

A comparative study of audiological and surgical results in partial versus complete strip cartilage reinforcement tympanoplasty

Hesham A. AbdelKader^a, Ahmed G. Khafagy^a, Tayseer T. Abdel Rahman^b

^aLecturer of Otolaryngology, ^bLecturer of Audiology, E.N.T. Department, Faculty of Medicine, Ain Shams University, Egypt

Correspondence to, Hesham A. AbdelKader, MD, Flat 743, Tower B, Bat ElEzz Towers, 35/45 Ibn Alhakm Square, Egypt
Tel: +20 100 155 4404;
e-mail: heshament@gmail.com

Received 16 March 2013

Accepted 25 August 2013

The Egyptian Journal of Otolaryngology
2014, 30(1):1-4

Hypothesis

Different techniques used in cartilage tympanoplasty are palisade technique, shield graft, in-lay butterfly graft, and island flap cartilage.

Purpose

The aim of the study was to compare audiological and graft take results in partial versus complete strip cartilage reinforcement tympanoplasty.

Materials and methods

A total of 60 patients with central perforation of the tympanic membrane and age ranging from 18 to 40 years were selected. They were divided into two equal study groups of 30 patients each. The first group underwent complete strip cartilage reinforcement tympanoplasty and the second group underwent partial strip cartilage reinforcement tympanoplasty.

Results

The overall success rate was 83.3% in the complete strip technique and 86.66% in the partial strip technique. In both study groups, there was statistically significant difference between the audiological results before and after operation. Furthermore, audiological and graft take results were better in the partial strip technique but with no statistically significant difference.

Conclusion

The overall results of partial strip tympanoplasty are better than complete strip tympanoplasty regarding graft take and audiological results.

Keywords:

cartilage tympanoplasty, complete strip, graft medialization, graft take, partial strip

Egypt J Otolaryngol 30(1):1-4

© 2014 The Egyptian Oto - Rhino - Laryngological Society
1012-5574

Introduction and rationale

Since Wullstein and Zoellner popularized tympanoplasty in the 1950s, various materials have been used for the procedure, including fascia, skin, vein, dura, and cartilage [1]. Currently, temporalis muscle fascia is the most frequently used grafting material in tympanoplasty [2], but unfortunately in atelectatic ears the fascia and perichondrium have been shown to undergo atrophy and subsequent failure during the postoperative period. Thus, it would be better to choose a grafting material that can resist the continuous negative middle ear pressure. Cartilage might be a better choice than fascia to resist the negative middle ear pressure because it is rigid and more stable [3,4].

Cartilage contributes minimally to an inflammatory tissue reaction and is well incorporated with the tympanic membrane layers; it also provides firm support to prevent retraction. The greatest advantage of the cartilage graft has been thought to be its very low metabolic rate. It receives its nutrients by diffusion, is easy to work with because it is pliable, and it can resist deformation from pressure variations. Perichondrium and cartilage share with fascia the quality of being mesenchymal tissue, but they are thicker and stiffer.

However, they mechanically reduce the vibratory pattern of the tympanic membrane, contributing to some impairment in the functional results, especially in the higher tones [5].

Different techniques used in cartilage tympanoplasty are palisade technique, shield graft, in-lay butterfly graft, and island flap cartilage.

The aim of this study was to compare between the complete and partial strip tympanoplasty regarding the audiological and graft take results.

Materials and methods

Participants

A total of 60 patients were selected, with central perforation of the tympanic membrane. These 60 patients (with age ranging from 18 to 40 years) were divided into two equal study groups of 30 patients each. The first group underwent complete strip cartilage reinforcement tympanoplasty and the second group underwent partial strip cartilage reinforcement tympanoplasty with homograft cartilage between 2012 and 2013 in Demerdash Hospital, Ain Shams

University, with 6 months follow-up. Tragal cartilage and perichondrium were used as graft material.

