

Incidence of immediate allergy to latex gloves in hospital personnel

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Latex surgical gloves may cause contact urticaria and serious allergic reactions in sensitized persons, but the frequency of this allergy is not known. In the present study, 512 hospital employees were screened with a latex-glove scratch-chamber test; 23 (4.5%) were suspected and 15 (2.9%) were proven allergic with latex prick and use tests. All of them were doctors and nurses, and 12 had had contact urticaria but no serious symptoms. They could continue their routine work using cotton or vinyl undergloves or special latex surgical gloves. Atopy, hand eczema and surgical work seemed to be predisposing factors. In operating units, 7.4% of the doctors and 5.6% of the nurses were allergic; the frequency was lower in non-operating units and among laboratory personnel. The high frequency of latex glove allergy, especially in operating units, focuses attention on the quality of surgical latex gloves.

Key words: Rubber gloves – contact urticaria – scratch chamber and prick tests.

Accepted for publication 20 May 1987

Various types of rubber or vinyl gloves are used in hospital work for many purposes; sterile rubber (latex) gloves for surgical operations and examinations, non-sterile latex or vinyl gloves for personal protection, and thicker rubber or vinyl gloves for cleaning. Rubber chemicals are well-known contact allergens, and hospital workers sometimes develop contact dermatitis as a result of wearing rubber gloves (1-2). The 1st case of contact urticaria from rubber gloves was seen in a housewife by Nutter (3). Since then, several cases of this immediate contact allergy have been reported in medical personnel using latex surgical gloves (4-9). Recent studies have suggested that the allergen is a protein derived from natural rubber and that the sensitized persons have specific IgE-antibodies which can be detected by skin prick test or RAST (5, 9, 10, 11). In addition to contact urticaria, anaphylactic reactions may occur, especially when people allergic to surgical gloves are themselves operat-

ed upon (10). In order to examine the frequency of latex glove allergy and to establish the risk groups in our hospital, 512 employees who used gloves were questioned about hand symptoms; they were all tested by the scratch-chamber test.

Material and Methods

Employees working in different operating units (surgery, ophthalmology, oto-rhino-laryngology, gynaecology and obstetrics) or laboratory units (clinical chemistry, microbiology, clinical physiology, pathology and radiology) at the University Central Hospital in Tampere, were examined. The aim was to study all employees in these units, where different gloves are widely used. The mean age of the 512 persons examined was 37.2 years (range 19-61 years). They totalled about $\frac{1}{3}$ of all employees in the hospital; 94 (18%) were male and 418 (82%) female.

Their occupational history was recorded, and they were questioned about the glove material, and whether they had experienced any symptoms when using them. They were examined for hand eczema or other signs, and any personal history of atopy (asthma, allergic rhinitis or conjunctivitis, atopic eczema) was recorded.

The scratch-chamber tests were performed on the forearm with moist pieces of sterile surgical glove (Exona®, Lic Ab, Solna, Sweden) placed under aluminium cups (Finn Chamber®, Epicon Ltd, Helsinki, Finland) as previously described (12). Before the test, glove pieces (5 mm × 5 mm) were incubated (1 mg/1 ml) in sterile physiological saline at room temperature, for either 1 or 24 h. The 3rd test was performed with the 24-h incubation solution. Control tests included histamine (3 mg/ml, Allergologisk Laboratorium A/S, Copenhagen, Denmark) and sterile physiological saline. The latter was stored in plastic bags and was therefore not contaminated by the rubber. The results were read after 15–20 min. Wheal and flare reactions, which were half those of histamine, were regarded as positive.

The control scratch-chamber latex tests were performed on 130 consecutive patients, 30 male and 100 female (mean age 30.8 years, range 7–73 years), admitted to the Allergological Laboratory of the Department of Dermatology for routine prick testing. 19 (15%) had hand eczema, 19 (15%) had urticaria, and atopy was suspected in the rest.

