International Journal of Pediatric Otorhinolaryngology 110 (2018) 76–80

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

The prevalence and impact of otitis media with effusion in children admitted for adeno-tonsillectomy at Dr George Mukhari Academic Hospital, Pretoria, South Africa

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A B S T R A C T

Introduction: Otitis media with effusion (OME) is a leading cause of acquired hearing loss in children worldwide. However, previous South African studies have consistently reported the local paediatric OME prevalence to be lower than typically published in international literature. Furthermore, no South African studies have investigated OME in children with adenotonsillar hypertrophy. The objective of this study was to determine the prevalence of OME in children admitted for adeno-tonsillectomy at our institution in Pretoria, South Africa. In addition, the study sought to gauge the impact of OME on quality of life using a validated questionnaire (OM-6).
Methods: A cross-sectional, observational study was conducted between July 2015 and May 2016 at the Otorhinolaryngology outpatient department at DGMAH. he study included 109 consecutively sampled children, aged 2–12 years (mean 6.1; 49.7% female). Pneumatic otoscopy and tympanometry were performed on all participants. Adenoid hypertrophy was quantified using he adenoid-nasopharyngeal ratio (ANR) on a lateral post-nasal space radiograph (Fujioka's method). The OM-6 questionnaire was completed for each participant. Pure tone audiometry was performed for participants diagnosed with OME.
Results: The prevalence of bilateral OME was 11.9%. For unilateral OME, the prevalence was 22.9% and 16.5%, for the left and right ears, respectively ($p > 0.05$). The mean hearing loss (SD) was 19.8 dB (9.4). Clinically significant adenoid hypertrophy (ANR ≥ 0.71) was present in 43% of participants. There was no statistically significant ($p > 0.05$) correlation between the presence OME and adenoid hypertrophy. The mean total OM-6 survey score was 1.67 (SD ± 0.59) in children with OME, and 1.31 (SD ± 0.45) without OME, showing no statistically significant difference ($p > 0.05$). There was a significant ($P < 0.05$) correlation between OME and the presence of atopy.
Conclusion: Adeno-tonsillar pathology may play an aetio-pathological role in the development of OME. However, this may be due to the presence of biofilms rather than obstructive adenoid hypertrophy, given the lack of a significant ($p > 0.05$) correlation between adenoid hypertrophy and OME. Whilst OME was not found to impair quality of life in this population group, the validity of the OM-6 in the South African paediatric population requires further investigation.

1. Introduction

Otitis media with effusion (OME) refers to the accumulation of mucoid or serous fluid, within the middle ear cleft, without features of acute infection. With an estimated prevalence of 20%, it is the most common diagnosis in children after the common cold, and when persistent for ≥12 weeks (chronic OM) is a leading cause of treatable childhood deafness worldwide [1–3].

The pathogenesis of OME is incompletely understood; however, there is evidence to support an association between OME and adenoid hypertrophy, either due to physical obstruction of the *torus tubarius* by an enlarged adenoid pad, or due to the latter harbouring pathogenic biofilms [4,5]. Furthermore, several studies of OME in children with adenoid hypertrophy have shown a significantly higher prevalence than the general population [6,7]. Given this association, adjuvant adenoidectomy is frequently performed along with ventilation tube (VT) insertion in the treatment of chronic OME [1,5]. However, a recent systemic review found no benefit from tonsillectomy without adenoidectomy for the treatment of OME [8].

OME-related hearing loss may result in significant speech and

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https://doi.org/10.1016/j.ijporl.2018.04.030
Received 13 February 2018; Received in revised form 27 April 2018; Accepted 28 April 2018
Available online 03 May 2018

language delay with impaired quality of life in childhood [9,10]. In South Africa, three large community-based screening studies (including approximately 3252 otherwise children) found a relatively low prevalence (3.4–3.8%) of OME [11–13]. A more recent study (2014) found a higher prevalence (16.5%); however, this was performed in a primary health care clinic, and thus selection bias may potentially explain the observed difference in prevalence between these studies [3]. However, none of these studies investigated either population-based risk factors for OME or its impact on hearing loss and quality of life [11–13]. Whilst a number of international studies have focused on adenoid hypertrophy as a risk factor for OME, there are no comparable South African studies [5,14,15].

The present study determined the prevalence of OME in children scheduled for adenoidectomy, with or without tonsillectomy, at the Otorhinolaryngology department of Dr George Mukhari Academic Hospital (DGMAH, Pretoria, South Africa). The impact of OME on quality of life was quantified using the OM-6 (Otitis Media-6) questionnaire; a 6-item questionnaire validated for evaluating the effects of otitis media on the quality of life in children. The questionnaire covered physical (otalgia, hearing loss, and speech impairment) and emotional (distress and activity limitations) domains of the functional health status of children, and the concerns of their caregivers [16].

2. Methods

This cross-sectional, observational study was conducted between July 2015 and May 2016 at the Otorhinolaryngology department of DGMAH. Prior institutional approval was granted for the study (Protocol No: SMUREC/M/123/2015:PG), and informed consent was obtained from the parents or legal guardians of all participants.

The study included consecutively sampled children, aged 2–12 years, with recurrent tonsillitis, obstructive sleep apnoea or chronic tonsillitis, admitted for either adenoidectomy or adenotonsillectomy. Exclusion criteria included: failure to obtain consent, craniofacial abnormalities, Down's syndrome, chronic suppurative otitis media, acute otitis media, and patients scheduled for ventilation tube insertion.

