

SCORPION STINGS IN ONE PROVINCE OF MOROCCO: EPIDEMIOLOGICAL, CLINICAL AND PROGNOSIS ASPECTS

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ABSTRACT: The present study aimed at verifying the impact of a Moroccan strategy against scorpion stings and, specifically, at identifying the epidemiological features of the patients envenomed or just stung by scorpions. The investigation included 4089 patients from a province of Morocco which were evaluated over three years (2001, 2002 and 2003). Most stings occurred during the hot period and mainly at night (between 6:00 p.m. and 12:00 p.m.). The average incidence was 2.8‰, the average age of the patients was 26.7 ± 18.2 years, and the envenomation rate was 6.7%. Mortality rate was 0.05‰, and average lethality rate was 0.7%. Analysis of variance showed that young age, symptoms at admission, and long time elapsed between sting and admission were correlated with poor outcome. Comparison among data of the three years revealed an increasing number of reported cases and decreasing morbidity and mortality.

KEY WORDS: epidemiology, scorpions, strategy, Morocco.

CONFLICT OF INTEREST: There is no conflict.

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INTRODUCTION

Scorpions play an important role in cases of severe human toxicity in Morocco. Previous epidemiological studies showed that scorpion stings accounted for 30% of all the envenomation cases reported to the Poison Control Center of Morocco (CAPM) and mainly occurred in South and Central South provinces of the country, where the highest mortality rate (up to 53%) has been reported.

Ninety percent of the fatal victims were younger than 10 years old (24). According to data from the national strategy against scorpion stings, approximately 25000 stung patients are currently recorded every year in Morocco.

In other North African countries, besides Morocco, the genera *Androctonus* and *Buthus* are most frequently involved in scorpion stings. *Androctonus* species, which are considered very aggressive to humans, are responsible for the highest envenomation frequency and severity; they are endemic and well adapted to the presence of humans. *Androctonus mauretanicus mauretanicus* is the most lethal scorpion species in Morocco (22). One component of the national strategy against scorpion stings is an information system which was established, based on a national records and hospitalization files, to trace morbidity and mortality indicators. The present study aimed at investigating such indicators using the national records from Khouribga province, Morocco, over 3 years (2001, 2002 and 2003) as well as at describing the province specific epidemiological map, defining the disease prognosis, and, finally, assessing the impact of the national control strategy on scorpionism.

MATERIALS AND METHODS

Study Area and Population

Khouribga is a province located in central Morocco in Chaouia-Ourdigha plain, 750 meters above sea level (Latitude: 32°55'N; Longitude: 6°40'W) showing temperate climate. Other towns representative of this region (Oued Zem and Bejaad) were also evaluated. Thus, the total sample (492000 in 2001; 493000 in 2002; and 494000 in 2003) corresponded to 116 inhabitants/km² and 1.65% of the whole country (Source: National Administrative Department of Statistics).

Epidemiological Data

Children and adults who were stung by scorpions between 2001 and 2003 and sought medical aid at the hospitals of the cities mentioned above were included in

the study. Information about all patients was obtained from Morocco's National Record. Clinical and epidemiological data were recorded, including characteristics of the stings, time elapsed between sting and admission to the hospital, clinical severity score at admission (based on local and systemic signs of envenomation), follow-up length, treatment received, complications and outcome of the cases as well as referrals.

Clinical severity was assessed according to Abroug's classification (3), which is easy to sort the envenomation cases and to compare the severity classes with literature data. Thus, in the present study the severity classes were defined as following:

Severity class I: local symptoms; severity class II: thrill, hypersudation, nausea, vomiting, diarrhea hypertension and priapism; and severity class III: cardiovascular and/or respiratory and/or neurological symptoms

Data Analysis

The program Microsoft Office Excel was used to compare valid information about the patients and the descriptive analysis was performed using the programs STATISTICA and EPI INFO 6. Statistical analysis was carried out using the Chi-squared test for independence (χ^2) or analysis of variance (F). In case of significant differences, intragroup comparison was made using the Duncan's test to determine the number of subgroups for each parameter. Values of p lower than 0.05 were considered statistically significant.

