



Research Article

Efficacy of anti-scorpion venom in preventing and reducing the severity of scorpion sting myocardial injury

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Abstract

Background: *Mesobutus tamulus* (Indian red scorpion) is one of the most common lethal venomous scorpion species in India. Scorpion venom is very well known to cause myocardial injury (Myocarditis). Antiscorpion venom is the specific treatment for scorpion sting aimed at neutralizing the venom. Since advent of ASV, its role in management scorpion sting and myocardial injury is in debate due to lack of evidence of benefit and availability. So here we are attempting a study to assess the efficacy of ASV in managing scorpion stings and associated myocardial injury.

Methods: The study was conducted in emergency medicine department in tertiary health care center in central part of Karnataka. It was study done between two groups with scorpion sting involving 26 patients. Group I consist of 12 patients managed without ASV. Group II consists of 14 patients managed with ASV. End results were compared in terms of requirement of mean prazosin dosage in mg, number of days dobutamine infusion, number days assisted ventilation and number of days to recover in each group. Group II result were compared retrospectively with group I.

Results: The study has shown that mean dosage requirement of prazosin {Group I(1.95) Vs Group II(1.21)}, number of hours dobutamine infusion{Group I(2.17) Vs Group II(1.42)}, number of hours of assisted ventilation{Group I(60) Vs Group II(52)} and number of days required to recover{Group I(4.10) Vs Group II(3.09)}in Group II managed with ASV was less compared to Group I who were managed without ASV. Study also showed that deterioration of patients due to cardiovascular complications managed with ASV were considerably reduced

Conclusions: ASV is safe, it can improve and prevent the cardiovascular complications. In management scorpion sting early administration of ASV reduces severity of envenomation and helps to recover in lesser duration

Keywords: scorpion bite, Antiscorpion venom.

Introduction

Scorpion sting is the most common envenomation following by snake bite. It can lead to life threatening medical emergency and it is most neglected public health problem in India. *Mesobutus tamulus* (Indian red scorpion) is one of the most common lethal venomous scorpion species in India¹. Most common other venomous scorpion species include Indian Black scorpion (*Heterome trusbengalensis*), Gain forest scorpion (*hetermutus Swammerdam*), Fattail scorpion (*Androstanes*), euscorpions *Asthenuruss*).

Mesobutus Tumulus
(Indian Red Scorpion)



Heterome Trusbengalensis
(Indian Black Scorpion)



Scorpion venom is known to cause myocardial injury (myocarditis). Mortality due to scorpion sting results from cardiogenic shock, acute pulmonary oedema and multi organ failure.

Scorpion sting and Myocardial injury due to its venom managed by prazosin, inotropes like dobutamine, assisted ventilation and other supportive medications. Since advent of ASV, its role in management scorpion sting and myocardial injury in debate, due to lack of evidence of benefit and its availability.

ASV is a monovalent anti venom against Indian red scorpion venom is used to assess its Efficacy in management of scorpion sting and myocardial injury in a comparison study.

Methods

The study was conducted in emergency medicine department in tertiary health care centre in central part of Karnataka. It was a comparative study done between two groups with scorpion sting involving 26 patients. Group I consist of 12 patients admitted in year 2017 managed without ASV. Group II consists of 14 patients admitted in year 2018 managed with ASV.

Inclusion Criteria: Patients with all age group and sex with all clinical grades of scorpion sting were including (Table 1).

Exclusion Criteria: patients who refused give consent. Patient who has taken ASV prior to reach our hospital

For all the patient ECG, 2D echo was done on admission to find out cardiac status EF and RWMA. Tab prazosin was given at dosage 1mg in adults and children 500mcg repeated if required after 6hours. Dobutamine infusion given at dosage 10mcg/kg/min continued till cardiovascular status became normal. Assisted ventilation used in study consists of invasive ventilation and non-invasive CPAP machine

ASV Is lipolyzed monovalent enzyme refined Antiscorpion venom equine immunoglobulin fab2 fragments manufactured by Premium venom and vaccine private ltd is used. It is supplied in 20ml glass vail along with 10ml of sterile water for injection. Each ml of ASV neutralise not less than 1mg of Red scorpion. 3 vails given per dose with 100ml NS at rate 10 minutes per vail. For children 2 vails given per dose. Repeated after 6-8 hours, if symptoms persisted.

Statistical Tests applied: Descriptive statistics (Mean, Standard deviation). Independent sample t test and Fisher-exact test. p value < 0.05 is considered as a significant.

