Latex and Latex Allergy in Spina Bifida

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Introduction

(In these guidelines, "latex allergy" refers to type I hypersensitivity to *Hevea brasiliensis*, also known as natural rubber latex.)

The history of latex allergy and its intersection with people with Spina Bifida dates back to the late 1980's in the United States with the advent of Universal Precautions and no regulation of latex in gloves. As clinical reports of severe allergic reactions, including anaphylaxis and a 500-fold increase of life-threatening events in surgery for Spina Bifida, efforts were made to better understand the patterns of these episodes. In doing so, latex allergy was subsequently found to be the associated trigger in surgical procedures in patients with Spina Bifida and other conditions, particularly those with congenital neurogenic bladder conditions.[1-2]

As a result, by the early 1990's there were efforts to systematically avoid exposing infants and children with Spina Bifida to natural rubber products such as red rubber catheters and surgical gloves, or latex products used in various settings such as in neonatal intensive care units or newborn nurseries. As the importance of these measures became more widely accepted, there followed an extension to other areas of children's hospitals, emergency rooms, and to many pediatric offices where the children were subsequently seen.

Despite these efforts, exposure to latex remains relatively prevalent in the different environments frequented by people of all ages with Spina Bifida — hospitals, clinics, schools, homes, and community facilities. Exposure to latex could take place by direct contact or inhalation. Symptoms of latex allergy may initially be considered mild, such as skin irritations, rash, hives, flushed cheeks, itchy eyes, or sneezing. However, they can immediately progress or evolve related to subsequent exposures to more dramatic systemic responses such as generalized urticaria, wheezing, coughing, periorbital erythema and swelling, and even nausea and vomiting.[3]

Until better scientific explanations are available to specifically drive prevention and intervention, people with Spina Bifida should continue to avoid skin contact with latex protein in the environment including foods with similar proteins, and avoid inhalation of powder that contains latex.[4-7] Avoidance of latex should extend to latex-containing products used for personal care, medical care, dental care, and community participation.[8-9]

Children, families and adults should be aware that caution should be taken regarding what has come to be labeled "latex fruit syndrome." This remains incompletely understood and likely related to epigenetic factors.[10] The protein allergen (example, *Hev b 6* hevein) in some latex products makes up a considerable amount of the total protein. This has been shown to have significant cross-reactivity to certain proteins (chitinases) in banana, avocado and chestnuts, for example. While these fruits have been the most commonly described, there are at least 25 other fruits that may have some level of cross-reactivity with latex. For example, potatoes, eggplant, and kiwi have been described as potential concerns.

At this time, it is helpful to understand that not all patients with true latex allergy have clinical reactions to fruit (~50%) and that few (~ 10%) of individuals with known allergy to a latex-cross-reacting fruit develop latex allergy symptoms.[10] Parents and patients should be aware of potential "latex-fruit syndrome" reactions, but should also be aware of its relative risk. (Appendix 2)

For additional details and resources on latex allergy, please review Appendix 1: Latex Allergy Fact Sheets and Other Materials and Appendix 2: Latex Allergy and Foods.

Outcomes

Primary

1. Avoidance of all direct contact to natural rubber latex.
2. Awareness and understanding that latex allergy remains a relatively high-risk condition for this group.
3. Avoidance of skin contact with latex protein in the environment and inhalation of powder that contains latex (i.e. gloves).
4. Avoidance of latex-containing products used for personal care, medical care, and community participation (e.g., adhesive bandages, latex gloves, surgeries in medical setting that may not be latex-free.)
5. Awareness of signs and symptoms of latex allergy.

Secondary

1. Persons with known latex allergy routinely wear medical-alert identification.
2. Persons with known latex allergy and their family know the signs of life-threatening anaphylaxis.

Tertiary

1. Persons with known latex allergy and their family have a pre-arranged plan for action in the event of a severe, life-threatening anaphylaxis.

0-11 months

Clinical Questions

1. Are health care providers becoming complacent about latex risks in hospital and office settings?
2. How do we recognize infants who are most at risk or those that may turn positive?

