

Latex allergy in housekeeping personnel

Gordon L. Sussman, MD*; Doreen Lem, RN†; Gary Liss, MD‡; and Donald Beezhold, PhD§

Background: Latex allergy has been well described in healthcare workers and children with spina bifida. Cost effective measures to avoid latex allergic reactions are possible in these recognized risk groups.

Objective: To study the prevalence of latex allergy among hospital housekeepers regularly exposed to latex gloves.

Methods: Fifty members of the housekeeping staff at a Toronto teaching hospital were screened by questionnaire for latex allergy. Patients with possible atopy or symptoms suggestive of latex allergy (20) were skin tested with latex (Bencard Laboratories) eight common allergens and histamine control.

Results: Four of 20 tested had a positive latex prick skin test representing an 8% prevalence overall within this group, and a 20% prevalence among atopic housekeepers. Based on an expected 1% prevalence in the general population, this was statistically significant ($P < .005$). Latex-positive patients had extensive exposure to high protein-unlined latex gloves. Positive patients had a similar yet completely unique immunoblot pattern of IgE binding. All four positive patients had unrecognized latex allergic symptoms (hand dermatitis, rhinoconjunctivitis). One housekeeper experienced itchiness of her face, angioedema, and lightheadedness immediately after inflating a latex balloon.

Conclusions: The 8% prevalence of a positive latex skin test in regularly exposed hospital housekeepers is similar to that observed among healthcare workers suggesting this is a new risk group.

INTRODUCTION

Latex-containing products pose a hazard to individuals who are allergic to residual rubber tree latex proteins. Allergic reactions range from contact urticaria to anaphylaxis causing death.¹⁻⁸ While use of products with lower levels of latex antigen release may prevent sensitization, for individuals already sensitized to latex, no latex product can be considered nonallergic and avoidance is mandatory.

The prevalence of latex allergy in the general population is believed to be less than 1%.⁹ Only 1 of 800 (0.125%) surgical patients demonstrated a positive latex prick skin test¹⁰; therefore, it

is not cost effective to screen the entire population for latex allergy. Nevertheless, studies have established a high prevalence of latex allergy among certain risk groups.^{9,11-15} Children with spina bifida demonstrate a 28% to 67% prevalence of latex sensitization.^{14,15} The other major group at risk of latex allergy are regularly exposed healthcare workers.^{9,11-13}

It is suspected that regular exposure causes the development of latex allergy. Patients with multiple surgeries and occupationally exposed workers with skin and airborne latex contact are at risk of developing allergy. If these and other groups with a high prevalence of latex allergy can be identified, cost effective measures can be taken to avoid severe latex allergic reactions. Individuals belonging to a significant risk group could have pre-operative testing for latex allergy. When the prevalence of latex sensitization is very high as in spina bifida children it would be logical to proceed on the presumption of latex allergy and insti-

tute full latex avoidance procedures. This is particularly important before, during, and after operative procedures.

The objective of this study was to examine the prevalence of latex allergy among nonprofessional healthcare workers. We report hospital housekeepers as a new occupational risk group for latex allergy.

METHODS

All 71 members (36F/35M) of the housekeeping staff at The Wellesley Hospital, Toronto, Canada were invited to participate in this study. The study protocol was approved by the institutional review board at the University of Toronto and informed consent was obtained from all study participants. Fifty housekeepers (70%) volunteered for this study. All housekeepers wore yellow rubber latex gloves (Cor-Tech) during work hours with approximately 25 to 30 hours of latex glove use per week. These gloves were not powdered or flocked.

Study participants were screened by questionnaire. This questionnaire identified cutaneous, ocular and upper or lower respiratory symptoms that could possibly represent latex or other allergy. It also identified a positive family history of atopy. Only patients felt to have possible atopy or latex allergy on questionnaire were skin tested (20 patients, 14 females and six males). Skin tests were done by the prick through drop method on the forearm using a 25-gauge needle and read at 15 minutes. Positive skin tests were greater than 3-mm wheal and flare reactions. Skin test reagents included Bencard latex and eight common inhalant and food allergens (grass mix, Alternaria, house dust, house dust mite, cat hair, milk, egg, and shrimp) and histamine control (1/1,000 histamine, Bencard Laboratory).

