

Middle Ear Effusion in Preschool Children in Dar-es-Salaam, Tanzania

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Abstract

Background: Otitis media with effusion is a common disorder in children, which may either resolve spontaneously or cause undesirable complications especially if associated with persistent hearing loss.

Otitis media with effusion contributes to hearing loss, poor speech acquisition and learning difficulties. There has not been any retrievable study done to show the magnitude of otitis media with effusion and its complication in our country.

Aim: This study aimed at determining the prevalence of otitis media with effusion among preschool children in Kinondoni District, Dar es Salaam.

Materials and Methods: This study was conducted in Kinondoni District, Dar es Salaam in Tanzania among 541 preschool children aged 2 to 6 years. Random sampling method was used. Otoscopic examination was done by the principal investigator using pneumatic otoscope. Diagnosis of otitis media with effusion was reached by findings of the ear drum with exclusion of features of acute otitis media. Tympanometry was conducted by research assistant and type B curve was regarded as diagnostic for otitis media with effusion.

EPI-INFO version 6.04d computer program was used to analyze the data and relationships were tested at 5% tolerable error.

Results: Out of 541 preschool children screened, 24% had otitis media with effusion in one or both ears. Fifteen percent had bilateral otitis media with effusion while 4.8% had right and 4.3% had left otitis media with effusion respectively. Of the screened female children, 26.5% had otitis media with effusion which was slightly higher than males (21.7%). The prevalence of otitis media with effusion was higher (24.5%) among children aged 5 to 6 years as compared to prevalence of 22.5% among children aged 2-4 years.

Both pneumatic otoscopy and tympanometry detected otitis media with effusion in 17.8% of children aged 2 to 4 years while 14.3% of children aged 5 to 6 years were detected by pneumatic otoscopy and 14.1% were detected by tympanometry.

The pneumatic otoscopy was found to be as good as tympanometry in diagnosing otitis media with effusion and its sensitivity was found to be 97.7% and specificity was 99.5%.

Conclusion: The overall prevalence of otitis media with effusion among preschool children in Kinondoni District in Dar es Salaam was noted to be high. The prevalence was higher among children aged 5 to 6 years and in females. Pneumatic otoscopy was as good as tympanometry in diagnosing otitis media with effusion.

Keywords: Otitis Media with Effusion; Preschool Children; Prevalence

What is already known about Otitis media with effusion in Africa

Otitis media with effusion is a prevalent condition in Sub-saharan region.

- Otitis Media with effusion affects mostly the preschool children due to recurrent upper respiratory tract inflammatory disorders and the anatomical structure of Eustachian tube in young children.
- The diagnosis of Otitis media relies on good history taking, physical examination (including pneumatic otoscopy) and audiology tests such as tympanometry and audiometry.

What is not known about Otitis media with effusion

- Prevalence of Otitis media with effusion in preschool children in Tanzania by evidence.
- The role of both pneumatic otoscopy and tympanometry in the diagnosis of otitis media with effusion in Tanzania
- Can the Otitis Media with Effusion occur in preschool children without parents or teachers recognition?

Introduction

The OME guidelines define OME as “fluid in the middle ear without signs or symptoms of year infection”. The guideline listed the following synonyms for OME: serous otitis media, secretory otitis media, allergic otitis media, catarrhal otitis media, non suppurative otitis media, mucoid otitis media, secondary otitis media, hydro tubotympanum, exudative catarrh, tubotympanitis, tympanic hydrops, glue ear, fluid ear, middle ear effusion, and tubotympanic catarrh [3].

- Glue ear is a name given to OME with thick viscous effusion (fluid)
- However a better and widely used definition is OME [1].

If OME persist result in decreased mobility of TM and serves as a barrier to sound conduction leading to conductive HL.

OME has reached epidemic proportion and can cause deafness at a critical child’s language development [2].

OME is common in children with prevalence of about 20% at age of 2-3 yrs [3,4].

It usually follows unresolved acute otitis media (AOM) and it is asymptomatic in most cases. It’s social impact is evident since it is recognized to cause language impairment because it is associated with hearing loss which occurs at a very sensitive age of language acquisition [5]. This finding has led to implementation of programs for earlier detection of OME.

