

Latex Allergy: A Relevant Issue in the General Pediatric Population



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ABSTRACT

Although latex allergy is a widely recognized problem of the pediatric myelomeningocele population and of frequent users of latex products, it is often overlooked in the general pediatric population. The prevalence of latex in common household items and in medical environments increases one's exposure and thus one's possibility of sensitization to latex. Latex allergy may range from mild local reactions such as erythema to more severe systemic reactions such as asthma or anaphylaxis. The immunoglobulin E-mediated mechanism of these reactions has been confirmed serologically by the presence of latex-specific immunoglobulin E with radioallergen sorbent testing. Because avoidance of latex is currently the only way to prevent reactions, the identification of household items that contain latex is extremely important. However, because inadvertent exposure to latex is not uncommon, Medic-Alert bracelets and an Epi-Pen should be provided for children allergic to latex. Pediatric nurses should consider latex allergy as a possible diagnosis in situations of unexplained allergic or anaphylactic reactions and should be aware of optimal therapeutic interventions. *J Pediatr Health Care* (1998). 12, 242-246.

Latex allergy has only recently been recognized as a pediatric problem. Although latex allergy was first reported in the 1920s (Stern, 1927), it became more widely recognized in Europe in the 1980s after two cases of contact urticaria in response to latex were described, one in a housewife and the other in a nurse. By 1980 two major risk groups, health care workers who use latex products frequently and the myelomeningocele population, had been recognized. Reported sensitization rates in the myelomeningocele population have ranged from 10% to 68% (Slater, Mostello, & Shaer, 1991). Before anaphylaxis to latex was reported, adverse reactions to latex were perceived by most health care workers to be limited to contact dermatitis. It is now known that patients with immunoglobulin E (IgE)-mediated latex allergy can also have immediate contact or systemic urticaria, rhinoconjunctivitis, asthma or bronchospasm, and anaphylaxis (Sussman, Tarlo, & Dolovich, 1991).

HISTORIC ASPECTS OF LATEX USE

The *Hevea brasiliensis* tree is the main commercial source of latex. With more than 40,000 consumer products containing natural rubber latex, most everyone has some exposure to latex (see Table for a partial list of common latex products). Dipped products such as condoms and examination gloves are considered more allergenic than other latex products such as tires, which have little extractable protein. Because of the recommendations by the Centers for Disease Control for universal precautions to prevent the transmission of bloodborne pathogens in the health care setting, the use of latex gloves has skyrocketed (Centers for Disease Control, 1987). In the general population use of latex condoms became more common as safe-sex measures were promulgated.

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TABLE Common household items containing latex and non-latex alternatives

Items containing latex	Possible alternatives
Balloons	Mylar balloons
Balls (koosh, tennis, rubber, basketball)	PVC (Headstrom Sports Ball)
Bath mat	Gerry baby products, Pound Pales
Bathroom throw rugs (nonskid latex backing)	100% cotton reversible throw rugs
Chewing gum	Check with manufacturer
Cleaning/kitchen gloves	Vinyl, cotton liners as barriers
Condoms	Polymer, polyurethane condoms (Avanti)
Disposable diapers, rubber pants	Tranquility, First Quality, Huggies, and Gold Seal, Velcro closures
Elastic in waistbands	Cotton draw strings
Erasers	Check with manufacturer
Feeding nipples	Silicone (Gerber, Evenflo, MAM)
Bicycle helmets	Check with manufacturer
Infant toothbrush massager	Soft bristle brush or cloth
Lottery tickets (scratch-off is latex)	None
Mouse pads for computers	Check with manufacturer
Pacifiers	Plastic, silicone, and vinyl made by INFA, Gerber, MAM, Binky, or Kip
Racquet handles (table tennis, golf clubs, bats)	Vinyl, leather handles
Rain coats, rubber boots	Neoprene coated nylon as barrier
Rubber bands	String, spring clips, Plasti Band
Silly putty	Check with manufacturer
Socks	Buster Brown cotton socks without elastic
Spandex swim suits	Non-spandex/cloth swim suits
Swimming goggles, caps, snorkels	Check with manufacturer
Tape (adhesive)	Plastic, silk tape (Microfoam, Micropore, Dermaclear)

Information obtained from list provided by SBA of A (for most current version, call (800) 621-3141).

times fatal, were reported in adults ("Allergic Reactions to Latex-Containing Medical Devices," 1991). It was believed that the retention piece that contained latex was the antigenic protein source causing these severe reactions (Gelfand, 1991).

