Contents lists available at ScienceDirect

Disease-a-Month

journal homepage: www.elsevier.com/locate/disamonth

Natural rubber latex allergy

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Natural rubber latex allergy was identified as an increasingly significant health care problem in the late 1980s. Though the incidence of latex allergy has decreased in the United States over the last several years, 150,000 to 1 million healthcare workers and over 15 million people worldwide still suffer from latex allergy.[1–3]

Natural rubber is obtained from the *Hevea brasiliensis* tree, a tree of the family Euphorbiacieae and also known as the "rubber tree." Through a process called "rubber tapping," latex is collected from the milky sap of this tree and is derived of 33% rubber, cis-1,4-polyisoprene, 2% resin, 65% water, and proteins.[4] Crude latex is collected in ammoniated solution to prevent microbial growth. It contains an array of cellular proteins, lipids, and amino acids, which are the allergens that induce sensitization. In manufacturing rubber, many chemicals may be added to latex such as thiurams in the vulcanization process, stabilizers, and antioxidants.[5] Vulcanization is the chemical process by which the physical properties of natural or synthetic rubber are improved by heating rubber with sulfur. Since rubber deteriorates with aging by oxidation, antioxidants are incorporated in the final rubber products to prevent the polymer chain from degrading. Current antioxidants include thiocarbamates, diphenylamines, dihydroquinolines, and phenylenediamine, all of which are potential contact allergens.

The prevalence of latex allergy is dependent on the population studied and ranges from 3% to 64%. Latex sensitization in the general population varies from 5.4% to 7.6%.[6] Repeated contact with or prolonged exposure to latex containing products may result in adverse latex reactions. Patients with spina bifida or urogenital abnormalities are a particular subpopulation at risk with a prevalence $>60\%$ due to multiple surgeries early in life, resulting in frequent exposure to latex. Approximately 10–20% of healthcare workers are sensitized to latex.[7] Exposure to rubber gloves is a frequent cause of occupational latex allergy, but contact with other types of latex containing

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http://dx.doi.org/10.1016/j.disamonth.2015.11.002

Table 1
Latex exposures in the medical and nonmedical setting.

Latex in the medical setting	Latex in the nonmedical setting
Catheters	Baby pacifiers
Endotracheal tubes	Balloons
Enema kits	Bracers
Gastroscopic tubes	Condoms
Gloves	Dental rubber dams
Incubator	Door/window isolations
Nasogastric tubes	Elastic bands
Operation room masks, hats, shoe covers	Hot watter bottle
Orthodontic elastics	Rubber bands
Oxygen masks	Sailing equipment
Pulmonary resuscitation bags	Shower curtain
Reflex hammer	Stamps
Stethoscope tubing	Toys
Syringes	Sports equipment
Tracheal tubing	

articles both in the medical and nonmedical settings may also play a role (Table 1). Workers in the latex manufacturing industry are another subpopulation at risk.[8]

Adverse reactions to latex may be categorized as immunologic vs. non-immunologic reactions. Of the immunologic type, latex reactions may be further subdivided into type I IgE-mediated reactions vs. type IV cell-mediated reactions (Table 2).

Non-immunologic reactions lead to an irritant contact dermatitis with redness, scaling, and itching predominantly on the dorsal hands and digits. This reaction is not based on an immunologic mechanism. It is an irritation induced “mechanically” or by the alkaline pH of gloves and is independent of the chemical composition of gloves. Such reactions should be differentiated from a true allergic contact dermatitis to latex. In a study examining glove wearing on powdered and unpowdered hands, increased skin roughness was detected via laser profilometry after wearing the same glove on prepowdered hands.[9] Powdered gloves may also contribute to a long-lasting alkaline skin surface pH after removal of powdered gloves while powder-free gloves yield a lower surface pH within the natural skin surface pH range, which is slightly acidic.[10]

Table 2
Types, causes, and clinical presentations of latex reactions.

