

# Role of prazosin in management of scorpion sting in pediatrics: a comparative study

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## Background

Scorpion stings represent an important and serious public health problem worldwide owing to their high incidence and potentially severe and often fatal clinical manifestations. Children are at greater risk of developing severe cardiac, respiratory, and neurological complications owing to lesser body surface area. Prazosin, a postsynaptic alpha blocker, is an effective drug in the treatment of serious scorpion envenomation with significant sympathetic symptoms.

## Aim of the study

To study the role of prazosin in the management of scorpion envenomation in children at Assiut University Children Hospital.

## Patients and methods

The study included 60 patients with scorpion stings admitted to Assiut University Children's Hospital from November 2016 to November 2017. Their ages ranged from 1 to 18 years. Patients were randomized into two groups: group A underwent conventional therapy and prazosin and group B underwent conventional therapy.

## Results

Our results showed that addition of prazosin to antivenom induced earlier clinical recovery than in cases treated with conventional therapy. Administration of prazosin is one of the most useful strategies to reduce mortality in scorpion envenomation. A total of 60 cases of scorpion envenomation were observed during the study time period. Male children predominated over female.

## Conclusion

Scorpion sting envenomation is an acute life-threatening emergency, and recovery from scorpion sting is hastened by simultaneous administration of scorpion antivenom plus prazosin compared with antivenom alone.

## Keywords:

antivenom, prazosin, scorpion sting

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## Introduction

Scorpions are a group of arthropods belonging to the family Buthidae, which are potentially dangerous to humans [1]. Owing to their high incidence, scorpion envenomation is an important and serious health problem in many tropical and subtropical countries with a potential of severe and often fatal clinical manifestations among children [2]. Envenomation of children can cause multiple organ failure and death [3].

Children are at greater risk of developing severe envenomation like cardiac, respiratory, and neurological complications as compared with the adults. The clinical manifestations of scorpion envenomation are vomiting, profuse sweating, cold extremities, pulmonary edema, and death. The deaths in scorpion sting envenomation are attributed to cardiopulmonary complications like myocarditis and acute pulmonary edema [4].

Pulmonary edema is a very common manifestation of scorpion sting envenomation in children. Overall,

40% of fatalities have been reported owing to refractory pulmonary edema [5]. As the mortality rates owing to scorpion sting envenomation are as high as this, new treatment modalities have begun to be discussed.

Prazosin, a postsynaptic alpha-1 blocker, counteracts the effects of excessive catecholamines and arrests the development of severe systemic features. It has been found to be an effective drug for scorpion sting envenomation, and it has reduced the mortality rate to 1% as compared with a 30% mortality rate in the pre-prazosin period [6]. The present study was done to observe the outcome and the efficacy of prazosin in scorpion sting envenomation in children who were admitted at tertiary care center.

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## Patients and methods

### Study site

The study was approved by the ethical committee of Assuit faculty of medicine at Assuit University. A written informed consent was obtained from parents of the enrolled cases. The study was conducted at Emergency Unit, Intermediate Care Unit, and Pediatric intensive care unit at Assuit University Children's Hospital.

### Study population

The study included 60 patients with scorpion stings admitted to Assuit University Children's Hospital from November 2016 to November 2017. Their ages ranged from 1 to 18 years.

### Inclusion criteria

All cases with scorpion sting were admitted to Assuit University Children's Hospital.

### Exclusion criteria

All other envenomation cases or poisoning were excluded.

### Dose and administration

Prazosin, per oral, 30 µg/kg/dose was administered. In case of vomiting or unconsciousness, prazosin was administered through nasogastric tube with securing of the airway. Blood pressure, pulse rate, respiration rate, and oxygen saturation were monitored every 30 min for 3 h, every hour for next 6 h, and later every 4 h till improvement. Prazosin was repeated in the same dose at the end of 3 h according to clinical response and later every 6 h till extremities were warm and dry and peripheral veins were visible easily. It should not be given as prophylaxis in children when pain is the only symptom. The patient should be kept in a lying posture for approximately 3 h (even while examining the case) to prevent first-dose phenomenon (hypotension) from prazosin.

