Recent 5-year trends of asthma severity and allergen sensitization among children in southern Thailand

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Summary

Background: **Asthma is a major public health issue that affects morbidity. The greater severity of asthma requires more health care resource utilization.**

Objective: **To investigate the possible changes in disease severity and allergen sensitization of children with asthma in an interim period of 5 years.**

Methods: **We retrospectively reviewed the charts of 200 patients with established asthma in the pediatric allergy clinic. The data were collected in different time periods with 100 consecutive cases in each group starting in January of 2004 and in January of 2009. All patients underwent a skin prick test (SPT) to common allergens, with positive and negative controls. SPTs with a mean wheal diameter 3 mm greater than a negative control were considered test-positive.**

Results: **The mean ages of patients in the 2004 and 2009 groups were 7.54 and 7.73 years. Compared with patients in the 2004 group, the 2009 group had more severe asthma (p =0.006). The distribution of asthma severity was mild (intermittent and mild persistent) 98.0% in 2004 and 87.9% in 2009, and moderate to severe persistent 2.0% in 2004 and 12.1% in 2009. The prevalence of patients sensitized to both house dust (HD) and house dust mites (HDM) increased from 21.2% in 2004 to 34.3% in 2009 (p =0.007). Sensitization to allergens of HD, HDM and cockroach increased to 14.1% in 2009 from 9.1% in 2004 (p =0.021).**

Conclusions: **During the years between 2004 and 2009, asthma severity increased with increasing sensitization to HD, HDM and cockroach. Awareness of these changes and further studies are required.** ***(Asian Pac J Allergy Immunol 2013;31:242-6)***

Key words: *asthma, asthma severity, allergen sensitization, skin prick test, Thai children*

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Submitted date: 17/8/2012
Accepted date: 2/11/2012

Introduction

Asthma is a complex clinical syndrome characterized by variable airflow obstruction, airway hyperresponsiveness, and airway inflammation.[1] The severity of asthma in childhood determines the severity of the symptoms and loss of lung function in later years. Moreover, asthma has an impact on quality of life.[2]

The prevalence of asthma has increased over the last 2 decades worldwide.[3] Allergen exposure is a major contributor to asthmatic attacks and chronic airway inflammation in patients with asthma. The vast majority of these patients were allergic to aeroallergens.[4] As many as 95% of patients with asthma had aeroallergen sensitization identified by positive skin testing.[5] Published studies have shown the association between airway hyperresponsiveness and the number of allergen sensitizations.[4-8] Moreover, The Inner City Asthma Study found morbidity associated with aeroallergen exposure in 5- to 11-year-old children residing in the inner cities of the United States. More than 50% of these children were allergic to cockroach, house dust mite and mold,[9] whereas house dust mite is the most common allergen that induces sensitization in many parts of Asia, accounting for 40-80% of patients with asthma.[6,10-12] Sensitization with exposure to cockroach was associated with increased asthma morbidity and dust mite sensitization was correlated with asthma morbidity independent of exposure.[13] In addition, a recent study in the United States reported an increased risk of wheeze, persistent cough and higher asthma severity score in asthmatic children sensitized and exposed to fungal allergen; furthermore, sensitization and exposure to house

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DOI 10.12932/AP0289.31.3.2013

dust mite or pet allergens associated with an increased use of asthma rescue medication.[14]

In Thailand, the prevalence of house dust mite sensitization among children with asthma with or without allergic rhinitis between 1997 and 2004 rose from 60% to 80%.[11-12] Aside from the allergen sensitization, the asthma severity may change between the different time points; thus, we investigated the possible changes in disease severity and allergen sensitization 5 years apart among children with asthma in Songkhla Province, Southern Thailand.

Methods

Study population

A retrospective chart review was performed on 200 patients with established asthma in the Pediatric Allergy Clinic, Songklanagarind Hospital which is a university hospital in Songkhla Province in southern Thailand. All patients underwent a skin prick test (SPT) to common allergens, with positive and negative controls. The data was collected in two separate time periods with 100 consecutive cases in each group starting in January of 2004 and in January of 2009. Two patients (1 in each group) were excluded from the study because of false positive SPT results. The study has been reviewed and approved by The Ethics Committee, Faculty of Medicine, Prince of Songkla University.

Skin Prick Tests

Skin prick testing with common aeroallergens, including positive and negative controls, were performed at the Pediatric Allergy Clinic by the same well-trained technician using the Duotip-Test® devices with the rotation method. All patients withheld antihistamines for at least one week prior to skin prick testing. SPTs were performed on the upper back and the results were recorded 15 minutes thereafter by the same experienced technician. A mean wheal diameter of 3 mm greater than a negative control was considered test-positive.

