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The prevalence of otitis media in 2–3 year old Cameroonian children estimated by tympanometry

John Njuma Libwea[a,b,d,*], Marie Kobela[b,e], Paul Koki Ndombo[c,e], Ritva K. Syrjänen[d], Heini Huhtala[a], Ninying Fointama[e], Sinata Koulla-Shiro[e,f], Hanna Nohynek[d], J. Pekka Nuorti[a,d], Arto A. Palmu[a,d]

[a] Epidemiology/Health Sciences, Faculty of Social Sciences, University of Tampere, Finland
[b] Expanded Programme on Immunization, Cameroon
[c] Mother & Child Center (MCH), Chantal Biya Foundation, Yaoundé, Cameroon
[d] National Institute for Health and Welfare (THL), Finland
[e] Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Cameroon
[f] Ministry of Public Health, Yaoundé, Cameroon

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ABSTRACT

Background: Acute otitis media is a common illness in children under-five years of age and associated with major health care resources in high-income countries. However, there is paucity of data on its epidemiology and clinical presentation in low-income countries. We estimated the prevalence of otitis media and assessed risk factors among children in Cameroon.

Methods: A community-based cross-sectional prevalence study of otitis media (OM) was performed on randomly selected children aged 2–3 years in Yaoundé, Cameroon from March to June 2013. OM was assessed by clinical inspection for chronic suppurative otitis media (CSOM) and tympanometry for otitis media with effusion (OME). CSOM was defined as draining of the middle ear with duration of more than two weeks and OME was defined as a flat 'type B' tympanogram.

Results: Out of 529 children enrolled in the study, 433 (56% males) subjects with available tympanograms were evaluated. Altogether, 9.7% (42/433) of children met the case definition of CSOM, OME or its complications. This consisted of 3 (0.7%) children identified with unilateral CSOM; 7 (1.6%) children with bilateral OME; 31 (7.2%) with unilateral OME and 1 (0.2%) subject with unilateral dry tympanic membrane perforation.

Logistic regression analyses showed statistically significant association between OM and parental reporting of "current symptoms of upper respiratory tract infections", Prevalence Odds Ratio (POR) = 3.71; 95% CI = 1.69–8.14).

Conclusion: As many as two out of a hundred children between the ages of 2–3 years were affected by significant middle ear disease i.e. CSOM or bilateral OME. These data could be useful as a baseline for estimating the impact of pneumococcal conjugate vaccines (PCV13) introduced in July 2011 for infants in Cameroon.

1. Introduction

Otitis media is reported as one of the most common respiratory illnesses affecting children under five years old worldwide [1–3]. The disease and its complications are diagnosed and treated more actively in developed countries than in resource-poor settings like Cameroon [3]. In most developing countries, acute otitis media goes usually undiagnosed and consequently, affected children are not timely identified to be treated. Otitis media may also occur as chronic otitis media with effusion or chronic suppurative otitis media, and it may remain persistent in early childhood [4]. Prolonged hearing loss and delayed development are potential long-term complications of otitis media. These long-term complications in children may amount to considerable socio-economic costs both to the children, parents and the public health system [5], especially in most communities in Cameroon where 24% of the population lived under the poverty line i.e. < $US2 daily [6].

Thus, access to care is not easy to everybody due to financial constraints. Although drugs are prescribed in the hospitals and available in pharmacies, it is a very common practice to buy antimicrobials over-the-counter at local markets. More so, the doctor-patient ratio is low

* Corresponding author. Faculty of Social Sciences, University of Tampere, FI-33014, Finland.
E-mail addresses: Libwea_j@yahoo.com, john.njuma.libwea@staff.uta.fi (J.N. Libwea).

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and it was reported the country is experiencing a crisis in human health resources with an estimated ratio of 1 clinician and 8 nurses/midwives per 10000 people reported in 2010 [7]. However, there are many health institutions (both public and private) in the country staffed with nurses and general practitioners. A few specialists are available usually in major cities.

Epidemiologic studies on the burden of otitis media in Cameroonian children are lacking. However, the disease incidence is expected to be high considering data from other low-resource settings [8–11].

The 13-valent pneumococcal conjugate vaccine (PCV13) was introduced in Cameroon's Expanded Immunization Programme in July 2011. The primary aim of this study was to measure the prevalence of OM occurring in PCV-unvaccinated children 2–3 years old, as a baseline for estimating the PCV13 impact on OM disease burden and sequelae.

2. Methodology

2.1. Study description

PCV-unvaccinated children aged 2–3 years were enrolled from March to June 2013 in a community-based cross-sectional study to evaluate the prevalence of OM in children. Ethical approval was obtained from the Cameroon National Ethics Committee and from the Institutional Review Board of the Yaoundé Gynaeco-obstetrics and Paediatric Hospital (YGOPH). Further, informed consent was obtained from parents/caretakers in addition to permission from the local administrative authorities.

