

ment regimens do not prevent this complication, and because it may recur, this case would not support the use of nonionic low contrast medium as a preventive measure for subsequent needed procedures.

Although rare, acute pulmonary edema after administration of radiographic contrast media is potentially life-threatening. Treatment must be directed toward diuresis and the maintenance of adequate gas exchange. Acute pulmonary edema must not be confused with the more typical bronchospastic anaphylactoid reaction in order to avoid delay in starting appropriate therapy. This case reinforces the need for a high index of suspicion for this problem in any patient experiencing acute dyspnea after a radiologic procedure with any of the currently available contrast media.

REFERENCES

1. McClennan BL, Kassner G, Becker JA. Overdose at excretory urography: toxic cause of death. *Radiology* 1972;105:383-6.
2. Cameron JD. Pulmonary edema following drip-infusion urography. *Radiology*. 1974;111:89-90.
3. Greganti MA, Flowers WM Jr. Acute pulmonary edema after the intravenous administration of contrast media. *Radiology* 1979;132:583-5.
4. Boden WE. Anaphylactoid pulmonary edema ("shock lung") and hypotension after radiologic contrast media injection. *Chest* 1982;81:759-61.
5. Madowitz JS, Schweiger MJ. Severe anaphylactoid reaction to radiographic contrast media. *JAMA* 1979;241:2813-5.
6. Borish L, Matloff SM, Findlay SR. Radiographic contrast media-induced noncardiogenic pulmonary edema: case report and review of the literature. *J ALLERGY CLIN IMMUNOL* 1984;74:104-7.
7. Delacour JL, Floriot C, Wagschal G, Daoudal P, Chambers R, Bui Xuan P. Non-cardiac pulmonary edema following intravenous contrast injection. *Intensive Care Med* 1988;15:49-50.
8. Sawda SG, Segar DS, Ryan T, et al. Echocardiographic detection of coronary disease during dobutamine infusion. *Circulation* 1991;83:1605-14.
9. Lieberman P. Anaphylactoid reactions to radiocontrast media. *Ann Allergy* 1991;67:91-100.

Prevalence of latex allergy among greenhouse workers

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In the last decade, latex IgE-mediated hypersensitivity has been recognized as an international health problem because of the increase in frequency and the potential severity of the latex-induced reactions. To date, several different high-risk groups have been identified, including hospital personnel, rubber industry workers, and children with spina bifida who have undergone multiple operations.¹ Universal precautions to prevent the spread of human immunode-

ficiency virus have increased the frequency of latex exposure. Probably, repeated exposure to latex together with genetic predisposition have led to latex sensitization. Recently, it has been demonstrated that cornstarch powder, which is used as lubricant in some latex gloves, can act as a carrier for latex antigens, inducing respiratory allergic reactions in latex-sensitive patients.²

We have prospectively studied 418 agricultural workers from a flower greenhouse (mainly geranium plants), who needed to use latex gloves in their

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TABLE I. Summary of data recorded in clinical questionnaires

General data		
Type of work:		Working years:
Latex glove use:	Yes/No	Time of use:
Mask use:	Yes/No	Time of use:
Insecticide contact:	Yes/No	Time of contact:
Medical data		
History:		
Smoking:		
Present symptoms:		
- Respiratory		
- Skin		
- Gastrointestinal		
- Neurologic		
- Other		
Atopy:	Yes/No	Type:
Latex glove-induced symptoms:		
- Isolated itching		
- Local urticaria		
- Hand eczema		
- Rhinoconjunctivitis		
- Angioedema		
- Asthma		
- Other		
Food intolerance:	Yes/No	
- Food:	Symptoms:	

workplace, by means of a clinical questionnaire, skin testing, and in vitro studies. We found a high prevalence of latex hypersensitivity among greenhouse workers.

