



Epidemiology of Scorpion Stings in Southern Iran (Area under the Coverage of Iranshahr University of Medical Sciences) between 2020 and 2022

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Abstract

Background: Scorpion envenomation remains a major public health problem in tropical and subtropical regions, particularly in southern Iran. The southeastern provinces, including Sistan and Baluchestan, provide favorable ecological conditions for scorpion proliferation. This study aimed to describe the epidemiological characteristics and outcomes of scorpion sting cases recorded in the catchment area of Iranshahr University of Medical Sciences.

Methods: A retrospective descriptive-analytical study was conducted on all medical records of scorpion sting cases registered in health centers and hospital emergency departments across 12 counties affiliated with Iranshahr University of Medical Sciences between March 21, 2020, and March 20, 2022. Data included demographics, occupation, residence, sting location, temporal distribution, treatment received, and clinical outcomes.

Results: During the two-year period, 12,307 scorpion sting cases were recorded, with a period prevalence of 319 per 100,000 population. Females (56.2%) and housewives (40.2%) were disproportionately affected. Most cases occurred in rural areas (78.5%) and during summer months, peaking between 10 PM and 2 AM. The hands and feet were the most common sting sites (77.6%). Antivenom was administered in 88.5% of cases, and the case fatality rate was 0.2% (21 deaths). Mortality was significantly associated with delayed hospitalization and lack of timely antivenom administration.

Conclusions: Scorpion stings represent a continuing health challenge in southeastern Iran, particularly among rural women. Strengthening preventive education, ensuring timely access to antivenom, and improving clinical management protocols are essential to reduce morbidity and mortality in this endemic region.

Keywords: Scorpion sting, Retrospective study, Period prevalence, Mortality, Southeastern Iran.

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Introduction

Scorpion envenomation remains a major public health challenge in Iran, especially in the southern and southwestern provinces where climatic and ecological conditions favor scorpion activity^{1, 2}. In 2023, the Iranian health surveillance system recorded 63,760 scorpion sting cases, with six deaths reported¹. Historically, Iran has averaged 40,000 to 50,000 stings and around 20 fatalities annually^{2, 3}. Although scorpion

species are distributed throughout the country, the Buthidae family is the most common, whereas *Hemiscorpius lepturus* (Hemiscorpiidae) is uniquely responsible for most of the lethal envenomations in southern Iran^{2, 4, 6}.

In Iran, *Hemiscorpius* species account for approximately 95 % of scorpion-sting related deaths in the southern territories⁴. In recent years, taxonomic work has even discovered a new *Hemiscorpius* species in southern Kerman Province (*Hemiscorpius jiroftensis*), highlighting ongoing species diversity and its relevance for local envenomation risk⁷. Meanwhile, molecular surveys in Hormozgan Province have confirmed the presence and validity of *H. lepturus*, *H. acanthocercus*, and *H. enischnochela* in that region⁸.

Epidemiologic studies in southwestern Iran (e.g. Khuzestan) show a male predominance (about 55.9 %) in hospitalized sting cases, with most victims aged 21–40, and most stings occurring during the summer months⁹. The most common sting sites are the hands and feet, typically occurring indoors or in residential settings⁹. Common symptoms include local pain, erythema, swelling, and laboratory abnormalities such as hematuria or abnormal urinalysis; more severe systemic effects like hemolysis, renal injury, cardiovascular disturbances, and coagulation disorders are also documented⁹⁻¹¹.

Time-series modeling in the city of Shoushtar (Khuzestan province) from 2017 to 2022 revealed strong seasonal patterns and allowed forecasting of sting incidence in the region¹². Over that period, the average annual incidence of scorpion stings in Shoushtar was estimated at about 579 per 100,000 people, with peaks in June–July and dips in winter months⁹. The provinces with the highest burden of scorpionism (in both case frequency and fatality proportion) are Khuzestan, Hormozgan, Kerman, and Sistan-Baluchestan^{2-4, 6, 12, 13}.

Therapeutically, the administration of polyspecific antivenom is standard clinical care in Iran, but there is ongoing concern that current antivenoms may inadequately neutralize the distinct toxins of *Hemiscorpius* species^{2, 6, 11}. Researchers have called for refinement and improvement of antivenom formulations to match local venom profiles more closely⁶.

