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Respiratory tract infections and asthma control in children

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Summary
Introduction: Asthma control is considered the major goal of asthma management, while many determinants of control are difficult to modify. We studied the association between respiratory infection episodes (RTIs) of various types and asthma control.
Methods: Cross-sectional data were used from children aged 4–18 years with physician-diagnosed asthma who participated in a web-based electronic portal for children with asthma, allergies or infections. Asthma control was measured using the Childhood Asthma Control Test (C-ACT) or the Asthma Control Test (ACT). Linear regression was used to analyse the association between categories of numbers of various types of RTIs sustained in the preceding 12 months (categorized) and asthma control, adjusted for potential confounders.
Results: Asthma control was assessed in 654 children, and 68.5% were clinically well controlled (ACT $\geq$ 20). Higher total numbers of RTIs in the last 12 months were strongly associated with a lower level of asthma control ($p_{trend} < 0.001$). Similarly strong statistically significant

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associations were found for subtypes of RTI: ≥4 vs. 0 otitis episodes: coefficient −1.7 (95% CI −3.3 to −0.2); ≥5 vs.0 colds: coefficient −2.3 (95% CI −3.0 to −1.6); ≥3 vs. 0 bronchitis episodes: coefficient −3.1 (95% CI −4.0 to −2.3), each with $p_{trend} < 0.05$.
Conclusion: Higher numbers of reported respiratory tract infections are associated with lower level of asthma control. The different type of respiratory tract infections contribute equally to less controlled asthma.

Introduction

Asthma is the most prevalent chronic disease in childhood. International guidelines focus on asthma control as a therapeutic goal [1]. Various studies report that asthma control can be achieved for a majority of patients receiving appropriate asthma therapy [2—4], yet poor asthma control remains a large problem in the developed world. During wheezing episodes, viruses are found in approximately 80% of school-aged children [5]. Many studies have shown that upper respiratory tract infections (URTI) can trigger asthma exacerbations [6—8], but there is limited information about the association between the frequency of upper and lower respiratory tract infections and the impact on asthma control in children.

Several other factors have been associated with lower asthma control in children; e.g. older age [9], and the female sex [10—12], medication adherence [4,10,13], tobacco smoke exposure [10,14,15], and increased body mass in boys [16—19]. Furthermore, allergic co-morbidity has been described as a determinant of poor asthma control [20,21], with eczema being associated with uncontrolled asthma during autumn and winter, and allergic rhinitis during spring and summer [22]. In general, asthma control is best during summer, and lowest during autumn and spring [22].

Poorly controlled asthma increases the risk for exacerbations [23]. In children, severe asthma exacerbations are often preceded by upper respiratory tract infections [6—8,24,25]. Despite the established relation between acute viral infections and exacerbations, solid evidence on the role of numbers of URTIs and lower respiratory tract infections (LRTIs) on longer term asthma control is lacking.

We investigated if a higher number of RTI episodes in the last 12 months was related to impaired asthma control. We assessed the relative roles of URTIs (otitis, colds) and LRTIs (bronchitis) in asthma control.

Methods

Study population

Within a nationwide collaborative network of Dutch caregivers, children presenting with asthma symptoms at the outpatient department were included from June 2011 to June 2013 [26]. In addition, children from the PACMAN cohort study, identified via a pharmacy network that received at least 3 prescriptions for asthma medication in the last 2 years were included [27]. From those, patients that were diagnosed with asthma, and completed the Asthma Control Test (ACT), were selected for further analyses. Asthma was defined as a doctors' diagnosed asthma, based on the ERS/ATS guidelines [1]. Parents gave informed consent for participation, and the medical ethics committee of the University Medical Centre Utrecht approved the study.

Electronic portal

Questionnaires were filled in by each patient or parents on a personal page within an Electronic Portal (EP). This web-based application contains health- and disease-related questions on respiratory- and allergic diseases, as well as questionnaires about exposures and demographic information. Information about current asthma symptoms was adopted from the ISAAC questionnaire. Detailed information about asthma control, treatment and adherence were obtained [26]. Medication adherence was measured by using the Medication Adherence Report Scale (MARS) comprising five questions on medication use behaviour [28]. Patients with a MARS score ≥20 were considered to be adherent [29].

The number of LRTIs was defined as the answer to the question: 'how many bronchitis episodes (=coughing, dyspnoea and fever) did your child experience in the last 12 months?' URTIs were divided into otitis episodes and colds; the number of otitis episodes was defined as the answer to the question 'how many otitis episodes (=earache, otorroea, fever) did your child experience in the last 12 months?' and for colds as: 'how many cold-episodes (=blocked nose, running nose and coughing), did your child experience in the last 12 months?'. As ages of all children ranged between 4 and 18 years, anthropometric measurements were transformed into z-scores.

Asthma control

Asthma control was measured using the Childhood Asthma Control Test (C-ACT) for children 4—11 years old [30] or the Asthma Control Test (ACT) for children 12 years and older [31]. For each patient, the total score was calculated ranging from 0 to 27 for the C-ACT and from 5 to 25 for the ACT, with a score below 20 indicates inadequately controlled asthma for both age categories. The ACT score as hereafter used in this article refers to the combination of ACT and C-ACT score.