

Scorpion sting syndrome: epidemiology, clinical presentation and management of 2240 cases

Hisham M.A. Mahaba¹

متلازمة لدغة العقرب : وبائياتها وصورتها السريرية ومعالجة 2240 حالة
هشام محمد عبد الفتاح مهابة

خلاصة : تم تسجيل جميع حالات لدغ العقرب (2240) التي ترددت على مراكز الرعاية الصحية الأولية والمستشفيات في منطقة حائل بالملكة العربية السعودية في الحقبة الممتدة من حزيران / يونيو، 1994 حتى آخر آب / أغسطس 1995 ، كما تم تحليلها . وجرى دراسة معدل وقوع لدغات العقارب ومعالجتها بمضادات الزحاف . ووجد أن معدل الوقوع الإجمالي كان 1.87% خلال فترة خمسة عشر شهرا . ولوحظ أن العلامات والأعراض كانت شديدة بين الرضع . وتشتمل المقالة على إرشادات مقترحة لمعالجة لدغات العقارب ، تشدد على أهمية المعالجة المحلية للدغات العقرب في الرضع والأطفال دون سن المدرسة .

ABSTRACT All cases of scorpion stings (2240) that attended all primary health care centres and hospitals in Hail region, Saudi Arabia, from 1 June 1994 to 31 August 1995 were recorded and analysed. The incidence of scorpion stings and treatment by antivenom were studied. A total incidence of 1.87% was found for the 15-month period. The severity of symptoms and signs were marked among infants. Guidelines for the management of scorpion stings are suggested and the importance of local treatment of stings affecting infants and preschool children is emphasized.

Syndrome de la piqûre de scorpion: épidémiologie, signes cliniques et prise en charge de 2240 cas

RESUME Tous les cas de piqûre de scorpion (2240) qui se sont présentés dans l'ensemble des centres de soins de santé primaires et hôpitaux de la région de Hail en Arabie saoudite durant la période allant de juin 1994 à fin août 1995 ont été enregistrés et analysés. L'incidence des piqûres de scorpion et le traitement par l'administration de sérum antivenimeux ont été étudiés. On a trouvé une incidence totale de 1,87% pour cette période de 15 mois. La gravité des symptômes et des signes cliniques était prononcée chez les nourrissons. Des directives pour la prise en charge des cas de piqûre de scorpion sont proposées, et l'importance du traitement sur place lorsqu'il s'agit de nourrissons et d'enfants d'âge préscolaire y est soulignée.

¹Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt, and Director of the Department of MCH services, Primary Health Care Administration, Directorate of Health Affairs, Hail, Saudi Arabia.
Received: 08/11/95; accepted: 08/02/96

Introduction

The sociocultural disposition and geographical features of Saudi Arabia expose its inhabitants to the risk of contact with a range of venomous animals. Although modern means of transportation have contributed to the decrease of such contact, the sociocultural habits prevalent are still conducive to such a risk. A few studies have described the incidence rates of some venomous bites in Saudi Arabia, but the size of the problem is not fully appreciated [1].

Scorpion sting is responsible for a number of deaths each year in many countries. Of even greater importance is the loss in economic productivity and human potential resulting from the many serious, non-fatal envenomations which occur annually in otherwise healthy children or working adults [2]. In the south of the Libyan Arab Jamahiriya, there were 900 stings with seven deaths per 100 000 population in 1979. In Mexico, there are between one to two thousand deaths each year with an incidence of 84 deaths per 100 000 per year. In Algeria, there was an average of 1260 stings and 24 deaths per year [3].

This work was therefore conducted to study the incidence of scorpion stings in Hail region of Saudi Arabia. Moreover, information about the treatment of scorpion stings with antivenom is still needed. The average initial dose of antivenom required should be based on results of clinical studies, but these are rarely available. Most manufacturers base their recommendations on mouse assay, which may not correlate with clinical findings [4]. Therefore, this study also evaluated the management of scorpion stings with antivenom to give guidelines for future management.

Subjects and methods

Surveillance of cases of scorpion stings in Hail region, Saudi Arabia, started in May 1994. A special scorpion sting form was prepared, to be completed by physicians at all primary health care (PHC) centres and hospitals in Hail region for each case of scorpion sting. Completed forms were sent to the Directorate of Health Affairs for Hail region for analysis. The form collected personal data, data about conditions of the sting, the clinical picture and the treatment with antivenom.

