A Review of Latex Sensitivity Related to the Use of Latex Gloves in Hospitals

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Skin and respiratory allergies are known occupational problems for health care workers. Powdered latex gloves have been identified as a major source of occupational allergenic exposure because they contain water-soluble proteins responsible for antigenic sensitization. Latex gloves used during surgical and clinical procedures have proven to be effective in preventing the transmission of infectious diseases to health care workers. Increased use of latex gloves, however, has corresponded to an increase in the number of reported cases of latex sensitivity. Until the late 1980s, latex gloves were thought to be innocuous, but currently, they are considered to be major sensitizing agents.

**Manufacture of Natural Rubber Latex Gloves**

Latex is a milky, viscous, cytoplasmic exudate that is extracted from the tropical tree *Hevea brasiliensis*. It is produced in the cytoplasm of lactiferous cells along with amino acids, phospholipids, carbohydrates, and proteins (ie, 2% to 3%). The essential functional unit of latex consists of cis-1,4-polyisoprene covered by a layer of lipidic and phospholipidic proteins that ensure its structural integrity. The proteins present in latex serum are the antigens considered to be responsible for causing type I hypersensitivity to latex. Sixty percent of these proteins are linked to rubber and isopropene polymers, and 40% are in the latex cytosol.

Latex is extracted from the trunk of the *Hevea brasiliensis* tree, and ammonia, tiuram, or sulfides are added immediately to prevent bacterial contamination and coagulation of the extract. The liquid portion then is separated by centrifuge, which concentrates up to 60% of the solid portion and removes the serum containing the hydrosoluble proteins. Later, other concentrated chemicals, such as catalysts (eg, tiuram, carbamates) and antioxidants (eg, phenylenediamine) are added to obtain the desired properties of rubber (ie, tension force, elasticity, durability, tactile sensitivity). Gloves are made by immersing molds in an extract of natural rubber latex.

In response to the AIDS epidemic that began in the 1980s, the Centers for Disease Control and Prevention issued universal precautions that recommend glove use to protect health care workers against exposure to blood and body fluids. High demand for natural rubber latex gloves after the introduction of universal precautions caused many manufacturers to alter their manufacturing processes, either shortening or eliminating important phases that removed proteins and chemical residues.

**ABSTRACT**

- **BEGINNING IN THE 1980s**, use of latex gloves to protect health care workers against exposure to blood and body fluids increased. Since then, the number of reported cases of latex sensitivity also has increased.
- **REACTIONS TO LATEX** range from contact dermatitis to anaphylactic shock.
- **LOW-POWDER, POWDER-FREE, and non-latex gloves** provide alternatives to protect health care workers from occupational latex exposure.

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resulted in poor quality products with high allergen concentration.²

**Latex Exposure**

Exposure to latex antigens occurs via direct contact with the skin or mucous membranes or through inhalation of aerially transported protein particles that adhere to the powder in latex gloves. Absorption of latex proteins through the skin is considered to be the main pathway of sensitization and also is mainly responsible for local urticaria manifestations that eventually may become systemic.² The inhalation of protein particles dispersed in the air is capable of triggering nasal, ocular, and respiratory symptoms,² and in sensitized individuals, they may lead to rhinitis, conjunctivitis, and asthma, as well as to more severe manifestations, such as systemic anaphylaxis, tachycardia, angioedema, nausea, vomiting, abdominal discomfort, and hypotension.²

**Clinical Manifestations**

Clinical manifestations of latex sensitivity are irritant contact dermatitis, allergic contact dermatitis, and type I hypersensitivity. Contact dermatitis is an inflammatory response to one or more external agents that may behave as skin irritants when immunologic mechanisms are not involved or as allergens when hypersensitivity is mediated by T cells.³⁰ Irritant contact dermatitis is an occupational rather than an immunologic dermatosis, which occurs when exogenous substances directly damage the skin. This condition often is related to the use of latex gloves. The predominant immunologic response is allergic contact dermatitis or type IV hypersensitivity resulting from an immune response to the allergen mediated by T lymphocytes that in this case are chemical substances, mainly accelerators and antioxidants, that are added to latex during its manufacture.³¹

Although, type I hypersensitivity occurs less frequently than type IV hypersensitivity, it is the most severe reaction provoked by latex. In previously sensitized individuals, it is characterized by a systemic reaction mediated by immunoglobulin E (IgE) anti-latex after exposure to latex antigens. Reactions range from mild urticaria to systemic anaphylaxis. The development of type I hypersensitive symptoms to latex involves a series of interactions mediated by specifically activated T lymphocytic products and B lymphocytes that trigger the production of the antibody mechanism. These antibodies play a fundamental role in allergic reactions and are an integral part of the pathophysiology of latex allergy, as well as of other allergic diseases.³²

