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## A Study Of Prevalence Of Myocarditis In Scorpion Envenomation And Its Outcome In GVMCH, Vellore, Tamil Nadu, India.

G Abirami<sup>1</sup>, Sathi V<sup>2\*</sup>, Balachandar S<sup>3</sup>, and Vikram T<sup>4</sup>.

<sup>1</sup>Associate Professor, Department of General Medicine, Vellore Medical College, Vellore, Tamil Nadu, India.

<sup>2</sup>Associate Professor, Department of General Medicine, Vellore Medical College, Vellore, Tamil Nadu, India.

<sup>3</sup>Assistant Professor, Department of General Medicine, Vellore Medical College, Vellore, Tamil Nadu, India.

<sup>4</sup>Junior Resident, Department of General Medicine, Vellore Medical College, Vellore, Tamil Nadu, India.

### ABSTRACT

Scorpion stings are a major public health problem in many underdeveloped countries. In India most of the people are stung by red scorpion (*Mesobuthus tamulus*). Among villagers it's still a life-threatening emergency. In India many people are stung by the red scorpion with fatalities in adults and children. Scorpion venom is species specific and their toxins act over sodium, potassium, calcium and chloride channels producing direct effects. Toxins also stimulate neurotransmitter release such as acetylcholine and catecholamines. To study the prevalence of myocarditis in scorpion envenomation using ECG, ECHO and cardiac enzymes. The data for the purpose of the study was collected in a predesigned and pretested proforma which include various socioeconomic parameters like age, sex, occupation, religion etc after getting Ethical committee approval which was obtained on February 26, 2021 and attached below. About 50 cases were selected on the basis of the simple random sampling method. The analysis of data was made on the basis of the important statistical parameters like the mean deviation, standard error, the t-test and the proportion test. The study duration is one year from march 2021 to February 2022. Demographics: In the present study 40% were in the age group of 11 to 20 years. About 28% were in the age group of 21 to 30 years. About 10% were in the age group of 31 to 40 years. Only 3% were above the age of 60 years. Mean age is 15.67 and standard deviation is 3.67. About 52% were males and 48% were females. About 46% of study participants came to hospital within 18 hours. Sting bite: About 56% of sting bites were grade I, 24% were grade II and 20% of bites were grade III. About 94% had local pain. About 20% had tachycardia, 16% had hypotension and another 16% had hypertension. ECG changes among study participants: About 8% had Sinus tachycardia and another 8% had Sinus tachycardia with ST depression. ST elevation was present in 6% of study participants. ST depression with T wave inversion was present in 6% of study participants. RBBB was present in 6%. Tall T wave was present in 8% of study participants. Complete heart block was present in 4% of study participants Cardiovascular changes: About 20% had Myocardial dysfunction. About 20% had Myocarditis. About 24% had Pulmonary edema. About 4% had Altered sensorium. About 26% had Cardiogenic shock. Electrolyte abnormalities: About 10% had hyponatremia, 10% had hypocalcaemia. Echo findings among study participants: About 20% had left ventricle systolic dysfunction. About 6% had mild MR. About 14% had Myocarditis. Serum CKMB among study participants: About 30% of study participants had elevated CKMB. Envenomation due to scorpion sting results in the various clinical manifestations. They range from mild local pain to the diffuse irresistible pain of whole limb and body to a systemic expression involving almost all systems, predominantly cardiovascular and may sometimes lead to death. Most of these manifestations of scorpion envenomation are due to stimulation of the autonomic nervous system either directly or indirectly, primarily in autonomic storm. Early hospitalisation following sting bite can reverse the pathological changes. More studies to be conducted in future to take necessary steps.

