Influence of Single-Trial Results on Clinical Practice

Example of Adenotonsillectomy in Children

Maroeska M. Rovers, PhD; Arno W. Hoes, MD, PhD; Sanne Klinkhamer, MD; Anne G. M. Schilder, MD, PhD

Objective: To establish whether the results of a 2004 trial on the effectiveness of adenotonsillectomy in children with mild to moderate symptoms of throat infection or adenotonsillar hypertrophy affected physicians’ beliefs about the benefits of the operation and influenced clinical practice.

Design: Prospective prior-posterior study.

Setting: Academic research.

Participants: We evaluated beliefs prior and posterior to the 2004 trial regarding the benefits of adenotonsillectomy in a random sample of 120 Dutch otolaryngologists and 120 Dutch general practitioners.

Main Outcome Measure: Physicians were asked to give their estimates of the probability of recovery during 1 year after adenotonsillectomy or a nonsurgical strategy in 3 scenarios of children aged 3 to 4 years with recurrent throat infection, upper respiratory tract infection (with or without fever), or sleep-related breathing disorder.

Results: Ninety-four percent of otolaryngologists (n=46) and 31% of general practitioners (n=14) were familiar with the 2004 trial results. Posterior beliefs of otolaryngologists and general practitioners did not differ substantially from prior beliefs; overall expectations regarding the benefits of adenotonsillectomy remained high.

Conclusion: Dissemination of the 2004 trial results did not seem to affect the beliefs of physicians regarding the benefits of adenotonsillectomy.

Trial Registration: isrctn.org Identifier: ISRCTN04973569


ONSILLECTOMY, with or without adenoidec- tomy, is one of the most commonly performed surgical procedures among children in Western countries. The rate of this procedure varies considerably across and within countries. For example, the 1998 adenotonsillectomy rate among children varied from 19 cases per 10,000 in Canada to 65 cases in England to 115 cases in the Netherlands. Within the Netherlands, surgical rates ranged from 72 cases per 10,000 in the Flevopolders province to 156 cases in the neighboring Overijssel province.1 This variation suggests that surgical rates are determined not only by cultural and societal differences regarding the management of upper respiratory tract disease (ie, a preference for surgical vs medical therapy) but also by the fact that physicians have different beliefs regarding the benefits of surgery.

In 2002, a total of 6 randomized controlled trials on the effectiveness of adenotonsillectomy in children had been published.2-6 A 2004 trial among children moderately affected by throat infections or by symptoms of enlarged tonsils and adenoids was added to the literature (summarized in the next section).6 This allowed us to study how new evidence influences the beliefs of physicians regarding adenotonsillectomy.

SUMMARY OF THE 2004 TRIAL

A 2004 open randomized controlled trial studied the effectiveness of adenotonsillectomy in children with mild to moderate symptoms of throat infection or adenotonsillar hypertrophy.6 Three hundred children aged 2 to 8 years requiring adenotonsillectomy, according to clinical practice, were recruited by otolaryngologists in 21 general hospitals and 3 academic centers in the Netherlands. The children were randomly assigned to adenotonsillectomy within 6 weeks or to watchful waiting. During a median follow-up period of 22 months,
50 children randomized to watchful waiting underwent adenotonsillectomy, and 7 children randomized to adenotonsillectomy did not undergo surgery. Children in the adenotonsillectomy group had 2.97 episodes of fever per person-year vs 3.18 episodes in the watchful waiting group (difference, −0.21; 95% confidence interval, −0.54 to 0.12), 0.56 throat infections vs 0.77 (−0.21; −0.36 to −0.06), and 5.47 upper respiratory tract infections vs 6.00 (−0.53; −0.97 to −0.08). Sleep and eating patterns of children randomized to adenotonsillectomy initially improved more than those in children randomized to watchful waiting, but the differences had disappeared by 24 months. No clinically relevant differences were found for health-related quality of life. Adenotonsillectomy was more effective in children with a history of 3 to 6 throat infections than in children with 0 to 2. Twelve children had complications related to surgery. For children with mild to moderate symptoms of throat infection or adenotonsillar hypertrophy, it was concluded that adenotonsillectomy has no clinically relevant benefits over watchful waiting. The trial was funded by grant OG-99-060 from the Dutch Health Care Insurance Board.

