

Otitis Media with Effusion in Children: A Follow up Study in West Baghdad, Iraq

Ahmad N. Al-Juboori^{1*}, Ameer A. Al-Aqeedee¹ and Hussam D. Saeed²

¹Department of Otorhinolaryngology, Al- Fallujah General Hospital, Baghdad, Iraq

²Department of Community Medicine, Ibn Sina College of Medicine, Al-Iraqia University, Baghdad, Iraq

*Corresponding author: Professor Ahmad Nasrat Al-Juboori, Department of Surgery, Ibn Sina College of Medicine, Al-Iraqia University, Baghdad, Iraq, Tel: +9647902892674; E-mail: ahmednas2005@yahoo.com

Received: October 20, 2014; Accepted: November 20, 2014; Published: November 27, 2014

Copyright: © 2014 Al-Juboori AN, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Objective: To study the clinical, audiological and radiological characteristics as well as treatment outcome of children less than 12 years old suffered from Otitis Media with Effusion (OME) from West Baghdad, Iraq.

Materials and Methods: This is a follow up study performed upon 180 child under 12 years old, diagnosed having OME by clinical, audiological and radiological means, they were treated in Al-Ramadi and Al-Fallujah General Hospitals drained from West Baghdad and Al-Anbar Governorate, during the period from May 2010 to July 2012. The data obtained from the parents, clinical examination and investigations like Pure Tone Audiometry (PTA), tympanometry and lateral soft tissue x-ray of the neck had been done. The treatment outcome studied after follow up for six months.

Results: There were 54.4% boys and 45.6% girls. The main presenting symptom was hearing impairment (brought by family) (47.2%) and the main presenting sign was retraction of tympanic membrane (91.7%), the mean amount of hearing loss by PTA was 22.6 ± 5.5 dB. In 92.2% of patients tympanometry was type B. The size of the adenoid measured by Adenoid/Nasopharyngeal ratio was located mainly on Grade 3+ (43.3%). All the patients were given medical treatment, 61.1% of them responded. Patients that failed to response to medical treatment underwent different modalities of surgical means represented mainly by myringotomy and adenotonsillectomy.

Conclusion: There was significant correlation between the size of adenoid and the type of tympanogram and hearing threshold. The treatment was mainly medical, while surgical means if indicated they were myringotomy accompanied mainly with adenotonsillectomy.

Keywords: Otitis media with effusion; Myringotomy; Tympanometry; Audiometry

Introduction

Otitis Media with Effusion (OME) is defined as an inflammatory state of the middle ear characterized by the presence of fluid in the middle ear resulting in decreased mobility of the tympanic membrane and a conductive type of hearing loss in the absence of signs and symptoms of acute infection [1,2]. It is one of the common health problems seen in children and, when inadequately treated or left untreated, it may lead to sequelae and complications, consisting in permanent hearing loss and impairment in development of speech and language [2]. The prevalence of OME is rather variable, ranging from 6 to 64% [2-10]. Approximately 90% of children (80% of individual ears) have OME sometimes before school age, most often from 6 months to 4 years of age. In the first year of life, about 50% of children will experience OME, increasing to more than 60% by two years. Many episodes resolve spontaneously within three months, but 30% to 40% of children have recurrent OME, and 5% to 10% of episodes last one year or longer [2-10]. However, the main clinical problem for some children with symptoms of OME is occult; in 40% to 50% of cases of OME, neither the affected children nor their parents or caregivers describe significant complaints referable to a middle-ear effusion.

