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LATEX SENSITIVITY AMONG HOSPITAL EMPLOYEES AND ATOPIC CHILDREN*

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Allergic reactions to latex products are an important health problem for health care workers and children. To investigate the prevalence of latex and latex-associated food sensitivities among hospital employees and atopic children, 61 hospital employees (44 nurses, 13 cleaning staff, 4 technicians) and 40 atopic children were evaluated by in vivo and in vitro testing methods. All subjects were also skin prick tested with common inhalant allergens and some cross-reactive food allergens to latex. In addition, all subjects were evaluated using an enzyme-linked immunometric assay for detection of specific IgE to inhalant allergens and to the known food latex cross-reactant food allergens (banana, chestnut, peanut and kiwi fruit). Latex challenges were performed in 12 history-negative and anti-latex IgE positive atopic children. Seven of the 61 hospital staff (11.4%) and four of the 40 atopic children (10%) showed skin reactivity to latex. By serologic testing, hypersensitivity to latex was found in 30 subjects, to banana in 23, to chestnut in 37, to peanut in 32, and to kiwi fruit in 22 subjects. Latex challenges were negative in all of the children who were tested. Total IgE was higher than expected in 32 subjects and 50 individuals tested positive for specific IgE to common inhalant allergens (AlaTOP). These results indicate that latex allergy may be a health problem for our hospital staff and atopic children. In vitro testing may detect latex-specific IgE in atopic children even when no history of an adverse reaction to latex is present. *Key words: latex sensitivity, hospital employees, atopic children.*

Latex is derived from the milky sap of the rubber tree Hevea brasiliensis and has been used widely in medical supplies for decades. However, over recent years, many cases of latex IgE-mediated allergy have been described with clinical manifestations ranging from contact urticaria and bronchial asthma to anaphylactic shock[1-3]. Reactions to latex are more commonly encountered in those working in the latex industry, hospital operating room staff, and surgical

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patients[4,5]. This study was undertaken at a university hospital and a children's hospital to assess the prevalence of latex and latex-associated food sensitivities among hospital employees and atopic children in the care of the Pediatric Allergy Department.

Material and Methods

Seventy employees of the university hospital and 40 atopic children were evaluated with regard to latex allergy. The employees took part voluntarily in the study following the declaration of the study in the hospital. The children were selected randomly among those with positive skin prick tests to common allergens. The study was described in detail to all participants (and their parents where appropriate) and informed consent obtained. Those subjects in whom skin tests were contra-indicated were excluded from the study. Skin prick tests were performed on the volar aspect of the forearm using Stallerpoint needles (Stallerpoint, Laboratorie des Stallergenes, Fresnes Cedex, France). Skin prick tests were made with serial 10-fold dilutions of latex extract in phosphate-buffered saline (weight/volume concentrations ranged from 1:10000 to 1:10) (Stallergenes)[6]. Histamine phosphate (1 mg/ml) was used as the positive control and phosphate-buffered saline as the negative control. The cutaneous reactions were read after 15 minutes and were evaluated according to the size of wheal and erythema. Skin prick tests were defined as positive if the mean wheal diameter was > 3 mm and mean erythema > 5 mm larger than the negative control[7]. Skin tests were also performed with extracts of certain grasses (Poa mix, C. dactylon, P. pratensis, D. glomerata, A. sativa, Festuca), trees (Ulmus, Quercus, Populus, Platanus, Salix), weeds (Chenopodium, Artemisia, Plantago, Salsola kali), cat and dog danders, some fruits (peanut, kiwi fruit, chestnut and banana), Dermatophagoides pteronyssinus (DP) and Dermatophagoides farinae (DF).

In addition, total IgE concentration; specific IgE to latex, banana, kiwi fruit, chestnut, and peanut; and specific IgE to inhalant allergens (AlaTOP) were measured using the AlaSTAT assay (Diagnostic Products Corporation, Los Angeles, USA). The results of these tests were divided into six classes as reported by the manufacturer. Samples recorded as class 0 to 0-1 were considered negative, samples reported as class I or above were considered positive. Latex challenges were done in 12 history-negative and anti-latex IgE positive atopic children as described by Kelly et al.[2]: After explaining the risk of the test to the patients, a finger tip was cut from a surgical glove, dampened with water, and placed on one finger for 15 minutes. If no reaction was seen an entire glove was placed on the hand for the same length of time.

