ORIGINAL ARTICLE

Managing scorpion envenomations: A Gabes emergency department case study of 60 patients

Gestion des envenimations scorpioniques: Étude de 60 patients aux urgences de Gabès

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Abstract

Introduction: Scorpion envenomation constitutes a major public health issue in Tunisia, especially in arid regions such as the Gulf of Gabes. It is necessary to understand the epidemiological and clinical characteristics of this condition and the importance of early management.
Aim: This study aims to assess the epidemiological and clinical profile of patients admitted to the emergency department of Gabes University Hospital for scorpion envenomation, as well as the timing of management and intra-hospital evolution.
Methods: A retrospective descriptive study of 60 patients admitted for scorpion envenomation to the Acute Assessement unit at the Emergency Department of the Gabes University Hospital from January 2020 to January 2023.
Results: The average age was 35 years [1-85 years]. A slight male predominance (51.7%) was noted. Patients with chronic somatic diseases accounted for (25%) of our series. The predominant scorpion species was Androctonus australis (71.7%). The majority of incidents occurred during the nighttime (71.7%). Most patients were of rural origin (58.3%). The most common sting sites were the lower limbs (48.8%) and upper limbs (36.7%). Scorpion envenomation stages at admission were: Stage I (3.3%), Stage II (83.3%), and Stage III (8.33%). The average time to management was 2 hours. Patients classified as Stage II at admission or afterward were seen after an average of 3 hours. Patients initially classified as Stage III were seen after an average of 3 hours and 30 minutes, and those classified as Stage III during the hospitalization were seen after an average of 4 hours. The average time to management for patients transferred from the Emergency Department to the Intensive Care Unit was 4 hours.
Conclusion: This study highlights the importance of early management of scorpion envenomation.

Key words: Scorpions, Envenomation, Antivenom, Epidemiology, Treatment

Résumé

Introduction: L'envenimation par scorpion constitue un problème majeur de santé publique en Tunisie, notamment dans les régions arides telles que le golfe de Gabès. Il est nécessaire de comprendre les caractéristiques épidémiologiques et cliniques de cette condition ainsi que l'importance de la prise en charge précoce.
But: Cette étude vise à évaluer le profil épidémiologique et clinique des patients admis pour envenimation par scorpion au service des urgences de l'hôpital universitaire de Gabès, ainsi que le moment de la prise en charge et l'évolution intra-hospitalière.
Méthodes: Une étude descriptive rétrospective de 60 patients admis pour envenimation par scorpion à l'unité de soins intensifs et de réanimation du service des urgences de l'hôpital universitaire de Gabès de janvier 2020 à janvier 2023.
Résultats: L'âge moyen était de 35 ans [1-85 ans]. Une légère prédominance masculine (51,7%) a été notée. Les patients atteints de maladies somatiques chroniques représentaient (25%) de notre série. L'espèce de scorpion prédominante était Androctonus australis (71,7%). La majorité des incidents se sont produits pendant la nuit (71,7%). La plupart des patients étaient d'origine rurale (58,3%). Les sites de piqûre les plus courants étaient les membres inférieurs (48,8%) et les membres supérieurs (36,7%). Les stades d'envenimation par scorpion à l'admission étaient : Stade I (3,3%), Stade II (83,3%) et Stade III (8,33%). Le temps moyen de prise en charge était de 2 heures. Les patients classés en Stade II à l'admission ou par la suite ont été vus après un temps moyen de 3 heures. Les patients classés en Stade III initialement ont été vus après un temps moyen de 3 heures et 30 minutes, et ceux classés en Stade III finalement ont été vus après un temps moyen de 4 heures. Le temps moyen de prise en charge pour les patients transférés en unité de soins intensifs était de 4 heures.
Conclusion: Cette étude met en évidence l'importance de la prise en charge précoce de l'envenimation par scorpion.

Mots clés: Scorpions, Envenimation, Antivenin, Épidémiologie, Traitement

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Introduction

Scorpion envenomation poses a major challenge to public health, both globally and specifically in Tunisia (1). Every year, there are more than 30000 scorpion envenominations in Tunisia (2). Scorpions, particularly those of the genera Androctonus and Buthus, are the main culprits in the majority of envenomation cases in this region (3). This condition represents a significant burden on the healthcare system due to its considerable medical, social, and economic impact. Due to its diverse geography and conducive climatic conditions, Tunisia provides a favorable habitat for the proliferation of several species of venomous scorpions (4). Scorpion envenomations are frequent, especially in arid and semi-arid regions such as the Gulf of Gabes area (4). This condition can lead to severe, even fatal complications, especially in young children and the elderly, particularly when there is a delay in seeking medical consultation or treatment (3). A comprehensive understanding of the epidemiological and clinical profiles of patients is essential for developing effective therapeutic strategies aimed at improving the quality of medical care.

