

Prevalence and Risk Factors of Otitis Media with Effusion in Patients with Adenoid Hypertrophy at Kigali University Teaching Hospital – A Cross-Sectional Study

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ABSTRACT

BACKGROUND: Otitis media with effusion (OME) is a middle ear effusion without signs and symptoms of middle ear infections. It is mainly due to Eustachian tube dysfunction or sequelae of acute otitis media. There are different risks predisposing to OME (otitis media with effusion), among them adenoid hypertrophy.

METHODS: This study was conducted at a tertiary hospital in Kigali, Rwanda. Children (1 to 12 years of age) with symptoms and signs of adenoid hypertrophy were included in the study. Questions about risk factors of OME were asked, then a physical examination with pneumatic otoscopy and fiberoptic nasopharyngoscopy were done as investigation tympanometry was performed to confirm the presence of OME.

RESULTS: 152 children met the inclusion criteria. The prevalence of otitis media with effusion was 46%. The age group 1-4 years was highly associated with OME ($p=0.024$). Low Socioeconomic Status (Ubudehe category 2 and 3) were also associated with OME ($p<0.05$), accounting for 75% of patients. Attending daycare centers, parents with OME, previous acute otitis media (AOM), smoking at home, bottle feeding and feeding while supine were not shown to be risk factors.

CONCLUSION: Otitis media with effusion is highly prevalent in children with adenoid hypertrophy. Proper examination is mandatory to prevent possible sequels from unnoticed OME.

Keywords: Adenoid Hypertrophy, Otitis Media With Effusion, Risk Factors

INTRODUCTION

Adenotonsillar hypertrophy is a common disorder in pediatric patients. Studies have shown that children with adenoid hypertrophy (AH) are more likely to have Chronic Otitis Media with Effusion (COME). However, not every child with AH has COME [1]. Otitis media with effusion is defined as the persistence of serous or middle ear effusion

for 3 months or more. In many cases, the only symptom of OME is fluctuating hearing status. Up to 60 % of children with OME may present with hearing loss [2–4]. There are two theories about the pathogenesis of OME, namely, i. Eustachian tube dysfunction and ii. the sequelae of acute otitis media (AOM) [5].

Known risk factors for OME include bottle feeding, feeding while supine, having a sibling with AOM,

***Corresponding author:** Dr Umutoni Josiane, Email: umujo125@gmail.com; **Potential Conflicts of Interest (Col):** All authors: no potential conflicts of interest disclosed; **Funding:** All authors: no funding was disclosed; **Academic Integrity:** All authors confirm that they have made substantial academic contributions to this manuscript as defined by the ICMJE; **Ethics of human subject participation:** The study was approved by the local Institutional Review Board. Informed consent was sought and gained where applicable; **Originality:** All authors: this manuscript is original has not been published elsewhere; **Review:** This manuscript was peer-reviewed by three reviewers in a double-blind review process; **Type-editor:** Cartledge (UK).

Received: 19th April 2020; **Initial decision given:** 24th July 2020; **Revised manuscript received:** 06th December 2020; **Accepted:** 28th February 2021.

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Citation for this article: J. Umutoni; R. Mugabo. Prevalence and Risk Factors of Otitis Media with Effusion in Patients with Adenoid Hypertrophy at Kigali University Teaching Hospital – A Cross-Sectional Study. Rwanda Medical Journal, Vol. 78, no. 2, pp. 22-28, 2021.

attending daycare, having allergies to common environmental entities, lower socioeconomic status, living in a home in which people smoke tobacco, parental history of OME, previous acute otitis media (AOM), male sex, and autumn season [6,7]. The presence of OME is dependent on age less than 8 years, family size of more than 4 years, mother education less than secondary school [8].

The tonsils are lymphoepithelial tissues located at the entrance of the upper aerodigestive tract. They consist of nasopharyngeal (adenoids), palatine, lingual, tubal tonsils, and together they form the Waldeyer's ring. For diagnosis, a good history which includes a history of open-mouth breathing, snoring and sleep apnea. Excessive daytime sleepiness, aggressive behavior, attention deficit, and enuresis are also features of adenotonsillar hypertrophy. Adenoid hypertrophy can be graded into 4 grades by using fiber endoscopic findings, grade 3 and 4 are considered hypertrophy [8,9].

Studies done in other countries showed that in Iraq, a prevalence of 37% of OME, mean age was 6.5 years, and OME was more common in 5-6 years of age. Studies in Nigeria and Kenya demonstrated that the prevalence of OME among children with adenoid hypertrophy was estimated at 56% and 67%, respectively [1,6,10].

