
Mouse allergy among asthmatic children from rural Appalachia

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Background: Mice are a common finding in the indoor environment of many homes. In a recent study, 18% of children with asthma from an inner-city environment were reported to be allergic to mouse allergen.

Objective: To determine the frequency of skin test reactivity among asthmatic children in a rural environment.

Methods: We consecutively evaluated 209 (82 female, 127 male) children between the ages of 5 months and 19 years with asthma for mouse allergy. A careful environmental history was obtained on all children. Children older than 3 years of age were skin tested to mouse allergen and other indoor/outdoor inhalant allergens. Children younger than 3 years were skin tested to mouse and indoor allergens.

Results: Thirty-three percent of parents reported seeing mice in their homes. Overall, 25 of 209 (12%) children with asthma were skin test-positive for mouse. For children 3 years or younger, 6 of 52 were skin test-positive for mouse (12%). There was no correlation among socioeconomic status, skin test reactivity, and the presence of mice in the home. Children with multiple skin test reactions were more likely to be reactive to mouse ($P < 0.01$). Mice seen in the home did not correlate with positive mouse skin tests.

Conclusions: The frequency of skin test reactivity to mouse allergen in asthmatic children from rural areas appears slightly less than that in children from inner-city environments. However, a frequency of 12% suggests that skin testing for this allergen provides useful information for environmental control measures in the home.

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INTRODUCTION

Recurrent wheezing in children is a common and widespread problem, with almost half of children having some form of wheezing during childhood.¹ There are several known triggers which contribute to the development of asthma in children. Viral upper respiratory infections, exposure to second hand cigarette smoke,² and immunoglobulin E-mediated allergies are well established aggravating factors for wheezing in the pediatric population.³ Exposure to indoor allergens such as dust mites, molds, animal danders, and cockroach are known to induce and promote asthma.⁴ Children with asthma are routinely skin tested to these allergens. It is unlikely that these are the only potential allergens in the home environment capable of causing asthma.

Mouse allergen as a cause of occupational asthma in laboratory workers is well known. However, the association of mouse allergen with asthma in home environments is just starting to be appreciated. Phipatanakul et al⁵ recently reported the incidence of skin test positivity and exposure to mouse allergen in lower socioeconomic status: inner-city children with asthma.

METHODS AND MATERIALS

Infants and children presenting to the Pediatric Allergy and Asthma clinic between January 1999 and October 2001 with a history of asthma were evaluated. Data for age, sex, race,

socioeconomic status, presence of pets, and whether mice had been seen in the home were collected at the initial evaluation. Lower socioeconomic status was defined by the presence of Medicaid insurance or lack of insurance.⁶ The Institutional Review Board of West Virginia University approved the protocol.

Each subject underwent allergy skin tests supervised by an allergist (NWW, MBH). Skin tests were performed using the prick-puncture method using a five-prong Greer Dermalpik (Greer Laboratories, Lenoir, NC). Saline and histamine controls were used in all patients. A positive skin test was defined as a wheal and flare at least one half the size of the histamine control. Wheals and flares were read 20 minutes after placement and responses were measured in millimeters. Patients were skin tested to a standard battery of extracts consisting of *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*, cockroach (*Periplaneta americana*), animal danders, 6 grass pollens, 9 weed pollens, 12 tree pollens, and 8 molds. In addition all subjects were tested to mouse epithelia extract (1:20 wt/vol; Greer Laboratories). Children younger than 3 years of age were tested only to indoor allergens: dust mites, cat, dog, cockroach, molds, and mouse extract. Data were entered on an IBM compatible computer using FileMaker Pro Database (Santa Clara, CA). χ^2 Statistical analyses were performed on the data obtained (GraphPad Software, San Diego, CA).

RESULTS

Two hundred nine (82 female, 127 male) patients with mean age of 8.7 years with asthma were evaluated. Fifty-two children were 3 years of age or less. Ninety-eight percent of the

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patients were Caucasian, which is consistent with the ethnic distribution for the area. Fifty-one percent were of lower socioeconomic status as defined by enrollment in Medicaid or having no private insurance. The percentage of lower socioeconomic status patients younger than 3 years of age was 58%, and that of patients greater than 3 years of age was 49%. Demographic data are summarized in Table 1.

Many patients reported exposures to factors known to exacerbate asthma. Forty-three percent of the patients were exposed to environmental tobacco smoke. Parents reported seeing mice in 33% of all homes. Percent exposure to indoor animals was 52% to dog, 43% to cats, and 10% to birds. The environmental exposure history for these patients is summarized in Table 2.

Forty-two percent of all children tested had positive skin tests to cockroach allergen, making this the most common sensitizing agent. This is consistent with our previously published data.⁷ Other common skin test reactions included dust mites (34%), cat (22%), grasses (26%), weeds (26%), trees (29%), and molds (23%). In total, 69% of the patients tested had at least one positive skin test. Skin test results are summarized in Table 3.