RESULTS

Over the three years of investigation, 4089 data about scorpion stings were collected. The frequency of victims increased year after year and the incidence was 2.76‰. The mean age of the patients was 26.7 years (Standard Deviation: 18.2; age range: 1-97 years). The age group 1-15 years represented one third of cases; the group 20-30 years, 779 cases; and the group <1 year, 25 cases. The group <30 years was the most affected, which corresponded with the demographic profile of the country; 33% of the patients were 15 years old or younger.

The male/female ratio was 0.92, confirming that scorpions sting at random, independent of sex.

Stings were mainly observed between May and September with a peak in July (29.8%) and an incidence of 2.4‰. Forty-three percent of the stings occurred

between 6:00 p.m. and 12:00 p.m. The average time elapsed between sting and admission to hospital (TPP) was 1.5h (Standard Deviation: 28min or 0.46h; time range: 10min – 24h). The majority of victims (91.4%) arrived at the hospital in less than three hours after the accident. Most patients were admitted to the central hospital in Khouribga (40%) and 6.6% were referred to the same hospital, mainly from Oued Zem. Based on clinical evaluation, the great majority of patients belonged to severity class I (93.3%), followed by class II (6.6%) and class III (0.1%). The average time of follow up was 4 hours. The higher the TPP, the shorter the follow-up length. Two percent of the stung patients were hospitalized, which represented 30% of the envenomation cases.

Twenty-five deaths were recorded, out of which 10 cases were from the age group 5-10 years. Lethality rate of the stung patients was 0.7% and that of envenomed patients was 9.2%, which was marked in children (Table1).

Table 1. Specific lethality rate according to parameters that influenced management.

Parameters		Specific lethality rate (%)	Statistical significance
Patients' age (years)	0-1	10.7	F=10.46 (<i>p</i> <0.001)*
	1-2	2.4	
	2-5	1.9	
	5-10	2.7	
	10-15	0.0	
	15-20	0.4	
	20-30	0.1	
	30-40	0.0	
	40-50	0.0	
	>50	0.4	
Hospitalization	yes	15	$\chi^2=128.59$ (<i>p</i> <0.001)*
	no	0.5	
Treatment	yes	0.52	$\chi^2=1.001$ (<i>p</i> =0.32)
	no	0.95	
Referral	yes	13.60	$\chi^2=417.02$ (<i>p</i> <0.001)*
	no	0.08	
City	Oued Zem	0.85	$\chi^2=1.56$ (<i>p</i> =0.46)
	Khouribga	0.56	
	Bejaad	0.46	
TPP (hours)	< 1	0.27	F=10.46 (<i>p</i> =0.006)*
	1-2	1.23	
	2-3	0.43	
	≥3	1.28	
Severity class at admission	I	0.03 (1 death)	$\chi^2=327.98$ (<i>p</i> <0.0001)*
	II	18.75 (24 deaths)	
	III	0	

TPP: Time elapsed between sting and admission to the hospital.

* *p*<0.05 was considered statistically significant.

Table 2. Characteristics of scorpion stings over the study period.

	N	2001	2002	2003	Statistical Significance
Stung patients	4089	1212	1363	1514	$\chi^2=3.46$ ($p<0.001$)*
Months showing the highest incidence of accidents	-----	July (n=371)	July (n=354)	July (n=456)	-----
Age (years)	4081	25.7 (n=1205)	27.1 (n=1362)	27.1 (n=1514)	F=2.39 ($p=0.09$)
Sex ratio	4088	0.91 (n=1212)	0.99 (n=1362)	0.92 (n=1514)	$\chi^2=2.26$ ($p=0.32$)
TPP (hours)	3943	1.88 (n=1097)	1.51 (n=1353)	1.20 (n=1493)	F=18.79 ($p<0.001$)*
Follow-up length (hours)	3774	3.56 (n=1181)	3.66 (n=1285)	3.87 (n=1308)	F=66.32 ($p<0.001$)*
Treated patients (%)	4032	100 (n=1202)	89 (n=1351)	86 (n=1479)	-----
Patients referred to Khouribga hospital (%)	3915	4 (n=1088)	4 (n=1340)	11 (n=1487)	-----
Percentage of patients hospitalized	4087	7 (n=1211)	37 (n=1363)	38 (n=1513)	$\chi^2=11.70$ ($p=0.0006$)*
Number of deaths	3840	16 (n=1194)	4 (n=1237)	5 (n=1409)	$\chi^2=9.17$ ($p=0.002$)*
Lethality (‰)	3840	13.5 (n=1194)	3.20 (n=1237)	3.50 (n=1409)	$\chi^2=12.73$ ($p=0.002$)*

TPP: Time elapsed between sting and admission to the hospital.

