



STING TO THE HEART: A STUDY ON THE CLINICAL SPECTRUM OF SCORPION STING EVENOMATION AT A TERTIARY CARE CENTER

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ABSTRACT

Introduction: Though not a big problem in developed countries, scorpion sting still occupies a major health issue in developing countries. Late presentation to hospital due to local practices, false beliefs and unavailability of specific medical care leads to severe manifestation, even death. **Methods and Materials:** A descriptive observational study was done at Government medical college and District hospital Vidisha for duration of 18 months in which 30 children were included from Aug 2020 to Jan 2022. Their symptomatology, clinical manifestations, complications and outcome were studied. **Results:** Pain and parasthesia at the sting site was reported in almost all patients. Myocarditis (26%) and pulmonary edema (6.6%) were less frequently encountered. Complications were seen in children who presented late but no death was reported due to scorpion sting in this duration. Prazosin therapy proved to be the most effective and life saving measure if administered on time. **Conclusion:** Scorpion sting can be considered as 'occupational hazard' for rural children playing and working in agricultural fields. Early and specific medical therapy with close monitoring can limit the resulting morbidity.

KEYWORDS: Scorpion evenomation, paediatric emergency, prazosin therapy.

INTRODUCTION

Scorpions are nocturnal arachnids that typically live in deserts, mountains, caves and usually do not prey unless disturbed.^[1] Scorpion sting is considered as a life threatening medical emergency of villagers in India.^[2] All lethal scorpions belong to *buthide* family but in India *mesobothus tumulus*, *palamneus swammerdamei*, *heterometrus bengaleruis* are of medical importance as children are mainly stung by the red scorpion (*mesobothus tamulus*) with recorded fatalities.^[3]

Composition and mechanism action of the venom

The scorpion toxic peptides are broadly classified as alpha and beta toxins. It consists of neurotoxins, cardiotoxin, nephrotoxin, hemolytic toxic, phosphodiesterases, histamine, serotonin, the most potent being the neurotoxin concentration, which has neuromuscular and neuroautonomic effects, as well as damages the surrounding local tissue.^[4] The nerve damage is due to the stabilization of voltage-dependent sodium channels (by alpha toxins) which leads to the prolonged and continuous firing of neurons in the somatic, sympathetic, and parasympathetic nervous systems. Short polypeptide neurotoxin blocks potassium channels (by beta toxin). Upon injection with the venom, sacral parasympathetic nerves are stimulated, VIP is

released which causes relaxation of the penile musculature leading to priapism.^[5]

Local manifestations

- Serotonin, bradykinin, substance P causes severe pain and TAP sign

Autonomic manifestations^[6]

- Cholinergic stimulation- sweating, excessive salivation, priapism, bradycardia.
- Adrenergic stimulation- tachycardia, hypertension, mydriasis, ultimately cold shock and hypotension. It causes myocardial injury leading to peripheral circulatory failure and pulmonary oedema.

Systemic complications

- Cardiovascular system- myocarditis, ventricular dysfunction, arrhythmias
- Respiratory system- respiratory distress, pulmonary oedema
- Haematological system- priapism, DIC
- Neurological- altered sensorium, seizures, headache
- Kidney- hematuria, ATN, pre renal or renal AKI
- GIT- vomiting, severe abdominal pain, hematemesis

Grading of the severity/shock

Grade 1- excruciating local pain, local edema with sweating

Grade 2- autonomic storm

Grade 3- pulmonary oedema, hypertension then hypotension leading to compensated shock

Grade 4- uncompensated shock

The toxicity depends on the following factors.^[7]**Related to the scorpion**

- Species

- Number of stings
- Quantity of venom injected
- Composition of the venom

Related to the victim:

- Age
- Site of envenomation- closer proximity of the sting to the head results in faster venom absorption into central circulation.
- Presence of comorbidities
- Timing of initiation of treatment