PRIOR AND POSTERIOR BELIEFS

We evaluated physicians’ beliefs regarding the benefits of adenotonsillectomy prior to (in 2002) and posterior to (in 2006) publication of the 2004 trial results. Publication occurred in 2 PhD theses7,8 and in national9-11 and international12-17 journals, and findings were presented at national and international meetings.11-17 Random samples of 120 otolaryngologists and 120 general practitioners (GPs) were drawn from a list of approximately 400 members of the Netherlands Society of Otorhinolaryngology and Head and Neck Surgery and from a database that included approximately 9000 Dutch GPs. These samples were chosen based on the assumption that we needed at least 50 respondents in each group to obtain a precise point estimate and assumed a response rate of 50%. Both groups were contacted by mail and were asked to complete a structured questionnaire. Reminders were sent to all physicians after 4 and 9 weeks. All questionnaires were processed anonymously.

The questionnaire included 3 scenarios of children aged 3 to 4 years with recurrent throat infection, upper respiratory tract infection (with or without fever), or sleep-related breathing disorder. Respondents were asked to give their estimates of the probability of clinical improvement (in throat infections, fever episodes, and sleep) during 1 year after adenotonsillectomy or a nonsurgical strategy. Fever episodes were included in the questionnaire because most fever episodes in young children are caused by upper respiratory tract infections18,19 and because it was used as an objective outcome in the 2004 trial.

The probabilities were scored on a visual scale ranging from 0% to 100%. To verify whether the 2004 trial results had been disseminated effectively among the respondents, the questionnaire included questions about their knowledge and acceptance of the trial results.

SCENARIOS

For each scenario, differences in physicians’ estimates of the probabilities of clinical improvement before and after dissemination of the 2004 trial results were tested using the Wilcoxon rank sum test, as the scores were not normally distributed. Differences in beliefs between otolaryngologists and GPs were also assessed.

Scenario 1

A 4-year-old girl visits her physician with symptoms of a sore throat and fever. Physical examination reveals enlarged and erythematous tonsils with crypt debris and a few tender cervical lymph nodes. She has a history of 4 throat infections with high fever during the past year, for which she has missed school for several days. Antibiotics have been prescribed on 2 occasions. She sometimes snores at night; she has no difficulty eating solid food.

Scenario 2

A 3-year-old girl is seen by her physician with a history of fever for several days and symptoms of rhinorrhea and coughing. She is a mouth breather, there are signs of rhinitis, and her tonsils are slightly enlarged but not inflamed. Several cervical lymph nodes are palpable. Otoscopy shows otitis media with effusion. She has had frequent upper respiratory tract infections with fever during the past year (6 episodes of the common cold), twice followed by an episode of acute otitis media. She has missed day care on many occasions. Her eating pattern is normal, as are her growth and development.

Scenario 3

A 4-year-old girl visits her physician with a history of restless sleep for 2 years. She snores heavily, and she sometimes seems to stop breathing during sleep. Her mother is worried because she has difficulty eating solid food. She has had 2 throat infections with fever during the past year. Physical examination reveals enlarged (almost “kissing”) tonsils. She breathes noisily through her mouth. A few cervical lymph nodes are palpable.

RESULTS

Of 120 otolaryngologists we approached, 76 (63%) returned a completed questionnaire, 6 (5%) indicated that they did not want to participate, and 38 (32%) did not respond to 2 reminders. Of 120 GPs we approached, 69 (57%) returned a completed questionnaire, 8 (7%) indicated that they did not want to participate, and 43 (36%) did not respond to 2 reminders.

We plotted the distributions of physicians’ personal estimates of the probability of clinical improvement in throat infections, upper respiratory tract infections, fever episodes, and sleep after adenotonsillectomy and after a nonsurgical strategy. These results are shown in Figures 1, 2, 3, and 4.

Median expectations of otolaryngologists regarding clinical improvement after adenotonsillectomy varied between 68% (upper respiratory tract infections in scenario 2) (n = 52) and 93% (sleep pattern in scenario 3) (n = 72). Median expectations regarding clinical improvement following a watchful waiting strategy varied between 18% (sleep pattern in scenario 3) (n = 14) and 38% (fever episodes in scenario 1) (n = 29).

Median expectations of GPs regarding clinical improvement after adenotonsillectomy varied between 36%
Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery of throat infections after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.50 for ORL and P=.42 for GP) and without T&Ads (P=.25 for ORL and P=.93 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P<.001) and without T&Ads before the trial (P=.12) and after the trial (P<.001). GP indicates general practitioner; ORL, otolaryngologist.

Figure 1. Scenario 1. Four-year-old girl with recurrent throat infections. Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery of throat infections after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.04 for ORL and P=.45 for GP) and without T&Ads (P=.76 for ORL and P=.09 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P<.001) and without T&Ads before the trial (P=.03) and after the trial (P<.001). GP indicates general practitioner; ORL, otolaryngologist.

