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Prognostic factors in type I tympanoplasty

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ABSTRACT

Objective: To identify the preoperative factors that influence the success rate of type I tympanoplasty.
Methods: A total of 247 type I tympanoplasty procedures were included in the present study. We determined the effects of the following preoperative variables on the anatomical and functional outcomes of type I tympanoplasty in order to identify prognostic preoperative factors: age (<16 years vs. >16 years), history of ear surgery, state of the contralateral ear (healthy vs. diseased), size of perforation, presence of septal pathology, presence of adenoid disease and history of smoking. Additionally, we stratified the surgical procedures according to the type of graft materials used and analyzed the effects of the above preoperative variables on the success rates of each type of procedure separately in order to eliminate the confounding effect of surgical technique.
Results: The study was conducted on 217 subjects (130 females, 87 males) who underwent a total of 247 surgical procedures. The graft take rate was significantly higher after tympanoplasty with perichondrium–cartilage island flap (PCIF) grafts than after tympanoplasty with temporalis fascia (TF) grafts (87.8% vs. 72.3%, $p = 0.008$). Young age ($p = 0.013$), presence of adenoid hypertrophy ($p = 0.001$) and abnormality of the contralateral ear ($p = 0.027$) were associated with lower success rates after tympanoplasty with TF grafts. The success rate of tympanoplasty with PCIF grafts was not affected by any of the preoperative variables we tested. Postoperative audiometry showed that the improvement in hearing ability did not differ between patients who received TF grafts and those who received PCIF grafts ($p = 0.325$).
Conclusion: Tympanoplasty with cartilage grafts was associated with better graft takes and comparable hearing outcomes than those associated with tympanoplasty with TF grafts. In patients with risk factors such as contralateral ear disease, a young age or adenoid disease, cartilage–perichondrium grafts are preferable to TF grafts.

1. Introduction

A successful tympanoplasty requires a mucosa-lined middle ear cleft with an intact tympanic membrane (TM) and an intact, mobile ossicular chain. In type I tympanoplasty, in which the ossicular chain is always intact, closure of the TM perforation seems to be the most influential factor for the success of the procedure. Since the introduction of tympanoplasty surgery, many materials like skin, fascia, vein, perichondrium, dura mater and cartilage have been used as graft materials [1]. Cartilage grafts have become very common in recent years because of their rigidity, resistance to atrophy and association with good hearing outcomes. High success rates have been reported for type I tympanoplasty with cartilage grafts. Nevertheless, fascia grafts remain the most commonly used grafts for the closure of the TM perforation in primary tympanoplasties [2].

Several other factors are also thought to influence the success rate of tympanoplasty, such as patient age, Eustachian tube function, perforation size, smoking, bilateral disease and septal deviation [3–5]. However, the effects of these factors on the success rates of tympanoplasties with different types of graft

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materials for the closure of TM perforations are not known. In this study, we aimed to identify the preoperative variables that influence the success rates of type I tympanoplasties with two different graft materials.

2. Patients and methods

2.1. Study design

We reviewed the medical records of patients who underwent tympanoplasty type I between January 2007 and June 2013. Patients who had persistent TM perforation with dry ear for an at least 3-month-period before the surgery were included in the study. Patients with cholesteatoma, those who underwent concomitant otologic surgery such as mastoidectomy and those with ossicular chain discontinuity or any additional pathologies that might affect the middle ear (e.g., cleft palate, Kartagener's syndrome) were excluded from the study. In all, 217 patients who had undergone type I tympanoplasty (247 procedures) were included in the present study. The protocol of this study was approved by our institution's ethics committee. All patients included in the study provided informed written consent.

We analyzed the differences in anatomical and functional outcomes with preoperative variables such as age (<16 years vs. >16 years), gender, state of the contralateral ear (healthy vs. diseased), size of perforation (<50% vs. >50%), septal pathology, adenoid disease and history of smoking, in order to determine the predictive value of each variable. Chronic serous or adhesive otitis media and chronic supurative or nonsupurative otitis media in the contralateral ear were interpreted as disease. Deviation of the nasal septum and adenoid hypertrophy were assessed as being absent or present based on physical examinations and computed tomography (CT) imaging. The size of the perforation was assessed and measured subjectively by transcanal endoscopic examination. Additionally, we stratified the surgical procedures according to the type of graft material and analyzed the independent effects of the above variables on surgical outcomes in each group in order to eliminate the confounding effect of surgical technique. The configurations of the two groups (TF and PCIF group) were similar.

