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A Case Report of Acute Ischemic Stroke Following Scorpion Sting: That's Too Coincidental to be Coincidence

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ABSTRACT

Introduction: Envenomation is common in developing countries, more than 2600 reports of mortality following scorpion envenomations being reported per year. It also can produce a variety of clinical presentations, from minimal to life threatening, including neurological disorder. There are some brain ischaemic infarct cases following scorpion bite reported in India and some African country but there is no official data reported in Indonesia.

Case Presentation: A 56-year-old female patient with controlled Diabetic who was stung by a small yellowish white scorpion in the morning on the tip of her right finger felt pain and found a small redness bump on it. She also vomited twice and got epigastric pain. In the afternoon, she came to ED with chief complain of spinning sensation, weakness of her left arm and slurred speech when getting up from bed. This symptom are appropriate to the three stages of scorpion envenomation.

Discussion: The neurological examination indicates lessions in the sub cortex and the dizziness suggests cerebellum lesion. The results of a head CT also showed signs of infarction in the pons which direct us to multiple site infarct as what has been reported that infarct in scorpion envenomation tend to be multiple and predominant in parieto-occipital, cerebellar and capsuloganglionic regions.

Conclusion: This case report is meant to remind us regarding mortality and morbidity caused by scorpion sting which tend to be underestimated in Indonesia. We recommend to observe (at least for 12 hours) the scorpion sting patient who show symptoms of envenomation.

INTRODUCTION

Envenomation from scorpion stings is a significant public health concern, particularly in developing countries, where it is responsible for over 2,600 deaths annually (Chippaux & Goyffon, 2008; Godoy et al., 2021). However, In Indonesia, there is no official data regarding the morbidity and mortality associated with scorpion envenomations. The clinical manifestations of scorpion envenomation can vary widely, ranging from mild symptoms to life-threatening conditions, including cardiovascular issues (such as myocarditis and shock), respiratory distress (acute respiratory distress syndrome [ARDS]), hematological complications (disseminated intravascular coagulation [DIC]), nephrological problems (acute kidney injury), and neurological effects (seizures and strokes) (C et al., 2017; Godoy et al., 2021; Shahi et al., 2019). Although scorpion bite-induced ischemic infarcts are rare, they have been reported in India and some African

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countries. Given the similarities in climate and biodiversity, it is plausible that such cases could also occur in Indonesia (Marks et al., 2019; Mishra et al., 2022).

Scorpion stings are particularly prevalent in South Asia and the Middle East, with epidemiological patterns varying significantly based on geographic, demographic, and environmental factors. The age distribution of scorpion sting incidents indicates that young children and adults are disproportionately affected, with individuals aged 15-29 experiencing the highest incidence rates. This trend is likely due to increased outdoor activities among these age groups and behaviors such as exploring rocky terrains without protective clothing (Boşnak et al., 2009; Kachel, 2020; Sagheb et al., 2012). In Iran, for example, incidents peak among younger demographics, with severe cases reported in children, leading to higher complication rates compared to adults (Sagheb et al., 2012). The curiosity and risk tolerance of younger individuals, particularly those aged 15-24, contribute to their heightened risk, especially in rural areas where scorpions are more prevalent (Hidan et al., 2016; Kassiri et al., 2018).

Seasonal variations also play a crucial role in scorpion sting incidents, with a notable increase during warmer months, particularly in late spring and summer, when outdoor activities are more common (Boubekeur et al., 2020; Moosavy et al., 2016; Rahimi et al., 2020). A seven-year retrospective study in Tehran found that most stings occurred during these warmer periods, aligning with patterns observed in neighboring countries that reported increased incidence rates during the summer heat (Boşnak et al., 2009; Rahimi et al., 2020). Additionally, regions with higher ambient temperatures and significant rural populations tend to report elevated sting incidents (Ghorbani et al., 2021; Hurtado-Díaz et al., 2017).

