

## Short communication

# Latex allergens in glove-powdering slurries

Lundberg M, Wrangsjö K, Johansson SGO. Latex allergens in glove-powdering slurries.

Allergy 1995; 50: 378–380. © Munksgaard 1995.

Exposure to airborne glove powder contaminated with latex allergens is known to provoke respiratory symptoms in latex-sensitized individuals. In the commonly used wet-powdering process in glove manufacturing, powder is applied by dipping gloves in a cornstarch suspension, a slurry. The slurry is a potential source of allergen contamination of the powder. The protein and latex allergen contents in five different slurries and in extracts from the corresponding latex gloves were measured using the BCA assay and the IgE antibody inhibition assay (EAI assay). Latex allergens were found in all slurries and gloves. No correlation between the values of protein contents and allergen contents was found. Wet powdering of gloves induces a risk of latex protein contamination of the cornstarch.

M. Lundberg<sup>1</sup>, K. Wrangsjö<sup>2</sup>,  
S. G. O. Johansson<sup>3</sup>

<sup>1</sup> MIAB, Box 97, Knivsta; Departments of

<sup>2</sup> Occupational Dermatology and <sup>3</sup> Clinical

Immunology, Karolinska Hospital, Stockholm, Sweden

Key words: glove manufacturing; glove powder; IgE antibody inhibition assay (EAI assay); latex allergens; natural rubber; RAST inhibition.

Maria Lundberg

MIAB, Box 97

S-741 00 Knivsta

Sweden

Accepted for publication 10 January 1995

IgE-mediated sensitization to natural rubber has been recognized during the past 15 years as an increasing clinical problem in glove-wearing hospital and dental personnel (4, 8, 10, 11, 13). Contact urticaria and allergic rhinoconjunctivitis are common symptoms, and anaphylactic reactions may also occur (10). However, exposure to airborne latex-allergen-contaminated glove powder provokes facial and respiratory allergic symptoms (6, 12, 14, 15) and may make it difficult for sensitized personnel to continue working in jobs involving such exposure. Latex allergen contamination of the cornstarch used as glove powder is documented (1, 2, 4, 12, 14).

One way of preventing this occupational risk would be to reduce the allergen contamination of the powder. Important questions are, at what point in the manufacturing process of gloves does the powder become contaminated, and how could allergen contamination be prevented or reduced?

Originally, mineral talcum powder was used to reduce the stickiness of the latex materials. However, since the 1940s, cornstarch, which absorbs humidity, has been the main constituent of glove powder (3). In latex glove manufacturing, different methods of powdering are used. Dry cornstarch may be blown onto the finished gloves, or, as in the commonly used wet-powdering process, the starch may be applied by dipping the vulcanized gloves into a

water-based slurry. During the wet process, water-soluble, potentially allergenic latex proteins may leach from the gloves into the slurry and contaminate the powder. The same powdering slurry may be used for many weeks, and hundreds of thousands of latex gloves may be dipped into the same slurry.

To determine to what extent these powder slurries are contaminated by latex allergens, the latex IgE antibody inhibition technique (9, 16) was used to detect and measure the allergen content in slurries from various production units.

## Material and methods

### Material

Five Malaysian manufacturers (named A–E) of latex examination gloves, supplying gloves to the European and US markets, provided six different cornstarch slurries. The slurries were preserved with 0.15 M saline containing 0.02% NaN<sub>3</sub>. The extent to which the different slurries had been in use and the numbers of gloves dipped into the slurries prior to the sampling are presented in Table 1. Dry, original cornstarch, ammoniated latex concentrates, and corresponding gloves from the manufacturers were also analyzed. An extract of Triflex® surgical glove (lot 2D 7253M, Baxter Health Care Corporation, Valencia, CA, USA) was also investigated as a latex

Table 1. Duration of slurry use and number of gloves dipped

| Manufacturer   | Duration of slurry use | Gloves produced |
|----------------|------------------------|-----------------|
| A              | 51 days                | 4 200 000       |
| B              | < 1 week               | 100 000         |
| C              | 14 days                | 2 100 000       |
| D <sub>1</sub> | 5 days                 | 450 000         |
| D <sub>2</sub> | 5 days                 | 450 000         |
| E              | —*                     | —*              |

\* Information not available.

allergen reference. Dry cornstarch powder 1/10 w/v suspended in 0.15 M saline was used as a negative control.

