

SCORPION STING ENVENOMATION IN CHILDREN: A STUDY ON CLINICAL PRESENTATION, CLINICAL GRADING AND OUTCOME

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Abstract

Background: Scorpion sting is a frequent, life-threatening medical emergency in children. They constitute a significant public health problem in many underdeveloped and developing countries, including India. This study aimed to investigate the symptoms and outcomes of scorpion stings in children. **Materials and Methods:** This descriptive study of 50 scorpion sting cases admitted to PREM (Pediatric Resuscitation and Emergency Medicine) Unit, District Head Quarters Hospital (Presently Government Medical College Hospital), Namakkal, Tamilnadu. On admission, a detailed clinical history was taken, including the time of the sting, symptomatology, and details of prehospital treatment received (structured proforma). **Results:** In our study, male children (68%) were affected more than females (32%), and children between 2 to 4 years were most affected (28%). Children from the rural (82%) population were more affected, with an increased incidence among children in class III (50%) and class IV (40%) socio-economic sections. The maximum stings occurred outdoors (90%) and at night-time (88%). The most common site was extremities (foot more than the hand) (96%). The most common clinical manifestation is pain (100%), followed by sweating (58%), cool peripheries (38%), excessive salivation(12%), vomiting(8%) and breathing difficulty(4%). Tachycardia was observed in 54% and priapism in 6%. At presentation, 6% were hypertensive, and 2% were hypotensive. Myocarditis(4%) and pulmonary oedema(2%)were also observed. Most children fell under grade 2 severity(58%). Severity was greater in children in whom sting to prazosin interval was higher. Out of 50 children, all (100%) recovered without any complications. **Conclusion:** Scorpion sting is a serious, potentially fatal medical emergency in our area. Cardiovascular manifestations are life-threatening. Administration of Prazosin as early as possible is probably, the single most effective intervention in preventing complications and mortality.

INTRODUCTION

Scorpion sting envenomation is an acute life-threatening and time-limiting emergency in both adults and children in developing countries. However, in children, it should be treated without any delay. Children with no alarming symptoms should be observed to watch for any newly developing signs and symptoms. Unfortunately, many scorpion stings are unnoticed. Hence it is

difficult to conclude a proper incidence of the scorpion sting, particularly in children.^[1,2]

Around 1400 species of scorpions have been discovered worldwide, and 700 species were found to be toxigenic. They manifest as severe cardiovascular, neurological and respiratory dysfunction, eventually leading to death.^[3] In India, more than 86 toxigenic species of scorpions have been discovered, out of which the most commonly encountered species are *Mesobuthus tumulus* (commonly known as Indian red scorpion) and

Palamneus swammerdami (black rock scorpion).^[4] From the species mentioned earlier, increased morbidity has been encountered with Mesobuthum tumulus. Scorpions are more commonly seen in Tropical, Temperate, and Subtropical regions. In India, Scorpions are more commonly seen in the southern part, such as Tamilnadu, Andhra Pradesh, Karnataka, Maharashtra, Gujarat etc.^[4] Moreover, the pediatric population are highly vulnerable to the toxic manifestation and severity of scorpion stings than adults.

Scorpion stings usually manifest as multisystem involvement; however, in children, manifestation includes severe pain and paresthesia, followed by cardiovascular system involvement. In males, the development of priapism indicates worsening of the envenomation. Cardiovascular manifestations like acute myocarditis and LV Dysfunction, resulting in pulmonary oedema development, contribute to increased morbidity and mortality in scorpion sting envenomation.^[5] Consequently, Prazosin is the first-line drug (lifesaver) in the treatment of scorpion sting envenomation. It is a competitive, highly selective alpha-1 adrenergic receptor antagonist with an alpha-1: alpha-2 selectivity ratio of 1000:1. Since scorpion envenomation acts mainly via the alpha-1 adrenergic receptor stimulation, Prazosin plays a vital role in its management.^[6]

