

Allergy to Latex Rubber

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■ **Objective:** To summarize the clinical symptoms of latex rubber allergy and provide guidelines for the management of this allergy.

■ **Data Sources:** The English-language literature was searched from 1979 through 1994 manually and using MEDLINE. Conference proceedings and reference lists of relevant articles were reviewed.

■ **Data Extraction:** Studies clinically relevant to latex allergy were selected.

■ **Results:** The most common clinical presentation of latex allergy is a nonimmunologic, irritant dermatitis of the hand. Contact dermatitis (type IV delayed hypersensitivity reactions to rubber additives) is the most common immunologic manifestation of latex rubber allergy. Type I allergic responses are less common and include contact urticaria, rhinoconjunctivitis, asthma, and anaphylaxis. Seven percent to 10% of health care workers regularly exposed to latex and 28% to 67% of children with spina bifida have a positive skin test result to latex proteins indicating increased blood levels of IgE antibody. About one third of patients with positive skin test results, however, do not yet have symptoms of latex allergy. Systemic (life-threatening) anaphylactic shock can occur intraoperatively in highly sensitive patients because of mucosal absorption of latex protein allergens from the surgeon's gloves. The present treatment for latex allergy is careful avoidance of latex materials. In addition, the use of powder-free latex gloves can eliminate airborne latex exposure and can allow health care workers with inhalant allergic reactions to return to work.

■ **Conclusion:** Latex allergy currently affects thousands of people. These persons have IgE-mediated cutaneous, respiratory, and systemic allergic reactions. A reduction of the total protein level on latex rubber devices may prevent further sensitization and eliminate latex allergic reactions.

Latex gloves are indispensable in today's health care practice. The comfort, barrier, and tactile properties of powdered latex gloves have been thought to be ideal. Between 1988 and 1992, an estimated 11.8 billion examination gloves and 1.8 billion surgical latex gloves were used in the United States. Recent reports of allergic responses to latex have led some authors to re-examine the safety of latex medical devices. Although many health care workers report allergic reactions to gloves, most are not serious. The predominant immunologic response (82%) to natural rubber latex is type IV delayed hypersensitivity to rubber additives, which presents clinically as contact dermatitis (1). However, between 1988 and 1992, the FDA received reports of more than 1000 systemic allergic reactions to latex, 15 of which were fatal (2). These systemic reactions are type I immunologic responses that are mediated by IgE antibody to residual rubber tree proteins in latex medical devices. Health care workers develop sensitization from regular latex exposure: wearing latex gloves or inhaling aerosolized latex in the workplace (3). Re-exposure in a sensitized patient may result in contact urticaria, allergic rhinoconjunctivitis, asthma, or anaphylaxis (4).

Epidemiology

There are several explanations for the recent epidemic of latex allergy. After the introduction of universal precautions for human immunodeficiency virus, use of natural rubber latex gloves increased. The increased demand for gloves may have temporarily changed manufacturing procedures, resulting in a poor-quality, highly allergenic product. Increased awareness of latex allergy has resulted in more numerous reports (5) of this allergy during the last 6 years.

Presently, the incidence of latex sensitization is unknown. The prevalence of latex allergy in the general nonatopic population is believed to be less than 1%. Latex sensitivity has been reported in 1 of 800 patients (0.125%) before surgery (6). However, the prevalence of latex allergy in children with spina bifida ranges from 28% to 67% (5). Mucosal absorption of latex allergens during multiple surgical procedures done early in life may have sensitized these children. The prevalence of latex allergy in health care workers is between 7% and 10% (7, 8). Health care workers with atopic allergy have been reported (8) to have a 24% prevalence of a positive result from latex skin-prick testing. Fifty percent (5 of 10) of patients in this study (8) were clinically asymptomatic. The risk for subsequent development of latex allergy in this group is unknown.

