



OTITIS MEDIA WITH EFFUSION AND ITS ASSOCIATED FACTORS AMONG PATIENTS WITH CEREBRAL PALSY: A MULTI-CENTER STUDY

ENT

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ABSTRACT

Children with cerebral palsy (CP) are more prone to Otitis media with effusion (OME). We set out to determine the prevalence and factors associated with OME among patients with CP aged 2 to 18 years of age at two tertiary hospitals. A cross-sectional study design was used. Diagnosis of OME was made on presence of a type B tympanogram. Of the 151 patients with CP recruited the median age was 3 years (IQR 2.5-6.9). Majority were males (64.2%), had non-ambulatory CP (78.8%) and had breastfed for over 6 months (74.8%). Allergic rhinitis and nasal regurgitation of feeds were reported in 40.4% and 69.5% respectively. The prevalence of OME was 43.7%. Children who were breastfed for over 6 months (p value = 0.025) were less likely to have OME while presence of allergic rhinitis (p value = 0.016) and nasal regurgitation of feeds (p value = 0.035) increased the odds of presence of OME. The prevalence of OME among patients with CP is high (43.7%). Children with CP should breastfeed for more than 6 months to protect them against OME while timely management of nasal regurgitation of feeds and allergic rhinitis may minimize the risk of OME in these patients.

KEYWORDS

Otitis media with effusion, (OME), cerebral palsy, associated factors

INTRODUCTION

Otitis media with effusion (OME) refers to the presence of fluid within the middle ear cavity (1, 2) and affects 90% of children globally before school age (3). In Africa the overall prevalence of OME has been reported to be 6% while in Uganda it varies from 11 to 14% (4-6). Hearing loss due to OME can result in delayed speech and language development (7).

Cerebral palsy is a collective term encompassing a group of permanent neurodevelopmental disorders characterized by motor dysfunction arising from injury to the developing brain in the perinatal period (8-14). It is the commonest motor disability with a prevalence of 2-2.5/1000 live births globally and 2.9/1000 live births in Uganda (8, 15). Children with CP are more prone to conductive hearing loss arising from eustachian tube dysfunction (ETD) leading to subsequent development of OME. (13, 16). The prevalence of OME in children with CP reported is 78.6% in Nigeria, 52% in Egypt and 16.2% in India. (10, 11, 13).

Feeding and swallowing disorders are reported to increase odds of OME in patients with CP (17). Regurgitation of feeds into the eustachian tube causes inflammation of the tube in these patients hence subsequent OME (18). Swallowing disorders as a result of neurological impairment of the pharyngeal musculature also causes impaired opening and ventilation of the middle ear by the eustachian tube resulting into retention of fluid within the middle ear (17). Non-ambulatory CP is associated with a higher risk of OME (16, 19). Other associated factors of OME in CP are young age, male sex, attending day care, passive smoking and upper respiratory tract infections (7).

Early assessment for OME in children with CP enables early identification of children at risk of hearing loss, timely interventions are instituted leading to an improved quality of life among these children. This study therefore set out to determine the prevalence of OME among children with CP using tympanometry and also assess for factors associated with OME in these children.

Literature Review

Akpalaba et al in Nigeria conducted a case control study on 112 participants with CP between 1 to 18 years of age. The focus of the study was to establish patterns of middle ear pathology by use of

tympanometry. Otitis media with effusion was reported in 78.6% of children with CP (10).

El Behairy et al in Egypt conducted a descriptive cross-sectional study of 30 children with CP ages 2 months to 8 years. All patients had tympanometry and OME was reported in 52% of cases (11).

In India two studies were conducted to determine the prevalence of OME among children with CP. Ansari et al conducted a retrospective study among 117 children with CP between 2 years and 12 years. A total of 16.2% had OME (13). Ohal et al conducted a cross-sectional study among 67 children with CP between 6 months to 16 years and reported OME in 6% cases for the right ear and 4.5% cases for the left ear (20).

METHODS AND MATERIALS

A cross-sectional study was conducted at the outpatient physiotherapy and occupational therapy clinics at 2 public tertiary hospitals in Uganda; Mulago and Kawempe National Referral Hospitals (NRHs). These clinics provide occupational therapy and physiotherapy services to patients with neurological disorders like cerebral palsy, Erb's palsy, muscular dystrophy, Down's syndrome and stroke.

