

# Repair of small-sized and medium-sized tympanic membrane perforation using butterfly cartilage graft: evaluation of take rate and hearing result

Mohammed Fawzy Moustafa Ahmed<sup>a</sup>, Asser Abd El-Raouf El-Sharkawy<sup>b</sup>,  
Waleed Moneir Abd El-Rahman<sup>b</sup>

<sup>a</sup>Department of Otorhinolaryngology, Mansoura University Students' Hospital, <sup>b</sup>Department of Otorhinolaryngology, Faculty of Medicine, Mansoura University, Mansoura, Egypt

Correspondence to Mohammed Fawzy Moustafa Ahmed, MSc, Department of Otorhinolaryngology, Mansoura University Students' Hospital, Mansoura University, Mansoura 35516, Egypt; Tel: 01226043631; e-mail: dr.moha1291986@yahoo.com

Received 25 February 2016  
Accepted 1 May 2016

The Egyptian Journal of Otolaryngology  
2017, 33:5–8

Our aim was to evaluate the function and take rate of the butter cartilage technique (BCT) for reconstruction of small-sized and medium-sized tympanic membrane (TM) perforation by comparing it with temporalis fascia (TF). Repair of the TM was carried out in 40 patients with unilateral Chronic Suppurative Otitis Media (CSOM) with small-sized and medium-sized TM perforation. The patients were divided into two groups: group 'A', in which the BCT was used, and group 'B', in which TF graft was used. During the follow-up period, we found that the graft take-up rate was 90% in the BCT, whereas it was not complete in TF cases. There was marked improvement in hearing in both groups. We concluded that the BCT is optimal in the reconstruction of small-sized and medium-sized TM perforation because it is excellent to obtain high take rate with good hearing results.

## Keywords:

butterfly cartilage graft, repair, tympanic perforation

Egypt J Otolaryngol 33:5–8  
© 2017 The Egyptian Journal of Otolaryngology  
1012-5574

## Introduction

Different methods of tympanoplastic surgery have been used. Overlay, underlay, sandwich, pegging, rosette and plugging techniques have been described and are in use. Overlay and underlay are the most popularly used techniques. In 1998, Eavey introduced cartilage, perichondrium butter cartilage technique (BCT) for closure of small-to-medium-sized perforations [1–4]. This transcanal technique used composite tragal perichondrium cartilage graft, which is specially designed like a butterfly to fit in the perforation without support in the middle ear or the external auditory canal. The technique carries practical advantages of decreased surgical time, comfort to patient, cosmesis in terms of minimal scarring, improved hearing and dry ear.

The aim of this study was to evaluate the function and take rate of the BCT for repair of small-sized and medium-sized tympanic membrane (TM) perforation by comparing it with temporalis fascia (TF) [5,6].

## Patients and methods

Ethical approval for this work was obtained from the Ethics Committee in our Otorhinolaryngology Department in a Tertiary Care Hospital. Informed consent was obtained from parents before treatment. The study was conducted in the Otorhinolaryngology Department, Mansoura University Hospital, Egypt, between 2013 and 2015. A total of 40 patients with

a safe central perforation of small-to-medium-sized were selected for this study. There were male and female patients with a mean age of 13.2 (range: 9–17) years. Patient demographics are shown in Table 1.

Inclusion criteria were as follows: inactive CSOM, small-sized and medium-sized TM perforation, no middle ear pathology, no mucosal changes, dry for at least 3 months without any episode of otorrhea, a conductive hearing loss correlating with the perforation, and no pathology in the contralateral ear, with normal hearing and Eustachian tube function.

Patients were divided into two groups: group A and group B.

Group A included 20 cases reconstructed using the BCT. Group B included 20 cases reconstructed using TF.

Data were evaluated using online GraphPad software, US. Mean and SD were calculated and unpaired *t*-test was used to compare between two means to calculate the *P*-value.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work noncommercially, as long as the author is credited and the new creations are licensed under the identical terms.

### Preoperative assessment

Pure Tone Audiometry (PTA) was performed preoperatively and postoperatively (at third and sixth month) during regular follow-up of patient's until 6 months.

### Surgical procedure

Procedures were performed under local anaesthesia using a xylocaine with adrenaline 1/80 000.

### Technique

Perforation is visualized under microscope and margins are freshened. If entire perforation is still visible in one field in transcanal manner the surgery is continued, else abandoned in favour of classical myringoplasty. Squamous epithelium from under and over the surface of the TM is scraped off with a circular knife. Dimensions and shape of perforation are measured using a right-angled pick. The tragal cartilage with the perichondrium attached on its

both sides is harvested by means of a small incision on the inner aspect of the tragus, taking care that the dome of the tragus is preserved (Fig. 1).

