

Latex Allergy in Primary Care Providers

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■ Abstract

Background: Health care workers represent one of the major risk groups for developing latex allergy. Most studies have examined hospital workers. The aims of this study were to analyze the prevalence of latex allergy in primary care providers and to describe the characteristics of health care workers who are allergic to latex.

Material and methods: A self-administered questionnaire on work activity, history of symptoms, and allergic reactions to latex products was completed by a sample of primary care workers. Skin prick tests were performed with a commercial latex extract, and serum specific immunoglobulin (Ig) E to latex and its main allergens was determined.

Results: Of the 620 workers contacted, 341 completed the questionnaire and 170 were tested with latex allergens. The prevalence of latex allergy was 5.9% (95% confidence interval 2.4%-9.4%). Most allergic workers with a previous diagnosis of latex allergy showed negative or lowered specific IgE levels and a reduced wheal size to latex in comparison with the previous tests. We found 3 cases with elevated latex-specific IgE due to cross-reactivity with pollen profilin, although the results were not clinically relevant. Allergy to latex was associated with the number of surgical interventions and with allergy to kiwi, banana, chestnuts, and avocado.

Conclusions: The prevalence of latex allergy in this study was 5.9%. The importance of a firm diagnosis at the onset of symptoms should be stressed, since reducing contact with latex can yield negative test results. Assessment of IgE reactivity to the individual latex allergens (component-resolved diagnosis) can detect sensitization to panallergens such as profilin and help to clarify the diagnosis.

Key words: Healthcare workers. Specific IgE. Latex allergy. Prevalence. Skin tests.

■ Resumen

Fundamento: El personal sanitario constituye uno de los principales grupos de riesgo para desarrollar alergia al látex. La mayoría de los trabajos han estudiado trabajadores hospitalarios. El objetivo de este estudio es analizar la prevalencia de alergia al látex en personal sanitario de atención primaria y describir las características de los trabajadores alérgicos.

Material y métodos: Se aplicó un cuestionario autoadministrado sobre actividad laboral, antecedentes de síntomas y reacciones alérgicas. Se realizaron pruebas cutáneas con extracto de látex y se realizaron determinaciones serológicas de IgE específica al látex y a sus principales alérgenos.

Resultados: De los 620 trabajadores, 341 contestaron el cuestionario y se realizaron pruebas alérgicas en 170. Se encontró una prevalencia de alergia al látex del 5,9% (intervalo de confianza del 95% 2,4-9,4%). En la mayoría de los trabajadores alérgicos con diagnóstico previo de alergia al látex se habían negativizado o disminuido los niveles de IgE específica al látex y el tamaño de la pápula del prick test previo. Se encontraron 3 casos con IgE específica al látex elevada, sin relevancia clínica, por reacción cruzada con profilina de polen. Se han encontrado asociaciones estadísticas con el número de intervenciones quirúrgicas y alergia al kiwi, plátano, castaña o aguacate.

Conclusiones: La prevalencia de alergia al látex fue de 5,9%. Debe destacarse la importancia del diagnóstico cuando comienzan los síntomas, ya que al ir disminuyendo el contacto con látex pueden negativizarse las pruebas. El diagnóstico por componentes alérgicos, estudiando la reactividad a los distintos alérgenos del látex, permite detectar la sensibilización a panalérgenos como la profilina y facilita el diagnóstico correcto.

Palabras clave: Trabajadores sanitarios. IgE específica. Alergia al látex. Prevalencia. Prick test.

Introduction

Latex allergy has implications both in patient care, since it is during health care when patients are at the greatest risk of reactions [1-5], and in the need to avoid risks to health care professionals, who are one of the main risk groups for this type of allergy [6-9].

Although there has been significant research into latex allergy, many questions remain unanswered, and few studies have examined health interventions in the workplace. Recently, the British National Health Service and the College of Physicians of Great Britain published national guidelines on occupational latex allergy [10].

