



Descriptive- Analytical Evaluation of Scorpion Sting Incidence in Masjed-Soleyman County, Southwestern Iran

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ABSTRACT

Scorpions are dangerous for humans due to having deadly and toxic sting. Scorpion sting is a major public health challenge in many countries. The south and southwest of Iran with about 95% species of scorpions are the most heavily occupied regions in the country. Khuzestan Province is highlighted for its scorpions and scorpionism amongst the provinces of Iran. Khuzestan with 19 species of scorpions is one of the most important regions in terms of scorpionism problem in the southwestern Iran. Therefore, this study was conducted with the aim of survey epidemiology of scorpion sting in Masjed-Soleyman County from 2015 till 2017. This research is a descriptive - analytical study. All the scorpionism cases who were referred to the 22-Bahman Hospital of Masjed-Soleyman during the study period were included in this research. The required information was extracted from the patients' recorded data in the hospital. Information for each case were recorded in a special checklist and imported into the computer for statistical analysis. Epidemiologic and demographic data were analyzed using the software SPSS-20. Descriptive statistics, including frequency and percentage were used for data analysis. The Chi square test (X^2) and the T test were used to compare variables. P- values of 0.05 or less were considered statistically significant. Out of 11685 cases of scorpionism, 5894 cases were women (50.5 %) and 5791 cases were men (49.5%). Most cases (25% and 24.3%) were in the age groups between 10- 24 and 25-34 years old, respectively ($P<0.01$). Scorpion sting cases took place throughout the year, however the highest frequency happened in May (1637, 14%) ($P<0.05$). Moreover, results showed that the highest rate of scorpion stings cases occurred in summer (36.5%) followed by spring (35.4%) ($P<0.05$). The place of residence was rural district in 3551 (30.3%) patients and the urban in 8134 (69.7%) ($P<0.05$). Among 11685 cases of scorpion sting, 4538 (38.8%) were found on hand, and 3956 (33.8%) on leg. About 31.3% of scorpion cases did not receive any the antiscorpion venom vaccine. The rest of the stung patients received the antiscorpion venom vaccine within 6 hours after the sting. No cases were exposed to multiple stings. Nocturnal and diurnal stings accounted for 78.2% and 21.8% of stings, respectively ($P<0.05$). All scorpion sting cases have gotten better throughout the study and one death (a five- year- old girl, stinged by *Androctonus cradssicauda* from the leg in 2015) have been reported. Scorpionism information are able to guide responsible persons to reduce the cases of scorpion sting. Considering that the highest percentage of scorpion stings have been reported in urban regions accordingly, training prevention methods of scorpion sting to urban people and also development and improving human dwellings can greatly reduce the scorpion sting.

Keywords: Scorpion Sting, Scorpion, Epidemiology, Incidence, Iran.

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INTRODUCTION

Scorpion sting is an unpleasant human life experience, specifically for those who live in scorpion

prone areas. Although venom of some scorpions is dangerous or even fatal, it seems that people are more fearful of seeing a scorpion than the complications of scorpion sting [1].

Scorpions are venomous hunter arthropods that belong to the class Arachnida and order Scorpiones, and are active at night. These creatures hide during the day in their shelters and come out at night for hunting. Scorpions have long been known because of their painful venomous, sometimes fatal, stings, and specific fearsome look [2]. Scorpions are amongst the most important venomous animals in the world. The overall estimated number of scorpion stings is approximately 1.2-1.5 million with nearly 3000-5000 deaths per year [3, 4]. Scorpions mainly inhabit in arid and tropical areas of the world, even deserts, in latitudes lower than regions with a temperate climate [5]. The frequency of scorpion sting and related casualties in different parts of the world vary according to the lifestyle, place of living, socioeconomic status, level of healthcare services and scorpion species in each geographic region. Scorpion sting is a major health problem in the African and Middle Eastern countries, such as Saudi Arabia, Morocco, Turkey, Jordan, Algeria, Egypt, Iraq, Sudan, South Africa and Madagascar, and in the South and Central American countries, such as Brazil, Mexico, Guyana and Trinidad [6-11].

Due to its climatic conditions, Iran has a variety of insect and arthropod species capable of transmitting various diseases or causing toxicities. On the other hand, Iran, second to Mexico, has approximately 250000 cases of stung by venomous animals per year. On average, the incidence of scorpion sting in Iran is approximately 42000-54000 cases. Most of scorpion sting and most of its deaths occur in Khuzestan Province. Although scorpion sting is reported in all provinces, but Khuzestan, Hormozgan, Sistan-Baluchestan, Bushehr, Fars and Kerman have the highest incidence and related mortality, respectively. The lowest incidence was reported in the northern Provinces and Tehran [12].

