




An Epidemiological Survey of Scorpion Sting in Five Counties of North Khorasan Province, Iran, From 2007 to 2018

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Abstract

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Background: Scorpion sting (SS) is an important public health hazard that may cause a potentially lethal condition especially in tropical and sub-tropical regions. Although scorpions are locally abundant in some parts of North Khorasan Province, SS has been poorly studied in this region. The current survey was carried out to investigate the epidemiological aspects of SS in North Khorasan Province, Iran.

Methods: This cross-sectional descriptive-analytic study collected and analyzed the data of SS cases admitted to medical centers of different counties in North Khorasan Province including Bojnurd, Shirvan, Esfarrayen, Jajarm, and Raz from 2007 to 2018. The descriptive statistical analyses were carried out with SPSS software (version 24), and logistic regression analyses were performed using the STATA software.

Results: During the study period, 540 SS cases were admitted to hospitals, of whom 44 persons were hospitalized, and nearly half of them were male (50.2%). Most SS cases occurred indoors (58.4%). The mean age of the patients was 35±18.0 years. Furthermore, the annual number of SS cases varied with an increase in 2013. The most common site of the sting was in the hands (41.8%) followed by feet (40.5%). The most common time for SS occurrence was 12 a.m. to 6 a.m. (38%). The majority of victims admitted to the hospital less than 3 hours after the sting (84.6%) and all of them were recovered. The results of multiple regression analysis indicated that the risk of hospitalization in people who had more than one bite was significantly higher than those who had been bitten once.

Conclusion: Given the low average number of SS cases reported in the area compared to the south of Iran, SS does not seem to be an important health issue in this area except for Jajarm County.

Keywords: scorpion sting, Epidemiology, Iran, North Khorasan



Introduction

Scorpions are predatory arachnids of the genus *Phylum Arthropoda*, Class *Arachnida*, and Order *Scorpionida* (1). These creatures have a hard and rough body cover. The length of scorpions varies from 3 to 18 cm and their venom tract is located at the end of the tail and is made of two venom glands encased in a thick chitin coating. Scorpion venom is a protein (2) rich in disulfide (3). Scorpions' venom is a clear and colorless liquid that is mostly used to catch insects and defend the scorpion (2). Scorpions often feed on insects, worms, arthropods, lizards, or even small rodents (4). These cannibal creatures also eat each other (5). Scorpions do not transmit any infectious diseases to humans, but they play an important role in the ecosystem (6). These arthropods are active at night and hide in shelters during the day (1, 7). The number of scorpion species has increased in the last 50 years (8) reaching 2231 species worldwide which are classified into 208 genera and 20 families (9). Scorpions found in Iran are generally classified into three families; *Buthidae*, *Hemiscorpiidae*, and *Scorpionidae* (10, 11), representing 20 genera and 64 species (8, 10). *Hemiscorpius lepturus* is the most important species of the genus *Hemiscorpius* in Iran (11, 12) and is called "Gadim" by locals in southern Iran (6, 7).

Scorpion sting is one of the major health problems in the world, especially in underdeveloped tropical and subtropical countries (5, 13). Scorpion sting is a health emergency in African and Middle Eastern countries such as Algeria, Egypt, Iraq, Jordan, Morocco, Sudan, South Africa, Turkey, as well as Central American countries such as Brazil, Mexico, Argentina, Venezuela, and Trinidad (14). According to the World Health Organization (WHO), 1.2 to 1.5 million people are infected with scorpion stings annually (1, 10, 15, 16), and 3,000 to 5,000 die from scorpion stings (1, 10). Mexico with 300,000 scorpion sting cases per year has the highest rate of scorpion stings and deaths (17). The average prevalence of scorpion stings in Iran is 42,000 to 54,000 cases per year. Compared to other Middle Eastern countries, Iran has the highest rate of scorpion stings, with most scorpion sting cases occurring in Khuzestan, Hormozgan, Sistan and Baluchestan, Bushehr, Fars, and Kerman provinces (18). Approximately 75% of scorpion sting deaths

occur in the three provinces of Khuzestan, Sistan and Baluchestan, and Kerman (2) with the lowest number of cases found in the northern provinces of the country and also Tehran (1, 9) which is due to scorpions' tendency to live in warm and dry climatic conditions (18).

