Sequelae of Tympanostomy Tubes in a Multihospital Health System

Reema Padia, MD¹, Daniel Hall², Phayvanh Sjogren, MD¹, Prem Narayanan², and Jeremy D. Meier, MD¹

Abstract

Objectives. Review the incidence of long-term sequelae after placement of tympanostomy tubes.

Study Design. Case series with chart review.

Setting. Multihospital network.

Subjects. Patients 0 to 3 years old undergoing tympanostomy tube (TT) placement.

Methods. A case series of 14,058 children between 2004 and 2010 was reviewed. The patients were followed for 5 years to determine number of repeated tube placements, need for surgical removal of tubes, and presence of perforation requiring repair.

Results. The study cohort included 14,058 children who underwent TT placement. The mean age at time of procedure was 1.4 years. A total of 14.4% of patients required a second set of tubes within the 5 years of follow-up studied, and 4.6% required 3 or more sets. Three percent required removal of a tube, and this occurred at an average time of 34.2 ± 17.6 months postplacement. In total, 5.1% had a resulting perforation after either tube extrusion or tube removal requiring myringoplasty.

Conclusions. The rate of multiple tube placements and myringoplasty and tympanoplasty to correct resulting perforations has yet to be studied in a single large population. This information allows for more detailed preoperative counseling to patients and families. Better characterization of these populations with accurate rates of sequelae can help to tailor treatment and preoperative counseling in the future.

Keywords

perforation, retained tubes, myringoplasty, tympanoplasty, tympanostomy tube

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Background

Otitis media (OM) is one of the most prevalent illnesses diagnosed in the pediatric population.¹ Recurrent otitis media or chronic otitis media with effusion is frequently treated by tympanostomy tube (TT) placement. TT placement is the most common ambulatory procedure performed in the United States.²,³ Typically, TT placement is performed as an elective procedure with relatively well-defined benefits and is perceived by most caregivers and health care providers as a low-risk procedure. While major short-term complications with general anesthesia or intraoperative bleeding are rare, the long-term risks of retained tubes, chronic perforation, or cholesteatoma are difficult to quantify. Effectively conveying the risks vs benefits to caregivers during preoperative counseling for TT placement is challenging.

The objective of this study is to review the incidence of long-term sequelae from tympanostomy tube placement, including (1) the need for additional sets of tubes and (2) procedures to remove retained tubes or (3) repair a residual tympanic membrane perforation.

Methods

This study was approved by the Institutional Review Board at Intermountain Healthcare and the University of Utah. Intermountain Healthcare is a not-for-profit, integrated health care system serving the Intermountain West and comprises rural and urban community and tertiary care hospitals. Intermountain Healthcare maintains a large Enterprise Data Warehouse (EDW) that contains administrative, financial (including both costs and charges), and clinical data. This database has been used to study complications and outcomes for other otolaryngology procedures.⁴⁻⁸ The EDW was queried for patients ages 0 to 3 years who had TT placement with at least one of the following International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes: 381.81 (eustachian tube dysfunction), 384.82 (retraction of
TM), 381.4 (OM with effusion), 382.4 (purulent otitis media), 382.9 (acute OM/chronic OM), 381.3 (chronic OM with effusion), 381.2 (mucoid middle ear effusion), 382.3 (purulent middle ear effusion), or 381.1 (serous middle ear effusion) and the Current Procedural Terminology (CPT) code 69436 (tympanostomy with tube placement under general anesthesia) between January 2004 and December 2011. These patients were followed to measure sequelae until December 2016 to allow for a 5-year follow-up period. Encounters associated with these patients were queried for additional sequelae, including additional tympanostomy tube placement (CPT code 69436), removal of tympanostomy tubes (CPT code 69424), tympanoplasty (CPT codes 69631, 69633, 69641, 69642, 69643, and 69644), and myringoplasty (CPT codes 69610 and 69620), from 2004 to 2016. The time between the additional codes and the index procedure for TT placement was recorded. The following ICD-9-CM codes were used to exclude individuals from the study: 744.x (congenital abnormalities), 277.x (immunodeficiency disorders), 277.0x (cystic fibrosis), 759.3 (Kartagener syndrome), 749.0 to 749.24 (cleft palate), and 758 (immunodeficiency disorders), 277.0x (cystic fibrosis), 759.3 (Kartagener syndrome), 749.0 to 749.24 (cleft palate), and 758 (Down’s syndrome), as these patients are more likely than the general population to require tympanostomy tubes, which could have skewed our data for need of repeated tube placement.6 In addition, removal of a foreign object was also excluded (CPT codes 69200 and 69210) because these codes are not exclusively for tube removal.

Results

A total of 14,058 patients met the inclusion criteria. The average age at index procedure for TT placement was 1.4 years. The average cost of tube placement alone was $741 ± $5.

