Prevalence of latex sensitivity and allergy among physicians of a residency program in a children's hospital of Buenos Aires

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ABSTRACT

Introduction. International publications estimate a 7 %-17 % latex sensitization (LS) prevalence among health care workers, but values in Argentina are unknown.

Objectives. To estimate the prevalence of latex sensitization and allergy among residents of a children's hospital using the immediate-reading prick test and to assess associated risk factors in this population.

Population and methods. Cross-sectional study. Residents, trainers, and Chief residents of the Departments of Pediatrics, Orthopedics, Surgery and Intensive Care were included between June and October 2017. All of them were administered a questionnaire (assessing atopic diseases and other risk factors) and underwent the immediate-reading prick test. Total and latex-specific immunoglobulin E levels were determined in a subgroup of individuals (first- and fourth-year residents, surgical specialties, and intensive care).

Results. A total of 113 participants were included. LS prevalence was 7.96 % (95 % confidence interval: 3.70-14.58); 4 participants were allergic to latex. A history of latex-related symptoms (LRS) was significantly associated with a positive result in the immediate-reading prick test (p = 0.0196; odds ratio: 6.13; 95 % confidence interval: 1.44-26.04). There was no association between LS and the year of the residency program.

Conclusions. The observed LS prevalence was 7.9 %. There was a significant relation between a history of LRS and a positive result in the immediate-reading prick test.

Key words: *latex allergy, physicians, skin tests.*

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INTRODUCTION

In their practice, health care workers are exposed to different situations which pose a risk for their health and are not always acknowledged. For several years now, latex allergy has become an occupational problem for people who come into contact with this material because of their profession.[1]

The main source of exposure is latex gloves; the use of which was largely driven by the emergence of the human immunodeficiency virus (HIV) infection.[2,3] This protective measure against emerging infections accounts for the increased prevalence of latex allergy in the last decades.[4] Even though the use of latex-free materials has increased globally, latex is still preferred in low-resource countries because of its low cost, durability, and elasticity.[2,4,5]

Latex is made up of different proteins, out of which at least 15 were identified as strong allergens. Some of them (Hev b1 and Hev b3) need to be in direct contact with mucosa in order to produce sensitization, whereas others (Hev b5 and Hev b6), which are present in powdered latex gloves, are aerosolized into the environment, potentially causing sensitization by contact or inhalation.[6] This evidences that the skin, the mucosa, and the airway are exposure routes.[5]

Based on the above mentioned, latex allergy manifestations may range from skin lesions (urticaria, contact dermatitis, etc.) to respiratory (rhinoconjunctivitis, asthma, etc.) or systemic (anaphylaxis) diseases, which imply limitations in the worker's quality of life, with socioeconomic consequences in the work environment.[6,7]

Several publications from the beginning of the 21st century have shown a latex sensitivity (LS) prevalence ranging from 7 % to 17 % among health care workers.[8-12] A current systematic review is consistent with these findings and describes a

9.7 % prevalence, suggesting that this variability may be due to the trend towards using latex-free products in developed countries.[5]

Several studies have proposed that the time of exposure to latex is correlated to the degree of sensitization; however, a recent meta-analysis has concluded that the evidence is not clear.[13] Due to the lack of studies assessing the prevalence of this pathology among hospital staff in Argentina and the lack of awareness of this condition among professionals, we decided to carry out this study in order to assess LS in the population of physicians of a residency program in a children's hospital of the city of Buenos Aires.

OBJECTIVES

To estimate the prevalence of latex sensitization and allergy among residents of a children's hospital using the immediate-reading prick test and to assess associated risk factors in this population.

POPULATION AND METHODS

Design

Observational, descriptive, cross-sectional study.

POPULATION

Inclusion criteria

All first- through fourth-year pediatric residents, trainers and heads of Pediatrics, and residents of surgical specialties (Pediatric Surgery and Traumatology) and closed areas (Intensive Care) of Hospital General de Niños Pedro de Elizalde (HGNPE) from June to October 2017, who gave their informed consent.

Exclusion criteria

The prick test was not performed on patients with a history of topical corticosteroids or antihistamines within 21 or 10 days before the test, respectively, atopic eczema at the time of the test, and/or a history of latex anaphylaxis (referred by the individual when answering the questionnaire).

Sample size

The sample size calculation (n) to estimate a prevalence of 17 %[8-12,14] ± 5, with a 95 % confidence interval (CI), for a population of 180 subjects, resulted in the need to assess at least 98 participants (Statcalc Epi Info 7.1). The entire accessible population was included given that this was an exploratory study.