Environmental factors, particularly climatic variables, significantly influence scorpion sting prevalence. Research indicates that rising temperatures and changes in precipitation patterns are closely linked to increased rates of scorpion stings. Areas with hotter climates often experience a surge in scorpion encounters, suggesting that climatic conditions directly affect scorpion behavior and habitat, leading to more frequent human-scorpion interactions (Hurtado-Díaz et al., 2017; Molaee et al., 2014). Furthermore, geographical assessments within regions like Iran reveal distinct variances in sting incidence, highlighting how local environmental conditions can impact scorpion activity and human interactions (Ghorbani et al., 2021).

Scorpion stings constitute a significant public health concern, particularly impacting younger populations and exhibiting strong correlations with specific climatic conditions and geographical locations. Understanding these trends is crucial for developing preventive strategies to reduce stings' incidence and associated complications. This case report highlights a scorpion bite that is strongly suspected to present with stroke symptoms characterized by multiple infarcts. This phenomenon has never been documented in Indonesia, despite existing case reports from India, the Middle East, and various African countries. This finding emphasizes the urgent need to raise awareness about the potential risks of scorpion stings moving forward in Indonesia.

CASE PRESENTATION

A 56-year-old female patient came to ED with a chief complaint of a spinning sensation, weakness of her left arm, and slurred speech since 3 hours ago (04.30 pm) when getting up from bed. She was stung by a yellowish-white, little-finger-sized scorpion in the morning (06.00 am) on the tip of her right ring finger. She felt pain and found a redness, a green-bean-sized bump on it. Soon after that, she vomited twice and got epigastric pain.

A family member brought her to the nearest public health center. Her blood pressure and other vital signs were normal. She was prescribed antibiotic ointment and some gastric medications.

Her abdominal pain is gradually improving with the medicine, but the patient still feels the spinning sensation. She didn't have a fever or diarrhea. Her past medical history was controlled—diabetes mellitus for 4 years.

Due to limited data, the alleged scorpion species cannot be determined. However, when several photos of scorpions were shown, the patient pointed out two yellowish-white scorpions most similar to the scorpion that bit the patient. As additional information, several case reports of scorpion bites that cause ischemic stroke cases in India are of a species with the same characteristics as the scorpion indicated by the patient.

