

Educational Clinical Case Series

Latex allergy: Two educational cases

Baker L, and Hourihane J. O'B. Latex allergy: Two educational cases. *Pediatr Allergy Immunol* 2008; 19: 477–481.

© 2008 The Authors

Journal compilation © 2008 Blackwell Munksgaard

Natural rubber latex (NRL) allergy is a significant problem both for health care workers and for children with complex medical and surgical conditions that require multiple surgical interventions. Primary and secondary prophylaxis are effective measures in identified high risk groups, such as spina bifida (SB). It is therefore likely that with proper attention to prevention and secondary prophylaxis in the highest risk groups that the numbers of paediatric SB patients with NRL allergy will continue to decrease. In contrast medical awareness of established latex allergy needs to be maintained. The issue of latex sensitisation via fruit and food allergy will also remain, so some of the attention that SB patients have received in the past may need to be refocussed onto other emerging high risk groups. Innovative immunomodulatory approaches may soon translate to the clinic for latex sensitised or allergic subjects.

L. Baker and J. O'B. Hourihane

Paediatrics and Child Health, University College,
Cork, Ireland

Key words: latex; fruit; allergy; anaphylaxis;
prophylaxis

JO'B Hourihane, Paediatrics and Child Health, Clinical
Investigations Unit, Cork University Hospital, Cork,
Ireland

Tel.: +353 214901237

Fax: +353 214345217

E-mail: j.hourihane@ucc.ie

Accepted 9 June 2008

Introduction

Natural rubber latex (NRL) originates from about 2000 plant species. It is an aqueous elastomer emulsion composed mainly of water (60%), rubber (35%) and proteins (2%) (1). Latex has been identified in balls used in games from as far back in 1600 BC (2). Surgical rubber gloves have been used since the 1900s but NRL allergy (NRLA) really came to prominence after a dental case report in 1979 (3). Primary prevention in high-risk groups seems effective (4) but it appears that there is a poor medical awareness of risk of NRLA in medical communities that may care for other high-risk children such as those with relevant food allergies.

Universal precautions against health care-related infection – both nosocomial infection for patients and occupational exposures to viral and other infections for health care workers (HCWs) – led to dramatic increase in the use of NRL products, especially NRL gloves. There

remains uncertainty over the contributory roles of both NRL processing, e.g. the relative allergenicity of ammoniated NRL and the overuse of cornstarch powder, used to make gloves more easily wearable but possibly contributing to distribution of allergen (1).

Natural rubber latex allergic reactions have been reported in many domestic situations from blowing up rubber balloons, pacifier use in infants, sports equipment including racquet sports and gymnastics equipment, and the use of barrier contraceptives. It is also reported in medical settings, both in hospitals and at home, ranging from formal surgical procedures to outpatient dental procedures and home care of patients with neuropathic bladders requiring intermittent self-catheterization. It is timely to note that the general population of both adults and children probably have low prevalences of NRL sensitization or clinical, symptomatic NRLA (5), though about 5% of blood donations have latex-specific antibodies (1). In contrast to certain groups, especially children with complex congenital malformations requiring multiple surgeries could almost be considered universally at risk (6, 7).

Abbreviations: HCW, Health care workers; NRL, natural rubber latex; NRLA, natural rubber latex allergy; SB, spina bifida and hydrocephalus; SLIT, sublingual immunotherapy.

Two illustrative cases from clinical practice are outlined below. It will be evident that the first case is more reflective of historical interest to paediatric allergologists than representing current best practice. Non-IgE-mediated reactions to latex are also described, particularly in those occupationally exposed such as HCWs and home carers of children with complex medical needs (1), usually causing allergic contact dermatitis. Our clinical experience is that such cases are unusual in children, so they have not been discussed further.

Case 1

A 5-yr-old boy presented to the Emergency Department (ED) with severe lip swelling, facial oedema and a new onset of wheeze. He was wheeled into the resuscitation room in his wheelchair by his parents who lived nearby and felt it would be quicker to rush him to the hospital themselves than wait for an ambulance. He had a large birthday badge on his jumper and told to staff that he was '5 TODAY'. He was well known to the paediatric department but this was his first attendance at the ED. He had been antenatally diagnosed with a lumbar myelomeningocele and hydrocephalus and was born vaginally, without instrumentation in his local hospital. His parents had not wished their baby to be delivered in the Regional University Maternity and Paediatric Hospital. There had been no peripartum complications. Postnatally he was transferred to the Regional Paediatric Neurosurgical Unit and had his spinal defect repaired and a ventriculoperitoneal shunt sited. For 6 months he suffered recurrent urinary tract infections and his parents were instructed for intermittent bladder catheterization (no latex precautions or policies were in place in his local hospital or the referral surgical unit).

