

ORIGINAL ARTICLE

Sociodemographic and Laboratory finding in children Attending Aswan University Hospital with Scorpion Envenomation

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ABSTRACT

Keywords: laboratory Changes,

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Background: Creatures that can produce a poison in a gland and then delivering that toxin by stinging or biting are called venomous animals. Arthropods (scorpions, spiders, bees, and wasps) are examples. **Aim of the work:** The aim of this study is to identify demographic and laboratory characters of children following scorpion envenomation by assessment of clinical picture, WBC, BUN level, SGOT, SGPT and PT in children attending Aswan University Hospital with scorpion sting. **Patients and Methods:** This study is an observational cross-sectional study, conducted in the period from September 2019 to February 2020 on children aged from one month up to 18 years attending Aswan university hospital by history of scorpion sting. **Results:** There were statistical significance higher mean value of WBC, BUN level, SGOT, SGPT and PT level in grade 3 compared to grade one and two. **Conclusion:** Scorpion stings is a life threatening medical emergency. *Leiurus quinquestriatus* scorpion (yellow scorpion) and *Androctonus crassicauda* (black scorpion) scorpion species are among endemic scorpion species in Egypt. According to Abroug's classification, more than half of our cases classified as grades 2, while 1/3 were grade 3.

INTRODUCTION

Scorpion stings are a cutaneous condition caused by the stinging of scorpions, usually resulting in pain, paresthesia, and variable swelling. The anatomical part of the scorpion that delivers the sting is called a "telson" ⁽¹⁾. Scorpions have a stinger (or telson) in their tail (terminal segment) that contains venom glands. The scorpion hooks the tail over its body, which allows the stinger to penetrate the skin and inject venom. Numerous toxins have been identified in scorpion venoms, most of which are small peptide toxins that target ion channels found in both mammals and insects ⁽²⁾. Most scorpion stings vary from small swelling to medically significant lesions in severity, with only a few able to cause severe allergic, neurotic, or necrotic reactions. However, scorpion stings account for approximately 3000 deaths a year worldwide ⁽³⁾.

Scorpion venom is highly toxic, with fast diffusion and action on tissues. Chromatographic analysis of scorpion venoms reveals a very complex composition in both their toxic and nontoxic fractions. The nontoxic fraction is a mixture of hyaluronidase, phospholipases, and other enzymes, protease inhibitors, mucopolysaccharides, and bioamines such as serotonin and histamine. The more-thoroughly studied toxic fraction contains highly specific neurotoxins active on the ion channels (Na, K, Ca₂, or Cl) of excitable cells. While having high sequence identity, these neurotoxins differ in their degree of toxicity and affinity to specific animal species as targets, for example, mammals, crustaceans, and insects. Signs of toxicity observed after Buthidae envenomation are essentially due to its action on Na or

K channels, leading to neurotransmitter release and inducing local pain, inflammation, cardiorespiratory distress, and neurological disorders ⁽⁴⁾.

Children are at greater risk of developing severe envenomation like cardiac, respiratory, and neurological complications as compared to the adults. The clinical manifestations of scorpion envenomation are vomiting, profuse sweating, cold extremities, pulmonary edema, and death ⁽⁵⁾.

Outcome of scorpion sting depends upon the dose of the venom, the age of the child, the season of the sting and the time lapse between the sting and hospitalization. Time gap between hospitalization of patient and scorpion sting is one of significant risk factors for determining outcome and mortality. Children who present to hospital after six hours of sting have significantly higher mortality rate ⁽⁶⁾.

AIM OF THE WORK

The aim of this study was to identify the frequency and variation of laboratory changes following scorpion envenomation by assessment of clinical picture, WBC, BUN level, SGOT, SGPT and PT in children attending Aswan University Hospital with scorpion sting..

PATIENTS AND METHODS

This is a prospective observational study carried out on all children aged from one month up to 18 years attending Aswan university hospital by history of scorpion sting in the period from September 2019 to February 2020. Any patient with a previous history of liver or renal disease were excluded. All patient subjected to history, examination and investigations. History included child sex, age, residency, timing of sting (day or night and season), place of exposure of the sting, color of scorpion, if possible, site of sting, time to hospital admission, presenting symptoms, local and systemic effects (onset, duration, and severity), receive treatment before arrival to the hospital (anti venom... or others), clinical severity of each case was evaluated by the Abroug's classification. Physical examination included local signs of scorpion sting (all patients were examined for swelling, redness, tenderness at site of sting mark), general and systematic examination in details. Laboratory investigations included complete blood count, blood glucose, liver function test, urea, and creatinine at the time of arrival

Table 1: Abroug's classification for grading Signs and Symptoms of scorpion sting cases (*Abd El-Aziz et al., 2019*).