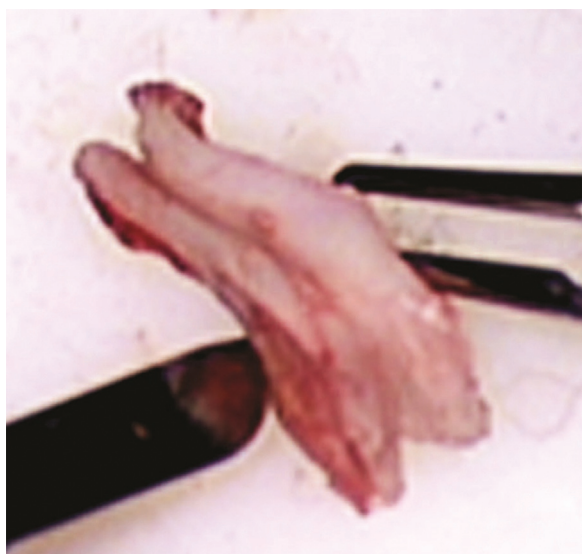
Graft is cut in the same shape as the perforation, but 1 mm larger than the size of perforation. Graft is scored into the shape of a butterfly by means of incision in the centre of the cartilage and parallel to two layers of the perichondrium with a #15 blade.

The graft is then inserted in a transcanal manner, microscopically, in such a way that the groove grasps the anterior edge of perforation first and then placed with one wing of butterfly above and one below the margins of perforation. Gelfoam soaked in antibiotic solution is placed in the external auditory canal (Fig. 2).

**Table 1 Characteristics of the studied groups**

Parameters	Group A (n=20)	Group B (n=20)
Age (mean±SD)	27.5±7.18	29.15±7.56
Sex [N (%)]		
Male	10 (50)	11 (55)
Female	10 (50)	9 (45)
Operation time (mean±SD)	20.75±2.94	30±4.87
Site of perforation [N (%)]		
Right	8 (40)	9 (45)
Left	12 (60)	11 (55)
Bone hump [N (%)]		
No hump	12 (60)	7 (35)
Anterior	1 (5)	9 (45)
Posterior	7 (35)	4 (20)

**Figure 1**



Butterfly cartilage after scoring.

### Results

This study included male and female patients with a mean age of 27.5±7.18 (range: 10–40) years and with a median age of 25 years. Patients were divided into two groups: group A included 20 cases reconstructed using the BCT, and group B included 20 cases reconstructed using TF.

Preoperative and postoperative means and SDs of air conduction at frequencies 250–8000 Hz were recorded for both groups. The unpaired *t*-test was used to calculate *P*-value. Statistically significant difference (*P*=0.0001) was noticed between the preoperative and postoperative means of air conduction at all frequencies (Table 2). Preoperative and postoperative air conduction average means are recorded in Tables 2–4.

**Figure 2**



Graft after taking.

**Table 2 Comparison between preoperative and postoperative air bone gap of group A and group B at 250 and 8000 Hz**

	Preoperative air bone gap		Postoperative air bone gap		Test of significance
	Median (minimum–maximum)	Mean±SD	Median (minimum–maximum)	Mean±SD	
250 Hz					
Group A	5 (5–15)	6.3±2.8	0 (0–10)	1.8±2.9	Z=4.2; P<0.0001**
Group B	5 (0–10)	4±3.5	0 (0–5)	1.8±2.5	Z=3; P=0.003*
8000 Hz					
Group A	10 (5–20)	9.5±4.6	7.5 (0–20)	7.8±5.7	Z=2.6; P=0.008*
Group B	10(5–15)	9.5±3.6	10(0–10)	7.3±3.4	Z=3; P=0.003*

\*\*Most indicative points of improvement.

**Table 3 Comparison of the air conduction, BC, and air bone gap preoperative and postoperative for each studied groups**

Parameters	Preoperative air bone gap Median (minimum–maximum)	Postoperative air bone gap Median (minimum–maximum)	Test of significance
Group A	10 (5–15)	0 (0–10)	P<0.0001**
Group B	10 (5–20)	0 (0–5)	P<0.0001**
Parameters	Preoperative AC (mean±SD)	Postoperative AC (mean±SD)	Test of significance
Group A	28.25±3.354	20.50±2.76	P<0.0001**
Group B	29.25±2.936	20.50±2.236	P<0.0001**
Parameter	Preoperative BC (mean±SD)	Postoperative BC (mean±SD)	Test of significance
Group A	19.75±2.552	19±2.62	P=0.27
Group B	19.25±3.354	18.25±2.447	P=0.1

AC, air conduction; BC, bone conduction. \*\*Highly significant (P<0.001).