He then had an uneventful medical history until he was 2 yr old when he presented to hospital with vomiting and lethargy for 3 days. He was opisthotonic. He was diagnosed with a blocked shunt on MRI scan under sedation and was taken to surgery immediately. Post-operatively in the recovery room it was difficult to oxygenate after he was extubated. He had an audible wheeze and lip angioedema. A diagnosis of latex allergy was made and he was treated appropriately. An allergy consult was sought and outpatient review organized. His suspected latex allergy was confirmed on skin prick test using an available commercial extract (5 mm wheal) and a prick-prick test with an ammoniated latex surgical glove (6 mm wheal) and by measurement of

latex-specific IgE specific (11 kU_A/L). Latex precautions were outlined to parents and other carers in the community, with an emergency action plan and a medical identity bracelet. Adrenaline autoinjectors (AAIs) were prescribed as the boy had shown signs of airway involvement (8).

From the age of 2 to his 5th birthday, the parents were vigilant regarding latex avoidance, but had not attended allergy clinic as they felt they had the problem of NRLA under control and they wanted to reduce the number of clinics their child attended. Mum used latex-free gloves while catheterizing his neuropathic bladder three times daily. He had an inguinal hernia repair at the age of three and a half years, operated first case in the morning after the theatre was carefully cleaned overnight. The surgical team and carers wore latex-free gloves (8). He made an excellent recovery.

So what happened on his 5th Birthday?

This young boy started main stream school in September. He was reaching his cognitive milestones and had settled well in school. His parents invited his whole class to his birthday party. His parents had booked an inflatable bouncing castle (latex free) and a clown who gave to every child, except the NRL allergic birthday boy a balloon to blow up, while prepared food party in another room. One child overinflated his balloon and it burst right beside the boy's wheelchair, showering him in latex dust. The patient became distressed and wheezy immediately.

Discussion

In this historical case, we see a child suffering from spina bifida who has surgery shortly after birth with a ventriculoperitoneal shunt inserted. No NRL precautions were in place at that time. He was then intermittently catheterized from age 6 months, again with no NRL precautions in place. This child was exposed to latex intraoperatively on the first day of life and daily thereafter to 2 yr of age.

Children with spina bifida (SB) and hydrocephalus have a high exposure to surgery and urinary catheters or other medical indwelling devices. It is thought that such children develop specific IgE antibodies against NRL proteins due to their early mucosal exposure and persistent exposure through their early years. It has been suggested that there is a specific high susceptibility of NRL allergy in spina bifida patients due to the strength of the association but other high-risk groups exist (e.g. bladder

extrophy) which also vary in the number of operations undergone early in life. Clinical conditions such as gastroschisis and exomphalos, with a similar need for surgery early in life have been shown to have lower rates of latex sensitization than SB patients, which has suggested that there is a particular, possibly genetic, predisposition to NRLA in SB patients (9). It remains a fact that the highest prevalence rate is documented in paediatric patients which have been shunted due to hydrocephalus. This hydrocephalus is largely due to SB but cases of latex allergy in children with other causes of hydrocephalus which have also been shunted are also documented (10). All population groups studied have shown latex allergies to be associated with atopy. Bernardini et al. showed latex sensitization present only in atopic children (11). Multivariate analysis in many studies have shown that atopy, fruit allergies and a history of repeated surgical procedures are associated with latex sensitization (7, 11). The type of surgery may also be important with VP shunt insertion considered critical in some studies (6, 12).

The child from this case was probably sensitized during his operation on the first day of life or during the early stages of ICS training. He also had a iatrogenic anaphylactic reaction in the anaesthetic room post-shunt revision. No system was put in place to educate the parents post-natally about the risk of latex sensitization and it was only when they were finally informed after their child's anaphylactic reaction that they became vigilant about the use of non-latex products.

