REVIEW

ALTON L. MELTON, MD Dr. Melton is head of the Section of Allergy and Immunology in the Department of Medical Subspecialty Pediatrics at the Cleveland Clinic.



Managing latex allergy in patients and health care workers

ABSTRACT: The new and important problem of latex allergy deserves the attention of all health care professionals and institutions. Latex products we use every day may cause serious consequences for patients and coworkers. All providers must develop a plan for protecting allergic patients and staff from latex exposure, and for managing allergic reactions should they occur.

n recent years many patients and health care workers have been placed at risk by a marked increase in serious allergic reactions to latex. Until recently, latex (or natural rubber) was considered relatively harmless and inert, except for occasional cases of contact dermatitis. However, during the past decade latex allergy has been responsible for a growing number of severe and occasionally fatal anaphylactic reactions.

Latex is used in numerous consumer and medical products. Its barrier properties, elasticity, and shape memory make it the preferred material for surgical and examination gloves and a host of other devices used in everyday medical and dental practice. It is hard to replace with alternative materials.

All health care professionals need to know about this potential hazard and be able to manage it effectively if encountered. To that end, this review summarizes current knowledge about latex allergy.

HOW LATEX IS MADE

Latex is a complex product of the Brazilian rubber tree *Hevea brasilien*sis, mostly grown on rubber plantations in Malaysia and surrounding countries. The latex flows in lactifers under the surface of the bark. Workers tap the tree by making diagonal cuts in the bark and collecting the milky sap that oozes forth. The raw product is mixed with a preservative such as ammonia, concentrated, and shipped to

KEY POINTS:

Sensitized persons need to avoid latex exposure completely, an approach that may appear simplistic, but the only effective method currently available.

Allergic reactions to latex can take two forms: contact dermatitis (provoked by chemical additives used in manufacturing) and immediate hypersensitivity reactions (provoked by the natural latex proteins).

"Hypoallergenic" gloves are not necessarily safe; they cause less contact dermatitis but can still provoke immediate hypersensitivity reactions.

Latex absorbed by glove powder can become aerosolized and cause rhinitis, conjunctivitis, and asthma. manufacturers as ammoniated latex concentrate.¹

Vulcanization (heating in the presence of sulfur) greatly enhances the elasticity, strength, and stability of latex; numerous chemical "accelerators" reduce the temperature and time required.² These accelerators can cause allergic reactions, and are responsible for many cases of contact dermatitis.³

Chemically, latex contains cis-polyisoprene (the major component), water, and lipids. Proteins, such as prenyltransferase and rubber elongation factor, account for less than 5% of its weight, but polymerize the basic isoprene molecule to molecular weights that can exceed 100 000 daltons.³ These proteins cause virtually all the severe immediate hypersensitivity reactions.⁴

TYPES OF LATEX ALLERGIC REACTIONS

Contact with natural latex rubber usually produces no injury at all. However, possible reactions can take several forms.

Nonimmunologically mediated dermatitis

Abrasion and maceration can cause nonimmunologically mediated dermatitis in persons who wear gloves constantly, such as medical or laboratory personnel.

Contact reactions

True contact dermatitis can develop through the immunologic mechanism of delayed hypersensitivity (Gell and Coombs type 4), usually hours to days after latex contact. Well described and known for decades,⁵ latex contact dermatitis causes the same symptoms observed with other contact allergens such as nickel or poison ivy—usually itching, redness, and occasional blistering in areas of direct contact.

The causative agent is often an accelerator or a similar additive. "Hypoallergenic" latex gloves, which contain little or no additives, cause significantly less contact dermatitis, but do not prevent other types of allergic reactions.

In many cases, contact urticaria reflects an

IgE-mediated immediate hypersensitivity reaction. However, not all cases of contact urticaria are associated with detectable latexspecific IgE.⁶ This contact urticaria may represent a transitional stage in a progression between contact dermatitis and immediate hypersensitivity. Some patients initially develop delayed-type contact dermatitis, then urticaria, and finally—months to years later systemic immediate hypersensitivity.⁶

Immediate hypersensitivity reactions

Immediate hypersensitivity reactions (Gell and Coombs type 1) usually occur within minutes of allergen exposure and are mediated by allergen-specific IgE molecules. These reactions, only recently recognized with latex allergy, typically cause urticaria, angioedema, rhinitis, conjunctivitis, bronchospasm, and anaphylaxis. The offending allergen is one of the several proteins contained in latex. Affected persons must eliminate latex exposure altogether—not even hypoallergenic latex gloves are safe.

