The Open Access Journal of Science and Technology
vol. 5 (2017), Article ID 101281, 8 pages
doi:10.11131/2017/101281

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Research Article

Questionnaire's and Diagnostic Tests' Reliability on Natural Rubber Latex Allergy among Albanian Dental Students

Alketa Bakiri[1,2,3], Skender Skenderaj[4], Dhimiter Kraja[5], Elizana Petrela[6], Doris Mingomataj[2], and Ervin Ç. Mingomataj[7,8]

[1]*Logos University, Faculty of Applied Sciences, Department of Advanced Techniques in Medical Laboratory, Tirana, Albania*
[2]*Albanian University, Faculty of Medical Sciences, Department of Stomatology, Tirana, Albania*
[3]*Hygeia Hospital Tirana, Department of Outpatients Service, Tirana, Albania*
[4]*Medicine University of Tirana, Faculty of General Medicine, Department of Environmental and Work Medicine, Tirana, Albania*
[5]*Medicine University of Tirana, Faculty of General Medicine, Department of Infective and Dermato-Venerologic Diseases, Tirana, Albania*
[6]*Medicine University of Tirana, Faculty of General Medicine, Department of Statistics and Epidemiology, Tirana, Albania*
[7]*Medicine University of Tirana, Faculty of Technical-Medical Sciences, Department of Paraclinical Disciplines, Tirana, Albania*
[8]*"Mother Theresa" School of Medicine, Department of Allergology and Clinical Immunology, Tirana, Albania*

Corresponding Author
Ervin Ç. Mingomataj
allergology@gmx.de

Editor
Kazuhito Asano

Dates
Received 13 February 2017
Accepted 28 February 2017

Abstract. Latex allergy is a common occupational disease among healthcare workers. Self-administrated questionnaires, physical examination and allergic tests are largely used to assess data about natural history, risk factors, clinical phenotype, etc. The aim of the present study was to determine the prevalence of allergy to latex gloves among dental students and the association between questionnaire items and diagnostic tests.

In this prospective study, a total of 240 students completed a self-administrated questionnaire that comprised of a total of different items and gave information about the participants and their glove use, working habits and glove use, signs and symptoms related to glove use, precautions taken to minimize it, etc. Patch test is performed through latex gloves, while skin prick test with a commercial extract.

Questionnaire items and diagnostic tests revealed that one-fourth of subjects were suspicious for latex gloves hypersensitivity. Their mean value for skin reactions like contact urticaria, irritant or allergic dermatitis was between 10% and 14%, while for other symptoms the mean value was under 5%. Logistic regression analysis revealed an association between different questionnaire items and positive allergy tests among suspected cases and diagnosed cases of latex allergy, but not with control tests (including between the positive patch test and presence of non-cutaneous symptoms).

These findings suggest that respiratory exposure plays an important role on the interaction between different mechanisms during sensitization processes, and that questionnaire statements about latex allergy in combination with positive diagnostic tests can be reliable on the identification of allergic subjects.

Keywords: latex allergy, clinical phenotypes, questionnaire, diagnostic tests.

1. Introduction

Latex allergy is a common occupational disease among healthcare workers who use latex gloves [1–3]. The use of latex gloves by healthcare workers can lead to multiple symptoms like eczema, contact urticaria, rhinitis, conjunctivitis, asthma, and anaphylaxis [4, 5]. Diagnosis of latex allergy is based on personal history, physical examination, and diverse diagnostic procedures (skin prick tests, specific IgE, patch test, challenge test), while self-administrated questionnaires are largely used to assess a wide variety of data [6–9].

Today, gloves are worn routinely by many dental practitioners while treating patients, with natural rubber latex being the most commonly used glove material worldwide [10]. Despite the widespread use of latex gloves, there is lack of data with regards to latex allergy in the dental care setting in Albania. The aim of the present study was to determine the relationship between diverse items regarding to latex gloves allergy among dental students in the Albanian University of Tirana (Albania)—obtained by questionnaire and diagnostic tests.