Due to its cardioprotective nature, it may be regarded as an antidote for scorpion sting envenomation. The toxic effect of envenomation is easily reversed by this drug if given appropriately without any delay during the early stage of the envenomation. Prazosin made a major contribution in decreasing the mortality rate from 30% in the pre-prazosin era to 1% in scorpion sting envenomation.^[7] Good prognosis is seen in children with early admission to the health care facility, early prazosin administration and cautious management of cardiovascular, pulmonary and neurological complications. Poor prognosis is seen in children with delay in hospitalization, delay in the administration of Prazosin and children associated with multiple systemic involvements or associated comorbidities.^[6,7] Therefore, this study aimed to investigate the symptoms and outcomes of scorpion stings in children.

MATERIALS AND METHODS

This descriptive study was performed from October 2019 to June 2020 in PREM (Pediatric Resuscitation and Emergency Medicine) Unit, District Head Quarters Hospital (Presently Government Medical College Hospital), Namakkal, Tamilnadu. All children under 12 years of age admitted to the PREM unit, who fulfilled the inclusion and exclusion criteria, were included in the study. Fifty cases of suspected and clinically proven scorpion stings were taken for the present study. Prior written

informed consent was taken from all the parents or guardians of the children after assuring that their identity would be kept anonymous. In addition, ethical approval was obtained from the ethical review board of the Institute before the commencement of data collection.

Based on the study by Soren C et al., 53.65% had severe scorpion stings, and the sample size was estimated using the formula $(N=Z\alpha PQ/d^2)$.^[8] All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size was reached.

Children up to 12 years of age who were admitted with (i) a history of scorpion stings and (ii) a history of unknown bite with classic clinical manifestations of scorpion stings at the PREM unit of District Head Quarters Hospital (Presently Government Medical College Hospital), Namakkal were included. Children with no bite marks or parents who just noted scorpions nearby their children were excluded from the study.

A detailed clinical history was taken on admission, including the sting time, symptomatology, and details of treatment received (structured proforma) before admission. Further, a description of the scorpion and details about the circumstances leading up to the sting was obtained. Hourly monitoring of respiratory rate, heart rate, blood pressure, saturation, and urine output was done, and all patients were observed for any signs of an autonomic storm. Children were subjected to Routine basic blood investigations. A chest radiograph has been done in children with evidence of myocarditis or pulmonary oedema. Electrocardiography (ECG) was done in all cases. However, ECHO was done in children with myocarditis, pulmonary oedema and abnormal ECG changes.

In our study, children were graded based on the clinical severity as follows grade I: (local manifestation) severe pain, paresthesia; grade II: (Systemic manifestations) Sweating, cool peripheries, vomiting, hypertension, priapism; and grade III: (life-threatening manifestations) pulmonary oedema, cardiovascular complication, and altered consciousness.

Symptomatic children received a dose of Prazosin (30 mcg/kg/dose) at admission, along with IV fluids. Until the peripheries get warm, sweating decreases, the prazosin dose is repeated 4th hourly, and urine output is monitored cautiously. Children presenting with cardiovascular manifestations like myocarditis were given oxygen (1 to 2 L/min), along with maintenance IV fluids and Prazosin (Nasogastric tube/oral). Very few children needed Dobutamine infusion (10 mcg/kg/min). Pulmonary oedema was treated with frusemide, oxygen, Prazosin, and dobutamine infusions. All children were monitored closely for complications and managed accordingly. Data were presented as Mean and Standard deviation for continuous variables and percentages for categorical variables. First, a Chi-square test was

done to find any association between categorical variables. Then, an ANOVA test was done to compare the three groups' mean.

RESULTS

Of 50 children, there was a male predominance of 34 (68%) than female 16 (32%). The peak incidence was noted in the age group of 2-4 years (28%), followed by the 6-8 years (20%) age group. Most

(90%) of the stings occurred outdoors, and mostly among children in Class III (50%) & Class IV (40%) socioeconomic status. It was more common in rural areas (82%) and marginally higher in pucca houses (54%). Most patients (88%) had scorpion stings at night, while only 12% had scorpion sting at day time. The body extremities were the most common site for Scorpion stings (96%) [Table 1].

