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ORIGINAL RESEARCH

Clinical Features and Outcomes of Scorpion Sting in Western Lowlands of Eritrea: A Prospective Study

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Background: Scorpion envenomation is a global health problem that results in life-threatening medical emergencies in the tropical and subtropical regions. Pediatric victims are at a higher risk of severe envenomation than are adults.

Objective: This study aimed to determine the clinical features and outcomes of patient's hospitalized for scorpion stings at Tesseney Community Hospital.

Material and Methods: A prospective, descriptive, cross-sectional study was conducted from 1st June 2019 to 31st May 2020 in patients hospitalized due to scorpion stings at the Tesseney Community Hospital.

Results: About 165 scorpion-sting patients were admitted during the study period. The majority of cases were older than 15 years (61.8%) with an approximately equal male-to-female sex ratio (0.94:1), and the scorpion sting cases largely occurred in urban areas (57%) compared to rural areas. The black scorpion (38.8%) was the predominant scorpion; however, in some cases, the scorpion color was undetermined (31.5%). The foot was the predominant sting site (64.8%), followed by the hand (31.5%). Single stings (91.5%) were more frequent than multiple stings (8.5%). The majority (94.8%) of scorpion sting cases occurred during summer, with the highest scorpion sting cases occurring in September and October. The main clinical manifestations upon presentation were localized pain (70.3%) and sweating (56.4%), with more severe symptoms exhibited among age groups less than 15 years. The fatality rate (4.8%) was largely associated with age groups less than 15 years and class three scorpion stings.

Conclusion: Our study found that children experienced more severe envenoming symptoms and related mortality than adults did. This study may be a tool to identify at-risk population groups and build measures to prevent scorpion stings within the western lowlands of Eritrea.

Keywords: scorpion sting, envenomation, clinical features, Eritrea

Introduction

Scorpion stings are a life-threatening medical emergency with frequent presentations within ED department in many areas of the world.[1] Accurate global statistical evidence on scorpion stings are not readily available, but the literature indicates that all settings are usually affected by this medical threat.[2] In 2018, WHO reported that the true scorpion sting envenomation burden is not known because many accidents occur in villages within tropical and subtropical countries where victims likely do not seek medical attention.[3] It is estimated that 1.23 million scorpion stings occur per year with roughly 3250 deaths per year.[1,2,4–6] Developing countries are often reported with higher scorpion envenomation accidents and related mortality compared to developed countries due to lower socioeconomic structures and inadequately equipped

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health facilities.[2] Pediatric victims are more at risk to severe envenomation with related mortality compared to adults due to their small body size.[4,7]

Scorpions are predatory arachnids with four pairs of legs, a pair of grasping pedipalps, and a narrow-segmented tail with a characteristic curved back-ending and venomous sting.[5] Currently, there are more than 1500 subspecies of scorpions are recognized worldwide, with 50 subspecies having dangerous venom for humans.[4,8] The *Parabuthus* (western and southern Africa), *Hottentotta* (south Africa and south-east Asia), *Leiurus* (northern Africa and middle East), and *Androctonus* (northern Africa and southeast Asia) scorpion species are reported to be found within the African continent.[5] Within East Africa, scorpion sting cases are common in the central-west regions of Sudan owing to their geographical location, climate, and socioeconomic structure.[8,9] Diverse color of scorpions had been identified though there is no ecological survey of scorpion species (Figure 1).

Scorpion venom is composed of complex structures comprising neurotoxic proteins, acidic proteins, salts, and organic compounds, with variable compositions and lethality among subspecies.[4,5,8] Venom mainly affects the neurological, cardiovascular, respiratory, haematologic, and renal systems, with local effects around the sting site (ie redness, pain, swelling, and burning).[4,8] Toxins and enzymes within venom exert neurological tropism effects that act on voltage-gated sodium and potassium ion channels in excitable cells of nerves and muscles.[5] Venom from the same scorpion can contain multiple toxins that can interact with each other, modulating the response of the ion channels involved and leading to complex, rapidly progressive symptoms.[5–8,10–12] The main effect of the venom in a victim is to mediate ion channels for intense, persistent depolarization of autonomic nerves, leading to massive discharges of neurotransmitters from both autonomic nervous system branches.[5] This is referred to as an autonomic storm, owing to the sudden pouring of endogenous catecholamines into the circulation.[5,11–14] The effects of an autonomic storm are seen throughout the body, but are more serious on the cardiovascular and respiratory systems leading to arrhythmia, hypertension or hypotension, and pulmonary edema.[15] Clinically, autonomic storm evoked by scorpion envenoming is characterised by transient parasympathetic stimulation (vomiting, profuse sweating, ropy salivation, bradycardia, ventricular premature contraction, priapism in males, and hypotension) and prolonged sympathetic stimulation (cold extremities, hypertension, tachycardia, pulmonary oedema, and shock).[5,16–19]