Variables

Outcome variables:

- Prick test: nominal variable ("+" positive or "–" negative).
- Total immunoglobulin E (IgE) level: continuous, numerical variable.
- Specific IgE level: nominal variable (positive or negative).

Control variables:

- Age: discrete, numerical variable (years).
- Sex: nominal variable (male or female).
- Year of residency: ordinal variable (current year of residency, from first to fourth).
- Personal history of allergy: nominal variable (yes/no). History of asthma, allergic rhinitis, atopic or contact dermatitis, fruit allergy, urticaria, eczema, as referred.
- Family history of allergy in first-degree relatives: nominal variable (yes/no).
- Previous surgical procedures: nominal variable (yes/no).
- Questionnaire on symptoms caused by contact with latex: nominal variable (positive or negative).

Operational definitions

- LS: positive prick test and/or positive latex-specific IgE, but no history of symptoms caused by contact with latex.
- Latex allergy: presence of immediate hypersensitivity symptoms caused by contact with latex (generalized erythema, urticaria, rhinitis, asthma, angioedema, anaphylaxis) and positive tests (positive specific IgE and/or prick test).

Research procedure

Once the informed consent was obtained, the questionnaire "Diagnostic evaluation of patients with potential latex sensitization" (see *Annex*), which was designed by the Department of Allergy of HGNPE, was administered. Trained staff from the Department of Allergy performed the prick tests following international recommendations.[15] They were performed in the anterior side of the forearm with a Morrow-Brown sterile lancet ("DIATER S.R.L." laboratory, ID code nº 33.01.002009.8, Bac NNE 9092500) with a 1-mm tip, over which a commercial latex extract (non-modified *Hevea brasiliensis* latex allergen, batch 15M21P, in glycerinated solution, "Inmunotek" laboratory), a positive control with histamine, and a negative control with saline

solution were previously placed; a sterile lancet was used for each puncture. The reading was done at 15 minutes: measuring with a wheal meter, a wheal diameter ≥ 3 mm compared to the negative control was considered positive.[15]

In the subpopulations with the least (first-year residents) and the greatest time of exposure (fourth-year residents, heads, trainers, surgical specialties, and closed units), the total and latex-specific IgE levels were analyzed in serum obtained by venipuncture. Total IgE levels were determined by nephelometry (IMMAGE Beckman Coulter), and the reference value for adults was < 150 U/mL. Latex-specific IgE was determined by an enzyme-linked immunosorbent assay (ELISA) (ALLERgen Kit Básico^{R}, BIOARS), and the reference value was < 0.36 IU/L. It was subdivided into class 0: < 0.36 IU/L; class 1 (low): 0.37-0.71 IU/L; class 2 (moderate): 0.72-3.59 IU/L; class 3 (high): 3.60-17.99 IU/L; class 4 (very high): 18-49.99 IU/L; and class 5 (extremely high): ≥ 50 IU/L.

Ethical aspects

This study was approved by the Teaching and Research Committee and the Research Ethics Committee of HGNPE, and was registered under number 406/16. All participants signed the informed consent in order to participate. Anonymity was maintained and participants were informed of results, with the counseling and follow-up of the Department of Allergy regarding necessary preventive measures related to the allergen under study.

Statistical analysis

Analyzed variables were described using proportions for categorical variables and average with standard deviation or median with interquartile range for continuous variables, based on their adjustment or not to normality (Kolmogorov-Smirnov test).

The prevalence of positive prick tests was expressed as the proportion of positives over the total population of prick tests performed. The same procedure was used to assess the prevalence of latex allergy. The χ^2 test with Fisher's correction was done to determine if there was a relation between risk factors by year of residency program, specialty, and history. All values were reported with their corresponding 95 % CI. For association tests, a p value < 0.05 was considered significant. Analysis was done using StatCalc Epi Info 7.1.

RESULTS

A total of 158 professionals were invited to participate, of which 6 were excluded because they did not give their informed consent, and 39, because they were not at the hospital during the study period. Finally, a total of 113 participants were included, of which 91 were women (80.5 %) and 22 were men (19.5 %). Participants' average age was 28.7 (+/- 2.42) years.

Out of the 113 professionals, 96.4 % were pediatrics Chief residents/trainers (11.5 %) and residents (first year: 26.5 %; second year: 15 %; third year: 20.3 %; fourth year: 23 %), and the remaining 3.6 % corresponded to residents from surgical and closed areas. Even though the latter were a small part of the population, they were considered for analysis, given that this was an exploratory study. Out of all participants, 9 (7.9 % 95 % CI: 3.7-14.5) had a positive prick test; out of which, 4 referred symptoms when exposed to latex and were considered allergic to latex.

