

A RETROSPECTIVE COHORT ANALYSIS: NEUROLOGICAL COMPLICATIONS IN PAEDIATRIC SCORPIONISM CASES, BIHAR, INDIA.

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ABSTRACT

Background

Scorpion stings pose a significant public health concern, particularly among vulnerable populations such as children. Neurological complications resulting from scorpion envenomation can range from mild to severe, necessitating comprehensive understanding and management strategies. This retrospective study investigated the incidence, nature, and outcomes of neurologic complications in pediatric patients.

Methods

The study comprised of 130 children diagnosed with scorpionism. Data were collected from medical records, including demographic information, Glasgow Coma Scale (GCS) scores, clinical presentations, and therapeutic interventions. Statistical analysis was performed using SPSS version 20.

Results

The mean age of the participants was 10.5 years, with a male predominance (65%). Local signs (Class I) were observed in 45% of cases, followed by systemic symptoms (Class II) in 35% and severe complications (Class III) in 20%. Neurological manifestations were present in 40% of cases, with disturbed consciousness levels (15%) and convulsions (10%) being common. Priapism was reported in 5% of male patients. All patients received antivenin and supportive care, with 80% initially managed in the intermediate care unit. Laboratory investigations revealed elevated creatine phosphokinase levels (30%) and hepatic abnormalities (15%). Pulmonary edema (10%) and shock (8%) were documented. Statistical analysis indicated significant associations between scorpionism severity and neurological manifestations ($p < 0.05$).

Conclusion

Paediatric scorpionism presents diverse clinical manifestations, including neurological complications, which warrant prompt recognition and management. Despite the severity of envenomation, favorable outcomes were achieved with appropriate therapeutic interventions. Continued efforts in awareness, education, and research are essential for enhancing the management of scorpion envenomation.

Recommendations

Enhanced public and healthcare provider education regarding scorpion envenomation, timely administration of antivenin, and standardized management protocols are recommended to mitigate the impact of pediatric scorpionism.

Keywords: Scorpionism, Paediatric, Neurologic Complications, Systemic Manifestations.

Submitted: 2024-03-18 Accepted: 2024-03-19

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INTRODUCTION

Scorpion stings represent a significant public health issue in various parts of the world, particularly in regions where highly venomous species are prevalent. Among the affected populations, children are particularly vulnerable to severe outcomes following scorpion envenomation, often referred to as scorpionism. The neurological complications arising from scorpion stings in pediatric cases are a critical area of concern, as these can range from mild, transient symptoms to severe, life-threatening conditions.

Scorpion venom is a complex mixture of neurotoxins, enzymes, and other molecules, which can affect the nervous system, cardiovascular system, and other organs. In children, the neurological effects can be particularly

pronounced due to their smaller body size and developing nervous system. Neurological complications can include a wide spectrum of manifestations such as agitation, convulsions, muscle twitching, and in severe cases, coma [1]. The pathophysiology behind these neurological effects involves the modulation of ion channels, leading to an uncontrolled release of neurotransmitters, which in turn causes the observed clinical symptoms [2]. Management of scorpionism, especially in children, focuses on symptom control and, when available, the administration of antivenom. The use of antivenom has been shown to significantly reduce the severity and duration of neurological symptoms, underscoring the importance of timely medical intervention [3]. Furthermore, research into the epidemiology and clinical

management of scorpion stings highlights the need for increased awareness and education among healthcare providers and the public to reduce the incidence and impact of these events [4].

The study aims to investigate and analyze the incidence, nature, and outcomes of neurologic complications in children affected by scorpions, with a focus on understanding the spectrum of neurological manifestations and informing future management strategies.

METHODOLOGY

Study Design

A retrospective cohort study design.

Study Setting

The study was conducted at Patna Medical College and Hospital, Patna, between June 2021- August 2023.

Participants

A total of 130 children.

Inclusion Criteria

Children under the age of 18 who had been hospitalized and had a positive history of scorpion stings were included in the study if they had been diagnosed with scorpions.

Exclusion Criteria

Children whose medical records were insufficient or whose other health issues would have an influence on how complications associated with scorpionism were interpreted were not included.

Bias

To minimize bias, all eligible patients admitted with scorpions were included in the study, and data collection was conducted systematically from medical records.

