

ORIGINAL ARTICLE

The current practice and outcomes of managing scorpion stings in Riyadh

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ABSTRACT

Background: Scorpion stings are a significant public health issue in many underdeveloped tropical and sub-tropical countries. The aim of this study was to review the demographics of scorpion stings in Riyadh region, the current practice of management, the utility of the laboratory investigations, and their effect on hospitalizations, length of stay in the emergency department (ED), and return visits.

Methods: This is a retrospective observational descriptive chart review study. Data were collected from the electronic health system (BESTCare2.0A.Ink) during January 2016–April 2019. We included all adult patients (>14 years old) who presented to King Abdul-Aziz Medical City (KAMC) complaining of clinical manifestations of scorpion envenomation.

Results: We collected 286 patients; the mean age was 34.5 (± 13.8). Male patients represented 85.66% of the sample. All the patients presented with either Grade 1 (83.6%) or Grade 2 (16.4%) envenomation severity, and all of them had different pain control interventions. Antivenom was given to only one patient unnecessarily. Overall, the mean ED length of stay by hours was 2.7 (± 1.6). Only 33.22% of the patients had obtained laboratory investigations that were normal or clinically insignificant. There was a significant increase in the ED length of stay between the patients who did and those who did not obtain laboratory investigations (3.9 ± 1.5 vs. 2.1 ± 1.3 hours; p -value = 0.0001).

Conclusion: The study redemonstrates the predominance of weak scorpion envenomation in Riyadh region. We observed that patients with Grades 1 and 2 envenomation could be managed safely without ordering laboratory investigation or using antivenom therapy.

Keywords: Scorpion envenomations, scorpion sting, Riyadh, antivenom.

Introduction

Scorpion stings are a significant public health issue in many underdeveloped tropical and subtropical countries, especially in Sahelian Africa, South India, the Middle East, Mexico, and South Latin America [1,2]. It is also a significant public health issue in Saudi Arabia with more than 25 scorpion species identified in the country [3–6]. One study showed that the total number of scorpion stings in 11 selected areas of Saudi Arabia between 1993 and 1997 was 72,168, with an estimated average of 14,500 stings per year [7]. Scorpion envenomation has different clinical presentations, ranging from local pain to paresthesia at the sting site (Grade 1) plus remote pain and paresthesia (Grade 2). The more severe presentations feature cranial nerve or somatic skeletal neuromuscular dysfunction, which may be accompanied by autonomic dysfunction (Grade 3). Finally, it can manifest as both cranial nerve dysfunction and somatic skeletal

neuromuscular dysfunction (Grade 4) [8]. The previous study, which was conducted in Riyadh, reviewed 391 cases, and 75% of the patients showed local signs and symptoms. Most of the patients (72.1%) were treated with antivenom (282). The study concluded that the high prevalence of scorpion stings exhibiting only mild signs/symptoms without any mortality suggests the predominance of weak-venomed scorpion species.

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Therefore, the protocol of managing scorpion-sting patients with antivenom irrespective of the intensity of the manifestations warrants a detailed review [9]. Other studies conducted in Saudi Arabia and neighboring countries have shown that the majority of scorpion envenomation elicit local manifestations, and they have also noted the uncertainty of administering antivenom in correlation with clinical manifestations [5,9–11]. An early study conducted in Al-Madena Al-Munawara, which investigated hematological and biochemical effects in children stung by scorpions, did not reveal any significant hematological or biochemical abnormalities secondary to scorpion stings in children [10].

We believe that the practice of managing scorpion stings changed since the previous study [9]. Therefore, we conducted this study to review the demographics of scorpion stings in the Riyadh region and the current practices in terms of management and the utilization of laboratory investigations, together with their effect on hospitalizations, lengths of stays in the emergency department (ED), and return visits.

Subjects and Methods

The study was a retrospective observational descriptive chart review using BESTCare2.0A.Ink, the health electronic system implemented in King Abdul-Aziz Medical City (KAMC) at the time of this study. It was a consecutive sample from January 2016 to April 2019. Patients were categorized into two groups. The first group received laboratory investigations with treatment, and the second group was treated without laboratory investigations.

