

# Prevalence of latex sensitization in subjects attending health screening: implications for a perioperative screening

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## Summary

**Background** Because latex is a common allergen, the rate of latex sensitization may be high in the general population. A major issue would then be to determine whether a systematic preoperative screening in the general population should be recommended.

**Objective** The purpose of the study was to evaluate the prevalence of latex sensitization in a sample of the general population and to assess the role of possible risk factors.

**Methods** The subjects were 258 people, aged from 20 to 40 yr, visiting a health care centre for a check-up. The protocol included: a questionnaire (occupation, symptoms of atopy, use of latex goods and possible reactions, history of previous surgery), a skin-prick test, and a CAP RAST to latex. Atopy was evaluated by a skin-prick test to common allergens and a Phadiatop® test.

**Results** Some 6.6% of the study group had either a positive skin test or a positive RAST to latex. These subjects had a four-fold higher prevalence of symptoms when wearing gloves. The rate of latex sensitization was higher by fivefold in subjects with a history of reactions to latex goods and by fourfold in atopic subjects.

**Conclusions** Because the rate of latex sensitization is much higher than the anticipated rate of perioperative reactions due to latex allergy, a systematic preoperative screening for latex allergy should not be recommended for adults.

**Keywords:** latex, prevalence, occurrence, screening

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## Introduction

Latex is involved in several types of allergic manifestations such as contact urticaria, rhinitis, asthma and anaphylaxis [1], and it is responsible for 12% of peroperative anaphylactic reactions in adult patients [2] and for 70% in children [3]. Populations at a high risk of latex sensitization are health care workers [4], workers in the latex industry [5], and children with multiple surgeries, especially for spina bifida [6]. The prevalence of latex sensitization has been evaluated to be 5–10% in health care workers [2, 7], 11% in workers in the latex industry and 30 to 65% in spina bifida

children. The rate of latex sensitization in these populations is higher in atopic individuals in whom latex can be considered a common allergen [8].

However, the rate of latex sensitization outside of recognized risk groups has rarely been reported. A few small studies of children evaluated for allergy [9, 10] have provided prevalence figure up to 10%. A study using the ALASTAT assay system in 1000 volunteer blood donors, with health care workers excluded, reported 6.5% with latex sensitization and 2.3% with RAST grade 2 or more [11]. Latex is an ubiquitous allergen. Babies are readily exposed to latex through baby pacifiers during early life. Thus, a systematic, peroperative screening for latex allergy has been proposed, to detect sensitized subjects and prevent anaphylactic reactions. Nevertheless, the predictive value of latex

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sensitization for the occurrence of peroperative anaphylactic reactions depends on the rate of sensitization in the general population. The aim of our study was to evaluate both the rate of latex sensitization in a group of subjects visiting a health care centre for a check-up and the possible risk factors influencing this rate.

## Methods

The population study included 747 subjects aged from 20 to 40 yr, visiting a health care centre for a check-up. This examination is provided by the National Health Service on a 5-yearly basis, to all those affiliated, i.e. 95% of the general population. The protocol included a questionnaire concerning occupation, symptoms of atopy, occupational use of latex gloves and latex goods, symptoms during their use and the number of previous surgical procedures and reactions occurring during these procedures. Only 258 subjects agreed to undergo skin tests and RAST tests. Skin-prick tests were performed with common inhalant allergens and a commercial extract of ammoniated latex at 1/15 w/v (Stallergènes Co., Paris, France). Common inhalant allergens tested were commercial extracts (Stallergènes Co.) standardized in terms of biological units ('reactivity index': RI) or only in terms of w/v. The following allergens were used: *Dermatophagoides pteronyssinus* (100 RI/mL), cat (100 RI/mL), *alternaria* (100 RI/mL), cypress (1/20 w/v), grass pollen (100 IR/mL) and parietaria (100 IR/mL). The positive control was a 9% codeine phosphate solution and the negative control was the allergen diluent.

