Screening for hearing loss versus parental concern regarding hearing problems: Subsequent referral and treatment for otitis media in the Netherlands

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Abstract
Objective. The present study investigates whether general practitioner (GP) consultation initiated by failing the population hearing screening at age nine months or GP consultation because of parental concern over ear/hearing problems was more important in deciding on referral and/or surgical treatment of otitis media (OM). Design. A questionnaire covering the history between birth and 21 months of age was used to obtain information on referral after failing the hearing screening, GP consultations for ear/hearing problems, and subsequent referral to a specialist and possible surgical treatment at an ENT department. Setting. The province of Limburg, the Netherlands. Subjects. Healthy infants invited for the hearing screening at age nine months, who responded in an earlier study called PEPPER (Persistent Ear Problems, Providing Evidence for Referral, response rate 58%). Main outcome measures. The odds of a child being surgically treated for OM. Results. The response rate for the present questionnaire was 72%. Of all children tested, 3.9% failed the hearing screening and were referred to their GP. Of all 2619 children in this study, 18.6% visited their GP with ear/hearing problems. Children failing the hearing screening without GP consultation for ear/hearing problems were significantly more often treated surgically for OM than children passing the hearing screening but with GP consultation for ear/hearing problems. Conclusion. Objectified hearing loss, i.e. failing the hearing screening, was important in the decision for surgical treatment in infants in the Netherlands.

Key Words: General practitioner, hearing screening, infants, otitis media, referral

Introduction
Ear and/or hearing problems caused by otitis media (OM) are highly prevalent in young children [1–4] and represent about one-fifth of all general practitioner (GP) visits in children aged 0–2 years in the Netherlands (http://www.nivel.nl). Until 2006 all children in the Netherlands were screened for hearing loss at the age of nine months. Most cases failing this screening had a conductive hearing loss due to otitis media [5–7] and failing this hearing screening prompted GP consultation.

In the Netherlands the GP acts as a gatekeeper and the Ear, Nose and Throat (ENT) specialist is seldom consulted for small children without initial referral by the GP [8]. Before the replacement of the hearing distraction test at nine months by neonatal screening, referrals to the ENT specialist could therefore be initiated by parental concern regarding ear and/or hearing problems, or by failing the hearing screening at nine months. Understanding these referral pathways has become of present interest because the number of young children treated with ventilation...
Failing the hearing screening at age nine months was linked to surgical treatment for otitis media in the Netherlands.

- After the replacement of the hearing screening at age nine months the number of children treated surgically for otitis media increased.
- This increase could reflect clinical uncertainty in the absence of an audiometric evaluation.

The present study investigates whether the result of the hearing screening was important in deciding on referral and/or surgical treatment of OM.

Material and methods

Hearing screening

The hearing distraction test (CAPAS, Compact Amsterdam Paedo-Audiometrical Screening [7]) was conducted in the Netherlands at age nine months until 2005–2006. Children were referred to their GP upon either failing the CAPAS three times or failing twice when combined with other problems warranting referral, for example developmental problems or a suspected severe hearing loss. The GP could thereafter refer the child to a specialist directly, or opt for watchful waiting.

Subjects

The potential sample consisted of 3681 children, born between 1 June 2004 and 31 December 2004 in the province of Limburg, Netherlands, whose parents had already participated in the ‘Persistent Ear Problems, Providing Evidence for Referral’ (PEPPER) study [10] by returning the PEPPER questionnaire (6531 children received a questionnaire, response rate 56%). The PEPPER study uses risk factors to predict OM-related hearing loss. For the present study those parents that returned the PEPPER questionnaire received a second questionnaire by mail when the children reached the age of 21 months. This structured history questionnaire was sent together with a letter explaining the purpose of the study and a stamped return envelope. Therefore the potential study population consists of 3681 children born between 1 June 2004 and 31 December 2004 whose parents received both questionnaires.

Questionnaire

The structured history questionnaire sent to the parents when their child was aged 21 months comprised 12 questions about attending the hearing screening, referral subsequent to this hearing screening, visits to the GP because of suspected ear and/or hearing problems, and subsequent referral to a specialist (ENT specialist, paediatrician, or audiology department etc.) and treatment by an ENT specialist (see Appendix to be found online at http://www.informahealthcare.com/abs/doi/10.3109/02813432.2012.688704). The data from the questionnaires was incorporated into an SPSS data file.