We involved all adult patients (over 14 years old) who presented to the adult emergency medicine department in KAMC complaining of clinical manifestations related to

scorpion envenomation. We excluded all other types of envenomations (snakes, spiders, or if unknown, stingers).

Data were collected using an electronic data collection sheet designed by the Open Data Kit system, KoBoToolBox, which was developed by the Harvard Humanitarian Initiative and Office for the Coordination of Humanitarian Affairs (OCHA) (kobotoolbox.org). The data were analyzed. Bars were created using KoBoToolBox and Excel, and a *t*-test was used to compare the length of ED stay between the group of patients who received laboratory investigations and the group that did not.

Results

A total of 286 patients met the study inclusion criteria during the period January 2016–March 2019. Baseline characteristics (Table 1) showed that the patients' mean age was 34.5 (± 13.8); male patients represented the majority (85.6%).

All the patients presented with either Grade 1 (83.5%) or Grade 2 (16.4%) envenomation, according to the classification system used in this study [8]. Among the presented patients, 66.7% were treated without laboratory investigations, whereas 33.2% of the presented patients received laboratory investigations. Overall, patients received different analgesic regimens. Acetaminophen was the most common type of analgesia administered (43.7%). Nonsteroidal anti-inflammatory drugs (NSAIDs) (diclofenac IM) were given to 26.2% of the patients. Regional nerve blocks were administered to 12.9% of the patients, and opioids (morphine intravenous (IV)) were used in 10.4% of the patients. Other treatment modalities used included IV diphenhydramine (4.2%), cooling measures (1.0%), and IV promethazine (0.3%). Interestingly, the antivenom was administered only one time to a patient who

Table 1. Baseline characteristics

Characteristic	Result
Age	Mean 34.52 (± 13.80)
Gender	Male (85.66%)
Clinical presentation Scorpion envenomation with neuromuscular toxicity (grading of severity) [8].	Grade 1 (83.57%) Grade 2 (16.43%) Grade 3 (0%) Grade 4 (0%)
Laboratory investigations	- 191 patients with non-laboratory (66.78%) - 95 patients with laboratory (33.22%)
ED management	Acetaminophen (43.71%) NSAID (26.22%) Nerve block (12.94%) Opioid (10.49%) Antivenom (0.35%) Others* (5.59%)
The patient discharged on oral analgesia (without in-ED management)	26.92%
Tetanus vaccine	33.92%
Overall length of stay in ED (hours)	Mean (2.68 $\pm$ 1.61) <2 (42.31%) 2–4 (39.86%) 4–6 (13.29%) >6 (4.55%)
Hospital admission	0 %
Complication or return visit to ER within 2 weeks	0.39 %**

*Diphenhydramine (4.2%), cooling measurement (1.05%), promethazine (0.35%).

**Only one patient (laboratory group) made a return visit to the ED for pain control.

presented with Grade 2 envenomation, and the decision was made by the primary physician without toxicologist consultation. It seems not to have changed the outcome. There was a group of patients (26.9%) that mostly presented with Grade 1 envenomation; they were discharged on oral analgesia, either acetaminophen or NSAIDs, without any in-ED management. The tetanus vaccine was given to only 33.9% of the presented patients.

Overall, the mean ED length of stay, in hours, was 2.6 (± 1.6). 42.3% of patients spent less than two hours in the ED. 39.8% of patients spent between 2 and 4 hours in the ED. 13.2% of patients spent between 4 and 6 hours in the ED, and 4.5% of patients spent more than 6 hours in the ED.

There were zero hospital and intensive care unit admissions; all patients were managed and discharged from the ED. Among all the presented patients, there was only one patient (0.3%) who made a return visit to the ED after a couple of hours for pain control; the patient received pain management and was discharged. There were no documented cases of mortality, anaphylaxis, pulmonary edema, limb threat, or hematological or DIC sequelae.

Scorpion sting frequency is shown in Figure 1. According to the seasonal distribution (January 2016-December 2018), we excluded patients who presented in 2019 from the figure data to have the exact number of envenomations per month. We noticed that the rate of envenomations increased in the summer months.

