

Survey of fatal anaphylactic reactions to imported fire ant stings

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A physician questionnaire survey was conducted by the Fire Ant Subcommittee of the American Academy of Allergy and Immunology to document deaths caused by imported fire ant stings. From the 29,300 physicians surveyed, reports of 83 fatal and two near-fatal fire ant-sting reactions were received. Most anaphylactic deaths were reported from Florida (22) and Texas (19). After excluding duplicate reports, four confirmed deaths were documented in Alabama, 10 in Florida, two in Georgia, two in Louisiana, and 14 in Texas. (J ALLERGY CLIN IMMUNOL 1989;84:159-62.)

During the past 50 years, two IFA species have been introduced into the United States through the port of Mobile, Ala.¹ *Solenopsis richteri* Forel was brought in on vegetation and produce imported from Uruguay. *Solenopsis invicta* Buren migrated via a similar route from its homeland along the Guaporé and Paraguay river basins in Brazil.

Although the spread of *S. richteri* has been limited to a small area along the northern Mississippi and Alabama border, *S. invicta* has adapted well to climatic conditions throughout the Southeast where it now infests more than 160 million acres in 13 states. It has aggressively devoured all native ant competitors and now accounts for 90% of all ants in heavily infested areas.

The IFA has also become an important public health hazard for more than 30 million people who live in

Abbreviation used

IFA: Imported fire ant sting

fire ant-infested areas of the southern United States. In areas of heavy infestation, the exposure rate to fire ant stings is quite high compared to stings for other Hymenoptera. At an average sting attack rate of 31%, approximately 9.3 million subjects may be stung by fire ants each year during the spring and summer months.^{2-4*} In fact, it is unusual to find people living in heavily infested areas who have not been stung by fire ants.

The severity of fire ant-sting reactions range from the typical local sterile pustule to severe secondary infection or life-threatening anaphylaxis.* Systemic allergic reactions account for approximately 12% of IFA sting reactions requiring medical treatment.* However, in spite of an increasing awareness of the medical problems caused by the IFA, only a few anaphylactic deaths from fire ant stings have been documented.^{5-10*} Therefore, the Fire Ant Subcommittee of the American Academy of Allergy and Immunology undertook a large physician survey in an effort to document the occurrence and geographic distribution of anaphylactic deaths to IFA stings in the United States.¹¹

MATERIAL AND METHODS

Survey questionnaires were mailed from the office of the Academy to 29,300 physicians, including emergency room physicians, family practitioners, pediatricians, internists,

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*Triplett RF. Unpublished survey, 1971.

A 1. Are you aware of any deaths related to imported fire ant stings? No _____ (If no, please discontinue and return questionnaire) Yes _____ (If yes, please continue) Source of information: your patient _____ colleague's patient _____ newspaper _____ news media _____ hearsay _____ 2. For each fatal reaction, please provide the following information: a. Patient's physician _____ b. Geographic location: _____ city _____ county _____ state _____ c. Date of sting(s): _____ d. Victim identification: (1) Patient's initials: _____ (2) Age: _____ (3) Sex: _____ (4) Race: _____ (5) Nationality: _____ (6) Occupation: _____ 3. What predisposing factors/activities, if any, were identified? a. Recreational: _____ b. Occupational: _____ c. Location/vicinity (field, yard, lake, stream, etc): _____ d. Time of day: _____ e. Other: _____ f. Unknown: _____ 4. What is the evidence that an ant was the culprit insect? Ants seen on the patient _____ Patient was in ant infested area _____ Other (specify): _____ 5. What evidence is available to document that the imported fire ant was the culprit insect? a. Culprit insect captured? Yes _____ No _____ (1) Identified by an entomologist? Yes _____ No _____ (2) Identified by non-entomologist? Yes _____ No _____ b. Insect from same/similar mound/nest identified? Yes _____ No _____ If yes, by whom? _____ c. Typical mound/nest identification? Yes _____ No _____ If yes, by whom? _____ d. Known infested area? Yes _____ No _____ e. Other (specify): _____	B 6. What clinical signs and symptoms did the patient exhibit? (Check all which apply): a. Flushing _____ b. Generalized pruritis _____ c. Generalized urticaria (distal to sting) _____ d. Angioedema _____ e. Laryngeal edema _____ f. Stridor _____ g. Dyspnea _____ h. Bronchospasm _____ i. Nausea _____ j. Vomiting _____ k. Diarrhea _____ l. Hypotension (BP) _____ m. Dysrhythmia _____ n. Convulsions _____ 7. What was the number of stings inflicted? One _____ 5-20 _____ 1-5 _____ >20 _____ 8. Was an autopsy performed? Yes _____ No _____ Please attach a copy of the findings or provide source available: _____ 9. Did the patient have any previous history of reaction to ant stings? Systemic _____ No history of reaction _____ Large local _____ Unknown _____ 10. Did the patient have a previous history of reaction to stings of other insects? Systemic _____ Which insect? _____ Large local _____ Which insect? _____ No history of reaction _____ Unknown _____
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FIG. 1, A-B. Questionnaire for survey of fatal anaphylactic reactions to IFA.

