A Study on the Spectrum of Clinical Manifestations and Outcomes of Scorpion Envenomation

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ABSTRACT

BACKGROUND

Scorpion sting is a public health hazard in tropical and subtropical countries. Our objective was to study the clinical manifestations, various electrocardiographic features and outcome of scorpion sting envenomation. We also intended to identify prognostic factors that could aid in preventing fatal outcomes in scorpion envenomation.

METHODS

A retrospective analysis of 156 patients of scorpion sting envenomation aged above 15 years admitted at our hospital between January 2015 and December 2019 was done. Based on signs and symptoms, patients were classified into three classes of the ADELF congress consensus classification.^{3,11}

RESULTS

Scorpion envenomation accounted for 7.26 % (156) of all admissions with a case fatality rate of 1.92. Majority of the patients presented to the hospital between 1 - 4 hours of the sting (46.8 %). As the duration between the sting and arrival to the hospital increased, a higher proportion of patients were classified into class 3. All the patients reported pain at the local site of sting (100 %). Life threatening signs like pulmonary oedema (7.7 %) and myocarditis (7.7 %) were infrequent. Majority of the patients had normal sinus rhythm (56.4 %). Sinus tachycardia was found in 24.4 % patients followed by T wave changes in 10.3 % patients. Mortality was significantly higher in severe envenomation (p value 0.004). Prazosin therapy was noted to be significantly effective as compared to symptomatic management alone (p value 0.04).

CONCLUSION

Pain was noted to be sine-qua-non for the diagnosis of scorpion envenomation in our study. Majority of the patients had one or the other autonomic findings, most common being tachycardia and profuse sweating. Sinus tachycardia and T wave inversion were common ECG findings. All patients responded well to prazosin therapy. Although sinus tachycardia was a non-specific sign, its persistence for more than 24 hours could herald an autonomic storm with features of myocarditis and pulmonary oedema as seen in our study. We propose the use of persistent tachycardia as a prognostic marker to aid intensive care management in anticipation of an impending autonomic storm.

KEYWORDS

Scorpion Sting Envenomation, Outcome, Clinical Features, Electrocardiographic Features

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BACKGROUND

Scorpion sting is a public health hazard in tropical and subtropical countries. The fact that many of them are underdeveloped and lack medical facilities, the disease burden is under reported.1-4 The annual incidence of envenomation exceeds 1.2 million globally with a case fatality rate of 0.27 %.1In India, scorpion envenomation are commonly encountered in the rural areas. They account for nearly 10 % of annual ICCU admissions and much more outpatient visits.^{2,3} Indian case fatality was as high as 3-22 % in different regions. With the advent of newer treatment protocols, mortality has declined to <2 %.³ The true incidence is not known due to the scarcity of ICU facilities and access to healthcare in these reaions.2-4 Symptomatology and severity of envenomation varies greatly. Ranging from mild local pain to severe myocarditis and death.^{2,5} Cardiotoxicity and dysautonomia are its cardinal manifestations.^{3,6-8} А few non-specific electrocardiographic changes have been documented to be reflective of cardiotoxicity.9,10 However, their premonitory significance is not established.

Our objective was to study the clinical manifestations, the various electrocardiographic features and outcome of scorpion sting envenomation. We also intended to identify prognostic factors that could aid in preventing fatal outcomes in scorpion envenomation.

METHODS

A record-based case series study was designed with a sample size of 156 using open epi software version 2.3.1. A retrospective analysis of 156 patients of scorpion sting envenomation aged above 15 years admitted at our hospital between January 2015 to December 2019 was done. Based on signs and symptoms, patients were classified into three classes of the ADELF congress consensus classification.^{3, 11}

- CLASS 1- Local pain and mild local oedema.
- CLASS 2- Systemic manifestation- Profuse sweating, sinus tachycardia or bradycardia, tall 'T' waves on ECG, reduced LV function on 2D ECHO, hypertension, hypotension, LVF (Killip's class I & II) + Local signs.
- CLASS 3- Cardiorespiratory manifestations- cardiogenic shock, acute pulmonary oedema, severe neurodeficit (GCS<6).

