Effect of Water Precautions on Otorrhea Incidence after Pediatric Tympanostomy Tube: Randomized Controlled Trial Evidence

Joao Subtil, MD1, Ana Jardim, MD2, Joao Araujo, MD2, Carla Moreira, MD3, Tiago Eça, MD4, Merlin McMillan, MBChB, MSc, MRCPCH2, Sara Simoes Dias, PhD5, Paulo Vera Cruz, MD, PhD1, Richard Voegels, MD, PhD6, Joao Paco, MD, PhD7, and Richard Rosenfeld, MD, MPH8

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Abstract

Objectives. Tympanostomy with ventilation tube insertion is the most common otologic surgery. Many surgeons recommend water precautions, although its utility is questioned. We aimed to investigate if water precautions reduce the rate of otorrhea after trans tympanic tube insertion.

Study Design. Multicenter randomized controlled trial.

Subjects and Methods. A total of 244 children aged 2 to 10 years undergoing their first set of Shepard tubes for otitis media with effusion and concomitant adenoidectomy were randomized to 2 groups: 1 with ear protection during water exposure (ear plugs and headbands, n = 130) and 1 without (n = 114). Bathing or swimming with unprotected ears was considered the exposure event and incidence of otorrhea, the primary outcome. Outcomes were assessed during the 6-month follow-up period.

Results. In the water precaution group, 32% had at least 1 episode of otorrhea as compared with 22% in the unprotected group, which was not statistically significant (P = .09). Only 37% of the episodes of otorrhea in the protected group and 36% in the unprotected group had a temporal relation to water exposure (no difference, P = .81). Respectively, 56% and 52% of the episodes of otorrhea were in the context of upper respiratory tract infection. Global quality of life improved significantly, irrespective of whether water protection was prescribed.

Conclusion. The incidence of otorrhea was not different with or without prescription of ear protection during water exposure among children with tympanostomy tubes, which supports current guideline recommendations that routine water precautions are unnecessary in this population.

Keywords
middle ear ventilation, otitis media with effusion, postoperative care, swimming, water precautions

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Tympanostomy tube insertion is the most common otologic surgery, with otorrhea episodes occurring postoperatively in 30% to 83% of patients.1-6 Upper respiratory tract infections (URTIs) are a frequent cause, but water penetration has been implicated1,2,7-9; therefore, water precautions have traditionally been prescribed.1,3,10-14

There is mounting evidence that water does not traverse tympanostomy tubes unless under significant pressure.1,2,5,7,11,15 Most of these studies have several limitations.10,16 The 1 randomized controlled trial (RCT)1 found that children who swam without ear plugs had more otorrhea episodes. The clinical magnitude was unimportant, and the authors did not recommend routine water precautions.

The most recent American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF) clinical

1 Nova Medical School, Lisbon, Portugal
2 Hospital Cuf Descobertas, Lisbon, Portugal
3 Hospital D Este, Lisbon, Portugal
4 Hospital Santa Maria, Lisbon, Portugal
5 EpiDoc Unit—CEDOC, NOVA Medical School, Lisbon, Portugal
6 University of Sao Paulo, Sao Paulo, Brazil
7 Nova Medical School, Lisbon, Portugal
8 Department of Otolaryngology, SUNY Downstate Medical Center, Brooklyn, New York, USA

Corresponding Author:
Joao Subtil, MD, Nova Medical School, R. Manuel da Fonseca n9-4A, 1600-181 Lisbon, Portugal.
Email: joaosubtil@gmail.com
practice guidelines for otitis media with effusion (OME) state that it is fine to swim and bathe.\textsuperscript{17} The AAO-HNSF guidelines for tympanostomy tubes also state that routine water precautions should not be prescribed.\textsuperscript{18} The same recommendation is made in Triological Society Best Practice articles.\textsuperscript{19,20} However, these precautions are still frequently recommended.\textsuperscript{18} Seemingly harmless, they may deprive children of social engagement in water activities and therefore should be an evidence-based recommendation.

The aim of this study is to determine the effect of ear protection on the rate of otorrhea after tympanic tube insertion in children aged 2 to 10 years old. Our main hypothesis is that water exposure is not related to otorrhea incidence and that prescription of ear protection is not relevant.

