

## Original Research Article

# Socio-demographic, clinical, laboratory profile and outcome in children with scorpion envenomation

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## ABSTRACT

**Background:** Aim was to study clinical, socio- demographic and laboratory profile and outcome in children with scorpion envenomation up to 12 years of age. This study conducted to provide better insights in to the socio-demographic, clinical, laboratory profile of scorpion envenomation in rural health setting in India.

**Methods:** This was a hospital based, prospective observational study done in children up to 12 years of age admitted in a tertiary care centre between March 2018 to April 2020 with history of scorpion envenomation, presence of sting mark or scorpion seen in vicinity of child by parents or near family members. Unknown bites or stings and cases where the clinical manifestations are not compatible with scorpion sting were excluded.

**Results:** During the study period, 28 children were admitted for scorpion sting. Maximum number of cases were noted in the age group of 3-6 years and there is equal distribution of cases among males and females. Majority of cases from rural areas, 46.42% of the cases had black scorpion sting, most of the stings occurred during evening time and spring season. The most common sting sites were the distal part of the extremities. Pain at the sting site and local swelling were the most common presenting symptoms. The common signs noted were tachycardia. The most common ECG changes noted in the present study was sinus tachycardia (46.42%) followed by ST segment changes noted in 21.4% of children. Commonest complications noted myocarditis, pulmonary edema, myocardial dysfunction, peripheral circulatory failure. One patient died due to pulmonary edema. Majority of the cases recovered without any sequelae.

**Conclusions:** Scorpion envenomation is a preventable emergency among children and closely associated with environmental condition, socioeconomic status and child activities. Supervised outdoor play, early hospitalization, close monitoring of vitals and management of complications and supportive care may reduce the mortality and morbidity.

**Keywords:** Myocarditis, Pulmonary edema, Scorpion sting

## INTRODUCTION

Scorpion envenomation is a major public health problem in tropical and subtropical countries including India. The annual estimate of cases with scorpion sting exceeds 1.2 million with 2.3 billion people at risk.<sup>1,2</sup> Children are prone to develop severe cardiac and respiratory complications as compared to adult population.

Furthermore, scorpion anti-venom is not available in this region indicating the seriousness of the problem. More than 86 species of scorpions exist in India, most of which are harmless. *Mesobuthus tamulus* (Indian red scorpion) and *Palamneus swammerdami* (black scorpion) are of medical importance.<sup>3</sup> These scorpions residing in the underground burrows and crevices of dwelling emerge only at night, thus most stings are reported at night.

Scorpion venom initially has a transient cholinergic phase manifests in the form of vomiting, profuse sweating, bradycardia, ropy salivation and hypotension. It is followed by adrenergic hyperactivity in the form of cold extremities, hypertension, tachycardia, myocardial failure, pulmonary edema and shock.<sup>4-6</sup> Severity of scorpion sting occur in children with 3.9-10% fatality irrespective of intensive care management.<sup>7-10</sup>

The severity of scorpion sting envenomation is classified as per Abrougs classification. The toxicity variation and duration of symptoms depends upon species, size of scorpion, number of stings, quantity of the venom injected, depth of the skin and composition of the venom. However age, health, weight of the child and timing of initiation of treatment independently affect the outcome. Site of envenomation closer proximity of the sting to the head and tarso result in quicker venom absorption into central circulation and quicker onset of symptoms.<sup>11-16</sup> Complications such as myocarditis, congestive cardiac failure, peripheral circulatory failure, acute pulmonary edema and encephalitis are associated with higher mortality and morbidity rates.<sup>17-20</sup>

## METHODS

This was a hospital based, prospective observational study done in children up to 12 years of age admitted in a tertiary care centre between March 2018 to April 2020 with history of scorpion envenomation, presence of sting mark or scorpion seen in vicinity of child by parents or near family members. Unknown bites or stings and cases where the clinical manifestations are not compatible with scorpion sting were excluded.

Demographic data, sting location on the body, location and time of sting and time to admission to emergency department were noted. Clinical data such as pain, fever, vomiting, sweating, salivation, priapism, dyspnoea, cough and vital signs including respiratory rate, heart rate and blood pressures were recorded. Hourly monitoring of cardiorespiratory status, vital signs and urine output was entered in predesigned proforma. Complete hemogram with peripheral smear, random blood sugar, bleeding and clotting times, Chest X-ray and electrocardiogram were done in all children. All the enrolled patients were treated with pre-approved treatment protocol.