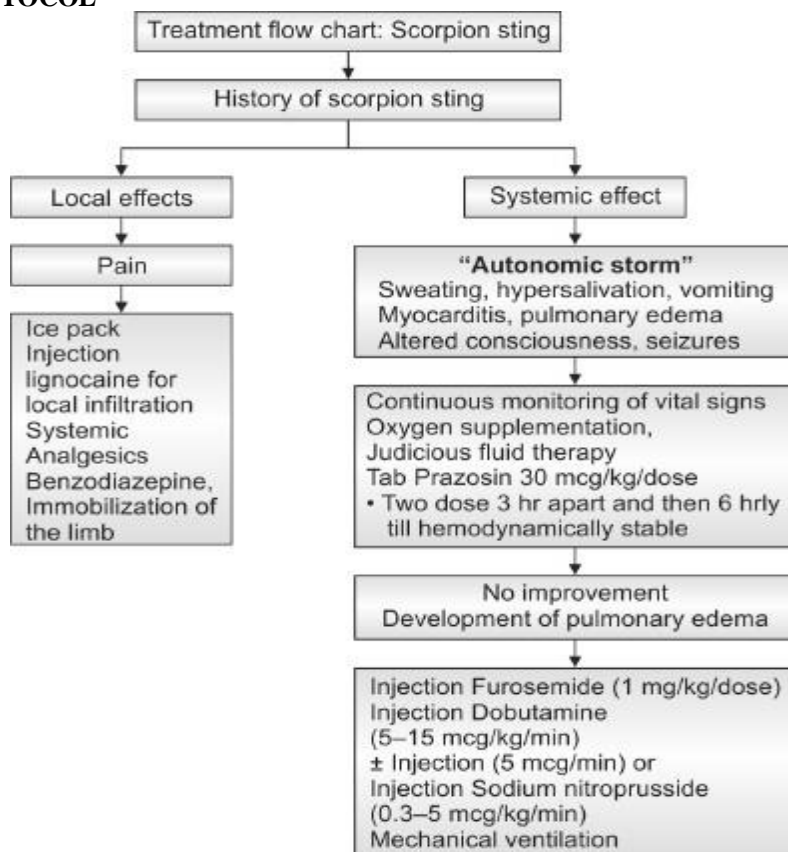
TREATMENT PROTOCOL

Fig. 1: Tabular flow chart showing management protocols after scorpion bite.^[8]

Anti-venom reaches the target too fast and within 30 minutes of sting, it may reverse their effect but usefulness of scorpion anti-venom varies between countries. Systematic administration of scorpion antivenin did not alter the clinical course of scorpion sting in many studies⁸. Antivenom against the toxins of Indian scorpions is not easily available for clinical use in most areas. Moreover children reaching hospital late, already exhibits cardiac manifestations. It is not clear from published reports whether antivenom is effective in prevention or abolition of cardiovascular manifestations, therefore it would be practical to neutralize the effects of an overstimulated autonomic nervous system through prazosin than attempting to neutralize toxin already bound to receptors on sodium channel.

The diagnosis of scorpion sting is usually straight forward based on the history of sting but it is wise to

consider a diagnosis of scorpion sting in all cases of unexplained shock with profuse sweating, myocarditis or pulmonary oedema in rural areas.

Scorpion sting, just like snake bites are an occupational hazard especially for the rural population. Many cases of scorpion sting envenomation go unreported and the true incidence is difficult to report. Case fatality rates vary widely among different regions from 3-22% but over the years with improvement in management protocols there has been a dramatic decline in mortality.

This study has its importance as Vidisha lying in the peripheral areas of M.P. is mainly a rural agricultural land, heavily infested with scorpions. A study about the overall accidental poisoning in the same area also revealed the predominance of scorpion sting over other toxins.^[9]

AIM AND OBJECTIVES

- To study the clinical spectrum of scorpion sting in children.
- To study the outcome of scorpion sting in children.

INCLUSION CRITERIA

- Children between 1 month to 12 years of age presenting in PICU or emergency ward/casualty with history of scorpion sting
- Children between 1 month to 12 years of age presenting in PICU or emergency ward/casualty with unknown bite/sting having profuse sweating, myocarditis or pulmonary oedema or priapism.

EXCLUSION CRITERIA

- Infants less than 1 month or children more than 12 years of age.
- Children who presented late or referred at our centre after 24 hours of sting in which initial presentation could not be assessed.
- Children who left against medical advice (LAMA)
- Children already having cardiopulmonary disorders or on related medications.