Our study population included all patients with a diagnosis of cerebral palsy aged 2 to 18 years attending the above mentioned clinics from November 2021 to January 2022. We excluded patients with outer ear anomalies, craniofacial anomalies, Down's syndrome, cleft palate, history of ear surgery, very sick patients, upper respiratory tract infections, ear discharge with tympanic membrane perforations.

Consecutive sampling was used to recruit study participants. Sociodemographic and clinical characteristics of participants were collected using a semi-structured questionnaire. Otoscopy using a Welch Allyn otoscope was performed to exclude foreign bodies and active ear infections and findings recorded.

Tympanometry was performed using calibrated Inventis tympanometer at Kawempe NRH and Grason-Stadler tympanometers at Mulago NRH. An appropriate sized ear probe was placed into the ear canal that created an airtight seal at 226Hz. The test assesses middle ear compliance and pressure and results were recorded for each ear.

Patients with normal tympanometry (type A) results, a written record of the result was provided, results explained to the parent and discharged from the study. Those with abnormal tympanometry (type B and type C) were referred to the ENT clinic for further assessment and management. Probes were disinfected using 80% alcohol between participants to avoid cross-infections.

Data Management and Statistical Analysis

We entered the data into Epi-data version 4.6 and exported into STATA version V16.0 for statistical analysis. Continuous variables were summarized into means and standard deviations and categorical variables were summarized into frequencies and presented in tables.

Modified Poisson regression analysis was used to predict crude prevalence ratios (cPR). All variables that had p values < 0.2 in the bivariate model were considered for multivariate analysis using the backward stepwise method to generate adjusted prevalence ratios (aPR), their 95% confidence intervals and p values. Variables with a p value < 0.05 were considered statistically significant.

Ethical Considerations

This study was approved by the Makerere University of School of Medicine Research and Ethics Committee approval number 2021-180. All study participants were given unique identification numbers and all data collected was protected by the PI to protect participant confidentiality.

RESULTS

A total of 151 participants with cerebral palsy between 2 to 18 years of age were recruited from Mulago and Kawempe NRHs. Majority of study participants were between 2 to 5 years at 66% (100/151) with a median age of 3.9 (IQR 2.5-6.9). Majority of participants were males at 64.2% (97/151) and non-ambulatory CP accounted for 78.8% (119/151). Majority of study participants had breastfed for more than 6 months at 74.8% (113/151). History of passive smoking was present in 15.2% (23/151) while indoor charcoal stove smoke exposure was reported in 40.4% (61/151). Allergic rhinitis was present in 40.4% (61/151) while nasal regurgitation of feeds was found in 69.5% (105/151) of study participants.

Table 1: Demographics of 151 participants with cerebral palsy

Variable	Frequency n=151)	Percentage
Age in years, median (IQR)	3.9 (2.5-6.9)	
Age		
2-5 years	100	66.2
>5-10 years	37	24.5
>10-18 years	14	9.3
Sex		
Male	97	64.2
Female	54	35.8
Type of CP		
Ambulatory	32	21.2
Non-ambulatory	119	78.8
Was the child breast-fed		
<6 months	24	15.9
>6 months	113	74.8
No	14	9.3
Passive smoking		
Yes	23	15.2
No	128	84.8
Indoor charcoal stove smoke		
Yes	61	40.4
No	90	59.6
Allergic Rhinitis		
Yes	61	40.4
No	90	59.6
Nasal regurgitation of feeds		
Yes	105	69.5
No	46	30.5

Table 2: Tympanometry findings of the study participants

Tympanometry	Right ear, n(%)	Left ear, n(%)	Diagnosis
A	94 (62.3)	102 (67.5)	Normal
B	53 (35.1)	46 (30.5)	OME
C	4 (2.6)	3 (2.0)	ETD

As shown in the table 2 above, the commonest tympanometry pattern was a type A tympanogram with 62.3% and 67.5% in the right and left ears respectively. A type B tympanogram which is also diagnostic of OME was found in 35.1% and 30.5% of right and left ears respectively. A type C tympanogram was the least detected pattern in 2.6% and 2.0% of right and left ear respectively.