The aeroallergen extracts (GREER®, Lenoir, NC) used in our standard panel were: *Dermatophagoides pteronyssinus* (*D. pteronyssinus*), *Dermatophagoides ferinae* (*D. ferinae*), House Dust (HD), *Periplaneta Americana* (Amercan cockroach), *Cynodon dactylon* (Bermuda grass), *Sorghum haleperise* (Johnson grass), Acacia, *Felis catus* (Cat hair), Dog epithelia, *Ceiba pentandra* (Kapok seed), Feather Mix (Chicken feathers, Duck feathers, Goose feathers), *Aspergillus* Mix, and Alternaria Mix. Histamine hydrochloride 1 mg/ml and 50% glycero-saline were used as positive and negative controls.

Statistical analysis

Statistical analysis was performed by using R software (version 2.14.0; The Comprehensive R Archive Network). The Chi-square test was used to compare categorical variables. The mean age of patients between groups were compared by t-test. A *p* -value of less than 0.05 was considered significant.

Results

A total of 198 patients (99 patients in each group) with asthma were enrolled in this study. The mean ages of patients in the 2004 and 2009 groups were 7.54 and 7.73 years, respectively. There were 67.7% and 73.5% of patients in the 2004 and 2009 groups who had co-morbid allergic rhinitis. Consequently, the prevalences of atopic asthma, defined by having at least one positive allergen sensitization, among patients in 2004 and 2009 group were 61.6% and 64.6% (Table 1).

Table 1. Characteristics of patients

	Group		
	2004 N = 99* (%)	2009 N = 99* (%)	*P* -value†
Gender			0.56
Male	62/99 (62.6)	58/99 (58.6)	
Female	37/99 (37.4)	41/99 (41.4)	
Age (years): median ± SD	7.54 (± 3.63)	7.73 (± 4.06)	0.73‡
Co-morbid allergic rhinitis	65/96 (67.7)	72/98 (73.5)	0.40
Severity of asthma			0.04
Mild intermittent	17/99 (17.2)	13/99 (13.1)	
Mild persistent	80/99 (80.8)	74/99 (74.7)	
Moderate persistent	2/99 (2.0)	10/99 (10.1)	
Severe persistent	0/99 (0)	2/99 (2.0)	
Skin prick test results			0.66
Positive	61/99 (61.6)	64/99 (64.6)	
Negative	38/99 (38.4)	35/99 (35.4)	

*In each group, there was one patient who was excluded because of false positive SPT result.

†Using Chi-square test; ‡Using t-test.

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The distribution of asthma severity was mild (intermittent and mild persistent) 98.0% in 2004 and 87.9% in 2009, and moderate to severe persistent 2.0% in 2004 and 12.1% in 2009 (Figure 1). Compared with patients in the 2004 group, the 2009 group had more severe asthma ($p = 0.006$).

Among children with asthma, *Dermatophagoides* was the most common sensitizing allergen, accounting for nearly half of the patients in both 2004 and 2009 groups, with no statistically significant difference between the groups. The prevalences of sensitization to *D. pteronyssinus* in the 2004 and 2009 groups were 50.5% and 48.5%. In addition, 52.5% and 48.5% of asthmatic children in the 2004 and 2009 groups were sensitized to *D. ferinae*. There was a trend of increasing prevalence of asthmatic children who were sensitized to house dust during the 5-year interim from 23.2% to 35.4% ($p = 0.06$). Sensitization to American cockroach was 20% of the patients in 2004 and 26.3% of the patients in 2009. There were no statistically significant differences in American cockroach, Bermuda grass, Johnson grass, Acasia, Cat hair, Kapok seed and *Aspergillus* mix between the 2 groups. No children with asthma were sensitized to Dog epithelia and Alternaria mix. Table 2 shows the pattern of allergen sensitization between the 2004 and 2009 groups. The prevalence of patients who were sensitized to both house dust and house dust mites (*D. pteronyssinus* and *D. ferinae*) increased from 21.2% in 2004 to 34.3% in 2009 ($p = 0.007$). Taking into account house dust, house dust mites and cockroach, sensitization to these allergens in asthmatic patients increased to 14.1% in 2009 from 9.1% in 2004 ($p = 0.021$).