METHODS AND MATERIALS

A Descriptive study was conducted at Atal Bihari Vajpayee govt. medical college and District hospital Vidisha from August 2020 to Jan 2022 for a duration of 18 months in which 30 children from 1 month to 12 years of age who presented in PICU or emergency ward/casualty with history of scorpion sting or patient with unknown bite/sting with profuse sweating, myocarditis or pulmonary oedema referred from rural agricultural areas were included.

Identification of scorpion sting was done either by recall, history, image of the scorpion or by the dead scorpion brought by accompanying attendants of the patient.

Patients fulfilling the inclusion criteria were evaluated for demographics and epidemiology. Their initial presentation, signs, symptoms, systemic manifestations were noted. Related investigations including complete blood picture, renal function test, urine routine, ESR, CRP were sent.

Chest radiographs and ECG was also recorded to look for myocarditis and pulmonary oedema.

Early and specific medical care along with symptomatic support was started including oxygen support, adequate IV fluids, local and IV analgesics, prazosin therapy, inotropic support (IV dobutamine).

Outcome was also noted, as patients after recovery were shifted to ward and discharged. They were advised to follow up in OPD to assess for any long term complication.

RESULTS**1. Age wise distribution****Table 1: Showing age distribution of children admitted with scorpion evenomation.**

	Age group	n	%
1	1 month- 1y	2	6.6%
2	1y- 4 y	3	10%
3	5y- 8y	12	40%
4	9y- 12y	13	43.3%

2. Sex distribution**Table 2: Showing sex distribution of children admitted with scorpion evenomation.**

	Gender	n	%
1	Male	21	70%
2	Female	09	30%

3. Type of housing**Table 3 showing the socio-economic status of children with scorpion bite in form of housing condition.**

	Types of house	n	%
	Kuccha	24	80%
	Pakka	06	20%

4. Place of sting**Table 4: Depicting that maximum scorpion sting incident were outdoors.**

	Place	n	%
1	Indoor	11	36.6%
2	Outdoor	19	63.3%

5. Time of sting**Table 5: Showing that maximum scorpion sting was mostly after 6pm in the evening and night hours.**

	Time	n	%
1	Day (6am- 6pm)	8	26.6%
2	Night (6pm- 6am)	22	73.3%

6. Site of sting**Table 6: Showing that mainly sting was found in the extremities only.**

	Site	n	%
1	Extremities	27	90%
2	Others :		
	• Face	02	6.3%
	• Back	01	3.3%

7. Interval between sting and arrival at the hospital**Table 7: Showing sting bite- hospital arrival time interval which is important to understand the outcome.**

	Time interval	n	%
1	0-1 hours	05	16.6%
2	1-6 hours	18	60%
3	6-12 hours	05	16.6%
4	12-24 hours	02	6.6%

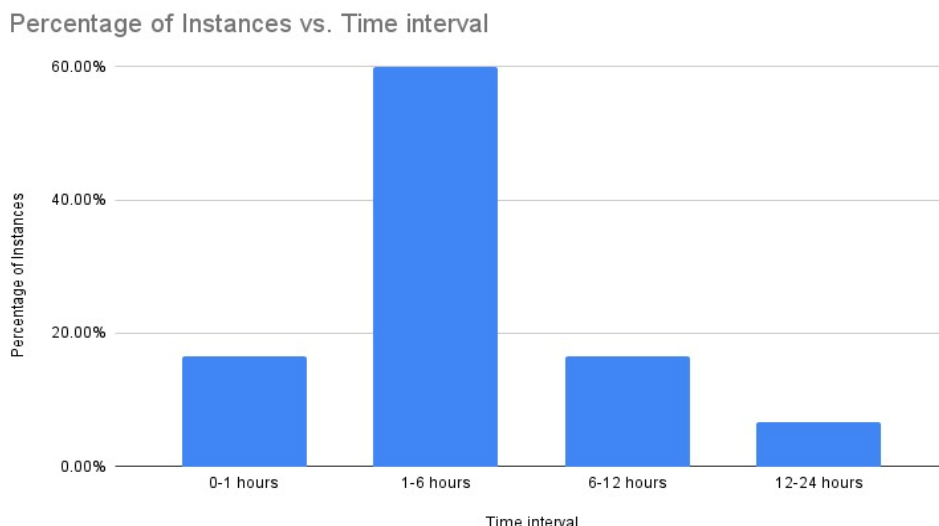


Fig 2: Showing the bar graph representation of the incident- hospital arrival interval.