In this context, several efforts have been made to study and understand the management of scorpion envenomation in Tunisia, highlighting the importance of continued surveillance and standardized management protocols in enhancing patient outcomes (4,5,2,6). Goyffon et al. (1982) examined clinical and epidemiological aspects, highlighting a mortality rate of 0.35% predominantly among children under 15 years old, and emphasized the efficacy of serotherapy with a specific antivenom (4). Bouaziz et al. (2008) identified predictive factors for poor prognosis in severe cases, emphasizing the importance of early recognition and intensive care management (5). Similarly, Ben Othman et al. (2016) in the Faouar region underscored the significance of timely medical intervention and adherence to treatment protocols in achieving favorable outcomes (2). Lastly, Chakroun-Walha et al. (2018) update demonstrated a decrease in mortality rates, attributed to improved management practices and early medical consultation (6).

In this research paper, we aim to thoroughly examine the epidemiological and clinical profile of patients admitted to the emergency department of the University Hospital of Gabes following scorpion envenomation and to analyze the intra-hospital evolution of these patients to identify avenues for improvement in the medical management of this condition. We begin by explaining our approach (Section 3). Then, we provide our results on the epidemiology of scorpion envenomations in the University Hospital of Gabes from January 2020 to January 2023 (Section 4). Subsequently, we discuss our findings by comparing them with the current state-of-the-art research on scorpion envenomations both in Tunisia and internationally, as well as with previous studies focusing on the management of scorpion envenomations in our region (Section 5). Finally, we conclude our study and outline future research directions based on our findings (Section 6).

Methods

This was a retrospective descriptive study conducted within the intensive care and resuscitation unit of the emergency department at the University Hospital of Gabes. This study encompassed patients hospitalized for scorpion envenomation management, over a period of three years, from January 2020 to January 2023. We included in our study any patient stung by a scorpion regardless of age, the site of the sting, and the type of scorpion. Our study excluded cases where the scorpion species was not identified and records where essential information was missing, especially the time of the incident, the delay in management, and the site of the sting. During the study period, 127 patients consulted the Emergency Department (ED); among them, 74 were admitted to the Intensive Care and Resuscitation Unit, and 14 were excluded due to either unidentified species and/or missing data.

Definitions

The severity of scorpion envenomation was assessed based on Khattabi et al.'s classification (1), dividing the clinical condition into three stages of increasing severity. Stage I includes patients with localized signs only, such as isolated pain, tingling, paresthesia, or burning sensation. Local numbness triggered by percussion or touch may be observed. In Stage II, local signs become more pronounced and extensive, with paresthesias potentially affecting the entire affected limb. The onset of moderate systemic signs is mandatory, such as sweating, diarrhea, vomiting, hypertension or hypotension, rapid breathing, and moderate fever. Elements integrating into Stage II indicative of severity include priapism, vomiting, sweating, and fever > 39°C. Stage III is characterized by the presence of at least one of the following: state of shock, pulmonary edema, and alteration of consciousness.

Criteria for assessment include coma, defined by the absence of eye-opening, spontaneous or provoked, coherent verbal output, and response to commands, indicating loss of consciousness and alertness while vegetative functions (respiration, circulation) are normal or impaired (7). Respiratory distress signs are defined by the French College of Teachers of Intensive Care Medicine (8). It is characterized by supraclavicular, suprasternal, and intercostal retractions that correspond to a major activity of the extra-diaphragmatic inspiratory muscles (such as the scalenes and external intercostals) and by the recruitment of accessory muscles (sternocleidomastoid, intercostal, and abdominal muscles). Contraction of these muscles, especially the abdominal muscles, reflects active expiration (which is normally a passive phenomenon) (8). At its extreme, thoraco-abdominal swinging with paradoxical abdominal respiration indicates diaphragmatic failure and is thus a sign of extreme severity (respiratory exhaustion) (8). Hypotension is defined as systolic blood pressure (SBP) less than 90 mm Hg, or a decrease of more than 30% (or 40 mm Hg) from the usual blood pressure in hypertensive patients or those with usually low blood pressure (9). Time to medical care

is defined as the time from envenomation to the first medical contact (6). Pediatric age group encompasses individuals aged between 0 and 14 years according to the National Agency for the Safety of Medicines and Health Products[1]. Young adults are aged between 20 and 40 years, while elderly individuals are those aged 65 years and older.