Clinical symptoms and mortality from scorpion stings are related to two main factors, i.e. the patient's condition such as age and health status, and the characteristics of the scorpion, such as the species and the strength of the venom (7, 11, 19). Most stings cause local pain (10). Localized redness and swelling are the most common symptoms (20) and other symptoms such as blood pressure changes, respiratory changes, excessive sweating, abnormal salivation, nausea and vomiting, dizziness, anxiety, seizures, confusion, renal symptoms, internal bleeding, abdominal pain, painful breathing, cold, dampness of the extremities, thirst, fever, sweat, weakness, and lethargy, palpitations, hypotension, restlessness, mental disorders, and even death are also found (7, 19, 21, 22). In most cases, a person bitten by a scorpion may not need special treatment, but due to the reduction of mortality especially in children, one of the specific treatments prescribed in Iran for scorpion sting patients is the use of polyvalent antivenom that can be used to treat stings of 6 important species of scorpions in the country including *Hemiscorpius lepturus* (23).

In general, lack of epidemiological data is a limiting factor in disease prevention, control, and care. Therefore, understanding the epidemiology of scorpion stings and related risk factors is of particular importance. In recent years, many studies have addressed the epidemiology of scorpion stings in different parts of the country. However, the geographical area, climatic diversity, diversity of scorpion species, and demographic differences require separate studies for each region. Since there is no comprehensive study on the frequency of scorpion stings in North Khorasan Province, this study aims to provide an epidemiological analysis of scorpion sting from 2007 to 2018. The results of the study can be used by officials to identify groups at risk, and body parts with a high risk for scorpion sting. Besides, the medical staff in medical centers and hospitals in North Khorasan province can use the insights from this study to be prepared for peaks of scorpion sting during the year.

Methods

This research was a descriptive-analytical cross-sectional study approved under the code IR.NKUMS.REC.1396.55 by the Ethics Committee of North Khorasan University of Medical Sciences. To investigate the cases of scorpion sting, the researchers visited Imam Reza Hospital in Bojnourd, Javad al-Aemeh Hospital in Jajarm, Imam Khomeini Hospital in Shirvan, Imam Khomeini Hospital in Esfarayen, and Raz Medical Health Center, and they reviewed all 540 scorpion sting cases recorded from 2007 to 2018 and extracted the required data including scorpion sting victims' age and sex, region, the sting site, year, and outcomes.

Data were analyzed using SPSS software (version 24) and the results were presented in the form of percentages, central and dispersion indicators, tables and figures. Furthermore, logistic regression analysis was performed to evaluate the factors affecting the hospitalization of scorpion sting cases using the STATA software. First, the relations between each variable and the dependent variables were investigated and variables with a significance less than 0.2 were included in the multivariate

regression model.

Results

All 540 cases of scorpion sting who were admitted to the mentioned hospitals from 2007 to 2018 were treated and discharged, and no death from scorpion stings was reported.

A total of 271 scorpion sting patients (50.2%) were male. The most common site of the sting was in the hands accounting for 41.8% of the cases, 40.5% of the cases were in the feet, and the lowest number of stings was found in the head and neck (2.7%). The mean age of the scorpion sting victims was 35.0 ± 0.18 years. The most frequent interval between the sting and the admission and injection of anti-scorpion serum was less than 3 hours (84.6%) and the highest frequency of scorpion sting occurred from 6 a.m. to 12 a.m. (38.0%). Besides, 225 people (58.4%) were bitten indoors and 160 people (41.6%) were bitten outdoors. It was also shown that 81.4% of scorpions were yellow, 4.7% were black, and 0.14% of them were in other colors. Table 1 shows the descriptive statistics for the participants' demographic characteristics.

Table 1. The demographic characteristics of the patients admitted to hospital due to scorpion sting

Variable	Categories	Frequency	Percentage
Gender	Male	271	50.2
	Female	269	49.8
Sting site	Hands	217	41.2
	Feet	210	38.9
	Trunk	51	9.4
	Head & neck	14	2.6
	More than one limb	27	5
	Missing data	21	3.9
The interval between sting and admission	less than 3 hours	402	74.4
	3-6 hours	49	9.1
	more than 6 hours	24	4.4
	Missing data	65	12
Sting time	12 a.m. to 6 a.m.	170	31.5
	6 a.m. to 12 p.m.	112	20.7
	12 p.m. to 6 p.m.	83	15.4
	6 p.m. to 12 a.m.	82	15.2
	Missing data	93	17.2
Hospital (city)	Javad al-Aemeh Hospital (Jajarm)	270	50
	Imam Reza Hospital (Bojnurd)	67	12.4
	Imam Khomeini Hospital (Shirvan)	119	22.03
	Imam Khomeini Hospital (Esfarayen)	67	12.4
	Medical Health Center (Raz)	17	3.1
Place	Indoors	225	41.7
	Outdoors	160	29.6
	Missing data	155	28.7
Total		540	100

As shown in Figure 1, the highest number of scorpion stings occurred in 2013 with 76

cases and the lowest number of scorpion stings was reported in 2009 with 6 cases.

