

## Cardiac Markers in scorpion envenomed children in some hospitals in Sohag.

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### Abstract

**Background:** Scorpionism is an endemic health problem in Upper Egypt. This study shows the epidemiological, clinical and laboratory manifestations of scorpion envenomation and identify factors that are predictive of severe cases.

**Methods:** Prospective study had been performed at Emergency Unit in the Sohag university hospital and Sohag General Hospital from January to December, 2016. It included 50 patients with definite history of scorpion sting envenomation. The epidemiological, clinical, and laboratory findings of patients were recorded.

**Results:** We found that 44% had abnormal serum troponin and 58% had abnormal serum CK-MB. Also 54% had abnormal serum lactate dehydrogenase and 44% had abnormal serum myoglobin. ECG study revealed changes in the severe group in the form of low QRS, ST segment change, sinus tachycardia and ventricular ectopics. Severe group showed significant reduction in the %SF and LVEF in the comparison to the mild/moderate group.

**Conclusions:** The present study is demonstrated that cTnI is a highly specific and sensitive indicator for myocardial injury and adverse outcome in victims of scorpion envenomation. So cTnI may be used in these cases for both diagnosis and prognosis. The use of cTnI in the immediate assessment of patients with severe systemic envenomation appears warranted to identify those at risk of myocardial injury.

### Introduction:

Scorpion envenomation is an important public health hazard in tropical and subtropical regions (1). Envenomation by scorpions can result in a wide range of clinical effects, including, cardiotoxicity, neurotoxicity, respiratory dysfunction and multiorgan dysfunction syndrome (MODS)(2). There are 1500 scorpion species known to exist, only 30 are of medical importance and majority of them produce similar cardiovascular effects. These effects were studied by critical observations of clinical, neurotransmitter studies, radioisotope studies, echocardiography and haemodynamic patterns (3). Regimen including scorpion antivenom, vasodilators, intensive care management have been used to alleviate

the systemic effects of envenoming (4). Scorpion antivenom (SAV) use in children was shown to accelerate recovery times (5). Having achieved significant reduction in mortality in scorpion sting envenomation, the need of the hour is to reduce morbidity due to scorpion sting envenomation, among which myocardial dysfunction is most important (6). Myocardial damage in children may be clinically not clear in a variety of stressful conditions. However, biochemical markers have not been routinely used in children at risk of myocardial damage due to lack of sufficient specificity (7). As the criterion for myocyte injury is not well established, so the need for a specific serum marker for myocardial injury might be useful to

augment the clinical and echocardiographic (Echo) diagnosis of myocarditis. Cardiac troponin I (cTnI) have non-cross reactivity with the skeletal muscle proved that cTnI is an early marker for viral myocarditis(8). Identification of factors that could potentially predict myocardial dysfunction could be helpful in providing appropriate and timely management, thereby reducing the morbidity due to the condition (9). This study shows the epidemiological, clinical and laboratory manifestations of scorpion envenomation and identify factors that are predictive of severe cases.

### **Pateints and methods:**

observational prospective study conducted in the period from January to December , 2016.at the Emergency Unit in the Sohag university hospital and Sohag General Hospital.It included 50 patients with definite history of scorpion sting envenomation.All patients were subjected to:**Full history taking with focus on:** Age of the patient, time of sting, site of sting, color of the scorpion, duration between sting and hospital admission and local and systemic symptoms.**Thorough clinical examination with focus on:**Cardiovascular examination, Glasgow-coma scale (GCS).**Assessment of cardiac function:(1)Cardiac markers:**Serum cardiac Troponin I (cTnI) was done by the use of immunochemiluminescence micro particle immunoassey reagents by the use of Architect-1000 (Abbott-Dalace-USA).Serum Creatinephospho Kinase

isoenzyme-MB (CpK-MB), Serum Lactate dehydrogenase (LDH) and Serum Myoglobin (Mb) were done by the use Cobas-C 311, a fully automated chemistry analyzer (Roche-USA).**(2)Electrocardiography(ECG):standard 12 leads.****(3)X-ray.****(4)Echocardiography (ECHO).**The patientsweregroupedaccordingtoagradings ystem : thesevere gradegroupincludedpatientswith severe clinical findings,suchasacute pulmonaryedema,myocarditis,cardiopulmonaryfailure,shock,andcoma;themildmoderate gradegroupincluded asymptomaticpatients and patientswithlocalormildsystemic findings

### **Ethical consideration:**

Approval ofSohag faculty of Medicine Research Ethical Committee was taken. written informed consent was taken from the parents.