* Department of Medicine, University of Toronto, Toronto, Ontario, Canada.

† St. Clair Allergy, 202 St. Clair Ave. West, Toronto, Ontario, Canada.

‡ Ontario Ministry of Labour, Toronto, Ontario, Canada.

§ The Guthrie Foundation for Medical Research, Sayre, Pennsylvania.

Received for publication July 11, 1994.

Accepted for publication in revised form September 26, 1994.

Table 1. Latex Allergic Housekeepers

Latex Glove Exposure		Skin, Nasal, Eye Symptoms	Latex Test
49F	10 yr 30 h/wk ICU & burn unit	Generalized dermatitis, rhinitis & conjunctivitis at work	9mm wheal & flare
30F	17 yr 30 h/wk Office work	Hand dermatitis, rhinitis & conjunctivitis at work	8mm wheal & flare
32F	8 yr 30 h/wk Office work	No skin symptoms, rhinitis at work	6mm wheal & flare
55F	15 yr 30 h/wk Previously floor work, now 2 yr in office area	Hand dermatitis, rhinitis at work	22mm wheal & flare

Latex Protein Glove Testing

A latex protein-specific, indirect ELISA technique was used to quantify the latex protein content in the gloves. Latex protein antigens from a standard preparation (prepared from ammoniated latex) and glove extracts were adsorbed onto the wells of a 96-well ELISA plate by incubating 2-fold serial dilutions of the solutions in the wells for four hours. Latex antigenic protein of the glove extracts was then determined by immunologic assay as described previously.¹⁶

IgE Immunoblot Studies

Latex-specific IgE antibody was detected in prick skin test-positive patients' sera by Western blot using a triple antibody sandwich technique. Latex protein preparations were separated by SDS-PAGE on 15% gels as previously described.¹⁷ The proteins

were transferred to nitrocellulose (0.1 μ m, Schleider and Schnell) according to the method of Towbin et al.¹⁸ The nitrocellulose membrane was blocked with 2% dry milk and reacted with a 1/10 dilution of the patient sera. Following washing with 0.1% Tween-20 in phosphate buffered saline, the blot was reacted with a 1/2000 dilution of monoclonal anti-human IgE (clone GE-1, Sigma, St. Louis, MO) and a 1/5000 dilution of alkaline phosphatase-labelled goat anti-mouse IgG (Promega, Madison, WI). Visible bands indicating IgE reactivity were produced by developing in the alkaline phosphatase substrate (nitroblue tetrazolium/bromo-chloro-indolyl phosphate) (Promega).

RESULTS

Of the 50 housekeepers who completed the latex allergy questionnaire, 20 (40%) were eligible for allergy skin testing. All housekeepers who were skin tested had at least one positive test (latex, inhalant, or food allergens). Overall four (8%) of 50 hospital housekeepers and four (20%) of 20 atopic housekeepers were skin test positive to latex. All four latex skin test-positive patients had unrecognized symptoms of latex allergy including mucosal contact (Table 1). In particular, all had occupational rhinoconjunctivitis and three had hand dermatitis. One patient with a large positive skin test (22-mm wheal with surrounding flare) developed localized angioedema, generalized urticaria, and light-headedness after inflating a latex balloon.

One housekeeper worked in the Intensive Care Unit, who would presumably be associated with significant exposure to airborne latex. Three of the four patients worked in offices or hospital wards that were not recognized as areas with high latex use or aerosolized latex exposure.

The housekeeping latex glove antigenic protein content was 714 μ g and 531 μ g latex protein per gram dry weight. This would represent 20 mg and 16 mg of antigenic protein per glove. This is extremely high when compared with most other tested gloves¹⁶ (Fig 1).