CHARACTERISTICS OF IMMEDIATE HYPERSENSITIVITY REACTIONS

Immediate hypersensitivity reactions to latex were essentially unknown before Nutter⁷ reported contact urticaria in 1979, and others reported similar cases in the mid to late 1980s.^{8–10}

Situations in which anaphylactic reactions develop

During surgery. In 1989, Slater¹¹ reported two cases of intraoperative anaphylaxis in children with spina bifida, and demonstrated that latex allergy was the cause. Kelly et al¹² independently reported anaphylactic reactions to general anesthesia in children with spina bifida and latex allergy.

During barium enemas. Ownby et al¹³ studied several cases of fatal anaphylaxis during barium enemas, and found all the victims had evidence of sensitization to latex, which was contained in a balloon-tipped barium-injection device. The Food and Drug

"Hypoallergenic" latex gloves, which contain little or no additives, cause significantly less contact dermatitis, but do not prevent other types of allergic reactions Administration (FDA) subsequently summarized the numerous reports of anaphylactic reactions to latex-containing medical devices, including 15 deaths after barium enemas.¹⁴ Latex-tipped barium-injection devices are no longer in routine use.

Other situations. Anaphylactic reactions have also resulted from latex exposure during routine physical examinations,¹⁵ contact with a squash racket handle,¹⁶ intravenous fluid administration,¹⁷ childbirth,¹⁸ and contact with balloons and other rubber toys.¹⁹ One emergency medical services worker with latex allergy experienced anaphylaxis after handling a steering wheel covered with glove powder from the previous driver. A homemaker suffered reactions to glove powder adhering to clothing brought home by her spouse.²⁰

GROUPS AT RISK

Numerous case reports and series have helped clarify the nature of the problem, identify groups at high risk, and elucidate the types of exposures likely to cause sensitization and reactions.

Children with spina bifida are at extraordinarily high risk of latex hypersensitivity. In 1990, the New England Myelodysplasia Association surveyed 179 children with spina bifida and found that 28% had experienced allergic reactions to latex.²¹ Yassin et al²² performed latex allergy skin testing in 79 spina bifida patients; 49 of them had positive results. Moneret-Vautrin et al²³ found that 32% of their spina bifida patients with no history of latex allergy had positive skin-test results.

Using allergy skin testing, we found that 21 of 42 spina bifida patients had evidence of sensitization, although most had no history of latex-allergic reactions.²⁴ Konz et al²⁵ found that patients with spina bifida had an increased risk of latex allergy, but other neurologic or neurosurgical patients did not.

Patients with congenital urologic abnor*malities* such as bladder exstrophy also have a high risk of severe latex allergy. Gold et al²⁶ reported 19 episodes of intraoperative anaphylaxis in 15 children with either congenital urologic abnormalities or spina bifida. We have also seen a few children with latex allergies and positive skin-test results who had no obvious risk factors.

Health care workers, who have frequent and prolonged occupational exposure to latex, also have an increased risk of developing severe latex allergy, although their risk appears lower than that of spina bifida patients.²⁷ However, the large number of highly skilled professionals involved make this population incredibly important, especially considering the issues of employee safety and disability.

In Finland, Turjanmaa⁹ found that 7.4% of operating-room nurses, 2.8% of clinic and laboratory workers, and 0.8% of non-health-care workers were latex-sensitive. Yassin et al²⁸ studied 224 hospital employees and found 38 (17%) of them had positive skin-test results. Our own studies have shown a similar prevalence among dental professionals²⁹ and emergency medical services workers.³⁰ Susmann et al³¹ found 8% of hospital housekeepers had positive latex skin-test results.

Rubber industry workers may have a prevalence of latex allergy similar to that of health care workers, although less is known about this group and few studies have been done. Bascom et al³² reported an overall increase in serum IgE levels and eosinophil counts in workers with high exposure. Tarlo et al³³ found that 11% of workers at a latex glove factory had positive allergy skin test results. Of the 81 workers studied, five had symptoms of asthma at work. Orfan et al³⁴ reported two cases of occupational asthma in workers at a latex doll factory.

