

## PREVALENCE OF AND RISK FACTORS FOR LATEX SENSITIZATION IN PATIENTS WITH SPINA BIFIDA

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### ABSTRACT

**Purpose:** We determined the prevalence of and risk factors for latex sensitization in patients with spina bifida.

**Materials and Methods:** A total of 59 consecutive subjects 2 to 40 years old with spina bifida answered a questionnaire, and underwent a latex skin prick test and determination of serum IgE specific for latex by RAST CAP radioimmunoassay.\* We also noted the relationships of total serum IgE skin prick tests to common air and food allergens. In addition, skin prick plus prick tests were also done with fresh foods, including kiwi, pear, orange, almond, pineapple, apple, tomato and banana.

**Results:** Latex sensitization was present in 15 patients (25%) according to the presence of IgE specific to latex, as detected by a skin prick test in 9 and/or RAST CAP in 13. Five latex sensitized patients (33.3%) had clinical manifestations, such as urticaria, conjunctivitis, angioedema, rhinitis and bronchial asthma, while using a latex glove and inflating a latex balloon. Atopy was present in 21 patients (35.6%). In 14 patients (23%) 1 or more skin tests were positive for fresh foods using a prick plus prick technique. Tomato, kiwi, and pear were the most common skin test positive foods. Univariate analysis revealed that a history of 5 or more operations, atopy and positive prick plus prick tests results for pear and kiwi were significantly associated with latex sensitization. Multivariate analysis demonstrated that only atopy and a history of 5 or more operations were significantly and independently associated with latex sensitization.

**Conclusions:** A fourth of the patients with spina bifida were sensitized to latex. Atopy and an elevated number of operations were significant and independent predictors of latex sensitization in these cases.

**KEY WORDS:** latex, spina dysraphism, abnormalities

Many products derived from the latex of *Hevea brasiliensis* (rubber tree) contain allergenic latex proteins.<sup>1</sup> Direct contact with latex products as well as the inhalation of airborne latex particles may lead to latex sensitization.<sup>2</sup> Health care<sup>3</sup> and rubber industry workers,<sup>4</sup> and patients with spina bifida<sup>5</sup> are commonly considered at high risk for latex sensitization.<sup>6</sup> However, epidemiological studies do not agree on the prevalence of latex sensitization in patients with spina bifida. IgE specific to and clinical manifestations due to latex have been reported in European and North American studies in 30% to 49%<sup>8</sup> and up to 72%<sup>9</sup> of patients with spina bifida, respectively. A low prevalence of latex sensitization (2.9% to 4.3%) and symptoms due to latex (0.9% to 3.2%) has been reported in South American studies.<sup>10,11</sup> Different socioeconomic strata, disparate levels of latex exposure and diverse predispositions are likely responsible for this discrepancy.

An association between sensitization to latex proteins and sensitization to various foods (apricot, avocado, banana, buckwheat, celery, chestnuts, fig, grape, kiwi, melon, orange, papaya, passion fruit, peach, peanuts, pineapple, potato and tomato) has been reported.<sup>12-17</sup> Therefore, a specific food sensitization may also be associated with latex sensitization in patients with spina bifida. We evaluate the prevalence of latex sensitization in patients with spina bifida in our area and assess the risk factors associated with latex sensitization

in these patients, including the presence of IgE specific to food as a possible predictor of latex sensitization.

### MATERIALS AND METHODS

We evaluated 59 consecutive patients, including 42 female subjects (71.2%) with spina bifida 2 to 40 years old (mean age plus or minus standard deviation 14.3 ± 9.3). All patients with spina bifida or their parents gave informed consent to study participation. Study duration was 10 months, and patients were seen by allergists in the Allergic and Immunology Unit, Department of Pediatrics, Florence, University of Florence, Italy. Subjects and/or parents answered a questionnaire supervised by an allergist that revealed any current or previous presence of IgE mediated disease, such as asthma, rhinitis, conjunctivitis, atopic dermatitis, urticaria, drug reactions, food and fruit allergy, and rubber clinical manifestations, including urticaria, angioedema, rhinitis, conjunctivitis, asthma, anaphylactic shock or other latex symptoms. The number and dates of previous operations and the duration of intermittent catheterization were also noted.

