

Latex allergy in hospital employees

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To investigate the incidence of latex IgE-mediated hypersensitivity, 224 hospital employees were interviewed and prick skin tests were performed to six common aeroallergen extracts, one non-latex "synthetic" glove extract, and four different latex glove extracts. Of the 224 subjects, there were 136 nurses, 41 laboratory technicians, 13 dental staff, 11 physicians, 6 respiratory therapists, and 17 housekeeping and clerical workers. All 224 subjects tested negative for the nonlatex glove (Tactylon®) extract but 38 (17%) tested positive for latex extracts. The incidence ranged from 0% in housekeeping staff to 38% in dental staff.

Eighty-four percent of the latex skin test-positive employees complained of itching and 68% of rash upon exposure to latex, whereas the latex skin test-negative employees reported these symptoms in 29% and 17%, respectively. Urticaria was a symptom in 55% of the latex skin test-positive and 0.5% of the skin test negative-subjects. Anaphylaxis occurred in 10.5% of the skin test-positive and in none of the skin test-negative employees. Symptoms of sneezing (34% vs 7%), nasal congestion (39% vs 7%), and lacrimation and ocular itching (45% vs 6%) were also significantly different between the latex skin test-positive and latex skin test-negative subjects.

We conclude that the incidence of latex IgE-mediated allergy in hospital employees is 17%. The symptoms of anaphylaxis and hives when using latex gloves are sensitive predictors of IgE-mediated latex allergy.

INTRODUCTION

Latex is a common antigen for IgE-mediated allergic reactions.¹⁻⁵ Although IgE-mediated allergy to latex is the least common type of allergic reaction when compared with delayed hypersensitivity (Type IV), it is the most potentially life-threatening and dangerous. The use of protective latex devices to prevent exposure to the human immunodeficiency virus (HIV) and the Occupational Safety and Health Administration (OSHA) regulations in 1986 have resulted in the wider exposure to latex products by health care workers. This frequent and intense exposure to latex products has been associated with an increased incidence of symptomatic latex allergy in health care workers.

In this prospective study we investigated the incidence and risk factors for latex IgE-mediated al-

lergic reactions among university hospital employees. This study correlates the symptoms (anaphylaxis, hives, rash, pruritus, sneezing, ocular symptoms, and cough) with work exposures and skin test reactivity to latex.

SUBJECTS

Two hundred twenty-four employees of the Children's Hospital Medical Center (Cincinnati, Ohio), who were not taking antihistamines, tricyclic antidepressants, or beta blockers, were evaluated for latex sensitivity. The 224 subjects tested included 136 nurses, 41 laboratory technicians, 17 housekeeping and clerical personnel, 13 dental assistants and dental residents, 11 physicians, and 6 respiratory therapists.

MATERIAL AND METHODS

The protocol was reviewed and approved by the Institute Review Board and an informed consent was signed by all subjects enrolled in the study. Subjects who fulfilled the criteria and consented to the study were interviewed to determine the status of employment (full time vs part time), number of years of employment, sex, and the history of asthma, seasonal allergic rhinitis,

eczema, or sinus disease. Also the number of personal surgical procedures, frequency of using household latex gloves, or history of immediate reactions (within one hour of exposure) to latex gloves (anaphylaxis, hives, rash, itching, sneezing, nasal congestion, itchy watery eyes, and cough) were determined.

Extracts of five different glove brands were prepared in our laboratory and used for skin testing.⁶ The four Latex glove brands were Omicron (Becton Dickinson Acute Care, Franklin Lakes, NJ), Travenol (Travenol Laboratories, Inc., Deerfield, IL), Baxter (Baxter Healthcare Corporation, Pharmaseal Division, Valencia, CA), and Perry Dermaguard (Smith and Nephew Medical, Massillon, OH). The one nonlatex brand was Tactylon synthetic glove (Tactyl technologies, Inc., 2595 Commerce Way, Vista, CA 92083).

Each extract was prepared as follows: the gloves were rinsed with distilled water to remove cornstarch, cut into 1-centimeter square pieces, and the glove pieces were soaked in normal saline for 30 minutes. This solution was decanted through a Millex GV 0.22 μ m filter (Millipore Corporation, Bedford,

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MA). The filtered fluid was frozen and then lyophilized. The lyophilized extract was reconstituted 1:10 (wt:vol) using 0.9% sodium chloride with 0.03% human serum albumin and 0.4% phenol (Hollister-Stier); glycerine was added at a final concentration of 50% and this solution was again passed through a Millex GV 0.22- μ m filter. In addition to the extracts of the five different gloves, extracts of cornstarch, cat hair, *Monilia* (*Monilia sitophila*) (1:10 wt:vol), short ragweed (*Ambrosia artemisiifolia*), Kentucky bluegrass (*Poa pratensis*) (1:20 wt:vol), and dust mite (*D. farinae* and *D. pteronyssinus*, 50/50 mix, 15,000 AU/mL each species) (Hollister-Stier Laboratories); 50% glycerine saline (negative control) (Hollister-Stier); and histamine phosphate 1 mg/mL (positive control) (Eli Lilly) were used to skin test.