The general population. Assessments of prevalence in groups without defined risk factors suggest there is a low but definite level of latex sensitization in the general population. Hadjiliadis et al³⁵ tested 224 adult allergy patients (11% were health care workers) and found 4.5% of them were allergic to latex. Merrett et al³⁶ tested 1436 adult blood donors in the United Kingdom and found between 4.1% and 7.9% had latex-specific IgE. Reinheimer and Ownby³⁷ found 24 of 200 serum samples from allergy patients had measurable latex-specific IgE.

LATEX ALLERGENS

Investigators have learned a great deal about the allergenic properties of latex and latexcontaining products in recent years, using radioallergosorbent test (RAST) inhibition assays to measure the relative allergenicity of latex products.

Products vary widely in allergen content. For example, the allergen content of surgical and examination gloves varies up to 300-fold among manufacturers and even among lots

Anaphylactic reactions have resulted from latex exposure during routine physical examinations

Downloaded from www.ccjm.org on May 7, 2025. For personal use only. All other uses require permission.

from the same manufacturer.³⁸ Further, latex allergen can be found in many "hypoallergenic" gloves. Gloves and balloons tend to have higher latex allergen content than syringe plungers, condoms, and rebreather bags.³⁹

Powdered gloves increase aerosolization. Many latex allergens are water-soluble and easily absorbed by the cornstarch used in glove powder. During glove changes, this powder can become aerosolized and cause rhinitis, conjunctivitis, and asthma.⁴⁰ Swanson et al⁴¹ found considerable amounts of latex allergen in the air of hospital areas where rubber gloves were regularly used, and on the laboratory coats of personnel in those areas. Tarlo et al⁴² found that changing to powder-free gloves reduced the airborne allergen load to undetectable levels.

Several foods share cross-reactivity with *latex*, notably bananas, avocados, and chestnuts.^{43–49} Two of our patients experienced anaphylaxis to both latex and bananas.⁴⁷

LATEX ALLERGY DIAGNOSIS

The diagnosis of latex allergy is based mainly on the clinical history and on examination of the involved areas; the clinical history often provides the most important diagnostic information. Testing for immediate hypersensitivity to latex is particularly difficult for most physicians because of a paucity of standardized, FDA-approved testing materials. No material for latex skin testing has yet been approved by the FDA, and commercially available in vitro tests were found insufficiently sensitive in preliminary studies.^{19,50}

For these reasons, some researchers use their own materials for skin testing and in vitro analysis. Unfortunately, even epicutaneous skin testing can provoke anaphylactic reactions.^{51,52} Because of these problems and risks, physicians should rely only on skin testing by experienced investigators or on newer in vitro tests with higher sensitivity performed by reputable laboratories.

Testing for contact dermatitis is best done

by patch testing with latex and latex additives, such as accelerators. "Use" tests have also been advocated: the patient places a latex glove on one finger and then gradually increases the level of skin contact with the glove.⁵³

MANAGING LATEX-ALLERGIC PATIENTS

Management involves identifying the problem and completely avoiding allergen exposure. Identification not only includes diagnosing the allergy, but also assessing the risk of a reaction. Persons with contact dermatitis alone have a low risk of severe reactions, but do need to avoid latex or additives to control their symptoms. A trial of latexfree or additive-free gloves can help determine if the dermatitis will resolve. Patch testing can help to confirm the identity of the offending agent with reasonable accuracy.

Persons with a convincing history of immediate hypersensitivity reactions and children with spina bifida or congenital urologic anomalies have such a high risk as to warrant comlatex plete avoidance regardless of current allergy status. Health care workers and rubber-industry workers should be asked about latex allergy, and testing should be considered.