Demographic data regarding the size and composition of the population (the denominator) were obtained from the annual health report of the Directorate of Health Affairs for Hail region. Only those living outside Hail city were considered at risk of scorpion stings (population at risk). This is the rural population registered at all 76 PHC centres outside the main city. The study involved all cases of scorpion stings that were admitted to all PHC centres and hospitals in Hail region during the 15-month period from the beginning of June 1994 to the end of August 1995.

Treatment of scorpion stings was conducted according to a protocol, with directions for lines of treatment, set by the Ministry of Health. During the study, the dose of antivenom recommended was changed from one ampoule containing 1 ml antivenom to five ampoules. Thus, some patients received only one ampoule 1 ml antivenom (Nile Company, Egypt) while others received five ampoules. After sensitivity testing, patients received the antivenom intravenously. The antivenom was diluted with normal saline. All cases were then referred to hospitals for further observation and management.

Auxiliary drugs for treatment of symptoms and signs of envenomation included:

- sedation using chlorpromazine and promethazine, and avoidance of pethidine;
- diazepam as an anticonvulsant, and avoidance of barbiturates;
- hydralazine or nifedipine for treatment of hypertension;

Pulmonary oedema was treated by oxygen, Lasix, central venous pressure line and monitoring fluid intake, and intermittent positive pressure ventilation.

The incidence of scorpion stings was studied in relation to country of origin, sex and age. Data were analysed using the *Epi-Info* computer package. Pearson χ^2 test was used for comparison between the groups studied.

Results

A total of 2241 cases of stings were reported during the 15-month period between June 1994 and the end of August 1995. One of them, a male child aged 4 years and living in a remote area, suffered a scorpion sting and was carried by his parents directly to the hospital. Unfortunately he died before arrival without receiving antivenom at the PHC centre and no reliable data could be obtained.

According to the treatment protocol, cases of scorpion sting should be referred to the hospital after their management at

the PHC centre for further management. However, only 532 cases attended the hospitals during the period studied. Children under 10 years of age were admitted for one day, while older subjects were observed for three hours at the emergency room and then discharged if asymptomatic.

Table 1 describes the incidence of scorpion stings in Hail region during the study period. The total incidence of scorpion stings was 18.7 per 1000 for the 15-month period. This incidence was approximately the same in both the Saudi and non-Saudi population. Males were more affected than females ($P < 0.001$) and the incidence of scorpion sting was found to be highest among those over 15 years ($P < 0.00001$). Figure 1 shows the monthly distribution of

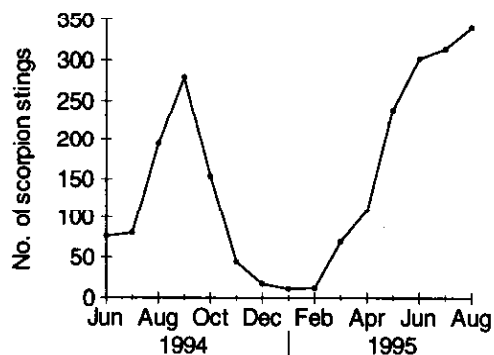


Figure 1 Frequency distribution of cases of scorpion stings by month

Table 1 Incidence of scorpion stings in Hail region during the studied period

Scorpion stings	Total	Nationality ^a		Sex ^b		Age (years) ^c		
		Saudi	Non-Saudi	Male	Female	< 5	5-15	> 15
Number	2 240	1 741	499	1 270	970	235	536	1 467
Population at risk	119 889	93 955	25 934	63 624	56 265	18 327	34 113	67 449
Incidence per 1000	18.7	18.5	19.2	20.0	17.2	12.8	15.8	21.7

^a $\chi^2 = 0.52$, $P > 0.05$; ^b $\chi^2 = 11.9$, $P < 0.001$; ^c $\chi^2 = 84.7$, $P < 0.00001$

cases of scorpion stings. The frequency was highest during summer months, mainly from June to September.

Table 2 describes the details of scorpion stings encountered. The foot represented the most common site for stings (60.0%). In addition, most of the stings occurred at night (60.0%) and a high percentage of cases (18.7%) had suffered previous scorpion stings.

As regards the clinical presentation, pain was present in almost all cases (98.3%) and persisted for up to 72 hours in one case. Systemic manifestations of envenomation were present in a much lower proportion. Vomiting, sweating, restlessness, tachycardia and hypertension were fairly common manifestations (Table 3).