The signs and symptoms of scorpion stings are divided into three classes, commonly known as Abroug classification.[4–6,8,11,14,20] Majority of scorpion sting cases only require supportive therapy, including ibuprofen, cleaning of the sting area, and tetanus prophylaxis. In certain areas of the world where scorpions are more poisonous (eg the Middle East), scorpion stings are treated with drugs and methods that reduce symptoms and complications.[21] Over the course of the 20th century, scorpion antivenom (SAV), vasodilators, and intensive care facilities have significantly reduced the fatality rate of severe scorpion envenomation.[5] Administering SAV can neutralise unbound circulating venom to reduce the probability of sympathetic nervous system overstimulation.[5] Though the benefits of SAV have been proven in some studies, its effectiveness continues to be debated.[4,5,19,22] A critical component of scorpion sting pathogenesis is alpha-receptor stimulation.[5,14] Prazosin is an α_1-blocker, commonly known as a pharmacological and physiological antidote to the venom. This drug relieves serious breathing difficulties caused by high blood pressure.[5,12] The drug reduces blood pressure by reducing preload and left ventricular impedance without increasing heart rate.[5]

Figure 1 Unidentified yellow (left) and black (right) colored scorpions found within Tesseney, Eritrea obtained by data collectors.

Previous studies have recommended prazosin as a first-line treatment for patients arriving at the ED with scorpion envenoming, owing to the high availability of drugs in rural settings.[12,23]

Scorpion-sting accidents are common in the western lowlands of Eritrea which borders Sudan, and this study aimed to describe the clinical manifestations and outcomes of scorpion-sting patients admitted to Tesseney Community Hospital. Furthermore, study seeks to inform medical professionals and public health workers to design better preventive measures to reduce scorpion sting incidents in Eritrea.

Objective

Primary Objective

The study aims to provide clinical features and outcomes of patient admitted to Tesseney Community Hospital due to scorpion stings.

Secondary Objective

To describe the clinical features of scorpion stings and to determine the risk factors associated with fatal outcomes.

Materials and Methods

Study Design

This was a prospective, descriptive, cross-sectional study conducted from 1st June 2019 to 31st May 2020 on patients admitted to the Tesseney Community Hospital due to scorpion stings.

Study Area

Tesseney Hospital is a community hospital located in the Gash-Barka region of Eritrea. It serves a catchment population of 87,992 and is distributed in an area of 1096.83 km^2. (Figure 2). The hospital provides inpatient and outpatient services, delivery services, laboratory services, imaging units, and physiotherapy units, and possesses a 115-bed capacity.