## Results

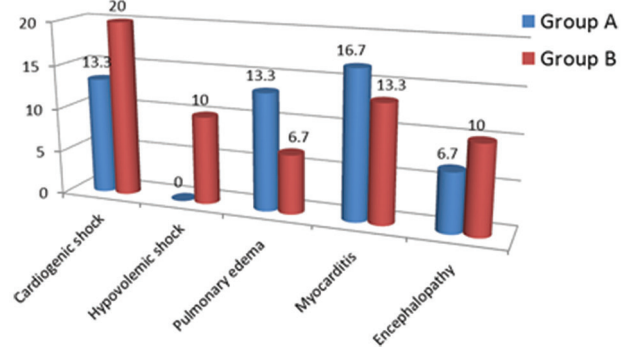
The study included 60 cases with scorpion sting, comprising 35 males and 25 females. Their ages ranged from 1 to 18 years. Cases were divided into two groups, i.e. group A and group B, regarding prazosin administration.

Recorded data about laboratory and imaging study of cases with scorpion stings on admission showed that no

**Table 1** Recorded demographic data of the studied cases

Variables	n (%)	P
Age (years)		
1-<6	33 (55.0)	0.728
6-<10	13 (21.7)	
10-18	14 (23.3)	
Sex distribution		
Male	35 (58.3)	0.432
Female	25 (41.7)	
Geographical distribution		
Rural	53 (88.3)	1.000
Urban	7 (11.7)	

**Figure 1**



Complication of case with scorpion at the time of admission.

abnormalities were detected in complete blood count and kidney function and impaired values of creatine kinase level, blood gases, serum electrolyte, and ECG, with no significant difference between group A and group B (Tables 1–3 and Figs 1–3).

## Discussion

Scorpion envenomation is an important public health problem in many tropical and subtropical countries [7]. Envenomation by scorpions can result in a wide range of clinical effects including cardiotoxicity, neurotoxicity, and respiratory dysfunction. Prazosin, a competitive postsynaptic alpha-1, adrenergic receptor antagonist, should be the first line of management after antivenom therapy. Prazosin by blocking alpha receptors corrects the abnormal hemodynamic and metabolic effects of circulating catecholamines [8].

In our study, male children predominated over females, where 35 (58.3%) cases were males and 25 (41.7%) cases were females. Arivoli and Ganesh[9] found that the numbers of stings in boys were higher than in girls, with 61.7% in male and 38.3% in female.

In our study, the distribution of age was more common in the age group 1–6 years, with 33 (21.7%) cases. This may be related to the careless behavior such as

**Table 2 Variables of symptoms and signs of case with scorpion stings among the studied cases at the time of admission, at 3-h follow-up, and after 24 h of admission**

