



Supporting Documentation
On Latex Sensitivities

Latex Allergy

-Sumana Reddy, M.D.

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Latex Allergy

SUMANA REDDY, M.D.

Salinas Valley Medical Group, Salinas, California

Natural latex from the rubber tree *Hevea brasiliensis* is an allergen in persons with significant cumulative latex exposure, such as those in the health care and rubber industries, as well as those undergoing repeated surgeries, especially if they undergo surgeries early in life. Symptoms of latex allergy may progress rapidly and unpredictably to anaphylaxis. The prevalence of latex allergy has increased as the use of rubber gloves in health care settings has increased. Airborne latex particles that adhere to the cornstarch used to powder gloves are a significant cause of respiratory symptoms and a source of sensitization. Once an individual has become sensitized, he or she may experience allergic symptoms when exposed to any product containing latex. Diagnosis is made initially by the history. Latex-specific IgE testing and skin prick testing may confirm the suspicion. The most effective strategy in the treatment of latex allergy is avoidance; however, there is a large group of sensitized people who have not been identified and who do not recognize that their symptoms are caused by latex allergy. Physicians caring for latex-sensitive persons must act as their advocates in building awareness of the problem and developing protocols for their safe care. Latex-sensitized persons should be educated about the latex content of common objects. A patient information handout on latex allergy, written by the author of this article, is provided on page 101.

Natural rubber latex has been in widespread use for over a century. Reports of immediate hypersensitivity to latex have increased dramatically since the first case was reported (in English) in 1979.¹ Sixteen deaths occurred in association with the use of a latex barium enema tip, leading to the recall of the device in 1991 by the U.S. Food and Drug Administration (FDA)² and an increase in awareness of the risk of a life-threatening type I allergy associated with natural latex devices. Ten to 17 percent of health care workers have already become sensitized, and over 2 percent have occupational asthma as a result of latex exposure.³

Other persons at high risk of sensitization include those with cumulatively prolonged exposure to latex. Among those who have undergone repeated surgeries, particularly early in life--especially those with myelomeningocele (spina bifida) or urogenital abnormalities--the prevalence of latex allergy may be greater than 60 percent (*Table 1*). Workers in the latex manufacturing industry are also at risk, with one glove manufacturing plant reporting a 3.7 percent prevalence of occupational asthma caused by latex allergy among its employees, based on positive results of skin prick testing and spirometric data.⁴ Among workers at a latex doll manufacturing plant, the prevalence of latex sensitization was also shown to be significant.⁵

While studies repeatedly uncover high prevalence rates, the nonspecific nature of symptoms and lack of knowledge about latex allergy result in missed diagnosis in many sensitized persons who are at risk of progression to serious allergic reactions.

Since 1985, the establishment of policies of "universal precautions" and the increased barrier requirements resulting from the epidemic of human immunodeficiency virus infection and acquired immunodeficiency syndrome have resulted in an exponential increase in the use of latex gloves. In 1987, 1 billion latex gloves were imported into the United States; in 1988, 8 billion gloves were imported.⁶ The use of latex condoms has also increased. It appears that the increase in total exposure to latex and variations in manufacturing have led to a true increase in the number of persons with latex sensitivity.

Illustrative Case

A 37-year-old woman reported that during college, she had experienced three bouts of urticaria of unknown origin involving lip mucosa and skin. She experienced similar symptoms following repair of a fractured femur, but these symptoms were attributed to an antibiotic reaction. While the patient was in medical school, she noted occasional localized hives following use of latex gloves and, despite switching to "hypoallergenic" latex gloves, she continued to have hives every few months. Increased urticaria, at times generalized, continued to occur. During the patient's second pregnancy, a vaginal examination with membrane stripping was performed by a physician wearing latex gloves. Within 30 minutes of this procedure, the patient had an anaphylactic reaction that necessitated hospitalization and resuscitation. One week later, a nonelective cesarean delivery necessitated multilevel consultation to create a latex-free environment for her safe care.

At five-year follow-up, the patient has been forced to leave hospital practice because of symptoms of asthma. She now works in a clinic where latex is not used, but she continues to have hives whenever staff (wearing latex gloves) from an adjacent dental clinic are in proximity. She reports a history of atopic illness and has developed food allergies to avocado and melon.