- | |
|---|
| - Grade I: Pain and/or paresthesia at the scorpion sting site, tingling, numbness and minor swelling in the skin area encompassing the sting (local symptoms). |
| - Grade II: Fever, chills, tremor, excessive sweating, nausea, vomiting, diarrhea, hypertension, and priapism (systemic symptoms ± local symptoms). |
| - Grade III: Cardiovascular, respiratory, and/or neurologic distresses (complications) |

Statistical analysis

Data was analyzed using the Statistical Package for Social Science (SPSS), version 26.0 for Windows. Mean and standard deviation or standard error were used to express quantitative data while qualitative data were presented by frequencies and percentages. Quantitative data for normality by Shapiro-Wilk test, non-parametric tests were performed. Chi square test was used to compare proportion between two different groups. Kruskal-Wallis H test was used to compare mean difference between the three grades of scorpion sting. The statistical significance was determined at P-Value less than 0.05.

RESULTS

124 children were included in this study. Mean age of studied cases was 9.48 ± 0.5 years, 45.2% of them were more than 10 years old, 35.5% were between 5 and 10 years and 19.3 % less than 5 years old (Fig 1). 54% were males (Fig 2) and 71 % were from rural area.

All studied cases suffered from pain at the site of sting (Fig 3), while only 2.4 % of them suffered from swelling. The most common systemic symptoms occurred among our cases were hypotension, sweating, salivation, vomiting, restlessness, dyspnea, and fever (65.3%, 55.6%, 54.8%, 50.8, 46.0%, 25.0% and 11.3% respectively). **Table (2)** showed that 65.5% of sting occurred from yellow species of scorpion followed by unknow type (29.8%), while the black scorpion species represent 4.8% from all stings. Hand

and foot were the most common site of scorpion sting (34.7 and 31.5% respectively) followed by leg (26.6%) and arm (7.3%). 63.7% of sting occurred during daytime, and 36.3% occurred during night. According to Abroug's classification, 12.1 % of cases classified as grade 1, 55.6 % as grade 2, and 32.3% lies in grade 3.

Table (3) showed the laboratory parameters among scorpion envenomed children according to their grade. Regarding CBC, there were statistical significance higher mean WBC value in grade 3 (19.48 ± 1.07) compared to grade one and two (9.80 ± 0.88 , 9.80 ± 0.34 respectively), p value < 0.001 , while there was no statistically significant difference between the three-grade regarding Hb level, Hct, MCV, MPV, PLT count, p value > 0.05 . Regarding renal function, there were statistical significance higher mean urea level in grade 3 (18.35 ± 1.07) compared to grade one and two (11.28 ± 0.89 , 11.59 ± 0.37 respectively), p value < 0.001 , while there was no statistically significant difference between the three grade regarding creatinine level, p value > 0.05 .

Regarding liver function, there were statistical significance higher mean value of SGOT, SGPT and PT level in grade 3 compared to grade one and two, p value < 0.001 . Mean level of SGOT in grade three was 35.99 ± 3.09 compared to 25.83 ± 7.31 and 26.65 ± 7.64 in grade one and two respectively, mean level of SGPT in grade three was 19.01 ± 4.21 compared to 16.40 ± 5.63 and 16.29 ± 4.64 in grade one and two respectively. In addition, there was statistical significance higher mean PT level in grade 3 (13.05 ± 1.10) compared to grade one and two (12.40 ± 0.80 , 12.46 ± 0.76 respectively), p value < 0.001 . No statistically significant difference between three grades regarding mean level of PTT, fibrinogen, p value > 0.05 .

Regarding line of management of our cases, 46% of scorpion envenomed children required observation only, 44.4% of children received antivenom, and 9.6% received antivenom plus dobutamine. 14.5% of children needs Pediatric Intensive Care Unit (PICU), 60.5% required pediatric emergency. recovery occurred to all cases.