Statistical analysis

Four groups of children were defined for comparison:

- Group one: Children failing the hearing screening and with subsequent referral to their GP; no parent-initiated GP consultation about ear/hearing problems independent of the hearing screening.
- Group two: Children failing the hearing screening and with subsequent referral to their GP, and also with parent-initiated GP consultation about ear/hearing problems.
- Group three: Children passing the hearing screening but with parent-initiated GP consultation about ear/hearing problems.
- Group four: Children passing the hearing screening and with no parent-initiated GP consultation about ear/hearing problems.

We were especially interested in whether or not failing the hearing screening increased the odds of surgical treatment for OM and we therefore calculated odds ratios (ORs) for surgery and for tube placement for groups one and two, separately, relative to group three (SPSS 15.0).

Results

A total of 2684 (72.9%) parents returned the structured history questionnaire; 65 had completed it for a non-index child, leaving 2619 usable cases.

Hearing screening and subsequent referral to the general practitioner

Most children (74%) were screened only once. According to the parents, 132 children were tested
Screening for hearing loss versus parental concern regarding hearing problems

In total, 488 (18.6%) children consulted their GP with ear and/or hearing problems. Table I presents the number of children with ear/hearing problems according to the age at the first visit to the GP. Of these 488 children, 24 (4.9%) had also failed the hearing screening and were therefore referred to their GP. Fourteen of these 24 children (58%) had consulted their GP before the hearing screening at the age of nine months.

Referral to a specialist

Of the 488 children consulting their GP with ear/hearing problems 261 children were referred further to a specialist, mostly to ENT (77.8%), with 12.3% to audiology, 18.4% to paediatrics, and 2.3% to another specialist (ophthalmologist, dermatologist, plastic surgeon, not specified). Only 17 children were referred to more than one specialist, mostly (n = 14) to the ENT and paediatric department. Of the 261 children who were referred to a specialist, 79 were referred after failing the hearing screening.

Of the 204 children referred to ENT, 83 were treated with medication and 169 with surgery (Table II).

Table III shows the numbers of children in the defined groups and the number of children referred and/or treated within each group. Children in group one (failing the hearing screening without previous parent-initiated GP consultation because of ear/hearing problems) were more often referred, and had a 2.9 higher odds (p < 0.0005, CI 1.73–4.94) of undergoing tube placement than children in group three (passing the hearing screening and with a parent-initiated GP consultation because of ear/hearing problems). Children failing the hearing screening followed by referral and GP consultation because of ear/hearing problems (group two) had a 6.1 higher odds (p < 0.0005, CI 2.76–13.28) of being treated with tubes than children who consulted the GP because of ear/hearing problems without failing the hearing screening (group three).

Discussion

The relationship between screening for hearing loss at the age of nine months and subsequent treatment with tubes has been discussed before [9,11], but definite conclusions could not be drawn. The present study intends to determine to what extent failing the hearing screening at nine months resulted in surgical treatment for OM in an attempt to better understand why the number of children treated surgically increased after the disbanding of the screening at nine months [9].

The response rate in the current study was reasonable, almost 73% [12]. We are, however, reporting on a subpopulation as only parents who had responded in the PEPPER study [10] (response rate 56%) received an invitation to participate in this study. Analysis revealed that parents who returned both questionnaires had a relatively higher SES, which usually is accompanied by better health [13]. Returning both questionnaires could also reflect more concern regarding ear/hearing problems in

Table I. Number of children according to age at time of first visit to the GP with ear and/or hearing problems.1