METHODS

Four hundred eighteen workers from a flower company took part in this study, which was approved by the hospital ethical committee. They included 98% of all employees in the greenhouse. Written informed consent was obtained from all subjects. They were studied as outpatients, simultaneously with the annual revision performed by the occupational health unit from the health department of the Autonomic Canarian Government. Three hundred fifty-six (85%) subjects were female, and 62 were male. Their mean age ($\pm$ SD) was 29.9 ± 7.8 years, and they had been working in greenhouses for a mean ($\pm$ SD) duration of 6.4 ± 3.4 years. All of them used DELFIN household gloves (GOMAYTEX, S.A., Hernani, Spain), made from natural latex, to avoid plant contamination.

A complete medical questionnaire was recorded for each patient (Table I). It included information about the type of work performed, years of experience, working conditions, possible contact with chemicals or symptoms of chronic insecticide poisoning, glove-wearing time, local or systemic symptoms related to latex exposure, and personal history of atopy.

Skin prick tests were carried out on the volar side of the forearm by puncture with a Morrow-Brown needle (Bayer S.A., Madrid, Spain) with a series of commercially available aeroallergens and with the following extracts prepared in our laboratory: latex,³ chestnut, almond, banana, and avocado.⁴ The latex extract was prepared by washing the inside of a DELFIN glove for 10 minutes with 10 ml of phosphate-buffered saline, centrifuging the solution at 1000 g for 30 minutes, and filtering the supernatant through a 22 μ m Millipore filter (Millipore Corp., Bedford, Mass.). The protein concentration of the latex extract, estimated with the Lowry method, was 0.8 mg/ml. The skin tests were evaluated 15 minutes after application, and a mean wheal diameter more than 3 mm larger than the saline control was considered a positive response. Finally, a sample of venous blood was obtained from each patient for determination of total IgE (DELPHIA; Pharmacia SA, Uppsala, Sweden) and specific IgE. Latex-specific IgE was determined by using the commercial latex ImmunoCAP allergen for the Pharmacia CAP system according to the manufacturer's instructions.

RESULTS

Analysis of the questionnaire responses revealed that 75 workers (18%) reported immediate symptoms associated with wearing gloves, suggesting an IgE-mediated allergy; and another 37 subjects (9%) reported delayed cutaneous local symptoms, suggesting contact dermatitis. The most frequent immediate clinical manifestations were isolated local pruritus ($n = 52$) and pruritus with erythema and/or urticaria ($n = 23$), together with nasal and/or bronchial respiratory complaints in 20 patients. Twenty-one (5% of the total population) of the 75 patients who reported latex-induced immediate symptoms showed a positive skin prick test response to latex extract. The positive predictive value of the questionnaire in workers complaining of immediate symptoms when wearing gloves was 28%. If subjects who reported isolated pruritus are excluded, the questionnaire's positive predictive value increases to 91%: skin prick test response was positive in 21 of 23 patients who reported local urticaria with or without associated respiratory symptoms. No positive skin test response to latex was found in patients without latex-induced immediate symptoms. In our series, the positive predictive value of the latex skin prick test in relation to the clinical symptoms was 100%, the negative predictive value was 99.5%, diagnostic specificity was 100%, and sensitivity was 91%.

Among patients allergic to latex, as defined by a suggestive clinical history and a positive skin prick test response to the latex extract, the mean time of latex glove use was 8 hr/day for an average of 8.8 ± 3.2 years. There was a significant association between

latex allergy and glove-wearing years as determined by Student's *t* test ($p < 0.005$). Ninety-three (22%) of the 418 workers were atopic, as defined by positive skin prick test responses to major aeroallergens together with symptoms of atopic disease, whereas 10 of 21 (48%) patients with latex allergy were atopic (relative risk of latex allergy in atopic patients = 3.2). Twenty-two patients were given a diagnosis of food allergy (suggestive clinical history together with a positive skin prick test response) (Table II). The most frequent allergens were: chestnut (21), almond (18), banana (9), and avocado (8). Twelve patients showed simultaneous latex and food sensitivities (relative risk of latex allergy in food-sensitive patients = 24.0). Curiously, work-related symptoms always preceded food allergy onset. Finally, latex-specific IgE could be demonstrated in 16 patients (4%), all of whom were allergic to latex as determined by clinical history and a positive latex skin test response. In our series, the CAP system for latex-specific IgE determination showed a diagnostic sensitivity of 76%, specificity of 100%, negative predictive value of 98.7%, and positive predictive value of 100%.

