

Rhabdomyolysis and Acute Renal Failure After Fire Ant Bites

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We describe a 59-year-old patient who developed acute renal failure because of rhabdomyolysis after extensive red fire ant bites. This case illustrates a serious systemic reaction that may occur from fire ant bites. Consistent with the clinical presentation in rhabdomyolysis associated with non-traumatic causes, hyperkalemia, hypophosphatemia, hypocalcemia, and high anion gap acidosis were not observed in this patient. While local allergic reactions to fire ant bites are described in the literature, serious systemic complications with rhabdomyolysis and renal failure have not been previously reported. It is our effort to alert the medical community of the possibility of such a complication that can occur in the victims of fire ant bites.

KEY WORDS: rhabdomyolysis; acute renal failure; fire ant.

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INTRODUCTION

Rhabdomyolysis occurs after crush injury because of trauma, excessive muscle activity, hereditary muscle disorders, drugs, toxins, metabolic and endocrine disorders, infections, and hyperthermia.^{1,2} Rare cases of rhabdomyolysis have been described after insect stings (e.g., wasps, bees) and snake bites.^{3–5} While local allergic responses to fire ants are well-known, systemic reactions such as anaphylaxis, with life threatening laryngeal edema, bronchospasm, and hypotension, are less common.^{5–11} Seizures, serum sickness, and nephritic syndrome have also been reported with fire ant bites^{6,11,12}. Herein, we report an unusual case of acute renal failure because of rhabdomyolysis after red fire ant bites to alert the medical community of this rare complication that may occur in the victims with multiple fire ant bites.

CASE REPORT

A 59-year-old African-American male with a past medical history of hypertension, hepatitis C, and a right nephrectomy

for a benign renal cyst, presented to the emergency department in an unresponsive state. The patient was last seen and noted to be well 11 hours before presentation. On the day of admission, he was found unresponsive lying supine on the floor of his bedroom with multiple red fire ants crawling on his face, torso, and upper extremities. He was a known alcohol abuser and had a 30-pack-year smoking history. His medications included hydrochlorothiazide, amlodipine, and clonidine.

Physical examination revealed a pulse rate of 84 beats/minute, blood pressure of 155/84 mmHg, temperature of 98.4°F, and respiration of 18 breaths/minute. He was initially on a non-rebreather mask (FiO₂ of 100%) with 100% oxygen saturation and was switched to 2 L/minute oxygen by nasal cannula maintaining oxygen saturation above 90%. Pertinent positive findings included periorbital edema, numerous erythematous maculopapular and vesicular lesions on the eyelids, forehead, both upper extremities, and over the chest and upper abdomen (Fig. 1a), diffuse wheezing throughout lung fields and hypoactive bowel sounds. Lips were swollen significantly, but there was no evidence of tongue bite or incontinence of bowel or bladder or trauma to the head or extremities. Neurological examination was remarkable for the patient being stuporous, responsive only to painful stimuli, without focal neurological deficit. Pupils were normal. Reflexes were hypoactive and Babinski's sign was absent. There was no swelling or tenderness noted in the lower extremities. Other systems were normal.

Laboratory data on admission included serum sodium, 147 mEq/L; potassium, 3.3 mEq/L; chloride, 112 mEq/L; bicarbonate, 28 mEq/L; urea nitrogen, 19 mg/dL; creatinine, 2.8 mg/dL; calcium, 8.5 mg/dL; magnesium, 1.5 mg/dL; phosphorus, 4.1 mg/dL; total protein, 7.3 gm/dL; albumin, 3.9 gm/dL; aspartate aminotransferase, 317 U/L; alanine aminotransferase, 167 U/L; and alkaline phosphatase, 80 U/L. Complete blood count (CBC) was normal. Urinalysis revealed reddish brown urine with 3+ protein, positive for blood, 0–2 red blood cells, and 2–5 white blood cells/high-power field. Urine drug screen was positive for amphetamines and cannabinoids but was negative for cocaine. Blood alcohol level was undetectable. Renal ultrasound was normal except for surgical absence of right kidney. Creatine kinase (CK) on admission was 6,284 U/L, with CK-MB of 8.4 µg/L and troponin of 0.06 µg/L. Arterial blood gases revealed pH of 7.34, pCO₂ of 47 mmHg, pO₂ of 290 mmHg, and bicarbonate of 25 mEq/L (FiO₂ 100%). Cerebrospinal fluid analysis was normal and cultures for acid-fast bacilli, fungi, and West Nile virus were negative. Computed tomography (CT) scan and magnetic resonance imaging (MRI) of the head were normal. Electroencephalogram (EEG) revealed diffuse encephalopathy without any epileptiform foci or triphasic waves.