**Methods**

A multicenter RCT was conducted to compare rates of otorrhea between children with and without ear protection after tympanostomy tube insertion. Based on the expected difference calculated from data of a previous study,\textsuperscript{15}—an 18\% otorrhea incidence among unprotected swimmers and 35\% among swimmers with ear protection, excluding diving beyond 0.5 m—the sample size calculated was 105 participants per group, with a 2-sided 5\% significance level and a power of 80\%. Assuming a 15\% dropout rate, we aimed to recruit 240 patients. The study was authorized by the ethics committee of each hospital and complies with Portuguese legislation and the Helsinki Declaration. Informed consent was obtained. The study conforms to the CONSORT statement for reporting RCTs.\textsuperscript{21}

Inclusion criteria were as follows: age 2 to 10 years, chronic OME with indication for surgery (following AAO-HNSF guidelines\textsuperscript{18}), and primary caregivers willing to comply with recommendations in either group. This age interval was chosen because acute otitis media is frequent at ages <2 years,\textsuperscript{22} whereas OME indicating surgery is uncommon after age 10 years.\textsuperscript{23} Participants were consecutively recruited from 4 hospitals in Lisbon (Hospital Cuf Descobertas, Hospital Beatriz Angelo, Hospital D. Estefania, and Hospital Santa Maria) between February 2015 and August 2017. Only children with indication for concurrent adenoidectomy were included (either for OME or for a concurrent diagnosis, such as recurrent acute otitis media, chronic nasal inflammatory symptoms, obstructive sleep apnea, or recurrent adenoiditis or sinusitis). Exclusion criteria were as follows: unavailable for follow-up or unable to understand questionnaires in Portuguese, unilateral surgery, history of tympanic surgery, immunodeficiency, craniofacial syndromes or cleft palate, and previous tympanostomy. During the study, participants who did not comply with prescribed precautions or who had premature tube extrusion, >3 otorrhea episodes, or any complication (eg, acute mastoiditis) were also excluded.

The standard of care in Portugal as prescribed by many otolaryngologists for protection from water exposure—namely, moldable silicone earplugs and headbands for swimming and earplugs for showering and bathing—\textsuperscript{15} was compared with swimming and showering with no protection per the AAO-HNSF guidelines.\textsuperscript{17,18} All other aspects of care were the same, specifically the surgical technique, canal disinfection, and type of transfamypanic tube (Shepard type). Participants were randomized with simple randomization on Microsoft Excel. A trained independent trial assistant built a random allocation table, wherein each new participant was randomized to group A or B according to the Excel Rand function (from 0 to 0.499999999 to group A; from 0.500000000 to 0.999999999 to group B). This assistant enrolled the participants and assigned them to interventions.

Surgery was performed under general anesthesia; the canal was disinfected with 90\% alcohol, which was thoroughly removed or dried before incision. A radial incision in the anteroinferior quadrant was performed, and a fluoroplastic Shepard tube was inserted (gauge, 1.14 mm, 2.4 mm; length, 2.4-mm “button”). No other topical treatment was used. Postoperative instructions were explained to caregivers after randomization on the day of surgery, and a leaflet with written indications (according to randomization) was given, with forms for documenting events and their clinical context (episodes of otorrhea, water exposure, signs of URTI or acute otitis externa).

During the 6-month follow-up period, patients were evaluated every 2 months to assess their adherence to indications provided and for early extrusion of the tube. Caregiver-completed questionnaires for infectious episodes were collected at these points. Adherence was defined as using the prescribed care (protection or no protection) in at least 90\% of opportunities to do so. Participating in water activities (swimming) was defined as swimming in pools, lakes, or beaches at least once a week, on every week during the 6-month period. Otorrhea was defined as clearly visible drainage of liquid in the outer ear (any type of liquid drainage and any duration) that began at least 2 weeks after surgery. Parents were instructed to consider liquid drainage as otorrhea and solid or thick paste as wax; every episode was discussed and confirmed with a specialist. The questionnaire included symptoms of URTI to help identify infections associated with episodes of otorrhea. Water exposure was included in the questionnaire, including type of water when associated with otorrhea episodes (salt water, fresh water in swimming pools, fresh water in lakes or rivers, or soapy water). Significant risk factors for URTI were also items (age, allergy, siblings, day care, passive smoking, and season).\textsuperscript{24}

Quality of life (QOL) was assessed with the PedsQL (used with permission), a generic health questionnaire. The PedsQL is a modular health-related QOL questionnaire validated for the European Portuguese, reliable for parent or proxy report, developmentally appropriate, and adapted for various age ranges.\textsuperscript{25-28} The PedsQL questionnaire was filled out at 2 time points by the same caregiver: before surgery (baseline) and at a 2-month follow-up consultation.
Comparisons were made between pre- and postsurgery and between groups with and without water precautions. The specific impact on QOL from prescribing water protection was assessed globally and regarding specific domains.

