Prevalence of and risk factors for otitis media with effusion in primary school children: case control study in Erzurum, Turkey

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A total of 1021 children attending 2 primary schools in districts in Erzurum were enrolled in a study evaluating the prevalence of otitis media with effusion (OME) and its relationship with various risk factors. The prevalence of OME in this study was 6.8% (69/1021). The difference in OME prevalence between age groups (<9 years, >9 years) was statistically significant ($p<0.05$). Parental smoking ($p<0.001$), history of acute otitis media (AOM) and recent history of upper respiratory tract infection (URTI) ($p<0.001$), socioeconomic status ($p < 0.05$), family size ($p<0.001$), educational status of the parents ($p<0.05$) and breastfeeding history ($p<0.05$) were also statistically significant factors. Sex ($p>0.05$), consanguineous marriage ($p>0.05$) and history of hearing loss in the parents ($p>0.05$) were not statistically significant. Parents need to be informed about the symptoms of and risk factors for OME to avoid delayed diagnosis, which can lead to permanent hearing loss.

Key words: otitis media with effusion, risk factors, prevalence.

Otitis media with effusion (OME) is defined as the collection of fluid in the middle ear without signs or symptoms of ear infection. It is also known as serous or secretory otitis media or glue ear[1,2]. Collection of fluid occurs in the middle ear space due to Eustachian tube dysfunction. This can result from a viral upper respiratory tract infection (URTI) alone, with no pain or bacterial infection, or it can precede acute bacterial otitis media. Fluid in the middle ear sometimes causes conductive hearing impairment, but only when it interferes with the normal vibration of the eardrum. Hearing impairment is usually mild and is often identified when parents express concern regarding their children's behavior, success at school or language development. Over weeks and months, middle ear fluid can become very thick and glue-like, which increases the probability of conductive hearing impairment. When not treated properly, OME can lead to various complications, such as retraction pockets, tympanosclerosis, adhesive otitis media, permanent hearing loss and impairment in the development of language[1-3].

The immaturity of the immune system, with or without dysfunction of the Eustachian tube, is also considered a factor responsible for the development of OME[4,5]. Respiratory tract infections and mechanical obstruction of the nasopharynx by adenoid vegetation or craniofacial malformations are common causes of Eustachian tube dysfunction and, thus, OME[4,5]. Moreover, additional factors have been suggested as possible influences on the pathogenesis of OME; these include race, gender, climate conditions, humidity level of the environment, socioeconomic status, duration of breastfeeding, living in a crowded house or being in a crowded environment such as a kindergarten or school, passive smoking and gastroesophageal reflux[4-7]. However, as indicated in various studies concerning etiology, the influence of these factors on pathogenesis remains controversial; further multicenter investigations are needed to clarify the etiopathogenesis of OME.

Otitis media with effusion is one of the most commonly occurring childhood illnesses in the United States, with more than 2.2 million diagnosed cases each year; it is the most common reason for referral to surgery in children. As many as 80% of children will have at least one episode of OME by age 10, with the majority of cases occurring between the ages of 6 months and 4 years[8]. Many episodes of OME resolve spontaneously within 3 months, but 30 to 40 percent of children have recurrent episodes, and 5 to 10 percent of cases last more than 1 year[8,9].

No study exists concerning the prevalence of OME in Turkey as a whole. However, a number of studies provide information about prevalence in various regions of the country. The present study is the first that has been conducted to assess the prevalence of OME among children in the 7–12 age group in Erzurum province. Erzurum, located in the Eastern Anatolia region, is one of the coldest provinces in Turkey. It has a humid continental climate with warm summers and no dry season. Winters are long and very cold. The aim of this study was to investigate the prevalence of and demographic, environmental and child-associated risk factors for OME in Erzurum and to compare these statistical data with those of other locales.

Material and Methods

This study was carried out in the Department of Otolaryngology of the Erzurum Regional Training and Research Hospital, and involved examining all of the children in two primary schools in the district of Erzurum from March 2012 to April 2012; the study group consisted of 1021 children, 531 male and 490 female, ranging from 7 to 12 years of age and all attending district primary schools. The first school was located in a district with a relatively high socioeconomic status: the second school, in a district with lower socioecenomic status. After approval by the Erzurum Provincial Directorate of National Education and National Health, the study protocol was fully explained to the children and their school principals, and written informed consent was obtained from the children's parents. Out of 1068 sets of parents, 1021 agreed to participate in the study (a 95.6% response rate).

We made two consecutive visits to each school. Data for each child were collected using a study-specific questionnaire answered by the parents. On the day before a student was examined, the student's family was given a questionnaire, which was then collected at the time of the examination. The *questionnaire consisted of* questions concerning the age, gender and number of people in the household (3 or less; 4–5; 6 or more); the educational status of the parents (no schooling; primary school; high school; university); presence of parental smoking; existence of consanguinity between the parents; duration of breastfeeding (never; <6 months; 6–12 months; >12 months); otologic complaints of the child (otalgia, hearing loss, otorrhea) in the previous year; presence of recurrent URTIs; presence of hearing loss in another member of the family.