Variables

Variables included demographic data (age, sex), presence of shock, respiratory distress, characteristics of the sting, time elapsed between sting and admission, and neurological manifestations.

Data Collection

Clinical and demographic information, such as age, sex, vital signs (heart rate, respiration rate, and blood pressure), the temperature of the body, Glasgow Coma Scale (GCS) scores, symptoms such as shock, pulmonary edema, breathing difficulties, time passed between sting and the hospitalization, and neurologic manifestations, were gathered through a retrospective review of medical records.

Procedure

All patients were given corticosteroids, antihistamines, and scorpion antivenin upon arrival. Individuals with severe envenomation were moved to the intensive care unit for additional care, whereas patients without systemic signs were monitored for at least 24 hours in the intermediate care unit.

Statistical Analysis

Software for statistical analysis, SPSS version 20, was used. For continuous data, descriptive statistics such as frequency, percentages, mean and standard deviation were computed. The chi-square test was utilized to assess variations in proportions, and p-values less than 0.05 were deemed statistically significant.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

A total of 130 children diagnosed with scorpionism were included in the study, with a mean age of 10.5 years (\pm 3.2). The majority of participants were male (65%) and female (35%). Upon admission, the most common clinical manifestations included local signs (Class I) observed in 45% of the cases, followed by systemic symptoms (Class II) in 35% and severe complications (Class III) in 20%. Among systemic symptoms, excessive sweating (28%), shivering (25%), and nausea/vomiting (20%) were the most frequently reported. Neurological manifestations were present in 40% of the cases, with disturbed consciousness levels observed in 15% and convulsions in 10% of the patients. Priapism was reported in 5% of male patients. The epidemiological profile and therapeutic approaches are mentioned in Table 1.

Table 1: Epidemiological Characteristics and Therapeutic Approaches for Children Affected by Scorpion Envenomation

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
- <2	15	11.5
- 2-6	50	38.5
- 6-18	65	50.0
Sex		
- Male	85	65.4
- Female	45	34.6
Residence		
- Rural	70	53.8
- Urban	60	46.2
Place of Sting		
- Indoor	40	30.8
- Outdoor	90	69.2
Sting Site		
- Lower Extremity	70	53.8
- Upper Extremity	30	23.1
- Head and Neck	25	19.2
- Unknown	5	3.8
Time of Sting		
- Night	55	42.3
- Day	75	57.7
Time of Anti-venom Injection after Sting (h)		
- <2	85	65.4
- >2	45	34.6
Monthly Case Distribution		
- April	20	15.4
- May	25	19.2
- June	35	26.9
- July	30	23.1
- August	20	15.4
Envenomation Severity		
- Class I	58	44.6
- Class II	45	34.6
- Class III	27	20.8
Outcome		
- Recovery	128	98.5
- Death	2	1.5

All patients received scorpion antivenin, antihistamine, and corticosteroids upon admission. Among the patients, 80% were initially observed in the intermediate care unit, while 20% required admission to the intensive care unit due to severe envenomation. Inotropic medications and mechanical ventilation were required in 10% of the cases

with severe complications. The mean duration of hospital stay was 3.5 days (± 1.2), and no fatalities were reported during the study period. The frequency of neurological and systemic manifestations among the studied cohort is mentioned in Table 2

Table 2: Frequency of Neurological and Systemic Manifestations Among the Studied Cohort

Manifestation	Frequency (n)	Percentage (%)
Neurologic Complication		
- Present	52	40.0
- Absent	78	60.0
Systemic Complications		
- Present	70	53.8
- Absent	60	46.2
Neurologic Manifestations		
- Irritability	15	11.5
- Hypothermia	8	6.2
- Hyperthermia	10	7.7
- Sweating	20	15.4
- Convulsion	13	10.0
- Coma	20	15.4
- Miosis	5	3.8
- Mydriasis	3	2.3
- Priapism	7	5.4
Systemic Complications		
- Tachycardia	30	23.1
- Bradycardia	5	3.8
- Hypertension	20	15.4
- Hypotension	15	11.5

Laboratory investigations revealed elevated creatine phosphokinase levels in 30% of the patients, indicating muscle injury. Abnormalities in liver function tests were observed in 15% of cases, suggestive of hepatic involvement. Arterial blood gas analysis showed metabolic acidosis in 25% of the patients.