Western blot separation of latex proteins generally were similar but with significant differences demonstrating a unique pattern of IgE binding proteins in our latex prick skin test positive hospital housekeepers (Fig 2).

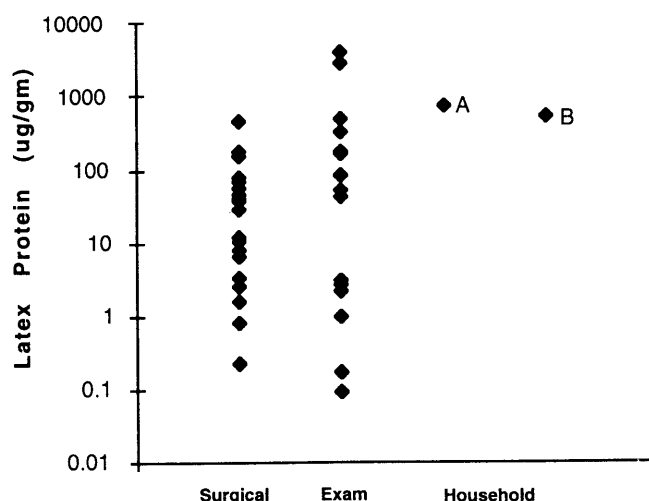


Figure 1. Protein levels in housekeeper's Gloves. Antigenic protein content of two separate housekeeping gloves. Protein levels were determined using the Latex ELISA for Antigenic Protein assay. The household gloves A and B are compared with 19 brands of latex surgical and 14 brands of latex examination gloves.

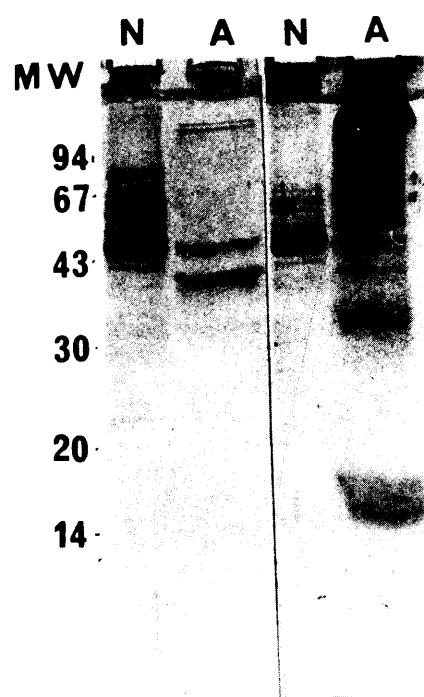


Figure 2. Western blot analysis of IgE reactivity in sera from two latex-allergic housekeepers. The reactivity of these two patients is similar in that similar non-ammoniated proteins (N) were recognized. The protein pattern of these two patients is different. These patients recognized multiple polypeptides in the ammoniated latex proteins (A). One patient recognizes a doublet of protein at 14 kD in the ammoniated proteins.

DISCUSSION

There was an 8% (4/50) prevalence of positive latex skin tests in regularly exposed hospital housekeepers. This may be an underestimate because 30 housekeepers who completed the questionnaire were not considered eligible for skin testing. There was a 20% (four of 20) prevalence of latex allergy in atopic housekeepers. Assuming an expected 1% prevalence of latex allergy and using the binomial distribution, the probability of observing four or more positives among 50 (or 20) housekeepers was .0016 (or .000043). Using a 2.5% prevalence of latex allergy in controls as suggested by another study¹⁹ the probability of identifying four positive tests was $P < .05$. In

other words, the observed high prevalence compared with the general population was unlikely to be due to chance.

