

Prevalence of Allergy to Hymenoptera Stings

D. Charpin,* D. Vervloet,* E. Haddi,* C. Segalen,** M. Tafforeau,* J. Birnbaum,* A. Lanteaume,* and J. Charpin*

ABSTRACT

In this study, we evaluated the prevalence of systemic reactions to hymenoptera stings in an adult general population, 20–60 years old. The protocol included a standardized questionnaire, skin tests to venom in subjects reporting a history of systemic reaction, and, in subjects reporting a history of severe local and systemic reactions, as well as in a control group, a radioallergosorbent test (RAST) to hymenoptera venoms. According to the questionnaire, 1.2% of the study population had a history of systemic reactions. Only 0.85% had both such a history and a positive skin test to venoms. RASTs were positive, for at least one venom, in 57% of subjects with a history of systemic reaction, 15.8% of subjects with a history of severe local reactions, and 6.0% of the control group. In conclusion, this study shows that systemic reactions are not uncommon in the general population. RASTs tests are not sensitive or specific enough to be considered, per se, for indications of allergy to venoms.

In the literature, there are been few studies devoted to assessing the prevalence of allergy to hymenoptera stings.^{1–8} The figures derived from these studies range from percentage as low as 0.15% or as high as 4.0%. None of these studies considered a nonselected group originating from a general population. Thus we decided to perform such a study in an health care center performing checkup examinations.

MATERIALS AND METHODS

Subjects

The study group included 2067 adults, 20–60 years old, who volunteered to get a checkup examination

in the Public Health Care Center of the District of Bouches du Rhône in Marseille, France. All subjects affiliated to the Social Security (i.e., 95% of the total population) are invited, at 5-year intervals, to get such a checkup. We studied subjects visiting the Center from January to July 1987. The group included 1164 men and 903 women, mean ($\pm$ SD) age equal to 39.3 ± 9.2 years. Mean ($\pm$ SD) age was similar in men (40.1 ± 9.4 years) and in women (38.5 ± 8.9 years).

Design of the Study

The study protocol included:

1. For all subjects a standardized questionnaire asked by an allergologist. Apart from demographic characteristics, this questionnaire asked about history of previous hymenoptera stings, history of local and general reactions (i.e., Quincke edema, giant urticaria, wheezing, breathlessness, malaise, and loss of consciousness), immediately following the sting, time of the last sting and whether or not the subjects visited a doctor for the reactions following the sting.

2. All subjects reporting a general reaction immediately following the sting were asked to be skin tested with venom allergens. These tests were performed on the volar surface of the forearm, using intradermal injections of serial tenfold dilutions of honeybee, yellow jacket, wasp (Laboratoires Dome, Paris, France), and vespa crabro (Laboratoire Stallergènes, Paris, France) venoms. The starting dilution used was 10^{-5} . Each intradermal injection included 0.05 ml of the diluted venom. At the same time were performed a positive control test using 9% codeine phosphate and a negative control test using saline solution. The tests were read 15 to 20 minutes later and were considered positive if the negative control test was negative and if the wheal induced by the venom injection was at least of the same diameter as the positive control test.

* Département des Maladies Respiratoires, Hôpital Sainte-Marguerite, Marseille, France

** Pharmacia France, Saint-Quentin-Yvelines, France

3. All subjects reporting severe local reactions or a general reaction, and a random sample of 82 subjects with a history of previous sting without any reaction, had a blood sampling for radioallergosorbent (RAST) determinations to honeybee, yellow jacket, and wasp venoms (Laboratoire Pharmacia, Paris, France), using the method described in the kit. However, among the studied population, some subjects provided no blood sample, and some sera tubes were broken or held too little serum. Thus only 21 sera out of 24 in the systemic reaction group and 101 out of 153 in the local reaction group were evaluated.

RESULTS

Prevalence of Reactions to Hymenoptera Stings

Three-quarters of the interviewees acknowledged a history of previous sting. Among those previously stung, 10% had had a severe local reaction (i.e., 7.4% of the total study group).

Twenty-four subjects, i.e., 1.16% of the study group, reported a history of at least one type of general reactions following the sting. Noteworthy, two-thirds of these subjects visited their doctor for the reaction following the sting. These reactions were as follows: malaise 18 times, Quincke's edema 11 times, breathlessness 10 times, giant urticaria 7 times, and loss of consciousness 6 times (some subjects reported several types of reactions). Three times out of four, stings responsible for these reactions had occurred in the last 3 years. A general reactions following the sting had occurred only once in 15 subjects, twice in 4, and more than twice in 5 subjects.