Anthropometric factors affecting the severity of symptoms and signs of envenomation were studied (Table 4). Shock was

marked among those under five years of age, and mild hypertension (150/95) was common among the adults and the elderly. Severe hypertension (220/120) was encountered in one patient with a known history of hypertension. In addition, shock was common among those weighing less than 10 kg.

Colour of the scorpion and site of the sting were shown to affect the severity of symptoms and signs (Table 5). Both yellow and black scorpions were found to be associated with toxic manifestations and shock.

Table 2 Details of scorpion stings among the studied cases

Characteristics	Number <i>n</i> = 2240	Percentage
<i>Colour of scorpion</i>		
Yellow	853	38.1
Black	960	42.9
Unknown	427	19.1
<i>Site of sting</i>		
Foot	1345	60.0
Hand	692	30.9
Body	134	6.0
Neck	69	3.1
<i>Time of sting</i>		
Day	883	39.4
Night	1343	60.0
Unknown	14	0.6
<i>Prior stings</i>		
Yes	418	18.7
No	1822	81.3

Table 3 Clinical presentation of cases of scorpion stings

Symptom and sign	Number <i>n</i> = 2240	Percentage
Pain	2202	98.3
Vomiting	172	7.7
Sweating	127	5.7
Fever	22	1.0
Semi-consciousness	22	0.9
Shock	16	0.7
Restlessness	327	14.6
Convulsions	14	0.6
Hypertonic muscle	15	0.7
Pallor	105	4.7
Cyanosis	1	0.04
Arrhythmia	13	0.6
Tachycardia	445	19.9
Bradycardia	12	0.5
Hypertension	197	8.8
Hypotension	19	0.8
Tachypnoea	34	1.5
Dyspnoea	12	0.5
Pulmonary oedema	1	0.04
Dehydration	24	1.1
Dilated pupils	1	0.04

In addition, stings affecting the body, head and neck, and upper limbs were associated with more toxic manifestations and shock than stings affecting the lower limbs ($P < 0.0001$).

Table 6 shows the details of treatment with the antivenom. History of previous treatment with antivenom was given by 302 (13.5%) of cases. Skin tests performed before injection of antivenom were positive in

Table 4 Anthropometric factors affecting the severity of symptoms and signs of envenomation

Anthropometric factor	Clinical presentation				Statistical significance
	Localized pain only	Systemic manifestations	Hypertension	Shock	
	<i>n</i> = 1904 No. (%)	<i>n</i> = 123 No. (%)	<i>n</i> = 197 No. (%)	<i>n</i> = 16 No. (%)	
Age group (years)					
< 1 [<i>n</i> = 34 (1.5%)]	14 (0.7)	14 (11.4)	0	6 (37.5)	$\chi^2 = 578$
1–5 [<i>n</i> = 211 (9.4%)]	164 (8.6)	39 (31.7)	0	8 (50.0)	$P < 0.0001$
5–15 [<i>n</i> = 538 (24.0%)]	507 (26.6)	29 (23.6)	2 (1.0)	0	
15–50 [<i>n</i> = 1276 (57.0%)]	1113 (58.5)	38 (30.9)	123 (62.4)	2 (12.5)	
>50 [<i>n</i> = 181 (8.1%)]	106 (5.6)	3 (2.4)	72 (36.5)	0	
Weight (kg)					
3–10 [<i>n</i> = 51 (2.3%)]	27 (1.4)	16 (13.0)	0	8 (50.0)	$\chi^2 = 262$
10.1–18 [<i>n</i> = 166 (7.4%)]	133 (7.0)	27 (22.0)	0	6 (37.5)	$P < 0.0001$
>18 [<i>n</i> = 1373 (61.3%)]	1184 (62.2)	48 (39.0)	139 (70.6)	2 (12.5)	
Unknown [<i>n</i> = 650 (29.0%)]	560 (29.4)	32 (26.0)	58 (29.4)	0	

Table 5 Sting factors affecting the severity of symptoms and signs of envenomation