The latex skin prick test was performed using a commercial extract, as previously reported.<sup>18,19</sup> Skin prick tests for other allergens were also done using 20 commercial glycerinated extracts of air and food allergens at 1:20 weight per volume, including *Dermatophagoides pteronyssinus*, *D. farinae*, horse, cat and dog dander, *Alternaria tenuis*, *Cladosporium herbatum*, grass pollen, *Parietaria officinalis*, *Artemisia vulgaris*, olive pollen, cypress pollen, plane tree pollen,

milk, egg white, tomato, peanut, codfish, wheat and soy bean. Skin tests with fresh food were done by the prick plus prick technique according to Dreborg and Foucard<sup>20</sup> with kiwi, pear, orange, almond, pineapple, apple, tomato and banana. Commercial extract and fresh food skin prick tests were performed on the volar side of the forearm using a lancet with a 1 mm. tip. Skin test results were considered positive when the wheal was 3 mm. or greater without any reaction to a negative control solution.<sup>21</sup> The PRIST test for total serum IgE\* and RAST CAP† specific IgE test against latex were done according to manufacturer instructions. Results greater than 0.35 kilounits per l. for RAST CAP and greater than 2 standard deviations per patient age in IU/ml. for PRIST were considered positive.

Latex sensitization was defined as the presence of latex specific IgE, as evidenced by a positive latex skin prick test or RAST CAP. A diagnosis of latex allergy was made when a history of a clinical reaction to latex products was confirmed by the attending physicians plus latex sensitization. Atopy was defined as PRIST greater than 2 standard deviations for age, and/or 1 or more positive skin prick tests to common air and/or food allergens.

The chi-square, Fisher exact and Student t tests were used for statistical analysis with  $p < 0.05$  considered significant. Multivariate analysis was performed using logistic regression. Variables were included in the multivariate models when they were significant in univariate analysis. All data were elaborated using a commercially available statistical computer software package.

#### RESULTS

Of our patients 15 (25.4%), 13 (22.0%) and 9 (15.3%) had IgE specific to latex, elevated serum levels of latex specific IgE (mean  $29.6 \pm 52.1$  kilounits per l., range 0.4 to 185) and a skin prick test positive for latex, respectively. Table 1 shows the relationships of the skin prick test with RAST CAP. RAST CAP was negative but the latex skin prick test was positive in 2 cases, while the skin prick test was negative but there was serum latex specific IgE in 6. No side effects of the latex skin prick test were noted.

Clinical manifestations of latex sensitization were reported by 5 of the 59 subjects (8.5%) with spina bifida, including urticaria in 4, conjunctivitis in 4, angioedema in 2, rhinitis in 2 and bronchial asthma in 2. No anaphylactic reactions to latex were reported. All patients had clinical manifestations while using a latex glove or inflating a latex balloon but only 1 had clinical manifestations after contact with a latex elastic band. Patients with a latex allergy were RAST CAP and skin prick test positive for latex. Mean serum latex specific IgE was  $69.3 \pm 68.9$  kilounits per l. (range 12 to 185). Table 2 shows the gender and age of latex sensitized and nonsensitized patients. No significant difference was found between the 2 groups in regard to gender and mean age.

Of the 59 patients 21 (35.6%) had atopy, while 16 (27.1%) had elevated serum IgE levels and 18 (30.5%) had 1 or more positive skin prick tests with commercial extracts of air and/or food allergens. Nine patients (15%) had clinical aller-

gic manifestations, such as rhinitis, conjunctivitis and bronchial asthma, for air allergens, while 1 had atopic dermatitis after eating soybean. Atopic patients were more likely to be latex sensitized than nonatopic patients (table 2). Elevated total serum IgE as well as 1 or more skin prick tests positive for air allergens were significantly more common with than without latex sensitization ( $p = 0.001$  versus 0.04, table 2). One or more skin prick tests positive for food allergens (commercial extracts) were not statistically associated with latex sensitization (table 2).

