

LATEX ALLERGY IN CHILDREN WITH UROLOGICAL MALFORMATION AND CHRONIC RENAL FAILURE

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ABSTRACT

Purpose: Children with spina bifida, bladder exstrophy and anorectal anomalies are at risk for latex allergy. Severe intraoperative anaphylaxis in a boy treated with kidney transplantation prompted this study to evaluate the prevalence of latex allergy in a cohort of children with chronic renal failure (CRF).

Materials and Methods: Between 1996 and 2002, 57 boys and 28 girls were investigated at a median age of 10.5 years (range 1.3 to 22.9). Urological malformations were the underlying cause of CRF in 33 patients (39%). Of the patients 39 were on conservative treatment, 20 were on dialysis and 26 had a functioning renal graft. Latex reaction was assessed by a careful history, specific serum latex IgE and skin prick test.

Results: A total of 19 patients (22%) showed latex reaction, of whom 8 had allergy (clinical symptoms included severe intraoperative anaphylaxis in 1) and 11 had sensitivity (positive IgE or prick test without symptoms). Of these 19 patients 11 had urological malformations. The number of surgical procedures, young age at operation and atopy were significant risk factors. When operations were analyzed separately, ie urological vs nonurological surgery, only urological surgery was significantly associated with latex reaction. A significant correlation was also found between the overall number of operations and latex radioallergosorbent class.

Conclusions: All children with CRF who undergo early and multiple urological surgery are at high risk for latex reaction. Primary latex prevention, ie the routine use of latex-free gloves, tubes and catheters, should be implemented in all children with complex urological malformations.

KEY WORDS: latex hypersensitivity, kidney, intraoperative complications, anaphylaxis, abnormalities

Latex, a natural substance from the sap of the rubber tree *Hevea brasiliensis*, is common in various products for medical use (eg gloves, face mask, intubation tube, bladder catheter and electrode pads) and household use (eg balloons, rubber lined helmets and swimming masks). As assessed by the serum latex IgE or skin prick test, latex sensitivity varies in the general pediatric population from 1% to 8.6%.^{1–3} However, latex allergy, ie anaphylactic symptoms after contact with latex, is rare in healthy children.^{1–5} Latex allergy is highly prevalent (up to 60%) in pediatric populations with bladder exstrophy, spina bifida, posterior urethral valves, prune-belly syndrome and neuropathic bladder. However, only an association of latex allergy with spina bifida^{6,7} and bladder exstrophy⁸ has been reported in the literature. Repeat surgical procedures and atopy were significant risk factors,^{1–3,6–8} as also observed in the general pediatric population.⁴

Immediate hypersensitivity reactions to latex (type I) are caused by cross-linking of latex protein specific IgE antibodies with mast cells and basophils.⁹ Clinical symptoms of latex allergy range from localized urticaria to severe grade IV anaphylaxis with hypotension and shock. Children with chronic renal failure (CRF) might be at higher risk for latex reaction since they often have urological malformations and undergo repeat surgery. Although this risk is mentioned in textbooks and reviews, to our knowledge no studies have been performed to date in children with CRF. In particular, it is not known whether children with CRF not due to urolog-

ical malformations or without urological surgery are at increased risk for latex reaction.

Severe intraoperative grade IV anaphylaxis to latex with hypotension, larynx edema and asthma in a boy with a transplant and prune-belly syndrome prompted this study to analyze the prevalence of latex allergy and sensitivity in children with CRF.

MATERIALS AND METHODS

Between 1996 and 2002, 57 boys and 28 girls with CRF were studied at a median age of 10.5 years (range 1.3 to 22.9). Urological malformations were the underlying cause of CRF in 33 patients (39%), including 2 boys with prune-belly syndrome and 2 patients with additional anorectal malformations (anal atresia and anus copertus, respectively). However, none had spina bifida or bladder exstrophy. At investigation 39 patients were on conservative treatment, 20 were on dialysis and 26 had a functioning renal graft with previous dialysis in 21. A history was obtained of atopy (rhinitis, asthma and neurodermitis), and allergic reactions to medical and household latex products, and food (eg bananas, chestnut, kiwi or avocado) known to cross-react with latex. In addition, the number of and age at surgical procedures was collected. A latex protocol was introduced at our unit in 1996, including annual assessment of latex history and specific serum latex IgE. The use of latex-free gloves is restricted to patients with latex allergy and to those in whom specific latex IgE develops. Primary latex prevention (ie avoidance of latex gloves and catheters) was implemented in the whole hospital in 1999 for children with spina bifida, bladder exstrophy and anorectal malformations.

