Myringoplasty
Is It Worth Performing in Children?
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Objective: To evaluate the results of myringoplasty in children 4 to 14 years old at the time of surgery.

Design: Retrospective analysis of case notes for 100 consecutive children who had myringoplasty in a teaching hospital serving as a primary care and referral center.

Methods: Between March 1994 and March 1999, patients 14 years or younger at the time of surgery were identified by the computer database. There were 118 procedures performed in 100 patients (18 had a second procedure performed in the contralateral ear at a later date). Twenty-three patients were excluded because they underwent concurrent mastoid exploration, and 6 others because of inadequate follow-up, leaving 89 cases for analysis. Data from revision procedures were not included.

Main Outcome Measures: Graft success was defined as an intact eardrum at 12 months postoperatively and middle ear effusion signaled graft failure. Success in terms of hearing was defined as an improvement in perception of pure-tone thresholds of 10 dB or greater over 2 consecutive frequencies compared with the results of the preoperative audiogram.

Results: Closure of perforation was achieved in 90% (80) of patients, but dropped to 88% (78) as 2 patients developed glue ear. Hearing improved in 64 patients (72%), deteriorated in 7 (8%), and remained unchanged in 18 (20%). There was no case of profound hearing loss.

Conclusions: The success rate of myringoplasty in children is comparable to that reported for adults. The incidence of middle ear effusion in grafted ears is not higher than that reported for nongrafted ears, and children who have had myringoplasty can be treated as safely with ventilation tubes as any other children.


PERFORATION of the tympanic membrane in children can cause significant disability. Myringoplasty is a simple and effective procedure that results in the successful closure of the perforation in most cases. However, there seems to be no consensus among otologists regarding the benefits of myringoplasty in children. The rationale for operating early in children is 3-fold: (1) to prevent the possibility of chronic ear disease and its related complications; (2) to improve hearing without the need for a hearing aid and thus optimize one of the main conditions for speech and language development; and (3) to help the child enjoy water activities. On the other hand, persistent eustachian tube (ET) dysfunction, recurrent upper respiratory tract infections, technical difficulty, and reperforation are the predominant arguments put forward for delaying the procedure until a certain age, which can vary from 10 to 14 years. It has also been argued that a perforation in the eardrum is an equivalent to a ventilation tube.

Pediatric myringoplasties were performed as early as 1962 in the United States and in the early 1970s in the United Kingdom. Since then, several studies on pediatric myringoplasty published in English have reported success rates between 56% and 94%. Criteria of success and study design were not similar in these studies, making it difficult to compare results and draw impartial conclusions. Nevertheless, a meta-analysis concluded that there was no difference associated with age in the success rate of myringoplasty. Our aim was to evaluate the results of myringoplasty in children in our hospital.

METHODS
One hundred consecutive children, 4 to 14 years old, who underwent myringoplasty in our hospital between March 1994 and March 1999 formed the study group. Sex and age distribution of the study group is shown in Figure 1 and Figure 2.
respectively. Data regarding patients, procedures, and reasons for exclusion are shown in the following tabulation:

<table>
<thead>
<tr>
<th>Patients, Procedures, and Exclusions</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children considered for the study</td>
<td>100</td>
</tr>
<tr>
<td>Bilateral procedure on separate occasions</td>
<td>18</td>
</tr>
<tr>
<td>Total number of procedures</td>
<td>118</td>
</tr>
<tr>
<td>Exclusions because of concurrent mastoidectomy</td>
<td>23</td>
</tr>
<tr>
<td>Exclusions because of inadequate follow-up</td>
<td>6</td>
</tr>
<tr>
<td>Children included in the study (boy/girls)</td>
<td>89 (54/35)</td>
</tr>
</tbody>
</table>

The length of follow-up ranged from 12 to 72 months (mean, 34 months). The study population was divided into children 4 through 8 years old (n=23) and children older than 8 years through 14 years old (n=66), on the basis of expected ET maturity. The results regarding successful closure of perforation and hearing improvement corresponding to these 2 age groups are shown in Figure 3.

Successful closure of perforation was defined as an intact ear-drum at 1 year postoperatively. Success in terms of hearing was defined as an improvement of 10 dB or greater in 2 consecutive frequencies compared with the preoperative air conduction thresholds. Preoperative and postoperative thresholds were measured at 500, 1000, and 2000 Hz (preoperative thresholds at 4000 Hz were not available for many patients). Postoperative incidence of otitis media with effusion (OME) was regarded as failure.

Surgery was performed by a consultant surgeon in 86 cases and by senior trainees in the remaining 3 cases. An endaural approach was used in all cases. The temporoparietal fascia graft was harvested and positioned medial to the drum remnant using the underlay technique. Previous insertion of ventilation tubes was the most common cause of perforation; in most cases, the perforation was situated in the anteroinferior quadrant and measured less than 50% of the tympanic membrane. In 18 of the 28 cases in which perforation of the contralateral eardrum was noted, myringoplasty on the second side was performed at a later date. Acute infection of the ear was considered a contraindication for the operation. There were no patients with cleft palate or any other syndromal diagnosis.