Sting factor	Clinical picture				Statistical significance
	Localized pain only	Systemic manifestations	Hypertension	Shock	
	<i>n</i> = 1904 No. (%)	<i>n</i> = 123 No. (%)	<i>n</i> = 197 No. (%)	<i>n</i> = 16 No. (%)	
<i>Colour of scorpion</i>					
Yellow (<i>n</i> = 853)	763 (40.1)	32 (26.0)	57 (29.0)	3 (18.8)	$\chi^2 = 38.5$ $P < 0.0001$
Black (<i>n</i> = 960)	801 (42.1)	60 (48.8)	96 (48.7)	3 (18.8)	
Unknown (<i>n</i> = 427)	340 (17.8)	31 (25.2)	44 (22.3)	10 (62.5)	
<i>Site of sting</i>					
Foot (<i>n</i> = 1345)	1170 (61.4)	61 (49.6)	114 (57.9)	0	$\chi^2 = 129.0$ $P < 0.0001$
Hand (<i>n</i> = 692)	571 (30.0)	36 (29.3)	76 (38.6)	9 (56.2)	
Body (<i>n</i> = 134)	113 (6.0)	7 (5.7)	7 (3.5)	7 (43.8)	
Head and neck (<i>n</i> = 69)	50 (2.6)	19 (15.4)	0	0	

224 (10.0%) of cases, but only six cases (2.0%) of those who had had prior antivenom had positive skin tests. Most patients received the antivenom within three hours

Table 6 Treatment with antivenom in the cases studied

Treatment details	No.	%
Time elapsed between sting and presentation at PHC centre or emergency room (hours)		
< 1	1651	73.7
1-3	460	20.5
>3	129	5.8
Previous treatment with antivenom	302	13.5
Positive skin test before injection	224	10.0
Dose of antivenom		
Not given	295	13.2
1-4 ml	833	37.2
≥ 5 ml	1112	49.6
Allergic reaction to antivenom		
Skin rash	110	4.9
Shock	4	0.2

of the sting (94.2%) and 73.7% received it within one hour. Allergic reactions to the antivenom, in the form of a skin rash, were observed in 4.9% of cases and shock in 0.2% of cases. Patients with positive skin tests were not given antivenom (224 cases). Moreover, 70 cases refused injection with antivenom. In addition to the child that failed to reach the hospital in time, a total of 295 cases did not receive antivenom.

Table 7 shows factors affecting the dose of antivenom. According to the protocol, all patients should receive five ampoules but the protocol was not followed by all doctors. Age and weight did not affect the dose given, but the dose was modified by some doctors according to the clinical presentation.

Discussion

The incidence of scorpion stings detected is clearly higher than that reported from the Libyan Arab Jamahiriya [3]. The higher incidence of scorpion stings in those over 15 years of age indicates outdoor biting. This is mainly because many are shepherds and

Table 7 Factors determining the dose of antivenom used in treatment of the cases studied

Dose of antivenom (ml)	Clinical presentation ^a				Age group ^b (year)		Weight ^c (kg)	
	Localized pain only	Systemic manifestations	Hypertension	Shock	<5	≥5	<10	>10
	n = 1904	n = 123	n = 197	n = 16	n = 245	n = 1995	n = 51	n = 1539
0	No. 262	15	15	3	40	255	6	191
n = 295	% 13.8	12.2	7.6	18.8	16.3	12.8	11.8	12.4
1-4	No. 711	29	81	12	99	734	19	495
n = 833	% 37.3	23.6	41.1	75.0	40.4	36.8	37.2	32.2
≥5	No. 931	79	101	1	106	1006	26	853
n = 1112	% 48.9	64.2	51.3	6.2	43.3	50.4	51.0	55.4

^aχ² = 30.3, P < 0.001; ^bχ² = 5.1, P > 0.05; ^cχ² = 0.50; P > 0.05

^dWeight was not recorded in the remaining 650 cases

because of the habit of enjoying the desert during leisure time. This is also seen from the increased frequency of stings during summer rather than winter. Males were more affected than females and this also indicates outdoor exposure to scorpions.

The most common sting site was the foot, in 1345 cases (60.0%). In addition, adults were more affected. Therefore, a well planned health education programme might be useful in preventing stings by advocating the use of shoes and care in handling stones, clothes and bed sheets. Females were affected by more stings in the hands than males, which is attributed to their being stung while cleaning debris or removing stones. Environmental sanitation at and around houses will help to avoid these kinds of stings. A great proportion of cases had suffered previous stings, so health education of those affected by stings should prevent further incidents.

The scorpion is a nocturnal arthropod. Unable to tolerate high temperatures, it seeks protection from the heat during the day by sheltering under rocks or debris [5]. Both the nocturnal predatory pattern and the seasonal hibernatory cycle are supported by the data in this study. In addition, increased frequency of stings during the night may be due to the increased risk of accidental contact with the scorpion in the darkness. Thus, the use of a light source while walking or camping at night in the desert will help to avoid contact with scorpions and other venomous animals.