Prevalence of otitis media with effusion among study participants.

Of the 151 participants, 66 patients had otitis media with effusion in at least one ear. The prevalence of OME was 43.7%. Bilateral OME was present in 36 ears (11.9%). Unilateral OME was present in 17 ears (5.6%) on the right side and 13 ears (4.3%) on the left side.

Prevalence of OME among children with cerebral palsy

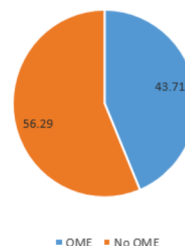


Figure 1: Prevalence of OME among patients with cerebral palsy

Factors Associated with Otitis Media with Effusion

As shown in table 3 below, after bivariate and multivariate regression analysis and adjusting for confounders, patients who were breastfed for more than 6 months (p value = 0.025, aPR = 0.62) were less likely to have OME while presence of allergic rhinitis (p value = 0.016), aPR = 1.54) and nasal regurgitation of feeds (p value = 0.035, aPR = 1.69) increased the odds of a child having OME.

Table 3: Factors associated with Otitis Media with effusion

Variable	No OME (n=85)	OME (n=66)	cPR (95% CI)	P-value	aPR (95%CI)	P -value
Age in years, mean (SD)	5.04 (3.45)	5.30 (3.90)	1.01 (0.96-1.06)	0.657		
Age						
2-5 years	56 (65.9)	44 (66.7)	Ref			
>5-10 years	21 (24.7)	16 (24.2)	0.98 (0.64-1.51)	0.937		
>10-18 years	8 (9.4)	6 (9.1)	0.97 (0.51-1.86)	0.936		
Sex						
Male	56 (65.9)	41 (62.1)	Ref			
Female	29 (34.1)	25 (37.9)	1.10 (0.76-1.59)	0.63		
Type of CP						
Ambulatory	18 (21.2)	14 (21.2)	Ref			
Non-ambulatory	67 (78.8)	52 (78.8)	0.99 (0.64-1.56)	0.996		
Was the child breast-fed						
No	5 (5.9)	9 (13.6)	Ref		Ref	
<6 months	11 (12.9)	13 (19.7)	0.84 (0.49-1.44)	0.533	0.81 (0.49-1.32)	0.399
>6 months	69 (81.2)	44 (66.7)	0.61 (0.38-0.95)	0.031	0.62 (0.41-0.94)	0.025
Passive smoking						
No	12 (14.1)	11 (16.7)	Ref			

Yes	73 (85.9)	55 (83.3)	1.11 (0.69- 1.79)	0.65 7		
Indoor charcoal stove smoke						
No	31 (36.5)	30 (45.5)	Ref			
Yes	54 (63.5)	36 (54.6)	1.23 (0.86- 1.76)	0.26 1		
Allergic Rhinitis						
No	27 (31.8)	34 (51.5)	Ref		Ref	
Yes	58 (68.2)	32 (48.5)	1.57 (1.10- 2.24)	0.01 4	1.54 (1.08- 2.19)	0.016
Nasal regurgitation of feeds						
No	52 (61.2)	53 (80.3)	Ref		Ref	
Yes	33 (38.8)	13 (19.7)	1.79 (1.08- 2.94)	0.02 3	1.69 (1.04- 2.76)	0.035

DISCUSSION

Children with CP have a multitude of neurological and motor deficits depending on the severity of CP. OME is a common condition in children as they have a shorter and more horizontal eustachian tube compared to adults(7). Timely identification of OME is crucial as OME may cause hearing loss in children and if undetected may cause speech and language delays in these children (7).

The prevalence of OME in children with CP is high. For our study, we report a prevalence of 43.7%. Similarly high prevalences are reported in by El Behairy in Egypt at 52% (11) and a much higher prevalence of 68.8% reported by Akpalaba in Nigeria (10). These prevalences are all much higher than the prevalence of OME in children without CP of 14.1% reported by Bisso in Uganda (5) and 11% reported by Bamaraki (6). These higher prevalences of OME in children with CP are due to eustachian tube dysfunction in children with CP (13, 16).