Eczematous hand dermatitis disrupts the skin barrier and may predispose persons to latex allergy. A progression may occur from localized (hand) to generalized (anaphylactic) allergic responses (9). Areas with significant

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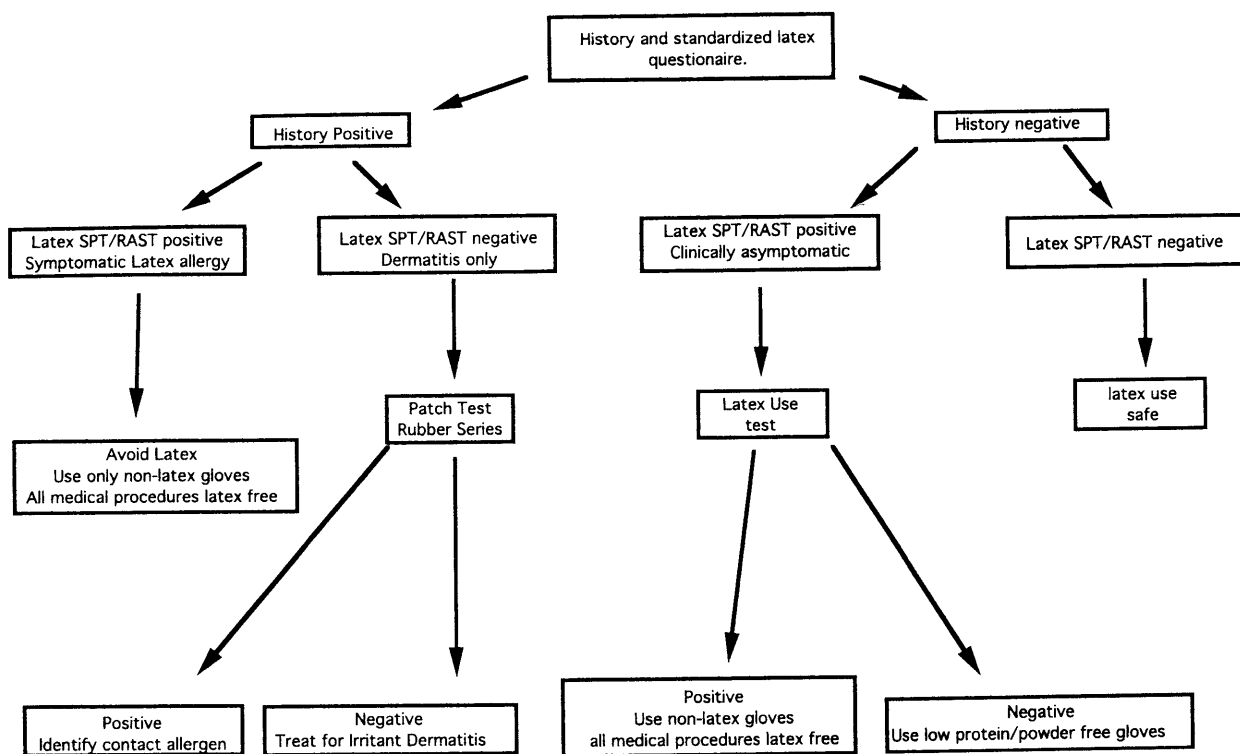


Figure 1. Overview of the identification and management of persons with latex allergy. Patients are divided into those with positive or negative histories and those with positive or negative results from skin testing, and a management outcome for these patients is given. Patients with negative histories do not receive skin testing unless they are categorized as high risk. RAST = radioallergosorbent testing; SPT = skin-prick testing.

airborne latex allergens (operating rooms, intensive care units, and dental suites) may sensitize health care workers who inhale allergenic proteins (10–12).

Clinical Latex Allergy

Irritant contact dermatitis, the most common clinical manifestation of latex allergy, is a nonallergic cutaneous response that manifests as dry, crusted lesions in latex glove-exposed areas. Prolonged and repeated latex exposure is aggravated by sweating and rubbing under the glove, leading to papular and ulcerative lesions (1).

