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Anatomic and Functional Results of Cartilage Type 1 Tympanoplasty in Children and the Evaluation of the Success of Surgery with Parental Perceptions

Original Investigation

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Abstract

Objective: This study aims to determine the anatomic and functional results of cartilage Type 1 tympanoplasty in children and to evaluate the success of surgery with parental perceptions.

Methods: Only pediatric patients who had undergone cartilage Type 1 tympanoplasty were included in this study. Patients older than 16 years and patients who had otorrhoea during the previous month, chronic otitis media with cholesteatoma and patients who had undergone mastoidectomy or ossiculopasty were excluded. The 'anatomical' success was accepted as an intact graft in the last control in the at least 6th month postoperatively. A satisfaction questionnaire with four questions about the perceptual results of surgical intervention was applied to the patients' parents on the telephone.

Results: In total, 44 ears of 41 cases (22 male 19 female) were included in the study. The mean age was 13.2±2.7 (8-16) and the mean follow-up time was 17 (7-36) months. Anatomical success rate was 88.6% (39/44). As a preoperative mean, the pure tone hearing threshold was 30.7±7.7 dB and the postoperative mean pure-tone hearing threshold was 18.8±7.8 dB. Among the operated ears, 88.6% (39/44) of the perforations were treated successfully. Of the 41 paediatric patients' parents, only 28 (68.2%) could be reached by telephone; nineteen (68%) of the 28 parents contacted thought that the hearing level had improved postoperatively and only 10 parents (35%) stated that his/her child could attend a preoperatively-restricted activity postoperatively.

Conclusion: Outcomes of cartilage tympanoplasty in children satisfy both surgeons and parents. Chronic otitis media in children must be managed with surgery as soon as favourable conditions are provided.

Key Words: Chronic otitis media, tympanoplasty, children, cartilage

Introduction

In children with chronic otitis media (COM), tympanic membrane perforation, recurrent infections, and hearing loss reduce their life quality. Tympanoplasty in children is controversial due to the possibility of spontaneous closure of the perforation, frequent upper respiratory tract infection, immune deficiency, Eustachian tube dysfunction, narrow external auditory canal, difficulty in cooperation, and difficulty in postoperative care. Moreover, some researchers do not recommend tympanoplasty surgery for children because of its lower success rate in children than in adults (1, 2). However, the number of researchers with this point of view is decreasing day by day. Furthermore, COM, which can be corrected through simple tympanoplasty or myringoplasty surgery, may lead to cholesteatoma formation or hearing loss due to delayed operation (3). However, there is no consensus on the most appropriate technique and age for surgery. Also, although high success rates of tympanoplasty surgery are reported in the literature, knowledge about the effect of this surgery on children's life quality and about the benefits of the surgery is limited.

In studies performed for evaluating the results of tympanoplasty, objective criteria, such as graft success and improvement in hearing level, are taken into consideration during the evaluation. In the literature, there have been a few studies conducted on the postoperative subjective perceptions of patients. The aim of our study was to determine the anatomic and functional results of cartilage Type 1 tympanoplasty in children and to evaluate the success of tympanoplasty surgery with parental perceptions.

Methods

Pediatric patients who had undergone cartilage Type 1 tympanoplasty in the Otorhinolaryngology Clinic at Sakarya University between the dates of May 2009 and January 2013 were included in this study. The study protocol was approved by the ethics committee of the Faculty of Medicine at Sakarya University (approval no: 71522473.050.01.04/103). The parents of all patients were informed about the process, and written informed consent was obtained from them. Patients older than 16 years and patients who had otorrhea during the previous month, chronic otitis media with cholesteatoma, and patients who had

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undergone mastoidectomy or ossiculoplasty were excluded. The patient files were evaluated retrospectively, and their age, gender, pre- and post-operative air-bone gap on pure tone audiometry, condition of the graft, and post-operative complications were recorded.