The negligence in improvement and rehabilitation of rural houses, agriculture, animal husbandry and farming as common occupations in rural areas, expansion of construction in urban areas and development of tourism areas which causes a greater connection between human society and wild life, have increased human vulnerability to scorpion sting. Obviously, familiarity with different epidemiological aspects of scorpion sting in each area is among the fundamental principles behind fighting and curing

scorpion sting. Since there are scant studies into this problem in Masjed- Soleyman, this study was conducted to determine the frequency of scorpion sting in this county with an average population of 210000 people.

MATERIALS AND METHODS:

Masjed - Soleyman is a historical city which is located among the Zagros Mountains. The county of Masjed-Soleyman located between 31°56'11"N latitude and 49°18'14"E longitude with the elevation of 240 meters above sea level. Masjed- Soleyman has a population of 111510 making it the 4th biggest county in Khuzestan Province. At Masjed-Soleyman, the summers are long, sweltering, arid, and clear and the winters are cool, dry, and mostly clear. Over the course of the year, the temperature typically varies from 45°F to 112°F and is rarely below 38°F or above 117°F. The hot season lasts for 4.0 months, from May 23 to September 23, with an average daily high temperature above 102°F. The cool season lasts for 3.4 months, from November 27 to March 7, with an average daily high temperature below 71°F.

This study has been ethically approved by the research ethics committee of the Ahvaz Jundishapur University of Medical Sciences, Iran (Approval ID: AJUMS.REC.1398.213/ Approval Date: 2019.06.08). This project was done in accordance to the ethical principles and the national norms and standard for conducting Medical research in Iran. The confidentiality of the records of patients was assured. Informed consent was obtained from all the participants under study. This descriptive-analytical survey was conducted on scorpion sting patients during 2015 to 2017. The population included all patients whose disease was confirmed through interview, giving the scorpion by the patient and clinical trials. Data were collected by the means of a checklist. A checklist, made by researcher, was completed for each patient, indicating age group, gender, region of residence, month, season, site of sting on the body, sting time during night and day, interval time between sting and reaching the hospital (hours), interval time between sting and antivenin injection (hours) and injection method of antivenin. After collecting the data, they were analyzed using SPSS 20, as well as descriptive statistics and chi-square and

T tests. Significance level was considered to be $P < 0.05$ at all stages of the study.

RESULTS:

Reported incidence of scorpion sting in this city was 11685 cases between 2015 and 2017 with 3722, 4037 and 3926 cases in these three years, respectively, showing an upward trend. The estimated incidence over this period was 18.5 per 1000 population.

The frequency of scorpion sting was 1% higher among women than men, so that 5894 cases (50.5%) of the stung cases were female and 5791 cases (49.5%) were male. In 2015, the incidence of scorpion sting was higher among males (51.4%) than females (Table 1). The paired T-test showed no significant difference between the sex and incidence of scorpionism.

The highest incidence of scorpion sting (21.8%) was observed in the age group of 10-24 years old. The least incidence (9.9%) was reported among people over 60 years. The non-parametric chi-square test showed a significant relationship between the incidence of the scorpionism and age group ($P < 0.001$). With respect to geographic distribution, people living in urban areas accounted for the majority of affected cases (69.7%) (Table 1). The T-test results indicated a significant relationship between the incidence of this accident and place of living ($p < 0.05$).

The highest and lowest incidence rates were observed in months May (14%) and February (2%), respectively. In terms of seasonal distribution, 35.4%, 36.5%, 19.6% and 8.5% of cases were reported in spring, summer, fall and winter, respectively (Table 2). The non-parametric chi-square test showed a significant relationship between the incidence of the disease and month ($P < 0.001$). With respect to the anatomic site of the sting, legs, hands, trunk, and head-face accounted for 3956 (33.8%), 4538 (38.8%), 2893 (24.8%) and 298 (2.6%) cases, respectively. The chi-square test showed a significant difference between the anatomic site of the stings and frequency of scorpionism ($P < 0.001$).

The majority of cases were stung between 24:00 and 6:00 with 5948 cases (50.9%). On the other hand, the least incidence rate was reported between 6:00 and 12:00 with 1153 cases (9.9%). The chi-square test showed a significant difference in the incidence rate between different times of the day and night with an error rate of less than 0.05. According to the findings, 6973 cases (59.7%) and 3003 cases (25.7%) visited medical hospital in less than 1.5 hours and between 1.5-3 hours after being stung, respectively (Table 1). The rest visited after 3 hours. The chi-square test showed a significant difference between these two variables with an error rate of lower than 0.05.

