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Otitis media with effusion in children with in Down syndrome

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ABSTRACT

Objective: To determine the prevalence of otitis media with effusion (OME) in children with Down syndrome (DS), and the associated to hearing loss at the age of 8 years.
Study design: A national population based clinical study of all children with DS born in Norway in 2002.
Results: OME was found in 20 out of 52 (38%) children. Those with OME had a significant lower hearing level with a mean pure tone average (PTA) of 33.4 dB HL compared to children with no OME whose mean PTA was 21.7 dB HL ($p < 0.0001$). Verified hearing loss above 25 dB HL in the better hearing ear was found in 12 out of the 20 with OME, compared to 5 out 31 without OME.
Conclusion: The findings of this present study uncover the increased risk of OME in eight year old children with DS as current otitis media was found in one of three. This reduced hearing ability in children with DS due to OME at age of 8 strongly emphasizes the need for optimal treatment and follow up to optimize hearing rehabilitation. The findings are further supported by the population based study design, the focus on the narrow age band and the high response rate.

1. Introduction

Otitis media with effusion (OME) has a peak prevalence of 10–20% in the age group 2–5 years in otherwise healthy children [1]. By the time of reaching school age, 90% of all children have had episodes of OME. With an improved function of the Eustachian tube and a decrease in upper airways infections with increasing age, the prevalence of OME declines to 3–4% by the age of 10 [2–5]. The current guidelines suggest a more conservative approach in the treatment of uncomplicated OME in otherwise healthy children. But children with DS are at risk of language and learning delay due to cognitive or craniofacial challenges. In these children close follow-up, awareness and handling of adverse audiology outcome is recommended [8,9].

Down syndrome (DS) is a craniofacial syndrome. Hypotrophy of the mid-face and a general muscle hypotrophy may contribute to a dysfunction of the Eustachian tubes also after the preschool years. Further nasopharyngeal hypertrophy of lymphatic tissue may, at least in part, contribute to a lack of sufficient ventilation of the middle ears and a stagnation of fluid. The otologic examination in children with DS may be difficult to conduct due to narrow external auditory canal and reluctance to cooperation in some of the children. It has been suggested that OME is an important contributor to hearing loss in children with DS [9–11], however no population based study has been conducted, known to the authors, hence the distribution of OME in a population of the same age and with data from cooperative children with DS, is still unknown.

In children with DS who are intellectually challenged due to mental retardation, the hearing loss may cause even further cognitive development delay [1,12]. Integrated in the public school system, children with DS, like other children, rely on hearing ability in the communication with teachers and fellow students. In Norway, there are no interdisplinary medical guidelines concerning treatment or follow up of hearing in children with DS.

Abbreviations: DS, Down syndrome; dB HL, decibel hearing level; Hz, hertz; kHz, kilohertz; OME, otitis media with effusion; PTA, pure tone average.

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In this present study we aimed to test the hypotheses that OME is still common in school age in children with DS. In addition, the association between OME and hearing loss was studied.

2. Methods

2.1. Subjects

This is a national population based study of all children with DS born in Norway in 2002. The children were located through the Departments of Medical Genetics, in the Universities of Oslo, Bergen and Tromsø, who have complete national data on genetic diagnostics. Eligibility criteria included a diagnosis of DS based on cariotypic information and physical examination. The Committee of Medical Ethics approved the study and the children were recruited in 2010. The communication with bilingual children with DS and poor parental language skills was considered to make the cooperation difficult. Hence children with more than one parent of other nationality than Norwegian were excluded from the study. 57 children met the inclusion criteria and all parents except 3 accepted the invitation to participate. The response rate was 93%. The children were included regardless of concurrent disease and one child was lost to follow up.

Written consent signed by both parents and the child was obtained as urged by the Committee of Medical Ethics. The agreement included a parental questionnaire on somatic and psychiatric disease and participation in clinical investigation of the child.