It needs to be considered that spina bifida children who become sensitized due to medical care that is not latex free may have a legal case against their medical carers, considering the weight of evidence that now exists (6, 7). Most integrated health care systems are now aware of this and practice primary prevention, leading to the impression in many countries that the peak of new cases of NRLA has passed (13). This may not be the case in countries such as the UK and Ireland where allergology is still struggling to establish itself and awareness of allergic considerations by other physicians and surgeons may be very low (author's personal observation).

Primary prophylaxis seems to be more efficient in the reduction of latex sensitization. Niggemann et al. reported that only 1 in 15 children with spina bifida were latex sensitized after the introduction of primary prophylaxis in 1995 (13). Nieto et al. also reported an excellent outcome with primary prophylaxis. After 6 yr of primary latex prophylaxis they reported a decrease from

26.7% before to 4.5% of spina bifida patients demonstrating latex sensitization (14).

Decreasing latex exposure at home is as important as in the hospital setting. A latex avoidance programme was studied by Reider et al. over a 5 yr period. This secondary latex prophylaxis was carried out in a population of children who were already shunted due to hydrocephalus and only 34% of the children studied (predominantly children already sensitized to latex) carried out both medical prophylaxis and latex avoidance at home to a high level (15). More emphasis may need to be given to this aspect of latex allergy as increasing complex medical care is now given in a community setting.

It is also important to note that the parents in our case did not follow their allergy action plan correctly. This is common in clinical practice and relates to parental (and medical) fears of the consequences of intervening, in contrast to the consequences of not intervening, which can be catastrophic in anaphylaxis (8, 16). Instead of treating their child with known latex allergy and clear allergic symptoms with adrenaline and seeking emergency assistance they possibly put the child at further risk by transporting him to their local hospital themselves.

They might have responded differently if they had kept up contact with the allergy clinic regarding anaphylaxis management and reinforcement of their information about the indications and techniques for using adrenaline autoinjectors (8, 16, 17). In food allergy, this regular contact can considerably decrease the rate of accidental exposure to allergens (18).

In vivo and *in vitro* diagnostic testing has now become more specific and the increasing use of recombinant allergens and component resolved diagnostics has broadly identified which proteins each risk group is affected by. The major allergens for the spina bifida group are Hev b1 and Hev b3 which are hydrophobic proteins found tightly bound to rubber particles. HCWs are exposed to latex from the use of gloves and from inhaling latex in their work place. The main proteins HCWs react to are Hev b5 and Hev 6.02 (1).

Cremer et al. has shown in a longitudinal study that there is an exposure response relationship. After measuring the antibody levels in spina bifida children post-operatively, it was noted that their latex antibody levels increased from their preoperative levels (19). Previous work by our group in a very high-risk paediatric surgical population showed a seroconversion rate of 1 case in every 50 operations (2%) (7).

Case 2

A family picnic took place with all family members and were asked to ensure that the youngest child, who was kiwi allergic, did not go near the fruit platter. Kiwi fruit was already excluded from the picnic, after she had vomited 6 months previously with mild eye swelling after lip contact with kiwi. She had been prescribed an adrenaline autoinjector by her family doctor. She was awaiting a specialist allergy appointment and had not had any skin prick tests or definitive diagnosis. Her autoinjector was kept in the car during the picnic. An hour into the picnic, the kiwi allergic child fell and cut her head with a large 5 cm laceration. At the ED, she was examined by a Plastic Surgery trainee, who wore gloves due to continuing bleeding. Urticaria soon developed on her face, arms and legs. Her blood pressure remained stable and she had no facial oedema, lip swelling or respiratory symptoms. She received a dose of an antihistamine and improved within 15–20 min. The paediatric registrar was called and she advised the plastic surgeon to use non-latex gloves while glueing her forehead due to a probable latex allergy as this was the only allergen they could definitively associate with the acute allergic reaction.

Her appointment with the Paediatric Allergist was brought forward. Skin prick tests using fresh fruits and specific IgE for latex and kiwi were performed. She was diagnosed with Latex Fruit Syndrome after kiwi produced a 7 mm wheal on SPT and a kiwi-specific IgE of 48 Kui/l and latex a 5 mm wheal using a commercial extract and a latex-specific IgE of 17 Kui/l.