The population sample was divided according to season of recruitment, as water exposure was assumed to be more frequent during summer months. We considered surgery between March and August as being in the “hot season” (summer), as the bathing season in Portugal is from May to October. Patients recruited from September to February were considered to be in the “cold season” (winter). Statistical analysis was performed with SPSS Statistics 23 (IBM Corporation, Armonk, New York) with \( P < .05 \) for significance for primary outcomes and \( .01 \) for risk factors outcomes. To minimize risk of type I errors from the number of bivariate \( P \) values (7 risk factors), Bonferroni adjustment was used, with \( P < .01 \) for significance. Relative risk, 95% CI, and chi-square test were used to identify associations.

**Results**

A consecutive sample of 291 participants was recruited (Figure 1) and randomly allocated to a group with ear protection (\( n = 149 \)) and another without (\( n = 142 \)).

Forty-seven children were excluded (16% from 291). Of the excluded, 51% were lost to follow-up. Thirty percent (\( n = 14 \)) were excluded for lack of compliance with prescribed precautions (8 in the group without ear protection and 6 in the protected group, \( P = .522 \)). Participants who did not adhere to prescribed precautions were asked what the motives were. These included conflicting advice from other doctors, imitating precautions prescribed to other children with the same surgery, fear of giving substandard care, feeling that the precautions were unnecessary or impractical, and in 1 case refusal to wear earplugs. Thirteen percent (\( n = 6 \)) were excluded for premature tube extrusion (5 in no-protection group and 1 in protection group) and 4% (\( n = 2 \)) for having >3 otorrhea episodes (1 in each group). One participant from the ear protection group was excluded for acute mastoiditis that resolved with medical therapy.

There were 138 males and 106 females included, with a mean age of 4.4 years (SD, 1.7); 142 (58%) were between 2 and 4 years old; and 146 (60%) regularly practiced swimming (pool and/or beach) at least once a week. There were no significant differences in demographic data between the groups (Table 1). The proportion of patients recruited during summer months and winter months was not statistically significantly different (\( P = .99 \)).

The cumulative otorrhea incidence over the course of the study was 27% (\( n = 66 \)), with 32% in the ear protection group (ear plugs and headbands) and 22% in the unprotected group. There was no significant difference between groups (Table 2). Sixteen participants (7%) had 2 episodes (6 from the unprotected group), and 2 had 3 episodes (both

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**Figure 1. CONSORT flowchart.**

(with tympanostomy tubes in situ).
from the unprotected group). No factor was associated with multiple episodes.

In 24 otorrhea episodes, the parents described a temporal relation with more substantial water exposure (diving deeper or swimming longer than usual, head submersion in bathwater, or other relevant exposure). Of these, 9 were in the nonprotected group (36% of total group episodes) and 15 (37%) in the ear protection group ($P = .81$). Twenty-one percent of otorrhea episodes that parents associated with water exposure were related to bathwater submersion (1 from the unprotected group), 38% to submersion in pool water, and 38% in sea water. Only 13% were related to diving deeper than 0.5 m.

Swimming activity participation was not associated with a higher incidence of otorrhea in either group (group A, $P = .37$; group B, $P = .22$), and ear protection was not associated with a difference in otorrhea rate between swimmers and nonswimmers (Table 2). The rate of participation in swimming activities was different by months of recruitment. Participants recruited during hot months participated significantly more in swimming activities than during cold months: respectively, 89 of 135 (66%) versus 57 of 109 (52%, $P = .031$). There was no significant difference of otorrhea incidence between seasons ($P = .47$) and no difference between groups during neither hot nor cold months ($P = .05$ and $P = .78$, respectively; Table 2).

The global cumulative incidence of URTI was 36.9% (n = 90 of 244), with no significant difference between groups (n = 42 of 114 without ear protection, n = 48 of 130 with ear protection, $P = .99$), and no risk factor was

| Table 1. Baseline Characteristics of Groups and Total Sample. 