Baseline data included age, gender, socioeconomic indicators (maternal education, household location, income), surgical and medical history. The latter included HIV status, previously diagnosed atopy (specifically allergic rhinitis), and the use of topical nasal steroids. Medical records were perused to identify whether OME was diagnosed preoperatively.

The diagnosis of OME was confirmed using pneumatic otoscopy and tympanometry, and pure tone audiometry was carried out by an audiologist. Tympanometry results were coded according to the Jerger system (Type A, B or C), and a Type B result was interpreted as indicative of a middle ear effusion [17]. A Type C result (indicating negative middle ear pressure) was not considered to be diagnostic of OME, as literature suggests only an intermediate probability of effusion [1]. In cases where patients had a Type B tympanogram but normal (or equivocal) findings on pneumatic otoscopy, the tympanogram was taken a diagnostic of OME [1].

The degree of adenoid hypertrophy was quantified by analysing a lateral radiograph of the post-nasal space to determine the adenoid-nasopharyngeal ratio (ANR) by Fujioka's method, to allow correlation with the presence of OME [14]. An ANR of ≥ 0.71 was interpreted as clinically significant adenoid hypertrophy as described by Egeli et al. [15].

The impact of OME on quality of life was assessed using the OM-6, a 6-item questionnaire validated for evaluating the effects of otitis media on a child's quality of life [16]. The English version of the OM-6 was administered to all primary caregivers of participants in the study (almost exclusively mother or grandmother) to compare scores for children with and without OME. This was done with the assistance of the principle researcher and a Setswana speaking nursing sister.

All statistical analyses were performed using Microsoft Excel 2013.

Table 1
Baseline data for participants.

	Total; n (%)	Age Groups (years)			Gender	
		2–5	6–9	10–12	Male	Female
Study Participants						
Total	109 (100)	54	43	12	57	52
HIV Positive	6 (5.5)	1	3	2	2	4
History of Atopy	60 (55.0)	31	23	6	32	28
Degree of Adenoid Hypertrophy						
ANR ≤ 0.70	62 (57.0)	16	34	12	30	32
ANR ≥ 0.71	47 (43.0)	38	9	0	27	20
Indication for Surgery						
Obstructive Sleep Apnoea (OSA)	20 (18.4)	20	–	–	15	5
Recurrent Tonsillitis	84 (77.1)	31	42	11	37	47
Chronic Tonsillitis	2 (1.8)	2	–	–	2	–
OSA & Recurrent Tonsillitis	3 (2.8)	1	1	1	3	–

Descriptive statistics, including standard measures of central tendency and variance were used to summarise data. Comparisons of children with and without OME were conducted using the Student's t-test, and the Chi square test. A p-value of ≤ 0.05 was regarded as statistically significant.

3. Results

A total of 109 children, aged 2–12 years, were included in this study (Table 1). There were 57 males (52.3%) and 52 females (49.7%); Male to female ratio, 1.1:1. The mean (SD) ages for males and females were 5.54 (2.37), and 6.75 (2.54) years. Children were subdivided into 3 age groups, namely 2–5 years (n = 54; 49.5%), 6–9 years (n = 43; 39.4%), and 10–12 years (n = 12, 11.0%). The overall prevalence of HIV infection and atopy in the study population were 5.5% and 55.0%, respectively. Clinically significant adenoid hypertrophy (ANR ≥ 0.71) was present in 43% of participants, and the highest prevalence of adenoid hypertrophy was found in the 2–5 year age group ($p < 0.05$). The indications for adenotonsillectomy for participants are shown in Table 1.

The overall prevalence of bilateral OME was 11.9% (Table 2). By age and gender, prevalence was found to be highest in the 6–9 year group (16.3%) and in males (14.0%) with a male to female ratio of 1.6:1. However, there was no statistically significant ($p > 0.05$) relationship between OME and either age or gender. The mean hearing loss (SD) was 19.8 dB (9.4). Prevalence for unilateral OME was 22.9% for the left and 16.5% for the right ears, respectively; however, the difference was not significant ($p > 0.05$). Whilst OME was not significantly ($p > 0.05$) correlated with the presence of HIV infection, there was a significant ($p < 0.05$) correlation with the presence of atopy, with a higher chance of a patient having OME when atopic (OR 5.97, $P < 0.05$).

There was no statistically significant ($p > 0.05$) relationship between the presence OME and adenoid hypertrophy (ANR ≥ 0.71). Similarly, the difference in mean ANR between patients, with and without OME, was not statistically significant ($p > 0.05$). However, there was a significant ($p < 0.05$) correlation between the mean ANR and the type of tympanogram (A, B or C), as well as a higher chance of having an abnormal tympanogram (either Type B or C) in patients with an ANR ≥ 0.71 (OR 3.98, $p < 0.05$).

Table 3 shows the results of the OM-6 survey. Out of a maximum possible score of 7, the mean total OM-6 survey score was 1.67 (SD ± 0.59) in children with OME, and 1.31 (SD ± 0.45) in those without OME, showing no significant difference ($p > 0.05$). When scores for each of the six domains were compared in children with and without OME, the difference in scores for the domains of “emotional distress,” and “caregiver concerns,” was statistically significant