

TRANSCANAL CARTILAGE TYMPANOPLASTY

Abou-Bakr Mohammed Salahudin Behery

Department of Otolaryngology - Head and Neck Surgery, Faculty of Medicine, Tanta University.

Follow this and additional works at: <https://mmj.mans.edu.eg/home>

Recommended Citation

Salahudin Behery, Abou-Bakr Mohammed (2005) "TRANSCANAL CARTILAGE TYMPANOPLASTY," *Mansoura Medical Journal*: Vol. 34 : Iss. 1 , Article 2.

Available at: <https://doi.org/10.21608/mjmu.2005.127745>

This Original Study is brought to you for free and open access by Mansoura Medical Journal. It has been accepted for inclusion in Mansoura Medical Journal by an authorized editor of Mansoura Medical Journal. For more information, please contact mmj@mans.edu.eg.

TRANSCANAL CARTILAGE TYMPANOPLASTY

By
Abou-Bakr Mohammed Salahudin Behery, M.D.

From
*Department of Otolaryngology – Head and Neck Surgery,
Faculty of Medicine, Tanta University.*

ABSTRACT

Although the temporalis fascia has been widely used since 1957 as a graft in tympanoplasty, the utility of cartilage in middle ear reconstructive surgery is becoming apparent. Autogenous cartilage contributes minimally to an inflammatory tissue reaction and is incorporated in the middle layer of the tympanic membrane (TM) giving a firm scaffolding and resistance for infection during the healing period.

Via a transcanal approach without raising a posterior tympanomeatal flap and after freshening of the edge of the TM perforation, a disc of tragal cartilage-perichondrium composite graft was applied medially to repair the defect in 64 patients. They all had dry central perforation of the small - to - medium sized category with conductive hearing loss no greater than 35 dB in any

frequency at the time of surgery.

Anatomically, the success rate in terms of "graft take" was 95.3% and functionally the postoperative air-bone gap was reduced to less than 10 dB in 87.5% and to less than 20dB in 98% at the end of the follow-up period (longest follow-up, 30 month; shortest follow-up, 6 month; average follow-up, 16 months).

These results demonstrate that the described technique is efficient and effective to close a subgroup of non-marginal TM perforations. The post-operative patient comfort and the cost-effectiveness of the technique show additional advantage. Tragal cartilage was found to be an excellent graft material and its use has made a significant improvement in the TM reconstruction procedure. Cartilage should be used more widely in tympanoplasty.

INTRODUCTION

Since the introduction of tympanoplasty in 1952 by Zöllner¹ and Wullstein², numerous graft materials and methods of placement have been described to close perforations in the tympanic membrane (TM). Popular techniques for closure of a TM perforation include either the underlay or onlay approach³, and temporalis fascia or perichondrium remain the most commonly used materials.⁴ Successful closure is expected in approximately 90% of primary tympanoplasties with temporalis fascia or perichondrium grafts.⁴

The use of cartilage for middle ear reconstruction is not new. In 1963, Jansen⁵ reported the use of cartilage composite grafts for TM reconstruction. Although it is similar to fascia in that it is mesenchymal tissue, its more rigid quality tends to resist resorption and retraction, even in the milieu of continued Eustachian tube dysfunction.⁶

Autogenous cartilage contributes minimally to an inflammatory tissue reaction and is incorporated in the middle layer of the TM providing a firm scaffolding and resistance from infection during the healing process.⁷

Nevertheless, there has been concern regarding potentially poor hearing results using this technique. Several studies have now shown an acceptable result with cartilage techniques, and comparisons with temporalis fascia and perichondrium only techniques have shown no significant differences in functional results. (4,8,9)

The purpose of this study was to evaluate the efficacy and simplicity of the primary transcanal cartilage tympanoplasty technique in adults in whom the ossicular chain was intact by assessing the "take rate" and postoperative hearing outcomes.

PATIENTS AND METHODS

This prospective study involved 64 consecutive adult patients with chronic otitis media who had not previously undergone any tympanoplasty operation (thus excluding revision surgery). A history of past ventilation tube insertion was obtained in 3 patients (5%).

All surgeries were performed by the author at the university ENT department between 2001 and 2004. The ages of the patients ranged from

16 to 58 years (average 30 years), 56% were men and 44% women.

