



Keeping children with latex allergies safe

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ALTHOUGH 8% to 17% of U.S. healthcare workers have a sensitivity to latex, fewer than 1% of Americans in the general population share this sensitivity.¹ (See *Defining terminology*.) In contrast, due to exposures to latex during many surgeries, as many as 68% of children with spina bifida have a latex sensitivity.¹ Pediatric latex allergies are more likely to affect children who've undergone multiple surgeries, including those born with defects such as spina bifida and genitourinary tract abnormalities.¹

This article addresses how to identify children with an allergy to latex and how to keep them safe in the hospital and the community.

What's latex?

Hevea brasiliensis, the rubber tree grown in southeast Asia and Africa, produces a milky sap that's used in the manufacturing of natural latex rubber products such as gloves, balloons, and condoms. (See *What products contain natural latex?* for a more comprehensive list.) At least 25 proteins of the *H. brasiliensis* rubber tree have been identified as possible allergens.² The latex proteins are potent allergens that cause the body to make the immunoglobulin E (IgE) antibody. Exposed individuals then can experience varying levels of allergic reactions.³

Defining terminology¹⁵

- **Allergy** occurs when a person develops allergen-specific IgE antibodies and signs and symptoms when exposed to the allergens.
- **Atopy** is an inherited predisposition. When exposed to allergens, the atopic person produces IgE antibodies.
- **Sensitization** involves a person's body responding to allergens by producing allergen-specific IgE but not showing signs or symptoms of an allergic reaction.

The chemicals used during the latex manufacturing process can also cause a delayed hypersensitivity reaction to the chemicals, complicating the identification of a latex allergy. One example of a delayed hypersensitivity reaction is a type IV reaction called contact dermatitis. These chemicals include accelerants, curing agents, and antioxidants. According to the American College of Allergy, Asthma and Immunology, latex allergy involves the proteins of natural latex rubber, not synthetic rubber products such as those found in latex house paints.⁴

High-risk populations

Besides multiple exposures to latex, factors that increase a person's risk of developing a latex allergy include delayed hypersensitivity reactions, atopic reactions, and allergies to certain foods.⁵ (See *Pathophysiology of sensitization and allergy*.) Often atopic reactions result in type I IgE-mediated hypersensitivity reactions with skin reactions (urticaria and dermatitis) and respiratory signs (rhinitis and bronchial asthma). Work to identify the genome responsible for atopic reactions isn't complete, but several chromosomal regions are recognized as being linked to atopy and asthma. Blood test results from patients with atopic reactions show elevated levels of eosinophils, basophils, mast cells, and allergen-specific levels of IgE.⁵

According to the Association of periOperative Registered Nurses (AORN) Standards 2017, researchers recognize that risk factors increase the chances of a serious allergic reaction. They believe that contact dermatitis lets more latex proteins penetrate the skin, increasing the risk of an allergic reaction.⁶

The four foods with the highest risk of cross-reaction to latex are bananas, kiwis, avocados, and chestnuts. The foods considered to have a moderate risk of cross-reaction to latex include apples, carrots, celery, papayas, tomatoes, melons, and potatoes.⁷



What products contain natural latex?¹⁶

Teach family and caregivers to keep pediatric patients with latex allergies away from products containing natural latex rubber, including common household items and toys such as:

- disposable diapers*
- pacifiers, baby bottle nipples, and eye dropper bulbs
- rubber balloons including reflective (Mylar) balloons
- toys such as rubber balls, beach toys, and rubber filament (Koosh) balls
- rubber bands and erasers
- condoms and diaphragms
- sanitary napkins*
- rubber gloves including dishwashing gloves
- sports shoes and rubber raincoats
- rubber handgrips on bicycles and racquets
- wheelchair tires.

*The American Latex Allergy Association provides information about latex-free diapers, pull-ups, and sanitary napkins at http://latexallergyresources.org/consumer-products?term_node_tid_depth=22.

