

Anaesth Intensive Care 2001; **29**: 43-47

The Prevalence of Latex Allergy in Operating Theatre Staff

M. E. HACK*

The Anaesthetic Department, Princess Alexandra Hospital, Brisbane, Queensland

SUMMARY

Latex allergy has become increasingly common amongst health care workers. The prevalence of latex allergy in 102 theatre personnel at Princess Alexandra Hospital was determined by the results of a standardized questionnaire and a latex specific IgE radioallergosorbent test (RAST). Volunteers had their forced expiratory volume in 1 second/forced vital capacity (FEV₁/FVC) measured at the beginning and end of their working shifts.

Only one of 102 volunteers had a positive latex specific IgE RAST and he also experienced both local and systemic symptoms with latex exposure and a deterioration in daily FEV₁/FVC. The 14 volunteers using asthma medications had significantly higher incidence of operating theatre symptoms (10/14), local reactions (8/14), and atopy (14/14). There was no clinically significant daily change in FEV₁ in the total population or any specific group.

The 1% (1/102) prevalence of latex allergy and sensitization in theatre staff demonstrates a much lower incidence than previously reported (12.5%¹, 15.8%²).

Key Words: ALLERGY: latex, specific IgE, radioallergosorbent test, RAST

The increased incidence of latex allergy³ is thought to be due to both changes in the manufacturing process of rubber and the increasing use of latex gloves since the introduction of *universal precautions* in 1987^{4,6}.

Latex contains numerous proteins of different molecular weights. All of these proteins may be altered or degraded by the ammonia used in the preservation of latex shortly after collection. Sensitization may occur transcutaneously or by direct mucosal contact. Allergy symptoms may range from localized symptoms to systemic reactions. As latex proteins absorbed by glove powder become aeroallergens, sensitized patients may suffer from allergic reactions by inhalation of these latex aeroallergens.

Latex gloves offer better protection than non-latex gloves against contagious diseases⁷ such as HIV and hepatitis B. Many surgeons and proceduralists believe that latex gloves offer greater sensitivity than non-latex alternatives, making surgery easier and needle-stick injury and surgical complications less likely. Glove manufacturers add cornstarch powder to some latex gloves to reduce friction and improve comfort.

The lack of a standardized latex skin test extract has led to the use of "in-house" skin test allergens and the using of extracts from available latex products such as surgical gloves. However, due to differences in latex sources and manufacturing processes, a wide range of allergen content can be detected in various surgical gloves. Systemic reactions including anaphylaxis have been reported after these skin tests⁸. The immunology department at the Princess Alexandra Hospital does not use skin tests in the diagnosis of latex allergy because of non-standardization and potentially life-threatening complications of skin tests. The diagnosis is made on both a positive history and serum latex specific radioallergosorbent (RAST) test. The RAST is an in vitro test for the presence of IgE antibody to specific latex proteins. In vitro tests may not be sensitive enough to detect all persons who may be at risk from latex contact.

The RAST has a reported sensitivity of 91 to 100% and specificity of 60 to 80%⁹. A person is sensitized to latex if there is a positive RAST result and no symptoms of latex allergy. If RAST is negative and there is a strong history of allergy symptoms on latex exposure, latex allergy cannot be excluded.

MATERIALS AND METHODS

One hundred and two volunteers were recruited in to the study. Approximately six to eight people who were asked to be in the study declined and gave needle phobia as their reason for refusal to participate.

*F.F.A.R.C.S.I., F.A.N.Z.C.A., Staff Specialist, Princess Alexandra Hospital, Brisbane, Queensland.

Address for Reprints: Dr M. E. Hack, The Anaesthetic Department, Princess Alexandra Hospital, Ipswich Road, Brisbane, Qld 4102.

Accepted for publication on October 16, 2000.