DISCUSSION

Scorpion is defined as predatory arachnids having venomous and painful stings, which are a medical emergency and a serious public health problem in the field of pediatric practice⁽⁸⁾. Scorpionism (scorpion envenomation) is the disease caused in human beings by a scorpion sting, it is common in tropical regions and it is an acute life threatening in the rural places. In Upper Egypt scorpions sting still represent a medical problem and a life hazard, especially to children⁽⁹⁾. Scorpion Stings are rarely fatal in developed countries, but they are still a significant cause of mortality in developing nations. It is estimated that over one million scorpion stings (with approximately 3000 deaths) occur every year in endemic areas⁽¹⁰⁾.

The present study revealed that the mean age of the studied cases was 9.48 ± 0.5 years. This was close to *Meki et al.*⁽¹²⁾ as mean age of their patients was 7.3 ± 0.72 years. *Çağlar et al.*⁽¹³⁾ and *Prasad et al.*⁽¹⁴⁾ reported that all of their cases were less than 18 and 16 years respectively. *Bouaziz et al.*⁽⁹⁾ found 72 % of their studied populations in Tunisia were below 16 years. in contrast, *Abd El-Aziz et al.*⁽¹⁵⁾ and *Al et al.*⁽²¹⁾ reported mean age of their cases were 45.22 ± 17.99 and 31.9 ± 17.9 years respectively. This difference may be due to the different inclusion and exclusion criteria between the studies.

54.0% of our cases were males, this is close to *Meki et al.*⁽¹²⁾, *Çağlar et al.*⁽¹³⁾, *Prasad et al.*⁽¹⁴⁾ and *de Roodt et al.*⁽¹⁶⁾ as they reported had 63 %, 58.5%, 65%. And 58 %. *de Roodt et al.*⁽¹⁶⁾ attributed this because males may had more contact with different types of scorpions than females. On the other hand, *Abd El-Aziz et al.*⁽¹⁵⁾ and *Al et al.*⁽²¹⁾ found females were more frequently affected. This difference may be due to different sample size and different age distributions

Most of our cases were exposed to stings at rural areas which agree to *Prasad et al.*⁽¹⁴⁾ and *Gökay et al.*⁽²²⁾ *Kumar and Prasad*⁽¹¹⁾ found 96% of their cases were from rural areas. In contrast to *Mohamed et al.*⁽²³⁾ and *Carmo et al.*⁽²⁴⁾ found 93% and 84.5% of their cases from urban.

Regarding manifestation of scorpion sting among studied cases, all children suffered from pain at the site of sting, while swelling present in small number. The most common systemic symptoms were hypotension, sweating, salivation, vomiting, restlessness, dyspnea and fever. This is close to *Çağlar et al.*⁽¹³⁾ and *Abd El-Aziz et al.*⁽¹⁵⁾ study. Pain occurred in stings from almost all the scorpion types (yellow, black and unknown types) in our study, which agreed to *Al et al.*⁽²¹⁾, *Khatony et al.*⁽²²⁾, *Chippaux and*

Goyffon⁽¹⁰⁾ and *Isbister and Bawaskar*⁽²³⁾ studies. In contrast, *Bouaziz et al.*⁽²⁵⁾, *Osnaya-Romero et al.*⁽²⁶⁾ and *de Roodt et al.*⁽¹⁶⁾ found severe neurological manifestations (coma and/or convulsions), and *Farghly and Ali*⁽²⁷⁾ reported hyper sweating, myoclonus, agitation, and priapism were the most common symptoms in their patients. *Bouaziz et al.*⁽²⁵⁾ found agitation and priapism were observed in more than 70% of cases, while myoclonus in 11% of cases. Variations in the manifestations between studies may be due to the variability in the scorpion's types in the different world regions, severity of the stings, and different ages between them.

The majority of scorpion sting in our cases occurred from yellow species of scorpion, while the black species represent very small percent. This is in line with *Abd El-Aziz et al.*⁽¹⁵⁾ and *Mohamed et al.*⁽²³⁾ study and agreed with almost all studies held in Egypt and Middle East. These two species belong to family of Buthidae, which is the largest group in scorpion families (more than 800 scorpion species), and is mainly found in North Africa, Middle East, Asia, and India as stated on *Alkahlout et al.*⁽¹⁷⁾ study. In addition. *Ozkan et al.*⁽¹⁸⁾ revealed that *Leiurus quinquestriatus* and *Androctonus crassicauda* are endemic in Africa and Middle East than other Buthidae species. In addition to that *Lowe et al.*⁽¹⁹⁾ stated that Egyptian scorpions *Leiurus quinquestriatus* and *Androctonus crassicauda* were found on patient's bed clothes. In contrast *Prasad et al.*⁽¹⁴⁾ study found the Indian red scorpion (*Mesobuthus tumulus*) was the type of the scorpion in their study. *Mesobuthus tumulus* is the most toxic scorpion species in India, which is abundantly found in coastal areas and paraganatic regions.