Prevalence of Systemic Reactions Confirmed by a Positive Skin Test to Venom

Among the 24 subjects reporting systemic reactions following the sting, 15 agreed to have skin tests to venoms. These tests were positive in 11 subjects. All subjects had no reaction to the negative control test. Thus, $1.16 \times 11/15$, i.e., 0.85% can be considered to have a history of true systemic reaction. In the four subjects who had negative skin tests, the systemic reaction occurred an average ($\pm$ SD) of 9.2 ± 4.3 years before the study, whereas this interval was only equal to 3.6 ± 3.7 years for subjects with positive skin tests. The type of systemic reaction reported by these four subjects was twice Quincke's edema (in association with breathlessness and giant urticaria), and twice a malaise without loss of consciousness.

Prevalence of Positive Rast

In the group of 24 subjects with a history of systemic reaction, 21 had a RAST evaluation. The RASTs to honeybee, wasp, and yellow jacket were negative in 7

subjects, grade 1 in 2, grade 2 in 11, and grade 3 in 1. Among the 14 subjects who had both skin tests and a RAST evaluation, only 2 had both negative results.

In the group of subjects with a history of severe local reaction, 15.8% had a RAST grade 2 or more (Table I). A positive RAST to yellow jacket antigen accounted for almost all of the positive RASTs (4 out of 5) in the subgroup which had no local or systemic reaction following the sting (Table II).

DISCUSSION

In our survey, the prevalence of true systemic reactions following hymenoptera stings can be evaluated to 0.85%. The fact that two-thirds of these subjects visited their doctors because of the reaction means that it was considered by them as severe. A third of the subjects reporting such reactions had negative skin test. This phenomenon can be due either to negation of positive skin tests over time, which has been documented in the natural history of that disease,⁹ or to a false positive history. The former hypothesis is backed up by the fact that the time interval between the sting and the study was much longer in the subgroup of subjects than for those who had positive skin tests. The latter hypothesis might be involved in the two patients who reported as general reaction a malaise without any other reaction. The figure of 0.85% is likely to be an underestimate, as most subjects reported a general reaction following stings which occurred in the last 3 years. In the literature, the first report devoted to the prevalence of hymenoptera stings allergy was performed by Chaffee¹ in the records of 3705 patients with asthma or seasonal or nonseasonal allergic rhinitis. Of these patients, 14 or 0.38% had a history of severe systemic reaction. As practically all were seen primarily because of the sting, it is difficult to infer from this study the prevalence of such reactions in a normal population, and even in a "normal" atopic population. Then Settupane and Boyd reported a questionnaire

TABLE I
Distribution of RAST in 101 Subjects with History of Severe Local Reactions

Grade	Venom Antigen			
	Honey- bee	Wasp	Yellow jacket	Any of the three
0	92	92	87	75
1	2	5	4	10
2	4	2	8	11
3	2	2	2	4
4	1	0	0	1

TABLE II

Distribution of RAST in 82 Subjects, Chosen at Random, Who Had No Local or Systemic Reactions Following Hymenoptera Stings

Grade	Venom Antigen			
	Honeybee	Wasp	Yellow jacket	Any of the three
0	76	78	74	70
1	4	3	4	7
2	2	1	4	5
3	0	0	0	0
4	0	0	0	0

survey in 4992 Boy Scouts 11–16 years old whose parents were questioned before a summer camp about history of general reactions to stings in their children. According to the questionnaire filled out by the parents, 4% of the children had had such reactions. However, after a medical interview, only 0.4% of the children were thought to have had true general reactions.² In another study, using a different wording for the question intended to identify allergy to hymenoptera stings, the same group reported a prevalence rate of 0.8%³ in 3000 Boy Scouts. Again the same group published in 1971 a similar survey performed in 2010 Girl Scouts 7–16 years old.⁴ Using the same questionnaire than in the first survey, they obtained a 0.35% prevalence rate of general reactions to stings in the Girl Scouts between to age of 11 and 16 years, while the prevalence in the total Girl Scout population was 0.15%. Newman and Ishay⁵ in Israel performed a questionnaire survey on 1851 first grade school children. They recorded a prevalence rate of general reactions ranging from 0.4% to 0.8%, according to ethnic group studied.⁵ The only study so far performed in adults involved a small group of 187 subjects, randomly selected from an industrial population.⁶ Insect stings had caused general reactions in 4% of the subjects. Herbert and Salkie⁷ also studied a small group of 86 selected adult male office workers among whom only 1 had a history of general reaction. Bousquet et al.⁸ evaluated 200 beekeepers among whom 3.3% reported systemic reactions to bee stings. Thus, none of these studies involved subjects selected from the general population and none of them had included skin tests to venom to confirm the data gathered from the questionnaire. Our study population attending a Health Care Center is unlikely to give a biased prevalence rate of allergy to hymenoptera stings because 1) the sex, age, and occupation distribution in this study was comparable to the one observed in the same age range for inhabitants of Marseille at large⁹; 2) it is not