8. Local manifestations

Table 8: Showing the percentage distribution of local manifestations of scorpion sting.

	Local signs	n	%
1	Pain at the site	30	100%
2	Redness	08	26.6%
3	Oedema/ swelling	05	16.6%
4	Parasthesia	20	66.6%
5	Bleeding at the site	02	6.6%

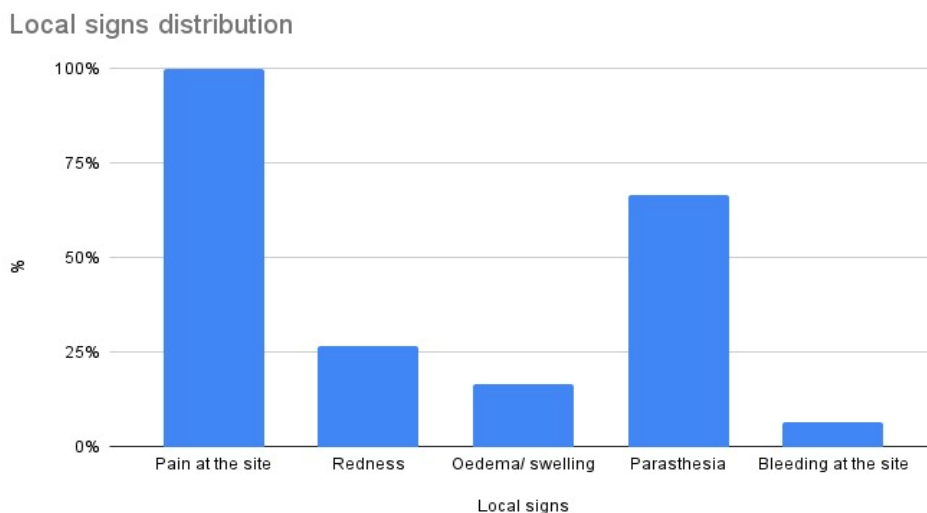


Fig. 3: Showing the bar graph description of local signs and symptoms after the scorpion sting.

9. Initial presentation

Table 9: Showing the initial presentation with which the patient came to hospital after the sting.

	Symptoms	n	%
1	Restlessness	20	66.6%
2	Vomiting	08	26.6%
3	Sweating	06	20%
4	Excessive salivation	06	20%
5	Any bleed other than sting site	02	6.6%

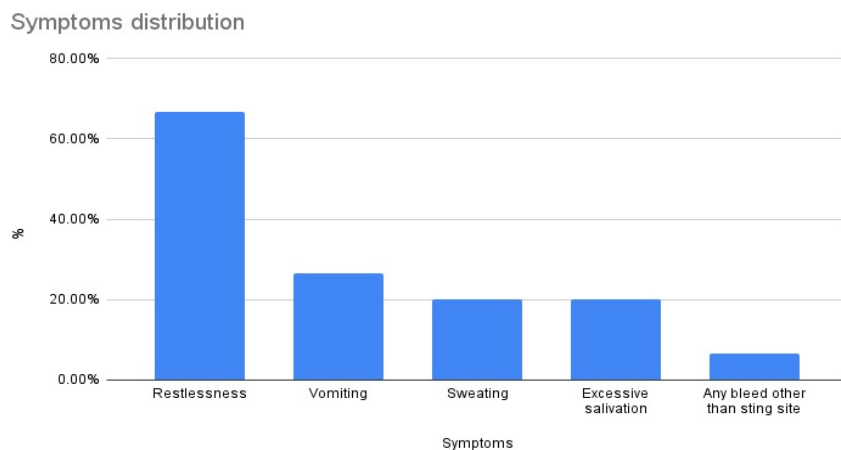


Fig. 4: Showing the bar graph representation of autonomic and cholinergic signs after the sting.

10. Systemic signs

Table 10: Showing the systemic sting after scorpion sting.

