
Hymenoptera hypersensitivity in an imported fire ant endemic area

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Background: Imported fire ants are a common cause of insect venom hypersensitivity in the Southeastern United States.

Objective: The purpose of this study was to determine the most frequent insect cause for evaluation in a Hymenoptera hypersensitivity clinic in an area endemic for the imported fire ants.

Methods: This was a retrospective study reviewing all patients seen in a venom clinic at a large teaching hospital.

Results: Of the 703 patients evaluated, between 1985 and 1995, 515 (73%) had reactions consistent with systemic anaphylaxis for which a determination of specific IgE was appropriate. Of the 703 patients seen, 315 (45%) had a positive history and skin test positivity and were offered specific immunotherapy. This was 61% of those individuals skin tested. Of the total patients seen, imported fire ants were responsible for 42% of the visits to the clinic and accounted for 59% of the total immunotherapy that was begun in this endemic area.

Conclusion: In areas endemic for the imported fire ants, the most frequent cause of Hymenoptera hypersensitivity is the imported fire ant.

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INTRODUCTION

Previous studies of the epidemiology of insect stings as evaluated by allergists have been done. In 1965, the Insect Allergy Committee of the American Academy of Allergy and Immunology published a survey study of 2,606 cases.¹ They reported that yellow jackets, bees, and wasps were named in that order as significant offenders.¹ They also noted that moderate and severe generalized reactions occurred more often with yellow jackets than with the other insects.

Since the development of venom for use in evaluation and treatment of Hymenoptera-hypersensitive patients, a survey known as the "Hymenoptera

venom study" was reported in a series of articles beginning in 1988. Dr. Lockey et al found that the insect most frequently reported as causing a reaction was the yellow jacket, followed by the honey bee and the wasp.² White-faced hornets and yellow hornets were a distant fourth and fifth, and the imported fire ant was a very distant number six in frequency.² Unfortunately, only a small number of subjects, (approximately one-fifth) came from endemic fire ant areas in the Southeast. The purpose of this study is to examine the epidemiology of patients seen in the Venom Clinic at Wilford Hall Medical Center as an example of what might be expected in an endemic imported fire ant area.

METHODS

Study Design

This study was designed as a retrospective review of the data accrued from the Wilford Hall Medical Center Venom Clinic from 1985 to 1995. Wilford Hall Medical Center is an Air Force hospital serving, primarily, the San Antonio military beneficiary pop-

ulation, but also has the mission of serving as a referral center for smaller Air Force hospitals throughout the Air Force system. Patients are drawn from the whole Wilford Hall Medical Center referral area, but the majority (>95%) were from the San Antonio area. These clinics are held every 4 to 8 weeks depending on the number of patient consults received.

Every patient has a history reviewed and is discussed by the fellows and the staff in a group meeting. Decisions concerning skin testing and the appropriateness of immunotherapy in individual patients are discussed in a joint forum in a half-day clinic. Generally, only reactions considered to be IgE-mediated by history are evaluated by skin testing. Large local reactions are not evaluated by skin testing. Cutaneous reactions (hives) in children (less than 16 years of age) are not evaluated unless a question concerning the agent is raised where specific avoidance recommendation may be useful or parental anxiety levels are very high. The number of patients requesting Hymenoptera evaluations generally result in eight to ten venom clinics per year at Wilford Hall Medical Center. Each venom clinic is summarized with a list of all the patients who attended, their age, sex, a description of the reaction that they had after exposure to the insect, what the insect was identified as (to the best of the patient's ability), whether skin testing was done, the results of the skin testing, and whether immunotherapy was offered. It was a review of these summary sheets that was undertaken to develop this paper.

Skin Testing

When skin testing is offered, unless the patient was absolutely sure of identifying the correct insect, which is very rare, the patient receives a full evalua-

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tion for honey bee, yellow jacket, yellow hornet, white-faced hornet, and wasp. Individuals with histories of reactions to imported fire ants alone received only evaluations for imported fire ants. Any who had a history of both imported fire ant and winged Hymenoptera hypersensitivity received evaluations for both. The evaluations for the winged Hymenoptera include prick testing at 1 $\mu\text{g}/\text{mL}$ and intradermal testing using .02 ml at .001 $\mu\text{g}/\text{mL}$, .01 $\mu\text{g}/\text{mL}$, .1 $\mu\text{g}/\text{mL}$, and 1 $\mu\text{g}/\text{mL}$. Those for imported fire ants receive a prick test at 1:1,000 wt/vol and intradermal testing at 1:10,000,000, 1:1,000,000, 1:100,000, 1:10,000, and 1:1,000wt/vol. For the intradermals, a 5 to 10-mm wheal and 11 to 20-mm of erythema or greater was considered positive.

For the purposes of reporting the data, if more than one log dilution was seen between any individual venom component and the other venoms, the venom giving a positive response at the lowest concentration was considered the sole agent responsible, unless the history suggested multiple different insects as causative agents. If the patient had multiple positives within one log of concentrations, the reaction was attributed to all those with positive skin tests as well as being attributed to the multiple category.