The number of operations in the 59 patients with spina bifida ranged from 1 to 14 (mean 5). All patients underwent surgery on day 1 of life, and 48 (81%) performed intermittent catheterization for 12 to 276 months (mean 91.4). Patients with latex sensitization had undergone more operations than those without any sensitization to latex ( $p = 0.005$ , table 2). Those who had undergone 5 or more operations were more likely to be latex sensitized than those who had undergone fewer than 5 (odds ratio 7.7, 95% confidence interval [CI] 2.0 to 29.4,  $p = 0.002$ ). No significant association was noted between latex sensitization and the duration of intermittent catheterization (table 2). One or more prick plus prick tests were positive for fresh food in 14 patients (24%) but only 1 had a clinical manifestation (the oral allergy syndrome) after eating kiwi and tomato. Only prick plus prick tests positive for kiwi and pear were significantly associated with latex sensitization ( $p = 0.01$ , table 3).

A multivariate logistic model was constructed using only variables found to be significant on univariate analysis. After including in the multivariate model atopy 5 or more operations and a prick plus prick test positive for pear and kiwi, only atopy and a history of 5 or more operations were significant and independent predictors of latex sensitization (table 4). No interaction was observed between 5 or more operations and atopy for predicting latex sensitization.

#### DISCUSSION

The prevalence of latex sensitization in patients with spina bifida was 25%. According to the presence of IgE specific to latex in serum and a skin prick test positive for latex the rates were 22 and 15%, respectively. In the literature in patients with spina bifida positive latex RAST CAP prevalence rates range from 34<sup>22</sup> to 64.5%,<sup>23</sup> while latex skin prick test prevalence rates range from 2.97<sup>10</sup> to 32%.<sup>5</sup> These differences between the skin prick test and RAST CAP are probably due to differences in the latex source and possibly different allergenic proteins in the in vivo and in vitro tests. However, in other groups the latex skin prick test was more sensitive than RAST CAP.<sup>5,24</sup>

The discrepancy between patients with spina bifida and the remainder of the population may be explained by more frequent sensitization to certain latex proteins (molecular weight 14.6, 20, 24 and 27 kD.) in patients with spina bifida than in others.<sup>25,26</sup> These proteins are more easily detectable with in vitro (RAST CAP) than in vivo (skin prick test) assessments. Although the rate of a positive RAST CAP for latex was higher than a positive latex skin prick test in our study, 2 patients were latex skin prick test positive and RAST CAP negative. Thus, we decided to define latex sensitization as a positive latex RAST CAP or skin prick test.

Five of the 59 patients (8%) had an IgE mediated allergy to latex. The most common clinical manifestations were urticaria and conjunctivitis, and symptoms were always reported while patients were using a latex glove or inflating a latex balloon. In the literature in patients with spina bifida the prevalence rates of symptoms to latex glove range from 0.99<sup>10</sup> to 72%.<sup>9</sup> Greater exposure to latex products with a higher content of allergenic proteins and a different socioeconomic status as well as a different personal predisposition may explain such different prevalences.

\* Sanofi Diagnostic Pasteur, Inc., Chaska, Minnesota.

† CAPSystem, Pharmacia, Uppsala, Sweden.

