

The Prevalence of Latex-Specific IgE Antibodies Among Pediatric Patients in a Chronic Care Facility

LYNELLE GRANADY, M.D., VICKI JO DEUTSCH, M.D.,¹ JOSE MANSUETO, M.D.,¹
BARBARA SCHOFIELD, M.D.,¹ ELENA ELKIN, M.P.A., and MARY DIMAIO, M.D.

ABSTRACT

We conducted a study to determine the prevalence of natural rubber latex (latex) hypersensitivity among children living in a chronic care facility and to assess symptoms and demographic and medical risk factors for latex hypersensitivity. A cross-sectional descriptive study was conducted on a population of 50 children with complex medical problems living in a chronic care facility. Latex hypersensitivity was determined by radioallergosorbent assay (RAST). Demographic and medical history data were collected from the medical chart. Twelve (24%) of the children in the cohort tested positive for latex-specific IgE antibodies. Six (50%) had a history of urticaria and all 12 had a history of wheezing. Both symptoms were significantly associated with the presence of latex-specific IgE antibodies by statistical analysis. In chi-square analyses, male sex and presence of a ventriculoperitoneal (VP) shunt were significantly associated with latex hypersensitivity. Adjusted for covariates, the presence of a VP shunt increased the odds of a positive antilatex IgE test result by 3.8 (95% confidence interval: 1.4 to 10.1). The prevalence of latex hypersensitivity among children in chronic care facilities is substantially greater than in the general population. These children have multiple complex medical problems and appear to be at increased risk. Prospective long-term studies of children in all domiciles are required to further delineate factors contributing to latex hypersensitivity. (*Pediatr Asthma Allergy Immunol* 1999;13[1]:15–20.)

INTRODUCTION

LATEX IS AN INTRACELLULAR CYTOSOL secreted by lactiferous cells of the rubber tree *Hevea brasiliensis*. Hypersensitivity reactions are mediated against specific polypeptides.⁽¹⁾ The incidence of latex hypersensitivity (latex-specific IgE) in the general population is estimated to be less than 1%.^(1,2) Allergic reactions to latex have been reported with increased frequency in specific populations with chronic latex exposure (e.g., health care workers, rubber and doll manufacturing workers, and children with spina bifida).^(1,3–7) Some studies have described latex allergy among children with medical conditions other than spina bifida or those requiring multiple surgical procedures.^(8–11) Children with multiple complex medical

The Division of Pediatric Allergy, Immunology and Pulmonology, and the Department of Public Health, Cornell University Medical College; and ¹The Specialty Hospital of Terence Cardinal Cooke Health Care Center, New York, New York.

problems have frequent exposure to latex, particularly those residing in chronic care facilities. Commonly, these children have spent long periods of time in hospitals prior to placement in these facilities. They are frequently nourished through enteral feeding tubes, and have tracheostomies to facilitate pulmonary toilet, suctioning, or mechanical ventilation. These treatment modalities utilize latex-containing objects or require a health care worker to wear latex gloves. This study attempts to determine the prevalence of latex-specific IgE antibodies by radioallergosorbent test (RAST) in a population of institutionalized children, to assess risk factors for latex hypersensitivity, and to determine a correlation between patient symptomatology attributable to a latex exposure and the RAST status of the patient.

METHODS

The study was performed at Terence Cardinal Cooke Health Care Center (TCCHCC) and was approved by the Institutional Review Board. TCCHCC has a 50-bed specialty hospital for infants, children, and young adults with severe disabilities or complex medical problems. Four of the beds are used by children on assisted ventilation.

Each patient's chart was reviewed by the physicians involved in the study. Gender and age of the patient at commencement of the study were recorded. In addition, the length of stay at TCCHCC, as well as the patient's residence prior to placement at TCCHCC, were noted. The medical diagnoses, gestational age at birth, and the number and nature of surgical interventions were obtained. Other possible factors that could increase latex exposure were also analyzed; these were method of feeding, diet, and oral or tracheal suctioning. Symptoms such as urticaria, wheezing, and hypotension were considered possible manifestations of latex allergy.

Over a 1-month period, 50 patients had 5 mL of whole blood drawn by venipuncture. The specimens were mailed to LabCorp (Laboratory Corporation of America, New York, New York) for RAST analysis. The RAST identifies allergen-specific IgE *in vitro*, using a Hycor latex allergen disk (K82) and the patient's serum. Using this method, the test manufacturer estimates that the RAST has a sensitivity of 93.5% and a specificity of 84.0%.⁽¹²⁾ The IgE values are expressed in units of per liter (ku/L) and values greater than 0.35 ku/L were classified as positive.

STATISTICAL ANALYSIS

The association between a positive antilatel IgE test result ($\text{IgE} > 0.35 \text{ ku/mL}$) and symptoms of latex allergy, and between a positive test result and risk factors for latex allergy, were assessed using chi-square analysis. In a multivariate logistic regression, a positive test result modeled as a function of characteristics that demonstrated significance ($p < .05$) in the bivariate analysis, adjusted for selected covariates. Data were analyzed using SPSS software.

