Indian Academy of Pediatrics (IAP)

STANDARD TREATMENT GUIDELINES 2022

Scorpion Envenomation

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Scorpion Envenomation

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Introduction

- ☑ Scorpion envenomation is a common medical emergency in the tropical and subtropical countries. In India, commonly affected states are *Maharashtra, Karnataka, Tamil Nadu, West Bengal, Madhya Pradesh, Puducherry, and Odisha*.
- ☑ The most common types of poisonous species found in India are the *Indian red scorpion (Mesobuthus tamulus)* (most poisonous) **(Fig. 1)** and the *black (Palamnaeus swammerdami)*.
- ☑ Severity of envenomation depends on multiple factors such as *species of scorpion, age, and body surface area*. Children are more vulnerable owing to lesser body surface area.

Fig. 1: Indian red scorpion (*Mesobuthus tamulus*).
Courtesy: Dr MV Khadilkar.

The scorpion venom is a water-soluble antigenic complex mixture of neurotoxin, cardiotoxin, nephrotoxin, hemolysins, phosphodiesterases, phospholipase, hyaluronidases, histamine, and other chemicals. The primary target of scorpion venom is voltage-dependent ion channels.

These toxins cause massive release of autonomic neuromuscular neurotransmitters such as acetylcholine, norepinephrine, epinephrine, aspartate, and glutamate and evoke an "autonomic storm".

The effects on various tissues and organs are described here.

Autonomic Nervous System

- ☑ Sympathetic system stimulation leads to increased levels of catecholamines, resulting in "adrenergic storm" which manifests as tachycardia, hypertension, diaphoresis, hyperthermia, hyperglycemia, urinary retention, tachypnea, mydriasis, tremor, and convulsions.
- ☑ In contrast, parasympathetic nervous system stimulation leads to *muscarinic response* manifesting as salivation, sweating, vomiting, urinary incontinence, bronchial hypersecretion, diarrhea, miosis, bronchospasm, bradycardia, hypotension as well as *priapism* in males **(Fig. 2)**.

Fig. 2: A 6-year-old boy with scorpion envenomation—priapism.
Courtesy: Prof A Thangavelu, Chennai.

Cardiovascular System

Initially, bradycardia occurs then tachycardia and hypotension, followed by hypertension. Vasospasm and increased myocardial demand causes myocardial injury. Adrenergic stimulation is responsible for free radical-induced myocardial injury. Cardiac dysfunction leads to acute pulmonary edema and is responsible for one-third of the fatalities **(Table 1)**.

TABLE 1: Grading of severity.

Grades	***Clinical features***
Grade I	Isolated pain
Grade II	Hypertension, sweating, vomiting, priapism, fever, shivering
Grade III	Cardiogenic shock, pulmonary edema, altered consciousness
Grade IV	Tachycardia, hypotension with or without pulmonary edema

Nervous System

Neurological manifestations in stings by *Mesobuthus* are seizures due to cortical damage secondary to high blood pressure or cerebral infarcts. Peripheral nervous system stimulation manifests as wild flailing and thrashing of limbs, abnormal oculomotor movements, visual disturbances, muscle fasciculation, and spasms of the face, tongue, arms, and legs.

Hematological System

Scorpion venom can cause alteration in clotting pathway and disseminated intravascular coagulation. Acute lung injury may occur from microthrombi. Stroke may occur due to thrombosis, hemorrhage, or cerebral vasospasm.

Other Organs

- ☑ *Kidney*: Acute renal failure may occur due to severe hemolysis
- ☑ *Liver*: Liver necrosis and raised enzymes
- ☑ *Lung*: Pulmonary edema
- ☑ *Skin*: Erythema, necrosis, edema, and lymphangitis
- ☑ *Pancreas*: Pancreatitis
- ☑ *Gastrointestinal*: Nausea, vomiting, pain in abdomen, and diarrhea.