Contrary to most studies reporting a higher prevalence of OME in children with CP, in India, Ansari et al reported a much lower prevalence of OME of 16.2% among children aged 2 to 12 years with CP (13) and Ohal et al reported a prevalence of OME of 6% in the right ear and 4.5% in the left ear among patients aged 6 months to 16 years (20).

In our study, the age group most affected by OME were children between 2 to 5 years with a decrease in prevalence as children got older. These findings have similarly been reported by studies in Uganda, Denmark and Rwanda (6, 21, 22). This might be explained by anatomical differences in the eustachian tube in this age group as compared to older children. The eustachian in children is shorter and more horizontal which increases the risk of fluid retention in the middle ear (7).

Swallowing disorders were associated with increased odds of OME in our study. This has been similarly reported by Rawool et al in India where 54.5% of children with swallowing disorders had OME compared to 28.8% in normal children (17). Mehmet et al in Turkey also reported an association between laryngopharyngeal reflux and OME among 31 children (23) and Luo et al in China reporting an association between regurgitation of gastric contents into the nasopharynx and OME (24). Impaired swallowing and regurgitation of feeds into the nasopharynx in patients with CP causes inflammation of the eustachian tube resulting in inadequate drainage of the middle ear hence increase risk of OME (24, 25).

Presence of allergic rhinitis was also associated with increased odds of OME in our study. Several studies have reported an increased risk of OME in children with allergic rhinitis as compared to children without allergic rhinitis. For example Ayotunde et al in Nigeria reported a prevalence of OME of 54.6% in children with allergic rhinitis compared to a prevalence of 4.6% in children without OME (26).

Kwon et al in Korea also reported that 33.8% of children with allergic rhinitis had OME (27). The higher prevalence of OME among children with OME is as a result of inflammation by allergens causes swelling and defective muco-ciliary clearance by the eustachian tube resulting into OME (27, 28).

Breastfeeding for greater than 6 months was protective against OME in children with CP in our study. Various studies in literature have reported a possible protective role of longer period of breastfeeding against OME. For example Garcia et al reported that children that are breastfed for the first 6 months had a low risk of OME compared to those that are bottle-fed or mixed fed (29). Similarly, in Australia, Brennan et al in reported a lower risk of OME in children breastfed for more than 6 months compared to those breastfed for less than 6 months. (30). This protective function is due to the mechanical pressure generated during breastfeeding that helps to open the eustachian tube and drain the middle ear hence less risk of OME (30-33)

Surprisingly, although household smoke from indoor charcoal stove(34, 35), passive smoking (36, 37), age (38, 39), sex (21, 40) and type of CP (10) (19) have been reported to be associated with OME, this was not the case for our study.

CONCLUSIONS

The prevalence of OME among patients with CP is high. Nasal regurgitation of feeds and allergic rhinitis were associated with increased odds of OME in children with CP while breastfeeding for greater than 6 months was protective against OME in children with CP.

Recommendations

Children with CP should routinely be managed by a multidisciplinary team including audiologists, ENT surgeons, speech and language therapists among others. Audiologists for example would help with tympanometric assessments and hearing assessment as required.

Tympanometry should be included in the routine care of patients with CP to ensure early diagnosis and management of OME thus preventing hearing impairment in the long run hence improving their overall quality of life.

The Ministry of Health should put in place infrastructure and human resources that include ENT surgeons, audiologists in regional referral hospitals to diagnose and manage OME in patients with CP.

All patients with CP should have speech therapy included into their management protocols to help diagnose and manage swallowing disorders among patients with CP. In addition to the above, health workers attending to patients with CP should prescribe anti-reflux therapy to reduce the incidence of reflux of gastric contents into the nasopharynx. This would assist in prevention of OME in these children.

Allergic rhinitis in children with CP should be promptly treated to reduce their chances developing OME.

Mothers to children with CP that are able to breastfeed should be encouraged to continue breastfeeding beyond 6 months as this was the only protective factor from developing OME in children with CP in our study.

Conflict of Interest

No conflict of interest exists for any of the authors.

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