Variables	At admission [n (%)]			After 3 h [n (%)]			After 24 h [n (%)]		
	Group A (n=30)	Group B (n=30)	P	Group A (n=30)	Group B (n=30)	P	Group A (n=30)	Group B (n=30)	P
<b>Symptoms</b>									
<b>Local manifestations</b>									
Local pain	30 (100)	30 (100)	-	20 (86.7)	26 (86.7)	0.127	10 (33.3)	13 (43.3)	0.595
Swelling	8 (26.7)	10 (33.3)	0.573	6 (20.0)	10 (33.3)	0.383	6 (20.0)	10 (33.3)	0.383
Redness	12 (40.0)	10 (33.3)	0.170	10 (33.3)	9 (30.0)	0.998	10 (33.3)	9 (30.0)	0.998
<b>Gastrointestinal symptoms</b>									
Salivation	19 (63.3)	15 (50.0)	0.432	5 (16.7)	9 (30.0)	0.362	2 (6.7)	5 (16.7)	0.421
Vomiting	30 (100)	28 (93.3)	0.492	5 (16.7)	14 (46.7)	0.026	3 (10.0)	5 (16.7)	0.701
Abdominal distension	4 (13.3)	3 (10.0)	0.966	4 (13.3)	4 (13.3)	0.704	1 (3.3)	2 (6.7)	0.990
<b>Respiratory symptoms</b>									
Cough	4 (13.3)	2 (6.7)	0.671	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
Cyanosis	4 (13.3)	2 (6.7)	0.671	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
Difficulty breathing	4 (13.3)	2 (6.7)	0.671	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
<b>Cardiovascular symptoms</b>									
Palpitation	7 (23.3)	4 (13.3)	0.317	6 (20.0)	9 (30.0)	0.371	5 (16.7)	13 (43.3)	<b>0.049</b>
<b>Neurological symptoms</b>									
Cold extremities	30 (100)	30 (100)	-	9 (30.0)	24 (80.0)	<b>&lt;0.001</b>	4 (13.3)	9 (30.0)	0.371
Sweating	15 (50.0)	19 (63.3)	0.432	4 (13.3)	18 (60.0)	<b>0.001</b>	3 (10.0)	8 (26.7)	0.181
Hallucination	4 (13.3)	2 (6.7)	0.671	3 (10.0)	4 (13.3)	0.966	-	-	-
<b>Genitourinary symptoms</b>									
Priapism	6 (20.0)	4 (13.3)	0.726	0 (00.0)	3 (10.0)	0.236	-	-	-
<b>Signs</b>									
<b>Vital signs</b>									
Tachycardia	9 (30.0)	6 (20.0)	0.371	6 (20.0)	9 (30.0)	0.371	5 (16.7)	13 (43.3)	<b>0.049</b>
Bradycardia	1 (3.3)	2 (6.7)	0.990	-	-	-	-	-	-
Hypotension	4 (13.3)	9 (30.0)	0.371	4 (13.3)	7 (23.3)	0.317	4 (13.3)	7 (23.3)	0.504
Hypothermia	8 (26.7)	14 (46.7)	0.181	5 (16.7)	14 (46.7)	<b>0.026</b>	2 (6.7)	5 (16.7)	0.422
Hyperthermia	0 (0.00)	1 (3.3)	0.992	-	-	-	-	-	-
Tachypnea	4 (13.3)	9 (30.0)	0.371	5 (16.7)	5 (16.7)	0.994	2 (6.7)	4 (13.3)	0.671
<b>Cardiovascular signs</b>									
Arrhythmia	2 (6.7)	1 (3.3)	0.990	2 (6.7)	7 (23.3)	0.145	2 (6.7)	8 (26.7)	<b>0.038</b>
<b>Respiratory signs</b>									
Crepitation	4 (13.3)	2 (6.7)	0.990	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
Cyanosis	4 (13.3)	2 (6.7)	0.990	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
Pulmonary edema	4 (13.3)	2 (6.7)	0.990	4 (13.3)	5 (16.7)	0.994	2 (6.7)	5 (16.7)	0.422
<b>Neurological sign</b>									
Disturbed conscious level	2 (6.7)	3 (10.0)	0.996	1 (3.3)	4 (13.3)	0.349	1 (3.3)	3 (10.0)	0.601
<b>Genitourinary sign</b>									
Priapism	6 (20.0)	4 (13.3)	0.726	0 (00.0)	3 (10.0)	0.236	-	-	-
<b>Gastrointestinal signs</b>									
Paralytic ileus	4 (13.3)	3 (10.0)	1.000	4 (13.3)	4 (13.3)	0.704	1 (3.3)	2 (6.7)	0.990

Bold: Statistically significant.

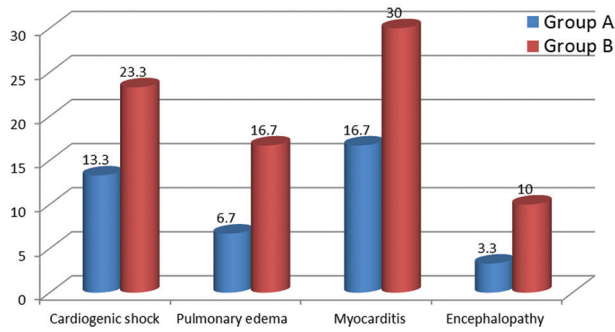
**Table 3 Recorded data about outcome of cases with scorpion stings according to prazosin administration**

Variables	Group A (n=30) [n (%)]	Group B (n=30) [n (%)]	P
<b>Outcome</b>			
Death	1 (3.3)	4 (13.3)	0.353
Improved	29 (96.7)	26 (86.7)	
<b>Need for respiratory support</b>			
Mechanical ventilation	4 (13.3)	5 (16.7)	0.488
Nonmechanical ventilation	26 (86.7)	25 (83.3)	
<b>Hospital stay (days)</b>			
<2	26 (86.7)	21 (70.0)	0.378
2-3	1 (3.3)	5 (16.7)	
>3	3 (10.0)	4 (13.3)	

walking barefoot, lifting up stones, and putting on clothes and shoes without checking them. Accordingly, Saminathan *et al.*[10] showed the percentage of cases among age group in 1–3 years was 42%, 4–6 years was 34%, 7–9 years was 12%, and older than 10 years was 12%.

Regarding the geographical distribution, 53 (88.3%) cases were from rural areas and seven (11.7%) cases from urban areas. Accordingly, Konca *et al.*[11] had similar study that showed the rural areas were presented in 28 (84.8%) cases and the urban areas were presented in five (15.2%) scorpion sting cases.