Guidelines

1. Inform parents and caregivers about latex allergy and ways to provide safe infant care while avoiding exposure to latex products.[3-4,11-19]
2. Avoid using health care products that contain latex when caring for infants with Spina Bifida[3-4,11-19]
3. Inform staff and families of any latex-containing products such as bottle nipples, pacifiers, teething rings, toys, and other items such as urinary catheters.[3-4,11-19] (Appendix 1)

1-2 years 11 months

Clinical Questions

1. Is there consensus on how to conduct preventive screening, or should investigation begin when a patient has a reaction and needs specific testing?
2. How do we recognize those most at risk or those who may turn positive?
3. When are diagnostic studies being done, and is there unified consensus on the process or timing?

4. Are health care providers becoming complacent about latex risks?
5. Has the problem of airborne latex been solved by not having powder in latex gloves?

Guidelines

1. Develop awareness that increased mobility puts the child at greater risk for exposure to latex products. (clinical consensus)
2. Avoid toys and other items such as urinary catheters with latex. All toys should be latex-free.[1,20-23] (Appendix 1)
3. Encourage careful parental observation of latex avoidance.[1,20-23]
4. Encourage the child with a history of latex allergy to wear a medical identification bracelet showing allergy to latex. (clinical consensus)

3-5 years 11 months

Clinical Questions

1. Is there consensus of how preventive screening should be done, or should investigation begin when a patient has a reaction and needs specific testing?
2. How do we recognize those most at risk or those who may turn positive?
3. When are diagnostic studies being done, and is there unified consensus on the process or timing?
4. Has the problem of airborne latex been solved by not having powder in latex gloves?
5. Are health care providers becoming complacent about latex risks?
6. Given that there is potential for cross-reactivity in numerous foods, how should families prepare their children?

Guidelines

1. Screen toys and the environment of preschoolers as they start to interact with their peer group more regularly. Keep children away from toys and other products that contain latex such as latex-containing urinary catheters. (clinical consensus) (Appendix 1)
2. Discuss avoidance of rubber balloons at parties, school activities, restaurants, and other gathering places for events.[14-16,18, 21-30]
3. Teach children to ask questions about items that may contain latex.[24,26]
4. Teach children, at a very basic level, to avoid latex products.[24,26]
5. Help children and parents identify latex-free substitute products, such as Mylar balloons, for celebrations. (clinical consensus) (Appendix 1)
6. Instruct families to check that food made in public venues has been prepared with latex-free gloves. (clinical consensus)
7. Refer to an allergist when the child is allergic to latex but does not know if he or she is allergic to cross-reacting foods; this is particularly crucial in those who have had a systemic or anaphylactic episode. (Appendix 2) If a positive test is found, then a food challenge would be indicated in the case where there is no history of food-related clinical reaction. Many of the positive tests may be due to laboratory cross-reactivity, but a clinical response of allergy will not be provoked.[32]

6-12 years 11 months

Clinical Questions

1. Is there consensus of how preventive screening should be done, or should investigation begin when a patient has a reaction and needs specific testing?
2. How do we recognize those most at risk or those who may turn positive?
3. When are diagnostic studies being done, and is there unified consensus on the diagnostic process or timing?
4. Has the problem of airborne latex been solved by not having powder in latex gloves?

5. Are health care providers becoming complacent about latex risks?
6. Given that there is potential for cross-reactivity in numerous foods, how should families prepare their children?

Guidelines

1. Educate school-age children about their avoidance of latex products such as latex-containing urinary catheters and inform them about safe, latex-free alternatives. (clinical consensus) (Appendix 1)
2. Discuss avoidance of rubber balloons at parties, school activities, restaurants, and other gathering places for events.[14-16,18, 21-30]
3. Tell parents and caregivers of children identified as having a latex allergy, and the children themselves, to have diphenhydramine and self-administered epinephrine available at all times. (clinical consensus)
4. Instruct families to check that food made in public venues has been prepared with latex-free gloves. (clinical consensus)
5. Urge children to continue following latex precautions because risk-taking during the teen years is common. (clinical consensus)
6. Review the principles of latex precaution with the child during a clinic visit and answer any questions. (clinical consensus)
7. Refer to an allergist when the child is allergic to latex but does not know if he or she is allergic to cross-reacting foods; this is particularly crucial in those who have had a systemic or anaphylactic episode. (Appendix 2) If a positive test is found, then a food challenge would be indicated in the case where there is no history of food-related clinical reaction. Many of the positive tests may be due to laboratory cross-reactivity, but a clinical response of allergy will not be provoked.[32]