### **Statistical analysis:**

Statistical package for social sciences (IBM-SPSS), version 20 IBM- Chicago, USA .Data expressed as mean, standard deviation (SD) for quantitative data, while number and percentage for qualitative data.Student t test was used to compare the means between two groups for quantitative data. Chi square test was used to compare two groups for qualitative data. P value < 0.05 was considered as statistically significant.

### **Result:**

This study was conducted on 50 children presented with scorpion envenomation to the Pediatric Emergency Unit in Sohag University Hospital and Sohag General Hospital from January to December, 2016 .Table (1) shows that the mean age of our study group was 6 years, with standard deviation (SD) 3.7 years, and this reflected in wide range from 2 months to 12 years. 60% of study group were male. All patients were from rural areasand had definite history of scorpion sting.62% had sting at day. 86% of scorpion were black colour and only 14% were yellow.The mean of time between sting and admission was 48 minute and range from 18 minute to 2.5 hours.The mean of number of scorpion antivenom was 6.5, and range from 1 to 20. 62% of stings were in lower extremities, 28% were in upper extremities, and few were in other sites (back, head, and neck).Table (2) shows the symptoms developed in children included in the study. 52% of envenomation was mild, and 48% was severe.The most frequent symptoms were tachycardia, vomiting, cold extremities, lacrimation developed in 76%, 68%, 68%, 52% of patients respectivity while other symptoms were encephalopathy in 42%, agitation in 42%, tachypnea in 40%, myocarditis in 30%, itching in

28%, salivation in 26%, pulmonary edema (manifested by: basal crepitations, hypoxemia and respiratory distress) in 18%, abdominal distension in 12%, parathesia in 10%, bronchospasm in 8%, seizure in 6%, mydriasis in 2%. Investigations of all cases are summarized in Table (3) Blood glucose level was markedly increased in the severe group than mild/moderate group ( $P < 0.001$ ). Values of troponin, CPK-MB, LDH and Myoglobin in severe group were significantly higher than mild/moderate group ( $P < 0.001$ ). Pulmonary edema was observed in X-ray of 8 patients in the severe group ( $P = 0.001$ ). ECG study revealed changes in the severe group in the form of low QRS, ST segment change sinus tachycardia and ventricular ectopics ( $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$  and  $P = 0.001$ , respectively). Severe group showed significant reduction in the % SF in comparison to the mild/moderate group ( $P < 0.001$ ). Meanwhile, the Severe group showed significant lower value of LVEF in comparison to the mild/moderate group ( $P = 0.001$ ).

**Table (1):** Clinical characteristics of study participants.

Descriptive data of envenomed children	
Age (years), (mean $\pm$ SD)	6.364 $\pm$ 3.7171
Sex	
Female, n (%)	20(40.0)
Male, n (%)	30(60.0)
Residency	
Rural, n (%)	50(100.0)
Definite history of scorpion sting, n (%)	
yes	50(100.0)
Time of the sting, n (%)	
Day	31(62.0)
Night	19(38.0)
Color of the scorpion, n (%)	
black	43(86.0)
yellow	7(14.0)
Timing between sting and admission (hours) (mean $\pm$ SD)	.883 $\pm$ .6134
Number of scorpion antivenom (mean $\pm$ SD)	6.56 $\pm$ 4.824
Site of the sting, n (%)	
Back	1(2.0)
Head	1(2.0)
lower extremity	31(62.0)
Neck	3(6.0)
upper extremity	14(28.0)
Duration of hospitalization (days) (mean $\pm$ SD)	1.720 $\pm$ .9802

**Table (2):** Clinical manifestations of scorpion envenomation.

Clinical manifestations of scorpion envenomed children	n (%)
Clinical Severity of envenomation	
Mild	26(52.0)
Severe	24(48.00)
Encephalopathy (disturbed conscious level)	21(42.0)
Seizure	3(6.0)
Agitation	21(42.0)
Tachycardia	38(76.0)
Tachypnea	20(40.0)
Pupil (miosis, mydriasis, anisocoria) (mydriasis)	1(2.0)
Pulmonary edema	9(18.0)
Myocarditis	15(30.0)
Bronchospasm	4(8.0)
Abdominal distension	6(12.0)
Vomiting	34(68.0)
Cold extremities	34(68.0)
Salivation	13(26.0)
Lacrimation	26(52.0)
Parathesia	5(10.0)
Itching	14(28.0)

**Table (3):** Comparison between investigation results in patients with mild to moderate envenomation and those with severe envenomation.