Table 1 describes the incidence of each sequela. In total, 2671 (19.0%) patients required at least one additional set of tubes, while 647 (4.6%) required 2 or more additional sets of tubes; 424 (3.0%) patients required a procedure for tube removal for a retained tube. On average, tube removal occurred 34.2 ± 17.6 months after the placement of the tubes. Overall, 1052 (7.5%) patients underwent either a myringoplasty or a tympanoplasty to repair a tympanic membrane perforation. Myringoplasty was performed at the same time as tube removal in 39 (0.2%) of these patients. Myringoplasty was performed on a separate occasion in 719 (5.1%) patients at an average time of 38.3 ± 20.6 months after tube removal. Tympanoplasty was performed at the same time as tube removal in 1 (0.01%) patient. Tympanoplasty was performed on a separate occasion in 293 (2.1%) patients at an average time of 61.9 ± 24.3 months after tube removal.

Discussion

This study describes the incidence of associated sequelae after TT placement in patients without significant comorbidities in a multihospital health system. A meta-analysis in 2001 determined rates of otorrhea, tympanosclerosis, perforation, and cholesteatoma.13 Our study finds similar results and allows for an updated patient cohort with a more homogeneous patient population. Using a large population with a minimum follow-up of 5 years, we hoped these data could better inform caregivers during preoperative counseling for TT placement. The patients included in our study were treated by otolaryngologists in academic, hospital employed, and private practice groups, therefore potentially providing a more accurate depiction of outcomes across practice types.

The likelihood of requiring at least 1 additional set of TT in our series was 19.0%, consistent with the range of reported frequencies in the literature (5.6%-19.9%).14,15 We did not assess risk factors for repeat TT placement in our study. However, multiple factors affect the likelihood of repeat TT, including parental smoking, young age, and addition of adenoidectomy.14,16

In the literature, variable times for tube extrusion occur depending on the type of tube placed and type of effusion present upon placement of tube.17,18 Average time of extrusion for Armstrong tubes has been reported to be 16.5 months with general early extrusion rates measuring 1%19,20. We did not assess time to extrusion of tubes in this study but did evaluate intraoperative removal of tubes. Indications for tube removal include prolonged presence, persistent otorrhea, or obstruction of the tube.21 The results in this study showed 3% of patients requiring a procedure for tube removal under general anesthesia. Need for surgical removal for retained tubes has had published frequencies ranging from 3% to 12%.20,22 Our study may underestimate the true incidence as patients can have tubes removed in the clinic or in the operating room bundled under a different procedure (eg, myringoplasty or tympanoplasty), and these patients were not captured in our inclusion criteria. However, this percentage is comparable to those cited in the literature.

After deliberate removal of a retained tube or spontaneous extrusion, resultant perforations can occur at a rate of 1% to 11%.20,23-25 Perforations that last greater than 3 months after tube removal or extrusion will frequently be repaired with gelfoam placement, fat, or paper patch myringoplasty. This patient cohort showed 5.1% of patients requiring a myringoplasty and 2.1% requiring tympanoplasty closure. These procedures occurred 3 to 5 years after tube removal. A limitation of this study is that the type of tube, short vs long term, was not specified, and this could

<table>
<thead>
<tr>
<th>Sequela</th>
<th>Percentage (No.) of Patients</th>
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<tbody>
<tr>
<td>Two sets of tubes</td>
<td>14.4 (2024)</td>
</tr>
<tr>
<td>Three of more sets of tubes</td>
<td>4.6 (647)</td>
</tr>
<tr>
<td>Tube removal</td>
<td>3.0 (424)</td>
</tr>
<tr>
<td>Myringoplasty</td>
<td>5.4 (759)</td>
</tr>
<tr>
<td>Tympanoplasty</td>
<td>2.1 (295)</td>
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</table>
have contributed to the likelihood of retention and presence of residual perforation.

While this study evaluates a large number of patients over 5 years after tube placement, several limitations exist. The accuracy of the data is limited by appropriate documentation and coding in the EDW. Some of the patients may have moved out of the area or changed health care provider and may have had additional procedures later performed outside the Intermountain Healthcare system. Therefore, our results could be underestimating the true incidence of postoperative sequelae. In addition, we cannot account for provider practice pattern differences or control for all patient comorbidities. Some surgeons may have been more likely to place second and third sets of tubes more quickly than others based on provider and family preferences. Also, type of tube placement varies among providers, and the sequelae following these tube placements are affected by the tube used, and we could not obtain this information through the database.

Conclusion

Tympanostomy tube placement is a common procedure that has associated sequelae in some patients. Accurately understanding the incidence of these long-term complications can better inform caregivers during the preoperative decision-making process. In addition, approaches to identify patients most at risk for these complications and mitigate those sequelae are needed.

Author Contributions

Reema Padia, study design, interpretation of data, drafting manuscript; Daniel Hall, data analysis, drafting manuscript; Phayvan Sjogren, data analysis, drafting of manuscript; Prem Narayanan, data acquisition, drafting of manuscript; Jeremy D. Meier, study design, data analysis, drafting of manuscript.

Disclosures

Competing interests: Jeremy D. Meier, AHRQ R03 grant recipient (unrelated to this study).

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References