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (N = 244)</th>
<th>No Precautions</th>
<th>With Precautions</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age $\leq$ 4 y</td>
<td>142 (58.2)</td>
<td>62 (43.7)</td>
<td>80 (56.3)</td>
<td>.258</td>
</tr>
<tr>
<td>Male</td>
<td>138 (56.6)</td>
<td>64 (46.4)</td>
<td>74 (53.6)</td>
<td>.902</td>
</tr>
<tr>
<td>Swimming activities</td>
<td>146 (59.8)</td>
<td>64 (43.8)</td>
<td>82 (56.2)</td>
<td>.270</td>
</tr>
</tbody>
</table>

*Children with history of tympanic surgery were excluded. Values are presented as n (%). |

| Table 2. Otorrhea Incidence by Ear Protection and Relation to Risk Factors. 

<table>
<thead>
<tr>
<th>Incidence of otorrhea</th>
<th>Total</th>
<th>With Ear Protection</th>
<th>Without Protection</th>
<th>P Value</th>
<th>Relative Risk</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\geq$ 1 per week</td>
<td>45 of 146 (30.8)</td>
<td>29 of 82 (35.4)</td>
<td>16 of 64 (25)</td>
<td>.178</td>
<td>0.707</td>
<td>0.42-1.18</td>
</tr>
<tr>
<td>$&lt;$ 1 per week</td>
<td>21 of 98 (21.4)</td>
<td>12 of 48 (25)</td>
<td>9 of 50 (18)</td>
<td>.399</td>
<td>0.72</td>
<td>0.33-1.55</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>25 of 106 (23.6)</td>
<td>15 of 56 (26.8)</td>
<td>10 of 50 (20)</td>
<td>.411</td>
<td>0.747</td>
<td>0.37-1.51</td>
</tr>
<tr>
<td>Male</td>
<td>41 of 138 (29.7)</td>
<td>26 of 74 (35.1)</td>
<td>15 of 64 (23.4)</td>
<td>.134</td>
<td>0.667</td>
<td>0.39-1.15</td>
</tr>
<tr>
<td>Siblings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\geq$ 1</td>
<td>41 of 144 (28.5)</td>
<td>22 of 75 (29.3)</td>
<td>19 of 69 (27.5)</td>
<td>.811</td>
<td>0.939</td>
<td>0.56-1.58</td>
</tr>
<tr>
<td>None</td>
<td>25 of 100 (25)</td>
<td>19 of 55 (34.5)</td>
<td>6 of 45 (13.3)</td>
<td>.015</td>
<td>0.386</td>
<td>0.17-0.88</td>
</tr>
<tr>
<td>Medical history</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergy</td>
<td>9 of 38 (23.7)</td>
<td>5 of 22 (22.7)</td>
<td>4 of 16 (25)</td>
<td>— b</td>
<td>1.1</td>
<td>0.35-3.46</td>
</tr>
<tr>
<td>No allergy</td>
<td>57 of 206 (27.7)</td>
<td>36 of 108 (33.3)</td>
<td>21 of 98 (21.4)</td>
<td>.056</td>
<td>0.643</td>
<td>0.40-1.02</td>
</tr>
<tr>
<td>Passive smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed</td>
<td>15 of 80 (18.8)</td>
<td>9 of 40 (22.5)</td>
<td>6 of 40 (15)</td>
<td>.390</td>
<td>0.667</td>
<td>0.26-1.70</td>
</tr>
<tr>
<td>Nonexposed</td>
<td>51 of 164 (31.1)</td>
<td>32 of 90 (35.6)</td>
<td>19 of 74 (25.7)</td>
<td>.174</td>
<td>0.722</td>
<td>0.45-1.16</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>40 of 142 (28.2)</td>
<td>29 of 80 (36.3)</td>
<td>11 of 62 (17.7)</td>
<td>.015</td>
<td>0.489</td>
<td>0.27-0.90</td>
</tr>
<tr>
<td>5-10</td>
<td>26 of 102 (25.5)</td>
<td>12 of 50 (24)</td>
<td>14 of 52 (26.9)</td>
<td>.735</td>
<td>1.122</td>
<td>0.58-2.18</td>
</tr>
<tr>
<td>Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot months</td>
<td>39 of 135 (28.9)</td>
<td>26 of 72 (36.1)</td>
<td>13 of 63 (20.6)</td>
<td>.048</td>
<td>0.571</td>
<td>0.32-1.01</td>
</tr>
<tr>
<td>Cold months</td>
<td>27 of 109 (24.8)</td>
<td>15 of 58 (25.9)</td>
<td>12 of 51 (23.5)</td>
<td>.778</td>
<td>0.910</td>
<td>0.47-1.76</td>
</tr>
</tbody>
</table>

