



Research Paper

Prevalence and associated risk factors of recurrent otitis media with effusion in children in Upper Egypt

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Received 12 April 2020; received in revised form 2 August 2020; accepted 30 August 2020

Available online 19 September 2020

KEYWORDS

Otitis media with effusion;
Children;
Risk;
Prevalence;
Recurrent

Abstract *Objective:* We conducted this study to determine the associations of possible risk factors and prevalence of recurrent otitis media with effusion (OME) in a cohort of children in Upper Egypt.

Methods: This was a cross-sectional study undertaken in two tertiary referral centers in Upper Egypt. Associations of possible risk factors with prevalence of recurrent OME were studied. Multi-factor logistic regression analysis was done to recognize the statistically significant risk factors associated with recurrent OME.

Results: We collected the data of 2003 pediatric patients, of which 1016 were males (50.7%). A total number of 310 children have OME, including 159 males (51.3%). The prevalence rate of OME in our cohort was 15.5%. Multi-factor logistic regression analysis of the risk factors related to recurrent OME showed it was strongly associated with adenoid hypertrophy ($P < 0.0001$), tonsil hypertrophy ($P < 0.0001$), sinusitis ($P < 0.0001$), posterior nostril polyps ($P = 0.009$), allergic rhinitis ($P < 0.0001$), recurrent URTIs ($P = 0.029$) and gastroesophageal reflux ($P = 0.031$).

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Peer review under responsibility of Chinese Medical Association.



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Conclusions: Our study showed that recurrent OME in children in Upper Egypt is a common multifactorial problem, especially in young age. In our locality, allergic rhinitis, recurrent upper respiratory tract infections, gastroesophageal reflux, adenoid and tonsil hypertrophy were the most important associated factors related to the etiopathogenesis of OME.

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Introduction

Otitis media with effusion (OME) is a highly prevalent disease in young children under six years and one of the most significant causes of hearing loss in children. OME is a chronic inflammatory condition that is characterized by a non-suppurative effusion which may be serous or mucoid. Most of the clinical episodes are spontaneously resolved within a few months. However, a considerable number (40%) of children with OME show recurrence.^{1,2} The exact etiopathogenesis of the middle ear infection and effusion is still unknown; however, researchers believe that it is related to a variety of virulence factors. These factors include environmental, genetic, demographic, and other diseases like adenoid hypertrophy, cleft palate, allergic disorders, and asthma.³ Reviewing the risk factors for OME is important as it gives a clue for the understanding of the etiopathogenesis and disease nature, which is an essential step for early detection of high-risk children, who should receive the priority in primary prevention and proper treatment policies.¹ Researches on the factors of OME often give inconsistent results, possibly because of methodological inadequacies, e.g., different sample sizes, invalid statistical analyses, and deficiency of correction for interdependencies among risk factors. Therefore, we conducted this study to determine the associations of possible risk factors and the prevalence of recurrent OME in a cohort of children in Upper Egypt.

Materials and methods

Study design

This was a cross-sectional study undertaken in two tertiary referral centers in Upper Egypt: Assiut and Al-Azhar universities hospitals, Egypt. Written informed consents of parents of all children were taken after explanation of the study objectives. Faculty of Medicine, Assiut University Ethical Committee approved the study protocol.

Patients

All children under 18 years referred with ear problems to our tertiary Hospitals, Assiut, Egypt, from 2007 to 2017, constituted the study population. The diagnosis of OME was made by a senior ENT consultant. All participants are subjected to thorough clinical history, ENT examinations with video otoscopy, otomicroscopy, nasal endoscopy, pure tone audiometry, and tympanometry. Diagnosis of OME was established by type B tympanogram, and the presence of