Type of reaction	Cause	Clinical presentation
Non-immunologic	Occlusion, moisture accumulation, mechanical irritation, high glove pH	Irritant contact dermatitis: erythematous, scaly plaques and fissures on the dorsal hands and interphalangeal digits.
Type IV immunologic	Rubber chemicals	Acute allergic contact dermatitis: pruritic, erythematous, scaly plaques with possible vesicles and crusting on the dorsal hands and wrists 24–48 h after contact. Chronic allergic contact dermatitis: lichenified, erythematous, scaly plaques on the dorsal hands and wrists.
Type I immunologic	Latex proteins	Contact urticaria: erythematous, pruritic patches and hives within minutes after exposure; generalized urticaria; rhinitis; conjunctivitis; asthma; anaphylaxis.

Clinical pearl: Mechanical irritation can be reduced by use of powder-free gloves.

Type IV cell-mediated reactions are induced by allergens that are additives in the rubber manufacturing process. These include thiurams and benzothiazoles from the vulcanization of rubber and thiocarbamates and phenylenediamines from the antioxidant additives.[11] Delayed hypersensitivity reactions occur 24–48 h after contact with the offending agent and lead to an eczematous rash, typically on the dorsal hands (Fig. 1). Patient with a chronic history of allergic contact dermatitis present with lichenified, erythematous, scaly plaques on the dorsal hands (Fig. 2). Lichenification refers to a thickening of the epidermis with exaggeration of the normal skin markings. Most manufacturers have stopped using thiurams so these delayed type reactions are no longer as prevalent as they used to be. Standard patch testing can be performed to determine contact allergens in patients with suspected contact dermatitis.

Clinical pearl: Patients with contact urticaria, an IgE-mediated condition, present with pruritus, erythema, or hives approximately 10–30 min after wearing natural rubber latex gloves.

Type I IgE-mediated hypersensitivity reactions typically occur within minutes of latex exposure. The term “latex allergy” generally refers to these immediate-type reactions. Symptoms may be mild with urticarial reactions, rhinoconjunctivitis, or mucosal swelling or more severe, systemic symptoms may develop, including generalized urticaria, asthma, bronchospasm, hypotension, and anaphylactic shock.[12–15] IgE-mediated reactions are thought to be due to water-soluble proteins that remain in the latex following manufacturing processes. Approximately 19% of all anaphylactic reactions during surgery are related to latex allergy, and this percentage is higher in children.[16,17]

Clinical pearl: Latex allergy accounts for the second main cause of intraoperative anaphylaxis reactions and the main cause in children in several studies.[18]

The severity of clinical reactions can be classified into stages according to von Krogh and Maibach[19] (Table 3). Several factors may influence the severity of reactions—route of exposure (e.g., skin, mucosa, and intravascular), the source of exposure (gloves vs. other exposure), latex type (ammoniated vs. non-ammoniated), and individual immune responses.[20] Direct contact to latex allergens can cause allergic contact urticaria and protein contact dermatitis. Signs and symptoms of these reactions include pruritus, hives, and a wheal and flare reaction in areas of direct contact with latex containing products. Exposure via mucous membranes and parenteral exposure to latex proteins are associated with more severe reactions such as anaphylaxis. Though direct contact with a latex-containing product is the most common route of exposure,

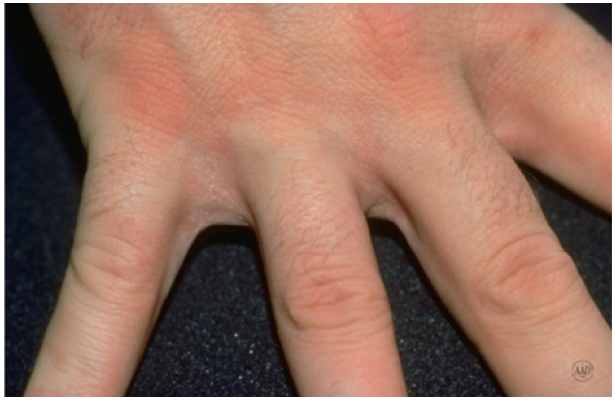

Fig. 1. Latex protein contact dermatitis of the hands. (Reproduced with permission from *the American Academy of Dermatology*, Copyright© 2015. All rights reserved.)

