

Case Report: “Killer Bee” Swarm Attacks in French Guiana: The Importance of Prompt Care

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Abstract. In French Guiana, a French overseas region partly located in the Amazon, “Africanized” bees, a hybrid species of Brazilian bees known as “killer bees,” have been observed since 1975. Since then, several cases requiring long hospitalization times have been described, allowing for a better understanding of the physiopathological mechanisms of this particular envenomation. Here, we report on a series of 10 cases of patients simultaneously attacked by hundreds of killer bees and immediately treated by a prehospital medical team already on site. Between 75 and 650 stingers were removed per victim. The reference treatment for anaphylaxis using intramuscular injection of epinephrine, vascular filling, and oxygen therapy was administered to all patients without delay. A clinical description was provided, and biological tests were performed immediately after the envenomation. We therefore observe the existence of a two-phase, medically well-controlled systemic toxic reaction. Thus, all our patients left the hospital after 44 hours of monitoring with no complications or sequelae, despite levels of intoxication described as potentially fatal elsewhere in the literature.

INTRODUCTION

“Killer bees,” observed since 1975 in French Guiana, a French overseas region partly located in the Amazon, are known to regularly provoke swarm attacks involving several hundred individuals in populations throughout the Americas.^{1–5} There is a risk of systemic toxic reaction from as few as 50 stings for an adult, and the median lethal dose is 19 stings/kg.⁶

Here, we describe the immediate clinical symptoms and early biological disorders following a swarm attack by hundreds of Africanized bees on a group of 10 healthy adult men. To our knowledge, no collective attack of this magnitude has been reported thus far.

The reference treatment using intramuscular epinephrine injection, vascular filling, and oxygen therapy was administered to all patients without delay. The objective of this article is to highlight the prompt recovery of our 10 patients and to clinically and biologically describe the biphasic reaction of massive envenomation by bee venom treated immediately according to the international recommendations for anaphylaxis.^{7–9}

CASES DESCRIPTION

In Cayenne, French Guiana, at 3:00 PM, 10 male police officers were attacked by hundreds of killer bees during an intervention on the edge of the Amazon forest, less than 1 km from the nearest houses. The incidental presence of a Cayenne hospital mobile emergency unit on site made it possible to provide emergency care without any response times. Because of signs of anaphylaxis (Figure 1), each of them immediately received an intramuscular (IM) injection of epinephrine 1 mg, combined with oxygen therapy using high-concentration masks befitting their blood oxygen saturation levels, vascular filling with

a NaCl 0.9% solution, and an intravenous injection of 2 mg/kg of methylprednisolone and 5 mg of polaramine (dexchlorpheniramine).

During the first hour, five patients improved rapidly, whereas the other five required a second IM injection of epinephrine 1 mg. One patient required a third dose.

Once stabilized, all 10 patients were evacuated to the Cayenne hospital. In the emergency department, between 75 and 650 stingers were removed per victim. Most were located on their arms, head, neck, and abdomen. The victims were male, aged between 22 and 52 (median age = 27) years, weighing between 71 and 97 (median weight = 82) kg, with no medical history.

Two hours after envenomation, all the patients suffered from digestive symptoms (nausea, vomiting, and abdominal pain), which disappeared within 24 hours with intravenous symptomatic treatment: 120 mg of phloroglucinol, 4 g of paracetamol, and 30 mg of metoclopramide. Electrocardiograms were all normal. Breathing improved rapidly, and oxygen support was stopped within the first 24 hours.

Four blood tests were performed per patient at 2 hours (H2), 10 hours (H10), 16 hours (H16), and 40 hours (H40) after envenomation. A first biological phase, characterized by moderate acute renal failure, an increase in troponins and an inflammatory syndrome peaked at H2 and gradually normalized after H16. From H16 onward, a second phase peaked at H28 and normalized after day 4, showing an increase in creatinine kinase (CK) associated with an increase in aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (Figure 2).

After 44 hours of hyperhydration with a NaCl 0.9% solution at 3 L/24 hours, all 10 patients were discharged with an oral prescription of 5 mg/day of dexchlorpheniramine, 1 mg/kg/day of prednisolone, 4 g/day of paracetamol, and antiseptic cleanser for local application. A medical, clinical, and biological checkup carried out on day 4 (D4) and day 11 (D11) did not reveal any complications.