Figure 2



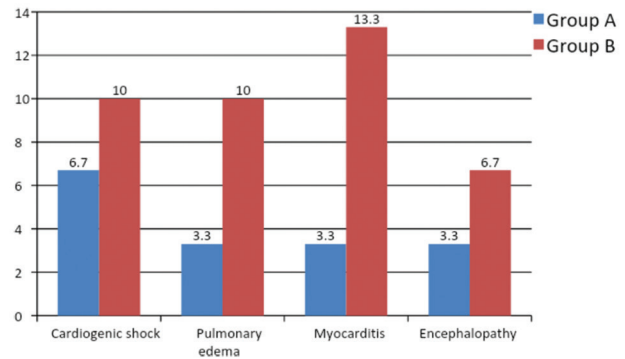
Complications of cases with scorpion stings after 24 h.

Regarding the site of sting in our study, 22 (36.7%) cases were stung in the upper limbs, whereas 31 (51.7%) cases were stung in the lower limbs and seven (11.6%) cases were stung in the head, neck, and trunk. Extremities were the most common part affected by scorpion sting in our study, which is also reported in other studies. 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 wearing sandals, walking barefoot, putting on shoes without preshaking, and lifting up stones in a careless manner [12].

In our study, the symptoms and signs among the studied cases at the time of admission showed that all patients have pain at the site of sting in 60 (100%) cases, vomiting in 58 (96.7%) cases, cold extremities in 60 (100%) cases, salivation in 34 (56.7%) cases, swelling in 18 (30%) cases, difficult of breathing in six (10%) cases, sweating in 34 (56.7%) cases, priapism in 10 (16.7%) cases, tachycardia in 15 cases, and bradycardia in three (5%) cases. Accordingly Ganesh and Kumaravel[13] showed similar study results, where pain was present at the site of sting in 66 (100%) cases, salivation in 26 (36%) cases, vomiting in 34 (47%) cases, dyspnea in 23 (32%) cases, swelling in 28 (39%) cases, and diaphoresis in 57 (79%) cases. Moreover, Arivoli and Ganesh[9] presented that pain at the site of sting was seen in 79.4%, swelling in 10.2%, salivation in 36.7%, vomiting in 41.1%, priapism in 30.9%, diaphoresis in 70.5%, cold extremities in 83.8%, hypotension in 66%, bradycardia in 10%, and tachycardia in 55%.

The systemic manifestations are owing to the release of neurotransmitters in response to the actions of the toxin on sodium channels causing an adrenergic or cholinergic syndrome leading to a range of clinical pictures according to the species of scorpion [13]. The unopposed effects of alpha-receptor stimulation can lead to suppression of insulin secretion causing hyperglycemia and liberation of free radicals causing

Figure 3



Complications of cases with scorpion stings after 48 h.

injury to the myocardium [14]. Clinical features can be localized (pain, hyperemia, edema, and numbness) and systemic effects (hyperthermia, nausea and vomiting, tachycardia, shivering) [14]. Severe scorpion envenomation can result in cardiovascular, pulmonary, and neurological manifestations and may be life-threatening owing to myocardial dysfunction, shock, pulmonary edema, or hypertensive encephalopathy.

Regarding the manifestations, after 3 h, there was improvement of some clinical symptoms and signs. Vomiting was seen in 16.7% in group A compared with 46.7% in group B, with significant *P* value of 0.026. Moreover, cold extremities were seen in 30.0% in group A compared with 80% in group B, with significance *P* value less than 0.001. Moreover, sweating was seen in 13.3% in group A compared with 60.0% in group B, with significant *P* value of 0.001, and hypothermia was seen in 16.7% in group A compared with 46.7% in group B, with significant *P* value of 0.026. After 3 h, three new cases developed pulmonary edema in group B. Accordingly Khalaf *et al.* [15], showed that rewarming of extremities after prazosin occurred after  $7.2 \pm 3.26$  h in group A and  $12.75 \pm 5.10$  h in group B.

In our study, the symptoms and signs after 24 h of admission showed improvement of tachycardia seen in 16.7% in group A compared with 43.3% in group B, with significant *P* value of 0.049 and also arrhythmia was seen in 6.7% in group A compared with 26.7% in group B, with significant *P* value of 0.038. Our results showed that addition of prazosin to antivenom induced earlier clinical recovery than in cases treated with conventional therapy only. Most of them needed only one dose of prazosin for clinical recovery. These results were in agreement with other studies, such as by Khalaf *et al.* [15] who showed that normalization of heart rate occurred after  $20.64 \pm 9.49$  h in group A and  $46.5 \pm 12.29$  h in group B.