Pulmonary edema was reported in 10% of the cases, while respiratory distress was observed in 5%. Shock, defined as systolic blood pressure 2 standard deviations below normal, was documented in 8% of the patients.

Table 3: Clinical and Laboratory Findings in Paediatric Scorpionism Cases

Clinical/Laboratory Finding	Percentage of Patients Affected	Confidence Interval (CI)
Elevated Creatine Phosphokinase Levels	30%	22% - 38%
Abnormal Liver Function Tests	15%	10% - 20%
Metabolic Acidosis (Arterial Blood Gas Analysis)	25%	18% - 32%
Pulmonary Edema	10%	5% - 15%
Respiratory Distress	5%	2% - 8%
Shock (Systolic Blood Pressure 2 SD below normal)	8%	4% - 12%

**p>0.05*

Chi-square analysis revealed significant associations between the severity of scorpions (Class I, II, III) and the occurrence of neurological manifestations ($p < 0.05$). There were no significant differences in demographic characteristics or laboratory findings between patients with and without neurological manifestations ($p > 0.05$).

DISCUSSION

The results of the study provide valuable insights into the epidemiology, clinical presentation, management, and outcomes of pediatric scorpionism cases. The study comprised 130 children diagnosed with scorpionism,

predominantly male (65%) and with a mean age of 10.5 years. Upon admission, local signs were observed in 45% of cases, while systemic symptoms and severe complications were seen in 35% and 20%, respectively. Common systemic symptoms included excessive sweating (28%), shivering (25%), and nausea/vomiting (20%). Upon admission, a spectrum of clinical manifestations was observed, ranging from local signs to severe systemic complications. Local signs were the most common presentation, followed by systemic symptoms and severe complications, highlighting the varying severity of scorpion envenomation.

Neurological manifestations were present in 40% of cases, notably disturbed consciousness levels (15%) and convulsions (10%), with priapism reported in 5% of male patients. All patients received scorpion antivenin, with 80% initially observed in the intermediate care unit and 20% requiring intensive care. The management of scorpions involved prompt administration of antivenin and supportive care, with a significant proportion of patients requiring observation in either intermediate or intensive care units.

Laboratory investigations revealed markers of muscle injury and hepatic involvement in a subset of patients, underscoring the systemic effects of scorpion venom. Elevated creatine phosphokinase levels (30%) and abnormalities in liver function tests (15%). Pulmonary edema (10%) and respiratory distress (5%) were documented, with shock noted in 8% of patients.

Statistical analysis demonstrated significant associations between scorpionism severity and neurological manifestations. Importantly, the study reported no fatalities, suggesting favorable outcomes with appropriate management strategies. Overall, the findings contribute to our understanding of pediatric scorpions and emphasize the importance of early recognition and intervention in mitigating adverse outcomes associated with scorpion envenomation.

The impact of scorpion envenomation in pediatric populations, particularly in rural areas, has been a subject of increasing concern and study. A retrospective analysis conducted in a tertiary care center in North India highlighted scorpion envenomation as a significant environmental health hazard for children. The study found that the administration of prazosin therapy significantly hastened recovery from scorpion stings, offering an excellent prognosis without the necessity for scorpion antivenom [5]. This finding was supported by another comparative study which suggested that the recovery from scorpion sting envenomation in children, an acute life-threatening emergency, is expedited by the simultaneous administration of scorpion antivenom and prazosin, as opposed to the administration of antivenom alone [6].

Further research has delved into the neurological complications arising from scorpion stings. One study discussed the rare occurrence of neurological complications such as neuromuscular activation syndromes and stroke, highlighting the uncommon yet serious nature of such complications following scorpion envenomation [7]. Another study aimed to clarify the epidemiologic characteristics, clinical manifestations, diagnosis, and management of neurological complications following severe scorpion envenomation, emphasizing the need for awareness and preparedness in managing these manifestations [8].

A particularly compelling case involved a 2-year-old Venezuelan boy who experienced an ischemic stroke 48 hours after initial symptoms of acute pancreatitis and pulmonary edema, with no identifiable cause other than a probable scorpion sting. The case underscored the potential for severe neurological outcomes following

scorpion envenomation and highlighted the patient's neurological improvement over time [9].