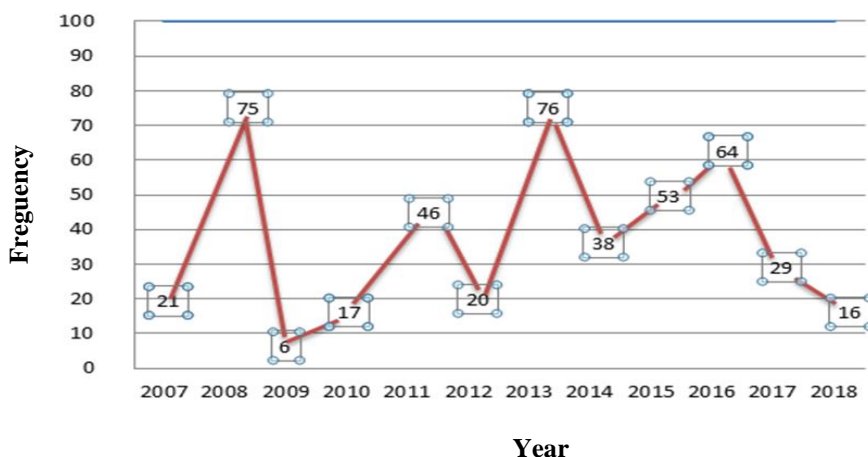


Figure 1. The number of scorpion sting cases from 2007 to 2018

Figure 2 shows that the highest number of scorpion stings was reported from Jajarm city with 39.61 per 10,000 cases and the lowest

incidence rate was found in Bojnurd with 1.9 per 10,000 cases.

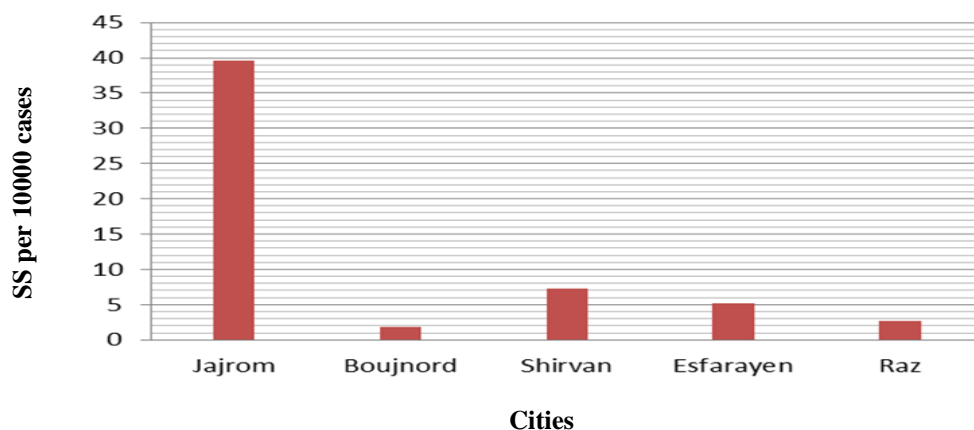


Figure 2. Scorpion stings per 10000 cases

The results showed that from 540 people who visited hospitals for a scorpion sting, 44 were hospitalized and 390 were not. However, the hospitalization data were not available for 106 persons. The results of the univariate logistic regression analysis showed the number of the

number of sting and the color of the scorpion had a significant relation with the number of hospitalized persons. However, multiple regression analysis suggested only the number of scorpion scorpion stings had a significant relation with the need for hospitalization (Table 2).

Table 2. The results of logistic regression analysis in odds ratios, for scorpion sting cases

Variable	Category	Univariate regression		Multivariate regression	
		OR	P-value	OR	P-value
Age		1.00	0.34	-	-
Gender	Male	Reference	-	-	-
	Female	0.97	0.94	-	-
Number of stings	One	Reference	-	-	-
	More than one	1.65	0.04	1.96	0.02
Scorpion color	Yellow	Reference	-	-	-
	Black	3.73	0.05	3.24	0.15
	Other	1.24	0.70	0.72	0.58

Discussion

In total, 540 scorpion sting cases were reported in 5 cities of North Khorasan province from 2007 to 2018. Data reported in various studies show that most scorpion stings occur in men as they more frequently work in high-risk places and thus are more likely to encounter scorpions. A study by Kassiri et al. in Masjed Soleiman showed that 50.5% of scorpion stings occurred in men (1). Another study in 2018 in northern Khuzestan reported that 51.3% of scorpion stings occurred in men (14). Furthermore, other studies reported an incidence rate of 60.25% in Qom (4), 67% in Kashan (21), 62.44% in Qeshm (7), 74% in Isfahan (24), 75% in Oman (25), and 72% in Qatar, in men (20).