TABLE 1. Concordance of RAST CAP and skin prick test for latex in 59 patients with spina bifida

| Skin Prick Test | No. Pts. With RAST CAP (%) |         | Total No. Pts. |
|-----------------|----------------------------|---------|----------------|
|                 | Pos.                       | Neg.    |                |
| Pos.            | 7 (78)                     | 2 (22)  | 9              |
| Neg.            | 6 (12)                     | 44 (88) | 50             |
| Totals          | 13                         | 46      | 59             |

TABLE 2. *Characteristics of the 2 groups of patients with spina bifida*

|                                                                     | Nonsensitized to Latex | Sensitized to Latex | Odds Ratio (95% CI) | p Value (test)                                         |
|---------------------------------------------------------------------|------------------------|---------------------|---------------------|--------------------------------------------------------|
| No. female pts.                                                     | 31                     | 11                  | 1.15 (0.27-5.28)    | Not significant (Fisher's 2-tailed exact)              |
| No. male pts.                                                       | 13                     | 4                   | 0.87 (0.19-3.77)    | Not significant (Fisher's 2-tailed exact)              |
| Mean age $\pm$ SD (yrs.)                                            | 14.86 $\pm$ 9.79       | 12.93 $\pm$ 7.82    |                     | Not significant (Fisher's 2-tailed exact, Student's t) |
| Mean intermittent bladder catheterizations $\pm$ SD                 | 66.15 $\pm$ 49.14      | 98.40 $\pm$ 89.10   |                     | Not significant (Student's t)                          |
| Mean operations $\pm$ SD                                            | 4.09 $\pm$ 2.05        | 6.4 $\pm$ 2.92      |                     | 0.005 (Student's t)                                    |
| No. pts. with atopy                                                 | 11                     | 10                  | 6.0 (1.73-20.66)    | 0.004 (Fisher's 2-tailed exact)                        |
| No. pts. with total serum IgE greater than 2 SD for age             | 7                      | 9                   | 7.93 (1.81-37.04)   | 0.001 (Fisher's 2-tailed exact)                        |
| No. pts. with 1 or more pos. skin prick tests (commercial extract): |                        |                     |                     |                                                        |
| Air allergens                                                       | 10                     | 8                   | 3.89 (0.97-16.13)   | 0.04 (Fisher's 2-tailed exact)                         |
| Food allergens                                                      | 1                      | 2                   | 6.62 (0.42-201.90)  | Not significant (Fisher's 2-tailed exact)              |

TABLE 3. *Comparison of prick plus prick test reactions to fresh food in the 2 groups of patients with spina bifida*

| Food      | No. Nonsensitized | No. Sensitized | p Value (Fisher's 2-tailed exact test) |
|-----------|-------------------|----------------|----------------------------------------|
| Apple     | 0                 | 0              | Not significant                        |
| Tomato    | 5                 | 2              | Not significant                        |
| Kiwi      | 1                 | 4              | 0.0126                                 |
| Pear      | 1                 | 4              | 0.0126                                 |
| Banana    | 2                 | 1              | Not significant                        |
| Orange    | 0                 | 2              | Not significant                        |
| Pineapple | 2                 | 0              | Not significant                        |
| Almond    | 0                 | 1              | Not significant                        |

TABLE 4. *Multivariate analysis of risk factors significantly associated with latex sensitization in patients with spina bifida*

|                                  | Odds Ratio (95% CI) | p Value |
|----------------------------------|---------------------|---------|
| Atopy                            | 5.6 (1.2-26.7)      | 0.0295  |
| 5 or More operations             | 6.6 (1.4-32.3)      | 0.0194  |
| Pos. prick + prick test for pear | 12.3 (0.6-252.1)    | 0.1032  |
| Pos. prick + prick test for kiwi | 6.8 (0.2-206.3)     | 0.2686  |