**Keywords:** myocarditis, scorpion, *Mesobuthus tamulus*, toxins.

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\*Corresponding author

## INTRODUCTION

Scorpion stings are one of the significant public health problems in many tropical countries, including India. For every person killed by Snake bite, around ten are killed by a toxic scorpion [1]. Although the exact incident of scorpion stings is unknown, it is estimated that the annual number of scorpion stings exceeds 1.2 million, with 2.3 billion populations at risk world-wide [2]. There are about 1500 scorpion species worldwide, out of which 50 types are dangerous to humans. Almost all lethal scorpion belongs to the Buthidae family [3]. There were about 86 species of scorpions found in India [4–6]. Only three scorpions that have been found in India are poisonous, viz. (i) *Mesobuthus stimulus*. (ii) *Palamneus swammerdami* and (iii) *Heterometrus bengalensis*. Envenomation due to scorpion sting results in the various clinical manifestations. They range from mild local pain to the diffuse irresistible pain of whole limb and body to a systemic expression involving almost all systems, predominantly cardiovascular and may sometimes lead to death [7]. Most of these manifestations of scorpion envenomation are due to stimulation of the autonomic nervous system either directly or indirectly, primarily in autonomic storm [8]. Cardiovascular complications are the most critical manifestations of Indian red scorpion envenomation. A full spectrum from the hypotension and peripheral circulatory collapse to hypertension leading to the stroke has been observed. Initially, hypotension and bradycardia are encountered within 1–2 hours of the sting, followed by hypotension and Tachycardia between 4 and 48 hours due to severe left ventricular dysfunction and hypotension alone with good volume pulse warm extremities is observed later in the recovery stage. Acute pulmonary oedema complicates around 3–24.5% of all scorpion stings and is a leading cause of mortality in these patients, accounting for about 30% of fatalities. The clinical profile evolves within 30 mins to 6 hours after the sting. Hypertensive stress, an direct toxic effects of the venom on the myocardium & catecholamine-induced myocardial injury; all contribute to rhythm disturbance and left ventricular failure. Myocardial injury is well exacerbated by free fatty acid and free radical accumulation, and hyperkalemia [9-11]. Scorpion venom has a complex structure and shows variability according to subspecies. This venom is composed of neurotoxic proteins, acidic proteins, salts, and organic compounds, thereby having cardiovascular, neurologic, hematologic, and renal side effects, in addition to local products such as pain, burning, redness, and swelling [12-15].

Scorpion envenomation can produce a diversity of clinical presentations, together with cardiovascular manifestations like myocarditis, cardiogenic and/or distributive shock, respiratory manifestations like acute respiratory distress syndrome [ARDS]), haematological (disseminated intravascular coagulation [DIC]), renal (acute kidney injury), and neurological (seizures, autonomic dysfunction, and ischemic or hemorrhagic stroke) including death [16, 17].

Old World and New World scorpions usually differ in venom composition, clinical presentation and severity, as well as different therapeutic approaches. They are either dry or result in low amounts of injected venom, thus explaining why up to 95% of scorpion stings supervene only in local signs. Clinically to produce envenomation, it has been suggested that the interaction between the quantity of venom introduced in the body and the distribution volume should result in a critical threshold of scorpion toxin plasma concentration. If this occurs, there is an enormous release of neurohormonal mediators (mainly catecholamine), with systemic vasoconstrictor effects producing a sharp increase in systemic arterial pressure and LV-filling pressure resulting in decreased cardiac output. This initial phase of cardiac dysfunction is the vascular phase; followed by severe cardiomyopathy, involving both ventricles and which is reversible in days to weeks. The more wide-ranging understanding of the disease pathophysiology has permitted for a well-organized symptomatic treatment, thus resulting in a substantial reduction in the death among scorpion envenomation in the past few decades. Severe acute pulmonary oedema and cardiogenic shock are reduced because of standard intensive-care treatment. Even though it continues to motivate many evaluative studies, immunotherapy seems less attractive since mediators hold it in the pathogenesis of envenomation and unfavorable pharmacokinetic properties to existing sera compared to venom [18].

## MATERIALS AND METHODS

**Study design:** Prospective Study

**Sample Size:** 50

### Inclusion criteria

All the patients who were admitted with scorpion envenomation in the department of general Medicine in government Vellore medical college.

### Exclusion criteria

- Patients with unknown bites [ by history] were excluded from the study.
- The patients who had a history of diabetes were excluded.
- The patients who had a history of recent myocardial infarction were excluded from the study.

### Study setting and patients

After prior Institutional ethical clearance and obtaining informed consent, the participants satisfying inclusion criteria will be selected for the study.

