Epidemiology of scorpion stings in the West Bank, Palestinian Territories

Running title: Scorpion stings in the Palestinian Territories

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Abstract

Introduction: Scorpionism (scorpion sting envenoming) is an endemic public health concern in many Arab Middle Eastern countries. Our knowledge of the epidemiology of scorpion stings in the Palestinian Territories is very limited.

Methods: Records for 2175 cases of scorpion stings were obtained and retrospectively analysed for the years 2012 and 2014-2020 from the main hospitals in four districts in the West Bank.

Results: The average age and standard deviation (\pm SD) for both sexes was 24.7 \pm 17.5 years (22.7 \pm 16.5 and 27.1 \pm 18.4 years for males and females, respectively). The median age was 20 years and 47.2% were children under 18 years. Most cases were reported during the summer months, between June and October, with a peak in July–August.

By anatomic site, the right hand was most commonly stung in both sexes, followed by the right foot, whereas the chest, buttocks and scrotum were the least affected body parts. Clinical data were available for 405 cases, in which pain, vomiting and sweating were the most common symptoms. The overall incidence of stings was 26.32 per 100,000 inhabitants per year over the study period of eight years (59.21–171.67, 95% CI).

Conclusion: Medical staff should be trained to manage scorpion sting cases, with an emphasis on effective analgesia in most cases. Prospective recording of adequate medical histories should be established. Evaluation of the currently used antivenom is also a priority.

Keywords: Scorpions, Palestinian Territories, West Bank, seasonality, clinical symptoms, children

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Introduction

Scorpionism (scorpion sting envenoming) is an endemic public health concern in many Arab Middle Eastern countries (1). Our knowledge of scorpion stings in the Palestinian Territories is very limited.

Wahbeh (2) reported scorpion stings among children in Ramallah area with a total of five fatalities. Dudin et al. (3) described the clinical symptoms associated with scorpion stings among children in the Jerusalem area. Sawalha et al. (4) recorded 154 scorpion stings from Nablus Governorate without clinical or epidemiological data. The annual report for 2020 issued by the Palestine Ministry of Health reported 500 scorpion stings with 34.2% of the cases from Jericho and the Jordan Valley (5). Adawi et al. (6) studied the epidemiology of scorpion stings reported in 2014–2015 in the Salfit District.

At least 10 species of scorpion belonging to three families were reported from the West Bank of the Palestinian Territories. The family Buthidae is represented by seven species (*Androctonus crassicauda, Androctonus bicolor, Birulatus israelensis, Compsobuthus werneri, Hottentotta judaicus, Leiurus hebraeus* and *Orthochirus scrobiculosus*); family Diplocentridae by one species (*Nebo hierichonticus*); and family Scorpionidae by two species (*Scorpio fuscus* and *Scorpio palmatus*) (1,7). Hottentotta judaicus is a strictly Mediterranean species known in wooded areas, while *A. crassicauda* has been found in arid areas, especially in the Jordan Valley. *Leiurus hebraeus* is confined to arid Mediterranean areas and to parts of the Jordan Valley (7). Representative taxa are shown in Figure 1.

[Add Figure 1 near here]

The aim of this study was to investigate the epidemiology of scorpion stings encountered in four districts in the Palestinian Territories in 2012 and 2014–2020 in the interest of evaluating the public health importance of a neglected cause of distressing symptoms, especially in children.

Methods

IRB approval was granted by the Office of the Dean of Research, responsible for Research Ethics Committee (Institutional Review Board) at Bethlehem University. Records were obtained and retrospectively analysed for 2012 and 2014–2020 from the main hospitals in four districts in the Palestinian Territories: Bethlehem: Al-Hussein Governmental Hospital; Hebron: Princess Alia Governmental Hospital; Jericho: Jericho Governmental Hospital; and Salfit: Salfit Governmental Hospital (see Table 1).

[Add Table 1 near here]

No data were available for 2013 because the data gathering system was not functioning in the ministry's hospitals and clinics in that year. Gender, age and date of admission were available for all patients, but the site of the sting and clinical symptoms were recorded in only 723 and 405 cases, respectively. Hospitals included in this study serve all major towns, villages and refugee camps within the vicinity of each district.

Data were analysed using SPSS version 17 (SPSS, Chicago). A chi-squared test was used for comparison of qualitative data, and a t-test was used for qualitative analysis.

Results

A total of 2175 cases of scorpion stings were reported from four districts in the Palestinian Territories in 2012 and 2014–2020. The highest number of cases was reported from Hebron District, and the lowest from Salfit District (see Table 1). Male to female ratio was 1.26:1 and was statistically significant (P <0.004, 0.54–0.58, 95% CI). The median age was 20 years and the average age and standard deviation (\pm SD) for both sexes was 24.7 \pm 17.5 years (22.7 \pm 16.5 and 27.1 \pm 18.4 years for males and females, respectively).