Latex Origins and Latex Products

Latex products are derived from the latex sap of commercially grown rubber trees, *Hevea brasiliensis*. The sap is extracted and heated while chemical preservatives, primarily ammonia, are added to enhance the rubber's structural qualities. Latex contains low-molecular-weight soluble proteins, which are the cause of IgE-mediated allergic reactions. At least 10 different proteins have been implicated.⁷ Added accelerators and antioxidants may also be significant mediators of type IV or allergic contact dermatitis, and may cause or exacerbate irritant contact dermatitis.

Latex products are made either by pouring the rubber into molds or by forming a coating in a dipped process, as is done with gloves, balloons and condoms. Dipped, or very soft, rubber products appear to have the highest content of latex proteins and, therefore, have the greatest allergenic potential. Cornstarch powder is applied to latex gloves during the manufacturing process to prevent stickiness and give the gloves a smooth feel. Latex protein particles have been shown to adhere to the surface of these cornstarch particles and to aerosolize on removal of the gloves.⁸

High-exposure areas, such as operating rooms and labor and delivery suites where powdered latex gloves are used, contain sufficiently elevated concentrations of aerosolized latex to produce significant symptoms in sensitized persons. Based on manufacturer, lot number and type of gloves, considerable variation exists in the antigenicity of latex gloves and the potential for aerosolization of latex by the "snap" of gloves on removal.^{9,10}

Latex proteins are water soluble. Manufacturing processes including washing, chlorination and other treatments can reduce the burden of latex protein antigen. Low protein, powder-free gloves have minimal potential for sensitization in those who have not yet become sensitized to latex.

TABLE 1
Risk Groups for Latex Allergy*

Health care workers
Rubber industry workers
Persons with spina bifida or urogenital abnormalities
Persons who have undergone repeated or prolonged surgeries or mucous membrane exposure to latex devices, especially early in life
Persons with an atopic history or history of food allergy (cross-reacting proteins, especially in banana, avocado, passion fruit, chestnut, kiwi fruit, melon, tomato, celery)

*--Even patients with no identifiable risk factors may experience significant allergic reactions to latex.

Allergic Reactions

Latex allergy can give rise to a broad range of symptoms (*Table 2*). Glove wearers may experience a type IV, or delayed hypersensitivity, contact dermatitis that ranges from nonspecific pruritus to eczematous, red, weepy skin. These symptoms and the irritant contact dermatitis are caused by the accelerators and chemicals used in glove manufacture and not by the latex itself. Avoidance of latex gloves or the use of glove liners, and attention to hand care and minimizing occlusion, are often sufficient to contain these symptoms.

Anaphylactic reactions to latex have been reported in persons who had previously only experienced irritant or allergic contact dermatitis. One theory is that underlying dermatitis breaches the skin's protective barrier, facilitating increased latex protein absorption and increasing the likelihood that the person will become sensitized to latex.⁸ Contact dermatitis may also be caused by a wide range of chemicals used in glove manufacturing; in particular, the accelerators.

Direct skin contact with latex may cause a type I, or immediate hypersensitivity, IgE-mediated reaction within 30 to 60 minutes of exposure. Urticaria may be local or generalized, and the spectrum of progression is notably unpredictable--some persons have experienced anaphylactic reactions after having minimal or no previous symptoms. It is possible to have used latex gloves for years and to suddenly have a progression to systemic symptoms.

Studies indicate that over 50 percent of persons who are sensitive to latex have a history of some type of atopic illness.¹¹ It has been shown that among atopic health care workers, one in four have a positive skin prick test to latex. Since only 50 percent of these persons were clinically symptomatic, the clinical implications for the other 50 percent remain uncertain.¹²

TABLE 2
Symptoms of Latex Allergy

Irritant contact dermatitis (nonimmune)

Gradual onset, over days, caused by hand washing, occlusion, antiseptics and glove chemicals; symptoms include redness, cracks, fissures, scaling

Allergic contact dermatitis, or type IV (delayed hypersensitivity)

Onset six to 48 hours after contact, caused by chemicals; symptoms include erythema, vesicles, papules, pruritus, blisters, crusting