2.2. Surgical procedures

All operations were performed by one of the surgeons in our department (random allocation) with the patient under general anesthesia with endotracheal intubation. The underlay grafting technique was used in all procedures. Two types of graft materials were used, which were also selected at random: temporalis fascia (TF) or composite perichondrium/cartilage island flap (PCIF). TF grafts were harvested from the ipsilateral temporalis muscle, and PCIF grafts were harvested from two areas of the ipsilateral tragus or cymba, depending on the size of the TM perforation and whether a retroauricular or an endaural approach was used. A no. 11 blade was used for thinning and shaping the cartilage graft. A 2-mm-wide strip was excised vertically from the center of the cartilage graft in order to facilitate accommodation of the graft on to the handle of the malleus, if needed. The mobility of the ossicular chain was evaluated during the surgery.

2.3. Outcomes

The main outcome measure was successful tympanoplasty as indicated by the closure of the TM perforation. A successful anatomical outcome was defined as an intact TM without any retraction or lateralization for at least 6 months after the surgery. A successful functional outcome was defined as an improvement in pure tone average (PTA) and closure of the air–bone gap on postoperative audiometric testing. Hearing ability was analyzed at frequencies 0.5, 1, 2 and 3 kHz for both bone and air conduction.

2.4. Statistical analysis

Statistical analysis was performed using SPSS 21.0 for Windows. The distribution of the data was analyzed with the Kolmogorov–Smirnov test. The chi-square test was used to compare nonparametric variables, and the Kruskal–Wallis, Mann–Whitney U and independent-variables t tests were used to compare parametric variables. Statistical significance was accepted at p values of <0.05. Pearson correlation analysis was used to identify independent prognostic factors and to assess their relative importance.

3. Results

This retrospective study involved 217 patients (130 females, 87 males) and 247 surgical procedures. The mean age of the patients was 27.7 ± 11.8 years (range, 9–61 years). TF and PCIF grafts were used in 173 (70%) and 74 (30%) surgical procedures, respectively. The overall graft success rate was 77% (190/247), as assessed using closure of the TM perforation. Audiometric tests revealed a mean postoperative improvement in PTA of 12.3 ± 12.4 dB.

The graft take rate was significantly higher for PCIF grafts than for TF grafts (87.8% vs. 72.3%; $p = 0.008$). The presence of adenoid disease ($p = 0.047$) and abnormality of the contralateral ear ($p = 0.041$) were associated with lower success rates in all procedures, regardless of the graft material used. The size of the TM perforation ($p = 0.074$), patient age ($p = 0.147$), presence of septal deviation ($p = 0.981$) and history of smoking ($p = 0.223$) were not related to graft take rates (Table 1).

We also analyzed the effects of preoperative variables on the success rates of procedures with TF and PCIF grafts. Young age ($p = 0.013$), adenoid disease ($p = 0.001$) and abnormality of the contralateral ear ($p = 0.027$) were associated with lower success

Table 1
Relationship between surgical success rate and preoperative prognostic variables.

Preoperative variable	Number of cases	Success rate	p value
Age			
<16 years	38	27 (71.0%)	0.387
>16 years	209	162 (77.5%)	
Sex			
Male	96	70 (72.9%)	0.233
Female	151	120 (79.5%)	
Graft material			
Cartilage	74	65 (87.8%)	0.008*
Fascia	173	125 (72.3%)	
Nasal septal deviation			
Present	87	67 (77.0%)	0.981
Absent	160	123 (76.9%)	
Adenoid disease			
Present	47	36 (66.0%)	0.047*
Absent	200	159 (79.5%)	
Perforation size			
<50%	108	81 (75.0%)	0.740
>50%	102	78 (76.5%)	
Contralateral ear			
Affected	118	84 (71.2%)	0.041*
Not affected	129	106 (82.2%)	
Smoking			
Yes	31	22 (71.2%)	0.223
No	111	90 (81.1%)	

* Significant p values.

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