### Study procedure

Each of the participants will be asked pre-specified questions according to the Proforma. Blood samples will be collected for laboratory investigations. A total sample of fifty patients will be studied using a carefully prepared proforma and by detailed history, clinical examination and investigated with complete hemogram, renal function test, liver function test, RBS, serum creatine kinase-MB at the time of admission. serial ECG and ECHO during admission and after clinical management were taken for the study

### Statistical analysis

Data will be collected by Epi Collect, v5.0 and entered into an excel sheet.

Data will be analyzed using STATA v14.0. All continuous variables will be summarized as mean with S.D. or median with IQR. All categorical variables will be summarized as proportion with confidence interval

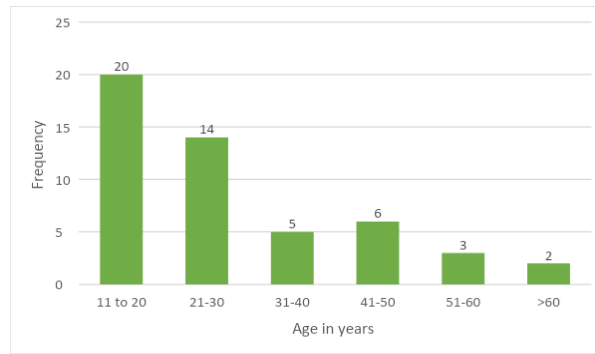
## RESULTS

**Table 1: Age wise distribution of study participants**

Age in years	Frequency	Percentage	Mean $\pm$ S.D
11-20	20	40	
21-30	14	28	
31-40	5	10	15.67 $\pm$ 3.67
41-50	6	13	
51-60	3	6	
>60	2	3	
Total	50	100	

In the present study 40% were in the age group of 11 to 20 years. About 28% were in the age group of 21 to 30 years .About 10% were in the age group of 31 to 40 years. Only 3% were above the age of 60 years. Mean age is 15.67 and standard deviation is 3.67

**Figure 1: Age wise distribution of study participants**

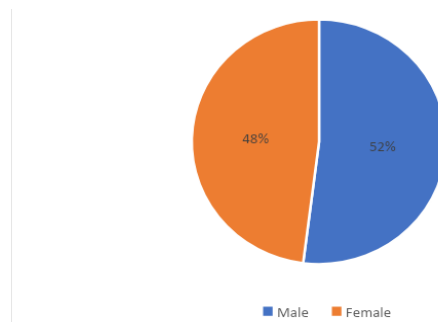


**Table 2: Sex wise distribution of study participants**

Sex	Frequency	Percentage
Male	26	52
Female	24	48
Total	50	100

About 52% were males and 48% were females

**Figure 2: Sex wise distribution of study participants**

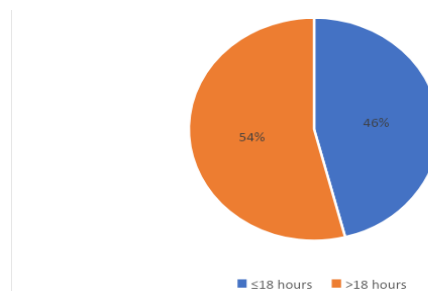


**Table 3: Time of admission to hospital after sting bite**

Time	Frequency	Percentage
≤18 hours	23	46
>18 hours	27	54
Total	50	100

About 46% of study participants came to hospital within 18 hours

**Figure 3: Time of admission to hospital after sting bite**

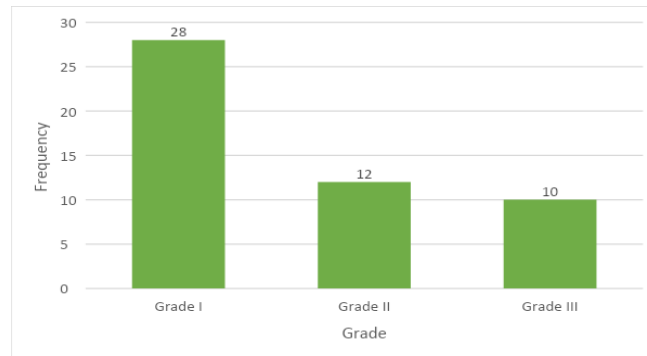


**Table 4: Severity of scorpion sting bite**

Severity	Frequency	Percentage
Grade I	28	56
Grade II	12	24
Grade III	10	20
Total	50	100

