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Inlay butterfly cartilage tympanoplasty for large central perforations

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ABSTRACT

Objective. The aim of this study is to evaluate the results of inlay butterfly tympanoplasty technique in large central tympanic membrane perforations. ***Methods.*** The files of the patients who underwent inlay butterfly cartilage tympanoplasty for large central tympanic membrane perforations were reviewed. Patients were followed with otoscopy and audiometry. Preoperative and postoperative pure-tone audiometry results were calculated and analyzed to evaluate the hearing gain. The grafting procedure was considered successful if no perforations were observed during postoperative microscopic or endoscopic evaluation during the follow-up period. ***Results.*** Twenty-nine patients with large central tympanic membrane perforation who were operated by inlay butterfly tympanoplastytechnique were included in the study. Twenty-one (72.4%) ears were operated with endoscope and 8 (27.6%) under microscope. The mean duration of surgery was 30.5±3.77 minutes. The mean follow-up time was 69.6±21.6 (range; 24-112 weeks). Graft take rate was 89.7% (26/29). ***Conclusion.*** Inlay butterfly cartilage tympanoplasty is a minimal invasive and effective technique for repairing large central tympanic membrane perforations.

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Keywords: tympanoplasty, butterfly, cartilage, central perforations, take rate

Introduction

Since the first application of the tympanoplasty, various graft materials and techniques have been used to repair tympanic membrane perforations [1]. Both the underlay and overlay techniques using the temporalis muscle fascia or perichondrium have been regarded as popular and reliable methods [2]. The inlay butterfly cartilage tympanoplasty (IBT) was first described by Eavey in 1998 for the repair of small central perforations [3]. In this technique, tragal cartilage is used as a graft and placed transcanally. It has been shown that transcanal IBT technique is more advantageous when compared to onlay and underlay tympanoplasty because of the possibility of performing under local anesthesia, reducing the need for postoperative follow-up and care, and being a faster and cheaper procedure [4]. Since than IBT technique has been used to repair small central tympanic membrane perforations and has successful

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results. However, there are not enough studies on the use of the butterfly cartilage tympanoplasty technique in large tympanic membrane perforations. In this study our aim is to evaluate the results of inlay butterfly tympanoplasty technique in large central tympanic membrane perforations.

Methods

This retrospective study was performed by analyzing the clinical records of 29 patients who underwent transcanal IBT for large central tympanic membrane perforation between 2013 and 2016 in a tertiary hospital. The study was approved by Adiyaman University Institutional Review Board with the number: 2016/6-7. Patients who had no ear discharge within the last three months, no signs of inflammation or infection of the middle ear mucosa, and no signs of inflammation or infection of mastoid cells, as evaluated with temporal bone computed tomography were included study. Patients with insufficient data and follow-up period were excluded from study. All the operations were performed by the same surgeon (MK). The absence of an intact ossicular chain was an exclusion criterion. Preoperative and postoperative pure-tone audiometry results at 0.5, 1, 2 and 4 kHz were calculated and analyzed to evaluate hearing improvement. The grafting procedure was considered successful if no perforations were observed in postoperative microscopic or endoscopic evaluation during the follow-up period. Perforations covering more than 2/3 of the tympanic membrane were considered as large tympanic membrane perforations. The time between the local anesthetic infiltration and the packing of the external ear canal with gelfoam following grafting was recorded as the durationof surgery.

Surgical technique

Figure 1 shows the main steps of surgery. The procedure is performed under general anesthesia. Patients are prepared in a sterile fashion. The meatal surface of the tragus is injected with 1 to 3 mL of the