Avoiding allergen exposure may appear a simplistic approach to managing a potentially

TABLE 1

PATIENT CARE PRODUCTS THAT OFTEN CONTAIN LATEX

Gloves

Sterile surgical gloves Nonsterile examination gloves Finger cots

Intravenous supplies

Bags (latex injection port) Tubing (latex injection port) Buretrols Medication pumps Multidose medication vials PRN adaptor (heparin lock)

Respiratory supplies

Ambu bags Rubber suction catheters Face masks Airways Endotracheal tubes Ventilator bellows

Catheters

Indwelling Foley catheters Condom catheters Straight catheters Rectal pressure catheters Urodynamic catheters

Surgical supplies

Anesthesia bags and circuits Drains (rubber, Penrose) Gastrostomy tubes Disposable hats, shoe covers, masks

Dental supplies

Bite blocks Cofferdams Orthodontic elastics Teeth protectors

Hospital and nursing supplies

Disposable syringes Stethoscope tubing Tourniquets Absorbent bed pads Dressings Adhesive tape Blood pressure cuffs Electrocardiographic electrode pads Adhesive strips Bulb syringes

TABLE 2

CONSUMER PRODUCTS THAT OFTEN CONTAIN LATEX

Household gloves Rubber balls Balloons Condoms Diaphragms Carpet backing and pads Foam rubber Bath mats Elastic in clothing and disposable diapers Infant pacifiers and bottle nipples Rubber toys Rubber bands Automobile tires Swimming, snorkeling, and scuba equipment Athletic shoes Crutches (arm and hand pads) Rubber cement Rubber boats Sports racquet handles Wheelchair tires, cushions Pencil erasers Art and craft supplies Halloween masks

TABLE 3

LATEX-FREE MEDICAL GLOVES

Vinyl

TruTouch* (Becton Dickinson) Vinylite (SmartPractice) Triflex vinyl* (Baxter Pharmaseal) Allerderm vinyl (Allerderm Labs) SensiCare* (Becton Dickinson) Royal Shield (SmartCare)

Neoprene

Dermaprene* (Ansell) Neolon* (Becton Dickinson)

Nitrile

Allerderm Nitrile* (Allerderm Labs) N-dex (Best Company) Nitrile* (Pure Advantage)

Thermoplastic elastomer

Tactyl 1* (Allerderm Labs) Allergard (Johnson and Johnson) Tactylite* (Smart Care)

Styrene-butadiene block polymer Elastyren* (Hermal)

*Available sterile

life-threatening problem, but it is the only effective method currently available. Avoiding latex may be difficult because of the extensive use of latex products in medical (TABLE 1) and consumer goods (TABLE 2).^{54–56} Fortunately, suitable latex-free replace-

ments do exist for most items—but not all: condoms made from animal sources do not adequately protect against viral transmission during sexual contact.

Treating allergic reactions

Treatment for allergic reactions to latex is similar to that for reactions to other allergens. First, the patient must be removed from allergen contact. Contact dermatitis and eczematoid reactions usually respond to topical corticosteroids. Immediate rhinitis and conjunctivitis can be treated with systemic or topical corticosteroids. antihistamines and Cutaneous urticaria also responds well to systemic antihistamine therapy and corticosteroids, but may require epinephrine if it becomes rapidly progressive with development of angioedema. Asthmatic reactions should be treated aggressively with bronchodilators and may require corticosteroid treatment if persistent.

Anaphylaxis, the most serious complication of latex allergy, can be life-threatening. Treatment needs to be swift and aggressive. Injectable epinephrine is the drug of choice, accompanied by systemic antihistamine. Appropriate respiratory and cardiovascular support can be life-saving. Pretreatment with antihistamines, corticosteroids, and bronchodilators does not necessarily prevent anaphylactic reactions to latex or other IgEmediated anaphylactic reactions, although it may prevent reactions to radiocontrast media.⁵⁷

RECOMMENDATIONS

The American Academy of Allergy, Asthma, and Immunology and the American College of Allergy, Asthma and Immunology have outlined general concerns and possible solutions.^{58,59}

• Every institution that uses latex products must establish policies to protect allergic patients and workers, and prevent latex allergy from developing in the future.

• All health care providers should ask if their patients are allergic to latex before exposing them to it. Patients allergic to latex should have this information permanently indicated in the chart, on the hospital room door, and at the bedside.

• Patients allergic to latex need a latexfree medical environment. This includes latexfree hospital rooms, latex-free procedure trays and crash carts, substitutes for latex products on every floor, latex-free operating rooms (or provision for such patients to be scheduled first in the day), and allergy consults for patients at risk.