The sampling method was convenience sampling, and participants were comprised of patients who were hospitalized with chronic otitis media and who underwent homograft cartilage tympanoplasty. The exclusion criteria were patients with membrane retraction pocket, with severe atelectasis, patients who underwent middle ear intact canal cholesteatoma surgery, patients with air–bone gap (ABG) more than 35 dB, and patients who refused to come for the follow-up visits.

The study protocol was approved by the Ethics Committee of Ain Shams University Hospital, Ain Shams University, and informed consents were obtained from all patients after explaining the study protocol and aims.

Methods

All patients were subjected to the following:

- (1) Complete history taking and otological examination were carried out.
- (2) Basic audiological evaluation: Pure-tone audiometry including air and bone conduction and speech audiometry including speech reception threshold using bisyllabic words and speech discrimination using Arabic phonetically balanced words were carried out (Soliman, 1976) [6].
- (3) Successful graft take was defined as having no perforation, retraction, lateralization, or medialization.

Surgical procedure

All procedures were performed by the senior author according to the well-established principles of ear surgery; the ear must be free of disease before the reconstruction of the hearing mechanism.

A postauricular approach was used under general anesthesia supplemented with local infiltration of 2% lidocaine with 1 : 100 000 epinephrine.

The edges of the perforation were scrupulously denuded to promote good capillary blood flow. All tympanic membrane remnants with tympanosclerosis were removed. The middle ear was explored and any pathologic material was removed. A cut through the skin and cartilage was made on the medial side of the tragus, leaving 2 mm of cartilage in the dome of the tragus for cosmesis.

The tragal cartilage was harvested together with the perichondrium. This cartilage is ideal as it is thin, flat,

and in sufficient quantities to permit reconstruction of the entire tympanic membrane. Typically, the piece of cartilage is 15 mm in length and 10 mm in width in children and somewhat larger in adults.

The tragal perichondrium was placed lateral to the cartilage and medial to the edges of the perforation and extended posteriorly onto the canal wall, when present (underlay technique). Next, a complete strip of cartilage 2 mm in width was removed vertically from the center of the cartilage (extending from upper edge to inferior one) to accommodate the entire malleus handle versus partial strip (extending from superior edge to midway between superior and inferior edge) to accommodate part of the malleus. In both methods, the outer perichondrium toward the external auditory canal was left intact. The postauricular incision was closed in two layers and pieces of gelfoam impregnated in antibiotic ointment were placed in the ear canal (Fig. 1).

Postoperative care

Patients were given water precautions and caution against vigorous nose blowing. Sutures were removed 1 week after surgery, and the gelfoam was suctioned from the ear canal 3 weeks postoperatively. Antibiotic steroid-containing drops were used for further 2 weeks to clear the ear of residual gelfoam, which can lead to granulation and fibrous tissue formation if not completely removed from the tympanic membrane.

An audiogram was performed 2 months after surgery, and the tympanic membrane was examined. If the hearing result was good and the tympanic membrane was clear, the ear was examined after 6 months.

Figure 1



Partial strip cartilage graft (one of our study patients).

Statistical analysis

The data were analyzed using SPSS for Windows (version 18; SPSS Inc., Chicago, Illinois, USA). The pure-tone average (PTA)-ABG for each audiogram, preoperative and postoperative PTA-ABG, and graft take results were compared between the two study groups using the χ^2 -test and the Mann-Whitney *U*-tests. *P*-value of less than 0.05 was considered statistically significant for analyses.

Results

There were 60 patients in this study; these patients underwent tympanoplasty with homograft cartilage and their follow-up period was 6 months. The study population was divided into two groups: group 1 (complete strip) and group 2 (partial strip) (Tables 1–5).

Discussion

In our study, there was a significant difference in the mean of PTA-ABG before and after surgery. Closure of the tympanic membrane was achieved at a rate of 83.3% in the complete strip technique and 86.66% in the partial strip technique.

