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Case report

Scorpionism in Ecuador: First report of severe and fatal envenoming cases from northern Manabí by *Tityus asthenes* Pocock

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ABSTRACT

The presence in rural areas of western Ecuador of scorpions in the genus *Tityus* capable of producing pediatric mortality is hereby evidenced. The medical significance of scorpions in Ecuador has been underestimated partly because of the clinically unimportant stings delivered by *Centruroides margaritatus* and *Teuthraustes atramentarius*, which have venom with low toxicity to vertebrates. Five intradomiciliary cases of scorpion envenoming in victims aged between 1.9 and 16 years old, including one fatality, are reported from rural settings in forest areas of Chone (n = 2) and Flavio Alfaro (n = 3) counties, northern Manabí province, western Ecuador. Three cases were graded as Class II (moderate) and two in Class III (severe) envenoming. Manifestations showed characteristic autonomic nervous system hyper-stimulation and the fatality (a 1.9-year-old boy from Flavio Alfaro) was due to cardio-respiratory failure. Marked leukocytosis in four of the cases (21,800–31,800 cells/mm^3), with notable neutrophilia (58–82%), suggests induction of a venom-mediated systemic inflammatory response-like syndrome. Specimens responsible for cases in Flavio Alfaro County, including the fatality, were classified as *Tityus asthenes* Pocock, accountable for severe scorpionism in Colombia. These findings demand implementation of control and therapeutic measures in affected areas in Ecuador, including evaluation of available scorpion antivenoms.

1. Introduction

Scorpionism, or the medical consequences of a scorpion sting, is a major health problem worldwide, with incidences above 50 cases per 100,000 inhabitants in several countries, which remains neglected in many affected regions. Northern and southern Africa, the Middle East, southern India, and Latin America, including Mexico, Brazil and other countries of the Amazon basin such as Colombia, the Guyanas and Venezuela, show the highest morbidity and mortality rates, particularly among children. These accidents occur at a frequency of over a million annually worldwide (Chippaux and Goyffon, 2008).

Low molecular weight neurotoxins in scorpion venoms, acting on the gating mechanism of various ion channels, elicit the release of autonomic and central nervous system mediators, including acetylcholine, catecholamines and peptidergic neurotransmitters, which can cause, either directly or indirectly, myocardial damage, cardiac arrhythmias, pulmonary edema, shock, paralysis, muscle spasms and pancreatitis (Amitai, 2005; Quintero-Hernández et al., 2013). In addition, scorpion venom components can trigger a systemic inflammatory response-like syndrome as a result of the enhanced production of inflammatory mediators from mast cells, macrophages, neutrophils and other targeted tissues (Borges et al., 2011; Zoccal et al., 2014). In the case of species of medical significance, the rapid tissue distribution of neurotoxins and their ability to cause early death, especially in infants, demands prompt treatment with specific antivenom and intensive cardio-respiratory support (Bahloul et al., 2012; Isbister and Bawaskar, 2014).

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Ecuador shares with Colombia, Peru, and the upper Amazon region of Brazil the highest scorpion alpha-diversity of the world, with nearly 80% of endemic species (Brito and Borges, 2015; Lourenço and Ythier, 2013), a calculation largely applicable to the Amazonian region that interpolates the Andean foothills. However, data are scarce regarding the incidence of scorpion envenoming in the country despite the presence of 16 species of the medically important genus *Tityus* (Brito and Borges, 2015), some of them shared with the above countries where they have been accountable for severe cases and deaths (Otero et al., 2004; Pardal et al., 2014). Mild clinical outcome of envenoming by the urban species *Centruroides margaritatus* (range Pacific coast of Ecuador, including the Guayas province) and *Teuthraustes atramentarius* (range Pichincha, Cotopaxi, and Ibarra provinces) has led to the generalization that Ecuadorian scorpions are of low public health importance when in fact severe and fatal sting cases have occurred in the eastern provinces of Sucumbíos and Morona Santiago (Brito and Borges, 2015). We report here on five scorpion envenoming cases from western Ecuador that evidence for the first time the existence of species in this region capable of eliciting systemic manifestations and producing death in children of early age. Treatment relied on vital support measures and pharmacological management since no scorpion antivenom is currently available in Ecuador.