• Latex-free gloves should be provided for latex-allergic health care workers (TABLE 3). Gloves are the single major source of potential latex exposure in the medical environment. Suitable substitutes now exist for both examination and surgical gloves. These gloves, made of vinyl, neoprene, or synthetic material, provide adequate barrier and tactile performance and some are equivalent to latex in nearly all respects. One major university hospital has switched almost completely to latex-free gloves.⁶⁰ Coworkers who prefer latex gloves

80 CLEVELAND CLINIC JOURNAL OF MEDICINE VOLUME 64 • NUMBER 2 FEBRUARY 1997

-

should only wear powder-free low-allergen gloves to eliminate airborne sources of latex exposure.

- For workers and patients with contact dermatitis, low-allergen, powder-free, additive- free gloves should help.
- Perhaps most helpful, manufacturers should clearly label products that contain latex. The term "hypoallergenic" should be eliminated from gloves and replaced with "low-addi-

REFERENCES

- Pendle TD. The production, composition and chemistry of natural latex centrates. International Latex Conference [abstract #1]. Baltimore, Nov 1992.
- Tillotson TN. The manufacture of products from latex—an overview. International Latex Conference [abstract #2]. Baltimore, Nov 1992.
- Slater JE. Latex allergy. J Allergy Clin Immunol 1994; 94:139–149.
 Hammann CP. Natural rubber latex protein sensitivity in review.
- Am J Contact Derm 1993; 4:4–21.
- Taylor JS, Praditsuwan P. Latex allergy. Review of 44 cases including outcome and frequent association with allergic hand eczema. Arch Dermatol 1996; 132:265–271.
- Charous BL, Hamilton RG, Yunginger JW. Occupational latex exposure: characteristics of contact and systemic reactions in 47 workers. J Allergy Clin Immunol 1994; 84:12–18.
- Nutter AF. Contact urticaria to rubber. Br J Dermatol 1979; 101:597–598.
- Axelsson JG, Johansson SGO, Wrangsjo K. IgE-mediated anaphylactoid reactions to rubber. Allergy 1987; 42:46–50.
- Turjanmaa K. Incidence of immediate allergy to latex gloves in hospital personnel. Contact Derm 1987; 17:270–275.
- Taylor JS, Cassettari J, Wagner W, Helm T. Contact urticaria and anaphylaxis to rubber. J Am Acad Dermatol 1989; 21:874–877.
- Slater JE. Rubber anaphylaxis. N Engl J Med 1989; 320:1126–1130.
 Kelly K, Sitlock M, Davis JP. Anaphylactic reactions during general
- anesthesia among pediatric patients. MMWR 1991; 40:437–443. 13. Ownby D, Tomlanovich M, Sammons N, McCullough J. Fatal ana-
- phylaxis during barium enema examinations. Am J Roentgenol 1991; 156:903–908.14. Dillard SF, MacCollum MA. Reports to FDA: allergic reactions to
- Dillard Sr, MacCollum MA. Reports to FDA: allergic reactions to latex-containing medical devices [abstract]. International Latex Conference, Baltimore, Nov 1992.
- Safadi GS, Wagner WO, Pien LC, Melton AL. Latex-induced anaphylaxis following routine medical examination [abstract]. Ann Allergy 1996; 76:77.
- Beuers U, Baur X, Schraudolph M, Richter WO. Anaphylactic shock after game of squash in an atopic woman with latex allergy [letter]. Lancet 1990; 335:1095.
- Schwartz HA, Zurowski D. Anaphylaxis to latex in intravenous fluids. J Allergy Clin Immunol 1993; 92:358–359.
- Laurent J, Malet R, Smiejan JM, Madelenat P, Herman D. Latex hypersensitivity after natural delivery. J Allergy Clin Immunol 1992; 89:779–780.
- Mathew SN, Melton AL Jr, Wagner WO. Latex allergy: a case series. Ann Allergy 1993; 70:483–486.
- Karathanasis P, Cooper A, Zhou K, Mayer L, Kang BC. Indirect latex contact causes urticaria/anaphylaxis. Ann Allergy 1993; 71:526–528.
- 21. Meeropol E, Kelleher R, Bell S, Leger R. Allergic reactions to rubber

tive." Glove manufacturers should endeavor to produce only low-allergen latex gloves, and the FDA should establish the maximum allowable level of allergen.

