



STUDY ON BIOCHEMICAL CHANGES AND SEVERITY OF SCORPION ENVENOMATION IN CHILDREN AGED 1 TO 12 YEARS

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ABSTRACT

Scorpion envenomation is a lifethreatening medical emergency especially in children. Aim of our study was to identify the alteration in biochemical profile in children admitted with varying grades of scorpion envenomation. In this prospective descriptive study, 100 children aged 1 to 12 years admitted with history of scorpion sting were included and they were graded according to the clinical severity. Blood investigations (blood glucose, serum insulin, serum amylase and serum creatinine kinase myocardial band (CK-MB levels)) were done and any alteration in the above parameters were noted and its statistical significance with all grades of scorpion envenomation was studied. From our study it was observed that high glucose levels, low insulin levels and high serum amylase levels at presentation in children admitted with scorpion sting were statistically significant with varying grades of scorpion envenomation, whereas high CK-MB levels did not show any statistical significance with the severity of envenomation. Hence early identification of altered biochemical profile in varying grades of envenomation may help to initiate early treatment to provide a better outcome. These simple biochemical markers can be used for early initiation of intensive treatment and supportive care which may bring down the morbidity and mortality due to scorpion envenomation. So in children brought with scorpion sting, it is important to assess not only the clinical manifestations but also the altered biochemical markers should be appraised.

KEYWORDS : scorpion, envenomation, biochemical, severity.

INTRODUCTION

Scorpion envenomation is a primary public health problem in tropical and sub-tropical countries, especially in rural areas. There are about 1500 species of scorpions worldwide, out of these 50 are dangerous to human¹. In India, there are 86 species, out of which *Mesobuthus tamulus* (Indian red scorpion) and *Heterometrus swammerdami* are of medical importance¹. In literature, the published studies suggest a higher prevalence and mortality among children². Case fatality rates of 3–22% were reported among children hospitalized for scorpion stings in India, Saudi Arabia, South Africa and Upper Egypt^{3,7}. The venom initially leads to a transient cholinergic phase, followed by sustained adrenergic hyperactivity, which is a venom dose dependent phenomenon⁸. Due to the autonomic storm, children stung by scorpion clinically manifest with irritability, profuse salivation, hyperhidrosis, tremors, breathlessness with cardio-respiratory changes, nausea, vomiting, hyperthermia, acute myocarditis, disseminated intravascular coagulation, acute pancreatitis, multi-system-organ-failure and death⁸. Scorpion envenomation causes a massive release of catecholamines, glucagon and cortisol. It also causes suppressed insulin secretion or Insulin resistance⁴. All these effects lead to increased glucose levels and decreased insulin levels in the blood. Moreover, levels of serum amylase, which is a marker of pancreatic damage, are often elevated in patients stung by scorpions¹². Raised CK-MB level is an important indicator of myocardial injury. Myocardial involvement is very common in scorpion envenomation, possibly because of severe adrenergic storm, and some other yet unknown factors¹⁰. Children due to their spirited and exploring nature are more susceptible to scorpion sting compared to adults. Scorpion sting is very common among the rural areas and hence an attempt was made to study the biochemical and clinical profile among the children admitted with scorpion sting in a tertiary care hospital in South India as literature has very less data regarding the biochemical alterations and varying grades of envenomation.

AIMS AND OBJECTIVES

Aim of our study was to identify the alteration in biochemical profile in children admitted with varying grades of scorpion

envenomation.

SUBJECTS AND METHODS

This was a prospective descriptive study conducted in the Department of Paediatrics, Rajah Muthiah Medical College and Hospital, Chidambaram in children aged 1 to 12 years admitted with scorpion sting between October 2019 to September 2021.

Sample size: 100
Study population

Inclusion Criteria

All children aged 1 to 12 years admitted with scorpion sting.