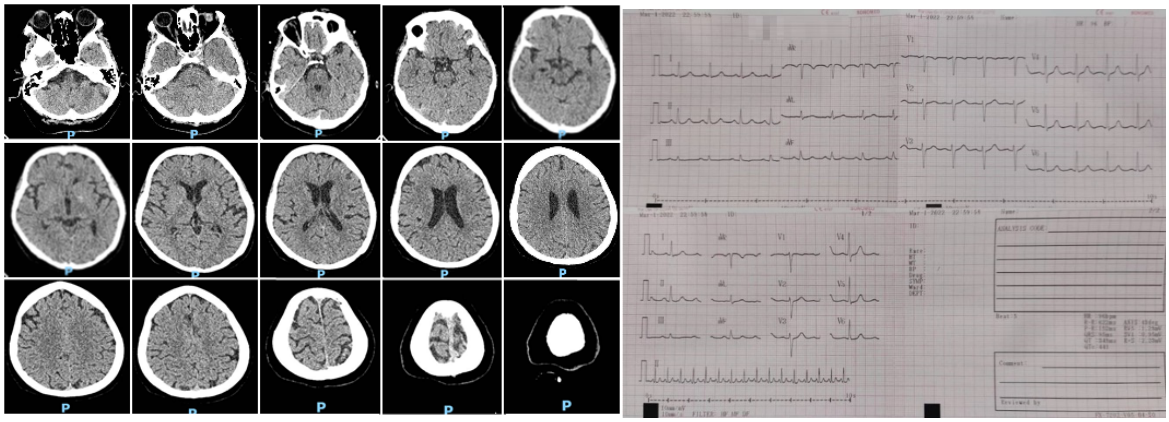

Figure 1. Head CT and ECG of the patient

In the emergency department, the patient was alert, and vital signs were recorded: blood pressure of 180/90 mmHg, heart rate of 98 beats per minute, respiratory rate of 16 breaths per minute, and peripheral oxygen saturation of 98%. No signs of dehydration were observed. The random blood sugar level was measured at 186 mg/dL. Consideration for thrombolytic therapy was canceled due to the patient presenting with a wake-up stroke, the exact onset of which was unknown. The initial treatment provided to the patient consisted solely of symptomatic management, including the administration of oxygen at 4 liters per minute via nasal cannula, intravenous fluid infusion with normal saline at a rate of 20 drops per minute, a diphenhydramine bolus of 30 mg intravenously for spinning sensations, and a ranitidine bolus of 50 mg intravenously for abdominal discomfort.

The neurological examination revealed weakness in the left upper extremity and slurred speech, with a National Institutes of Health Stroke Scale (NIHSS) score of 8, indicating suspected lesions in the subcortex. Additionally, the patient exhibited spinning dizziness and impaired coordination, suggesting a cerebellar lesion. However, the results of a head CT scan indicated signs of infarction in the pons without any evidence of hemiplegia alternates, and no lesions were identified on the cranial nerves. It can be concluded that this case involves multiple infarctions; however, unfortunately, an MRI was not performed to evaluate this patient further.

In light of the presence of multiple infarcts in the brain, an electrocardiogram (ECG) was performed on this patient with the hope of identifying any arrhythmias, particularly atrial fibrillation, which is a significant risk factor for multiple infarct strokes. However, no ECG findings were observed that would support the underlying cause of the various infarcts. These findings lead us to consider scorpion stings as a potential cause of infarcts, further supported by pre-existing risk factors such as hypertension and diabetes mellitus.

The patient was admitted to the stroke unit for five days without any deterioration in condition. Blood pressure remained stable, ranging from 140 to 160 mmHg, and no arrhythmias

were documented. The spinning sensation improved from day two onward, facilitated by administering diphenhydramine in divided doses. Antiplatelet therapy with clopidogrel at a dosage of 75 mg once daily was initiated without any complications. The patient's condition had improved on the third day of hospitalization, as evidenced by a gradual decrease in the NIHSS score. The patient was discharged with mild residual symptoms, with a final NIHSS score of 5.

DISCUSSION

The scorpion's venom is produced by glands at the tail's distal end (telson). The telson comprises water-soluble polypeptides of varying molecular weights with enzymatic and pro-inflammatory properties. The toxin causes inflammation by activating a cascade of cytokines, which also regulates and amplifies the immune response. (C et al., 2017; Chippaux & Goyffon, 2008; Godoy et al., 2021)

For prognostic and therapeutic purposes, the following three stages have been established based on the severity of the signs and symptoms. (Abroug et al., 2020; Godoy et al., 2021; Mishra et al., 2022)**:** Stage I (mild): Agitation, tachycardia, pain, and erythema at the site of the sting; Stage II (moderate): Sweating, nausea, vomiting, tachypnea, and hypertension in addition to the above symptoms; Stage III (severe): Severe systemic and multi-organ life-threatening involvement.

At the time of initial presentation, this patient exhibited no neurological symptoms or depressed sensorium; however, she reported pain and erythema at the site of the sting. She also experienced vomiting twice and reported epigastric pain, which is indicative of mild to moderate envenomation. A few hours later, she began to experience spinning sensations and weakness on the left side of her body, leading us to suspect multiple site infarcts. This aligns with existing literature indicating that infarcts tend to be numerous and predominantly located in the parieto-occipital, cerebellar, and capsuloganglionic regions. Coagulation blood work and ECG results did not reveal any abnormalities. The patient's past medical history may also have contributed to the occurrence of this incident; however, it would be overly simplistic to attribute her diabetic condition as the sole risk factor responsible for these complications.(Abroug et al., 2020; Godoy et al., 2021; Mishra et al., 2022)

The repercussions of central nervous system involvement are pretty rare. They can manifest in one of two ways: encephalopathy or stroke, both of which are associated with a high mortality rate. In children, the toxin exerts immediate neurotoxic effects, leading to seizures and encephalopathy (Abroug et al., 2020; C et al., 2017; Mishra et al., 2022; Naik & Taly, 1996). However, a case reported in Turkey indicated that it could also cause transient ischemic attacks due to vasospasm secondary to catecholamines, particularly in strokes occurring within 36 hours of envenomation (Aslanyavrusu et al., 2024).

