

Contact dermatoses in healthcare workers: reduction in type I latex allergy in a UK centre

T. H. Clayton and S. M. Wilkinson

Department of Dermatology, The General Infirmary at Leeds, Leeds, UK

Summary

Natural rubber latex (NRL) allergy has been recognized as a public health concern. NRL allergy frequently occurs in healthcare professionals. In this retrospective study we report the changing frequency of Type I NRL allergy amongst healthcare workers suffering from hand dermatitis referred to our department between 1996 and 2003. We identified 224 healthcare workers from the patch test database with a diagnosis of hand dermatitis who had undergone NRL skin prick testing (SPT). We report the SPT results, patch test results and diagnoses for each individual. The percentage of positive SPT to NRL in healthcare workers decreased from 62% in 1996 to 10% in 2003. Type IV allergy to fragrance mix (13%) was the most frequent cause of allergic contact dermatitis. Thiuram mix (8%) and carba mix (4%) were the most frequent indicators of type IV allergy to chemicals in rubber gloves. Fragrance allergy was the most frequent type IV allergen found in healthcare workers with hand dermatitis. We conclude that hand care preparations free from fragrance allergens should be available in all areas of clinical work.

Introduction

Natural rubber latex (NRL) is derived from the sap of the rubber tree, *Hevea brasiliensis*. NRL allergy was first reported in 1979.¹ Since the early 1980s NRL allergy has been recognized as a public health concern and an increased prevalence has been described in healthcare workers.² Contact with NRL gloves may cause irritant dermatitis, delayed hypersensitivity and immediate hypersensitivity reactions.³ The use of NRL gloves as an element of personal protective equipment has become an essential part of clinical practice for healthcare professionals.⁴ Gloves are worn to protect hands from contamination with organic matter and microorganisms, and also to reduce the risks of transmission of microorganism to both patients and staff. However, there is good

evidence that the gloves used for clinical practice leak when they appear apparently un-damaged and gloves made from NRL have been shown to perform better than vinyl gloves when laboratory tested for leakage.^{5,6} In the mid 1980s there was increased demand for NRL gloves, some were imported from manufacturers inexperienced with the production of latex products for healthcare use and not subject to quality assurance procedures appropriate for medical equipment. This lack of quality assurance was felt to account for the increase in latex allergy. NRL gloves remain the glove of choice due to their efficacy in protecting against blood-borne viruses. The major risk factors in sensitization to NRL are intense exposure to NRL allergens, atopy, and hand eczema.^{2,7} Powdered latex medical gloves have been shown to be a potent source of rubber latex allergen, as they are frequently used and rich in allergens.⁸ Pre-existing hand dermatitis has been identified as a risk factor for experiencing latex allergy and allergic contact dermatitis to rubber chemicals.⁹ Following the introduction of low protein powder-free latex examination gloves to try to

Correspondence: T. H. Clayton, Department of Dermatology, The General Infirmary at Leeds, Leeds, UK. E-mail: tim.clayton@leedsth.nhs.uk

Accepted for publication 20 December 2004

prevent NRL sensitization, it would appear that Type 1 allergy to NRL is declining.

Patients and methods

A total of 1300 patients underwent NRL skin prick testing (SPT) in our department between 1996 and 2003. We identified 224 healthcare workers from the patch test database with a diagnosis of hand dermatitis who had undergone NRL skin prick testing. The skin-prick test results, patch test results and diagnoses were reviewed for each individual.

SPT

SPT was performed with a commercial natural-latex extract in aqueous dilution (0.5 mg/mL) supplied by ALK-Abello S.A. Patients were also prick tested to high ammoniated natural rubber latex. Controls were made with normal saline and aqueous dilution of histamine (10 mg/mL). SPTs were performed according to standard procedure¹⁰ in the volar side of the forearm using a sterile lancet. Tests were read after 20 min. A weal diameter greater than 3 mm, compared with the saline control, was considered a positive response.

