

## Research Article

# Scorpion sting envenomation, Vijayapur, Karnataka, India experience: new observations

Mallanagouda M. Patil\*, Bhavana Lakhkar, Shankargouda V. Patil, Aravind S. Akki,  
Raghavendra H. Gobbur, Siddarameshwar S. Kalyanshettar

Department of Pediatrics, BLDE University's Shri BM Patil Medical College, Vijayapur, Karnataka, India

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**\*Correspondence:**

Dr. Mallanagouda M. Patil,

E-mail: [mmp076@gmail.com](mailto:mmp076@gmail.com)

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### ABSTRACT

**Background:** Scorpion sting is a very common problem in rural areas of Vijayapur. Financial status of people and non-availability of antivenin are concerns. The present study enumerates risk factors and experience of using drug Prazosin hydrochloride (Prazosin) at higher initial dose (80-90 microgram/kg) in scorpion sting envenomation.

**Methods:** A retrospective study was carried out at Shri BM Patil Medical College Hospital and Research Centre Vijayapur Karnataka during the period of September 2014 to August 2015. Case records of 40 cases of scorpion sting envenomation were reviewed. Risk factors were correlated with outcome. Effect of accidental administration of high dose of Prazosin was studied.

**Results:** Local pain, profuse sweating, vomiting, cold extremities were common presentations. Six patients had myocarditis and one had neurological involvement. One patient was brought dead. Age of patient, time interval between symptoms and treatment, use of steroids and other drugs were main risk factors. High dose Prazosin reduced the time for first response ( $p < 0.001$ ), total recovery time ( $p < 0.001$ ), Pediatric Intensive Care Unit stay ( $p < 0.001$ ) and use of inotropes ( $P = 0.042$ ).

**Conclusions:** High dose Prazosin is useful and safe in severe cases of scorpion sting envenomation in the resource poor settings.

**Keywords:** Scorpion sting, Prazosin, Risk factors

### INTRODUCTION

Vijayapur is a district place, which is surrounded by many villages where people survive on farming. Education level among rural people is low. Bare foot walking is common.

The soil is dry and known to be suitable for scorpion inhabitation. Hot climate of Vijayapur adds to it. Though more common in adults, scorpion sting envenomation is common in rural children as scorpions in this region live near human dwellings.

Indian red scorpion *Mesobuthus Tamulus* is the most common scorpion species found in this region and is the most toxic type known<sup>1</sup>. Mortality due to envenomation has decreased due to an alpha receptor blocker drug

called Prazosin hydrochloride (Prazosin) which is given as primary antidote even at the village level<sup>2</sup>. The serious morbidity due to scorpion sting is noticed when people consult spiritual healers or are brought late due to nonavailability of transport facilities in time.

The mortality and severity of envenomation also depends upon cardiac involvement which might continue in spite of Prazosin administered in usual doses. Possibility of higher dose requirement when there is cardiac involvement remains to be studied.

The present study analyses the epidemiological and clinical features in patients presenting to a tertiary care hospital to assess whether these can be used to judge the prognosis. The children are often brought to our hospital after visiting rural health centers or local doctors who

promptly treat these children with Prazosin and then refer them to higher center. This information is often not conveyed to us by doctors or patients which results in additional doses of Prazosin to the patients. We have also studied beneficial or otherwise impact of accidental high dose of Prazosin on the outcome.

## METHODS

Case records of 40 cases of scorpion sting envenomation of different severity who were admitted in PICU (Pediatric intensive care unit) of Shri BM Patil Medical College Hospital and Research Centre Vijayapur Karnataka during the period of September 2014 to August 2015 (one year) were analyzed.

After seeking the ethical clearance, the case records of above patients were studied in detail. The epidemiological and clinical features, types of treatment before coming to hospital, treatment in our hospital, duration of stay in the hospital, grade of severity and central nervous system involvement, outcome as discharge or death, were noted in a pretested prevalidated proforma. Nurses' notes and monitoring sheets were also reviewed to study the time required for improvement in the hospital.