## Methods

The slurries were examined as delivered. Extracts of corresponding gloves were prepared as 1/10 w/v in 0.15 M saline containing 0.02% NaN<sub>3</sub>. The extraction was performed for 24 h at room temperature. Specific IgE antibodies to latex were measured using the Pharmacia CAP System (Pharmacia Diagnostics, Uppsala, Sweden). In the IgE antibody inhibition assay (EAI assay), the Pharmacia CAP System was also used, with a pool of sera from three adult patients who were clinically allergic to latex. The patients were also positive in SDS-PAGE and IgE immunoblotting to several latex components. The pool was incubated with five serial dilutions of each latex extract. Good parallelism between different samples was obtained. The extracts were compared at 50% inhibition. The inhibitory capacity was expressed in arbitrary units (U), in relation to an arbitrary reference value of 1000 U (cytosol from *Hevea brasiliensis* without ammonia). Protein contents in slurries and extracts were measured using the Pierce BCA Protein Assay<sup>TM</sup> (Pierce, Rockford, IL, USA).

## Results

The latex IgE antibody inhibition value (EAI value) and protein content of the different slurries and glove

Table 2. IgE antibody inhibition (EAI) and protein content of starch powder suspensions (slurries) and glove extracts from manufacturers A–E. Ratios between values are also shown (EAI/protein). Inhibitory capacity is expressed in arbitrary units (U) and protein content in mg/ml

| Manufacturer   | Slurries  |               |       | Glove extract |               |       |
|----------------|-----------|---------------|-------|---------------|---------------|-------|
|                | EAI units | Protein mg/ml | Ratio | EAI units     | Protein mg/ml | Ratio |
| A              | 88        | 0.26          | 338   | 51            | 0.08          | 638   |
| B              | 38        | 0.15          | 253   | 67            | 0.12          | 558   |
| C              | 0.7       | 0.38          | 2     | 8             | 0.14          | 57    |
| D <sub>1</sub> | 151       | 0.18          | 838   | 78            | 0.06          | 1300  |
| D <sub>2</sub> | 17        | 0.06          | 283   | 8             | 0.02          | 400   |
| E              | <0.1      | <0.01         | <10   | 95            | 0.19          | 500   |

extracts are presented in Table 2. The inhibition value for the suspension of dry cornstarch was <0.1 U, and for Triflex<sup>®</sup> glove extract, 140 U. The ratios between the inhibition value and protein contents of the slurries and glove extracts are also presented in Table 2.

## Discussion

It is essential to reduce the latex contamination of glove powder in occupational preventive work among latex-sensitized health-care personnel. Our findings indicate the presence of latex allergens in the cornstarch slurries used in wet-powdering in concentrations that vary more than 100-fold. The results suggest a possible risk of contamination of the glove powder, since the water-based slurries in reality function as a leaching bath for the gloves. Our findings point to the possibility of reducing this contamination by using alternative powdering methods. The content of latex allergens is high in powdered gloves and medical examination gloves, compared to that in unpowdered and sterile gloves (17). Differences in the manufacturing process are thus of crucial importance for the allergen load of the different gloves.

The amount of latex allergen leaching into the powder suspension depends on the original allergen content and the previous leaching of the dipped product. Leaching of latex products is a procedure known to reduce the allergen content (7). The effect of factors such as water volume, temperature, and number of leaching baths on the allergen content of the final product is of great practical importance, and is also being studied by the manufacturers (5). Increased leaching, however, requires fresh water, energy, and time, and is thus of significant economic importance, and this will be taken into consideration by manufacturers and consumers.

Since this study was done, improvements of the leaching routines have been discussed by the manufacturers.

No correlation was found between the allergen concentration in the slurries and the number of gloves dipped or the length of time the slurries were used (Table 1). However, factors of potential importance, such as the dipping time for each glove, the temperature, and the water volume of the slurries, were not documented in this study.