Twelve percent (25 of 209) of those children tested had positive skin tests to mouse allergen. This was equally true for those patients 3 years of age or less where 6 of 52 reacted to mouse allergen. There was no relationship between age ($P = 0.89$) or sex ($P = 0.47$) and skin test reactivity to mouse allergen. Those children who had other skin test reactions were significantly more likely to react to mouse allergen ($P < 0.01$). Thirty-three percent of parents reported seeing mice in their homes. However, there was no relationship between parental reporting of the presence of mice seen in the house and skin test reactivity to mouse ($P = 0.31$). Interestingly, parents were more likely to report seeing mice if a cat was present in the home ($P = 0.003$). No relationship between the presence of a cat in the home and skin test reactivity to mouse ($P = 0.22$) was found. There was no significant difference between lower and higher socioeconomic groups in the incidence of skin test reactivity to mouse ($P = 0.47$) or in reports of seeing mice in the home ($P = 0.59$).

Table 1. Demographic Data

	<3 years	>3 years	All children
N	52	157	209
Female	18 (22%)	64 (78%)	82 (39%)
Male	34 (16%)	93 (84%)	127 (61%)
Race			
White	50	154	204
Black	1	1	2
Hispanic	0	1	1
Filipino	0	1	1
Asian	1	0	1
Medicaid or no insurance	30 (58%)	77 (49%)	107 (51%)

Table 2. History of Exposures

	<3 years	>3 years	All children
Heating system			
Gas	65%	67%	67%
Wood	8%	12%	11%
Kerosene	3%	5%	5%
Coal	0%	2%	2%
Electric	17%	15%	15%
Cigarette smoke			
Primary	0%	0.1%	0.1%
Secondary	40%	44%	43%
Total exposure	40%	45%	44%
Animals			
Dog	42%	55%	52%
Cat	37%	45%	43%
Bird	8%	11%	10%
Mice seen	27%	35%	33%

Table 3. Skin Test Results

	<3 years	>3 years	All children
Mouse	12%	12%	12%
Roach	38%	43%	42%
Dust mite	12%	42%	34%
Cat	10%	26%	22%
Dog	5%	7%	6%
Grass	N/A	34%	26%
Weed	N/A	35%	26%
Tree	N/A	39%	29%
Mold	12%	27%	23%
Any positive skin test	67%	69%	69%

DISCUSSION

In this study of 209 pediatric patients from a rural community, we found that the frequency of skin test reactivity to mouse allergen was 12%. This effect was independent of age or socioeconomic status. Our rate of 12% is somewhat lower than that of 18% noted in a recent study of inner-city children with asthma.⁵ This suggests that allergy to mouse allergen may be slightly less common in a rural setting, but is still a significant sensitizing antigen. It appears that children with multiple positive skin tests are more likely to have skin test reactivity to mouse allergen.

Allergy to mouse and rat allergens are well documented causes of immediate hypersensitivity in occupational settings, eg, laboratory workers.⁸ It is only now being appreciated as a potential allergen in the home environment. Phipatanakul et al,⁵ reported that 89 (18%) of the 499 inner-city children with asthma had a positive mouse skin test response. Children whose homes had higher mouse allergen levels in the kitchen were more likely to be sensitized. Atopy was also significantly related to mouse sensitization, with 40% of those with more than four positive skin tests having mouse sensitivity compared with 4% of those with no other positive skin test responses.

Phipatanakul et al⁹ also has reported the prevalence of mouse allergen in inner-city homes. They found that 95% of

all homes had detectable mouse allergen in at least one room, with the highest levels found in kitchens. Interestingly, 100% of the kitchens in Baltimore had detectable mouse allergen, compared with 74% in Cleveland homes. Forty-nine percent of the homes had reported problems with mice within the last year, and 29% of the homes had evidence of mice in one or more rooms on home inspection. Higher mouse allergen levels were also associated with evidence of cockroach infestation.

The source of mouse exposure for this rural population remains unclear. In our study, there was no relationship between parental reports of seeing mice in the home and skin test reactivity to mice. Parents were more likely to have seen mice if there was a cat present in the home, but there was no relationship between the presence of a cat in the home environment and skin test reactivity to mouse. It appears that having a cat in the environment does not have a protective effect in preventing sensitivity to mouse in asthmatic children. Some families may have obtained a cat as a form of rodent abatement. The positive skin test to mouse allergen in these children would reflect either previous exposure or remaining mouse allergen in the home. It is also possible that these children are being exposed to mouse allergen in other environments such as barns, schools, or other public places. Examination of antigen levels for mouse in the homes of these patients would be helpful in answering this question.

CONCLUSION

Allergy to mouse antigen is relatively common in children with asthma and may be a significant factor for asthma in these patients. It appears slightly less common in a rural environment than previously reported in children from an inner-city environment. Control measures such as extermination of mice present in the home to decrease allergen may be of benefit, but data are scant and other ways to decrease antigen levels remain unproven. However, skin testing to

mouse allergen in asthmatic children does provide clinically relevant data.

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