## RESULTS

A total of 28 children were included who met the selection criteria. Most common age-group affected was 3-6 years (n=12, 42.8%) followed by 1-3 years (n=8, 28.5%). There is equal distribution of cases among males and females (Table 1). Majority of this children (53.57%) were from rural areas and 13 kids (46.42%) belongs to lower socio-economic status. In terms of type of scorpion, 13 (46.42%) children were stung by Black scorpion and 11 (39.28%) by red scorpion, in 4 (14.28%)

cases, color was not observed. Most of the stings (64.28%) happened indoors.

**Table 1: Demographic and epidemiological profile of children stung by scorpions.**

Characteristics	Number ( n )	Percentage
<b>Sex</b>		
Male	14	50
Female	14	50
<b>District</b>		
Rural	15	53.57
Urban	13	46.42
<b>Color of scorpion</b>		
Black	13	46.42
Red	11	39.28
Unknown	4	14.28
<b>String site</b>		
Lower extremity	19	67.85
Upper extremity	6	21.42
Trunk	3	10.71
Head and neck	-	-
<b>Admission time after sting (hour)</b>		
1-6	3	10.71
6-24	17	60.71
>24	8	28.57
<b>Time of sting</b>		
Morning (6am-6pm)	13	46.4
Evening (6pm-6am)	15	53.57
<b>Envenomation severity</b>		
Class 1	16	57.14
Class 2	9	32.14
Class 3	3	10.71
<b>Seasonal distribution</b>		
March-June (spring)	13	46.42
June-September (summer)	8	28.57
September-December (rainy)	4	14.28
December-March (winter)	3	10.71
<b>Socio economic status</b>		
Low	16	57.14
Middle	12	42.85
<b>Place of sting</b>		
Indoor	18	64.28
Outdoor	10	35.71
<b>Sting-prazosin interval (hours)</b>		
0-6	3	10.71
6-12	9	32.14
12-24	12	42.85
>24	4	14.28

The most common sting site were lower limbs 19 (67.85%) and were mostly stung in the evening (53.57%). Majority of cases (46.42%) were reported during spring.

Most of the children were admitted to hospital with a mean time of 9.3 hours (SD=7.09), only three children (10.71%) received prazosin within 6 hours of sting.

**Table 2: Symptoms and signs at presentation.**

Symptoms	Number (n)	Percentage
Pain	26	92.85
Profuse sweating and cold peripheries	11	39.28
Excessive salivation	2	7.14
Local swelling	18	64.28
Vomiting	3	10.71
Priapism	6	21.42
Inconsolable cry	3	10.71
Dyspnea	2	7.14
<b>Signs</b>		
Tachycardia	8	21.42
Tachypnoea	3	10.71
Hypertension	2	7.14
Bradycardia	1	3.57
Hypotension	3	10.71

**Table 3: Modalities of treatment taken prior to admission.**

Mode of prior treatment	Number (n)	Percentage
<b>Prazosin</b>	9	32.14
<b>Chlorpheniramine, Dexamethasone</b>	3	10.71

**Table 4: Laboratory findings in children stung by scorpion.**

Laboratory findings	Number (n)	Percentage
<b>High LDH</b>	12	42.85
<b>High CK</b>	22	78.57
<b>Leukocytosis</b>	17	60.71
<b>High AST/ALT</b>	21	75
<b>Hypoglycemia</b>	1	3.57
<b>Hyperglycemia</b>	2	7.14

The most common presenting symptoms were pain (n=26, 92.85%) followed by swelling (n=18, 64.28%) at the site of sting. Profuse sweating and cold peripheries were noted in 39.2% (n=11). Tachycardia (n=8, 21.42%) was the most common clinical sign followed by tachypnea and hypotension seen in 10.71% of cases. Based on clinical evaluation 57.14% of cases were classified as class I severity, followed by class II (32.14%) and class III (10.71%). Myocarditis was noted in (n=6) 21.42% (Table 5), and 10.71% (n=3) had hypotension and shock.

Laboratory features are summarized in Table 4. Leucocytosis was present in 60.71% children, high CK in 78.57%, high LDH in 42.85%, elevated AST/ALT in

75%, hyperglycemia in 7.14% and hypoglycemia seen in 3.57% of children.

Electrocardiography was done in all cases. Most common electrocardiographic finding was sinus tachycardia noted in 13 children (46.42%) and ST segment changes was observed in 6 (21.4%) children. Chest ray was done in children with respiratory distress which showed pulmonary edema in two (7.14%) children.

Patients were admitted in the PICU and treated as per hospital protocol. Before admission, 9 (32.1%) children received prazosin and 3 (10.7%) children chlorpheniramine maleate with dexamethasone. Prazosin was needed in 57% (n=16) patients. Rest of them were given supportive care like analgesia. Inotropic support was needed in 21.4% (n=6) children and one child needed invasive ventilation. However this child needed multiple ionotropes, had severe myocardial dysfunction, pulmonary edema and succumbed to death.