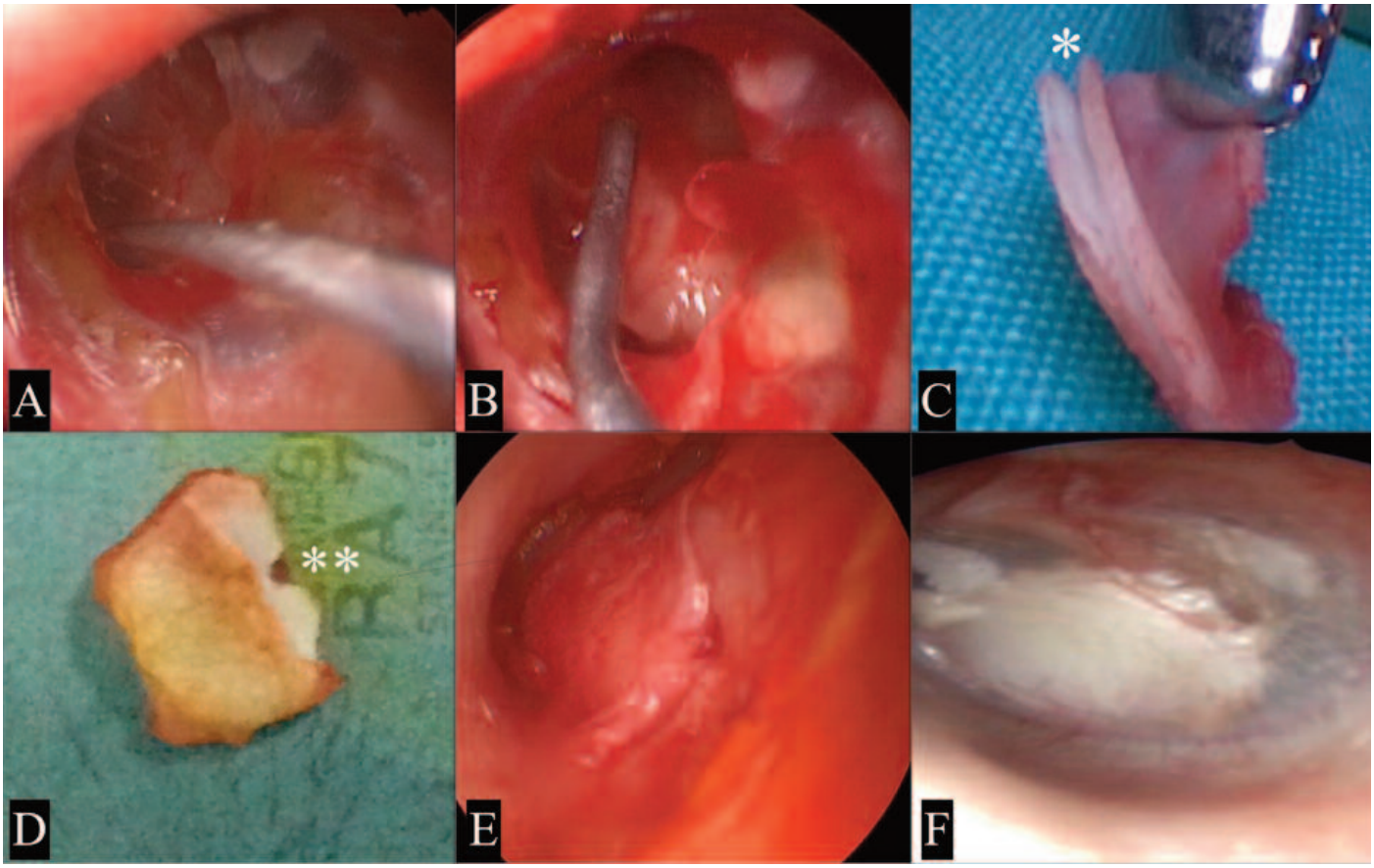

Figure 1. The main steps of inlay butterfly cartilage tympanoplasty. Initial perforation (A), the tympanic membrane remnant is refreshed and dimensions of the perforation are measured (B), a butterfly shaped tragal cartilage graft with preserved perichondrium (C), a triangular notch created in the cartilage to insert the graft laterally to the malleus (D), aspect of the tympanic membrane at the end of the procedure (E), Post-operative view of the tympanic membrane (F). *=circumferential notch around the graft, **=triangular notch

Table 1. Descriptive characteristics and clinical findings of the patients (n=29)

Sex (male / female)	16 (55.2%) / 13 (44.8%)
Age (year)	31.1±16.5
Operation side (right / left)	17 (58.6%) / 12 (41.4%)
Mean follow-up (month)	69.6±21.6
Graft intake success rate	26 (89.7%)
Preoperative ABG	22.7± 6.96
Postoperative ABG	8.9±4.5

Data were shown as mean±SD or n (%). ABG= air-bone gap

local anesthetic contained 40 mg of lidocaine HCl and 0.025 mg of epinephrine (Jetokain Ampule; Adeka Medical Inc., Samsun, Turkey). The graft is harvested by preserving the perichondrium on both surfaces of the tragal cartilage. Graft is prepared by measuring with a hook slightly larger than the perforation. The perichondrium must exceed the cartilage and a circumferential notch is opened all-around graft. The tympanic membrane remnant is refreshed with a pick, under the annulus edge and around the malleus, which needed to be stripped in some cases. The cartilage is then inserted throughout the perforation, yielding a butterfly configuration, with one wing remaining in the lateral position and the other lying medially to the perforated ear drum. In perforations which the malleus is exposed, a triangular notch is created in the cartilage and the graft is positioned laterally to the malleus. In such cases tympanic membrane remnants must be cleaned from malleus to prevent iatrogenic cholesteatoma. No packing is placed in the middle ear. The external ear canal is then packed with gelfoam and an ear wick is placed in the external meatus.