RESULTS

The demographic characteristics of the subjects are presented in Table 1. Of the 50 children, 29 (58%) were boys and the mean age was 9.4 years. The mean length of stay at TCCHCC was 5.1 years. All of the patients were severely developmentally delayed and most carried a diagnosis of cerebral palsy. Twelve children (24%) tested positive for antilatel IgE antibodies. One patient was a class 1 (0.35 ku/L), two patients were class 2 (0.70–3.50 ku/L), 6 patients were class 3 (3.50–17.5 ku/L), 2 patients were class 4 (17.5–50.0 ku/L), and 1 patient was class 5 (50.0–100 ku/L). Although male children comprised less than 60% of the sample, they represented more than 80% of the antilatel IgE antibody positive cases. In the chi-square analysis, male sex was significantly associated with latex-specific antibodies ($p < .04$). In a comparison independent sample of means, age and length of stay did not differ significantly between the antilatel IgE antibody positive and antilatel IgE negative groups (Table 1).

LATEX HYPERSENSITIVITY IN CHILDREN

TABLE 1. SUBJECT DEMOGRAPHICS AND RELATION TO LATEX ALLERGY

	<i>Antilatex IgE positive</i> (N = 12)	<i>Antilatex IgE negative</i> (N = 38)
Male	10 (83.3%) ^a	19 (50.0%)
Mean age (yr)	6.5	10.3
Mean length of stay at Terence Cardinal Cooke Health Care Center (yr)	4.4	5.3

^a $p < .05$ by chi-square analysis.

The association of latex allergy symptoms and possible risk factors for latex hypersensitivity are shown in Table 2. Of the antilatex IgE antibody positive children, 6 (50%) had a history of urticaria and all 12 had a history of wheezing. In chi-square analysis, both symptoms were significantly associated with the presence of latex-specific IgE antibodies. No child had a history of anaphylaxis or unexplained hypotensive episodes. Of the nine medical history characteristics examined in bivariate analysis, only the presence of a ventriculoperitoneal (VP) shunt was significantly associated with latex-specific antibodies (Table 2). A VP shunt was present in 6 (50%) of the children who tested positive for antilatex IgE antibody. Further analysis indicated that the presence of a VP shunt was not significantly associated with any of the other risk factors examined. In a multivariate logistic regression, the presence of a VP shunt had a significant impact on the odds of a child testing positive for latex-specific antibodies. Adjusted for selected covariates, the presence of a VP shunt increased the odds of a positive test result by 3.8 (95% confidence interval: 1.4 to 10.1).

DISCUSSION

This study shows that the prevalence of latex hypersensitivity in a population of chronically ill institutionalized children is higher than that in the general population. The data reveal that latex hypersensitivity is increased among males and patients with VP shunts. In addition, a statistically significant asso-

TABLE 2. SYMPTOMS, RISK FACTORS, AND LATEX ALLERGY

	<i>Antilatex IgE positive</i> N = 12 <i>Number (%) with characteristic</i>	<i>Antilatex IgE negative</i> N = 38 <i>Number (%) with characteristic</i>
Symptoms		
Urticaria ^a	6 (50.0)	2 (5.3)
Wheezing ^b	12 (100.0)	27 (71.1)
Medical History		
Genitourinary disease	0 (0.0)	4 (10.5)
Spina bifida	1 (8.3)	0 (0.0)
Born prematurely	5 (41.7)	7 (18.4)
One or more previous surgeries	11 (91.7)	32 (84.2)
Previous institutionalization	5 (41.7)	23 (60.5)
Dietary intake by gastric tube	12 (100.0)	36 (94.7)
Suctioning of the oropharynx	12 (100.0)	35 (92.1)
Tracheostomy	9 (75.0)	20 (52.6)
Ventriculoperitoneal shunt ^a	6 (50.0)	2 (5.3)

^a $p < .001$ by chi-square analysis.

^b $p < .05$ by chi-square analysis.

ciation is seen between the symptoms of wheezing and urticaria, and the presence of latex-specific IgE antibodies.

Individuals with spina bifida have been regarded as a high risk group for the acquisition of latex allergy, with incidence rates ranging from 20% to 60%.^(4,5) More recently, patients with other medical conditions have been identified. Investigators have determined that sensitivity to latex is greater in atopic individuals.⁽⁸⁻¹⁰⁾ Using RAST, Liebke et al.⁽⁸⁾ evaluated 303 atopic children and found that 20.8% were latex allergic compared with 0.3% in a nonatopic control group. However, only 17% of the RAST-positive children had a medical history suggestive of a reaction to latex and laboratory provocation was not always positive. Similar to our findings, they noted that boys were significantly latex RAST-positive. The risk factors for a clinical manifestation of latex allergy were a positive history on contact to latex and frequent operations. Comparable with our findings, the tendency to more frequent operations in the RAST-positive group was not statistically significant.