Studies of the prevalence of latex allergy in healthcare workers have been conducted mainly in hospitals [11-17], and it is not known whether the prevalence in primary care providers is similar or not. Therefore, it is essential to study the magnitude of the problem in primary care, to confirm whether data from other studies can be extrapolated and to assess whether adequate preventive measures are available at this level [8,9,18,19].

The main objective of this study was to analyze the prevalence of latex allergy in primary health care workers. The secondary objectives were to describe the characteristics of workers who are allergic to latex and identify statistically associated variables.

Material and Methods

Study Design

We performed a cross-sectional descriptive study among health care providers (physicians, nurses, midwives, medical assistants, dentists, dental hygienists, and therapists) in Primary Care Area 2 of the Autonomous Community of Madrid, Spain.

We excluded the following providers: 1) professionals who do not work in a health center (nurses, mental health assistants, and some physiotherapy units); and 2) professionals who stated that they were allergic to latex but had not undergone testing or did not provide a clinical history.

To calculate the sample size, estimates were made based on different prevalences (between 0.01 and 0.1). For example, for a population of 620 subjects, accepting an alpha risk of 0.05 for an accuracy of ± 0.01 percentage units for an estimated ratio of 0.05 and estimating a replacement rate of 0.15, we needed a random population sample of 531 subjects.

Since the sample size and population were so similar and we did not know the actual prevalence in primary care, we decided to include the entire population of health care workers in the study. To estimate prevalence, we calculated the proportion of workers allergic to latex with a confidence interval of 95%.

To identify cases, a questionnaire was completed on work activity and history of symptoms, and allergic reactions and skin prick tests were performed [8,20] using a standardized latex extract. Serum specific immunoglobulin (Ig) E to latex [20,21] and to its main allergens (in recombinant form) was

determined. The clinical history of previously diagnosed workers was assessed.

A case was considered positive if the worker had symptoms consistent with latex allergy and a positive skin prick test result, a positive latex-specific IgE result, or a prior diagnosis of latex allergy according to their written medical reports. Newly diagnosed patients were offered the option of completing the study at the Department of Allergy, Hospital La Paz, Madrid, Spain.

The self-administered questionnaire was completed to collect the following information: demographic data (name, age, gender, employment status); work-related data (years spent in primary care, work hours, shift, previous work, after-work activities); number of surgical interventions undergone; smoking habit; previous respiratory disease; family and personal history of atopy; cutaneous, nasal, ocular or respiratory symptoms and their association with the workplace and/or with the use of latex gloves; allergic reactions after contact with latex products or with fruits related to latex allergy (banana, kiwi, chestnut, and avocado); use of latex gloves or other materials; and previous diagnosis of latex allergy.

Written informed consent was obtained from the participants. The Clinical Research Ethics Committee of Hospital de la Princesa approved the study on October 10, 2007 (Registration No. PI-227).

Skin Prick Tests

We performed the skin prick tests using standardized 1-mm-tipped lancets (ALK-Abelló, Madrid, Spain) and the following allergens: latex extract (500 $\mu\text{g}/\text{mL}$ protein concentration); grass, olive, and cypress pollen; *Dermatophagoides pteronyssinus*; dog and cat dander; and *Alternaria* (all from ALK-Abelló). Histamine (10 mg/mL) was used as a positive control, normal saline as a negative control (ALK-Abelló).

The prick tests were performed by placing a drop of the extract on the forearm and introducing it into the epidermis through the lancet puncture. The result was examined after 15 minutes and the average diameter of the wheal was measured. A positive reaction was interpreted as the presence of a wheal with an average diameter equal to or greater than 3 mm [22]. Atopy was defined as the presence of a positive skin test result to at least 1 common aeroallergen.