All surgeries were performed under general anesthesia and with a postauricular approach. A conchal/tragal cartilage island graft was used as graft material. The cartilage graft prepared was placed with the underlay technique, and all patients underwent type 1 tympanoplasty. The intact graft was evaluated as 'anatomical' success in the last post-operative control performed in at least the sixth month. The follow-up examinations were performed by using a microscope. Hearing results were evaluated by comparing the mean of pre-operative and post-operative pure-tone audiometry hearing thresholds at 0.5, 1.2, and 4 kHz. The first assessment of post-operative hearing level was done in the sixth month after the surgery, and subsequently, it was repeated once a year. In the study, pure-tone audiometry results obtained in the last post-operative control were used for the comparison of hearing results. In the second stage of the study, the parents of the patients were contacted via telephone and given a satisfaction questionnaire, including four questions about their perceptions related to the results of the surgery (Table 1).

Statistical Analysis

Statistical analysis of the obtained data was performed using Pearson's chi-square test (IBM SPSS Statistics 20, SPSS Inc., an IBM Co., Somers, NY). The value of $p<0.05$ was accepted as significant.

Results

A total of 44 ears of 41 cases (22 males, 19 females) were included in the study. The mean age was 13.2±2.7 (8-16), and the mean follow-up time was 17 (7-36) months. For 25 patients (56.8%), conchal cartilage was used as graft material, and for 19 patients (43.2%), tragal cartilage was used. Among the operated ears, 88.6% (39/44) of the perforations were treated successfully. The mean pre-operative pure-tone hearing threshold was 30.7±7.7 dB, while it was 18.8±7.8 dB for the post-operative pure-tone hearing threshold. The gain was <10 dB in 15 patients (34.1%), 10-20 dB in 20 patients (45.4%), and ≥20 dB in 9 patients (20.5%). The gain considering the mean pure-tone was about 11.9±6.8 dB. When anatomically unsuccessful patients were excluded, the mean gain was found to be 13.7±7.4 dB. For the patients with anatomical success, the mean pre-operative pure-tone hearing threshold was 31.1±7.4 dB, while the post-operative mean was 17.4±7.6 dB. In anatomically unsuccessful patients, the rate of hearing gain was less than expected (mean, 3.8±2.3 dB). For all patients, the pre-operative air-bone gap was found to be 27.4±5.2, whereas the post-operative air-bone gap was 16.5±6.6 dB. This change on audiometric evaluation was found to be statistically significant. No serious complication was encountered during or after the surgery.

Twenty-eight (68.2%) (28 ears) of 41 pediatric patients' parents were reached by telephone. The time that passed between the interviews and surgery was 21±6.4 (7-44) months on average. Nineteen (68%) of 28 parents who were contacted thought that there was an increase in the hearing level, and 21 (75%) mentioned that otorrhea had decreased (Table 2 and 3). Of these 28 patients, 22 had a medical history of pre-operative otorrhea. In 21 of these 22 patients, decreased otorrhea was detected. Only 10 parents (35%) reported that after surgery, their children could perform activities that had been restricted pre-operatively (Table 4). The rate of overall satisfaction with the surgery was found to be 85% (24-28) (Table 5).

Discussion

In children, surgical treatment of chronic otitis media is controversial as well as important. The aim of tympanoplasty is eradication of ear infection, improvement of hearing, and removing the necessity of protecting the child's ears against water. However, some authors do not recommend tympanoplasty surgery for children because of its lower success rate, recurrent upper respiratory tract infections, difficulty in cooperation, and possibility of spontaneous closure of the perforation (1, 2, 4) Moreover, some authors think that tympanic membrane perforation protects the ear against possible negative effects of Eustachian tube dysfunction by acting as a ventilation tube (3, 5). In the literature, the rates of successful tympanoplasty surgeries differ between 35% and 94% (6, 7). Some authors considered only the strength of the graft membrane as a success criterion, but for others, the success criteria included the absence of retraction, a healthy tympanic cavity, and improved hearing as well as the strength of the graft membrane. Therefore, various success rates are reported in the literature. In our study, the rate of anatomical success, defined as successful perforation closure in the last follow-up examination, was found to be 88.6%.

