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Prevalence of otitis media with effusion in children with allergic rhinitis, a cross sectional study

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ABSTRACT

Objectives: Otitis media with effusion (OME) may be caused by various factors including Eustachian tube dysfunction, inflammatory response as well as atopy. Allergic rhinitis (AR), a common chronic disorder in children, is associated with swelling of the mucosa and can therefore result in Eustachian tube dysfunction. This study aims to compare the prevalence of OME in subjects with and without AR.
Method: Children aged 4–12 were recruited from the clinics at Kwong Wah Hospital, Hong Kong. Subjects recruited were interviewed and a questionnaire filled in regarding nasal obstruction, rhinorrhea, sneezing, itching of the nose and/or post nasal discharge (ARIR document). The children were then examined by a doctor using a pneumatic otoscopy and a portable tympanometer. Children found to have OME were offered a follow-up visit 3 months later.
Results: 12 out of 159 (7.5%) of the AR group were found to have OME compared with 3 out of 185 (1.6%) in the non-AR group, $p = 0.016$. During the 2nd visit at 3 months, 85.7% of the AR subjects showed resolution of their OME.
Conclusions: Our data showed a significant difference in the prevalence of OME between AR and non-AR subjects. Of the 185 non AR subjects (Control group), 3 was found to have OME, suggesting a point prevalence of OME of 1.6% in the community in Hong Kong. OME is more likely to occur in children with allergic rhinitis and it may be wiser to manage OME in these individuals differently.

1. Introduction

Allergic rhinitis (AR) is the most common chronic illness in children. Its prevalence in Hong Kong ranged from 38.9% to 42.4% [1]. AR is associated with swelling of nasal mucosa, therefore resulting in Eustachian tube dysfunction and subsequently otitis media with effusion (OME). OME is defined by the presence of a non-purulent fluid in the middle ear without signs or symptoms of an acute ear infection [2]. The etiology of OME is multifactorial which maybe due to a combination of Eustachian tube dysfunction [3], inflammatory response as well as atopy. Following an acute infection or secondary to allergic reactions, increased fluid secretion from inflamed middle ear mucosa produces effusion. It is likely that allergy plays a role in the development of middle ear disease [4–6]. Atopic children may be more susceptible to acute otitis media (AOM) as well as OME, which is often clinically silent [4,6]. The point prevalence of OME was found to be 5.3% in Hong Kong children [7] and 6.67% in China [8] which seems to be lower compared with western countries, prevalence of OME among children in Denmark is 9% [7]. It is estimated that as much as 90% of children will have OME at some time before school age, the majority of the cases occurring between 6 months and 4 years of age. In the first year of life, >50% of children experience OME, increasing to >60% by 2 years. Many episodes resolve spontaneously within 3 months, but ~30 to 40% of children have recurrent OME, and 5–10% of episodes last 1 year or longer [9].

Tomonaga et al. [4] found a high incidence (21%) of OME in those with AR ($N = 605$) in a group of kindergarten and elementary school children. They concluded that AR affects Eustachian tube function and increases the risk of OME. Nasal antigen challenge in children with AR resulted in Eustachian tube dysfunction, development of a negative middle ear pressure change which in turn may promote the accumulation of middle ear fluid by transudation. The accumulated fluid combined with Eustachian tube dysfunction causes OME.

Wright et al. [10] compared middle ear mucosa biopsy taken from subjects with persistent OME. The study found increased

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expression of allergy associated inflammatory cells (CD3) and cytokines (interleukin-5) on the mucosa of specimens from atopic subjects compared to control. This suggested a relationship between allergy and inflammation in the middle ear. Similarly, Hurst et al. [11] found extensive activation of mast cells and its mediator tryptase in a majority of the ears from subjects with chronic effusion. These Th-2 driven immune response suggested inflammation that are allergic in nature [11].

Using myringotomy as the gold standard for the diagnosis of OME the Agency for Healthcare Research and Quality (AHRQ) evidence reported that pneumatic otoscopy had the best sensitivity (94%) and specificity (80%). However, in practice, its accuracy is dependent on the training and experience of the clinician [12]. Tympanometry, which is reliable for infants 4 months or older, may provide additional diagnostic accuracy when used in conjunction with pneumatic otoscope.

The current study was carried out in a convenient sample of children attending the pediatric respiratory out patient clinic in Kwong Wah Hospital in Hong Kong. The prevalence of OME in AR and non-AR subjects is documented by an abnormal pneumatic otoscopy examination and tympanogram in the clinic.

2. Methods

2.1. Subjects

The study was conducted in Kwong Wah Hospital, Hong Kong from December 2007 to November 2008. AR subjects were recruited from the respiratory out-patient clinic and children between 4 and 12 years of age were invited for entry into the study. Children who have had a recent upper respiratory tract infection within the preceding two weeks and patients with signs and symptoms suggestive of acute otitis media were excluded. In addition subjects with craniofacial malformations such as cleft palate, Downs Syndrome, past history of ear, nose and throat surgery, those with significant ear wax occlusion or structural defects were also excluded.