Exposure to latex occurs several ways

The highest risk of a latex allergic reaction occurs when a person's mucous membranes are exposed repeatedly to latex. The mucous membranes include the mouth, urethra, vagina, rectum, lungs, and eyes. This explains why children with birth defects requiring multiple surgeries or indwelling urinary catheters develop a latex allergy in higher numbers than children in other groups.⁵

Patients can be exposed to latex proteins through the skin or by inhalation of the aerosolized proteins. Internal exposure could involve a surgeon wearing latex gloves and touching internal organs during surgery, or medication administration through the rubber ports of I.V. tubing.⁶

Signs and symptoms of latex allergy

Several factors determine which signs and symptoms an individual has: the causative mechanism, the exposure route, and the amount of latex allergen present.

Allergic contact dermatitis occurs 1 to 4 days after skin contact with latex. This reaction begins as an acute eczematous skin rash, vesicles, and pruritus. With continued latex exposure, the rash becomes dry, crusty, and irritated. This reaction is a type IV delayed T-cell-mediated response to chemicals used in the latex manufacturing. This dermatitis isn't an allergic reaction to *H. brasiliensis*, but the damage to the person's skin allows increased latex exposure with the possibility of IgE sensitivity developing.³

Allergic contact urticaria is a skin reaction that occurs with type I IgE-mediated allergic response. Signs and

symptoms begin within 10 to 15 minutes of latex exposure and include erythema, pruritus, and urticaria. This skin response can progress to a chronic allergic contact dermatitis.³

Rhinoconjunctivitis and asthma can occur when a person inhales airborne latex particles. This response can include sneezing, teary itching eyes, nasal congestion, and rhinorrhea. Healthcare workers and those who work around latex products should be alert to signs and symptoms following latex exposures because severe airway compromise can occur.³

Anaphylaxis is the life-threatening systemic allergic response to latex allergen. This IgE-mediated response begins with pruritus and rash. It can progress to multisystem signs such as hypotension, tachycardia, dyspnea, and gastrointestinal disturbances. Without prompt treatment, this reaction can progress to cardiac dysrhythmias, bronchospasm, cardiac collapse, and death.³

Latex products that most commonly cause anaphylaxis include gloves, balloon-tipped catheters, condoms, hair extension adhesives, bottle nipples, pacifiers, teethingers, and toy balloons.³ (See *What products contain natural latex?*)

Testing for latex allergy

A healthcare provider can diagnose a latex allergy based on the patient's history, physical examination, and results of skin testing or blood tests. Although a latex skin prick test produces the most reliable results (with more than 90% accuracy), this test also carries a risk of adverse or anaphylactic reactions for patients who are allergic to latex.⁸ It should be performed only by healthcare professionals in a setting with appropriate resuscitation resources. The FDA hasn't cleared latex skin testing reagents.⁸

FDA-approved latex-specific IgE blood tests measure the latex IgE antibody and predict the risk of an allergic reaction. The tests' sensitivity ranges from 75% to 90%.⁸ A patient history of latex exposures and signs and symptoms is an indication that the patient is allergic.³

Emergency management of anaphylaxis in children

Monitor the patient's vital signs closely and place the patient on continuous cardiac monitoring. Treatment of anaphylaxis begins with I.M. epinephrine injected in the mid-outer thigh. If the response is inadequate, another injection of I.M. epinephrine can be given within 5 to 10 minutes. If treatment begins promptly, patients respond to the first, second, or at most, third injection of epinephrine. I.V. epinephrine may be necessary if

Pathophysiology of sensitization and allergy¹⁵

The immune system functions to protect the individual from toxic substances and microorganisms. When someone's body responds with hypersensitivity reactions, the reaction itself may be harmful. Four types of immunologic reactions occur, with Types I and IV being most common:

- **Type I** is an immediate hypersensitivity reaction, a classic allergic response. It occurs quickly when a person is exposed to an antigen. IgE antibodies cause a release of mast cells, basophils, and eosinophils, resulting in signs and symptoms of an allergic reaction.
- **Type II** is an IgG or IgM antibody-mediated delayed response that causes cellular destruction. An example of Type II is Graves disease, in which autoantibodies cause hyperthyroidism.
- **Type III** is an immune complex-mediated response in which the antigen-antibody complexes travel through the bloodstream, causing inflammation and damage to tissues and organs. An example of Type III is systemic lupus erythematosus.
- **Type IV** is a T-cell-mediated, delayed-onset response. Four subtypes of Type IV are categorized according to which type of cells are involved. Allergic contact dermatitis is a Type IV hypersensitivity response. Two examples of allergic contact dermatitis are poison ivy rash and contact dermatitis in healthcare workers after exposure to latex gloves.

