The mechanical reduction of early acquired cholesteatomas in children: Indications and limitations

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Abstract
The standard treatment for acquired cholesteatoma involves surgical removal of the lesion and reconstruction of the tympanic membrane. In some children, these lesions can be treated more conservatively. We conducted a retrospective study of 29 ears in 24 children who had been treated for early acquired cholesteatoma with mechanical reduction and a tympanostomy tube. Outcomes measures included hearing status, the postoperative appearance of the tympanic membrane, and the need for additional surgery. We found that anterior and inferior pars tensa lesions, with or without squamous debris, can be successfully reduced, but that posterolateral resections respond less well when the ossicular chain has been eroded. None of the children who responded to mechanical reduction required major reconstructive surgery later. We conclude that mechanical reduction of retraction pocket cholesteatomas with tympanostomy tube placement is sufficient to restore normal hearing and a normal tympanic membrane appearance in selected children with early lesions. We also identified several important prognostic features, including the patient’s age, the specific location of the retraction pocket on the tympanic membrane, the extent of the pocket, ossicular chain involvement, and the patient’s adenoid status.

Introduction
Several authors have described cholesteatomas in children as particularly aggressive and have recommended radical therapies based on this natural history. Other authors have suggested that pediatric cholesteatomas, when encountered early in their development, can be managed more conservatively. Specifically, some contend that ventilation of the middle ear and mechanical reduction or excision of the retraction pocket with close follow-up may be successful, given these children’s potential for maturational improvement in eustachian tube function. We retrospectively studied a group of children who were managed in this fashion in hopes of determining this method’s potential and limitations and its effectiveness over the long term. We also tried to identify prognostic factors.

Patients and methods
During the 1-year period between Sept. 1, 2001, and Aug. 31, 2002, we collected data on all children who had undergone reduction of retraction pocket cholesteatomas. In addition, we reviewed the charts of all children who had undergone tympanoplasty for cholesteatoma during the 5 years between Sept. 1, 1997, and Aug. 31, 2002. Children with fewer than 6 months of postoperative follow-up were excluded from our analysis. We collected data on each patient’s age at presentation, the location and extent of each cholesteatoma, surgical treatment (e.g., tympanostomy tube placement, with or without adenoidectomy; mechanical debridement or reduction of the retraction pocket; the need for subsequent tube placement or tympanoplasty), audiometric results, and long-term outcomes.

All patients had been treated by a single pediatric otolaryngologist (G.I.) at one of two tertiary children’s medical centers or one of two suburban hospitals. Deep retraction pockets, with or without squamous debris, were treated by placing a tympanostomy tube in the pars tensa, in a location removed from the lesion (figure). Armstrong-beveled grommets and butterfly-type tubes were used. Most of those children who still had their adenoids underwent concomitant adenoidectomy under indirect mirror guidance. Some retractions reduced spontaneously from anesthetic gases, and others were treated by removal of squamous debris and/or mechanical reduction. Pockets were reduced with a 5-French Frazier suction tube, manipulated directly with a cup forceps, or freed by trans tympanic insertion of angled hooks.

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Treatment success was defined as (1) the resolution of a retraction pocket with restoration of a normal-appearing tympanic membrane or (2) improvement and eventual resolution without additional surgical intervention. Treatment also was considered successful if a retraction pocket recurred after a spontaneous extrusion or removal of the tympanostomy tube only to resolve upon placement of another tube. Children whose retraction pockets remained deep at their initial postoperative visit were scheduled for tympanoplasty with or without mastoidectomy.

Results
Our study included 29 ears in 24 patients—14 boys and 10 girls, aged 2 to 20 years (median: 8). Two patients had bilateral involvement at presentation, 1 had recurrent disease in another location, and 2 developed subsequent disease in the contralateral ear. Deep retraction pockets had occurred in 15 left ears and 14 right ears. Fourteen patients (58.3%) had undergone ventilation tube placement more than once, 3 patients (12.5%) had undergone a previous tympanomastoidectomy, and 1 patient (4.2%) had undergone a type I tympanoplasty.

Location. Retraction pockets were found in the posterosuperior quadrant in 14 of the 29 ears (48.3%), in the anterosuperior quadrant in 8 ears (27.6%), in the posteroinferior quadrant in 4 (13.8%), in the anteroinferior quadrant in 2 (6.9%), and in most of the membrane in 1 (3.4%). Many of these pockets occurred at former tube sites.

Debris. Seven pockets (24.1%) contained significant squamous debris. Removal of this debris was successful in 5 of the 7 cases, including the patient with bilateral involvement.

Adenoidectomy. Simultaneous adenoidectomy was performed in 13 patients (54.2%); 4 other patients (16.7%) had undergone adenoidectomy previously.