The present study revealed that hand and foot were the most common site of scorpion sting followed by leg and arm. This is close to *Çağlar et al.*⁽¹³⁾, *Meki et al.*⁽¹²⁾ *Abd El-Aziz et al.*⁽¹⁵⁾ and *Goyffon et al.*⁽²⁹⁾ studies as they found that upper and lower extremity were the most common site of scorpion sting in their study. In addition, *Chippaux et al.*⁽¹⁰⁾ stated that the ends of the lower limbs were the most affected anatomical regions. This necessitate wearing a personal protective equipment as a preventive measure for the protection of the body with the use of boots and gloves for populations at high risk during work is suggested. Workers' health in this region needs more attention from policymakers⁽¹⁰⁾.

We found that majority of sting occurred during daytime, this agreed with *Gökay et al.*⁽²²⁾ as they found 85.7% of their cases occurred during daytime. In contrast *Çağlar et al.*⁽¹³⁾, *Mohamed et al.*⁽²³⁾ and *Bosnak et al.*⁽²⁰⁾ found that majority of sting occurred during night. Many studies revealed that 80% of scorpion sting occur at night between 6:00 pm and 12:00 am and 20% occurs from 6:00 am to 12:00 pm. Both peaks coincide maximum human activity with maximum scorpion activity as Scorpions are nocturnal creatures; they hunt during the night and hide in crevices and burrows during the day to avoid the light^(23,28).

according to Abroug's classification, more than half of our cases classified as grade 2, while 1/3 were grade 3, this agreed with *Abd El-Aziz et al.*⁽¹⁵⁾ and disagree with *Meki et al.*⁽¹²⁾ as all of their patients had severe envenomation (grade III) and showed manifestation of multiple organ failure. *Çağlar et al.*⁽¹³⁾ stated that 66 % of their cases were grade I to II and 34 % were grade III. This difference can be explained by different times of hospital arrival after stings that affect appearance of clinical manifestation.

Regarding the laboratory investigation, there was statistical significance higher mean WBC, BUN, SGOT, SGPT and PT levels in grade 3 compared to grade one and two, while there was no difference between three grade regarding Hb level, Hct, MCV, MPV and PLT count. This agreed with *Çağlar et al.*⁽¹³⁾ as they found statistical significance higher mean WBC in grade 3 but they found platelet count increased markedly in the severe group (grade 3), in addition, they found no statistical significance difference between groups regarding BUN level, SGOT, SGPT and PT level. In contrast to our study, *Gökay et al.*⁽²²⁾ study found no statistically significant difference was identified in any group regarding the laboratory parameters among scorpion envenomed children according to their grade. This difference may be due to different grades and severity between the studies.

No treatment, just observation was given to 46% of our cases, while 44.4% received antivenom, 14.5% of children needs PICU, 60.5% admitted to pediatric emergency and 25% needed observation only for 24 hrs. Recovery occurred in almost all the scorpion envenomed children with 2.4% deaths. This is in line with *Çağlar et al.*⁽¹³⁾ as most of their patients were treated with scorpion antivenom. The first choice of inotropic drugs in their study was dobutamine. *Abd El-Aziz et al.*⁽¹⁵⁾ found that there was high recovery rate (96.4%) among scorpion sting patients (grade 1 and 2). *Alkahlout et al.*⁽¹⁷⁾ registered

recovery of all scorpion sting cases (grade 1). In *Gökay et al.* ⁽²²⁾ study, most of their patients were treated with Antivenom + doxazosin + dobutamine (Inotrop), and 85.7 % of their cases were admitted PICU. *Alkahlout et al.* ⁽¹⁷⁾ reported all stings in their with grade 1 had 100% recovery rate and all deaths were grade 3. In addition, *Chippaux and Goyffon* ⁽¹⁰⁾ stated that deaths from scorpion stings are rarely fatal in developed countries, but they are still a significant cause of mortality in developing nations. *Meki et al.* ⁽¹²⁾ stated that mortality of victims of scorpion envenomation admitted to medical PICU is still high.