Skin testing and in vitro testing of allergens may show a positive IgE response and "sensitivity" to an allergen. However, a person isn't considered "allergic" until signs and symptoms occur when the person is exposed to an allergen.

inadequate perfusion and inadequate control of signs and symptoms continue. There are no contraindications to using epinephrine during anaphylaxis.⁹

Provide supplemental oxygen at 8 to 10 L/minute (up to 100%) via facemask.⁹ Airway control with endotracheal intubation may be needed because angioedema can result in airway obstruction. Early intervention by experienced clinicians is critically important. Cricothyrotomy may be needed to provide an airway during anaphylaxis.

Place the patient in supine position with the legs elevated to increase cerebral perfusion.⁹ Start an I.V. of 0.9% sodium chloride solution and give rapid bolus. Continue to evaluate the patient's response and administer additional fluid boluses as prescribed. Monitor intake and output closely.⁹

Additional drugs may include:

- albuterol for bronchospasm via nebulizer
- an H1 antihistamine such as diphenhydramine
- an H2 antihistamine such as ranitidine I.V.
- a glucocorticoid such as methylprednisolone I.V.⁹

Prevention in the hospital

- **Minimizing early exposure.** Latex exposure to mucous membranes at an early age is considered the biggest risk factor for latex allergy development. Children who face multiple surgeries during infancy, such as urogenital procedures, face this increased risk.¹

Articles published as early as 1998 discussed avoiding latex exposures to children born with spina bifida as key prevention practices. A small but important study that followed 67 children for 4 years produced an interesting result: A latex-free surgical environment and patient and family education about avoiding latex reduced the expected latex sensitization by 37%. In patients who had latex antibodies, the latex-free environment decreased antibody levels by 27%. In fact, 12% of the children who previously had latex antibodies no longer had detectable levels. The authors concluded that latex exposure causes sensitization and that a latex-free environment can reduce latex antibody levels in children.¹⁰ The authors of a 7-year study published in 2007 agreed that "latex-safe perioperative management offers guarantees of safety against latex-allergy phenomena."¹¹

- **Screening.** All patients should be screened for latex allergy routinely during preoperative assessment, testing, and teaching. Staff should include questions about latex and any unexplained allergy issues in the patient history. The healthcare provider may choose to have latex allergy testing done.

- **Environmental safety.** If the facility isn't latex-safe, the room prepared for a patient with a latex allergy should be labeled "latex-safe" with signage affixed to doorways. If the facility or hospital room isn't latex-safe, preparing the room means cleaning it with latex-safe gloves and supplies.⁶

Also, nonlatex products should be substituted for latex products, equipment, and supplies. Common items that may contain latex include urinary catheters, gloves, I.V. supplies, and adhesive tape. Surgeries for patients with a latex allergy should be scheduled as the first surgery of the day to protect them from aerosolized latex particles that can trigger a reaction.⁶

Nonpowdered and latex-free gloves are used by many healthcare workers. If latex gloves are being worn, the healthcare worker should remove latex gloves, wash hands thoroughly, and put on latex-free gloves before touching a patient with suspected allergy.⁶

According to AORN Standards 2017, medication vials with rubber stoppers should be punctured only once to withdraw the medication and the medication should be administered right away. Removing rubber stoppers isn't recommended because doing so doesn't



reduce rubber contamination of the medication.⁶ Hand-off communication between all departments should include the patient's latex allergy.

- **Staff education.** A critically important step involves educating healthcare staff about latex allergy issues and in-house supplies. Because the FDA has required companies to label their products' latex content since 1997, staff can more easily identify latex-safe products to keep their patients safe.

- **Improving practice.** Providing a latex-safe medical environment begins with facility leaders and healthcare providers who, recognizing the risk to their patients and staff, choose latex-safe products. While latex-free products and supplies are readily available for many uses, constant vigilance must be used to attain and maintain a latex-safe hospital environment. Whenever new pricing and contracts are negotiated, select products that are latex safe whenever possible. The American Latex Allergy Association provides updated lists of latex-free medical supplies at <http://latexallergyresources.org/medical-products>.