A blood sampling was also performed to measure specific IgE to a group of common inhalant allergens (Phadiatop®, Pharmacia, Sweden) and to latex by the RAST method (Radioanalysis Laboratory of Institut Pasteur, Lyon,

France). A prick test was considered as positive if the weal measured was 3 mm larger than the weal of the negative control. The threshold of positivity for the RAST was set at 0.35 KU/L. Atopy was diagnosed by the presence of one or more positive prick tests of common inhalant allergens and/or a positive Phadiatop® test. Sensitization to latex was defined by either a positive skin-prick test or a positive RAST. The study was approved by the ethic committee and subjects signed an informed consent to participate in the study.

The statistical analysis included chi-square tests to compare percentages, and unpaired *t*-tests to compare mean values of continuous variables. We also used a logistic regression analysis (SPSS software) to assess risk of latex sensitization in respect of several independent variables. In all instances, a *P*-value less than 0.05 was considered as significant.

## Results

Seven hundred and forty-seven subjects were included in the study but only 258 completed it. Answers to the questionnaire in the 489 subjects who did not undergo skin prick tests and RAST tests were analysed to evaluate the percentage of atopic patients in this group. Patients were considered to be atopic if they answered 'yes' to at least one of following questions: Have you ever had hay fever? Almost every spring? Do you usually have rhinitis or nasal obstruction? Does it last more than 3 months per year? Have you ever had asthma? Has it been confirmed by a doctor? Among the 489 subjects who did not participate in the study, 167 (34%) were atopic according to the questionnaire, i.e. a similar rate (33%) to that in the 258 tested subjects. Age and sex distribution was similar in those who participated and in those who did not. The proportion

**Table 1.** Characteristics of latex sensitized (+) and non-sensitized (−) subjects. Sensitization was defined as a positive skin test or RAST to latex

|                                   | Latex + ( <i>n</i> = 17) |                   | Latex − ( <i>n</i> = 241) |  |
|-----------------------------------|--------------------------|-------------------|---------------------------|--|
| Mean (± SD) age (yr)              | 32 ± 6                   | NS                | 32 ± 5                    |  |
| Sex (male/female)                 | 6/11                     | NS                | 117/124                   |  |
| Atopy*                            | 13                       | <i>P</i> = 0.003  | 102                       |  |
| Symptoms with latex gloves        | 4                        | <i>P</i> = 0.0005 | 15                        |  |
|                                   | (23.5%)                  |                   | (6.2%)                    |  |
| Previous number (mean ± SD) of SP | 13 (76.5%)               | NS                | 17 (71%)                  |  |
|                                   | 3.5 ± 5.1                | NS                | 2.04 ± 1.5                |  |
| Peroperative reactions            | 5.9%                     | NS                | 2.1%                      |  |

SP = surgical procedures

\* Positive skin tests and Phadiatop® test

**Table 2.** Value of skin test and RAST to latex as screening tests for perioperative reactions

|                    | Sensitivity | Specificity   | Predictive value |                 |
|--------------------|-------------|---------------|------------------|-----------------|
|                    |             |               | Positive         | Negative        |
| Skin test to latex | 16.6% (1/6) | 96% (173/180) | 12.5% (1/8)      | 97.2% (173/178) |
| RAST to latex      | 0*          | 97% (175/180) | 0*               | 96.7% (175/181) |

\* No subject with history of perioperative reactions had a positive RAST

of subjects wearing gloves and the percentage of skin reactions to gloves were similar in both groups.

