**Epidemiological aspects of scorpion stings in Al-Jouf Province, Saudi Arabia**

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**BACKGROUND:** Information on scorpion stings is available for many parts of Saudi Arabia, but not for Al-Jouf Province.

**METHODS:** We reviewed and analyzed 1449 cases of scorpion stings that presented to the emergency department of the hospitals and medical centers in Al-Jouf Province during a 2-year period (2005-2006).

**RESULTS:** The majority of patients (92.7%) manifested class I envenomation with local pain at the sting site as the primary complaint. Systemic toxicity was noticed in 7.3% of cases but no deaths were reported. Scorpion stings were recorded throughout the year with the highest seasonal incidence in the summer (64.3%) and the lowest during the winter (10.6%). The highest monthly incidence was in June (21.5%) and the lowest in December (1.5%). Most of the patients were male (77.3%) and the age of 44.2% of victims ranged between 15 to 30 years. Diurnal stings exceeded the nocturnal ones with a ratio of 3:2, and most of the stings were located mainly on the exposed limbs (88.6%), especially the lower limbs (51.7%). *Leiurus quinquestriatus* and *Androctonus crassicauda* were incriminated in most recorded cases.

**CONCLUSIONS:** Our findings indicate that scorpion stings are common in Al-Jouf Province, especially during the summer. The overall threat to human health was found to be low.

Scorpion sting syndrome is a medical problem that represents a real threat in many parts of the world including Saudi Arabia. Annually, thousands are stung by scorpions in Saudi Arabia with an average of 14,500 stings per year. While considerable information is available about scorpion sting syndrome in most districts of Saudi Arabia, little is known about scorponism in Al-Jouf province. The present study aims to assess the risk of scorpion stings together with the efficacy of scorpion antivenom therapy, and to clarify the epidemiological features of scorpion stings in this province.

**METHODS**

This study was based on 1449 cases of scorpion stings submitted to the emergency department at the hospitals and medical centers of cities and towns of Al-Jouf province, Saudi Arabia (Skaka, Domat Al-Jandal, Tabarjal and Qorayat) (latitude, 29°47 N, longitude 40°06 W) over a period of 2 years (January 2005-December 2006). The victims belonged to ten nationalities (Saudi and non-Saudi). The data were extracted from the victim records and analyzed by age, sex, time of sting and submission (month and time of day), sting location on body, scorpion species, presenting complaint, systemic symptoms, received treatment, period of observation and outcome of each sting. The clinical severity of each case was assessed according to Abroug’s classification, where the envenomation cases were sorted into class I: local symptoms at the site of sting; class II (symptomatic): thrill, sedation, nausea, vomiting, diarrhea and hypertension; class III (systemic): cardiovascular, respiratory, and/or neurological disorders.

**RESULTS**

The total number of scorpion stings reviewed in Al-Jouf province over the period (2005-2006) was 1449 (Table 1). The total number of sting cases by city was 381 in Skaka, 149 in Domat Al-Jandal, 575 in Tabarjal, and 344 in Qorayat. The notification records indicated that the elapsed time between the sting and patient admission ranged between 30 to 90 minutes. Treatment protocols included sensitivity tests and injection of 5 mL of polyvalent antiscorpion venom vaccine. Most of the stung patients received the antiscorpion venom vaccine within 45 to 120 minutes after the sting. In addition,
the spring months (March and April) there was a relatively moderate rate of scorpion envenomation (14.1%). The highest rate of scorpion stings was in June (21.5%) followed by July (15.1%), while the lowest one was in December (1.5%). The peak incidence occurred from May to October (Figure 1).

The gender distribution was 77.3% male and 22.7% female. The male incidence exceeded the female one during all months of the 2-year study period, for a male-female sting ratio of 3.4:1. Non-Saudi female victims represented 6.7% of the total stung females and all were housemaids. The non-Saudi male victims constituted 20.4% of stung males; most were farm workers.

The highest incidence of stings (45.1%) was recorded for the 15-30 year age group. Sting incidence for patients younger than 6 years old was 4.2%, while those 6-15 years old had an incidence of 17.6%, and 66% of the victims were younger than 30 years of age. Only 6.8% of the sting cases were seen in patients older than 50 years of age, with a considerable number of stings (22.5%) recorded in the age category of 30-50 years old.

Nocturnal and diurnal stings accounted for 41% and 53% of stings, respectively, while the incidence of undecided time cases was 6%. The majority of stings occurred in the early morning and in the first half of the night. The incidence of sting sites was as follows: lower limbs (51.7%), upper limbs mainly in the right hand (36.9%), neck and head (2.3%) while the rest of stings were on other parts of the body.