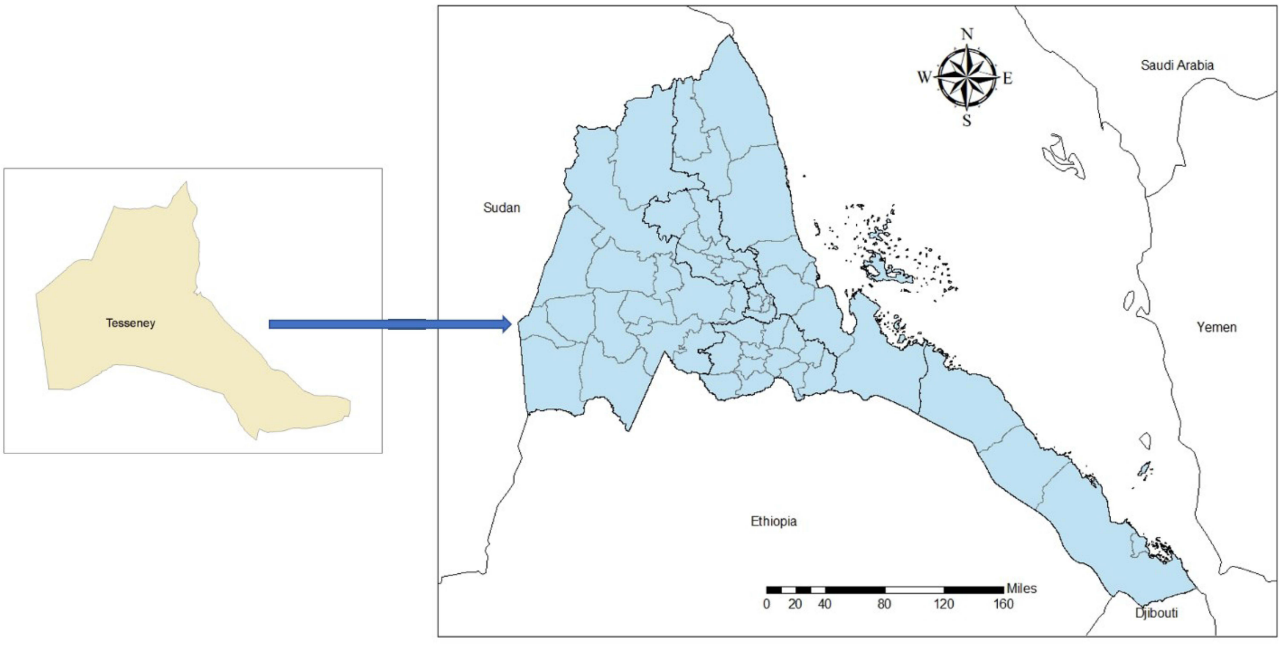

Figure 2 Map of Tesseney subzone, Eritrea.

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Study Population

All patients admitted to the hospital due to scorpion stings from 1st June 2019 to 31st May 2020 were considered the study population. Patients who had a history of scorpion sting and had seen or killed the scorpion (via a victim or bystander) were also included in the study population. Patients with a history of unknown bites, who arrived at the ED without signs of death, and/or who died after discharge from the hospital were excluded from this study.

Data Collection and Analysis

Data were collected by admitting doctors to a predesigned questionnaire survey prepared using an open data kit (ODK) and were followed until the final outcome. Demographic characteristics, vital signs, symptoms, time interval between scorpion sting incident and arrival at the hospital, and medications administered were also recorded. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) v.23 software. The symptoms and signs were categorised into three classes according to the Abroug classification (Table 1). Abroug's classification was used because of the catalogue's convenience and its common use in neighbouring countries (Table 1).[4–6,8,11,14,20] Descriptive data were expressed as frequency and percentage while intergroup differences were analysed using Chi-Square or Fisher test depending on the characteristics of the data (p-value < 0.05 as statistically significant).

Ethical Approval

This study was approved by the Zonal Office of the Ministry of Health Research and Ethics Approval Committee (reference number: 3/31/2897). Written informed consent was obtained from each patient or parent/caregiver taker for children and the study complies with the declaration of Helsinki. The confidence of the study participants was maintained by analysing anonymised aggregate data and coding personal identifiers. The patients were reassured that there was no environmental or occupational harm from participating in this study. All patients were provided with standard treatments for the disease.

Results

A total of 165 patients with scorpion stings were admitted to the Tesseney Community Hospital from 1st June 2019 to 31st May 2020. Our results showed an approximately equal male-to-female ratio of 0.94:1. The mean, median, and standard deviation of age according to sex were 26.03, 17.50 and 19.73 for males and 23.89, 20.00, 16.56 for females, respectively, for women. The majority of hospitalized patients were older than 15 years (61.2%), whereas 38.2% were younger than 15 years (Table 2). Regarding occupational frequency, shepherds (31.5%), farmers (21.2%), and students (26.9%) ranked highest, while the remainder were registered as others (21.2%).

The sting site was primarily located on the foot (64.8%), followed by the hands (31.5%). Regarding the time of the scorpion sting incident, 62.4% of the stings occurred at night compared with 37.6% during the day. The number of indoor stings (56.4%) was slightly higher than that of the outdoor stings (43.6%) (Table 3). Of all admitted patients, eight were deceased; thus, the case fatality rate was 4.8%. The fatality outcome was largely associated with class III scorpion stings ($p = 0.088$).