Figure 2. Scenario 2. Three-year-old girl with frequent upper respiratory tract infections (URTIs). Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery URTI after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.02 for ORL and P=.63 for GP) and without T&Ads (P=.35 for ORL and P=.13 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P=.18) and without T&Ads before the trial (P=.74) and after the trial (P=.04). GP indicates general practitioner; ORL, otolaryngologist.

Figure 3. A, Scenario 1. Four-year-old girl with recurrent throat infections. Distributions of physicians’ beliefs before and after the 2004 trial results regarding the probability of recovery of episodes of fever after adenotonsillectomy (T&Ads) and a nonsurgical strategy (without T&Ads)—with T&Ads (P=.25 for ORL and P=.28 for GP) and without T&Ads (P=.17 for ORL and P=.93 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P<.001) and without T&Ads before the trial (P=.03) and after the trial (P<.001). B, Scenario 2. Three-year-old girl with frequent upper respiratory tract infections. Distributions of physicians’ beliefs before and after the 2004 trial regarding the probability of recovery of episodes of fever after T&Ads and without T&Ads—with T&Ads (P=.02 for ORL and P=.63 for GP) and without T&Ads (P=.35 for ORL and P=.13 for GP). Differences were assessed between ORL and GP regarding the expectations of improvement with T&Ads before the 2004 trial (P<.001) and after the trial (P=.18) and without T&Ads before the trial (P=.74) and after the trial (P=.04). GP indicates general practitioner; ORL, otolaryngologist.

Of 120 otolaryngologists we approached, 49 (41%) returned a completed questionnaire, 17 (14%) indicated that they did not want to participate, and 54 (45%) did not reply to 2 reminders. Of 120 GPs we approached, 45 (38%) returned a completed questionnaire, 18 (15%) indicated that they did not want to participate, and 57 (47%) did not reply to 2 reminders.

The Table gives results of the knowledge, acceptance, and policy change rates among the participating otolaryngologists and GPs. Forty-six of 49 responding otolaryngologists (94%) and 14 of 45 responding GPs
were familiar with the 2004 trial results on the effectiveness of adenotonsillectomy in children, and 29% (n=14) of otolaryngologists and 82% (n=37) of GPs agreed with the conclusions drawn from the trial. Twenty-four percent (n=12) of otolaryngologists and 20% (n=9) of GPs indicated that they had changed their policy regarding adenotonsillectomy. Some reported that they referred (n=12) or operated on (n=13) more children than before, whereas others reported that they referred (n=16) or operated on (n=7) fewer children than before.

Physicians’ expectations regarding clinical improvement after adenotonsillectomy and after a nonsurgical strategy varied considerably (Figures 1, 2, 3, and 4). After dissemination of the 2004 trial results, expectations of otolaryngologists and GPs regarding the benefits of adenotonsillectomy remained high. Only in the scenario of the girl with frequent upper respiratory tract infections (scenario 2) did otolaryngologists have lower expectations after dissemination of the 2004 trial results than before regarding clinical improvement of upper respiratory tract infections (60% after vs 69% before, P=0.04) and fever episodes (56% after vs 71% before, P=0.01) following adenotonsillectomy. The other estimates did not change in either group of physicians.

Despite dissemination of the 2004 trial results that adenotonsillectomy had no clinical benefits over a watchful waiting policy in children moderately affected by throat infections or symptoms of adenotonsillar hypertrophy, overall expectations regarding the benefits of adenotonsillectomy in children remained high. Posterior beliefs of otolaryngologists and GPs did not change relative to prior beliefs. The overall expectations of otolaryngologists regarding the benefits of adenotonsillectomy remained higher than the expectations of GPs.

These results agree with findings of a previous study. In that study, new evidence from a trial on the effects of ventilation tubes did not change the beliefs of otolaryngologists regarding the benefits of tubes on hearing and language development.

Several barriers are known to influence the implementation of trial results, namely, external barriers and lack of awareness, familiarity, and agreement. Most GPs (69%; n=31) seemed to be unfamiliar with the 2004 trial results, whereas most otolaryngologists (94%; n=46) were familiar with them. However, 82% (n=37) of GPs who were familiar with the results agreed with the conclusions drawn vs only 29% (n=14) of otolaryngologists. Therefore, unfamiliarity with and unwillingness to accept the trial results and its conclusions, as well as familiarity and willingness, may have had important roles in our finding that physicians’ beliefs did not change.