	Systemic signs	n	%
1	Hyperthermia	05	16.6%
2	Tachycardia	13	43.3%
3	Hypertension	04	13.3%
4	Tachypnoea	07	23.3%
5	Signs of shock(increased CRT, cold extremities, hypotension)	13	43.3%
6	Altered sensorium	01	3.3%

11. Treatment protocol

Table 11: Showing the treatment protocol of poisonous and non-poisonous scorpion bite.

	Treatment	N	%
A	Non poisonous sting:		
	IV fluids, oral paracetamol, topical analgesic	06	20%
B	Poisonous sting:		
1	Prazosin therapy	20	66.6%
2	IV Dobutamine	14	46.6%
3	Treatment of complications	05	16.6%
4	Mechanical ventilation	01	3.3%

Treatment for Poisonous and Non-poisonous sting distribution

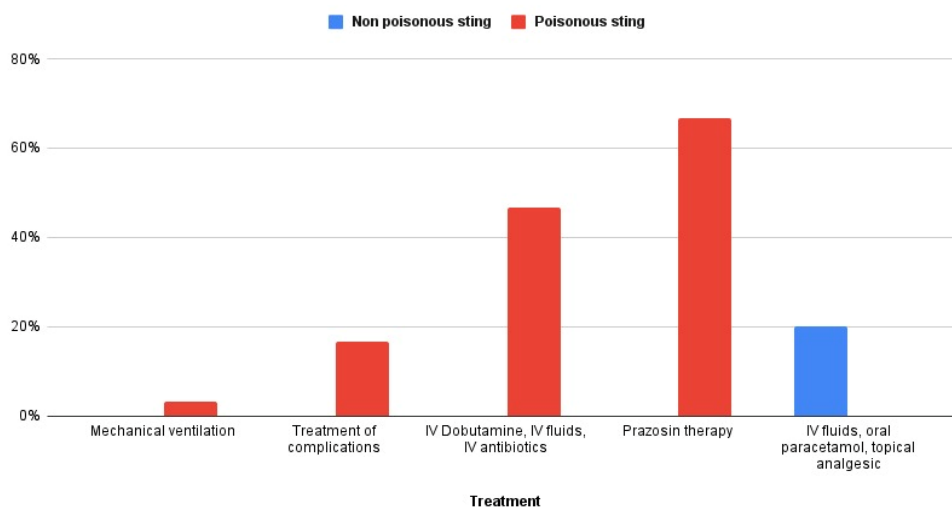


Fig. 5: Giving the graphical representation of the of the various treatment protocols of scorpion bite.

12. Complications due to sting

Table 12: Showing various systemic complications after scorpion sting.

	Complications N= 13	n	%
1	Myocarditis	04/13	30.8%
2	Arrhythmias	03/13	23.1%
3	Pulmonary oedema	02/13	15.4%
4	Priapism	01/13	7.7%
5	Hematuria	01/13	7.7%
6	Seizures	01/13	7.7%
7	DIC	01/13	7.7%

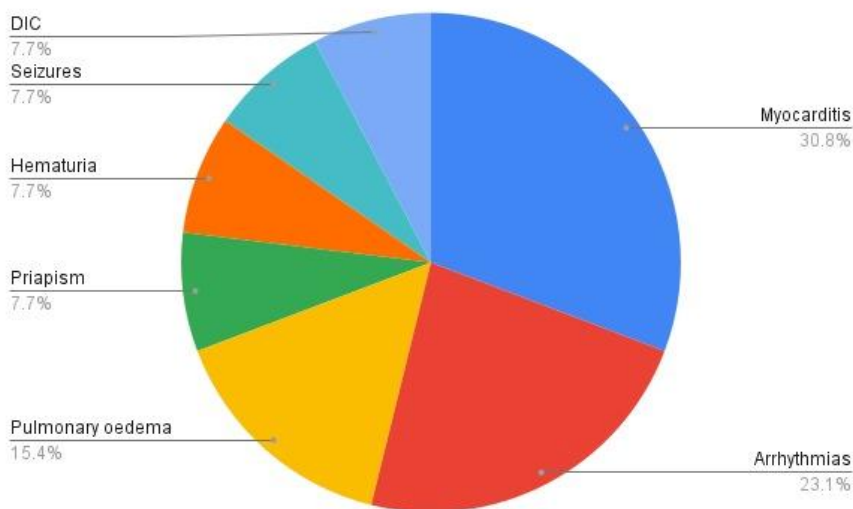


Fig. 6: Pie chart showing distribution of complications after scorpion sting.

