

Medical consequences of multiple fire ant stings occurring indoors

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Stings by the imported fire ant almost always lead to dermal wheal and flare reactions followed by sterile pustules at sting sites. Less commonly, large local dermal reactions, pyoderma, anaphylaxis, or neuropathy may occur. Such reactions have previously been associated with contact with the insects out of doors. We present two previously unreported cases of indoor attacks on individuals by imported fire ants. One patient experienced a cerebrovascular accident in association with the attack, whereas the second patient had no obvious sequelae. With these two reports, a total of four such indoor massive sting episodes have appeared in the recent medical literature. Physicians and other individuals living in areas indigenous to the fire ant should be aware that infestation of buildings with fire ants may be associated with attacks on human beings indoors. Individuals with cognitive dysfunction seem to be especially at risk for attacks by fire ants. (J ALLERGY CLIN IMMUNOL 1994;93:847-50.)

Key words: Imported fire ants, insect reactions, stinging insects, cerebrovascular accidents, residential insect infestation

Since importation into the United States through the port of Mobile, Alabama in the 1930s, the primary imported fire ant species, *Solenopsis invicta* has spread throughout the southern and southeastern United States.¹ Attempts to control the spread of these ants have been ineffective to the degree that 30% to 40% of individuals living in urban areas colonized by the ant are stung each year.^{2, 3} For the most part, clinical reactions to the venom of fire ants are limited to pruritic local dermal responses, the most common of which is an immediate painful and pruritic wheal and flare reaction followed by the formation of a "sterile pustule" at the sting site. The pustule appears to result from direct tissue damage caused by alkaloids, which are the major components of the venom.⁴ Although only 0.1% of the venom by weight is protein, this component effectively induces IgE antibody responses such that IgE-mediated anaphylactic reactions after fire ant stings are increasingly common.^{5, 6} Over 50 deaths from anaphylactic reactions to fire ant venom have been reported.⁷

Most encounters with fire ants occur out of doors in the summer months.^{8, 9} Although the pugnacious ants usually sting persons with whom they come in contact, organized attacks of human beings have not been noted in the United States until recently.¹⁰⁻¹³ Most of these have occurred on exposure to the ants in their outdoor habitat. This report describes two previously unreported indoor attacks on adults by fire ants, one of which led, directly or indirectly, to the death of the patient. Whether or not this and similar reports of unprovoked fire ant stings represent a developing propensity by fire ants to take up residence in inhabited buildings or a trend toward more aggressive behavior of these insects requires further study.

CASE REPORTS

Case 1

MC was an active, employed, 69-year-old man with adult-onset diabetes, mild hypertension, and mild chronic renal insufficiency, all of which were under good medical control with glipizide and atenolol administered daily. He had experienced fire ant stings on multiple occasions in the past while doing yard work in southern Florida. These stings had resulted in pruritic and persistent large local reactions at the sites of the stings and were severe enough that he routinely treated them with over-the-counter topical corticosteroid creams. He had had no symptoms of anaphylaxis after stings.

In October of 1990 in the course of an automobile trip across the southern United States, he and his wife stopped to spend the night at a motel in central

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TABLE I. Circumstances of four reported cases of fire ant attacks on human beings indoors

Age	Sex	Mental status	Location	Syndrome
84 yr	F	Alzheimer's disease	Bed in a private home	None
5 day	M	Normal	Crib in a private home	Shock, coma, sepsis, focal neurologic signs, hemolytic anemia
69 yr	M	Normal	Bed in a hotel	Late cutaneous allergic response, stroke
74 yr	F	Alzheimer's disease	Bed in a nursing home	None

IV, Intravenous.

Louisiana. Earlier that morning, a guest in a room adjoining the room to which MC and his wife were assigned awakened and found numerous ants on his body but was apparently not stung. He reported to the motel manager that his room was "infested with ants." Around 6:00 AM the next morning, MC awoke and informed his wife that he was nauseated and itching all over. When his wife turned on the light and pulled back the sheets, she noted that he had numerous ants over his body and had been stung repeatedly. No food was present or had been eaten in the room by the patient or his wife.