Atopy was a significant and independent predictor of latex sensitization in patients with spina bifida. An association between atopic status and latex sensitization risk has been reported by others in those with<sup>7,8,27</sup> and without spina bifida.<sup>5,19</sup> A high number of previous operations have also been recognized as a risk factor for latex sensitization. Kelly et al found that 9 or more previous surgical procedures as well as a medical history of immediate rubber contact allergy and food allergy identified patients with spina bifida as being at higher risk for anaphylactic reactions during operations using general anesthesia.<sup>28</sup> In patients with spina bifida Nieto et al demonstrated a statistically significant association between latex sensitization and the number of operations (mean 8.34).<sup>27</sup> On the other hand, Tosi et al reported no significant difference between the number of previous operations in latex RAST CAP positive and negative cases.<sup>29</sup> However, we believe that latex-free products should be used in medical and surgical procedures in all patients with spina bifida because an increased number of operations and a massive exposure to latex products may be contributing factors in latex sensitization and severe rubber clinical manifestations. Our study shows that 5 or more operations are a significant risk factor for latex sensitization. The type of surgical procedure (abdominal versus orthopedic) may be a further risk factor for latex sensitization. Unfortunately we did not obtain data on the different types of operations performed in our patients.

In our study intermittent catheterization did not identify patients as having a significant risk for latex sensitization. It is likely that during this procedure catheters with a small amount of latex or latex-free catheters were used, decreasing or eliminating latex exposure. However, Nieto et al noted a significant association between latex sensitization and previous intermittent catheterization.<sup>27</sup>

Latex sensitized patients often present with clinical symptoms after eating fruit.<sup>14</sup> Indeed, latex has some proteins in common with foods such as banana, avocado, pear, papaya, Ficus species, mango, melon, passionfruit, chestnut, kiwi, pineapple, peach and tomato.<sup>15-17</sup> In our study there was a high prevalence of IgE specific to fresh food (24%) but only 1 patient had symptoms after eating those foods. Tomato and kiwi caused the oral allergic syndrome in a patient with latex sensitization. A positive prick plus prick test for pear and/or kiwi was significantly associated with latex sensitization but only on univariate analysis.

We found that the major risk factors for latex sensitization in patients with spina bifida were atopy and a high number of operations. Questions that remain unanswered include whether patients with spina bifida who are currently latex negative will eventually become sensitized to latex and whether they will require repeat testing in the future to detect that change. The cross-sectional design of our study does not allow us to draw any conclusions about this issue. Further prospective studies are needed for allergological long-term followup of patients with spina bifida.

## CONCLUSIONS

Latex sensitization was present in 25% of our patients with spina bifida. Only atopy and a history of 5 or more operations were significantly and independently associated with latex sensitization. The significant association between latex sensitization and atopy suggests that in patients with spina bifida atopic status plus early and increased latex exposure (elevated number of operations) is responsible for latex sensitization.

## REFERENCES

- Levy, D. A., Charpin, D., Pecquet, C., Leynadier, F. and Vervloet, D.: Allergy to latex. *Allergy*, **47**: 579, 1992.
- Turjanmaa, K., Alenius, H., Mäkinen-Kiljunen, S., Reunala, T. and Palosuo, T.: Natural rubber latex allergy. *Allergy*, **51**: 593, 1996.
- Yassin, M. S., Lierl, M. B., Fisher, T. J., O'Brien, K., Cross, J. and Steinmetz, C.: Latex allergy in hospital employees. *Ann. Allergy*, **72**: 245, 1994.
- Tarlo, S. M., Wong, L., Roos, N. and Booth, N.: Occupational asthma caused by latex in a surgical glove manufacturing plant. *J. Allergy Clin. Immunol.*, **85**: 626, 1990.
- Moneret-Vautrin, D. A., Beaudouin, E., Widmer, S., Mouton, C., Kanny, G., Prestat, F., Kohler, C. and Feldmann, L.: Prospective study of risk factors in natural rubber latex hypersensitivity. *J. Allergy Clin. Immunol.*, **92**: 668, 1993.
- Anonymous: Task Force on Allergic Reactions to Latex. American Academy of Allergy and Immunology. Committee Report. *J. Allergy Clin. Immunol.*, **92**: 16, 1993.
- De Swert, L. F. A., Van Laer, K. M. I. A., Verpoorten, C. M. A., Van Hoeyveld, E. M., Cadot, P. and Stevens, E. A. M.: Determination of independent risk factors and comparative analysis of diagnostic methods for immediate type latex allergy in spina bifida patients. *Clin. Exp. Allergy*, **27**: 1067, 1997.
- Michael, T., Niggemann, B., Moers, A., Seidel, U., Wahn, U. and

