

Underlay cartilage tympanoplasty: different ways of application of the graft

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Introduction

The objective of this study was to evaluate underlay tympanoplasty technique of perichondrium cartilage graft according to the position of the graft with respect to the handle of malleus and remnant of tympanic membrane.

Patients and methods

In all, 150 patients with chronic suppurative otitis media (safe type) underwent tympanoplasty with or without mastoidectomy. The patients were divided into three groups (50 patients in each group). Group I graft was placed medial to the handle of malleus, group II graft was placed at the plane of malleus, group III graft was placed lateral to the malleus between it and remnant of tympanic membrane.

Results

Success rate (graft taken with no residual perforation) in all cases is 98% (147 cases). Success rate in groups I–III is 98% (49 cases), 100% (50 cases) and 96% (48 cases), respectively. There is significant statistical improvement of postoperative pure tone audiogram.

Conclusion

Underlay cartilage tympanoplasty was associated with a high rate of graft taken and good hearing results despite the position of the graft in relation to the handle of malleus.

Keywords:

cartilage tympanoplasty, tympanoplasty, underlay technique

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Introduction

Tympanoplasty surgery was applied in 1950, and various techniques and graft material were used [1]. The underlay and the overlay procedure were developed as two classical techniques [2]. The underlay technique is widely used as it is relatively easily to perform [3]. Various graft material can be used as cartilage, perichondrium, temporalis fascia, vein tissue and fat [4]. But the most popular graft used is cartilage and temporalis fascia. Cartilage graft can be used as a total, shield or palisade graft in ear surgery [5].

In this study, we evaluated the underlay tympanoplasty technique of the perichondrium cartilage graft according to the position of the graft with respect to the handle of malleus and remnant of tympanic membrane.

Patients and methods

This study is a prospective, analytic, randomized and longitudinal study, which was performed in the Otolaryngology Department of El-Minia University Hospital from March 2006 to May 2011.

Underlay tympanoplasty with or without cortical mastoidectomy was performed on 150 patients.

This study was designed in three groups according to the relation of the graft to the handle of malleus and remnant of tympanic membrane, each group included 50 patients.

Group I: graft medial to the handle of malleus.

Group II: graft at the plane of the malleus.

Group III: graft lateral to the malleus/over-underlay technique.

Exclusion criteria

- (1) Age of the patient less than 12 years old.
- (2) Previous otological surgery.
- (3) Sensorineural hearing loss.
- (4) Total and subtotal perforation.
- (5) Cholesteatoma.
- (6) Air-bone gap more than 35 dl.

Evaluation of graft taken (no residual perforation detected by otoscopic examination) and hearing result by audiogram (preoperative and postoperative air-bone gap) were done.

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The study was conducted according to the Declaration of Helsinki and was approved by Minia Faculty of Medicine Institutional Review Board.

Surgical procedure

All procedures were performed under general anesthesia by the same surgeon (author of the paper).

Postauricular approach was used. Explore middle ear to exclude any pathology and to examine mobility of ossicles. A cut through the skin and cartilage was done leaving 2 mm of cartilage in the dome of tragus. Cartilage with attached perichondrium is dissected medially from the overlying skin and laterally from soft tissue by dissection. Perichondrium from side of cartilage towards the ear canal is dissected off. Epithelial cells along the perforation margin of the tympanic membrane were carefully stripped. Gel foam is packed in the middle ear. Graft is placed in an underlaying manner (lateral, medial or at the level of the handle of malleus).

