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EPIDEMIOLOGICAL DESCRIPTION OF SCORPION ENVENOMATION SYNDROME, A THREEE YEAR EXPERIENCE, DEZFUL COUNTY, SOUTH-WESTERN IRAN

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Abstract:

Objective: *Scorpions envenomation cases are prevalent in Iran due to its socioeconomical structure, weather and geographical situations. Scorpion sting is significant health challenge in Khuzestan Province, South-western Iran. This study aims to evaluate the epidemiology findings of scorpion stings in Dezful, a county in the southwest of Iran.*

Methods: *This study was based on the 2281 subjects with scorpion stings from 2012 to 2014. A questionnaire was distributed to physicians in county health care facilities to collect patient data [age, gender, month, geographical region, location of sting in the body, sting time in the day, interval time between sting and antivenin injection, sting scorpion history, history of receiving antivenin, color of scorpion and injection site of antivenin]. Scorpion [color of scorpion] identification was made according to the color of scorpion defined by the patient. This information was analyzed by SPSS software.*

Results: *Analysis of questionnaire data revealed that 506 of the 2281 scorpion stings resulted from black scorpions [22.2%]. Also, 1775 of the cases [77.8%] were reported as yellow scorpion stings. Out of the 2281 scorpionism cases, 770 took place in the summer period [33.7%], the monthly distribution being as October [12.6%], July [11.9%] and June [11.9%]. Meantime, 39 of the cases were encountered in February [1.7%] and 36 in January [1.5%]. It is also seen from the findings that women were more liable to scorpion sting than men, the cases being reported as 54.9% for women and 45.1% for men. With respect to age groups, it is shown the 25 – 34 age group has faced more scorpion sting [26.7%] than the other groups, the distribution being 24.5% for the 15-24 age group, 14% for the 35-44 age group and 8.9% for 45-54 age group. The body locations of stings given in the study are 37.1% for upper extremities and 42.7% for lower extremities.*

Conclusion: *Results of this study showed that intoxications caused in Dezful County were seen in summer and in hot months, especially in October, June and July. Females and males above 15 years of age were mostly affected and stung from extremities.*

Key Words: *Epidemiology, Scorpion Sting, Iran.*

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INTRODUCTION:

Scorpions are among the oldest organisms on Earth. They have real stingers with a venom sac, where venom is produced from a pair of glands near their tail and, therefore, they are considered the most dangerous arthropods to humans [1].

Scorpion sting is a health issue in undeveloped tropical and subtropical countries that endangers thousands of people each year. At present time, scorpion sting is a major health problem in South Africa, Middle East, southern states of America [Mexico], and the Indian subcontinent. It is said that about 1.2 billion people are living in areas with the possibility of scorpion sting, and about one million people are stung each year by scorpions, resulting in a mortality rate of 0.027% [2]. The severity of poisoning is influenced by various factors, such as patient age and weight, sting location, sting time, and scorpion species. The scorpion sting is more dangerous in the elderly and children. The less the weight of a stung, the more will be the ratio of venom amount to body weight, resulting in a higher risk of poisoning [3].

The status of scorpion sting varies in different regions and countries according to lifestyle, socio-economic status, housing, health services and scorpion species in different geographical regions [4,5]. Scorpions are widely distributed, and the highest species diversity is seen in the subtropical regions, *i.e.* at latitudes 23°-38° [6].

Given the geographical location of Iran at northern latitudes 25°-40°, there is a fairly substantial diversity and distribution of scorpion species [7,8]. Due to its climate and weather, Iran is a very rich country in terms of arthropods, especially scorpions [9]. Iran is among the countries with many species of scorpions particularly the dangerous types [10]. In a manuscript entitled "identification of venomous animals of Iran" in 1908, cities such as Tehran, Qazvin, Qom, Kashan, Tafresh, Khorramshahr, Ahvaz, Soleymanieh, Kordestan, Kerman, Bampoor, Shushtar and Shahrood are reported as scorpion habitats, and their stings were one of the most important problems of residents of these cities [7]. Sting-induced deaths occur in all parts of the country, but about 75% of deaths happen in provinces of Sistan -Baluchestan, Kerman and Hormozgan [11].