13-17 years 11 months

Clinical Questions

1. Is there consensus of how preventive screening should be done, or should investigation begin when a patient has a reaction and needs specific testing?
2. How do we recognize those most at risk or those who may turn positive?
3. When are diagnostic studies being done; any unified consensus on the process or timing?
4. Has the problem of airborne latex been solved by not having powder in latex gloves?
5. Are health care providers becoming complacent about latex risks?
6. Given that there is potential for cross-reactivity in numerous foods, how should families prepare their children?

Guidelines

1. Educate teens directly about avoidance of latex products including latex-containing urinary catheters and educate them to know about safe latex-free alternatives. (clinical consensus) (Appendix 1)
2. Discuss avoidance of rubber balloons at parties, school activities, restaurants, and other gathering places for events.[14-16,18, 21-30]
3. Teens identified as having a latex allergy should have diphenhydramine and self-administered epinephrine available at all times. (clinical consensus)
4. Instruct families to check food preparation in public venues as it should be prepared with latex-free gloves. (clinical consensus)
5. Educate teens about latex-safe contraceptive products before they decide to become sexually active. (clinical consensus) (Sexual Health and Education Guidelines) (Appendix 1)

6. Urge children to continue following latex precautions because risk-taking during the teen years is common. (clinical consensus)
7. Review principles of latex precaution with the teen during a clinic visit and answer any questions. (clinical consensus)
8. If a latex allergic patient does not know if he or she is allergic to cross-reacting foods and has had anaphylaxis to latex exposure, it may be prudent for an allergist to test the patient. If a positive test is found, then a food challenge would be indicated in the case where there is no history of food related clinical reaction. (Appendix 2) Many of the positive tests may be due to laboratory cross-reactivity, but a clinical response of allergy will not be provoked.[32]

18+ years

Clinical Questions

1. Is there consensus of how preventive screening should be done, or should investigation begin when a patient has a reaction and needs specific testing?
2. How do we recognize those most at risk or those who may turn positive?
3. When are diagnostic studies being done, and is there unified consensus on the process or timing?
4. Are health care providers becoming complacent about latex risks?
5. What research endeavors, clinical practices, and/or education is needed to best assure a latex-free medical environment for women with Spina Bifida who are being seen in obstetric/gynecologic medical environments?
6. Has the problem of airborne latex been solved by not having powder in latex gloves?
7. Given that there is potential for cross-reactivity in numerous foods, how should families and adults prepare for cross-reactivity in numerous foods?

Guidelines

1. Urge adults with Spina Bifida to continue following latex precautions, even if they have not experienced an adverse response to latex products (for example, latex-free condoms), until better scientific explanations are available to specifically drive prevention and intervention.[1-2,12-15,22,24,31-33] (Sexual Health and Education Guidelines)
2. Educate adults directly about avoidance of latex products including latex-containing urinary catheters and educate them to know about safe latex-free alternatives. (clinical consensus) (Appendix 1)
3. Discuss avoidance of natural rubber products in the home and work environments.[14-16,18, 21-30]
4. Adults identified as having a latex allergy should have diphenhydramine and self-administered epinephrine available at all times. (clinical consensus)
5. Instruct adults to check food preparation in public venues as it should be prepared with latex-free gloves. (clinical consensus)
6. Educate adults about latex safe contraceptive products before they decide to become sexually active. (clinical consensus) (Sexual Health and Education Guidelines) (Appendix 1)
7. Review principles of latex precaution with the adult during a clinic visit and answer any questions. (clinical consensus)
8. If a person that is allergic to latex does not know if he or she is allergic to cross-reacting foods and has had anaphylaxis to latex exposure, it may be prudent for an allergist to test the patient. If a positive test is found, then a food challenge would be indicated in the case where there is no history of food related clinical reaction. Many of the positive tests may be due to laboratory cross-reactivity, but a clinical response of allergy will not be provoked.[32] (Appendix 2)