When analyzing participants in relation to their personal history of atopic diseases and other LS-related risk factors which were identified with the questionnaire (*Table 1*), a statistically significant difference was observed for a history of latex-related symptoms (16 individuals, 14.1 %) and a positive prick test result, with an odds ratio (OR) of 6.13 (95 % CI: 1.44-26.04), $p = 0.0196$. In relation to a positive prick test result, a history of latex-related symptoms showed a sensitivity of 44 % (95 % CI: 12.0-76.9) and a specificity of 88 % (95 % CI: 82.3-94.6) with a high negative predictive value of 95 % (95 % CI: 90.4-99.2).

A history of contact dermatitis with other substances, eczema, rhinitis, asthma, anaphylaxis, and related food allergies did not show a significant association. No differences that would allow to relate years of exposure during the residency program and the prevalence of sensitization were observed either (*Table 1*).

In an exploratory manner, total and latex-specific IgE levels were determined in a subgroup of subjects, including those with the most and least likelihood of sensitization based on their length of service and/or specialty (on the one side, first-year residents and, on the other side, fourth-year residents, Chief residents and trainers, and residents from pediatric closed areas and surgical units). A total of 87 samples were processed; of these, 20 were excluded due to the lack of prick test (they could not attend the department when they were asked to). The results of 67 samples were analyzed, as shown in *Table 2*.

Out of the 9 participants with a positive prick test, only 1 of them also had a positive specific IgE.

DISCUSSION

For several years now, latex allergy has become an occupational problem for health care workers.[1] In Argentina, no studies have been published describing the local epidemiology. In our study, the prevalence of LS was 7.9 %, with a 3.5 % of allergic subjects, which is consistent with international publications.[3,8-12,16-18] Regarding a history of atopy or other factors related to latex

TABLE 1. *Relation between participants' characteristics and the prick test*

Total N = 113		**Positive prick test (N = 9) N (%)**	**Negative prick test (N = 104) N (%)**	**Odds ratio/95 % CI *p***
Latex-related symptoms				
Yes	16 (14.1 %)	4 (44.4 %)	12 (11.5 %)	0.0196
No	97 (85.8 %)	5 (55.6 %)	92 (88.4 %)	6.13 (1.44-26.04)
Related food allergy				
Yes	2 (1.76 %)	1 (11.1 %)	1 (0.96 %)	
No	111 (98.2 %)	8 (88.9 %)	103 (99.04 %)	NS
History of atopy				
Yes	36 (31.8 %)	5 (55.6 %)	31 (29.8 %)	
No	77 (68.2 %)	4 (44.4 %)	73 (70.2 %)	NS
Contact dermatitis				
Yes	35 (31 %)	2 (22.2 %)	33 (31.7 %)	
No	78 (69 %)	7 (77.8 %)	71 (68.3 %)	NS
Rhinitis				
Yes	40 (35.4 %)	4 (44.4 %)	36 (34.6 %)	
No	73 (64.6 %)	5 (55.6 %)	68 (65.4 %)	NS
Asthma				
Yes	14 (12.4 %)	2 (22.2 %)	12 (11.5 %)	
No	99 (87.6 %)	7 (77.8 %)	92 (88.5 %)	NS
Eczema				
Yes	14 (12.4 %)	1 (11.1 %)	13 (12.5 %)	
No	99 (87.6 %)	8 (88.9 %)	91 (87.5 %)	NS
History of anaphylaxis				
Yes	5 (4.4 %)	1 (11.1 %)	4 (3.8 %)	
No	108 (95.6 %)	8 (88.9 %)	100 (96.2 %)	NS
History of surgical procedure				
Yes	50 (44.2 %)	3 (33.3 %)	47 (45.2 %)	
No	63 (55.8 %)	6 (66.7 %)	57 (54.8 %)	NS

CI: confidence interval; NS: not significant.

TABLE 2. *Relation between immunoglobulin E and the prick test*

	Positive prick test (N = 7) N (%)	**Negative prick test (N = 60) N (%)**
Total IgE (N = 67)		
Increased (>150 IU/mL) 12 (17.9 %)	4 (57.1 %)	8 (13.3 %)
Normal 55 (82.1 %)	3 (42.9 %)	59 (86.7 %)
Latex-specific IgE (N = 67)		
Positive (>0.36 IU/L) 1 (1.5 %)	1 (14.3 %)	0 (0 %)
Negative 66 (98.5 %)	8 (85.7 %)	60 (100 %)

IgE: immunoglobulin E.

allergy, other publications, such as the study by Wudy et al.,[5] found a significant association between male sex, asthma, oculorhinitis, and atopic eczema, and a positive prick test result. Other studies found an association between the latter and a history of food allergy.[3] In our exploratory study, we could only find a significant association with a history of latex-related symptoms.