Results

The study was completed with a total of 101 subjects: 44 nurses (40 of whom were working in the operating room), 13 cleaning staff, 4 technicians and 40 atopic children. Nine of the hospital employees were excluded from the study because they failed to react to a histamine control skin prick test, probably due to an inhibiting agent received. The demographic and clinical data of hospital employees and atopic children are shown in Table I. Varying allergic diseases were diagnosed in 33 (54%) hospital employees (20 nurses, 9 cleaning staff, 4 technicians) by means of clinical history and physical examination. Positive skin test reactions to latex were found in seven of the hospital staff compared to four of the atopic children (Table II). All of the subjects with a positive skin test to latex had concurrent allergic diseases. Skin tests with common allergens were positive in four of seven hospital employees and in all of the children (in both groups reactions to pollens were predominantly positive). The subjects with positive latex tests did not have a higher prevalence of other specific allergies. The results of the skin prick tests with latex and other allergens can be seen in Table III. The results of the in vitro tests were as follows: total IgE values were higher than expected in 32 individuals; AlaTOP tests were positive in 50 individuals. Specific IgE to latex was present in 300 individuals, to kiwi fruit in 22 individuals, to banana in 19 individuals, to chestnut in 37 individuals and to peanut in 32 individuals (Table IV). Only five of the 11 subjects showing positive skin tests for latex had latex-specific IgE. One of the five also demonstrated specific IgE to banana, chestnut and kiwi fruit. Latex challenges were negative in all of the children who were tested.

Tablel I: Characteristics and Clinical Diagnoses of the Study Population

Characteristics	Hospital Employees	Atopic Children	Total
Number of participants	61	40	101
Gender (M/F)	10/51	28/12	38/63
Age (years)	32 ± 8	11.8 ± 2.3	
Diagnoses			
Asthma	6	29	35
Rhinitis	7	–	7
Asthma + rhinitis	2	10	12
Urticaria	5	–	5
Contact dermatitis	3	–	3
Eczema	3	–	3
Drug allergy	4	–	4
Asthma + latex allergy	2	–	2
Asthma + contact dermatitis	1	1	2

Table II: Results of in Vivo and in Vitro Tests with Latex

	Latex-Specific IgE (+)				Latex-specific IgE (–)			
Skin Test	N	CS	T	AC	N	CS	T	AC
Positive skin test with latex	1	3	–	1	1	2	–	3
Negative skin test with latex	3	2	–	20	39	6	4	16
Total	4	5	–	21	40	8	4	19

N: nurse. CS: cleaning staff.
T: technician. AC: atopic children.

Table III: Results of Skin Prick Tests with Common Allergens, Latex, and Latex Food Cross-Reactant Allergens

Antigen	Hospital Staff Positive (%)	Atopic Children Positive (%)
LATEX	7 (11.5)	4 (10.0)
MGP	9 (14.7)	35 (87.5)
MWP	8 (13)	36 (90)
MTP	4 (6.5)	29 (72.5)
Dog dander	4 (6.5)	5 (12.5)
Cat dander	5 (8.2)	10 (25)
DP + DF	4 (6.5)	33 (82.5)
Banana	1 (1.6)	13 (32.5)
Chestnut	1 (1.6)	–
Kiwi fruit	–	–
Peanut	3 (5)	3 (7.5)

MGP : mixed grass pollens. MWP: mixed weed pollens.
MTP : mixed tree pollens. DP : Dermatophagoides pteronyssinus.
DF : Dermatophagoides farinae.

Table IV: Results of the Positive in Vitro Tests in the Study Groups

Test	Hospital Staff (n: 61) Number (%)	Atopic Children (n: 40) Number (%)	Total (n: 101) Number (%)
AlaTOP	23 (37.7)	27 (67.5)	50 (49.5)
Elevated IgE	8 (13.1)	24 (60)	32 (31.7)
Chestnut-specific IgE	20 (13.1)	17 (42.5)	37 (36.6)
Peanut-specific IgE	7 (11.5)	25 (62.5)	32 (31.7)
Latex-specific IgE	9 (19.7)	21 (52.5)	30 (29.7)
Banana-specific IgE	8 (14.75)	15 (37.5)	23 (22.8)
Kiwi-specific IgE	6 (9.8)	16 (40)	22 (21.8)