Clinical Features: (Time is Life: Venom and the Clock)

- ☑ Clinical picture may evolve within 30 minutes to 6 hours and subside within a day or two.
- ☑ Severity is dependent on the potency of a particular species' venom, volume of venom injected, and body weight of the victim.
- ☑ The symptomatology can be broadly divided into local, systemic manifestations, and complications.
- ☑ *Local manifestations* include severe pain and paresthesia
- ☑ *Systemic manifestations* include features of cholinergic storm starting from 0–4 hours (can last for 6–13 hours) followed by features of adrenergic stimulation which starts at 4 hours and can last up to 48 hours.
- ☑ *Complications* include encephalopathy, convulsions, aphasia, hemiplegia, cerebral hemorrhage, disseminated intravascular coagulation, and respiratory failure.

Investigations

It is aimed at identifying the complications of myocardial dysfunction and pulmonary edema.

- ☑ Electrocardiogram
- ☑ Chest X-ray
- ☑ Echocardiography
- ☑ *Biochemical abnormalities*: These are elevated potassium levels, amylase, and lactate dehydrogenase (LDH) levels, raised liver enzymes, glucose, and free fatty acids, reduced cholesterol, triglyceride levels.

Pain Relief and Fluid Management

- ☑ *Paracetamol*: 15 mg/kg/dose oral/IM/IV every 4–6 hours till resolution of pain.
- ☑ *Local measures*: Ice packs and xylocaine.
- ☑ To settle restless children, midazolam or diazepam can be used.
- ☑ Oral fluids should be given whenever possible.
- ☑ Children showing symptoms of altered sensorium and tachypnea require parenteral fluids—NS or RL or balanced salt solution with/without dextrose depending on blood sugar level.
- ☑ Care in PICU by hemodynamic monitoring is vital as fluid requirement has to be balanced in children with pulmonary edema.

Prazosin

- ☑ Prazosin is a competitive postsynaptic alpha 1-adrenoceptor, which is the first-line drug and is given to all patients showing evidence of the autonomic storm in the dose of 30 µg/kg/dose.
- ☑ Prazosin is available as an oral preparation in the form of 1 mg tablets. Owing to its photosensitivity, it has to be stored in airtight containers away from light. *Sustained-release tablets are not suitable in this condition*.
- ☑ It is not to be given as prophylaxis when the only symptom is pain.
- ☑ In case of vomiting, it can be administered through the nasogastric tube.
- ☑ After giving prazosin, the mother should be advised not to lift the child to prevent the effects of the "first-dose phenomenon".
- ☑ *Close monitoring of vitals*: Blood pressure, pulse rate, and respiration must be monitored every 30 minutes for 3 hours, every hour for the next 6 hours, and thereafter every 4 hours till improvement.
- ☑ Repeat dose prazosin should be considered at 30 µg/kg/dose after 3 hours of the first dose based on clinical response. It can be given till improvement of symptoms such as extremities are warm and dry, and peripheral veins are easily visible.
- ☑ In general, no more than four doses have been required in most patients.
- ☑ *Dr Himmatrao Saluba Bawaskar*, the unsung warrior and living legend who first gave prazosin in scorpion envenomation management in rural Maharashtra and published the article in Lancet Journal as early as 1986 and has revolutionized the treatment and is being followed throughout India.

Scorpion Antivenom

- ☑ The recommended dose is a single 30 mL (3 vials) dose of Haffkine Biopharmaceutical monovalent scorpion antivenom (SAV) diluted in 100 mL of normal saline infused intravenously over 30 minutes in patients with Grade-2 and above severity irrespective of age and weight of the patients.
- ☑ The adverse reaction to SAV is managed by withholding of infusion and supportive management. After stabilization, further infusion at a constant rate over 1 hour is advised.