In 1988, Axelsson, Eriksson, and Wrangjso reported the first case of type I hypersensitivity caused by latex exposure in children. These cases involved children between the ages of 5 and 13 years who had systemic reactions after oral mucosal contact with latex balloons. The presenting symptom in all three children was angioedema; however, one child later had anaphylaxis during a dental procedure in which a rubber cofferdam was used. Each patient had a history of atopy, but previous surgical procedures were not noted.

From 1990 to 1991 the Centers for Disease Control and Prevention received reports of intraoperative anaphylaxis from more than 29 pediatric centers. These severe reactions occurred within minutes to hours after general anesthesia was induced (Gold et al, 1991). The reactions were traced to contact with latex gloves, anesthesia masks, and intravenous tubing (Kwittken et al, 1992).

TYPES OF REACTIONS

Latex can cause medical problems through several mechanisms. Quite common is an irritant contact dermatitis, in which use of latex gloves, for example, causes local cracking, fissuring, erythema, and lichenification. Closely related in clinical appearance is an allergic contact dermatitis, which is a T-cell-mediated immunologic reactivity to one of the accelerators or antioxidants added to the latex manufacturing process.

Much more serious and not recognized until recently are type I IgE-mediated reactions that vary from mild to severe depending on the circumstances of exposure and the allergic sensitivity of an individual. Local reactions such as erythema, pruritis, and edema have been reported by parents after their child's skin came into contact with such items as rubber toys, elastic thread, bandage adhesives, latex gloves, and tourniquets. On the other hand, the presentation can be quite subtle; for example, a sensitized child may simply have itchy eyes or a runny nose when he or she is in proximity to

RECOGNITION OF LATEX ALLERGY IN CHILDREN AND ADULTS

In 1979 Nutter reported the first case of latex-induced urticaria in a housewife who used latex gloves (Nutter, 1979). A Finnish group in 1983 demonstrated that latex allergy is IgE-mediated (Kopman & Hannuksela, 1983). In 1986 Van der Meeren and van Erp reported a life-threatening reaction from latex glove powder made of corn starch but could not show that the powder alone instigated the reactions. Later, investigators showed that water-soluble latex proteins are easily absorbed onto and carried by corn starch and are responsible for these types of reactions (Turjanmaa, Reunala, Alenius, Bummer-Korvenkontio, & Palosuo, 1990). European and North American medical centers soon

noted immediate hypersensitivity reactions in hospital personnel after exposure to latex gloves (Spaner, Dolovich, Tarlo, Sussman, & Burroo, 1989). In one study, with the use of questionnaires and skin testing, it was estimated that as many as 17% of health care workers are sensitized to latex (Yassin et al, 1994). However, these high prevalence rates may reflect ascertainment bias (ie, workers more likely to be allergic may have volunteered for testing).

In 1986, anaphylactoid reactions to saline solution enemas in 6 children with myelomeningocele were noted (Lozynsky, Shandling, Gilmour, & Zimmerman, 1986). The causative agent was isolated to the enema retention piece, which contained latex. Four years later, during administration of barium enemas, cases of anaphylaxis, some-

balloons. Systemic reactions including angioedema, bronchospasm, and urticaria have also been observed, more commonly with sustained mucosal exposure, but also with mere respiratory exposure to a latex product (Sussman et al, 1991).

Severe reactions with the classic anaphylactic signs of cardiovascular collapse have been well described upon mucous membrane and peritoneal exposure to latex (Gelfand, 1991). However, even parenteral infusion of latex particles from the buretrols of certain intravenous solusets and the breach of latex injection ports with needles has caused reactions in exquisitely sensitized patients (Kwittken, Pawlowski, & Sweinberg, 1992). Because numerous latex exposures may occur during operating procedures, it may not always be possible to single out one specific item as the reaction trigger.

PATHOPHYSIOLOGY OF ALLERGIC REACTIONS TO LATEX

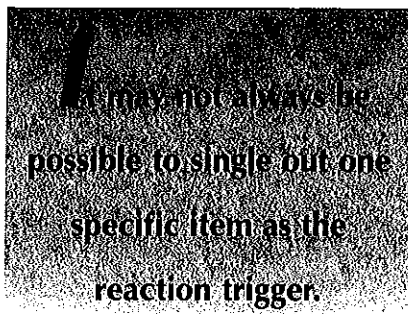
The immediate nature of these reactions clearly implies an IgE-mediated mechanism, which has been confirmed serologically by the presence of latex-specific IgE with use of radioallergosorbent tests and enzyme-linked immunosorbent assays (Kelly, Kurup, Resnick, Fink, & Roberts, 1992). It is widely accepted that IgE antibodies to some of the latex proteins have developed in patients sensitive to latex. IgE-mediated activation of mast cells can result in rhinoconjunctivitis, bronchospasm, urticaria, and even hypotension. The threshold tolerance for the amount of latex protein that may cause symptoms has not been established and probably varies with the individual.