Infants and children were severely affected by toxicity of envenomation. This is attributed to their small body mass, a proportionately greater number of stings to the head, neck and body and their poor withdrawal reflex when suffering a sting; this latter factor gives the scorpion chance to inject more venom and to inflict multiple stings. Therefore, local treatment seems to

be more important in infants and preschool children than in adults.

History of the colour of scorpion was not informative. Both those who reported being affected by black or yellow scorpions developed symptoms and signs of toxicity although the black scorpion is described as being of low toxicity [6]. As regards symptoms and signs of envenomation, tachycardia was common in our study, but it was the only sign in a large number of cases and could not be regarded in such cases as a sign of toxicity. Hypertension was common among the elderly but most of these cases were mild and they required no medication for hypertension. Our results support those described by Dittrich et al [7].

The role of antivenom treatment is not clearly established. A World Health Organization publication states that "antivenoms are among the few pharmacological agents in widespread use today whose therapeutic value remains largely untested by clinical trial" [8]. However, antivenom has been found effective against stings from some species such as *Crotalus exilicauda* in Arizona [9]. Symptomatic treatment without the use of antivenom was successful in the management of 205 cases of scorpion stings in Riyadh, Saudi Arabia, without any deaths [6]. The clinical conditions of these patients were not severe. However, 8% mortality was reported from Al Baha, Saudi Arabia [10]. This is due to a greater prevalence of more toxic species. In this study, a much lower case fatality rate was found (0.04%). This fact, in addition to the appearance of systemic symptoms and signs of envenomation in 15 % of the cases, suggest a lower prevalence of toxic species than is present in Al Baha. The good prognosis of scorpion stings suggests a beneficial role of the antivenom in the management of scorpion stings. However,

spontaneous recovery due to being affected by a less toxic scorpion species is possible.

According to the guidelines set by the Saudi Ministry of Health for treatment of scorpion stings, the dose of antivenom was changed from one to five ampoules, 1 ml antivenom. Thus, some patients were treated with one ampoule and other patients received five ampoules. In addition, some doctors at PHC centres did not adhere to the protocol and gave variable doses, from one to six ampoules, according to the severity of the symptoms. We suggest that the use of antivenom should be restricted to those showing systemic manifestations of

envenomation and only be used after skin testing because of the common allergic reactions encountered.

In conclusion, the high incidence of scorpion stings in Hail region suggests the necessity of preventive programmes for decreasing the incidence. Such programmes could start by educating those affected by scorpion stings on how to avoid further stings. In addition, local treatment is particularly important for infants and preschool children. Finally, the use of antivenom should be restricted to those with systemic manifestations as it is better kept for such cases.

References

1. Mohammed KS, Soud AE. *Poisonous snakes in the kingdom of Saudi Arabia. Types, breeding sites and prevention against its toxins*, 2nd ed. Riyadh Saudi Arabia, King Saud University, Faculty of Science, 1992.
2. Plorde J. Diseases caused by bites and stings. In: *Harrison's principles of internal medicine*, 10th ed. Petersdorf et al., eds. New York, McGraw-Hill, 1985:1245.
3. Warrell D. Animal poisons. In: *Manson's tropical diseases*. Manson PEC, Bahr, Bell DR, eds. London, Baillière Tindall, 1987: 889-90.
4. Warrell DA et al. Comparison of Pasteur and Behringwerk antivenoms in envenoming by the carpet viper (*Echis carinatus*). *British medical journal*, 1980, 280:607-9.
5. Brownell PH. Prey detection by the sand scorpion. *Scientific American*, 1984, 251:94-105.
6. Neale JR. Scorpion sting syndrome in eastern Riyadh. *Annals of Saudi medicine*, 1990, 10(4): 383.
7. Dittrich K, Power AP, Smith NA. Scorpion sting syndrome—a ten year experience. *Annals of Saudi medicine*, 1995, 15:148.
8. World Health Organization. *Progress in the characterization of venoms and standardization of antivenoms*. Geneva, World Health Organization, 1981 (WHO Offset Publication No. 58).
9. Charele SS, Mary TI. *Emergency diagnosis and treatment*, 4th ed. USA, Lange Medical Books, 1990:723.
10. Fatani AJ. *Some pharmacological studies of the cardiovascular and related effects of scorpion envenomation: the setting up of an experimental treatment protocol* [Dissertation]. Riyadh, Saudi Arabia, King Saud University, 1987.