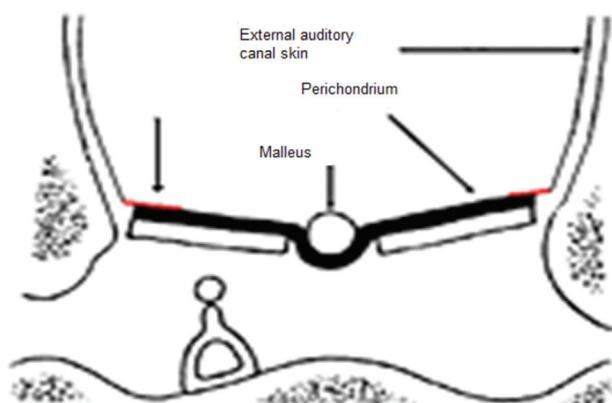
Group I (medial to the handle of malleus)

A complete strip of cartilage 2 mm wide is removed vertically from the center of the graft to accommodate the entire malleus handle. The graft is placed in an underlay fashion, with the malleus fitting into the groove. The cartilage is placed toward the promontory, with the perichondrium immediately adjacent to the tympanic membrane remnant, both of which are medial to the malleus (Fig. 1).

Group II (at the plane of the malleus)

A V-shaped notch is removed from the cartilage to accommodate the malleus handle. The cartilage graft is placed on the same plane as the manubrium of the malleus and medial to the tympanic membrane remnant (Fig. 2).

Fig. 1



Medial to the handle of malleus (group 1).

Group III (lateral to the malleus/over-underlay technique)

We dissected the remnant of the tympanic membrane from the handle of the malleus and then the graft was placed between the remnant of the tympanic membrane and the handle (Fig. 3).

Informed consent was obtained from all the patients.

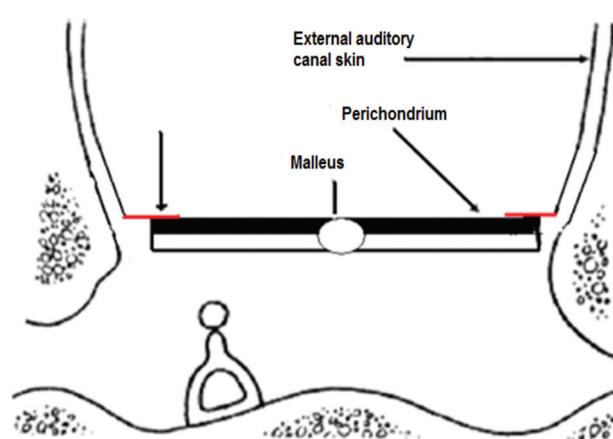
Postoperative care and follow-up

Aural pack is removed on the fifth day and stitches on the seventh day. Follow-up of the patients on 2, 4, 6 and 12 weeks for assessment of graft taken. Postoperative pure tone was assessed on the 12th week (Tables 1–3).

Statistical analysis

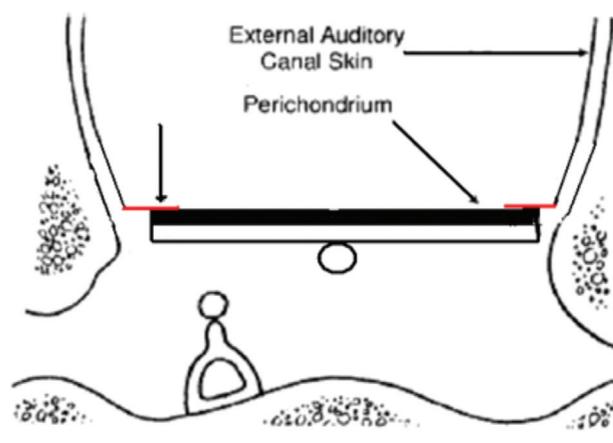
Results were expressed as mean±SD or number (%). Comparison between categorical data was performed using the χ^2 -test. The data were considered significant if *P* value less than 0.01. Statistical analysis was performed

Fig. 2



At the plane of the malleus (group 2).

Fig. 3



Lateral to the handle of malleus and medial to remnant of tympanic membrane, over-underlay technique (group 3).

with the aid of SPSS computer program (version 12 Windows).

Results

Patient's ages ranged from 12 to 39 years with an average age of 22.44 ± 5.72 . Of these, 63 (42%) patients were men and 87 (58%) patients were women, the follow-up period was 12 weeks.

The success rate (graft taken with no residual perforation) in all cases is 98% (147 cases). Success rate in groups I–III is 98% (49 cases), 100% (50 cases) and 96% (48 cases), respectively.