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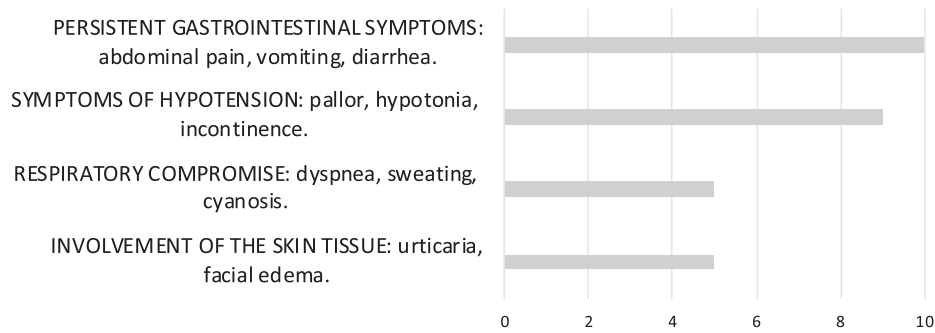


FIGURE 1. Frequency of symptoms reported immediately after envenomation by the 10 patients and the on-site physicians.

DISCUSSION

In French Guiana, located within the Intertropical Convergence Zone, all local bees have been Africanized since the arrival of the “killer bees” in 1975.¹⁰ Killer bee venom, composed of 102 proteins and peptides, is no different from that of European bees.^{11,12} But the release of a pheromone (2-heptanone) onto the skin of their target, in addition to that injected via the venom, emits a powerful alarm signal and causes swarm attacks involving hundreds of individuals.¹³ It is therefore the high dose of venom injected that makes these attacks so dangerous.

In 2018, Schmidt analyzed the cases reported in the Americas and defined three grades of severity of envenomation according to the number of stings: moderate from 50 to 200, severe from 200 to 500, and potentially fatal as of 500 stings.⁶ According to Schmidt’s classification, one of our patients with 75 stings fell within the category of moderate envenomation, seven patients with 200–500 stings fell within that of severe envenomation, and two patients with 600 and 650 stings fell within the clinical definition of potentially fatal envenomation.

In our cases, the immediate combination of clinical signs (Figure 1) allowed the on-site physician to diagnose anaphylaxis, according to the criteria put forward by Sampson et al.¹⁴ and based on American and European guidelines.^{7–9} The physician immediately administered epinephrine combined with isotonic saline vascular filling and oxygen therapy.

The clinically necessary epinephrine dose seemed to increase with the number of bee stings (Figure 3). This shows that the immediate systemic toxic reaction observed is caused by the high dose of venom injected. It was observed

in our 10 patients with no known history of Hymenoptera allergy. It therefore does not require prior exposure and is not IgE-mediated. The early clinical signs are therefore caused by, on the one hand, mast cell degranulation due to the action of melittin and the “mast cell degranulation peptide” in the venom, and, on the other hand, the direct action of the biogenic amines in the venom.

Furthermore, according to Kounis, the degranulation of myocardial mast cells leads to coronary vasoconstriction and may explain the increase in troponin levels at H2.¹⁵ Twenty-eight hours later, we observe that aminotransferase (AST-ALT) and CK peak levels were significantly correlated with the number of stings (Table 1). This result suggests that a direct toxic mechanism causes rhabdomyolysis (Table 1). Among the components of venom, it is melittin and PLA2 that cause lysis of the muscle cell membranes.

In most cases described in the literature, acute renal failure ensues, requiring dialysis and hospitalization in the intensive care unit for several days.^{1,3,16–21} In accordance with American and European guidelines,^{7–9} the early administration of epinephrine via intramuscular injection at a dose of 10 µg/kg (repeated every 10–15 minutes until there is a response) to our 10 patients²² blocked mast cell activation, reduced the cascade of anaphylaxis mediators, and increased vascular resistance.

Thanks to this apt and immediate treatment, renal medullary ischemia due to anaphylaxis-induced hypovolemia was avoided. The initially impaired renal function rapidly returned to normal (H16) before the peak in rhabdomyolysis (H28) (Figure 4).

This allowed the renal system to progressively eliminate myoglobin, thus avoiding acute tubular necrosis due to its accumulation. Corticosteroids and antihistamines given in

TABLE 1

Correlation between the number of stings and the peak value of biological parameters in the 10 patients hospitalized (lowest value for GFR).

Parameter	Correlation coefficient	95% CI	Correlation strength
Aspartate aminotransferase	0.91	(0.64–0.98)	High
Alanine aminotransferase	0.89	(0.58–0.97)	High
CPK	0.87	(0.54–0.97)	High
Troponin	0.82	(0.38–0.95)	Moderate
ANC	0.69	(0.10–0.92)	Low
Creatinine	0.61	(–0.03–0.90)	Low
GFR	–0.38	(–0.81–0.33)	Low

GFR = glomerular filtration rate.

