Retained Ventilation Tubes

Should They Be Removed at 2 Years?

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Objectives: To assess the complications of ventilation tubes that were retained in children for 2 years or longer and the necessity of removal.

Design: A retrospective chart review of all patients who underwent ventilation tube removal from 1997 to 2000, with the exclusion of patients with craniofacial anomalies.

Setting: A tertiary children’s hospital.

Patients: One hundred twenty-six children with ventilation tubes that were retained for 2 years or longer.

Interventions: Ventilation tube removal and tympanic membrane (TM) patching.

Main Outcome Measures: Otorrhea, formation of granulation tissue, TM perforation, development of cholesteatomas, and tube reinserterion.

Results: A total of 126 patients aged 2½ to 14 years (59 girls and 67 boys) underwent removal of their ventilation tubes after 2 years or more. The patients were divided into 2 groups. Group 1 included 67 patients (29 girls and 38 boys) who were younger than 7 years at the time of tube removal. The tubes were retained for 2 to 5½ years (mean retention time, 3.3 years). Group 2 included 59 patients (30 girls and 29 boys) aged 7 years and older at the time of tube removal. The tubes were retained for 2 to 10½ years (mean retention time, 4.2 years). Complications such as otorrhea, formation of granulation tissue, and TM perforation were seen in 10.3%, 13.8%, and 5.2% of the patients with tube retention of 2 to 3 years, compared with 40.0%, 40.0%, and 46.7% of patients with tube retention of more than 5 years. In group 1, transient otorrhea, formation of granulation tissue, and TM perforation occurred in 13.4%, 7.4%, and 6.0% of the patients, respectively, after 2 years of tube retention. In group 2, similar complications occurred in 23.7%, 25.4%, and 27.1% of the patients, respectively. Forty-six patients in group 1 underwent TM patching (31 with paper and 15 with absorbable gelatin film, with a success rate of 91.3%; however, 8 patients (11.9%) required tube reinserterion. In group 2, patching of the TM was done in 40 patients (13 with paper, 24 with absorbable gelatin film, and 3 with fat), with a success rate of 67.5%. Tube reinserterion was necessary in 1.7% of the patients in group 2. No cholesteatoma was encountered.

Conclusions: Higher complication rates are seen in children when ventilation tubes are retained longer than 2 years. Children 7 years and older have a higher incidence of complications from the tube retention than children younger than 7 years. Early removal of ventilation tubes in children younger than 7 years of age, when the risk for otitis media is still present, may result in the need for tube reinserterion.


Myringotomy is an old procedure dating back to 1760, when it was used to relieve “deafness.” However, the concept of placing a tube to ventilate the middle ear space was launched in 1954 to become one of the most common procedures performed in children.7 The incidence of otitis media in the pediatric age group peaks between the ages of 6 months and 3 years, with another, less prominent peak at 4 to 7 years of age. During that period, children may need repeated ventilation tube insertions or insertion of a long-standing tube. In either case, concerns about complications have been raised, especially when a tube is retained for longer than is expected.

The procedure of ventilation tube removal and myringoplasty is becoming quite prevalent. However, very few reports have been published that address the need to remove a ventilation tube that has been retained for at least 2 years, whether the case is asymptomatic or associated with complications such as persistent otorrhea, formation of granu-
lation tissue, or impending development of cholesteatomas.

We conducted this retrospective study to assess the complications of ventilation tubes that have been retained for at least 2 years and the medical necessity to remove them.

**METHODS**

A retrospective chart review was performed in all cases involving children who underwent ventilation tube removal at the Children's National Medical Center, Washington, DC, between 1997 and 2000. Children who had retained ventilation tubes for at least 2 years and did not have any craniofacial anomalies were identified. The sample consisted of 126 patients who were then divided into 2 groups: group 1 included patients younger than 7 years at the time of tube removal, and group 2 included patients 7 years and older at the time of tube removal. The parameters studied were the duration of tube retention, the occurrence of otorrhea after at least 2 years of tube retention, the development of granulation tissue and cholesteatomas, and the need for ventilation tube reinsertion. All patients were followed up for at least 3 months after tube removal.