Moreover if the ear canals are narrow, it is very difficult to examine the tympanic membrane, and then OME can easily be neglected to a superficial examination [11]. When inadequately treated or left untreated, OME may lead sequelae and complications, consisting in acute otitis media with tympanic perforation, retraction pockets, tympanosclerosis, adhesive otitis media, cholesteatoma all clinical conditions characterized in children by permanent hearing loss and impairment in development of speech and language [12-14]. The association of OME with the Eustachian Tube (ET) dysfunction and the disorders of the nose have repeatedly been confirmed [4]. It is often associated with an abnormal or malfunctioning ET, which causes negative pressure in the middle ear and leaking of fluid from tiny blood vessel or capillaries into the middle ear. Problems with the ET can be caused by viral infections, injury or birth defects (such as cleft palate) [15]. Hypertrophy of the adenoids and ET dysfunction are often considered to be causal factors of OME. Recent guidelines from otologists, pediatricians, and allergists based on clinical evidence support the role of atopy in the development of OME; the important role of allergy in the genesis and recurrence of OME is also supported by data literature that evidence a statistically significant differences in audiological characteristics among atopic and non atopic subjects suffering from OME. In fact in atopic children it found a predominance of bilateral OME and an higher hearing impairment [16,17]. Furthermore, OME produces a complex multifactorial process

that is why the pneumatization of the mastoids and the variation in the gaseous diffusion in circulation has an important role in the negative pressure phenomenon in the affected middle ear. Fluid from the ears of children with otitis media with effusion usually does not show infection with bacteria. In some cases, however, the fluid may contain organisms such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis* or other bacteria [18]. Medical management would potentially be of greatest benefit if it could speed the resolution of an episode of OME. Hence, randomized controlled trails carried out in primary care setting would be those most appropriate to consider using resolution of OME as the outcome. Most trail follow up children for one to two weeks after therapy. If at this point the therapy is ineffective, there is no reason for further follow up as it is unlikely to be of benefit thereafter. However, if it is effective after one to two weeks, then follow up for the recommended watchful waiting period of 12 weeks is necessary to see if it is of benefit in the longer term and might be used to reduce the proportion of children being considered for surgery [19]. The potential of OME to cause serious sequelae and complications that may affect children's life long-term; make the disease an important health problem. Environmental, epidemiological and familial factors play an important role in pathogenesis of OME [20]. The aim of this study was to study the clinical, audiological and radiological characteristics along with the treatment outcome of children less than 12 years suffered from OME in west Baghdad, Iraq.

Materials and Methods

The study was conducted from May 2010 to July 2012 in Al-Ramadi and Al-Fallujah General Hospitals and was performed upon 180 children up to 12 years old suffered from OME and who were coming from different areas in West Baghdad and Al-Anbar Governorate. The study was approved by Al-Anbar Health Directorate, and an informed consent was taken from the parents of the suffered children. Patient's data included age, sex and presenting symptoms (hearing impairment referred by parents for the lower ages and/or by patients; scholastic retardation; snoring and/or mouth breathing; earache); all the patients underwent ENT examination, including otoscopic examination. If present the wax was carefully removed. All children with tympanic membrane perforation, acute otitis media and chronic otitis media, cleft palate and Down's syndrome were excluded from the study. Suspecting OME subjects underwent tympanogram; the results were evaluated according to Fiellau-Nikolajsen's modification of Jerger's system [21]. The results were classified as Type A (+100 and -100 daPa), Type B (no pressure peak), Type C1 (-101 and -200 daPa), Type C2 (-201 and -300 daPa). Furthermore a Pure Tone Audiometry (PTA) was used to assess the hearing threshold [19] which was done only for children above the age of six years (62 patients) because the test is subjective one, we tried to do the test in younger children but the results was not conclusive, tuning fork test was also done but the test in younger children was not informative. The PTA was done using six frequencies (250, 500, 1000, 2000, 4000, 8000 Hz). Further investigation, if indicated, included plane x-ray of the neck in lateral views to assess adenoid size, were measured by A/N ratio, where N is the distance between the posterior superior edge of the hard palate and the anteroinferior edge of the sphenobasioccipital synchondrosis, and A is the distance between the maximum convexity of the adenoid and a line drawn along basocciput. A/N ratio below 25% was scored as 1+, those between 26% and 50% as 2+, those between 51% and 75% as 3+, and those between 76% and 100% as 4+ [22]. OME suffered were treated with medical therapy consisting of local nasal steroid, systemic

and/or local decongestant and in presence of Upper Respiratory Tracts Infections (URTI) or adenoid inflammation systemic antibiotics was administered. After two weeks the children underwent new examination that confirmed the treatment up to 12 weeks or with evidence of lack of medical therapy benefit lead to surgical choose in form of myringotomy alone or may be associated with grommet insertion, or myringotomy and adenoidectomy, or myringotomy and adenotonsillectomy. The clinical course was followed up to six months after surgery.