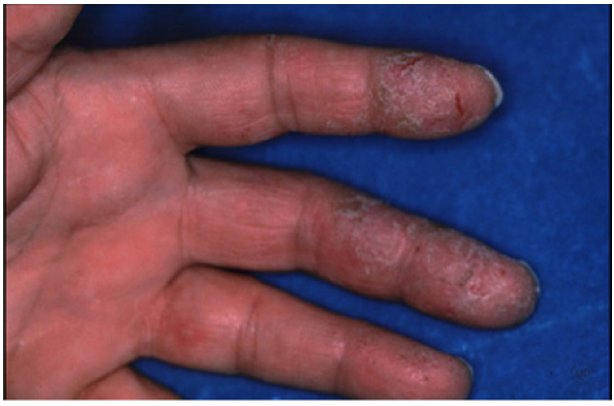

Fig. 2. Chronic hand dermatitis. (Reproduced with permission from *the American Academy of Dermatology*, Copyright© 2015. All rights reserved.)

adverse reactions may also result from inhalation of airborne allergens bound to substances such as glove powder.[21,22] Airborne latex allergens most commonly manifest as rhinoconjunctivitis but can also trigger asthma, airborne allergic contact urticaria, and airborne allergic contact dermatitis (Fig. 3). Parenteral latex exposure can also induce reactions.[13,23]

The measurement of natural rubber latex allergen is based on a standard preparation that was assigned a content of 100,000 allergen units (AU). Latex allergen levels are considered low if their allergen content is < 10 AU/mL, moderate at 10–100 AU/mL, and high at > 100 AU/mL. The amount of latex allergen content in latex gloves is highly variable, ranging from 22 to 12,000 AU/mL, and variation may be noted between gloves in the same batch.[24] The risk of sensitization depends on the latex allergen content of gloves, the amount of aeroallergen, and the use of cornstarch powder, which adheres latex proteins to become airborne.[25]

The responsible allergens in latex have not been fully developed, but a list of 15 allergens, termed "Hev b 1" through "Hev b 15," has been registered by the International Nomenclature Committee of Allergens.[26] Hev b 1, 2, 3, 4, 5, 6, 6.01, 6.02, 7.01, 13, and 14 have been identified as the most sensitizing *Hevea* allergens.[27] Additional allergens continue to be investigated. Few studies have suggested that different latex allergens could sensitize different categories of individuals. Per Yeang et al.,[28] Hev b 1 and Hev b 3 elicited reactions primarily in spina bifida patients. Hev b 2 and Hev b 4 may play a more important role in health care workers with latexy allergy.[29] Hev b 5 is a major allergen in the majority of both health care workers and children with latex allergies.[30] Hev b 7 may be associated with adults with latex allergy rather than children.[31] Avoidance of all relevant latex allergens is critical in the management of patients with latex allergy.[24,32–36]

Though some latex allergens such as Hev b 1 and Hev b 6, may be specific for latex, other latex allergens have been found to share IgE epitopes with plant-derived foods. This implies that sensitivity to latex may be initiated because of sensitization to homologous allergens in certain foods and vice versa. The latex-fruit syndrome (or "latex food allergy syndrome") is due to this cross-reactivity of latex proteins to similar proteins in fruits and vegetables.[37] For instance, Hev b 2 (β-1,3-gluconase) cross-reacts with a homologous protein in bell peppers.[38,39] Although

Table 3
Clinical reaction severity according to the system of von Krogh and Maibach.

Stage I	Stage II	Stage III	Stage IV
Localized urticaria	Generalized urticaria with or without angioedema.	Bronchial asthma, rhinoconjunctivitis, orolaryngeal, and gastrointestinal symptoms.	Anaphylactic shock