- Scheffner, D.: Risk factors for latex allergy in patients with spina bifida. *Clin. Exp. Allergy*, **26**: 934, 1996.
9. Konz, K. R., Chia, J. K., Kurup, V. P., Resnick, A., Kelly, K. J. and Fink, J. N.: Comparison of latex hypersensitivity among patients with neurologic defects. *J. Allergy Clin. Immunol.*, part 1, **95**: 950, 1995.
  10. Benhabib, G. O., Maspero, J. F., Kohan, M. J., Garde, A. and Paulin, P.: Latex allergy is not common in meningocele children in Argentina. *J. Allergy Clin. Immunol.*, **95**: 152, 1995.
  11. Capriles-Huleit, A., Sánchez-Borges, M., Von-Scazon, C. and Medina, J. R.: Very low frequency of latex and fruit allergy in patients with spina bifida from Venezuela: influence of socioeconomic factors. *Ann. Allergy Asthma Immunol.*, **75**: 62, 1995.
  12. Ceuppens, J. L., Van Durme, P. and Dooms-Goossenes, A.: Latex allergy in patients with allergy to fruit. Letter to the Editor. *Lancet*, **339**: 493, 1992.
  13. Frankland, A. W.: Food reactions in pollen and latex allergic patients (editorial). *Clin. Exp. Allergy*, **25**: 580, 1995.
  14. Blanco, C., Carrillo, T., Castillo, R., Quiralte, J. and Cuecas, M.: Latex allergy: clinical features and cross-reactivity with fruits. *Ann. Allergy*, **73**: 309, 1994.
  15. Lavaud, F., Prevost, A., Cossart, C., Guerin, L., Bernard, J. and Kochman, S.: Allergy to latex, avocado pear, and banana: evidence for a 30 kd antigen in immunoblotting. *J. Allergy Clin. Immunol.*, **95**: 557, 1995.
  16. Brehler, R., Theissen, U., Mohr, C. and Luger, T.: "Latex-fruit syndrome": frequency of cross-reacting IgE antibodies. *Allergy*, **52**: 404, 1997.
  17. Beezhold, D. H., Sussman, G. L., Liss, G. M. and Chang, N. S.: Latex allergy can induce clinical reactions to specific foods. *Clin. Exp. Allergy*, **26**: 416, 1996.
  18. Novembre, E., Bernardini, R., Brizzi, I., Bertini, G., Mugnaini, L., Azzari, C. and Vierucci, A.: The prevalence of latex allergy in children seen in a university hospital allergy clinic. *Allergy*, **52**: 101, 1997.
  19. Bernardini, R., Novembre, E., Ingargiola, A., Veltroni, M., Mugnaini, L., Cianferoni, A., Lombardi, E. and Vierucci, A.: Prevalence and risk factors of latex sensitization in an unselected pediatric population. *J. Allergy Clin. Immunol.*, **101**: 621, 1998.
  20. Dreborg, S. and Foucard, T.: Allergy to apple, carrot and potato in children with birch pollen allergy. *Allergy*, **38**: 167, 1983.
  21. Dreborg, S., Backman, A., Basomba, A., Bousquet, J., Digies, P. and Malling, H. I.: Skin tests used in type I allergy testing. Position paper prepared by the Subcommittee on Skin Tests of the EAACI. *Allergy*, **44**: 1, 1989.
  22. Slater, J. E., Mostello, L. A. and Shaer, C.: Rubber-specific IgE in children with spina bifida. *J. Urol.*, **146**: 578, 1991.
  23. Yassin, M. S., Sanyurah, S., Lierl, M. B., Fisher, T. J., Oppenheimer, S., Cross, J., O'Brien, K., Steinmetz, C. and Khoury, J.: Evaluation of latex allergy in patients with meningocele. *Ann. Allergy*, **69**: 207, 1992.
  24. Hamann, C. P.: Latex hypersensitivity: an update. *Allergy Proc.*, **15**: 17, 1994.
  25. Alenius, H., Palosuo, T., Kelly, K., Kurup, V., Reunala, T., Mäkinen-Kiljunen, S., Turjanmaa, K. and Fink, J.: IgE reactivity to 14-kD and 27-kD natural rubber proteins in latex-allergic children with spina bifida and other congenital anomalies. *Int. Arch. Allergy Immunol.*, **102**: 61, 1993.
  26. Yeang, H. Y., Cheong, K. F., Sunderasan, E., Hamzah, S., Chew, N. P., Hamid, S., Hamilton, R. G. and Cardosa, M. J.: The 14.6 kd rubber elongation factor (Hevb 1) and 24 kd (Hevb 3) rubber particle proteins are recognized by IgE from patients with spina bifida and latex allergy. *J. Allergy Clin. Immunol.*, **98**: 628, 1996.
  27. Nieto, A., Estornell, F., Mazón, A., Reig, C., Nieto, A. and García Ibarra, F.: Allergy to latex in spina bifida: a multivariate study of associated factors in 100 consecutive patients. *J. Allergy Clin. Immunol.*, **98**: 501, 1996.
  28. Kelly, K. J., Pearson, M. L., Kurup, V. P., Havens, P. L., Byrd, R. S., Setlock, M. A., Butler, J. C., Slater, J. E., Grammer, L. C., Resnick, A., Roberts, M., Jarvis, W. R., Davis, J. P. and Fink, J. N.: A cluster of anaphylactic reactions in children with spina bifida during general anesthesia: epidemiologic features, risk factors, and latex hypersensitivity. *J. Allergy Clin. Immunol.*, **94**: 53, 1994.
  29. Tosi, L. L., Slater, J. E., Shaer, C. and Mostello, L. A.: Latex allergy in spina bifida patients: prevalence and surgical implications. *J. Ped. Orthoped.*, **13**: 709, 1993.