Subjects who fulfilled the inclusion criteria were enrolled by the study investigators on a consecutive basis after omitting subjects as per the exclusion criteria. Non-AR subjects were recruited from the Special Assessment Clinic for children exposed to melamine tainted milk products. This is a clinic run by the Hospital Authority in 2008 for normal Hong Kong children in light of the melamine tainted milk incident.

The study protocol was reviewed and approved by the Clinical Research Ethics Committee, Kowloon West Cluster, Hospital Authority, Hong Kong [Protocol number: KW/FR/09-003]. The research was fully explained to patients or their guardians and informed consent was obtained. A leaflet with details on the study, available in Chinese or English, was handed out. After recruitment, a focused history will be taken to explore any recent upper respiratory tract infection, ear infection, family history of atopy as well as looking at environmental factors such as smoking. The subjects were then examined by a doctor using a pneumatic otoscopy to see if there are any signs of ear infection or OME. The ear movement and air pressure in the middle ear were tested using portable tympanometry.

Recruited subjects were divided into AR group and non AR group (control). Based on the existing data on the incidence of OME in normal and AR patients, 84 subjects in each group are required to achieve 80% power, allowing a type 2 error of 20%.

2.2. Allergic rhinitis

Allergic rhinitis is clinically defined as symptomatic disorder of the nose characterized by nasal obstruction, rhinorrhea, sneezing, itching of the nose and/or post nasal discharge (ARIR document) [13]. All AR subjects recruited from the clinic were interviewed by a respiratory specialist nurse and a questionnaire filled in. The AR group was then subdivided into intermittent or persistent in accordance to ARIA guideline, i.e. persistent if symptoms present for more than 4 days per week for more than 4 weeks [13].

2.3. Atopic status

Retrospective review of the study participant's case notes was carried out. Subjects were said to be atopic if they had a positive skin prick test, an elevated serum IgE level or a blood eosinophil count of $>400\ \mu l^{-1}$.

2.4. Ear assessment

During the 1st visit, subject's ear canals are examined with a pneumatic otoscope. Cases with significant accumulation of ear wax were excluded. An abnormal otoscopic examination is defined as cloudy appearing tympanic membrane (TM), presence of a fluid level/bubble, decreased or absent movement of TM to pressure change. In addition, relevant information such as presence of TM inflammation or perforation will be noted. Subjects would also be further assessed with the Weber and Rinnie test using a 500 Hz tuning fork.

Portable Tympanometry (WelchAllyn™ MicroTymp®2, USA) was carried out in the clinic by a medical doctor. A tympanometer contains an ear piece which is introduced into the ear canal. A miniature loud speaker generates a 226 Hz probe tone which is reflected off the ear drum. The sound pressure produced is recorded by a miniature microphone, suggesting the compliance of the ear drum. The pressure in the sealed ear canal is changed with a miniature pump so that the ear drum compliance is tested at different pressure. The data is generated in a graph which is interpreted as normal (Jerger type A), flat or decreased maximum ear drum compliance (Jerger type B) or of negative middle ear pressure (Jerger types C1 and C2). The most common cause of a type B tympanogram is decreased mobility of the tympanic membrane secondary to middle ear fluid (OME). Other causes include increased stiffness of the eardrum (from scarring), tympanosclerosis, cholesteatoma or a middle ear tumor. Tympanograms are labeled as Type C1 if there is presence of a significant negative pressure −100 to −199 daPa in the middle ear whilst pressures −200 to −400 daPa are referred to as Type C2 [14]. For this study, Jerger type B tympanogram was considered abnormal.

OME is diagnosed if a subject had a abnormal findings on pneumatic otoscopic together with an abnormal tympanogram (type B curve) [15–17]. In accordance with the guidelines published by the American Academy of Pediatrics [12], a 3 month period of watchful waiting is recommended for children with OME who are not at risk for speech, language or learning problems. Those with abnormal tympanogram will be retested after a 3 month interval. During this 2nd visit, subjects will also be re-examined with a pneumatic otoscope. Physical symptoms of persistent OME (otalgia, unexplained sleep disturbances and co-existing recurrent AOM) will also be explored. Pure tone audiometry would be offered to those with persistently abnormal tympanogram. Slight hearing loss is defined as hearing thresholds between 16–25 dB; 26–40 dB for mild hearing loss and >40 for moderate and severe hearing loss.

Subjects with moderate and severe hearing loss will be referred to an Ear, Nose and Throat (ENT) specialist for further assessment. In the absence of physical, behavioral or development sequelae of OME, a further watchful period of 3 months will be offered to those whom tympanometry is persistently abnormal. Repeat tympanometry and audiometry will then be offered to these subjects. Subjects with abnormal tympanometry 6 months after initial