Most of the studies have reported that the highest percentage of scorpion stings occurred in young people, because people in this age group are more active and more likely to encounter scorpions. In the present study, the mean age of people with scorpion sting was 35. Similarly, Manouchehrifar et al. showed that the mean age of scorpion sting cases in Ahvaz was 35.2 ± 15.8 years (26). Besides, the mean age of scorpion sting in Qatar was 38 years (20). Talebian et al. found that the mean age of scorpion sting was 23.1 ± 15.1 years in Kashan (21).

In the present study, most scorpion stings were reported in the hands and feet and the lowest number of stings was found on the victims' head and neck. In Kashan, Talebian et al. reported the highest number of stings (64.3%) in lower limbs (21). A study by Khosravani et al. in Qeshm showed that 44.68% of the stings were in the hands, 42.35% of the stings occurred in the legs, and only 5.35% of the stings were found in the head and neck (7). A study by Kassiri in northern Khuzestan found most stings (39.7%) on the legs (14), and Saghafipour et al. found that most scorpion stings were on the hands (45%) and legs (43.8%) (27). Furthermore, Pipelzadeh et al. conducted a study in southwestern Iran and found 41% of stings occurred in the lower extremities (12), which is in line with other studies (26,28).

Scorpions are active at night, hiding in shelters during the day and coming out of the shelter in search of food and prey as it gets dark. They hide in shoes, attics, carpets, clothes, and damp areas. Therefore, most

stings occur in the late hours of the night until morning. The present study showed that most stings occurred at midnight until 6 o'clock in the morning. A study by Khosravani et al. in Qeshm reported that most stings occurred between 1-6 in the morning (7). Moreover, Saghafipour et al. showed that most scorpion sting cases occurred between 10 p.m. and 4 a.m. (27) Pipelzadeh et al. conducted a study in southwestern Iran and found that most scorpion bites occurred between 7 p.m. and 5 a.m. (12).

The present study showed that most biting scorpions were yellow. In a study conducted by Saghafipour et al., it was found that 79% of the victims in Qom were bitten by yellow scorpions, 18.7% by black scorpions, and 2.3% by other scorpions (27). However, Talebian et al. reported that 34.9% of scorpion stings were caused by black scorpions and 19.6% were caused by yellow scorpions (21). Saghafipour et al. also reported 18.7% of the victims were bitten by black scorpions (4). Furthermore, a study by Hosseininasab in the south of Kerman showed 73.8% of cases were bitten by black scorpions, 25.9% by yellow scorpions, and 0.3% by other scorpions (13). These findings were not consistent with the present study and this discrepancy can be due to differences in the scorpion fauna of different regions.

The present study also showed most people were bitten by scorpions indoors. Most indoor stings can be due to the use of unsuitable building material. Besides, old buildings are a good place for scorpions to live. Furthermore, sleeping on the floor and not sleeping on beds, putting blankets, sheets, and clothes on the ground that may be used by scorpions as a shelter during the day, not using proper foot cover and walking bare feet especially at night, and the lack of knowledge about the dangers of scorpion sting and its symptoms can be some possible factors in increasing the risk of scorpion stings, indoors.

This study reported the highest number of scorpion stings in Jajarm and the lowest number in Bojnourd. The reason for this difference could be that Jajarm is climatically classified as a hot and dry area, and Raz is located in a mountainous area, and scorpions tend to live in hot and dry climates (18).

Based on the findings of this study, the

distribution of scorpion stings in five counties of North Khorasan Province is similar to other parts of the country in terms of incidence, age, sex, the sting site, and the sting time. The number of scorpion sting cases in five counties of North Khorasan Province was less than the cases in southwestern Iran and this difference can be due to weather conditions. For instance, the number of scorpion stings in Jajarm which has a hot and dry climate was greater compared to all parts of the province. Fortunately, anti-venom is available in all medical centers, even in remote areas of Iran, and as a result, the number of deaths due to scorpion stings has decreased in recent years.

Conclusion

Given the relatively high number of scorpion sting cases in Jajarm, prevention plans must be put into place to control scorpion stings including checking shoes and clothes before wearing, not walking barefoot outdoors at night, using thick gloves when working, giving the necessary knowledge and training to health

experts and indigenous people and familiarizing them with existing species and seasonal activities, improving the living place and destroying scorpion sanctuaries, reviving old buildings, proper collection and burial of construction waste, and use of pesticides.

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Conflict of interest

The authors declared no conflict of interest.

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