However, epidemiological patterns are not uniform across the country, and surveillance data is often fragmented. Considering that few studies have been conducted on this topic



in Southeast Iran, the present research aims to investigate the epidemiological characteristics of scorpion envenomation in all areas covered by the Iranshahr University of Medical Sciences from 2020 to 2022.

Materials and Methods

Study design and setting: This was a retrospective descriptive-analytical study conducted in the catchment area of Iranshahr University of Medical Sciences, Sistan and Baluchestan Province, southeastern Iran. The study covered 12 counties (Iranshahr, Bampur, Chabahar, Dashtiyari, Delgan, Rask, Mehrestan, Sarbaz, Fanouj, Qasr-e Qand, Konarak, and Nikshahr), all located within the Iranian scorpionism belt. This study was approved by the Research Ethics Committee of the Iranshahr University of Medical Sciences (ethical code: Number IR.IRSHUMS.REC.1401.035).

Study population and data collection: Data were collected by census from all medical records of scorpion sting cases registered at health centers and hospital emergency departments between March 21, 2020, and March 20, 2022. All documented cases during this period were included in the study.

Variables and definitions: Collected variables included demographic information (age, sex, occupation, nationality), place of residence (urban/rural), sting site (hand, leg, trunk, neck), temporal distribution (month, season, time of day), scorpion type (yellow, black, or unknown), type of medical intervention (antivenom administration or supportive care), and outcome (recovery or death).

All variables were defined and categorized according to the standardized registration forms of the Iranian Ministry of Health. Age was recorded as a continuous variable but

categorized into conventional epidemiological groups for descriptive purposes. Gender was classified as male or female. Occupation was coded according to medical records (homemaker, farmer/livestock keeper, student, employee, child, and other/unemployed). Residence was classified as urban or rural using official administrative divisions. The anatomical site of sting was grouped into hand, leg, trunk, and neck. Treatment-related variables, including antivenom administration and hospitalization duration, were classified based on medical documentation. These categorizations ensured consistency with national surveillance data and comparability with other epidemiological studies in Iran and endemic countries.

Statistical analysis: As all registered cases were included, no sampling was performed. This study estimated and reported period prevalence, while incidence rates were not calculated. Data were analyzed using SPSS version 19. Depending on variable type, Chi-square test was used for categorical variables, and Fisher’s exact test was applied when expected cell counts were small. Independent t-test was used for continuous variables (e.g., age, time of sting, delay in referral). A P-value<0.05 was considered statistically significant. Geographic distribution of cases was visualized using ArcGIS version 10.5.

Results

Of 13,515 total envenomation records (snake, scorpion, spider, and bee) registered across 12 countries under Iranshahr University of Medical Sciences between March 21, 2020 and March 20, 2022, 12,307 cases (91 %) were due to scorpion stings. There were 21 deaths, yielding a case fatality rate (CFR) of 0.17% (12/12,307) (Table 1).

Table 1. Demographic, temporal, and spatial distribution of scorpion sting cases in 12 countries under the coverage of Iranshahr University of Medical Sciences, southeastern Iran (n=12,307)

Variable	Frequency	Percentage (%)	
Year of envenomation	2020	666	5.4
	2021	2985	24.3
	2022	8656	70.3
City of envenomation	Iranshahr	817	6.6
	Bampur	198	1.6
	Chabahar	219	1.8
	Dashtiyari	249	2.0
	Dalgan	581	4.7
	Rask	1462	11.9
	Mehrestan	583	4.7
	Sarbaz	672	5.5
	Fanouj	1858	15.1
	Qasr-e Qand	852	6.9
	Konarak	764	6.2
	Nikshahr	4052	32.9
Nationality	Iranian	12270	99.7
	Non-Iranian	37	0.3
Occupation	Healthcare employee	53	0.4
	Homemaker	4951	40.2
	Child	1931	15.7
	Student	2801	22.8
	Farmer/Livestock keeper	515	4.2
	Employee of other institutions	223	1.8
Other/Unemployed	1833	14.9	



Place of referral	Healthcare centers	6626	53.8
	Hospitals	5681	46.2
Gender	Male	5390	43.8
	Female	6917	56.2
Residence area	Urban	2649	21.5
	Rural	9658	78.5
The result of scorpion sting	Recovery	12286	99.8
	Death	21	0.2

Note: Data are presented as frequency (n) and percentage (%).