Outcomes. Follow-up ranged from 6 to 57 months (median: 16). At the most recent follow-up examination, 19 patients (79.2%) and 24 ears (82.8%) were free of disease; 5 of these patients had required a repeat tympanostomy tube placement, 3 of whom retained their adenoids. Another 5 patients (20.8%) exhibited persistent retraction pockets at the first follow-up visit, and they underwent middle ear surgery for cholesteatoma removal. Of these 5 patients, 4 had posterosuperior retractions, including only 1 who had significant squamous debris; the remaining patient had atelectasis of the tympanic membrane. In the 5 patients in whom treatment had failed, ossicular chain adhesions and/or erosions were a common finding.

Pre- and postoperative audiometric evaluations were normal in 10 ears. Of the remaining 14 ears in which the lesions had resolved, hearing returned to normal in 6, mild conductive hearing loss persisted in 5, and no improvement after tube placement was seen in 3. Of the 5 patients who required additional surgery, 3 experienced no change in their hearing (2 had a mild conductive hearing loss and 1 a moderate loss), and 2 had not undergone follow-up testing by study’s end.

The median age of the successfully treated children was 7 years, and the median age of the others was 12 years.

Discussion
The orderly progression of events in the development of primary acquired cholesteatoma is well established.\(^5\) The development of negative middle ear pressure, focal retraction of the tympanic membrane (often in an area of previous weakness), invagination of the retraction pocket, and subsequent accumulation of squamous debris have been well documented in human investigations,\(^2\) animal experiments,\(^6\) and temporal bone studies.\(^7\) The point at which a retraction pocket becomes an acquired cholesteatoma is a matter of greater debate.\(^8\) For the purpose of our study, we considered a retraction pocket to be an early cholesteatoma if its apex was no longer visible on binocular microscopy. This liberal definition led to the inclusion of a number of lesions that had not yet collected squamous debris. Some would argue that such lesions are not cholesteatomas, but...
the destructive potential of squamous epithelium medial to the tympanic annulus has been well established.\(^9\) The standard treatment for acquired cholesteatoma in both children and adults is tympanoplasty with or without mastoidectomy.\(^{10,11}\) Such therapy includes complete removal of matrix and squamous debris from the middle ear and mastoid and reconstruction of the tympanic membrane with sturdy graft material.\(^{12}\) It occasionally includes middle ear ventilation.\(^{13}\) This approach is logical in adults and in older children, for whom the prospects of improving eustachian tube function are remote. In young children and in children who have not previously undergone adenoidectomy,\(^{14}\) hope remains that eustachian tube function will normalize.\(^{15}\) For such cases, several authors have suggested that major surgery can be avoided by the insertion of a tympanostomy tube to temporarily ventilate the middle ear while eustachian tube function matures.

Once normal barometric pressure has been established in the middle ear by tympanostomy tube placement, it is sometimes necessary to manipulate the retraction pocket to allow its return to anatomic position. This must be done with care because retraction pockets lack the middle fibrous layer that gives the tympanic membrane its strength.\(^{16,17}\) Portions of retraction pockets will often balloon outwardly under the influence of anesthetic gases. It is sometimes possible to carefully grasp these segments with a small cup forceps and pull the retraction pocket away from the underlying structures to which it is adherent. In some cases, a right-angle hook can be inserted through a small, separate myringotomy to dissect an adherent portion of a retraction pocket from the underlying mucous membrane. In our experience, injection of saline into the middle ear has little effect on retraction pockets that are not already being reduced by anesthetic gas. If a retraction pocket tears during reduction, further manipulation should be aborted for fear of leaving squamous remnants within the middle ear.

There are no established selection criteria in terms of age or the location or extent of a lesion that would help us identify those children who are likely to respond. Bluestone and Klein have suggested that the prognosis is good for patients whose retraction pockets are reduced by anesthetic gas and for those whose pockets can be debrided at the time of tympanostomy tube placement.\(^{18}\) They also suggested that pockets that are not reduced by such treatment require tympanoplasty in order to avoid progression and potential ossicular damage.

Our study identified several important prognostic factors, including the patient’s age, the specific location of the pocket on the tympanic membrane, the extent of the retraction pockets, and the patient’s adenoid status.

- The median age among children whose retraction pockets were reduced was 7 years. Among the children who required additional surgery, the median age was 12 years.

- All lesions that involved the anterior half of the ear drum and the posterosuperior quadrant were reduced. By contrast, only 9 of the 14 lesions in the posterosuperior quadrant were reduced.
- Children did poorly—that is, they required a repeat tube insertion or additional surgery—if their retraction pocket was extensive, if their ossicular chain was eroded, or if their adenoids had not been removed.

We also found that the presence of a removable squamous plug within the retraction pocket was not a contraindication to treatment by middle ear ventilation. Finally, 5 of the 7 early cholesteatomas were successfully managed without tympanoplasty. Because the cholesteatomas in our series were early, nearly all of our patients had good hearing both before and after their surgeries.

References