RESULTS

Figure 1 shows that the number of patients seen each year varied from a low of 37 in 1987 to a high of 99 in

1992, with an average of 64 patients per year. Generally, about three of four patients were evaluated with skin tests (515 patients) and this was fairly consistent from year to year. Of the 703 patients seen, 45% (315) were offered immunotherapy, representing 61% of the patients who were skin tested.

Figure 2 breaks down these patients into six groups. The first bar reflects the percentage of total stings by a particular insect as determined by history and/or skin test results. The second bar reflects the percent of immunotherapy patients offered a particular Hymenoptera venom or imported fire ant whole body extract. Imported fire ants were implicated in 42% of those evaluated in the clinic. Wasp was second with 29%, yellow jacket had 15%, white-faced hornet and bald-faced hornets were responsible for 16%, honey bee for 12%, and unknown or other evaluations for 13% of these evaluations. Individuals giving multiple histories accounted for 15% of the total evaluations. Multiple evaluations were included in each individual total as well. Figure 2 combines yellow jacket and mixed vespid histories and immunotherapy recommendations together as hornets are rarely seen in Texas. Other evaluations include mosquito bites, spider bites, scorpion stings, reduvid (kissing bug bite) evaluations, and an occasional unusual individual insect evaluation.

Of the 673 patients for whom sex was reported, 338 were male and 335 were female. Of the 700 patients for

whom age was reported, 113 (16%) were 16 years of age or younger, and 587 (84%) were more than 16 years of age. The mean age of all the individuals seen was 36 years. Table 1 lists the youngest and the oldest individuals seen each year and the youngest and the oldest individuals offered immunotherapy each year. Ages ranged from 17 months to 80 years. The youngest individual offered immunotherapy was 18 months of age and the agent was the imported fire ant. The oldest individual offered immunotherapy was 80 years of age and the agents were wasp and yellow jacket.

DISCUSSION

When compared with the Hymenoptera venom study reported by Lockey et al in several articles beginning in 1988, our study has some parallel data. In Lockey's study, 89% (2866 out of 3236 patients) had systemic reactions indicating a need for evaluation with skin testing.² In our study, 73% (515 out of 703) patients had reactions for which skin testing was appropriate. In Lockey's subsequent studies 76% (2181/2866) of patients with systemic reactions and 67% (2181/3230) of all patients evaluated had positive skin tests.³ Our study, however, showed that only 45% (315/703) of the total number of subjects tested were skin test positive. Interestingly, Lockey et al had reported that only 44% of their patients agreed to undergo venom immunotherapy.⁴ In our clinic, 45% of patients were offered immunotherapy, and this offer was generally accepted.

In terms of demographics, the mean age in the Lockey et al paper was 30.5 years while our mean age was 36 years of age.² Both Lockey and the original insect committee reported a male predominance. The Insect Venom Committee reported 57.3% males, while Lockey et al reported 61.6% males. This contrasts with our findings of nearly equivalent numbers of males and females presenting for evaluation. This sex difference may reflect the difference between surveys attempting to access data on all individuals stung, in which case males clearly predominate,

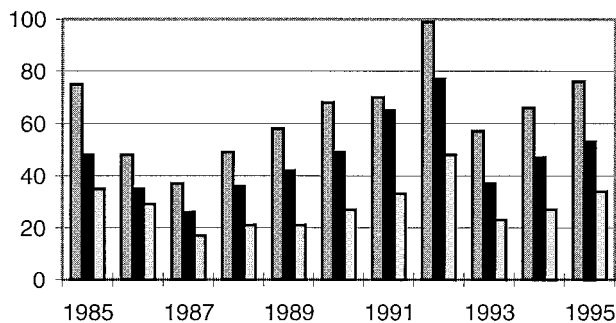


Figure 1. Number of patients seen, number of patients receiving skin tests, and number offered immunotherapy by year over the last decade at Wilford Hall Medical Center. ■ Total seen, ■ skin test, and □ IT start.

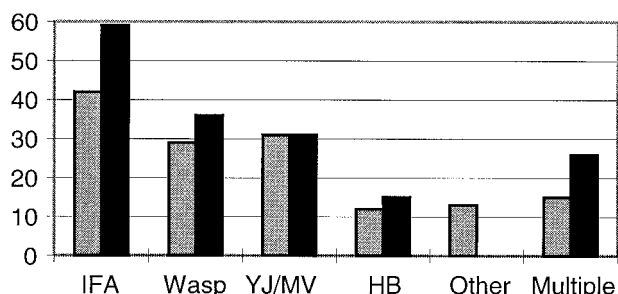


Figure 2. Percentage of all patients seen during the last 10 years attributing their reactions to a specific agent or agents by history. Other category included non-Hymenoptera agents such as spiders, scorpions, mosquitoes, and reduvids. Percentage of all immunotherapy offered during the last 10 years broken down by agent(s). IFA = imported fire ant, YJ = yellow jacket, MV = mixed vespid, HB = honey bee, and multiple = more than one agent offered. ▨ % of Total (history) and ■ % of those offered immunotherapy.