## DISCUSSION

Scorpion envenomation is currently the leading cause of venom related injury to the humans. Different scorpion subspecies may possess different venoms. The clinical manifestations of scorpion sting are predominantly sympathetically and parasympathetically mediated, depending upon species of scorpion. The main molecular targets of scorpion neurotoxins are the voltage-gated sodium channels and calcium activated potassium channels, thereby initiating autonomic storm. Alpha receptors stimulation by the toxin plays a major role, resulting in hypertension, tachycardia, myocardial dysfunction, pulmonary edema and cool extremities.<sup>21</sup> The unopposed effects of alpha receptor stimulation leads to suppression of insulin secretion, hyperglycemia, free fatty acids and free radical accumulation injurious to myocardium.<sup>22</sup> Catecholamine induced hypertension and increased after load will add to myocardial failure. In our study most commonly observed local symptom were pain and local swelling and common systemic signs include tachycardia, cool extremities, sweating, which was similar in the study conducted by Ramesh et al, in which 91% cases presented with pain.<sup>23</sup> Another study by Kumar et al 96% of cases had pain at sting site while only 72% of cases in study by Pol et al had local pain or irritability.<sup>24,25</sup>

Different studies have shown varied age distribution for scorpion envenomation. In our study mean age of presentation is 7 years. Study by Adiguzel et al observed that children from 9 to 15 years old were more frequently affected (54.1%) than other age groups and Altinkayank et al reported that most scorpion envenomation cases were seen in 1-10 years age group.<sup>26,27</sup> Similarly Osnaya-Romero et al observed that in Mexico, majority of cases belongs to 1-9 years (60.8%).<sup>28</sup> This high incidence of stings among children attributed to their higher inquisitive nature and risk taking behavior of children.

In our study, there is an equal distribution of cases among males and females in all age groups and majority of cases occurred in spring season. But study conducted by Ramesh et al in which 81.8% of the cases were male and 72.7% of cases occurred in the months of May to August.<sup>16</sup> Another study conducted by Pol et al, most cases were males with peak occurring during summer months. These variations may reflect difference in environmental conditions, especially a rainy or summer.<sup>29</sup>

Epidemiological studies invariably have shown that the affected body parts are mostly the extremities.<sup>30</sup> In the present study, 67.85% of the children had scorpion sting in their lower extremities. This finding is similar to that reported in the Jarrar et al and Bosnak et al.<sup>31,32</sup> People are stung by scorpions on their extremities because it is the part that is presented most commonly to the scorpion. Moreover, the incidence depends on the agricultural habits in rural areas such as walking barefoot and lifting up stones in a careless manner. Our study it was noticed that majority (53.57%) of scorpion stung people reported from rural areas. But study conducted by Vazirizadeh et al shows most of the cases reported from urban areas.<sup>33</sup> Children from lower socio-economic status were found to be affected more. Similar observations were also made by Bawaskar et al and Biswal et al which could be due to living conditions of these children and also noticed that more cases (53.57%) were encountered during evening time.<sup>34,35</sup> This observation was consistent with those made by Bawaskar et al and Abdulaziz et al. which is due to nocturnal nature of scorpions.<sup>34,36</sup>

The venom may cause hepatotoxicity and hematological derangements which is the result of stimulation of chemical mediators (neurotransmitters, catecholamines) and release of cytokines, inflammatory mediators implicated in organ involvement.<sup>37</sup> In addition, higher AST, ALT and CPK levels may be sign of cardiac and/or skeletal muscle injury; in the current study, majority of children (75%) had altered liver function tests followed by high CPK level.<sup>38</sup> Electrocardiogram was performed in all cases at admission, most common finding were sinus tachycardia (46.42%), ST segment changes noted in 22.42% of cases. In a prospective observational study done in Turkey, sinus tachycardia was present in 17.1% of the patients and ST segment changes in 7.9% of the children. In another cross-sectional study conducted in Iran, tachycardia was noted in 11.6% of the cases, ST-depression was noted in 9.3% of the children and T-wave inversion in 4.6% of the cases.<sup>29,30</sup> Differences in the venom load could be the reason for these differences.

## CONCLUSION

Scorpion envenomation is a preventable emergency among children and closely associated with environmental condition, socioeconomic status and child activities. Supervised outdoor play, early hospitalization, close monitoring of vitals and management of

complications, and supportive care may reduce the mortality and morbidity.

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