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# Latex allergy in the workplace: an overview of where we are

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## INTRODUCTION

Allergy to natural rubber latex has become the most common cause of occupational rhinoconjunctivitis and asthma among health care workers.<sup>1</sup> In questionnaire-only surveys, up to 53% of responding health care workers<sup>2</sup> self-report some type of reaction to rubber gloves. In surveys involving both questionnaires and either latex skin testing or immunoassays for latex-specific IgE antibodies, 5%<sup>3</sup> to 17%<sup>4,5</sup> of various hospital employee groups were documented as latex-sensitive. The high variation of prevalences reported is due to use of different skin test materials, small sample populations, and use of selected populations.

## CLINICAL MANIFESTATIONS

Since 1990 we have evaluated over 350 employees of Mayo Medical Center-Rochester whose clinical histories and laboratory findings indicated sensitization to latex.<sup>6</sup> Risk factors for latex sensitization include frequent use of disposable rubber gloves, presence of prior atopic disease, and prior or current hand dermatitis.<sup>7</sup> The peak onset of symptoms occurred in late 1989 and early 1990 and did not correlate with any peak in glove usage, which has continued to rise. Most sensitized workers (77%) reported contact urticaria from gloves, and over 50% also experienced allergic rhinitis, conjunctivitis, or asthma when working in areas of high glove use. Sixteen episodes of natural rubber latex-induced ana-

phylaxis were documented in 12 employees.

## DIAGNOSIS OF LATEX ALLERGY

Immunologic reactions to latex include cell-mediated, delayed-type hypersensitivity to low molecular weight chemicals compounded into liquid natural rubber, and IgE-mediated, immediate-type reactions to one or more natural rubber proteins. The former reactions can be confirmed by patch testing to rubber additives such as thiurams, carbamates, benzothiazoles, thioureas, and paraphenylenediamines.<sup>8</sup> The latter reactions can be evaluated by measuring latex-specific IgE antibodies, for which there are three FDA-licensed reagents at present.

Unfortunately, there is no FDA-licensed skin test material presently available in the United States, and clinicians often test with in-house extracts of finished rubber products, such as gloves, or with samples of ammoniated, compounded latex obtained from a rubber manufacturer. These materials vary widely in their allergen contents,<sup>9-11</sup> and systemic reactions have been reported with these unstandardized preparations.<sup>12</sup> A more recent study has shown that skin testing with glove extracts, ammoniated latex, or nonammoniated latex, all standardized on their protein contents, is safe and efficient.<sup>13</sup>

One should not assume that all health care workers with compelling histories of latex allergy can in fact be documented as being sensitized to latex. In a collaborative study conducted by Johns Hopkins investigators,<sup>14</sup> 15% of volunteers whose histories were compatible with latex allergy had both negative prick skin tests to a well-characterized latex extract and a negative

inhalation provocation test using powdered rubber gloves.

## LATEX AEROALLERGENS

Hospitals and clinics may contain high levels of latex aeroallergens, which can be measured using high-volume air samplers (3 L/sec) or personal breathing zone samplers (4 L/min) equipped with polytetrafluoroethylene (Teflon™) filters.<sup>15</sup> In our medical center, latex aeroallergen levels were highest (range = 14 to 208 ng/m<sup>3</sup>) in work areas where powdered rubber gloves were in frequent use, and lowest (range 0.3 to 1.8 ng/m<sup>3</sup>) in work areas where powder-free or synthetic gloves were in use (Table 1). Latex allergen was airborne only when there was activity in the work area. Latex allergen concentrations in personal breathing zone samplers were highly variable, ranging from 8 to 974 ng/m<sup>3</sup> in areas where powdered gloves were frequently used. Subsequently, our medical center phased out the use of high-allergen latex gloves,<sup>16</sup> and follow-up studies in the same work areas showed that latex aeroallergen levels had fallen to <3 ng/m<sup>3</sup>.

To confirm that powdered rubber gloves were the major contributor to latex aeroallergen levels, we conducted a 52-day, prospective, multiple crossover study in a single operating room, during which either high-allergen or low-allergen gloves were used and latex aeroallergen levels were monitored daily (Fig 1).<sup>17</sup> Latex aeroallergen levels during low-allergen glove use days (range = 0.1 to 3.5 ng/m<sup>3</sup>) were significantly lower than on high-allergen glove use days (range = 2.2 to 56 ng/m<sup>3</sup>). On designated high-allergen glove use days, latex aeroallergen levels were strongly

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Table 1. Latex Aeroallergen Levels in Various Clinic and Hospital Areas Using High-Volume Area Samplers (3 L/sec)

| Area Sampled                            | Latex Aeroallergen (ng/m <sup>3</sup> ) |
|-----------------------------------------|-----------------------------------------|
| Extensive use of powdered rubber gloves |                                         |
| Operating room (n = 4)                  | 96 –208                                 |
| Cystology room                          | 122                                     |
| Orthodontics outpatient surgery         | 100                                     |
| Dermatology outpatient surgery          | 78                                      |
| Blood bank—donor center                 | 46                                      |
| Blood bank component lab                | 38                                      |
| Surgical pathology lab                  | 37                                      |
| Venipuncture room                       | 30                                      |
| Blood bank—crossmatch lab               | 16                                      |
| Hematopathology lab                     | 14                                      |
| Allergy research lab                    | 14                                      |
| Minimal use of powdered rubber gloves   |                                         |
| Allergy clinic                          | 1.8                                     |
| Spirometry lab                          | 0.6                                     |
| Bone marrow transplant unit             | 0.6                                     |
| Virus serology lab                      | 0.3                                     |

(Modified with permission from Swanson MC, Bubak ME, Hunt LW et al: *J Allergy Clin Immunol* 1994;94:445.)