N: total sample

n: number of valid information

* $p<0.05$ was considered statistically significant.

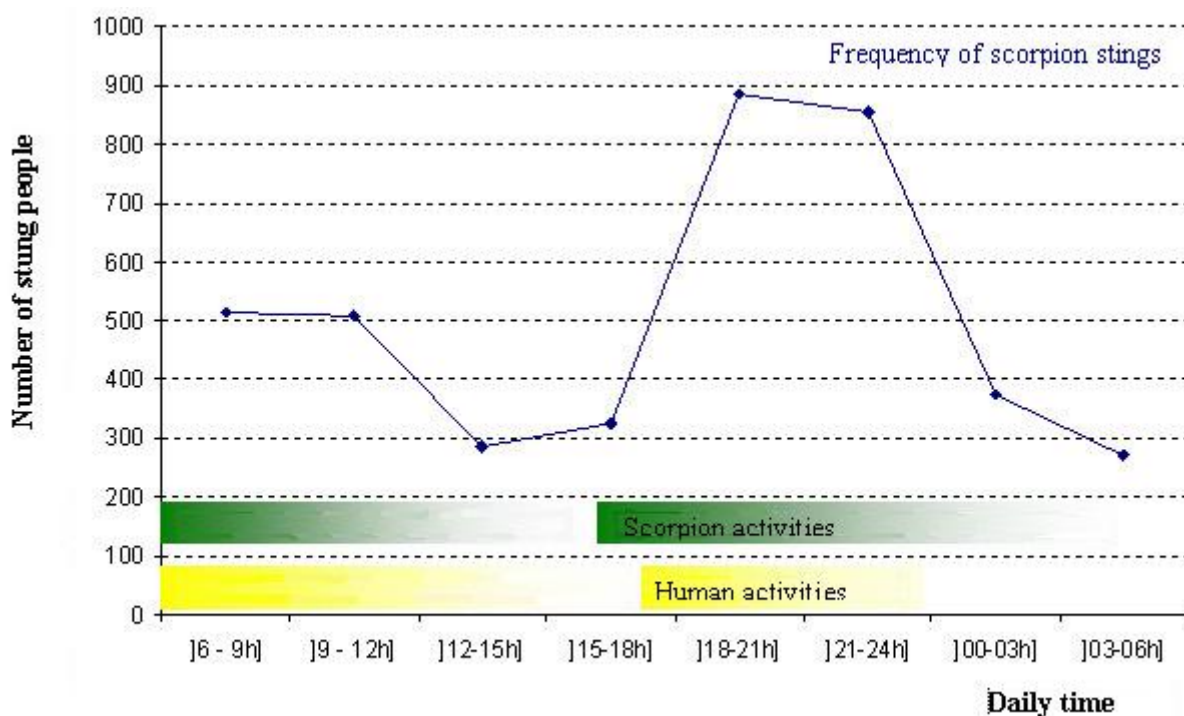


Figure 1: Frequency of scorpion stings according to periods of human and scorpion activities. Note that maximum scorpion and human activities were between 6:00 p.m. and midnight.

DISCUSSION

The present study, as far as we are concerned, is the first that compares an important number of scorpion stings as well as envenomation cases in Khouribga region, Morocco, during three successive years. Differences among the three years and the influence of certain parameters on the patients' outcome were investigated.

Reports of scorpion stings increased over the three years because the standardized data collection form is more and more known and the population has had easier access to medical care. In addition, the Poison Control Center of Morocco (CAPM) has promoted several campaigns alerting the population about the severity of envenomation cases and the inefficiency of the traditional treatments.

The age range showed high concordance with the age pyramid of Morocco. Actually, according to literature, scorpion stings occur accidentally, independent of age or sex (1,3,5,11,16).

Envenomation cases as well as mortality mainly affected children. Morbidity is determined by the victim's body weight, since the same dose of venom by scorpions

of the same species can lead to different morbidity, and the higher the body weight, the more diluted the venom, leading to fewer harmful effects. In these cases, death at advanced ages can be related to pre-existing flaws.