Patch testing

All patients were patch tested to the British Contact Dermatitis Society standard series, with additional series added where implicated from history. Allergens were applied to healthy skin on the patients' backs under Finn chambers secured with scanpor tape supplied by Alpharma AS Norway, and left for 48 h. Readings were made at 48 and 96 h. Reactions were scored according to the criteria of the International Contact Dermatitis Research Group.¹¹

Results

SPT

Three-hundred and one healthcare workers underwent SPT to NRL in our department between 1996 and 2003, of these 224 individuals had a diagnosis of hand dermatitis. In 1996, 62% of those healthcare workers referred with a diagnosis of hand dermatitis had positive SPT to NRL. Over the next 8 years the number of positive SPTs to NRL amongst healthcare workers declined to 10% by 2003 (Fig. 1).

Between 1998 and 1999 a sharp increase in the number of healthcare workers referred to our department occurred which was reflected by an increase in the number of positive NRL SPTs (Fig. 2).

Amongst nonhealthcare workers there has also been a decrease in the percentage of positive SPTs to NRL in our department although not as great as in healthcare workers (Fig. 3).

Patch testing

Fifty-four per cent of the 224 hospital workers referred with a diagnosis of hand dermatitis had at least one positive result, and 37% had two or more positive reactions (Table 1). Of the 187 positive reactions, 51% were felt to be relevant. Nickel sulphate was the most frequent positive test (28%), although it was found to be not relevant in most cases. Fragrance mix (13%) was the most frequent relevant positive test. Thiuram mix (8%) and carba mix (4%) were the most frequent reactions to rubber chemicals.

One-hundred and forty-eight (65%) hospital workers referred with a diagnosis of hand dermatitis were subsequently diagnosed as having an irritant contact dermatitis.

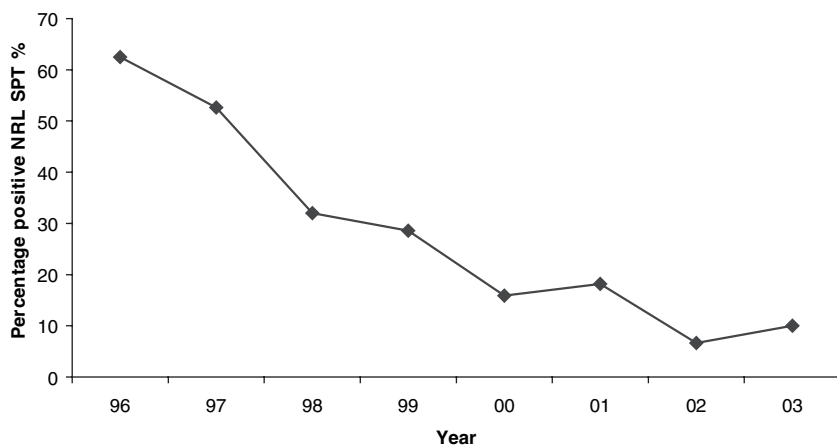


Figure 1 Percentage positive latex prick tests in medical/nursing staff with hand dermatitis 1996–2003.

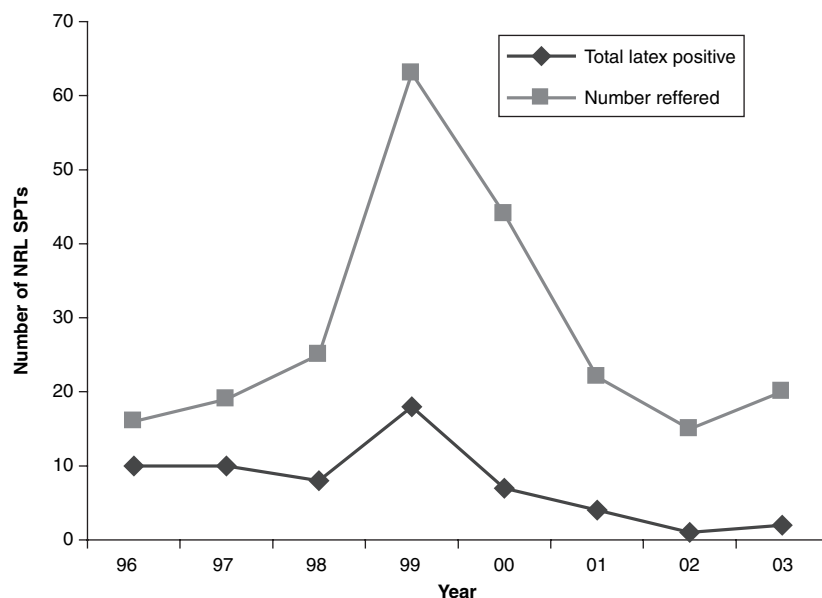


Figure 2 Latex prick tests in health-care workers 1996–2003.