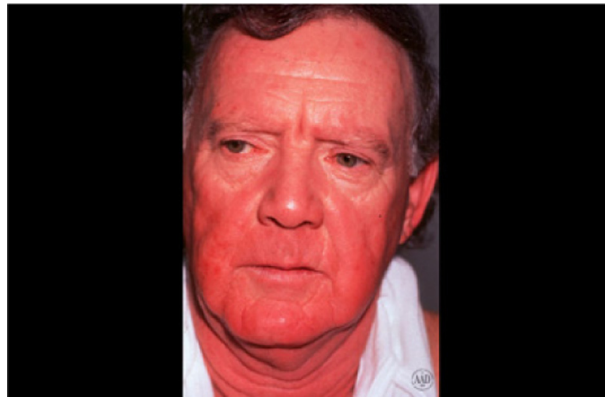

Fig. 3. Acute contact dermatitis with airborne distribution. (Reproduced with permission from *the American Academy of Dermatology*, Copyright© 2015. All rights reserved.)

reports vary, up to 50% of individuals allergic to natural rubber latex may have food allergies.[40] Other investigators have suggested an even higher incidence. The most commonly implicated fruit is avocado, but the relevance of fruit sensitization varies with a patient's diet and cultural background.[41] Other associated foods include banana, kiwi, chestnut, tomato, potato, and mango. Less commonly implicated foods are apple, beet, buckwheat, wheat, flour, carrot, citrus fruit, fig, grapefruit, hazelnut, lettuce, peach, peanut, pear, spinach, strawberry, sweet pepper, tomato, watermelon, walnut, passion fruit, papaya, and pineapple.[27] One particular protein of a class I endochitinase contains a hevein domain and is considered the panallergen in the latex-fruit syndrome involving avocado, chestnut, and banana.[42] Other enzymes present in various plants may represent common antigens. For instance, Hev b 7 demonstrates 60% homology with patatin, a protein found in potato and tomato.[43,44] In addition, Hev b 5 is highly homologous to the kiwi fruit protein pKIWI501.[30] Allergens believed to be responsible for cross-reactions include patatin, profiling, chitinases, plant endo-1,3-β-glucosidases, glucanases, and hevein.[45–55]

Clinical pearl: Frequent exposure to latex remains the main cause of sensitization.[56–58]

In addition to frequent exposure to latex, risk factors for latex allergy include age, predisposing skin injuries, atopy, spina bifida, and employment. Certain genetic profiles (HLA-DR phenotypes) may also increase the likelihood of developing latex allergies.[59] Younger patients are more often latex allergic, possibly due to a higher rate of employment in fields involving exposure to latex.[60] Furthermore, IgE responses may be age dependent.[61] Preexisting skin injuries such as hand dermatitis compromises the skin barrier and can lead to increased invasion of latex proteins.[62,63] Less than 1% of natural rubber latex proteins penetrate intact skin, while 23% are able to penetrate abraded skin.[64] Atopic individuals have the propensity to produce latex-specific IgE and are at risk for developing a latex allergy with sensitization rates of 3–9.4%.[65,66] Spina bifida patients have a high risk for latex sensitization due to the frequent number of surgical interventions early in life and repeated contact with latex during multiple operations.[67,68] Children with spina bifida have sensitization rates ranging from 29% to 49%.[69] Latex allergy is a common occupational issue among health care workers, with a sensitization rate of 5–17% of exposed health care workers.[70,71] Other employees at risk include food handlers, restaurant workers, domestic workers, security personnel, construction workers, housekeeping personnel, funeral home workers, first responders (e.g., police officers, firefighters, and ambulance attendants) workers at latex-manufacturing plants, florists, gardeners, and hair-dressers.[72–76] Pollen allergy may be a risk factor for latex allergy as a high-molecular-weight cross-reactive glycoprotein allergen has been identified in timothy grass pollen, weed pollen, and latex.[77]

Latex Allergy Screening Questionnaire

Risk Factor Assessment: Circle Y or N

Exposure History:

Are you a health care worker?	Y N
Do you wear latex gloves regularly or are you otherwise exposed to latex regularly?	Y N
Do you have a history of eczema or other rashes on your hands?	Y N
Do you have a medical history of frequent surgeries or invasive medical procedures?	Y N
Did these take place when you were an infant?	Y N
Do you have a history of "hay fever" or other common allergies?	Y N
Do your fellow workers wear latex gloves regularly?	Y N
Do you take a beta-blocker medication?	Y N