Patients in our hospital were treated based on a convenient protocol made for PICU. As per protocol, if a patient presenting with history of sting has autonomic or any other systemic symptoms or signs they were immediately treated with 30 µg/kg of Prazosin by oral route. Blood counts, electrolytes, renal function test were done for all patients. Aspartate transaminase (AST) and Creatinine Phosphokinase MB (CPK – MB) was done when myocarditis was suspected. Vital Parameters of child were monitored hourly. Electrocardiogram (ECG) and Echocardiogram (ECHO) was done, if myocarditis was suspected. Chest x-ray was done, if pulmonary edema was suspected. Prazosin was repeated 3 hourly in the same dosage (30µg/kg) till symptoms improve. If any dose received outside, that was also counted. Rest of the treatment was symptomatic like Paracetamol or Mefenamic acid for pain, antiemetics for vomiting etc. Special precaution of avoiding the inotropes (especially Dopamine) was kept in mind, as patients would be already in a state of catecholamine surge. Even when patients were brought in the phase of hypotension, they were initially managed with maintenance intravenous fluids and Prazosin as a part of protocol. Dobutamine was used if other measures for hypotension management failed. Tetanus prophylaxis was given based upon child's immunization status. Patients were discharged if they were asymptomatic for 48 hours. Since scorpion antivenom was not available, it was not included in the protocol.

Categorization of severity of scorpion sting envenomation was done as follows<sup>3</sup>

Grade I - local pain/paresthesia at sting site, no systemic manifestations.

Grade II - Pain/paresthesia which has travelled from sting site with /without tachycardia but without cardiovascular involvement.

Grade III - Peripheral circulatory failure, CVS or respiratory manifestations.

Grade IV - CNS and /or multisystem involvement.

Patients having muffled heart sounds, tachycardia persisting after one dose of Prazosin, ECG changes (low voltage QRS with depressed ST segment and prominent T wave.), raised AST (more than twofold rise), congestive cardiac failure (CCF) or poor ejection fraction on ECHO were suspected of having myocarditis. As tachycardia is a manifestation of autonomic storm, it is difficult to diagnose myocarditis till at least one more additional feature was present. Pulmonary edema was diagnosed based on tachypnoea, orthopnea, basal crepitations, and pink frothy sputum with typical chest x-ray changes.

## RESULTS

Total of 40 cases below the age 15 years were admitted, of which 29 (72.5%) were between the ages 1 to 3 years. Male to female ratio was 1.8:1. Male predominance was more visible in children above 5 years. All the children were from rural areas and from families involved in farming. Most children were stung while working in fields with parents or in the house where grains were stored. Two children were around 1 year and were made to sleep in the cradle near stored grains. Among the older children, 3 were stung while helping in loading of grain bags. Ninety percent of stings were between 6 PM to 5 AM. The cases where scorpion could be seen, reported it to be Red species except in one who insisted it was yellow scorpion.

Time interval between sting to symptoms ranged from 10 minutes to 30 minutes, mean being 15 minutes. The time interval between symptoms and hospitalization (any hospital) ranged from 50 minutes to 13 hours, mean being 4.2 hours.

Most common site of sting was over lower limb (18 cases, 45%), followed by upper limb (14 cases, 35%). Other sites were scalp and ear pinna which were involved in younger children who were sleeping.

Most common symptoms at presentation were severe pain (35, 88%) at local site, profuse sweating (36, 90%), cold extremities (37, 93%) and shivering (8, 20%). On examination, children were anxious and scared due to pain, but sensorium was normal. Children below 3 years were brought with incessant cry. One child was brought dead. Tachycardia was present in all (39, 98%) children, transient hypertension in 3 (8%), low normal blood pressure (BP) in 16 (40%), brought with hypotension in 5 (11%), remaining 15 (38%) had BP near 50<sup>th</sup> percentile for age. Three (8%) children had gallop rhythm out of which 2 (5%) had liver enlargement with pedal edema and respiratory distress indicating cardiac failure.

Pulmonary edema was found in 2 patients (5%). Priapism was seen in 4 (10%) patients.