**Table 4 The take rate in different groups**

	Small-sized perforation			Medium-sized perforation		
	Total number of cases	Take	Failure	Total number of cases	Take	Failure
Group A	5	5	0	15	14	1
Group B	8	8	0	12	9	3

## Discussion

Since the introduction of tympanoplasty by Wullstein and Zöllner [1,2], many graft materials were used for building of the TM perforation, but the TF remains the most commonly used one for myringoplasty, with a success rate of about 90% for primary tympanoplasty [4,7].

In TM building, two goals must be fulfilled: the first goal is the closure of the perforation, and the second goal is to get a new TM with acoustic qualities near to that of normal TM [3,5].

Hence, the use of a less compliant and more rigid material as composite cartilage and perichondrial graft may be beneficial.

Although it is similar to the TF in being mesodermal tissue, its more rigid quality tends to be against resorption and retraction even in the presence of poor Eustachian tube function [6].

We applied this technique of inlay tympanoplasty and conducted a study in 20 patients (10 male and 10 female) between 10 and 40 years. All patients were having small-to-medium-sized safe perforation in the TM. No patient with a component of sensorineural hearing loss (SNHL) or any revision surgery was included in this study [7,8].

As regards the take rate in our study, it was significantly high in both cartilage groups, and this could be explained on the basis of the rigid quality of the cartilage, which resists infection or change in middle ear pressure [5,6].

We observed a graft take-up rate of 90% (with two failures due to infection). Four cases developed otomycosis 1–2 weeks postoperatively. Antifungal ear drops were given and graft was intact and taken up.

We found that the postoperative hearing was significantly improved in all groups, but there was

no significant difference in hearing results between the group of partial thickness cartilage and fascia groups.

This procedure offers many advantages. Surgery takes 30 min or less for completion in expert hands. The technique is easy to perform and can be performed as a day care surgery. It is associated with less morbidity to the patient.

Cartilage perichondrium graft used appears stiff and thick but allows good sound conduction, hence gratifying postoperative hearing results [6]. Graft is resistant to initial period of bad nutrition when survival depends upon plasmic circulation. Neo TM grows on both sides of graft, and graft stays *in situ* for long periods. The disadvantage that this technique carries is that large perforations cannot be repaired [8,9].

---

### Conclusion

BCT is a simple technique for repair of small-to-medium-sized perforation with gratifying results and take-up rates of up to 90%. It carries definitive advantages of less operative time, day care surgery

and minimal scarring, and hence can be accepted as a routine procedure in day-to-day practice.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

---

### References

- 1 Millwski C. Composite graft tympanoplasty in the treatment of ears with advanced middle ear pathology. *Laryngoscope* 1993; 103:1352–1356.
- 2 Eavey RD. Inlay tympanoplasty: cartilage butterfly technique. *Laryngoscope* 1998; 108:657–661.
- 3 Arenberg IK, Stahle J, Glasscock ME, Shambaugh GE. Endolymphatic sac valve implant surgery. *Laryngoscope* 1979; 89:1–20.
- 4 Gross CW, Bassila M, Lazar RH, Long TE, Stagner S. Adipose plug myringoplasty: an alternative to formal Myringoplasty techniques in children. *Otolaryngol Head Neck Surg* 1989; 101:617–620.
- 5 Lubianca-Neto JF. Inlay butterfly cartilage tympanoplasty (Eavey technique) modified for adults. *Otolaryngol Head Neck Surg* 2000; 123:492–494.
- 6 Irwin Harris VG, Brockman SJ. Tympanoplasty with perichondrial graft. *Arch Otolaryngol* 1964; 79:131–137.
- 7 Adams ME, El-Kashlan HK. Tympanoplasty and ossiculoplasty. In: Flint PW, Haughery BH, Lund VJ, editors. *Cummingsotolaryngology head and neck surgery*. 5th ed. China: Mosby; 2010. 2003–2004.
- 8 Dornhoffer JL. Cartilage tympanoplasty. *Otolaryngol Clin North Am* 2006; 39:1161–1176.
- 9 Chang CYJ. Chronic disorders of the middle ear and mastoid (tympanic membrane perforations and cholesteatoma). In: Mitchell RB editor. *Pediatric otolaryngology for the clinician*. New York, NY: Springer; 2009. 111–121.