Table 1: Characteristics in children with scorpion sting envenomation

		FREQUENCY	PERCENTAGE
Gender	Male	34	68.0
	Female	16	32.0
Age Group (in years)	< /=2	7	14.0
	2-4	14	28.0
	4-6	8	16.0
	6-8	10	20.0
	8-10	9	18.0
	10-12	2	4.0
Residence	Urban	9	18.0
	Rural	41	82.0
Housing	Pucca	27	54.0
	Kutchra	23	46.0
Place	Outdoor	45	90.0
	Indoor	5	10.0
Socio-economic class	Class I	0	0
	Class II	1	2.0
	Class III	25	50.0
	Class IV	20	40.0
	Class V	4	8.0
Time of sting	Day	6	12.0
	Night	44	88.0
Site of sting	Extremities	48	96.0
	Abdomen	1	2.0
	Buttock	1	2.0

Table 2: Clinical manifestations of scorpion sting in the study population.

Clinical features	Frequency	Percentage
Pain	50	100.0
Paresthesia	16	32.0
Sweating	29	58.0
Salivation	6	12.0
Vomiting	4	8.0
Swelling	4	8.0
Altered sensorium	2	4.0
Cold extremities	19	38.0
Priapism	3	6.0
Breathing difficulty	2	4.0
Pulmonary edema	1	2.0
Myocarditis	2	4.0

Table 3: Observation of Heart rate, Respiratory rate, Blood pressure and Abrog's grade in children

		Frequency	Percentage
Heart rate	Tachycardia	27	54.0
	Normal	23	46.0
Respiratory rate	Tachypnea	3	6.0
	Normal	47	94.0
Blood pressure	HIGH	3	6.0
	NORMAL	46	92.0
	LOW	1	2.0
Abrog's grade	GRADE I	19	38.0
	GRADE II	29	58.0
	GRADE III	2	4.0

Table 4: Distribution of sting to prazosin interval, dose, duration of hospital stay and autonomic storm recovery time among the study population.

Variables	Mean	SD	Minimum	Maximum
Sting to prazosin interval	2.7	1.2	0.5	5.0
Number of prazosin dose	1.7	1.1	1.0	5.0

Duration of stay	2.8	1.4	1.0	7.0
Autonomic storm recovery time	8.4	4.5	3.0	21.0

The current study also analysed clinical manifestations of the Scorpion sting. It was found that all children presented with pain (100%), followed by sweating (58%), cold extremities (38%), paresthesia (32%), salivation (12%), vomiting (8%), swelling (8%), priapism (6%), breathing difficulty (4%), myocarditis (4%) and pulmonary oedema (2%). However, all children in our study group recovered [Table 2].

In our study group, the majority of 54% of the children presented with tachycardia. Most of the children in our study had normal respiratory rates with no breathing difficulty, but 6% were tachypneic due to delayed presentation and delay in starting treatment. Out of 50 children, 6% of the children presented with high BP, and 1 child presented with low BP. The majority of the children didn't require inotropic support. Only 4% of children needed dobutamine infusion, and the remaining 96% didn't require such lifesaving effort. All the children were also evaluated on Abroug's clinical grading. It was found that 58% of the children came under grade 2 severity, 38% fell under grade 1 severity, and 4% fell under grade 3 severity. All children recruited in this study recovered completely from the envenomation [Table 3].

The mean sting-to-prazosin interval noted in children was 2.7, and the maximum interval was 5 hours. Therefore, the mean prazosin dose number was 1.7, and the maximum number of doses received was 5. The average stay in the hospital was 2.8 days, and a maximum of 7 days have been recorded. The mean autonomic storm recovery time was 8.4 hours, with a maximum recovery time of around 21 hours [Table 4].