Parameter		Mild-moderate grade (26)	Severe grade (24)	P value
Blood glucose level		128.77±27.26	177.04±54.99	<0.001
Serum troponin	Median	0.01 (0.001-0.03)	0.5(0.01-5)	<0.001
	Abnormal	0	22(91.7%)	<0.001
Creatine kinase	Median	22(15-27)	55(26-270)	<0.001
	Abnormal	5(19.2%)	24(100%)	<0.001
Lactate dehydrogenase	Median	546(97-760)	802 (593-1344)	<0.001
	Abnormal	4(15.4%)	23(95.8%)	<0.001
Myoglobin	Median	38(19-70)	79.5(26-105)	<0.001
	Abnormal	0	22(91.7%)	<0.001
X ray	Normal	26(100%)	16(66.7%)	0.001
	Pulmonary edema	0	8(33.3%)	
ECG	Low amp. QRS	0	10(41.7%)	<0.001
	ST segment change	0	10(41.7%)	<0.001
	Ventricular ectopics	0	8(33.3%)	0.001
	Sinus tachycard.	0	19(79.2%)	<0.001
	Ventricular tachycard.	0	2(8.3%)	0.435
ECHO	LVEF	71.73±2.31	65.83±7.23	0.001
	SF%	31.50±2.35	25.5±3.48	<0.001

### Discussion:

Mean of age of our study group was 6 years, with SD 3.7 years, and this reflected in wide range from 2 months to 12 years, 60% of study group were male, 40% were female, and all patients were from rural areas, this was with agreement with *Chippaux et al. (10)* as mean age of the person stung in their study was 48 months, age of the severe group was significantly less than that of the mild- moderate group. The majority of cases (58.5%) were boys. Also *Mohamad et al. (11)* reported in their study that all of the patients lived in rural areas and had a low socioeconomic status. Most of the children typically played outside of their homes. All our patients had definite history of scorpion sting, 62% had sting at day, 38% had sting at night, 86% of scorpion were black colour and only 14% were yellow. Mean of time between sting and admission was 48 minute and range from 18 minute to 2.5 hours, also *Cesaretli et al. (12)* reported that the median duration between sting and hospital admission was longer for the severe group compared with the mild-moderate group, mean of number of scorpion antivenom in our study was 6.5, and range from 1 to 20. 62% of stings were in lower extremities, 28% were in upper pulmonary edema, only 30% of patients had myocarditis, only 8% had bronchospasm, 68% of patients had vomiting, 68% of patients had cold

extremities, and few were in other sites (back, head, and neck), this was in agreement with study of *Bosnak et al. (13)* as in their study the most common sting site involved the extremities, only 2 patients were stung on the neck while sleeping, and 1 of them died. *Otero et al. (14)* also reported in their results that stings occurred to lower or upper extremities in 86.5% of the cases. This is likely due to factors including the high level of agricultural activity in rural areas, the frequency of wearing sandals or walking barefoot, the habit of putting on shoes without preshaking them, and hand searching for scorpions in homes (15). In our study 52% of envenomation was mild, and only 48% was severe, this was similar to study by *Adiguzel et al. (16)* as there were 27 patients (65.9%) in the mild-moderate group and 14 patients (34.1%) in the severe group and majority of stings in both groups (36.6%) occurred in July. Regarding clinical manifestations 42% of our patients had encephalopathy (disturbed conscious level), only 6% of patients had seizures, 42% of patients had agitation, 76% of patients had tachycardia, only 40% of patients had tachypnea, only 18% of them had extremities, only 26% had salivation, only 1 patient of all cases had mydriasis, 52% of patients had lacrimation, and only 28% had itching. Our findings confirmed by