The period prevalence for the study interval was approximately 319 per 100,000 population (Tree- year population average about 1,286,935).

Temporal distribution: Annual distribution: 2020- 666 cases (5.4%); 2021 - 2,985 (24.3%); 2022- 8,656 (70.3 %) (Table 1).

Monthly pattern: Peak in summer (37% of cases), highest monthly count in July (1,703 cases), lowest counts in January-February (Figure 1).

Spatial distribution: Highest burden in Nikshahr (4,052; 32.9%), followed by Fanouj (1,858; 15.1%) and Rask (1,462; 11.9%). Majority of cases occurred in rural areas (9,658; 78.5%) (Figure 2).

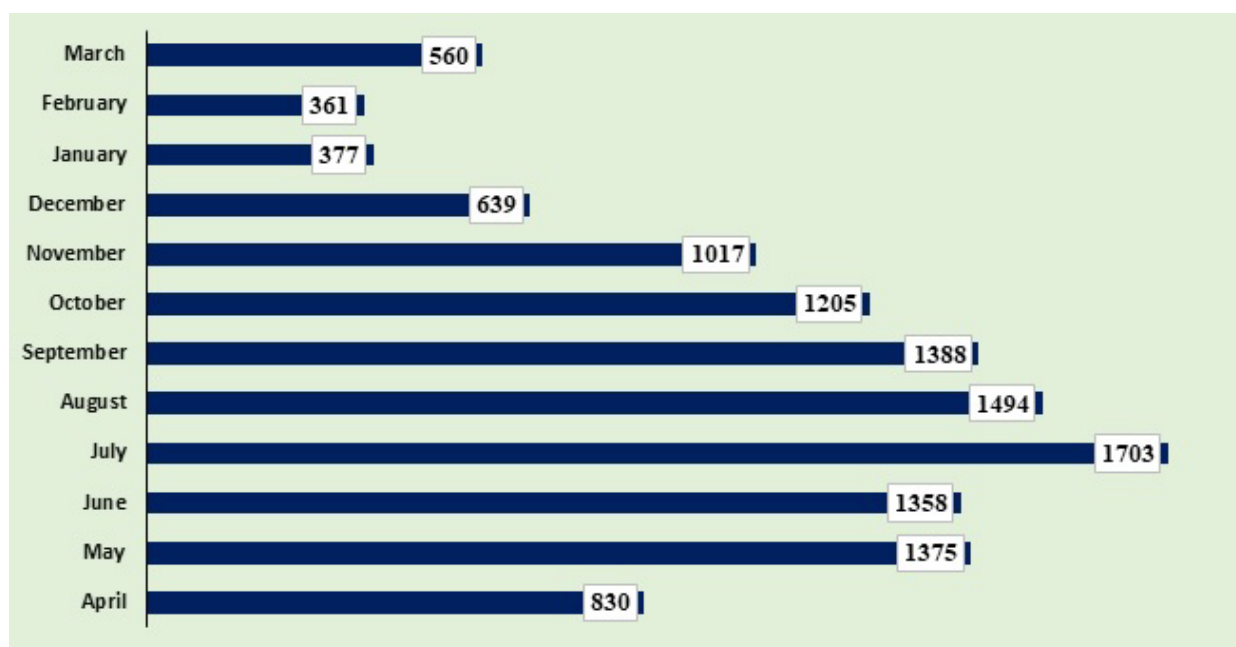


Figure 1. Monthly trend of scorpion stings (cumulative frequency of three years 2020-2022)

