

Original article

Occupational exposure of Brazilian neonatal intensive care workers to latex antigens

Background: Frequent exposure to latex causes various reactions such as respiratory symptoms and anaphylactic shock. In these cases, proteins found in natural latex are responsible for the serious systemic antilatax-mediated immediate hypersensitive reactions.

Methods: Cross-sectional descriptive survey focusing on 96 Brazilian health care workers (HCW) in the neonatal intensive care unit at CAISM, State University of Campinas UNICAMP, Brazil. All subjects were interviewed, donated blood samples for the latex-specific immunoglobulin E measurement and underwent the skin prick test (SPT) with an antigen extracted from latex gloves.

Results: The prevalence of latex positive SPT was 8%. There were eight SPT positive and only one serologic test was in agreement with the SPT. Overall, there was evidence of an association between the latex SPT and reported eczema ($P = 0.01$); food allergy ($P = 0.009$) with pineapple ($P = 0.01$).

Conclusions: These results suggest that the identification of reactions of immediate hypersensitivity mediated by antilatax antibodies in HCW should be encouraged to prevent occupational exposure to latex products.

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Key words: latex allergy; latex gloves; occupational
allergy; occupational health.

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Accepted for publication 23 July 2003

Allergic skin and respiratory diseases are considered the main occupational hazards faced by health care workers (HCW) (1, 2). The main source of allergic exposure is the use of powdered latex gloves (3) and the sensitivity is caused by the water-soluble proteins present in these products (4). Latex gloves were considered innocuous until the end of the 1980s, but they have proved to be important allergic sensitizers (5). In 1987, because of the acquired immunodeficiency syndrome, the use of gloves increased worldwide and consequently the number of occupational latex allergy cases among hospital workers (4, 6). The first Brazilian-controlled epidemiologic study on latex allergy was conducted on a group of 50 professionals working in the operating room of a metropolitan hospital in Rio de Janeiro and the allergic sensitivity found using the skin prick test (SPT) was 6% (7). Three other cases of Brazilian HCW who presented a clinical condition strongly suggestive of latex allergy were described (8).

Material and methods

This is a cross-sectional descriptive study of the nursing and medical staff in a neonatal intensive care unit (ICU) at the Women's Integral Healthcare Center (CAISM), State University of Campinas (UNICAMP), conducted from July to November 2001. All the team members who agreed to participate in the study were included with

the exception of those members who had used beta-blockers, antihistamines, tricyclic antidepressives and corticosteroids up to 3 weeks before the study, women who were pregnant or breastfeeding. After the above cited criteria were fulfilled, the study population consisted of 96 HCW: 26 nurses, 23 nursing technicians, 26 nursing assistants, two nursing attendants, 14 physicians and five medical residents. This study received the approval of the Research Ethics Commission, UNICAMP. All the participants signed terms of informed consent.

Questionnaire

Sociodemographic data were checked to characterize the study population, investigate risk factors and clinical complaints. These concepts are found in literature and are related to this area of investigation (<http://www.allergy.mcg.edu/physicians/latex.html>; 9). Six specialists in this area who investigated their adequacy in relation to the elements, clarity, comprehension and structural form confirmed the validity of the tool used.

Measures of latex-specific immunoglobulin E

The latex-specific immunoglobulin E (IgE) in the serum was measured by UNICAP-PHARMACIA[®] system (Uppsala, Sweden). For the purposes of these analysis, values from 0.7 to 17.5 kUA/l were classified as positive

(presence of specific IgE) and those > 17.5 kUA/l were considered as strongly positive.

Latex allergen preparation

It was obtained by cutting the gloves into small pieces, which were then put into an Erlenmeyer containing 1000 ml of sterile saline solution. The solution was kept magnetically agitated for 4 h at room temperature and then maintained at 4°C overnight. The solution was filtered using a no. 10 filter paper and concentrated in an evaporation apparatus RC 10.10 (Jouan Quality System, Herblain, France) and stored at -70°C. The concentrated solution was diluted in saline solution and the protein content dosage (10) was 184 µg/ml.

Skin prick test

Skin prick tests were performed (11) with disposable sterile punctors in the volar region of the forearm with latex antigen extracts obtained from sterile powdered and nonpowdered gloves used at the ICU. Histamine at 10 mg/ml was used as the positive control and a sterile-buffered saline solution as the negative control. After 20 min the test was considered positive for wheel ≥ 3 mm.

Statistical analysis

The Statistical Analysis System (SAS) software for Windows (version 8.1, SAS Institute Inc., Cary, NC, 1999–2000), was used to perform the statistical analysis. The Fisher's exact test was used to verify association and compare proportions and the Mann–Whitney test and *t*-test for independent samples to compare continuous variables between the two groups. The significance level adopted was 5% and the adjustment for multiple tests (or Bonferroni correction/adjustment, $P \leq 0.0125$) was performed.