**RESULTS**

Between 1997 and 2000, a total of 126 patients were found who had at least 1 ventilation tube that had been retained for 2 years or longer (166 tubes). None of the patients had the tube extruding spontaneously after 2 years; instead, the tube was removed in the operating room for variety of reasons (Table 1). The patients (59 girls and 67 boys) were between 2½ and 14 years of age. They were divided into 2 groups. Group 1 included 67 patients (29 girls and 38 boys) who had retained their tubes for 2.0 to 5.5 years (mean retention time, 3.3 years). Group 2 included 59 patients (30 girls and 29 boys) who had retained their tubes for 2.0 to 10.5 years (mean retention time, 4.2 years). Regardless of the age of the patients, higher rates of complications were seen with longer periods of tube retention (Table 2). Complications such as transient otorrhea (occurring >2 years after tube reinsertion), formation of granulation tissue, and tympanic membrane (TM) perforation were seen in 10.3%, 13.8%, and 5.2% of the patients with tube retention of 2 to 3 years, respectively, compared with 40.0%, 40.0%, and 46.7% of patients with tube retention of more than 5 years.

When the age of the patient was taken into account, a higher incidence of complications were seen in children 7 years and older (Table 3). In group 1, transient otorrhea, formation of granulation tissue, and TM perforation were seen in 13.4%, 7.4%, and 6.0% of the patients, respectively. Similar complications occurred in 23.7%, 25.4%, and 27.1% of the group 2 patients.

Forty-six patients in group 1 underwent TM patching (31 with paper, 15 with absorbable gelatin film [Gelfilm; Upjohn Corp, Kalamazoo, Mich], and none with fat) at the time of tube removal, with a success rate of 91.3% (Table 4). However, tube reinsertion was required in 8 patients (11.9%) in group 1. In group 2, TM patching was done in 40 patients (13 with paper, 24 with absorbable gelatin film, and 3 with fat), with a success rate of 67.5%. Only 1 patient (1.7%) in group 2 required tube reinsertion (Table 5). Therefore, tube reinsertion was 7 times more likely in patients younger than 7 years. No cholesteatoma was detected in any patient.

**COMMENT**

Approximately 80% of children have at least 1 episode of otitis media at the preschool age.1-3 During the past decade, myringotomy and ventilation tube insertion became one of the most common surgical procedures performed in children. Thus, we became interested in the complications associated with ventilation tubes, especially when they are retained for an extended period. In a recent meta-analysis on ventilation tubes, prolonged intubation was found to increase the risk of otorrhea by a factor of 2.1, the risk of cholesteatoma formation by 2.6, and the risk of TM perforation by 3.5.4 Although some tubes (eg, T tubes) are meant to stay in place for an extended period, others remain in place longer than is expected. It is believed that if a tube is retained for 30 months, it is unlikely to extrude spontaneously.5 There are several reasons to remove a retained ventilation tube, including otorrhea that is not responsive to medical treatment, persistent formation of granulation tissue, impending development of a cholesteatoma, a blocked tube, or a tube that is displaced into the middle ear.6 However, there is a lack of universal guidelines on when to remove a retained “asymptomatic” ventilation tube. Therefore, we decided to review our experience with the removal of ventilation tubes in order to suggest clear recommendations regarding this issue.

It is well known that there is a risk of recurrent otitis media to the age of 7 years; therefore, until then, adequate middle ear ventilation may be needed. For this reason, we divided our patients into 2 groups according to the age at the time of ventilation tube removal, with 7 years being the cutoff point. We first looked at the du-

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**Table 1. Reasons for Removal of Ventilation Tube After 2 Years**

<table>
<thead>
<tr>
<th>Reason</th>
<th>No. of Tubes</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>128</td>
<td>77.1</td>
</tr>
<tr>
<td>Granulation tissue</td>
<td>21</td>
<td>12.7</td>
</tr>
<tr>
<td>Blocked tube</td>
<td>13</td>
<td>7.8</td>
</tr>
<tr>
<td>Persistent otorrhea</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Intrusion into the middle ear</td>
<td>2</td>
<td>1.2</td>
</tr>
</tbody>
</table>

**Table 2. Duration of Ventilation Tube Retention as a Risk Factor**

<table>
<thead>
<tr>
<th>Duration, y</th>
<th>No. of Patients</th>
<th>Otorrhea</th>
<th>Granulation Tissue</th>
<th>Perforation of Tympanic Membrane</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
<td>58</td>
<td>10.3</td>
<td>13.8</td>
<td>5.2</td>
</tr>
<tr>
<td>3-4</td>
<td>33</td>
<td>21.2</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>4-5</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>&gt;5</td>
<td>15</td>
<td>40</td>
<td>40</td>
<td>46.7</td>
</tr>
</tbody>
</table>

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ration of tube retention alone as a risk factor regardless of the age of the patient (Table 2). There was a significant increase in the risk of complications after 4 years of tube retention. A similar observation was reported by Mangat et al when the tubes remained in place more than 36 months. When we analyzed the complications by age group (Table 3), it became clear that complications such as otorrhea, granulation tissue formation, and TM perforation were more common among group 2 patients.