DISCUSSION

Envenomation from a scorpion sting is considered a medical emergency in all age groups, including children and adults. However, morbidity and mortality are more in children than in adults encountering this condition. Therefore, the clinical presentation, clinical grading, and outcome of scorpion sting envenomation in children were investigated in our study. In the present study, male predominance was observed, with maximum Scorpion stings reported in the age group of 2 to 4 years. Kumar et al. also reported a male majority, but most scorpion stings were reported in the age group of 5 to 10 years. This male predominance of scorpion stings may be due to the higher inquisitive nature of boys, and boys go outside more often than girls, especially at night.^[9]

The majority of the cases were from rural areas. Like snake bite, Scorpion sting is mainly a rural emergency. Children from rural areas are at the highest risk for accidental contact with scorpions.^[10] Kutcha houses have mud floors, walls and thatched roofs. Scorpions inhabit the crevices and

underground caves in dwellings, and these houses provide a haven for them. In contrast, pukka houses with tiled floors and cemented walls and roofs are safe, as observed by **Rajarajeshwari et al.**, In our study, we couldn't establish a strong association between scorpion sting and the type of housing. A higher incidence of the sting was noted in lower socioeconomic status. The high incidence in this group is due to the type of housing and farms nearby their houses.^[11]

The clinical features of a scorpion sting include pain at the site of the sting (most common), followed by sweating, cold extremities and paresthesia. Cold extremities were reported by the majority of patients in the **Biswal et al.**, in their investigation.^[12] Although any part of the body can be exposed to sting, in 96% of the cases in our study, the sting was sustained on the extremities. This was comparable to **Mahaba et al.**, Observation.^[6] Night-time stings were more common in our study, with 44 cases. Our findings correlate with the study by **Clark et al.**, where scorpion stings were more common during night-time.^[13]

Scorpion venom delays the closing of sodium channels in neurons and inhibits potassium channels, both of which stimulate the autonomic nervous system intensely and persistently. This massive release of neurotransmitters from the adrenal medulla stimulates the parasympathetic and sympathetic nervous systems, which starts an autonomic storm. An "autonomic storm" marked by cold extremities, tachycardia, hypotension, or hypertension was present in 60% to 70% of scorpion bite patients. In this study, 6% of the patients presented with hypertension. The incidence of hypertension in Indian studies on scorpion stings varies from 12.6% to 29% and is usually seen within 4-8 hours after the sting.^[14] Hypotension was recorded in 1 case in our study. The hypotension can happen within 1-2 hours after the sting due to loss of fluid and within 4-8 hours due to left ventricular dysfunction.^[10] Tachycardia was present in 54%, whereas 6% of the children had tachypnea.

Pazhanisamy et al. found 43.5 % of children with tachycardia, which is comparable to our findings.^[15]

In our study, most children didn't require inotropic support. Only 4% of children needed dobutamine infusion, and the remaining 96% didn't require such lifesaving effort. In comparison, a maximum number of children were reported with Grade II severity of Abroug's grading system. **Bosnak et al.** also reported similar findings in their study.^[16]

Prazosin, an alpha-adrenoceptor antagonist, is a physiological and pharmacological antidote for scorpion venom. Cardiovascular morbidity depends on the time interval between the sting and administration of Prazosin. A consensus regarding the early use of Prazosin has been established. In the present study, the mean sting-to-prazosin interval noted in children was 2.7 hours; the maximum

interval noted was 5 hours. The mean autonomic storm recovery time was 8.4 hours, with a maximum recovery time of around 21 hours. Complications developed less frequently in children who were treated with Prazosin early. These findings in the present study follow earlier reported studies.^[17] Death due to scorpion sting occurs mainly due to massive pulmonary oedema and Congestive Cardiac Failure with cardiogenic shock. The mortality due to scorpion stings has dramatically declined from 68% to less than 1%. Similar findings were reported in our study; out of 50 cases, there was no mortality.^[10,14]

CONCLUSION

Envenomation from scorpion sting is a potentially life-threatening medical emergency in children. Administration of Prazosin as early as possible is probably the single most effective intervention in preventing complications and mortality. The development of CVS manifestations are life-threatening. Effective monitoring and managing cardiovascular and other uncommon complications will limit the morbidity and mortality associated with a scorpion sting.

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