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Scorpion Sting Presenting with Sympathetic Activation and Neurotoxicity: A Case with a Complex Clinical Course

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Abstract

Scorpion stings can lead to serious complications, particularly in children and high-risk groups. Here, we present a case in which prominent neurological findings, such as agitation, seizure-like convulsions, and disorientation, developed following a scorpion sting. The patient received early antivenom and supportive therapies, and the neurological symptoms were controlled with benzodiazepine treatment. This case demonstrates that scorpion envenomation may involve not only cardiac but also neurological complications, and that neurotoxic effects can predominate in the clinical presentation.

Keywords: Scorpion sting; Neurological symptoms; Doxazosin; Scorpion antivenom; Agitation; Hypertension; Scorpion envenomation

Introduction

Scorpions are arthropods that are easily recognized by their characteristic morphology, with lengths ranging from 13 to 220 mm. Depending on their habitat, they can be observed in a variety of color tones, from straw-yellow to yellow, and from light brown to black. Scorpion stings represent a significant public health problem in the Southeastern Anatolia and Mediterranean regions. Scorpion venom contains enzymes such as phosphodiesterase, acetylcholinesterase, phospholipase, and hyaluronidase. Consequently, depending on the system affected by the sting, clinical manifestations can range from mild local reactions (pain, swelling, erythema, numbness) to, particularly in children, life-threatening conditions. In this report, we present a 56-year-old male patient who developed both neurological findings (agitation and seizure-like convulsions) and cardiac involvement (cardiac-type chest pain) following a scorpion sting.

Case Presentation

A 56-year-old male patient presented to the emergency department due to a scorpion sting on the first finger of his right hand. His medical history was notable for asthma and hypertension. Additionally, review of hospital records and the e-Nabız system revealed a prior history of epilepsy, for which levetiracetam had been prescribed; however, the patient was not taking the medication. His current medications included metoprolol 50 mg, montelukast sodium, and acetylsalicylic acid 100 mg. The patient reported being stung by a scorpion on the first finger of his right hand approximately one hour earlier. He had made a small incision of about 0.5 cm at the sting site on his own. His initial presentation was at an external facility, where he received intravenous (IV) diphenhydramine (Avil®) and methylprednisolone (Prednol®), as well as intramuscular (IM) diclofenac sodium (Dikloron®). He was subsequently referred to our emergency department for further evaluation and treatment. On presentation, the patient experienced severe pain and numbness at the sting site, reporting that the pain radiated up to the elbow. The TAP test was positive upon examination. Vital signs at presentation were as follows: general condition good, Glasgow Coma Scale (GCS): 15, arterial blood pressure (BP): 130/80 mmHg, pulse: 77 beats/min, oxygen saturation (SpO_2): 97%, respiratory rate (RR): 22 breaths/min, and fingertip blood glucose: 135 mg/dL.

In the emergency department, the patient was started on intramuscular tetanus vaccination, intravenous (IV) paracetamol (Parol® vial), scorpion antiserum diluted in 100 mL of normal saline (administered as a 1-hour infusion), and cefazolin 2 g (Iespor®) diluted in 100 mL of normal saline, administered concurrently. Approximately two minutes after the initiation of treatment, the patient developed agitation, involuntary movements, seizure-like convulsions, disorientation, and loss of speech. Consequently, all medications were discontinued. No urticaria or uvular edema was observed; respiratory examination was normal, hypotension did not develop, but hypertension was present. Therefore, anaphylaxis was not considered. Thirty minutes after presentation, control vital signs were as follows: blood pressure (BP) 198/91 mmHg, oxygen saturation (SpO_2) 98%, respiratory rate (RR) 32 breaths/min, pulse 81 beats/min, and body temperature 36.9 °C. These emerging findings were interpreted as secondary to sympathetic activation and neurotoxic effects of scorpion venom. Accordingly, under close monitoring, scorpion antiserum was re-administered alone as a 1-hour infusion. During this period, no clinical signs suggestive of anaphylaxis were observed. The patient experienced a brief improvement in consciousness, during which he reported cardiac-type chest pain. Electrocardiography (ECG) revealed a sinus rhythm. After completion of the scorpion antiserum infusion, intravenous (IV) paracetamol (Parol® vial) infusion was continued. However, during the infusion, the patient again developed agitation, involuntary movements, disorientation, and amnesia. Consequently, 10 mg of IV diazepam was administered slowly, resulting in partial relief of agitation. At this time, a second dose of scorpion antiserum was initiated. Following completion of the antiserum infusion, the patient experienced recurrent convulsions, and 5 mg of IV diazepam was administered. Based on the clinical course, brain and thoracic computed tomography (CT) scans were planned. No pathological findings suggestive of hemorrhage or effusion were detected on the brain and thoracic CT examinations. Following imaging, the patient received a third dose of scorpion antiserum, after which doxazosin was administered orally at a dose of 0.03 mg/kg. Following treatment, the patient's vital signs stabilized, consciousness improved, and agitation subsided. However, the patient reported persistent chest pain of a cardiac nature. Laboratory findings are presented in (Table 1). During follow-up, the patient, whose pain persisted, was treated with analgesic agents and hydration therapy. At approximately the sixth hour of monitoring in the emergency department, his consciousness had fully recovered, and his agitation was observed to have markedly decreased. Vital signs returned to physiological ranges and remained stable. At around the 24th hour of follow-up, he additionally received one more dose of intravenous scorpion antiserum and oral doxazosin at a dose of 0.03 mg/kg. Control electrocardiograms and laboratory tests obtained during monitoring showed no abnormal changes. The patient, who remained asymptomatic until the third day, was discharged with recommendations.