air bubbles or fluid behind the drum and any retraction suggested OME by otomicroscopic examination. Initially, all patients with the first episode of OME received a tympanostomy tube either bilaterally or unilaterally. Clinical follow-up appointments were arranged for ten days post-operative, and every three months for two years. In every visit, otomicroscopy was done for evaluation of the patency or extrusion of tubes and the existence of recurrent OME. Children were diagnosed with recurrent OME at audiology units if the patient has manifestations of OME six months after the spontaneous extrusion of tympanostomy tubes.² Data from all patients were obtained by the authors including; age, sex, birth history, type of infant feeding, presence of passive smoking by the parents, presence of any ENT complaints of the patients (snoring, otalgia, otorrhea, hearing loss) in past history, presence of recurrent upper respiratory tract infections (URTIs), previous ENT operations, e.g., tonsillectomy, adenoidectomy and the presence of a family history of atopy and ear disease. We excluded any patient with noise exposure and ototoxic drug history, Down's syndrome, head trauma, craniofacial malformation, congenital hearing loss, immune deficiency disorders, immotile cilia syndrome, and chronic kidney and liver diseases.

Statistical analysis

We used SPSS (version 21, Inc., Chicago, IL, USA) for analysis of patients' data. Categorical data are presented as proportions and continuous data as means \pm SD (standard deviations). We used the chi-square test to compare the proportions of categorical variables. Finally, a multi-factor logistic regression analysis was done to recognize the statistically significant risk factors associated with recurrent OME.

Results

We collected the data of 2003 pediatric patients, of which 1016 were males (50.7%). A total number of 310 children have OME, including 159 males (51.3%). Three hundred four patients have bilateral OME, and only six patients (2%) have unilateral disease. All subjects were assessed for eligibility for tympanostomy tube placement, of which 217 patients were eligible for bilateral grommets and 93 for unilateral tube placement. The prevalence rate of OME in our cohort was 15.5% (310/2003). The age ranged from 1 to 17 years (mean = 7.13 ± 1.30 years). One hundred sixty patients were less than six years, and 150 were from 6 to 17 years (Table 1). Children with recurrent OME were 112 cases,

including 59 males and 53 females, with no statistically significant difference between both sexes. All patients with recurrence OME have bilateral disease except one patient with recurrence on the same ear.

Table 2 shows a comparison of the associated factors in children with recurrent OME in different age groups. Adenoid hypertrophy ($P < 0.05$), tonsil hypertrophy ($P = 0.03$), and recurrent URTIs ($P < 0.01$) were significantly higher in the lower age group (≤ 6 years), with no significant differences in other factors, e.g., family history of atopy and ear diseases and passive smoking. Table 3 shows the multi-factor logistic regression analysis of the factors related to recurrent OME. Adenoid hypertrophy ($P < 0.0001$, 95% $CI = 6.03$ – 53.17), tonsil hypertrophy ($P < 0.0001$, 95% $CI = 3.80$ – 34.06), sinusitis ($P < 0.0001$, 95% $CI = 2.67$ – 47.99), posterior nostril polyps ($P = 0.009$, 95% $CI = 1.58$ – 6.77), allergic rhinitis ($P < 0.0001$, 95% $CI = 7.32$ – 49.85), recurrent URTIs ($P = 0.029$, 95% $CI = 1.87$ – 39.88) and gastroesophageal reflux ($P = 0.031$, 95% $CI = 1.80$ – 5.01), have significant effects on the recurrence of OME. Besides, the younger age is also one of the associated risk factors for OME recurrence. Our results did not reveal any significant effect of the duration of breast-feeding and recurrent OME ($P = 0.51$). However, children who were never breastfed had a higher risk for OME recurrence ($P < 0.001$, Table 3). Family history of

atopy ($P = 0.88$), passive smoking history ($P = 0.73$), gender ($P = 0.63$), family history of ear disease ($P = 0.70$), and history of adenoidectomy ($P = 0.18$) have no significant effect on the recurrence of OME.

