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CME CREDIT HOURS

Managing latex allergy in patients and health care workers

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.

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.

In 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 brasiliensis*, 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

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 latex-specific 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 Nutter[7] 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, Slater[11] reported two cases of intraoperative anaphylaxis in children with spina bifida, and demonstrated that latex allergy was the cause. Kelly et al[12] independently reported anaphylactic reactions to general anesthesia in children with spina bifida and latex allergy.

During barium enemas. Ownby et al[13] 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

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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 al[22] performed latex allergy skin testing in 79 spina bifida patients; 49 of them had positive results. Moneret-Vautrin et al[23] found that 32% of their spina bifida patients with no history of latex allergy had positive skin-test results.

Anaphylactic reactions have resulted from latex exposure during routine physical examinations

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 al[25] 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 abnormalities such as bladder exstrophy also have a high risk of severe latex allergy. Gold et al[26] 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, Turjanmaa[9] 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 al[28] 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 professionals[29] and emergency medical services workers.[30] Susmann et al[31] 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 al[32] reported an overall increase in serum IgE levels and eosinophil counts in workers with high exposure. Tarlo et al[33] 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 al[34] 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 al[35] tested 224 adult allergy patients (11% were health care workers) and found 4.5% of them were allergic to latex. Merrett et al[36] tested 1436 adult blood donors in the United Kingdom and found between 4.1% and 7.9% had latex-specific IgE. Reinheimer and Ownby[37] 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 latex-containing 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

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 al[41] 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 al[42] 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 latex-free 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 complete latex 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 replacements 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 antihistamines and corticosteroids. 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 IgE-mediated 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 latex-free medical environment. This includes latex-free 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

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-additive." 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. ■

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