Allergic contact dermatitis is a delayed hypersensitivity reaction to rubber additives (thiurams, mercaptobenzothiazole, carbamates) (13). The acute phase of the reaction occurs 48 to 96 hours after exposure, affects the dorsum of the hands, and is characterized by vesicular skin lesions. With continued latex exposure, these skin lesions develop a crusted, thickened appearance.

Immunoglobulin E-mediated latex allergy may be locally visible as contact urticaria (14) or may present as occupational rhinoconjunctivitis or asthma (3, 12). Anaphylactic reactions have most often been caused by exposure to the surgeon's latex gloves during abdominal or genitourinary surgery or by other sources of mucosal exposure to latex (barium enema, dental procedures) (3–5). Anaphylaxis has been reported less often from latex exposure that occurs when health care workers put on gloves or work in a latex-laden environment.

Identification and Management of Latex Allergy

The prevention of adverse latex reactions depends on identification of patients who are allergic. A careful and

complete history will not identify all persons at risk for latex allergy. The latex skin-prick test is a sensitive indicator of IgE sensitization, but a standardized latex extract that can be used in this test is presently not available. Latex skin-prick testing of extremely allergic persons using commercially available extracts has been safe (3, 6–8). However, five (15, 16) anaphylactic episodes occurring after the use of extracts prepared from latex gloves or after the use of certain skin test reagents have been reported. Extracts prepared from latex gloves have variable allergenic potency, and skin-prick testing appears to have an increased risk for adverse reactions. Latex skin-prick tests should therefore be done cautiously starting with very diluted (1:1 million) extracts of the stock testing solution. This should only be done in an allergy center familiar with the test. Full emergency equipment must be available to treat possible systemic reactions. In vitro testing for latex protein-specific IgE antibodies (using radioallergosorbent tests, enzyme-linked immunosorbent assays, and Western blots) reportedly identifies 50% to 60% of persons with IgE sensitivity (17).

The American Academy of Allergy and Immunology has published guidelines (18) for providing care to persons with latex allergy. A flow chart for management of latex allergy is shown in Figure 1. Key points include the following:

1. All persons at risk for latex allergy should have a careful history and should complete a standardized latex allergy questionnaire (Table 1).
2. High-risk patients should be offered clinical testing for latex allergy. This includes children with spina bifida and health care workers with atopy (type I allergic reactions) (Table 1).

Table 1. Questionnaire for Identification of Possible Latex Allergy*

Medical history
Presence of atopy including hayfever, food allergy (especially reactions to banana, avocado, potato, and tomato), childhood or adult eczema, and asthma
Surgical history
Multiple surgeries
Intraoperative events consistent with anaphylaxis (episodes of urticaria or angioedema, respiratory distress, difficulty with ventilation), hypotension, reactions during dental procedures, and radiologic procedures (barium enema)
Occupational history
History of latex exposure; type of latex device, nature, and duration of exposure
Work-related symptoms of possible latex allergy
Cutaneous symptoms including hand dermatitis, eczema, and urticaria
Upper respiratory symptoms including nasal rhinorrhea, pruritus, and sneezing
Lower respiratory symptoms including cough, wheeze, and shortness of breath
Other symptoms including itchy hands, localized angioedema, possible systemic anaphylactic symptoms with use of household latex cleaning gloves, balloons, condoms, and diaphragms

* Sample of pertinent questions adapted from latex allergy questionnaire.

3. A latex-free environment is defined as one in which there is no latex glove use by any personnel. In addition, no direct patient contact should occur with other latex devices (catheters, condoms, adhesives, tourniquets, and anesthetic equipment).