A child with an episode of OME often experiences a mild to moderate fluctuating hearing loss, thus receiving partial or inconsistent auditory cues, which may make speech more difficult to detect and/or to filter from background noise.

It has been hypothesized that the resulting misperception or missing of words may affect the input to the knowledge base or to the neural substrate on which language learning is built [5].

Academic skills, particularly in reading and other language based subjects may be affected when there is a high demand for attention to verbally presented information [6].

This study focused the first six years of life because this is the age at high risk of acquiring OME and yet is the period of most rapid language development. In addition children of this age group are least likely to be able to report or seek help for impaired hearing, particularly if these problems have a slow onset and are subtle.

Persistent OME may be associated with physical or behavioral symptoms including hyperactivity, poor attention and behavior problems and reduced child gravity of life in some studies [6].

Early interventions have been shown to minimize the complications.

Children with chronic OME are also at risk of structural tympanic membrane damage such as retraction pocket, ossicular chain erosion, adhesive otitis media, cholesteatoma and atelectasis.

Children who experience persistent or repeated OME and associated with HL during early childhood may be at a disadvantage of learning speech and language [7].

The etiology and pathogenesis of OME are not yet fully understood, however, multiple factors and complex interaction of biochemical, immunologic and inflammatory mediators in the middle

ear cavity have been documented in various studies. Among these factors abnormal function of the ET, mucosal changes, presence of microorganisms, and the effect of inflammatory cells seem to have the most influence on the etiology and pathogenesis of OME [7].

Infection or allergic reaction resulting in congestion of the respiratory mucosa of the nose, nasopharynx and ET obstructs the narrowest portion of the tube, the isthmus. This obstruction causes negative middle ear pressure followed by OME [7].

Anatomic or physiologic abnormality of the ET can cause recurrent episodes of AOM or persistent OME [8].

The hypothesis that abnormal function of ET is important factor in the pathogenesis of ME disease was first suggested more than 100 years ago by Politzer [8].

Studies done revealed that inflammation due to infection or allergy may cause intrinsic mechanical obstruction of the ET [7,8].

A much smaller proportion of children have mucosal disease of middle ear as a result of allergy itself [3,7,8].

In the past OME was thought to be non infective condition [7]. Recently studies done i identified bacteria by means of smear and culture and by Polymerase Chain Reaction (PCR) in about 42% of children with OME [7,8].

Bacteria, mycoplasma and viruses have all been shown to be present in some samples.

The type of microorganisms isolated are similar to those isolated in AOM predominantly B- hemolytic streptococci and H. influenza [7].

Diagnosis

Diagnosing OME correctly is fundamental to proper management; moreover OME must be differentiated from AOM.

OME may be asymptomatic or patients may experience ear discomfort, hearing loss, tinnitus, possibly vertigo, feelings of ear fullness most of these vague presentation can be noted and expressed by adult but in young children the features frequently noted are hearing loss, unstable gait and language problems.

Often the child with OME is so accustomed to reduced hearing sensitivity that parents become aware of the problems only after the child turns up the volume of the radio or television or is not attentive during conversation [7,8].

Complications of OME

Persistent or fluctuating HL is present in most of children who have OME. Conductive HL (mild to moderate), Sensorineural HL, Linguistic and learning effects are the commonest complications of OME [9,10].

Methodology

Study location

The study was conducted in Dar es Salaam city in Tanzania in day care centers in Kinondoni District.

Study population

The study population included preschool children aged between two six years of age in selected school.

Inclusion criteria

- All children aged between two to six years old.
- Children whose parents consented for the study.

Exclusion criteria

- Children younger than two years and those older than six years.
- Children with craniofacial malformations and those with Downs syndrome.
- Children with symptoms and signs of AOM or COM.
- Children whose parents/caretakers did not consent.

Ethical consideration

Ethical clearance was obtained from MUHAS Ethical Committee. The principal investigator went to Kinondoni District office. A written consent was sought from the parents of all children involved in the study. All children who were found with ear diseases during screening were advised and managed accordingly after notification of the parents or the caretakers by school teachers.

Results

Total of 541 children were recruited for study. The diagnosis of OME was made by either pneumatic otoscopy or tympanometry.