Latex fruit syndrome

A surgical registrar elicited no medical history of allergies and used latex gloves. When the child reacted with typical allergic features, a paediatric consult was required to advise the surgeon to use non-latex gloves. The diagnosis of latex fruit syndrome was made after allergy testing by a specialist. Her skin prick tests were positive and her IgE for kiwi and latex were raised. Fifty per cent of patients who are sensitized to latex also show sensitization to food most commonly fruit. These foods include kiwi, potato, chestnut, tomato, banana and avocado. Almost 50% of the latex-sensitized children have allergies mostly to bananas, kiwis and avocados (20, 21). Latex hevein (Hev b 6.02) and Hev b 11 have been implicated, which contrasts with the major allergens implicated in spina bifida patients (Hev b1 and Hev b3) (1).

Atopic children without obvious risk factors for NRLA have also been studied. 1–2% of these children were sensitized to latex. These children were documented to have no specific or abnormal latex exposure (22). It is not certain if primary latex avoidance is required in kiwi allergic children and vice versa.

Therapies for latex allergy

It appears clear that successful latex avoidance eliminates the risk of an allergic reaction and that primary and secondary prophylaxis appear to be effective strategies. Predictably several groups have examined immunomodulatory therapeutic strategies. Conventional subcutaneous immunotherapy was neither successful nor well tolerated (23). One year of sublingual immunotherapy (SLIT) appeared to eliminate symptoms on exposure in a heterogeneous group of 10 latex allergic children with a variety of primary diagnoses, including SB, but also cases of Ehlers Danlos syndrome and diaphragmatic hernia. The children underwent rush desensitization followed by thrice weekly SLIT and daily wearing of latex gloves for 30 min. Challenge after 1 yr showed variable positive effects (24). Anti-IgE therapy has also been reported as effective and well tolerated in health care workers in a double-blind placebo-controlled study over 16 wk (25).

The future of latex allergy

It is likely that with proper attention to prevention and secondary prophylaxis in the highest risk groups, the numbers of paediatric SB patients with latex allergy will decrease. However, increasingly complex surgery for other conditions and the increasing rates of relevant food allergies may see a shift in the patient profile of latex allergy away from SB children, whose high risk is well known. There will remain HCWs and adults with spina bifida, who were born before such strategies were established, who will remain at risk. The issue of latex sensitization via fruit and food allergy will also remain, so some of the attention that SB patients have received in the past may need to be refocused onto other emerging high-risk groups. Allergists will need to continue to advocate for the safety of latex allergic patients who often have complex primary medical conditions, requiring lifelong medical care. It seems reasonable to hope that emerging immunomodulatory approaches to latex allergy will translate to the clinic for those people sensitized to latex after infancy and who

do not otherwise belong to the groups to whom primary prevention of latex allergy is currently offered.