*Isbister et al.*, *Chippaux et al.* (3,10) as the most common findings in their studies was pain, the most common systemic clinical findings were cold extremities, tachypnea, vomiting, sweating, tachycardia, and agitation. All of these systemic findings were increased in the severe group, and the differences from the mild-moderate group were statistically significant. Fever was noted in 7 patients (17.1%). In the severe group, 5 patients had fever, and 2 of these patients had mydriasis. One of the patients with mydriasis had a seizure. Both patients with mydriasis died. Myocarditis was frequently observed in patients with fevers, a finding that was statistically significant. The most commonly observed dysrhythmia in all patients was sinus tachycardia, observed in 14 patients (34.1%) (1). *Bosnak et al.* (13) reported priapism in 72.4% patients; in contrast, we observed priapism in 26% patients. Although fever was observed less frequently in this study compared with other studies (17,11). *Petricevich et al.* (18) said that in particular, myocarditis was more frequently observed in patients with fever. These results can be explained by the effects of cytokines: proinflammatory cytokines cause fever and other systemic symptoms; and an imbalance between proinflammatory and anti inflammatory mediators may be associated with mortality and morbidity (18). Previous studies on scorpion envenomation reported left ventricular dysfunction, myocarditis, respiratory failure, and pulmonary edema in victims of scorpion stings (19). We found that 56% had normal serum troponin, and 44% had abnormal serum troponin with mean 0.486, 42% had normal serum CK, and 58% had abnormal serum CK with mean 61, SD 70, and range from 15 to 270. Also 46% of patients had normal serum lactate dehydrogenase, and 54% had abnormal serum lactate dehydrogenase with mean 656, SD 232,

and range from 97 to 1344, serum myoglobin was normal in 56% of patients, and it was abnormal in 44% of patients with mean 57, SD 25, and range from 19 to 105. Our findings were in agreement with *Sofer et al.* (20) as they found that leukocyte levels were markedly increased in the severe group, and on admission, their troponin I, CK-MB, and CPK levels were markedly increased. Median troponin I values peaked at 24 hours and then decreased. Two patients had initial troponin levels that were normal. Pulmonary edema was present in only 16% of our patients which less frequently than reported in other studies and it was observed in all myocarditis cases, however, supporting the hypothesis that pulmonary edema results from cardiac dysfunction (2,21), only 20% of our patients had ECG low amplitude QRS, only 20% had ECG changes in ST segment, and only 16% had ECG ventricular ectopics. In study of *Abroug et al.* (22) pulmonary edema developed in 9.6% and dyspnea in 23.0% of their patients. Acute pulmonary edema has been attributed to acute left ventricular failure due to massive release of catecholamines or myocardial injury induced by the venom. Cardiogenic shock and pulmonary edema are the leading causes of death after scorpion envenomation; however, breathing disturbances have also been observed in patients without pulmonary edema or myocardial damage after scorpion envenomation (23). Mean of ECHO left ventricular ejection fraction was 68, with range from 40 to 78, however mean of ECHO shortening fraction of left ventricle (SF%) was 28, and range from 15 to 35, this was similar to results of *Sofer et al.* (20) as LVEF was 25% on echocardiography. *Bucarechi et al.*, *Izquierdo et al.* (24,25) analyzed 1327 patients stung by scorpions in Brazil; found only 1 patient had ventricular tachycardia.

## Conclusion:

We found that 44% had abnormal serum troponin and 58% had abnormal serum CKmb. Also 54% had abnormal serum lactate dehydrogenase and 44% had abnormal serum myoglobin. ECG study revealed changes in the severe group in the form of low QRS, ST segment change, sinus tachycardia and ventricular ectopics. Severe group showed significant reduction in the %SF and LVEF in the comparison to the mild/moderate group.

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## References :