Statistical Analysis

SPSS 21 software was used for statistics. Distribution property (Normality) was performed with Kolmogov Smirnov test. Descriptive statistics were used and values were expressed as mean±SD or n (%). Normal distribution data were analyzed with an Independent t test (Student t test). p value <0.05 was evaluated as statistically significant.

Results

Twenty-nine patients with large central tympanic membrane perforation who were operated by IBT technique were included in the study. Sixteen (55.2%) patients were male and 13 (44.8%) were female. The mean age of the patients was 31.1±16.5 (8-67 years) years. Seven (24.1%) patients were children and 22 (75.9%) patients were adult patients. Seventeen (58.6%) patients were operated on the right ear and 12 (41.4%) on the left ear. Twenty-one (72.4%) of the surgeries were performed by endoscope and 8 (27.6%) under the microscope. The mean duration of surgery was 30.5±3.77 minutes. The mean follow-up time was 69.6±21.6 (range; 24-112 weeks). The graft take rate was 89.7% (26/29) (Table 1). Of the unsuccessful three cases, in one patient total graft extrusion was observed, and in the other 2 cases perforation diameter became smaller than the preoperative diameter, and annular perforations were observed around the grafts. The mean preoperative air-bone gap was 22.7±6.96 dB, with an average postoperative 8.9±4.5 dB gap. A significant decrease in the mean air-bone gap from the preoperative period to the last follow-up was found (p<0.001) (Figure 2). No complications or adverse reactions were noted in the patients.

Discussion

Tympanoplasty operations are one of the most common surgical procedures in the middle ear surgery. The goal of tympanoplasty is to repair the perforated ear drum, to create a middle ear free of infection and to improve hearing ability of the patient. For this purpose, many materials such as fascia, skin, venous vein wall, perichondrium, fat, dura have been used [5]. Classical tympanoplasty techniques have a success rate between 80% and 95%, but can cause some problems during the postoperative period. A wider incision is made in order to harvest a graft. The elevation of the tympano-meatal flap temporarily deteriorates the anatomy of the middle ear cavity and the external ear canal and requires more postoperative care [6, 7]. These procedures prolong the duration of