The present data were in agreement with previous studies based on the overall results of cartilage reinforcement tympanoplasty. In both study groups, there was statistically significant difference between audiological results before and after operation. Furthermore, audiological and graft take results were better in the partial strip technique but with no statistically significant difference.

In the study by Dornhoffer [1], the mean of ABG before and after tympanoplasty with homograft cartilage was similar to that in our study. Hashemi *et al.*, in Shiraz University, reported the mean of SRT and air bone gap (ABG) in 4 frequencies of 500, 1000, 2000 and 4000 in patients who had undergone tympanoplasty to be 17, 15, 15 and 18 with perichondrium cartilage and 19, 18, 19 and 23 with fascia [7]. Mokhtarinejad *et al.* (2012) also showed similar results to our study [8].

Conclusion

The findings of this study demonstrated that partial strip cartilage tympanoplasty was more effective technique for tympanic membrane closure with acceptable hearing results compared with the complete strip technique.

Table 1 Preoperative air–bone gap in both study groups

	Frequency	%	Significance	Z
Group 1 (dB)				
10–20	11	36.66	0.469	–0.724
20–30	10	33.33		
30–35	9	30		
Group 2 (dB)				
10–20	7	23.33	50	26.66
20–30	15	50		
30–35	8	26.66		

Table 2 Graft take results in both study groups

	Frequency	%	Significance	Z
Group 1				
No	5	16.7	0.720	–0.359
Yes	25	83.3		
Group 2				
No	4	13.33	86.66	
Yes	26	86.66		

Table 3 Postoperative air–bone gap in both study groups

	Frequency	%	Significance	Z
Group 1 (dB)				
0–10	13	52	0.382	–0.874
10–20	10	40		
20–30	2	8		
Group 2 (dB)				
0–10	17	65.3	23.07	11.53
10–20	6	23.07		
20–30	3	11.53		

Table 4 Medialization of the graft in both study groups

	Frequency	%	Significance	Z
Group 1				
Yes	7	28	0.252	–1.145
No	18	72		
Group 2				
Yes	4	15.4	84.6	
No	22	84.6		

Table 5 Comparison between the two study groups with respect to the degree of improvement of air — bone gap before and after operation using the Mann — Whitney U-test

	Improvement
Mann-Whitney <i>U</i> -test	219.000
Wilcoxon <i>W</i>	544.000
Z	–0.466
Significance (two-tailed)	0.641

Acknowledgements

Conflicts of interest

None declared.

References

- 1 Dornhoffer J. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1,000-patient series. *Laryngoscope* 2003; 113(11):1844–56.
- 2 Amedee RG, Mann WJ, Riechelmann H. Cartilage palisade tympanoplasty. *Am J Otol* 1989; 10(6):447–50.

- 3 Duckert LG, Muller J, Makielski KH, Helms J. Composite autograft "shield" reconstruction of remnant tympanic membranes. *Am J Otol* 1995; 16(1):21–6.
- 4 Page C, Charlet L, Strunski V. Cartilage tympanoplasty: postoperative functional results. *Eur Arch Otorhinolaryngol* 2008; 265(10):1195–8.
- 5 Tos M. *Cartilage Tympanoplasty*. 1st ed. (2009). New York: Thieme; 2009: 7, 147.
- 6 Soliman S. Speech discrimination audiometry using Arabic phonetically balanced words. *Ain-Shams med. J*, 1976; 27:27:30.
- 7 Hashemi SB, Sohrabi H, Omranifard H. Comparison of tympanoplasty results with use of perichondrium-cartilage and temporalis facia. *Iran J Otorhinolaryngol* 2009; 21(56):63–66.
- 8 Mokhtarinejad F, Abtahi SH, Noei Alamdary Sh. Postoperative anatomic and functional results of homograft cartilage tympanoplasty. *J Res Med Sci* 2012; 17(Spec 1):S120–S124.