OME can be suspected clinically and later on, it will be confirmed by tympanometry. A type B tympanogram with a flat curve and normal canal volume is considered diagnostic of OME. Orji showed in his study that Simple otoscopy produced 84.4% agreement with tympanometry in detecting OME [11]. The otoscopic findings in OME are mainly different combinations of retraction of the pars tensa and wide variations in the color of the tympanic membrane [12].

Currently, in Rwanda, there are no published articles on the risk factors of OME in general or among patients with adenotonsillar hypertrophy. Our aim was to determine the prevalence and risk factors of otitis media with effusion in children with adenotonsillar hypertrophy. Specifically, we determined the socio-demographic distribution of patients, the clinical presentation of adenoid hypertrophy, the tympanometric findings in patients with adenoid hypertrophy, risk factors of OME in patients with adenoid hypertrophy and the accuracy of pneumatic otoscopy compared

to tympanometry in the diagnosis of otitis media with effusion.

METHODS

Study design: This is a cross-sectional study.

Study setting and location: This study was conducted at a tertiary hospital (Kigali university teaching hospital) located in Rwanda's capital. It was conducted in the Ear, Nose and Throat (ENT) department, specifically in the Outpatient department (OPD).

Participants/subjects: Participants were all patients from 1 to 12 years of age who consulted with symptoms and signs of adenotonsillar hypertrophy.

Inclusion criteria: Children aged 1-12 years. Parent or guardian who consented to the study, Patients who were cooperative during the examination process

Exclusion criteria: Patients with chronic suppurative otitis media, Patients who have had previous adenoid surgery, Patients with upper respiratory tract infection

Enrolment of participants: During the consultation, when the consulting doctor identified parents or guardians complaining of children with open mouth breathing, snoring, sleep apnea or other symptoms related to adenotonsillar hypertrophy, the consulting doctor discussed the study and gained consent for participation.

Study questionnaire: The consulting doctor filled a questionnaire composed of less common symptoms and signs of adenotonsillar hypertrophy, such as drooling and diaphoresis during the night. Secondly, the doctor asked about other risk factors associated with the development of acute otitis media with effusion, such as sibling with OME, attending daycare center. Finally, the consulting doctor completed the history with physical examination and performed the flexible nasopharyngoscopy to grade adenoids, then otoscopy to exclude/confirm an OME, and tympanometry as an investigation to exclude/confirm OME. The physical examination results were recorded on the questionnaire.

After the parents or guardians consented to the study, the consulting doctor filled a questionnaire about the socio-demographic history of the patient, history of the disease, finding on physical examination and investigations.

The primary outcome: Otitis media with effusion.

The outcome was measured by Tympanometry.

Secondary outcomes: Other risks factors other than adenoid hypertrophy with OME.

Independent variables: Age, sex, province of origin, the clinical presentation of adenoids hypertrophy, grade of adenoids, type of tympanogram, risk factors of otitis media with effusion (bottle feeding, feeding while supine, having a sibling with otitis media with effusion, attending daycare, having allergies to common environmental entities, frequent nasal obstruction, rhinorrhea, sneezing, having a lower socioeconomic status, living in a home in which people smoke, previous acute otitis media, a parent with a history of OME, overcrowded homes: more than 2 people in one room according to WHO.

Sample size (power calculation): Sample size calculation has been performed using Kelsey formula (<http://www.openepi.com/SampleSize/SSPropor.htm>) using:

$$n = deff \times (Np\hat{q}) / (d^2 / [1.96]^2 (N-1) + p\hat{q})$$

Where: n=sample size; deff=design effect=1; N=population size; $p\hat{}$ =the estimated proportion; $q\hat{}$ = 1- $p\hat{}$

p=desired absolute precision or absolute level of precision = 5%

Our preliminary data was obtained from the registry of outpatient clinic ENT/CHUK for eight months. It was found that the average of 24 children among 131 who consulted each month have adenoid hypertrophy. This gave us an anticipated annual population of 288 children under 12 years of age with adenoid hypertrophy (N).

Regarding the prevalence of OME in children less than 12 years, studies from African countries like Nigeria and Kenya show a prevalence of around 50% [6,10]. This has been used as the estimated proportion ($p\hat{}$). A 95% CI required sample size (n) of 165 subjects

Data collection tools and data collection: Data was collected using a questionnaire where socio-demographic descriptions of the patient were recorded, presenting symptoms, associated risk factors and finding on physical examination and investigation were as well recorded. Data was collected by different consulting doctors in CHUK/ENT during OPDs.