DISCUSSION

In the last few years, latex immediate hypersensitivity has been recognized as a serious medical problem. Prevalence of latex sensitivity among operating room nurses is approximately 10%.⁵ In our study the prevalence of latex glove-induced immediate symptoms was 18%, a percentage higher than that reported by other authors, which could be related to the brand of gloves used or to longer latex exposure. Perhaps environmental working conditions, such as a constant very warm weather, could also favor sensitization. In 21 (5%) patients a positive skin prick test response to a latex extract was found; furthermore, in 16 subjects (4%) specific IgE to latex was demonstrated. It is very important to consider that the percentage of skin reactions to latex was 24 times higher in workers with food allergies (54%) than in workers without food sensitivities (2.3%). This could be due to latex cross-reactivity with fruits. In contrast, relative risk of latex allergy in atopic patients was only 3.2. In our study local symptoms, such as isolated pruritus, showed a low positive predictive value. Meanwhile, the existence of local urticaria with or without accompanying respiratory symptoms in relation to latex exposure was strongly associated with positive skin test response and specific IgE to latex. Both skin prick test response to a latex glove extract and specific latex IgE determined by CAP system showed an excellent diagnostic accuracy in our series.

In our experience, latex immediate hypersensi-

TABLE II. Food allergies in greenhouse workers

Food	No. of patients*	Clinical symptoms (no.)	Positive food SPT response	Latex allergy
Chestnut	22	Anaphylaxis (5) Urticaria/AE (7) OS† (14)	21	10
Almond	19	Anaphylaxis (1) Urticaria/AE (4) OS† (15)	18	6
Banana	11	Urticaria/AE (4) OS† (6)	9	7
Avocado	8	Anaphylaxis (3) Urticaria/AE (4) OS† (5)	8	8

SPT, Skin prick test; AE, angioedema; OS, oral syndrome.

*Number of subjects with clinical history suggestive of food allergy.

†Including perioral pruritus and/or angioedema.

tivity is a medical problem that could affect any subject with a high level of exposure to latex products. In this report we have found that agriculture workers who need to use latex gloves daily showed a prevalence of latex sensitization similar to that found among hospital personnel, and they should therefore be included among risk groups for latex allergy. The development of allergic reactions (some of them extremely severe) to some fruits commonly consumed in our community, together with the risk of perioperative anaphylactic reactions, focus attention on the importance of early diagnosis of latex hypersensitivity.

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REFERENCES

- Slater JE. Latex allergy. What do we know? *J ALLERGY CLIN IMMUNOL* 1992;90:279-81.
- Tomazic V, Shampaine E, Lammana M, Withrow T, Adkinson F, Hamilton R. Cornstarch powder on latex products is an allergen carrier. *J ALLERGY CLIN IMMUNOL* 1994;93:751-8.
- Carrillo T, Cuevas M, Muñoz T, Hinojosa M, Moneo I. Contact urticaria and rhinitis from latex surgical gloves. *Contact Dermatitis* 1986;15:69-72.
- Blanco C, Carrillo T, Castillo R, Quiralte J, Cuevas M. Latex allergy: clinical features and cross-reactivity with fruits. *Ann Allergy* 1994;73:309-14.
- Lagier F, Vervloet D, Lhermet I, Poyen D, Charpin D. Prevalence of latex allergy in operating room nurses. *J ALLERGY CLIN IMMUNOL* 1992;90:319-22.