In grading the severity of scorpion envenomations among the presented patients, Figure 2 shows that

58.7% came from the non-laboratory group and 24.8% from the laboratory group. They presented with Grade 1 envenomation; however, the rest of the patients, 8.0% from the non-laboratory group and 8.3% from the laboratory group, presented with Grade 2 envenomation. Zero patients presented with Grade 3 or 4 envenomation in either group.

We compared the management of scorpion stings among patients who received laboratory investigations and those who did not in Table 2. Both groups were treated with different modalities of analgesia, but only one patient in the laboratory group presented with Grade 2 envenomation. He had received the antivenom regardless of his laboratory results (which were within normal range); this decision was made by the primary physician without a toxicologist consultation.

The laboratory investigation and results showed in Table 3 indicate that more than 420 laboratory tests were sent. CBC, basic screen, and coagulation profile were the most commonly ordered. The majority of laboratory results were within the normal range; even the abnormal results were not clinically significant and did not have any implications for the patients' management.

The length of stay in the ED is a major concern for treating physicians, so one of the study goals was to measure the effects of ordering laboratory investigations on this variable. Table 4 shows that there was a statistically significant (p -value 0.0001) difference in the length of stay in the ED in hours between a patient who did not obtain a laboratory investigation and a patient who did (2.0 ± 1.3 vs. 3.8 ± 1.5). Patients who were discharged less than 2 hours after ED presentation made up 39.5% of the non-laboratory group and 2.8% of the laboratory

