

FIRST AID MANAGEMENT IN SNAKE BITE

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INTRODUCTION

Most snake bites occur when someone accidentally steps on a snake while walking in the countryside. Snakebite is an injury caused by the bite of a snake, especially a venomous snake. A common sign of a bite from a venomous snake is the presence of two puncture wounds from the animal's fangs. Sometimes venom injection from the bite may occur, resulting in physiological problems and alteration in the functioning of vital organs. The venom may cause bleeding, kidney failure, a severe allergic reaction, tissue death around the bite, or respiratory and cardiac failure. Some snakes are venomous and can inject venom containing toxins as they bite. Even a bite from a harmless snake can be serious, leading to an allergic reaction or an infection. A bite from a venomous snake is a medical emergency because it can be deadly if not treated quickly.

Statistics of snakebite

As per the reports of WHO (2015) & American Society of Tropical Medicine and Hygiene (2016):

- Worldwide, >5 million persons/ year are bitten by snakes, out of which approximately 100,000 die.
- Nearly, 46,000 people die of snakebites in India every year. In India, more than 200 species of snakes have been identified but only 52 are poisonous.
- 70% of all snakebites are by nonvenomous snakes and 30% snakebites are venomous, from these 30% venomous bite 50% of bites are dry bites.

Venomous snake species in India

The most poisonous species of snakes in India are: the common krait (*Bungarus caeruleus*), Indian cobra (*Naja naja*), Russell's viper (*Daboia russelii*), and saw-scaled

viper (*Echis carinatus*). In the Indian setting, almost two-thirds of bites are attributed to saw-scaled vipers, about one-fourth to Russell's viper, and only a small proportion to cobras and kraits. Identification of snake is very important. One should remember the appearance of snake or if possible take picture of the snake in mobile phone. The identification details of the snake must be told to the physician as it helps in determining the type of antivenom to be used.

Chemical composition of snake venom

The toxic component of snake venom can be classified into four broad categories: enzymes, polypeptides, glycoproteins, and compounds of low molecular weight. The toxic effect of snake venom is further complicated by the inflammatory response of the victim's body.

Toxic Compound in Snake Venom	Harmful Effect
Phospholipase A2 Enzyme (Hemotoxic)	Inhibits electron transfer at cytochrome C level and renders mitochondrial-bound enzymes soluble. It damages red blood cells, leukocytes, platelets, skeletal muscle, vascular endothelium, peripheral nerve endings, and the myoneural junction.
Hyaluronidase Enzyme (cytotoxic)	Helps spread of venom through tissues, and proteolytic enzymes are responsible for the local edema, blistering, and necrosis.
Neurotoxins	α - Neurotoxins bind to acetylcholine receptors at the motor end-plate, whereas β - neurotoxins first cause release of acetylcholine at the nerve endings at the myoneural junction and then damage the endings, preventing further release of transmitter. All this leads to a flaccid paralysis of the victim.
Polypeptides (cardio toxic, renal toxic)	Polypeptides, being smaller molecules, are rapidly absorbed into the systemic circulation and cause systemic toxicity in vessel-rich organs (e.g., heart, lung, kidneys, etc.) as well as at pre- and postsynaptic membranes.

Clinical manifestations of snake bite

As the venom spreads in the body (envenomation), it produces varying symptoms as per the toxicity level. Some of the common symptoms are as follow:

Affected body part	Symptoms
Central nervous system	Headache, dizziness, fainting & increased thirst.
Respiratory system	Dyspnoea, shortness of breath, respiratory arrest.
Cardiovascular symptoms	Rapid pulse, low blood pressure, severe shock.
Muscular system	Convulsions, loss of coordination, weakness.
Digestive system	Nausea, vomiting, diarrhoea.
Wound site	Fang marks, bleeding, swelling, discoloration, burning sensation.
Other skin sites	Bleeding spots, numbness, tingling, sweating.
Systemic	Fever, severe pain
Eyes	Blurred vision.

Assess for the severity of envenomation as follows

No envenomation	Absence of local or systemic reactions; fang marks (+/-)
Mild envenomation	Fang marks (+), moderate pain, minimal local edema (0–15 ce), erythema (+), ecchymosis (+/-), no systemic reactions
Moderate envenomation	Fang marks (+), severe pain, moderate local edema (15–30 cm), erythema and ecchymosis (+), systemic weakness, sweating, syncope, nausea, vomiting, anemia, or thrombocytopenia
Severe envenomation	Fang marks (+), severe pain, severe local edema (>30 cm), erythema and ecchymosis (+), hypotension, paresthesia, coma, pulmonary edema, respiratory failure

Factors contributing to severity of symptoms and outcome in snakebite

Factors	Effect on outcome
Size of victim	Bigger the size, good is the outcome due to less amount of toxin per kg of body weight
Part bitten	Patients bitten on the trunk, face, and directly into bloodstream have a worse prognosis
Exercise	Exertion following snake bite has poor outcome due to enhanced systemic absorption of toxin
Bite characteristics	Bite number; depth of bite; dry bite; bite through clothes, shoes, or other protection; amount of venom injected; condition of fangs; and duration for which snake clings to the victim, all affect outcome
Secondary infection	Presence or absence of pathogenic organisms in the mouth of the snake
Snake species	Different species have different lethal dose, lethal period, and aggressiveness
Treatment	Nature of first aid given and time elapsed before first dose of antivenom.