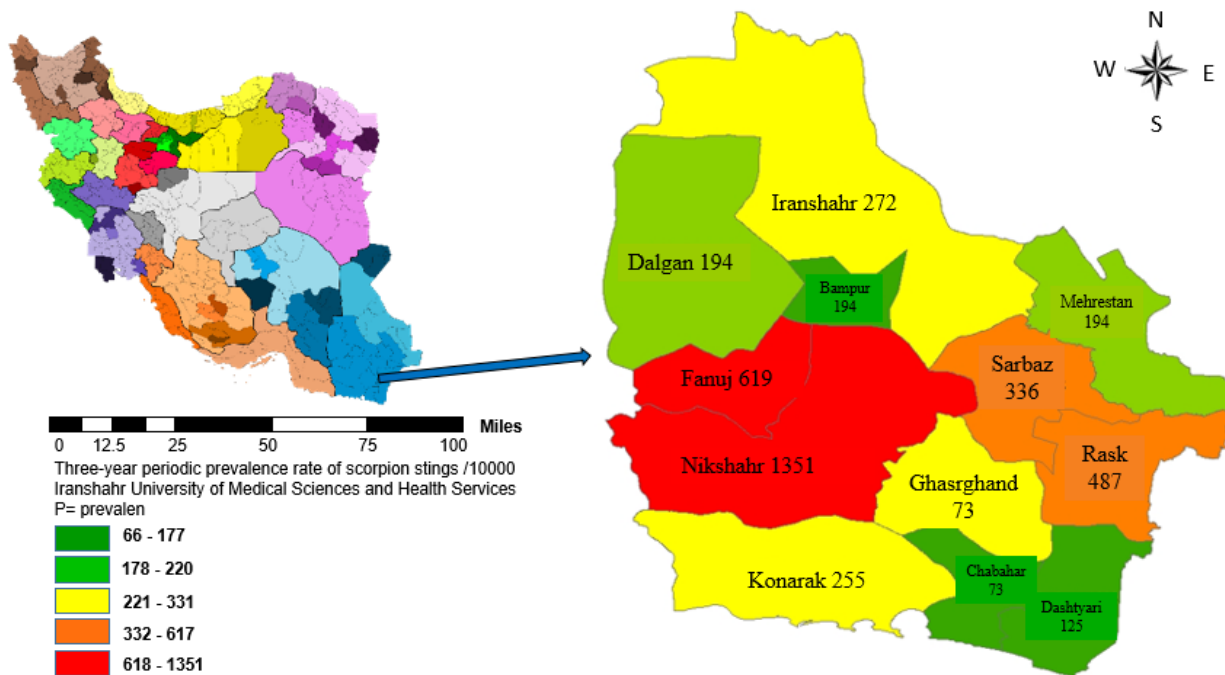


Figure 2. Cumulative three-year (2020-2022) prevalence of scorpion stings in Iranshahr University of Medical Sciences and Health Services

Demographics and occupation: Sex: female 6,917 (56.2%) male 5,390 (43.8%). Occupation: homemakers 4,951 (40.2%), students 2,801 (22.8%). Nationality: 99.7% Iranian (Table 1).

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Clinical features and management: Most common sting sites: hands and feet (77.6%) (Table 2). Antivenom given in 10,886 cases (88.5%); 1,421 (11.5 %) did not receive antivenom at current visit. Local pre-referral treatment in 217 cases (1.8%). Median delay to medical care: 2 hours (Table 2).

Table 2. Clinical characteristics, management features, and outcomes of scorpion envenomation cases, along with the statistical association between variables based on scorpion envenomation incidence status (N=12307)

Qualitative Variable	Category	Frequency (n)	Percent (%)	Test statistic	P-value
Sting site	Hand	4401	35.8	$\chi^2=2.07$	0.15
	Leg	5140	41.8		
	Trunk	2103	17		
	Neck	663	5.4		
Local treatment before referral	Yes	217	1.8	$\chi^2=0.37$	0.539
	No	12090	98.2		
Previous antivenom history	Yes	498	4.0	$\chi^2=0.02$	0.862
	No	11809	96.0		
Antivenom at current visit	Received	10886	88.5	$\chi^2=5.97$	0.015*
	Not received	1421	11.5		
Chronic illness	Yes	105	0.9	$\chi^2=0.18$	0.671
	No	12202	99.1		
Hospitalization period	< 6 hours	3311	26.9	$\chi^2=0.34$	0.001*
	6-24 hours	584	4.7		
	> 1 day	242	2.0		
	Not hospitalized	8170	66.4		
Place of death	Hospital	19	0.2	Fisher's exact	0.001*
	During dispatch	2	0.0		
	Discharge/recovery	12286	99.8		

*P-value<0.05 considered statistically significant.