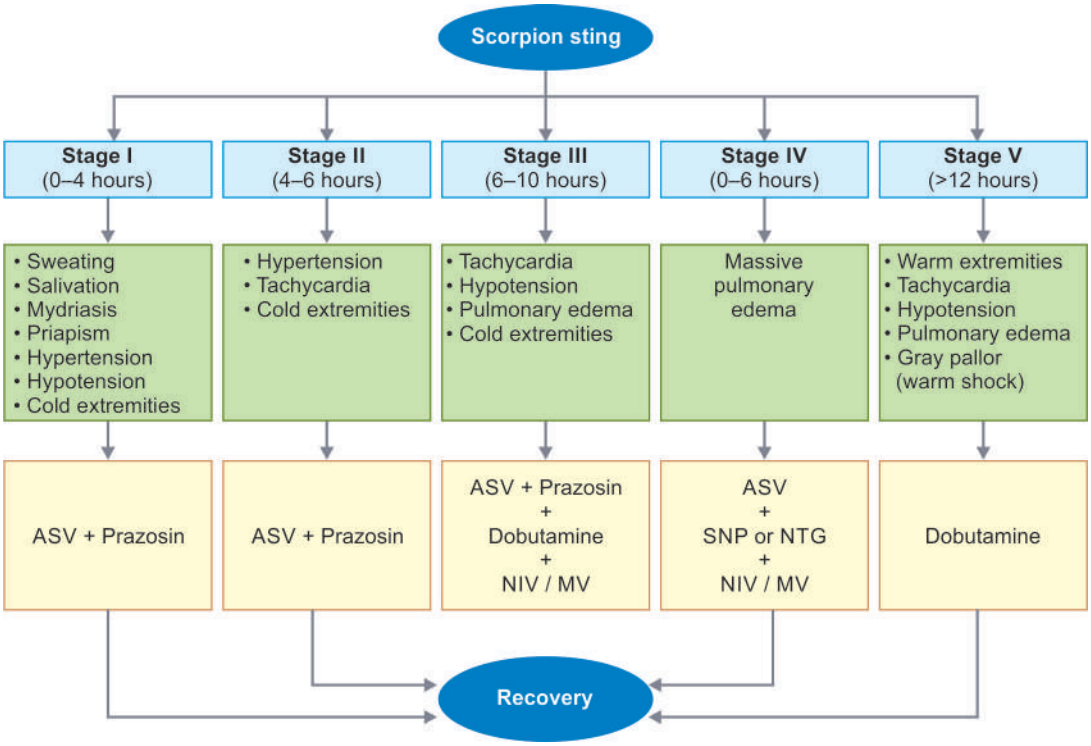
Management of Pulmonary Edema

- ☑ Pulmonary edema is primarily due to myocardial dysfunction. Though it is severe, it does not necessarily mean a poor prognosis.
- ☑ *The management remains supportive*: The use of diuretics to minimize or reduce fluid overload is done only when renal water excretion is impaired.
- ☑ Dobutamine support (5–15 µg/kg/min) with vasodilatation through sodium nitroprusside (0.3–5 µg/kg/min) or nitroglycerine (0.1–1 µg/kg/min) infusion is preferred in this situation.
- ☑ Prazosin is to be given 1 hour before termination of sodium nitroprusside drip. If it is not available, one can use isosorbide dinitrate, 10 mg every 10 minutes sublingually as an emergency measure.
- ☑ Morphine, a standard therapy in pulmonary edema, should be avoided in scorpion sting since narcotics worsen dysrhythmias in these patients.

Management

The algorithm for management of scorpion sting is detailed in **Flowchart 1**.

Flowchart 1: Management of scorpion sting.



(ASV: antiscorpion venom; MV: mechanical ventilation; NIV: noninvasive ventilation; NTG: nitroglycerine; SNP: sodium nitroprusside)

Source: Bawaskar HS, Bawaskar PH. Scorpion sting: update. J Assoc Physicians India. 2012;60:46-55.

Prevention

The following preventive measures can be considered:

- ☑ Clear debris and trash from areas one inhabits and have clean surroundings
- ☑ Inspect shoes, clothing, bedding, and packages for scorpion
- ☑ Never explore into places one cannot see
- ☑ Spraying 10% DDT + 0.2% pyrethrin + 2% chlorine in oil base or fuel oil + kerosene + creosote as spray in roof complexes and building foundations are known to kill scorpions
- ☑ Use mosquito nets and sleep in cots
- ☑ At times of school opening, the tables and rooms (roof, walls, and floor) should be thoroughly cleaned and washed.

Further Reading

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