Exclusion Criteria

1. Unknown bite.
2. Whole blood clotting time > 20 minutes.
3. Children with diabetes mellitus or diabetic ketoacidosis.
4. Children treated with dextrose containing fluids/ steroids before admission to our hospital.

Study procedure

Children admitted with scorpion sting were included in the study based on the inclusion and exclusion criteria after obtaining informed consent. They were graded according to their severity of symptoms into grade 1, grade 2 and grade 3.

Severity of symptoms were graded as follows:

Grade 1: Isolated pain.

Grade 2: Systemic manifestations - Hypertension, sweating, vomiting, priapism, fever, shivering.

Grade 3: Life-threatening manifestations - Cardiogenic shock, pulmonary oedema, altered consciousness³.

Blood investigations like blood glucose, serum insulin, serum amylase and serum CK-MB levels were done in the study population during admission. The following abnormal values were taken into the study- hyperglycemia (random blood

glucose >126 mg/dl) (normal <126 mg/dl), hypoinsulinemia (<16 mU/L) (normal 16-166 mU/L), increased serum amylase(>110 U/L) (normal 20-110 U/L), increased serum creatinine kinase – MB isoenzyme (>25 IU/L) (normal 0– 25 IU/L).

All children admitted with scorpion envenomation were treated according to the standard treatment protocol. Children with signs of autonomic storm were given prazosin in a dose of 30 micrograms/kg/dose. Inotrope (dobutamine) was started in children who had signs of myocarditis and appropriate treatment was given for other complications. Blood pressure, heart rate, respiratory rate and oxygen saturation were monitored at regular intervals.

Data Analysis

All data about demographic profile, clinical profile (grades of scorpion envenomation) and biochemical profile (blood glucose, serum insulin, serum amylase and serum CK-MB levels) were statistically analysed with the following measures which include percentages, frequency, mean \pm SD, p value using Chi square test wherever applicable.

RESULTS

Demographic profile

In our study, most common age group involved was 1 to 5 years (55%) as depicted in the table number 1 below.

Table 1: Age distribution among study population

Age	N(%)	Mean \pm SD
1 to 5 years	55(55)	2.833 \pm 1.262
5 to 12 years	45(45)	8.977 \pm 2.105
Total	100(100)	

It was observed that majority of children were males 66 (66%) among the study population whereas females contribute to 34 (34%).

Clinical profile

Most of the children (51%) belonged to grade 1 category, followed by grade 2(27%) and grade 3(22%) envenomation as depicted in figure number1.

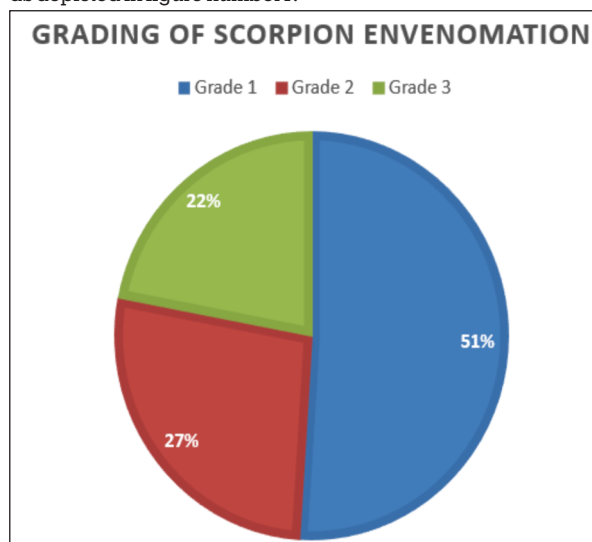


Figure.1: Grading of scorpion envenomation among study population

Biochemical profile

In our study, 53% children had increased blood glucose levels and serum amylase levels were increased in 38% of the study population. Out of all children only 32% of the children showed decreased insulin levels and CK-MB levels were increased in 70% children as depicted in table number 2.