Most stings occurred between the ages of one and 20 years (P <0.001, 0.91-0.93, 95% CI), constituting 51.3% of total cases; 47.2% of all studied cases were under the age of 18 (i.e. children, as defined by WHO); and 19.1% occurred in people 40 years old or older (see Figure 2). Among males, most stings occurred between the ages of one and 20 years (P <0.001, 0.07-0.03, 95% CI). Among those aged 20 years and older, there was no statistical difference between males and females.

[Add Figure 2 near here]

Most of the cases were reported during the summer months (32.6%), between June and October, with a peak in July–August (P <0.01, 0.17–0.20, 95% CI), while the lowest numbers of recorded cases were in January and December, at 1.2% and 1.8%, respectively (see Figure 3). Seasonal differences affected males and females similarly (P <0.135, 0.12–0.15, 95% CI).

[Add Figure 3 near here]

Table 2 and Figure 4 show the frequency of stings according to the affected body part in 723 cases. By site, the right hand was stung most commonly in both sexes (P < 0.001, 0.43-0.54, 95% CI) followed by the right foot, whereas the chest, buttocks and scrotum were the least affected sites.

[Add Table 2 and Figure 4 near here]

The duration of hospital stay varied from less than six hours to three days. There were no fatalities. Administration of scorpion antivenom (one to seven ampoules) was documented in 344 cases. The only available antivenom in hospitals is Scorpion Venom Antiserum IHS (VINS BIO Products, India).

Clinical data were obtained for 405 cases from all hospitals included in the study (see Table 3). Unfortunately, since neither the species nor any other distinguishing feature, such as colour or size, of the scorpion involved was mentioned, symptoms or severity of envenoming cannot be attributed to a particular species. Pain, vomiting and sweating were the most commonly observed symptoms.

[Add Table 3 near here]

Table 4 shows the incidence per 100 000 inhabitants by governorate. Jericho Governorate had the highest incidence of scorpion sting encounters, followed by Bethlehem Governorate. The lowest incidence was reported from Salfit Governorate and highest from Hebron area. The overall incidence was 26.32 per 100 000 inhabitants over the study period of eight years (P < 0.0067, 59.21-171.67, 95% CI).

[Add Table 4 near here]

Discussion

Our data reveal a high incidence of scorpion stings in the districts served by the four participating hospitals, with an average of 26.32 cases per 100 000 inhabitants per year over an eight-year period (see Table 4). However, incidence varied considerably. Jericho had an incidence 10 times higher than districts like Hebron and Salfit. The reason is probably that Jericho District is situated in the Jordan Valley below sea level, with a warmer, semi-tropical climate, and is predominantly rural where most people are engaged in agriculture. This biogeographical zone harbours two highly venomous species: A. crassicauda and L. hebraeus but fewer less-dangerous Mediterranean wooded-area species like Scorpio (7). On the other hand, Hebron District has the highest population (696 599) and largest area (997 km²) in the West Bank.

Scorpion stings appear to be a common problem in the Palestinian Territories. The terrain of these districts provides a suitable habitat for scorpions, and many people are engaged in agriculture in this rural landscape and so are exposed to scorpion stings. The seasonal pattern for scorpion stings is similar to that reported from Salfit District (6) and neighbouring countries such as Saudi Arabia (8) and Jordan (9). Males were more likely to be stung than females (6, 8, 10). This is due to their greater exposure while working in the fields as adults or playing in open areas as children.

Stings on the hands (36.7%) were the most common. This is probably the result of inadvertent handling of scorpions while picking vegetables or other objects. In Saudi Arabia, the lower extremities and especially the feet (10, 11), fingers and hands (12), and feet (45%) and hands (24%) (11) were variously reported to be most affected. In Jordan, fingers and toes were stung most often (10).

Associated clinical symptoms are similar to those described by several authors in Jordan, the Palestinian Territories and Saudi Arabia (6, 10, 11, 13, 15). Dudin et al. (3) give a comprehensive account of clinical symptoms associated with scorpion stings among children in the Jerusalem area.

Although substantial numbers of scorpion stings were recorded during the study period, the symptoms recorded were mostly consistent with a Class II classification: minor manifestations (nonlife threatening), according to Khattabi et al. (14), namely, vomiting, sweating, nausea, priapism, salivation and tachycardia. Only eight patients had dyspnoea, suggesting a Class III classification: severe manifestations (life threatening), and no fatalities were reported. Dudin et al. (3) reported two fatal cases among children in the Jerusalem area who had not received antivenom intravenously.

In the Palestinian Territories, the only antivenom available is Scorpion Venom Antiserum IHS manufactured in India by VINS BIO Products. The antivenom is specific for *L. quinquestriatus* and *A. amoreuxi*, neither of which species occurs in the Palestinian Territories. Paraspecificity is claimed by the manufacturer against *Androctonus crassicauda*, *A. aeneas*, *A. australis*, *Scorpio marus* [sic] *palmatus* and *Buthus occitanus*. In our study, 344 (15.8% of the total cases) patients, most of them children, received this antivenom, but there was no information about effectiveness or adverse events.