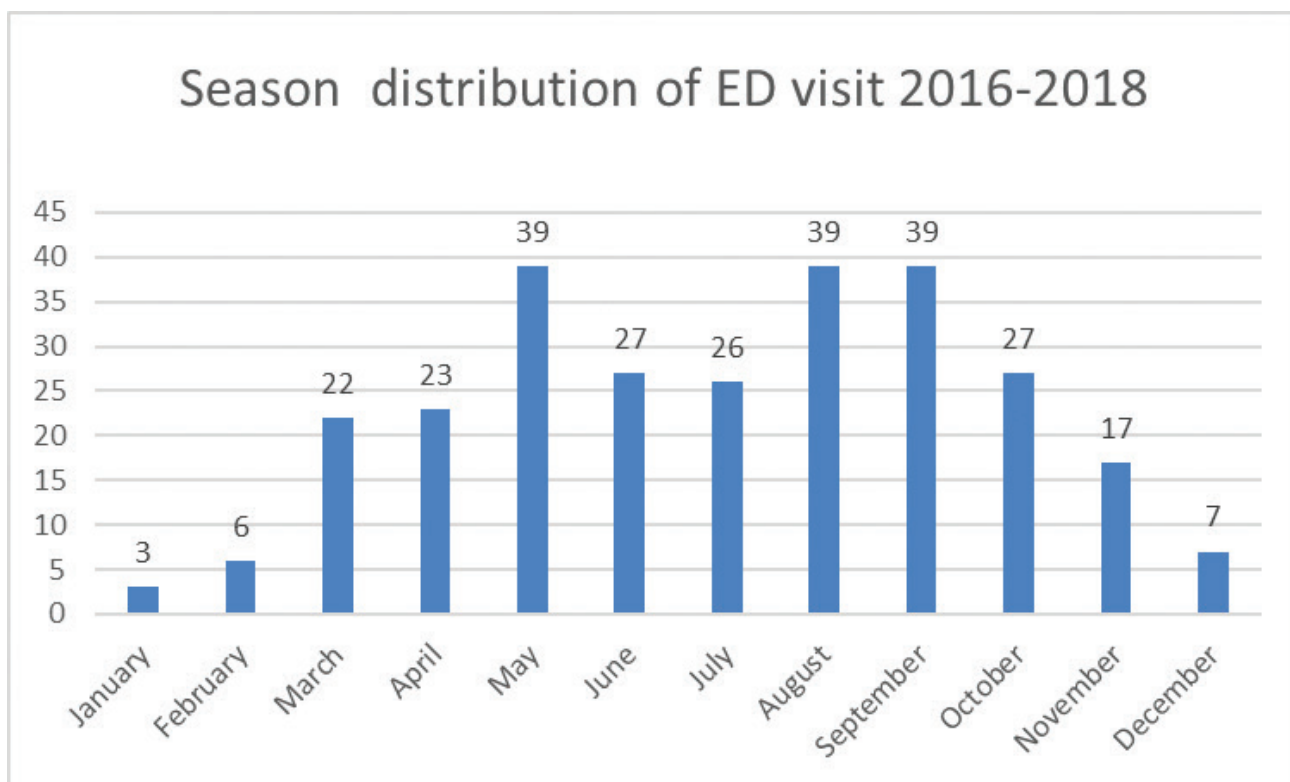


Figure 1. Distribution of incidence by month (2016-2018) for scorpion envenomation patients who presented in the ED of KAMC.

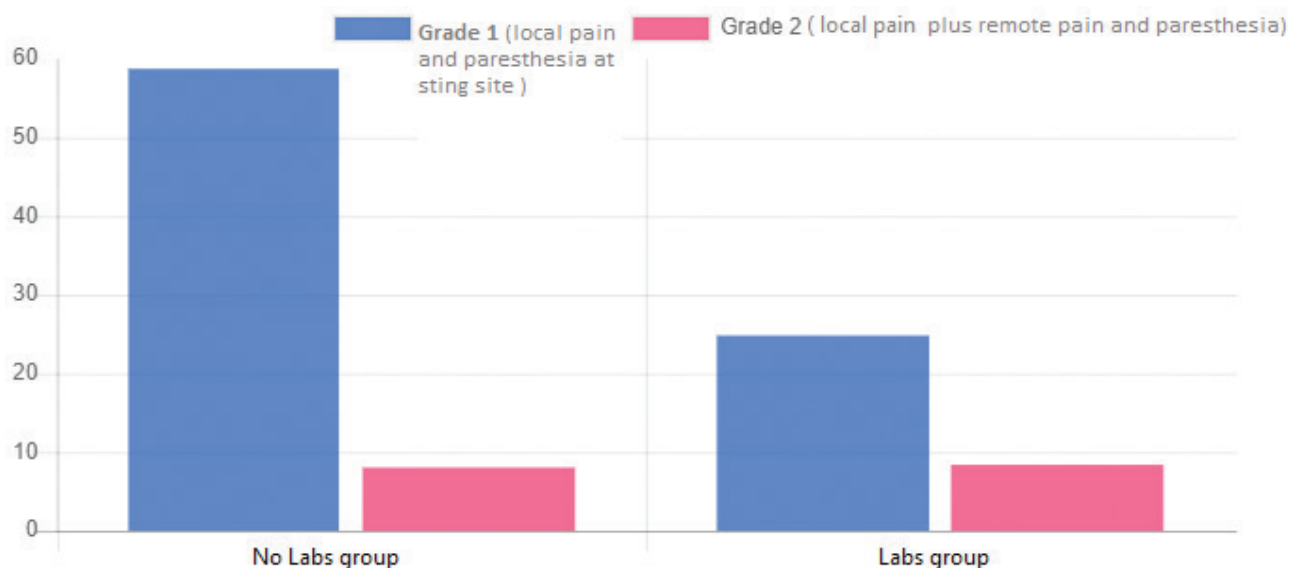


Figure 2. Distribution of patients according to grades of scorpion envenomation among patients who received laboratory investigations and patients who did not.

Table 2. Management of scorpion stings among patients who received laboratory investigations and patients who did not.

In ED management	Non- laboratory group: 191 patients (66.78%)	Laboratory group: 95 patients (33.22%)
Acetaminophen	18.28%	16.34%
NSAIDs	13.02%	7.76%
Nerve block	8.31%	1.94%
Opioids	2.77%	5.54%
Antivenom	0%	0.28%
Others*	1.66%	2.77%
Discharged on oral analgesia**	18.01%	3.32%

* Diphenhydramine, cooling measurement, and promethazine.

** Without any in-ED management

group. Patients who stayed between 2 and 4 hours made up 21.6% of the non-laboratory group and 18.1% of the laboratory group. Patients who stayed between 4 and 6 hours made up 4.5% of the non-laboratory group and 8.7% of the laboratory group. Patients whose stays exceeded 6 hours made up 1.0% of the non-laboratory group and 3.5% of the laboratory group.