Among these 258 subjects, the mean ( $\pm$ SD) age was  $32.1 \pm 5.3$  yr. Seventeen out of 258 (6.6%) were sensitized to latex: nine had a positive RAST (grade 1: four subjects; grade 2: five subjects) and eight had a positive skin prick test. No one had both tests positive. There was no sex and age difference between subjects sensitized or not sensitized to latex. Among the 17 latex-sensitized subjects, four (23.5%) reported clinical manifestations when wearing latex gloves. This rate was only equal to 6.2% in non-sensitized subjects ( $P = 0.0003$ ) (Table 1). Prevalence of atopy according to skin tests and/or Phadiatop® tests was equal to 76.5% in latex-sensitized subjects and 42.7% in non-sensitized subjects ( $P = 0.003$ ) (Table 1). Overall, 26.3% of the group had positive Phadiatop tests; 21% of patients complaining of reactions to latex gloves were sensitized, compared to 5.4% in patients without symptoms, i.e. four times more. Reported reactions consisted of urticaria in three cases, eczema in two cases, itching in seven cases, and erythema in three cases. Two patients out of the three with urticaria were sensitized to latex. None of those who experienced itching with latex gloves were sensitized.

Two parameters significantly increased the risk of latex sensitization. First atopy (odds ratio = 4.2, 95% CI: 1.4–14.0,  $P = 0.016$ ). One hundred and sixteen subjects (45%) were atopic according to skin tests and/or Phadiatop® tests. Among the atopic subjects, 13 (11.2%) were sensitized to latex compared to only four (2.8%) among non-atopic subjects. The other parameter which was linked to latex sensitization was a history of reaction to latex gloves (odds ratio = 5.4, 95% CI: 1.7–20.7,  $P = 0.011$ ). This percentage of latex sensitization was equal to 23.5% in subjects who reported a reaction to latex gloves and 6.2% in those who did not (see Table 1). The logistic regression analysis including latex sensitization as the dependent variable and atopy, skin reactions to gloves and their interaction as independent variables, showed that atopy (odds ratio = 37.8,  $P = 0.0001$ ) and the interaction term (odds ratio = 50.2,  $P = 0.006$ ) were both predictors, whereas skin reactions to latex was not any longer. Out of 43 subjects who were

used to wearing latex gloves, 23 (6.9%) were sensitized, compared to 14 (6.5%) in the 215 subjects who were not used to wearing gloves.

No sex difference in the latex sensitization rate was demonstrated among the 17 subjects sensitized to latex. A history of surgery was found in 13 of these patients and in 171 out of the 241 others ( $P > 0.05$ ). The mean number of previous surgeries was 3.5 in latex-sensitized subjects and 2 in the others ( $P > 0.05$ ). Reactions during previous surgical procedures were only one among latex-sensitized subjects and three among non-sensitized subjects. Table 2 illustrates sensitivity, specificity, and positive and negative predictive values of the skin test or RAST to latex relative to perioperative reactions. The negative predictive value of skin test or RAST to latex was high whereas the positive predictive value was very low.

## Discussion

Prevalence of latex sensitization in our study was equal to 6.6%. We feel this figure is truly representative of latex sensitization in this population, aged from 20 to 40 yr, since sex, age distribution, the proportion of subjects wearing latex gloves, as well as skin reactions to gloves and the prevalence of symptoms suggestive of atopy, were identical in subjects who agreed to participate in the study and in those who did not. The percentage of positive Phadiatop tests was only slightly higher in the study group (26.3%) than in another sample of the general population previously studied (20%) [12]. Besides, subjects volunteering for a check-up examination in French social security health care centres do not differ from the general population with regard to age, sex and education [13] and from those who do not attend in respect to medical history [14]. Prevalence of latex sensitization was much higher in atopic (11.2%) than in non-atopic subjects (2.8%). Atopy is a well-known risk factor for latex allergy. Many papers have reported a high prevalence of atopy in latex-sensitized subjects [8, 15]. In a previous survey performed on a group of operating room nurses, we demonstrated that the predictive value of reported urticaria for skin sensitization to latex was equal

to 43% overall and 70% in the subgroup of atopic nurses [4]. More recently, Moneret-Vautrin *et al.* have shown that 9.4% of atopic outpatients were sensitized to latex compared to only 0.37% of non-atopics [8].