Complete blood count, blood glucose, serum urea, serum creatinine, serum potassium, chest x-ray and 2D echocardiographs were recorded in all patients.

Inclusion Criteria

- 1. All patients with history of scorpion sting.
- 2. Patients aged 15 years and above.

Exclusion Criteria

- 1. Patients with pre-existing:
 - Congenital heart diseases.

- Ischaemic heart diseases.
- Valvular heart diseases.
- 2. Pregnant women
- 3. Patients with Diabetes and Chronic kidney disease.

RESULTS

A total of 156 patients was retrospectively studied during the period of 5 years. Off the 2150 cases admitted to the ICCU during the five-year study period, scorpion envenomation accounted for 7.26 % (156) of all admissions.

Age of the patients in this study ranged from 15 years to 80 years. Most (46) of the patients belonged to the age group of 21-30 years (29.5 %). This may be due to the fact that the scorpion envenomation is purely an accidental phenomenon, associated with increased human activity which is rather common during this age group.

Time of Presentation	Frequency	% age	Class 1	Class 2	Class 3				
< 1 hour	36	23.1 %	16	20	0				
1 – 4 hours	73	46.8 %	19	44	10				
4 – 12 hours	40	25.6 %	12	24	4				
> 12 hours	7	4.5 %	3	2	2				
Total	156	100 %	50	90	16				
Table 1. Time Since Sting to Arrival at the Hospital andSeverity in Relation to the Time of Presentation									

Majority of the patients presented to the hospital between 1 - 4 hours of the sting (46.8 %). As the duration between the sting and arrival to the hospital increased, a higher proportion of patients were classified into class 3 (13.69 % in 1 - 4 - hour category, 10 % in 4 - 12 - hour category and 28.57 % in > 12 - hour category). Suggesting the delay in seeking medical care contributes to the severity in presentation of scorpion envenomation.

	No.	%	No.	%	No.	%			
Clinical Feature	Male (69)		Femal	e (89)	Total (156)				
Local Pain	69	100	87	100	156	100			
Sweating	31	44.9	47	54	78	50			
Vomiting	11	15.9	20	22.9	31	19.9			
Salivation	7	10.1	18	20.7	25	16.1			
Hypotension	4	5.8	7	8.1	11	7.1			
Myocarditis	2	2.9	10	11.4	12	7.7			
Pulmonary Oedema	2	2.9	10	11.4	12	7.7			
Tachypnoea	4	5.8	7	8.1	11	7.1			
Abdomen Tenderness	1	1.45	6	6.9	7	4.5			
Table 2. Clinical Features in Scorpion Envenomation									

All the patients in our study population reported pain at the local site of scorpion sting (100 %). Life threatening signs like pulmonary oedema (7.7 %), myocarditis (7.7 %), hypotension (7.1 %) and tachypnea (7.1 %) were noted in a few patients. Abdominal tenderness was one of the rare clinical features seen in only 4.5 % of our study group. Majority of the patients had normal sinus rhythm (56.4 %). Sinus tachycardia was found in 24.4 % patients followed by T wave changes in 10.3 % patients. All patients belonging to class 1 had a favorable outcome. Hence mortality was significantly higher in severe envenomation (p value 0.004). Our case fatality rate was 1.92. Since all the patients

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receiving prazosin had a favorable outcome, prazosin therapy was noted to be significantly effective as compared to symptomatic management alone (p value 0.04).