The following inclusion criteria were adopted: (1) small to medium-sized perforations (smaller than 50% of the total surface of the TM,

(2) non-marginal TM perforations that could be seen entirely through a transcanal view, (3) dry ears with no granular myringitis, (4) conductive hearing loss no greater than 35 dB in any frequency, and (5) at least 3 months of clinical observation for non-healing of the perforation.

Patients who fulfilled the eligibility criteria and signed the informed consent form were assigned to the surgical procedure.

Surgical Technique:

The operation was performed under G.A. with infiltration of 1% xylocaine and 1:100,000 epinephrine on both sides of the tragus. Through a transcanal approach using the largest most comfortable ear speculum, the TM was accessed, where the edge of the perforation was freshened by the standard methods. Sufficient margins in all directions of the perforation after freshening were assured to accommodate the composite graft. An initial

cut through skin and cartilage was made on the medial side of the tragus, leaving 2mm of cartilage in the dome of the tragus for cosmesis. A piece of cartilage with attached perichondrium on one side was dissected from the overlying skin and soft tissue by spreading a pair of sharp scissors in a plane that is easily developed superficial to the perichondrium on one side and at the sub-perichondrial level on the other side. The harvested cartilage perichondrium composite graft (CPCG) was trimmed to the desired size which is a slightly larger (~2mm on all sides) than the perforation size. Placement of the graft involved manipulation with a pick to help pushing the leading section of the graft anteriorly followed by manipulating the remaining section to gain an intratympanic position.

The entire graft was placed in an underlay fashion with the perichondrium immediately adjacent to the TM remnant and the cartilage facing the promontory (Fig. 1).

The middle ear space and the external auditory canal were packed in a standard way using gelfoam. An antibiotic ointment is inserted in the ear canal, then a cotton wool ball is

placed in the meatus. The patient may be discharged home the same day.

After the operation, patients were seen routinely every 2 weeks by the surgeon for 12 weeks then at 3 months basis for the rest of the follow-up period. At each follow-up visit, the patients were examined under the microscope to detect the changes at the TM. On the 30th postoperative day the "take rate" was assessed. An audiogram was performed at the end of the third postoperative month and a second one at the end of the follow-up period.

RESULTS

A total of 64 adult patients were enrolled into the study, of whom 36 were men and 28 women. The average follow-up period was 16 months (range 6-30 mo). No significant intraoperative or postoperative complications were encountered except one

case of TM inflammation seen during the first 30 postoperative days. Our results may be reported in anatomic and functional terms.

Surgical (anatomic) Data :

Complete TM closure was achieved in 61 cases at the latest follow-up visit which resulted in 95.3% "take rate". Total graft failure was not seen in the rest of the cases (5%), but only smaller perforations than shown preoperatively. Among these three cases, was the patient who had postoperative inflammation.

Audiometric (functional) Data :

All patients, except one, showed an improvement in the air-bone gap (ABG) at all frequencies after surgery. There was closure of the ABG to within 10 dB in 87.5% and to within 20 dB in 98% at the end of the follow-up period. In one case, hearing did not change (2%). The hearing gain is shown in table I.

Table I: Postoperative hearing gain with cartilage tympanoplasty (n=64)

Air-Bone Gap (ABG)	Number (%) of ears	
	Preoperative	Postoperative
0-10 dB	21 (33)	56 (87)
11-20 dB	33 (52)	7 (11)
> 20 dB	10 (15)	1 (2)

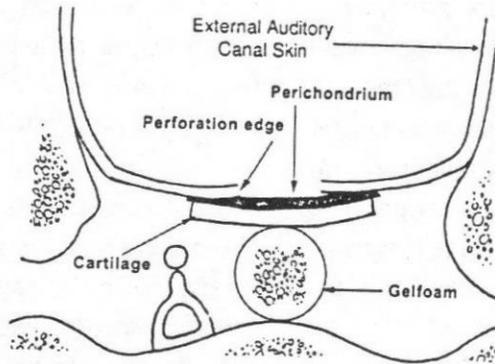


Fig.1: Placement of graft in transcanal cartilage tympanoplasty.