The majority of scorpion stings were recorded in July and August, corroborating the data from medical literature (3, 22, 25), which indicates that sanitary authorities must reinforce the efforts during this summery period.

Scorpion stings mostly occurred at the end of the day and during the first half of the night (from 6:00 p.m. to 12:00 p.m.; Fig. 1), which was consistent with scorpions' ontological data (2, 7, 13-15, 17, 20).

Late medical aid constituted a negative impact on the envenomation prognosis; however, patients that arrived at the hospital within 1 hour after the accident presented favorable evolution, similarly to other studies (12, 18, 25). Comparison among the three years studied (Table 2) showed highly significant differences and a reduction in TPP, which was probably due to frequent awareness campaigns and strategies implemented by CAPM.

The stings clinical manifestations are different and depend on the sting site, the patient's age, the geographical area, and the scorpion species (19). Patients belonging to severity class I (local symptoms) were predominant (93.3%), as in literature (4, 21, 26). The percentage of patients belonging to severity class II (thrill, hypersudation, nausea, vomiting, diarrhea and hypertension) was lower (6.6% of the cases) than those stated in literature and included 70% children younger than 15 years old, confirming the relationship between the venom dose injected and the body weight of the patient stung (9). The percentage of patients belonging to severity class III (cardiovascular and/or respiratory and/or neurological distress and often fatal evolution in the absence of appropriate management) was 0.1%.

The envenomation incidence (% class II + % class III) increased from 2001 to 2003 because the number of recorded cases also increased.

Following CAPM instructions for scorpion sting management, the patients were observed for approximately 4 hours after the sting to detect any general signs related to envenomation.

According to literature, the mean duration of the scorpion envenomation effects is 33 minutes in Morocco; less than two hours in Algeria (23), between two and four hours in Saudi Arabia (10); less than 30 minutes in Niger (6); and between five and 30 minutes in Mexico (8).

The number of treated cases decreased between 2001 and 2003 due to the training of health professionals for scorpion stings management and the development of a clear and easy algorithm, which allows distinguishing between a scorpion sting not requiring therapy and a scorpion envenomation requiring treatment in an intensive care unit.

The referral rate increased over the years since the number of cases reported increased. When the health unit does not have any resuscitation resources and the patient presents predictive severe signs, he/she is automatically referred to a specialized center since there is high risk of death.

The present investigation showed that most of the referred patients arrived at the hospital presenting severity class II symptoms and late first aid (>1h), mainly children younger than 15 years old. The relationship between specific mortality rate and age range allowed the following conclusion: the group of patients younger than one year old showed the highest lethality; a group of patients aged between one and 10 years old presented high lethality; and the group of patients older than 10 years old showed low lethality.

In Khouribga province, general mortality rate was 0.02‰ and the outcome was generally favourable. The reduction of lethality over the three years of investigation resulted from improved health management.

REFERENCES

- 1 ABARDA M. *Les piqûre de scorpion à la Wilaya d'Agadir: étude prospective d'avril à octobre*. Rabat: Faculté de Médecine et de Pharmacie, 1997. p.4-70. [Doctoral Thesis].
- 2 ABOUIHIA B. *Envenimations scorpioniques à la province de Tiznit: étude prospective de Mars à Septembre 1997*. Rabat: Faculté de Médecine et de Pharmacie, 1998. p.4-70. [Doctoral Thesis].
- 3 ABROUG F., NOUIRA S., SAGUIGA H. *Envenimations scorpioniques: avancées chimiques, physiopathologiques et thérapeutiques* [Monograph]. 1994. p.1-68.
- 4 ABROUG F., ELATROUS S., NOUIRA S., HAGUIGA H., TOUZI N., BOUCHOUCHA S. Serotherapy in scorpion envenomation: a randomised controlled trial. *Lancet*, 1999, 354, 906-9.