Data Collection and Analysis

Data for each patient were recorded on a form derived from the electronic health records (EHR) of Gabes University Hospital's emergency department (Appendix A on line). Each case's details included:

- Demographic data: age, sex, habitat origin and past medical history.
- Incident characteristics: scorpion species, time, and site of the sting.
- Clinical manifestations: respiratory (UA state, SpO2, respiratory rate), cardiovascular (heart rate, systolic blood pressure, diastolic blood pressure, signs of peripheral hypoperfusion), neurological (agitation, confusion, drowsiness, coma).
- Initial stage of envenomation.
- Paraclinical study: ECG, Imaging (Echocardiography/ Chest X-ray), laboratory tests (transaminases, urea-creatinine, troponins, CPK, Hb, WBC).
- Time to management and intra-hospital evolution.
- Evolution: evolving stage, final outcome.

For statistical analysis, binary qualitative variables were expressed as absolute values and percentages, while quantitative variables were expressed as mean ± standard deviation (Confidence Level: 68.2%). Statistical analysis was conducted using SPSS 20.0 software.

Results

In our series, 60 patients were hospitalized for scorpion envenomation, with a median age of 35 years and ages ranging from 1 to 85 years old as shown in Figure 1. Envenomated patients went to the Emergency Department using their means (33.3%), type B ambulance (13.3%), civil protection (45.0%), and emergency medical services (8.3%). The significant use of personal means highlights the challenges in efficiently transporting envenomated patients to the emergency department. The age group <10 years was predominant, comprising 16 patients (26.7%), and a slight male predominance was noted (31 males, 51.7%) with a sex ratio of 1.07. Of the total, 35 patients hailed from rural areas, representing 58.3% of the cohort. Comorbidities were present in 15 patients (25%) as shown in Table 1. Scorpion species included all three identified in our country, with Androctonus Australis being the most prevalent (43 cases, 71.7%) followed by Buthus Occitanus (15 cases, 25%) and Androctonus Aenas (2 cases, 3.3%)[2] . Sting occurrences were prevalent during the nighttime period (71.7% of cases) as shown in Figure 2, with the majority of stings occurring at the extremities: 29 (48.8%) in the lower limbs and 22 (36.7%) in the upper limbs. Other sting sites include the neck (6.7%), head (5%), and body trunk (3.3%). Local manifestations such as redness (all cases), local edema (40 cases), itching sensation (27 cases), and scarification (1 case) were observed in all patients.

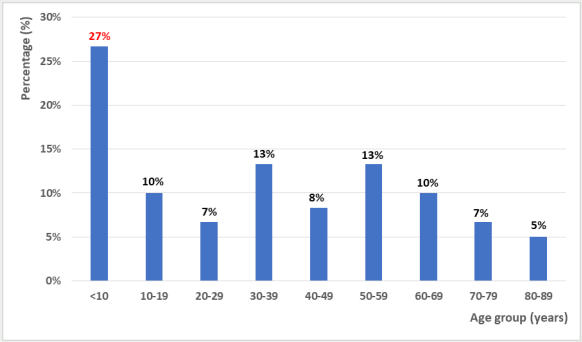

Figure 1. Distribution of patients according to age groups

Table 1. Distribution of patients according to comorbidity

Comorbidity	Frequency (%) (N = 25)
Hypertension	18 (72%)
Diabetes	20 (80%)
Chronic renal insufficiency	6 (24%)
COPD	7 (28%)
Asthma	5 (20%)
Coronary artery disease	3 (12%)
Atrial fibrillation	2 (8%)
Left heart failure	4 (16%)

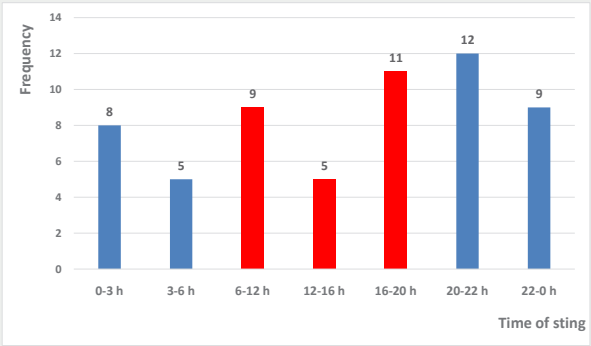

Figure 2. Distribution of patients according to the time of sting: Daytime (Red), Night-time (Blue).