and allergists. A copy of the survey questionnaire form is illustrated in Fig. 1, A and B.

RESULTS

Of the 29,300 physicians surveyed, 2506 responses (8.6%) were received. These included reports of 84 fatal and two near-fatal reactions. Most anaphylactic deaths were reported from Florida (23) and Texas (19). Approximately 11% were obtained from the victims' physicians, 8% from physicians' colleagues, and 5% from medical reports, but 76% of the information was gathered from other sources, including news media reports. From reports that provided adequate information to substantiate individual fatalities and separate overlapping cases, it was possible to document four deaths in Alabama, 10 in Florida, two in Georgia, two in Louisiana, and 14 in Texas (Fig. 2).

The victims were predominately male and ranged in age from infancy to 65 years. Most deaths were caused by less than five stings. Approximately the same number of deaths occurred in and around patients' homes that occurred in field settings related to occupation. At least two victims were found unresponsive after fire ant stings and were successfully resuscitated from near-fatal anaphylaxis.

Typical fatal reactions are described in the following case reports.

Case report 1

A healthy 16-month-old white child was bumped by the family dog and fell into a fire ant mound. She suffered fire

stings from head to toe. Her mother, a registered nurse, immediately brushed off most of the ants and bathed the child in an attempt to remove the remaining ants. During this process, the mother noted the child was experiencing respiratory distress. She initiated mouth-to-mouth resuscitation and notified the emergency medical services who transported the child to the emergency room while CPR was continued enroute. On arrival, the child underwent full cardiopulmonary resuscitative measures. Analysis of her blood gases revealed a pH of 6.76, P_{CO_2} of 68, and P_{O_2} of 111. She survived another 6 days with ventilator support in the intensive care unit. Life-support systems were stopped after she exhibited evidence of ischemic brain death. Ants collected from the site of the sting attack were confirmed by an entomologist to be *S. invicta*.

Case report 2

A 52-year-old white male cabinet maker from San Antonio died shortly after being stung on the lower extremities by fire ants. Only 4 months before his demise, he had been started on immunotherapy with fire ant whole body extract for a previous fire ant-sting reaction.

Case report 3

A 32-year-old white, female junior high school teacher experienced a systemic reaction to a fire ant sting. She then consulted an allergist who recommended immunotherapy, but she declined treatment. She subsequently suffered 10 stings from *S. invicta* on her feet and ankles. She immediately developed dyspnea and chest pain. An ECG that was taken in the emergency room just before her death revealed ST segment changes in the lateral precordial leads.



FIG. 2. Number and geographic distribution of fatal anaphylactic reactions to IFA stings. Area outlined indicates geographic spread of *S. invicta*; dark shaded area indicates geographic limits of *S. invicta*.

Case report 4

A 45-year-old white man from Dallas was stung by ants during the summertime while he was working in his garden. He lapsed into unconsciousness but survived for 3 days in the intensive care unit. Before expiring, he developed multiple pustular lesions over his anterior chest. He had no history of previous reactions to fire ant stings, but had an elevated IgE RAST to IFA.