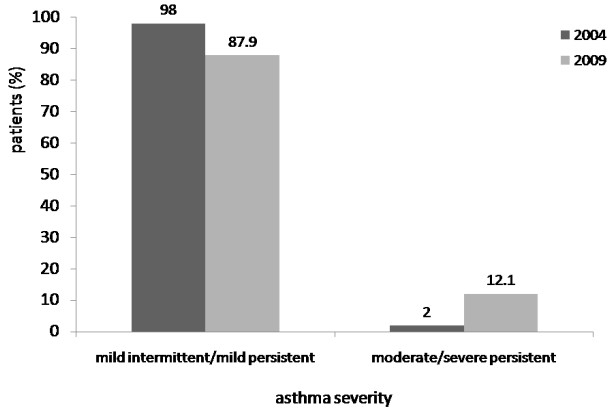

Figure 1. Distribution of asthma severity between patients in 2004 and 2009

Table 2. Pattern of allergen sensitization

Aeroallergens	Group		*P*-value*
	2004 N = 99 (%)	2009 N = 99 (%)	
D. pteronyssinus	50 (50.5)	48 (48.5)	0.78
D. ferinae	52 (52.5)	48 (48.5)	0.57
House dust	23 (23.2)	35 (35.4)	0.06
American cockroach	20 (20.2)	26 (26.3)	0.31
Bermuda grass	4 (4.0)	10 (10.1)	0.10
Johnson grass	4 (4.0)	9 (9.1)	0.15
Acacia	1 (1.0)	1 (1.0)	1.00
Cat hair	10 (10.1)	7 (7.1)	0.45
Dog epithelia	0 (0.0)	0 (0.0)	-
Kapok seed	3 (3.0)	1 (1.0)	0.31
Feathers Mix	3 (3.0)	0 (0.0)	0.08
Aspergillus mix	3 (3.0)	2 (2.0)	0.65
Alternaria mix	0 (0.0)	0 (0.0)	-
***D. pteronyssinus* + *D. ferinae* + house dust**	21 (21.2)	34 (34.3)	0.007
***D. pteronyssinus* + *D. ferinae* + house dust + American cockroach**	9 (9.1)	14 (14.1)	0.021

*Using Chi-square test.

There was no correlation between single-aeroallergen sensitization and asthma severity. When aeroallergens were classified into the 4 groups of 1) arachnid and insect (*D. pteronyssinus*, *D. ferinae*, House dust, American cockroach), 2) grass and tree (Bermuda grass, Johnson grass, Acasia, Kapok), 3) mold (Aspergillus Mix, Alternaria Mix) and 4) animal allergens (Cat Hair, Dog Epithelia, Feather Mix) there was no relationship between each group of allergens and the severity of asthma.

Discussion

This study showed an increased trend in the severity of asthma among pediatric patients in the 5-year interim. However, there was no difference in the pattern of allergen sensitization among the patients between different time periods. Our results demonstrate that there was no difference in the percentage of atopic asthma between the groups, accounting for nearly two-thirds of the patients in each group. This is similar to a previous study which found that 64.3% of Thai children with asthma had

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at least one positive skin prick test result.[17] However, other studies have reported higher rates of allergen sensitization among Thai children with asthma ranging from 74 to 94%.[11,12,18] The prevalences of allergic rhinitis among children with asthma in our study were 67.7% in 2004 and 73.5% in 2009 which are higher than the previous study in central Thailand which reported a prevalence of 61%.[12]

We confirmed that indoor allergens, especially house dust mites, were the major sensitizing allergens among asthmatic children in Thailand,[11,12,19] and other Asian countries.[10, 20-23] Dermatophagoides was the most common cause of sensitization in this study, accounting for 50% of the patients. Moreover, our results are consistent with previous studies that the American cockroach was the second most common allergen to induce sensitization among Thai children with asthma.[11,12,17] Nevertheless, compared to the previous studies that reported 60-70% of Thai children with asthma were sensitized to Dermatophagoides, we found a lower rate of this allergen sensitization.[11,17] The differences in regions and time periods of the study may affect this result. In addition, sensitization to domestic animal allergens and grass pollens is not common among Thai asthmatic children. On the other hand, these allergens are the major cause of hypersensitivity in Western countries.[24-26] This may result from the higher percentage of homes with house pets in Western cultures, different environments, living conditions and life-styles.

There was no correlation between allergen sensitization and asthma severity in our study. This result was consistent with the earlier research in the United States which indicated that there was no significant correlation between specific allergen sensitization or total number of allergen sensitivities and asthma severity in asthmatic children. [27] In contrast, Wang et al.[13] found an increased risk for asthma hospitalizations and corticosteroid use in the inner-city asthmatic children having sensitization to cockroach and house dust mite allergens. The morbidity of asthma associated with allergen sensitization and the exposure to the same allergen.[14,28] Gent et al.[14] reported an increased risk of wheeze in asthmatic children who sensitized and exposed to house dust mite, cat and dog allergens. This recent study also showed that sensitization and exposure to house dust mite and cat allergens was associated with an increased asthma rescue medication use.[14] Rosenstreich et al. demonstrated that sensitization and exposure to cockroach allergen was associated with asthma symptoms and asthma exacerbation.[28] In addition, a correlation between asthma severity and exhaled nitric oxide and the level of serum total IgE was also observed in some studies.[15,16] The different ethnic origin and environmental exposure of subjects and the varying research methods among our work and previous studies might have an effect on the different results. However, this retrospective chart review limited our ability to gather data on the allergen exposure and its association with asthma severity.

In conclusion, we demonstrated that asthma severity increased with increasing sensitization to house dust, house dust mite and cockroach during the years between 2004 and 2009. Although the association between allergen sensitization and asthma severity was not observed in this study, the awareness of these changes and further studies are required.

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