Clinical Study

Clinical assessment was conducted according to the ABCDE approach in the emergency setting. Airway compromise was observed in only one patient (1.7%). The mean respiratory rate (RR) was 19.4 ± 5.8 cycles/min (range: 11 to 40 cycles/min), with 16 patients exhibiting tachypnea (RR > 20 cycles/min), accounting for 26.66% of cases. Peripheral oxygen saturation (SpO2) was ≤90% in 5% of cases, with a mean SpO2 of 97.3% (range: 65% to 100%). The mean heart rate (HR) was 88.1 ± 20 bpm (range: 42 to 140 bpm), and six patients displayed extreme tachycardia (HR ≥ 120 bpm), accounting for 10% of cases, while one case of extreme bradycardia (HR < 50 bpm) was noted. The mean systolic blood pressure ranged from 60 to 190 mmHg, with two patients having

systolic blood pressure ≤90 mmHg (3.33%). Mean diastolic blood pressure was 74.7 ± 14.3 mmHg (range: 30 to 110 mmHg), and signs of peripheral hypoperfusion were present in 3 patients at admission (5%). The Glasgow Coma Scale (GCS) was 15 in 57 patients (95%). Meanwhile, two patients had a GCS score of 14 (3.33%) and another had a GCS score of 5, indicating profound coma. Patients were classified into three stages based on their clinical status at admission. Two patients presented with features consistent with stage I, accounting for 3.3% of our series. Within our series, 53 patients (88.3%) were categorized into stage II. Specificities of these patients included twelve patients having known chronic diseases (22.6%), and twenty-six were male (49.1%). Clinical data of stage II patients are detailed in Table 2. Five patients in our series were classified as stage III (8.33% of cases). Clinical manifestations of severity presented by these patients included shock (3 patients, 60%), pulmonary edema (1 patient, 20%), and alteration of consciousness (3 patients, 60%). Out of a total of 5 patients, 2 (40%) exhibited hypotension, while 1 (20%) showed signs of tachycardia. Tachypnea was observed in 4 patients (80%), indicating rapid breathing. Additionally, 1 patient (20%) displayed signs of respiratory distress. Desaturation, defined as a peripheral oxygen saturation (SpO2) level below 95%, was present in 2 patients (40%). One patient (20%) was in coma, while 2 others (40%) exhibited altered consciousness, as indicated by a GCS score not equal to 15. All stage III patients had no medical history, and three patients were male (60%). The mean age of this category was 41 years, with extremes ranging from 3 to 85 years, and no age group was predominant.

Table 2. Distribution of stage II patients according to significant clinical data of stage II

Clinical sign	Frequency (%) (N = 53)
Excessive sweating	39 (73.6%)
Vomiting	35 (66%)
Priapism[1]	5 (20%[1])
Fever > 39°C	0 (0%)
Diarrhea	0 (0%)
Runny nose	1 (1.9%)
Bradycardia[2]	1 (1.9%)
Tachycardia[3]	5 (9.43%)
Tachypnea[4]	12 (22.64%)
Moderate hyperthermia	8 (15%)

1: Priapism is a clinical sign that is restricted to male patients. We have 25 male patients seen at stage II., **2** : Heart Rate < 50 bpm, **3** : Heart Rate ≥ 120 bpm, **4** : Respiratory Rate ≥ 25 cycles/min.

