

Echocardiography Guided Therapy for Myocarditis after Scorpion Sting Envenomation

SURESH V SAGARAD¹, SUDHA BIRADAR KERURE², BALARAMSINGH THAKUR³, S S REDDY⁴, BALASUBRAMANYA K⁵, R M JOSHI⁶

ABSTRACT

Objective: This study was to evaluate echocardiographic findings and its usefulness in clinical management of patients with scorpion sting envenomation.

Material and Methods: A total of 84 consecutive patients were prospectively studied. The data included demographics, at the time of presentation to the hospital, the clinical features, echocardiographic findings, admission to intensive care unit, use of inotropic medication, time to discharge, and mortality.

Results: Out of 84 patients studied 60 patients (71.4%) had echocardiographic evidence of myocarditis (LVEF <50%). Majority of patients had LVEF <40% (50 patients, 83.3%). Severe LV dysfunction (LVEF <30%) was noted in 20 patients (33.3%). No patient had significant valvular regurgitation. RV dysfunction was noted in half of the patients who had LV dysfunction. RV dysfunction was not seen in isolation. Twenty four patients without evidence of myocarditis on echocardiography were observed in general wards and were discharged in 24 to 48

hours of admission. Ten patients with mild LV dysfunction (LVEF 50-40%) and 20 patients with moderate LV dysfunction were observed in high dependency units with regular monitoring for 24 to 48 hours. Only 3 patients were put on inotropics support and others could be discharged in 72 to 96 hours. All the patients with severe LV dysfunction and moderate LV dysfunction with significant RV dysfunction were admitted in intensive care unit irrespective of symptoms (Total 30 patients). These patients were put on inotropics support. Among severe LV dysfunction group, 4 patients required ventilator support and 2 (2.3%) patients died with refractory shock and multi-organ failure. Tachycardia, muffled and or gallop heart sounds and hypertension didn't predict presence of LV dysfunction. Persistent hypotension requiring inotropics support was a marker of severe LV dysfunction.

Conclusion: Echocardiography is a useful tool in emergency to assess LV function in patients with scorpion sting envenomation. It can guide therapy by identifying patients with severe LV dysfunction.

Keywords: Scorpion, Myocarditis, Envenomation, Echocardiography,

INTRODUCTION

Scorpion sting envenomation is an occupational hazard for farmers, farm labors, villagers, migrating population and hunters. The annual number of scorpion sting cases exceeds 1.23 million, of which over 32,250 may be fatal [1]. However, real incidence, morbidity and deaths appear under reported. During 60s and 70s cases fatality rate of up to 30% were reported [2,3]. Since the advent of vasodilators, prazosin, captopril, nifedipine, sodium nitroprusside, hydralazine, scorpion anti-venom and intensive care management the fatality is <2-4% [4-8].

Scorpion sting envenomation is an acute life threatening time limited medical emergency. *Mesobuthus tumulus* is the most common or the Indian red scorpion is the most toxic scorpion species in India, which is abundantly found in western Maharashtra, northern Karnataka, Andhra Pradesh, Saurashtra and Tamilnadu, India [9,10]. The clinical manifestations of scorpion sting envenomation are vomiting, sweating, cold extremities, pulmonary edema, and death [11, 12]. Cardiopulmonary complications, mainly pulmonary edema and shock are the leading causes of death [13-15]. Severity of envenomation is related to age, size of scorpion and the season of the sting and time elapsed between sting and hospitalization [16,17]. Severe scorpion sting envenomation occur in children with 3.9-10% fatality irrespective of intensive care management in Israel, Turkey and India [8,12,18,19]. No clinically useful demographic or epidemiological data to guide decision making regarding the need for intensive care unit admission for paediatric victims of scorpion sting was noted by Bosnak et al., in Turkey [19]. Decision to transfer and admission to intensive care unit is usually based on development of systemic findings of envenomation. Presence of tachycardia, muffled heart sounds, basal rales may not indicate LV systolic dysfunction especially in paediatric subgroup. However,

clinical condition may rapidly deteriorate after the development of systemic features. There is a need of reliable clinical, biochemical or other investigative parameter to identify high risk group (severe myocarditis).

Earlier studies have evaluated various biochemical and inflammatory markers. High Creatinine Phospho Kinase (CPK) levels have been attributed to increased skeletal muscle activity and signs of cardiac and skeletal muscle injury [19-21]. Meki et al., [21] have reported importance of cardiac troponin (cTnI) levels in scorpion sting myocarditis. The non-survivor victims showed significant higher mean values of cTnI on admission. The cTnI showed 100% specificity and sensitivity for diagnosis of myocardial injury in relation to echocardiography. They had concluded that cTnI may be useful to forecast the fatal outcome in scorpion envenomation. Similar finding has been reported by our group [22]. In a recently reported study, newer biomarker like N terminal pro BNP estimation could predict presence of myocardial dysfunction [23].