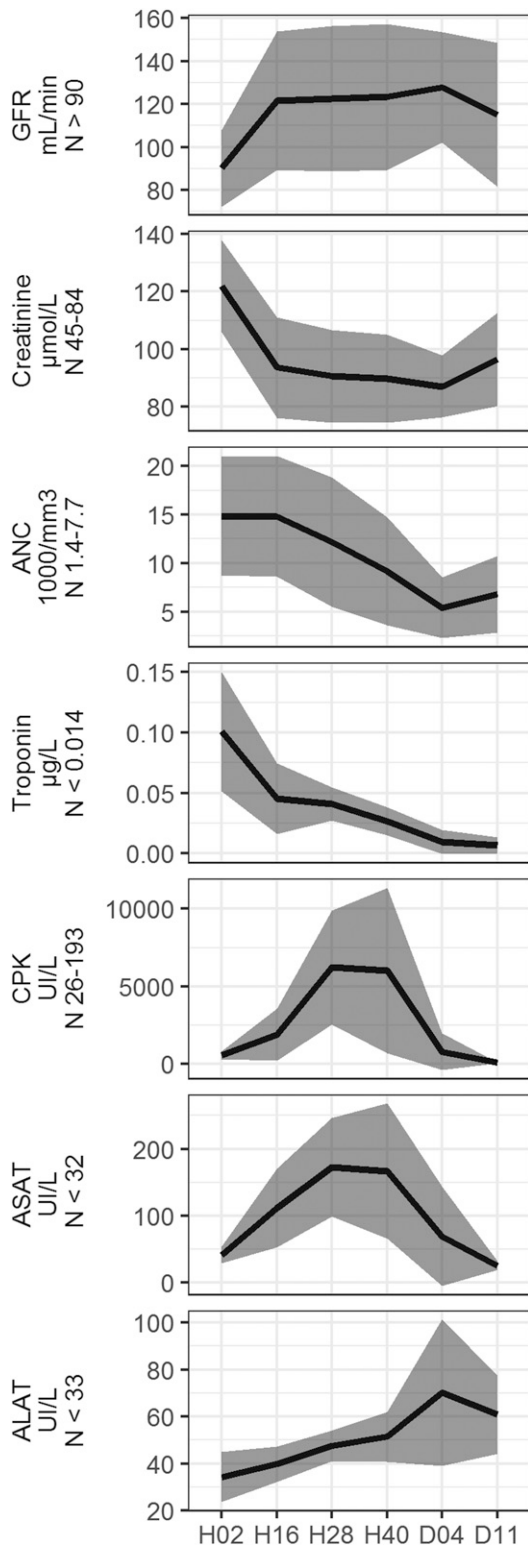


FIGURE 2. Mean kinetics of seven biological parameters, suggesting two phases before and after 16 hours (mean and SD for the 10 patients hospitalized). From top to bottom: glomerular filtration rate (GFR), creatinine, neutrophils (ANC), troponin, creatine phosphokinase (CPK), aspartate aminotransferase (AST), and alanine aminotransferase (ALT).

addition to epinephrine do not constitute emergency treatments to be used in cases of anaphylaxis. Their action is likely limited.²³

CONCLUSION

In summary, our 10 patients suffered an anaphylactic-type reaction followed by a toxic reaction, which were treated early with prehospital medical care. Finally, our clinical and biological data suggest that an early injection of epinephrine combined with vascular filling prevented a chain reaction of acute functional renal failure, myoglobin accumulation, acute tubular necrosis, and acute organic renal failure. This observation is reinforced by the prompt recovery and absence of complications or death in our patient group, despite levels of envenomation described as potentially fatal elsewhere in the literature. This case demonstrates the importance of emergency treatment via IM epinephrine injection, available as a self-administered single-use autoinjector pen for use in the event of killer bee swarm attack.