Investigations

ECG was performed in 58 cases (96.7%), with sinus rhythm being regular in 57 cases (98.2%). ECG anomalies were distributed as the following: Negative T wave (6 patients), Sinus tachycardia (6 patients), AV Block (1 patient), Sinus bradycardia (1 patient), and Ventricular arrythmia with wide QRS (1 patient). Imaging studies revealed that echocardiography (TTE) was performed in 16 patients (26.7%), with reduced left ventricular function observed in 4 cases (25%), while TTE without anomalies was noted in 12 cases (75%). Chest X-rays were conducted for twenty patients (33.33%), with findings suggestive of pulmonary edema in 5 images (25%) and inhalation pneumonia in 1 image (5%). Regarding laboratory tests, thirty-eight patients in our series had a complete blood count (CBC) (63.33%), showing a mean hemoglobin (Hb) value of 13.9 ± 2.8 g/dL, with anemia (Hb < 12 g/dL) noted in 10 patients (26.3%). The mean white blood cell count (WBC) was 17617 ± 3828 cells/mm3, with leukocytosis (WBC > 10000 cells/mm3) noted in 19 patients (50%). Troponin levels were assessed in 33 patients (55%), with a mean value of 149.22 ± 457.54 ng/mL, and troponin was positive (> 20 ng/mL) in 9 cases (27.3%). Creatine phosphokinase (CPK) levels were measured in 16 patients (26.7%), with a mean value of 185 ± 87.84 IU/L, and CPK was elevated (> 200 IU/L) in 4 cases (25%). Transaminases were measured in 6 patients and returned normal in all cases. Renal function tests (urea, creatinine) were performed in 35 patients (58.33%) and were normal in all cases.

Evolution and Patient Management

Stage II was predominant, followed by stage III and then stage I, with no patient experiencing worsening of their initial envenomation stage. In terms of final outcomes, forty-nine patients were discharged home after emergency room observation, accounting for 81.6% of cases. Additionally, five patients (8.3%) were transferred to hospitalization services (general medicine or pediatrics), while four patients (6.7%) were transferred to intensive care. Two patients died (3.3%), both of whom were initially seen at stage II and stage III and consulted the hospital after delays of 24 hours and 20 hours, respectively. The average time to management upon arrival to the emergency department was approximately 2 hours, ranging from 20 minutes to 24 hours as shown in Table 3, with around 25% and 5% of patients seen at the 1st and 2nd hour, respectively (Figure 3). In terms of therapeutic management, 81.7% of patients received first-tier analgesics, while 86.7% received scorpion antivenom serum (SAS). In Gabes, the antivenom targets only the venom of Androctonus australis and Buthus occitanus, and it is the SAS antivenom produced by the Pasteur Institute of Tunis (10). It is always available and never in shortage in Gabes, allowing to reduce the mortality rates due to scorpion envenomations. Oxygen therapy was prescribed for 6.7% of patients, and ionic correction was administered to 5%. Glycemic correction was required for 16.7% of patients, and dobutamine was administered in 6.7% of cases. Additionally, one case of invasive ventilation was noted, with no instances of non-invasive ventilation.

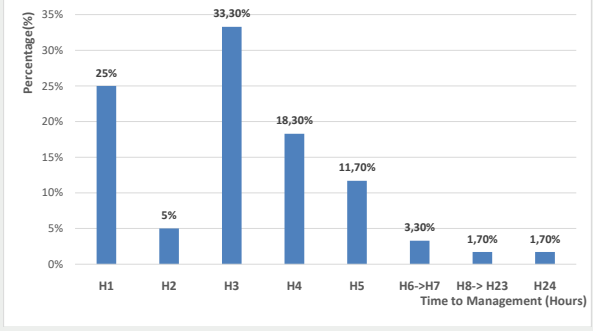

Figure 3. Distribution of patients according to time to management

Table 3. Time to management upon arrival to the emergency department according to severity stages and final outcome

Criteria		Time to Management		
		Average	*Minimum*	*Maximum*
Initial Stage	***Stage I***	1h : 15min	30 min	2h
	Stage II	3h	20 min	24h
	Stage III	3h: 30min	1h: 30min	24h
Final Stage	***Stage I***	2h: 50min	20min	24h
	Stage II	3h	2h	4h
	Stage III	4h	2h: 30min	7h
Final Outcome	***Discharge***	3h	20min	24h
	Transfer to pediatrics or medicine units	3h	2h	4h
	Transfer to intensive care unit	4h	1h: 30min	7h
	Death	3h		