4. Procedures on children with spina bifida should be done in a latex-free environment (Table 2).

5. Procedures on all patients with positive skin test results should be done in a latex-free environment.

Treatment of Latex Allergy

Patients with an irritant latex reaction should eliminate unnecessary glove use. Cotton liners or barrier creams can be effective treatments. Patients who have contact dermatitis (type IV delayed hypersensitivity reaction) to latex additives should be appropriately diagnosed by patch testing. The implicated allergen should be avoided by changing to a different glove (1).

Patients with a negative history for latex allergy but with a positive result from latex skin testing or radioallergosorbent testing (RAST) or both should have a latex glove challenge test called a "use test" (19). Patients with a positive latex challenge result should wear nonlatex gloves (Table 2). Patients with a negative challenge test result who have a positive result from latex skin testing or radioallergosorbent testing may tolerate low-protein latex glove use, but these patients should not have mucosal latex exposure during surgery or medical procedures.

Patients with symptomatic latex allergy often present with severe allergic rhinoconjunctivitis and asthma that require them to leave their workplace. Although it is known that latex proteins are the responsible allergens, cornstarch glove powder has an important role. Latex proteins are easily absorbed by glove powder and are aerosolized at levels similar to those of other occupational

Table 2. Nonlatex Alternatives for Patients Allergic to Latex*

Item	Manufacturer	Composition
Sterile surgical gloves		
Allergard, Tactyl 1 and 2	Johnson & Johnson	Synthetic copolymer
Dermaprene	Ansell	Neoprene
Elastyren	ECI	Styrene
Neolon	Becton Dickinson	Neoprene
Examination and procedure gloves		
Sensicare	Becton Dickinson	Vinyl
Tactyl 2	SmartPractice	Synthetic copolymer
Tactyl 1 and 2	SmartPractice	Synthetic copolymer
Elastyren	Baxter Corporation	Styrene-butadiene
N-Dex	Best Glove	Nitrile
N-Dex Long Cuff	Best Glove	Nitrile
Tru-touch	Becton Dickinson	Vinyl
Royal Shield/Vinylite	SmartPractice	Vinyl
Safe+Touch	A. R. Medicom	Vinyl
Sime Vinyl	Sime Darby Canada	Vinyl
Baxter	Baxter Corporation	Vinyl
Fisherbrand	Fisher Scientific	Vinyl
MediTouch	AMG Medical	Vinyl
Dispos-a-glove	Johnson & Johnson	Polyethylene/methyl Acrylate copolymer
Tape		
Micropore	3M	
Blenderm	3M	
Dressings		
Tegaderm	3M	
Steri-strips	Johnson & Johnson	
Catheters		
Silicone Foley	Sherwood	
Malecot	Cook Urological	
Drains		
Jackson Pratt (with silicone)		

* For complete list consult: *Compendium of Non-Latex Gloves*. Medical Devices Bureau, Health Protection Branch, Health Canada: July 1994.

respiratory allergens (10-12). Complete removal of powdered latex gloves has resulted in undetectable levels of airborne latex particles. When all their coworkers switch to using powder-free latex gloves, health care workers with latex allergies have been able to return to their workplace (12).

In 1991, latex and banana were reported to be cross-reactive. Patients with latex allergy have subsequently presented with allergies to avocado, kiwi, and chestnut (20). Clinically, these patients often have perioral itching and local urticaria, and they occasionally have been reported to have life-threatening, food-induced anaphylactic shock. The observed cross-reactivity of latex with avocado, kiwi, and chestnut probably occurs because latex proteins are structurally homologous with other plant proteins.

Latex is ubiquitous in the medical environment, and health care workers encounter these allergens by multiple routes, including compromised skin and mucous membranes of the respiratory tract. Once sensitized, these health care workers are at risk for severe systemic allergic reactions. The antigenic protein level on latex rubber devices should be reduced to prevent further sensitization and allergic reactions (21). Low-allergen latex gloves are available (22), and most manufacturers are working to lower protein levels. As cleaner products are brought to market, the incidence of new sensitization and adverse reactions is expected to decrease.