Further studies on factors of importance for the latex allergen contamination of the glove powder may, however, be relevant for as long as powdered protective latex gloves continue in common use. Questions of interest may be how far different types of powder are prone to absorb and bind latex allergens, and whether storage factors such as time, temperature, humidity, and type of package are also of importance.

Protein assay methods are sensitive to interfering components such as rubber chemicals. Residues of these chemicals may be present in the examined slurries and glove extracts. This fact must be taken into account when interpreting the results of protein content.

The similar EAI values for glove extracts with highly varying protein content (Table 2) illustrate the importance of measuring the content of relevant allergens in latex products. In addition, there was no obvious correlation between allergenicity and protein content of the slurries or glove extracts (Table 2). The lack of correlation found underlines the need to measure the allergen content of latex products, and not rely on an estimation of total protein concentration when labeling latex gloves and other latex devices for medical use.

References

1. BAUER X, JAEGER D. Airborne antigens from latex gloves. *Lancet* 1990; 335: 912.  
2. BLEEZHOLD D, BECK WC. Surgical glove powders bind latex antigens. *Arch Surg* 1992; 127: 1354-7.  
3. ELLIS H. The hazards of surgical glove dusting powders. *Surg Gynecol Obstet* 1990; 171: 521-7.  
4. JAEGER D, KLEINHANS D, CZUPPON AB, BAUR X. Latex-specific proteins causing immediate-type cutaneous, nasal, bronchial, and systemic reactions. *J Allergy Clin Immunol* 1992; 89: 759-68.  
5. KAMATH SR, ABRAHAM MS. Effect of leaching parameters on the water soluble protein content of latex examination gloves. Program and Proceedings from the International La-

tex Conference: Sensitivity to Latex in Medical Devices. Baltimore, MD, 1992.  
6. LAGIER F, BADIER M, CHARPIN D, MARTIGNY J, VERVLOET D. Latex as aeroallergen. *Lancet* 1990; 336: 516-17.  
7. LEYNADIER F, XUAN TT, DRY J. Allergenicity suppression in natural latex surgical gloves. *Allergy* 1991; 46: 619-25.  
8. LEVY DA, CHARPIN D, PECQUET C, LEYNADIER F, VERVLOET D. Allergy to latex. *Allergy* 1992; 47: 579-87.  
9. SCHRÖDER H, YMAN L. Standardization of the RAST inhibition assay. *Allergy* 1980; 35: 234-6.  
10. SUSSMAN GL, TARLO S, DOLOWICH J. The spectrum of IgE-mediated responses to latex. *JAMA* 1991; 265: 2844-7.  
11. TAYLOR JS, MELTON A, HAMANN CP. Selected highlights of the International Latex Conference: Sensitivity to Latex in Medical Devices. Baltimore, MD, 1992. *Am J Contact Dermatitis* 1993; 4: 101-5.  
12. TOMAZIC VJ, SHAMPAINE EL, LAMANNA A, WITHROW TJ, ADKINSON NF, HAMILTON RG. Cornstarch powder on latex products is an allergen carrier. *J Allergy Clin Immunol* 1994; 93: 751-8.  
13. TURJANMAA K. Incidence of immediate allergy to latex gloves in hospital personnel. *Contact Dermatitis* 1987; 17: 270-5.  
14. TURJANMAA K, REUNALA T, ALENIS H, BRUMMER-KORVENKONTIO H, PALOSUO T. Allergens in latex surgical gloves and glove powder. *Lancet* 1990; 336: 1588.  
15. VAN DER MEEREN HLM, VAN ERP PEJ. Life-threatening contact urticaria from glove powder. *Contact Dermatitis* 1986; 14: 190-1.  
16. VAN HAGE-HAMSTEN M, JOHANSSON SGO, JOHANSSON E, WIRÉN A. Lack of allergenic cross-reactivity between storage mites and *Dermatophagoides pteromyssinus*. *J Clin Allergy* 1987; 17: 23-31.  
17. YUNGINGER JW, JONES RT, FRANSWAY AF, KELSO JM, WARNER MA, HUNT LW. Extractable latex allergens and proteins in disposable medical gloves and other rubber products. *J Allergy Clin Immunol* 1994; 93: 836-42.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.