Discussion

The etiopathogenesis of OME in children is partly understood. OME seems to be a multifactorial disease that could result from a diversity of predisposing factors, e.g., inflammation, effusion, and tissue hyperplasia. The interaction of these risk factors with mucosal hyperplasia and mucus overproduction contributed to the development and persistence of OME.^{3,4} However, the exact etiopathogenesis of OME seems to be more complicated and needs more researches. OME is more prevalent among young children.^{3,4} The prevalence ranged from 10% to 17% in children less than six years and decreased to 3%–4% in older children.^{4–6} About 90% of children had at least one episode of OME by the age of four years.⁵ Our results showed that the younger the child, the higher the recurrence rate of OME ($P = 0.024$, $OR = 0.45$, 95% $CI = 0.17$ – 0.85 , Table 3), this may be related to the anatomical criteria of the eustachian tube in younger age, which is short and flat, with an acute angle to the horizontal plane with a large lumen, and a wide isthmus. All these factors predispose to OME.^{1,2}

In our study, we found no significant association between genders in the prevalence of OME ($OR = 1.02$, 95% $CI = 0.43$ – 3.68). Our data are in line with previous studies.^{1,6}

Table 1 Comparison of the proportion of children with recurrent and non-recurrent OME in different age groups [case (%)].

Age groups	Total number	Recurrent groups		Sex	
		Recurrent OME	Non-recurrent OME	Male	Female
≤ 6 years	160	71 (44.4%)	89 (55.6%)	81	79
6–17 years	150	41 (27.3%)	109 (72.7%)	78	72
<i>P</i> value		0.002	0.001	0.44	

Table 2 Comparison of the associated risk factors in children with recurrent OME in different age groups [case (%)].

Risk factor	≤ 6 years	6–17 years	<i>P</i> value
	(<i>n</i> = 71)	(<i>n</i> = 41)	
Allergic rhinitis	44 (61.9%)	29 (70.7%)	0.36
Adenoid hypertrophy	55 (77.4%)	18 (43.9%)	<0.05
Tonsil hypertrophy	34 (47.8%)	10 (24.4%)	0.03
Gastroesophageal reflux	41 (57.7%)	25 (60.9%)	0.46
Recurrent upper respiratory tract infection	44 (61.9%)	12 (29.2%)	<0.01
Sinusitis	43 (60.6%)	29 (70.7%)	0.65
Nasal polyp	41 (57.7%)	27 (65.8%)	0.44
Passive smoking history	11 (15.5%)	7 (17%)	0.71
Family history of atopy	12 (16.9%)	8 (19.5%)	0.29
Family history of ear diseases	14 (19.7%)	9 (21.9%)	0.40

Table 3 Multi-factor logistic regression analysis of the associated risk factors for recurrent OME.

Risk factor	β	<i>OR</i>	95% <i>CI</i>	<i>P</i> value
Age				
≤ 6 years	0.70	0.45	0.17–0.85	0.024
6–17 years	0.16	1.85	0.61–2.73	0.79
Gender				
	0.78	1.02	0.43–3.68	0.63
Allergic rhinitis	2.42	14.27	7.32–49.85	<0.0001
Adenoid hypertrophy	2.35	15.85	6.03–53.17	<0.0001
Tonsil hypertrophy	2.78	7.87	3.80–34.06	<0.0001
Gastroesophageal reflux	1.08	3.22	1.80–5.01	0.031
Recurrent upper respiratory tract infection	1.20	7.21	1.87–39.88	0.029
Sinusitis	1.41	10.77	2.67–47.99	<0.0001
Nasal polyp	1.11	7.55	1.58–6.77	0.009
Adenoidectomy	0.53	1.08	0.64–1.84	0.18
Breast feeding				
Never	1.03	2.89	2.14–3.89	<0.001
Breast feeding (6–12 months)	0.41	0.80	0.38–1.67	0.51
Passive smoking history	0.17	1.71	0.48–3.19	0.73
Family history of atopy	0.22	0.83	0.20–1.99	0.88
Family history of ear disease	0.51	1.02	0.18–4.66	0.70

In these studies, sex was not recognized as a good predictor of OME in pediatric patients. Tos⁵ reported that sex difference in OME denotes mostly the impact of cultural factors.