The data showed that 94.7% of the stung persons received treatment, 5.3% refused treatment, 43.7% were treated and discharged home, 31.6% were observed after treatment, 19.4% were hospitalized and 1.9% abandoned hospitalization against medical advice and were lost to follow-up. No deaths were recorded.

According to Abroug’s classification (1994), the clinical severity was mainly class I where local pain was the primary presenting compliant (92.3%). Swelling, redness and tenderness were also noted at the sting site. Systemic toxicity (class II envenomation) was seen in 7.3% of the admitted patients. Signs of systemic envenomation included mainly hypertension, restlessness and to a lesser extent anxiety, vomiting and tachycardia. Systemic envenomation was encountered mainly in patients having a history of hypertension or diabetes. Six patients (0.4%) manifested evidence of severe envenomation.

In the medical reports, the scorpions were described as black and yellow. Fifty-six percent identified the color as yellow, and 34.5% as black. The incidence of undecided scorpion color was 9.1% of the stings. The scorpions brought to the medical centers by the patients or their

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**Table 1.** Characteristics and disposition of patients stung by scorpions in Al-Jouf province (January 2005-December 2006).

| Patient age (years) | Percent |
|--------------------|--------|
| 1-5                | 4.2    |
| 6-15               | 17.6   |
| 16-20              | 7.9    |
| 20-29              | 36.3   |
| 30-39              | 11.6   |
| 40-49              | 10.9   |
| 50-59              | 5.9    |
| <60                | 0.88   |

| Sex                | Percent |
|--------------------|---------|
| Male               | 77.3    |
| Female             | 22.7    |

| Nationality        | Percent |
|--------------------|---------|
| Saudi              | 79.6    |
| Non-Saudi          | 21.4    |

| Stung patients     | Percent |
|--------------------|---------|
| Refused treatment  | 5.3     |
| Received treatment | 94.7    |
| Treated and discharged home | 43.7 |
| Observed after treatment | 31.6 |
| Hospitalized       | 19.4    |
| Abandoned hospitalization | 1.9 |

| Envenomation severity | Percent |
|-----------------------|---------|
| Class I envenomation   | 92.3    |
| Class II envenomation   | 7.3     |
| Class III envenomation   | 0.4     |

| Outcome               | Percent |
|-----------------------|---------|
| Recovery              | 100     |
| Lethality             | 0.0     |

| Time of sting         | Percent |
|-----------------------|---------|
| Diurnal               | 53      |
| Nocturnal             | 41      |

| Sting site            | Percent |
|-----------------------|---------|
| Lower limbs           | 51.7    |
| Upper limbs           | 36.9    |
| Other body parts      | 9.1     |
| Neck and head         | 2.3     |
relatives were classified as *Leiurus quinquestriatus* and *Androctonus crassicauda*. A lack of experience in scorpion taxonomy was noticed among health professionals at the emergency department of the hospitals and medical centers in the province under study.

**DISCUSSION**

Al-Jouf Province is located in the north of Saudi Arabia, bordering Jordan, with an average elevation of 689 meters above sea level and a tropical desert climate, with an average humidity of 36.5%. This province includes four small cities (Skaka, Domat Al-Jandl, Tabarjal and Qorayat) together with many small villages. It has an area of 139 000 km² and a population of 362 000 in 2006, according to Saudi National Department of Statistics, corresponding to 13 inhabitants/5 km².

Scorpions are widely distributed in Saudi Arabia and the Arabian Peninsula in general. Fourteen species have been identified in Saudi Arabia, with six of these recorded in Al-Jouf province. The results of the present study indicate that 1449 scorpion stings were recorded in Al-Jouf province during two years (2005-2006) with an average of 4 cases/1000 inhabitants annually. No deaths were recorded in spite of the high incidence of stings. This finding is in agreement with the results of some investigations in other regions of Saudi Arabia,10-13 but not with others that reported deaths following scorpion stings in some areas of the Kingdom.11-15

Some studies reported that the mortality rate due to scorpion stings in Saudi Arabia was 3% between 1985 and 1993,10,16 but was less than 0.05% in 1997.1 Similar studies in Jordan and Morocco have shown a high rate of scorpion sting envenomation with several deaths.17-19 In some countries, such as Brazil, Mexico and Venezuela, scorpion envenomation is considered a real public health issue.20-21 In the city of Durango in Mexico, 1608 deaths were recorded in a 30-year period, with an average of 800 to 1000 deaths per year in all Mexico21-22 while in the past 20 years, there have been no reported fatalities in the US due to scorpion stings.