The employees and the controls with a positive scratch-chamber test were also prick and use tested. Prick tests were performed with

1-h latex (Exona®) and vinyl (Triflex®, Travenol Laboratories S.A. Lessines, Belgium) glove incubation solutions. The routine prick test series included 20 common inhalant allergens (Allergologisk Laboratorium A/S, Copenhagen, Denmark) with histamine (10 mg/ml), and diluent as controls.

The use test was performed on wet hands for 15 min with a sterile latex glove (Exona®) and a non-sterile vinyl glove (Triflex®), both of which contained glove powder. Epicutaneous tests (Finn Chamber®), were performed on 23 employees with the standard ICDRG series, including the following rubber chemicals: thiuram mix, carba mix, PPD mix and mercapto mix.

To evaluate whether increasing use of gloves or changes in glove materials account for the frequent latex glove allergy in our hospital, the total number of different gloves used annually was recorded.

Results

23 (4.5%) of the 512 employees examined had positive scratch-chamber tests with latex gloves. In 17 of the 23, all 3 latex tests were positive, in 4 employees 2 were positive, and in 2, there was 1 positive reaction. The mean size of the latex reactions with the glove pieces incubated for 1 and 24 h and for the 24 h incubation solution were about the same (Table 1).

Prick tests confirmed latex allergy in 15 of 23 employees with a positive scratch-chamber test, and 14 of these also had a positive use test. The symptoms in positive use tests in-

Table 1. Mean diameter (mm ± S.D.) of different latex glove scratch-chamber test reactions in 23 hospital employees.

	Glove pieces		Glove incubation solution	Histamine (3 mg/ml)
	1-h incubation	24-h incubation		
all employees (n=23)	3.6 ± 2.5	3.5 ± 2.5	3.5 ± 3.4	4.4 ± 0.8
positive prick test (n=15)	4.5 ± 2.6**	4.0 ± 2.8	4.4 ± 3.8*	4.5 ± 1.0
negative prick test (n=8)	1.9 ± 1.0**	2.5 ± 1.5	1.8 ± 1.5*	4.3 ± 0.5

* $p < 0.05$; ** $p < 0.01$ (Student *t*-test).

cluded local pruritus and erythema and/or urticaria. None of the 23 had a positive vinyl glove prick or use test although 3 experienced pruritus during the use test. The 15 employees with positive scratch-chamber and latex prick tests were considered true positives; the 8 with positive scratch-chamber tests but negative prick tests were considered false positives. In the latter group, the mean size of the scratch-chamber test reaction was significantly smaller than the corresponding figures in the 15 prick test positive individuals (Table 1). The 23 employees were patch tested; 1 with a positive latex prick test showed an allergic reaction to thiuram mix. She had a positive history of contact dermatitis from all types of rubber glove.

10 (67%) of the 15 latex allergic employees had a personal history of atopy (Table 2). 3 of these had asthma, 8 had allergic rhinitis, 7 atopic eczema, and 7 had at least 2 positive reactions in the routine prick test series.

The frequency of atopy was significantly lower ($p < 0.001$, Fisher's exact test) in 8 employees with negative latex prick test and in 489 employees with negative latex scratch-chamber test (Table 2). No significant difference was found between the latex allergic and non-allergic groups with regard to daily glove use or material type (Table 2).

14 of the 15 latex allergic employees had experienced pruritus and redness and 12 of them also had contact urticaria when using latex surgical gloves. 5 of these had current hand eczema, and 9 had a positive history of it (Table 2). However, only 1 of the 15 latex glove allergic employees had consulted a dermatologist for hand symptoms. 6 of them had changed to less-irritant latex surgical gloves (Ansell Gammex®, Ansell Rubber Co Ltd., Malacca, Malaysia) and 8 used plastic or cotton undergloves to avoid symptoms. The only asymptomatic latex allergic person was a laboratory doctor. In his present work, he needed

Table 2. Occupational and medical history of latex scratch-chamber (S-C) test positive and negative hospital employees

