

Prevalence of *Pachycondyla chinensis* venom allergy in an ant-infested area in Korea

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Recently, immediate allergic reactions, including anaphylaxis, after *Pachycondyla chinensis* ant stings have been frequently reported in Korea. To estimate the prevalence of these reactions and the sensitization rate to *P chinensis*, we undertook a visit-questionnaire survey of the 327 adult residents living in a town in an ant-infested area in Korea. Skin prick tests with 6 common inhalant allergens, 3 bee venom allergens, and *P chinensis* whole body extract were performed on all ant-allergic subjects, on 86 asymptomatic residents, and on 37 controls outside the area. The serum-specific IgE to *P chinensis* extract was determined by ELISA. Seven subjects (2.1%) reported that they had experienced systemic allergic reactions to *P chinensis* stings; 4 of them had anaphylactic reactions. Large local reactions occurred in an additional 5 subjects (1.6%). All subjects with systemic allergic reactions had positive skin prick test results to *P chinensis* extract, whereas 23.3% of asymptomatic residents and 2.7% of the controls showed positive skin prick test results. The serum-specific IgE level was significantly higher in the subjects with systemic reactions than in the subjects with local reactions, the asymptomatic sensitizers, and the nonatopic controls. Sensitization to bee venom was found in 25% of the *P chinensis*-allergic subjects; this was significantly higher than the 3% rate seen in nonsensitized subjects. In conclusion, we report a 2.1% prevalence of systemic allergic reactions after *P chinensis* stings, based on self-reported symptoms, in an ant-infested area in Korea. (J Allergy Clin Immunol 2002;110:54-7.)

Key words: *Pachycondyla chinensis*, anaphylaxis, epidemiology

Some aggressive ants, such as imported fire ants (IFAs; *Solenopsis invicta* and *Solenopsis richteri*) in the United States and jumper ants (*Myrmecia pilosula*) in Australia, have caused anaphylaxis with a high incidence.¹⁻³ In the United States the IFA may be the most common cause of insect sting hypersensitivity in endemic regions,⁴ and public health concern has heightened because of the continued expansion of IFA habitat.¹

Abbreviations used

AU: Arbitrary unit
IFA: Imported fire ant
SPT: Skin prick test

Recently, sporadic cases of allergic reactions after stings by *Pachycondyla chinensis* ants, which belong to the Poneriae subfamily of the Formicidae family, have been frequently reported in Korea.^{5,6} It is known that *P chinensis* exist in Far East Asian countries, including Korea, Japan, and China. Most reported cases of *P chinensis* allergy were anaphylactic reactions, which could be responsible for the considerable morbidity in the residents of an endemic area. However, the prevalence of allergic reactions to *P chinensis* venom in the ant-infested areas in Korea has been unknown.

There have been a couple of reports demonstrating that specific IgE-mediated reactions contribute to the development of *P chinensis*-induced anaphylaxis.^{5,6} Cross-allergenicity has also been suggested between *P chinensis* and bee venom antigen,⁶ such as the cross-reactive allergens of IFA that bind to bee venom.⁷ However, epidemiologic data for this possibility are also lacking.

We undertook a questionnaire survey and determined specific IgE levels to *P chinensis* by means of skin prick test (SPT) and ELISA to evaluate the epidemiologic features of immediate allergic reactions to *P chinensis* stings in an ant-habitat area in Korea.

METHODS

Study subjects and design

We undertook a questionnaire survey asking whether immediate generalized allergy symptoms or unusual local swellings occurred after ant stings to the 327 adult (>15-year-old) residents living in a town of 80 households in an ant-infested area. The ants collected from this town were confirmed to be *P chinensis* (personal communication, Professor B. J. Kim, Wonkwang University, Iksan, Korea). All subjects with ant allergy suggested by their self-reported clinical history and 86 (45 male) randomized selected asymptomatic residents were enrolled for further investigation. Thirty-seven subjects outside the ant-endemic area were enrolled as control subjects. They underwent SPTs to common inhalant allergens, bee venoms, and *P chinensis* whole-body extract. Their sera were also collected to measure the specific IgE levels to *P chinensis*.

SPTs and ELISAs for specific IgE to *P chinensis*

SPTs with 6 common inhalant allergens (*Dermatophagoides*

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Received for publication January 7, 2002; revised March 12, 2002; accepted for publication March 19, 2002.