Anaesthesia and Intensive Care, Vol. 29, No. 1, February 2001

The study was approved by the Hospital Ethics Committee. Princess Alexandra Hospital is a large tertiary referral centre with approximately 18,000 surgical procedures per year resulting in a broad exposure of staff to latex. A total of 102 theatre staff including anaesthetists, wardsmen, theatre and recovery nurses was recruited. These people were the first 102 volunteers of a potential eligible pool of 169 staff. Each volunteer to qualify for the study, had to have worked a minimum of 24 hours per week or six sessions per week for a minimum of three months in the operating theatre.

Prior to the commencement of this study, non-sterile powdered latex gloves were removed from the anaesthetic trolleys. These were replaced by non-sterile, non-powdered latex gloves. Non-powdered latex gloves and vinyl gloves are routinely available in the recovery ward. Both sterile powdered and non-powdered latex gloves as well as sterile non-latex alternatives such as Dermapren (Ansell Medical, Sri Lanka) are available in the scrub area.

Each volunteer was allocated an identifying number which was known only to the individual concerned and the sole researcher. This number was used to label the RAST test, questionnaire and spirometry results. Confidentiality was thus maintained. All 102 volunteers had 10 ml of venous blood collected in an additive-free tube which was tested for latex-specific IgE RAST using Sanofi AllercoatTM Compact Disc Pasteur Kit (Sanofi, Munich, Germany). EMLA (AstraZeneca) cream pre-venepuncture was offered to potential volunteers who expressed anxiety about experiencing pain from the venepuncture.

One hundred and sixty-nine people working in theatre met the study's inclusion criteria and the first 102 people who volunteered to participate were recruited. All 102 volunteers completed a questionnaire determining general demographic data (age, occupation, sex, smoking history), history of latex allergy and possible latex allergy risk factors, such as history of atopy, fruit allergy, past surgery or insertion of indwelling urinary catheter, years worked in operating theatre and duration of latex exposure including use of powdered and non-powdered latex gloves and non-latex gloves.

Medical International Research (Rome, Italy) Spirobank, a pocket size multifunction spirometer with accuracy $\pm 3\%$, was used to measure the volunteer's FEV₁/FVC. The best of two efforts of FEV₁/FVC was recorded at the beginning and end of three daytime shifts.

Data obtained was analysed with Chi-square test using SPSS software. The volunteers diagnosed as

latex-allergic or sensitized were to be referred to the hospital immunologist for further management and advice. When a volunteer was recruited to the study, he or she was assured that an immunology referral if indicated was voluntary and would not be arranged if the individual did not consent.

RESULTS

A total of 102 theatre personnel including doctors, nurses and wardsmen completed the study questionnaire (Table 1). Previously stated risk factors for latex allergy, such as atopy, fruit allergy, past surgery and a history of urinary catheter were not associated with a positive latex-specific IgE RAST. Tomato, avocado and pineapple were included in four of the 39 described allergies.

Volunteers using asthma medications had significantly higher operating theatre symptoms (tinnitus, conjunctivitis, shortness of breath, wheeze, chest tightness, generalized hives), local reactions (irritation, dryness, erythema, pruritus, swelling, localized urticaria, hand cracking, fissuring, weeping) to latex and also atopy (hayfever, asthma, eczema, recurrent sinusitis). Only 20 of the 102 volunteers experienced operating theatre (OT) symptoms whilst at work (Table 2).

TABLE 1
Volunteer demographic data

	Total	Doctors	Nurses	Wardsmen
Study totals	102	22	76	4
Males:females	33:69	17:5	12:64	4:0
Average age (years)	34.4	39.0	33.0	36.0
Average hours worked per week		49.4	38.3	39.5
Atopic individuals	44	11	33	0
Smokers	19	1	15	3
Smoke at work	7	0	4	3
Previous surgery or IDC	58	16	41	1
Known allergies	39	7	31	1
Previous anaphylaxis	4	0	3	1
Asthmatics	18	4	14	0

Table 3 summarizes the data concerning latex and non-latex glove usage.