	Positive latex S-C test				Negative latex S-C test	
	prick test positive (= 15)	(%)	prick test negative (n = 8)	(%)	(n = 489)	(%)
Use of gloves						
daily > 4 h	5	(33.3)	3	(37.5)	87	(17.8)
daily < 4 h	7	(46.7)	5	(62.5)	273	(55.8)
weekly	3	(20.0)	0	(0)	96	(19.6)
monthly	0	(0)	0	(0)	33	(6.8)
Material of gloves						
latex	7	(46.7)	2	(25.0)	213	(43.6)
vinyl	1	(6.6)	2	(25.0)	112	(22.9)
both	7	(46.7)	4	(50.0)	164	(33.5)
Skin irritation from gloves	14	(93.3)	5	(62.5)	122	(24.9)
Glove years						
0-5	3	(20.0)	2	(25.0)	126	(25.8)
6-10	3	(20.0)	3	(37.5)	113	(23.1)
> 10	9	(60.0)	3	(37.5)	250	(51.1)
Hand eczema						
present	5	(33.3)	1	(12.5)	24	(4.9)
past	9	(60.0)	1	(12.5)	85	(17.4)
Personal atopy	10	(66.7)	2	(25.0)	117	(23.9)

only vinyl gloves, but in previous work, he had used latex surgical gloves. A surprisingly high number (25%) of latex non-allergic employees had experienced glove irritation, and 22% of them had a present or past history of hand eczema (Table 2).

Latex glove allergy was significantly more common ($p < 0.01$, Fisher's exact test) in operating units than in examination units and laboratories (Table 3). 9 (6.2%) of 145 employees in operating units had latex glove allergy in contrast to 6 (1.6%) of 367 employees in non-operating units. The allergy frequency was 6.5% in doctors, 2.2% in nurses and 1.3% in the other employees (Table 3).

In the control group of 130 patients, 1 woman and 1 man had positive latex scratch-chamber tests. The man with chronic urticaria was regarded as false positive because he had no history of glove irritation and the latex prick tests were negative. The woman was a housewife who had severe atopic eczema with hand dermatitis. She had experienced intense pruritus when using rubber but not when using vinyl cleaning gloves; she had definite positive latex-glove prick and use tests. The allergy frequency (0.8%) in controls is significantly ($p < 0.01$, Poisson test) lower than in the hospital personnel examined.

Discussion

The present study revealed 15 persons with immediate latex glove allergy among 512 glove-using hospital employees. Initial screening with a latex glove scratch-chamber skin test revealed 23 positive reactions, but a latex glove

prick test confirmed the allergy in only 15 of them. The scratch-chamber test technique is known to give false-positive reactions, but it is a convenient technique for testing firm materials when allergen solutions are not available (12).

In the present study, moistened pieces of latex glove were used for scratch-chamber testing. It was found that the latex allergen was eluted from the glove pieces into the incubation solution. This solution gave similar scratch-chamber test reactions as the glove pieces and it was then used successfully in prick tests.

A glove use test was performed on wet hands to confirm the allergy. Correlation between the use test and prick test was good; 14 of 15 employees with positive prick tests had a positive latex glove use test, and none of 8 employees with negative prick tests reacted to the use test. This is in accordance with recent reports (5, 8, 9, 11, 13) which have presented evidence that the use test is helpful when confirming contact urticaria caused by the rubber gloves or other immediate-type allergens (14).

The overall frequency of immediate surgical latex glove allergy found in the present study was 3%. As expected, the highest prevalence (6.2%) occurred in operating units where latex gloves are in daily use. Allergic persons were from the units of main surgery, gynaecology and obstetrics, and oto-rhino-laryngology. The total allergy frequency was 7.4% in doctors and 5.6% in nurses working in operating units. Previously, several cases of latex glove contact urticaria have occurred in nurses but only a

Table 3. Occupation of 15 latex glove allergic employees

	Doctor	Nurse	Other	Total
operating units	4/54* (7.4%)	4/71 (5.6%)	1/20** (5%)	9/145 (6.2%)
examination units and laboratories	3/54 (5.6%)	3/254 (1.2%)	0/59 (0%)	6/367 (1.6%)
total	7/108 (6.5%)	7/325 (2.2%)	1/79 (1.3%)	15/512 (2.8%)

* Allergic persons/total tested.