Latex allergy was defined as allergic symptoms to latex

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and positive latex specific serum IgE with a positive prick test. Latex sensitivity was defined as no history of allergic symptoms to latex but positive latex specific serum IgE or a skin prick test.¹

Total serum IgE in κ U/l and specific serum IgE to latex were measured by fluorescence-enzyme immunoassay (PRIST, Pharmacia Diagnostics, Uppsala, Finland) with a cutoff of 0.35 κ U/l or greater. Positive results were categorized according to 6 radioallergosorbent (RAST) classes, 1—0.35 to 0.70, 2—0.70 or greater to 3.5, 3—3.5 or greater to 17.5, 4—17.5 or greater to 50, 5—50 or greater to 100 and 6—100 or greater. The epicutaneous latex prick test was performed on the right forearm using Soluprick ALK (Tri-medal AG, Brüttisellen, Switzerland). A wheal diameter of 3 mm or greater was regarded as positive. Groups were compared using the Student *t* and chi-square tests with significance considered at *p* < 0.05.

RESULTS

Of the 19 patients (22%) with a latex reaction 8 had latex allergy and 11 had latex sensitivity (table 1). One patient had severe grade IV intraoperative anaphylaxis with hypotension, larynx edema and asthma, while the others mainly complained of urticaria and conjunctivitis. Of the patients with a latex reaction 11 had urological malformations, representing 33% of this group. In addition, 8 of 52 patients (15%) with acquired or inherited renal disease showed a latex reaction (table 2). Multiple surgical procedures, young age at operation and atopy were significant risk factors for latex allergy and sensitivity (table 3). When surgical procedures were analyzed separately, ie urological vs nonurological, only urological procedures were significantly associated with a risk of latex reaction. A significant correlation was found between the overall number of operations and RAST class of serum latex IgE (see figure). Patients 1 and 2 with prune-belly syndrome, and 6 and 8 with anorectal malformation had latex allergy. Current or previous dialysis did not significantly correlate with latex reaction. Mean total serum IgE $\pm$ SEM was significantly higher in 19 children with latex reaction compared to 66 latex nonreactors (410 ± 161 vs 72 ± 19 κ U/l, *p* < 0.001).

DISCUSSION

Pediatric patients with spina bifida, bladder exstrophy and anorectal malformations are at high risk for latex allergy.^{1,2,6-8} This study demonstrates that a third of the children with urological malformations had latex allergy or sensitivity. Thus, all children with urological malformations, not only those with spina bifida or bladder exstrophy, are at high risk for latex reaction. Significant risk factors were early and multiple surgery. However, when urological and nonurological surgery were analyzed separately, only urological surgery was significantly associated with a risk for latex reaction.

Thus, children with CRF due to acquired or hereditary disorders are in general at no significantly increased risk for latex reaction except for a few individuals undergoing early and repeat surgery. Pediatric age at exposure to latex also appears to be a major contributing factor in the general pediatric population because any previous operation, even a single operation, increases the odds of latex reaction by 13 times.⁴ Adult patients after spinal cord injury¹⁰ or on long-term hemodialysis¹¹ do not show an increased prevalence of latex reaction.

The allergen source for symptomatic patients was a household or medical product, the latter being mainly gloves, tubes or catheters. Although most anaphylactic symptoms were mild, one patient had severe intraoperative anaphylaxis. Known risk factors for latex reaction present in known high risk populations with spina bifida and bladder exstrophy^{1-3,6-8} were also found in our pediatric population with CRF, ie a history of early (during the neonatal period or year 1 of life) and multiple urological procedures, and a history of atopy.

Primary prevention of latex reaction is generally restricted to the high risk population since such measures are costly. The efficacy of latex avoidance has been demonstrated in several studies. Primary prevention significantly decreased the prevalence of latex reaction in children with spina bifida.^{12,13} In addition, the implementation of secondary latex precautions led to a significant decrease in intraoperative allergic symptoms.¹⁴

Our findings suggest that the pediatric population at high risk for latex allergy¹⁵ must be extended to include all children with urological malformations leading to early and multiple urological surgery. A careful history and testing for