Data Management and Statistical analysis: Data was entered into the computer by epidata and

analysed using SPSS version 20 software. Variables were presented in frequencies. Odds ratio (OR) with 95% confidence interval were calculated for the risk of the patient to have otitis media with effusion. A p-value ≤ 0.05 was considered statically significant.

Ethical consideration: Risk to subjects (including safeguards to mitigate these risks): There were no risks to the subject. The investigations used were with no risks.

The collected data were kept in a locked cupboard where the principal investigator was the only one keeping the key. The consent was in English and Kinyarwanda. The parents were given time to read it and consent for it after receiving the desired explanation. No incentives for subjects were offered or given.

Institutional review board (IRB): The research protocol was reviewed and approved (Ref: No 338/CMHS IRB/ 2018 on 10/10/2018.

Reporting of this study has been verified per the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist [13,14].

RESULTS

Socio-demographic description: According to the Socio-demographic characteristics, 68% of participants were males and 32% female. 75 % were less than 4 years old and only 1% older than 8 years. 63% of consulting children belong to the third category of Ubudehe, which is the category of the well-doing families. Kigali City had the majority of the study participants, 70%.

Clinical presentation of the patient with adenoid hypertrophy: According to the clinical presentation of patients with adenoid hypertrophy, 97% of participants had snoring, 94% had sleep apnea, enuresis was present 26%, diaphoresis 41%, drooling 44%, nighttime mouth breathing 88%, daytime somnolence 14%. Morning headache, dry mouth, halitosis, hyponasal speech, daytime open mouth breathing and poor weight gain were present at 3%, 30%, 46%, 53%, 82% and 22%, respectively (Table 2).

Prevalence of otitis media with effusion: The prevalence of otitis media with effusion was estimated at 46% according to the tympanometry measurement in general. Specifically,

Table 1: Socio-demographic characteristics of participants

Characteristics	Frequency	Percentage
Gender		
Female	48	31.6
Male	104	68.4
Age group		
≤ 4 YO	114	75
4-8 YO	36	23.7
≥ 8 Y	2	1.3
Ubudehe Category		
Category 1	14	9.2
Category 2	42	27.6
Category 3	96	63.2
Province of Origin		
Kigali City	106	69.7
Eastern province	20	13.2
Southern Province	9	5.9
Western province	5	3.3
Northern Province	12	7.9

tympanometric measurement on the right ear showed 49% type A, 39% type B and 12 % type C. On the other hand, the left ear showed 49% type A, 41% type B and 9% type C.

Table 2: clinical presentation of patients with adenoid hypertrophy

Characteristics	Frequency	%
Snoring	147	96.7
Sleep apnea	143	94.1
Enuresis	40	26.3
Diaphoresis	63	41.4
Drooling	67	44.1
Nighttime mouth breathing	134	88.2
Daytime somnolence	21	13.8
Morning headache	5	3.3
Dry mouth	46	30.3
Halitosis	70	46.1
Hyponasal speech	81	53.3
Day open mouth breathing	126	82.8
Poor weight gain	34	22.4

Risks factors for otitis media with effusion: In bivariate analysis, age group, province of origin, Ubudehe category, history of a sibling with Otitis media and overcrowded at home were showed to be associated with otitis media with effusion.

Multivariate analysis: characteristics associated with otitis media with effusion were: age group with Comparably to Ubudehe category 1, Ubudehe category 2 OR: 45.391, [95% CI (1.444-36.539), P-value=0.003] and Ubudehe category 3 with OR: 29.378, [95% CI (1.444-36.539), P-value=0.008] and history of sibling with Otitis media OR: 14.073, [95% CI (2.392-82.817), P-value=0.003]. effusion. However, patients with two characteristics were protected against otitis media with effusion: these are a group of the age of 4-8 years old comparably to patients below 4 years old with OR: 0.273, [95% CI (0.088-0.846), P-value=0.024], and being overcrowded at home with OR: 0.093, [95% CI (0.025-0.397), P-value=0.001].

DISCUSSION

To our knowledge, this is the first study that has explored the prevalence and risk factors of otitis media with effusion in patients with adenoid hypertrophy in Rwanda. We found that the prevalence of OME in this population is 46%. Compared to other African countries like Nigeria and Kenya, which had 55% and 67% respectively, the results are similar. According to risk factors being among the young age (1-4 years) was the main risk factor for OME; it is again similar to other studies done (2). This study was conducted at CHUK, located in Kigali, Rwanda's capital; expectantly, most children were coming from this region. The most presenting symptoms for children with adenoid hypertrophy were snoring, sleep apnea and daytime open mouth breathing. Currently, we are facing, especially in developing country a high prevalence of ear infections which result in hearing loss with poor quality of life (reference) [15]. If it is overlooked, OME can result in permanent damage to the tympanic membrane or expose the ear to repetitive infection with subsequent hearing loss. Again, children with OME have learning difficulties due to hearing loss. This high prevalence of OME should alert primary care doctors to perform a thorough ear examination in children presenting with adenoid hypertrophy and reduce the high prevalence of hearing loss