The work of Kwittken et al.⁽¹¹⁾ suggests that latex-specific IgE is present in groups not usually viewed as high risk. Their subjects presented for evaluation after a presumptive reaction to latex. Of interest, only half of the children had a pre-existing history suggestive of sensitivity before the reaction that brought them to medical attention. Although many had spina bifida, children with VP shunts alone, tracheoesophageal fistula, cerebral palsy, gastroesophageal reflux, and urogenital anomalies were found to be RAST positive to latex. Although not statistically significant, most of the children had had numerous medical admissions and multiple surgical procedures, reflecting an increased exposure to latex. Most of the surgeries occurred before age 1 year and some of the children were premature. Our study included 12 premature infants, but no significant relationship was found between prematurity and a positive RAST to latex. The data of Kwittken et al. suggest that conditions requiring chronic or recurrent exposure to latex could result in latex hypersensitivity, particularly if exposure occurs at a young age.

The present work supports the findings of previous investigators regarding significant association with the presence of latex-specific IgE antibodies, male gender, and the presence of a VP shunt.⁽¹¹⁾ Numerous surgical interventions and a positive RAST did not reach statistical significance. The absence of a positive result in our one patient with spina bifida was probably due to the small sample size for this disease. This study also attempted to demonstrate an association between a positive RAST and clinical symptoms such as wheezing and urticaria. The patients in our study were extremely technology dependent. Many aspects of care required the use of latex manufactured products or the repetitive use of latex gloves to render care. However, difficulty is seen in correlating a symptom such as wheezing with the RAST result in our subjects. Almost all of the subjects have conditions that predispose them to chronic aspiration, poor pulmonary toilet and mucus impaction, chronic lung disease, and reactive airways disease. Thus, wheezing in these children could have many causes. Consequently, latex exposure as a precipitant of wheezing might be overlooked as the causative agent. The finding of an association between urticaria and a positive RAST result is consistent with latex hypersensitivity because most patients who have latex allergy have skin manifestations.⁽¹⁾ In addition all the antilatelatex IgE antibody-positive patients were exclusively fed a milk-based formula through a gastrostomy. They never received any fruit or vegetable that could cross-react with latex. However, the patients would need to be subjected to latex provocation in order to demonstrate absolutely a clinically relevant association between a positive RAST to latex and the ensuing symptoms diagnostic of allergy.

This study did not address the effect that atopy may have contributed to the results. Patients did not have a total IgE antibody level drawn, and a clear history of atopy could not be obtained from the medical charts. The study also lacked documentation of a pre-existing history of clinical reactions to latex before the children were placed at TCCHCC. However, it is possible that the presence of measurable latex-specific IgE antibodies may precede the development of clinical symptoms by months or years.⁽¹⁾

Several methodologic limitations of our study exist that merit attention. The small sample size may have impaired the detection of statistical significance between the RAST positive and negative children in the other characteristics examined in Table 2. The study lacked a noninstitutionalized comparison group. Instead, recent literature on the prevalence of latex allergy in the general population was used.^(1,2) In addition, a prospective design, rather than a cross-sectional one, would have permitted us to determine if con-

LATEX HYPERSENSITIVITY IN CHILDREN

version to RAST-positive occurred at TCCHCC. Future studies might collect prospective data from chronically ill children in diverse settings. Pinpointing the time of conversion could help direct policies on latex exposure within chronic care facilities or other domiciles. Finally, the RAST and other methods of detecting latex hypersensitivity have limitations.⁽¹³⁾ Currently, RAST is the main method of documenting latex hypersensitivity in the United States.^(1,4) Skin testing has not been standardized in the United States.⁽¹⁾ Slater has commented that the predictive value of RAST is dependent on the population studied; for example, the sensitivity in spina bifida may be greater than that in the general population. In addition, the different latex RAST discs available have various degrees of sensitivity and specificity.⁽¹⁾ This study utilized the Hy-cor latex allergen disc, which has been shown to have a sensitivity and specificity of 93.5% and 84%, respectively.⁽¹²⁾ Despite the drawbacks, many studies use RAST alone, or in combination with skin testing, to demonstrate latex hypersensitivity. The predictive value of either of these tests, without a clear history of symptoms or a provocative challenge, is unknown.

CONCLUSIONS

Based on our findings and the observations of others, it appears that the population of individuals with latex-specific antibodies is expanding. The literature suggests that children with chronic exposure to latex could be at risk for latex allergy. Although it might appear that many children with multiple complex medical needs would be at risk, we need to identify these groups more clearly. We recommend prospective, long-term studies of these children (who are exposed to latex on a daily basis) cared for at home, in hospitals, and in chronic care facilities. Annual latex testing, with a careful medical history pointed to associated symptoms, could determine if hypersensitivity is secondary to specific surgical procedures or environmental exposure such as repetitive contact or inhalation. Once hypersensitivity is documented, a provocative challenge under controlled circumstances could be attempted. Only then can clinical relevancy be determined and future recommendations for care policies be instituted.

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GRANADY ET AL.

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Address reprint requests to:
Lynelle Granady, M.D.
The New York Presbyterian Hospital
525 East 68th Street, Suite J114
New York, New York 10021

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