Circle any foods below that cause hives, itching of the lips or throat, or more severe symptoms when you eat or handle them:

avocado	apple	pear	celery	carrot	hazelnut
kiwi	papaya	pineapple	peach	cherry	plum
apricot	banana	melon	chestnut	nectarine	grape
fig	passion fruit	tomatoes	potatoes		

Contact Dermatitis Assessment: (for patients who wear latex gloves frequently)

Do you have rash, itching, cracking, chapping, scaling, or weeping of the skin from latex glove use?	Y N
Have these symptoms recently changed or worsened?	Y N
Have you used different brands of latex gloves?	Y N
If so, have your symptoms persisted:	Y N
Have you used non-latex gloves?	Y N
If so, have you had the same or similar symptoms as with latex gloves?	Y N
Do these symptoms persist when you stop wearing all gloves?	Y N

Contact Urticaria (Hives) Assessment: (for patients who wear latex gloves frequently)

When you wear or are around others wearing latex gloves do you get hives, red itchy swollen hands within 30 minutes or, "water blisters" on you hands within a day?	Y N

Aerosol Reaction Assessment:

When you wear or are around others wearing latex gloves, have you noted any:

Itchy, red eyes, fits of sneezing, runny or stuffy nose, itching of the nose or palate:	Y N
Shortness of breath, wheezing, chest tightness or difficulty breathing?	Y N
Other acute reactions, including generalized or severe swelling or shock	Y N

History of Reactions Suggestive of Latex Allergy:

Do you have a history of anaphylaxis or of intra-operative shock?	Y N
Have you had itching, swelling or other symptoms following dental, rectal or pelvic exams?	Y N
Have you experienced swelling or difficulty breathing after blowing up a balloon?	Y N
Do condoms, diaphragms or latex sexual aids cause itching or swelling?	Y N
Do rubber handles, rubber bands or elastic bands or clothing cause any discomfort?	Y N

This questionnaire is intended for screening purposes only. See an allergist or physician for diagnosis.

ALAA 8/2014 www.latexallergyresources.org ALAA American Latex Allergy Association

Fig. 4. Latex allergy screening questionnaire. Reproduced with permission from the *American Latex Allergy Association.*

Clinical pearl: Children with over eight surgical procedures had a significantly higher risk of a

Fig. 5. Diagnostic algorithm for latex allergy. *Provocation testing is often discouraged due to the risk of systemic reactions.

clinically relevant latex allergy.[78]

The initial step in diagnosing latex allergy is obtaining a thorough clinical history. Questioning patients about symptoms consistent with latex allergy is a basic step in the routine screening for all medical and dental practitioners. The American Latex Allergy Association has released an excellent questionnaire assessing risk factors, contact dermatitis, contact urticaria, aerosol reactions, and history of reactions suggestive of latex allergy (http://latexallergyresources.org/articles/alaa-latex-allergy-screening-questionnaire; Fig. 4 and Table 4).

Clinical pearl: Ask patients about localized symptoms such as erythema, itching, and hives after putting on gloves. Also, ask about systemic symptoms of chest tightness, wheezing, cough, shortness of breath, rhinorrhea, sneezing, lacrimation, ocular itching, and any history of systemic anaphylaxis.

Clinical pearl: While patch testing can identify type IV mediated reactions, the two widely available tests to screen for type I mediated reactions are skin prick tests and radio-allergosorbent tests (RAST) to detect IgE-specific antibodies to latex protein.