Qualitative variable	Median	Mean±SD	Test	P-value
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Age	23	25.4±18.2	t-test/ANOVA	0.036*
Time to get stung	7	7.8±7.5	t-test/ANOVA	0.021*
Delay in referral (hour)	2	5.8±6.9	t-test/ANOVA	0.401

Note: Data are presented as frequency (n) and percentage (%). Statistical associations were tested using Chi-square and ANOVA where appropriate. Quantitative variables (age, time of sting, referral delay) are expressed as median and mean±SD. *P-value<0.05 considered statistically significant

Outcomes and associations with mortality: Among 12,307 scorpion sting cases, 21 deaths (19 in-hospital, 2 during transfer) were recorded (Table 2). No significant association between mortality and affected body region, prior local treatment, prior antivenom experience, or chronic illness (P-value≥0.05). Significant associations with mortality were observed for age (median 23 years), time of envenomation (median 07:00), midnight occurrence (53.2% of cases), antivenom administration at admission, duration of hospital stay, and place of death (P-value≤0.05). Notably, delayed or absent timely antivenom and prolonged hospitalization were more frequent among fatal cases.

Discussion

Scorpion stinging has been reported as a health risk factor for Iran in most epidemiological studies in the past decade. Southeast Iran, due to its warm and dry climate, provides a suitable habitat for various scorpion species. Five dangerous scorpion species have been observed in Iran, with two dangerous types of yellow scorpions named *Hemiscorpius lepturus* and *Odontobuthus doriae*, and one black scorpion species called *Androctonus crassicauda* having a greater distribution in southern Iran^{14, 15}. The present study indicates that different types of envenomations, including fatal cases, are associated with various scorpion species in southern Iran. The percentage of deaths due to scorpion stings in this study has been reported as 0.2%. However, other studies conducted in different parts of Iran and neighboring countries have not reported any fatalities due to scorpion stings¹⁶⁻¹⁹. In the present study, the cases of death did not show a relationship with underlying diseases, delayed referral of the injured, or local treatment prior to seeking medical help and receiving serum in the previous encounter. The high number of deaths in this study can be attributed to the unknown exact species of scorpions and inappropriate serum administration in these areas. This study showed that the incidence of scorpion stings was highest (70%) in 2021 and lowest in 2020. The decrease in scorpion stings in 2020 can be attributed to the COVID-19 pandemic. During this time period, people were less exposed to scorpion stings due to increased cleanliness and staying more at home²⁰. With the end of the COVID-19 pandemic in 2022, the sensitivity to cleanliness decreased and the interaction with the outside of the home increased, leading to an increase in the incidence of scorpion stings.

This study showed that the percentage of scorpion stings was higher in women compared to men, and also higher in housewives compared to students and university students. Some studies conducted had similar results to the present study, where Moghadam (2013) reported 1.56% scorpion stings in women and 9.43% in men in 2014²¹. However, most studies reported a higher percentage of scorpion stings in men than in women^{18, 22, 23}. Additionally, there were studies that did not show a difference in scorpion sting cases between men and

women¹⁷. Scorpions live in shaded areas, under rocks, and in places where they can stay away from other creatures during the day due to their intolerance to high temperatures. With their flat and smooth body shape, they can even pass through cracks as narrow as 3 millimeters and enter human homes. They are commonly found in bathrooms, toilets, kitchens, and damp environments. Since women are responsible for household chores and cleaning various parts of the house, especially storerooms and under carpets and furniture, which are mostly hiding places for scorpions, they are more exposed to scorpion stings.