DISCUSSION

Repair of tympanic membrane (TM) perforations with most accepted techniques reaches a success rate of over 90%.⁴ The most frequently used technique globally is underlay of temporalis fascia.¹⁰ However, the technique necessarily invokes lifting of a tympanomeatal flap for fixation of the graft, with its inherent tendency to provoke bleeding that sometimes impairs visualization and causes flap tears, particularly with neophyte surgeons. Also, unknown to the surgeon, subsequent packing may cause displacement of the graft, which may contribute to the failure rate. In addition, the flap elevation and subsequent packing introduce a degree of morbidity.¹¹ Compared with the technique discussed herein, the time taken for the temporalis fascia technique is longer and less cost-effective with more involvement of postoperative care.⁷ Transcanal cartilage tympanoplasty technique also avoids an endaural or postaural scar.

Smyth et al.¹² reported that cartilage with perichondrium, on one or both sides, had better viability (better metabolism and stronger enzymatic reaction) than totally naked cartilage. It is well known that cartilage has no

vessels and receives nourishment by diffusion from the surface with help of the perichondrium.¹⁶ As a grafting material, cartilage composite graft offers advantages. It is an autogenous tissue that can be easily harvested from the existing surgical field in plentiful amounts. It does not require hair shaving and extensive dissection and can be easily shaped. The donor site heals without complications or deformity in a short period of time and with minimal care.¹³

Cartilage perichondrium grafts are frequently the material of choice for the reconstruction of the atelectatic tympanic membranes and recurrent perforations (revision tympanoplasties). Reports in the literature suggest favourable anatomic results and low recurrence rate.^{6,8,12}

As the indications for routine use of this more rigid material in tympanoplasty, however, remain somewhat controversial and type I tympanoplasties, (myringoplasties) represent only a minority of otologic cases in which cartilage is used, an attempt was made through approaching the perforation transcanally to assess the impact of the tragal CPCG on healing and hearing by isolating a clearly de-

fined patient population group in whom the ossicular chain was intact.

The anatomic success rate in this study (95.3% "graft take") may be related to the careful selection criteria used. However, a 100% success rate has been obtained in other studies using cartilage and perichondrium.^{4,7,9,11,13} Cartilage is easier to tailor, manipulate and position than fascia and supplies both the scaffolding necessary during healing (epithelialization) and subsequent support from recurrence of perforations.^{6,13} During healing, the cartilage scaffolding stabilizes and fixes the perichondrium, thus preventing it from herniating into the middle ear cavity and contributing to a failure.¹⁴ Shrinking of the perichondrium is also minimized by its attachment to the cartilage. Temporalis fascia grafts rely on fixation by adhesion and can easily be displaced during healing.¹⁴

Since the introduction of cartilage in the reconstruction of the TM⁵, the acceptance on routine reconstruction of the TM with cartilage has been hampered by its putative detrimental impact on hearing. Conceptually, one might anticipate a significant conductive hearing loss, especially in the

high tones, with a TM that is rigid and thick.⁴

Various studies using cartilage to repair TM perforations seem to exonerate cartilage as a significant impediment to vibration^{8,9,13}.

For example, Amedee et al.¹⁴ reported an average of postoperative ABG of 4 dB and Adkins⁸ reported that grafting the entire tympanic membrane with cartilage resulted in a 5-10 dB ABG. Levinson¹³ reported that 65% of his patients had closure of the ABG to within 10 dB and 86% to within 20 dB. More recently, Fernandes⁷ reported that the postoperative ABG was reduced to within 10 dB at all frequencies in his 15 cases series.

Dorhoffer showed that there is no difference in postoperative hearing results when comparing cartilage tympanoplasty and perichondrium tympanoplasty. Gerber et al.⁹ showed an improvement in ABG after surgery and found no significant difference when comparing it with the temporalis fascia group.

This study demonstrates overall hearing improvement after the trans-canal cartilage tympanoplasty which

is comparable to that in the literature. The significant reduction of the ABG remained stable at the various follow-up intervals, which points to good middle ear function following this simple technique.

The biochemical and histological properties of cartilage, along with the surgical and audiological results reported here and in other studies^{4,6,17,18} suggest that cartilage can be used in eardrum reconstruction with remarkable success.

Finally, although treatment efficacy and the balance between risks and benefits are the primary criteria to select treatment options, limitations in health care resources enhance efforts to choose treatment options based on cost-effectiveness.