The DermaPIK System (Greer Laboratories, Lenoir, NC) was used to apply the extracts to the volar aspects of the forearms of the study subjects. The DermaPIK was used as an epicutaneous test device. It was held perpendicular to the skin at the test site to ensure that all six times were in contact with the skin, and gently rotated one-quarter turn. The skin tests were examined at 15 minutes and the resulting wheal and flare was measured. A test was considered positive if the wheal was 3 mm larger in diameter than the negative control wheal.⁷

Data analysis was performed using True Epistat (Epistat services, Richardson, TX). Chi-Square analysis was used to examine the association between skin test positivity to latex and the independent variables. Two-tailed *P* values were calculated with 95% confidence limits.

RESULTS

Thirty-eight (17%) of the 224 subjects who were interviewed and skin tested showed positive reactions to one or more latex antigens. The rate

of the latex skin test positivity to each of the four different latex extracts ranged from 81.5% to 97%. The difference, however, was not statistically significant (two-tailed *P* = .17). No subject in either group tested positive to the Tactylon, the nonlatex glove extract used. Tactylon is a polystyrene ethylene butylene styrene block polymer.

All 224 subjects were then divided into two groups, "Latex positive" and "Latex negative" based on the skin test results. When the two groups were compared (Table 1 and

Fig 1) the variables with statistical significance, (*P* value < .05) included a history of bronchial asthma, symptoms (clearly related to the use of latex gloves) of anaphylaxis, hives or urticaria, rash, itching, sneezing, nasal congestion, itchy, watery eyes, and cough. Although a history of seasonal allergic rhinitis was not significantly different between the two groups (*P* = .1), 26 (68.4%) of the subjects in the latex-positive group tested positive to two or more aeroallergens compared with 58 (31%) in the skin test-

Table 1. Comparison Between Latex Skin Test Positive and Latex Skin Test Negative In-hospital Employees

	Latex Skin Test Negative	Latex Skin Test Positive	Two-Tailed P Value
Subjects tested	186	38 (17%)	
Full-time employees	145 (78%)	28 (74%)	ns
Sex F/M	164/22	33/5	ns
No. of years of hospital employment	928/186 (4.98 yr)	198/38 (5.2 yr)	
History of hay fever	51 (27%)	16 (42%)	ns
History of sinus disease	97 (52%)	21 (55%)	ns
History of bronchial asthma	14 (7.5%)	8 (21%)	<i>P</i> < .05
History of eczema	17 (9%)	8 (21%)	ns
No. of surgical procedures	266/186 (1.43)	50 ÷ 38 = 1.3	
Use of latex gloves at work	170 (91%)	38 (100%)	
"always"	70 (41%)	20 (53%)	
most of the time	57 (33.5%)	17 (45%)	
occasionally	43	1 (3%)	ns
Daily use of household latex gloves	39 (21%)	3 (8%)	
Symptoms when using latex gloves	71 (38%)	38 (100%)	<i>P</i> < .000001
Anaphylaxis	0 (0%)	4 (10.5%)	<i>P</i> < .000001
Hives (urticaria)	1 (0.5%)	21 (55%)	<i>P</i> < .000001
Rash	31 (17%)	26 (68%)	<i>P</i> < .000001
Itching	54 (29%)	32 (84%)	<i>P</i> < .000001
Sneezing	13 (7%)	13 (34%)	<i>P</i> = .0000069
Nasal congestion	13 (7%)	15 (39%)	<i>P</i> < .000001
Itchy watery eyes	11 (6%)	17 (45%)	<i>P</i> < .000001
Cough	3 (2%)	7 (18%)	<i>P</i> = .0000346
Symptoms when using latex condoms or diaphragms	10 (5%)	4 (10.5%)	ns
Subjects who tested positive to two or more aeroallergens tested	58 (31%)	26 (68%)	<i>P</i> = .0000352
Subjects tested for latex antigens	0 (0%)	38 (100%)	
Subjects tested positive for vinyl extract	0 (0%)	0 (0%)	

ns = not significant.

negative group ($P = .0000352$, 95% CI: 0.092 – 0.469). There was no difference between the two groups in the status of employment (full-time vs part time), number of years of employment, gender, frequency of latex glove use at home, symptoms when using condoms or diaphragms, and the history of seasonal hay fever, eczema, and sinus disease.