Otoscopic examinations of all students were conducted by the same two otolaryngologists. Tympanometry was subsequently performed with a portable tympanometer (Welch-Allyn Diagnostics Inc., USA) in all children except those who had impacted wax, ear discharge or a perforated tympanic membrane. Tympanograms were divided into the following types: type A (+99 to −99 mm H_2O), type C (>100 mm H_2O) and type B (flat curve without an identifiable peak) (Fig. 1.). Children with otoscopic evidence of OME and abnormal tympanograms (type B or C) were regarded as having positive screens and given a follow-up appointment within 3 months of the initial screening.

The study criteria for diagnosis of OME were as follows: documented middle ear effusion on otoscopic examination and presence of B or C tympanograms. Children with active otitis media were provided with appropriate treatment during the period of the study. Cases requiring surgery were referred to the nearest referral hospital.

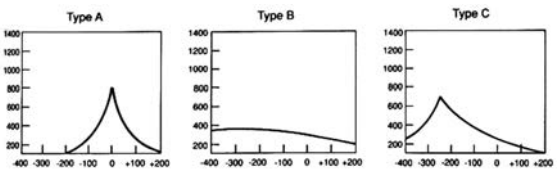

Fig. 1. Tympanograms categorized according to the shape of the plot. A normal tympanogram, labeled Type A, indicates normal pressure in the middle ear with normal mobility of the eardrum and conduction bones. Type B and C tympanograms may reveal fluid in the middle ear or Eustachian tube dysfunction.

Table I. Distribution of Otoscopy Findings in Entire Study Population (n = 1021)

Diagnosis	Number of cases (%)	
Normal	710	(69.5)
Wax	224	(22)
Acute otitis media	11	(1)
Otitis media with effusion	69	(6.8)
Chronic otitis media	5	(0.5)
Otitis externa	2	(0.2)

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS 11.5) program. Prevalence was calculated by dividing the total number of students by the number of students with positive otoscopic findings: a 95% confidence interval was used. Statistical analysis of the data was done using a chi-square test. A p value of <0.05 was considered significant.

Results

The response rate was 95.6%. The mean age of the study group of children was 9.2±0.5 years (ranging from 7-12). In the study, 52% (531/1021) of the participants were boys and 48% (490/1021) were girls. The overall prevalence of reported OME was 6.8% (69/1021). Of the children with OME, 7.1% (38/531) were boys and 6.3% (31/490) were girls; sex was not statistically significant (p>0.05)

The distribution of the otological findings of the 1021 children is presented in Table I. Wax was the most common otoscopic abnormality (22%); it was found to be hard and impacted in 82 children (8%). Five patients had tympanic membrane perforation. There were no patients with aural cholesteatoma or adhesive otitis media.

The two schools were evaluated independently in terms of OME frequency. OME prevalence was significantly higher in the school located in the socioeconomically lower-status district (40/463, 8.6%) than in the higher-status district's school (29/558, 5.2%) (p<0.05) (Table II).

The most prevalent risk factors for OME, such as frequent acute otitis media and history of upper respiratory tract infection, are seen mostly in children aged 4 to 9. The results in our study were consistent with this, with the difference between the two age groups (<9 years, >9 years) being statistically significant (p<0.05) (Table III). Likewise, significant differences were seen when looking at exposure to cigarette smoke (p<0.001), family size (p<0.001) and parental educational status (p<0.05) (Table III). However, no significant difference was apparent in regard to history of consanguineous marriage or hearing loss in family members (p>0.05). The results of the study are summarized in Table III.

Discussion

Otitis media with effusion is defined as the presence of fluid in the middle ear without signs or symptoms of acute ear infection[1,2]. It is a significant, common health problem in children, with higher rates seen in younger age groups. Its importance lies not only in its impact on utilization of health care services[9,10], but also in its potential to cause chronic ear problems and hearing loss, leading to delay of speech and language development[11,12]. The morbidity, complications and sequelae of the disease can be avoided by early diagnosis and prompt treatment. However, early diagnosis is not always possible, since the disease is insidious and usually seen in small children. Therefore, it is essential to clearly establish the risk factors for and prevalence of OME, both to prevent its occurrence and to determine the proper treatment plan for affected children.