Table 1: Frequency distribution of scorpion sting cases based on age group, gender, residential area, interval time between sting and reaching the hospital, site of sting on the body, site of sting on the body, sting clock, interval time between sting and antivenin injection, injection method of antivenin and interval time between sting and reaching the hospital in Masjed-Soleyman County, Khuzestan Province, South-western Iran during 2015-2017

Year Variable		2015 No (%)	2016 No (%)	2017 No (%)	Total No (%)	P Values
Age group	0-9	649 (17.4)	688(17.0)	644(16.5)	1981(16.9)	<0.001
	10-24	811 (21.8)	858(21.3)	871 (22.2)	2540(21.8)	
	25-34	565 (15.2)	510(12.6)	526 (13.4)	1601(13.7)	
	35-44	503 (13.5)	483(12.0)	515 (13.1)	1501(12.8)	
	45-54	455 (12.2)	526(13.0)	453 (11.5)	1434(12.3)	
	55-64	419 (11.3)	524 (13.0)	531 (13.5)	1474 (12.6)	
	>64	320 (8.6)	448 (11.1)	386 (9.8)	1154 (9.9)	
Gender	Male	1915 (51.4)	2002(49.6)	1874(47.7)	5791(49.5)	0.67
	Female	1807 (48.6)	2035(50.4)	2052(52.3)	5894(50.5)	
Residential area	Urban	2363(63.5)	2950(73.1)	2821(58.1)	8134(69.7)	<0.05
	Village	1359 (36.5)	1087(26.9)	1105(41.9)	3551(30.3)	
Site of sting	Hands	1613 (43.3)	1583(39.2)	1342(50.8)	4538(38.8)	

	Feet	1075 (28.9)	1321(32.7)	1560(49.2)	3956(33.8)	<0.001
	Trunk	956 (25.7)	996(24.7)	941(33.3)	2893(24.8)	
	Faces	78 (2.1)	137(3.4)	83(44.2)	298(2.6)	
Sting time during day and night	0-6	2091(56.2)	2068(51.2)	1789(45.6)	5948(50.9)	<0.05
	6-12	646 (17.4)	183(4.5)	324(8.3)	1153(9.9)	
	12-18	506 (13.6)	392(9.7)	493(12.6)	1391(11.9)	
	18-24	479 (12.8)	1394(34.5)	1320(3..6)	3193(27.3)	
Interval time between sting and antivenin injection (hours)	No injection	944 (25.3)	1539(38.1)	1170(29.8)	3653(31.3)	<0.05
	<6	2778 (74.7)	1555 (38.5)	1801(45.9)	6134(52.5)	
	6-12	0 (0.0)	943(23.3)	955(24.3)	18.98(16.2)	
Injection method of antivenin	No injection	944 (25.3)	1539 (38.1)	1170 (29.8)	3653(31.3)	<0.05
	Muscle	589 (15.8)	0 (0.0)	0(0.0)	589 (5.0)	
	Vein	2189 (58.9)	2498 (61.9)	2756 (70.2)	7452 (63.7)	
Interval time between sting and reaching the hospital(hours)	<1.5	2119 (56.9)	2607 (64.6)	2247(57.3)	6973(59.7)	0.05<
	1.5-3	994 (26.7)	916 (22.7)	1093(27.8)	3003 (25.7)	
	>3	609 (16.4)	514 (12.7)	586 (14.9)	1709 (14.6)	

Table 2: Frequency distribution of scorpion sting cases based on month in Masjed- Soleyman County, Khuzestan Province, Southwestern Iran during 2015-2017

Year Month/Season	2015 No (%)	2016 No (%)	2017 No (%)	Total No (%)	P-value
April	270 (7.3)	368 (9.1)	445 (11.3)	1083(9.3)	<0.001
May	587 (15.8)	616 (15.3)	434 (11.0)	1637(14.0)	
June	469 (12.6)	489 (12.1)	455 (11.6)	1413(12.1)	
<u>Spring</u>	1326(35.6)	1473(36.5)	1334 (34.0)	4133(35.4)	
July	421 (11.3)	526 (13.0)	526 (13.4)	1473(12.6)	
August	442 (11.9)	431 (10.7)	505(12.7)	1378(11.8)	
September	463 (12.4)	442 (10.9)	511(13.0)	1416 (12.1)	
<u>Summer</u>	1326 (35.6)	1399(34.7)	1542 (39.3)	4267 (36.5)	
October	257 (6.9)	389 (9.6)	247(6.3)	893 (7.6)	
November	359 (9.6)	343 (8.5)	322 (8.2)	1024(8.8)	
December	129 (3.5)	120 (3.0)	131(3.3)	380(3.2)	
<u>Autumn</u>	745(20.0)	852 (21.1)	700 (17.8)	2297(19.6)	
January	35 (0.9)	79 (2.0)	84(2.1)	198 (1.7)	
February	89 (2.4)	55(1.4)	91(2.4)	235 (2.0)	
March	201 (5.4)	179 (4.4)	175(4.5)	555(4.7)	
<u>Winter</u>	325(8.8)	313(7.8)	350 (8.9)	988 (8.5)	
Total	3722	4037	3926	11685	