DISCUSSION

Over the study period of 5 years, scorpion envenomation accounted for 7.27 % of our ICCU admissions. Thus, making it a relatively common medical emergency. The various manifestations of scorpion sting envenomation are due to autonomic storm and range from simple local pain to severe systemic manifestations.^{3,6-8} The manifestations become apparent within a few minutes after sting, usually progress to a maximum severity within 5 hours and last for 24–72 hours.⁴

Sympathetic Abnormality	Rajarajeshwari ¹⁵	N = 68	Poonking ¹⁶ N = 45		Mahadevan ¹⁷ N = 100		Das ¹⁸ N = 32		Shashidhar ¹⁹ N = 100		Present N = 156	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Tachycardia	46	68	17	38	62	62	26	81.2	40	40	38	24
Profuse Sweating	46	68	14	31	52	52	25	78.1	32	32	78	50
Hypertension	-	-	-	-	-	-	-	-	8	8	52	33.3
Pulmonary Oedema	2	3	-	-	22	22	3	9.32	9	9	12	7.7
Tachypnoea	46	68	22	49	-	-	-	-	38	38	11	7.1
Table 4. Some of the Sympathetic Findings in Different Studies												

Pain at the local site of sting was reported by all the patients in our study (100 %). Profuse sweating in 50 % of the patients followed by vomiting in 19.9 % of them. In a Raichur based study, majority of the patients complained pain at the site of sting (93.9 %) followed by sweating (33.7 %) and palpitations (27.3 %).¹²

Most common sign in our study was tachycardia, seen in (24.4 %) patients. Although most patients were anxious, the tachycardia was probably an expression of sympathetic

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overactivity since it lasted beyond 6 hrs. in 20 patients.⁶ The persistence of this sign beyond 24 hours could be due to myocarditis and pulmonary oedema.^{5,13,14} The previous studies as depicted below have recorded tachycardia in 40 % cases.15-19 Next common autonomic %-81.2 manifestation was profuse sweating, which lasted for 8 to 10 hours and was noted in 50 % of the patients. This was comparable to previous reports.¹⁵⁻¹⁹ Tachycardia was a nonspecific sign of cardiac involvement. It persisted beyond 24 hours in 12 patients (7.7 %) who ended up in pulmonary oedema. Our findings were similar to the Das et al series (9.32 %).¹⁸ A much higher rate of complications was noted by Bawaskar et al, where pulmonary oedema was seen in 27 % of the patients.²⁰ So were the findings of Mahadevan et al (22 %) and Rathod et al (25 %).^{17,21}

Hypertension was noted in 52 (33 %) patients, majority had moderate hypertension, only 10 patients had severe hypertension (>180/100 mm of Hg). Quite surprisingly the higher occurrence of hypertension in our study was in sharp contrast to the previous study groups.¹⁵⁻¹⁹ all these hypertensive patients were treated with prazosin irrespective of the blood pressure levels.

Para- Sympathetic Abnormality	Rajarajeshwa	N = 68	Poonking ¹⁶ N = 45		Mahadevan ¹⁷ N = 100		Das ¹⁸ N = 32		Shashidhar ¹⁹ N = 100		Present N = 156	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Hypotension	46	68	9	20	56	56	13	40.6	6	6	11	7.1
Salivation	-	-	45	100	-	-	-	-	10	10	25	16.1
Priapism	-	-	-	-	-	-	-	-	-	-	-	-
Nausea/Vomiting	29	40	42	93	-	-	-	-	10	10	31	19.1
Bradycardia	2	3	8	18	9	9	2	6.25	4	4	3	2
Table 5. Some of the Parasympathetic Findings in Different Studies												

Most common parasympathetic manifestation was nausea / vomiting noted in 31 patients (19.9 %) followed by excessive salivation noted in 25 (16.1 %) patients. Hypotension was documented in 7.1 % of the patients which was strikingly low compared to previous series which ranged from 18-68 %.15-20 All 11 patients with hypotension had pulmonary oedema. Three of which succumbed to the envenomation. Bradycardia was noted in 2 % of the patients which was comparable to Rajarajeshwari et al. who observed 3 %.¹⁵ While other studies recorded 4-18 %.¹⁶⁻¹⁹ in all these studies, the early part of autonomic storm was heralded by bradycardia. In due course it was replaced by tachycardia.^{3,6,15-19} the same sequence was noted in the present study also. The lower incidence of bradycardia in this study could be due to late arrival of the patients to the hospital.