Discussion

Scorpion stings continue to be a significant public health problem, particularly in tropical and subtropical regions. Approximately 1,500 scorpion species have been identified worldwide, of which only 25 are reported to pose serious danger to humans [1]. Globally, more than one million scorpion sting cases are reported annually, with a calculated prevalence of 20 per 100,000. Most of these cases occur in endemic regions such as India, Africa, and Latin America. Climate change, global warming, and migration from rural to urban areas have been emphasized as contributing factors to the increase in scorpion sting cases [2]. In Turkey, scorpion stings are most frequently reported in the Eastern Anatolia, Southeastern Anatolia, and Mediterranean regions, with hot climate conditions and rural lifestyle being the main underlying reasons. The yellow scorpion (Leiurus abdullahbayrami) in Adıyaman and the black scorpion (Androctonus crassicauda) in Malatya have been identified as dominant species, and children in these regions are at higher risk of mortality [1]. The mortality rate in children and the elderly can reach up to 1% [3]. Studies from Turkey have also indicated that children are at higher risk. In a series of 345 cases reported from Hatay, the most common symptoms were local pain, erythema, and edema, while severe systemic manifestations occurred less frequently; the mortality rate was reported as 0.6% [4]. Similarly, in a series of 312 cases from Sanliurfa, children and the elderly were the most affected groups, and cardiopulmonary complications were identified as the leading cause of mortality [5]. Furthermore, following the 2023 Kahramanmaras earthquakes, the increased scorpion population in Hatay and its surroundings demonstrated that scorpion stings may emerge as an even more prominent public health concern under disaster conditions.

The most serious consequences of scorpion envenomation occur in the neurological and cardiovascular systems. In addition to its effects on sodium and calcium channels, scorpion toxin increases catecholamine release, leading to cardiac dysfunction and pulmonary edema, with these complications being reported to have a more severe course particularly in children with low body weight [1,16]. In a large Tunisian series of 685 pediatric cases, pulmonary edema developed in 63.4% and cardiogenic shock in 14.3%, with cardiac complications identified as the leading cause of mortality [2]. These findings indicate that cardiogenic complications are among the most critical determinants of mortality. In a case reported from the Cukurova region, both heart failure and the rare finding of priapism developed, which resolved

after treatment with prazosin and inotropes [6]. Similarly, cases reported from Hatay described pulmonary edema and cardiac dysfunction, with clinical improvement achieved through treatment with dopamine, dobutamine, and doxazosin [7,8]. Particularly, cases reported from Mustafa Kemal University demonstrated that doxazosin, in addition to prazosin, can reduce catecholamine-mediated cardiac injury [7].

Table 1: *Laboratory Findings of the Patient.*

Parameter	Result	Reference Range	Comment
Complete Blood Count			
Leukocytes	21.07 ×10³/µL	3.8 – 10.4 ×10³/µL	↑
Neutrophils	75.5 %	50 – 70 %	↑
Hemoglobin	14.6 g/dL	13.6 – 16.9 g/dL	–
Platelets	270 ×10³/µL	150 – 450 ×10³/µL	–
Biochemistry			
Sodium	140 mmol/L	136 – 145 mmol/L	–
Potassium	3.8 mmol/L	3.5 – 5.1 mmol/L	–
Creatinine	0.99 mg/dL	0.7 – 1.3 mg/dL	–
CK (Creatine Kinase)	207 U/L	30 – 200 U/L	↑
LDH (Lactate Dehydrogenase)	224 U/L	120 – 246 U/L	–
CRP (C-Reactive Protein)	3.2 mg/L	0 – 5 mg/L	–
Glucose	144 mg/dL	74 – 106 mg/dL	↑
Cardiac Marker			
hs-Troponin I (High-Sensitivity Troponin I)	0.0016 → 0.01 ng/mL	0 – 0.045 ng/mL	↑ on follow-up
Arterial Blood Gas			
pH	7.44	7.35 – 7.45	–
pCO_2	44 mmHg	35 – 48 mmHg	–
pO_2	57 mmHg	83 – 100 mmHg	↓
HCO_3^-	29 mmol/L	22 – 28 mmol/L	↑
SpO_2	90 %	95 – 100 %	↓
Lactate	1.9 mmol/L	0.5 – 1.6 mmol/L	↑