All patients (150) underwent tympanoplasty and cortical mastoidectomy.

Discussion

Cartilage tympanoplasty is a safe and a reliable technique in tympanic membrane reconstruction [6] and achieves good anatomical and audiologic results [7]. Cartilage graft

resists negative middle ear pressure and infection [8], it has low reperforation rates [9]. As it has very low metabolic rates, it is nourished by diffusion [10], and incorporated into the tympanic membrane easily [11]. It can be used as a cartilage perichondrium composite island graft, palisade and thin or thick plates not covered by the perichondrium [5]. The cartilage covered by the perichondrium had better metabolism than naked cartilage [1]. In this study, the overall graft taken rate is 98% (147 patients) and there is significant statistical improvement of postoperative pure tone audiogram (PTA). These results are similar to the results of Demirpehlivent *et al.* [9] and Onal *et al.* [12]. Demirpehlivent *et al.* [9], made a study on 34 patients (with intact ossicular chain, normal middle ear mucosa and subtotal perforation), patients younger than 15 years and patients with cholesteatoma were excluded from this study, graft taken was 97.7% with significant statistical improvement of postoperative PTA. Onal *et al.* [12], made their study on 44 patients (with intact ossicular chain, normal middle ear mucosa and dry ear for ≥ 1 month), graft taken rate was 93.2% with significant statistical improvement of postoperative PTA. In this study, group I graft taken and postoperative PTA is better than groups II and III but with no statistical significance. Cavaliere *et al.* [13], made their study on 100 patients as in group II in this study and graft taken was 100% with significant statistical improvement of postoperative PTA. Also Yurttas *et al.* [14], made their study on 87 patients using the technique as in group II in this study and graft taken was 93% but they use conchal cartilage and 27 patients had central perforation, 43 had subtotal perforation, six with adhesive otitis media and 10 patients with total perforation. Kulduk *et al.* [15] made their study on 114 patients with chronic suppurative otitis media; they divided them into two groups. Tympanoplasty (underlay technique with graft medial to the handle of malleus) was used in 61 patients (first group) and tympanoplasty (underlay technique with graft

Table 1 Comparison of preoperative and postoperative pure tone audiogram

	Pure tone audiogram		P value
	Preoperative	Postoperative	
In all cases			
Range	5–30	0–25	<0.001*
Mean±SD	19.2±5.61	12.9±6.05	
Group I			
Range	5–25	0–25	<0.001*
Mean±SD	18.7±5.32	11.3±6.29	
Group II			
Range	10–30	5–25	<0.001*
Mean±SD	19.9±5.66	14.6±6.21	
Group III			
Range	10–30	5–25	<0.001*
Mean±SD	19±5.89	12.8±5.26	

*Means significant.

Table 2 Comparison of success rate (graft taken) of three groups

	Group I (1–50) [n (%)]	Group II (51–100) [n (%)]	Group III (101–150) [n (%)]	P value		
				I vs. II	I vs. III	II vs. III
Fate						
Success	49 (98)	50 (100)	48 (96)	1	1	0.495
Failed	1 (2)	0 (0)	2 (4)			

Table 3 Comparison of air-bone gap in three groups

	Group I (1–50) [n (%)]	Group II (51–100) [n (%)]	Group III (101–150) [n (%)]	P value		
				I vs. II	I vs. III	II vs. III
Air-bone gap						
Range	0–20	–5–20	–5–25	0.055	0.208	0.539
Mean±SD	7.6±6.16	5.3±6.17	6.2±6.81			

at plane of malleus) was used in 53 patients and they found a success rate of 89.1 and 90.5%, respectively, with no statistical significance; there was significant improvement of postoperative PTA in both groups [15]. In Kulduk *et al.* [15], the study success rate is less than this study as we exclude patients with total and subtotal perforations but they made study on patients with large perforations more than 50% of the tympanic membrane.

Conclusion

Underlay cartilage tympanoplasty was associated with a high rate of graft taken and good hearing results despite the position of the graft in relation to the handle of malleus.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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