SCORPION STING ENVENOMATION: COMPLICATIONS AND MANAGEMENT

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Scorpion sting envenomation is quite common in rural and coastal India. Eighty six species of scorpions are found in India but of them only 2 are poisonous, *i.e., Mesobuthus tamulus* (the common red scorpion) and *Palamnieus swammerdami*(1). Scorpions are commonly seen in Rayalseema (AP), Bellary, Madurai, Madras, Pondicherry, Madhya Pradesh, Maharashtra and Ganjam (Orissa). Scorpion sting is usually harmless in adults but causes serious systemic toxicity in children. The chemical properties and physiological effects of the toxin vary in different species of scorpion(2). Virulence of scorpion toxin is more in summer and breeding season(3).

Venom

The venom is acidic and contains 5 distinct fractions on chromatographic fractionation. Two different toxins are responsible for pulmonary edema and hyperglycemia (4,5). Charybdotoxin, a protein isolate from the venom of the scorpion, *Leiureus quinquestriatus*, is a high affinity specific inhibitor of the high conductance calcium activated potassium channel(6).

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Systemic Complications

Cardiovascular Complications: The cardiovascular response to scorpion venom in man resembles that of a catecholamine overdose by either adrenergic stimulation or direct sympathomimetic cardiac effect(7). The clinical picture is characterized by hypertension, hypotension, anxiety, profuse perspiration, pulmonary edema and congestive cardiac failure. Myocarditis, focal myocardial infarction, arrhythmias, fleeting apical systolic murmur, ventricular gallop, various degrees of block and compensated shock state all have been described (7-10).

Necropsy studies of myocardium suggest degenerative muscle fibre changes, focal necrosis, interstitial edema and cellularity with maximal involvement of the papillary muscles and subendocardial areas. The necrotic myocardial lesions are probably caused by hypoxia from the inotropic effects of the catecholamines on the myocardium (adrenaline myocarditis). Catecholamines are capable of enhancing oxygen consumption to the extent of resulting in myocardial hypoxia through direct chemical interference(11). Reduction glycogen content of atria was noted in dogs with acute myocarditis produced by scorpion (*Buthus tamulus*) venom(12).

Respiratory System: Pulmonary edema may occur due to myocarditis and left ventricular failure(4,7,8). Pulmonary edema and alveolar hemorrhage with hemoptysis may

also occur due to a neurovegetative effect of the increased level of circulating pressor amines on the pulmonary capillary permeability. Dyspnea and cyanosis may be noted.

Central Nervous System: Scorpion venom may induce encephalopathy, convulsions (focal and generalized), hemiplegia and other focal neurological deficits including transient blindness(13).

Hepatobiliary System: Rise in the level of hepatic enzymes and bilirubin has been noted after scorpion sting(14). Depletion in liver glycogen has been noted in dogs with acute myocarditis produced by scorpion venom(12,15). Dilatation of branches of the hepatic artery and vein, intravascular thrombus, subcapsular hemorrhage, focal hydropic degeneration and focal necrosis have also been reported.

Pancreas: Acute pancreatitis, elevation of serum amylase (in the absence of abdominal pain) as well as pancreatic cysts have been noted after scorpion sting(16). Reduced insulin secretion and hyperglycemia have also been reported(17).

Kidney: Hematuria and hydropic degeneration as well as focal hemorrhages have been observed on autopsy studies(14,18).

Hematological System: Hematemesis, malena, hematuria, disseminated intravascular coagulation and increased erythrocyte fragility have been observed by various workers(18,19).

Local Reactions: Pain, swelling, ecchymosis and acro-osteolysis secondary in tissue necrosis by venom can occur(20).

Miscellaneous: Priapism, sweating, mydriasis and vomiting are other associated complications. Certain studies have demonstrated that there is a positive correlation between occurrence of priapism in a male and the later development of cardiac manifestations after a scorpion sting(21). Teratogenecity in rats due to scorpion venom has been observed(22).