Echocardiography is an excellent tool to evaluate various parameters of cardiac function and can be done in emergency setting. It has been used to document myocarditis in scorpion sting envenomation [24-27]. Left ventricular (LV) systolic dysfunction is the dominant finding and LV dilatation and regional wall motion abnormalities have been described infrequently. Kumar et al., [28] have reported echocardiographic finding in 30 children affected by scorpion stings. They divided in to two groups based on initial findings, group 1 consisting 18 children with normal echo and group 2, consisting of 12 children with compromised LV function (LVEF <55%). In group 2 the LV end systolic dimension was increased significantly and the interventricular septal thickening fraction was depressed significantly, compared to Group 1. Nine children in Group 2 showed improvement in all measurements of contractility,

Age	< 12 years	48 (57.1%)
	12 to 18 years	24 (28.5%)
	>18 years	12 (14.2%)
Symptoms	Local only	12 (14.2%)
	Local & systemic	72 (85.7%)
ECHO findings	LVEF <50%	60 (71.4%)
	LVEF 50-40%	10 (16.6%)
	LVEF 40-30%	30 (50%)
	LVEF <30%	20 (33.3%)
	RV dysfunction	30 (50%)
Cardiac Troponin	<0.01 µg/L	12 (14.2%)
	0.01 to 0.11 µg/L	12 (14.2%)
	>0.11 µg/L	60 (71.4%)
	>10 µg/L	6 (7.1%)
LVEF (%) and Troponin (µg/L)	LVEF 50-40	1.2±0.2
	LVEF 40-30	2.1±0.4
	LVEF <30	6.5±1.9
NT-proBNP in relation to LVEF (N=30, mean, range)	LVEF >50%	65.6pg/ml (25-125)
	LVEF <50%	7862 pg/ml (1525 to 25,000)
	LVEF <30%	15,200 pg/ml (7880 to 25,000)

[Table/Fig-1]: Clinical and Investigation findings

Parameter	Normal LVEF	Low LVEF	P
Tachycardia	60 %	62 %	NS
Muffled heart sounds / S3	50 %	52 %	NS
Hypertension	30 %	33 %	NS
Persistent hypotension	0 %	30 %	<0.01
Troponin (mean)	<0.11 µg/l	2.3 µg/l	<0.05
NT-proBNP (mean)	65.6 pg/ml	7862 pg/ml	<0.05

[Table/Fig-2]: Various parameters in Normal and Low LVEF

usually within 24 to 48 hours. Out of the remaining children, one showed no echocardiographic changes and subsequently died. Another child made a slow improvement over several weeks.

In a retrospective study of 24 patients with myocardial toxicity due to scorpion sting, Rajashekhar and Mohan [29] have reported echocardiographic findings. Echocardiography was done within 6 hours of admission to the emergency with emphasis on LV end-diastolic (LVEDV) and End-Systolic Volumes (LVESV), Stroke Volume (SV) and Ejection Fraction (LVEF). LVEDV, LVESV, SV and LVEF improved after L-carnitine treatment.

This study conducted to evaluate the usefulness of echocardiography in treating patients with scorpion sting envenomation.

MATERIAL AND METHODS

This study was conducted at Raichur in Northern Karnataka part of India during the period from April 2009 to March 2012 (3 years). Three centers with tertiary care facilities (Rajiv Gandhi Super speciality Hospital, Navodaya Medical College and Hospital and Shivam Hospital and Research centre) participated in the study. All the patients presented to the emergency department with a history of scorpion sting envenomation were enrolled in the study. Total 84 patients were studied during the study period. An informed consent was taken. The clinical features and treatment which was given at the referring centre was noted from referral letters. Detailed clinical examination was done at admission (blood pressure, heart rate, temperature, chest findings). Base line ECG was recorded at admission and various biochemical investigations were done as

per the recommendation of treating physician including cardiac troponin.

Echocardiography: All the patients underwent echocardiography within 6 hours of their presentation to the emergency department. The echocardiography was done with a Sonosite M Turbo Ultrasound system by using standard views and protocol. A parenteral sedation was used in paediatric patients to maximize their cooperation during the study. The main parameters studied were LVEF, regional or global hypokinesia, valvular regurgitation, global RV function, pulmonary artery pressure using TR velocity.

Myocarditis was suspected if the patient had tachycardia, muffled heart sounds, a gallop rhythm and ECG changes (low amplitude, ST segment changes, arrhythmia, QRS widening). It was confirmed on echocardiography if LVEF was less than 50%.

The study was conducted according to Good Clinical Practice guidelines and the Declaration of Helsinki, and the protocol was approved by the Ethics committee of the hospital. Written informed consent was obtained from all the patients prior to their inclusion into the study.

STATISTICAL ANALYSIS

Basic descriptive statistics were calculated and values were expressed as mean ± SD. Statistical analysis was performed using software MINITAB 16. A p-value less than 0.05 was considered significant.