Regarding laboratory and imaging study of cases with scorpion stings on admission, it showed that no



abnormalities were detected in complete blood count and kidney function and there were impaired values of creatine kinase level, blood gases, serum electrolyte, and ECG, with no significance difference between group A and group B. These results are in agreement with Arivoli and Ganesh [9] who showed that abnormal results in chest radiography (pulmonary edema) were found in six (8.8%) cases and abnormal ECG sinus tachycardia was found in 42 (61.7%) cases with use of prazosin.

The present study showed that the complications among the studied cases at time of admission were cardiogenic shock in 10 (16.7%) cases, hypovolemic shock in three (5%) cases, pulmonary edema in six (10%) cases, and myocarditis in 11 (18.3%) cases, with no significance difference between group A and group B. Accordingly, Bosnak *et al.* [12] had similar results, with pulmonary edema in five (9.6%) cases, hypotension in two (3.8%) cases, and tachycardia in 19 (36.5%) cases. Moreover, Bawaskar [16] showed that in patients with severe envenomation by *Mesobuthus tamulus* admitted at Mahad, pulmonary edema was seen in 27% and tachycardia with hypotension in 18%. In addition, Rathod and Tamba [17] had similar study who showed that pulmonary edema was found in three (25%) cases in group B only.

In our study, the complications among the studied cases at 3-h follow-up showed that three cases developed pulmonary edema and one case developed cardiogenic shock in group B with no deterioration in group A.

After 24 h of admission, the patients showed improvement of pulmonary edema in 6.7% in group A compared with 16.7% in group B, with no significance difference between group A and group B. Bawaskar and Bawaskar [6] concluded that scorpion antivenom is no more effective at alleviating or reversing the cardiovascular effects of scorpion venom in severe cases when compared with prazosin, which prevents and reverses the cardiovascular manifestations of severe scorpion envenomation. Accordingly, Khalaf *et al.* [15] showed that normalization of blood pressure occurred after  $12.48 \pm 2.4$  h in group A and  $28.5 \pm 8.62$  h in group B. Moreover, Natu *et al.* [18] performed a similar study which showed that patients with prazosin showed early recovery than in the other group.

After 48 h of admission, the patients showed improvement of cardiogenic shock in 6.7% in group A compared with 10% in group B, with no significant difference between group A and group B. Moreover, improvement of pulmonary edema was seen in 3.3% in group A compared with 13.3% in group B with no significant difference between group A and group B. Accordingly, Peker *et al.* [19] showed that the patient

symptoms had fully resolved within 36 h. Respiratory difficulty had disappeared, and the patients were discharged 48 h after admission.

Regarding the outcome, cases with scorpion stings showed that five (8.3%) cases died [one (3.3%) case in group A and four (13.3%) cases in group B] and 55 (91.7%) cases improved [29 (96.7%) cases in group A and 26 (86.7%) cases in group B]. Prazosin has been found to improve scorpion sting envenomation. Accordingly, Bahloul *et al.* [20] reported that the mortality rate was reduced to 1% as compared with a 30% mortality rate in the pre-prazosin period. In addition, Koseoglu [21] showed that impressive reductions in mortality from *Mesobuthus tamulus* sting have also been observed with the use of prazosin, from 26% in 1961 to 6% in 1980, and less than 1% in 2006. In addition, Rathod and Tamba, 2013, performed a similar study with recovery rate of 50% in group A and 25.0% in group B [17].

Regarding the need for respiratory support, 9 cases (15%) needed mechanical ventilation, with 4 cases (13.3%) in group A and 5 cases (16.7%) in group B. Accordingly, Arivoli and Ganesh [9] showed that 14.7% needed CPAP/MV with use of prazosin.

In our study, the duration of hospital stay was less in group A in comparison with group B. Patients in group A showed early recovery than in the group B. This is in accordance with Arivoli and Ganesh [9] who found that 82.3% stayed for < 3 days and 17.6% stayed for > 3–5 days with the use of prazosin. Moreover, Rathod and Tamba [17] showed that the time for recovery was better in cases treated with prazosin.

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## Conclusion

Our results showed that addition of prazosin to antivenom induced earlier clinical recovery than in cases treated with conventional therapy only. Most of the patient needed only one dose of prazosin for clinical recovery.

## Recommendations

The time interval between sting and arrival to health care should be recorded.

Duration between the time of sting and prazosin administration should be recorded.

Comparison between three group (antivenom only, prazosin only, and antivenom and prazosin) should be done.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

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