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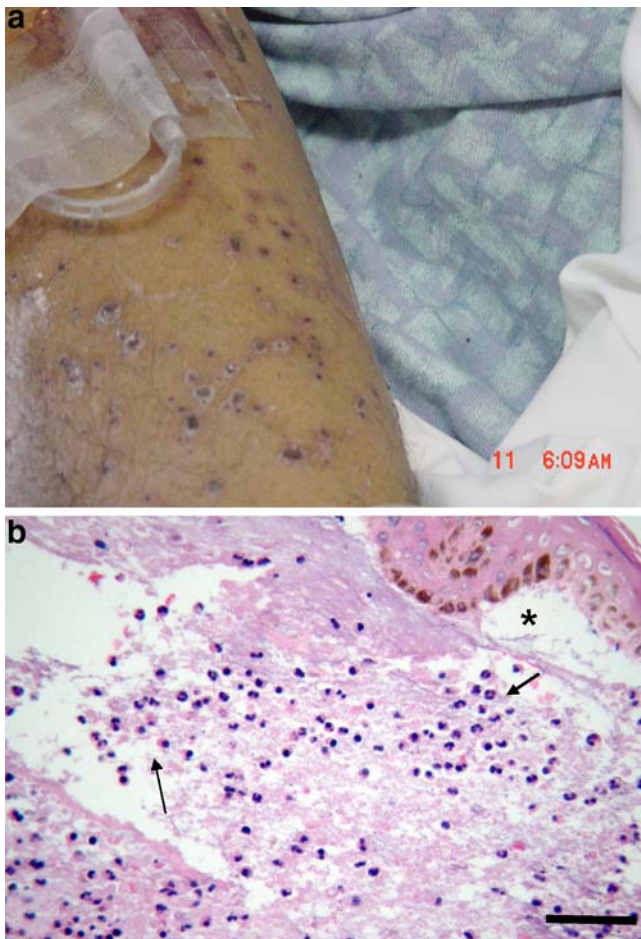


Fig. 1. a Erythematous maculopapular and vesicular lesions following multiple fire ant bites on the patient's upper extremity is shown. **b** Hematoxylin and Eosin staining of the skin biopsy showing epidermal necrosis with subepidermal blister (*), underlying dermal necrosis and patchy acute inflammatory cell infiltration (arrows). Magnification bar=100 microns.

During the hospital course, the patient's renal function deteriorated, and the CK level increased to 158,610 U/L on day 2 after admission (Fig. 2). A diagnosis of acute renal failure secondary to rhabdomyolysis was made, and the patient was treated with intravenous fluids, alkalinization and potassium supplementation. He continued to be stuporous, and a neurologist was consulted who considered metabolic or hypoxic encephalopathy as the cause for the patient's neurological status. The patient remained non-oliguric, and because of deteriorating renal function and encephalopathy, hemodialysis was initiated. Nutrition was maintained during the hospital course initially with parenteral nutrition, followed by tube feeds, and subsequently, an oral renal diet.

Treatment for a possible anaphylactic reaction was also initiated with epinephrine, steroids, albuterol and atrovent inhalation. Local calamine lotion was applied to the skin lesions. The skin lesions demonstrated central clearing and peripheral erythema. Most of the lesions on the face, including the upper chest, were vesicular with a milky appearance. Some of the lesions appeared crusted and weeping. No new lesions

were noted from the day of presentation. A punch biopsy of the skin lesion revealed localized area of epidermal necrosis with subepidermal blister, underlying dermal necrosis, and patchy acute inflammatory changes consistent with arthropod bites (Fig. 1b).

After 6 hemodialysis treatments that were given every other day, his mental status improved to a point where he became alert, responsive, and communicative. His CK levels returned to normal (Fig. 2), and he was discharged 14 days after admission. He required intermittent outpatient hemodialysis for 4 months thereafter until his serum creatinine returned near his admission value of 3.0 mg/dL, and dialysis was discontinued. About a year later, he was seen in the emergency department for uncontrolled hypertension at which time his creatinine was 3.5 mg/dL.