In children, there are many factors affecting the success rate of tympanoplasty, like age, location and size of perforation, otorrhea, and the condition of the contralateral ear. Of these prognostic factors, age is mostly emphasized. No consensus is available about the most appropriate age and technique for tympanoplasty in pediatric patients. Some authors reported age of 8 years and below as a poor prognostic factor for tympanoplasty surgery in children (8). Carr (9) and Caylan (6) stated that age did not influence the success rate of tympanoplasty in chil-

Table 1. Questions asked to the parents in the telephone interview

1	In your opinion, how was your child's hearing after the surgery? a) improved, b) remained same, c) deteriorated
2	After surgery, your child's ear infection and otorrhea a) decreased, b) did not change
3	Did your child begin to perform any activity, like swimming, that she/he had not used to do before the surgery? a) yes, b) no
4	In general, I am a) satisfied with the surgery, b) unsatisfied with the surgery

Table 2. Perceptions of the parents about their children's post-operative hearing

	Improved hearing	Hearing with no change	Deteriorated hearing
Successful Graft (n=24)	16 (75%)	5 (21%)	1 (4%)
Unsuccessful Graft (n=4)	1 (25%)	3 (75%)	0
Total (n=28)	19 (68%)	8 (29%)	1 (3%)

Table 3. Post-operative perceptions of parents about otorrhea and ear infections

	Decreased	Not changed	Also not existed before surgery
Successful Graft (n=24)	17/18 (94.4%)	1/18 (5.6%)	6
Unsuccessful Graft (n=4)	4/4 (100%)	0	0
Total (n=28)	21/22 (95.5%)	1/22 (4.5%)	6

Table 4. Post-operative perceptions of parents about otorrhea and ear infections

	Yes	No
Successful Graft (n=24)	8 (33%)	16 (67%)
Unsuccessful Graft (n=4)	2 (50%)	2 (50%)
Total (n=28)	10 (35%)	18 (65%)

Table 5. Overall satisfaction with surgery

	Satisfied	Unsatisfied
Successful (n=24)	21 (87%)	3 (13%)
Unsuccessful (n=4)	3 (75%)	1 (25%)
Total (n=28)	24 (85%)	4 (15%)

dren. Ozbek et al. (10) found a lower success rate for children younger than 10 years, which was not statistically significant. In addition to age, there are many prognostic factors, such as a history of otorrhea, Eustachian tube function, location and size of the perforation, surgery technique, and the type of graft material, that contribute to the success rate in children. In a study by Uyar and colleagues in which they evaluated the results of tympanoplasty surgery in children, it was reported that the success rate of surgery was higher in pre-operative dry ears (11). Some authors (12, 13) found that the surgical success rate was higher in small and posterior perforations, but others reported that the location and size of the perforation did not contribute to surgical success (6, 11). Eustachian tube function is considered an important prognostic factor for pediatric tympanoplasty surgery. The condition of the contralateral ear can suggest Eustachian tube function. Caylan (6) and Uyar (11) reported that the success rate of tympanoplasty was lower in the presence of bilateral chronic otitis media and otitis media with effusion or retraction pouch in the contralateral ear. Similarly, Collins et al. (14) notified that post-operative middle ear aeration would be lower in the presence of effusion or atelectasis in the contralateral ear, which would decrease the surgical success rate. Merenda et al. (15) found that the anatomical success rate was high in children with improved middle ear and mastoid aeration and high tympanometric volume. On the other hand, Pignataro (12) reported that a history of previous adenoidectomy and the condition of the contralateral ear did not have any effect on the surgical success.