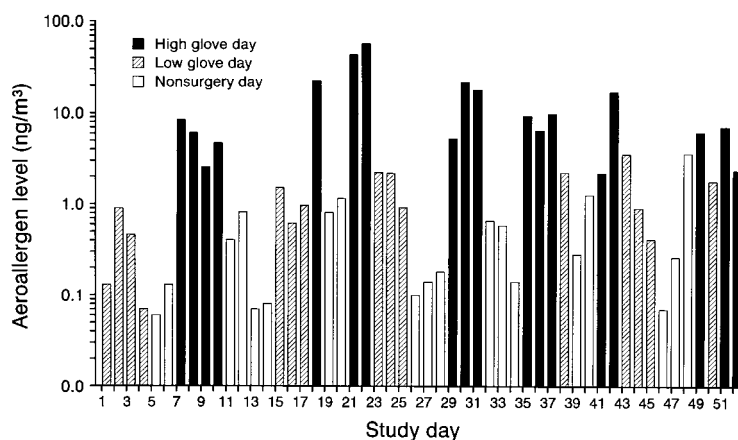


Figure 1. Mean latex aeroallergen levels in a single operating room during a 12-hour sampling period for 52 consecutive days, including nonsurgery days and surgery days when either high-allergen content gloves ("high glove day") or low allergen content gloves ("low glove day") were in use. (Used with permission from Heilman DK, Jones RT, Swanson MC et al. *J Allergy Clin Immunol* 1996;98:325.)

correlated with the total number of gloves used.

## LATEX AVOIDANCE

Successful long-term management of individuals with latex allergy involves documentation of latex sensitization by skin test or immunoassay and education regarding rubber avoidance. Latex-sensitive persons should be provided with lists of substitute rub-

ber-free products for daily personal or occupational use. These individuals should not assume that such rubber-free products are universally available; for example, they should be advised to carry with them nonlatex examination gloves when seeking medical or dental care. Rubber-free condoms are available; in one study, condoms made from thermoplastic elastomers were as

resistant to leakage and viral penetration as latex condoms.<sup>18</sup>

## MEDICAL GLOVES

Rubber gloves vary widely in their latex allergen contents.<sup>9,19</sup> As a group, powdered rubber gloves contain more allergen than powder-free gloves. A modified Lowry assay has been established to measure extractable total proteins in gloves, but inhibition immunoassays using rabbit or human antisera to latex allergens are more sensitive.

In 1990, the FDA adopted a regulation in which the maximum allowable failure rate for standardized tests for leakage was set at 2.5% for unused surgical gloves and 4% for unused examination gloves.<sup>20</sup> Studies of previously used and discarded gloves found leakage rates between 43% and 85% for vinyl gloves and between 9% and 31% for latex gloves.<sup>21,22</sup> Further, in a study of the ability of examination gloves to exclude virus particles, polyethylene and polyvinyl gloves failed in 40% and 22% of cases, respectively, whereas latex gloves failed in less than 1% of cases.<sup>23</sup> Collectively, these data suggest that substitution of synthetic elastomer gloves for latex gloves may involve some sacrifice in barrier protection.

## "LATEX-FREE" MEDICAL ENVIRONMENTS

Because most IgE-mediated reactions to rubber have been described in health care workers or in latex-sensitive individuals undergoing medical or dental procedures, emphasis has been placed on providing "latex-free" clinic and hospital environments. This is defined as one in which no latex gloves are worn by any personnel and no latex accessories are brought into direct contact with the patient. There are anecdotal reports of latex-sensitive individuals who experienced systemic allergic reactions preoperatively or postoperatively purportedly induced by latex allergens present in intravenous fluids<sup>24</sup> or by injection of medications through latex ports in intravenous tubing.<sup>25</sup> In contrast to dipped products made from liquid rubber latex, dry rubber prod-

ucts have generally low levels of extractable protein, and extracts of these products do not produce positive skin tests in latex-sensitive persons.<sup>26</sup> Some hospitals have expended considerable effort to identify all medical care products made from rubber and to substitute similar products made from non-latex materials.<sup>27</sup> As of September 30, 1998, all medical devices or medical device packagings containing natural rubber latex have been required to be so labelled by the FDA.<sup>28</sup>

Detailed perioperative nursing plans have been published for managing latex-sensitive patients,<sup>29</sup> and some management protocols recommend preoperative prophylactic administration of glucocorticoids and both H<sub>1</sub> and H<sub>2</sub> class antihistamines to latex-sensitive patients undergoing surgery.<sup>25,30,31</sup> In a retrospective study of children with myelodysplasia undergoing surgery, the use of empiric latex-avoidance protocols was associated with a significant decline in intraoperative allergic reactions, but the critical elements within the protocol were not identified.<sup>32</sup> Although surgery can be performed safely in latex-sensitive persons using these protocols,<sup>29,33,34</sup> several groups have reported the occurrence of life-threatening intraoperative anaphylactic reactions, despite premedication and latex avoidance.<sup>25,30,35,36</sup> Further, life-threatening allergic reactions may be the presenting factor of latex allergy in up to 30% of latex-sensitive children.<sup>37</sup>

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