Immediate hypersensitivity, or type I

Onset within minutes, very rarely longer than two hours, caused by latex; symptoms include local and generalized urticaria, feeling of faintness, feeling of impending doom, angioedema, nausea, vomiting, abdominal cramps, rhinoconjunctivitis, bronchospasm, anaphylactic shock

Curiously, certain fruits such as bananas, chestnuts, kiwi fruit, avocado and tomato¹³ show cross-reactivity, perhaps because of resemblance to a latex protein component. These foods have been responsible for anaphylactic reactions in latex-sensitive persons, while many other foods, including figs, apples, celery, melons, potatoes, papayas and pitted fruits, such as cherries and peaches, have caused progressive symptoms beginning with oral itching.¹⁴ Persons with a history of reactions to these foods are at increased risk of developing latex allergy, and those who are sensitive to latex should avoid foods to which they have had previous reactions. While food cross-reactions remain an evolving area of knowledge, it is clear that the elimination of all of these foods would cause significant dietary restriction and is therefore not recommended categorically for latex-allergic persons.

Latex products can produce contact dermatitis, urticaria and anaphylaxis; even aerosolized latex particles can cause significant allergic symptoms in sensitized persons.

TABLE 3
Screening Questionnaire to Determine Latex Sensitivity

Allergies

Do you have a history of hay fever, asthma, eczema, allergies or rashes?

Are you allergic to any foods, especially bananas, avocados, kiwi or chestnuts? Do you experience rash, oral itching, swelling or wheezing when exposed to these foods?

Occupation

Are you exposed to any products that contain latex, including gloves, at work?

Have you ever had an allergic reaction to something in your work environment?

If you have had a rash on your hands after wearing latex gloves, how long after putting on the gloves did the rash develop?

What did the rash look like?

Hidden reactions to latex

Have you ever had swelling, itching, hives, shortness of breath, cough or other allergic symptoms during or after blowing up a balloon, undergoing a dental procedure, using condoms or diaphragms, or following a vaginal or rectal examination?

Have you ever had an allergic reaction of unknown cause, especially during a medical or dental procedure?

Surgical history

Have you ever had surgery? If so, what kind?

Do you have spina bifida or any urinary tract problem requiring surgery or catheterizations?

Diagnosis

Diagnosis of latex allergy is made by the history and by immunologic testing; a thorough medical history is the cornerstone of diagnosis. The patient should be asked about his or her occupation, and other factors for high risk should be explored (*Table 3*). Also, the history should determine whether previous reactions have occurred in an occupational or other setting and, if so, what type of reactions occurred. Reactivity to foods, symptoms following use of a rubber condom or diaphragm, or symptoms associated with pelvic examination should raise the suspicion of latex sensitivity (*Table 4*).

Frequently, either because of a lack of awareness of latex allergy and/or because of a concomitant history of atopic illness, sensitized persons do not attribute their respiratory symptoms of rhinoconjunctivitis or bronchospasm to latex exposure. For this reason, eliciting a suspicious history before elective surgery or other major latex exposure is of utmost importance. However, none of the patients whose deaths were attributed to anaphylaxis caused by latex exposure had any known risk factors other than atopic illness, illustrating that the above precautions may be insufficient.¹⁵

Standardized extracts for skin prick testing are not available in the United States. Therefore, because such testing may cause anaphylaxis, it should only be conducted by centers with experience in preparing extracts. FDA-approved in vitro tests to measure latex-specific IgE are available (Pharmacia CAP, Pharmacia-UpJohn Diagnostics Inc, Kalamazoo, Mich.; AlaSTAT, Diagnostic Products Corp., Los Angeles, Calif.).¹⁶ The low specificity of these tests, which have a false-negative rate of at least 20 percent and, thus, unclear positive predictive value, limits clinical usefulness. Negative serologic testing with a strongly positive history would suggest the value of skin prick testing to confirm the diagnosis.

Management

In a health care setting, the two major strategies for management are (1) prevention and treatment of occupational latex allergy in employees, and (2) the safe care of the latex-allergic patient. The cornerstone of latex allergy treatment is avoidance. Many persons who are constantly exposed to powdered gloves, the most sensitizing latex product, are likely to become sensitized. Workplace decisions should be made to reduce cumulative exposure to latex, including the widespread purchase of

Reactions to condoms or diaphragms, symptoms associated with pelvic examinations or a history of atopic dermatitis should alert the patient or physician to the possibility of latex allergy.