In the literature, various tympanoplasty techniques and graft materials have been described so far (6, 7). Each technique has some advantages and disadvantages. The temporalis muscle fascia graft has been one of the most frequently used graft materials up to now. High success rates have been reported for pediatric tympanoplasty surgeries performed using fascia grafts. Riberio et al. (16) found the success rate as 85.7% in their series including 91 pediatric patients, and Uyar et al. (11) reported an anatomical success rate of 90.2% in their series with 41 children. Recently, especially for cases with a lower likelihood of success, such as allergy, tubal dysfunction, reperforation, and total perforation, cartilage has been preferred as the graft material. Unlike fascia, cartilage displays higher mechanical stability and slower metabolism. Moreover, cartilage is resistant to retraction and infection, and it maintains its form and vitality for a longer time (17, 18). In the literature, the success rates of pediatric cartilage tympanoplasty range from 71% to 100% (19). Albirmawy (20) evaluated 82 pediatric patients who underwent type I tympanoplasty surgery, and he found the success rate to be 95% in the cartilage group and 76.2% in the fascia group. In addition, Ozbek et al. (21) compared the results of type I tympanoplasty surgeries performed using palisade cartilage technique and a fascia graft and found that the anatomical success rate was significantly higher in the cartilage group. Despite the fact that anatomical success rates are higher for cartilage than for fascia, there are still doubts about the use of cartilage, because it is assumed that such a thick and rigid material can affect post-operative hearing in negative way. However, many studies proving the contrary are available in the literature. Dornhoffer (22) compared the audiological results of pediatric patients who underwent cartilage and fascia tympanoplasty surgeries and did not find any statistically significant difference between them. Likewise, Yetişer (23) conducted a series with 115 patients for 3 years and revealed that hearing gain was higher in cartilage tympanoplasty compared to fascia tympanoplasty. In our study, the rate of functional success was 81.8%, and the improvement of post-operative hearing threshold was 11.9 dB on average.

Chronic otitis media affects the quality of life in negative way, especially in pediatric patients. Recurrent infections lead them to see a doctor very often. Moreover, it causes them to avoid many activities, particularly with water. The anatomical success of tympanoplasty is evaluated considering perforation closure, and functional success was evaluated by interpreting audiometry results. Strength of graft, the absence of any lateralization, and improvement in hearing levels suggest the success of tympanoplasty surgery. On the other hand, anatomical healing and improvement on pure-tone audiometry do not always satisfy the

patient. The results that are satisfying for the surgeon may not be satisfying for the patient. The patient with improved audiometric hearing threshold may not recognize this healing or find it adequate. Aihara (24) reported that in 89% of 212 patients who underwent tympanoplasty, audiometric healing was observed, but only 63.2% of them subjectively stated that they recognized this change. Yuen (25) explored that there was a strong relationship between pure-tone audiometry results and patient satisfaction. In the literature, there are limited studies evaluating patient satisfaction levels after pediatric tympanoplasty subjectively. In this study, we sought to determine the most influential factor for post-operative patient satisfaction. In our study, it was found that the most common benefit of tympanoplasty was decreased ear infections. In a similar study conducted by Sheahan et al. (26), they subjectively stated that the most common benefit (78%) of the surgery was the decrease in ear infections. The rate of subjective improvement in hearing was 68% in our study, while it was 50% in the study of Sheahan et al. (26) Of the pediatric patients who were operated on successfully, only 8 patients (33%) attended new activities, but 16 (67%) patients still avoided these activities. Similarly, Sheahan (26) also reported that 45% of patients having successful surgery results participated in new activities. Interestingly, it was observed that the patients avoided activities with water, in spite of obtaining anatomical success. This may be due to the parents being concerned about the recurrence of their children's disease.

Conclusion

In pediatric patients, the results of cartilage tympanoplasty are both surgical and satisfactory for parents. If optimum conditions are available, the surgery should be planned as soon as possible. Delay in treatment may cause progression in hearing loss and affect the child's school success and life quality negatively.

Ethics Committe Approval: Ethics committee approval was received for this study from the ethics committee of Sakarya University Faculty of Medicine (Date: 28.11.2013, document no: 71522473.050.01.04/103).

Informed Consent: Written informed consent was obtained from parents of the patients who participated in this study.

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