Patients aged <15 years ($p = 0.006$) and with no formal education ($p = 0.008$) showed a possible predisposing factor for symptom severity (Table 2). The number of stings, scorpion colour, and sex of the victim were not found to be significant risk factors for symptom severity (Table 3). According to Abroug's classification, 43.6% cases had class three,

Table 1 Abroug's Classification

Classes	Signs and Symptoms
Class I	Pain and/or paraesthesia at the scorpion sting site
Class II	Fever, chills, excessive sweating, nausea, vomiting, diarrhea, hypertension and priapism.
Class III	Cardiovascular, respiratory, and/or neurologic

Table 2 Distribution of Scorpion Sting Outcomes According to Socio-Demographic Factors in Western Lowlands of Eritrea: a Prospective Analytic Study from 1st June 2019 to 31st May 2020 (n = 165)

Characteristics		Total		Outcome					
				Recovered		Died		p-value	OR (95% CI)
		N	%	N	%	N	%		
Age	<15 years	63	38.2	58	92.1	5	7.9	0.06	2.845 (0.656–12.343)
	>15 years	102	61.8	99	97.1	3	2.9		1
Sex	Male	80	48.5	76	95.0	4	5.0	0.930	1.066 (0.257–4.413)
	Female	85	51.5	81	95.3	4	4.7		1
Occupation	Farmer	35	21.2	34	97.1	1	2.9		1
	Shepard	52	31.5	48	92.3	4	7.7	0.361	2.833 (0.303–26.479)
	Student	43	26.9	43	100	0	0.0		1.360 (0.136–13.554)
	Other	35	21.2	32	91.4	3	8.6		1

Table 3 Distribution of Scorpion Sting Outcomes According to Scorpion Characteristics and Abroug's Classification in Western Lowlands of Eritrea: a Prospective Analytic Study from 1st June 2019 to 31st May 2020 (n = 165)

Characteristics		Total		Outcome					
				Recovered		Died		p-value	OR (95% CI)
		N	%	N	%	N	%		
Place of Sting	Indoor	93	56.4	90	96.8	3	3.2	0.281	1
	Outdoor	72	43.6	67	93.1	5	6.9		2.239 (0.517–9.697)
Site of sting	Hand	52	31.5	51	98.1	1	1.9		1
	Foot	113	64.8	106	93.8	7	6.2	0.262	3.368 (0.404–28.108)
Number of Stings	Single	151	91.5	144	95.4	7	4.6		1
	Multiple	14	8.5	13	92.9	1	7.1	0.679	1.582 (0.181–13.870)
Abroug's	Class I	33	20.6	33	96.3	1	2.9		1
Classification	Class II	59	35.8	58	94.2	1	1.7		2.726 (0.326–22.800)
	Class III	72	43.6	66	91.7	6	8.3	0.088	4.136 (0.809–21.141)

35.8% cases had class two, and 20.6% of patients had class one (Table 3). Children under five years of age held class III scorpion stings at presentation in 75% of cases. The most common clinical manifestations were localised pain (70.3%), sweating (56.4%), vomiting (33.9%), paraesthesia (29.2%), bradycardia (24.8%), restlessness (24.2%), fever (19.4%), and shock (3.6%) (Table 4).

Among all admitted patients, those with mild symptoms (class I) were managed with local anaesthesia (84.8%) and oral analgesics (41.4%). Patients experiencing generalised pain, restlessness, and convulsions were managed with diazepam (23.6%), with a minority requiring intravenous fluids (1.9%) or antibiotics (1.2%). Patients with moderate-to-severe symptoms (classes II–III) were managed with nifedipine and/or SAV (15.2%) (Table 5).

Although scorpion sting cases were common throughout the year, the highest number of cases occurred during the summer season (93%), with September and October being the leading months (Figure 3). Within the summer season, 94.8% of the patients recovered, with only seven fatalities during this period.

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Table 4 Distribution of Scorpion Sting Envenomation Symptoms Compared to Socio-Demographic Factors in Western Lowlands of Eritrea: a Prospective Analytic Study from 1st June 2019 to 31st May 2020 (n = 165)