One hundred thirty-six (60.7%) of the 224 subjects tested were nurses (Table 2). Twenty-four (17.6%) of the 136 nurses tested showed positive reactions to latex. We were successful in including 50 neonatal intensive care and 32 emergency room nurses in our study (41.6% and 42.1% of the total number of nurses working in each unit, respec-

tively). Of the other nurses tested, 35 worked on inpatient medical units, nine worked in outpatient clinics, eight in the bone marrow transplant unit, and two in the operating rooms.

The percentage of subjects who tested positive for latex ranged from 0% in housekeeping and clerical personnel to 38% in the dental assistants and dental residents. The total number of dental assistants and dental residents tested (13) is small and a larger number is needed to establish a true prevalence for this group (Table 2).

DISCUSSION

Natural rubber is derived from the latex, or milky sap, of the rubber tree *Hevea brasiliensis*. Although

there are over 200 species of plants that produce rubber, only *Hevea brasiliensis* and the guayule bush *Parthenium* produce large amounts of rubber.¹

Latex products have been used for many years prior to the first report of latex-induced urticaria by Nutter² in 1979. Latex IgE-mediated reactions are caused by latex proteins remaining in the latex products after manufacture.^{1,3,4} In the last decade there have been numerous reports of latex IgE-mediated reactions reflecting a dramatic increase in incidence. Many factors might have contributed to this rise in incidence of latex reactions. Increased usage and changes in manufacturing methods are important factors. The sales of latex gloves rose from about \$126 million in 1987 to a projected \$263 million in 1991.⁵ To meet the increased consumer demands, manufacturers shortened the storage time for crude latex and steam sterilization was discontinued. A recent study by Dalrymple et al⁸ acknowledged that both discontinuation of steam sterilization and the short storage time are possible important factors in increasing the levels of allergenic latex proteins of the latex products.

Three groups have been identified to have an increased risk of IgE-mediated latex allergy: rubber industry workers,⁹ patients with meningomyelocele,⁶ and health care workers.¹⁰⁻¹² Nonetheless, patients who are not in any of these groups have been reported to have serious anaphylactic reactions including death.^{13,14}

In this study, the prevalence of latex skin positivity was 17% in hospital employees. Those figures are higher compared with two of the previous reports.^{10,11} A recent study by Iacobelli et al found an incidence of 14.4% latex skin test positivity in health care workers.¹² One of the major differences is our use of four different brands of latex gloves which increased the incidence from 13.7% if one glove brand is used to

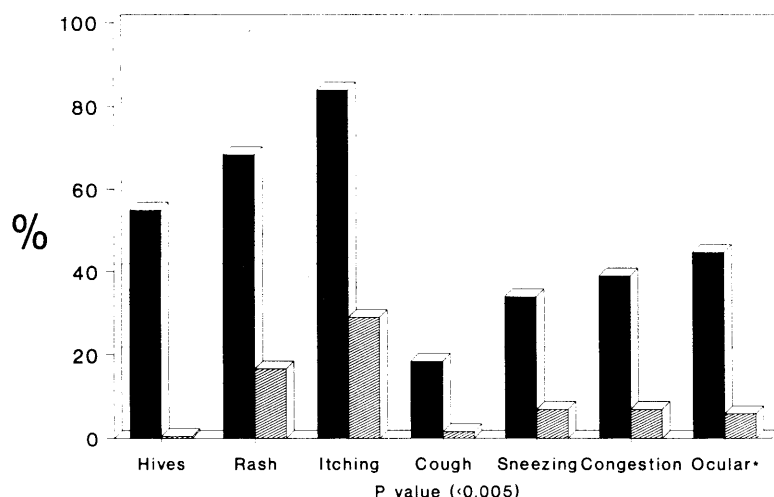


Figure 1. Symptoms when using latex gloves in latex negative and latex positive groups. * Itchy, watery eyes. ■ Latex positive and ▨ latex negative.

Table 2. Comparison Between Latex Skin Test Positive and Latex Skin Test Negative Groups

Subject (number)	Latex Skin Test Negative	Latex Skin Test Positive
Subjects tested (224)	186	38
Nurses (136)	112	24
Laboratory technicians (41)	34	7
Dental assistants and dental residents (13)	8	5
Respiratory therapists (6)	5	1
Physicians (11)	10	1
Housekeeping and clerks (17)	17	0

the 17% where all four brands were utilized.

