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Risk factors for otitis media with effusion: Case–control study in Sicilian schoolchildren

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ABSTRACT

Objective: To identify the prevalence and demographic, maternal and child risk factors for otitis media with effusion (OME) in Sicilian schoolchildren and analyse the results with reference to the review of the literature.

Methods: Associations of possible risk factors with prevalence of otitis media with effusion (OME) were studied in a cohort of 2097 children, aged 5–14 years. In order to determine OME, otoscopy and tympanometry were performed at 3-monthly intervals beginning at term date. Sixteen epidemiologically relevant features were inventoried by means of standardized questionnaires and skin tests were performed. Univariate analysis was performed to examine the association between determinants and occurrence of OME; multivariate logistic regression analysis was made to investigate the joint effect of atopy and other determinants on OME.

Results: Prevalence of OME resulted 6.8% (143/2097) and it was most strongly associated with atopy ($P < 0.0001$; *or* = 12.67; 95% CI = 8.78–18.27). Other factors significantly associated with the prevalence of OME were snoring ($P < 0.0001$), previous history of acute otitis media ($P < 0.001$) and of recurrent URTIs ($P < 0.0001$), mother's no schooling ($P = 0.01$) and no breastfeed ($P = 0.05$). No significance was found for school type, economic status of the family, family size, family history of presence of allergy and of ear disease, mother's work status, smoking parents and birth history. Moreover on multivariate logistic regression analysis it resulted that age, positive URTI's history and smoking exposure were found to be significant ($P < 0.0001$).

Conclusions: OME during infancy is a common and multifactorial disease; as most of the risk factors associated with its etiology and pathogenesis, are modifiable, their modification should represent the reasonable primary care intervention leading to a decrease in OME prevalence.

1. Introduction

Otitis media with effusion (OME) is characterized by the collection of serous or mucous fluid behind an intact tympanic membrane cavity during an inflammatory process and the lack of acute signs and symptoms of infection. It leads to a reduction of the tympanic membrane mobility and a conductive hearing loss. When inadequately treated or left untreated, it may lead sequelae and complications, consisting in retraction pockets, tympanosclerosis, adhesive otitis media, permanent hearing loss and impairment in development of speech and language [1–4].

The importance of this disease for the public health comes from its tendency to follow a silent course in fact in ~40–50% of cases of OME, neither the affected children nor their parents or caregivers describe significant complaints referable to a middle-ear effusion [5].

For these reasons recently researchers have conducted studies to reinforce and support past knowledge of OME that, with its prevalence range (from 6 to 64%), remains one of the common health problems seen in children [6–10].

The 'Panel report from the Ninth International Research Conference on Otitis Media' suggests that the etiology of OME is multifactorial and many different factors are implicated in the pathophysiology of this disease [11].

The immaturity of function of both the immune system and the eustachian tube dysfunction are considered the main responsible factor for the development of OME; also upper respiratory tract infections (URTIs), mechanical obstruction of the nasopharyngeal

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by adenoid hypertrophy or craniofacial malformations, such as cleft palate deformities and Down syndrome are common causes of Eustachian tube dysfunction and thus OME [2,12,13].

Thus, OME is a topic for concern, which requires prevention and treatment; in particular the recognition of all risk factors for OME represents certainly the crucial value to the physicians in the clinical management of patients. Frequent discussion topics are the associations with demographic factors, socioeconomic class, passive smoking, bottle-feeding, allergy, sex, tonsillitis, acute otitis media (AOM) and family history of otitis media [6,8,14–20]. Even if risk indicators for OME have been widely studied in western countries, modern literature regarding risk factors for OME in Sicily children is however lacking.

The aim of this study, carried out primary school children aged 5–14 in Western Sicily, was to value the prevalence of OME and to examine the demographic, maternal and child risk factors associated with OME comparing the results with literature data.

2. Materials and methods

This study was carried out in Department of Audiology, University of Palermo, examining all the children of primary schools in the District of Sciacca from September 2006 to June 2007; the subject group consisted of 2132 children, 948 male and 1184 female, ranging from 5 to 14 years of age and attending all District's primary schools. After ethical Committee approval, the study protocol was fully explained to patients or their guardians, and written informed consent was obtained from each patient. Out of 2132 parents, 2097 accepted to participate in this study (98.35% response rate).

Data for each child were collected using a specific questionnaire answered by the parents about the age, gender, school type (public school; private school), number of people in the household (3 or less; 4–5; 6 or more), educational status of the parents (no schooling; low; high school; university), economic status (low; medium; high) and mother's work status (housewife; working), presence of smoking parents, children's birth history, the duration of breastfeeding (never; <4 months; 5–9 months; >9 months), presence of snoring, otologic complaints of the child (otalgia, hearing loss and otorrhea) in the previous year, presence of recurrent URTIs and/or chronic disease, previous ENT operations including adenoidectomy, tonsillectomy, myringotomy and VT insertion, presence of allergy and of ear disease in another member of the family.