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References

1. Heese A, von Hintzenstern J, Peters KP, Kock HU, Hornstein OP. Allergic and irritant reactions to rubber gloves in medical health services. Spectrum, diagnostic approach, and therapy. *J Am Acad Dermatol*. 1991;25:831-9.
2. Scarbeck K. Latex: Is it safe? *Acad Gen Dentistry*. 1993;21:2-6.
3. Sussman GL, Tarlo S, Dolovich J. The spectrum of IgE-mediated responses to latex. *JAMA*. 1991;265:2844-7.
4. Slater JE. Allergic reactions to natural rubber. *Ann Allergy*. 1992;68:203-9.
5. Kelly KJ, Kurup VP, Reijula KE, Fink JN. The diagnosis of natural rubber latex allergy. *J Allergy Clin Immunol*. 1994;93:813-6.
6. Turjanmaa K. European medical experiences. From latex protein allergy: The present position. *Proceedings of the International Conference of Rubber Consultants and the European Rubber Journal*. 1993; P17-9.
7. Turjanmaa K. Incidence of immediate allergy to latex gloves in hospital personnel. *Contact Dermatitis*. 1987;17:270-5.
8. Arellano R, Bradley J, Sussman G. Prevalence of latex sensitization among hospital physicians occupationally exposed to latex gloves. *Anesthesiology*. 1992;77:905-8.
9. Charous BL, Hamilton RG, Yunginger JW. Occupational latex exposure: characteristics of contact and systemic reactions in 47 workers. *J Allergy Clin Immunol*. 1994;94:12-8.
10. Beezhold DH, Beck WC. Surgical glove powders bind latex antigens. *Arch Surg*. 1992;127:1354-7.
11. Swanson MC, Bubak ME, Hunt LW, Yunginger JW, Warner MA, Reed CE. Quantification of occupational latex aeroallergens in a medical center. *J Allergy Clin Immunol*. 1994;94:445-51.
12. Tarlo SM, Sussman G, Contala A, Swanson MC. Control of airborne latex by use of powder-free latex gloves. *J Allergy Clin Immunol*. 1994;93:985-9.
13. Hamann CP. Natural rubber latex protein sensitivity in review. *Amer J Cont Dermatitis*. 1993;4:4-21.
14. Turjanmaa K, Laurila K, Makinen-Kiljunen S, Reunala T. Rubber contact urticaria. Allergenic properties of 19 brands of latex gloves. *Contact Dermatitis*. 1988;19:362-7.
15. Kelly KJ, Kurup V, Zacharisen M, Resnick A, Fink JN. Skin and serologic testing in the diagnosis of latex allergy. *J Allergy Clin Immunol*. 1993;91:1140-5.
16. Spaner D, Dolovich J, Tarlo S, Sussman G, Butto K. Hypersensitivity to natural latex. *J Allergy Clin Immunol*. 1989;83:1135-7.
17. Turjanmaa K, Reunala T, Rasanen L. Comparison of diagnostic methods in latex surgical glove contact urticaria. *Contact Dermatitis*. 1988;19:241-7.
18. Task Force on Allergic Reactions to Latex. American Academy of Allergy and Immunology. Committee report. *J Allergy Clin Immunol*. 1993;92:16-8.
19. Lahti A, Turjanmaa K. Prick and use tests with 6 glove brands in patients with immediate allergy to rubber proteins. *Contact Dermatitis*. 1992;26:259-62.
20. Fernandez de Corres L, Moneo I, Munoz D, Bernaola G, Fernandez E, Audicana M, et al. Sensitization from chestnuts and bananas in patients with urticaria and anaphylaxis from contact with latex. *Ann Allergy*. 1993;70:35-9.
21. Beezhold DH. Measurement of latex proteins by chemical and immunological methods. From latex protein allergy: The present position. *Proceedings of the International Conference by European Rubber Journal and Rubber Consultants*. 1993.
22. 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.