A facility wanting to convert to a latex-safe environment may need to establish a latex-safe committee during the conversion. The American Latex Allergy Association recommends an allergist be included in this committee as the expert on preventing latex exposure for patients and healthcare workers.

Latex allergy education for families

If repeated exposures to latex and its proteins cause increased sensitivity to natural latex, then avoiding latex in the home and community environment would help prevent latex allergy development.

Natural latex can be found in over 40,000 commonly used products.⁵ Teach the family and caregivers of

high-risk children about latex sources in the home and community environment and eliminate these objects. For thorough primary prevention, recommend that they limit vulnerable children's exposure to latex found in baby bottle nipples, pacifiers, toys, and household objects.¹²

Family education begins with signs and symptoms of anaphylaxis. Remind parents to call for emergency help right away, especially if epinephrine has been given. Teach parents when and how to use the epinephrine autoinjector for allergic reactions in the community setting. Parents should always carry two epinephrine autoinjectors because 20% of patients require a second injection. They should know that they can give the second autoinjector dose within 5 to 10 minutes based on the patient's status. Teach parents about possible adverse reactions to epinephrine and how to properly store and dispose of the autoinjector after use. Remind them of the importance of checking the expiration date and replacing the drug when it has expired.

Allergy clinics, healthcare providers' offices, and Internet resources can be involved in teaching pediatric patients and their families to prevent latex allergic reactions in the community. For updated lists of latex-free consumer supplies, see the American Latex Allergy Association website at <http://latexallergyresources.org/consumer-products>.

Patients with latex allergies should wear a medical-alert bracelet or necklace. The child's family should inform all caregivers about the child's latex allergy and teach them how to administer an autoinjector. Caregivers include teachers, day-care workers, babysitters, friends, and family members. Parents should also inform healthcare providers, dentists, physical or occupational therapists, hospitals, and clinics the child visits.

The Joint Task Force on Practice Parameters, which includes representatives from the American Academy of Allergy, Asthma and Immunology, the American College of Allergy, Asthma and Immunology, and the Joint Council of Allergy, Asthma and Immunology, recommends an allergist be involved with patient and family education to achieve optimal results.¹³ Several studies show problems with family education about how to use epinephrine autoinjectors. In one study involving 277 families of patients at risk for anaphylaxis, only 44% of these families had their autoinjector with them. When asked why, 47% said they didn't realize they should carry it at all times. Other studies showed the need for continued parent and family empowerment and training in using the autoinjector.¹³

A study looking at child-care facilities found education about using epinephrine autoinjector was suboptimal. A

Reliable sources about latex allergies

Information about latex allergies for families and community members can be found at trusted Internet sources such as the following:

- **American Academy of Family Physicians** at <http://familydoctor.org/familydoctor/en/diseases-conditions/latex-allergy.html>.
- **American Latex Allergy Association** at <http://latexallergyresources.org>.
- **Children's Hospital St. Louis** at <http://healthlibrary.stlouischildrens.org/Search/85,P00022>.
- **Children's Hospital of Wisconsin** at www.chw.org/medical-care/asthma-allergy-and-clinical-immunology-center/conditions/allergy/types-of-allergens/latex.
- **Cincinnati Children's** at www.cincinnatichildrens.org/health/l/latex-allergy.



survey of child-care centers in one Midwestern city found only 24 of the 42 day-care directors knew how to use the epinephrine autoinjector for anaphylaxis, and only 55% had staff who'd been trained to deal with such an emergency.¹³ When the day-care center directors received training on proper use of the epinephrine autoinjector, 77% could demonstrate proper usage 1 month after training, but knowledge and expertise decreased with time; proficiency was only 31% at 1 year after training.¹³ This study highlights the need for ongoing training for day-care centers. (See *Reliable sources about latex allergies*.)

Education and training of healthcare workers helps them protect themselves and their patients from latex exposure and an allergic response. Beginning with families and caregivers of at-risk children, more education is needed in the community setting to help prevent the development of latex allergic reactions and to appropriately treat latex allergic reactions. ■

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