- The FDA should approve testing reagents so that allergists can improve their diagnostic capabilities.
- More studies need to be funded to assess the natural history, prevalence and pathogenesis of latex allergy.

in patients with myelodysplasia [letter]. N Engl J Med 1990; 323:1072.

- 22. Yassin MS, Sanyurah S, Lierl MB, et al. Evaluation of latex allergy in patients with myelomeningocele. Ann Allergy 1992; 69:207–211.
- Moneret-Vautrin DA, Beaudouin E, Widmer S, et al. Prospective study of risk factors in natural rubber latex hypersensitivity. J Allergy Clin Immunol 1993; 92:668–677.
- 24. Mathew SN, Melton A, Wagner W, et al. Latex hypersensitivity: Prevalence among children with spina bifida and immunoblotting identification of latex proteins [abstract]. J Allergy Clin Immunol 1992; 89:225.
- Konz KR, Chia JK, Kurup VP, Resnick A, Kelly KJ, Fink JN. Comparison of latex hypersensitivity among patients with neurologic defects. J Allergy Clin Immunol 1995; 95:950–954.
- Gold M, Swartz JS, Braude BM, Dolovich J, Shandling B, Gilmour RF. Intraoperative anaphylaxis. An association with latex allergy. J Allergy Clin Immunol 1991; 87:662–666.
- Sussman GL, Beezhold DH. Allergy to latex rubber. Ann Intern Med 1995; 122:43–46.
- Yassin MS, Lierl MB, Fischer TJ, O'Brien K, Cross J, Steinmetz C. Latex allergy in hospital employees. Ann Allergy 1994; 72:245–249.
- Safadi GS, Safadi TJ, Terezhalmy GT, Taylor JS, Battisto JR, Melton AR Jr. Latex hypersensitivity: its prevalence among dental professionals. J Am Dent Assoc 1996; 127:83–88.
- Safadi GS, Corey EC, Taylor JS, et al. Latex allergy in emergency medical service providers. Ann Allergy 1996; 77:39–42.
- Sussman GL, Lem D, Liss G, Beezhold D. Latex allergy in housekeeping personnel. Annals of Allergy, Asthma, and Immunology 1995; 74:415–418.
- Bascom R, Baser M, Thomas R, Fisher JF, Yang WN, Baker JH. Elevated serum IgE, eosinophils, and lung function changes in rubber workers. Arch Environ Health 1990; 45:15–19.
- Tarlo SM, Wong L, Roos J, Booth N. Occupational asthma caused by latex in a surgical glove manufacturing plant. J Allergy Clin Immunol 1990; 85:626–631.
- Orfan NA, Reed R, Dykewicz MS, Ganz M, Kolski GB. Occupational asthma in a latex doll manufacturing plant. J Allergy Clin Immunol 1994; 94:826–830.
- Hadjiliadis D, Khan K, Tarlo SM. Skin test responses to latex in an allergy and asthma clinic. J Allergy Clin Immunol 1995; 96:431–432.
- Merrett TJ, Merrett J, Bhambri S, Kekwick R. Prevalence of latexspecific IgE antibodies in the United Kingdom [abstract]. J Allergy Clin Immunol 1995; 95:154.
- Reinheimer G, Ownby DR. Prevalence of latex-specific IgE antibodies in patients being evaluated for allergy. Ann Allergy 1995; 74:184–187.
- 38. Jones RT, Scheppmann DL, Heilman DK, Yunginger JW. Prospective



Preventive cardiology: Whose job is it? disease: Where we are now

D. LEVY. D.L. SPRECHER, AND E.J. TOPO CURRENT DRUG THERAPY Current issues in menopausal

hormone replacement therapy COMPLETE TABLE OF CONTENTS PAGE 3

Dear Doctor:

As editors, we'd like you to look into every issue, every page of the Cleveland Clinic Journal of Medicine. We'd like to know...

1. How many ISSUES do you look into per YEAR?*

Here's our goal: □ None □ 1–33% □ 34–66% 🗹 67–100%

2. How many PAGES do you look into per ISSUE?*

Here's our goal:

□ None □ 1–33% □ 34–66% 1 67–100%

We put it in writing... please put it in writing for us. We want to hear from you.