In relation to sex, like in other studies,[4] most participants were women. This is because the study was carried out in a residency program of a children's hospital and, in consistency with the statistics of the Government of the Autonomous City of Buenos Aires, 87 % of pediatric residents are women.[19]

Regarding the risk of sensitization in relation to years of service, no significant differences were observed, as it has been described in publications like the one by Arroyo-Cruz et al.;[6] even though it is worth mentioning that the aforementioned study was done in residents from surgical areas with a greater exposure to latex than clinical specialties. Given that in our hospital residents from surgical specialties are scarce, it would be interesting to broaden the sample in future studies and include other institutions to achieve a greater balance among participants.

Like in the study by Wudy et al.,[20] only one participant had a positive prick test result within the subpopulation of our study where latex-specific IgE was analyzed. The lack of correlation between the prick test and latex-specific IgE may be due to the latter's lower sensitivity and specificity, with a described false negative rate of up to 30 %.[21,22]

One of the strengths of this study is that the prevalence of LS could be determined with the prick test –considered the gold standard for the diagnosis of LS– which was performed by trained staff from the Department of Allergy. In addition, a population undergoing a training stage with exclusive dedication was selected, which would allow to observe the time of exposure to the studied allergen.

One of the weaknesses of our study is that, in order to collect data on the history of atopy and other LS-related risk factors, a non-validated questionnaire was used, which was developed by specialists in the area, like in many published international studies.[3,4,6,20,23] In addition, it is worth noting that, even though the international bibliography describes the use of challenge tests, which are useful in case of discrepancy between medical history and diagnostic tests, this type of tests may trigger severe acute allergic reactions.[20] Therefore, since our study was carried out in a children's hospital, where adults cannot be hospitalized, we decided not to perform them. This may underestimate the prevalence of latex allergy in our population.

Even though not all sensitized individuals will be symptomatic,[24] in countries like Argentina, where latex-free work environments have not yet been implemented, it is essential to identify these professionals in order to take secondary preventive measures.[14] The most effective interventions to reduce the prevalence of latex allergy include taking cognizance of sensitization in order to avoid contact, which underscores the importance of knowing its epidemiology. In addition, a study by F. Al-Niaimi et al. evidenced a major lack of knowledge concerning latex allergy among health care workers,[25] which suggested the need for a greater dissemination of this problem.

CONCLUSIONS

The prevalence of latex sensitivity and allergy in the studied population of residents was 7.9 % and 3.5 %, respectively. A history of latex-related symptoms was the only statistically significant risk factor for a positive prick test. Such relation was not found with the other history-related data collected in the questionnaire. It was not evidenced either that a higher exposure time led to a higher prevalence of LS. ■

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REFERENCES

1. Bedollas-Barajas M, Macriz-Romero N, Jara-Ettinger AC, Macriz-Romero M, et al. Autorreporte de alergia al látex en estudiantes de medicina: prevalencia y factores asociados. *Rev Alerg Mex*. 2018; 65(1):10-8.
2. Bedollas-Barajas M, Machuca-Rincón ML, Morales-Romero J, Macriz-Romero N, et al. Prevalencia de 2017; 64(4):430-8.
3. Lopes RA, Benatti MC, Zollner RL. Occupational exposure of Brazilian neonatal intensive care workers to latex antigens. *Allergy*. 2004; 59(1):107-10.
4. Fajardo-Zapata AL. Alergia al látex en trabajadores de la salud. *Iatreia.* 2014; 28(1):17-23.
5. Wu M1, McIntosh J, Liu JJ. Current prevalence rate of latex allergy: Why it remains a problem? *J Occup Health.* 2016; 58(2):138-44.
6. Arroyo-Cruz ME, Collado-Chagoya R, Hernández-Romero J, Alvarado-Gumaro AE, et al. Sensibilización y alergia al látex en residentes quirúrgicos del Hospital General de México. *Rev Alerg Mex*. 2018; 65(2):128-39.