Many persons allergic to latex, regardless of age, have a history of atopy (Turjanmaa, 1989). In one epidemiologic study of health care workers, a history of atopy was associated with an odds ratio of twentyfold in having a latex allergy (Arellano, Bradley, & Sussman, 1992).

DIAGNOSIS

All patients with unexplained allergic reactions should be questioned about previous reactions that occurred during anesthesia, during dental visits, and when they had contact with rubber toys. Patients' allergies to certain fruits such as bananas, kiwifruit, chestnuts,

and avocados should also be noted, because such allergies have been associated with an increased risk for having latex allergy (Kobrynski, 1996). However, given the history of a previous allergic reaction during parenteral drug administration, an allergy to anesthetics, antibiotics, or other medication infusing at the time must be ruled out before the reaction can be attributed to latex allergy.



It may also be hypothesized that children of health care workers could be exposed to latex allergens brought home on clothes worn in the workplace. Such exposure to latex antigens increases a child's possibility of early sensitization. This hypothesis is supported by one case in which a former intensive care unit nurse had a complex case of urticaria/anaphylaxis from latex allergens transferred through intimate contact with her spouse, who used latex gloves at work (Karathanasis, Cooper, Zhou, Mayer, & Kang, 1993). Children at day care centers may also be exposed to latex through gloves that are used when diapers are changed. Infants in day care who have erythematous ankles may be having contact urticaria in response to latex gloves.

Because no standard in vitro or in vivo assay exists, objective confirmation of latex allergy may be challenging. Two in vitro assays for detecting latex-specific IgE antibodies have been approved by the Food and Drug Administration: the Alastat (Diagnostic Product Corporation, Los Angeles, Calif) and the CAP (Pharmacia, Kalamazoo, Mich). The predictive value of such in vitro tests remains to be established in larger studies.

Skin testing, the gold standard of allergy, is also problematic because

of the lack of standardized antigen. Commercial latex preparations for skin testing are currently available only in Europe and Canada, although glove and raw ammoniated latex extract have been used for this purpose in the United States. The risk of precipitating anaphylaxis has prevented the widespread acceptance of skin testing. Skin test results of one study showed that 3 of 44 atopic children had a positive reaction to latex. Only 2 of these 3 children had surgical histories, and none had any clinical reaction to latex (Blais & Shield, 1992). Once again, the overall sensitivity and specificity of skin testing requires better definition.

The necessity and validity of pre-screening children from high-risk groups for latex allergy is debatable. Despite the shortcomings of in vitro assays, serologic testing for latex-specific IgE may be used either to confirm a history of latex allergy or to detect the presence of latex-specific IgE before surgery. One study reports that skin testing has better sensitivity than both the Alastat and CAP assays (Kim, Sadafi, & Sheikh, 1998). Because of the risk of anaphylaxis, prick testing should be performed when emergency medical equipment and personnel are quickly available. In cases in which neither the prick nor in vitro assays correspond to the history, some type of challenge procedure may be needed to establish or rule out a latex allergy diagnosis. Because a test result, whether in vivo or in vitro, is valid only at the time of examination, retesting may be indicated if the clinical symptoms evolve.

PREVENTION

Avoidance of latex is the only way to prevent reactions. Gloves, feeding tubes, and Foley catheters made of non-latex alternatives should be used. Because it is not known whether the rubber contained in the syringe plunger will leech latex proteins after prolonged contact with various liquids, medication should be prepared immediately before use. Unless the manufacturer can state that the stopper is not latex, single-use vials with "breakaway" glass tops should be used instead of multidose vials. Institutional purchasing departments should obtain non-latex alternatives for essential supplies whenever they are available. However, complete

avoidance of latex is often impossible, because aerosolized latex particles from gloves are present where powdered gloves are used (Swanson et al, 1994). In addition, certain anesthesia circuits and essential medical equipment may not have non-latex alternatives. Therefore antigen avoidance can only be carried out to a limited degree.

The United States Food and Drug Administration, which has been working actively with rubber manufacturers to identify and reduce the amount of antigenic material in latex, recently issued guidelines for public comment on labeling medical devices for latex content (Food and Drug Administration Register, 1996). Latex products pose a threat not only to the person allergic to latex but also to those who are at risk of becoming sensitized in the future. Therefore avoidance of latex toys and medical devices in children with myelomeningocele and genitourinary anomalies and in children for whom multiple surgeries are anticipated is now common practice. Adolescents who are sensitive to latex should be counseled to avoid use of latex condoms. Condoms made of lamb intestine provide inadequate protection against sexually transmitted diseases. The new non-latex polyurethane male and female condoms made by Avanti may be suitable alternatives. However, manufacturers are currently evaluating their comparative barrier properties. In general, the patient and family, in learning to recognize and avoid latex products, can prevent or slow the appearance of latex-allergic reactions.

