RISK FACTORS OF OTITIS MEDIA WITH EFFUSION IN CHILDREN: A CASE-CONTROL STUDY

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ABSTRACT

***Background**: Otitis media with effusion (OME) is a common disease, especially in children. **Objective:** To study demographic and clinical characteristics, tympanometry, and risk factors of OME in children. **Materials and methods:** In a case-control study, 35 OME pediatric patients and 35 healthy children whose parents responded to questionnaires designed to capture the history of diseases in the early life of participants, family history of allergy, family socioeconomic status, and home environmental factors. **Results**: In the univariate analysis, there were associations between OME and exposure to smoking at home [odd ratios (OR)=2.97; p=0.029], snoring (OR=3.63; p=0.019), history of acute otitis media (AOM) (OR=7.11; p=0.002), history of upper respiratory tract infections (URTIs) (OR=6.30; p<0.0001). However, only two of them had statistically significant correlations with OME in the multivariate logistic regression model: history of acute otitis media [OR=5.98; 95% confidence interval (CI), 1.25-28.54; p=*0.025*], history of URTI (OR=7.33; 95% CI, 2.04-26.39; p=*0.002*). **Conclusion**: OME is asymptomatic, especially in children. URTI and acute otitis media in early life are closely associated with OME.*

***Keyword*: otitis media with effusion, URTI, acute otitis media, tympanometry**

1. INTRODUCTION

Otitis media with effusion (OME) is defined as a collection of fluid behind the closed eardrum in the middle ear without signs or symptoms (fever, otalgia, irritability) of infection. Furthermore, OME is one of the most common diseases in childhood and, unless treated properly, will cause severe sequelae in the middle ear reducing the function of the eardrum and middle ear. Consequently, these impairments lead to hearing loss, delayed language development, and learning activities. To the best of our knowledge, OME occurs commonly during childhood. Ninety percent of children have at least one episode of OME by 10, especially from 6 months to 4 years of age. OME is usually asymptomatic due to non-aggressive symptoms. Thus, the progress of the disease is latent and easily overlooked on

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examination. Due to the prevalence, complication, and sequelae of OME, understanding the risk factors is essential in prevention and early diagnosis [1]. Daly et al. suggested that the etiology of OME is multifactorial [2]. Many different factors are implicated in the pathophysiology of this disease. The immaturity of the immune system and the eustachian tube dysfunction are considered the main responsible factors for the development of OME. Moreover, upper respiratory tract infections (URTIs), mechanical obstruction of the nasopharyngeal by adenoid hypertrophy or craniofacial malformations, such as cleft palate deformities and Down syndrome are common causes of Eustachian tube dysfunction and thus OME [3]. Although postulated in previous studies, the effects of these factors on the pathogenesis of OME are controversial when comparing the results of previous studies and need to investigate in the future. Thus, this study was conducted aims to evaluate "**Risk factors of otitis media with effusion in children**".

2. MATERIALS AND METHODS

2.1. Material. 58 ears of 35 pediatric patients with OME and 35 healthy children without OME in Hue Medical University Hospital from 05/2019 to 03/2020.

2.2.Methods. An unmatched case-control study.

The criteria for the study included: gender, age, symptoms, tympanic membrane findings, tympanogram, daycare attendance, family size, mother's education, exposure to smoking at home, weight at birth, breastfeeding, history of URTIs, history of acute otitis media (AOM), snoring, atopy, family history of atopy. Study facilities included: otoscopy, endoscopic system, and tympanometry device. The authors identified the case group and control group (asking for medical history and current status, taking the examination and capturing the image of the tympanic membrane, and performing tympanometry). Parents of children and older patients were fully explained and agreed to participate in answering the study questionnaire with informed consent. All statistical analyses used SPSS 20.0 biostatistical software.

3. RESULTS

3.1. Demographic characteristics

Age and gender: The mean age of the case group was 6.01±4.3 years old (range, 1-15 years old). The most common age group was ≤3 years of age, including 16 children (45.7%). The mean age of the control group was 5.69±3.81 years old (range, 1-15 years old). The male-to-female ratio of the case group was 1.69/1 (22 males, 13 females). This ratio of the control group was 1.06/1 (18 males, 17 females). Twenty-three children had OME in both ears (65,7%), and 12 had unilateral ears (8 left ears, 4 right ears).

3.2. Clinical symptoms

Table 3.1. Clinical symptoms

Age group		Clinical symptoms						
		URTIs	Ear rubbing	Hearing loss	Speech delay	Tinnitus	Mood swing	Otalgia
≤6 years	n	20	13	9	6	4	4	2
(22 patients)	%	90.9	59.1	40.9	27.3	18.2	18.2	9.1
>6 years	n	9	1	7	0	10	8	4
(13 patients)	%	69.2	7.7	53.8	0.0	76.9	61.5	30.8
Total	n	29	14	16	6	14	12	6
(35 patients)	%	82.9	40.0	45.7	17.1	45.7	34.3	17.1

In the ≤6 years of age group, the most common symptom was URTIs (90.9%) and ear rubbing (59.1%). The percentage of hearing loss was 40.9%. On the contrary, in the>6 years of age group, who can recognize and communicate well, the most common symptoms were tinnitus (76.9%) and URTIs (69.2%). The percentage of hearing loss was 53.8%.