In the most recent period [past 2-3 decades], with the start of Iran-Iraq war, medical importance of scorpions was more concerned [1].

Due to the increasing population and expanding urban and rural areas, the advancement of knowledge and greater use of public media, health issues have gained more attention. Given that scorpion sting is a health problem in Iran, it should be further addressed due to painful complications and injuries of stings. In addition, the economic damage should not be forgotten. Of course, apart from health issues and anti-venom serum in the medical field, scorpion sting prevention and control programs, as well as studying other aspects of this organism, including biology, ecology, toxicology is of the responsibility of different disciplines, which is very time-consuming. Therefore, studies should be placed together, and it is clear that until achieving the ultimate result and resolving scorpion sting complications, knowledge of various bio-ecologic aspects of scorpion species and recognizing dangerous species in each region are basic principles of management of scorpion sting prevention and treatment [12]. According to the studies , little research has been done in Dezful County in this field so far, and the present study aimed to investigate the epidemiologic aspects of scorpion sting during 2012-2014.

MATERIALS AND METHODS:

This cross-sectional study was performed in Dezful County next to Dez River in Khuzestan Province in southwestern Iran. The city is located on the slopes of the central Zagros and dates back to the Sassanid era. Dezful enjoys of a hot and humid weather. Dezful city is the center of Dezful County and is bounded by Andimeshk and Aligoudarz [Lorestan Province] cities from north, to Lali and Masjed Soleiman Counties and Gotvand County from east, and to Shush County from south and west. Dezful city, center of Dezful County, is geographically located at 48°24' east longitude and 32°22' north latitude and at 140 meters above sea level.

The study was performed through attending at the covering health care centers and reviewing all records of scorpion stings during 3 years of 2012 to 2014. A checklist was used to collect the demographic [age, gender, *etc.*] and epidemiologic [scorpion color, sting site, *etc.*] characteristics and the data were entered into SPSS and analyzed using descriptive statistics [mean and SD].

RESULTS:

A total of 2281 cases of scorpion sting were recorded from 2012 to 2014 in the health centers of Dezful. Given the city population, the incidence of scorpion sting during these 3 years was estimated as 2.6 per thousand population. Findings of this study showed that during these years, the incidence of scorpion sting was about 750 cases per year with no fluctuation.

In terms of month, the highest and lowest incidence rates were recorded in October [n=287; 12.6%] and in January [n=36; 1.6%], respectively. Regarding the seasons, 719 patients [31.5%] were stung in spring, 770 [33.7%] in summer, 631 [27.7%] in autumn, and 161 [7.1%] in winter. Table 1 shows the incidence of stings by the months of the year.

Regarding gender, 54.9% of subjects were female and 45.1% were male [Table 2]. By age, the highest and lowest incidence of stings was occurred in the

age range of 25-34 years [n=609; 26.7%] and over 65 years [3.7%], respectively. The frequency of scorpion stings by age groups is demonstrated in Table 3.

During these years, the highest incidence of sting [32.2%] happened at evening from 18 to 24 and the lowest [19.0%] at morning from 6 to 12 [Table 4]. Regarding on the residence, 1168 patients [51.2%] lived in the city, while 1113 [48.8%] lived in rural areas [Table 5]. In terms of anatomy, 37.1% of stings were in the hands, 42.7% in the feet, and 20.2% in the trunk and head [Table 6]. Time to access the service providing health centers in the city of Dezful was less than three hours in most cases [n=1764; 77.3%] [Table 7].

Based on the study objectives, the phenotype was not determined, however, 77.8% of scorpions were yellow and 22.2% were black [Table 8]. The majority of cases [99.2%] had not a history of receiving antivenin [Table 9]. Totally, 47 cases [2.1% of victims] recovered using convenience treatments without scorpion antivenin serum. However, the rest treated by scorpion antivenin serum including intra-venin [0.8%] and intramuscular [97.2%] injections and convenience treatments [Table 10]. The most of cases [99%] had not a history of scorpion sting [Table 11].

Table 1: Distribution of the scorpion sting cases according to the month, Dezful County, Southwestern Iran [2012-2014].

