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CONTACT DERMATITIS

ENVIRONMENTAL AND OCCUPATIONAL DERMATITIS

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Contact Dermatitis

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Contact urticaria from rice

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A 30-year-old man with atopic dermatitis had had erythema and itching of the hands after washing rice in water, though he had always eaten cooked rice without problems. Handling test with water used to wash regular rice was performed on abraded hands, and produced urticarial erythema after several minutes. Applications of water used to wash allergen-reduced rice were negative for urticarial reaction. Prick test with water used to wash regular rice was ++++. However prick test reaction with water used to wash allergen-reduced rice was +. Histamine-release test of regular rice-washing water was grade 3 and that of allergen-reduced rice grade 1. In immunoblotting analysis with regular rice washing water, there were no bands with this patient. These results suggest that the allergen responsible for contact urticaria in this patient might be water-soluble, heat-unstable, and not contained in allergen-reduced rice.

Contact urticaria has been reported with increasing frequency, and a growing number of eliciting agents are now recognized. A few reports have appeared of contact urticaria from rice (1–3), though the antigenic components have not yet been well-established. This report describes a case of contact urticaria from rice, where we investigated the allergen responsible.

Patient and Methods

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Case report

A 28-year-old man visited our hospital for treatment of atopic dermatitis. The condition had started when the patient was 10 years old, worsening slightly from the age of 17. Remission had rapidly been obtained with systemic antihistamine and disodium cromoglycate. At the age of 30 years, the patient began to experience erythema and itching of the hands after washing rice in water, though he had always eaten cooked rice without problems. On admission, the blood count showed 330 eosinophils/mm³. Total serum IgE was 4200 IU/ml and RAST was class 2 for rice.

Handling test

A handling test with water used to wash rice was performed on the patient's hands for several minutes. As previously described, we developed 2 types of allergen-reduced rice by reduction of major allergenic rice proteins (4). One of these is hypoallergenic rice from Shiseido (HRS-1, Fine rice®; Shiseido, Japan) (4), and the other is allergen free technology rice (AFT-R, AFT-R1®; Allergen-free Technology Laboratory Inc., Japan). Applications of water used to wash these allergen-reduced rice were also performed.

Prick tests

Prick tests with various allergens were carried out. Salt-soluble rice protein, one of the rice allergens, was

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Affiliations

extracted from rice powder with phosphate buffered saline (PBS) containing NaCl. The salt-soluble rice protein, commercially available rice allergen, water used to wash regular rice, water used to wash AFT-R, and the 16kDa rice allergen were used as allergens. Histamine dihydrochloride 10 mg/ml was used as positive control. We measured the wheal diameter. A reaction of the same order of size as that of the positive histamine reference is recorded as +++, double size of reference reaction as +++, half size of reference reaction as ++, quarter size of reference reaction as +, and negative reference reaction as – (5).

Histamine-release test

Further, we evaluated the value of a glass microfiber-based histamine-release test (HRT) by using an HRT kit (Rusika®; Asahikasei Kogyo K.K., Japan) (6). We used commercially available rice allergen, regular rice-washing water, salt-soluble rice protein, AFT-R washing water, and 16 kDa allergen as allergens. The allergens were diluted serially 5-fold, and 6 different concentrations of allergen were prepared in separate microtiterplates. 25 µl of heparinized whole blood from this patient was placed onto each well of the plate, and then incubated for 90 min at 37°C. The net release of histamine is calculated on the basis of a standard curve. The results are graded from 0 to 4, according to significant allergen-induced histamine release (cut-off level, 15 ng/ml). Grade 4 means that histamine release is more than the cut-off level at 5—5 lowest allergen concentration; grade 3 means that histamine release is more than cut-off level at 5—3; grade 2 means that it is at 5—2; grade 1 means that it is at 5—1; and grade 0 means that histamine release is under the cut-off level at all concentrations.