Results

The total number of OME suffered was one hundred and eighty, 98 boys (54.4%) and 82 girls (45.6%); with a male: female ratio of 1.19 there was no significant differences among the sex. The age of children ranged from 2 to 12 years old with a mean age of 5.7+2.4 years. Figure 1 shows the distribution of the cases according to age and sex; the study of the mean did not evidenced difference among the groups (t value=0.6905; f.d.=18; p=0.4987). With r value of 0.91 and 0.89 for boys and girls respectively, regression analysis showed a strong correlation between the first ages of life and OME disease; it is also evidenced by the two peaks at two and five years of life either for boys and girls.

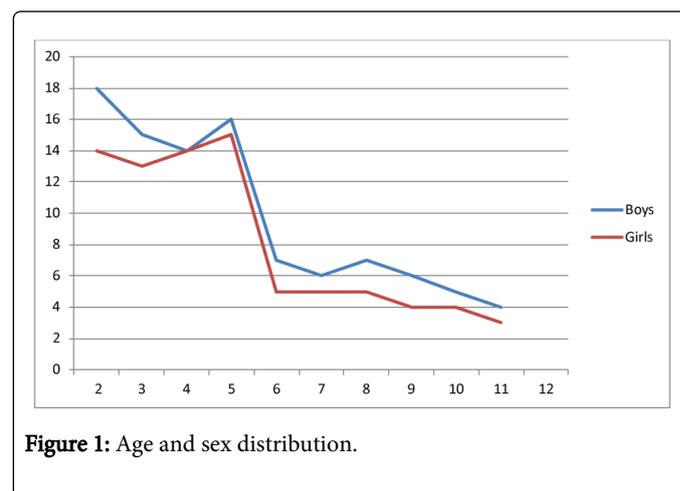


Figure 1: Age and sex distribution.

OME diagnosis was also studied in relation to months and seasons and it was evidenced that with 61.11% corresponding to 110 cases the peak of OME suffered resulted in winter with a significant statistical difference among the months (t value=2.4749; f.d.=22; p=0.02) (Figure 2).

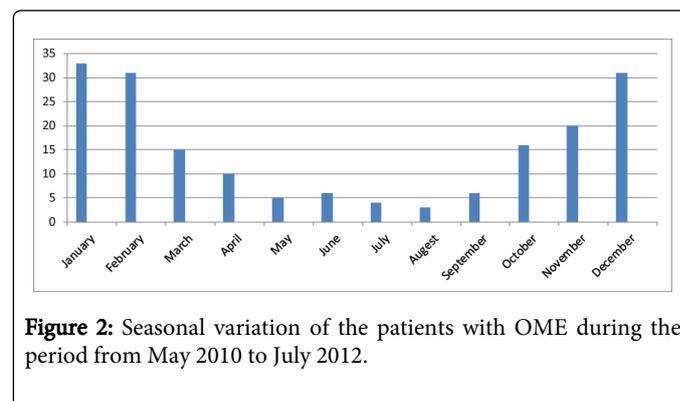


Figure 2: Seasonal variation of the patients with OME during the period from May 2010 to July 2012.

Regarding the presenting symptoms, 47.2% of the suffered children, hearing impairment referred by parents result the commonest presenting symptom followed by scholastic retardation (20%) and by snoring and or mouth breathing (18.3%). Table 1 showed the distribution of presenting symptoms in order of frequency.

Presenting symptom	Numbers	Percentage
Hearing impairment (brought by family)	85	47.2
Scholastic retardation (referred from the teacher)	36	20
Snoring and or mouth breathing	33	18.3
Hearing impairment (patient complaint)	13	7.2
Fullness in the ear or ear discomfort	8	4.5
Earache	3	1.7
Discovered accidentally during ENT (non otological) examination	2	1.1
Total	180	100

Table 1: The presenting symptoms of total 180 children with otitis media with effusion.