DISCUSSION

The purpose of this survey was not to establish the statistical incidence of fire ant–sting deaths but simply to document the occurrence of fatal anaphylactic reactions to fire ant stings. We, therefore, gave broad latitude to interpretation of incomplete data and accepted newspaper and media reports of deaths after presumed fire ant stings. Reports, therefore, range from well-documented cases observed by medical personnel, including allergists, to reports derived from news media.

Few previous reports have presented data on fire ant–sting deaths. Parrish⁵ reviewed vital statistics data that included four deaths from ant stings during a 9-year period, but the ant species were not specified. Bowen⁶ reported a single fatality from three ant stings in north Texas before 1950, before fire ants had invaded that region. In a 3-year study,* a survey was made of 2485 physicians in three states heavily infested with fire ants. Responses received from 1325 doctors included 154 cases of anaphylactic shock and a total of 17 deaths; however, it is unclear whether these deaths were related to anaphylaxis or to complications of secondary infection. A well-documented case of a delayed anaphylactic death caused by IFA stings was reported by Bloom and DelMastro.⁸

A number of documented cases and anecdotal ac-

counts of near deaths have also been reported. These include patients who have been initially observed in profound anaphylactic shock with seizure activity or with absence of vital signs after fire ant stings. Two near deaths from fire ant–sting anaphylaxis were reported in response to our survey. Both were successfully resuscitated; otherwise, the reactions would have presumably been fatal.

The documentation of these fire ant–sting fatalities emphasizes the need for continuing medical education for health care providers who may encounter patients with systemic allergic reactions to fire ant stings. This is a potentially fatal condition that may require emergency treatment for acute reactions and immunotherapy for long-term management.

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Prospective observations on stopping prolonged venom immunotherapy

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After a decade spent establishing the safety, efficacy, and optimal techniques for venom immunotherapy, we have begun a series of studies to determine how long venom immunotherapy must be continued. In retrospective surveys, patients who had stopped venom immunotherapy after 1 to 2 years had a substantial risk (25%) of systemic sting reactions, but this was <50% of the risk in untreated patients. In this first prospective study, 30 patients elected to stop venom immunotherapy after at least 5 years of therapy. Skin test sensitivity had decreased significantly during therapy in 18/30 patients but remained clearly positive in 23/30 (seven patients became equivocal or negative). Serum venom-specific IgE antibodies were at the lower limit of detection (1 ng/ml) in 11/30 patients. After stopping treatment, the mean serum venom-specific IgG antibody level declined from $5.5 \pm 0.6 \mu\text{g/ml}$ to $2.4 \pm 0.3 \mu\text{g/ml}$ by 9 months, which is the same as the mean venom IgG in untreated patients. After 12 months without therapy, live sting challenge caused no systemic reaction in 29 patients. The mean venom IgG level 1 month after the sting had risen significantly to $4.1 \pm 0.5 \mu\text{g/ml}$, but there was no significant increase of venom IgE. These results suggest that prolonged venom immunotherapy leads to isotype-specific suppression of the venom IgE antibody response and may provide persistent clinical protection by mechanisms other than IgG blocking antibodies. The observations are to be interpreted very cautiously. Further investigations are needed to extend these observations in additional patients and for longer periods of time, and to examine possible mechanisms for this apparent loss of clinical reactivity. (J ALLERGY CLIN IMMUNOL 1989;84:162-7.)

Immunotherapy with Hymenoptera-venom extracts prevents anaphylactic reactions to insect stings in 98% of susceptible patients¹ and continues to be effective

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Abbreviations used

YJV: Yellow jacket venom
HBV: Honeybee venom

during the 10 years that we have monitored prolonged maintenance treatment.^{2, 3} However, it is unknown whether, and when, venom immunotherapy may be stopped. Unlike immunotherapy of respiratory allergic disease with inhalant allergens, it would be potentially unsafe to stop venom therapy if the patient is still allergic to Hymenoptera venom. It has been recommended that venom treatment be continued for as long as the sensitivity persists, as judged by the presence