Results

An 8% positive prevalence to the SPT was obtained: six nursing and two medical staffs. Eight HCW were (+)SPT and only one worker presented concordance between serologic (positive-specific IgE) and SPT. Regarding the risk factors studied, evidence of a relationship between certain listed food, fruits and SPT was found, $P = 0.009$ (Table 1).

The association between latex SPT and allergy to pineapple ($P = 0.01$), and eczema was observed ($P = 0.01$). Contact dermatitis related to the use of latex gloves represented 43% and showed no association with SPT (Table 2). Among the workers who were positive to the latex SPT, three did not present any clinical complaints compatible with latex specific IgE-mediated reactions (Table 3). Nonetheless, with the exception of the one

Table 1. Distribution of the skin prick test (SPT) according to the risk factors studied

Risk factors	SPT	n	Mean	SD	Maximum	Median	Minimum	P-value*
Use in years	Negative	88	11	7	28	10	1	0.8
	Positive	8	11	9	28	8	5	
Daily use	Negative	8	111	82	480	90	05	0.04
	Positive	88	56	35	120	60	10	
Fruit	Negative	88	0	1	4	0	0	0.009
	Positive	8	2	3	8	2	0	
Surgical antecedents	Negative	60	2	2	7	2	1	1.0
	Positive	5	2	1	4	2	1	

* Bonferroni's weighted: $P \leq 0.0125$.

Table 2. Skin prick test (SPT) percentage according to the risk factors studied

Risk factors	Categories	SPT		P-value*
		Positive, n (%)	Negative, n (%)	
Atopy†	Yes	7 (87)	36 (41)	0.02
Eczema	Yes	4 (50)	9 (10)	0.01
Foods				
Pineapple	Yes	4 (50)	11 (13)	0.01
Medication allergy	Yes	2 (25)	21 (24)	1.00
Surgery	Yes	5 (63)	60 (68)	0.7
Contact dermatitis‡	Yes	3 (37)	38 (43)	1.0
Itching	Yes	3 (37)	33 (37)	1.0
Peeling	Yes	2 (25)	19 (22)	1.0
Fissure	Yes	1 (13)	23 (26)	0.7
Exudation	Yes	1 (13)	7 (8)	0.5
Vesicles	Yes	2 (25)	5 (6)	0.1

* Fisher's exact test (significant at $P \leq 0.05$).

† $n = 43$, more than one report of atopy status per worker.

‡ At least one of the complaints listed.

Table 3. Skin prick test (SPT) percentage result in accordance with complaints of contact urticaria resulting from the use of latex gloves

Clinical manifestation	Categories	SPT		P-value*
		Positive, n (%)	Negative, n (%)	
Contact urticaria†	Yes	1 (13)	4 (5)	0.3
Urticaria	Yes	1 (13)	4 (5)	0.4
	Local	0 (0)	4 (100)	
	Disseminated	1 (100)	0 (0)	
Edema	Yes	1 (13)	3 (3)	0.3
Reactions due to airborne dissemination†	Yes	5 (62.5)	24 (27.3)	0.05
Red eyes	Yes	1 (12.5)	3 (3.4)	0.3
Sneezing attacks	Yes	4 (50)	13 (14.7)	0.03
Runny nose	Yes	3 (37.5)	11 (12.5)	0.09
Blocked nose	Yes	2 (25)	8 (9.1)	0.2
Itching nose	Yes	3 (37.5)	21 (23.8)	0.4
Breathing difficulty	Yes	2 (25)	3 (3.4)	0.05
Wheeze	Yes	1 (12.5)	0 (0)	0.08
Angioedema	Yes	2 (25)	2 (2.3)	0.03

* Fisher's exact test (significant at $P \leq 0.05$).

† At least one complaint reported.

worker who simultaneously reported disseminated urticaria, the other five workers with (+)SPT presented clinical complaints that were predominantly respiratory (Table 4).

Discussion

The prevalence of latex antigen positivity to SPT in our study was 8%. It was not possible to analyze the prevalence results in the general Brazilian population because specific epidemiologic studies were not available. International studies report 1% prevalence in the general atopic population (6), but there are studies demonstrating a prevalence of 6.4, 3.5 and 4% during winter and 7% in the summer in latex-specific IgE in the serum of blood donors (12, 13).

(+)SPT obtained in this study was greater than that obtained in the first controlled Brazilian epidemiologic study on latex allergy demonstrating the prevalence of (+)latex-SPT (commercial extract) in 50 (6%) surgery workers. All (+)SPT workers presented a personal and familial history of atopy and contact allergy (7). However, an American case-control study of ICU workers, using a latex-soluble antigen extracted from the powder gloves, found 14% (17/122) of (+)SPT (9). In our study, the risk factors did not demonstrate a significant association between exposure time to gloves when on duty and the SPT. Nevertheless, the data analysis of workers with (+)SPT, suggest that the use of latex gloves caused clinical symptoms that obligate them to change the manner of utilizing glove, i.e. they were now being used for shorter periods.

