

OPINION

PATHOPHYSIOLOGICAL APPROACH TO THE MANAGEMENT OF SCORPION ENVENOMATION

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Abstract : Indian red scorpion (*Mesobuthus tamulus*; MBT) produces lethal stings and is a matter of concern in certain parts of India. MBT envenomation produces multi-systemic involvement, thus presents difficulty in the management. Symptomatic treatment has been practiced earlier that failed to relieve the toxic effects of the venom. Therefore, present manuscript deals with pathophysiologically based approach in the management of toxicity considering the merits and the demerits of treatment protocols so as to evolve a consensus in the treatment strategies of scorpion envenomation.

Key words : Indian red scorpion stings anti-scorpion venom
 insulin α -blockers parasympatholytics
 kinin synthesis inhibitors kinin antagonists

INTRODUCTION

Scorpion stings are important causes of morbidity and mortality in India and throughout the world (1). Indian red scorpion (*Mesobuthus tamulus*; MBT) envenomation presents with multi-systemic abnormalities posing a great health problem (2–8). Even though the scorpion stings are responsible for the high morbidity and mortality in certain parts of India, the broad outline of scorpion envenomation and consensus in the treatment strategies with their merits and demerits are yet not available (9–13). This concerns not only the physicians, the patients and the attendants but the scientific workers also. Therefore, present manuscript discusses the merits and demerits of

presently available management protocols on scorpion envenomation. This will enable to evolve a consensus on the effective treatment strategy of scorpion stung victims.

In recent years, a number of toxins have been isolated from MBT venom such as Iberiotoxin, a high conductance Ca^{2+} activated K^+ channel blocker (14); Tamulustoxin, a novel K^+ channel blocker (15); Insect toxins like lepidopteran-selective toxin (16) and BtITx3 (17); Tamapin, a small conductance Ca^{2+} activated K^+ channel blocker (18); BTK-2, an inhibitor of voltage-gated K^+ channels (19); PoTx, a high molecular weight polypeptide pulmonary oedema producing toxin (20), etc. Of these

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Iberiotoxin and PoTx are lethal (14, 20). Mechanism of action of each of these toxins is different. Therefore, variability in symptoms and signs is likely to persist. Hence, the treatment of scorpion envenomation syndrome can only be effective when the underlying pathophysiology of individual case is considered.

Recently, utility of anti-scorpion venom (ASV) in the management of scorpion envenomation syndrome has been reported (9, 10, 21, 22). In situations where the identification of the species of scorpion is possible, a species specific ASV is the treatment of choice (22). But in most of the scorpion stung cases, identification of scorpion species is difficult. In such situations, an ASV raised against a particular species will not be able to protect. Since scorpion venom contains many toxins as mentioned before, an ASV raised against all the toxic principles present in various scorpion venoms (polyclonal ASV) is a better alternative (14–20). However, studies elsewhere have contradictory opinion regarding the effectiveness of ASV (10). This may be due to the fact that the scorpion venom is poorly antigenic (23), thus, the antisera raised may not be able to neutralize the toxins effectively. Therefore, the availability of proper and effective ASV is a necessity. Further, ASV should be used at earliest possible time after the sting to get effective response as bio-distribution of crude venom occurs in vital organs/systems within 5 minutes (24). Therefore, time of injection of ASV also affects the efficacy.

The α -1 adrenergic receptor antagonists like prazosin (25) and tolazoline (3) have been used to treat the autonomic storm following scorpion envenomation. This regime may be

useful in patients presenting with hypertension (sympathetic dominance). In case of hypotensive patients with parasympathetic dominance, parasympatholytics may be used under close observation as the parasympathetic effect is often transient. Either of these drugs pharmacologically antagonize the autonomic activity without reversing the underlying pathophysiology.

A study elsewhere has presented the comparison of ASV along with other treatments including prazosin (10). However, it is very difficult to compare the effectiveness of ASV v/s prazosin in the above study design. ASV and prazosin have different mechanisms of action, they should not be considered as replacement of one another rather patients should be treated with ASV or prazosin or both as per the need.

Metabolic abnormalities, myocarditis, electrocardiographic alterations, hemodynamic changes and pulmonary oedema are reported after scorpion envenomation (3–5). These abnormalities were successfully reversed by insulin administration (3–5). However, the detailed study on the mechanism of action of insulin is required in scorpion stung cases.

Pulmonary edema is an important cause of death after scorpion stings (5, 10). Kinins are being implicated in the pathophysiology of pulmonary edema (6). PoTx is emerging as an important cause for production of lethal pulmonary edema after scorpion envenomation which mediates its action involving B₂ receptors (20). Therefore, the role of kinin synthesis inhibitor like aprotinin was suggested (8, 20). Studies elsewhere have also reported reversal of pulmonary edema by aprotinin after envenomation with other species of scorpions (12, 13, 26).

Therefore, the treatment protocol should also include aprotinin/B₂ receptor antagonists to treat the scorpion envenomation besides other therapies.

Captopril has been used to treat the pulmonary edema (11). Captopril being ACE-inhibitor is known to increase endogenous kinins (27). Results from our laboratory have shown that captopril induced cardiopulmonary changes are similar to venom (6). Therefore, the use of captopril requires reconsideration in the treatment of

pulmonary oedema.

Thus, with the present knowledge, it appears irrational to advocate a fixed treatment protocol for all cases of scorpion sting. Rather the treatment should be based on the underlying pathophysiology of the particular case. ASV, insulin, α -blockers, parasympatholytics, kinin synthesis inhibitors/kinin antagonists may be used depending on the pathophysiology of individual case. However, the rationale for therapeutic use must be clear before any intervention.

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