The present study showed that scorpion stings occur in all age groups, but the median age of those affected by scorpion stings was 23 years. The age of scorpion stings has been reported very differently in other studies. For example, Osnaya-Romero (2001) reported the highest incidence of scorpion stings in childhood and children under 10 years old in Mexico in 2001²⁴. Özcan (2006) reported the highest age of scorpion stings in the age range of 15-29 in Turkey in 2006²⁵. Jahan (2007) showed that out of 6465 cases of scorpion stings over a 5-year period (1999-2003) in the primary healthcare department in northern Saudi Arabia, 50% were in the age group of 15-44²⁶. Mogaddam (2013) reported the highest number of scorpion sting cases in the age range of 35-44 in South Khorasan in 2016²¹. The reason for the difference in age of scorpion stings in different regions may be attributed to the level of awareness of individuals in different areas regarding the dangers of scorpion stings. In some areas, due to suitable climatic conditions for scorpion survival, awareness of the dangers of scorpion stings occurs at a younger age. However, in some areas with less prevalence of scorpions, this awareness occurs at older ages.

This study showed that the highest number of scorpion stings occurred at 12 midnight between the months of August and June, with a lower percentage in the spring season, and the lowest number of cases observed in the months of January and February. Most studies have reported the highest number of scorpion stings in the summer and spring seasons, and the lowest in the winter season^{16, 21}. In line with this, a study conducted in Turkey in 2006 showed that the highest number of scorpion stings occurred in the months of August and June, which is consistent with the present study, and the lowest number of cases was reported in September²⁵. Scorpions are mainly active during the night and in warm weather, so the percentage of scorpion stings is generally higher in the summer season.

In this study, it was found that the most affected body parts by scorpion stings were the hands and feet (6.77%). Most of the conducted studies were consistent with the present study, reporting the highest incidence of scorpion stings on the upper body, followed by the hands and then the feet^{17, 19, 21}.



The present study demonstrated a higher incidence of scorpion stings in rural areas compared to urban areas. Consistent with the present study, Moghadam and colleagues reported in 2016 that the incidence of scorpion stings in rural areas of South Khorasan was higher than in urban areas²¹. Additionally, Vazirian-Zadeh reported in 2013 that the incidence of scorpion stings in rural areas of Lordegan was higher than in urban areas¹⁷. However, contrary to the present study, some studies have reported a higher incidence of scorpion stings in urban areas compared to rural areas. For example, Kassiri and colleagues reported in 2012 that the incidence of scorpion stings in urban areas of Khuzestan province was higher than in rural areas²³.

The rural fabric and lack of rural housing development, agricultural activities, livestock farming, horticulture, and construction and development in rural areas, as well as the existence of a tourist region, have increased human interaction with wildlife. Since rural life is more prevalent than urban life in the Sistan and Baluchestan region, the likelihood of human encounters with scorpions is also higher. The highest incidence of scorpion stings was observed in Nikshahr city with 8.18%, followed by lower percentages in the cities of Fanuj and Rask. Due to the suitable climate of the Nikshahr region and its high population compared to other areas, there is an increased exposure and, consequently, a higher incidence of scorpion stings in this region.

Limitations: This study has several limitations. First, the data were retrospectively extracted from medical records and may be incomplete or subject to reporting errors. Second, in most cases the exact scorpion species was not identified, and species were recorded based on patient or staff reports. Third, behavioral and environmental factors such as housing conditions and outdoor sleeping habits were not included in the records. Finally, multivariable logistic regression was not performed to identify independent predictors of mortality; the results are therefore based primarily on descriptive statistics and univariate comparisons.

Recommendations: Future research should include analytical studies with multivariable models, precise identification of scorpion species, and educational interventions targeting high-risk groups. Strengthening electronic surveillance systems and evaluating the cost-effectiveness of antivenom distribution in rural settings are also recommended to improve clinical management and health policy.

Conclusion: Given the high burden of scorpion stings in southeastern Iran, particularly in Nikshahr and Fanouj counties, and the predominance of cases among rural residents and women (especially homemakers), scorpion envenomation remains a major public health challenge in this region. The observed low but significant case-fatality rate (0.2%) was mainly associated with delayed access to healthcare and lack of timely antivenom administration. Community education, strengthening rural healthcare infrastructure, and ensuring prompt availability of antivenom are essential measures to reduce morbidity and mortality.

Ethical Considerations

The study was approved from the ethical committee of the Iranshahr University of Medical Sciences (IR.IRSHUMS.REC.1401.035).

Acknowledgment

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Conflict of Interest

The authors declare no conflict of interest.

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