The later was regarded as gold standard. Among the 541 children screened, 277 (51.2%) were males and 264 (48.8%) were females. Of the screened children, 129 (23.8%) were aged 2 - 4 years, while 412 (76.2%) were aged 5 - 6 years (Table 1). Of the 277 screened male children, 59 (21.3%) were aged 2 - 4 years and 218 (78.7%) were aged 5 to 6 years. Among 264 screened female children, 70 (26.5%) aged 2 to 4 years and 194 (73.5%) aged between 5 to 6 years (Table 1).

Age	OME		Total
	Yes %	No %	
2 - 4	29 (22.5%)	100 (77.5%)	129
5 - 6	101 (24.5%)	311 (75.5%)	412
TOTAL	130 (24)	411 (76)	541

Table 1: Prevalence of OME by age.

Prevalence of OME by age

The overall prevalence of OME was 24%. This included the children who had OME in either or both ears. Of these 29 (22.5%) were aged 2 to 4 years while 101 (24.5%) were aged 5 to 6 years (Table 2).

Sex	OME		Total
	Yes %	No %	
M	60 (21.7%)	217 (78.3%)	277
F	70 (26.5%)	194 (73.5%)	264
Total	130 (24)	411 (76)	541

Table 2: Prevalence of OME by sex.

Prevalence of OME by sex

Out of 130 children who had OME, 60 (21.7%) were males while 70 (26.5%) were females (Table 2).

Prevalence of OME by sex according to pneumatic otoscopy

Among the 277 male children screened, 33 (11.9%) had bilateral OME and 15 (5.4%) had OME in the right ear only while 10 (3.6%) had OME in the left ear only.

Of the 264 female children screened 49 (18.6%) had bilateral OME and 9 (3.4%) had right sided OME while 13 (4.9%) children

had left sided OME. The p-value was 0.154 and Chi Square was 3.74, which was statistically not significant (Figure 1).

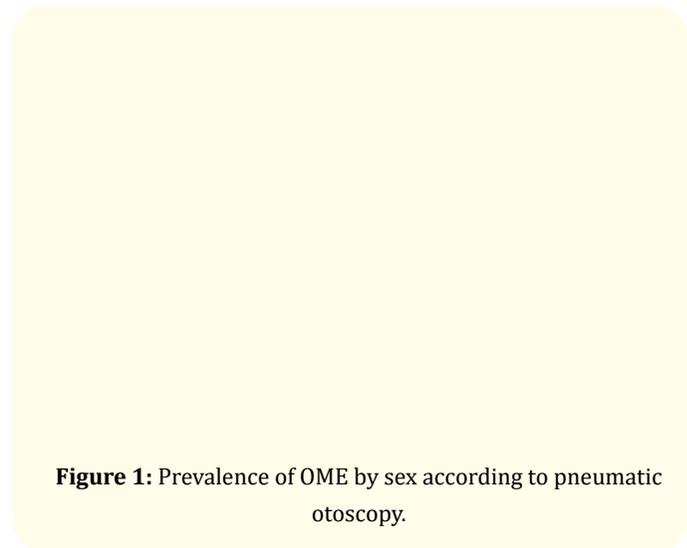


Figure 1: Prevalence of OME by sex according to pneumatic otoscopy.

Prevalence of OME by age according to pneumatic otoscopy

Out of the screened children 129 (23.8%) were diagnosed to have OME by pneumatic otoscopy of which 29 (22.5%) were aged 2 to 4 years while 100 (24.3%) were aged 5 to 6 years (Table 3).

Age (In Yrs)	OME		Total
	Yes %	No %	
2 - 4	29 (22.5)	100 (77.5%)	129
5 - 6	100 (24.3)	312 (75.5%)	412
Total	129 (23.8)	412 (76)	541

Table 3: Prevalence of OME by age according to pneumatic otoscopy.

Prevalence of OME by age and lateralization according to pneumatic otoscopy

Among the 129 children studied who were aged 2 - 4 years, 23 (17.5%) had bilateral OME, 3 (2.3%) had right OME and other 3 (2.3%) had left OME by pneumatic otoscopy.

Of the 412 children who were aged 5 - 6 years, 59 (14.3%) had bilateral OME and 21 (5.1%) had right OME while 20 (4.9%) had left OME. The chi-square was 3.98 and p-value was 0.263 which was not significant statistically (Figure 2).