7. Raulf M. Current state of occupational latex allergy. *Curr Opin Allergy Clin Immunol.* 2020; 20(2):112-6.
8. Floyd PT. Latex allergy update. *J Perianesth Nurs.* 2000; 15(1):26-30.
9. Roy DR. Latex glove allergy-Dilemma for Health Care Workers: An overview. *AAOHN J*. 2000; 48(6):267-77.
10. Reed D. Update on latex allergy among health care personnel. *AORN J.* 2003; 78(3):409-12, 416-22, 425-6.
11. Agarwal S, Gawkrodger DJ. Latex allergy: a health care problem of epidemic proportions. *Eur J Dermatol.* 2002; 12(4):311- 5.
12. Gil Macharet MS, Barriga Medina FJ, Pérez de Villar Grande JA. Alergia al látex en los profesionales sanitarios (i). Vigilancia de la Salud. *Med Segur Trab*. 2007; 53(208):53-61.
13. Garabrant D, Schewitzer S. Epidemiology of latex sensitization and allergies in health care workers. *J Allergy Clin Immunol.* 2002; 110(2 Sppl):S82-95.
14. Esteve M, Casas I, Baltasar M, Rodríguez D, et al. Prevalencia de sensibilización al látex en personal sanitario. *Med Clin (Barc).* 2003; 121(18):681-3.
15. García Robaina JC, Matheu Delgado V, Sánchez Machin I, Seoane Leston J. Técnicas diagnósticas in vivo. In: Peláez Hernández A, Dávila González IJ. *Tratado Alergología. Tomo I*. Madrid: Ergon; 2007.Pages 115-8.
16. Galindo MJ, Quirce S, García Olmos L. Latex Allergy in Primary Care Providers. *J Investig Allergol Clin Immunol.* 2011; 21(6):459-65.
17. Parisi C, Biló B, Bonifacci F, Bonini S, et al. Alergia al látex. *Arch Argent Pediatr.* 2006; 104(6):520-9.
18. Bousquet J, Flahault A, Vandenplas O, Ameille J, et al. Natural rubber latex allergy among health care workers: A systematic review of the evidence. *J Allergy Clin Immunol*. 2006; 118(2):447-54.
19. Eiguchi K. Visión actual del Sistema de Residencias Médicas en el GCBA. Buenos Aires: Ministerio de Salud del Gobierno de la Ciudad de Buenos Aires; 2014. [Accessed on: April 3rd, 2020]. Available at: https://buenosaires.gob.ar/areas/salud/dircap/REsidencias-Web.pdf.
20. Wudy AE, Negro C, Adami A, Larese Filon F. Atopic status and latex sensitization in a cohort of 1,628 students of health care faculties. *Ann Allergy Asthma Immunol*. 2017; 118(5):603-7.
21. Fuentes HR, Sandoval MD, Borzutzky SA, Nazar JC. Alergia al látex en el período perioperatorio. *Rev Chil Cir*. 2015; 67(3):318-24.
22. Porras Madrigal O. Alergia al látex: Una revisión. *Rev Méd Hosp Nac Niños (Costa Rica).* 2004; 39(1):12-23.
23. Japundžić I, Vodanović M, Lugović-Mihić L. An Analysis of Skin Prick Tests to Latex and Patch Tests to Rubber Additives and other Causative Factors among Dental Professionals and Students with Contact Dermatoses. *Int Arch Allergy Immunol.* 2018; 177(3):238-44.
24. Garnier L, Selman L, Rouzaire P, Bouvier M, et al. Molecular allergens in the diagnosis of latex allergy. *Eur Ann Allergy Clin Immunol.* 2012; 44(2):73-9.
25. Al-Niaimi F, Chiang YZ, Chiang YN, Williams J. Latex allergy: assessment of knowledge, appropriate use of gloves and prevention practice among hospital health care workers. *Clin Exp Dermatol.* 2012; 38(1):77-80.

ANNEX

DIAGNOSTIC EVALUATION OF PATIENTS WITH POTENTIAL LATEX SENSITIZATION HOSPITAL DE NIÑOS PEDRO DE ELIZALDE

UNIT OF ALLERGY

ID number				
Age		**Date of birth**		
History of surgical procedures	Yes	No		Number of interventions
Exposure to latex	Multiple operations	Myelomeningocele		Spina bifida
Previous reactions	Contact dermatitis: yes/no		Angioedema: yes/no	
	Anaphylaxis: yes/no		Need for CPR: yes/no	
	When did anaphylaxis occur?			
	What was the patient exposed to when anaphylaxis occurred? Surgery/balloons/gloves/other			
Preventive measures		Start date		
Personal history of allergy	Eczema: yes/no	Asthma: yes/no		Atopy: yes/no
Family history of allergy	Eczema: yes/no	Asthma: yes/no		Atopy: yes/no
Fruit allergy	Walnut: yes/no	Banana: yes/no	Kiwi: yes/no	Avocado: yes/no
Prick test	Latex	Histamine	Saline solution	Other
Measures	Identification badge: yes/no		Instructions for professionals: yes/no	

CRP: cardiopulmonary resuscitation.