



Long-term follow-up of chronic suppurative otitis media in a high-risk children cohort

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ABSTRACT

Objective: Chronic suppurative otitis media (CSOM) is the leading cause of mild to moderate hearing impairment in children worldwide and a major public health problem in many indigenous populations. There is a lack of basic epidemiological facts and knowledge on the development of CSOM, as the disease primarily affects developing countries where research capacities often are limited. The purpose of this study was to determine the long-term outcome of CSOM in a high-risk population and to identify risk factors.

Methods: Follow-up study (2008) on a population-based cohort of 465 children in Greenland, initially examined (1996–8) between the ages 0 and 4 years. Follow-up was attempted among 307 children living in the two major towns. Binomial logistic regression analysis was made to identify risk factors for developing CSOM and for maintaining disease in to adolescence (odds ratios). Log linear binomial regression was used to estimate risk ratios and absolute risks.

Results: At follow-up 236 participated (77% of those available). The prevalence of CSOM was 32/236 (14%) at age group 0–4 years and 21/236 (9%) at age group 11–15 years. Thirteen had disease debut after the initial study. Of those with CSOM in the initial study 24/32 (75%) healed spontaneously. Risk factors for the development of CSOM at any time in childhood was the mother's history of CSOM OR 2.55 (95% CI 1.14–5.70; $p = 0.02$), and mothers with low levels of schooling OR 1.57 (1.03–2.40; $p = 0.04$). Once CSOM had developed boys were more likely to have persistent disease OR 5.46 (95% CI 1.47–20.37; $p = 0.01$). The absolute risk of CSOM if the mother had both a history of CSOM and low schooling was for boys 45.4% (95% CI 26.5–77.7) and for girls 30.7% (95% CI 17.8–53.10). The cumulative risk of CSOM was 19% at follow-up.

Conclusions: Even though a large number of CSOM cases seemed to heal spontaneously, the prevalence of untreated CSOM among school-age children in Greenland remained high as new cases were found at follow-up. Increased focus on prevention and identification of children at special risk could reduce the high prevalence of CSOM.

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1. Introduction

Chronic suppurative otitis media (CSOM) is the leading cause of mild to moderate hearing impairment in children worldwide and a major health problem in many indigenous populations around the world. In 2004 the WHO estimated that CSOM affects between 65 and 330 million people worldwide, causing 28,000 deaths and leaving 39–200 million with hearing loss [1]. Even though it is the most severe form of otitis media, epidemiological research on this

disease is limited compared with the abundant literature on acute otitis media and otitis media with effusion.

CSOM is a chronic inflammation of the middle ear and mastoid mucosa, with discharge through a chronic perforation of the tympanic membrane. A chronic perforation without evident discharge is included under this definition as it is considered to be a different stage of the same disease, where the tympanic membrane fails to heal, leaving it vulnerable to recurrent infections and causing conductive hearing loss [2].

CSOM is thought to develop in early childhood and has the potential of persisting in to adulthood causing repeated periods with draining ears that can last for months or years. The associated hearing loss may cause educational difficulties in children [3–5].

Managing CSOM is challenging as there is no consensus on the optimal medical treatment [6]. Furthermore, the lack of specialists in Greenland limits access to surgical treatment and follow-up [7].

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Fifteen thousand of the total population of 56,000 live in the capital, Nuuk, where the only ear nose and throat specialist is based. The remaining part of the population is visited once per year by Danish otologists.

The WHO states that a CSOM prevalence above 4% is a massive public health problem which needs urgent attention [2]. During the last decades several epidemiological studies have confirmed a continuously high prevalence of CSOM in Greenland (7–12%) as well as in other Inuit populations in the Arctic [8,9]. Risk factors for upper respiratory tract infections (URTI) and acute and chronic suppurative otitis media have been identified [9–11]. However, the knowledge on the course of CSOM and long-term outcomes in high-risk populations is scarce and has not been described in Greenland before.

The lack of an effective medical treatment regime and low access to surgical treatment in the area underline the need for knowledge of factors that may predict CSOM and possible long-term sequelae of CSOM, to identify children at special risk, as well as the need for early treatment and follow-up.

Therefore, we conducted a follow-up study on a population-based cohort of children in order to describe the long-term outcome of CSOM, determine risk factors for development of CSOM and for persistence of CSOM. To our knowledge this is the first long-term population-based cohort study on CSOM.

2. Materials and methods

The present study is a follow-up study conducted in October and November 2008 of an open cohort of 465 children established between April 1996 and December 1998, when the children were between 0 and 4 years of age. The children were at that time living in the West Greenlandic town of Sisimiut which has 5400 inhabitants and is the second largest town in Greenland.