As for otoscopy the retraction of Tympanic Membrane (TM) resulted the commonest sign (91.7%) followed by hyperemia of TM (86.7%) , dull TM (81.1%), fluid behind TM (11.1%), and air bubbles behind the TM (10%) (Table 2).

Presenting sign	Numbers	Percentage
Retraction of Tympanic Membrane (TM)	165	91.7
Hyperemic TM	156	86.7
Dull TM	146	81.1
Fluid behind TM	20	11.1
Air bubbles behind the TM	18	10

Table 2: The presenting signs of total 180 child with otitis media with effusion seen by otoscopic examination (more than one sign was present in the same patient).

Type of treatment	Numbers of patients subjected (%)	Treatment outcomes	
		Success (%)	Failure or recurrence (%)
Medical	180 (100)	110 (61.1)	70 (38.9)
Surgical:	70 (38.9)	65 (92.9)	5 (7.1)
-Myringotomy with grommet insertion	11(15.7)	11 (15.7)	
-Myringotomy+Adenoidectomy alone	25 (35.7)	23 (32.9)	2 (2.85)
-Myringotomy+Adenotonsillectomy	28 (40)	26 (37.1)	2 (2.85)
-Myringotomy+Tonsillectomy alone	6 (8.6)	5 (7.1)	1 (1.4)

Table 4: Treatment modalities and there outcome of children suffered from OME from West Baghdad.

Tympanometry evidenced a type B curve in 92.2% of (166 cases–302 ears), type C2 in 5% (9 cases–16 ears) and type A in 2.8% (5 cases–10 ears), while hearing threshold performed on the children aged more than 6 years old, corresponding to 62 cases, showed a mild hearing impairment (<20 dB HL) in 54.8%, an impairment from 21 to 30 dB HL in 24.2%, and more than 31 dB HL in the 21%.

The relationship between the type of tympanogram and the hearing threshold showed that all the cases with type A and most of the type C2 had less than 20dB HL hearing threshold as shown in Table 3.

Hearing threshold (62 cases)	Type of tympanogram			Total (%)
	Type B	Type C2	Type A	
<20 dB HL	22 (40 ears)	7 (13 ears)	5 (10 ears)	34 (54.8)
21 to 30 dB HL	13 (24 ears)	2 (3 ears)	0	15 (24.2)
>31 dB HL	13 (24 ears)	0	0	13 (21)
Total	48 (88 ears)	9 (16 ears)	5 (10 ears)	62 (100)

Table 3: Correlation between type of tympanogram and hearing threshold (62 cases–114 ears).

Regarding the size of adenoid based on a A\N ratio, 22 patients presented a grade 1+ (12.2%), 36 cases (20%) grade 2+, 78 patients (43.3%) had grade 3+, and in 22 cases (24.5%) the adenoids resulted of grade 4+. It was evidenced a strong correlation between the adenoid size and the tympanogram; in fact the 70 cases (89.7%) and 41 cases (93%) of children with adenoids grade 3+ and grade 4+ presented a type B tympanogram respectively.

The examination after two weeks of medical therapy evidenced an improvement in 110 children corresponding to 61.1%; in all these cases the therapy was confirmed for a total of 12 weeks. In other cases the children were selected for surgical treatment; in particular of a total of 70 patients, 28 (40%) corresponding to the 15.55% of the total underwent myringotomy and adenotonsillectomy, 25 (35.7%) corresponding to 13.88% of the total underwent myringotomy and adenoidectomy and 11 (15.7%) corresponding to 6.11% underwent myringotomy with grommet insertion. Failure of surgical treatment or recurrence happened in five patients (7.1%) (Table 4).