About 56% of sting bites were grade I, 24% were grade II and 20% of bites were grade III

**Figure 4: Severity of scorpion sting bite**

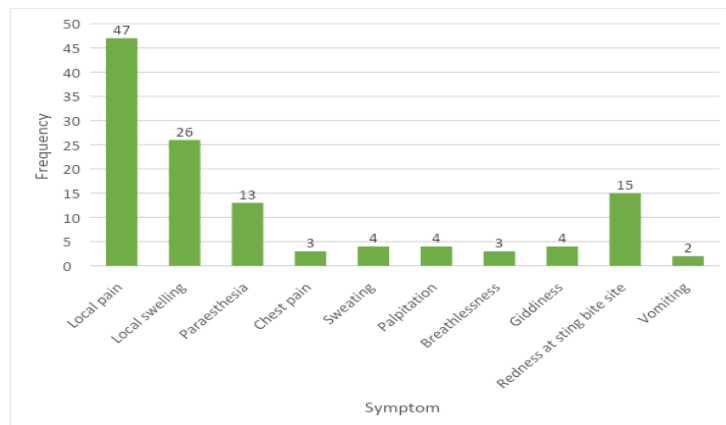


**Table 5: Symptom wise distribution of study participants**

Symptom	Frequency	Percentage
Local pain	47	94
Local swelling	26	52
Paraesthesia	13	26
Chest pain	3	6
Sweating	4	8
Palpitation	4	8
Breathlessness	3	6
Giddiness	4	8
Redness at sting bite site	15	30
Vomiting	2	4

About 94% had local pain.

**Figure 5: Symptom wise distribution of study participants**

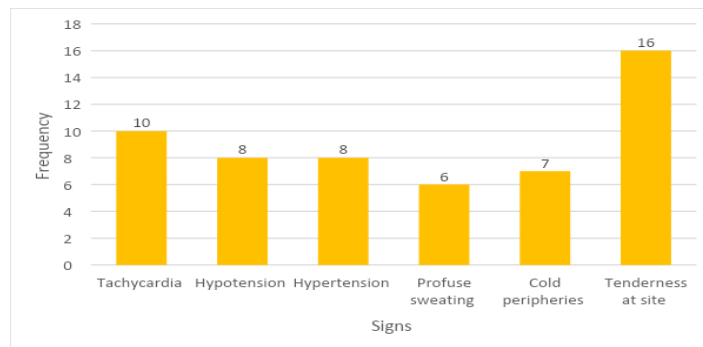


**Table 6: Signs of scorpion sting among study participants**

Signs	Frequency	Percentage
Tachycardia	10	20
Hypotension	8	16
Hypertension	8	16
Profuse sweating	6	12
Cold peripheries	7	14
Tenderness at site	16	32

About 20% had tachycardia,16% had hypotension and another 16% had hypertension

**Figure 6: Signs of scorpion sting among study participants**

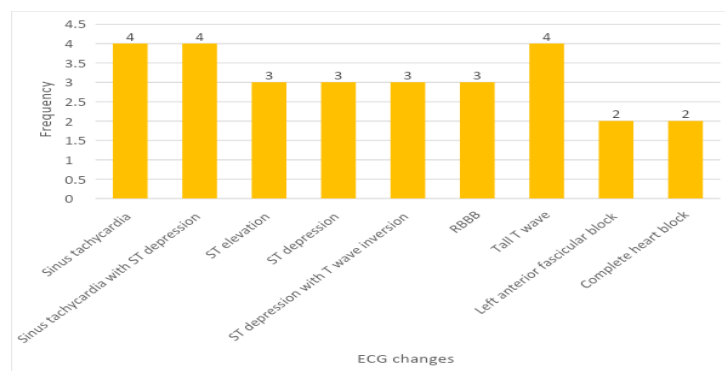


**Table 7: ECG changes among study participants**

ECG changes	Frequency	Percentage
Sinus tachycardia	4	8
Sinus tachycardia with ST depression	4	8
ST elevation	3	6
ST depression	3	6
ST depression with T wave inversion	3	6
RBBB	3	6
Tall T wave	4	8
Left anterior fascicular block	2	4
Complete heart block	2	4

About 8% had Sinus tachycardia and another 8% had Sinus tachycardia with ST depression. ST elevation was present in 6% of study participants. ST depression with T wave inversion was present in 6% of study participants. RBBB was present in 6%.Tall T wave was present in 8% of study participants . Complete heart block was present in 4% of study participants.