Years Months	2012 No. [%]	2013 No. [%]	2014 No. [%]	Total No. [%]
April	69[9.2]	63[8.2]	51[6.6]	183[8.0]
May	99[13.2]	91[11.9]	74[9.6]	264[11.6]
June	78[10.4]	105[13.7]	89[11.6]	272[11.9]
July	74[9.9]	100[13.1]	97[12.7]	271[11.9]
August	71[9.5]	85[11.1]	97[12.7]	253[11.1]
September	81[10.8]	95[12.4]	70[9.1]	246[10.8]
October	103[13.7]	74[9.7]	110[14.4]	287[12.6]
November	81[10.8]	78[10.2]	98[12.8]	257[11.3]
December	37[4.9]	29[3.8]	21[2.7]	87[3.8]
January	18[2.4]	7[1.0]	11[1.4]	36[1.5]
February	11[1.5]	9[1.2]	19[2.5]	39[1.7]
March	28[3.7]	28[3.7]	30[3.9]	86[3.8]
Total	750[100]	764[100]	767[100]	2281[100]

Table 2: Distribution of the scorpion sting cases according to the gender, Dezful County, Southwestern Iran [2012-2014].

Gender	Male	Female	Total
Years	No. [%]	No. [%]	No. [%]
2012	333 [44.4]	417 [55.6]	750 [100]
2013	328 [42.9]	436 [57.1]	764 [100]
2014	368 [47.8]	399 [52.2]	767 [100]
Total	1029 [45.1]	1252 [54.9]	2281 [100]

Table 3: Distribution of the scorpion sting cases according to the age groups, Dezful County, Southwestern Iran [2012-2014].

Years Age groups	2012 No. [%]	2013 No. [%]	2014 No. [%]	Total No. [%]
0-4	43[5.7]	42[5.5]	30[3.9]	115[5.1]
5-9	51[6.8]	35[4.6]	35[4.6]	121[5.3]
10-14	49[6.5]	51[6.7]	48[6.3]	148[6.5]
15-24	176[23.5]	215[28.1]	169[22.0]	560[24.5]
25-34	204[27.2]	195[25.5]	210[27.4]	609[26.7]
35-44	89[11.9]	106[13.9]	123[16.0]	318[14.0]
45-54	56[7.5]	63[8.2]	84[11.0]	203[8.9]
55-64	42[5.6]	32[4.2]	47[6.1]	121[5.3]
65<	40[5.3]	25[3.3]	21[2.7]	86[3.7]
Total	750[100]	764[100]	767[100]	2281[100]

Table 4: Distribution of the scorpion sting cases according to the sting time, Dezful County, Southwestern Iran [2012-2014].

Sting time Years	0-6 No. [%]	6-12 No. [%]	12-18 No. [%]	18-24 No. [%]	Total No. [%]
2012	236[31.5]	153[20.4]	141[18.8]	220[29.3]	750[100]
2013	173[22.6]	153[20.0]	194[25.4]	244[32.0]	764[100]
2014	196[25.5]	128[16.7]	173[22.6]	270[35.2]	767[100]
Total	605[26.5]	434[19.0]	508[22.3]	734[32.2]	2281[100]

Table 5: Distribution of the scorpion sting cases according to geographical area, Dezful County, Southwestern Iran [2012-2014].

Residential Area Years	Urban No. [%]	Village No. [%]	Total No. [%]
2012	429 [57.2]	321 [42.8]	750 [100]
2013	383 [50.1]	381 [49.9]	764 [100]
2014	356 [46.5]	411 [53.5]	767 [100]
Total	1168 [51.2]	1113 [48.8]	2281 [100]

Table 6: Distribution of the scorpion sting cases according to the site of sting on the body, Dezful County, Southwestern Iran [2012-2014].

Site of sting Years	Hands No. [%]	Feet No. [%]	Trunks No [%]	Head No. [%]	Total No. [%]
2012	274[36.6]	307[40.9]	125[16.6]	44[5.9]	750[100]
2013	288[37.6]	312[40.0]	116[15.2]	48[6.2]	764[100]
2014	284[37.0]	355[46.3]	93[12.1]	35[4.6]	767[100]
Total	846[37.1]	974[42.7]	334[14.6]	127[5.6]	2281[100]

Table 7: Distribution of the scorpion sting cases according to the Interval time between sting and antivenin injection, Dezful County, Southwestern Iran [2012-2014].