<table>
<thead>
<tr>
<th>Age at first visit to GP</th>
<th>Number of children</th>
<th>Referral to a specialist</th>
<th>Referral to audiology</th>
<th>Referral to ENT</th>
<th>ENT surgery2</th>
<th>Treatment with tubes3</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 months</td>
<td>20</td>
<td>15 (75.0%)</td>
<td>2 (10.0%)</td>
<td>12 (60.0%)</td>
<td>11 (55.0%)</td>
<td>10 (50.0%)</td>
</tr>
<tr>
<td>3–6 months</td>
<td>64</td>
<td>22 (34.4%)</td>
<td>3 (4.7%)</td>
<td>19 (29.7%)</td>
<td>16 (25.0%)</td>
<td>14 (21.9%)</td>
</tr>
<tr>
<td>6–9 months</td>
<td>90</td>
<td>43 (47.8%)</td>
<td>2 (2.2%)</td>
<td>39 (43.3%)</td>
<td>36 (40.0%)</td>
<td>30 (33.3%)</td>
</tr>
<tr>
<td>9–12 months</td>
<td>90</td>
<td>28 (31.1%)</td>
<td>1 (1.1%)</td>
<td>27 (30.0%)</td>
<td>16 (17.8%)</td>
<td>13 (14.4%)</td>
</tr>
<tr>
<td>12–15 months</td>
<td>116</td>
<td>27 (23.3%)</td>
<td>1 (0.9%)</td>
<td>27 (23.3%)</td>
<td>21 (18.1%)</td>
<td>18 (15.5%)</td>
</tr>
<tr>
<td>&gt; 15 months</td>
<td>108</td>
<td>34 (31.5%)</td>
<td>3 (2.8%)</td>
<td>29 (26.9%)</td>
<td>15 (13.9%)</td>
<td>13 (12.0%)</td>
</tr>
<tr>
<td>Total no. of children</td>
<td>488</td>
<td>169 (34.6%)</td>
<td>12 (2.5%)</td>
<td>153 (31.4%)</td>
<td>115 (23.6%)</td>
<td>98 (20.1%)</td>
</tr>
<tr>
<td>Total no. of children</td>
<td>2619</td>
<td>261 (10.0%)</td>
<td>32 (1.2%)</td>
<td>204 (7.8%)</td>
<td>169 (6.5%)</td>
<td>138 (5.3%)</td>
</tr>
</tbody>
</table>

Notes: 1Subsequent referral to a specialist (audiology and/or ENT) and/or surgical treatment by an ENT specialist for children who visited their GP with ear/hearing problems at a certain age for the first time. Percentages according to the total number of children in a certain age group, i.e. age at first visit to the GP with ear/hearing problems (parent-reported data). GP = general practitioner; ENT = ear, nose and throat. 2Surgical treatment for ENT problems. 3Tubes with/without adenoidectomy or adenotonsillectomy.
Table II. Number of children treated surgically for ENT problems.

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenoidectomy</td>
<td>13 (7.7)</td>
</tr>
<tr>
<td>Adenoidectomy and tubes</td>
<td>51 (30.2)</td>
</tr>
<tr>
<td>Adenotonsillectomy</td>
<td>8 (4.7)</td>
</tr>
<tr>
<td>Adenotonsillectomy and tubes</td>
<td>10 (5.9)</td>
</tr>
<tr>
<td>Tubes</td>
<td>77 (45.6)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (5.9)</td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
</tr>
</tbody>
</table>

Notes: 1 Abscess drainage, frenulum lingua dissection, paracentesis, laryngoscopy, excision sublingual cyst, cochlear implantation, suturing of the ear canal, cleaning of the ear canal.

general or specifically in their child, and this could then result in a higher percentage of referrals. In our study the referral rate after failing the hearing screening was 3.9%, compared with 4.9% in the Netherlands in 2004 (Dutch Society of the Deaf and Hearing impaired Children: NSDSK [Nederlandse Stichting voor het Dove en Slechtthorende Kind]). Of all children in this study, 18.6% of the parents took the initiative to visit the GP for ear/hearing problems in their child. The incidence of ear/hearing complaints presenting to GPs in the Netherlands for 2004–2005 was respectively 21.5 and 20.7 per 100 children aged 0–2 years (http://www.nivel.nl). It thus seems that we have sampled a group of children who had relatively fewer ear/hearing complaints or whose parents had a lower incidence in visiting the GP compared with national data, and that this may indeed be due to the higher SES of the responders. This does not invalidate associations (risk factors) within the sample but may raise issues of generalizability.

If we compare the children failing the hearing screening followed by referral but without GP consultation because of ear/hearing problems (group one) with children who consulted the GP because of ear/hearing problems but not failing the hearing screening (group three), then more screen-failing children were treated with tubes. For those children who consulted their GP because of ear/hearing problems, again failing the hearing screening increased the odds of treatment with tubes (group two versus group three). It seems that objectified hearing loss was indeed important in deciding on referral and treatment with tubes, and therefore screening for hearing loss was linked to treatment with tubes.