TABLE 1. Latex allergy and sensitivity in 19 patients

	Allergy (pt No.)								Sensitivity (pt No.)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19				
Symptoms:	No clinical symptoms																						
Urticaria/conjunctivitis	+	+	+	+	+	+	+	+															
Quincke edema								+															
Anaphylaxis grade IV	+																						
Allergen source:																							
Medical	+	+	+	+	+																		
Household	+		+	+		+	+	+															
Food	+																						
Atopy			+	+															+	+	+	+	+
Latex:																							
IgE RAST class	1	3	2	1	3	2	4	2	3	2	2	2	2	2	1	2	2	1	3				
Skin prick test	Neg	Pos	Pos	Pos	Pos	Pos	Pos	Not done											Pos				
Malformation:																							
Urological	+	+	+				+	+	+	+			+			+		+	+				
Anorectal						+	+																
Surgery:																							
3 or Greater	+	+	+	+	+	+	+	+				+	+	+	+		+	+	+				
Urological*	+	+	+				+	+	+	+	+	+	+	+	+	+	+						
Nonurological†		+	+			+	+	+	+	+	+	+	+	+	+		+	+	+				
Younger than 28 days							+	+	+				+				+	+		+			
Yr 1 of life	+	+			+			+	+	+			+	+	+		+	+					
Treatment:																							
Dialysis	+	+	+			+	+			+	+			+	+	+		+	+				
Transplantation	+	+																		+	+		

* Including renal transplantation but excluding cystoscopy, laparoscopy and peritoneal dialysis catheter insertion.

† Including single lumen hypodermic needle or peritoneal dialysis catheter insertion, arteriovenous fistula, renal biopsy or herniotomy.

TABLE 2. *Diagnosis in patients with and without latex allergy and sensitivity*

Diagnosis	No. Allergy	No. Sensitivity	No. Nonreactors	Total No.
Overall	8	11	66	
Urological malformations (renal dysplasia/hypoplasia):	6	5	22	33
+ Vesicoureteral reflux/megaureter	3	4	15	
+ Hydronephrosis	—	—	1	
+ Posterior urethral valves	1	1	4	
+ Prune-belly syndrome	2	—	0	
Acquired disorders:	0	6	18	24
Wilms tumor		1	—	
Focal segmental glomerular sclerosis		2	4	
Renal vein thrombosis		1	—	
Perinatal shock kidneys		2	3	
Glomerulonephritis		—	3	
Hemolytic-uremic syndrome			8	
Hereditary disorders:	2	0	26	28
Interstitial nephropathy	1		1	
Familial hemolytic-uremic syndrome	1		1	
Other (ie Alport syndrome, cystinosis, nephronophthisis + oxalosis)	—		24	

TABLE 3. *Risk factors for latex allergy and sensitivity*

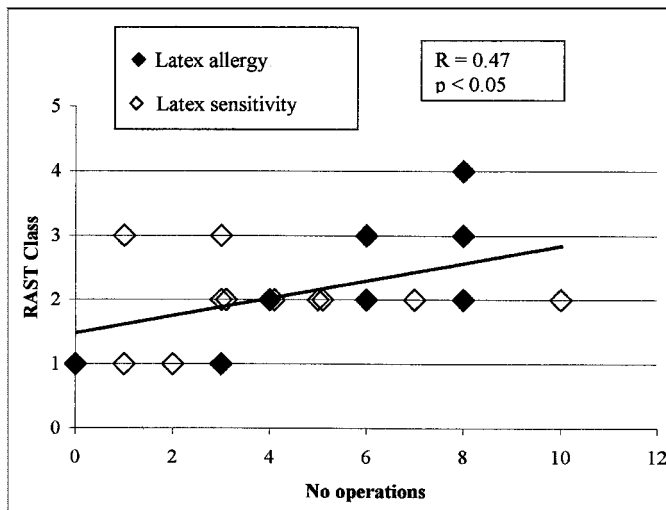
Overall	No. Allergy/Sensitivity (%)		
	Present	Absent	p Value (chi-square test)
Surgery:			
3 or Greater	16 (84)	29 (44)	<0.01
Urological surgery*	13 (68)	27 (41)	<0.05
Nonurological surgery†	16 (84)	47 (71)	
Only nonurological	6 (31)	21 (32)	
Neonatal	5 (26)	3 (5)	<0.01
Yr 1 of life	12 (63)	11 (17)	<0.01
Atopy	7 (37)	10 (15)	<0.05
Dialysis	11 (58)	33 (50)	
Urological malformations	11 (33)	22 (66)	
Acquired or hereditary disease	8 (15)	44 (85)	

* Including renal transplantation but excluding cystoscopy, laparoscopy and perineal dialysis catheter insertion.

† Including single lumen hypodermic needle or peritoneal dialysis catheter insertion, arteriovenous fistula, renal biopsy or herniotomy.

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Correlation between latex IgE RAST class and overall number of operations.

specific serum IgE are essential for the diagnosis. Primary latex prevention, at least the routine use of latex-free gloves, tubes and catheters, should be implemented, not only in pediatric patients with distinct malformations such as spina bifida, bladder exstrophy or anal atresia, but also in all children with urological malformations possibly requiring early and multiple surgery.

Mrs. Alig measured serum IgE.