conceivable that subjects invited to attend the Health Care Center could have chosen to do so or not, depending on whether they had had a systemic reaction to hymenoptera stings.

Among subjects with a history of systemic reactions, only one had a positive skin RAST (to honeybee, grade 2) and negative skin test to venoms. Two subjects had positive skin test to venom and negative RAST. In a group of 26 young patients who did not receive immunotherapy, Savliwala and Reisman¹⁰ showed that, at time of reevaluation (an average of 9.5 years after the initial sting reaction), skin tests had become negative in 6 patients and RAST negative in 11. Thus negative skin tests as well as negative RAST do not deny a true history of systemic reaction to stings. The percentage of RAST grade 2 or more was much higher (15.8%) in subjects with a history of severe local reaction than in the control group (6.0%) but lower than in the systemic reaction group (57%). However, Stuckey et al.,¹¹ in a large survey performed in Australia, surprisingly found a similar percentage of RAST grade 2 or more in systemic and severe local reactions, 50% and 43%, respectively. In this latter study, the percentage of RAST grade 2 or more was equal to 13.9% in control subjects. Herbert and Salkie⁷ also reported in 12% of 86 selected male office workers antibodies to yellow jacket or honeybee venom in subjects without a history of systemic reaction. Zora et al.¹² also measured immunoglobulin E antibodies to hymenoptera venoms in random blood bank donors. In sera collected in spring, they showed a 1% positivity, whereas it was equal to 7% for sera collected in autumn. Thus, in any case, a positive RAST is not per se indicative of an allergy to hymenoptera venoms.

REFERENCES

1. Chaffee FH. The prevalence of bee sting allergy in an allergic population. *Acta Allergol* 25:292–293, 1970.
2. Settupane GA, Boyd GK. Prevalence of bee sting allergy in 4,992 Boy Scouts. *Acta Allergol* 25:286, 1970.
3. Settupane GA, Newstead GJ, Boyd GK. Frequency of hymenoptera allergy in an atopic and normal population. *J Allergy Clin Immunol* 50:146–150, 1972.
4. Abrishami MA, Boyd GK, Settupane GA. Prevalence of bee sting allergy in 2,010 Girl Scouts. *Acta Allergol* 26:117–120, 1971.
5. Newman I, Ishay JS. Beekeeper's allergy in Israel: a medical profile. Paper read at the meeting of the European Academy of Allergy and Clinical Immunologie, Clermont-Ferrand, 24–26 September 1981.
6. Golden DBW, Valentine MD, Kagey-Sobotka A, Lichtenstein LM. Prevalence of hymenoptera venom allergy. *J Allergy Clin Immunol* 69:A124, 1982.
7. Herbert FA, Salkie ML. Sensitivity to hymenoptera in adult males. *Ann Allergy* 48:12–13, 1982.
8. Bousquet J, Ménardo JL, Aznar R, Robinet-Lévy M, Michel FB. Clinical and immunologic survey in beekeepers in rela-

- tion to their sensitization. *J Allergy Clin Immunol* 73:332-340, 1984.
9. Floch A, Gallats P, Gueguen R, Monneau JP. Etude de la représentativité des échantillons en médecine préventive. Colloque National des Centres d'Examens de Santé, Bordeaux, 4-5 June 1981.
 10. Savliwala M, Reisman RE. Studies of natural history of insect sting allergy: long-term follow up of patients without immunotherapy. *J Allergy Clin Immunol* 79:A127, 1987.
 11. Stuckey M, Cobain T, Sears M, Cheney J, Dawkins RL. Bee venom hypersensitivity in Busselton. *Lancet* 2:41, 1982.
 12. Zora JA, Swanson MC, Yunginger JW. A study of the prevalence and clinical significance of venom-specific IgE. *J Allergy Clin Immunol* 81:77-82, 1988. □

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.