**Diagnosis**

Diagnosis of latex allergy is based on a detailed clinical history of consistent IgE-mediated reactions to latex, as well as the presence of certain risk conditions, such as atopy, multiple surgeries, history of allergy to certain fruits and nuts, and occupational exposure to latex. A clinical diagnosis can be verified by laboratory tests, including a skin prick test that detects specific IgE to latex or a serologic test that detects and quantifies specific IgE in the serum.³³,³⁴ The most common auxiliary diagnostic tests used are in vivo tests, such as a skin prick test using a solution of rubber antigens, which is considered the most reliable diagnostic method, or an in vitro test using the enzyme-linked immunoabsorbent assay.³¹
Epidemiology

European studies on prevalence of positivity to a skin prick test using latex as an antigen vary between 0.9% and 10%. In a British hospital, the prevalence of type I allergy to latex extracted from gloves was 0.9% determined by a skin prick test. In a Swiss hospital, researchers found type I allergic sensitivity to latex in 10% of participants in an exposed group (ie, surgeons, anesthesiology care providers, nurses) and in 6% of a unexposed group (ie, hospital administrative personnel).

Canadian and American studies present high prevalence rates of type I allergic sensitivity to latex, ranging from 6.2% to 30%. Researchers found type I allergic hypersensitivity to latex in 30% of 342 health care workers in an American hospital, and their symptoms suggested that the allergic reactions were related to the use of latex gloves.

In Canada, a group of researchers used serological analysis and obtained a 12.5% prevalence of type I hypersensitivity to latex among anesthesiologists and nurses; 2.4% of these individuals had clinical symptoms, and 10.1% had no symptoms. Using a skin prick test, another group of researchers obtained a 14% prevalence of type I hypersensitivity to latex among workers in an intensive care unit. In a study conducted on the presence of IgE antilatex in 531 health care workers, researchers found a 6.2% prevalence of latex sensitization.

In Argentina, a study involving patients in a teaching hospital found the prevalence of latex allergy among children who had undergone multiple surgeries was 32.1% (nine of 28), and the prevalence for outpatients was 18.6% (23 of 123). The prevalence among health care workers in this same study was 17.3% (17 of 98).

In the first controlled Brazilian epidemiological study on latex allergy, researchers studied 50 professionals working in the surgical sector of a metropolitan hospital in Rio de Janeiro and, using a puncture test, found a prevalence of 6% allergic sensitization. Another cross-sectional, descriptive survey focused on 96 Brazilian health care workers in the neonatal intensive care unit at the Women’s Integral Health Center (ie, Centro de Atenção Integral à Saúde da Mulher), State University of Campinas, São Paulo, Brazil. The prevalence of latex allergy obtained by a skin prick test with an antigen extract from latex gloves and latex-specific IgE measure was 8%. In eight cases, the skin prick tests were positive, although only one serological test was in agreement with the skin test.

Atopy appears to be a determinant for the development of latex sensitization and allergic dermal manifestations.

Atopy. Studies have shown that atopy may be an important determinant for the development of latex sensitization and allergic dermal manifestations. Eczema is considered to be one of the main predisposing factors for type I latex allergy. Researchers studied 104 health care workers in a US hospital who were allergic to latex and found 76 of the participants were atopic. Another group of researchers also found a strong relationship between atopy and sensitivity to latex. Thirty-three percent of participants were confirmed to be atopic by puncture test using environmental allergens. In participants considered atopic, hypersensitivity to latex was 35% versus 3.7% in individuals who were not atopic.

Controlling Latex Allergens

Research has demonstrated that powdered gloves contain more proteins than those without powder, and powdered
gloves represent a risk factor by dispersing antigens into the work environment. The possible mechanisms that cause sensitivity in health care workers are inhalation of allergens dispersed in the air, which induces respiratory symptoms, and local skin exposure, which produces dermal reactions.

As with any environmental control program for the prevention of occupational diseases, the first step toward the primary prevention of type I hypersensitivity to latex is control of risks. One group of researchers demonstrated a reduction in free latex antigens circulating in the blood of health care workers who avoided using powdered gloves for 12 months.