Others have demonstrated wide variation in referral rates for tonsillectomy or adenotonsillectomy and in indications to perform this operation. Beliefs regarding the effectiveness of adenotonsillectomy vary within and between medical specialties. This may also have affected implementation of the 2004 trial results.

### Table. Knowledge, Acceptance, and Policy Change Rates Regarding Adenotonsillectomy Among Responding Otolaryngologists and General Practitioners (GPs) After Dissemination of the 2004 Trial Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Otolaryngologists, No. (%)</th>
<th>GPs, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 49)</td>
<td>(n = 45)</td>
</tr>
<tr>
<td>Changed practice regarding adenotonsillectomy over the past 2 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased</td>
<td>12 (24)</td>
<td>9 (20)</td>
</tr>
<tr>
<td>Decreased</td>
<td>13 (27)</td>
<td>12 (27)</td>
</tr>
<tr>
<td>Changes policy was based on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific literature</td>
<td>36 (73)</td>
<td>14 (31)</td>
</tr>
<tr>
<td>Conference information</td>
<td>24 (49)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Postgraduate education</td>
<td>16 (33)</td>
<td>17 (38)</td>
</tr>
<tr>
<td>Contacts with colleagues</td>
<td>24 (49)</td>
<td>13 (29)</td>
</tr>
<tr>
<td>Guidelines</td>
<td>5 (10)</td>
<td>20 (44)</td>
</tr>
<tr>
<td>Familiar with the 2004 trial results</td>
<td>46 (94)</td>
<td>14 (31)</td>
</tr>
<tr>
<td>Agreed with the conclusion of the 2004 trial</td>
<td>14 (29)</td>
<td>37 (82)</td>
</tr>
</tbody>
</table>

The question remains as to what methods might be successful to implement a change in beliefs regarding the indications for adenotonsillectomy. Unfortunately, there is no evidence concerning which dissemination strategies are likely to be effective under different circumstances. This outcome calls for further research in this area.

Some limitations of this study should be mentioned. First, the information included in the scenarios may have been insufficient for physicians to make a meaningful judgment. The information included was based on a previous inventory of the indications for adenotonsillectomy in children among Dutch otolaryngologists and GPs.
Second, many otolaryngologists, especially from countries with a more restrictive policy regarding surgery in children with upper respiratory tract infections, would not operate in scenarios 1 and 3. However, our results show that most participating Dutch otolaryngologists and GPs expect more children to do better after surgery compared with watchful waiting, indicating that they refer and operate on these children.

Third, the high nonresponse rate may have resulted in biased probability estimates. It is possible that physicians with stronger beliefs regarding the benefits of adenotonsillectomy were more willing to respond than those who did not have such a strong opinion. However, a sensitivity analysis showed that the results only changed if the range of the prior distribution was much smaller. Even if all randomly selected otolaryngologists and GPs had completed the questionnaire, it is unlikely that such a small range would have occurred or that the results would have changed.

Fourth, because the same physicians were approached both before and after the 2004 trial, a strong positive within-individual correlation can be expected between beliefs before and after the trial. This would have resulted in a smaller variance than the variance used in the Wilcoxon test. Because the questionnaires were processed anonymously, we could not study the prior and posterior beliefs on an individual level, which would have had added value.

Fifth, in an attempt to find more objective clues about how to interpret the incongruence between trial results and posterior beliefs, we calculated the yearly incidence of adenotonsillectomy. Strikingly, we found a slightly decreased incidence of adenotonsillectomy between 1998 and 2006. However, it is unlikely that this decrease is because of the publication of the 2004 trial results. Only an extra trend toward a reduction in the number of adenotonsillectomies could be owing to dissemination of the 2004 trial results, but such an extra reduction has not occurred. However, it is possible that other studies with similar outcomes (eg, the 2002 study by Paradise et al?) affected the outcome. Seventy-three percent (n=36) of participating otolaryngologists reported that they had changed their policy on the basis of scientific publications; however, most of them reported that they performed adenotonsillectomy more frequently.

In conclusion, dissemination of the 2004 trial results did not affect the beliefs of physicians regarding the benefits of adenotonsillectomy. Therefore, the adoption of research evidence in clinical practice remains a complex process.

Submitted for Publication: November 18, 2008; final revision received April 22, 2009; accepted May 11, 2009.

Correspondence: Maroesa M. Rovers, PhD, Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, Stratumweg 6, Utrecht, the Netherlands (M.Rovers@umcutrecht.nl).

Author Contributions: All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Rovers, Klinkhamer, and Schilder. Acquisition of data: Rovers and Klinkhamer.