At the time of the first screen, the children underwent pneumatic otoscopy and skin tests. These were performed using skin prick tests for 12 common perennial and seasonal allergens: Alternaria, Aspergillus, Cladosporium, Penicillium, ragweed, grass mix, trees mix, cockroach, dust mites, *Dermatophagoides farinae* and *Dermatophagoides pteronyssinus*, and cat and dog epithelium. Solutions of histamine and saline were used as positive and negative controls, respectively. The results were evaluated after 10 min. Wheals ≥3 mm in diameter than wheals at the site of the negative control were considered positive. As for otoscopic examination when abnormalities suggestive of OME, which included presence of retracted tympanic membranes, presence of fluid level, bubbles, hypervascularity, were noted, tympanogram and ipsilateral acoustic reflex were performed.

The instrument used was a tympanometry machine, model Amplaid 766, with a probe frequency of 220 Hz and an air pressure range of −400 to −100 mm H_2O with automatic recording. 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 peak identification). For ipsilateral acoustic reflex the same machine was used: an Amplaid 766, with a signal of 105 dB HTL and pure tone stimulus at 1000 and 2000 Hz.

Children with otoscopic appearance of OME and abnormal tympanogram (type B or C with no stapedial reflex) were regarded as positive screens and given a follow-up appointment within 3 months after the initial screening.

The criteria for diagnosis of OME in the study were as follows: documented persistent middle ear effusion by otoscopic examination for a minimum of 3 months; presence of B or C tympanograms; absence of ipsilateral acoustic reflex and a conductive hearing loss greater than 25 dB at any one of the frequencies from 250 Hz through 4 kHz.

Overall cases and controls were subsequently included in the case–control study to establish the role of various risk factors for OME.

Statistical analysis was performed using the Matlab® computer programme. To examine the association between determinants and occurrence of OME we applied a logistic regression analysis between binary data, calculating the partial logistic regression coefficient *b*, the logistic odds ratio (*or*) and its 95% confidence intervals. We also performed the multivariate logistic regression analysis to investigate the joint effect of atopy and other determinants on OME; this step was also studied with the Mantel Haenszel analysis for the global odds ratio (G.*or*).

3. Results

The age of 2097 children examined ranged from 5 to 14, with a mean age of 9.9 years (9.68 for male and 10.07 for female). Of the children, 932 (44.4%) were boys and 1165 (55.6%) were girls.

A total number of 143 children were diagnosed with persistent OME (≥3 months) for a total of 225 ears (82 cases with bilateral OME). The overall prevalence rate of OME was 6.8%; 12.9% between the age of 5 and 6; 9.2% between the age of 7 and 8; 6.4% between the age of 9 and 10; 5.2% between the age 11 and 12 and 3% between the age of 13 and 14. It resulted a slight significant relation between OME and age ($P < 0.001$).

The 64.88% of the ears had B tympanogram with negative reflex test while the others (35.12%) had C tympanogram with negative reflex test; the mean air conduction pure tone, according to diagnosis at frequencies 500 Hz to 4 kHz, resulted 30.1 dB HL.

Of children with OME, 43 were boys and 100 were girls with a statistical significant difference between the groups ($P < 0.001$) (Table 1). The 15.3% of cases, corresponding to 321 children, had positive skin tests for inhalant and food allergens; of these the 50.2% had positive skin tests for both inhalant and food allergens, the 37.4% had a positive test only for food allergy and the 12.4% had an allergy only against inhalant allergens. Of the 321 children with allergy, 90 (28.04%) had OME, whereas 62.9% of children with OME (90/143), had allergy; it clearly evidenced a strong correlation of atopy and OME (*or* = 12.67; 95% CI = 8.78–18.27).

The children were also studied according to their school type (public and private); from the univariant analysis there was no difference in the prevalence of OME between public and private school attendants. The prevalence rate in fact resulted 6.40% (79/1234) and 7.42% (64/863) respectively for public and private school ($P = 0.3646$).

Among the other variables examined in the univariate analysis, the economic status of the families, the family size and the mother's working status did not influence the OME prevalence in our study. However, as to parent's education, the children of mothers "with any education level" were found to have considerably lower OME prevalence than the children whose mothers were "illiterates" (13.70% versus 6.70%; $P = 0.0176$).

The univariant analysis showed a non statistically significant correlation between smoking exposure and OME ($P = 0.7571$) with an OME prevalence respectively of 7.53% (51/723) and 6.69% (92/1374) for children with parents smoking in the home