Otorrhea is a well-known complication of ventilation tubes and has been described as transient, recurrent (7.4%), and chronic (3.8%). The otorrhea we considered in our series occurred after at least 2 years of tube retention and was mostly transient. Two patients had chronic ear discharge (1.6%) that required tube removal. Otorrhea was seen more frequently in patients 7 years and older (23.7% vs 13.4%). The increase in incidence of otorrhea seen in patients 7 years and older could have resulted from prolonged tube retention, as more patients in group 2 than group 1 had tube retention for more than 4 years (44.1% vs 13.4%) (Table 3).

Water exposure has long been a potential cause of otorrhea, regardless of the age group or duration of tube retention. Parents may have a difficult time preventing exposure to water in young children, and older children may be more active in water sports. This factor, however, has been recently challenged by a few reports that negated the need for water precautions. Salata and Derkay suggested that there is no need for water precautions if children are surface swimming and not diving. Herbert et al found, using an in vitro model, that showering or bathing in clean water is safe. However, soapy water can increase the chance of ear contamination. Swimming is also acceptable without protection unless the head is submerged deeper than 60 cm.

Granulation tissue formation, which is thought to result from an increase in oxygen concentration in the middle ear, is another complication that we considered. Otorrhea may be transient and successfully treated with topical antibiotics and steroid drops, or persistent and unresponsive to medical treatment, necessitating tube removal. In our series, granulation tissue formation was more common among group 2 patients (25.4% vs 7.4%), especially when the tube was retained for more than 4 years (Table 3).

Tympanic membrane perforation has been reported to be more common when the ventilation tube is removed (14.3%) than when it extrudes spontaneously (4.0%). However, the longer the tube stays in, the higher the incidence of perforation. Our data showed that 75% of the TM perforations occurred when the tubes were retained for more than 4 years, regardless of the age group (Table 3). This trend was also observed by Nichols et al, who found an increase in perforation rate after 36 months of retention.

To decrease the incidence of persistent perforation after tube removal, surgeons have used different types of patching materials, including paper, absorbable gelatin film, or fat plug. Saito et al demonstrated a decrease in the incidence of TM perforation from 13.2% to 3.3% by using paper patching. Hekkenberg and Smitheringale showed similar results (decrease from 10.3% to 4.5%) when they used absorbable gelatin sponge or absorbable gelatin film.
patching. Others, such as Nichols et al., did not find any benefits from patching. Patching of the TM did not protect against persistent perforation in our series (Table 4).

Children younger than 7 years tend to have recurrent otitis media more frequently than older children. Therefore, removing the ventilation tube during that period may expose the child to recurrent infections and possible tube reinsertion. We looked at this factor and found that the need for tube reinsertion was 7-fold more common in group 1 than group 2 (11.9% vs 1.7%). All but 1 patient had the tube reinserted before the age of 7 years (Table 5).

None of our patients developed a cholesteatoma despite prolonged ventilation tube retention, although this complication has been previously described. In a recent study by Golz et al., a cholesteatoma incidence of 1.1% was reported. The suggested risk factors included age younger than 5 years, using Goode T tubes, multiple tube insertions, retention for more than 1 year, and frequent postoperative otorrhea.

In summary, prolonged tube retention may increase the incidence of otorrhea, granulation tissue formation, and persistent TM perforation. Children 7 years and older seem to have more complications from ventilation tube retention than children younger than 7 years. Tube reinsertion is required 7 times more often in children younger than 7 years. Therefore, tubes retained in this age group can be kept in place if they are “asymptomatic” until the patient reaches 7 years of age. The current growing practice of removing asymptomatic functioning ventilation tubes and myringoplasty in young children should be viewed critically until evidence suggests otherwise.

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REFERENCES