

# Comparison of three immunoassays for diagnosing sensitization to latex in children with spina bifida

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As natural rubber latex (latex) has become more widespread in our environment, physicians have become increasingly aware of the problem of possible allergic reactions. Many fatal and near-fatal incidents have been reported (mainly during surgery) (1–3) and data has been published on groups frequently exposed to latex, such as patients with spina bifida (4–9), healthcare professionals (10–12) and occupationally exposed persons (13). The incidence of latex allergy in children seems to be increasing (14). Tests are therefore needed which can reliably detect sensitization to latex. Our aim was to compare the diagnostic accuracy of three commercial immunoassays for measuring specific IgE in serum to latex.

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## Material and methods

We investigated 146 patients with spina bifida (75 female, 71 male) whose ages ranged from 9 months to 52 years (mean age 9.4 years). Fourteen patients (mean age 9.3 years) had recently shown typical immediate-type allergic reactions (e.g. urticaria or Quincke-edema at the site of contact to latex) and/or systemic clinical reactions (e.g. severe bronchospasm, arterial hypotension) within 30 min of contact to products containing latex. The other group of patients ( $n = 132$ , mean age 9.5 years) had not reported symptoms on contact with latex.

Specific IgE against latex was determined by: 1) a solid-phase immunoassay (FEIA), the Pharmacia CAP-system (PCS) (Kabi-Pharmacia, Uppsala, Sweden) (15), 2) an enzyme-allergo-sorbent-test (EAST) (Allergopharma, Reinbek, Germany), and 3) the chemiluminescent-immunoassay "Magic lite" (ML) (ALK, Copenhagen, Denmark) (16). Latex allergosorbents used for the three assays were: non-ammoniated natural rubber latex for PCS, ammoniated natural rubber latex for EAST, and low-ammoniated natural rubber latex for ML.

The assays were chosen due to their general acceptance and availability; PCS was preferred to the radioimmunoassay (RAST) method, because of its superior sensitivity and specificity for most aller-

gens (17). When comparing the mean classes in Table 1 it is important to remember that the assays use 6, 5, and 4 classes respectively. Results were considered as positive for each assay, if class was  $\geq 1$ .

Sensitivity was defined as the fraction of true positives among symptomatic individuals, specificity as the fraction of true negatives among non-symptomatic individuals, positive predictive value as the fraction of symptomatic individuals among test positives, negative predictive value as the fraction of non-symptomatic individuals among test negatives and efficiency as the fraction of tested individuals correctly classified by the test. For statistical analysis, Mann-Whitney-U-test and Fisher's-Z-test with correlation analysis were used.

## Results and discussion

Specific IgE to latex in serum

Of the 146 patients with spina bifida investigated, 79 patients (54%) were sensitized in terms of specific IgE to latex in serum (any of the three assays positive) of which 66 (84%), were positive for all three assays. Sixty-seven patients (46%) had no specific IgE in any test system. The correlation of the three assay systems was good: CAP/EAST ( $r = 0.886$ ,  $p < 0.0001$ ), CAP/ML ( $r = 0.892$ ,  $p < 0.0001$ ) and EAST/ML ( $r = 0.873$ ,  $p < 0.0001$ ).

Table 1. Clinical and laboratory data of 14 patients with local and/or systemic clinically relevant symptoms to latex

| Initials | Sex (5f/9m) | Age (years) | Symptoms      | PCS (of 6 classes) | ML (of 5 classes) | EAST (of 4 classes) |
|----------|-------------|-------------|---------------|--------------------|-------------------|---------------------|
| P.J.     | m           | 12.6        | local         | 2                  | 1                 | 1                   |
| K.K.     | f           | 4.5         | local         | 2                  | 2                 | 2                   |
| H.S.     | m           | 8.3         | local + syst. | 3                  | 2                 | 2                   |
| B.M.     | f           | 12.3        | local         | 3                  | 3                 | 2                   |
| M.T.     | m           | 5.8         | local + syst. | 3                  | 3                 | 3                   |
| S.R.     | m           | 6.8         | local + syst. | 3                  | 3                 | 3                   |
| B.M.     | m           | 14.2        | local         | 4                  | 4                 | 3                   |
| B.S.     | f           | 7.7         | local + syst. | 4                  | 4                 | 3                   |
| D.L.     | m           | 5.5         | local         | 5                  | 4                 | 3                   |
| S.S.     | f           | 7.1         | local         | 5                  | 5                 | 3                   |
| K.M.     | m           | 13.3        | systemic      | 5                  | 5                 | 3                   |
| S.T.     | f           | 17.6        | local         | 6                  | 5                 | 3                   |
| G.S.     | m           | 6.2         | local         | 6                  | 5                 | 3                   |
| R.T.     | m           | 7.7         | local         | 6                  | 5                 | 3                   |
| mean     |             | 9.3         |               | 4.1                | 3.6               | 2.6                 |

The results were discrepant in 13 patients (16%): Four patients were positive solely in the PCS, four patients in ML; three patients were positive in both ML and EAST, two patients in PCS and ML. All patients with discrepant results showed specific IgE values in the two lowest classes.

#### Clinically symptomatic patients

Specific IgE to latex was detected by all three assays for all of 14 symptomatic patients (Table 1). In general, patients with systemic symptoms had no higher IgE values than patients with local symptoms. Specificity ranged from 49% to 50%, positive predictive value from 16% to 17% (Table 2).

Symptomatic patients showed significantly higher values for specific IgE to latex in all three IgE-assays compared to the group of non-symptomatic patients: CAP ( $p < 0.0004$ ), EAST ( $p < 0.002$ ) and ML ( $p < 0.002$ ).

The low specificity (Table 2) of the measurement of specific IgE to latex (49% to 50%) is due to the well known fact that not every patient who is sensitized suffers from clinically relevant allergic symptoms.

We conclude that any of the three assays tested is suitable for determining sensitization to latex.

Table 2. Comparison of the three *in vitro* assays for measuring specific IgE to latex

|                           | CAP   | EAST  | ML    |
|---------------------------|-------|-------|-------|
| Sensitivity               | 100 % | 100 % | 100 % |
| Specificity               | 49 %  | 49 %  | 50 %  |
| Positive predictive value | 16 %  | 17 %  | 17 %  |
| Negative predictive value | 100 % | 100 % | 100 % |
| Efficiency                | 53 %  | 54 %  | 54 %  |

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