Local area of sting had only one mark in most patients 30 (75%). Six patients (15%) presented with history of sting but had no mark, though pain was present. Four patients (10%) had no history of scorpion sting but presented with typical symptoms of excessive sweating, shock like features, and response to Prazosin was immediate. These were children below 3 years. None of the patients were brought with tourniquet. Two (5%) of these patients felt pain after systemic symptoms disappeared after treatment. Local inflammation and infection was rare (2 patients).

Total of 6 patients (15%) were in grade II, 32 (80%) were in grade III out of which 26 peripheral circulatory failure had and 6 (15%) patients fulfilled the criteria for myocarditis. Only one patient (2.5%) had neurological features in the form of hemiplegia (grade IV) and this patient needed ventilator support due to respiratory paralysis. One patient was brought dead and by history looked like pulmonary edema.

Around 30% (12 patients) showed leucocytosis of neutrophilic type, electrolytes were within normal range but in 27% (11) patients, sodium was high normal (mean serum Na 145mg%), in 3 patients (7.5%) serum potassium was 5 to 5.5mg%, renal function tests

remained within normal range. Random blood sugar ranged from 42 mg% to 240mg%, mean being 150mg%. Only 2 patients (5%) had blood sugar below 60mg% and 4 children had above 180mg % (10%). AST was high in 6 patients (15%) and ranged from 50 to 200 mg%. CPK and CPK MB could be done only in six patients due to financial constraint and was high in 4 patients.

ECG changes with peaked T wave was seen in 4 patients who were diagnosed as myocarditis. Chest x ray was done when distress was present (2 patients) and showed evidence of pulmonary edema.

#### **Effect of high dose prazosin**

Patients were treated as per our PICU protocol. In 17 patients we found that they have already received at least 50-60 µgm/kg of Prazosin. This fact was revealed after child was better. In the meantime child was given additional dose (first dose in our hospital) as per protocol. This way these patients received around 80-90 µgm /kg Prazosin within one to one and half hours. These were mostly the patients who had comparatively severe symptoms. The results of these schedules are compared (Table 1).

#### **Safety profile of high initial dose of prazosin**

Prazosin was found to be safe even if it was given at higher dose. No harmful side effects were noticed.

**Table 1: Comparison of patient characteristics with two types of prazosin dosage.**

Patient characteristics	Usual dose Prazosin (30 µgm/kg)	High initial dose Prazosin (80-90 µgm/kg)	P Value
N= 39	N=22 (5 in GradeII,17 in Grade III)	N= 17 (1 in Grade II, 16 in Grade III)	--
Mean interval between sting and first treatment (hours)	3.6	4	p= 0.2722
Mean time for first sign of response (hours)	3	2	p<0.001
Mean time of full recovery (hours)	30	20	p<0.001
Mean duration of PICU stay (hours)	50	30	p<0.001
Number of patient received inotropes	10 (45%)	2 (11.7%)	p<0.05

#### **Risk factors**

Following were analysed to see whether these can be correlated with outcome.

#### **Age**

We found age was one of the important risk factor. Younger age group (<3 years, n=30) had symptoms early after the sting, mean time being 11.5 minutes, whereas above 3 years of age, it was 23 min (p= 0.94). Mean time for initial recovery was 3.5 hours below 3 years and 2.2 hours above 3 years (p= 0.02). Severity of illness was also more above 3 years as judged by number of children

receiving inotropes (23% below 3 years, 11% above 3 years) though statistical significance was not found (p= 0.43). Duration of PICU stay was longer in young children (<3 years, mean duration of PICU stay was 28.25 hours +/- 2.5 Vs >3 years 25.8 hours +/- 1.2 hours, p= 0.0076).

#### **Sex**

No difference in presentation or recovery was found between two sexes (p= 0.45, p= 36).

### **Delay in starting therapy**

Delay in introduction of Prazosin therapy, delayed the recovery. Mean time of interval between sting and receiving treatment with Prazosin after sting was 3.8 hours. Those who received Prazosin within 2 hours, had mean initial recovery time 2.1 hours whereas those who received after 2 hours mean initial recovery time was 3.6 hours after drug introduction ( $p=0.0006$ ).