Interval time between sting and antivenin injection[h]	<1.5 No. [%]	1.5-3 No. [%]	>3 No. [%]	Total No. [%]
2012	506[67.5]	113[15.1]	131[17.4]	750[100]
2013	466[61.0]	127[16.7]	171[22.3]	764[100]
2014	420[54.8]	132[17.2]	215[28.0]	767[100]
Total	1392[61.0]	372[16.3]	517[22.7]	2281[100]

Table 8: Distribution of the scorpion sting cases according to the color of scorpion, Dezful County, Southwestern Iran [2012-2014].

Color Years	Black No. [%]	Yellow No. [%]	Total No. [%]
2012	121[16.1]	629[83.9]	750[100]
2013	187[24.5]	577[75.5]	764[100]
2014	198[25.8]	569[74.2]	767[100]
Total	506[22.2]	1775[77.8]	2281[100]

Table 9: Distribution of the scorpion sting cases according to the history of receiving antivenin, Dezful County, Southwestern Iran [2012-2014].

History of Receiving Antivenin Years	Yes No. [%]	N0 No. [%]	Total No. [%]
2012	16[2.1]	734[97.9]	750[100]
2013	2[0.3]	762[99.7]	764[100]
2014	1[0.1]	766[99.9]	767[100]
Total	19[0.8]	2262[99.2]	2281[100]

Table 10: Distribution of the scorpion sting cases according to the the antiserum injection method, Dezful County, Southwestern Iran [2012-2014].

Method of Injection Years	Vein No. [%]	Muscle No. [%]	No Injection No [%]	Total No. [%]
2012	20[2.7]	718[95.7]	12[1.6]	750[100]
2013	0[0.0]	734[96.1]	30[3.9]	764[100]
2014	0[0.0]	762[99.4]	5[0. 6]	767[100]
Total	20[0.8]	2214[97.1]	47[2.1]	2281[100]

Table 11: Distribution of the scorpion sting cases according to the sting scorpion history, Dezful County, Southwestern Iran [2012-2014].

Sting scorpion history Years	Yes No. [%]	No No. [%]	Total No. [%]
2012	18[2.4]	73297.6]	750[100]
2013	4[0 .5]	760[99.5]	764[100]
2014	1[0.1]	766[99.9]	767[100]
Total	23[1]	2258[99]	2281[100]

DISCUSSION:

Scorpion sting is an injury that greatly scares people. Fear of sting pain and the stories they have heard about that make them more anxious. Given weather conditions, Khuzestan province has a high rate of scorpion sting in Iran, and despite a high prevalence, no comprehensive study has been performed on the necessity of prescribing anti-scorpion serum. The absence of anti-scorpion serum in sufficient quantities in all centers and lack of a clear indication for anti-scorpion serum prescription as well as insists of patients' relatives have resulted in confusion of health workers.

Literature review revealed that the highest incidence of scorpion sting is 26.7% among people of 25-34 years old. A study by Ozkan and Kat showed the highest frequency [36.2%] in the age group of 15-29 years [13]. In Saudi Arabia, Al-Sadoon and Jarrar showed that 65.46% of scorpion stung people are older than 15 [14]. Jarrar and Al-Rowaily showed that 36.3% of scorpion stung people in Saudi Arabia are 20-29 years of age, which is consistent to the present study [15]. Some studies have been carried out in the cities of Khuzestan Province, for example, a study by Vazirianzadeh *et al.* in Khuzestan suggests that the highest rate of scorpion sting was 22.3% among 20-30 years old people, which is similar to the results obtained in Shushtar [northwestern Khuzestan] [16]. The study by Kassiri in Behbahan County [Khuzestan Province] showed that 56.1% of stings occurred in 21-50 years old people [17]. In another study by Kassiri in Masjedsoleyman County, 77.4% of stung patients were over 15 years [18].