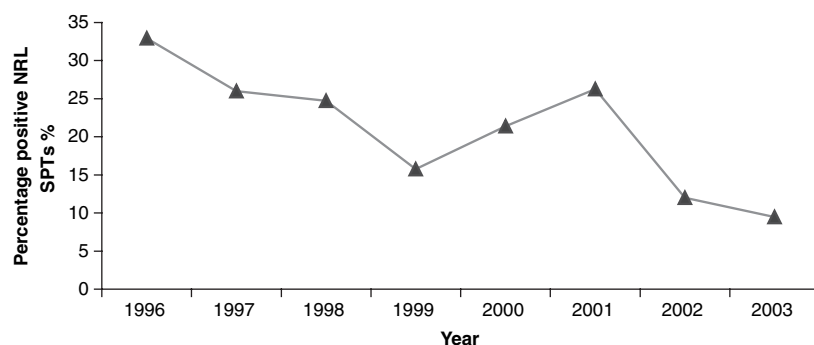


Figure 3 Percentage positive NRL skin prick tests in nonhospital workers 1996–2003.

Discussion

There was an increase in Type I latex allergy in the late 1980s and early 1990s, most probably due to an increased demand for latex products, which were often imported and of variable quality. Comparative studies have confirmed higher rates of type 1 allergy to latex in healthcare workers vs. the general population.¹² Results from our study indicate that Type I allergy to NRL is decreasing amongst healthcare workers. The availability of latex-free gloves and the introduction of low protein powder-free latex gloves over recent years is likely to have reduced the exposure of healthcare workers to latex antigens, in particular to the airborne allergens that are released from powdered latex gloves. Powdered latex gloves have been shown to be associated with very high concentrations of NRL aeroallergens (> 3500 particles/ m^3 of air).¹³ The use of low-protein, powder-free gloves has been associated with airborne

NRL levels below the detection limit (< 5 ng/ m^3) and a reduction in measurable specific IgE antibodies or skin test responses to NRL allergens in some sensitized healthcare workers.¹⁴ An increased awareness of latex allergy in healthcare settings coupled with the identification of latex-free equipment in hospitals has reduced the frequency of latex allergy. In 1999 the Leeds Teaching Hospitals approved a proposal to ban powdered latex gloves, prior to this a Latex awareness day had taken place within the trust during which low protein latex gloves and latex-free gloves were exhibited. It highlighted the need for staff to seek advice from the Occupational Health department for any suspected glove related reactions. A trust-wide changeover to powder-free low protein latex gloves occurred in April 2000. Figs 1 and 2 indicate that latex allergy was decreasing gradually from the mid 1990s, i.e. before the Leeds NHS trust introduced its policy regarding latex gloves. This reduction in latex allergy prior to 1999

Table 1 Type IV reactions in healthcare workers with hand dermatitis 1996–2003.