Although few severe cases and no fatalities were identified in this study, the most common management problem faced by medical staff is effective analgesia, especially in children. The official management recommendations for scorpion stings and their application by health personnel in the Palestinian Territories follow global recommendations, including using drugs like Prazosin in severe cases. Yet, there seems to be a lack of awareness among health providers about proper treatment, and ignorance of which species of scorpions are of medical importance. This can and should be addressed by training medical staff. The drugs currently available should be reevaluated for local efficacy since other sources of specific antivenoms for the local species are available, for example in Saudi Arabia.

Conclusions

Scorpion stings are a problem faced frequently by medical staff in the Palestinian Territories, especially in areas like Jericho District. They affect both sexes and particularly children. Most of the cases were reported during the summer period (with a peak in July–August). The right hand was most commonly stung in both sexes. Management guidelines for scorpion sting cases, especially for child victims, and prospective protocols for data collection should be established.

Authors' contributions

Elias N. Handal and Mohammad Abu Serhan collected and tabulated the data from hospitals. Rihan Bani Hani performed the statistical analysis. Mazin B. Qumsiyeh, David A. Warrell and Zuhair S. Amr drafted the manuscript. David A. Warrell critically revised the manuscript. David A. Warrell and Mazin B. Qumsiyeh are guarantors of the paper.

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Competing interests

None declared.

Ethical approval

Not required.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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Figures

Figure 1: Scorpions from the Palestinian Territories: A. Androctonus crassicauda; B. Leiurus hebraeus; C. Nebo hierichonticus; D. Scorpio maurus fuscus



Source: photos by E. Handal









Figure 4: Site of scorpion stings on the body: A. male; B. female



Tables

Table 1: Number of cases reported from four districts of the Palestinian Territories in 2012 and 2014–2020

(ND: No data)

Year	Beth	Bethlehem		Hebron		Jericho		lfit	Total	
	3	Ŷ	8	Ŷ	8	Ŷ	8	Ŷ	8	Ŷ
2012	ND	ND	19	30	ND	ND	ND	ND	19	30
2014	83	81	100	53	45	42	2	0	230	176
2015	33	37	96	57	42	31	ND	ND	171	125
2016	32	19	82	62	37	43	ND	ND	151	124
2017	26	14	69	40	49	49	ND	ND	144	103
2018	42	38	58	43	58	50	12	9	170	140
2019	42	40	69	61	60	52	18	16	189	169
2020	15	4	53	47	61	29	13	12	142	92
Total	273	233	546	393	352	296	45	37	1216	959

Site of sting	Female	Male	Total	P value (within same group)
D:1.1 1	n (%)	<u>n (%)</u>	n (%)	0.000
Right hand	74 (22.0)	81 (21.1)	155 (21)	0.008
Left Hand	47 (13.9)	63 (15.6)	110 (15.0)	0.001
Right Foot	56 (16.8)	62 (15.4)	118 (15.9)	0.014
Left Foot	50 (14.9)	60 (14.8)	110 (14.9)	0.001
Right Leg	28 (8.4)	31 (7.6)	59 (8.0)	0.083
Left Leg	28(8.4)	30 (7.4)	58 (7.9)	0.158
Head	13 (3.9)	21 (5.2)	34 (4.8)	0.005
Right Arm	16 (4.6)	14 (3.5)	30 (4.1)	0.158
Left Arm	7 (2.1)	13 (3.1)	20 (2.7)	0.014
Back	8 (2.3)	7 (1.7)	15 (2.0)	0.318
Abdomen	6 (1.8)	8 (1.9)	14 (1.8)	0.158
Chest	2 (0.6)	5 (1.1)	7 (0.9)	0.083
Buttocks	1 (0.3)	6 (1.4)	7 (0.9)	0.025
Scrotum	0 (0)	1 (0.2)	1 (0.1)	0.001
Total	336 (100)	402 (100)	738 (100)	

Table 2: Frequency of scorpion stings according to the affected body part

Symptom	Observed (n)	%	
Pain	131	32.35	
Vomiting	112	27.65	
Sweating	78	19.26	
Irritability	66	16.30	
Erythema	51	12.59	
Swelling	38	9.38	
Nausea	30	7.41	
Priapism	15	3.70	
Salivation	14	3.46	
Dizziness	11	2.72	
Abdominal pain	10	2.47	
Dyspnoea	8	1.98	
Itching	8	1.98	
Numbness	7	1.73	
Fever	6	1.48	
Tenderness	5	1.23	
Chills	46	1.14	
Tachycardia	2	0.49	

Table 3: Main clinical symptoms reported in 405 cases of scorpion stings

District	Hospital	Average population by census	Cases (n)	Incidence per 100 000 inhabitants/year
Bethlehem	Al-Hussein	213 357	506	29.64
	Hospital			
Hebron	Princess Alia	696 599	939	16.84
	Governmental			
	Hospital			
Jericho	Jericho	49 219	648	164.57
	Governmental			
	Hospital			
Salfit	Salfit	73 921	82	13.87
	Governmental			
	Hospital			
Total		1 033 096	2175	26.32

Table 4: Scorpion stings per 100 000 inhabitants by governorate over the study period (2012 and 2014–2020)