Several mechanisms have been proposed to explain how patients envenomated by scorpions can develop both ischemic and hemorrhagic strokes. For instance, during an autonomic storm, a rapid increase in blood pressure can lead to the rupture of unprotected or damaged vessels, particularly perforating arteries, resulting in hemorrhagic stroke. Additionally, toxic myocarditis may occur, leading to arrhythmias and subsequent cardioembolic strokes, which could be influenced by alterations in the blood clotting profile (Bawaskar, 2010; Godoy et al., 2021). We conducted an electrocardiogram (ECG) on this patient to identify cardiac abnormalities. Still, the results were expected, with no arrhythmias, particularly atrial fibrillation, and no indirect indicators of myocarditis, aside from multiple nonspecific ST-T segment changes. This prompted us to explore alternative hypotheses regarding the cause of the stroke related to the scorpion sting in this patient.

Fibrin deposits were also found in the affected blood vessels of scorpion sting victims during autopsies, indicating that disseminated intravascular coagulation can cause a stroke. Venoms have also been linked to platelet aggregation. The venom is vasotoxic, which can cause endothelial cell damage and vasculitis. This can lead to thrombosis. Watershed infarction can occur as a result of myocarditis-related hypotension, parasympathetic overactivity, or dehydration. Catecholamine excess causes cerebral vasoconstriction by increasing endothelin secretion via alpha receptor activation. This can lead to heart attacks caused by a lack of blood flow. The infarction in this patient was thought to have been caused by an intravascular clotting mechanism. In this patient, we hypothesized that the stroke occurred within less than 36 hours following the sting and showed improvement over several days, suggesting that vasospasm was present initially, leading to some permanent infarcts mediated by thrombosis as a complication of diabetes mellitus. As the vasospasm resolved with the elimination of the toxin, some areas of the penumbra likely improved through the reperfusion process.

Treating complications immediately after being stung by a scorpion is critical. Prazosin, a postsynaptic competitive alpha-1 adrenergic receptor antagonist, may be used. This is because alpha-receptor stimulation is essential to developing the clinical spectrum. Prazosin works by inhibiting sympathetic outflow and activating poison-inhibited potassium channels to reduce preload, afterload, and blood pressure without increasing heart rate. It protects the heart from further damage by inhibiting endothelin-induced vasoconstriction. The metabolic and hormonal effects of alpha receptor stimulation are reversed by prazosin. Prazosin is thus a cellular and pharmacological antidote to the effects of scorpion venom and a cardioprotective agent. The amount of time between the needle prick and the administration of prazosin for autonomic storm symptoms determines the outcome (Bawaskar, 2010; Mishra et al., 2022; Selladurai & Sagayanathan, 2019).

A case report detailing similar alterations in patients treated with oral prazosin has been published. While the effects of scorpion venom are too rapid to neutralize effectively, an antidote administered within 30 minutes after the sting can mitigate its impact. The availability of scorpion antidotes varies by country, with physicians in Brazil, Mexico, and Saudi Arabia reporting positive outcomes. However, a matched-pairs study conducted in Tunisian intensive care units found that systemic scorpion antitoxin therapy did not significantly influence the clinical course of scorpion stings (Bawaskar, 2010; Godoy et al., 2021). In our case, the patient did not exhibit any signs of sympathetic overdrive, and the blood pressure remained within a tolerable range for an ischemic stroke patient. It is important to note that lowering blood pressure too much in such cases can lead to irreversible infarction of the penumbra. Various mechanisms can cause different complications, necessitating a careful differentiation of therapeutic approaches for patients with scorpion stings. Understanding these mechanisms is essential in determining the most appropriate treatment strategies to mitigate the risks associated with envenomation.