2.1. Initial study 1996–1998

The specific objectives for the cohort study 1996–1998 were to describe incidence and prevalence of upper and lower respiratory tract infections and to identify risk factors for such. The cohort formation has previously been described in detail [9]. In brief, all children in Sisimiut and two adjacent settlements below 3 years of age were asked to participate. The 465 participating children (86% of children in the community) were followed at regular intervals for a 2-year period until their 3rd or 4th year birthday, and episodes of respiratory tract infections were recorded based on medical history and clinical examinations including otoscopy and tympanometry. Background information was obtained at enrolment through standardized interviews. CSOM was defined as either ear discharge from a tympanic membrane perforation or a dry perforation both persisting more than 14 days [11]. Diagnosis of CSOM could be made at any point in point during the study period.

2.2. Follow-up 2008

In August 2008 the addresses for the 465 children in the initial cohort study were sought in the Civil Registration System (CRS) that contains updated vital information on all Greenlanders. Towns in Greenland are scattered over a vast area and for logistic reasons we selected the 307 children who still lived in Sisimiut inclusive of the two settlements Itilleq and Sarfannguaq, or the capital Nuuk. The remaining children had moved to other towns in Greenland or to Denmark. A letter of invitation was sent to the selected families, followed by up to three phone calls, to invite children to participate. The clinical examinations were carried out at the local hospital where collection of questionnaire information was

carried out. Ear examinations were performed by the first author with a Carl Zeiss Otomicroscope (Opmi Pico ENT) and tympanometry with a Madsen Otoflex 100, GN Otometrics. All findings were reported in a standardized scheme modeled from the WHO WHO/PDH Ear and Hearing Disorders Examination Form Version 7.1A [12]. Information about previous otological disease, upper respiratory tract infections (URTI), former ear surgery, background information (family history, housing conditions, parents' educational level, childcare attendance and breast feeding) was obtained through a questionnaire. In Greenland all contacts to the healthcare system and prescription of medicine are recorded in the patient's medical files which follow the patient throughout life. Recordings are made by medical doctors, nurses or trained health personnel. The date of contact, treatment, otologic findings as otorrhea or perforations and duration of disease, were collected from the records, in order to define otitis media cases according to the study definitions. Information about ear surgery was also collected from the medical files.

Written informed consent was obtained by parents or guardians of all participating children. The study fulfilled the Helsinki II Declaration and was ethically approved by the Commission for Scientific Research in Greenland.

2.3. Definition of tympanic membrane pathology in the follow-up study

CSOM was defined as more than two weeks of ear discharge through a perforated tympanic membrane or a chronic perforation. A chronic perforation was defined as a tympanic membrane perforation lasting for more than 3 months, as this is the time when non-chronic tympanic membrane perforations (e.g. after acute otitis media) are expected to have healed spontaneously [13]. Participants with perforation at examination were asked about symptoms of otitis media or ear trauma during the previous three months and participants with discharge were asked about the duration. Otitis media with effusion (OME) was defined as a type B tympanogram with an ear canal volume (ECV) between 0.5 ml and 1.5 ml as this was considered normal in this age group [14]. ECV under 0.5 ml indicated misplacement of the immittance probe. ECV over 1.5 indicated perforation and was confirmed by otomicroscopy. Tubal dysfunction was defined as either type C1 or C2 tympanogram, Myringosclerosis was defined as calcified plaques and atrophy as localised areas of thinning of the tympanic membrane. Retraction was defined as a medialized area of the tympanic membrane and fibrosis was defined as areas of the tympanic membrane without translucency, with no other signs of oedema due to middle-ear effusion or inflammation.

2.4. Statistics

Statistical analyses were performed using SAS v 9.2 (SAS Institute Inc., Cary, NC, USA). Fisher's exact χ^2 test was used for test for proportions and Kruskal–Wallis test for testing medians between groups. The associations between potential risk factors and CSOM or ear surgery for CSOM at any time as outcome were analyzed separately using binomial logistic regression analysis adjusting for gender. All variables were analyzed as categorical variables with *p*-values indicating tests for homogeneity, but if estimates showed a consistent change in size over categories (e.g. maternal schooling), categories were given successive values (e.g. 1–4) and the variable tested for trend as continuous. Based on these univariate results a multivariate regression model was created with all risk factors with *p*-values < 0.1 included in the starting model. Insignificant factors were eliminated by backwards elimination until all factors in the final model had reached *p* < 0.05. Results are given in odds ratios. Direct estimations of risk

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