*Values are presented as n (%). |

bNot tested due to low incidence of allergic disorders.
associated with higher URTI incidence. In total, 36 of 66 (55%) otorrhea episodes had a context of respiratory infection symptoms: 13 of 25 (52%) otorrhea episodes in the nonprotected group and 23 of 41 (56%) in the protected group, with no significant difference ($P = .75$).

Intention-to-treat analysis of the 291 randomized children showed no statistical difference in otorrhea incidence (22% without protection, 31% with protection, $P = .059$). The relative risk was 0.69 (95% CI, 0.46-1.0). Children with multiple episodes of otorrhea (including those excluded from the analysis for having $>$3 episodes) were compared to evaluate the effect of water precautions in this subpopulation, and there was no difference between groups ($P = .73$).

QOL improved globally from 83% to 87% ($P = .001$). Standardized response mean was 0.27 (described in previous work [29]), suggestive of a small mean effect. Twenty-two percent showed a large change, and a further 11% had a moderate change. When participants who had a moderate to large increase in QOL were compared with the remaining ones, there was no difference in otorrhea episodes ($P = .51$), sex ($P = .59$), or having siblings ($P = .15$). There was also no significant difference in the distribution of these participants between groups ($P = .33$); however, all were $>$4 years old (vs 12.2% of the remaining population).

The group with no protection improved from 84% to 87% ($P = .004$), and the group with protection improved from 84% to 87% ($P = .002$). Global impact on QOL was inferred by comparing results for each group, and the difference was not statistically significant ($P = .88$, $SD = 1.6$).

**Discussion**

No significant difference was found in the incidence of otorrhea between groups (32% of protected children, 27% unprotected, $P = .09$). This is consistent with prior research showing that it is mechanically difficult for water to cross the ventilation tube [2,5,7,11] and with clinical studies that showed no relevant difference [10,12,15]. This reinforces the AAO-HNSF guidelines stating that protection is not needed in most cases [1,17].

The homogeneous population, with exclusion of other pathologies with high otorrhea rates, and a sample population with significant exposure to water reduced some limitations of previous studies. The results may be generalizable to children with recurrent acute otitis media because water should behave in a similar manner in an ear with normal middle ear anatomy. However, some of these children may still need earplugs if water bothers their ears [17]. The sample population size was adequate according to our power calculations, and relative risk and confidence interval favor no protection (0.67; 95% CI, 0.45-1.1), making it unlikely that a benefit of ear protection was missed. These results suggest that water protection (eg, earplugs or headbands) or prohibiting aquatic activities is not necessary.

Most primary care physicians (73%) and many otolaryngologists (47%) continue to recommend avoiding contact with water [3], even after randomized evidence suggested that this is unnecessary [1]. There is still a lack of consensus on this subject [20] due to the lack of strong evidence for or against. This RCT adds to the growing evidence that ear protection is not indicated. Our results agree with in vitro and epidemiologic studies showing that water crosses the ventilation tube only if under significant pressure [2,5,7,11]. In addition, otorrhea following tube insertion was most frequently associated with URTI as previously described [1,2,8,9]. Many episodes had no apparent causes but could also be related to the presence of viable bacteria in effusions before surgery [30].

The incidence of otorrhea (27%) was lower than that reported by other authors (30%-83%) [1,6]. In contrast to the Goldstein et al study [1], only patients with tubes inserted for OME were recruited, excluding cases that would have higher incidence of otorrhea, such as recurrent acute otitis media (in the Goldstein et al trial, 80% of patients underwent surgery for recurrent acute otitis media). Another advantage of our study is that a large percentage of participants regularly practiced aquatic activities (60%). Portuguese benefits from a subtropical Mediterranean climate with a long summer and a tradition of learning to swim, increasing the potential exposure to a presumed risk factor (water). Our results suggest that restriction of swimming activities or the use of ear protection does not affect otorrhea incidence.