Table 1: Clinical grades of scorpion sting¹

Grade 1	Severe, excruciating local pain at the sting site radiating along with corresponding Dermatomes, mild local oedema with sweating at the sting site, without systemic involvement.
Grade 2	Signs and symptoms of autonomic storm characterised by acetylcholine excess or Parasympathetic stimulation (vomiting, profuse sweating from all over body, ropey Salivation, bradycardia, premature ventricular contraction, hypotension, priapism in men) And sympathetic stimulation (hypertension with blood pressure >140/90, tachycardia with Heart rate >120 per minute, cold extremities, transient systolic murmur).
Grade 3	Cold extremities, tachycardia, hypotension or hypertension with pulmonaryoedema (respiratory rate >24 per minute, basal rales or crackles in lungs).
Grade4	Tachycardia, hypotension with or without pulmonary oedema with warm extremities (warm shock).

End results were compared in terms of requirement of mean prazosin dosage in mg, number of days dobutamine infusion, number days assisted ventilation and number of days to recover in each group. Group I result were compared retrospectively with group II.

Ethical approval: Ethics committee at SSIMS and RC Davangere; registration number IERB 205/2019.

Results

Table 2: Clinical characteristics and conditions of patients between two groups

Clinical Characteristics And Condition Of Patients	Group I		Group II	
	Mean	SD	Mean	SD
Age	25.4	8.93	22.82	15.72
Time Duration Between Sting And Admission In Hours	6.70	1.70	7.36	3.29
Lvef %	45.70	8.91	46.09	11.52
Hypertension	4/12		5/14	
Hypotension	6/12		7/14	
ST And T Wave Changes	9/12		10/14	

Group II had more paediatric patients compared two group I, so group II has more SD (15.72) for age. Time duration between sting and admission more in group II as one of patient presented after 16hours of sting, otherwise similar durations between two groups. Cardiovascular status between two groups of patients had similar clinical characteristics and conditions. Hypertension seen in 3 patients in group I and 4 patients in group II as a initial phases of envenomation due to stimulated effect of alpha

receptors. Hypotension seen in 6 patients in each group, initial hypotension due to volume loss and our patients had long lasting hypotension is due to cardiovascular involvement. Initial 2D echo in patients with hypotension showed global hypokinesia and reduced ejection fraction. The common ECG changes were tachycardia, tall T waves, inverted T waves and ST segment depression were seen in both groups

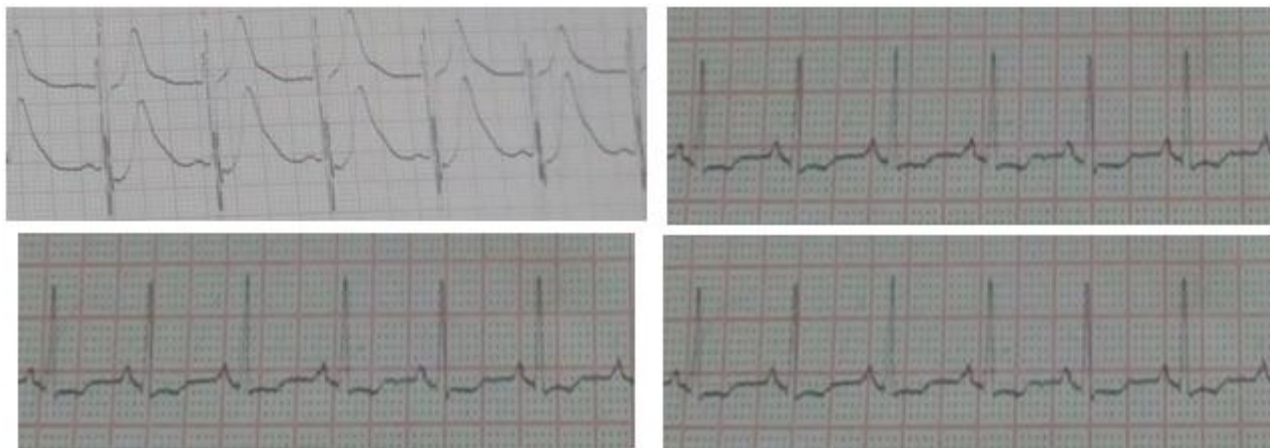


Figure No 3

Table 3: Distribution of patients according to clinical grades of scorpion sting

Clinical Grade of Study Population	Group I	Group II
Grade 1	2/12	3/14
Grade 2	7/12	6/14
Grade 2	3/12	4/14
Grade 4	0/12	1/14

Our study involved all clinical grades of scorpion sting and majority patients with clinical grade 2 and 3.

Table 4: ASV used in group II

	Mean	Standard Deviation
Number of ASV Used In Group II	3.81	1.4
Anaphylaxis to ASV	NIL	
Number of Patients Progressed to Clinical Grade 3 and 4 In Group I	2	
Number of Patients Progressed to Clinical Grade 3 and 4 in Group II	NIL	

Average ASV vails used in group II was 4 and there was no anaphylaxis developed to ASV this shows that 3-4 vails of initial dosage needed to

overcome envenomation and it also prevents deterioration of patients to further clinical grades.