The prevalence of latex allergy in hospital housekeepers was similar to latex-exposed dentists, physicians, and nurses as previously reported.^{9,11-13} Nonmedical personnel, as other groups regularly using high protein latex gloves, may therefore be sensitized and develop latex allergy.^{20,21} Hospital housekeepers appear to be an important risk group and should be screened for latex allergy prior to surgical or other medical procedures. The similar IgE binding pattern of latex allergens in our hospital housekeepers suggests a common source of latex exposure and sensitization.

The housekeepers with positive latex skin tests all had symptoms of latex allergy. IgE-mediated reactions included work-related rhinoconjunctivitis. One patient noted generalized latex allergy. Hand dermatitis alone is most often related to irritant and delayed hypersensitivity to rubber additives. Patients with IgE-mediated latex allergy, however, usually have associated local hand sensitivity to latex with contact pruritus, urticaria, and eczema.²

It is important to study the antigenicity and allergenicity of all latex devices. Sensitization appears to have emerged with the frequent use of high protein, high antigenic powdered latex gloves. We suggest that sensitization occurred by chronic exposure due to regularly wearing latex gloves with secondary absorption of allergenic proteins in predisposed hospital housekeepers. Airborne latex, which has been measured using powdered gloves, could be a significant route of exposure, with later development of latex allergy.²² Studies are currently needed to more carefully document whether low protein powder-free gloves prevent latex sensitization.

The only present treatment in symptomatic skin test-positive latex allergic patients is avoidance. Housekeeping hospital staff who regularly use latex gloves should be screened for latex

allergy. Individuals with positive skin tests to latex should use only nonlatex gloves in their work. The use of non-latex or powder-free gloves by all co-workers may allow allergic workers with severe rhinoconjunctivitis and asthma to tolerate work in areas where they previously had to be removed.²² Patients with positive latex prick skin tests should be cautioned to avoid exposure to latex-containing materials or devices should they undergo any medical procedure. Finally, manufacturers of industrial latex gloves should reduce the protein allergen levels of their products to prevent sensitization of predisposed workers.

REFERENCES

1. Wrangsjö K, Mellström G, Axelsson JGK. Discomfort from rubber gloves indicating contact urticaria. *Contact Dermatitis* 1986;15:79-84.
2. Sussman GL, Tarlo SM, Dolovich J. The spectrum of IgE-mediated responses to latex. *JAMA* 1991;265:2644-7.
3. Spanner D, Sussman GL, Tarlo SM, et al. Latex allergy: two case reports [Abstract]. *J Allergy Clin Immunol* 1988;81:179.
4. Slater JE. Rubber anaphylaxis. *N Engl J Med* 1989;320:1126-30.
5. Leynadier F, Pecquet C, Dry J. Anaphylaxis to latex during surgery. *Anaesthesia* 1989;44:547-50.
6. Wrangsjö K, Wahlberg JE, Axelsson JGK. IgE-mediated allergy to natural rubber in 30 patients with contact urticaria. *Contact Dermatitis* 1987;19:264-71.
7. Hamann C. Natural rubber latex protein sensitivity in review. *Am J Cont Dermatitis* 1993;4:4-21.
8. Heese A, v Hintzenstern J, Peters K-P, et al. Allergic and irritant reactions to rubber gloves in medical health services. *J Am Acad Dermatol* 1991;25:831-9.
9. Turjanmaa K. Incidence of immediate allergy to latex gloves in hospital personnel. *Contact Dermatitis* 1987;17:270-5.
10. Turjanmaa K. European medical experiences. From latex protein allergy: the present position. *Proc Int Conf Rubber Consultants and Eur Rubber J*. December 6, 1993;17-9.
11. Berky Z, Lucian J, James WD. Latex