13. Sting prazosin therapy

Table 13: showing the sting prazosin relationship.

	Sting prazosin interval in hours	n	%
1	Within 1 hour	04	13.3%
2	1-6 hours	14	46.6%
3	6-12 hours	02	6.6%
4	No prazosin	10	33.3%

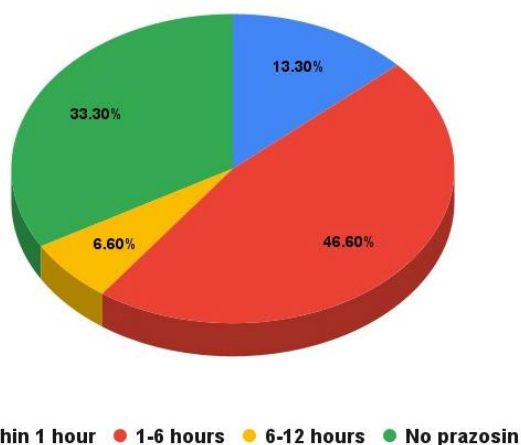


Fig. 7: Showing pie chart distribution of sting-prazosin interval.

14. Outcome

Table 14 discussing the outcome of children admitted with scorpion sting.

	Outcome	n	%	Mean and SD
1	Discharged	29	96.6%	
2	Death	0	-	
3	Refer to higher center	01	3.3%	

DISCUSSION

The study was done to study the clinical spectrum of the scorpion evenomation at a tertiary center where many patients from peripheral rural areas were referred, since many cases go unreported.^[9] The details are discussed below:

- In this study maximum number of patients belonged to 8 to 12 years of age (40% and 43.3% respectively). Out of them 21 were males, 70% and 9 were females, 30%. As male child wander more outside incidence was more in them which is evident in many other studies.^[10]
- Maximum of them belonged to lower socio-economic status and were farmers by occupation. Living conditions had kuccha house (80%) with place of sting was maximum outdoors (63.3%) mainly agricultural fields and playgrounds. It is

similar to study conducted by Mahadevan S and Rajarajeshwari G.^[10,11]

- The venom was mostly infested in the extremities, 90% mainly foot and fingers. In few cases the sting was on face and back (10%), which were exposed when sleeping inside house on floors. It is evident in many studies as done by Mahaba MHA^[12] and Dittrich K.^[13]
- Due to lack of transport facilities in many remote peripheral areas and lack of awareness many patients could reach to the hospital between 1-6 hours after the sting. Only 5 patients reached on time and 2 reached very late, after 12 hours of the sting. This is important for sting- prazosin therapy. Therefore only 4 could receive oral prazosin within 1 hour of sting (13.3%) and 14 patients within 1-6 hours sting (46.6%). Complications were noted less frequently in children who received a dose of prazosin early, <6 hours of sting. This finding is comparable to other studies done in india, which show that early and effective administration of prazosin significantly reduced the incidence of complications and mortality.^[14,15,16,17,18]
- As far as symptoms are considered pain at the site was seen in all patients, 100%, 8 patients experienced abnormal sensations in form of tingling, numbness and burning sensation, 66.6%. Few patients had swelling at the sting site (26.6%), redness (16.6) and only 2 had some bleeding from the site (6.6%). Pain being the commonest presentation is seen in almost all studies.^[11,19] Due to pain and parasthesia maximum patients were restless and were in confusional state, 66.6%. 26.6% had vomiting after the sting. 20% patient experienced cholinergic storm in form of profuse sweating and excessive salivation respectively. Similar presentation is seen in many previous studies,^[11,20]
- Systemic signs were also variable. Many had autonomic storm in form of tachycardia and hypertension (43.3%). Few patients had raised temperature, bradycardia due to cholinergic stimulation. 43.3% patients had signs of shock in form of cold extremities, increased CRT and altered sensorium.
- Total 13 patients had complications mainly in form of myocarditis(30.8%), arrhythmia (23.1%). Only 2 had pulmonary oedema (15.4%) presented with chest pain, dizziness and tachypnoea. Only 1 patient had multiple complications, presented with priapism(7.7%), also developed convulsions and went into DIC. Patient also developed purpuric rashes and hematuria. The patient was given oxygen support, blood transfusion, antibiotics. The patient was shifted to invasive ventilation (3.3%) and referred to higher center as required further investigations and urgent FFP transfusion which was unavailable at our center (3.3%). The reported incidence of pulmonary oedema secondary to scorpion sting in India is around 5%.^[11,21] Both cardiogenic and non cardiogenic factors have been