Discussion

Due to its varied geography and favorable climatic conditions, Tunisia is a territory where scorpion envenomations are frequent, especially in desert regions such as the Gulf of Gabes. This pathology, caused by scorpion stings, presents significant severity, requiring rapid and often intensive medical intervention. Symptoms can be extremely painful and potentially fatal, ranging from simple local pain to serious complications such as cardiorespiratory or neurological disorders. The mortality rate associated with these envenomations can be notable, especially among children and the elderly. In the absence of appropriate treatment, the consequences can be dramatic. Thus, healthcare professionals must be well-trained to identify and effectively manage cases of scorpion envenomation. Additionally, public awareness of preventive measures, such as protecting homes from scorpion intrusion and administering first aid, is essential to reduce the incidence of this pathology. Health authorities must also implement surveillance and control programs for scorpion populations, as well as long-term prevention policies. Furthermore, ongoing research on treatment and prevention methods is crucial to improve patient care and reduce the burden of this disease in the country. In summary, combating scorpion envenomations in Tunisia requires a comprehensive and coordinated approach involving various stakeholders, from health authorities to local communities.

Epidemiological Characteristics

The average age in our series was 35 ± 26 years, consistent with studies by Ben Othman et al. (2016) (2) and Boubekeur et al. (2020) (11). Regarding age groups, it is noteworthy that the pediatric population (<14 years) represents the most affected age group, accounting for 26.7% of cases. Series showing frequent involvement of young adults (aged between 20 and 40 years) followed by children are detailed in Table 4. No significant difference was observed between sexes regarding exposure to scorpion envenomation risk. However, a slight male predominance was noted in our series, consistent with other similar studies. Table 4 illustrates the distribution by gender according to literature data (6,2,11). In our series, a significant portion of envenomated individuals came from rural areas (58.3%), a result similar to the study conducted by Chakroun-Walha et al. (2018) (69.8%) (6). Other similar series also revealed a significant percentage of patients from urban areas (between 30 and 40%) (12,11). It is interesting to note that although scorpions are generally associated with rural areas, their presence in urban areas is not negligible. This observation may be explained by several hypotheses, including increasing urbanization leading to human intrusion into scorpions' natural habitats, or climate changes influencing scorpions' geographical distribution, causing them to be more frequently found in human-inhabited areas (13). These phenomena emphasize the importance of awareness and appropriate prevention measures, both in rural and urban areas, to reduce the risk of scorpion envenomation. A quarter of our patients are known carriers of chronic somatic diseases. This rate is relatively high compared to literature data, where the series of Chakroun-Walha et al. (2018) reported 14.2% (6), and that of Bouaziz et al. (2008) reported 5.1% (5). This disparity can be explained by the predominance of the pediatric population in these two studies compared to ours. Thus, the percentage of patients with a history of chronic diseases is proportional to the inclusion of adults in the study. Our study is in line with literature data (4), indicating a distribution of scorpion envenomations as follows: Australis (71.7%), Occitanus (25%), and Aenas (3.3%) (6). In Tunisia, the three most common scorpion species are Androctonus Australis, Buthus Occitanus, and Androctonus Aenas, which are members of the Buthidae family (4). In fact, according to Gyffon et al. (1982), a sample of 132 scorpions collected in the Sfax region showed that 70% were A. australis, with the remaining 30% consisting of Buthus occitanus and Scorpio maurus (4). In the Mediterranean region, 53.3% of scorpions are yellow (Australis or Occitanus), while 17.4% are black (Aenas) (14). Furthermore, in Asia, the most formidable species is Hemiscorpius lepturus (15). However, in the Mediterranean region, Buthus Occitanus is considered the most dangerous (14). Research conducted by Chakroun-Walha et al. (2018) (6) and Goyffon et al. (1982) (4) confirmed the predominantly nocturnal nature of scorpion venomous accidents. Our study, consistent with the literature, revealed that 71.7% of cases occurred between 7 pm and 5 am. Indeed, scorpions are mainly active at night. In arid and semi-arid regions, during hot seasons, the nocturnal period is characterized by slight air humidification after a hot and sunny day. This climatic condition encourages scorpions to leave their burrows (13). Our study revealed a clear predominance of extremities (upper and lower limbs) among the sites affected by scorpion stings, consistent with literature data (Table 4). This trend is explained by the frequent exposure of extremities during activities where the use of boots and protective gloves is often avoided. This observation highlights the importance of raising awareness about the proper use of personal protective equipment during

activities that may come into contact with scorpions to reduce the risk of stings to extremities.

Table 4. Average age, predominant age group, gender distribution, and major sting sites according to literature and our series.