E-mail: ccjm@cesmtp.ccf.org

WWW: http://www.ccf.org/ed/ccjhome.htm

10 issues per year

Cleveland Clinic Journal of Medicine The Cleveland Clinic Foundation, EE37 9500 Euclid Avenue Cleveland, Ohio 44195

Phone: 216.444.2661 Fax: 216.444.9385 study of extractable latex allergen contents of disposable medical gloves. Ann Allergy 1994; 73:321-325.

- Yunginger JW, Jones RT, Fransway AF, Kelso JM, Warner MA, Hunt 39. LW. Extractable latex allergens and proteins in disposable medical gloves and other rubber products. J Allergy Clin Immunol 1994; 93:836-842.
- 40. Baur X, Jaeger D. Airborne antigens from latex gloves [letter]. Lancet 1990; 335:912.
- 41. Swanson MC, Bubak ME, Hunt LW, Yunginer JW, Warner MA, Reed CE. Quantification of occupational latex aeroallergen in a medical center. J Allergy Clin Immunol 1994; 94:445-451.
- 42. Tarlo SM, Sussman G, Contala A, Swanson MC. Control of airborne latex by use of powder-free latex gloves. J Allergy Clin Immunol 1994; 93:985-989.
- 43. M'Raihi L, Charpin D, Pons A, Bongrand P, Vervloet D. Cross-reactivity between latex and banana. J Allergy Clin Immunol 1991; 87:129-130.
- 44. Ross BD, McCullough J, Ownby DR. Partial cross-reactivity between latex and banana allergens. J Allergy Clin Immunol 1992; 90:409-410.
- 45. Makinen-Kiljunen S. Banana allergy with immediate-type hypersensitivity to natural rubber latex. J Allergy Clin Immunol 1994; 93:990-996
- 46. Lavaud F, Prevost A, Cossart C, Guerin L, Bernard J, Kochman S. Allergy to latex, avocado, pear, and banana. J Allergy Clin Immunol 1995; 95:557-564.
- 47. Safadi GS, Melton AL, Wagner WO. Banana anaphylaxis in latexhypersensitive health care workers [abstract]. J Allergy Clin Immunol 1994; 93:283.
- 48. Rodriguez M, Vega F, Garcia MT, et al. Hypersensitivity to latex, chestnut, and banana. Ann Allergy 1993; 70:31-34.
- 49. Blanco C, Carillo T, Castillo R, Quiralte J, Cuevas M. Latex allergy: clinical features and cross-reactivity with fruits. Ann Allergy 1994; 73:309-314.
- 50. 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; 89:759-768.
- 51. 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; 91:1140-1145.
- 52. Spaner D, Dolovich J, Tarlo S, Sussman G, Buttoo K. Hypersensitivity to natural latex. J Allergy Clin Immunol 1989; 83:1135-1137.
- 53. Lahti A, Turjanmaa K. Prick and use tests with six glove brands in patients with immediate allergy to rubber proteins. Contact Derm 1992; 26:259-262.
- 54. Meeropol E. Leger R, Frost J. Latex allergy in patients with myelodysplasia and in health care workers: a double jeopardy. Urologic Nursing 1993; 13:34-44.
- 55. Shapiro E, Kelly JF, Setlock MA, et al. Complications of latex allergy. Dialog Ped Urol 1992; 15:1-8.
- 56. Young MA, Meyers M, McCulloch LD, Brown LJ. Latex allergy: a guideline for perioperative nurses. AORN J 1992; 56:485-497.
- 57. Kwittken PL, Becker J, Oyelara B, Danziger R, Pawlowski NA, Sweinberg S. Latex hypersensitivity reactions despite prophylaxis. Allergy Proc 1992; 13:123-127.
- 58. Latex Hypersensitivity Committee. American College of Allergy, Asthma and Immunology Position Statement. Latex allergy-an emerging healthcare problem. Ann Allergy 1995; 75:19-21.
- 59. Task Force on Allergic Reactions to Latex. American Academy of Allergy and Immunology. Committee report. J Allergy Clin Immunol 1993; 92:16-18.
- Sullivan TJ, Culver J. Development and implementation of latex 60. allergy policy [abstract]. Ann Allergy 1996; 74:76.

ADDRESS REPRINT REQUESTS to Alton L. Melton, MD, Department of Pediatric and Adolescent Medicine, A120, The Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44195.