He was taken to a local emergency room where severe left facial and periorbital swelling and evidence of multiple fire ant stings were noted on his left forearm and right leg. A developing sterile pustule on his left eyelid was noted by the emergency room physician. His blood pressure was 140/90 mm Hg, and no evidence of anaphylaxis was noted. He was given intramuscular injections of dexamethasone and hydroxyzine, observed for 1.5 hours and discharged with a prescription for an oral antihistamine. He resumed his journey with his wife driving. However, over the ensuing 7 hours, he remained nauseated, experienced additional vomiting, and became progressively disoriented and somnolent. Facial swelling continued to develop, and his tongue became swollen as well.

Some 8 hours after his first emergency room visit, he was taken to a second emergency room in central Texas where left facial and tongue swelling and evidence of multiple fire ant stings on his face, extremities, and trunk were noted. By that time, he was somnolent, disoriented, and unable to speak clearly. His blood pressure was 148/82 mm Hg; serum glucose level was 458 mg/ml with no serum ketones. Electrolyte values were normal with a normal anion gap, and serum creatinine was unchanged from previous outpatient determinations. An electrocardiogram showed no evidence of acute myocardial injury. He was admitted to the hospital with a diagnosis of an allergic reaction and hyperglycemia, treated with insulin and fluids, and observed. Evidence of a left facial paralysis and left hemiparesis was noted during the first 24 hours of hospitalization, and a neurologist confirmed the clinical impression of a cerebrovascular accident. A computerized axial tomogram of the brain was obtained approximately 48 hours after the fire ant stings occurred and showed an area in the right temporal lobe compatible with acute cerebral infarction. The patient was subsequently transferred to another Texas hospital and

placed in a stroke rehabilitation program. He had a stormy course, which was complicated by aspiration pneumonia, and he had a cardiopulmonary arrest and died approximately 1 month later.

Case 2

DM was a 74-year-old female nursing home resident in central Florida. She had Alzheimer's disease and was chronically disoriented. She also had previous diagnoses of Parkinson's disease, hypertension, transient ischemic attacks, and polycythemia vera. In the early morning hours of a day in June 1991, she was found in her bed covered with fire ants and had been stung approximately 1000 times. Her vital signs were unchanged, and no change was noted in her baseline mental status. She was taken to a local hospital emergency room where a physician noted diffuse erythema with pustules over her chest, abdomen, and arms. She was admitted to the hospital and treated with intravenously administered methylprednisolone and cephalothin and observed. No initial or subsequent evidence of anaphylaxis or other hypersensitivity reactions was noted, and results of hematologic and metabolic studies remained unchanged from previous outpatient values. She was observed for 24 hours and discharged to the care of her family. Three months later she was hospitalized with a febrile illness thought to be secondary to urosepsis and died of a respiratory arrest on the third day of hospitalization.

DISCUSSION

Imported fire ants are extremely aggressive insects that sting any person or anything with which they come in contact. Multiple stings of farm animals have long been a problem for farmers.¹ It is therefore not entirely surprising that there are two previous case reports in which individuals have sustained multiple fire ant stings in the context of remaining on the ground for long periods in close proximity to fire ant mounds (Table I).^{10, 11} In the first report a 49-year-old inebriated Texas resident was found covered with ants and was brought to a hospital after he had used a fire ant mound as a pillow for several hours of sleep.¹⁰ He sustained approximately 5000 stings without detectable adverse effects, other than multiple cutaneous pustules. Treatment was limited to topical hydrocortisone and zinc oxide oint-

Treatment	Outcome	State	Reference
Antihistamines, antibiotic, IV fluids	No sequelae	Florida	11
Antihistamines, antibiotics, corticosteroids, pressors	Delay in motor milestones at 6 mo	Alabama	12
Antihistamines, corticosteroid	Death	Louisiana	This report
Corticosteroid, antibiotic, IV fluids	No sequelae	Florida	This report

ment during 12 days of observation. The authors suggested that they had seen similar patients previously. In another report the badly decomposed body of an elderly man with Alzheimer's disease was found covered with ants in close proximity to a fire ant mound.¹¹ The serum level of mast cell tryptase obtained from post mortem blood was elevated, supporting the authors' hypothesis that the individual died of anaphylaxis associated with a suicide attempt.