Allergen	Total	Relevant	Not/past relevant
Fragrance Mix 8% pet	22	20	2
Myroxylon pereiriae 25% pet	6	6	0
Oak moss absolute 1% pet	1	0	1
Thiuram mix 1% pet	15	15	0
Carba mix 3% pet	7	7	0
1,3-diphenylguanidine 1% pet	1	1	0
Mercaptobenzothiazole 2% pet	1	1	0
Mercapto mix 2% pet	3	3	0
Cyclohexyl thiophthalimide 1% pet	1	1	0
Dibutyl phthalate 5% pet	1	1	0
Latex (as is)	7	7	0
PVC glove	2	2	0
Nickel 5% pet	53	3	50
Cobalt 1% pet	14	0	14
Colophonium 20% pet	8	1	7
Thiomersal 0.1% pet	9	0	9
Formaldehyde 1%aq	4	4	0
Quaternium 15 1% pet	5	5	0
Imidazolidinyl urea 2% pet	3	3	0
Diazolidinyl urea 2% pet	1	1	0
Potassium dichromate 0.5% pet	3	1	2
p-phenylenediamine 1% pet	4	0	4
Benzoyl Peroxide 1% pet	4	1	3
Benzalkonium chloride 0.05% aq	2	2	0
Betadine aqueous	1	1	0
Parabens mix 16% pet	2	2	0
Methylchloro- & methyl-isothiazolinone 0.01% aq	1	1	0
Tixocortol pivalate 1% pet	1	1	0
Ethylene diamine dihydrochloride 1%pet	1	0	1

reflects increased industry awareness of the problem, with improved methods of manufacture and quality assurance. Due to the increased demand for examination gloves in the 1980s, gloves were often imported and produced by manufacturers who were inexperienced in the production of latex products for healthcare use and not subject to appropriate quality assurance. This was felt to account for the increase in latex protein hypersensitivity that occurred in the early 1990s. Our results would suggest that improved manufacturing techniques and industry awareness of latex allergy resulted in a decrease in latex allergy from the mid 1990s. The subsequent change to powder-free latex examination gloves led to a further reduction. The increased awareness of latex allergy may have accounted for the increase in the number of healthcare workers being referred to the department, our result confirm that despite there being increased referrals the number of positive SPTs to latex decreased each year. It is also apparent from our results that NRL allergy is decreasing

in nonhealthcare workers but at a slower rate, and future efforts at reducing the prevalence of latex allergy need to be directed at the general population.

Allergic contact dermatitis due to rubber chemicals in patients with hand dermatitis is well recognized. The most common rubber chemical sensitizers in healthcare workers are the thiuram and carba mixes.¹⁵ Thiuram allergy increased during the early 1990s, but more recent studies suggest a decrease from 1995.¹⁶ Allergic reactions to carbamates occur less frequently. Our data were in accordance with these findings.

We also found type IV reactions to fragrances occurred most frequently in hospital workers with hand dermatitis. Hand dermatitis is the commonest presentation in patients with fragrance allergy,¹⁷ and healthcare workers have been shown to have an increased risk of fragrance allergy due to washing their hands regularly to prevent the spread of infection.¹⁸ Nursing staff, in particular are exposed to fragrance chemicals, when bathing patients and also when applying topical medications to patients. A higher relative risk of fragrance mix allergy has been reported in nurses and massage therapists.¹⁹ Hand sanitizers and hand washes are located in all clinical areas within hospitals, however, they do contain fragrance. Products free from fragrance sensitizers should be widely available to all healthcare workers.

Type IV allergy to formaldehyde, formaldehyde-releasing preservatives, and other preservatives was also found in our study. Hospital workers may become sensitized to preservatives when applying topical applications to patients and also by contact with hand care products and detergents that contain preservatives. We also observed that some hospital workers developed reactions with antiseptics. Use of alcohol gel might be expected to reduce exposure to preservatives and antiseptics, thereby reducing the potential for healthcare workers to become sensitized.

Irritant contact dermatitis is a frequent problem amongst healthcare workers, and a large number of dermatoses related to latex gloves are due to skin irritation rather than allergy.⁹ Healthcare workers with irritant contact dermatitis are more frequently exposed to soaps, detergents and antiseptics and the daily use of latex gloves. Latex gloves may provoke direct cutaneous irritation related to powder; irritant contact dermatitis may also be related to occlusion, friction and maceration from gloves thus increasing skin barrier damage from other irritants.

In conclusion this retrospective study has demonstrated a significant decrease in the number of healthcare workers with type I allergy to natural rubber latex protein. The reduction in latex allergy is also seen in

nonhospital workers, and is mostly due to the introduction of powder-free low protein latex gloves. These findings are in concordance with results from Ontario.²⁰ Fragrance allergy is a common finding amongst hospital workers with hand dermatitis, and nonsensitizing hand care preparations should be available in all areas of clinical work.