TREATMENT

Currently the best treatment strategy for persons allergic to latex is prevention and avoidance whenever possible. In a latex-triggered allergic reaction, assessment of the severity of the reaction and pertinent supportive measures should be instituted immediately (see Box). In the hospital, epinephrine, antihistamines, and corticosteroids should be quickly available at the patient's bedside for emergency use. Because of the lack of antigen standardization and the risk of anaphylaxis, hyposensitization protocols have not yet been started.

Parents of children sensitized to latex should be given lists of common latex products found in homes and possible latex-free alternatives (see Table). A

BOX Treating latex allergy

Mild, local reactions

- Remove latex source
- Administer an oral antihistamine (diphenylhydramine or chlorpheniramine)
- Apply hydrocortisone or other steroid cream to affected area

Systemic, anaphylactic reactions

- Keep airway open and assess respiration and circulation
- Use a cardiopulmonary monitor and oximeter
- Administer subcutaneous epinephrine (0.01 mg/kg of 1:1000 dilution, not to exceed 0.5 mg)
- Administer diphenylhydramine (1 to 2 mg/kg IM or IV)
- Administer methylprednisolone (1 mg/kg IM or IV every 6 hours)
- Administer ranitidine (1 mg/kg IM or IV every 8 hours; maximum daily dose = 400 mg)
- Use normal saline solution IV for hypotension
- Administer nebulized albuterol for bronchospasm (0.1 to 0.2 mg/kg/dose up to 4 mg/dose)

Data from Kelly, 1995.

number of internet sites devoted to providing information on latex allergy are also available (eg, www.flare.org). When substitutes are available for products that contain latex, they should be used. Given the possibility of a severe reaction, it would be prudent for the mother and child, if old enough, to carry or have quick access to epinephrine, such as an Epi-Pen-Jr. (Center Labs, Port Washington, NY). Because of the prevalent use of latex gloves, particularly in an emergent medical setting in which the child may not be accompanied by his or her parents or may be unable to convey his or her severe allergy, it is imperative that pediatric health care providers require their patients who are allergic to latex to wear a Medic-Alert bracelet (Medic Alert, Turlock, Calif). Day care centers and schools must also be notified of a child's latex allergy and should have

latex-free gloves available for emergency use.

CONCLUSION

Latex allergy today represents a challenge to the medical community and general population. The prevalence of latex products in both the medical environment and in the home poses a great threat to persons who are allergic to latex. Even when a mother and sensitized child are aware of the need for avoidance, inadvertent latex exposure can still occur, as seen in the following report.

CASE STUDY

A 10-year-old white boy was referred by his pediatrician for confirmation of a latex allergy. When he was 18 months old, he had systemic hives and swollen eyes after playing with a balloon in a park. His mother attributed his symptoms to his having played in the grass.

At the age of 4 years, while playing with a balloon in his pediatrician's office, he had diffuse wheezing and urticaria. The episode was self-limited and lasted for less than half an hour. The boy's pediatrician discounted the mother's suspicion that the balloon caused the allergic reaction.

One year later at a carnival, at the age of 5 years, the boy was again playing with a balloon when his face became swollen. The mother gave him diphenhydramine, and the swelling subsided after several hours.

Subsequently, the mother made meticulous efforts to keep her son from being exposed to latex. When he was 8 years old, however, he had immediate contact urticaria after trying on a Spandex swimsuit at a store. His waist and legs, which had touched the swimsuit, were covered with hives. The mother did not realize that Spandex contains latex. Again, he was treated with antihistamines, and the episode resolved over several hours. Diagnostic prick skin testing revealed positive wheal and flare reactions to both ammoniated and nonammoniated extracts. This case shows that latex allergy, although traditionally associated with the myelomeningocele population and frequent users of latex products, can present in healthy children with no obvious repeated latex exposure.

Inadvertent allergic reactions may also occur in the restaurant setting.

Many food handlers now use latex gloves that leave latex antigens on prepared food. Although complete avoidance of latex is impossible, education of patients and continued vigilance may minimize reactions to latex in sensitized children. Providing Medic-Alert bracelets and Epi-Pens should be part of the standard treatment of a child allergic to latex. Pediatric health care providers, in caring for a child with allergic reactions, should consider latex allergy as an easily missed diagnosis and be aware of the potential reactions and optimal therapeutic interventions.

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