CONCLUSIONS

Scorpion stings is a life threatening medical emergency. *Leiurus quinquestriatus* scorpion (yellow scorpion) and *Androctonus crassicauda* (black scorpion) scorpion species are among endemic scorpion species in Egypt. According to Abroug's classification, more than half of our cases classified as grade 2, while 1/3 were grade 3. There was statistical significance higher mean WBC, BUN, SGOT, SGPT and PT levels in grade 3 compared to grade one and two.

These results may provide illuminating data for future studies. However, because of our relatively low patient numbers, further studies are now needed to may help in the development of ideal therapeutic strategies to minimize the inflammatory response and myocardial injury associated with scorpion envenomation.

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Figure (1): Age distribution of the studied scorpion envenomed children

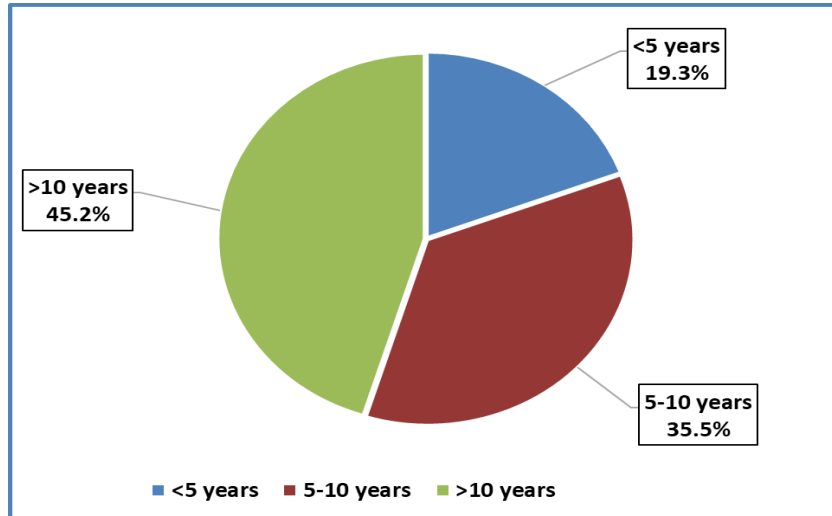


Figure (2): Gender distribution of the studied scorpion envenomed children

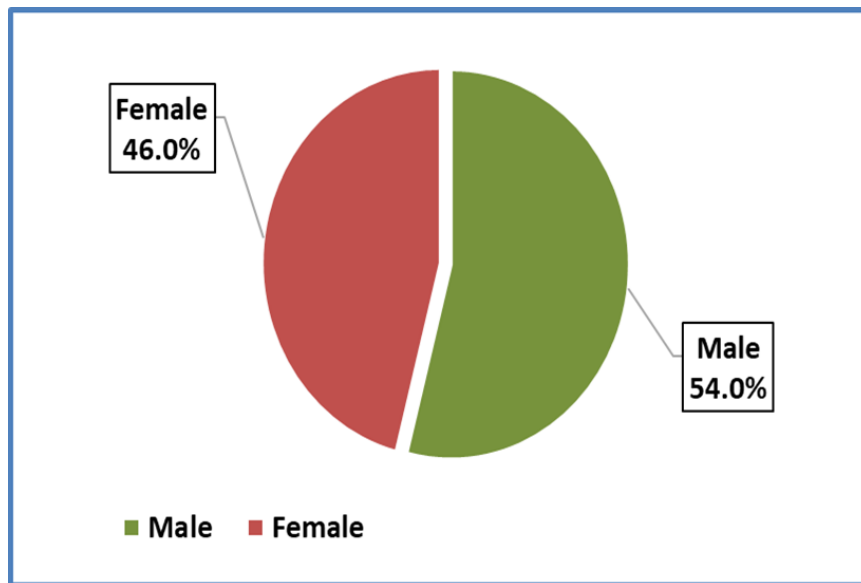


Figure (3) shows local and systemic manifestation of scorpion sting.