An experienced surgeon is able to conduct this procedure in no more than 30 minutes. This agrees with Mauri et al.¹⁹ statement that the average cost of the transcanal cartilage tympanoplasty is 65% less expensive than the conventional underlay tympanoplasty.

CONCLUSION

It would appear that transcanal

cartilage tympanoplasty offers the possibility of a rigorous TM reconstruction with excellent postoperative hearing outcomes. Our results are comparable to those after temporalis fascia tympanoplasty and to those in the literature utilizing the CPCG. Apart from ease and speed, this technique is also associated with minimal morbidity. Because an endaural or postaural incisions would be avoided, aural comfort and tidiness are enhanced. It is a cost-effective simple technique which requires minimal training and suits the noncompliant patients. Cartilage was found to be an excellent graft material and when coupled with the transcanal technique, an argument can be made for more liberal applications in tympanoplasty.

REFERENCE

- 1- Zöllner F. (1995) : The principles of plastic surgery of the sound-conducting apparatus. *J Laryngol Otol*;69: 657-9.
- 2- Wullstein HL. (1952) : Funktionelle operationen im mittelohr mit hilfe des freien spaltlappen-transplantates. *Arch Otorhinolaryngol*;161: 422-35.

- 3- Rize: FM. (1997) : Overlay versus underlay tympanoplasty. Laryngoscope (Suppl.);106: 26-36.
- 4- Dornhoffer JL. (1997) : Hearing results with cartilage tympanoplasty. Laryngoscope; 107: 102694-1099.
- 5- Jansen C. (1963) : Cartilage-tympanoplasty. Laryngoscope; 73: 1288-302.
- 6- Milewski C. (1993) : Composite graft tympanoplasty in the treatment of ears with advanced middle ear pathology. Laryngoscope;103: 1352-6.
- 7- Fernandes SV. (2003) : Composite chondroperichondrial clip tympanoplasty. Otolaryngol Head Neck Surg.;128: 267-72.
- 8- Adkins WY. (1990) : Composite autograft for tympanoplasty and tympanomastoid surgery. Laryngoscope; 100: 244-7.
- 9- Gerber MJ, Mason JC, Lambert PR. (2000) : Hearing results after primary cartilage tympanoplasty. Laryngoscope; 110: 1994-9.
- 10- Kessler A, Potsic WP, Marsh RR. (1994) : Type I tympanoplasty in children. Arch Otolaryngol Head Neck Surg. ; 120: 487-90.
- 11- Eavey RD. (1998) : Inlay tympanoplasty: cartilage butterfly technique. Laryngoscope; 108: 657-61.
- 12- Smyth GDL, Kerr AG. (1970) : Cartilage homografts. Experimental and clinical aspects. Acta Otorhinolaryngol Belg; 24: 53-59.
- 13- Levinson RM. (1987) : Cartilage-perichondrial composite graft tympanoplasty in the treatment of posterior marginal and attic retraction pockets. Laryngoscope; 97: 1069-1074.
- 14- Amedde RG, Mann WJ, Riechelmann H. (1989) : Cartilage palisade tympanoplasty. Am J Otol;10: 447-50.

- 15- **Borkowski G, Sudhoff H, Luckhaupt H. (1999)** : Autologus perichondrium-cartilage graft in the treatment of total and subtotal perforations of the tympanic membrane. *Laryngorhinootologie*; 78: 68-72.
- 16- **Stockwell RA. (1979)** : Biology of cartilage cells, 1st ed. Cambridge: Cambridge University Press: 81-86.
- 17- **Duckert LG, Muller J, Makielski KH, Helms J. (1995)** : Composite autograft "shield" reconstruction of remnant tympanic membranes. *Am J Otol*; 16(1): 21-26.
- 18- **Ferekidis EA, Nikolopoulos TP, Kandiloros DC, Yiotakis JE. (2003)** : Chondrotympanoplasty: a modified technique of cartilage graft tympanoplasty. *Med Sci Monit*; 9(2): 73-8.
- 19- **Mauri M, Lubianca Neto JF, Fuchs SC. (2001)** : Evaluation of inlay butterfly cartilage tympanoplasty: A randomized clinical trial. *Laryngoscope*; 111: 1479-85.