Local hand symptoms when wearing latex gloves were experienced by 32 of the 102 volunteers. A total of 24 of these 32 volunteers had consequently changed the gloves they routinely used; 22 of the 24 had changed to non-powdered gloves and the remaining two had changed to non-latex gloves. The symptoms of 19 of these 24 volunteers disappeared when they ceased wearing powdered latex gloves. Only four of the 102 volunteers routinely avoided latex and wore non-latex gloves.

The spirometry component of the study was

TABLE 2

Cross tabulation of asthma therapy and operating theatre symptoms

		OT Symptoms		
		No	Yes	Total
Asthma therapy	No	77	10	87
	Yes	4	10	14

Chi-square test, Fisher's Exact test
Exact Sig. (two sided) 0.000

Cross tabulation of asthma therapy and local reaction to latex

		Local Reaction		
		No	Yes	Total
Asthma therapy	No	14	73	87
	Yes	6	8	14

Chi-square test, Fisher's Exact test
Exact Sig. (two sided) 0.030

completed by 100 volunteers. A decrease in FEV₁ by 3% or greater was equivalent to an average decrease of 100 ml or greater in the afternoon FEV₁ compared with the morning FEV₁. The FEV₁ did decrease during the day but not by 3% or greater and was thus not deemed clinically significant (Table 4).

Only one of the 102 volunteers had a positive latex specific IgE RAST and this was strongly positive (3+). This volunteer stated he was asthmatic but not atopic, and was a non-smoker who had never had a urinary indwelling catheter or any surgery. He was not allergic to fruit but was allergic to penicillin. He had used latex gloves for the whole 10 years that he had worked in theatres. His symptoms included local skin irritation, erythema, urticaria and wheeziness on exposure to rubber products at work and at home. He experiences symptoms two to three minutes after wearing powdered latex gloves, and five to 10 minutes after wearing non-powdered latex gloves. His symptoms ceased if he wore non-latex gloves, for example, Dermapren. These non-latex neoprene gloves are expensive. He sometimes wears vinyl

TABLE 3

Frequency of powdered latex glove (PLG), non powdered latex glove (NPLG) and non latex glove (NLG) use

Average number of years worked in theatre per volunteer	8.4
Total number in study	102
Number using latex gloves (PLG and NPLG)	98/102 (96%)
Number using PLG	68/102 (66%)
Number using NPLG	82/102 (80.4%)
Experiencing symptoms	32/102
Number with symptoms who have changed from PLG to NPLG or NLG	24/32
Number changed to NPLG	22/24
Number changed to NLG	2/24
Number whose symptoms disappeared when changed from PLG to NPLG/NLG	19/24
Number who avoid latex and wear non-latex routinely	4/102 (3.9%)

Anaesthesia and Intensive Care, Vol. 29, No. 1, February 2001

TABLE 4

Variations in FEV₁

	Median	Min.	Max.	Mean	SD	Valid N
FEV ₁ am (litre)	3.497	1.823	5.927	3.485	0.761	N=100
FEV ₁ pm (litre)	3.445	1.827	6.417	3.444	0.789	N=100
FEV ₁ CHNG ^a (litre)	-0.038	-0.370	0.490	-0.041	0.143	N=100
FEV ₁ PERC ^b	-1.047	-13.481	13.898	-1.317	4.530	N=100

^a FEV₁CHNG=FEV₁pm-FEV₁am

^b FEV₁PERC=FEV₁pm-FEV₁am
FEV₁am

gloves for non-sterile procedures but these offer less protection.

Referral to the consultant immunologist resulted in a recommendation to avoid latex exposure. In view of his daily decrease in FEV₁ during the study and past history of asthma, he underwent formal respiratory function tests which were normal following a methacholine challenge. The immunologist referred him to the respiratory team as he is at risk of developing asthma in the future and it is therefore important to document his baseline respiratory function. The recommendation to change his work environment has not been followed. He is to be reviewed in four months.

DISCUSSION

This study was designed to determine the prevalence of latex allergy in an Australian operating theatre. An increasing incidence of latex allergy has been reported in hospital personnel in many countries, such as U.S.A. and Scandinavia³. Theatre staff are an interesting group because they spend a high percentage of their working time wearing latex gloves.