Electrocardiographic Changes

Literature on electrographic changes have documented the following abnormalities. 9,10,22

1. Cardiac rhythm disturbances: Sinus tachycardia, supraventricular tachycardia, bradycardia, sinus arrhythmia, pulsus alternans

- Conduction disturbances: Various degrees of heart block, AV dissociation with accelerated junctional rhythm, prolongation of QTc.
- 3. Ischaemic pattern: Hyperacute T-wave, inversion of T-wave.
- 4. Early myocardial infarction like pattern: Broad, tall, peaked T-wave measuring upto 20mm in height, with ST depression in precordial leads. This is followed by further ST segment changes (elevation and depression) in the limb leads with appearance of Q waves.

In the present study 68 patients had ECG changes. One of the common manifestations was T-wave changes, seen in 16 (10.3 %) patients. Other manifestations included ST changes (2.6 %) and bundle branch block (3.2 %) patients. However, sinus tachycardia was the commonest abnormality seen in 38 patients (24.35 %).In an Iranian study, tachycardia was noted in 11.6 % of the cases, ST-depression was seen in 9.3 % of the individuals and T-wave inversion in 4.6 % of the cases.¹⁰ Similarly, a Turkey based study, showed sinus tachycardia in 17.1 % and ST changes in 7.9 % of the individuals.²² Rao et al demonstrated ST changes, sinus tachycardia, atrial ectopic beats, bradycardia and ventricular ectopic beats.⁹

Outcome

The case fatality noted in our study was 1.92 which was lower than that reported in Maharashtra (2.89).²³ Akin to our outcome, the mortality was highest in the Class 3, suggesting higher mortality in severe envenomation. Studies on paediatric population have demonstrated case fatality rates between 4-10.7 %.24,25 Prazosin being an alpha adrenoceptor antagonist acts as a physiological and pharmacological antidote of scorpion venom.26,27 In the initial phase of autonomic storm characterized by sustained stimulation of alfa-receptors, it plays an important role. By reducing the pre and after load, it helps prevent the imminent cardiotoxicity.3, 23 we concurred the utility of prazosin. However, it comes with a limitation. Patil SN have demonstrated the uncontrolled stimulation of beta receptors after alfa blockade by prazosin leads to reduced cardiac efficiency. They have found addition of Dobutamine to prazosin therapy controls pulmonary oedema and reduces mortality.²³ The time taken for resolution of symptoms varied among studies. Peker et al. showed that the patient symptoms had fully resolved within 36 hours and Khalaf et al., showed that rewarming of extremities after prazosin occurred after 7.2 ± 3.26 hours.^{28,29}

CONCLUSIONS

Scorpion sting envenomation was a relatively common medical emergency accounting for 7.27 % of ICCU admissions. Pain was noted to be the sine-qua-non for the diagnosis of scorpion envenomation in our study. Majority of the patients had one or the other autonomic findings, most common being tachycardia and profuse sweating. A few had hypertension, and significant pulmonary oedema requiring

intensive care management. Majority of the patients with ECG changes showed either sinus tachycardia, peaked T wave or T wave inversion and ST segment changes. All patients responded well to prazosin therapy.

Out of 156 cases, only three patients succumbed to the envenomation accounting for 1.92 % case fatality rate. Although sinus tachycardia was a non-specific sign, its persistence for more than 24 hours could herald an autonomic storm with features of myocarditis and pulmonary oedema as seen in our study. We propose the use of persistent tachycardia as a prognostic marker to aid intensive care management in anticipation of an impending autonomic storm.

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