Our study exemplified a large discrepancy between the results of skin tests and RAST to latex. Indeed, no subject had both a positive skin test and a positive RAST. In studies comparing skin tests to latex and RAST to latex, skin prick tests are usually reported to be more sensitive than RAST tests for predicting symptoms on exposure to latex [16]. However, in these studies, skin tests were performed using a natural rubber emulsion, a glove rinsing liquid or by pricking through a latex glove. Unlike our study, no data are available comparing RAST tests to skin tests using a commercial latex extract. Besides, four positive RAST tests out of nine were grade 1. Conversely, in the field of respiratory allergy, it is not usual to get a negative skin test in a patient with a positive RAST. However, this discrepancy has been pointed out in the field of muscle relaxant allergy [17].

Another explanation for this discrepancy could be the presence of profilins in the sera of patients. Profilins are allergens present in many trees and grass pollens, in some foods, in human platelets and in latex [18]. A part of the IgE measured with the latex RAST could in fact be IgE directed towards profilins. A large number of atopic subjects may have profilins, thus a positive RAST to latex. The third hypothesis to explain this discrepancy between skin and RAST-tests could be the presence of different epitopes in the latex molecule. Specific IgE could be directed against each epitope separately. These IgE could be detected by the same test, i.e. a RAST test to latex. However, if some of these epitopes were not able to bridge IgE, no mast-cell degranulation could occur and skin tests would be negative. Indeed, we know that latex contains different allergens with different molecular weights.

In our study, we evaluated several risk factors for latex sensitization apart from atopy. In this sample from the general population, we did not confirm the high rate of sensitization among exposed subjects. Among the exposed atopic patients only 6% were sensitized. Moneret-Vautrin found 6.8% of sensitization in the exposed group and 36% in the exposed atopic group [8]. We did not find any sex difference in latex sensitization. In a previous study [4] we also did not find any sex difference, in contrast to Ownby [11] who demonstrated a three-fold higher risk of sensitization in males. We have evaluated the role of previous surgeries in latex sensitization rate. Repeated latex exposure in children who have undergone multiple surgeries, especially children with spina bifida, is a cause of latex sensitization. Our results did not show any difference between the number of previous surgeries in sensitized and non-sensitized subjects.

A final and very important practical issue is to determine whether latex allergy is common enough to warrant systematic preoperative screening. Very few data are available on the general population. Besides, sensitization without symptoms of latex allergy does not mean that an allergic reaction will occur. The main issue is: must we exclude contact with latex during surgical procedures in all latex sensitized individuals who have had no clinical manifestations of allergy? In order to be efficient, a test must have both a high positive and a high negative predictive value. For a high predictive value, the prevalence of the disease in the population must be high. The rate of sensitization is very high compared to the low rate of peroperative, anaphylactic reactions to latex. Anaphylactic peroperative reactions occur in around 1/4500 anaesthesias. Latex is involved in 12% of cases in adults, i.e. 1/37 350 anaesthesias [2]. Thus, 1/37 350, i.e. 0.003%, have a sensitization which could lead to a peroperative reaction. Since 6.6% of this population have latex sensitization, 2465 (i.e. 6.6%/0.003%) preoperative screening tests would have to be performed to identify a patient who would develop a peroperative anaphylactic reaction. The remaining 2464 tests could be classified as false positive inducing concern and unwarranted latex avoidance. In our study, 76.5% had undergone surgery but only one subject reported a peroperative reaction, possibly related to latex allergy. Thus, we must find out much more about risk factors for latex allergy before advising a systematic preoperative screening. This issue is quite different in a high risk group, i.e. spina bifida children, because the high rate of latex allergy in this group greatly enhances the predictive value of a positive test.

In conclusion, using skin reaction to latex or RAST, we demonstrated a 6.6% rate of latex sensitization in a group of 258 subjects visiting a health care centre for a check-up. In this sample, atopy and reported reactions to latex were strongly linked to latex sensitization. However, given the low rate of peroperative reaction to latex, a screening test before surgery is not advisable, even in this group which includes a high percentage of atopic patients. However, this statement does not hold true in groups who have a very high exposure to latex, i.e. medical and nursing staff and children with spina bifida.

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