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0091-6749/2002 \$35.00 + 0 1/81/124890

doi:10.1067/mai.2002.124890

TABLE I. Clinical features of patients showing allergic reactions to *P chinensis* ant sting

Patient No.	Age (y)	Sex	Atopy	Clinical features	SPT (A/H ratio)	slgE (AU)
1	32	F	+	Respiratory distress, hypotension	4+	654.12
2	39	F	—	Abdominal cramp, hypotension	4+	780.63
3	35	F	—	Respiratory distress, hypotension	4+	49.33
4	26	M	+	Respiratory distress	4+	66.40
5	34	F	+	Generalized urticaria	4+	341.68
6	39	F	+	Generalized urticaria	3+	29.79
7	59	F	+	Generalized urticaria	3+	19.01
8	35	M	—	Large local reaction	3+	18.26
9	35	F	—	Large local reaction	3+	37.87
10	16	F	+	Large local reaction	2+	28.62
11	61	F	—	Large local reaction	1+	4.34
12	68	F	—	Large local reaction	1+	2.92

A/H, Allergen-histamine ratio; slgE, specific IgE; +, presence; —, absence.

farinae, mugwort and ragweed pollens, tree and grass pollen mixtures, and *Aspergillus* species from Allergopharma), 3 bee venom allergens (yellow jacket, honey bee, and wasp from Hollister-Stier), *P chinensis* extract, and histamine (1 mg/dL) were performed on the forearms of study subjects. Details of *P chinensis* extract used for SPTs have recently been described.⁶ If the allergen/histamine wheal size ratio was less than 1, it was defined as 1+ when the diameter of erythema was less than 21 mm and as 2+ with a larger erythema. If the allergen/histamine ratio was in the range of 1 to 2, it was defined as 3+. If the ratio was larger than 2, it was defined to 4+. We considered subjects to be atopic when they demonstrated a 2+ or greater reaction to one or more of 6 common inhalant allergens.

The serum-specific IgE levels to *P chinensis* extract were determined by means of ELISA according to the method described previously.⁶ A standard curve was obtained by using mixed serum from 3 patients with *P chinensis*-induced anaphylaxis, and the levels of specific IgE were determined as arbitrary units (AU).

RESULTS

We found that 7 (2.1%) subjects among 327 adult residents had experienced immediate systemic allergic reactions to ant stings on the basis of self-reported symptoms. Four of them showed repeated anaphylactic reactions. Large local reactions characterized by edematous, pruritic, and painful lesions that persist for 24 to 72 hours occurred in an additional 5 (1.6%) subjects. Clinical features of these patients are presented in Table I.

The analysis of the skin reactivity to *P chinensis* extract and the serum-specific IgE levels indicated that the values of specific IgE of the subjects with 2+ or greater skin reactivity were significantly higher compared with those of subjects with 1+ or negative SPT responses. When we defined 2+ or greater reactions as positive SPT responses, which was considered as an indication of *P chinensis* sensitization, all 7 systemic allergic subjects, 60% of subjects with local reactions, 23.3% of asymptomatic residents, and 1 of the unexposed control subjects showed a positive SPT. The *P chinensis* sensitization rate was significantly higher in the asymptomatic residents of this town compared with that in the control subjects ($P < .001$).

In the systemic allergic subjects the median serum-specific IgE level to *P chinensis* extract was 66 AU. It was significantly higher than that of subjects with local reactions (18 AU), subjects classified as asymptomatic sensitizers (18 AU), and asymptomatic and nonsensitized residents (3 AU; Fig 1).

The subjects with ant allergy showed a much higher atopic rate (50%) compared with that seen in asymptomatic nonsensitized residents (29%, $P < .05$). Among 12 subjects with *P chinensis* allergy, 3 (25%) subjects were sensitized to bee venoms of yellow jacket and honey bee, and this was a higher sensitization rate than that of the ant venom-nonsensitized residents (3%, $P < .05$).

DISCUSSION

We report a 2.1% prevalence of systemic allergic reactions, including 1.2% of anaphylactic reactions, after *P chinensis* stings in the adult residents of an ant-habitat area in Korea, which is comparable with the 0.6% to 2% prevalence of anaphylaxis to IFA stings in the ant-endemic area in the United States.^{8,9} Also, more than half of the subjects with systemic allergy to *P chinensis* manifested potentially life-threatening anaphylaxis. Although the risk of recurrent anaphylaxis on re-stings by *P chinensis* has not been definitively defined, it should be proven to be high on the basis of the fact that 3 of 4 subjects with anaphylaxis had experienced several repeated reactions in this study.

We also demonstrated that subjects with ant allergy showed significantly higher serum-specific IgE levels than nonsensitized residents and unexposed control subjects. These results demonstrate that the *P chinensis*-induced allergic reactions are closely related to specific IgE.