References

1. CULLINAN P, BROWN R, FIELD A, et al. Latex Allergy. A position paper of the British Society of Allergy and Clinical Immunology. *Clin Exp Allergy* 2003; 33: 1484–99.
2. OWNBY D. A history of latex allergy. *J Allergy Clin Immunol* 2002; 110: S27–32.
3. NUTTER F. Contact urticaria to rubber. *Br J Dermatol* 1979; 101: 597–8.
4. CREMER R, KLEINE-DIEPENBRUCK U, HOPPE A, BLAKER F. Latex allergy in spina bifida patients – prevention by primary prophylaxis. *Allergy* 1998; 53: 709–11.
5. ROBERTS G, LACK G, NORTHSTONE K, GOLDING J. ALSPAC Study Team. Prevalence of latex allergy in the community at age 7 years. *Clin Exp Allergy* 2005;35:299–300. PMID: 15784106.
6. MAZON A, NIETO A, PAMIES R, et al. Influence of the type of operations on the development of latex sensitization in children with myelomeningocele. *J Pediatr Surg* 2005; 40: 688–92. PMID: 15852280.
7. HOURIHANE J, ALLARD J, WADE A, McEWAN A, STROBEL S. Impact of repeated surgical procedures on the incidence and prevalence of latex allergy: a prospective study of 1263 children. *J Paediatr* 2002; 140: 479–82.
8. SIMONS FE. Anaphylaxis, killer allergy: long-term management in the community. *J Allergy Clin Immunol* 2006; 117: 367–77. PMID: 16461138.
9. EIWEGGER T, DEHLINK E, SCHWINDT J, et al. Early exposure to latex products mediates latex sensitization in spina bifida but not in other diseases with comparable latex exposure rates. *Clin Exp Allergy* 2006; 36: 1242–6. PMID: 17014431.
10. HOCHLEITNER B, MENARDI G, HAUSSLER B, et al. Spina bifida as an independent risk factor for sensitisation to latex. *J Urol* 2001; 166: 2370–4.
11. BERNARDINI R, NOVEMBRE E, INGARGIOLA A, et al. Prevalence and risk factors of latex sensitisation in an unselected pediatric population. *J Allergy Clin Immunol* 1998; 101: 621–5.
12. BUCK D, MICHAEL T, WAHN U, NIGGEMANN B. Ventricular shunts and the prevalence of sensitization and clinically relevant allergy to latex in patients with spina bifida. *Pediatr Allergy Immunol* 2000; 11: 111–5.
13. NIGGEMANN B, BUCK D, MICHAEL T, HABERL H, WAHN U. Latex allergy in spina bifida: at the turning point? *J Allergy Clin Immunol* 2000; 106: 1201. PMID: 11112908.
14. NIETO A, MAZÓN A, PAMIES R, et al. Efficacy of latex avoidance for primary prevention of latex sensitization in children with spina bifida. *J Pediatr* 2002; 140: 370–2.
15. REIDER N, KRETZ B, MENARDI G, ULMER H, FRITSCH P. Outcome of a latex avoidance program in a high-risk population for latex allergy – a five year follow-up study. *Clin Exp Allergy* 2002; 32: 708–13.
16. SAMPSON HA, MUÑOZ-FURLONG A, CAMPBELL RC, et al. Second symposium on the definition and management of anaphylaxis: summary report – Second National Institute of Allergy and Infectious Disease/ Food Allergy and Anaphylaxis Network Symposium. *J Allergy Clin Immunol* 2006; 117: 391–7.
17. MURARO A, ROBERTS G, CLARK A, et al. The management of anaphylaxis in childhood: position paper of the European academy of allergology and clinical immunology. *Allergy* 2007; 62: 857–71. PMID: 17590200.
18. EWAN PW, CLARK AT. Efficacy of a management plan based on severity assessment in longitudinal and case-controlled studies of 747 children with nut allergy: proposal for good practice. *Clin Exp Allergy* 2005; 35: 751–6. PMID: 15969666.
19. CREMER R, LORBACHER M, HERING F, ENGELSKIRCHEN R. natural rubber latex sensitisation and allergy in patients with spina bifida, urogenital disorders and oesophageal atresia compared with a normal paediatric population. *Eur J Pediatr Surg* 2007; 17: 194–8 Fuchs T. Gummi und Allergie. Munchen: Dustri 1995: 119–125
20. BEEZHOLD DH, SUSSMAN GL, LISS GM, CHANG NS. Latex allergy can induce clinical reaction to specific foods. *Clin Exp Allergy* 1996; 26: 416–22.
21. RAULF-HEIMSOOTH M, KESPOHL S, CRESPO JF, et al. Natural rubber latex and chestnut allergy: cross-reactivity or co-sensitization? *Allergy* 2007; 62:1277–81. PMID: 17919142.
22. WEISSMAN D, LEWIS D. Allergic and latex specific sensitisation route, route, frequency and amount that are required to initiate IgE production. *J Allergy Clin Immunol* 2002; 110: S57–63.
23. TABAR AI, ANDA M, BONIFAZI F, et al. Specific immunotherapy with standardized latex extract *versus* placebo in latex-allergic patients. *Int Arch Allergy Immunol* 2006; 141: 369–76. PMID: 16943675.
24. NUCERA E, SCHIAVINO D, POLLASTRINI E, et al. Sublingual desensitization in children with congenital malformations and latex allergy. *Pediatr Allergy Immunol* 2006; 17:606–12. PMID: 17121589.
25. LEYNADIER F, DOUDOU O, GAOUAR H, et al. Effect of omalizumab in health care workers with occupational latex allergy. *J Allergy Clin Immunol* 2004; 113: 360–1. PMID: 14767458.