Table 5: Assisted Ventilation used in both group

Group	I	II
Number of Patient Required Assisted Ventilation	2	4

In group I, two patient required invasive ventilation and in group II, two patient required

invasive ventilation invasive ventilation and two patients required CPAP machine.

Table 6: End results comparison

Clinical Characteristics and Condition Of Patients	Group I		Group II		T value	P value
	Mean	SD	Mean	SD		
Mean Prazocin Dosage In Mg	1.95	0.69	1.27	0.61	2.40	0.027
No Of Days Dobutamine Infusion	2.17	0.41	1.42	0.49	2.875	0.017
Duration Of Ventilation In Hours	60	16.97	52	18.33	0.490	0.658
No Of Days Of Hospitalization	4.10	0.99	3.09	1.14	2.16	0.044

Table 7: Mortality Comparison

GROUP	I	II
MORTALITY	Nil	1*

Mortality seen in one* patient in group II as this patient presented late to hospital with clinical grade 4 with cardiac arrest due to cardiogenic shock resuscitated successfully and admissions was done. After 2 hours hospitalization patient died despite of resuscitative efforts

Discussion

Scorpion venom composed of toxins and enzymes with neurological tropism acting on ion channel of excitable cells. Its venom delays the closing of neuronal sodium (mainly and most important) potassium and calcium channels, leads to persistent depolarisation and release of neurotransmitter from adrenal medulla and autonomic nerves resulting in autonomic storm, characterised by transient parasympathetic and sustained sympathetic stimulation².

Absorption of scorpion venom from deposited site would occurs in 7-8 hours. $t_{1/2}$ intravenous injected venom takes 4-7minutes and takes 4.2h-13.4h for elimination from blood².

Cardiac injury by venom is due to myocardial ischemia by coronary spasms and Increased myocardial oxygen demand. Increased levels of circulating catecholamine, angiotensin (vasoconstriction) causes altered myocardial perfusion and altered metabolism leading to depletion of glycogen content of myocardium resulting in reduced contractility of ventricles. Direct cardiotoxic effect of venom and anaphylactic reaction can also have role⁴. Pulmonary oedema results from cardiogenic shock. Scorpion venom inhibits angiotensin converting enzyme, resulting in accumulation of bradykinin. Since use of prazosin, dobutamine and assisted ventilation in management of scorpion sting mortality has been reduced.

Anti-scorpion venom is the specific treatment for scorpion sting aimed at neutralising the venom. ASV Is lipolyzed monovalent enzyme refined

Antiscorpion venom equine immunoglobulin fab2 fragments. Scorpion anti-venom directly neutralizes the venom in the circulation as well as that present at the other body compartments.

In this study, group II, the mean prazosin dosage in mg required was significantly lesser compared to group I (p vale 0.027). Number of days of dobutamine infusion required was significantly reduced in group II (p valve0.017). Duration of assisted ventilation there is no significant hours of difference in requirement (p value 0.658) but mean duration required is reduced in group II, as sample size was too small to compare and different modes of ventilation. Hospitalisation in group two was one day less compared to other group (p value 0.044) shows ASV helps early recovery and reduces duration of hospitalisation.

Thus, ASV improves the cardiovascular condition of patients and study also showed deterioration of patients due to cardiovascular complications managed with ASV were considerably reduced (table 3). Due to less incidences of anaphylaxis, ease of administration and low cost make it better options in management.

This was also supported by previous studies by Bawaskar HS and Bawaskar PH¹ and Natu et al that administration of scorpion antivenom leads to early recovery in scorpion stings.

During our study no improvement seen in one paediatric patient, came after 16hours of scorpion sting and post cardiac arrest status due cardiogenic shock. Study also suggested that ASV useful if given early within 6-8 hours neutralise unbound venom and no benefit in myocardial injury due to severe envenomation in delayed presentation.

Conclusion

ASV is safe, it can improve and prevent the cardiovascular complications. In management scorpion sting early administration of ASV

reduces severity of envenomation and helps to recover in lesser duration.

Strengths of Study

ASV safe, no documented anaphylaxis and low dosage required. Species specific anti venom is needed to neutralise the circulating venom. However, prazosin by antagonising sympathetic over activity and correcting deranged metabolism, ASV is effective against envenomation by different species¹.

Limitation

It is a monovalent anti venom and there are other lethal venomous scorpion species. Like snake anti venom it is important to identify Geographical venomous scorpion species and prepare efficient polyvalent antiserum

Declarations

Funding: none

Conflict of interest: no conflict of interest

Ethical approval: Ethics committee at SSIMS and RC Davangere; registration number IERB 205/2019.

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