References

- 1 Nutter AF. Contact urticaria to rubber. *Br J Dermatol* 1979; **101**: 597–8.
- 2 Turjanmaa K. Incidence of immediate allergy to latex gloves in hospital personnel. *Contact Dermatitis* 1987; **17**: 270–5.
- 3 Zak HN, Kaste LM, Schwarzenberger K, Barry MJ, Gilbraith GMP. Health care workers and latex allergy. *Arch Envir Health* 2000; **55**: 336–46.
- 4 Infection Control Nurses Association. *Glove Usage Guidelines*. London: INCA & Regent medical; 1999, 43.
- 5 De-Groot Kosolchar. Permeability of latex and vinyl gloves to water and blood. *Am J Infection Control* 1989; **17**: 96–201.
- 6 Hamann CP. Permeability of latex and thermoplastic elastomer gloves to bacteriophage OX174. *Am J Infect Control* 1993; **21**: 289–96.
- 7 Moneret-Vautrin D-A, Beaudouin E, Widmer S *et al*. Prospective study of risk factors in natural rubber latex hypersensitivity. *J Allergy Clin Immunol* 1993; **92**: 668–77.
- 8 Yunginger JW, Jones RT, Fransway AF *et al*. Extractable latex allergens and proteins in disposable medical gloves and other rubber products. *J Allergy Clin Immunol* 1994; **93**: 836–42.
- 9 Nettis E, Assennato G, Ferrannini A, Tursi A. Type I allergy to natural rubber latex and type IV allergy to rubber chemicals in health care workers with glove related symptoms. *Clin Exp Allergy* 2002; **32**: 441–7.
- 10 Malling HJ. Methods of skin testing. In: Dreborg, S, Frew, A, eds. Allergen standardization and skin tests. Position paper. *Allergy* 1993, 48, 55–6.
- 11 Wilkinson DS, Fregert S, Magnasson B *et al*. Terminology of contact dermatitis. *Acta Derm Venereol (Stockh)* 1970; **50**: 287–92.
- 12 Liss GM, Sussman GL. Latex sensitization: occupational versus general population prevalence rates. *Am J Ind Med* 1999; **35**: 196–200.
- 13 Newsom SWB, Shaw M. A survey of starch particle counts in the hospital environment in relation to the use of powdered latex gloves. *Occup Med* 1997; **47**: 155–8.
- 14 Allmers H, Brehler R, Chen Z *et al*. Reduction of latex aeroallergens and latex-specific IgE antibodies in sensitized workers after removal of powdered natural rubber latex gloves in a hospital. *J Allergy Clin Immunol* 1998; **102**: 841–6.
- 15 De Groot H, de Jong NW, Duijster E *et al*. Prevalence of natural rubber latex allergy (type I and type IV) in laboratory workers in the Netherlands. *Contact Dermatitis* 1988; **38**: 159–63.
- 16 Gibbon KL, McFadden JP, Rycroft RJ *et al*. Changing frequency of thiuram allergy in healthcare workers with hand dermatitis. *Br J Dermatol* 2001; **144**: 347–50.
- 17 Buckley DA, Rycroft RJG, White IR, Mcfadden JP. Contact allergy to individual fragrance mix constituents in relation to primary site of dermatitis. *Contact Dermatitis* 2000; **43**: 304–5.
- 18 Buckley DA, Rycroft RJG, White IR, Mcfadden JP. Fragrance as an occupational allergen. *Occup Med* 2002; **52**: 13–6.
- 19 Schuh A, Uter W, Geier J *et al*. Contact allergies in healthcare workers. Results from the IVDK. *Acta Dermatol Venereol* 1998; **78**: 358–63.
- 20 Tarlo S, Easty A, Eubanks K *et al*. Outcomes of a natural rubber latex control program in an Ontario teaching hospital. *J Allergy Clin Immunol* 2001; **108**: 628–33.