Another group of researchers conducted a study of 20 anesthesiologists who exhibited type I allergy to latex as identified by skin or serological tests. After diagnosis, these individuals began using vinyl or nitrile gloves, and subsequent tests showed a reduction in the antilatex IgE circulating in their blood. The data revealed, however, that when other workers in the same unit used powdered latex gloves in a closed environment, avoiding direct contact with latex gloves was not enough to reduce sensitization in the individuals who were allergic. In this study, there was no change or reduction of sensitization in individuals who had no contact with latex for fewer than 15 months, which suggests the need for longer periods without antigen contact before sensitization is reduced.

A reduction in the number of antibodies found in a serological test or reduced reactivity to a skin test may indicate reduced sensitization, but it does not necessarily eliminate the risk of re sensitization upon reexposure.

A strategy of primary and secondary prevention to reduce the incidence of type I hypersensitivity to latex was adopted in a complex of teaching hospitals in Canada. The first measure was to provide latex-free gloves for workers diagnosed with latex allergy and transfer workers with occupational asthma to areas of the hospital where powdered latex gloves were not used. Soon after, the hospitals in the complex began using gloves with low quantities of proteins (ie, powder-free latex gloves, surgical gloves containing a small quantity of powder) instead of powdered surgical gloves. This measure was implemented because of a growing number of new cases of latex allergy. After these measures were implemented in 1995, a significant reduction in reports of new cases occurred.

SUPPORT FOR USE OF LOW-ALLERGEN GLOVES

The use of powder-free gloves or gloves containing a small quantity of allergens is accepted by various organizations as an important mechanism for establishing a latex-safe environment. According to the National Institute for Occupational Safety and Health, employers should adopt a policy that protects workers from latex exposure in the work environment by supplying latex-free gloves or latex gloves with a low quantity of proteins, such as powder-free latex gloves.

Health care workers who are allergic to latex should avoid contact with latex gloves and other products that contain latex. In 1999, the Occupational Safety and Health Administration issued a technical bulletin reaffirming these recommendations. Use of powder-free, low-powder, and nonlatex gloves provides health care workers with a strategy for preventing occupational exposure to latex allergens.

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NOTES
14. R Brehler, B Kutting, “Natural rubber


**Resources**


risk of becoming symptomatic?” Journal of Allergy and Clinical Immunology 102 (October 1998) 665-670.


Trape, M; Schenck, P; Warren A. “Latex glove use and symptoms in health care workers 1 year after implementation of a policy restricting the use of powdered gloves,” American Journal of Infection Control 28 (October 2000) 352-358.


Women with abnormal uterine bleeding who underwent hysterectomies after unsuccessful treatment with a common hormonal medication experienced greater improvement in their symptoms and expressed greater satisfaction with their overall health six months after treatment than women who were prescribed an alternate regimen of oral medication for the same condition, according to a March 23, 2004, news release from the Agency for Healthcare Research and Quality. Hysterectomy is the most common nonobstetric surgical procedure performed in US women. In 2000, approximately 633,000 women had hysterectomies, 90% of which were performed before menopause for abnormal uterine bleeding and other nonlife-threatening reasons. Approximately 5.6 per 1,000 women in the United States have hysterectomies—a rate that is three to four times higher than that of Australia, New Zealand, and most European countries. This, in addition to regional variations in the United States, has raised questions about whether so many hysterectomies really are needed.

The study—the first randomized, controlled trial to compare hysterectomy with oral medical treatment for abnormal uterine bleeding—was conducted by Miriam Kuppermann, PhD, MPH, of the Departments of Obstetrics, Gynecology, & Reproductive Sciences and Epidemiology & Biostatistics at the University of California, San Francisco (UCSF), and collaborators from UCSF and four clinical centers throughout the United States. The study examined differences in outcomes and satisfaction of 63 women 30 to 50 years of age who had experienced abnormal uterine bleeding for an average of four years and were dissatisfied with treatment by medroxyprogesterone, which is commonly prescribed for this condition. One-half of the women in the study were randomly selected to receive hysterectomies and the other one-half were treated with an alternate regimen of oral medication selected by the women’s gynecologists. The women were followed for two years.

The women who underwent hysterectomy experienced greater improvements in mental health, sexual desire and functioning, sleep, and overall satisfaction with health. Most of the improvement was evident within six months. By the end of the study, one-half of the women originally assigned to medical treatment had elected to undergo hysterectomies, and their improvements were similar to those of women who were assigned to have hysterectomies at the outset.

The researchers had difficulty recruiting women for this trial because many women were reluctant to agree to be assigned randomly to have a hysterectomy or not. The researchers noted, however, that there were enough participants to reveal significant differences in quality-of-life outcomes.