Signs and Symptoms	Sex (%)		Age in Years (%)				Total (%)
	Male	Female	<5	5–14	15–49	50+	
Fever	20.0	18.8	16.7	23.5	19.0	13.0	19.4
Elevation of Blood Pressure	1.3	4.7	0.0	3.9	3.8	0.0	3.0
Cardiac Rhythm Disorder	20.0	29.4	50.0	29.4	20.3	17.4	24.8
Vomiting	30.0	37.6	58.3	47.1	25.3	21.7	33.9
Sweating	60.0	52.9	83.3	66.7	49.4	43.5	56.4
Shock	3.8	3.5	16.7	3.9	1.3	4.3	3.6
Semi-consciousness	2.5	5.9	16.7	3.9	2.5	4.3	4.2
Restlessness	21.3	27.1	33.3	35.3	16.5	21.7	24.2
Convulsion	1.3	1.2	16.7	0.0	0.0	0.0	1.2
Hypertonic muscles	1.3	3.5	0.0	2.0	3.8	0.0	2.4
Drooling	17.5	18.8	66.7	19.6	7.6	26.1	18.2
Paresthesia	20.0	37.6	16.7	25.5	27.8	47.8	29.1
Dyspepsia	2.5	5.9	8.3	7.8	2.5	0.0	4.2
Pulmonary edema	0.0	1.2	0.0	2.0	0.0	0.0	6.0
Generalized pain	28.8	24.7	33.3	27.5	20.3	43.5	26.7
Localized pain	66.3	74.1	50.0	70.6	78.	52.2	70.3

Table 5 Distribution of Treatment Options Based on Abroug's Classification in Western Lowlands of Eritrea: a Prospective Analytic Study from 1st June 2019 to 31st May 2020 (n = 165)

Treatment	Class I (%)	Class II (%)	Class III (%)	Total (%)
Local Anesthesia	97.1	84.7	79.2	84.8
Oral Analgesics	14.7	40.7	54.2	41.2
Diazepam	2.9	22.0	34.7	23.6
IV Fluids	0.0	5.1	20.8	10.9
Antibiotics	0.0	0.0	2.8	1.2
SAV and/or Nifedipine	2.9	16.9	19.4	15.2

Discussion

Although medical science has advanced in recent decades, scorpion envenomation has largely been ignored because of the unknown prevalence of scorpion stings and high number of low-income victims.[22] Majority of scorpion sting accidents occur in villages in tropical or subtropical regions, where the victim does not fully appreciate the seriousness of the medical threat. Thus, victims rely more on traditional healers and remain unregistered in health care settings.[23] The Tesseney region, an Eritrean subzonal district that borders Sudan, is an agricultural-based economy often afflicted with scorpionism among its inhabitants.

Our study had an approximately equal male-to-female ratio (0.94:1) which is in contrast to other studies that reported a higher male-to-female ratio within the Middle East and North Africa (MENA) region, where deadly scorpion stings are the most common.[3,19,22] Children-based scorpionism studies conducted by Baseer et al, and Kannan et al also identified a higher male-to-female ratio compared to studies involving all age groups.[24–26] These different findings can likely be attributed to the differing social and behavioral factors children and adolescents to scorpion stings rather than scientifically relevant factors. Furthermore, male are more exposed to outdoor sting as they are engaged in field work. Age groups older than 15 years were more frequently affected by scorpion stings (61.8%) than those younger than 15 years (38.2%). Young people, especially age

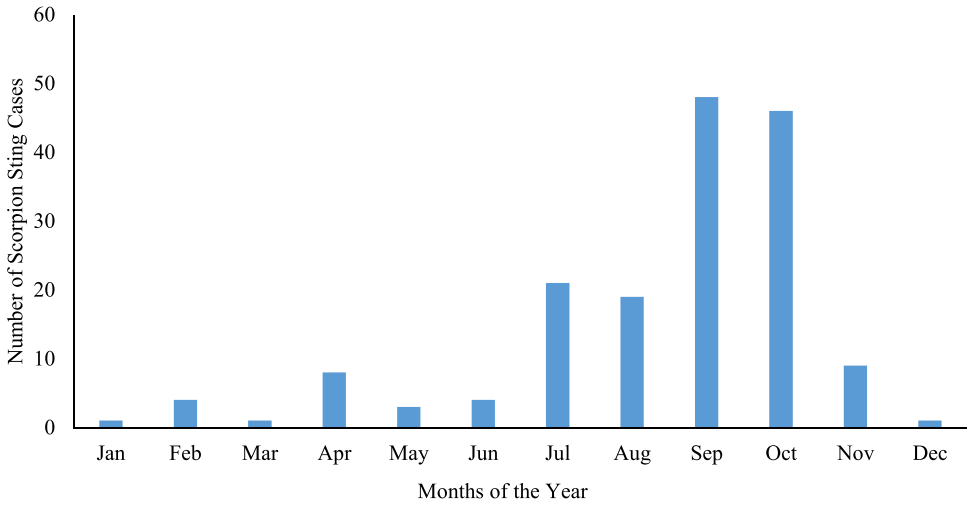

Figure 3 Annual distribution of scorpion sting cases in western lowlands of Eritrea from 1st June 2019 to 31st May 2020 (n = 165).