RESULTS

Among 84 patients studied majority were below 12 years [Table/Fig-1]. Twelve patients had only local symptoms and rest had symptoms suggestive of systemic involvement. Echocardiographic evidence of LV dysfunction (LVEF <50%) was noted in 60 (71.4%) patients. Among patients with LV dysfunction, LVEF 50-40% was noted in 10 (16.6%), LVEF 40-30% in 30 (50%) and LVEF <30% was found in 20 (33.3%). Right ventricular dysfunction was noted in 30 (50%) patients. RV dysfunction was associated with LV dysfunction and it was not an isolated phenomenon. No significant valvular regurgitation was noted in any patient. All the patients (24, 28.5%) with normal LVEF were observed in general wards and none of these patients had any complications and were discharged after 24 to 48 hours. Ten patients with mild LV dysfunction (LVEF 50-40%) and 20 patients with moderate LV dysfunction were observed in high dependency units with regular monitoring for 24 to 48 hours. Only 3 (10%) patients were put on inotropics support and others could be discharged in 72 to 96 hours. All patients with severe LV dysfunction and moderate LV dysfunction with significant RV dysfunction (majority with hypotension) were admitted in intensive care unit irrespective of symptoms (Total 30 patients, 50%). These patients were put on inotropics support. Frank pulmonary edema was found in 10 patients. Among severe LV dysfunction group, 4 patients required ventilator support and 2 patients died with refractory shock and multi-organ failure. Mean duration of hospitalization was longer in these patients. Presence of tachycardia (heart rate >100 per min), muffled heart sounds, hypertension [Table/Fig-2] couldn't differentiate normal LVEF vs low LVEF (60% vs 62%, 50 vs 52%, 30 vs 32% P=NS). Presence of persistent hypotension requiring inotropics support was a marker of severe LV dysfunction (p <0.01, positive predictive value 100%). None of our patients received anti-venom. Prazosin was used in 90% of patients.

DISCUSSION

Cardio-pulmonary complications mainly pulmonary edema and shock are the leading causes of morbidity and mortality after scorpion sting envenomation [13-15]. Cardiac complication is due to primary muscle dysfunction leading to LV and or RV dysfunction. No clinical marker are ideal in emergency setting to identify subgroup with LV systolic dysfunction early especially in paediatric patients as tachycardia, muffled heart sounds and chest signs

may be misleading. Bosnak et al., noted that no clinically useful demographic or epidemiological data to guide decision making regarding the need for intensive care unit admission in paediatric victims [19]. Biomarkers like cTnI may be useful adjunct to clinical and echocardiographic findings [19-23].

Echocardiography is an excellent tool to assess various parameters of cardiac anatomy and physiology. It can be performed in emergency department. It is very useful to assess LV function in scorpion sting myocarditis. Our study revealed 71.4% of patients having cardiac involvement and was mainly due to primary muscle disease leading to LV dysfunction. This is similar to earlier reports [28,29].

Echocardiography was done early in emergency as most of the cardiac changes occur early in the course of envenomation. Rajashekhar et al., [29] have done echocardiography in less than 6 hours of presentation and none of the patients with normal echocardiography showed clinical deterioration. In our study also 24 patients with normal LVEF didn't show systemic involvement and were admitted in general wards and discharged in 24 to 48 hours.

Based on echocardiographic evidence of LV dysfunction, two groups of patients were identified. One group with mild to moderate LV dysfunction and second consisting of severe LV dysfunction and significant RV dysfunction. Patients with mild to moderate LV dysfunction were admitted in high dependency units and only 3 patients required inotropics support and others could be discharged in stable state after 72 to 96 hours. Thirty patients were admitted to the cardiac intensive care received inotropics support and 4 requiring ventilator support and 2 died due to refractory shock and multi organ failure. Echocardiography appeared very useful in diagnosing myocarditis and aided in decision making regarding admission to intensive care.

Tachycardia, muffled heart sounds and chest signs are useful to suspect heart failure. However, in emergency setting in paediatric patients these may not be useful indicators of LV systolic dysfunction. Hence none of these parameters predicted LV dysfunction in this study. Only persistent hypotension was a marker of severe LV dysfunction.

CONCLUSION

Echocardiography is very useful in identifying patients with LV dysfunction after scorpion sting envenomation. Early use in emergency is feasible. Based on echocardiography patients with normal LVEF can be observed in general wards and safely discharged. Most of the patients with mild to moderate LV dysfunction can be managed in less intensive care unit. Patients with severe LV dysfunction should be observed in intensive care unit for requirement of inotropics support.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Cardiology, Rajiv Gandhi Super Speciality Hospital (A super speciality unit of Raichur Institute of Medical Sciences), Raichur, India.
2. Associate Professor, NMC & H, Raichur, India.
3. Professor, Department of Pathology, NMC & H Raichur, India.
4. Associate Professor, NMC & H & Consulting Physician SHRC, Raichur, India.
5. Consulting Pediatrician, RGSSH, Raichur, India.
6. Consulting Pathologist, RGSSH, Raichur, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Suresh V Sagarad,
Consultant Cardiologist, H No 1-11-72/23, Kakathiya Colony, Raichur. Pin 584101. Karnataka, India.
Phone: +919448139339, E-mail: drsagarad@hotmail.com

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