The present study shows that scorpion stings are frequent during the summer months (May through September), with a maximum frequency in June, which suggests that support for emergency departments should be increased during summer months. This result is in agreement with that of previous studies concerning the seasonal variations of scorpion stings in Riyadh city and in Saudi Arabia in general. The seasonal scorpion sting cycle in Al-Jouf district may reflect the annual climate variations in this area, activities of inhabitants, and the ontological behavior of scorpions. The peak incidence of stings in the summer months and the lowest incidence in winter could be attributed to the fact that scorpions become less active in the winter season. The periods with the highest incidence of scorpion stings in other countries were April to July in Mexico and July to September in Tunisia and Morocco, with a maximum frequency during July and August in Tunisia and Morocco, respectively. In Brazil, stings occur regularly throughout the year, with a slight increase in August.19,23-25 These variations may reflect differences in environmental conditions, especially a rainy or dry climate.
Stings among males outnumbered females in our study, which is in agreement with the results of previous studies focusing on the epidemiology of scorpion stings in Saudi Arabia\textsuperscript{2,3,9} and also in other countries such as Brazil.\textsuperscript{25} However, the present results contradict the findings in other countries such as Tunisia and Morocco where males and females are almost equally affected.\textsuperscript{19,24} The male predominance in Saudi Arabia may be related to the lifestyle where women spend most of their times indoors with their families.

Presently, the high rate of scorpion stings among victims younger than 30 years old may be explained by the fact that most stings occur during work. It is obvious that this age category is associated with most outdoor activities. The current results point to a high rate of stings in the lower limbs, with the upper limbs next. This finding is similar to that reported in Brazil where stings are mainly encountered in the hands.\textsuperscript{25} These observations may be explained on the basis that the exposed limbs are usually used in most manual activities. Stings in other parts of the body such as the neck and head take place while lying down for rest or sleep. These findings suggest that using proper shoes and gloves during farm work would help prevent stings.

Of 14 species belonging to \textit{Buthidae} and \textit{Scorpionidae} that have been indentified in Saudi Arabia,\textsuperscript{8,26} only six species have been identified in Al-Jouf province.\textsuperscript{4} The present study incriminates \textit{Leiurus quinquestriatus} and \textit{Androctonus crassicauda} in Al-Jouf scorpionism. These two species are also the most common species accounting for human stings throughout Saudi Arabia, the Arabian Peninsula and the Middle East.\textsuperscript{2-4,14,27-29} The predominance of stings by \textit{L. quinquestriatus} is in agreement with the finding of Dittrich et al.,\textsuperscript{10} but contrary to the results by Al-Sadoon,\textsuperscript{4} who concluded that stings by \textit{A. crassicauda} occurred more often than those of \textit{L. quinquestriatus}. Other deadly species have been reported in Saudi Arabia such as \textit{Nebo hierochonticus}.\textsuperscript{15} Globally, there are dangerous species such as \textit{Tityus stigmurus}, \textit{T. serrulatus} and \textit{T. brazili} in Brazil,\textsuperscript{20,25,30} \textit{Centruroides suffusus} in Mexico,\textsuperscript{16} \textit{Hemiscorpius lepturus} in Iran,\textsuperscript{31} \textit{Centruroides sculpturatus} in the United States, \textit{Mesobuthus tamulus} in India\textsuperscript{32} and \textit{Androctonus mauretanicus} in North African countries.\textsuperscript{18-19,33}

Local pain was the primary presenting complaint in our study. This finding is in agreement with the results of other reports from Saudi Arabia.\textsuperscript{2-4,10} The incidence of systemic envenomation in Al-Jouf province is less than that reported by similar investigations in other districts of Saudi Arabia,\textsuperscript{2-5,10} a point that remains to be investigated.

In conclusion, the high rate of scorpion stings in Al-Jouf province does not imply a real medical threat. This may be due to the excellent medical facilities and antivenom employment in recent years in different regions of Saudi Arabia including Al-Jouf province. Also, the present findings indicate the success of the Saudi national strategy against scorpion stings as a consequence of the establishment of national records and hospitalization files on scorpionism by the Ministry of Health.

\textbf{Acknowledgements}

\textit{We are grateful to the emergency departments at the hospitals and medical centers in Al-Jouf province, Saudi Arabia for giving us access to their medical records.}
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