## EDITORIAL COMMENT

This article addresses the issue of latex allergy in the spina bifida population. The authors noted a 25% incidence of latex allergy in their patients with spina bifida, which is similar to that previously reported and much lower than the 60% incidence that we previously noted.<sup>1</sup> They identified no correlation between latex allergy and patient gender or age, or duration of clean intermittent catheterization, which is consistent with previous studies. In this review as in others, including ours, a correlation was noted between latex allergy and the number of surgical procedures. However, in this study the authors were unable to evaluate whether there was a risk difference based on the type of surgical procedure. In our experience there appeared to be increased risk with intra-abdominal procedures, although it was not statistically significant. Atopy is reported to be a significant risk factor in this study, and the authors evaluated several fruits and common allergens, identifying kiwi and pear as significant. They did not postulate why this is so. As others have noted, including us, there is discordance between the RAST CAP and the skin prick test. Since the development of latex allergy is postulated to be the result of repetitive exposure to latex, one may conclude that latex allergy develops with time. This finding is extremely important in this patient population in whom multiple surgical procedures are common. Thus, all patients should be treated as potentially latex allergic and exposure to latex should be prevented.

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1. Ellsworth, P. I., Merguerian, P. A., Klein, R. B. and Rozycki, A. A.: Evaluation and risk factors of latex allergy in spina bifida patients: is it preventable? *J. Urol.*, part 2, **691**, 1993.

## REPLY BY AUTHORS

It should be noted that the prevalence of latex sensitization (presence of latex specific IgE) was 25% while the prevalence of latex allergy (latex sensitization plus clinical reactions to latex products) was 8%, and the risk factors were evaluated for latex sensitization only.