Attacks on human beings by fire ants indoors have been reported only recently. The first report of such an attack concerned an 84-year-old Florida woman with senile dementia and multiple hip fractures, who was found in bed covered with fire ants.¹¹ The authors estimated that she had been stung 10,000 times. She was treated with antihistamines, antibiotics, and intravenous fluids and had no obvious sequelae. In a second report a 5-day-old Alabama infant was found in his crib covered with fire ants; he was apneic without heartbeat. On intubation, fire ants were noted in the posterior pharynx. After resuscitation and treatment with epinephrine, corticosteroids, antihistamines, and antibiotics, disseminated intravascular coagulation, sepsis, coma, and focal neurologic signs developed. The infant was discharged from the hospital after a stormy course with cautious optimism as to his long-term neurologic status.

It is likely that the facial and tongue swelling, exhibited by our patient MC who was stung in his motel room, represented an IgE-mediated late-phase allergic response to envenomation similar to the large local reactions he experienced on previous occasions when stung by fire ants. Histopathologic examination of late cutaneous reactions to fire ant stings has demonstrated activation of the coagulation system in these reactions with polymerized fibrin in a gel structure, which facilitates trapping of tissue fluid.^{3, 14} The possible association between the activation of the coagulation system, which occurs locally in such reactions, and the induction of a systemic hypercoagulable state resulting in the stroke experienced by this patient offers a plausible mechanism for the

series of events that occurred after envenomation. The mast cell mediator, platelet activating factor, has also been implicated both in late-phase allergic reactions^{15, 16} and in the mechanism of stroke.¹⁷ Moreover, the fact that the patient was taking a β -adrenergic blocking agent for control of hypertension could have increased the severity of the reaction he experienced.¹⁸ Neurologic reactions, such as seizures and mononeuritis multiplex, have been reported to occur after five ant stings, although strokes have not.¹⁹ However, a cerebrovascular accident has been reported after a wasp sting.²⁰

It is not surprising that three of the cases of fire ant attacks on human beings, including the attack on our patient DM, involved patients with Alzheimer's disease and another case involved an intoxicated individual. Any condition associated with a change in mental status in the patient would facilitate multiple stings because the victim would be less likely to withdraw from the ants. Obviously, the infant who was stung in his crib was also unable to withdraw. The features of the patient or the patient's environment that actually triggered the attacks are unknown.

Why some individuals experience untoward effects after multiple fire ant stings and others do not is unclear. Fire ant venom possesses hemolytic, neurotoxic, and cytotoxic activity and has the capability to inhibit Na^+ and K^+ adenosine triphosphatases, reduce mitochondrial respiration, and uncouple oxidative phosphorylation.²¹ One of its proteins is a phospholipase with the capacity to release lipids from cell membranes and activate the cascade of arachidonic acid-derived inflammatory mediators.⁶ Individuals with underlying cardiovascular disease would more likely be sensitive to changes in platelet aggregation, blood pressure, and other related events than those without such disease. In this regard, fire ant venom alkaloids have recently been demonstrated to promote platelet aggregation *in vitro*.²²

In the case of the infant who had both hematologic and cerebral complications after envenomation, the authors concluded that these oc-

curred as a result of direct toxic effects of the venom, perhaps related to the infant's size. The fact that the child recovered to a near normal state supported this conclusion. Obviously, individuals who produce IgE or IgG antibodies to fire ant venom proteins, such as the individual with Alzheimer's disease who apparently experienced anaphylaxis, are at risk for hypersensitivity reactions. Moreover, those individuals with underlying cardiovascular disease can also be expected to have a greater risk of complications from the hypotensive effects of allergic reactions or toxins associated with envenomation. Quantities of venom proteins vary with the time of year.²³ Thus there may be seasonal variations in the concentrations of venom constituents, which could cause varying responses in individuals stung at different times.

Since their arrival from South America, imported fire ants appear to have made a number of adaptations that facilitate expansion of their range and increased density within their present habitat.⁸ These adaptations include hybridization between the two major species, *S. invicta* and *S. richteri*, which may increase cold tolerance; the use of heat sumps such as highways to facilitate overwintering; and multiple queen colonies facilitating survival threatened by cold and pesticides. Multiple queen colonies in particular appear to have increased the density of ants in infested areas 10 to 30 times and are associated with the increased foraging of the ants for food.²⁴ It is quite possible that with the increased density of the ants and increased competition for food sources, the ants may more frequently move into inhabited buildings and become even more aggressive than previously noted. Because there are now four recent reports of organized attacks by fire ants on individuals indoors, close observation of the continuing interactions between these insects and human beings is required.

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