal of edges). The overall success rate was 80.8%. In group A (those with a small perforation), the closure ratio was 93.7%, and in group B (those with a larger perforation), the closure rate was 70.7%. We want to emphasize that the perforation size increased in all patients after the removal of the edges of the perforation (Figure 1), so the selection criterion of size (less than one-fourth of the pars tensa) could be invalidated. In our opinion, a thorough preoperative otomicroscopic evaluation is mandatory so that the vascular aspects of the remnant membrane can be viewed to identify myringosclerosis or atrophy, the size of the edges to be removed can be noted, and the size of the perforation to be repaired can be accurately determined. To our knowledge, previous works have not been focused on those issues, but we suggest that variations in closure may be associated with those factors.

We also suggest that guidelines for the harvesting of fat be followed. First, the fat must be harvested after the refreshment of the edges of the perforation. In a few patients, with a small ear lobe, the graft taken from the lobule culb be too small because of the enlargement of the perforation. In those individuals, it was necessary to harvest the fat from the abdomen, a procedure that may also be required in patients who wear earrings. We modeled the adipose tissue into an hourglass shape, although other clinicians have preferred a champagne-cork shape or a bell shape. In our experience, the shape of the adipose tissue is not of great importance, although obtaining a fat graft that is 2 or 3 times larger than the perforation is essential.

In our opinion, the infiltration of an anesthetic could artificially enlarge the volume of fat tissue in the ear lobe. Although the excised fat may seems sufficient to close the perforation, it later dehydrates and may become too small.

The advantages of FM for the repair of a perforated tympanic membrane, then, are many. Surgery can be performed as an office procedure after the patient has received a local anesthetic. It is a relatively safe procedure because the likelihood of otologic trauma from the manipulation of the tympanic cavity is reduced. Bilateral surgery is possible, and the postoperative care required is minimal. Learning to perform FM is not difficult, and FM offers the possibility of recovery for noncompliant patients. However, performing FM is not without challenges. Finding an implant that is large enough to repair a large perforation in patients with a small lobule may be difficult. The possibility of postsurgical lobule deformity exists, as does the theoretical deposition of skin debris in the graft and the consequent development of an iatrogenic cholesteatoma (events never reported, to our knowledge). A sense of fullness in the ear and temporary tinnitus, which

are probably caused by the long-term persistence of the graft block, can develop. Some patients complain of an auricular discharge, which may be melting fat, for a few weeks after surgery.

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