Discussion

This study is important because it shows that the current practice of scorpion sting management in the Riyadh region has changed. Antivenom is one of the most controversial aspects of the management of scorpion envenomation [12], and previous local studies have shown uncertainty and variable practices among treating physicians [9,11,13]. Of 286 patients, only one patient received antivenom, which was not indicated; all of the other patients were treated without the antivenom and discharged safely from the ED, and there were no documented complications or mortalities resulting from withholding the antivenom.

Table 3. Number of laboratory tests and their results for scorpion sting patients who presented in ED of KAMC.

Laboratory test	Result
Complete blood count (×95)	Normal (83.16%)
Basic screen (×93) *	Normal (70.97%)
Renal profile (×57)**	Normal (98.25%)
Liver enzyme (×39)	Normal (92.31%)
Amylase (×24)	Normal (100%)
Coagulation profile (×73) ^a	Normal (94.52%)
Troponine (×18)	Normal (100%)
Others (×22)	
Creatine kinase (×10)	Normal (90%)
Creatine kinase-myocardial band (×4)	Normal (100%)
Lactate dehydrogenase (×3)	Normal (100%)
Fibrinogen (×2)	Normal (100%)
D-Dimer (×3)	Normal (66.6%)

*Basic screen includes sodium, potassium, chloride, glucose random, blood urea nitrogen, creatinine, serum HCO₃, and measured anion gap

**Renal profile includes albumin, adjusted calcium, phosphorus, magnesium, and uric acid.

^aCoagulations profile includes prothrombin time, partial thromboplastin time, and international normalized ratio.

This study also focused on the utilization of laboratory investigations for the management of scorpion sting patients. Only one study had previously been conducted, and it was only concerned with laboratory results for the pediatric population [10]. This study was conducted on adult patients to seek correlations between the laboratory results and the different modalities of management; it revealed that the laboratory results were normal for most of the patients and that even the abnormal laboratory results were not clinically significant and did not divert the course of management. Moreover, ordering laboratory investigations was associated with a significantly prolonged ED stay. We find in the Baha et al. study, performed in Qatar, that 97% of the patients spent less than 4 hours in the ED, whereas 82% of the patients spent less than 4 hours [11]. We believe that we have a similar spectrum of diseases, and the longer length of stay is

Table 4. Difference in length of stay in ED in hours between patients did not receive laboratory investigations and patients who did.

Length of stay in ED in hours	Non-laboratory group	Laboratory group	
Overall time	2.09 ± 1.30	3.85 ± 1.53	
<2	39.51%	2.8%	p-value (0.0001)
2-4	21.68%	18.18%	
4-6	4.55%	8.74%	
>6	1.05%	3.5%	

either due to over-ordering laboratory investigations or a slightly busier ED.

On the contrary to other studies that have shown more severe envenomations and complications [1,2], this study measured the grades of clinical presentation for scorpion envenomation. It redemonstrate the same predominantly weak envenomations as previous studies conducted in Riyadh, in other kingdom cities, and in a neighboring country [7,9,11]. In the study of Al Asmari et al., 25% of patients were labeled as systematic envenomations, whereas, in this study, no patients presented with systemic envenomations. This is due to differences in the grading systems; the other study labeled any patient with symptoms other than local pain as systemic envenomations. These symptoms included discomfort, dysphoria headaches, and tachycardia. In this study, we used specific grading systems for scorpion envenomation [8,9]. All of the patients were discharged from the ED; in addition, 26.22% of patients were discharged on oral analgesia (acetaminophen and ibuprofen) without any in-ED management. Previous evidence suggests that meperidine and other opioids were possibly harmful when given to envenomated subjects [13,14], whereas this study showed that 30 patients (10.5%) were safely treated with morphine IV and did not experience any complications.

Limitations

This was a retrospective, single-center, chart review study. A prospective national study is required to gain a deeper understanding of the grades of envenomation in different regions of the Kingdom and to compare the efficacy of different analgesic modalities.