Discussion

Otitis media with effusion is chronic accumulation of fluid within the middle ear, and occasionally in the mastoid air cell system. The time that the fluid has to be present for the condition to be chronic is generally around 12 weeks [19]. The prevalence of OME in children is mainly determined by the age of the child and the season of the year. The age prevalence is bimodal with the first and largest peak on approximately 20% at two years; and the second peak of approximately 16% at around five years of age. After the age of seven years old, the prevalence falls from 6.8% to 5% [15]; our results confirm data literature. In our study the distribution of the case in relation to season was different, in which the patients with OME were higher in the winter as opposed to the summer months which was consistent with other studies [11,23,24], this was probably due to increased frequency of upper respiratory tract infection during winter months. The study demonstrated that OME in West Baghdad is slightly more among boys (54.4%) than girls (45.6%); this is comparable with some studies which gave no significant difference in the prevalence of OME between both genders [25], even if the literature data are discordances because some studies demonstrate that males have a significantly higher proportion of OME ($p < 0.001$) while others founds that the number of girls with OME significantly exceeds the number of boys with OME ($\chi^2 = 7.384$, $P = 0.0067$) [17,26]. The hallmark of OME is the lack of obvious symptoms in those who most commonly have the condition. Older children often complaint of muffled hearing or a sense of fullness in the ear. Younger children may raise the television volume; sometime OME is diagnosed when someone examines the ear for another problem. In our study the most common presenting symptom was hearing impairment which was noticed by the parents, secondly; the hearing impairment discovered by the teacher due to scholastic retardation then the patient presented with snoring and or mouth breathing. In Syed et al. the common presenting symptom was fullness in the ear (50.3%) [15]. A general ear examination may show dullness, air bubbles and fluid behind the tympanic membrane or reduced mobility. In Syed et al. the common sign seen by otoscopic examination was dull eardrum (72.18%), while in our study the commonest was retraction of tympanic membrane [15]. The most common type of tympanometry results seen among children with OME in our study was type B (92%), Kemaloglu et al. [27] and Pan et al. [28] reported that B-type tympanogram positive predictive values were 96% and 92.57% respectively. The overall diagnostic accuracy of type B tympanogram for predicting middle ear effusion was 100% in the group with parental suspicion of hearing loss giving a sensitivity of 100%, which was higher than the group whose parents were not suspicious of hearing loss. That is, type B tympanogram is the best diagnostic tool for predicting OME in the children with parental suspicion of hearing loss [29]. Type A or C tympanogram sometime could be seen in the group of children with OME, especially peak pressure value is less than -300 daPa. [30] The mean air-bone gap obtained from PTA was 22.6 ± 5.5 dB. Meanwhile, most cases showed mild degree of hearing loss (54.8%). Thompson in 2008, Martines et al. in 2010 and 2011 revealed that the worse conductive hearing loss among children with OME was of moderate degree, which constitute up to 10% compared with 20-35% having mild degree hearing loss [15,27,31]. These results suggests that the degree of conductive hearing loss among cases with OME cannot be worse than a moderate hearing loss as the skull vibrate at intensities greater than 60-70 dB hearing level allowing the signal to go straight to the inner ear; anything greater than this is considered to be mixed hearing loss [31]. The study was able to demonstrate a high prevalence of adenoid size especially

grade 3+ (43.4%) among patients with OME, this was consistent with another recent study done in Nigeria in 2010 on number of children with OME, where they found a significant association between type B tympanogram and the presence of significant nasopharyngeal obstruction with odds ratio of 4.4 [32]. It was possible that such adenoid, even though of small size, encroached laterally to obstruct the ET of the involved ear, such lateral encroachment was reported to be significant in influencing development of OME. It was also possible that other risk factors for OME such as ET dysfunction were probably responsible for the development of OME in those children with small-sized adenoids [32]. While most cases of OME will resolve spontaneously, some children will need intervention because of the effects of hearing loss. This intervention may take the form of educational and social action or the provision of a hearing aid to minimize the impact of the hearing loss. No non-surgical intervention has yet been shown conclusively to be of benefit. Surgical management usually takes the form of myringotomy and insertion of a ventilation tube (grommet), with or without adenoidectomy [33]. There were 61.1% of our cases responded to medical treatment and the remaining patients subjected to surgical interference. More than one third of the surgical interference there were associated adenoidectomy, and 40% they were associated tonsillectomy as well. The efficacy of adenotonsillectomy on OME has been demonstrated by several randomized and controlled studies. It was speculated that tonsil and adenoid may play a role as an infectious focus to OME, so that some authors stated that, patients suffering from recurrent or chronic OME may benefit from adenotonsillectomy due to removal of an infectious source in the nasopharynx rather than the removal of a large adenoid mass [34].