Study	Average Age (Years)	Age Groups (%)			Male (%)	Lower limbs (%)	Upper limbs (%)
		Pediatric	Young Adults	Elderly			
Our study (Gabes)	35 ± 26	16 (26.7%)	15 (25%)	14 (23,4%)	51.7%	48.8	36.7
Ben Othman et *al.* (Kebili) (2)	37.6	51 (12%)	147 (35%)	84 (20%)	56.3%	N/A	N/A
Chakroun-Walha et *al.* (Sfax) (6)	27.4 ± 22.8	105 (37.2%)	80 (28,4%)	26 (9,2%)	51.4%	57.4	26.6
Bouaziz et *al.* (South of Tunisia) (5)	14.7 ± 17.4	685 (72%)	N/A	N/A	N/A	61.6	14.2

Patient classification upon admission

Local symptoms associated with scorpion stings manifest in the first stage of severity, often intensely due to nerve endings stimulation by neurotoxins, although they are not accompanied by inflammatory symptoms (12,16). These manifestations include burning-like pain, paresthesias, or numbness of the affected limb, leading to classifying patients at stage I when their symptoms are limited to local signs (12,16). The venom of the scorpion leads to the recruitment of monocytes and neutrophils, inducing the release of inflammatory mediators such as pro-inflammatory cytokines (IL-1, IL-6, IL-8, TNF-a) (17,16), explaining the local signs observed at stage I. Despite the prevalence of stage I universally (11), our series, limited to patients admitted to the Acute Assessement unit, presents a low rate of stage I (3.3% of cases), consistent with the data from Chakroun et al., which also focused on Acute Assessement units (6). Patients classified at stage I, without progression to later stages, generally require only simple monitoring of vital parameters and mild symptomatic treatments (18). A short-term hospitalization in first-line hospital facilities is often sufficient for their management, emphasizing the importance of careful assessment of symptom severity in the decision to hospitalize.

Buthus occitanus is considered the most dangerous scorpion species in Tunisia (14) because its venom is rich in neurotoxins that target the ion channels of excitable cells, disrupting nerve signals and causing the release of neurotransmitters and cytokines such as IL-1β, IL-6, IL-8, and TNF-α (19). Envenomation by this scorpion causes digestive, autonomic, neurological, cardiovascular, and respiratory symptoms, primarily due to the action of the neurotoxins (19). Studies on mice show that the venom induces histopathological changes in the brain, heart, lungs, liver, and kidneys (19).

In our series, stage II was predominating (88.3%), consistent with the percentages found in Chakroun-Walha et al.'s series (6), which also focused on patients admitted to the Acute Assessement unit. The two most commonly observed symptoms in our study were diaphoresis (73.6%) and vomiting (66%), results similar to those reported by Chakroun-Walha et al. (6). Other symptoms were present in about one in five patients at stage II, including hyperthermia, priapism, and polypnea. However, these signs were less frequent in our patients compared to the literature series (14,5,6). This variation could be due to differences in the demographic characteristics of the studied populations or different data collection methods. It is essential to consider these variations when evaluating and managing patients with scorpion stings at stage II.

Stage III is retained when signs of severe cardiovascular, respiratory, or neurological complications are observed, in addition to symptoms from previous stages (12). Among these complications, cardiac dysfunction and acute respiratory failure are most frequently observed in these patients (3,12). The cardiac involvement during stage III of scorpion envenomation is primarily attributed to venom's effect on myocardial tissues, increased adrenaline levels, and coronary vasoconstriction, resulting in cardiac dysfunction (20). Scorpion envenomation leads to a massive release of catecholamines, glucagon, and angiotensin II while reducing insulin levels, thereby contributing to cardiac and multi-organ failure and to severe envenomation cases in children, the most vulnerable age group (16). Scorpion-induced myocarditis, considered a potential cause of cardiac dysfunction, could result from catecholamine-induced hypoxia and the direct effect of the venom on the myocardium (16). Acute pulmonary edema is primarily of cardiogenic origin, although other mechanisms may also be involved (3). It is crucial to recognize these severe complications and treat them promptly to ensure effective management of patients with scorpion stings at stage III.

According to the published series, the most commonly described systemic signs at stage III are abdominal pain, vomiting, and diaphoresis. These manifestations have been associated with an increased risk of respiratory and neurological complications (21). It is crucial to carefully monitor these signs in patients with scorpion stings at stage III, as they may indicate a deterioration in health status and require urgent medical intervention. In our series, 8.33% of patients were seen at stage III, which is close to but significantly higher than the results reported in the literature. Stage III does not exceed 5% of the patients, in other studies (3,6).