OME is currently regarded as having a relevant impact on child QOL [17] and when tube surgery is indicated, QOL improves [2]. However, ear protection, when prescribed, may significantly alter regular daily life. We did not find any high-quality study addressing this issue. It is understood that avoiding water is at least inconvenient and may delay learning to swim at worst [18]. The present study is a relevant contribution to this discussion. In line with previous research [29,31-33], global QOL improved significantly. Not finding an impact on QOL from prescribing water precaution was unexpected, because it is thought that adding extra care and precautions would interfere with a child’s activities [18]. It is expected that children accept precautions once they are part of the routine.

QOL does not seem to be consistently improved by this procedure in the long term [34]; however, longer-duration studies are necessary. Our main objective was to assess the impact on QOL from protection measures. The measures are necessary only while the tubes remain in situ. We thought an interval of 2 months was sufficient time for relevant exposure and incorporation into the child’s routines. With no difference at 2 months, we believed repeat evaluation would show only equal or better tolerance to these measures and would be redundant.

One limitation of our study is that doing bivariate analysis of multiple risk factors introduces a multiple $P$ value problem. Multivariate analysis was not possible because of the small number of multiple otorrhea episodes. To minimize the potential error, Bonferroni adjustment was used, and with 7 predictive factors, a conservative $P$ value of .01 was used for significance.

By recruiting children evenly throughout the year, the bias of having a seasonal exposure to risk factors for
otorrhea was reduced (URTI in winter, swimming in summer). The 6-month follow-up period may have missed late episodes of otorrhea, especially for children whose tubes were placed early in the cold month period; however, the tubes used (the most common utilized in Portugal) are short-duration tubes (Shepard), and most are extruded shortly after this period. The fixed 6-month follow-up period ensured that each participant had equivalent exposure time.

The size of the tympanostomy tube may play a role: larger tubes may be associated with a higher incidence of otorrhea, and so these results may be applicable for only this tube size. However, as seen in our previous study, water flow through the tympanostomy tube is more dependent on eustachian tube patency, allowing air in the tympanic cavity to exhaust to the pharynx. Restriction of exposure to particular types of water (believed to be heavily contaminated) is still considered useful, and here water precautions may be prescribed.

The URTI incidence of 37% is in line with previous studies of similar groups (children attending day care in urban environment). Unexpectedly, URTIs were not significantly more common during the colder months, and no association with the usual risk factors was found. This could be due to underreporting, but participants’ parents were reminded to report whenever there were symptoms. Also, in each 2-month period, they were encouraged to report any episode suggestive of URTI. URTI symptoms were related to 55% of otorrhea episodes, and this is consistent with previous studies.

Adenoidectomy reduces the infection rate after surgery; therefore, it probably reduced the otorrhea rate in our study population. As all participants underwent adenoidectomy, it is unlikely that this introduced bias to our results. Relying on parental reporting of otorrhea or URTI may be considered a source of bias; however, a high level of agreement between parents and physicians in the assessment of those signs has been demonstrated. Counting only observed episodes would likely result in underestimating true incidence, and recall bias does not influence parents’ reporting accuracy in 3-month intervals.

Finally, treatment analysis was performed and not intention-to-treat analysis, because “perfect use” of ear protection was being studied rather than its recommendation per se. Recruitment was increased accordingly to maintain the calculated sample size. However, to avoid an exclusion bias (eg, if children without ear protection had had so much otorrhea that they dropped out), an intention-to-treat analysis was performed for the primary outcome, which confirmed no difference between groups.

Conclusion
This is a multicenter RCT with a high rate of water exposure without dives to a depth >0.5 m, with children undergoing their first tympanostomy tubes for OME, and with concomitant adenoidectomy. Prescribing ear protection did not reduce the incidence of otorrhea after tympanostomy with transtympanic tube for OME. No association was found between water exposure and otorrhea episodes. URTI symptoms accompanied 55% of otorrhea episodes. These results support the guidelines from the AAO-HNSF that discourage the routine use of water protections for children with tympanostomy tubes. Also, children with ventilation tubes for OME improved their global QOL. This improvement was statistically significant, irrespective of whether water protection was prescribed.

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Author Contributions
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**References**