From this study we concluded, there was significant correlation between the size of adenoid and the type of tympanogram and hearing threshold. The treatment was mainly medical, while surgical means if indicated they were myringotomy accompanied mainly with adenotonsillectomy.

References

1. Gates GA, Klein JO, Lim DJ, Mogi G, Ogra PL, et al. (2002) Recent advances in otitis media. 1. Definitions, terminology, and classification of otitis media. *Ann Otol Rhinol Laryngol Suppl* 188: 8-18.
2. Martines F, Bentivegna D, Di Piazza F, Martinciglio G, Sciacca V, et al. (2010) The point prevalence of otitis media with effusion among primary school children in Western Sicily. *Eur Arch Otorhinolaryngol* 267: 709-714.
3. Pelikan Z (2006) Chronic otitis media (secretory) and nasal allergy. *Scripta medica (BRNO)* 79: 177-198.
4. Williamson I (2002) Otitis media with effusion. *Clin Evid* : 469-476.
5. Takata GS, Chan LS, Morphew T, Mangione-Smith R, Morton SC, et al. (2003) Evidence assessment of the accuracy of methods of diagnosing middle ear effusion in children with otitis media with effusion. *Pediatrics* 112: 1379-1387.
6. Kubba H, Pearson JP, Birchall JP (2000) The aetiology of otitis media with effusion: a review. *Clin Otolaryngol Allied Sci* 25: 181-194.
7. Caylan R, Bektas D, Atalay C, Korkmaz O (2006) Prevalence and risk factors of otitis media with effusion in Trabzon, a city in northeastern Turkey, with an emphasis on the recommendation of OME screening. *Eur Arch Otorhinolaryngol* 263: 404-408.
8. Paradise JL, Rockette HE, Colborn DK, Bernard BS, Smith CG, et al. (1997) Otitis media in 2253 Pittsburgh-area infants: prevalence and risk factors during the first two years of life. *Pediatrics* 99: 318-333.