In our study, we found that adenoid hypertrophy, recurrent URTIs, and allergic rhinitis were the most important predisposing factors for OME (Table 2). In line with our findings, previous studies reported that chronic tonsillitis, adenoid hypertrophy, rhinosinusitis, and recurrent URTIs were the most common predisposing factors for OME.^{1,4,6}

Previous studies have demonstrated a potential role of atopic disorders in the etiopathogenesis of OME in children.^{1,6,7} Scientists have reported that among the atopic diseases, the prevalence of allergic rhinitis was significantly higher in patients with OME.^{4,7} Current epidemiological studies supported the evidence for a positive association between OME and atopic diseases, particularly allergic rhinitis.⁴ Roditi et al⁸ used data of nearly 1.5 billion pediatric visits from the National Hospital Ambulatory Medical Care Survey and the National Ambulatory Medical Care Survey from 2005 to 2010. They found a significant association between allergic rhinitis and OME in children older than six years; however, there was no association in children less than six years.⁸ Previous researches reported that children who suffered from atopic respiratory disorders were more vulnerable to adenotonsillar hypertrophy and inflammatory changes in Eustachian tube and middle ear mucous membranes, so this increase the development and persistence of middle ear effusion.⁹ The previous data were in line with our study, as allergic rhinitis was one of the significant risk factors for recurrent OME. Commonly, the manifestations of childhood rhinitis are neglected or underestimated by the caregivers, which predispose to mucosal edema and OME with a long duration with a high rate of recurrence.⁴

In our study, 65% of patients with recurrent OME had allergic rhinitis with no significant difference in both age groups ($P = 0.36$, Table 2). Previous studies,^{1,4,6} reinforced the presence of a significant association between OME in children and allergic disorders and concluded that atopy is a significant risk factor for the development of OME.

In our study, we found that gastroesophageal reflux is risk factor for OME ($P = 0.031$, $OR = 3.22$, $95\% CI = 1.80-5.01$). Miura et al¹⁰ supported our findings in a systematic review. They reported that OME patients had a significantly higher incidence of gastroesophageal reflux. They attributed this strong association to pepsin aspiration in airways, which resulted in exaggerated inflammatory reactions and hence effusion in the middle ear.¹⁰

Exposure of children with OME to passive smoking at home is one of the previously studied risk factors of OME.⁶ The rate of passive smoking in our patients was unpredictably low (15.5%). In our study, we failed to find any significant association between OME and exposure to passive smoking ($P = 0.73$, $OR = 1.71$, $95\% CI = 0.48-3.19$). The same findings were reported previously by Martines et al,¹ and Straetemans et al.² In contrast to our results, researchers have reported a statistically significant relationship between passive smoke exposure and OME.⁶ The valuable roles of breast-feeding are entirely accepted; previous investigations have shown numerous benefits of breast-feeding in reducing respiratory and GIT infections.¹¹ However, the beneficial

effect of breast-feeding on OME is still debatable; our findings did not show any effect of the duration of breast-feeding and recurrent OME. Though, children who were never breastfed had a higher risk for OME recurrence. Few studies showed a positive effect of breast-feeding on OME; however, others found no association between OME and breast-feeding.^{6,11-13}

Conclusion

The prevalence rate of OME in our cohort was 15.5%. Our study showed that recurrent OME in children in Upper Egypt is a common multifactorial problem, especially at young age. In our locality, allergic rhinitis, recurrent upper respiratory tract infections, gastroesophageal reflux, adenoid, and tonsil hypertrophy were the most important associated factors related to the etiopathogenesis of OME. As most of these factors are either treatable or at least modifiable, the treatment and modifications of these factors are a vital step in the primary prevention of OME and its complications. In addition, the epidemiological results of our study can improve the knowledge of parents, pediatricians, otolaryngologists, and primary healthcare providers about the detailed associated factors for the development of OME in children. Furthermore, it should be necessary for the implementation of guidelines for avoiding these risk factors, especially in children younger than six years.

Author contributions

Conceptualization of research and follow up of patients and final edition of the paper: Abobakr Abdelmoghny and Khaled Saad. Methodology and data curation and analysis: Yasser F. Abdel-Raheem and Eman Fathalla Gad. Writing, review & editing of the paper: Amira Elhoufey.

Declaration of competing interest

The authors have no conflict of interest to declare.

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Edited by Xin Jin