### **Steroids therapy with or without antihistamines**

There were 7 patients in whom steroids were given before shifting to our centre, three among these received antihistamines also. Initial recovery time of these patients was 4.5 hours (no steroid group – 3.3 hours,  $p=0.0202$ ). Recovery time was prolonged in steroid group even if they presented early after sting. Main reason for prolongation of recovery was vomiting due to gastritis and persistent tachycardia. Out of 6 patients who had myocarditis, three received steroids.

One child was brought dead but there were no deaths in the hospital. The child who was brought dead was taken to local faith healer and was brought to hospital after 7 hours of sting. He has not received Prazosin.

## **DISCUSSION**

Vijayapur is a district place of Karnataka, a southern state of India. It is surrounded by 199 panchayath villages. Scorpion sting is a climatic (dry and hot) and professional (farming) hazard for Vijayapur and similar places<sup>4</sup>. Poor educational status of villagers (literacy rate 67%) makes prophylactic education less effective.

Above situation makes it mandatory to understand the patho-physiology of scorpion sting better and study the risk factors for better prognostication and better solution of this ongoing problem.

The present study evaluated 40 cases presented during one year. All patients reported red to yellow color of scorpion which is common in *Mesobuthus Tamulus* species found in India and is the most toxic of the thirty poisonous types.<sup>1</sup>

We studied only the pediatric age group and found majority in 1 to 3 years age group. Ramesh pol, et al reported 2- 7 years as most involved group.<sup>5</sup> Their study area also is around 3-4 hours from Vijayapur. Studies<sup>5-7</sup> which compared adults with children reported more severe involvement in children though sting is more common in adults. As children have less weight same amount of injected venom becomes more toxic. Same may be the reason for more young children presenting to hospital. No difference in presentation between the sexes was found by us and it has not been reported by others. Similar to our observation, others also found stings to be nocturnal, more in fields and commonest sites were over the extremities.<sup>5-7</sup> Face and ear pinna was also affected in infants in our study which was also noticed by others.<sup>5</sup>

Stings near to head and torso are described to be more severe due to more venom absorption.<sup>8</sup>

The clinical manifestations of scorpion sting are described in three stages, first is transient parasympathetic stage with hypotension, vomiting, sweating, bronchorrhoea, salivation, and bradycardia. This stage is followed by sympathetic stage with hypertension, tachycardia, and dry mouth, cold extremities due to vasoconstriction, shock, pulmonary edema, and cardiac failure hyperglycemia. This stage is long lasting and may be fatal if not properly managed. Third phase is due to depletion of catecholamines from nerve terminals and can lead to hypotension and pulmonary edema.<sup>7</sup> Sometimes patients can present with initial hypotension due to fluid loss during parasympathetic phase and use of inotropes during this phase can be dangerous as this phase is followed by sympathetic phase and inotropes (especially dopamine) along with catecholamines can lead to coronary spasm. If it has to be used, it is advisable to use during hypotensive warm shock which is due to depletion of catecholamines.<sup>9,10</sup>

Most of our patients presented in sympathetic phase. In experimental animals it has been shown that the toxin after introduction is deposited in subcutaneous tissues and total absorption occurs in 7-8 hours and 70% concentration is reached in 15 minutes.<sup>9</sup> The mean time of hospitalization and treatment of our patients was 3.5 hours which is similar to other authors dealing with scorpion sting problems but many cases reach as late as 12 hours.<sup>5,7</sup> One child was brought dead as he presented after 7 hours. Mostly the time is lost in finding a transport and travelling. Faith in traditional healers is also an important issue. This makes the interval between sting and treatment an important risk factor.

Normal blood pressure or hypotension was more common, may be because they were in sympathetic phase and some of them already received Prazosin (44%). As per PICU protocol we avoid boluses and Dopamine. Prazosin 30  $\mu\text{g}/\text{kg}$ , maintenance fluids and close monitoring was the initial protocol, failing which Dobutamine was given.