9. Casselbrant ML, Mandel EM (2003) Epidemiology. In: Rosenfeld RM, Bluestone CD, eds. *Evidence- Based Otitis Media*, 2nd ed. Hamilton, Ontario: BC Decker, 147-162.
10. de Ru JA, Grote JJ (2004) Otitis media with effusion: disease or defense? A review of the literature. *Int J Pediatr Otorhinolaryngol* 68: 331-339.
11. Midgley EJ, Dewey C, Pryce K, Maw AR (2000) The frequency of otitis media with effusion in British pre-school children: a guide for treatment. ALSPAC Study Team. *Clin Otolaryngol Allied Sci* 25: 485-491.
12. Vicente J, Trinidad A, Ramírez-Camacho R, García-Berrocá JR, González-García JA, et al. (2007) Evolution of middle ear changes after permanent eustachian tube blockage. *Arch Otolaryngol Head Neck Surg* 133: 587-592.
13. Martines F, Bentivegna D (2011) Audiological investigation of otitis media in children with atopy. *Curr Allergy Asthma Rep* 11: 513-520.
14. da Costa JL, Navarro A, Branco Neves J, Martin M (2005) Otitis medias with effusion: association with the Eustachian tube dysfunction and adenoiditis. The case of the Central Hospital of Maputo. *Acta Otorrinolaringol Esp* 56: 290-294.
15. Syed HI, Arif HB, Abu Yusuf F (2009) Study on otitis media with effusion. *Bangladesh J otorhinolaryngol* 15: 50-54M.
16. Martines F, Martinciglio G, Martines E, Bentivegna D (2010) The role of atopy in otitis media with effusion among primary school children: audiological investigation. *Eur Arch Otorhinolaryngol* 267: 1673-1678.
17. Martines F, Bentivegna D, Maira E, Sciacca V, Martines E (2011) Risk factors for otitis media with effusion: case-control study in Sicilian schoolchildren. *Int J Pediatr Otorhinolaryngol* 75: 754-759.
18. Nasser SC, Moukarzel N, Nehme A, Haidar H, Kabbara B, et al. (2011) Otitis media with effusion in Lebanese children: prevalence and pathogen susceptibility. *J Laryngol Otol* 125: 928-933.
19. Browning G (2008) Otitis media with effusion. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones N, Lund V, Luxon L, Watkinson J (eds.), *Scott-Brown's Otorhinolaryngology, Head and Neck Surgery*, 7th edition, New York: Hodder Arnold, 895.
20. Kiris M, Muderris T, Kara T, Bercin S, Cankaya H, et al. (2012) Prevalence and risk factors of otitis media with effusion in school children in Eastern Anatolia. *Int J Pediatr Otorhinolaryngol* 76: 1030-1035.
21. Fiellau-Nikolajsen M (1983) Tympanometry and secretory otitis media. Observations on diagnosis, epidemiology, treatment, and prevention in prospective cohort studies of three-year-old children. *Acta Otolaryngol Suppl* 394: 1-73.
22. Fujioka M, Young LW, Girdany BR (1979) Radiographic evaluation of adenoidal size in children: adenoidal-nasopharyngeal ratio. *AJR Am J Roentgenol* 133: 401-404.
23. Rovers MM, Straatman H, Zielhuis GA, Ingels K, van der Wilt GJ (2000) Seasonal variation in the prevalence of persistent otitis media with effusion in one-year-old infants. *Paediatr Perinat Epidemiol* 14: 268-274.
24. Rovers MM, Stratman H, Ingels K, Van Der Wilt GJ, Van Den Broek P, et al. (2000) The effect of ventilation tubes on language development in infants with otitis media with effusion : a randomized trial. *Pediatrics* 106: E42.
25. Dewey C, Midgeley E, Maw R (2000) The relationship between otitis media with effusion and contact with other children in a British cohort studied from 8 months to 3 1/2 years. The ALSPAC study team. Avon Longitudinal Study of Pregnancy and Childhood. *Int J Pediatr Otorhinolaryngol* 55: 33-45.
26. Martines F, Martines E, Sciacca V, Bentivegna D (2011) Otitis media with effusion with or without atopy: audiological findings on primary schoolchildren. *Am J Otolaryngol* 32: 601-606.
27. Kemaloglu YK, Beder L, Sener T, Goksu N (2000) Tympanometry and acoustic reflectometry in ears with chronic retraction without effusion. *Int J Pediatr Otorhinolaryngol* 55: 21-27.
28. Pan LN, Feng XL, Wu XH (2009) Clinical observation of secretory otitis media diagnosis by tympanometry. *J Pract Med (Chin)* 25: 1462-1463.
29. Ren DD, Wang WQ (2012) Assessment of middle ear effusion and audiological characteristics in young children with adenoid hypertrophy. *Chin Med J (Engl)* 125: 1276-1281.
30. Gaihede M, Bramstof M, Thomson LT, Fogh A (2005) Accuracy of tympanometric middle ear pressure determination in secretory otitis media: dose-dependent overestimation related to the viscosity and amount of middle ear fluid. *Otol Neurotol* 26: 5-11.
31. Thompson PAP (2008) Occurrence of hearing loss and middle ear dysfunction among primary school children in the Christchurch area [M.Sc thesis]. University of Canterbury, Christchurch (New Zealand).
32. Orji FT, Okolugbo NE, Ezeanolue BC (2010) The role of adenoidal obstruction in the pathogenesis of otitis media with effusion in Nigerian children. *Niger J Med* 19: 62-68.
33. National Collaborating Centre for Women's and Children's Health (2008) *Surgical Management of Otitis Media with Effusion in Children*. National Institute for Health and Clinical Excellence: Guidance.
34. Park K (2011) Otitis media and tonsils, role of adenoidectomy in the treatment of chronic otitis media with effusion. *Adv Otorhinolaryngol* 72: 160-163.