Benzodiazepines (Diazepam) can often help reduce anxiety after a scorpion sting. Both benzodiazepines and aminobutyric acid open chloride ion channels. This action of diazepam prevents scorpion toxin from stimulating specific ion channels (Abroug et al., 2020; Rahimi et al., 2020). Analgesia is advantageous because it reduces anxiety and stress on the heart muscle. It has been reported that ice packs, xylocaine (a local anesthetic), dihydroemethine (an anti-irritant), nonsteroidal anti-inflammatory drugs, and streptomycin (a neuromuscular blocking agent) are all effective. Excessive sweating and vomiting cause significant fluid loss, which is frequently overlooked. As a result, oral rehydration should be recommended whenever possible. Using insulin and alpha-blocker in combination with sodium bicarbonate restored all ECG alterations (arrhythmias, conduction abnormalities, ischemia, and infarct-like patterns) in experimental

mice. In our case, the patient did not report any anxiety or extreme pain; the only complaint was epigastric pain, as the pain at the site of the scorpion sting had resolved. This presentation aligns with some signs and symptoms typically associated with scorpion envenomation. Remarkably, the patient showed improvement without the administration of benzodiazepines or analgesics. During the hospital stay, the patient did not complain of any pain, with the only discomfort being dizziness, which was resolved by day two. Improvement in hemiparesis was noted gradually from day three onward. The management of scorpion stings is primarily symptom-based, given the broad range of mechanisms caused by the venom and the challenges associated with identifying the exact species responsible for the sting. This necessitates categorizing and treating patients according to their specific symptoms.

The scorpion suspected to be involved in this case presentation is believed to belong to the genus Hottentota based on the characteristics described by the patient. The scorpion was reported to be the size of a little finger, with Hottentota species typically measuring between 4-6 cm and exhibiting a yellowish coloration. For instance, the species Hottentota tamulus found in India has a yellowish body with a reddish stinger, while another variant of Hottentota tamulus is characterized by a whitish-yellow hue (Mishra et al., 2022; Selladurai & Sagayanathan, 2019). Furthermore, stings from Hottentota scorpions have been documented to cause blisters, which aligns with the patient's report (Selladurai & Sagayanathan, 2019).

This scorpion is classified as possessing moderate venom, which can produce a synergistic effect on ion channels, leading to an "autonomic storm" that reflects the stimulation of the autonomic nervous system. This phenomenon can result in brain infarction, often multiple, due to excess catecholamines. The mechanisms by which this occurs may include cardioembolic stroke due to myocarditis, watershed infarcts secondary to vasospasm induced by catecholamines, and strokes secondary to increased platelet aggregation due to disseminated intravascular coagulation resulting from envenomation. The occurrence of a stroke within 36 hours of the sting is suspected to be related to vasospasm (Aslanyavrusu et al., 2024; C et al., 2017), which may explain the significant NIHSS improvement observed in this patient.

CONCLUSION

Although scorpion venom can induce neuromuscular activation syndromes and strokes, neurological complications resulting from scorpion envenomation are relatively uncommon, particularly in adults. This case report serves as a reminder of the potential mortality and morbidity associated with scorpion stings, especially concerning neurological complications such as stroke, which may occur in Indonesia. Factors such as the toxin's severity, patient presentation delays to healthcare facilities, and the absence of established treatment protocols may contribute to unfavorable outcomes. Further studies are necessary to investigate and develop comprehensive treatment policies for managing scorpion stings. In conclusion, we recommend that patients exhibiting symptoms of mild envenomation be observed for at least 12 hours. For cases of systemic envenomation, the administration of prazosin, diazepam, and streptomycin has been reported to yield favorable results based on the characteristics of the envenomation.

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