** An instrument service nurse.

few sensitized doctors have been reported (4, 8, 9).

The present study confirms that surgeons develop such allergy especially frequently. However, they seem to work successfully by wearing undergloves or using a brand of latex glove causing fewer symptoms. Moreover, none of the latex allergic doctors or nurses had had sick leave as a result. Interestingly, most of the doctors and nurses with latex glove allergy suspected glove powder as the cause of the hand symptoms, and even if they had noted contact urticaria, they were not aware that they had immediate allergy to the rubber in their gloves. Only 1 of the allergic employees had undergone allergological examination because of glove irritation, and she was suspected but not confirmed of having immediate latex glove allergy.

IgE-mediated allergies occur in atopic individuals; in agreement with this, 67% of the present employees with immediate latex glove allergy were atopics. Most latex-allergic patients discussed in previous reports, have also had atopic disease (3, 6, 9-11). Atopic individuals often suffer from irritant hand eczema in hospital work and hence must use rubber or vinyl gloves for hand protection (13, 15). Continuous rubber glove use on eczematous hands may be one predisposing factor for the development of either delayed or immediate rubber allergy. Of the present 15 latex allergic employees, 14 had a history of hand eczema but none seemed to have been sensitized from rub-

ber gloves used at home. At work, 14 of the employees used sterile or non-sterile latex gloves in either operating or examination rooms or in laboratories. Occupational use was the most likely reason for their latex allergy.

The only latex-allergic person among the controls was atopic with hand eczema, and she had been sensitized from rubber cleaning gloves used at home. The fact that rubber cleaning gloves can cause immediate latex allergy with symptoms of contact urticaria was reported first by Nutter (3) and then by several authors (4-9, 11, 13). Concomitant immediate and delayed allergy to rubber glove materials has been reported (7, 9, 16). One of the present employees with immediate latex glove allergy also showed a delayed hypersensitivity to rubber chemicals.

Although immediate latex glove allergy has been reported since 1979 (3), it appears to have passed unnoticed until then. 7 of the present employees with latex glove allergy had experienced symptoms of it for more than 10 years. It seems clear that no recent alteration in glove material or a change in the use of gloves in our hospital is responsible for the high prevalence of latex allergy. The total annual number of latex gloves used has not increased in our hospital in recent years (Table 4). A marked increase has occurred in the use of vinyl gloves. The total number doubled in 5 years; this seems to be at least partly due to an improved willingness to use gloves for protection against

Table 4. New cases of latex glove allergy and annual glove use, surgical operations and personnel at the University Central Hospital of Tampere, 1982-1986

	1982	1983	1984	1985	1986
New cases of latex glove allergy	2	1	1	1	0
Gloves:					
latex sterile	141904	113277	131180	153853	160176
latex unsterile	97500	58100	60900	74600	57750
vinyl	176100	285800	287650	326295	409750
total	415504	457177	479730	554748	627676
Surgical operations	16521	16003	16774	18147	18468
Whole personnel	2551	2632	2654	2703	2736

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possible HIV infection, especially when handling blood samples in laboratories. Many of the present 512 employees complained of irritation from vinyl gloves and preferred latex gloves for this reason. In the operating theatres, surgeons and nurses use latex gloves only because their properties are superior to those of vinyl gloves. Sterile or non-sterile latex gloves are also widely used in other units, including laboratories. Therefore, new cases may appear in the near future in our hospital. To prevent such allergies, more knowledge about the sensitizing allergen and its persistence after glove manufacture is needed.

In conclusion, the present study clearly shows that common but often occult immediate latex glove allergy merits more attention among hospital personnel. The correct diagnosis is important both for occupational and allergological reasons.

Acknowledgements

The excellent assistance of Mrs. Leena Petman in allergological testing is acknowledged. This study was supported by a grant from the Foundation of Allergy Research, Finland.

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