2. Method

In this prospective study, a total of 240 students (42% males and 58% females, mean age 22.8 ± 3.4 years) were first surveyed using a self-administered questionnaire during academic years 2012-2013 and 2013-2014. The questionnaire was comprised of different items and gave information about the participants in regard to working habits, glove use, previous chirurgical interventions, signs and symptoms related to latex gloves usage, any other type of allergy, symptoms associated with toy balloons, familiar atopy and tobacco smoking, as well as precautions taken to minimize it. Apart from questionnaire (completed by all subjects), prevalence of latex-related symptoms and sensitization was determined in a randomized sample of students by commercial skin prick tests (Stallergenes), patch tests with natural rubber glove (including latex-free glove as control), as well as through challenge test with dermal and airborne exposure to nature rubber latex and latex-free gloves. Similarly to self-administrated questionnaire, the challenge test has been performed by all students.

The suspected cases for adverse reactions during latex exposure were further classified as irritant skin reactions (dried skin, localized erythema, adverse reactions to detergents or disinfectants—mentioned on disease history questionnaire items and confirmed during challenge test, but lack of positive or relevant results for the latex allergy tests), allergic skin reactions (diverse allergy skin reactions like erythema, eczema/cracked hands, hives, angioedema, associated with positive results for latex allergy tests), and internal organs allergic reactions (breathlessness attacks, cough, rhinitis and/or conjunctivitis symptoms, arterial hypotension, associated by positive tests for latex allergy).

Comparisons between different variables are performed by Fisher's exact test, and Kendall's tau correlation coefficient and logistic regression helped to investigate the relationship between diverse questionnaire and diagnostic test items. Statistical significance is settled for p value 0.05 or lower.

3. Results

Ninety-five percent of students were regular users of natural rubber gloves. In total, 25% of subjects (60 cases) were suspected for adverse reactions during natural rubber latex exposure. With irritant skin reaction are diagnosed 46 subjects (19.2%), with allergic skin reactions 35 (14.6%), and with non-cutaneous reactions 9 subjects (3.8%).

A natural rubber latex allergy and hand erythema along work procedures was observed in about 10% of cases, while a short-term erythema was developed (immediately after gloves wearing) in more than 12% of subjects. About 14% of subjects reported for irritant dermatitis after hand wash or washout procedures, while nearby 10% of them complained for irritant symptoms after application of disinfectants. Hand eczema within two days after natural rubber latex gloves use is reported by 14% of the studied cases. Immediate facial allergic symptoms, rhino-conjuctival symptoms, lower respiratory symptoms, and visit of emergency services after latex exposure were reported by 5%, 5.4%, 2.5% and 7.1% of subjects respectively. Dyspnea after toy balloon blowing is reported in about 2% of cases. More than 40% of all subjects reported for symptoms improvement during regular use of latex-free gloves. In addition, 15% of subjects reported for food allergies. These findings are summarized on the Table 1.

Table 1: Summary of subjects' history for allergic reactions.

Questionnaire Variables	n = 240 (%)
Previous reports for latex allergy	24 (10.0)
Regular use of latex gloves	227 (94.6)
Assisting colleagues that use latex gloves	195 (81.3)
Hand erythema during work	23 (6)
Previous chirurgical interventions	57 (23.8)
Hypotension shock after chirurgical interventions	0
Irritant dermatitis after hand wash/washout procedures	33 (13.8)
Irritant disorders after hand disinfection procedures	26 (10.8)
History for additional allergic pathologies	42 (17.5)
Familiar history for allergic diseases	63 (26.3)
Smoking	65 (27.1)
Immediate erythema after use of latex gloves	31 (12.9)
Eczema or cracked skin within 2 days after use of latex gloves	34 (14.2)
Regular use of latex-free gloves	146 (60.8)
Adverse reactions after use of latex-free gloves	2 (0.4)
Attenuation of adverse symptoms after use of latex-free gloves	102 (42.5)
Sneezing, eye itching, nasal congestion after latex exposure	13 (5.4)
Breathlessness attack after latex exposure	6 (2.5)
Facial itching, angioedema, or erythema after latex exposure	12 (5.0)
Breathlessness attack after toy balloon blowing	5 (2.1)
Additional allergic reactions non-related to latex	28 (11.7)
Visit in emergency services after latex exposure	17 (7.1)
Previous positive allergy tests	13 (5.4)
Previous report for food allergies	37 (15.4)

With regards to diagnostic procedures, the patch test to latex resulted positive in about 15% of subjects. Commercial skin prick test to latex revealed a sensitization to latex on 20% and atopy response on 34% of subjects. Airborne challenge with natural rubber latex gloves confirmed the allergic sensitization on 7.5% of subjects. An additional population showed irrelevant or irritant skin symptoms, while respiratory allergic symptoms are shown in a minority of cases. For more information see the Table 2.