Serologic tests have a high number of false-negative results and should not be used alone for screening of latex allergy (Fig. 5).[79] There are a few different methods to evaluate in vitro measurements of latex-specific IgE. Some automated assays like Pharmacia CAP (Pharmaceia, Peapack, NJ) and Hycor HyTECH (Hycor Biomedical, Inc., Garden Grove, CA) involve antigens bound to a solid phase prior to reaction with the test antibodies. The DPC AlaSTAT assay (Diagnostic Products Corporation, Los Angeles, CA) differs in that the antigen and antibody interact in the liquid phase. The CAP and AlaSTAT systems, both FDA-approved, have a lower sensitivity than the HyTECH assay, which approaches 90% sensitivity. However, the CAP and AlaSTAT assays have a greater specificity ($>90\%$).[80,81] As commercial latex-specific IgE antibody assays approach a low positive value (0.35–0.45 kIUa/L), there may be significant imprecision.[82] For this reason, duplicate testing should be performed when a latex-specific IgE result is at the low end of the positive threshold.[83] Two serologic methods that are currently in use worldwide are the ImmunoCAP (Phadia) and the Immulite autoanalyzer (Siemans), both of which have a diagnostic sensitivity of 80% and a specificity of $>95\%$.[84] In vitro tests are used to detect circulating antibodies and do not represent clinical reactivity. However, a chip-based microarray containing 8 Hev b allergens is in development and may increase the diagnostic specificity and distinguish between patients with clinical sensitization and allergy.[85]

Clinical pearl: A positive serologic test can become negative after allergen avoidance.

Skin prick tests have a higher specificity and sensitivity than in vitro tests but have been associated with anaphylactic events during testing.[86–89] These tests can be performed using ammoniated, non-ammoniated commercial latex extracts, and glove extracts. The skin prick tests are performed by pricking the skin with increasing sequential concentrations of drops of latex extracts. Saline and histamine are used for controls, and the results are recorded after 15 min. A positive skin prick test results indicates IgE-mediated sensitization. Similarly to the

above serologic testing, a positive skin prick test result alone does not establish the diagnosis of a latex allergy. There are no commercially available FDA-approved skin test reagents for latex.[90,91] Many allergists create a homemade extract from gloves soaked in diluent. The resulting levels of hevea allergen vary greatly and have led to false-negatives due to low allergen concentrations or systemic reactions due to high allergen content.[3,92–94]

Challenge tests are thought to be the "gold standard" in latex allergy diagnosis. The provocation "use test" can be used when there is the clinical history and the latex-specific IgE antibody serologic and skin test results are incongruent. Provocation tests advantageously can identify a relationship between latex allergen exposure and the induction of allergic symptoms in a patient. However, provocation testing is often discouraged due to the risk of anaphylaxis.[95] Application of one finger of a latex glove for 15 min of exposure time will yield asthma, rhinitis, or urticaria if the test is positive. A vinyl glove on the other hand may be used as a negative control to rule out irritant reactions from occlusion and sweating. Milk-allergic patients may experience a false positive result due to casein, a stabilizer in some latex gloves, causing contact urticaria.[96] The entire latex glove should not be applied to one hand as anaphylaxis has been reported with this test used on eczematous skin.[97] The reliability of the outcome of glove wearing provocation tests is highly dependent on the test protocol and protein concentration of the gloves.[98] Other types of provocation testing have been used, including measurement of pulmonary function by spirometry after the inhalation of aqueous surgical glove extract as well as use of a "hooded exposure chamber" that permits progressive latex aeroallergen exposure to a patient's airway and conjunctiva.[99–102]

Currently, prevention is the only effective treatment for latex allergy. Avoidance as a primary prevention measure, meaning avoidance of exposure by non-sensitized individuals, is nearly impossible as latex allergens are ubiquitous and present in numerous household and medical devices. However, secondary prevention or avoidance of latex exposure in sensitized individuals is more easily accessible. Clinicians should attempt to identify latex allergy as early as possible to minimize disability. Though it may be nearly impossible to construct a "latex-free" environment, medical centers should be able to provide a "latex-safe" environment through elimination of latex gloves, bladder catheters, condom catheters, balloons, penrose drains, latex bandages, rubber dams, and rubber anesthesia masks. Powdered latex gloves should particularly be avoided as the problematic antigen may become aerosolized. In fact, elimination of powdered latex gloves may be the single most effective measure in the overall risk reduction of latex sensitization and clinical reactions.[103] Some clinics reserve the first morning patient slot for latex-allergic patients because latex aeroallergens are at their lowest levels. If the patient is not the first case of the day, a gap of at least 90 min should be reserved after the previous case to decrease aerolized latex antigen.[104]

Clinical pearl: Patients with a previous systemic reaction to latex should be instructed to carry an EpiPen® at all times for the treatment of anaphylaxis.