2. Case reports

2.1. Case 1

A 12 kg one year and eleven months old male stung by a scorpion on the lateral side of right foot while putting on a shoe inside his house at Estero Seco, on the road to Facundo (0°24′20″ S, 79°54′20″ W), 1.5 km south of Flavio Alfaro, Flavio Alfaro County, province of Manabí (Fig. 1), at 08:00 AM on 09/08/2014. The patient complained of immediate intense pain at the sting site; local erythema and intense sialorrhea also developed, followed by 10 episodes of emesis. Parents administered both orally and locally a rum-based extract containing pickled scorpions collected in the area. The patient was admitted to the local hospital at 09:50 AM with general paleness and sweating, clammy skin, bilateral bronchospasm, isochoric pupils, 96% oxygen saturation, and a Glasgow Coma Score of 15/15. The scorpion involved in the accident was preserved, handed to the medical personnel and later sent to one of us (A.B.) for identification. On arrival, the patient was hydrated with saline solution (0.9%) and administered dexamethasone (3.5 mg intramuscular) and acetaminophen (125 mg orally). Upon advice of the Ecuadorian National Center for Toxicological Information and Counselling (CIATOX), the patient was transferred to a hospital specialized in complex care, where he arrived at 03:00 PM with a Glasgow Coma Score of 13/15 and persisting vomiting. Auscultation showed abundant crackling rales and bibasal bronchial breathing, together with abdominal tenderness. Laboratory parameters and vital signs at the time of admission and at a later stage (Table 1) showed a 20 mmHg reduction in blood pressure during transfer of the patient, sustained hyperglycemia and leukocytosis (with marked neutrophilia) that persisted after 7 h, together with an increase in platelet count (from 400,000 to 473,000 cells/mm^3). There was no laboratory evidence of pancreatic or other tissue damage (Table 1). The patient was administered furosemide (0.48 mg intravenously) and ampicilline-sulbactam (300 mg intravenously each 6 h), nebulized with ipratropium bromide and salbutamol, and oxygenated at a rate of 3 L/min. Clinical condition worsened at 06:30 PM, with a total of 10 episodes of emesis since admission, 43% oxygen saturation, signs of cerebral decortication, cutis marmorata, and lack of corneal reflex, distended abdomen, and peripheral cyanosis. He presented with cardio-respiratory failure; advanced cardiopulmonary resuscitation maneuvers were then performed but the patient was pronounced dead at 08:00 PM.

2.2. Case 2

A 59 kg 16-year-old female stung by a scorpion on the second toe of right foot at 06:00 AM on 09/11/2014 inside her domicile at La Unión (0°12′10″ S, 79°37′23″ W), Chone County, province of Manabí. She immediately complained of intense pain and was admitted to the local hospital at 08:10 AM, presenting with abundant vomiting in two episodes, local erythema, paresthesia, and distal rigidity of upper limbs. Hydrocortisone (500 mg intravenously) and acetaminophen (500 mg orally) were administered and the patient then transferred to a more complex hospital to continue treatment following advice from CIATOX. At admission, vital signs remained unaltered; the patient was hydrated with saline solution (0.9%) and given sodium penicillin G intramuscularly, dexamethasone (8 mg intravenously), and ketorolac (60 mg intravenously). Laboratory parameters measured on admission (Table 1) indicated hyperglycemia and leukocytosis, with a high neutrophil count (82.8%). Clinical condition improved after 5 h, and the patient was discharged at 01:00 PM.

2.3. Case 3

A 12 kg 3-year-old male stung by a scorpion on the dorsum of right foot while putting on a shoe inside his house in Quiñónez Uno (0°23′10″ S, W 79°50′10″ W), 12 km northeast of Flavio Alfaro, Flavio Alfaro County, Manabí province (Fig. 1), at 10:30 AM on 09/

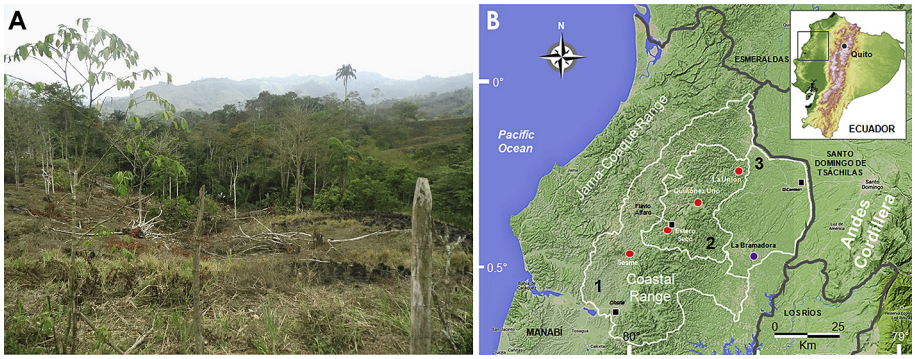

Fig. 1. (**A**) View of the intervened forest area surrounding the site of the reported fatal accident (Case 1) in Estero Salado, near Flavio Alfaro, Flavio Alfaro County, northern Manabí. (**B**) Map of northern Manabí province, western Ecuador, showing the localities (red dots) in the counties of Chone (**1**) and Flavio Alfaro (**2**) where scorpion envenoming cases were recorded from. The county of El Carmen (**3**) is also shown given the previous report of death of a 3-year-old girl in La Bramadora (blue dot) by scorpion envenoming. White line, county borders; Gray line, province borders (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.).