Research Gaps

1. Updated measures are needed on the true incidence and prevalence among people with Spina Bifida and a comparison to other potentially high-risk populations (i.e. nurses, environmental services workers, and others who routinely make use of latex products).
2. Determine if there is an impact of antenatal repair on latex allergy.
3. Further investigation is needed into patients with Spina Bifida who "turn positive," including questions about immunity, genetic differences, differences in exposure, and other factors.
4. Since latex gloves are used less frequently in children's hospitals now than in the past, and measures of true levels of exposure in other settings such as adult hospitals or dental offices is likely to be inexact, consider carrying out animal model studies to better answer questions of clinical impact of exposure to powder in latex gloves.
5. For cohorts of people with Spina Bifida who become positive to latex (clinically or based on screening labs), in-depth epidemiology studies need to be constructed and implemented.
6. Are health care providers becoming complacent about latex risks in hospital and office settings?
7. How do we recognize infants, children, teens, or adults who are most at risk or those that may turn positive? Is there consensus on how to conduct preventive screening, or should investigation begin when a patient has a reaction and needs specific testing?
8. When are diagnostic studies being done, and is there unified consensus on the process or timing?
9. Has the problem of airborne latex been solved by not having powder in latex gloves?
10. Among individuals with latex sensitivity, there is potential for cross-reactivity in numerous foods; what precautions might be shared with families in these instances?
11. What research endeavors, clinical practices, and/or educational initiatives are needed to best assure a latex-free medical environment specifically for women with Spina Bifida who are being seen in obstetric/gynecologic medical environments?

Appendix 1: Latex Allergy Fact Sheets and Other Materials

Permission to use the materials found in the *Latex Allergy Toolbox* [links to http://www.allergyasthmanetwork.org/education/allergies/latex-allergy/] has been granted by the Allergy & Asthma Network. The toolkit features variety of fact sheets and other materials for health care providers, parents, students, school staff, and others, including:

- Parent and practitioner resources
- Latex and vaccines
- School resources
- Allergy & Asthma Network webinars

Appendix 2: Latex Allergy and Foods

Parents and patients should be aware that caution should be taken regarding what has come to be labeled "latex fruit syndrome." Research has shown that some foods have proteins that are like those in rubber tree sap. Sometimes people with latex allergies experience a reaction to "latex reactive foods." This may be referred to as latex-food syndrome or latex-fruit allergy. Latex reactive foods include primarily nuts and fruit, but also some vegetables.[10,34-36]

Foods with a high degree of latex allergy association or prevalence:

- Avocado
- Banana
- Chestnut
- Kiwi

Foods with a moderate degree of latex allergy association or prevalence:

- Apple
- Carrot
- Celery
- Melons
- Papaya
- Potatoes
- Tomatoes

Foods with low or undetermined latex allergy association:
Apricot, Buckwheat**,** Castor Bean, Cayenne Pepper, Cherry, Chick Peas, Citrus Fruits**,** Coconut, Dill, Fig, Grape, Hazelnut, Lychee, Mango, Nectarine, Oregano, Passion Fruit, Peach, Peanut, Pear, Persimmon, Pineapple, Plum, Rye, Sage, Shellfish, Soybean, Strawberry, Sunflower Seed, Sweet Pepper, Walnut, Wheat, Zucchini.

References

1. Ausili E, Tabacco R, Focarelli B, Nucera E, Patriarca G, Rendeli C. Prevalence of latex allergy in spina bifida: genetic and environmental risk factors. *European Review for Medical and Pharmacological Sciences, 2007*; 11: 149-153.
2. Bernardini R, Novembre E, Lombardi E, Mezzetti P, Cianferoni A, Danti D A, Mercurella A, and Vierucci A. Risk factors for latex allergy in patients with spina bifida and latex sensitization. *Clinical and Experimental Allergy, 1999;* 29:681-686.