This study showed slightly less than a 1% prevalence of latex allergy, which is much lower than the prevalence reported in other countries and two earlier Australian studies^{10,11}. This low prevalence may be a genuine value or it may be falsely low. A genuine prevalence of 1% may be due to one or any combination of four reasons. A different purity of latex product may have been imported to Australia. Australians may be a less allergic (immunologically reactive) group. No similar study has been undertaken in Australia. One Australian study investigated latex allergy amongst dentists using a questionnaire survey only and the other Australian study investigated latex allergy among ward and intensive care nurses using a questionnaire survey and skin prick test. Some previous overseas studies have diagnosed latex allergy with skin tests and/or RAST or ELISA tests. These studies may have given a falsely high

prevalence since there is no standardized skin test for latex allergy and an "in-house" test has been used. Even RASTs differ. This study used the German Sanofi RAST test, which involves an inert powder-free disc. Overseas studies have used the CAP Pharmacia liquid test. The latex in the Sanofi disc is batch dependent and obtained from different countries. The Sanofi latex specific RAST test was the only one available to this researcher. The test for latex allergy diagnosis has not been standardized. Eighteen months before the study was commenced, the anaesthetic and recovery staff ceased using non-sterile powdered latex gloves and used non-sterile, non-powdered gloves instead. Only the surgeons and theatre nurses, and a few anaesthetists conducting sterile procedures such as insertion of epidural catheters, were still using powdered latex gloves. Several studies^{12,13} have demonstrated that powdered rubber gloves result in an increased latex aeroallergen level and increase the risk of developing a latex allergy. Consequently, the latex aeroallergen concentration in the operating theatre 18 months before and during this study was lower than previously and the staff possibly at decreased risk of developing a latex allergy.

This study prevalence may be falsely low for one of several reasons. The non-standardization of latex allergy diagnosis tests and in vitro tests may not be sensitive enough to detect all people who may be at risk from latex contact. Sanofi, the company that make the latex RAST tests used in this study, assume that the sensitivity and specificity of their latex RAST test is equivalent to the CAP Pharmacia (Uppsala, Sweden) latex specific IgE RAST test which has been quoted as 91 to 100% and 60 to 80% specific respectively⁹. However, a comparative study has yet to be completed. Selection bias may have occurred.

One hundred and two volunteers were recruited and six to eight staff refused to participate out of a total of 169 staff eligible for the study. Therefore, approximately 59 people were not asked to volunteer. The people who declined to participate gave needle phobia as their reason despite the offer of EMLA cream pre-venepuncture. Two of these staff coincidentally volunteered that they were allergic to condoms. Needle phobia has been described as a recruitment problem in a previous study⁵. It is possible that all or some of these individuals were not scared of needles. Some individuals may have been unwillingly to be tested because of the potentially adverse implications of a diagnosis of latex allergy or sensitivity on future operating theatre employment. They may have feared possible unemployment or redeployment to a

"safe" latex-free environment and possible loss of income, career progression and job satisfaction. These people may have felt or been advised by the operating theatre grapevine that it was easier to say they were scared of needles rather than give the real reason. All potential volunteers were assured that results would be treated in confidence and an individual would only be referred to an immunologist if it were both indicated and the individual consented.

Contrary to some other studies^{14,17}, a history of allergy to bananas, avocado and kiwi fruit, a past history of surgery or urinary catheterization as risk factors for the development of latex allergy was not identified. There was no clinically significant change in daily FEV₁/FVC.