Cumulative exposure to latex in the workplace may be reduced through the use of nonpowdered, low-protein latex and nonlatex gloves.

nonpowdered, low-protein latex and nonlatex gloves. New ways of treating latex have resulted in powder-free gloves that are actually easier to don than powdered gloves. Some newer glove products have very low solubilized and aerosol titers of proteins, but wide variation remains between brands. For health care workers and patients who are allergic to latex, nonlatex gloves must be used. The National Institute of Occupational Safety and Health (NIOSH) has just published an advisory document on natural latex rubber in the

workplace. It recommends that nonlatex gloves be used for all activities that are not likely to involve contact with infectious materials (e.g., food preparation, routine housekeeping and maintenance).¹⁷

TABLE 4
Sources of Possible Latex Exposure

Medical	Mattresses on stretchers	Sports equipment
Gloves	Dental devices	Carpet backing
Urinary catheters	Stethoscope and blood pressure cuff tubing	Feeding nipples and pacifiers
Face masks	Ambu bags	Clothing, including elastic on underwear
Tourniquets	PCA syringes	Food handled with powdered latex gloves
Adhesive tape		Handles on racquets, tools
Bandages	Household	Diapers, sanitary and incontinence pads
Wound drains	Balloons	Computer mouse pads
Injection ports	Condoms and diaphragms	Buttons on electronic equipment
Electrode pads	Rubber bands	
Rubber syringe stoppers and medication vial stoppers	Shoe soles	
Bulb syringes	Erasers	
	Toys	

NOTE: A more detailed and periodically updated list of latex-containing products and nonlatex substitutes is available from the Spina Bifida Association of America-- telephone: 800-621-3141, or on the World Wide Web: <http://www.infohiway.com/spinabifida/latex.html>. A compilation of information about latex allergy is available at this address: http://pw2.netcom.com/~nam1/latex_allergy.html

Any product containing latex may trigger a reaction. Therefore, cautious investigation of products at home, in the workplace and at sites of medical and dental care should occur. Manufacturers are increasingly providing lists of products that contain latex. Some nonlatex gloves have similar tensile strength and tactility to latex gloves. While vinyl gloves are not as effective as latex gloves against viral penetration, the American Society for Testing and Materials (ASTM) has demonstrated that other nonlatex materials provide excellent barrier integrity. Vinyl is comparable to latex in cost, but other materials are generally more expensive.

The physician caring for the latex-allergic person must act as both advocate and educator. Sensitized health care workers may be unable to perform their duties unless they avoid latex products and efforts are made in the workplace to reduce airborne antigen exposure. Such efforts provide the additional benefit of decreasing the risk of future sensitization in workers who are not currently affected.

In managing the patient with latex sensitivity, the distinctions between a true type I (or immediate hypersensitivity reaction to latex) and irritant and allergic contact dermatitis reactions caused by other factors must be considered. Any evidence of a history of type I reactions necessitates a latex-free environment. In the hospital setting, protocols for the emergency department, operating room and other areas where patients may come into contact with latex should be established and should be available to all hospital staff, including housekeeping staff (*Table 5*). At the time of admission, latex allergy status should be established by the history or screening questionnaire. Status should be documented and prominently displayed at the door and the bedside and on wristbands. Emergency department, operating room and crash cart supplies should include nonlatex products. "Hypoallergenic" latex gloves contain significant amounts of latex allergens and should not be worn in the vicinity of persons who are allergic to latex.

Latex-sensitive patients undergoing surgery should be scheduled as the first case of the day, when aerosolized latex particles are at a low. If blood pressure cuffs and tubing are made of latex, the patient's extremities should be wrapped to prevent contact. While it has been recommended that medications not be drawn up through rubber-stoppered vials or allowed to sit in preloaded syringes that contain latex rubber, and that latex ports should not be used for intravenous injections, these precautions appear to be impractical for all but the most exquisitely latex-sensitive patient and are likely not necessary. Premedication with antihistamines, steroids and histamine H₂-blockers is sometimes carried out, but anaphylactic reactions have occurred despite such pretreatment.¹⁸

TABLE 5
Latex Allergy Management
Guidelines for the Hospital Setting

Ask all patients about latex sensitivity, using a screening questionnaire if relevant.