3. Bueno de Sa A, Araujo RFC, Cavalheiro S, Mallozi MC, Sole D. Profile of latex sensitization and allergies in children and adolescents with myelomeningocele in Sao Paulo, Brazil. *J Investig Allergol Clin Immunol, 2013*; 23(1): 43-49.
4. Blumchen K, Bayer P, Buck D, Michael T, Cremer R, Fricke C, Henne T, Peters H, Hofman U, Keil T, Schlaud M, Wahn U, Niggemann B. Effects of latex avoidance on latex sensitization, atopy and allergic disease in patients with spina bifida. *Allergy, 2010*; 65: 1585-1593.
5. Raulf-Heimsoth M, Rihs H-P, Rozynek P, Cremer R, Gaspar A, Pires G, yean HY, Arif SAM, Hamilton RG, Sander I, Lundberg M, Bruning T. Quantitative analysis of immunoglobulin E reactivity profiles in patients allergic or sensitized to natural rubber latex (*Hevea brasiliensis). Clinical and Experimental Allergy, 2007*; 37: 1657-1667.
6. Woodhouse CRJ. Myelomeningocele: neglected aspects. *Pediatr Nephrol, 2008*; 23: 1223-1231.
7. Kurup VP, Sussman GL, Yeang HY, Elms N, Briteneder H, Srif SAM, Kelly K, Bansal NK, Fink JN. Specific IgE response to purified and recombinant allergens in latex allergy. *Clinical and Molecular Allergy, 2005*; 3: 11
8. Waseem M, Ganti S, Hipp A. Latex-induced anaphylactic reaction in a child with spina bifida. *Pediatric Emergency Care, 2006*; 22(6): 441-442.
9. Hepner DL, Castells MC. Latex allergy: An update. *Anesth Analg 2003*; 96: 1219-29.
10. Kelly KJ, Sussman G. Latex allergy: where are we now and how did we get there? J Allergy Clin Immunol Pract. 2017;5:1212-1216.
11. Bozkurt G, Sackesen C, Civelek E, Kalayci O, Akalan N, Cataltepe O. Latex sensitization and allergy in children with spina bifida in Turkey. *Childs Nerv Syst, 2010*; 26: 1736-1742.
12. Buck D, Michael T, Wahn U, Niggemann B. Ventriculra shunts and the prevalence of sensitization and clinically relevant allergy to latex in patients with spina bifida. *Pediatric Allergy and Immunology, 2000*; 11: 111-115.
13. Cremer R, Lorbacher M, Hering R, Engelskirchen R. Natural Rubber latex sensitization and allergy In patients with spina bifida, urogenital disorders and esophageal atresia compared with a normal paediatric population. *Eur J Pediatr Surg, 2007*; 17: 194-198.
14. Eiwegger T, Dehlink E, Schwindt J, Pomberger G, Reider N, Frigo E, Rokitansky AM, Urbanek R, Szepfalusi Z. Early exposure to latex products mediates latex sensitization in spina bifida but not other diseases with comparable latex exposure rates. *Clinical and Experimental Allergy, 2006*; 36: 1242-1246.
15. Johar A, Lim DL, Arif SAM, Hawarden D., Du Toit G, Weinberg EG, Motala C, Fieggen G, Yeang HY, Potter PC. Low prevalence of latex sensitivity in South African spina bifida children in Cape Town. *Pediatric Allergy and Immunology, 2005*; 16: 165-170.
16. Nieto A, Estornell F, Mazon A, Reig C, Nieto A, Garcia-Ibarra G. Allergy to latex in spina bifida: A multivariate study of associated factors in 100 consecutive patients. *J Allergy Clin Immunolo, 1996*; 99: 501-507.
17. Nieto A, Mazon A, Estornell F, Nieto A, Reig C, Garcia-Ibarra F. The search of latex sensitization in spina bifida: diagnostic approach. *Clinical and Experimental Allergy, 2000*; 30: 264-269.
18. Pamies R, Oliver F, Raulf-Heimsoth M, Rihs H-P, Barber D, Boquete M, Nieto A, Mazon A. Patterns of latex allergen recognition in children sensitized to natural rubber latex. *Pediatric Allergy and Immunology, 2006*; 17: 55-59.
19. Szepfalusi Z, Seidl R, Bernert G, Dietrich W, Spitzauer S, Urbanek R. Latex sensitization in spina bifida appears disease-associated. *The Journal of Pediatrics,1999*; 134 (3): 344-348.