The 23% prevalence of asymptomatic sensitizers to *P chinensis* venom in this town, which was based on the results of SPTs, was also similar to that of those with positive results for IFA exposure, demonstrating that the sensitization rate of asymptomatic subjects living in an IFA-endemic area was up to 24%.⁷ There also was an

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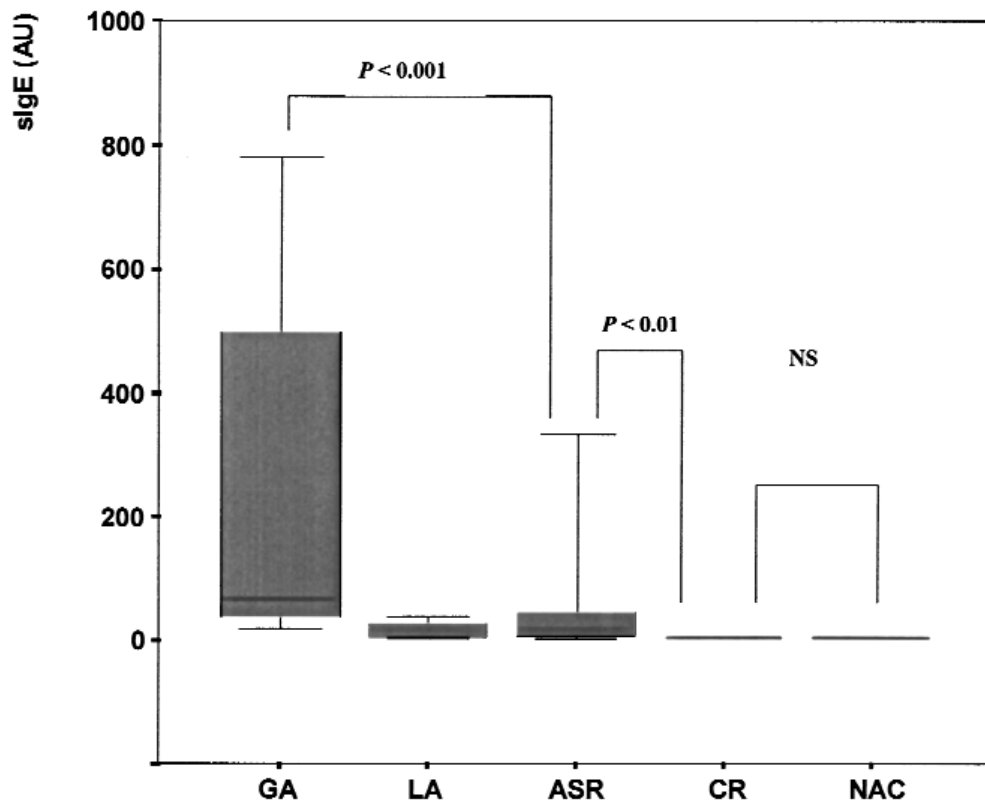


FIG 1. Association between SPT reactivity and levels of specific serum IgE (sIgE) to *P. chinensis*. Each box shows the median, quartiles, and extreme values. N, Negative SPT response.

interesting report showing that as many as 16% of SPT and RAST results of subjects stung by IFAs were converted to positive results after only a 3-week stay in an ant-endemic area.¹⁰ The prognostic significance of exhibiting a positive SPT response to *P. chinensis* in the asymptomatic residents has not yet been clarified. This emphasizes the need to perform further evaluation to ascertain the natural course of the ant allergy.

It would be important to find out which factors are related with allergic reactions to the ant stings. However, there have been few known risk factors that could identify individuals at potential risk for insect sting anaphylaxis other than a history of a prior anaphylaxis. In this study allergic reactions to the ant stings developed more frequently in atopic subjects. However, the number of patients with ant allergy in our study is small, and whether atopy could be an important risk factor in inducing ant allergy should be clarified by further investigations.

Cross-allergenicity between IFA and bee venom has been demonstrated.⁷ Interestingly, in this study the positive SPT response rate to bee venoms in subjects with ant allergy was significantly higher than that in the control subjects. According to these results, it is supposed that

cross-reactivity between bee venom and *P. chinensis* exists to some degree, despite the small number of cases.

In conclusion, a considerable proportion of residents living in a *P. chinensis*-infested area were sensitized to ant venom allergen and seem to be at risk for development of potentially life-threatening anaphylaxis. It is assumed that *P. chinensis* has become an important public health hazard in Korea. The identification of a definite causative allergen, effective methods of avoidance, possibility of immunotherapy, and a natural history of allergic reactions to *P. chinensis* venom remain to be elucidated.

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