- glove allergy. A survey of the US Army Dental Corp. *JAMA* 1992;268:2695-7.
12. Charpin D, Lagier F, Lhermet I, Vervloet D. Prevalence of latex allergy in nurses working in operating rooms [Abstract]. *J Allergy Clin Immunol* 1991;87:269.
 13. Arellano R, Bradley J, Sussman GL. Prevalence of latex sensitization among hospital physicians occupationally exposed to latex gloves. *Anesthesiology* 1992;77:905-8.
 14. Yassin MS, Sanyurah S, Lierl MB, et al. Evaluation of latex allergy in patients with menigomyelocele. *Ann Allergy* 1992;69:207-24.
 15. Kelly KJ, Kurup VP, Reijula KF, Fink JN. The diagnosis of natural rubber latex allergy. *J Allergy Clin Immunol* 1993;93:813-6.
 16. Beezhold DH. LEAP: latex ELISA for antigenic proteins. *Guthrie J* 1992;61:77-81.
 17. Beezhold DH, Beck WC. Surgical glove powders bind latex antigens. *Arch Surgery* 1992;127:1354-7.
 18. Towbin H, Staehelin T, Gordon J. Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: procedure and some applications. *PNAS USA* 1979;76:4350-4.
 19. Ownby DR, Ownby HE, McCullough JA, Shafer AW. The prevalence of anti-latex IgE antibodies in 1000 volunteer blood donors [Abstract]. *J Allergy Clin Immunol* 1994;93:282.
 20. Jaeger D, Kleinhans D, Czuppon AB, Baur X. Latex-specific proteins causing immediate-type cutaneous, nasal bronchial and systemic reactions. *J Allergy Clin Immunol* 1992;89:759-68.
 21. Slater JE, Chhabra SK. Latex antigens. *J Allergy Clin Immunol* 1992;89:673-8.
 22. Tarlo SM, Sussman GL, Contala A, Swanson MC. Control of airborne latex by use of powder-free latex gloves. *J Allergy Clin Immunol* 1994;93:985-9.

Request for reprints should be addressed to:
 GL Sussman, MD
 202 St Clair Avenue West
 Toronto, Ontario
 Canada M4V 1R2

ALLERGY TO AMOXICILLIN WITHOUT ALLERGY TO PENICILLIN

The authors studied 54 patients with histories of immediate allergic reactions (anaphylaxis, urticaria, or angioedema) to amoxicillin but tolerance to benzyl penicillin. These were selected from 177 patients allergic to β -lactam antibiotics of whom 146 had had immediate reactions, including 42 with histories of allergy to penicillin and 36 with positive skin tests or challenge to penicillin.

Allergy skin testing was done with benzylpenicilloyl-poly-L-lysine, 5×10^{-5} M; minor determinant mixture (benzylpenicilloate sodium with benzylpenicillin, 10^{-2} M; benzylpenicillin, 10,000 units/mL; ampicillin, 20 mg/mL; and amoxicillin, 20 mg/mL as well as histamine and saline controls. RASTs were done with penicilloyl-polylysine and amoxicillin polylysine. When both skin tests and RAST for benzylpenicillin were negative, the patient was challenged with penicillin, 1,000,000 units by intramuscular injection. If this challenge was negative and results of the history, skin testing, and RAST left the diagnosis of allergy to amoxicillin uncertain, the patient was challenged with amoxicillin with doses progressing from 5 mg to 500 mg.

The 54 patients with histories of allergy to amoxicillin and tolerance to penicillin were all skin test negative to penicilloyl-polylysine; 49 of 51 were also negative to the minor determinant mixture; and 44 of 46 were negative to penicillin. Skin tests with amoxicillin were positive in 34 patients; RAST for amoxicillin, in 22. Challenge tests established allergy to amoxicillin in 23 patients, including 15 in whom both skin tests and RAST for amoxicillin had been negative. All 54 patients tolerated challenge with penicillin.

These data confirm that diagnosis of allergy to amoxicillin in patients who are not allergic to penicillin may require specific amoxicillin-related reagents or challenge with amoxicillin.

—RMS

Vega JM, Blanca M, Garcia JJ, et al. Immediate allergic reactions to amoxicillin. *Allergy* 1994;49:317-22.