Investigations

Scorpion envenomation induces varied biochemical alterations in blood. Hyperkalemia, rise in free fatty acids and fall in cholesterol and triglycerides have been observed(18,19). Elevation in the level of serum amylase even in the absence of abdominal pain has also been observed(16,23). Marked elevation in the level of LDH, LDH_1, SGOT and SGPT have been noted in children with myocarditis(19,24). In experimental scorpion envenomation without ventilatory support, rise in PCO_2, fall in PO_2 and PH and significant fall in serum bicarbonate with rise in serum lactate leading to metabolic acidosis have been observed(25).

In children with myocarditis, serial ECG's are helpful especially when clinical manifestations are not obvious. RST segment may be normal or depressed and T wave may be flat or inverted in several leads. Conduction disturbances and arrhythmias have also been reported(26). Q wave in lead I and aVL, may be noted. Varieties of myocardial dysfunction, both focal and generalized, as well as ventricular dilatation may be seen on echocardiography.

Management

The management of scorpion sting envenomation is directed at neutralizing the toxin by antiserum and supportive therapy for the complications and is aimed at the major visceral dysfunctions.

Antivenom to scorpion toxin is species specific and is available only in a few countries. Presently, it is not available in India. Except for a single report of the efficacy of

the antitoxin for the treatment of the complications of scorpion envenomation(27), there is no other conclusive study justifying the superiority of antitoxin over other modes of management. As the venom accumulates in cardiac tissues and indirectly acts through the release of autopharmacologial substances, treatment with blockers may be more effective and rapid than serotherapy(5). Use of serotherapy has not been advocated because of the inherent morbidity and mortality(28).

In the early seventies lytic cocktail therapy comprising of chlorpromazine, promethazine and pethidine was thought to be the mainstay of therapy for inducing a state of suspended animation, thereby reducing the cerebral metabolism and further complications of scorpionism(29). Orthostatic hypotension, respiratory depression and convulsions were the frequent complications observed during lytic cocktail therapy. Utility of lytic cocktail therapy has been subsequently strongly disapproved in the management of scorpion sting complications(32).

Since the 70's other modes of therapy have been tried in scorpionism. Most of the cardiovascular and pulmonary complications are due to automatic storm resulting in adrenaline shock and adrenaline myocarditis. Therefore α and β adrenergic blocking agents can prevent this myocardial damage. Symptomatic treatment for hypertension can be successfully achieved with calcium channel blockers and vasodilators. Oral prazosin, a postsynaptic α-blocker and sublingual nifedipine has been used successfully(8,30). Combination of insulin, tolazoline and bicarbonate(25) or nifedipine and hydrallazine(28) have also been used effectively for the treatment of cardiovascular complications. Vasodilators, prazosin and isosorbide have been found to be superior to conventional treatment with digitalis, diuretics and steroids in cardiac complications(31).

Routine use of atropine in patients with hypertension and sweating increases the morbidity and mortality due to scorpion venom(32). As red scorpion venom induces raised angiotensin levels in animals, angiotensin blockers may be useful in the treatment of scorpionism. Insulin and tolazoline combination has reversed the rise in angiotensin levels in experimental conditions(25). Cardiovascular complications with peripheral circulatory failure has been effectively managed with low doses of dopamine(2-3 μg/kg/min) along with other supportive therapy(9).

Acute pulmonary edema has been effectively managed with vasodilator therapy (prazosin) and ventilatory support. Defibrination syndrome, acro-osteolysis and encephalopathy need appropriate medical management.

Prognosis

Scorpion sting envenomation may be fatal in young children and very old persons but rarely in healthy adults(3). Early intervention improves prognosis. Encephalopathy, coma, convulsion and life threatening arrhythmias carry adverse prognosis.

Thus, to conclude, in the absence of availability of specific scorpion antivenom in India, selective conservative treatment related to specific organ system and counteracting the biochemical alterations, as well as intensive care support for circulatory failure and pulmonary complications remain the treatment of choice for scorpion sting envenomation.

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