Table 1. Demographics of Patients seen by Year

Year	Ages (yr) of Patients seen		Ages (yr) of Patients Offered Immunotherapy (Agent)	
	Youngest	Oldest	Youngest	Oldest
1985	1.8	70	1.8 (Imported fire ant)	65 (Yellow jacket)
1986	2	65	7 (Imported fire ant)	65 (Wasp)
1987	6	75	20 (Honey bee, wasp, mixed vespid)	71 (Wasp)
1988	1.6	70	13 (Wasp, mixed vespid)	70 (Honey bee)
1989	3.5	71	11 (Imported fire ant)	67 (Imported fire ant)
1990	2	69	2 (Imported fire ant)	64 (Wasp, yellow jacket)
1991	1.5	75	1.5 (Imported fire ant)	66 (Imported fire ant)
1992	7	80	8 (Honey bee)	80 (Wasp, yellow jacket)
1993	1.7	77	2.5 (Imported fire ant)	67 (Wasp)
1994	1.8	71	1.8 (Imported fire ant)	67 (Wasp, mixed vespid)
1995	1.4	73	2.5 (Imported fire ant)	62 (Imported fire ant)

versus an evaluation for those interested in pursuing therapeutic options, where it is generally recognized that women are more willing than men to seek medical care.

As noted before, both the Insect Allergy Committee and the Hymenoptera venom study reported that yellow jackets were the most frequent offenders, followed by bees and wasps.^{1,2} Both Chipps et al⁵ and Ramirez et al⁶ reported exactly the same occurrence rate for yellow jacket/mixed vespids, followed by honey bees, and last, wasps in their papers on Hymenoptera hypersensitivity in children. Both of these reports were from areas in the mid-Atlantic states, where imported fire ants are not yet endemic. Clearly, in our endemic area, imported fire ants

are number one both from the number of individuals seeking evaluations (42% of the total) and the number of individuals who are skin test positive and are thus offered immunotherapy (59% of the total immunotherapy offered). Examining other areas endemic for the imported fire ant will determine whether these results can be generalized to all endemic areas or whether military beneficiaries in San Antonio are unique.

It is interesting to speculate why imported fire ants might be seen more frequently in imported fire ant endemic areas than the other Hymenoptera. It is clear that individuals living in endemic areas are more often exposed to imported fire ants than individuals living in non-endemic areas are exposed to

other Hymenoptera. Previous reports from this area have shown that up to half of the individuals living in an endemic area for 3 weeks may receive an imported fire ant sting.⁷ This no doubt is a greater rate than flying Hymenoptera sting rates. In addition, imported fire ants are very easy to identify because they do not fly away. In fact, they tend to grab on and continue to hold on while delivering multiple stings if left alone. In addition, they often leave a characteristic sterile pustule that is pathognomonic of imported fire ant sting. So the agent is often clearly identified as being imported fire ant. Furthermore, unlike other Hymenoptera where a single sting is the usual occurrence, multiple stings are the norm with imported fire ants, potentially leading to an increased prevalence of imported fire ant hypersensitivity.

In summary, in the San Antonio area of Texas, where imported fire ants are endemic, evaluations for Hymenoptera hypersensitivity are most frequently sought for imported fire ant hypersensitivity and result in more immunotherapy for imported fire ant than for the other Hymenoptera.

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REFERENCES

1. Insect Allergy Committee of the American Academy of Allergy. Insect sting allergy: Questionnaire study of 2606 cases. *JAMA* 1965;193:109–14.
2. Lockey RF, Turkeltaub PC, Barid-Warren IA, et al. The Hymenoptera venom study I, 1979–1982: Demographics and history sting data. *J Allergy Clin Immunol* 1988;82:370–81.
3. Lockey RF, Turkeltaub PC, Olive CA, et al. The Hymenoptera venom study II. Skin test results and safety of venom skin testing. *J Allergy Clin Immunol* 1989;84:967–74.
4. Lockey RF, Turkeltaub PC, Olive ES, et al. The Hymenoptera venom study III. Safety of venom immunotherapy. *J Allergy Clin Immunol* 1990;86:775–80.
5. Chipps BE, Valentine MD, Kagey-Sobotka A, et al. Diagnosis and treatment of anaphylactic reactions to Hymenoptera stings in children. *J Pediatr* 1980;97:177–84.
6. Ramirez DA, Summers RJ, Evans R III. The diagnosis of Hymenoptera hypersensitivity. *Ann Allergy* 1981;47:303–6.
7. Tracy JM, Demain JG, Quinn JM, et al. The natural history of exposure to the imported fire ant (*Solenopsis invicta*). *J Allergy Clin Immunol* 1995;95:824–8.

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