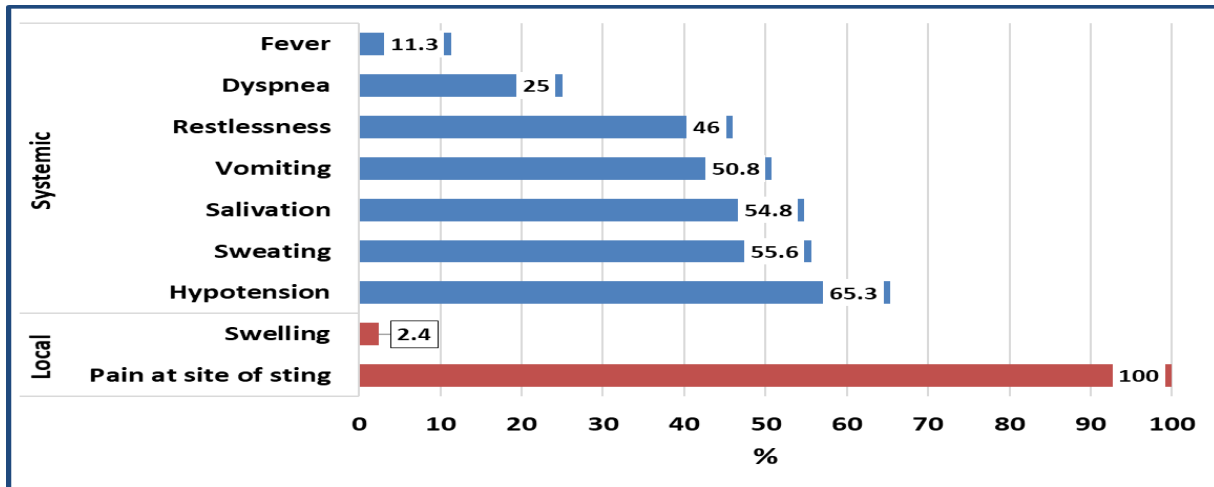


Table (2): Features of scorpion stings among the studied scorpion envenomed children

Variables	Frequency (n=124)	Percent (%)
Time of arrival hospital /hr. after scorpion sting		
Mean ± SE (Range)	1.67±0.1 (1-3)	
Type of scorpion		
Yellow	81	65.3
Unknown	37	29.8
Black	6	4.8
Site of sting		
Hand	43	34.7
Foot	39	31.5
Leg	33	26.6
Arm	9	7.3
Time of sting		
Day	79	63.7
Night	45	36.3

Table (3): Scorpion sting according to Abroug's classification for grading signs and symptoms of scorpion sting cases

Variables	Frequency (n=124)	Percent (%)
Grade 1	15	12.1
Grade 2	69	55.6
Grade 3	40	32.3

Table (4): Laboratory parameters among scorpion envenomed children according to their grade.

Laboratory parameters	Grade 1 N=15	Grade 2 N=69	Grade 3 N=40	P-Value*
Blood picture				
WBC	9.80±0.88	9.80±0.34	19.48±1.07	<0.001
HB	12.86±1.3	13.24±1.27	12.23±2.10	0.06
HCT	38.44±4.0	39.04±3.62	39.45±6.36	0.50
MCV	78.31±8.62	79.11±9.23	75.95±8.44	0.21
MPV	9.38±0.92	9.43±0.99	9.12±1.19	0.34
PLT	267.87±23.20	302.17±9.33	327.60±8.82	0.08
Kidney function				
BUN	11.28±0.89	11.59±0.37	18.35±0.96	<0.001
Creatinine	0.54±0.03	0.53±0.02	0.53±0.03	0.91
Liver function				
SGOT	25.83±7.31	26.65±7.64	35.99±3.09	<0.001
SGPT	16.40±5.63	16.29±4.64	19.01±4.21	0.01
PT	12.40±0.80	12.46±0.76	13.05±1.10	0.01
PTT	25.65±3.57	26.07±3.26	24.78±3.62	0.19
Fibrinogen	252.27±58.34	249.64±54.23	234.45±67.83	0.31

Data is expressed as a mean ± SE

*Kruskal-Wallis H test

Table (5): management of the studied scorpion envenomed children

Variables	Frequency (n=124)	Percent (%)
Type of treatment		
Observation only	57	46.0
Antivenom	55	44.4
Antivenom + Dobutamine	12	9.6
Hospitalization		
Pediatric emergency	75	60.5
Pediatric ICU	18	14.5
Self-discharge	31	25.0
Evolution		
Complete recovery	124	100.0