20. Cremer R, Kleine-Diepenbruck U, Hering F, Holschneider AM. Reduction of latex sensitization in spina bifida patients by a primary prophylazis programme (five years experience). *Eur J Pediatr Surg, 2002*; 12: 19-21.
21. Kattan H, Harfi HA, Tipirneni P. Latex allergy in Saudi children with spina bifida. *Allergy, 1999;* 54: 70-73.
22. Nieto A, Mazon A, Pamies R, Lanuza A, Munoz A, Estornell F, Garcia-Ibarra F. Efficacy of latex avoidance for primary prevention of latex sensitization in children with spina bifida. *The Journal of Pediatrics, 2002*; 140 (3): 370-372.
23. Ozkaya E, Coskun Y, Turkmenoglu Y, Samanci N. Prevalence of latex sensitization and associated risk factors in Turkish children with spina bifida. *Pediatr Surg Int, 2010*; 26: 535-538.
24. Chua X, Mohamed J, van Bever HPS. Prevalence of latex allergy in spina bifida patients in Singapore. *Asia Pacific Allergy, 2013*; 3: 96-99.
25. Hochleitner B, Menardi G, Haussler B, Ulmer H, Kofler H, Reider N. Spina bifida as an independent risk factor for sensitization to latex. *The Journal of Urology, 2001*; 166: 2370-2374.
26. Majed M, Nejat F, El Khashab M, Tajik P, Gharagozloo M, Baghban M, Sajjadnia A. Risk factors for latex sensitization in young children with myelomeningocele. *J neurosurg Pediatrics, 2009*; 4: 285-288.
27. Mazon A, Nieto A, Estornell F, Nieto A, Reig C, Garcia-Ibarra F. Factors that influence the presence of symptoms caused by latex allergy in children with spina bifida. *J Allergy Clin Immunolo, 1996;* 99(5): 600-604.
28. Obojski A, Chodorski J, Barg W, Medrala W, Fal AM, Malolepszy J. Latex allergy and sensitization in children with spina bifida. *Pediatric Neurosurgery, 2002*; 37 (5): 262-266.
29. Parisi CAS, Patriz NA, Busaniche JN, Cortines MC, Frangi FA, Portillo AS, de Badiola FI. Prevalence of latex allergy in a population of patients diagnosed with myelomeningocele. *Arch Argent Pediatr, 2016*; 114(1): 30-35.
30. Brei T, Sawin K, Buran C, Webb T, Cashin SE, Heffelfinger A. Secondary conditions in adolescents and young adults (AYA) with spina bifida (SB) in four US programs. I54th Annual Meeting of the Society for Research into Hydrocephalus and Spina Bifida, Vancouver, Canada. 7-10 July 2010.
31. Sampson H, Aceves S, Bock S, James J, Jones S, Lang D, Nadeau K, Nowak-Wegrzyn A, Oppenheimer J, Perry T, Randolph C, Sicherer S, Simon R, Vickery B, Wood R. Food allergy: A practice parameter update—2014. J Allergy Clin Immunol, 2014; 134(5): 1016-1025.
32. Minami C, Barnard C, Bilmoria K. Management of a patient with a latex allergy. JAMA, 2017; 317 (3): 309-310.
33. Mazon A, Nieto A, Pamies R, Felix R, Linana JJ, Lanuza A, Caballero L, Estornell F, Garcia-Ibarra F, Alvarez-Garijo JA. Influence of the type of operations on the development of latex sensitization in children with myelomeningocele. *Journal of Pediatric Surgery, 2005*; 40:688-692.
34. American Latex Allergy Association. *Cross Reactive Food*. 2007 http://latexallergyresources.org/cross-reactive-food
35. Asthma and Allergy Foundation of America, *Latex Allergy*, 2015 http://www.aafa.org/page/latex-allergy.aspx
36. American Latex Allergy Association. Allergenic cross-reactivity of latex and foods: A compilation from the literature. 2007 http://latexallergyresources.org/sites/default/files/attachments/TB10A%20Latex%20food%20cross-reactivities.pdf