Discussion

Latex allergy results from an IgE-mediated hypersensitivity reaction to constituent proteins retained in finished latex products such as surgical gloves, condoms, balloons, catheters, elastic thread, rubber bands and elastic adhesives. It has been increasingly associated with intraoperative anaphylaxis and occupation-related allergy[4, 6]. Latex contains at least 16 proteins of different molecular weights (the actual figure could well be nearer to 240 different proteins). These may be altered or partially degradded by the use of ammonia in preservation shortly after collection[6]. The increasing prevalence of human immunodeficiency virus has led to a heightened awareness concerning the importance of latex in medical practice[1]. The greater frequency with which gloves are being used may be resulting in increased contact with, or inhalant sensitization to, latex products, leading to an increasing prevalence of occupational latex allergy. Another reason for increasing latex sensitization could be inhalation of urban air which may contain abundant latex particles[8]. Latex products had been widely used for a number of years before the first report of latex-induced urticaria by Nutter[9] in 1979. Since then there have been numerous reports of IgE-mediated reactions to latex, suggesting a dramatic increase in its incidence[10-12]. A wide range of clinical manifestations have been associated with latex hypersensitivity from contact urticaria, rhinoconjunctivits and asthma to severe anaphylaxis[9, 12, 13]. Children with spina bifida, patients with genitourinary tract anomalies requiring daily bladder catheterization, health care workers, atopic patients and individuals with tropical fruit allergy have all been reported as having an increased risk of latex sensitivity[14-17]. In this study the latex skin test positivity rate was 11.4 percent among hospital employees (Table II). This figure has been reported as 4.7 percent by Vandenplas et al.[18] as 17 percent by Yassin et al.[11] and as 14.1 percent by Iacobelli et al.[19]. Among hospital personnel, operating room nurses are known to be at an increased risk of developing latex sensitization and allergy[10, 11]. Sensitivity to latex was identified in two of the 40 nurses by skin testing whereas four (9.1%) were identified by in vitro testing to possess specific IgE to latex (Table IV). This data is in agreement with latex positive rates of five to 10.7 percent previously reported by Vandenplas et al.[18] and Lagier et al.[10] for operating room nurses. Of the additional hospital personnel studied, nine of 13 cleaning staff were identified as allergic, with two subjects reporting contact dermatitis when wearing latex gloves. Latex sensitivity in these two subjects was confirmed by skin test. Using in vitro testing, five of the cleaning staff demonstrated latex-specific IgE. The technicians constituted the smallest group of hospital employees tested in this study, but none had a positive latex test either in vitro or in vivo. The high prevalence of allergies among hospital employees may represent selection bias, with those having a history of allergy being more willing to enter the study.

Within the pediatric populatilon, four showed a positive skin test to latex while 21 children had latex-specific IgE by in vitro testing. None of these children had a history of adverse reactions to latex products or foods known to cross-react with latex, including banana, chestnut, peanut or kiwi fruit. These children may have been sensitized to latex in their infancy by sucking latex pacifiers or playing with rubber toys or balloons[20]. but the negative results of the latex challenges suggest that this sensitization is not clinically important now. Similar observations were reported by Shield and Blaiss[21] who found that three of 44 atopic children had positive skin tests to latex without any history of latex-associated reactions. These results support the idea that these tests may detect latex-specific IgE in atopic individuals with no past history of known latex exposure[21, 22]. Reinheimer et al.[22] found that among those subjects undergoing evaluation with regard to allergy, 12 percent were positive for latex-specific IgE without having a history of latex exposure and that most of these subjects were less than 18 years of age. In another study, Ownby et al.[23] reported detectable anti-latex IgE antibodies in 1000 blood donors, most of whom (61%) were also positive in the CAP assay.

The association of latex hypersensitivity with banana, chestnut, avocado and kiwi fruit allergy has been described recenty, and the presence of cross-reactivity between them has been shown through radioallergosorbent test (RAST) inhibition[24-27]. Blanco et al.[28] described 17 patients with immediate allergic reactions to avocado: 10 were allergic to latex, eight to chestnut, eight to banana, four to kiwi fruit and four to walnut. In our study, specific IgE to certain foods were determined with the AlaSTAT assay and were found to be positive predominantly in atopic children (Table IV). The cross-reactivity between latex and the above-mentioned fruits will be tested by elimination-provocation tests, and the follow-up results will be documented. Latex may cross-react not only with foods, but also with pollens: Appleyard et al.[26] reported cross-reactivity between latex, ragweed and blue grass allergens. In this study, the atopic children were positive to grass, weed and tree antigens. Some researchers have suggested that profilin, an actin binding protein, may be responsible for these cross-reactions between latex and certain fruits[29, 30]. Our results also support the findings of Moneret-Vautrin et al.[31] that atopy may be a risk factor for latex sensitivity even without known exposure.

The specificity of in vitro assays for latex sensitivity is low, as documented in a study by Ownby et al[23]. In our study, AlaSTAT assay gave positive results in 20 (55%) of 36 children and in five (9.2%) of 54 adults with negative latex skin test. A possible explanation for this discrepancy may be as follows: AlaSTAT assay gives cross-reactivity between latex and other allergens such as pollens: Since all of our atopic children were sensitive to common allergens, this may have led to this high positivity. Unfortunately, we could not perform inhibition

assays because of technical difficulties, but this has already been reported several times[24-27]. Our results may not be confirmative, but may be suggestive for cross-reactivity between latex and some foods. On the other hand, there is no available standardized latex extract for skin tests and we have not performed intradermal tests with latex because of the risks. If we had performed intradermal tests. We believe the positive results with skin testing would have increased.

We think those children with either in vivo or in vitro positive latex tests should be followed up until adulthood with tests and that some precautions should be instituted for their job selections. These follow-up tests will shed light on whether these observations are an epiphenomenon in time.

In conclusion, latex allergy is a rapidly emerging health problem of particular concern among atopic children and hospital staff. Early diagnosis by reliable methods and avoidance represent the best approaches to this growing problem.

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