Immunoblotting

To determine the molecular weight of antigens contained in rice-washing water, we performed sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). Rice-washing water, extracted with 2 volumes of water from rice, was applied to SDS-PAGE. The electrophoresis was carried out according to the method previously described (7, 8). With rice-washing water, several bands at approximately 14 kDa, 20–30 kDa, 30–40 kDa , and 50 kDa were detected. After SDS-PAGE with 10 µl of rice-washing water (in each lane A) and of salt-soluble rice protein purified (in each lane B), the proteins fractionated were transferred to polyvinylidene difluoride membrane (PVDF membrane, PVDF®, Cosmo Bio., Japan). After blocking with skim milk, the PVDF membrane was subjected to a blotting unit (Screener Blotter®, Cosmo Bio.,Japan), this patient's sera was applied to lane 1 and the other 3 atopic dermatitis patients' sera were applied, respectively, to lanes 2–4. The 3 atopic dermatitis patients' IgE RAST was class 4 for rice. The membrane was incubated overnight at 4°C, washed with PBS containing 0.05% Tween 20, and incubated with anti-human IgE biotin conjugate for 2 h at 3°C. After washing with PBS-Tween 20, the membrane was incubated with avidin-horseradish peroxidase for 1 h at 37°C and washed again with rinse PBS-Tween20. Then the membrane was developed with 0.05M diaminobenzidine and 0.01 M hydrogen peroxide and washed with water.

Results

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The handling test with water used to wash rice produced urticarial erythema after several minutes. But applications of water used to wash HRS-1 or AFT-R were negative for urticarial reaction.

Prick test with commercially available rice allergen was ++. The results of water used to wash regular rice and the salt-soluble rice protein, respectively, were +++. However, reaction to the prick test with water used to wash AFT-R was + and that to the 16kDa rice allergen was –.

Further, the HRT results of commercially available rice allergen and of regular rice-washing water were grade 3. That of salt-soluble rice protein was grade 4. However, the result with AFT-R washing water was grade 1, and that with 16kDa allergen grade 2.

By immunoblotting analysis, in the 3 atopic dermatitis patients with high IgE RAST for rice, several polypeptides were detected (Fig. 1, lanes 2–4). However, no bands were detected in the sample from this patient (Fig. 1, lane 1).

Discussion

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Rice, a staple of the Japanese diet, is difficult to eliminate from the daily fare. Because rice is vigorously hand-washed several times before boiling, water-soluble allergens are considered to be responsible for producing the contact urticaria in this patient.

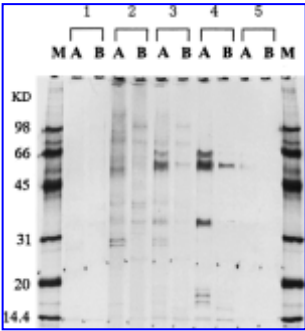
Recently, severe cases of atopic dermatitis have been noted to be on the increase. Based on a statistical analysis of the correlation between rice-RAST score and clinical severity in atopic dermatitis patients, we have reported the probable involvement of rice allergy in many such severe cases (9). Given that, in severe atopic dermatitis patients, eating boiled rice can induce cutaneous symptoms, the rice antigen may be stable to heat or digestive enzymes. In this patient, the oral intake of boiled rice allergens did not influence the clinical course of atopic dermatitis. We could not determine the rice antigenic components for this patient by immunoblotting analysis, in which the proteins in SDS-PAGE are treated by heat. This result means that, in the case of this patient, antigenicity may be unstable to heat; after boiling, the rice allergen may lose antigenicity.

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Fig. 1. Immunoblotting analysis of the patient's sera, the other 3 atopic dermatitis patients' sera a...

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We developed 2 types of allergen-reduced rice. One, HRS-1, is treated by enzymatic decomposition of the constituent proteins presumed to be the major allergens of rice (4). The other, AFT-R, is treated with alkali. We reported that protein analysis with SDS-PAGE of such rice indicated the near absence of 16kDa, 25kDa, and other higher molecular weight allergen bands corresponding to the globulin fraction (4). In this study, the patient showed no hypersensitivity response to allergen-reduced rice in the handling test, prick test or HRT. Moreover, prick test with the 16 kDa protein was negative and its HRT was weak. The results of this investigation suggest that the allergen responsible for contact urticaria in this patient might be water-soluble, salt-soluble, heat-unstable, not be contained in allergen-reduced rice and not be the 16kDa allergen.

The patient's atopic dermatitis has improved over the course of several years, and he has had no problems with his hands since avoiding direct contact with water used for washing rice.

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