Children with DS who had a home address within South-East Health Authority Trust were examined at an ear, nose- and throat-department of a local hospital Oslo (29/53). This also applied to the controls, whereas the other children with DS were examined at the nearest ear, nose- and throat-department, all in all 8 locations. All clinical examinations were performed by the same physician. Previous to the clinical examinations, considerations were made concerning how to approach these children. The examinations relied on the child's voluntarily wish to cooperate and the aim was to obtain data in all children. Their mental age was considered to enable an adequate approach. An age matched control group of otherwise healthy children ($n = 57$) considered socio-demographically representative for the Norwegian population were included.

The main outcome measure was the prevalence of OME at the age of 8 years with or without hearing loss. The association to earlier history of otitis media is considered. Data on the latter was obtained through a parental questionnaire.

2.2. Clinical examination

All children were scheduled for clinical ear, nose- and throat-examination including otomicroscopy, and regular audiological examinations. Tympanometry was performed using a field tympanometer, the data was copied into the electronic patient record. All hearing tests were performed in soundproof rooms by experienced audiologists. Cerumen was removed prior to tympanometry and audiologic examinations.

OME was stated in the presence of a tympanometry B curve, or C2 tympanograms, the absence of tympanic membrane movement and otomicroscopic signs of OME. No OME was stated in the absence of visible middle ear effusion, a mobile tympanic membrane and a tympanometry A curve. Hearing loss was categorized using pure tone average (PTA) after WHO [13] criteria in the better hearing ear: normal hearing ($\leq$25 dB HL), mild hearing loss (26–40 dB HL), moderate hearing loss (42–60 dB HL), severe hearing loss ($\geq$60 dB HL).

2.3. Statistical analysis

Descriptive statistic was applied. Chi square test was used to study the association between OME and hearing loss, in addition to study the association between OME and history of otitis media up to the age of 8.

3. Results

Otomicroscopy was performed in 52 out of 53 children. Current OME was found in 20/52 children (38%). The clinical examination revealed OME in 17 children. In addition, one child had ventilation tubes inserted less than three months prior to the examination due to OME and two non-cooperative children had ventilation tubes inserted during an examination in general anesthetics.

Hearing loss $>$ 25 dB HL in the better hearing ear was verified in 12/20 children with current OME, whereas 5 out of the 32 children without OME had hearing loss ($p < 0.0001$). The children with OME had a significant lower hearing level compared to those without OME (Table 1), the hearing distribution is shown in Table 2. One of the 57 children (2%) in the control group had unilateral OME on the left side with a corresponding hearing loss of 28 dB HL.

A significant relationship between current OME and the history of acute otitis media (AOM) and OME during the first 8 years of life was found ($p < 0.0001$).

Approximately two in three children with a history of AOM or a history of repeated periods of OME had current OME. 19 children had a history of OME and 13 of these had current OME. 22 children had a history of AOM and 12 of these had current OME. 8 children had a history of both OME and AOM, whereas 11 children had current OME and history of OME and AOM.

4. Discussion

These study findings suggests that 38% of Norwegian children with DS born in 2002 had OME at the age of 8 and that OME was significantly associated with hearing loss.

A strength of this national population based study with OME as the primary outcome is the homogeneous study population and the high response rate of 93%, although the homogeneity may represent a limitation to the generalizability to populations of other genetic background as OME may vary with ethnicity [14,15]. However, the trisomy 21 and associated anatomical changes may be the dominant common influencing factor in children with DS. Treating the children with patience and carefulness appropriate for the task of diagnosing significantly younger children without DS of 3–4 year of age [16], we succeeded in collecting clinical data in all children except 1.

We aimed to reduce observational bias to a minimum by allowing the same physician to conduct all clinical examinations. A second otolaryngologist was consulted in four children who did not cooperate during the clinical examination. However the clinical examination proved to be difficult, and these children were referred to examination in general anesthesia.

Table 1
Distribution of OME and pure tone average in children with DS.

Mean PTA	OME[a]	No OME
Number of children (%)	$n = 20$ (37)	$n = 32$ (62)
Mean pure tone average (SD)	33.4 dB HL (13.4)[c]	21.7 dB HL (10.2)[b]
Range	14–70 dB HL	6–80 dB HL

[a] Otomicroskopy performed in all children except 1.
[b] Pure tone hearing level in children with OME and children without OME ($p \leq 0.0001$).
[c] Audiological examination performed in all children except 2.