Table 2: Summary of diagnostic test results.

Diagnostic Variables	n = 240 (%)
Positive patch test to latex	7/48 (14.6)
Positive patch test to latex-free glove	1/48 (2.1)
Positive patch test to adhesive	6/48 (12.5)
Latex wheal	10/50 (20.0)
Latex flare	11/50 (22.0)
Presence of atopy	17/50 (34.0)
Positive latex challenge test	18 (7.5)
- Erythema	20 (8.3)
- Dry skin	6 (2.5)
- Itching	24 (10.0)
- Hives	1 (0.4%)
- Breathlessness	3 (1.3)
- Cough	2 (0.8)
Positive provocation test to latex-free glove	0

Logistic regression analysis showed that subjects with positive results for latex patch tests demonstrated a consistent association with different allergic and irritant symptoms. These symptoms were related to skin and internal organs, while the use of latex-free gloves showed a consistent but statistically insignificant effect on symptoms improvement among mentioned subjects (Table 3). There was no association between latex-free gloves patch test and mentioned variables (data not shown).

Table 3: Association between latex patch test positivity and other variables.

Association between latex patch test positivity and other variables (n = 48)			
Variables	r	R^2	p
Attenuation of adverse symptoms after use of latex-free gloves	.249	—	.087
Sneezing, eye itching, nasal congestion after latex exposure	.558	.311	<0.001
Breathlessness attack after latex exposure	.505	.255	0.001
Facial itching, angioedema, or erythema after latex exposure	.632	.399	<0.001
Breathlessness attack after toy balloon blowing	.353	.125	0.016
Positive patch test to adhesive	−.060	—	.679
Erythema after latex provocation test	.449	.201	0.002

Regarding subjects with skin erythema after latex gloves exposure, there is observed an association to different symptoms, their improvement when latex-free gloves were regularly used,

and an association with positive patch test result to latex but not to latex-free glove exposure (Table 4).

Table 4: Association between erythema after latex challenge and other variables.

Association between erythema after latex challenge and other variables (n = 240)			
Variables	r	R^2	p
Attenuation of adverse symptoms after use of latex-free gloves	.168	.028	0.010
Sneezing, eye itching, nasal congestion after latex exposure	.194	.038	0.003
Breathlessness attack after latex exposure	.241	.058	<0.001
Facial itching, angioedema, or erythema after latex exposure	.415	.0172	<0.001
Breathlessness attack after toy balloon blowing	.273	.074	<0.001
Positive patch test to latex (n = 48)	.449	.0201	0.002
Positive patch test to latex-free gloves (n = 48)	–.065	—	.655

With regards to correlation between studied variables and the suspicion of natural rubber latex allergy, our findings revealed consistent or strong links to hand erythema or eczema, and positive result for latex skin prick or patch tests. The suspecting of latex allergy correlated with diagnosed allergy showing an association to the skin and internal symptoms (see also Table 5).

Table 5: Association between suspected allergic reaction to latex and other variables.

Association between suspected allergic reaction to latex and other variables (n = 240)		
Variables	r	p
Hand erythema and discomfort during work	.466	<0.001
Eczema or cracked skin within 2 days after use of latex gloves	.676	<0.001
Immediate erythema after use of latex gloves	.581	<0.001
Cutaneous allergy to latex	.716	<0.001
Internal organ allergy to latex	.342	<0.001
Latex wheal (n = 50)	0.428	0.002
Positive patch test to latex (n = 48)	0.380	0.009

Moreover, logistic regression analysis demonstrated a consistent or strong correlation to allergic symptoms including them on the internal organs, as well as positive results for skin prick and patch test to latex among subjects who were diagnosed for latex skin allergy (Table 6).

Table 6: Association between cutaneous allergy to latex and other variables.