People who are latex allergic or sensitized should avoid latex aeroallergen exposure and direct contact with latex gloves. However, latex gloves provide the most effective barrier to disease transmission and many surgeons believe they are more sensitive than non-latex gloves currently available, resulting in fewer needle-stick injuries and intraoperative complications. If the use of powdered latex gloves is reduced, then the incidence of exposure and sensitization should be reduced. However, until there is a non-latex alternative that provides an effective and non-antigenic barrier to disease transmission, those people who are already latex-allergic would be advised to be redeployed to a non-latex, non-infectious work environment for their own safety. If they choose not to transfer, they risk disease if they use non-latex alternatives or possibly, symptoms ranging from mild local irritation to systemic upset, including anaphylactic shock if they use latex gloves or inhale latex aeroallergens from their colleagues using powdered gloves.

It is important that a standardized test for latex allergy be developed and a latex substitute that is both non-antigenic and protective be produced.

ACKNOWLEDGEMENTS

Many thanks to Glenda Balderson, Chief Professional Officer, Department of Surgery, University of Queensland for statistical advice, Ken Field, Senior Technician of the Immunoserology Laboratory for performing the blood tests and Brendon Eckett, Respiratory Scientist and Bart McKenzie, consultant anaesthetist, for their support.

REFERENCES

1. Brown R, Schauble J, Hamilton R. Prevalence of latex allergy among anesthesiologists. Identification of sensitized but asymptomatic individuals. *Anesthesiology* 1998; 89:292-299.
2. Konrad C, Fieber T, Gerber H, Schuepfer G, Muellner G.

Anaesthesia and Intensive Care, Vol. 29, No. 1, February 2001

- Prevalence of latex sensibility among anesthesiology staff. *Anesth Analg* 1997; 84:629-633.
3. Fisher AA. Allergic contact reactions in health personnel. *J Allergy Clin Immunol* 1992; 90:729-738.
 4. Hunt LW, Fransway AF, Reed CE. An epidemic of occupational allergy to latex including healthcare workers. *J Environ Med* 1995; 37:1204-1209.
 5. Arellano R, Bradley J, Sussman G. Prevalence of latex sensitization among hospital physicians occupationally exposed to latex gloves. *Anesthesiology* 1992; 77:905-908.
 6. Turjanimoa K. Update on occupational natural rubber latex allergy. *Dermatol Clin* 1994; 12:561-567.
 7. Heller E, Greer R. Glove safety: Summary of recent findings and recommendations from health care regulators. *South Med J* 1995; 88:1093-1098.
 8. Kelly K, Kurup V, Zacharisen M, Resnick A, Fink J. Skin and serologic testing in the diagnosis of latex allergy. *J Allergy Clin Immunol* 1993; 91:1140-1145.
 9. Slater JE. Latex allergy. *J Allergy Clin Immunol* 1994; 94:139-149.
 10. Katelaris C, Widmer, Lazarus R. Prevalence of latex allergy in a dental school. *Med J Aust* 1996; 164:711-714.
 11. Douglas R, Czarny D, Morton J, O'Heir R. Prevalence of IgE mediated allergy to latex in hospital nursing staff. *Aust NZ J Med* 1997; 27:165-169.
 12. Brehler R, Kolling R, Webb M, Wastell C. Glove powder—a risk factor for the development of latex allergy? *Eur J Surg* 1993; 163:23-25.
 13. Heilman D, Jones R, Swanson M, Yunginger J W. A Prospective, controlled studies showing that rubber gloves are the major contributor to latex aeroallergen levels in the operating room. *J Allergy Clin Immunol* 1996; 98:325-330.
 14. Rodriguez M, Vega F, Garcia MT et al. Hypersensitivity to latex, chestnut and banana. *Ann Allergy* 1993; 70:31-34.
 15. Slater JE. Allergic reactions to natural rubber. *Ann Allergy* 1992; 68:203-209.
 16. Ahlroth M, Alenius H, Turjanmaa K, Makinen-Kiljunen S, Reunala T, Palosuo T. Cross-reacting allergens in natural rubber latex and avocado. *J Allergy Clin Immunol* 1995; 96 no.2:167-173.
 17. Moneret-Vautrin D, Beaudouin E, Widmer S et al. Prospective study of risk factors in natural rubber latex hypersensitivity. *J Allergy Clin Immunol* 1993; 92:668-677.