Specific IgE Measurements

We used the ImmunoCAP system (Phadia, Uppsala, Sweden) to determine serum specific IgE to latex and its main allergens in recombinant form (rHev b 1, rHev b 3, rHev b 5, rHev b 6.01, rHev b 6.02, rHev b 8, rHev b 9, and rHev b 11). A reading of >0.35 kU_A/L was considered positive.

Development and Logistics

After a small-scale pilot study conducted in November 2007, a letter was sent to all medical coordinators, nurses and administrators to inform them about the study. We then contacted the coordinator of each health center by telephone to explain the study and arrange a day to carry it out. One week

before going to the center, we sent participants a folder with the questionnaires and envelopes to keep them in once completed.

We gave a clinical session on latex allergy in every center in order to explain the study and answer questions. For those who wished to participate in the tests, we provided them with information and consent sheets. Those who wished to participate underwent a prick test and blood sampling and were offered the chance to schedule another date to continue performing tests.

We collected information from the participants about their knowledge of latex-free materials in their center, problems among workers or patients with latex products, and knowledge of latex allergy. We contacted allergic participants to provide them with more information and assess the impact of their allergy in the workplace.

Statistical Analysis

We described the subsample of allergic patients by calculating the mean (SD) for the quantitative variables and the frequency table for the qualitative variables. To compare the allergic population with the nonallergic population, we used the Mann-Whitney test for quantitative variables and

contingency tables and the chi-squared test for qualitative variables. Values with $P < .05$ were considered statistically significant. The statistical analysis was performed with SPSS version 15.0.

Results

Participation

We contacted 23 area health centers and held the clinical session and performed the tests in 22 of them between November 2007 and November 2008. Of the 620 workers contacted, 341 participated in the study, of whom 170 underwent the allergy tests or provided medical reports from a previous diagnosis.

The participation rate according to occupational category is listed in Table 1. The participation rate according to the health care provider population for Area 2 is listed in Table 2.

Sensitization to Latex and Its Allergens

The prevalence of sensitization to latex in this study was

Table 1. Participation by Occupational Category

	Surveys, No. ^a	Percentage Surveyed	Surveys and Tests, No. ^b	Percentage Surveyed and Tested
Physicians	183	54.3	78	46.7
Nurses/Midwives	133	39.5	76	45.5
Nursing assistants	13	3.9	8	4.8
Dentists	2	0.6	2	1.2
Therapists	3	0.9	1	0.6
Dental hygienists	3	0.9	2	1.2
Unknown	4	1.2	3	1.8
Total	341	100	170	100

^aProfessionals who completed the questionnaire.

^bProfessionals who completed the questionnaire and underwent allergy tests.

Table 2. Percentage of Participation in Terms of Area 2 Population

	Total Population ^a	Percentage Surveyed ^b	Percentage Tested ^c
Physicians	326	56.1	23.9
Nurses	250	53.2	30.4
Nursing assistants	26	50.0	30.8
Dentists	6	33.3	33.3
Therapists	7	42.9	14.3
Dental hygienists	5	60.0	40.0
Total	620	55.0	27.5

^aNumber of professionals in the area.

^bProfessionals who completed the questionnaire.

^cProfessionals who completed the questionnaire and underwent allergy tests.

5.9% (95% confidence interval, 2.4%-9.4%). Participants who had a positive result in the tests performed with latex (skin test or determination of IgE) or who had a previous diagnosis of latex allergy are specified in Table 3, as is the length of time some of them had been avoiding contact with latex products. Positive cases are described in detail below.

Case 1 had never had an allergy test, although he avoided latex products due to the symptoms they produced when used (cutaneous, ocular, and nasal). The skin prick test with latex and specific IgE determination to latex were both positive.

Cases 2 and 3 reported contact urticaria with latex and had a positive skin prick test result with latex.

