RESEARCH PAPER

Association of Allergic Rhinitis and Sinusitis with Childhood Asthma

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Received: October 14, 2015;
Initial review: January 11, 2016;
Accepted: November 03, 2016.

Objective: To study the point prevalence of allergic rhinitis and sinusitis in childhood asthma and to examine the relationship among them. ***Methods:*** In 250 children (age <13 y) with mild-to-moderte asthma, allergic rhinitis was diagnosed by clinical plus nasal eosinophilia criteria, and sinusitis was diagnosed clinically plus confirmation by computerized tomography scan. ***Results:*** The point prevalence of allergic rhinitis was 13.6%, and of sinusitis was 2%. On multivariate analysis, allergic rhinitis, sinusitis, and family history were significantly associated with asthma severity. ***Conclusions:*** Allergic rhinitis is common in childhood asthama, but sinusitis is rare.

Keywords: *Atopy, Bronchial asthma, Nasal allergy, , Nasal eosinophilia.*

Published online: November 05, 2016. PII:S097475591600023

The terms 'allergic rhino-bronchitis', and 'united airway diseases', denote contiguous allergic inflammation of the airways, and to treat both the conditions simultaneously even if one (either upper or lower airway allergy) does not manifest clearly [1]. The epidemiological associations among asthma, rhinitis, and sinusitis have been observed since a long time [2]. Most of the studies have been done in Western countries which involved children of different ethnicity, where the incidence of atopy and allergic conditions are high, and children usually have intrinsic type of asthma which is different from extrinsic type of asthma commonly seen in Indian children. We determined the prevalence of allergic rhinitis (AR) and sinusitis in Indian children with asthma along with their effect on asthma severity.

METHODS

This observational study was conducted over a one-year period in the pediatric allergy and asthma clinic of a tertiary-care hospital in Chandigarh, India. Children (age<13 y) with asthma, presenting first time to the clinic, were eligible for inclusion. Some were already talking treatment from outside, but not on a regular basis. No child was using inhaled medications (steroids or others). Those with underlying chronic diseases or congenital malformations including those of upper airways (*e.g.*, cleft lip and cleft palate) were excluded. The study was approved by the Institute Ethics Committee.

Parents/guardians were provided detailed information about the study, and consent (along with assent in children >7 year old) was obtained prior to recruitment of children into the study. Asthma severity of each participant was classified as per National Asthma Education and Prevention program II (updated 2002) [3]. Parents were enquired about the age of child, presenting symptoms, number of episodes, diurnal and seasonal variation of symptoms, family history, and other pertinent history about AR and sinusitis.

AR was diagnosed clinically, if ≥2 of the symptoms (recurrent sneezing, nasal discharge, nasal itching, nasal blockage) were present for >1 hr on most days, along with nasal mucosa changes (pale or bluish, boggy with swelling and watery discharge). Clinically, sinusitis was considered if ≥2 of the symptoms (nasal congestion, facial pain, headache, thick yellow-green nasal discharge, hyposmia, dental pain) were present for >12 weeks along with mild erythema and swelling of nasal mucosa with or without sinus tenderness. Nasal smear for eosinophils was done in children suspected to be having AR. Nasal smear was obtained by gentle scraping of the lateral nasal wall and then using the Hansan's technique. The of eosinophils against total leucocytes was calculated and presence of ≥4 eosinophils was considered to be positive. Computed tomography (CT) scan of sinuses was performed in children suspected to be having sinusitis, to look for the presence of opacification, mucosal thickening, or air-fluid level.

Statistical analysis: The data were analyzed using SPSS version 16.0. Multiple logistic regression was used to explore the association between demography, symptoms/ signs, family history, presence of AR and sinusitis, with the asthma severity. Factors identified with univariate analysis (P<0.1) and the ones which were thought to be clinically important were considered for the multiple regression analysis.

RESULTS

We included 250 children with physician-diagnosed asthma (***Fig.* 1**). The mean (SD) age was 6.7 (3.11) years, with male preponderance (M:F=2.6:1). Asthma was mild intermittent in 28%, mild persistent in 41%, and moderate persistent in 31%. None had severe persistent asthma.

The most common symptoms of AR were nasal discharge and sneezing, and most common signs were allergic salute and allergic crease. AR was suspected in 90 (36%) children (M:F=2.4:1), and clinically diagnosed in 51, of which 34 (67%) had proven AR (nasal smear eosinophils ≥4%). Thus, the point prevalence of AR in asthma was 13.6%. Majority (85.3%) of children with AR had moderate persistent asthma. Five (2%) children (age, 5-12 years) had both clinical and CT findings suggestive of sinusitis, and all of them had moderate persistent asthma. Maxillary, sphenoid and ethmoid sinuses were commonly involved.

Risk factors for asthma severity, AR and sinusitis are shown in ***Table* I**. In case of asthma, family history was significantly associated with disease severity. Family history of asthma was significantly associated with sinusitis, whereas family history of allergy (AR and atopic drmatitis) was significantly associated with AR.

In multiple logistic regression model, for severity determination, persistent asthma (mild and moderate) was made as one group. Presence of AR, sinusitis, and family history of asthma were significantly associated with asthma severity (***Table* II**).

DISCUSSION

In the present study, the prevalence of proven AR was 13.6%, and of sinusitis was 2% in childhood asthma. On multivariate analysis, AR, sinusitis, and family history of asthma were associated with increased asthma severity.