- 5 ARBAOUI A. *Envenimation par piqûre de scorpion au Maroc*. Rabat: Faculté de Médecine et de Pharmacie, 1997. p.306-76. [Doctoral Thesis].
- 6 ATTAMO H., DIAWARA N A., GARBA A. Epidémiologie des envenimations scorpioniques dans le service de pédiatrie du CHD d'Agadez (Niger) en 1999. *Bull. Soc. Pathol. Exot.*, 2002, 95, 209-11.
- 7 CHAMPETIER DE RIBES G. Le scorpionisme chez les enfants. *Ann. Pédiatr.* 1985, 32, 399-404.
- 8 DEHESA-DALIVA M., POSSANI LD. Scorpion and serotherapy in Mexico. *Toxicon*, 1994, 32, 1015- 8.
- 9 EL AMIN EO., BERAIR R. Piqûres de scorpion chez l'enfant: Expérience saoudienne. *Arch. Péd.*, 1995, 2, 766-73.
- 10 GAJRE G., DAMMAS ALI S. Scorpion envenomation in children: Should all stings be given antivenom? *Ann. Saudi Med.*, 1999, 19, 444-6.
- 11 GOYFFON M. Le scorpionisme. *Rev. Française Lab.*, 2002, 342, 41-8.
- 12 GOYFFON M., ELAYEB M. Epidémiologie du scorpionisme. *Infotox*, 2002, 15, 2-6.
- 13 GOYFFON M., VACHON M., BROGLIO N. Epidemiological and clinical characteristics of the scorpion envenomation in Tunisia. *Toxicon*, 1982, 20, 337-44.
- 14 GUERON N. ILIA R., SOFER S. The cardiovascular system after scorpion envenomation, a review. *J. Toxicol. Clin. Toxicol.*, 1992, 30, 245-58.
- 15 HAMID A. *Envenimation par piqûres scorpioniques au niveau des centres de santé et dispensaires à la province de Taroudant*. Rabat: Faculté de Médecine et de Pharmacie, 1999. p.78. [Doctoral Thesis].
- 16 ISLAMI B. *Les envenimations par piqûre de scorpion à la province de Taroudant*. Rabat: Faculté de Médecine et de Pharmacie, 1998, 216. p.100. [Doctoral Thesis].
- 17 ISMAIL M. The scorpion envenoming syndrome. *Toxicon*, 1995, 33, 825-58.
- 18 JEDDI MH., BEN HAMIDA CH., DAMAK J., JEDDI M., AYADI N. Piqûre par scorpion chez l'homme en Tunisie: étude épidémiologique. *Publ. Fac. Med. Sfax*, 1988, p.1- 463.
- 19 MEBS D. Action of venoms on blood coagulation and diagnosis of bleeding. *Bull. Soc. Pathol. Exot.*, 2002, 95, 131.

20 NOUIRA S., HAGUIGA H., BOUAZIZ M., BEN HAMIDA C., KNANI J., EL ATROUS S., TOUZI N., LTAIEF M., ABROUG F. Facteurs prédictifs de l'hospitalisation chez les victimes de piqûre de scorpion. *Réanim Urgences*, 1999, 8, 132.

21 ROODT DE, GARCIA SI., SALAMON OD., SEGRE L., DOLAB JA., FUNES RF., TITTO EH. Epidemiological and clinical aspect of scorpionism by *Tityus trivittatus* in Argentina. *Toxicon*, 2003, 41, 971-7.

22 TOULOUN O., SLIMANI T., BOUMEZZOUGH A. Epidemiological survey of scorpion envenomation in Southwestern Morocco. *J. Venom. Anim. Toxins*, 2001, 7, 199-218.

23 TRIKI DH., FERQUEL E., ROBBE VA., BON C., CHOUMET V., LARABA DF. Epidemiological data, clinical admission gradation and biological quantification by ELISA of scorpion envenomations in Algeria: effect of immunotherapy. *Royal Soc. Trop. Med. Hyg.*, 2004, 98, 240-50.

24 SOULAYMANI R., FARAJ Z., SEMLALI I. Epidémiologie des piqûres de scorpion au Maroc. *Rev. Epidemiol. Santé Publ.*, 2002, 50, 341-7.

25 SOULAYMANI R., SEMLALI I., GHANI A., BADRI M. SOULAYMANI A. Implantation et analyse d'un registre des piqûres de scorpion au Maroc. *Rev. Epidemiol. Santé Publ.*, 2004, 3, 487-98.

26 SOULAYMANI R., SOULAYMANI A., SEMLALI I., TAMIM O.K., ZEMROUR F., EL OUFIR R. Les piqûres et les envenimations scorpioniques au niveau de la population de khouribga (Maroc). *Bull. Soc. Pathol. Exot.*, 2005, 98, 36-40.