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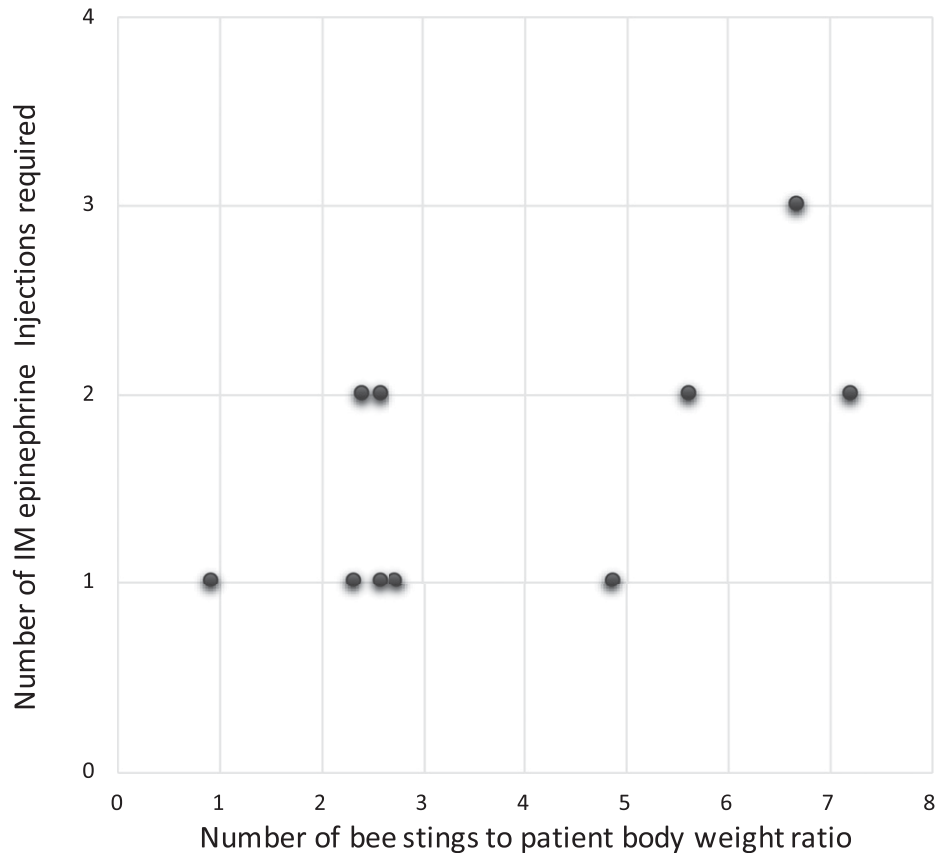
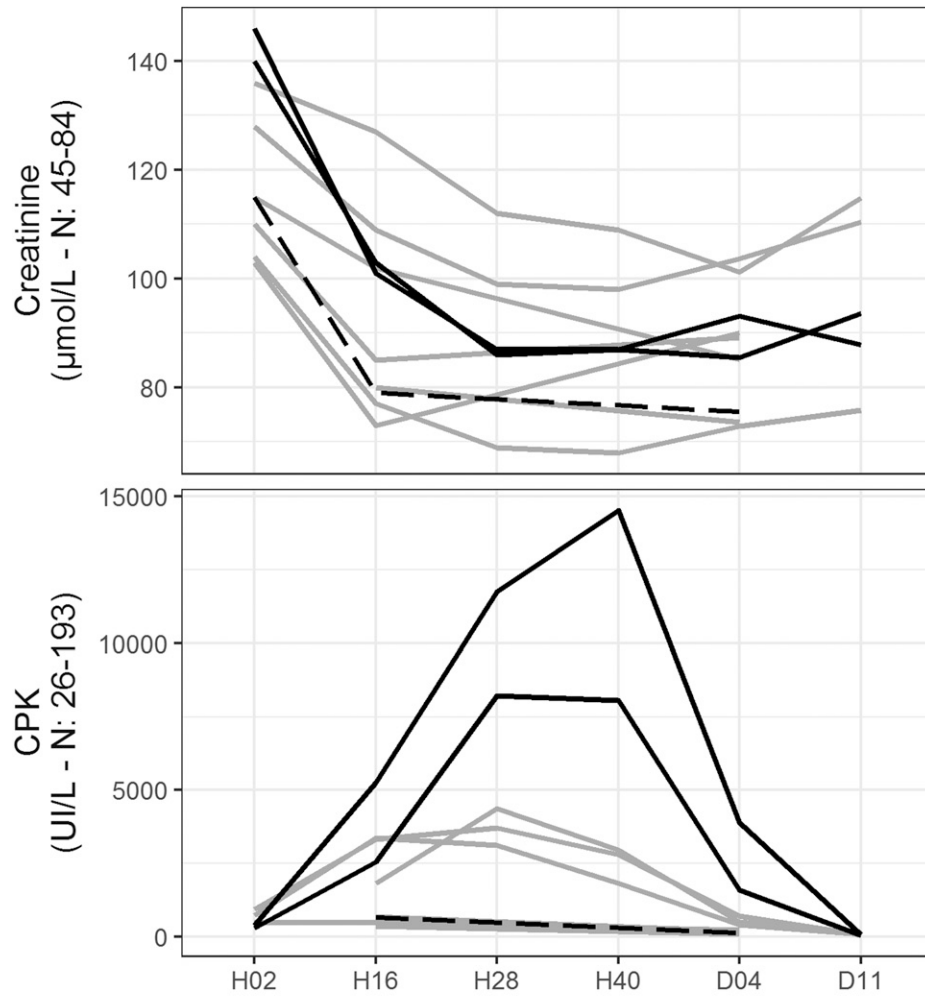


FIGURE 3. Scatterplot representing the number of intramuscular (IM) epinephrine injections required, as a function of the number of bee stings to patient body weight ratio.

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Schmidt's classification :

- — Moderate (< 200 stings)
- Severe (200 - 500 stings)
- Potentially fatal (> 500 stings)

FIGURE 4. Individual patient kinetics for creatinine (top) and creatine phosphokinase (CPK) (bottom) levels. Patients are grouped according to Schmidt's classification of the severity of envenomation.