implicated in pulmonary oedema secondary to scorpion sting. Amaral CF et al^[22] studied six cases of scorpion sting which demonstrated both reduced left ventricular systolic function and also increased pulmonary capillary permeability in those cases.

- Treatment was started as per protocols. Patients were initially admitted in PICU and were stabilized. IV fluids, bolus if required given along with oxygen support (if needed) and symptomatic treatment was started. Patients with suspected venomous sting and features of myocarditis were urgently started oral prazosin (66.6%) as per weight and repeated 3 hourly till the symptoms subside.^[16] Patient with shock were started IV dobutamine (46.6%) to stabilize myocardium. Role of anti venom is still controversial; trial could not be done due to its unavailability and lack of knowledge about specific scorpion species. ECG and X-ray changes were seen in 2 patients (6.6%).



Fig 8: Showing pulmonary oedema in a 2 year old male child.

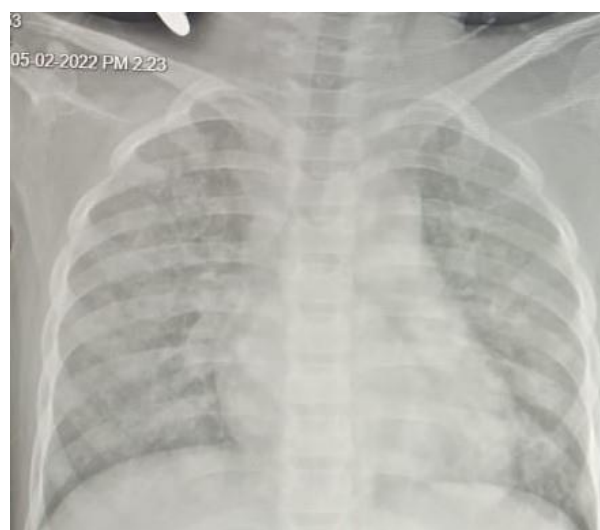


Fig 9: Showing pulmonary oedema in a 4 year old male child.

- Outcome is also comparable to other studies. Due to advance health care and availability of specific drugs, morbidity and mortality has declined. No mortality has been reported. Only 1 patient was referred, 3.3%, other 29 patients were discharged successfully (96.6%). Death earlier was mainly due to peripheral circulatory failure, leading to massive pulmonary oedema, CCF with cardiogenic shock^{10,21}

CONCLUSION

- Scorpion once considered a painful nuisance is given importance as 'occupational hazard' as mainly rural areas, agricultural fields show maximum incidence of scorpion envenomation.
- Cardiovascular morbidities are the most common life threatening complication. Anticipation and close monitoring for the uncommon complications is critical for effective management.
- Administration of prazosin as early as possible, is probably the single most effective intervention for preventing complications.
- The role of scorpion antivenom still remains controversial.
- To our surprise, scorpion envenomation was very common in this peripheral area of M.P. So complete clinical spectrum was studied in which mostly male children of 8-12 years of age were stung while playing or working outdoors during evening hours. Pain and parasthesia were mostly seen with cholinergic and autonomic dysfunction. Prazosin therapy was given as early as possible. No mortality was reported and almost all patients were successfully discharged.