Limitations of present study was that the children

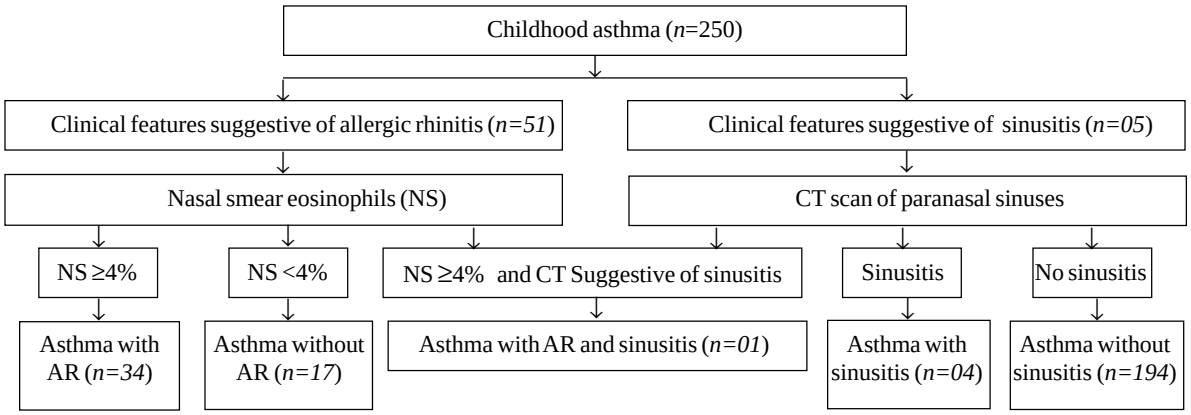

FIG. 1 *Flow of study participants.*

TABLE I UNIVARIATE ANALYSIS OF RISK FACTORS FOR ASTHMA SEVERITY, ALLERGIC RHINITIS AND SINUSITIS IN ASTHMATIC CHILDREN

Variables	*Moderate persistent asthma (n=77)*	*Allergic rhinitis (n=34)*	*Sinusitis (n=5)*
Age of onset of symptom >5y	1.16 (0.68-2.0)	0.85 (0.4-1.79)	5.8 (0.64-52.66)
Duration of symptom ≥2 y	1.38 (0.78-2.43)	0.73 (0.35-1.52)	0.9 (0.15-5.5)
Male gender	0.71 (0.39-1.28)	1.07 (0.47-2.42)	0.56 (0.09-3.45)
Family history of asthma	2.0 (1.08-3.7)	0.71 (0.28-1.82)	14.85 (1.62-135.69)
Family history of AR or AD	3.52 (1.57-7.87)	6.82 (2.86-16.25)	2.02 (0.22-18.72)

OR: Odds Values in odds ratio (95% confidence interval) AR: Allergic rhinitis; AD: Atopic dermatitis.

WHAT THIS STUDY ADDS?

- The point prevalence of allergic rhinitis in children with asthma is 13.6%, and that of sinusitis is 2%.
- A positive family history, allergic rhinitis, and sinusitis are associated with higher asthma severity.

TABLE II MULTIPLE REGRESSION ANALYSIS OF RISK FACTORS FOR SEVERITY OF ASTHMA

Variable	*OR (95% CI)*	*P value*
Age of presentation >5 y	0.67 (0.36-1.45)	0.386
Male gender	0.54 (0.29-1.08)	0.057
Duration of symptom >2	1.1 (0.56-1.98)	0.564
Family history of asthma	2.01 (1.22-4.15)	0.013
Family history of AR or AD	0.86 (0.44-2.37)	0.634
Presence of AR	3.72 (2.65-12.46)	0.001
Presence of sinusitis	10.85 (1.69-126.3)	0.005

OR: Odds ratio; 95% CI: 95% Confidence interval; AR: Allergic rhinitis; AD: Atopic dermatitis.

presenting only to the health facility were recruited; the actual prevalence of AR and sinusitis may either be over-estimated (being a tertiary-care hospital) or under-estimated (possibility of influence of anti-asthma medications on other allergic conditions). Absence of a control group (without asthma) also makes it difficult to interpret the point prevalence of AR and sinusitis estimated in the study.

A previous Indian study has found a higher prevalence of AR (28%) compared to the present study [4]. This difference may be because of employment of both clinical and nasal smear criteria to prove AR in the present study. In a study including 40 AR patients, 80% showed nasal smear eosinophilia (≥4%) [5]. When the nasal smear eosinophilia was compared to the skin tests, a high degree of correlation (88%) was found. On multiple regression analysis, AR was associated with increase in asthma severity in the present study. Similar findings have been reported by other studies [6,7].

The prevalence of sinusitis was also low in present study as compared to other studies. Nguyen, *et al*. [9] concluded that for diagnosis of sinusitis, imaging studies should be combined with clinical evaluation. In the present study, use of CT scan for diagnosis of sinusitis might have lead to a lower estimate of prevalence. Children with sinusitis had more asthma severity on multiple regression analysis. Tsao, *et al*. [12] found an improvement in the asthma symptoms, and normalization of pulmonary function after antibiotic treatment of sinusitis. Rachelefsky, *et al*. [13] reported that 79% of asthmatic cases could discontinue their bronchodilators after resolution of sinusitis with antibiotic use.

For measurement of true prevalence of AR and sinusitis in asthma, future studies should focus on district- or school-level surveys from various parts of the country.

Acknowledgement: Prof Naresh Kumar Panda, Department of Otorhinolaryngology, PGIMER, Chandigarh, India for providing technical assistance.
Contributors: SC, MS, JLP, AS: conceived and designed the study; SC: coordinated the study and collected data; MS, RRD: revised the manuscript for important intellectual content, drafted the paper, analyzed the data and helped in manuscript writing. The final manuscript was approved by all authors
Funding: None; *Competing interest*: None stated.

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