3.3. Tympanic membrane findings

Table 3.2. Clinical features of the tympanic membrane in OME ear (N=58)

Clinical findings		N	Percentage %
Opaque	No	35	60.3
	Yes	23	39.7
	Total	58	100.0
Air-fluid level	No	22	37.9
	Yes	36	62.1
	Total	58	100.0
Color	White grey	38	65.5
	Amber-colored	20	34.5
	Total	58	100.0
Morphology	Normal	15	25.9
	Contracted	26	44.8
	Flat	6	10.3
	Budging	11	19.0
	Total	58	100.0
Cone of light	Normal	42	72.4
	Less/Lost	16	27.6
	Total	58	100.0

3.4. Tympanogram results

Table 3.3. Type of tympanogram in ears with OME (N=58)

Type	N	Percentage %
Flat	51	87.93
Wide curve	7	12.07
Total	58	100.0

The percentage of flat-type tympanogram was 87.93% (51/58).

Table 3.4. Compliance level in the ears with OME (N=58)

Compliance level	N	Percentage %	Mean (mmHo)
>0,2 mmHo	0	0	0,06±0,07 (0;0.2)
≤0,2 mmHo	58	100.0	
Total	58	100.0	

All the ears had low compliance levels (≤0.2 mmHo). The mean is 0.06±0.07 mmHo, the lowest level was 0 mmHo, and the highest level was 0.2 mmHo.

3.5. The association between risk factors and otitis media with effusion

Table 3.5. Analysis of risk factors for otitis media with effusion: odds ratio (OR), p-value, and 95% confidence interval (95% CI)

Risk factor	No.OME(n=35) Number (%)	OME (n=35) Number (%)	p-value	OR	95% CI
Daycare attendance	20 (57.1)	24 (68.6)	0.332	1.64	0.62-4.35
Family size					
≥5 member	15 (42.9)	13 (37.1)	0.626	0.79	0.30-2.05
<5 member	20 (57.1)	22 (62.9)			
Mother's education					
Low[a]	21 (60.0)	19 (54.3)	0.810	0.89	0.35-2.29
High[b]	14 (40.0)	16 (45.7)			
Exposure to smoking	10 (28.6)	19 (54.3)	0.029*	2.97	1.10-7.99
Weight at birth					
<2500 gram	5 (14.3)	9 (25.7)	0.232	2.08	0.62-6.99
≥2500 gram	30 (85.7)	26 (74.3)			
Breastfeeding					
<6 months	13 (37.1)	17 (48.6)	0.334	1.60	0.62-4.15
≥6 months	22 (62.9)	18 (51.4)			
History of URTIs					
≥3 times	9 (25.7)	11 (31.4)	<0.0001*	6.30	2.23-17.85
<3 times	26 (74.3)	24 (68.6)			
History of AOM	3 (8.6)	14 (40.0)	0.002*	7.11	1.82-27.79
Snoring	6 (17.1)	15 (42.9)	0.019*	3.63	1.20-10.94
Atopy	3 (8.6)	7 (20.0)	0.172	2.67	0.63-11.31

**statistically significant*

[a]illiterate, primary or secondary school [b]high school, college, or university education

Statistics showed a significant association between OME and exposure to smoking, history of URTIs, history of AOM, and snoring.

3.6. Investigate risk factors related to otitis media with effusion according to the multivariate logistic regression model

Table 3.6. Multivariate logistic regression analysis for predicting OME

Risk factor	Coefficient	Standard error	Odds ratio (95%CI)	p-value
Exposure to smoking	1.177	0.661	3.25 (0.89-11.86)	0.75
History of URTIs	1.992	0.654	7.33 (2.04-26.40)	0.002
History of AOM	1.789	0.797	5.98 (1.25-28.54)	0.025
Snoring	1.196	0.706	3.31 (0.83-13.18)	0.09
Atopy	1.561	0.963	4.77 (0.72-31.49)	0.105

Children with a history of AOM and URTIs had high odds of developing OME by 6 and 7.3, respectively.

4. DISCUSSION

4.1. Demographic characteristics

In our study, the mean age of the case group was 6.01±4.3. We found that the ages of 0-3 years accounted for 45.7% of OME. As age gets older, the incidence rate of OME decreases. According to the anatomical alteration of the eustachian tube, its anatomical orientation gradually changes its angle from horizontal to vertical with age. Moreover, as the child grows, the immune system gets stronger by exposure to many allergens. Our results were similar to the outcomes of previous studies [4], [5]. Our study showed a higher percentage of OME in males. However, Humaid et al. and Kiris et al. reported no statistically significant difference between genders in the prevalence of OME [3], [6].