Although neurological complications are less frequent than cardiac involvement, agitation, restlessness, seizure-like convulsions, and encephalopathy may develop, especially in children [1,14,15]. In the Tunisian series, agitation, convulsions, and other neurological symptoms were reported in 84% of cases [2]. A prospective study from the Brazilian Amazon region reported cerebellar dysfunction (ataxia, dysarthria, myoclonus) in patients stung by Tityus obscurus, emphasizing the potential direct effects of the toxin on the central nervous system [9]. In the review by Yuksel et al., it was reported that the toxin opens sodium channels, induces prolonged action potentials, increases calcium permeability, and enhances acetylcholine release, thereby causing convulsions and involuntary muscle contractions [10]. It has also been shown that Tityus serrulatus venom can affect GABA and dopamine metabolism, leading to epileptiform activity, and experimental studies in rats have demonstrated neuronal loss and convulsions following intrahippocampal injection [3,13]. Symptoms considered to represent neurotoxic involvement, such as agitation, dysmetria, nystagmus, fasciculations, seizure-like muscle contractions, and epileptiform activities, can be controlled with benzodiazepines, and both benzodiazepines and barbiturates have been shown in many cases and studies to be protective against scorpion venom–induced epilepsy [12-16]. In our case, the control of agitation and seizure-like contractions with diazepam is consistent with the literature.

In the case reported by Cavari et al., a 2-year-old patient initially presented with symptoms such as priapism and restlessness, subsequently experienced generalized tonic-clonic seizures that were treated with benzodiazepines, and eventually deteriorated, developing multisystem involvement and cerebral edema, resulting in a fatal course [14]. These data demonstrate that neurological complications also represent an important determinant of mortality. Musculoskeletal complications are less common. In one adult case, isolated creatine kinase (CK)

elevation and rhabdomyolysis developed after a scorpion sting, which resolved with aggressive fluid therapy and antivenom (antiserum) [11]. This suggests that scorpion envenomation may, albeit rarely, present with isolated muscle injury. In terms of treatment, early diagnosis, early and sequential administration of antivenom, and supportive therapies play a critical role in reducing mortality [1]. In international literature, a Tunisian series reported that mortality was reduced to as low as 0.3% with antivenom and intensive care support [2]. In studies conducted in Brazil, 91% of patients with Tityus obscurus stings received specific antivenom, and most showed improvement in neurological findings, although adverse reactions such as urticaria and bronchospasm were also reported in some cases [9]. In cases reported from Turkey, tetanus vaccination was routinely administered, and antiserum was frequently used in addition to symptomatic treatment [1]. Antivenom therapy has been found effective in preventing cardiac and neurological complications, and in cases reported from Hatay and Cukurova, patients who developed heart failure or pulmonary edema recovered with antiserum and supportive therapy [6]. Findings such as hypertension, hypersalivation, sweating, tachycardia, cold extremities, and pallor on physical examination have been interpreted as "autonomic storm," for which initiation of oral prazosin was recommended [5]. Furthermore, α-adrenergic blockers have been shown to be beneficial particularly in cardiac complications, and clinical success with doxazosin in addition to prazosin was emphasized in cases from Mustafa Kemal University [7].

In conclusion, scorpion stings represent an important public health issue that may present not only with local symptoms but also with cardiac, neurological, and, rarely, musculoskeletal complications. The primary determinants of mortality in high-risk groups, especially children, are cardiac and neurological complications. Appropriate use of antivenom therapy, supportive care, and α-adrenergic blockers significantly reduces mortality. Cases reported from Turkey and international series strongly support these findings.

Conclusion

Scorpion stings may have a fatal course, particularly in the pediatric population, due to cardiac involvement. However, the present case demonstrates that neurological symptoms may also play a significant role in the clinical picture. As reported in the literature, findings such as agitation, convulsions, and encephalopathy can be life-threatening, and early administration of antivenom together with appropriate sedative and supportive therapies plays a critical role in prognosis. Therefore, we believe that scorpion envenomation should be carefully evaluated not only for cardiac but also for neurological complications.

Conflict of Interest Statement

The authors declare that they have no financial or other potential conflict of interest related to this study.

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