Since the hearing screening at the age of nine months was abandoned in the Netherlands, the percentage of children receiving tube placement has become higher over time while that for adenoidectomy is lower [9]. Similar results were found in Finland and Norway [14], i.e. a decreasing number of adenoidectomies in both countries and an increase in number of tube placements in Finland. In Finland these changes could be partly explained by a change in national guidelines. As the guidelines did not change in the Netherlands, we feel that the cross-over in predominant surgery found in our study and in the study from Haapkyla [14] is strongly suggestive of a shift in clinical rationale towards hearing rather than URTI. The decreasing number of adenoidectomies could also be explained by awareness of publications questioning the need for adjuvant adenoidectomy for OM [15].

Furthermore, since the replacement of the hearing screening at age of nine months, it was observed that more rather than less children are being treated at a younger age [9]. In the present study, consultation with the GP for ear/hearing problems before the age of nine months led to more referral to a specialist and more treatment with tubes compared with consultation after the age of nine months (referral to a specialist 46% vs. 27%; treatment with tubes: 31% vs.14%). The higher number of young children being referred could reflect parental concern, but could also

Table III. Number of children in different groups who were referred to a specialist (audiology; ENT specialist; underwent ENT surgery or were treated surgically with tubes).

<table>
<thead>
<tr>
<th>Group</th>
<th>Total no.</th>
<th>Referral to specialist</th>
<th>Referral to ENT</th>
<th>Surgical ENT treatment</th>
<th>Tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>74</td>
<td>56 (75.7%)</td>
<td>16 (21.6%)</td>
<td>36 (48.6%)</td>
<td>30 (40.5%)</td>
</tr>
<tr>
<td>Group 2</td>
<td>28</td>
<td>26 (92.9%)</td>
<td>5 (17.9%)</td>
<td>22 (78.6%)</td>
<td>19 (67.9%)</td>
</tr>
<tr>
<td>Group 3</td>
<td>460</td>
<td>145 (31.5%)</td>
<td>6 (1.3%)</td>
<td>132 (28.7%)</td>
<td>94 (20.4%)</td>
</tr>
<tr>
<td>Group 4</td>
<td>2057</td>
<td>34 (1.7%)</td>
<td>5 (0.2%)</td>
<td>14 (0.7%)</td>
<td>25 (1.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>2619</td>
<td>261 (100%)</td>
<td>32 (1.2%)</td>
<td>204 (77.8%)</td>
<td>169 (6.3%)</td>
</tr>
</tbody>
</table>

Notes: Group 1: Children failing the hearing screening and referred to the GP, no parent-initiated GP consultation regarding ear/hearing problems. Group 2: Children failing the hearing screening and referred to the GP, parent-initiated GP consult regarding ear/hearing problems. Group 3: Children passing the hearing screening and parent-initiated GP consult regarding ear/hearing problems. Group 4: Children passing the hearing screening and no parent-initiated GP consultation regarding ear/hearing problems. ENT = ear, nose and throat department, GP = general practitioner. 1 Surgical treatment for ENT problems. 2 Tubes with/without adenoidectomy and/or adenotonsillectomy.

Percentages according to the total number of children in groups 1–4.
be an indicator of an early and therefore more severe or more persistent problem [16–18]. However, a recent study did not show an increase in the incidence of OM [19].

The increased number of children treated at a younger age could reflect the GP’s clinical uncertainty in assessing hearing in infants. Testing hearing in infants is difficult for GPs. Tympanometry can help in diagnosing the presence of OM [20], although it does not give information on the hearing. It could be that in the absence of an objectified hearing test to triage children with OM, GPs have become risk-averse and refer more easily. Then, at the ENT department, the OM simply is confirmed and children might be treated, probably including a number of cases where the OM could have resolved within a watchful waiting period as OM is very often a self-limiting disease. Taking into account the recent publications regarding the (absence of the) need for treatment in simple OM [21] and existing OM guidelines in the Netherlands [22], watchful waiting should have led to fewer children being surgically treated rather than more.

Conclusion

Referral after failing the hearing screening at nine months was accompanied by a raised probability of referral for OM and treatment with tubes. In the current absence of this screening at nine months, more children seem to be treated with tubes and at a younger age. To what extent this reflects clinical uncertainty in the absence of an audiometric evaluation is unclear, but there is no evidence supporting an increase in severe cases.

Ethical approval

Ethical approval was not deemed necessary as data were essentially administrative, no identities were divulged to non-health staff, and no approaches were made to patients or parents.

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Declaration of interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

References

Supplementary material available online

Supplementary Appendix