Patients who develop contact dermatitis following exposure to chemical additives in gloves need to avoid these specific chemicals in the future. Suspected patients should be patch tested to determine these particular chemicals. Alternative materials may be used for gloves, such as vinyl, tactylon, nitrile, styrene, and butadiene. Use of alternative materials may come with risks such as increased cost and resources, possibility of contamination, and diminished barrier protection.

Anaphylaxis in latex-sensitized patients may result from antigen release from rubber medication stoppers. Thus, it may be prudent in some centers to avoid the use of multidose vials. Injectable epinephrine should be readily available at all times in centers treating latex-allergic patients.

Clinical pearl: Workers who regularly wear gloves in their professions should be advised to use latex-free gloves if eczema of the hand develops, especially if they have a history of atopy.

Table 4
Key elements of the occupational history in the evaluation of latex allergy.

(1) Demographics
(2) Employment
(A) Employment start and end dates
(B) Description of job details and work environment
(C) Identification of occupational chemicals/materials
(D) Listing of prior work history and occupational exposures
(3) Symptoms
(A) Type of symptoms
(B) Duration of symptoms and temporal relation to current employment
(C) Improvement of symptoms outside of the patient's work environment
(4) Risk factors
(A) Preexisting skin injuries or skin conditions
(B) Surgical history
(C) Smoking history
(D) History of seasonal allergies
(E) Family history of atopy
(F) History of allergic disorders (e.g., fragrances and metals)
(G) History of skin testing with latex or other allergens
(H) Prior exposure and reactions to latex outside of the workplace
(I) Immediate onset reactions after ingestion of foods (e.g., banana, kiwi, avocado, papaya, chestnuts, and potato)

Some physicians recommend that latex-sensitive patients be premedicated with corticosteroids and antihistamines before surgical procedures. Others are skeptical of these practices, as they have not been shown to prevent intraoperative anaphylaxis.[105] These critics are concerned that pretreatment may only attenuate early signs and symptoms, leaving anaphylaxis as the first evidence of an allergic reaction.[106,107] Results from a study by Setlock et al.[108] have shown that premedication is not universally successful in preventing latex anaphylaxis.

Possible latex allergen exposures outside of the healthcare setting should be identified and addressed. Latex-sensitive patients should be advised to be cautious when eating cross-reactive foods. Indirect contact with natural latex rubber proteins on contaminated surfaces such as clothing have been reported to cause a life-threatening reaction.[109] Contamination of foods with natural rubber latex allergens from kitchen personnel wearing powdered gloves can also lead to anaphylactic reactions.[110]

Clinical pearl: When a patient cannot completely avoid latex exposure, immunotherapy with latex can be discussed. Desensitization techniques have led to an improvement in cutaneous reactions and also rhinitis and asthma but did not seem to be effective on serum levels of specific IgE.[111]

Allergen immunotherapy may be an effective option in treating latex-allergic patients, but further trials need to be conducted in a larger population group. Several latex-specific immunotherapy case reports have been published, and administration of oral and subcutaneous allergens have been shown to decrease allergic symptoms from latex exposure.[112–115] Patients treated with their maximum tolerated dose of the Stallergènes latex extract over a period of 2 days, then weekly, biweekly, and monthly doses for a year had significantly reduced symptoms upon exposure to latex and decreased reactions to epicutaneous tests for latex. In a randomized, double-blind, placebo-controlled study of 17 patients with latex allergy, there was a significant decrease in rhinitis, conjunctivitis, and cutaneous scores reported by the patient group, but asthma symptoms were not significantly different in patients vs. controls.[116] Allergen immunotherapy remains an experimental treatment of latex allergy while avoidance of latex exposure is the foundation of management and prevention.

Educational resources for patients with latex allergies can be found at the American Latex Allergy Association (http://latexallergyresources.org), American College of Allergy, Asthma, and Immunology (http://www.acaai.org), and the American Academy of Allergy, Asthma and Immunology (http://www.aaaai.org).

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