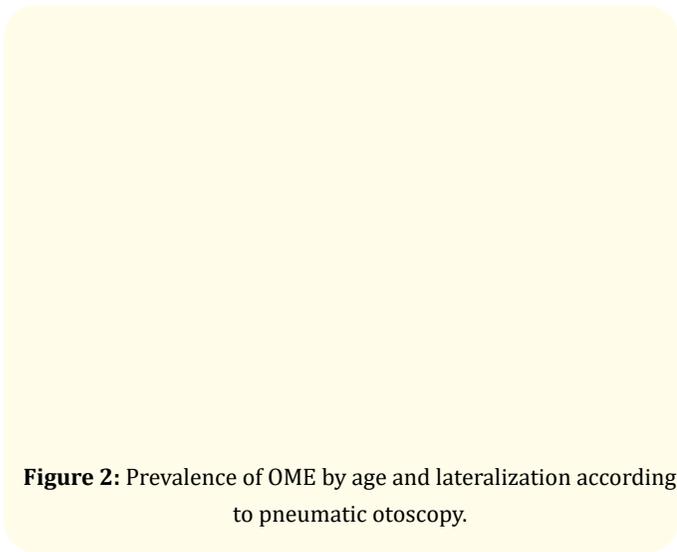


Figure 2: Prevalence of OME by age and lateralization according to pneumatic otoscopy.

Prevalence of OME by sex according to tympanometry

Out of 277 screened male children, 32 (11.6%) had bilateral OME and 17 (6.1) had right OME while 11 (4%) had left OME by tympanometry. Among the 264 female children screened 49 (18.6%) had bilateral OME while 9 (3.4%) and 12 (4.5%) had right and left OME respectively.

The chi square was 5.34 and p-value was 0.07 which was insignificant statistically (Figure 3).

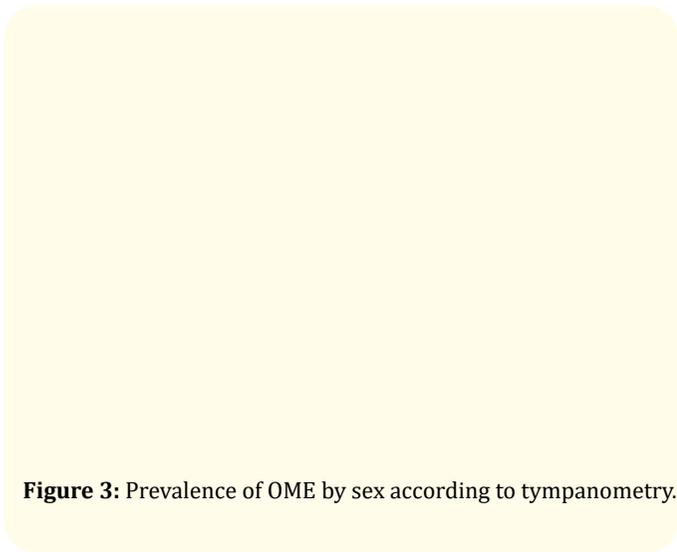


Figure 3: Prevalence of OME by sex according to tympanometry.

Prevalence of OME by sex according to tympanometry

Out of 130 children who had OME by tympanometry, 29 (22.5%) were aged 2 to 4 years while 101 (24.5%) were aged 5 -6 years (Table 4).

Age (yrs)	OME		Total
	Yes %	No %	
2 - 4	29 (22.5)	100 (77.5%)	129
5 - 6	101 (24.3)	311 (75.5%)	412
Total	130 (24)	411 (76)	541

Table 4: Overall Prevalence of OME by age according to tympanometry.

Out of 129 screened children who were aged 2- 4 years 23 (17.8%) had bilateral OME while equal number of children 3 (2.3%) had isolated right and left OME by tympanometry. Among those who were aged 5 to 6 years, 58 (14.1%) had bilateral OME while 23 (4.8%) and 20 (4.9%) had right and left OME respectively. Chi Square was 4.58 and the p-value was 0.263 which was not statistically significant (Figure 4).