Otitis media with effusion is very prevalent in young children. Screening surveys of healthy children range from 2.2 to 31.3%, depending on the methods used, population characteristics such as race, the country in question and

Table II. Differences Between the Schools

Schools	Number of children with OME (%)	p value
School in low socioeconomic district	40/463 (8.6%)	<0.05
School in high socioeconomic district	29/558 (5.2%)	

Total number Total number of cases with OME was 69; total number of patients with OM was 85.

environmental factors[13–16]. In one study, the prevalence was reported as 9.5% for Caucasian and 5.3% for Chinese primary school children[13]. In a study from Sicily, comprising 2097 children who varied in age from 5 to 14, the prevalence of OME was reported as 6.8%[14], while in a

Table III. Results of the Study

Risk factors	No. of children with OME	No. of children without OME	p value
Gender			
Girls	31	459	>0.05
Boys	38	493	
Age			
<9	51	552	<0.05
>9	18	400	
School district			
Low socioeconomic level	40	423	<0.05
High socioeconomic level	29	529	
Family size			
3 or less	3	83	
4-6	41	631	<0.001
7 or more	25	226	
Exposure to smoking			
Yes	58	672	<0.001
No	11	257	
Consanguineous marriage			
Yes	7	108	>0.05
No	62	823	
Breastfeeding duration			
Never	7	59	<0.05
<6 months	32	374	
6-12 months	16	223	>0.05
>12 months	14	246	
Frequent URTI anamnesis			
Yes	23	193	<0.001
No	46	754	
Previous otological complaints			
Yes	22	181	<0.001
No	47	766	
Presence of hearing loss in family members			
Yes	3	43	>0.05
No	66	914	
Parents' educational status			
No schooling	27	302	
Primary school	31	416	<0.05
High school	11	237	

study from Kuwait comprising 893 children of similar age, it was reported as 31.3%[15]. The prevalence rate in our study of a similar age group was 6.8%, consistent with the findings of the Sicilian study.

To the best of our knowledge, the current study is the first to report the prevalence rate of OME in Erzurum. The frequency of OME, which is common among younger schoolchildren, usually decreases with increasing age. In our study, the prevalence of the disease was 8.5% in the 7-9 age group and 4.3% in the 9-12 age group, a statistically significant difference ($p < 0.05$). Previous studies had shown that the prevalence of OME varies among primary school children in Turkey: Ozbilen et al.[17] reported it to be 13.3% (in 698 children aged 6 to 12); Caylan et al.[7], 11.1% (in 1077 children aged 5 to 12); Cuhruk et al.[18], 11.2% (in 1,391 children aged 6 to 12); and Kiris et al.[19], 10.4% (in 2355 children aged 6 to 11). The prevalence rate in the current study was lower than the rates reported in those studies. This is probably due to the absence of children attending kindergarten in our study[20].

Otitis media with effusion may occur due to poor Eustachian tube function or as an inflammatory response following AOM. In the current study, previous acute otitis media and URTI episodes were found to be risk factors (<0.001), which was in accordance with the literature[19]. It is recommended that a child with previous acute otitis media and URTI episodes have regular otorhinolaryngologic examinations. Although most OME episodes resolve spontaneously within 3 months, 30% to 40% of children have recurrent OME, and 5% to 10% of episodes last 1 year or longer[1,2]. The current study indicates the presence of URTIs and a previous history of AOM to be strong risk factors for OME. Therefore, it is necessary to educate teachers and family about the significance of these diseases.

The pathophysiology of OME is multifactorial. In the analysis of the socioeconomic data gathered by the current study, lower socioeconomic level of the community ($p<0.05$), lower parental educational status ($p<0.05$) and greater family size ($p<0.001$) were found to be important risk factors for OME. Environmental factors such as parental smoking ($p<0.001$) and duration of breastfeeding ($p<0.001$) were also found to influence the risk of OME. Most of the risk factors associated with the prevalence of OME in terms of etiology and pathogenesis are modifiable. Their modification represents the logical primary care intervention leading to a decrease in OME prevalence. Therefore, providers should counsel parents to avoid exposing their children to smoking, which can adversely affect their respiratory and otological health, and encourage breastfeeding, which was seen to have a protective role.

The main limitation of the current study was the absence of the children's immunization history in the study questionnaire. *Haemophilus influenzae* and pneumococcal vaccination, which were added to the national immunization schedule as of 2006 and 2008 respectively, have the potential to protect against otitis media. Further screening studies in larger populations are needed to examine the clinical impact of these vaccines.

It should be borne in mind that OME is a serious public health problem. Its high prevalence rate, the difficulties in diagnosis and assessing duration, the increased risk of conductive hearing loss and the potential impact on language and cognition, along with the significant practice variations in its management, make OME an important condition[21]. Furthermore, persistent OME may be associated with physical or behavioral symptoms, including hyperactivity, attention deficit, behavioral problems and reduced quality of life[11,12]. The primary healthcare priorities should be to: i) support strategies that reduce the transmission of bacterial infections to children; ii) encourage timely immunization; iii) advise on effective communication strategies for hearing-impaired children; iv) provide frequent and accurate assessment of middle ear disease in schoolchildren; and v) educate families about the importance of OME[20,22].

Conclusion

The present study reports the prevalence of OME among 7–12-year-old schoolchildren in Erzurum. Local data provide a population-specific standard and can be used in healthcare planning. Additional well-designed, longitudinal studies should be conducted in all regions of Turkey.

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