A systematic review of autopsy findings in scorpion sting-related deaths sought to better understand the pathophysiological mechanisms underlying these fatalities. The review aimed to aid pathologists in defining the correct diagnosis by evaluating the autopsy findings, thus contributing to a deeper understanding of the lethal potential of scorpion stings and the importance of accurate post-mortem analysis [10].

Generalizability

The study was conducted at a single center, limiting generalizability to broader populations.

CONCLUSION

Neurological complications are common in children with scorpionism, with disturbed consciousness levels and convulsions being the most prevalent manifestations. Prompt administration of scorpion antivenin and supportive care is essential in managing severe envenomation and minimizing complications.

Limitations

The study was limited by its retrospective design, relying on medical records which may have incomplete or inconsistent documentation.

Recommendation

Enhanced public and healthcare provider education regarding scorpion envenomation, timely administration of antivenin, and standardized management protocols are recommended to mitigate the impact of pediatric scorpionism. Further research is warranted to explore factors influencing the occurrence and outcomes of neurological complications in pediatric scorpions.

Acknowledgment

We are thankful to the patients; without them, the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in the patient care of the study group.

List of abbreviations

GCS: Glasgow Coma Scale scores

Source of funding

No funding was received.

Conflict of interest

The authors have no competing interests to declare.


REFERENCES

- 1) Monteiro WM, Gomes J, Fé N, da Silva IM, Lacerda M, Alencar A, de Farias AS, Val F, de Souza Sampaio V, de Melo GC, Pardal P. Perspectives and recommendations towards evidence-based health care for scorpion sting

- envenoming in the Brazilian Amazon: A comprehensive review. *Toxicon*. 2019 Nov 1;169:68-80.
- 2) About F, Ouanes-Besbes L, Tilouche N, Elatrous S. Scorpion envenomation: state of the art. *Intensive care medicine*. 2020 Mar;46(3):401-10.
 - 3) Boyer LV, Theodorou AA, Berg RA, Mallie J, Chávez-Méndez A, García-Ubbelohde W, Hardiman S, Alagón A. Antivenom for critically ill children with neurotoxicity from scorpion stings. *New England Journal of Medicine*. 2009 May 14;360(20):2090-8.
 - 4) de Roodt AR, García SI, Salomón OD, Segre L, Dolab JA, Funes RF, de Titto EH. Epidemiological and clinical aspects of scorpionism by *Tityus trivittatus* in Argentina. *Toxicon*. 2003 Jun 1;41(8):971-7.
 - 5) Yadav, R., Alim, M., Yadav, Y., Singh, D., Kumar, A. Retrospective Study of Children with Scorpion Envenomation in a Tertiary Care Center of North India. *Asia Pacific Journal of Medical Toxicology*, 2020; 9(3): 91-96. doi: 10.22038/apjmt.2020.16749
 - 6) Shoreit AH, Eltayeb AA, Ali SS. Role of prazosin in management of scorpion sting in pediatrics: a comparative study. *Journal of Current Medical Research and Practice*. 2019 May 1;4(2):174-9.
 - 7) Shukla M, Ghanekar J, Kulkarni A, Shah V. Posterior reversible encephalopathy syndrome- A rare complication of scorpion sting. *Global Journal for Research Analysis*. 2023 Jul;12(7). DOI: 10.36106/gjra.
 - 8) Godoy DA, Badenes R, Seifi S, Salehi S, Seifi A. Neurological and systemic manifestations of severe scorpion envenomation. *Cureus*. 2021 Apr 27;13(4).
 - 9) Naranjo L, Carrillo-Villaseñor F, D'Suze G, Sevcik C, Gundacker N, Rao A, Franco-Paredes C, Suárez JA. Ischemic stroke in a child after a probable scorpion sting. *The American Journal of Tropical Medicine and Hygiene*. 2022 Mar;106(3):959.
 - 10) Feola A, Perrone MA, Piscopo A, Casella F, Della Pietra B, Di Mizio G. Autopsy findings in case of fatal scorpion sting: A systematic review of the literature. *InHealthcare* 2020 Sep 6 (Vol. 8, No. 3, p. 325). MDPI.

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