Table 3: Risk factors for otitis media with effusion (bivariate analysis)

	frequency	Patients with OME(%)	Bivariate analysis		P
			OR	95% CI	
Sex of participants					
female	48	22 (45.8)	R		
male	104	48 (46.2)	1.013	(0.510-2.012)	0.971
Age group					
Under 4 years old	114	59(51.0)	R		
4-8 years old	36	11(30.6)	0.41	(0.185-0.992)	0.029
Over 8 years old	2	0	-	-	
Province of origin					
East	20	5(25)	R		
Kigali	106	47(44.3)	2.39	(0.810-7.053)	0.115
North	12	8(88.7)	6	(1.248-28.84)	0.025
South	9	7(77.8)	10.5	(1.620-68.072)	0.014
West	5	3(60)	4.5	(0.576-35.153)	0.152
Ubudehe category					
Category 1	14	2(14.3)	R		
Category 2	42	23(54.8)	7.263	(1.444-36.539)	0.016
Category 3	96	45(46.9)	5.294	(1.124-24.935)	0.035
Attending daycare	85	41(48.2)	1		
Sibling with OME	13	9(62.1)	0.311	(0.090-1.077)	0.065
Parents with OME	1	0	-	-	
Previous AOM	32	15(46.9)	0.995	(0.454-2.177)	0.989
smoking at home	9	6(66.7)	2.469	(0.594-10.260)	0.214
overcrowded at home	132	54(40.9)	0.13	(0.036-0.467)	0.002
feeding during spine	4	3(75.0)	5.538	(0.522-58.756)	0.155

R-reference group

in low-income countries. Young children (1- 4 years) were highly associated with OME at 51%. This is physiologically explainable at this age. The Eustachian tube is not completely well developed to equalize the middle ear pressure adequately. Our results are comparable to other studies where the peak incidence of OME was among the group age of (2- 5 years). This met our expectations; as we stated above, physiologically, young children are prone to have OME. This emphasizes again the need to detect OME in this group age.

Other risk factors associated with OME, as stated in the literature, like having a parent with OME, having a previous episode of AOM, smoking at home, bottle feeding and feeding while supine was not associated with OME. This can be due to the small size of the sample. However, we found

that children coming from Northern Province and Southern Province were having a high prevalence of OME, 88 % and 77%, respectively. This can be due to the delay in consultation as they are coming from a remote area.

Our study was limited because it was carried out on only one health facility, which is not representative of the hall country.

CONCLUSION

Otitis media with effusion is highly prevalent in children with adenoid hypertrophy. Clinical examination can be reliable to exclude otitis media with effusion. Hence OME can be diagnosed in even remote areas where there is no equipment to do

Table 4: Risk factors for otitis media with effusion (Multivariate analysis)

	Frequency	Patients with OME (%)	Multivariate analysis		P
			OR	(95%CI)	
Sex of participants					
Female	48	22(45.8)	R		
Male	104	48(46.2)	0.599	(0.248-1.444)	0.253
Age group					
Under 4 years old	114	59(51.0)	R		
4-8 years old	36	11(30.6)	0.273	(0.088-0.846)	0.024
Over 8 years old	2	0			
Ubudehe Category					
Category 1	14	2(14.3)	R		
Category 2	42	23(54.8)	45.391	(1.444-36.539)	0.003
Category 3	96	45(46.9)	29.378	(2.381-362.481)	0.008
Sibling with OME	13	9(62.1)	14.073	(2.392-82.817)	0.003
Overcrowded at home	132	54(40.9)	0.099	(0.025-0.397)	0.001

R-reference group

tympanometry for confirmation. Adenoidectomy with ventilation tube insertion is the proper management of those patients. Adenoidectomy can be with bleeding and risk of general anesthesia [16]. But the benefit of this procedure outweighs its risks.

RECOMMENDATIONS

To ENT specialist and medical officers: All patients presenting with features of adenoid hypertrophy

should be evaluated for otitis media with effusion. Otoscopy examination is mandatory; if there is any doubt, the patient has to be sent for tympanometry for confirmation. Otitis media with effusion is an easily treatable disease but left untreated, it can cause permanent damage to the tympanic membrane.

To the ministry of health: Awareness should be created in the general population about the risk factors for otitis media with effusion.

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