Our results showed no clear evidence of an association between atopy and latex allergy, which was different from previous studies (9, 14, 15). However, concerning the presence of eczema, our findings are very similar to those obtained by Watts et al. (9), that reported a relationship between the SPT and eczema in five of the eight subjects, while in our population, four of the 13 workers with a history of eczema were (+)SPT.

There are studies demonstrating that patients with type 1 latex allergy often suffer from food intolerance that produces allergy symptoms, principally papaya, avocado, pineapple, banana, chestnuts, kiwi, melon and peaches (3, 16, 17). Our results show evidence of a relationship between (+)latex SPT and food allergy. Regarding the list of fruits cited a relationship between pineapple allergy and latex positivity was found, suggesting the existence of common antigenic epitopes.

The powder in the gloves plays an important role in type 1 latex-specific hypersensitive reactions because it is not only responsible for the respiratory reactions caused by exposure to airborne allergens but also for dermal reactions due to skin exposure (3, 18). The detection of sensitized workers who may or may not present clinical symptoms is important for implementing measures to

Table 4. Clinical characteristics of the workers with type 1 latex hypersensitivity

Case	1	10	16	38	40	52	85	87
SPT	+	+	+	+	+	+	+	+
ELISA	-	-	-	-	-	-	-	-
Age	38	54	35	28	38	38	25	24
Job title	Nursing technicians	Nursing assistants	Nurse	Nursing technicians	Nurse	Physician	Resident	Nursing technicians
Sex	F	F	F	F	F	F	F	F
Race	White	Negro	Negro	Mulatto	White	White	White	Negro
Glove use in years	39	28	8	8	7	23	7	8
Time use daily	30	60	60	60	90	10	30	120
Atopy	Rhinitis	Atopic dermatitis	Atopic dermatitis	Rhinitis	Rhinitis and asthma	Atopic dermatitis	Rhinitis	No
Eczema	No	Yes	No	Yes	No	Yes	Yes	No
Food allergy	No	Pear, kiwi, peaches, chestnuts, pineapple, walnuts, grapes, apple	No	Pineapple, lactose	Kiwi, pineapple	Cinnamon, aspartame	No	Pineapple
Previous surgery	2	4	1	No	1	3	No	No
Contact dermatitis	No	Itching, peeling, fissure, exudation, vesicles	Itching, peeling, vesicles	Itching	No	No	No	No
Contact urticaria	No	Disseminated urticaria and edema	No	No	No	No	No	No
Airborne reaction	Sneezing attacks	Sneezing attacks, itching nose or palate, breathing difficulty, angioedema	Sneezing attacks	No	Itching or red eyes, sneezing attacks, runny nose, blocked nose, itching nose or palate, breathing difficulty, with a wheeze, angioedema	No	Sneezing attacks, runny nose, blocked nose, itching nose or palate	No

prevent the development or progression of allergic manifestations. Despite a strong complaint of contact urticaria, no relationship was observed with the SPT. This finding was not compatible with the results of the study conducted by Liss et al. (3) where this association was observed.

Reports of respiratory reactions were more prevalent among workers with (+)SPT than those with negative test. Regarding the nasal and lung symptoms, a relationship between complaints and SPT was evident in the case of sneezing attacks, breathing difficulty and angioedema. Studies conducted up to this moment demonstrated that gloves with powder have more proteins than nonpowdered gloves (19) and represents an occupational risk factor for sensitization due to antigen dispersion, particularly water-soluble proteins. Hence, the powder utilized in gloves to facilitate their donning seems to enhance exposure to latex allergens through direct skin contact and through the respiratory tract (20).

Decreased levels of latex-specific IgE in the blood of HCW who adopted measures to avoid the use of powdered gloves (20, 21) have been observed. An administrative measure was adopted 3 years ago in CAISM substituting nonsterile latex gloves used for medical procedures to nonpowdered gloves. In workers with latex-related complaints, even those without confirmation of type 1 hypersensitivity, nonsterile vinyl gloves and sterile synthetic surgical gloves were offered.

Our results reinforce the present policy adopted by CAISM regarding the standardized acquisition of nonpowdered latex gloves for procedures and discreetly powdered surgical gloves, in accordance with international recommendations for a safe working ambient with controlled antigen dispersion.

Finally, although a reduced latex-specific IgE or reactivity to the SPT may indicate a reduction in sensitization, whether it eliminates the risk of new sensitization on new exposure is still debatable.

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