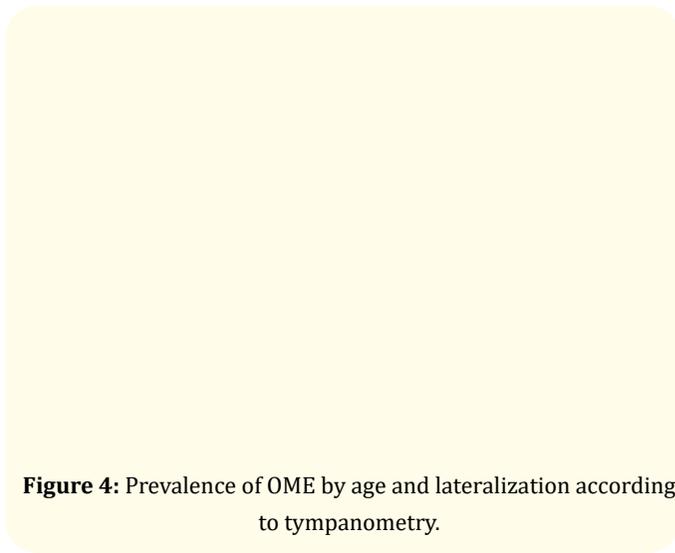


Figure 4: Prevalence of OME by age and lateralization according to tympanometry.

Validity of screening test

In this study the screening test was regarded as pneumatic otoscopy while the tympanometry was regarded as the gold standard. The sensitivity and specificity of the screening test was therefore calculated.

$$\text{Sensitivity} = \frac{\text{Children positive on screening test}}{\text{Total positive by gold standard}} = \frac{127 \times 100}{130}$$

= 97.7% [This is the probability that a child with OME had a positive test result].

$$\text{Specificity} = \frac{\text{Children negative for OME on the screening test}}{\text{Total negative by gold standard}} = \frac{409 \times 100}{411}$$

= 99.5% (This is the probability that a child without OME had a negative Test result) (Table 5).

	Tympanometry			Total
		+	-	
Pneumatic otoscopy	+	127	2	129
	-	3	409	412
Total		130	411	541

Table 5: Validity of screening test.

Discussion

The prevalence of OME and its complications is not well known in Tanzania.

Most of the studies done are on chronic otitis media, hearing impairment, and cerumen impaction. Example is the study done in Northern Tanzania (Moshi and Monduli) by Mallya J and Bastos on middle ear diseases and hearing impairment, which showed the prevalence of COM to be 1.6%, scarred and sclerotic tympanic membrane 10.9% [2].

This study revealed the overall prevalence of OME to be 24% which included OME in either or both ears. Prevalence of bilateral OME was 15%. This finding is different from the study done in Nigeria where by the prevalence of OME was 50% in the 5 to 23 months, 28.1% in the 2- 5 years age group, and 7.1% in the children aged 5 to 6 years [11].

Another study done in Kenya by Kabahuma in 1990 found point prevalence of 21.9% among children aged 6 to 10 years [20].

In Hong Kong a study done whereby preschool children were screened, the prevalence of OME was 13.8% which is also different from this finding [12].

In a study by Telle., *et al.* in children between less than 7 years noted overall prevalence of OM to be 7.1% while prevalence in 2 years children was 17% and prevalence increased during rainy seasons [13].

Prevalence of OME in Greece was found to be 6.5% between 6-8 years and it was found that the prevalence decreases as the age increase.

In a study done revealed prevalence of OME of 31.3% in either or both ears [14]. In this study the prevalence of bilateral OME was 22.5% in children aged 2-4 years and 24.5% in those aged 5-6 years. Most of other studies done were between 1 month to 15 years, therefore comparison may be difficult. The prevalence of OME in 5-6 years age group is comparable to the Kenyan study done by Kabahuma in 1990, where the prevalence of OME in 6 years old was 28.8%, this decreased to 2.7% in 10 years children.

The prevalence of OME was noted to be higher in 5 to 6 years old (24.5%) compared to 2 to 4 years age group (22.5%).

Another study showed significant changes of prevalence of OME by age whereby the prevalence of OME at 2 years was 22% while among 6-10 years was 7.1% [8].

The study showed low prevalence of OME in males as compared to females M.21.7% F. 26.5%. However the unpublished study done in Kenya also showed similar trend M: 18.7% F: 25.4% [20].