The higher frequency of scorpion stings in men is related to their occupational activity outdoors. For example, men in villages work in agricultural land and naturally are at higher risk than women who are at home. The results of this study showed that scorpion sting occurred in 54.9% of women and 45.1% of men, and this is not consistent with two separate studies in different regions of Saudi Arabia where the highest scorpion sting rate was seen in 73% and 77% of men and the rest in women [13, 15]. But these results are similar with that of Vazirianzadeh *et al.*'s [16] and Chitnis *et al.*'s [19]. In Turkey, Ozkan and Kat showed an equal number of scorpion stung men and women in their study [13].

Sting in the lower extremities can be related to inappropriate use of shoes in the yard or in the agricultural land. On the other hand, when people are awake, lower limbs are less in sight than upper parts of the body and hence scorpion approaching to the legs is less noticed. In terms of anatomy, 37.1% of stings were in the hands, 42.7% in the feet, and 20.2% in the trunk and head. In the study by Ozkan and Kat, 58.9% of people were stung by *Mesobuthus eupeus* at lower part [13]. In a study by Al- Rowaily and Al- Sadoon, 48.5% and 51.1% of stings were occurred in the upper and lower extremities, respectively [15, 20]. Head and neck stings were low, this can justify the low number of referrals and losses. According to studies, head and neck stings are more dangerous than limbs stings [21].

This study shows that the frequency of patients in rural and urban areas is not much different. In a research by Farghly and Ali [22], scorpion stings were reported to take place in many countries, especially in rural areas, which is not consistent with our results. Higher incidence of stings in rural areas may be due to lack of suitable building materials. But in Dezful, the city has not changed much and retained its old structure in most parts. Lack of modern buildings and existence of old urban structure can be the reason for indifference in scorpion stings in urban and rural areas.

Most stings occurred in October, June, and July. Other studies confirm these findings [23-25]. The lowest incidence of sting was in the winter. The highest incidence rates of stings in other studies are as follows: In Tunisia from May to September [26], in Mexico from June to October [27], in Turkey in the summer [24], and in Saudi Arabia in June [14], while in Brazil, most cases occur in July [28]. It seems that the incidence of scorpion sting in the warmer months of the year can be related to the higher activity of scorpions in these months and to the people resting in open environments.

Due to delay in admission, about 77.3% of people who visited the emergency room within 3 hours after sting were treated with anti-scorpion serum. Similar delays from the time of being stung to administration of anti-scorpion serum were also reported in other studies [29-30]. In a study conducted in Mexico [1991], the delay was less than 30 minutes in 48% of cases [27]. The delay can be attributed to ignoring the importance of immediate treatment or difficulty in referral to emergency due to financial or geographical constraints. A training program to inform women about the importance of treatment after scorpion stings can be effective in reducing the delay in referral and its consequences.

Most stings occur in the evening, between 6 PM to 6 AM. Scorpions usually stay motionless at days in safe places like crannies, under rocks, among shavings, under mats and wood chips, among leaves, under bark of trees such as eucalyptus, holes in the trunks of palm trees, among the debris of the building, and even inside shoes, boots, and closed front slippers, and exit their safe place at night for hunting [31].

Given the objectives of this study, phenotypes of scorpions were not determined; however, 77.8% of stings were caused by yellow scorpions and 22.2% by black scorpions. According to a study by Dehghani *et al.* in 1998 in Kashan, from 200 scorpion stings reported in one year, about 30% were caused by black scorpion, 62% by yellow scorpion, and 8% were unknown [12].

CONCLUSION:

Modernization and improvement of the environment, increasing awareness of urban and rural people in scorpion habitants about their biological characteristics of scorpions and natural enemies, preparation of educational brochures, right and timely performance of first aid, and finally preparation of regional monovalent or polyvalent anti-venom serum can have a significant role in reducing scorpion sting and its complications. Therefore, developing a coherent, comprehensive, and lasting program for prevention and control of scorpion sting and immediate treatment under the supervision of qualified personnel can greatly decrease complications of this problem throughout Iran. This can be realized through a strong leadership to guide the specialized group in all organizations and academic and research centers, and by performing fundamental and applied studies and projects, in particular in areas suffering from this problem through a collaborative effort in all areas.

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