- (1) Meki AR, Mohamed ZM, Mohey El-deen HM. Significance of assessment of serum cardiac troponin I and interleukin- 8 in scorpion envenomed children. *Toxicon*. 2003;41:129–137.
- (2) Bahloul M, Chabchoub I, Chaari A, et al. Scorpion envenomation among children: clinical manifestations and outcome (analysis of 685 cases). *Am J Trop Med Hygiene*. 2010;83:1084–1092.
- (3) Isbister GK, Bawaskar HS. Scorpion envenomation. *N Engl J Med*. 2014;371:457–63.
- (4) Prasad R, Mishra OP, Pandey N, Singh TB. Scorpion sting envenomation in children: Factors affecting the outcome. *Indian J Pediatr* 2011;78:544–8.
- (5) Bawaskar HS, Bawaskar PH. Efficacy and safety of scorpion antivenom plus prazosin compared with prazosin alone for venomous scorpion sting: (Mesobuthus tamulus) sting: Randomised open label clinical trial. *BMJ*. 2011;342:c7136.
- (6) Pandi K, Krishnamurthy S, Srinivasaraghavan R, Mahadevan S. Efficacy of scorpion antivenom plus prazosin versus prazosin alone for Mesobuthus tamulus scorpion sting envenomation in children: a randomised controlled trial. *Arch Dis Child* 2014;99:575–80.
- (7) Khattabi A, Oulaymani –Bancheikh R et al. Classification of clinical consequences of scorpion sting: consensus development. *Trans Roy Soc Trop Med Hyg* 2011;105:364–69
- (8) Konca C, Tekin M, Turgut M. Doxazosin in the treatment of scorpion envenomation. *Indian J Pediatr* 2014;14:1423–6.
- (9) Kumar M, Krishnamurthy S, Delhikumar CG, Narayanan P, Biswal N, Srinivasan S. Scrub typhus in children at a tertiary hospital in southern India: clinical profile and complications. *J Infect Public Health* 2012;5:82–8.
- (10) Chippaux JP, Goyffon M. Epidemiology of scorpionism: a global appraisal. *Acta Tropica*. 2008;107:71–79.
- (11) Mohamad IL, Elsayh KI, Mohammad HA, et al. Clinical characteristics and outcome of children stung by scorpion. *Eur J Pediatr*. 2014;173:815–818.
- (12) Cesaretli Y, Ozkan O. Scorpion stings in Turkey: epidemiological and clinical aspects between the years 1995 and 2004. *Rev Inst Med Trop Sao Paulo*. 2010;52:215–220.
- (13) Bosnak M, Ece A, Yolbas I, Bosnak V, Kaplan M, Gurkan F. Scorpion sting envenomation in children in southeast Turkey. *Wilderness Environ Med*. 2009;20:118–124.
- (14) Otero R, Navió A, Cespedes FA, et al. Scorpion envenoming in two regions of Colombia: clinical, epidemiological and therapeutic aspects. *Trans R Soc Trop Med Hyg*. 2004;98:742–750.
- (15) Ozkan O, Adiguzel S, Yakistiran S, et al. *Androctonus crassicauda* (Olivier 1807) scorpionism in the Sanliurfa Provinces of Turkey. *Acta Parasitol Turcica*. 2006;30: 239–245.
- (16) Adiguzel S, Ozkan O, Inceoglu B. Epidemiological and clinical characteristics of scorpionism in

- 
- children in Sanliurfa, Turkey. *Toxicon*. 2007;49:875–880.
- (17) Pipelzadeh MH, Jalali A, Taraz M, Pourabbas R, Zaremir-akabadi A. An epidemiological and a clinical study on scorpionism by the Iranian scorpion *Hemiscorpius lepturus*. *Toxicon*. 2007;50:984–992.
- (18) Petricevich VL. Scorpion venom and the inflammatory response. *Mediat Inflamm*. 2010;2010:903295.
- (19) Das S, Nalini P, Anantkrishnan S, et al. Cardiac involvement and scorpion envenomation in children. *J Trop Pediatr*. 1995;41:338–340.
- (20) Sofer S, Zucker N, Bilenko N, et al. The importance of early bedside echocardiography in children with scorpion envenomation. *Toxicon*. 2013;68:1–8.
- (21) Bouaziz M, Bahloul M, Kallel H, et al. Epidemiological, clinical characteristics and outcome of severe scorpion envenomation in South Tunisia: multivariate analysis of 951 cases. *Toxicon*. 2008;52:918–926.
- (22) Abroug F, Ayari M, Nouira S, et al. Assessment of left ventricular function in severe scorpion envenomation: combined hemodynamic and echo-Doppler study. *Intensive Care Med*. 1995;3:629–635.
- (23) Gueron M, Illia R, Margulia G. Arthropod poisons and the cardiovascular system. *Am J Emerg Med*. 2000;18:708–714.
- (24) Bucarechi F, Fernandes LC, Fernandes CB, et al. Clinical consequences of *Tityusbahiensis* and *Tityusserrulatus* scorpion stings in the region of Campinas, south eastern Brazil. *Toxicon*. 2014;89C:17–25.
- (25) Izquierdo LM, Rodriguez Buitrago JR. Cardiovascular dysfunction and pulmonary edema secondary to severe envenoming by *Tityuspachyurus* sting. *Casereport. Toxicon*. 2012;60:603–606.