4.2. Clinical symptoms

In Table 3.1, amongst the group of age ≤6 years old, the most common symptoms were URTIs (90.9%) and ear rubbing (59.1%). Patients in the >6 years of age group could recognize and communicate well. Then, the most common symptoms were tinnitus (76.9%), followed by URTIs (69.2%), mood swing (61.5%), and hearing loss (53.8%). The hearing loss in our study was usually mild, indicating that children can hear when asking loudly. In an observational study of children with OME and adenoiditis, the most common symptom is nasal obstruction and rhinorrhea (65,8%), tinnitus (52.6%), hearing loss (28.9%), speech delay (0.8%) [4].

4.3. Tympanic membrane findings

The contracted eardrum was observed during examination in 26 (44.8%) ears, amber-colored eardrum and air-fluid level were noticed in 20 (34.5%) and 36 (62.1%) ears, respectively. Opaque was found in 23 (39.7%) ears (Table 3.2). Gultekin et al. studied 219 ears of 152 children with OME, which had 112 air-fluid levels, 65 had bubbles in the middle ear, and 30 myringosclerosis [7].

4.4. Tympanogram results

Tympanometry showed flat type in 51 (87,93%) ears, corresponding to type B (Table 3.3). In Gultekin's study, all of the children had type B tympanogram [7]. Furthermore, in Martines's study, type B tympanometry was noted in 64.88% [8]. All the ear have low compliance levels (≤0.2 mmHo), mean was 0.06±0,07 mmHo (Table 3.4). Tympanometry is the objective method to evaluate the middle ear functions even in younger patients. However, we have to remove the factors causing false positive such as tympanic membrane perforation or ear wax.

4.5. The association between risk factors and otitis media with effusion

To date, it has been reported that the lower the socioeconomic status is, the higher the OME prevalence is [6], [7]. On the other hand, several studies found no relationship between socioeconomic status and OME [5], [8]. Our findings did not demonstrate any correlation between

daycare attendance (p=0.332), family size (p=0.626), mother's education (p=0.810) and OME. One of the most observed risk factors of OME is exposure to smoking at home. In our study, 54.3% of children with OME had exposed to cigarette smoke at home compared to 28.6% of normal children, and this was statistically significant (p=0.029). These findings were similar to the results of Gultekin's study [7]. Most epidemiologic studies did not identify the gestation period or birth weight as significant factors for OME [3], [8]. We also did not find weight of birth <2500gram as a risk factor for OME in children (OR=2.08; 95% CI, 0.62-6.99; p=0.232). According to our results, children with OME had a higher proportion of breastfeeding <6 months than those without OME (54.3% and 28.6%). Nevertheless, we did not find a significant relationship between OME and breastfeeding (OR=1.60; 95%CI, 0.62-4.15; p=0.334). Our results were similar to those done by Lee et al. and Humaid et al. [5], [6]. The 'Panel report from the Ninth International Research Conference on Otitis Media' suggested that OME is frequently a complication of URTI, history of acute tonsillitis, AOM; overall conditions may have common pathways, such as increased host susceptibility in the respiratory tract [2]. Our results confirmed data literature showing that children who had previous URTI or AOM might consequently have OME [8]. In our study, 86.6% of children with OME had history URTIs (>3 times) compared to 25.7% in normal children (p<0.0001). In the multivariate regression model, we found that the history of URTIs was a high-risk factor of OME (OR=7.33; 95% CI, 2.04-26.40; p=0.002). Our results displayed that 40.0% of children with OME had a history of AOM compared to 8.6% in normal children (p=0.002). In the multivariate regression model, we found that history AOM was a high-risk factor of OME (OR=5.98; 95% CI, 1.25-28.54; p=0.025). Kiris et al., Martines et al., and Quach's study similarly found that children with a history of URTIs or AOM are more likely to have OME [3], [8], [9]. Snoring, whether due to rhinitis or large adenoids, is more common in children with chronic ear problems. In our study, Snoring was reported in 42.9% of children with OME compared to 17.1% of normal children (OR=3.63; 95% CI, 1.20-10.94; p=0.019). Kiris et al. and Humaid et al. reported the relationship between these symptoms as risk factors associated with OME [3], [6]. This study did not find a significant relationship between OME and atopy (OR=2.67; 95% CI, 0.63-11.31; p=0.172). In the multivariate regression model, we did not find atopy to be a predictor of OME (p=0.105) either. Irreversibly, Kiris et al. and Quach's study found a significant association between atopy and OME prevalence [3], [9].

5. CONCLUSION

Otitis media with effusion is a common disease in childhood; common

causes are URTI and AOM. The symptoms in the ear are silent and difficult to detect in children. Tympanometry plays a major role in diagnosing and objectively evaluating middle ear status. Detecting preventable risk factors in developing OME and alerting the parents will avoid common utilization of health care and complications of the disease.

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