Conflicts of interest- none

No funding required

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REFERENCES

1. Jared, Carlos; Alexandre, César; Mailho-Fontana, Pedro Luiz; Pimenta, Daniel Carvalho; Brodie, Edmund D.; Antoniazzi, Marta Maria (2020-04-30). "Toads prey upon scorpions and are resistant to their venom: A biological and ecological approach to scorpionism". *Toxicon*, 178: 4–7.
2. Bawaskar HS, Bawaskar PH. Sting by red scorpion (*Buthus tamulus*) in Maharashtra state, India: A clinical study. *Trans Roy Soc Med Hyg*, 1989; 83: 858-60.
3. Nejati, Jalil; Saghafipour, Abedin; Rafinejad, Javad; Mozaffari, Ehsan; Keyhani, Amir; Abolhasani, Ali; Kareshk, Amir Tavakoli (2018-07-25). "Scorpion composition and scorpionism in a high-risk area, the southwest of Iran". *Electronic Physician*, 10(7): 7138–7145.
4. Zlorkint, Miranda F: Proteins in scorpion venom toxic to mammals and insects. *Toxicon.*, 1972; 10: 207-9.
5. Pajovic, B.; Radosavljevic, M.; Radunovic, M.; Radojevic, N.; Bjelogrljic, B. (2012). "Arthropods and their products as aphrodisiacs--review of literature". *European Review for Medical and Pharmacological Sciences*, 16(4): 539–547.
6. Bawaskar HS. Diagnostic cardiac premonitory signs and symptoms of red scorpion sting. *Lancet*, 1982; 1: 552-4.
7. Pazhanisamy S., Madhavan J., A study on clinical presentation and outcome of scorpion sting in children. *IP Int J Med Paediatr Oncol*, 2018; 4(3): 110-113.
8. Mahadevan S. Scorpion Sting. *Indian Pediatr*, 2000; 37: 504-14.
9. Priyasha Tripathi, Surendra Singh Raghuvanshi, Priya Gogia. Pattern of acute poisoning in children in rural areas: A retrospective observational study. *Int J Paediatrics Geriatrics*, 2021; 4(2): 01-06.
10. Mahadevan S, Choudhary P, Puri RK, Srinivasan S. Scorpion envenomation and the role of lytic cocktail in its management. *Indian J Pediatr*, 1981; 48: 757-761.
11. Rajarajeshwari G, Sivapraksam S, Vishwanathan J. Morbidity and Mortality pattern in Scorpion Stings. *J. Indian Med Assoc*, 1979; 73(7&8): 123-126.
12. Mahaba HMA. Scorpion Sting Syndrome: Epidemiology, clinical presentation and management of 2240 cases. *Eastern Mediterranean Health J.*, 1997; 3(1): 82-89.
13. Dittrich K, Power AP, Smith NA, Scorpion sting syndrome- A Ten Year Experience. *Ann Saudi Med.*, 1995; 15(2): 148-155.
14. Clark RF. Scorpion Envenomation. In: *Clinical Toxicology*. Ford MD, Delaney KA, Ling LJ, Erickson J, ed., 1stEdn., W.B. Saunders company; Pennsylvania, 2004; 290-93.
15. Bawaskar HS, Bawaskar PH. Clinical profile of severe scorpion envenomation in children at rural setting. *Indian Paediatr*, 2003; 40: 1072-1076.
16. Bawaskar HS. Management of severe scorpion sting at Rural settings: What is the role of scorpion antivenom? *J.VenomAnim Toxins incl Trop Dis.*, 2005; 11(1): 3-7.
17. Bawaskar HS, Bawaskar PH. Prazosin in the management of cardiovascular manifestations of scorpion sting. *Lancet*, 1986; 1(8479): 510-11.
18. Biswal N, Bashir Rani A, MurmuUday C, Mathai B, Balachander J, Srinivasan S. Outcome of scorpion sting envenomation after a protocol guided therapy. *Indian J Pediatr*, 2006; 73: 577-82.
19. Bawaskar HS, Bawaskar PH. Indian Red Scorpion Envenoming. *Indian J Pediatr*, 1998; 65: 383-91.
20. Singh DS, Bisht DB, Sukumar G, Muralidhar K. Scorpion stings in adult South Indians at Pondicherry. *J Indian M A.*, 1979; 72(10): 234-37.

21. Santhanakrishnan BR. Scorpion Sting. *IndPediatr*, 2000; 37: 1154-57.
22. Amaral CF, Rezende NA. Treatment of scorpion envenoming should include both a potent specific antivenom and support of vital functions. *Toxicon*, Aug, 2000; 38(8): 1005-7.