Case 4 used latex products without reporting any symptoms. He had a positive prick test result to latex (5×5 mm) and positive latex-specific IgE. The individual also showed positive specific IgE results to the latex recombinants Hev b 5 and Hev b 8. He

Table 3. Participants With Positive Results to Latex in Any of the Tests, or With a Previous Diagnosis of Latex Allergy

	Previous Prick Test (According to Reports)	Previous IgE to Latex (According to Reports)	Current Prick Test	Current IgE to	Time Avoiding Latex, y
1			+	+	6
2			+	-	
3			+	-	
4			+	+	
5	+	+		-	4
6	+	+		-	4
7	+	+	+	+	10
8	+	+	-	+	5
9	+		-	-	3
10	+		-	-	3
11	+	-			3
12	(+)	(+)	-	-	3
13	-	-	-	-	4
14	(+)		-		8
15	(+)	(+)			8-10
16				+	
17				+	
18				+	

(+), subjects who reported a past history of latex allergy but did not provide written reports (not considered allergic to latex in this study).

underwent a use test with a prewetted latex glove, which was worn for 15 minutes, and a 30-second rub test with a latex glove; the results of both were negative.

Cases 5 and 6 had a previous diagnosis of latex allergy, and both skin prick test and latex-specific IgE determinations were positive at the time of diagnosis. Only measurements of specific IgE to latex were performed in the present study, and these were now negative.

Case 7 had a previous diagnosis of latex allergy with positive prick test and latex-specific IgE results, which remained positive at the time of the study.

Case 8 had a diagnosis of latex allergy with positive prick and specific IgE results. The prick test had become negative, but the specific IgE remained positive.

Cases 9 and 10 had a prior diagnosis of latex allergy with positive prick test results to latex that had become negative.

Case 11 had a previous diagnosis with a positive skin prick test to latex, negative specific IgE to latex, and a positive latex use test result. He declined to be tested.

Case 12 had a previous diagnosis of latex allergy with a recommendation to avoid latex, although he had not been given a written report. The results of the skin prick test and specific IgE tests were negative in the present study.

Case 13 presented respiratory symptoms (rhinitis and asthma) when using latex gloves. He had prior negative prick and IgE test results, but was recommended to avoid latex even though he had not undergone provocation tests. The results of prick test and specific IgE to latex determinations were negative.

Table 4. Specific Immunoglobulin E Levels, kU_A/L

	Latex	rHev b 5	rHev b 6.01	rHev b 6.02	rHev b 8
1	1.98	1.31	-	-	-
4	3.96	1.31	-	-	9.32
7	0.41	1.54	0.4	0.5	-
8	0.73	-	0.93	-	-
16	2.46	-	-	-	17.8
17	0.51	-	-	-	1.11
18	0.35	-	-	-	0.99
W1	-	-	-	-	0.59
W2	-	-	-	-	2.1

-, specific immunoglobulin E levels <0.35 kU_A/L

W1 and W2, healthcare workers sensitized to grass pollen but not allergic to latex.

Case 14 had latex allergy (positive skin prick test result), but did not provide a clinical report. In our study, the skin tests were negative. No blood was drawn.

Case 15 had a diagnosis and symptoms that suggested latex allergy but declined to participate in the study by undergoing tests or by providing a report. The subject was excluded from the study.

Cases 16, 17, and 18 had no problems with latex usage and negative skin prick test results and positive latex-specific IgE results. They had positive measurements for specific IgE to Hev b 8 (profilin). These 3 individuals were atopic, with positive skin test results to grass pollen.

Two individuals also had negative specific IgE to latex, but had positive readings for specific IgE to Hev b 8. Both were atopic and sensitized to grass pollen (Table 4).

Positive readings for IgE specific to latex and its recombinants are listed in Table 4. Specific IgE measurements to the recombinant allergens Hev b 1, Hev b 3, Hev b 9, and Hev b 11 were negative in all participants.