Various snakebites, their fatal dose, quantity of venom injected, and time to fatality is given below

Snake	Fatal dose for humans	Average delivered dose per bite	Average fatal period
Indian cobra	12 mg	60 mg	8 h
Common krait	6 mg	20 mg	18 h
Russell's viper	15 mg	63 mg	3 days
Saw-scaled viper	8 mg	13-40 mg	41 days

Treatment of snakebite

As per WHO (2015) the following treatment guidelines are followed:

1. First aid

The current guidelines for first aid in snake bite include the following:

- Immediately move away from the area where the bite occurred.
- Reassure the victim.
- Keep the bitten limb below the level of heart
- Allow the bite to bleed (if present) freely for 15 – 30 seconds before cleansing with soap & water.
- Remove anything tight from around the bitten part of the body (e.g.: rings, anklets, bracelets) as these can cause harm if swelling occurs.
- Immobilize the affected limb by bandage/cloth to hold splint.

Pressure-Immobilisation technique

The venoms of snakes, blue-ringed octopus, cone shell and Funnelweb Spider circulate through the body via the lymphatic system, which works by muscular action. In order to slow down venom circulation for these specific creatures the pressure-immobilisation technique should be used.

Immediately apply pressure to envenomed area.

- 1 Apply broad pressure bandage
- 2 Bandage should be tight and firm but not too tight as to stop circulation. Start from below bite and work your way up.
- 3 Apply bandage as far up limb as possible.
- 4 Apply a splint to limb to inhibit movement. Fasten splint to limb using another bandage.
- 5 Bind splint as firm as possible to restrict all movement. Then seek urgent medical assistance.

When the arm is the site of affected area, after applying above steps a sling should also be used to immobilise the limb.

- Attempt to identify the snake, if possible.
- Avoid traditional first aid methods, herbal medicines and other unproven or unsafe forms of first aid.
- Transport the person to a health facility as soon as possible
- Vomiting may occur, so place the person on their left side in the recovery position.
- Closely monitor airway and breathing and be ready to resuscitate if necessary.
- Monitor the person's vital signs — temperature, pulse, rate of breathing, and blood pressure — if possible. Watch for any signs of shock (sweating, clammy skin, or shallow breathing), since the fear of having been bitten is often more dangerous than the bite.

- (d) Don't Cut open a bite wound.
- (e) Don't Try to suck out venom.
- (f) Don't Apply a tourniquet or ice.

2. Hospital Treatment

- TT Immunization.
- Monitor Airway, Breathing, Circulation, LOC & vital signs, if shock present plan for intubation & mechanical ventilator support.
- Administer oxygen & IV fluids to ever bitten case.
- Measure the circumference of the bitten limb every 15 minutes until the swelling is no longer progressing.
- Place the extremity in well-padded splint for at least 24 hours.
- Monitor for compartment syndrome.

DON'T'S

- (a) Do not try to handle, capture, or tease a venomous snake or snakes of unknown identity.
- (b) Don't let the allow the victim to engage in strenuous physical activity.
- (c) Don't let the snake bite victim eat or drink anything

SPECIFIC THERAPY

Anti-Snake Venom Therapy: Antivenom should be ideally administered within 4 h of the bite, but is effective even if given within 24 h. The dosage required varies with the degree of envenomation.

Indications for anti-snake venom therapy

System	Clinical features
	Spontaneous systemic bleeding
	Whole blood clotting time >20 min
	Thrombocytopenia (platelets <100,000/mm ³)
	Shock
	Arrhythmia
	Abnormal electrocardiogram
Neurological	Ptosis and paralysis
Renal	Acute renal failure
	Generalized rhabdomyolysis and muscular pains
	Hyperkalemia
	Local swelling involving more than half of the bitten limb
	Rapid extension of swelling
	Development of an enlarged lymph node draining the bitten limb

Dose of Anti-Snake Venom Therapy

Degree of envenomation	Initial dose
Mild	5 vials (50 ml)
Moderate	5–10 vials (50–100 ml)
Severe	10–20 vials (100–200 ml)
Additional infusions containing 5–10 vials (50–100 ml) are repeated until progression of swelling in the bitten part ceases and systemic signs and symptoms disappear	

ASV can be administered either by slow intravenous injection at a rate of 2 ml/min or by intravenous infusion (antivenom diluted in 5–10 ml per kilogram body weight of normal saline or D₅W and infused over 1 h). ASV should never be given locally at the site of the snakebite since it has not been shown to be effective and, moreover, this route of administration is associated with significant risks.

CONCLUSION

Snakes do not generally attack human beings unless provoked. However, once bitten, a wide spectrum of clinical manifestations may result. The emphasis should be on early and adequate medical management. Delayed medical management and lack of public awareness results in prolonged hospital and ICU stay of the patients. This can be decreased if regular public programmes regarding prevention, prehospital management (first aid), and the importance of early transfer to hospital are conducted.

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