20–29, often have a higher scorpion sting affliction rate, as reported by Boubekeur et al and Khatony et al[22,27] Older scorpion sting victims usually worked outdoors (eg shepherds or farmers) and were more likely to be exposed to scorpion habitats.

Previous epidemiologic studies have reported that sting sites are commonly located on the extremities rather than on the head or trunk.[3,9,10,22,24,25,27,28] Our results align with these studies, as most sting sites were located on either the upper or lower extremities, with the majority located on the foot rather than the hand. Scorpions hiding in shoes left empty overnight or in pockets of loose clothing or trousers are common causes of stung on the hand or foot.[2] Furthermore, wearing sandals instead of close-toed shoes, working in unprotected fields, and children running barefoot are common occurrences in the Gash Barka region. Lastly, our study observed that night-time stings were more common than daytime stings which is consistent with the findings of multiple studies.[4,7,22,25,26,29]

Warm temperatures and sunny weather are conditions that lead to a higher number of envenomation accidents. Our results indicated that the summer period had the highest scorpion sting incidence, with September and October being the leading months. Studies have shown that scorpion sting accidents are more common during the summer than during the winter or autumn.[3,4,22,27] The MENA region has also reported similar conditions, with Morocco having the highest scorpion sting incidence between June and September, Saudi Arabia between May and September, and Iran between April and October.[3]

The clinical features of scorpion envenomation often depend on the scorpion subspecies, amount of venom injected, age and feeding characteristics of the scorpion, seasonal conditions, and time elapsed between the time of sting and hospitalisation.[3,4,26] Different species of scorpions have different types of venom which may cause local and systemic effects during the first few hours.[3,5,7–9,20,30,31] Until recently, only eight species of scorpions of the genus Centruroides had been considered dangerous to humans.[8] Systemic manifestations (cardiovascular toxicity, respiratory failure, hypertension and hypotension, etc) are observed at various sites throughout the body and appear within the first 12–24 hours following immediate local effects around the sting site.[3] Our results indicate that the most common clinical features were localized pain, sweating, and vomiting. Local pain and sweating are frequent clinical features of scorpion envenomation surveys.[3,4,7,26] However, studies with differing clinical features may be attributed to scorpion subspecies relative to the region, site of sting, time elapsed from the incident until hospitalization, and/or the age of the victim. Bansal et al studied the clinical profile of scorpion stings in northern Uttar Pradesh, India, and identified tachycardia, a severe clinical manifestation, in up to a 1/5th of patients. Scarification was identified in approximately 39% of scorpions in a study by Abourazzak et al, signifying the importance of different scorpion subspecies on human health. In addition, vomiting was observed at a high frequency (73%) in a children-based study by Abourazzak et al. However, at a very low frequency (8.57%), Bansel et al, indicating that the study design can have an effect on the observed clinical features.

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Our study observed class II–III manifestations among children and younger persons, with cardiac arrhythmia (manifested as relative bradycardia compared with tachycardia), shock, convulsions, and semi-consciousness being the most severe clinical features. According to Mallanagounda et al, age is one of the most important risk factors associated with scorpion envenomation with earlier symptoms after the sting and a more delayed recovery compared with older individuals. Our findings align with those of multiple studies that have reported that envenomation severity was higher in children than in adults.[5,11,29,32] More severe scorpion envenomation symptoms found in children are likely attributable to their smaller body size. With a smaller body mass, venom may diffuse and act more rapidly on the autonomic nervous system; thus, they have a higher likelihood of systemic involvement, which positions a scorpion-sting victim at a higher risk of death.[5,26] This was illustrated in an autopsy case report that showed that the mortality rate of untreated babies was considerably higher than that of untreated school-aged children, followed by untreated adults.[33] In our study, patients younger than 15 years of age who passed away from class II–III manifestations contributed the most to the fatality rate (4.8%) and showed a predisposing risk factor ($p = 0.006$) for higher severity of symptoms or death.