Conclusion

The study reassesses predominantly weak scorpion envenomation in the Riyadh region. We observed that patients who presented with local envenomation Grades 1 and 2 could be managed safely without ordering laboratory investigations or administering antivenom.

List of Abbreviations

CBC	Complete blood count
ED	Emergency department
ER	Emergency room
IV	Intravenous
KAMC	King Abdul-Aziz Medical City
NSAIDs	Nonsteroidal anti-inflammatory drugs
OCHA	Office for the Coordination of Humanitarian Affairs

Conflicts of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication

Not applicable.

Ethical approval

Given the retrospective/observational design of the study, ethics approval is not required in the institution.

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References

1. Khatony A, Abdi A, Fatahpour T, Towhidi F. The epidemiology of scorpion stings in tropical areas of Kermanshah province, Iran, during 2008 and 2009. *J Venom Anim Toxins Incl Trop Dis*. 2015;21:e45. <https://doi.org/10.1186/s40409-015-0045-4>
2. Queiroz AM, Sampaio VS, Mendonça I, Fé NF, Sachett J, Ferreira LC, et al. Severity of scorpion stings in the Western Brazilian Amazon: a case-control study. *PLoS One*. 2015;10(6):e0128819. <https://doi.org/10.1371/journal.pone.0128819>
3. Al Asmari AK, Al Saif AA. Scorpion sting syndrome in a general hospital in Saudi Arabia. *Saudi Med J*. 2004;25:64–70.
4. Jahan S, Mohammad Al Saigul A, AbdulRahim Hamed S. Scorpion stings in Qassim, Saudi Arabia: a 5-year surveillance report. *Toxicon*. 2007;50:302–5. <https://doi.org/10.1016/j.toxicon.2007.03.013>
5. Jarrar BA, Al Rowaily MA. Epidemiological aspects of scorpion stings in Al Jouf Province, Saudi Arabia. *Ann Saudi Med*. 2008;28:183–7. <https://doi.org/10.5144/0256-4947.2008.183>
6. Al-Asmari AK, Al-Saif AA, Abdo NM, Al Moutaery KR. New additions to the scorpion fauna of Riyadh region, Saudi Arabia. *J Venom Anim Toxins Incl Trop Dis*. 2009;15:612–32. <https://doi.org/10.1590/S1678-91992009000400003>

7. Al Sadoon MK, Jarrar BA. Epidemiological study of scorpion stings Saudi Arabia between 1993 and 1997. *J Venom Anim Toxins*. 2003;9:1–8. <https://doi.org/10.1590/S1678-91992003000100003>
8. Curry SC, Vance MV, Ryan PH, Kunkel DB, Northey WT. Envenomation by the scorpion *Centruroides sculpturatus*. *J Toxicol Clin Toxicol*. 1984;21:417–49. <https://doi.org/10.3109/15563658308990433>
9. Al Asmari AK, Al Zahrani AG, Al Jowhary S, Arshaduddin M. Clinical aspects and frequency of scorpion stings in the Riyadh region of Saudi Arabia. *Saudi Med J*. 2012;33(8):852–8.
10. El-Amin EO, Ul-Din-Khan M. Hematological and biochemical findings in scorpion stung children. *Ann Saudi Med*. 1991;11(6):625–7. <https://doi.org/10.5144/0256-4947.1991.625>
11. Alkahlout BH, Abid MM, Kasim MM, Haneef SM. Epidemiological review of scorpion stings in Qatar. The need for regional management guidelines in emergency departments. *Saudi Med J*. 2015;36(7):851–5. <https://doi.org/10.15537/smj.2015.7.11749>
12. Isbister GK, Bawaskar HS. Scorpion envenomation. *N Engl J Med*. 2014;371:457–63. <https://doi.org/10.1056/NEJMr1401108>
13. Stahnke HL, Dengler AH. The effect of morphine and related substances on the toxicity of venoms. *Am J Trop Med Hyg*. 1964;13:346–51. <https://doi.org/10.4269/ajtmh.1964.13.346>
14. Greenberg L, Ingalls JW. Effect of drugs on survival time from scorpion envenomation. *J Pharm Sci*. 1963;52:159–61. <https://doi.org/10.1002/jps.2600520212>