2.2. Sites selection and inclusion criteria

The study sites were situated within 80 km radius from Yaoundé, Cameroon's capital city. Yaoundé and the surroundings harbour a population of over 3.5 million out of which 18% are children aged from 2 to 3 years, based on 2010 National Population Census. The sites were chosen as they constitute a group of health institutions described as the pneumococcal disease sentinel surveillance sites. These include the Cite Verte Health District (urban) with the Mother & Child Reference Hospital (MCH) and four other health districts. Sites were partitioned into 40 blocks (clusters) using the health map with each cluster hosting at least one health centre/clinic either, public or private. Children were eligible if aged from 24 to 36 months, and residing in the area for at least six months. Enrolment was restricted to those who had not received any doses of pneumococcal conjugate vaccine, as was confirmed from child's vaccination card or registers. The starting household within the cluster was selected after spinning a pen, usually at a central location in the community. Selection of participants was done randomly after every 10th home within a cluster. One participant was selected per home even if two or more were eligible (in such an event, selection was with respect to birth order); and twenty-five children were enrolled per "cluster".

2.3. Study team and participants

Training of the study team members in the practical aspects of the study (recruitment of subjects, questionnaires administration, clinical examination and tympanometry) was done prior to the start of the study by the principal investigator. Two mobile study clinic teams, each with three trained study nurses and a study physician were established to enrol children. Families were informed about the study by community "social mobilisers" (in addition to radio announcements and fliers) a week prior to visiting a specific area and within the actual planned visit days. The study clinics were established at a central location (e.g. chief's or local leader's compound or at a health centre).

2.4. Data collection

In order to enhance compliance of the children, inspection to detect draining ears was done first, followed by tympanometry. Clinical and visual examination involved a thorough inspection of the external ear structure for signs of drainage or cerumen accumulation in the outer third of the ear canal as recommended [12]. Pneumatic otoscopy was performed, but since most subjects had considerable cerumen accumulation and we lacked appropriate equipment to clean-up the wax in the field conditions, the otoscopic data were sparse and not used for this analysis. Tympanometry was performed using the Middle Ear Analyser Grason Stadler tympanometer (GSI-38 Autotymp, Grason-Stadler Inc., Milford, NH, USA). Tympanograms were recorded with a 226 Hz probe tone with a pressure varying from +200 daPa (daPa) to −400 daPa in a time of 7 s. Tympanometry was not performed on draining ears. Tympanometry was followed by parental questionnaire. It consisted of questions on potential risk factors, i.e. demographic characteristics, family socio-economic status, number of children under 18 years living in household, the number of children sleeping in the same bedroom, parental smoking status, source of household cooking, duration of breastfeeding and antibiotic use. In addition, the parents were asked about current symptoms of any respiratory tract infections.

2.5. Interpretation and classification of tympanograms

Tympanograms were independently interpreted by two researchers in retrospect. In an event of discordance in the interpretation, a third researcher interpreted for a final decision. The tympanograms (Table 1) were classified based on a modified version of Liden/Jerger's classification [13]. In this categorisation, flat, 'type B' tympanograms indicated the presence of middle ear fluid (MEF). Tympanograms with curve types A, As, C, or Cs suggested absence of MEF. High external ear canal volume (ECV > 1.0 cm^3) and with a 'flat curve' was interpreted as perforation of the tympanic membrane (TMP) i.e. type P

Table 1
Classification criteria used for reporting tympanograms in this study [13].

Curve Type	Criteria	Clinical Presentation
A	TPP ≥ −100 daPa, SAA ≥ 0.2 cm^3	Normal middle ear pressure (MEP), normal static admittance and no MEF
B	Flat curve; ECV = 0.3 to 1.0; no values for TPP	Consistent with Middle ear pathology (MEF)
C	TPP < −100 daPa, SAA ≥ 0.2 cm^3	Significant negative MEP, normal static admittance, no MEF
As	TPP ≥ −100 daPa, SAA ≤ 0.2 cm^3	Reduced admittance, Normal MEP, no MEF
Cs	TPP < −100 daPa, SAA ≤ 0.2 cm^3	Reduced admittance, decreased MEP, no MEF
F	Erroneous peaks (no distinct curves) or ECV < 0.3 in the absence of a distinct curve	Failed tympanogram, child unstable in process or probe in contact with ear canal or ear wax
P	No Peak (or flat curve); ECV > 1.0	Tympanic Membrane perforated

SAA = Static acoustic admittance; TPP = Tympanometry peak pressure; daPa = deca-pascals; MEF = Middle ear fluid; **ECV** = Ear can volume. The difference between A and As (and C & Cs) at SAA = 0.2cm3 was dependent on the graphical display of the curve. When the curve exceeded the lower limit of the graphic normal box, it was described as A (or C, depending on the TPP); A, As, C, Cs = Healthy ears; B = Diseased ear, F = Failed tympanogram; P = Perforation. Curves type B, P and F all have undetermined acoustic reflexes but could not be distinguished from each other based on the measure of the ear canal volume.