Include latex allergy information on patient's identification bracelet.

Label room "latex safe" and enter in all relevant areas of signage, notes and databases.

Disseminate latex allergy protocol and lists of nonlatex substitutes for latex-containing materials that may contact the patient.

Remove all latex products, including gloves, that may contact the patient.

Use tubing made of polyvinyl chloride (PVC) or, if using latex cuffs and tubing or tourniquets, wrap cotton gauze over patient's extremities.

Check adhesives and tapes, including electrocardiography electrodes and dressing supplies, for latex content.

Have a crash cart with latex-free supplies available to follow the patient through his or her stay.

Notify the pharmacy and central supply that the patient is sensitive to latex so that latex contact can be eliminated when materials or drugs are prepared for the patient.

Notify dietary staff of relevant food allergies and avoid handling food with powdered latex gloves.

As the FDA has established rules for labeling all medical devices that contain natural rubber latex,¹⁹ the process of identifying these products in the medical setting should be simplified.

Persons with latex hypersensitivity should carry an epinephrine auto-injection kit and wear Medic-Alert identification. Carrying extra pairs of nonlatex gloves for emergency medical or dental care is also advisable. The Spina Bifida Association of America (telephone: 800-621-3141) produces a list of latex products and latex-free substitutes in both community and hospital settings. This detailed list is helpful in preparing hospital protocols or finding nonlatex replacements for materials (*Table 6*).

TABLE 6
Hypoallergenic Nonlatex Gloves

Brand name	Material	Company	Cost vs. latex
Surgical gloves			
Dermaprene	Neoprene (polychloroprene polymer)	Ansell (telephone: 800-327-8659)	6x
Neolon	Neoprene (polychloroprene polymer)	Maxxim (telephone: 800-346-8849)	6x
Elastyren	Styrene butadiene block polymer	Center Labs (telephone: 800-437-6251)	5x
Tactylite	Styrene ethylene butadiene co-polymer	Smartpractice (telephone: 800-822-8956)	10x
Pure Advantage	Nitrile* (butadiene co-polymer)	Tillotson (telephone: 800-445-6830)	2x
Allergard	Styrene butadiene block polymer	Allergard (telephone: 800-255-2500)	5x
Examination gloves			
Royal Shield	Polyvinyl chloride	Smartprctice (telephone: 800-822-8956)	Comparable
Sensicare and Trutouch	Polyvinyl chloride	Maxxim (telephone: 800-346-8849)	Comparable
Allerderm	Polyvinyl chloride and nitrile	Allerderm (telephone: 800-365-6868)	1.5x and 2.x
Triflex	Polyvinyl chloride	Allegiance (telephone: 800-653-6021)	Comparable
N-DEX	Nitrile* (butadiene co-polymer)	Best Glove (telephone: 800-241-0323)	4x

*-- Gloves made from nitrile are produced with the same accelerator mercaptobenzothiazole, as some latex gloves. Persons with suspected irritant or allergic contact dermatitis to latex gloves may also react to nitrile.

Treatment of Reactions

Acute systemic reactions to latex should be treated in the same manner as any anaphylactic reaction. The airway, breathing and circulation are assessed, oxygen is provided, and epinephrine and steroids are administered. Diphenhydramine (Benadryl) may be used for urticaria. In the course of resuscitation, all latex contact is avoided. Fluids and nebulized medications for bronchospasm may be required. Treatment should be continued with monitoring after symptoms resolve. It is unfortunate that for the exquisitely latex-sensitive person, the hospital and emergency department settings may be the most fraught with danger. Growing awareness of the magnitude of health risk posed by latex allergy may improve this paradoxical situation.

The Author

SUMANA REDDY, M.D.

is a family physician in Salinas, Calif. Dr. Reddy earned a medical degree from the University of Toronto Faculty of Medicine, Ontario, Canada, and completed a residency in family practice at Natividad Medical Center, Salinas, through the University of California, San Francisco, School of Medicine.

Address correspondence to Sumana Reddy, M.D., Salinas Valley Medical Group, 909 Blanco Circle, Salinas, CA 93901. Reprints are not available from the author.

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