Table 5. Characteristics of Study Participants Who Were Tested

	Total Population Tested, Mean (SD)	Not Allergic to Latex, Mean (SD)	Allergic to Latex, Mean (SD)
Age, y	41.45 (10.723)	41.18 (10.614)	46.70 (11.567)
Years working in primary care	10.54 (8.007)	10.59 (8.164)	10.60 (5.317)
Work day, h	7.32 (1.218)	7.28 (1.133)	7.60 (1.897)
Number of times on duty a month	0.85 (1.697)	0.80 (1.659)	1.60 (2.171)
Surgical interventions	1.34 (1.374)	1.28 (1.346)	2.20 (1.619)
Pairs of gloves a day	7.98 (6.940)	7.98 (7.053)	8.50 (5.543)
Hours a day with gloves	1.64 (1.687)	1.64 (1.7167)	1.81 (1.251)
Years using gloves	15.23 (9.779)	15.31 (9.833)	15.00 (9.539)

Table 6. Comparison Between Workers Allergic to Latex and Workers Not Allergic to Latex.

	Allergic to Latex, %	Not Allergic, %
Occupational category		
Physician	20.0	48.1
Nurse/Midwife	60.0	44.9
Nursing assistant	20.0	3.8
Dentist		1.3
Physical therapist		0.6
Dental hygienist		1.3
Sex		
Male	30.0	19.2
Female	70.0	80.8
Work shift		
Morning	80.0	50.6
Evening	0	42.9
Night	20.0	6.4
Previous jobs		
None	0	30.4
Hospital	90.0	63.0
Nursing home	10.0	6.5
Smoking		
Nonsmoker	20.0	52.6
Smoker	30.0	27.9
Former smoker	50.0	19.5
Respiratory disease		
None	70.0	89.0
Asthma	30.0	9.1
Others	0	1.9
Drug Allergy		
Yes	30.0	11.0
No	70.0	89.0
Fruits related to latex		
None	60.0	91.6
Kiwi, banana, chestnut, avocado	40.0	7.7
Others	0	0.6
Atopy		
Atopic	60.0	37.5
Nonatopic	40.0	62.5

Ten cases (5.9%) were diagnosed with IgE-mediated allergy to latex. Case 4 was considered to have latent or subclinical sensitization. Cases 12, 13, and 14 were not considered allergic to latex. Cases 16, 17, and 18 were considered false positives because of cross-reactivity with pollen profilin.

The characteristics of the participants who were tested are listed in Table 5. When the group with latex allergy was compared with the nonallergic group (subclinical sensitization was not included in either of these), statistically significant differences were only detected in the number of surgical interventions (2.2 on average in the allergic group as opposed to 1.28 in the nonallergic group).

The allergic group comprised 2 physicians, 6 nurses, and 2 nursing assistants; 3 were male and 7 were female. Eight

had the morning shift and 2 had the night shift. Nine had previously worked in hospitals and 1 in a nursing home. Two were nonsmokers, 3 were smokers, and 5 were ex-smokers. Seven did not have lung disease and 3 were asthmatics. Three had drug allergy. Four had allergic symptoms with fruits related to latex and 6 were atopic.

When allergic participants were compared with nonallergic participants (Table 6), there were no significant differences in terms of occupation, sex, previous jobs, respiratory disease, drug allergy, atopy, skin problems, hobbies, or family history of atopy. Statistically significant differences were observed in work shift, smoking, and fruits related to latex.

Three of the allergic workers reported reduced symptom severity at work, since they were using nonpowdered latex gloves [23,24].

Discussion

The prevalence of latex allergy in our primary care provider population was 5.9%. The rate of participation was satisfactory for this type of study; 45% of the workers answered the questionnaire and 27.5% underwent the tests or provided previous medical reports. However, the sample was not obtained at random, which means we cannot really be sure that they represent the population as a whole.