Our results exhibited an unusually high frequency of class III envenoming symptoms (43.6%) compared with similar studies in the literature.[20,31] This was largely due to the villager's mindset towards arachnid bites or stings. Upon a scorpion sting accident, adult victims are likely to stay at home if they experience mild symptoms and to relieve their pain by cleaning the sting site using traditional home remedies. Adult victims likely seek medication attention only if the symptoms of scorpion stings are moderate to severe. It may take as long as one to two days after the incident has occurred. Children scorpions sting victims, however, were immediately admitted to the hospital because of intolerance to pain. For adults, a longer elapsed time increases the probability of developing systemic effects and experiencing an "autonomic storm", thus classifying the patient's symptoms as class III. If adult patients recognise the severity of the medical threat and are hospitalised early, medication management and monitoring would likely prevent systemic effects.

Despite the lack of ecological surveys in Eritrea, neighbouring Sudan has previously conducted ecological surveys to identify four scorpion species (C. werneri, L. quinquestriatus, O. olivaceus, and P. abyssinicus) prevalent within the Kassala state, bordering the Tesseney subzone.[34] This study cannot definitively correlate scorpion species venom with clinical features; however, the likelihood of scorpion species belonging to Sudan being similar to that of the Tesseney subzone is substantial. Despite the colour black being strongly identified with O. olivaceus, correlating scorpion species based on scorpion colour is not possible, as the remaining species are indistinguishable from one another.

In our cases, nifedipine was administered as a replacement for prazosin in patients with Class III symptoms. Nifedipine is often used to treat high blood pressure and is considered a 2nd line treatment with subpar results compared to prazosin. Only 15.2% of patients received either nifedipine and/or SAV to relieve class III symptoms. Diazepam was only administered when SAV was not administered. Diazepam is used as a sedative in patients experiencing convulsions, shock, and/or restlessness. Ampicillin was administered to 1.2% of the patients as prophylaxis for critical patients who were catheterised for an extended period to monitor urine output. In cases of severe pulmonary oedema, neurotoxicity, and circulatory failure, oxygen, sublingual nifedipine, digoxin, furosemide, aminophylline, dopamine, vitamin K, or fresh frozen plasma may be administered.[3,10,14] Phenobarbital and dexamethasone may be administered for 48 hours to patients with convulsions.[3,10,14]

Limitation of the Study

Our study was a prospective study with data limited to a single hospital within the Gash-Barka region, and the species type of scorpions was not identified. Within this region, victims of scorpion stings may not have been registered in a healthcare setting; thus, their experience was not documented. There were also limitations to accurate data recording, including the identification of scorpion colour and definitive rural versus urban criteria when registering patients. Owing to the dependence on subsidence agriculture and the low socio-economic structure across the Gash-Barka region, the criteria for classifying rural and urban areas are not definitive. Thus, an accurate classification of the patients' place of residence was not possible during the study. Follow-up of patients after discharge was not performed. Thus, fatalities at home days after discharge were often heard via word of mouth and were excluded from the study. During the study period, medication efficacy was difficult to determine because SAV stock ran-out and prazosin therapy were not available because the burden of scorpion sting was not known before.

Conclusion

This study allowed us to appreciate the epidemiological profile and clinical consequences of scorpionism previously undocumented in Teseeney, Eritrea. Localised pain, sweating, and vomiting were the major clinical features of our patient population. Most scorpion string victims were older individuals working in agriculture and were unaware of a typical scorpion habitat while performing daily activities. Although the scorpion sting incidence is higher in adults than in children, scorpion envenomation severity is greater in children than in adults. Envenomation severity is shown by the high frequency of class III symptoms found in children, such as cardiac arrhythmias, convulsions, shock, and semi-consciousness, with children contributing the most to the overall fatality rate.

Recommendation

Our study recommends prevention education programs targeting vulnerable groups (ie young people, new mothers, and children), particularly during summer/warmer seasons when scorpion stings are most prevalent. Additionally, establishing well-equipped healthcare facilities and essential drugs are the best means to manage scorpionism in resource-limited areas.

Abbreviations

MENA, Middle East and North Africa; SAV, Scorpion Antivenom; ED, Emergency Department; WHO, World Health Organization (WHO).

Ethical Approval

Ethical approval was obtained from the zonal branch of the Ministry of Health Research and Ethical Approval Committee (reference number: 3/31/2897). Written informed consent was obtained from the patients or caregivers who participated in the study.

Consent

Written informed consent was obtained from all the patients, and data confidentiality was ensured.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare no conflict of interest.

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