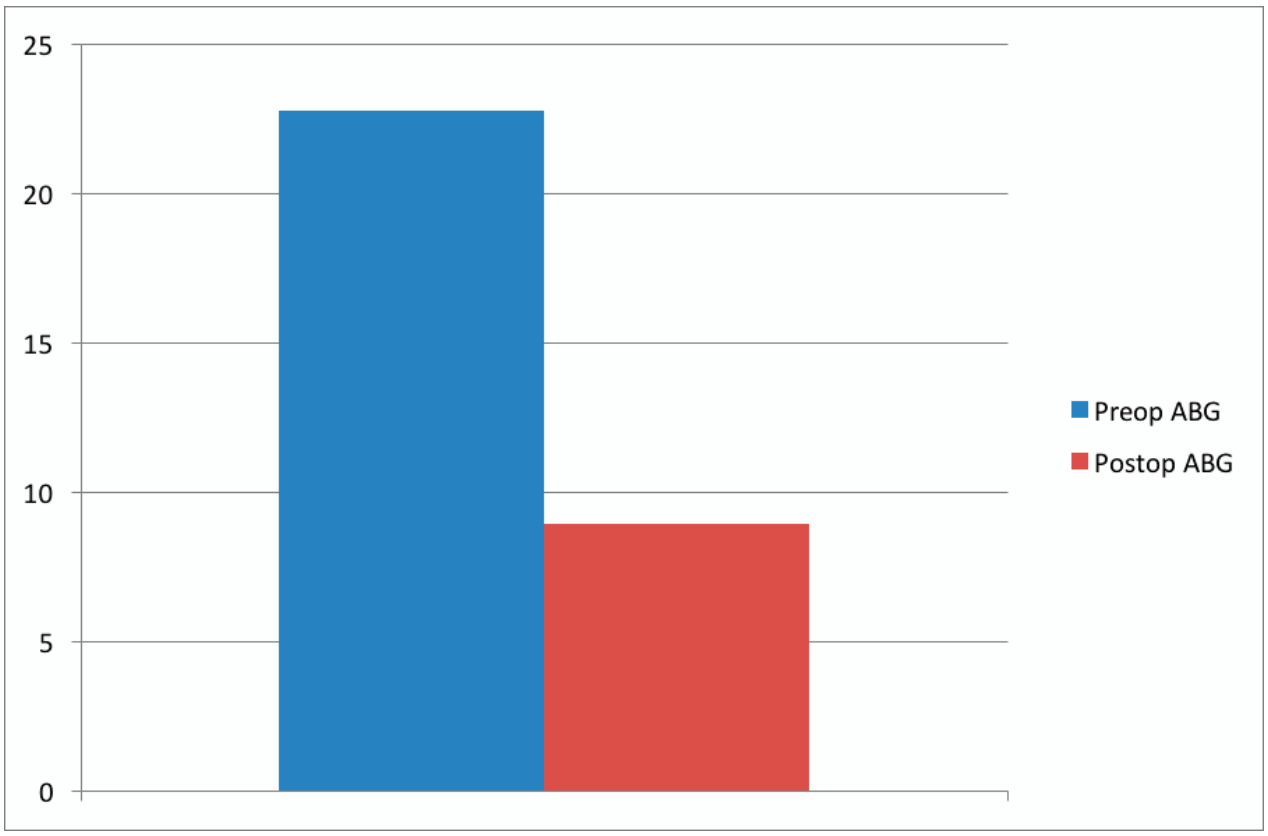

Figure 2. Comparison of preoperative and postoperative air-bone gap. ABG= air-bone gap, Preop=preoperative, Postop=postoperative

the surgery and hospitalization and the patients are susceptible to infection. Moreover, malleus head or damage to the ossicular chain may occur during operation [7].

IBT, which has been widely applied in the last two decades, is a comfortable and reliable method for both surgeon and patient and the results are also satisfactory. The main advantages of the butterfly technique are its reliability, avoidance of tympano-meatal flap elevation, which prolongs surgical time, and minimal postoperative discomfort [9]. Another important advantage of this technique is that the only incision is made on the tragus. There are many studies conducted in the literature in which the anatomical success rates range from 43% to 100% [3, 9-12]. Eavey [3] achieved 100% graft success with this technique in the pediatric age group. Lubianca-Neto [13] conducted a study in 2000, applying this technique under local anesthesia in adult patients and achieving success of 90%. Mauri et al. [14] compared the results of the IBT technique with the underlay tympanoplasty and suggested that there was no difference between the two techniques in terms of perforation repair and audiometric outcomes.

IBT related studies generally refer to successful outcomes of IBT techniques in patients with small central perforations. However, there is not enough study about the success of IBT technique in larger tympanic membrane perforations. Alain et al. [4] performed butterfly cartilage tympanoplasty in patients with total and subtotal tympanic membrane perforations and reported a graft success rate of 88%. Angeli et al. [15] and Fishman et al. [16] reported that graft success was 86% and 84%, respectively, in large tympanic membrane perforations with classic tympanoplasty techniques using fascia and dermis grafts. Moreover, IBT is discussed as a rapid and time saving procedure. Kim et al. [12] compared patients who underwent inlay butterfly cartilage tympanoplasty and patients who underwent conventional underlay tympanoplasty using the temporalis fascia. They reported that there was no statistically significant difference between two groups considering the surgical success rate, the mean air-bone gap decrease but they reported a significantly shorter operation duration in IBT group. The mean operation duration was 25.6±8.5 minutes in IBT group and 48.6±19.5 in conventional temporalis facia group. In our study, the mean operation duration was 30.5±3.77 minutes and the operation duration is

similar to the studies which were performed with IBT in the literature.

In this study, we presented our results with IBT technique in large central perforations. We demonstrated that the IBT technique is feasible and achieves good results. The graft take rate was 89.7% at the end of the follow-up and the mean operation duration was 30.5±3.77 minutes. The graft intake success rate is similar to the graft success rates of patients with large tympanic membrane perforations, which were performed with other methods in the literature and operation duration is shorter than conventional tympanoplasty methods.

Conclusions

Inlay butterfly cartilage tympanoplasty is a minimal invasiveand effective technique for repairing large central tympanic membrane perforations. Using IBT is shorter in duration than other methods and has less surgical and postoperative morbidity. Moreover, the duration of hospitalization was shorter and the success rates were found to be similar to the standard methods in our study. Therefore, IBT technique can be a feasible treatment option for large central tympanic membrane perforations.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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