The prevalence of latex allergy among health care workers varies between 3% and 18% depending on the study. This wide variability is due to the use of different criteria and diagnostic procedures and the different types of population studied [12-17,25]. In Spain, Esteve et al [11] found a prevalence of 3% in a study that included both health care and non-health care workers in a hospital. Dieguez et al [26] found a prevalence of 18.2%, although their study was not specifically designed to estimate the prevalence of latex allergy, and tests were only performed on 6% of workers. Valks et al [27] found a prevalence of 16.7% among the health care workers who attended an allergy center. A systematic review of the literature [8,9] revealed a prevalence of latex allergy of between 4% and 7.8% among health care workers in hospitals, findings that are similar to those of our study. However, we should bear in mind that the vast majority of primary health care workers have also worked in hospitals, and so could have become sensitized to latex in the hospital environment.

Although we found differences in work shifts, they do not seem to be clinically significant, since there are few differences in terms of possible latex content in the environment according to time schedule. Furthermore, the night staff worked in a center where no work occurred during the day, so no comparison was possible with the day shift. As for the evening shift, it is noteworthy that there was not a single case of latex allergy, although this could be more related to greater work instability for that shift (fewer permanent workers), which means they would feel less motivated to participate in the study.

We found differences in smoking habits, latex allergy being more common in ex-smokers; these differences persist if smokers and ex-smokers are grouped together. Although there is no known relationship between smoking and latex allergy, an

association was found in this study; however, this is probably due to the small number of allergic individuals [14].

Although the proportion of atopic participants in our study was greater in the latex-allergic group (60% vs 37.5%), it was not statistically significant, possibly because of the small number of allergic individuals [14,16,28].

We assessed allergy using skin prick testing and latex-specific IgE [20,21,29], which can become negative when exposure to this allergen ceases [24,30]. It is therefore very important to make an early and proper diagnosis, especially if we bear in mind that this type of latex allergy can be an occupational disease and the lack of a correct diagnosis can have future repercussions in terms of job relocations and financial remuneration. Proper follow-up through the occupational health department is also important. Thus, in our study, cases that were doubtful due to lack of clinical history or controlled provocation test results could not be regarded as allergic, but we could not rule out the possibility that the participants had previously been allergic to latex. These participants were therefore advised to avoid latex, thus making confirmation of the diagnosis more difficult the longer they went without wearing latex gloves.

Of note, the 3 allergic participants who had positive test results and the patient with asymptomatic sensitization to latex worked or were on call at an emergency center, where there could have been a greater possibility of accidental contact with latex (due to emergency situations or contamination of objects handled with latex gloves). There were no differences, however, with the rest of the centers in the number of latex gloves or hours they reported using them.

Latex-specific IgE measurements were performed using an enzyme immunoassay in whose solid phase the latex extract, which is composed of several proteins in different proportions, is set. We found that, in cases of latex allergy, the positive IgE measurements were against Hev b 5 and Hev b 6, whereas sensitization to Hev b 8 (latex profilin) seems to be more related to pollen allergy. This is consistent with studies reporting that sensitization to Hev b 5 and Hev b 6 is common among health care workers, while reactivity to Hev b 1 and Hev b 3 is common among children with spina bifida; reactivity to Hev b 1 is common among patients who have undergone surgery [31]. Therefore, in addition to highlighting the relevance of the clinical history combined with complementary tests, it is also useful to determine specific IgE to the recombinant latex allergens in cases of positive latex-specific IgE in order to clarify the diagnosis and detect sensitization to Hev b 8 (profilin). As we observed in this study, positive IgE results to Hev b 8 appear to be subclinical and are very likely due to cross-reactivity with pollen [32,33].

We should also be aware of new diagnostic tools in clinical allergology, such as microarray technology, which may help to confirm the diagnosis of latex allergy [34].

In conclusion, the prevalence of latex allergy in this study was 5.9%. The importance of a correct diagnosis at onset of symptoms should be stressed, since reducing contact with latex can yield negative results. Diagnosis based on allergenic components, by studying reactivity to different individual latex allergens, can reveal sensitization to panallergens such as profilin and help facilitate a correct diagnosis.

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