Though cardiac involvement was main complication in our patients, one child had neurological involvement in the form of hemiplegia. Thrombotic events due to DIC have been implicated in causation of hemiplegia. Neurological effects are not common with Indian red scorpion.<sup>7,11</sup> Pulmonary edema is described to be due to myocarditis or increased capillary permeability.<sup>12</sup> In our series 2 patients had pulmonary edema but Bawaskar reported 19% from Maharashtra and Bouaziz reported 68% from Tunisia.<sup>12,13</sup> In Bawaskar's series may be the delayed presentation and in Bouaziz study different species of scorpion may be responsible for pulmonary edema.

Priapism was seen in 10% (4 patients) of our patients, Prasad et al found in 31% cases and. Prasad et al and Udaykumar reported more mortality in these patients due to cardiac involvement.<sup>12,14</sup> Some authors report it to be more common in children.<sup>7</sup>

Abnormal laboratory investigations (total counts, neutrophilia, blood sugar) though helpful in management, is not reported to be of prognostic importance.<sup>8</sup> Serum electrolytes (sodium and potassium) if deranged have been found to be of prognostic significance.<sup>6</sup> We could not correlate serum electrolytes and outcome as major abnormalities were not found.

Chest x-ray was found useful only if pulmonary edema was present and this itself is an ominous sign. ECG is a very simple useful test indicative of diagnosis and recovery of myocarditis. We found abnormality of ST and T wave in cases of myocarditis. ST depression, arrow head T wave are suggestive of acute injury and T wave tenting suggests recovery. Low voltage QRS and arrhythmias also suggest Myocardial injury and may indicate fatal illness.<sup>1,6</sup>

It is reported that only 30% of scorpion sting cases have systemic manifestations, rest are dry stings.<sup>6</sup> As ours is a tertiary care hospital we get cases with systemic symptoms. Local pain is the commonest feature except when child has some other severe manifestations.<sup>8</sup> In these cases pain reappears when systemic symptoms are relieved we had two such cases.

In some patients recovery was unduly fast and these patients were further inquired about treatment and were found that they have already received Prazosin of 50 to 60microgram/kg and received additional dose in this hospital. All the doses given within 11/2 to 2 hours were taken as one dose (approx. - 90micogram /kg).

The patients receiving two types of doses were compared and the results were impressive and useful (Table 1). Though the mean time interval between symptoms and treatment was almost similar (p= 0.27), the time for first sign of response, (p= 0.00001), time for complete disappearance of symptoms, (P= 0.0001), mean duration of PICU stay, and use of inotropes was significantly less in high dose group (p= 0.0424).

In our set up we are not able to use antivenin due to financial constraint and non-availability. Only choice is Prazosin which works wonders if risk factors are not there. As no adverse effects are seen with high dose, it appears that high dose Prazosin may be a useful and cost effective strategy for severe envenomation and in those with risk factors and especially in absence of antivenin. We could not find any study where this observation has been made. We feel systematic studies or trials showing utility of high dose Prazosin which is described to be physiological antidote are required.

### **Risk factors**

A special effort has been made in the present study to find the risk factors.

Age, time interval between symptoms and treatment, use of steroids and other medications like antihistamines were the risk factors identified by other studies.<sup>5-8,15,16</sup> The present study also found these factors important.

Sting near head and tarso, presence of priapism, serum electrolytes, high blood sugar, temperature more than 39°C, Glasgow coma scale </-8 were other risk factors described but we could not correlate these may be due to less number of cases.<sup>6,7,16</sup>

Warm extremities, reappearance of pain, change in shape of T wave in ECG were the early signs of recovery noticed by us and others.<sup>7,8</sup>

### **CONCLUSION**

Present observational study presents important information about epidemiological and clinical features of scorpion sting which can act as risk factors. Age of child, time interval between symptoms and treatment and other therapies like steroids are main risk factors. It also finds a new high dose of Prazosin which can be a boon for patients with severe envenomation in rural setup with poor financial background.

The limitation of study is its retrospective nature and less sample size. Larger RCT is suggested for testing the high dose Prazosin therapy. It will be a low cost, safe alternative for expensive antivenin which has to be species specific also.

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