**Figure 7: ECG changes among study participants**



**Table 8: Myocardial dysfunction among study participants**

Myocardial dysfunction	Frequency	Percentage
Yes	10	20
No	40	80
Total	50	100

About 20% had Myocardial dysfunction

**Table 9: Myocarditis among study participants**

Myocarditis	Frequency	Percentage
Yes	10	20
No	40	80
Total	50	100

About 20% had Myocarditis

**Table 10: Pulmonary edema among study participants**

Pulmonary edema	Frequency	Percentage
Yes	12	24
No	38	76
Total	50	100

About 24% had Pulmonary edema

**Table 11: Altered sensorium among study participants**

Altered sensorium	Frequency	Percentage
Yes	2	4
No	48	96
Total	50	100

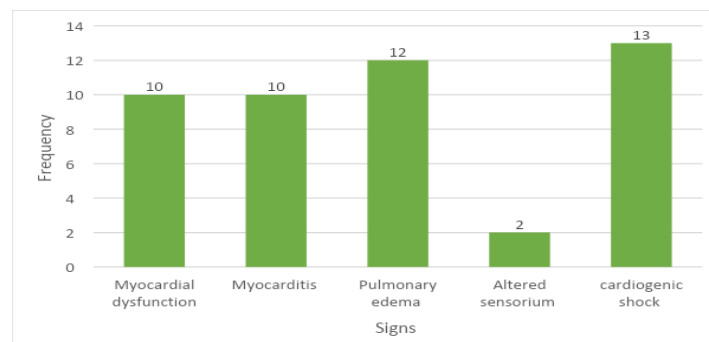
About 4 % had Altered sensorium

**Table 12: Cardiogenic shock among study participants**

Cardiogenic shock	Frequency	Percentage
Yes	13	26
No	37	74
Total	50	100

About 26% had Cardiogenic shock

**Figure 8: Signs of sting bite among study participants**

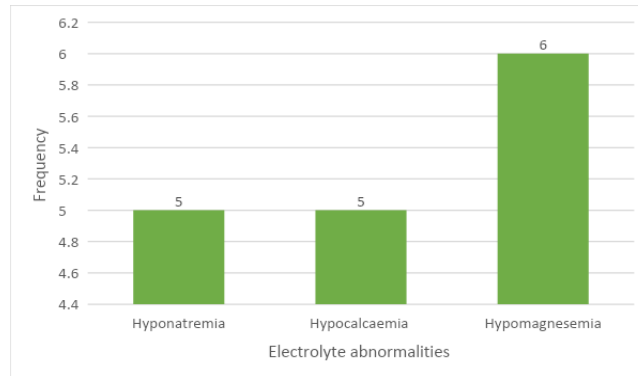


**Table 13: Electrolyte abnormalities among study participants**

Electrolyte abnormalities	Frequency	Percentage
Hyponatremia	5	10
Hypocalcaemia	5	10
Hypomagnesemia	6	12

About 10% had hyponatremia,10% had hypocalcaemia

**Figure 9: Electrolyte abnormalities among study participants**

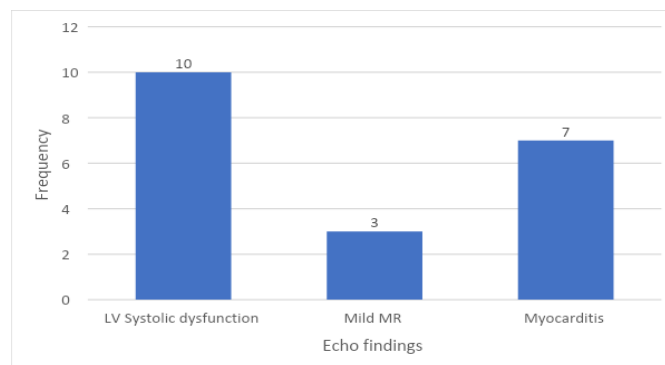


**Table 14: Echo findings among study participants**

ECHO finding	Frequency	Percentage
LVSystolic dysfunction	10	20
Mild MR	3	6
Myocarditis	7	14