DISCUSSION:

In this study, 11685 cases stung by scorpions between 2015 and 2017 were examined. The incidence rate was almost equal between males and females. The household chores, such as cleaning different parts of the house especially under carpets and furniture, and other probable hiding spots, and rearranging or moving furniture in such places as basement are the major

causes of women vulnerability to scorpion sting. In a study in Turkey, Ozkan and Kut showed that the incidence of scorpion sting was equal between males and females [13]. In a study in Kashan, Talebian and Dourodgar found that 76% of the scorpion sting cases were males. They attributed the higher incidence of scorpion sting among males to their occupation, which required working in outdoor [14].

The most affected age group was 10-24 years old (21.8%). The most affected age group in the Ozkan and Kut's study was 15-29 years old [13]. Among reasons for high frequency of scorpion sting in this age group was their curiosity, risk-taking characteristic and behaviors, such as lifting rocks and other objects without using gloves, walking barefoot in outdoor and not checking the clothing and shoes before putting them on [12]. Regarding the high frequency of scorpion sting among adolescents and youths who are at school and university ages, the Ministry of Health and Medical Education can collaborate with the Ministry of Education to hold specific educational programs for scorpion sting prevention.

The current study showed that the most common sting cases were among people living in urban areas (69.7%). In a two-year study from 2008 to 2010, Zanani-Alviye et al. reported that 93.3% of the scorpion sting and snake bite cases were living in urban areas [15]. In a study in Egypt, Farghly et al. reported the occurrence of scorpion sting in rural areas of many countries [16]. In a study in Kashan, Talebian reported that the highest frequency (58.3%) of scorpion sting was in rural areas. They attributed this high incidence to not using appropriate construction materials, old buildings and improper construction methods. They also reported greater presence of scorpions in agricultural lands and cattle ranches [14]. In a study in southern area of Kerman, Hossininasab et al. reported that people holding stocks of firewood and wood shavings accounted for 20% of scorpion-sting cases [17]. Regarding the higher incidence of scorpion stings in urban areas of Masjed-Soleyman, the best preventive solution is the rehabilitation of old buildings and proper collection and disposal of construction wastes. In addition, more control is required in more suitable areas for the presence of scorpions, such as humid places, warehouses, under tiles, edge of carpets, places used for storing clothing and shoes. It is also recommended to use thick gloves before moving objects and avoid walking barefoot outside of the house at night.

In vitro temperature tolerance of scorpions has been estimated between -3 °C and +53 °C. Summer months account for the majority of scorpion stings (36.5%), which can be attributed to greater activities of scorpions in warm seasons.

Kassiri et al. reported July and August in Behbahan County [18] and July in Abadan County [19] as the peak months of scorpion stings. Studies in different countries reported the following months with the peak incidence rate of scorpion stings: from June to September in Tunisia [20], from June to October in Mexico [21], June in Saudi Arabia [22], and August in Brazil [23]. The higher frequency of scorpion sting in warm seasons arises from higher activity of scorpions in warm temperatures. Resting in outdoors in warm seasons may be another predisposing factor of scorpion sting.

Different studies have shown that the toxicity symptoms were more severe in early night-stung patients [24]. In the present study, the majority of scorpion stings occurred between 24:00 and 6:00. Scorpions generally hide during the day in their shelters and come out at night for hunting [25]. The most commonly stung body parts were hands (38.8%), followed by the legs (33.8%). A study conducted by Yousef - Moghadam et al. in Darmian County showed that the hands (47.7%) and legs (39.4%) were the most affected parts of the body [26], which can be attributed to more use of hands, which increases their vulnerability to scorpion sting.

Regarding the effectiveness of health education programs in reducing the frequency of scorpion sting, the health promotion activities can be concentrated on informing people about biological characteristics of scorpions and their colonies, rehabilitation and renovation of houses, destroying scorpion shelters, avoiding walking barefoot at night, proper collection and disposal of construction wastes, using gloves for lifting and moving rocks and other objects, and providing first aid-scorpion sting training.

CONCLUSION:

Adequate awareness and training related to scorpionism and prevention are important items in reducing scorpion sting. Such epidemiological data can improve the determinants of scorpionism for effective health intervention plan.

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Conflict of interest statement:

The authors report no conflict of interest.

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