Evolution and Time to Management

The prognosis of patients classified at stage I or II in our study is generally favorable, with a favorable outcome in 100% and 88.7% of cases, respectively. However, scorpion envenomations at stage III present a bleak prognosis, with 80% of our patients requiring transfer to intensive care and 20% deceased. Systemic signs can evolve variably, either towards rapid improvement with adequate and early treatment, or towards worsening leading to moderate cardiac dysfunction (tachycardia,

tachypnea), or even more severe with the onset of acute respiratory failure, pulmonary edema, and shock in some of our cases. In our series, no patient progressed from stage I to stage II or III. However, the mortality rate in our series (3.3%) is potentially higher than that reported in other studies conducted on the hospitalized population in the Acute Assessement unit [0.4% according to Chakroun et al. (2018) (6)]. Compared to general population rates, nationally and internationally, death rates are lower (6). This higher mortality rate in our series could be explained by a significant delay in patient management, highlighting the crucial importance of rapid and effective medical intervention to improve clinical outcomes.

Only thirty percent of our patients consulted within the first two hours following envenomation, which is a considerably lower rate than the literature data (2,6). Indeed, a study conducted in Kébili by Ben Othman et al. (2016) (2) revealed that 87% of patients were seen within the first hour, while a study in Sfax by Chakroun-Walha et al. (2018) (6) showed that 67.4% of patients were managed within the first two hours, more than double the rate observed in our series. Other series conducted in different regions of the world also confirm that the majority of envenomated individuals consult before the third hour (5,6). This delay in consultation is associated with a bleaker prognosis for patients and a higher mortality rate (5,6). It underscores the crucial importance of raising awareness among the population about the importance of rapid medical management in case of scorpion envenomation, to improve clinical outcomes and reduce severe complications. In Tunisia, the management of poisoned patients includes administering paracetamol (Perfalgan®) at a dose of 1 g, three times a day, as an analgesic, along with two ampoules of SAS intravenously, diluted in 250 cc of 9 ‰ saline solution, as a single dose (10).

Conclusion

In our study, we examined the epidemiological and clinical aspects of scorpion envenomation in the Gulf of Gabes region, with a cohort of 60 patients included in our series. Our results emphasize the urgency of early management of scorpion envenomation victims, as these patients may experience rapid deterioration in their health condition. We found that the epidemiological characteristics of our series were similar to those reported in the literature. However, patients with initially unfavorable prognoses or during the course of evolution all shared significant delays in their medical management. Thus, the timeliness of management appears to be a crucial factor in improving clinical outcomes. It is imperative to conduct a thorough study to identify the underlying causes of delays in the medical management of scorpion envenomation victims. In the Gulf of Gabes region, we observed increased confidence in local healers compared to medical care, exacerbated by the difficulty of accessing civil protection vehicles or emergency medical services in rural areas. Delay in management is often attributed to a lack of transportation means to healthcare centers, as well as an underestimation of the severity of the condition. It is crucial to further raise awareness among populations about scorpion envenomation and to improve access to healthcare as well as healthcare infrastructure in the Gulf of Gabes region. Better dissemination of awareness on this issue, combined with measures to improve healthcare accessibility and strengthen medical infrastructure, are essential elements to reduce delays in management and improve clinical outcomes for envenomated patients.

Abbreviations

AV Block = Atrioventricular Block
COPD = Chronic Obstructive Pulmonary Disease
bpm = Beats per minute
C/min = Cycles per minute
CPK = Creatine Phosphokinase
ECG = Electrocardiogram
TTE = Trans-Thoracic Echocardiography
HR = Heart Rate
RR = Respiratory Rate
WBC = White Blood Cells
Hb = Hemoglobin
CBC = Complete Blood Count
SAS = Scorpion Antivenom Serum
SBP = Systolic Blood Pressure
DBP = Diastolic Blood Pressure
GCS = Glasgow Coma Scale
SpO2 = Oxygen Saturation
UA = Upper Airway
NIV = Non-Invasive Ventilation

[1]Further details are available at https://ansm.sante.fr/dossiers-thematiques/medicaments-en-pediatrie-enfants-et-adolescents/classes-dage-des-enfants-et-adolescents (Retrieved on February 24, 2024).

[2]For images of the scorpion species, please refer to Cupo (2015) (3).

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