DISCUSSION

Two common groups of ants seen in the US are fire ants (*Solenopsis* species) and harvester ants (*Pogonomyrmex* species).¹³ Historically, the red fire ant (*Solenopsis invicta* or *Solenopsis wagneri*) was imported from South America into Mobile, Alabama from soil of potted plants that were shipped in the 1930s and into Texas in the 1950s.^{8,14} Imported fire ants infest more than 310 million acres in the US and Puerto Rico.¹⁵ As fire ants do not survive winters, their incidence in the northern US is significantly less. The composition of venom from fire ants is complex. Formic acid, an important constituent of fire ant venom, is produced in ants mainly for hunting and protection of their brood. The presence of formic acid is responsible for the local pain at the sting bite and is also the reason for the use of the term "formicidae" for the fire ant superfamily.^{7,9,14} In small doses, formic acid is an antibiotic, but in larger doses, it acts as an inhibitor of the mitochondrial cytochrome oxidase complex, causing tissue suffocation, and consequently cell death; the latter is most likely the underlying mechanism for rhabdomyolysis from fire ant venom. The venom is also composed of a water-insoluble, nonproteinaceous alkaloid which results in local swelling and can induce hemolysis.⁹ In addition, several proteins that are capable of inducing allergic responses are found in ant venom.⁹

Rhabdomyolysis can manifest as a spectrum ranging from asymptomatic increases in CK to a medical emergency with

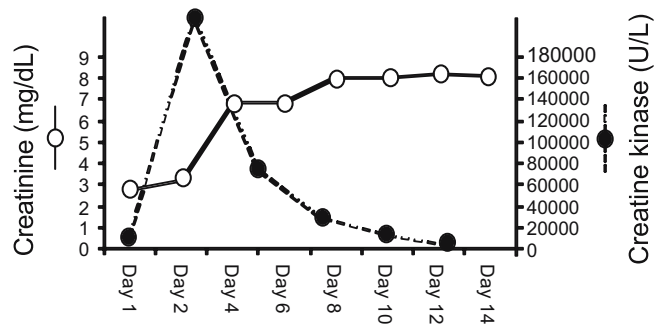


Fig. 2. Renal function measured by serial serum creatinine and creatine kinase (CK) during the initial 2 weeks of hospitalization.

complicated acute renal failure.^{1,2} In non-traumatic rhabdomyolysis, the usual features of hyperkalemia, hypophosphatemia, hypocalcemia, and high anion gap acidosis are not commonly seen, as was also not observed in this patient.¹ The pathogenesis of acute renal failure in rhabdomyolysis is secondary to renal vasoconstriction, intraluminal cast formation, and direct tubular toxicity by heme proteins (e.g., myoglobin).^{1,16} While it is not possible to directly implicate the fire ant bites in the causation of rhabdomyolysis and acute renal failure, the clinical presentation and the skin histology being suggestive of multiple arthropod bites raises the possibility of fire ant bites as a cause of rhabdomyolysis in this patient. Several other factors may have also contributed to the development of rhabdomyolysis and acute renal failure in this patient, including the possibility of seizures, amphetamine use, and immobilization, the latter known to be a risk factor for fire ant attacks.¹⁵ However, absence of clinical features suggestive of tongue bite or incontinence and the absence of circumstantial evidence of seizure surrounding the patient at the time of presentation rules out seizures as a cause of rhabdomyolysis. The absence of tachycardia, significant hypertension, hyperthermia, tremors, and pupillary dilatation on admission makes amphetamine-induced toxicity less likely. The patient was immobilized for a relatively short duration of time (11 hours) and did not have any features suggestive of a compartment syndrome or crush injury, eliminating prolonged immobilization as a cause of rhabdomyolysis in this patient. The presence of a single kidney and underlying chronic kidney disease may have further predisposed this patient to increased susceptibility and delayed recovery from acute renal injury. Although the above individual factors were considered less likely as a cause of rhabdomyolysis in this patient for the reasons described, the possibility still exists that multiple factors including amphetamines, immobilization, and the solitary kidney may have all together predisposed this patient to increased susceptibility to renal failure from fire ant bites and contributed to this clinical presentation.

In conclusion, an unusual case of rhabdomyolysis and acute renal failure after multiple fire ant bites is presented. This case illustrates a serious systemic reaction to multiple fire

ant bites and highlights the need for awareness of this complication in patients who are attacked by fire ants.

Potential Financial Conflicts of Interests: None disclosed.

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