About 20% had left ventricle systolic dysfunction. About 6% had mild MR. About 14% had Myocarditis

**Figure 10: Echo findings among study participants**



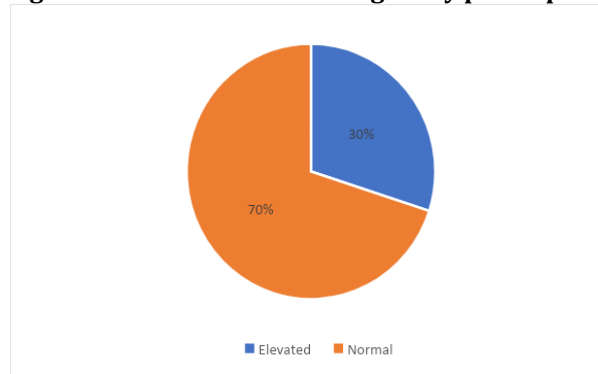
**Table 15: Serum CKMB among study participants**

CK MB	Frequency	Percentage
Elevated	15	30
Normal	35	70
Total	50	100

About 30% of study participants had elevated CKMB



**Figure 11: Serum CKMB among study participants**



## DISCUSSION

Cardiac dysfunction is usually characterized by myocarditis, left ventricular failure and carcinogenic shock. The most typical finding traditionally seen within the first 4 hours is Tachycardia and which may persist for even 24 - 72 hours; bradycardia can also be observed. Hypertension: it is because of catecholamine and rennin stimulation, which occur as early as 4 minutes after envenomation, which can even last for 4 - 8 hours; it may be high enough to produce hypertensive encephalopathy, cardiac failure leading to pulmonary oedema. Present study is a cross sectional study conducted among 50 patients.

**Demographics:** In the present study 40% were in the age group of 11 to 20 years. About 28% were in the age group of 21 to 30 years. About 10% were in the age group of 31 to 40 years. Only 3% were above the age of 60 years. Mean age is 15.67 and standard deviation is 3.67. About 52% were males and 48% were females. About 46% of study participants came to hospital within 18 hours

**Sting bite:** About 56% of sting bites were grade I, 24% were grade II and 20% of bites were grade III. About 94% had local pain. About 20% had tachycardia, 16% had hypotension and another 16% had hypertension. ECG changes among study participants: About 8% had Sinus tachycardia and another 8% had Sinus tachycardia with ST depression. ST elevation was present in 6% of study participants. ST depression with T wave inversion was present in 6% of study participants. RBBB was present in 6%. Tall T wave was present in 8% of study participants. Complete heart block was present in 4% of study participants

**Cardiovascular changes:** About 20% had Myocardial dysfunction. About 20% had Myocarditis. About 24% had Pulmonary edema. About 4% had Altered sensorium. About 26% had Cardiogenic shock.

**Electrolyte abnormalities:** About 10% had hyponatremia, 10% had hypocalcaemia.

**Echo findings among study participants:** About 20% had left ventricle systolic dysfunction. About 6% had mild MR. About 14% had Myocarditis

**Serum CKMB among study participants:** About 30% of study participants had elevated CKMB.

## CONCLUSION

Envenomation due to scorpion sting results in the various clinical manifestations. They range from mild local pain to the diffuse irresistible pain of whole limb and body to a systemic expression involving almost all systems, predominantly cardiovascular and may sometimes lead to death. Most of these manifestations of scorpion envenomation are due to stimulation of the autonomic nervous system either directly or indirectly, primarily in autonomic storm. Early hospitalisation following sting bite can reverse the pathological changes. More studies to be conducted in future to take necessary steps.

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