It is also possible that our study has identified a falsely high percentage of latex-positive employees. More symptomatic employees may have been more willing to participate in the study because participation was voluntary, anonymity was guaranteed to all participants, and the study followed an extensive latex sensitivity awareness program for all hospital employees. This possibility is supported by the high percentage of symptomatic subjects (100% in the latex skin test positive group; 38% in the latex skin test negative group). By contrast, in a previous study in which efforts were made to study the entire meningo-myelocoele clinic,⁶ 49% of latex skin test-positive subjects and none of the latex-negative subjects were found to have symptoms related to latex exposure.

We were able to study only two of the operating room nurses. This would be an interesting group to study since they spend a high percentage of their working hours wearing latex gloves.

The symptoms (with latex glove use) of anaphylaxis and hives were sensitive predictors and correlated with positive skin test reactions to latex extracts. Immediate rash, generalized pruritus, sneezing, nasal congestion, ocular pruritus and lacrimation, and cough were suggestive for possible latex sensitivity. These symptoms, however, were observed in nonlatex-sensitive subjects as well. These questions are critical to ask prior to undergoing any surgical or medical procedure that entails latex use, especially for health care workers.

A study by Lagier et al¹¹ has shown increased history of atopy (hay fever, asthma, or childhood dermatitis) in subjects sensitive to latex. In our study, the history of bronchial asthma was statistically significant and a trend towards statistical significance for the history of eczema and hay fever was noted.

Our finding that 68% of the latex-positive skin test group tested positive to two or more aeroallergens compared with 31% in the skin test negative group, raises the suggestion of utilizing aeroallergen skin tests in screening health care workers prior to any elective surgical or medical procedure. Whatever the result of the aeroallergen test, in-vivo or in-vitro determination of latex sensitivity is needed to determine the possibility of IgE-mediated latex allergy.

In our experience, latex epicutaneous skin testing is safe using latex glove extracts (1:10 wt:vol) prepared by the method we described. The subjects included in this study were carefully selected and latex skin testing was done in a hospital setting only if trained personnel and equipment for treatment of systemic anaphylaxis were present. Anaphylactic reactions have been reported when crude latex or non-wt:vol extracts were used.^{15,16} At this time, there is no FDA approved latex skin test extract. Latex extract is available in Canada.⁹ Although the in vitro tests (including RAST and ELISA) offer greater safety, they are less sensitive. In a study by Turjanmaa et al¹⁷ latex RAST was 53% sensitive. Recent efforts by many investigators in developing a more sensitive in vitro test are promising.

We conclude that the incidence of latex skin test positivity is 17% in hospital employees. The presence of two or more positive aeroallergen skin tests combined with the history of bronchial asthma and the symptoms of anaphylaxis and hives are sensitive predictors of IgE-mediated latex allergy. If a hospital employee develops symptoms when using latex products and/or prior to any personal surgical or medical procedure that entails latex use, proper evaluation including a detailed history and latex skin testing is strongly recommended. When skin testing is unavailable, and in the presence of negative in vitro latex tests, precautionary latex avoidance measures

should be undertaken empirically in this high risk group.

Physicians and hospitals can no longer ignore latex allergy in their patients and employees. In particular, more rigid guidelines are needed to screen hospital employees for latex allergy in order to avoid further sensitization, symptoms, absenteeism, and the possibility of exposure to severe fatal reactions. The future goal of the hospitals and latex industry should include the use of "less" sensitizing or nonlatex products to decrease the occupational exposure to latex. At the present time, the expense and the inelasticity of the nonlatex gloves limit their routine use.

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INCREASED RISK OF ASTHMA AMONG RESPIRATORY THERAPISTS

To investigate risk of asthma among respiratory therapists the authors conducted a mailed questionnaire survey of 2086 respiratory therapists and 2030 physical therapists and physical therapy assistants in Massachusetts. Response rates were 57% for respiratory therapists, 61% for physical therapists, and 62% for physical therapy assistants.

Histories of physician-diagnosed asthma were reported by 16% of respiratory therapists and 8% of the controls. Respiratory therapists also reported development of asthma after entry into their profession more frequently than controls (7.4 versus 2.8%). After adjustment for age, family history, atopic history, smoking, and sex the odds ratio for respiratory therapists was 2.5 (95% confidence interval 1.6-3.3).

These results confirm the earlier report of an increased frequency of asthma among respiratory therapists in Rhode Island. Possible risk factors include increased exposure to microbial agents and bronchodilator aerosols.

—RMS

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