**RESULTS**

Closure of perforation was successful in 80 (90%) of the 89 patients. Failure of the graft occurred in 5 patients, of whom 2 had revision procedures with successful outcomes. A smaller residual perforation was noted in 2 patients, both of whom (or their parents) declined any further surgery. Occurrence of OME accounted for the remaining 2 patients, 1 of whom was treated with ventilation tubes and the other managed conservatively. Improvement in hearing was achieved in 64 (72%) patients. Hearing was found to be worse postoperatively in 7 patients, while no change was noted in the remaining 18 patients. There was no case of profound hearing loss.

The most common postoperative complication in our study was granulation tissue formation in the tympanomeatal flap margin (3 patients), which was treated with silver nitrate cautery. Moreover, despite treatment with appropriate antibiotics, wound infection resulted in residual perforation in 1 patient and delayed healing of the skin in 1 patient; and the third patient developed implantation dermoid at the meatal flap (not a true cholesteatoma) that required surgical excision. Vertigo complicated early postoperative recovery in 1 patient; it resulted in prolonged hospital stay but settled with conservative management within a few days. None of these patients experienced any hearing deterioration.

**COMMENT**

Eustachian tube dysfunction has been one of the major factors implicated in the failure of myringoplasty in children. The ET attains reasonable anatomical maturity when children are about 7 years old; then, the tensor veli...
palatini muscle mass and the size of the cartilage portion of the ET increase, which presumably aids the ventilatory function. However, no simple tests can measure all aspects of the ET function. Caylan et al. used the status of the contralateral ear as a measure of ET function. Manning et al. demonstrated that the available tests have only limited prognostic value by showing that good ET function could predict good outcome, but that poor function does not necessarily predict poor outcome. Koch et al. showed that abnormal ET function could marginally reduce the success rate of myringoplasty in children. If ET dysfunction were to significantly compromise success, one would expect poor results in younger children deemed to have poor ET function. However, many studies have demonstrated that no significant differences in the results of myringoplasty in children of different age groups were associated with ET maturity, or even showed better results in children younger than 9 years. Nonetheless, others have shown no difference in the results.1,3,6,10,11 These reports effectively question the validity of the assumption that ET dysfunction compromises the success rate of myringoplasty in children.

Investigators who divided their study groups using 7, 8, or 9 years as a cutoff age on the basis of their estimation of ET maturity to analyze the results of myringoplasty in children arrived at conflicting conclusions. In our study, we chose 8 years as an age at which to assume good ET function as several important changes occur in the growth of the ET around that age. Our results demonstrated that there was no significant difference in the success of myringoplasty between the pre–ET-maturity and post–ET-maturity groups (Figure 3).

It is worth knowing the conditions of the contralateral ear, eg, if it presents glue ear, existing perforation, otorrhea, and/or a poor hearing level, as bilateral ear pathology implies serious ET dysfunction.4 While some studies have shown poor myringoplasty results when the contralateral ear is affected with one or more of the conditions just mentioned, others have shown no difference in the results. As our study was retrospective, the state of the opposite ear was not always documented clearly and we did not have enough information to comment on the opposite ear. However, it did not appear that surgery was declined on the basis of contralateral ear conditions. Although we were able to establish that many (68) of the patients in our study had ventilation tubes inserted, there was no recorded information about the etiology of the perforation. Therefore, we were unable to draw any conclusion on the relationship between etiology of the perforation and success of the surgery. Similarly, we were unable to verify the cause of deterioration of the hearing level that was noted in 7 patients, which precluded any meaningful conclusion. However, 4 of these 7 patients had successful closure of perforation and we do not wish to offer any hypothesis as to why these 4 patients’ hearing deteriorated after successful myringoplasty.

The incidence of OME in children after successful myringoplasty is about 5%.14 In our study OME developed in 2 (2%) patients, which resulted in conductive hearing loss. Their hearing improved to postmyringoplasty status after ventilation tube insertion in one case and conservative management in the other. There was no reperforation in either of these 2 cases. Tos et al. have also shown in a randomized controlled cohort study that the rate of type A tympanogram of otherwise healthy children is 61%, compared with a rate of 70% in children after myringoplasty. The authors postulated that, after myringoplasty, an aerated middle ear with intact eardrum improves ET function in children. Although OME can recur in children after successful myringoplasty, the risk is no greater than in other children of their age, and OME can be managed either conservatively or surgically, as in other children.

The outcome of myringoplasty depends on the criteria for selection and the length of follow-up. If closure of perforation alone is taken as a measure of success, the rate is reported to be between 75% and 92%. This compares favorably with the results reported for the adult population. However, success rate can be as low as 45% if factors such as occurrence of OME, reinsertion of ventilation tubes, and atelectasis are considered measures of failure. Although enjoyment of water activities and absence of otorrhea are well-recognized benefits that improve the quality of life of children after myringoplasty, there is as yet no scale to measure these benefits. It is therefore crucial to define the criteria of success in pediatric myringoplasty, preferably internationally, to enable us to compare the results in a more meaningful way.

Our study has demonstrated that myringoplasty in children as young as 4 years of age can result in an intact tympanic membrane and improved hearing.

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