Association between cutaneous allergy to latex and other variables (n = 240)		
Variables	r	p
Hand erythema and discomfort during work	.507	<0.001
Eczema or cracked skin within 2 days after use of latex gloves	.442	<0.001
Immediate erythema after use of latex gloves	.650	<0.001
Suspected allergic reaction to latex	.716	<0.001
Internal organ allergy to latex	.416	<0.001
Latex wheal (n = 50)	0.392	0.005
Positive patch test to latex (n = 48)	0.514	<0.001

Apart from other correlations, the association with above-mentioned diagnostic tests is reported also among subjects with internal allergy to latex (Table 7).

Table 7: Association between latex internal organ allergy and other variables.

Association between latex internal organ allergy and other variables (n = 240)		
Variables	r	p
Hand erythema and discomfort during work	.308	<0.001
Eczema or cracked skin within 2 days after use of latex gloves	.360	<0.001
Immediate erythema after use of latex gloves	.316	<0.001
Suspected allergic reaction to latex	.342	<0.001
Cutaneous allergic reaction to latex	.416	<0.001
Latex wheal (n = 50)	0.387	0.005
Positive patch test to latex (n = 48)	0.516	<0.001

4. Discussion

Latex allergy is a major occupational health problem in health care workers, affecting 0.5 to 18% of subgroups at risk [1, 2, 11, 13–15]. Above-mentioned epidemiologic findings agree with some items in our self-administrated questionnaire, which reports for natural rubber latex allergy among dental students on 10% of cases, hand erythema especially after latex glove wearing in more than 12%, or hand eczema in 14% of subjects. Similarly to this study, previous surveys have noted that family history of allergy, history of personal food allergy, or symptoms associated with toy balloons are frequent among individuals with latex allergy [2–4, 7, 8, 11].

Furthermore, the literature findings have demonstrated a significant association between patch test positivity to latex and rubber additives as well as between allergic and irritant dermatitis in hypersensitized subjects to latex gloves [13, 16]. The positivity to latex patch test among our population subjects is associated even with non-cutaneous symptoms, indicating that respiratory exposure plays an important role on the interaction between different mechanisms during sensitization processes [5, 17].

Subjects with skin erythema after latex gloves exposure developed symptoms improvement after systematical use of the latex-free gloves, and an association with positive patch test result to latex but not to latex-free glove exposure. Apart from the test reliability, this demonstrates that latex exposure plays an important role on the hypersensitivity to natural rubber latex gloves. In addition, this suggests that the latex glove avoidance is an effective prevention measure against latex allergy, especially among subjects with longer experience or work practice [17, 18]. Maybe simple measures such as the use of non-powdered latex gloves and use of latex-free gloves by sensitized subjects can stop the progression of latex symptoms, and probably, may avoid new cases of sensitization [19].

The correlation between the suspicion of natural rubber latex allergy and clinical allergic symptoms and positive diagnostic tests suggest that questionnaire statements about latex allergy especially in combination with positive diagnostic tests seems to be reliable on the identification of allergic subjects independently to symptoms phenotype at least when the pathologic processes and disease's installation reach an advanced stage [20]. This finding agrees with the argument

that quantity of gloves use should be considered a risk factor for latex allergy, and the recent confirmation that some commercial tests are useful diagnostic tools only for patients with a history of latex allergy and not for screening the population with a low prevalence of latex sensitization [4, 20].

This study reinforces the conclusion that it is essential to recognize which professionals are sensitized to latex in order to provide appropriate treatment and to establish adequate prevention [3]. A positive history for allergic and irritant symptoms, as determined by questionnaire is a significant predictor of a positive response to latex antigens. Its combination with positive diagnostic tests reinforces the confirmation of suspected latex allergy especially when pathology is already installed. Healthcare enterprise-wide interventions requiring use of low-allergen gloves, changing gloves to non-latex ones, or even using low-allergen latex gloves, in the affected individuals appears to confer adequate secondary prevention [5, 21, 22]. Because of relationship between allergic reactions to latex gloves and some medical histories, it seems to be necessary the pre-matriculation and pre-employment evaluation of dental students.

Authors' Contribution

AB developed questionnaire, assisted students to complete them, conducted diagnostic tests and collected the data; SS and DK coordinated and helped on the study designation and conduction; EP assisted on statistical analysis of the data; DM assisted on students' enrollment in the study and helped on study designation from the stomatological perspective; EÇM drafted the manuscript.

Unfortunately, SS passed away during the last year.

Competing Interests

The authors declare that they have no competing interests.

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