Even though the findings are not statistically significant, it showed an apparent higher prevalence in females than males.

Reasons for variation in these prevalence rates may be attributed to different climatic conditions, sample size used, environmental factors or methods used. Also most of the studies did not specify lateralization of OME.

In this study it was found that, among the 541 screened preschool children the prevalence rate of unilateral OME was 9.1% while bilateral OME was 15%. This was not statistically significant (p-value 0.07). This was different from another study done in Ri-

yadh whereby the rates of unilateral OME was 5.7% compared to 8.1% of bilateral OME, however both were not statistically significant [15].

Among the 541 screened children 129 (23.8%) were diagnosed to have OME in either or both ears by pneumatic otoscopy which is almost similar to those diagnosed by tympanometry, which was 130 (24%). A similar number 22.5% of children aged 2 to 4 years were diagnosed by both tests. The prevalence of bilateral OME diagnosed by tympanometry was 15% compared to 15.2% diagnosed by pneumatic otoscopy. This was almost similar to the other studies done in Nigeria where the two tests were used i.e. pneumatic otoscopy and tympanometry whereby the prevalence of OME by tympanometry was 8% and 7.6% by pneumatic otoscopy [3].

Another study done revealed prevalence of OME by tympanometry of 31.3% compared to 30% by pneumatic otoscopy [16]. In 2004, American Academy of Otolaryngology, Head and Neck surgeons made recommendations on use of pneumatic otoscopy as the primary diagnostic test for OME and can also differentiate between OME and AOM [17]. In this study the pneumatic otoscopy was regarded as screening test while the tympanometry was regarded as gold standard. After calculation the sensitivity of pneumatic otoscopy was 97.7% and the specificity was 99.5%. This shows that pneumatic otoscopy is almost just as good in diagnosing OME as is tympanometry. This finding is similar to that of another study done in United States by Hurriss and others in 1998 which evaluated validity of tympanometry and pneumatic otoscopy and it was found that the diagnosis provided by both tests were similar, agreeing in diagnosis 80-100% of the time [16].

Another study by Toner J G revealed no significant difference between predictive value of pneumatic otoscopy (88%) and tympanometry (89%). When both were used in conjunction the predictive accuracy did not increase significantly [4]. Casseblant, *et al.* did a study which showed that pneumatic otoscopy had best apparent performance with sensitivity of 94% and specificity of 80%. Examiner qualification is also a factor which can increase the accuracy. The conclusion made from the study was that pneumatic otoscopy can do just as well as or better than tympanometry and acoustic reflectometry in diagnosing OME [18]. Study done by [3] on clinical importance of pneumatic otoscopy in the diagnosis of OME showed sensitivity of 96% which was in agreement with this study [3,19].

Conclusion

This study clearly shows that OME is prevalent in Tanzania preschool children where by the prevalence rate was 24%. It was noted that the prevalence rate of OME was higher between 5-6 years of age (24.5%) than in the children 2-4 years of age (22.5%). The study also showed that the prevalence of OME is higher in females (26.5%) than in males (21.7%). This was not statistically significant. In this study OME was noted to be bilateral in 15%, and unilateral in 9.1% of the cases. This is important documentation because if only one ear is affected, the outcomes, complications and management differ from those of bilateral OME. In most other studies done, there was no documentation on lateralization of OME. Pneumatic otoscopy showed high sensitivity (97.7%) and high specificity (99.5%). This shows that pneumatic otoscopy is as good as tympanometry as a primary diagnostic tool in diagnosing OME. This finding is similar to other studies [4,16].

Recommendations

- Screening of preschool children for presence of OME should be introduced to enable early detection and therefore prevention of complications which will improve children's language acquisition and academic performance.
- Clinicians and other health care providers should build the habit of evaluating children at risk of developing OME and promptly referring those found to have OME.
- Further studies are important so as to address the magnitude of OME in other areas of sub-Saharan Africa. Follow up studies are also indicated so as to see the regression rate of OME.
- A study to evaluate predisposing factors and complications of OME is also recommended.
- Pneumatic otoscopy is as good as tympanometer in diagnosing OME. It is cheap, easy to use, causes less discomfort to children and it can differentiate OME from AOM.

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