Table 2: Biochemical Parameters and Grade of scorpion envenomation among the study population

Biochemical Parameters		GRADE I N(%)	GRADE II N(%)	GRADE III N(%)	TOTAL N(%)	P value
Hyperglycemia	Present	8(15.1)	23(43.4)	22(41.5)	53(100)	<0.001
	Absent	43(91.5)	4(8.5)	0(0)	47(100)	
Hypoinsulinemia	Present	0(0)	10(31.3)	22(68.8)	32(100)	<0.001
	Absent	51(75)	17(25)	0(0)	68(100)	
Increased serum amylase	Present	6(15.8)	17(44.7)	15(39.5)	38(100)	<0.001
	Absent	45(72.6)	10(16.1)	7(11.3)	62(100)	
Increased CK – MB	Present	31(44.3)	21(30)	18(25.7)	70(100)	0.116
	Absent	20 (66.7)	6 (20)	4 (13.3)	30(100)	

It was observed that majority of children with hyperglycemia were 53 out of which 23(43.4%) and 23(41.5%) belonged to grade 2 and grade 3 envenomation respectively where as 22 (68.8%) children with hypoinsulinemia belonged to grade 3 envenomation. Also majority of children with increased serum amylase levels 44.7% and 39.5% were seen in grade 2 and grade 3 of scorpion envenomation respectively. Hence hyperglycemia, hypoinsulinemia and increased serum amylase levels were found to be statistically significant with varying grades of scorpion envenomation with a p value of <0.001. Though majority of children with increased CK-MB levels 44.3% were noted in grade 1 envenomation, there was no statistical significance noted with the varying grades of envenomation.

DISCUSSION

Our study showed 55% of children belonged to the age group of 1 to 5 years which was similar to the study done by Mabrouk Bahloul et al⁴ which showed that majority (56.7%) of children belonged to the same age group, whereas study done by Reddy et al¹¹ (53%) showed that majority of children belonged to an age group greater than 6 years.

In our study 66% of the children were males which was similar to the study done by Ahmed et al⁸ which showed that 68% of the children belonged to male population. Hence it was observed that there was a male preponderance which may be due to their high exploring nature.

In our study 51% of the children belonged to grade 1 envenomation, 27% belonged to grade 2 and 22% belonged to grade 3 whereas study done by Sudhakar A et al³ showed that 33% belonged to grade 1, 59% to grade 2 and 8% to grade 3. Study done by Reddy RM et al¹¹ showed that 20% belonged to grade 1, 52% belonged to grade 2 and 28% belonged to grade 3.

Our study shows that 53 % of the children had increased blood glucose levels which was near similar to the study done by Ahmed et al² which showed 47% of the study population had increased blood glucose levels. In the study done by Ahmed et al², it was observed that serum insulin levels decreased significantly (mean- 8.40 u/ml) in severe cases of envenomation than in mild envenomation which was similar to our current study having statistical significance between low insulin levels and severity of envenomation. Our study showed that 70% had increased CK-MB levels indicating that this level is markedly elevated in children stung by scorpion but we couldn't get a statistical relationship between the CK-MB levels and the severity of sting. There was no sufficient data from other studies to relate with serum amylase and serum CK-MB levels.

CONCLUSION

Biochemical changes were common in children with scorpion envenomation and more apparently in children with moderate and severe envenomation compared with mild cases. Various hormonal and biochemical mediators were released after scorpion sting which may account for the inflammatory

manifestations like myocarditis, pulmonary oedema and multiple organ dysfunction. In this study it was observed that hyperglycemia, hypoinsulinemia and increased serum amylase levels were found to be statistically significant with varying grades of scorpion envenomation, whereas there was no statistical significance between increased CK-MB levels and varying grades of scorpion envenomation. Hence early identification of altered biochemical profile during admission would help in early intervention which may alter the outcome.

Therefore we conclude that this simple tool (biochemical parameters) may help in early initiation of treatment and supportive care, which may thereby bring down the morbidity and mortality of scorpion envenomation in children.

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