

Spectrum of Snake Bite, Symptoms and its Management: A Review

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Abstract

Snakebites are serious public health problem in many regions of the world, particularly in rural areas lacking medical facilities. Snake bite is a well-known occupational hazard amongst farmers, plantation workers, and other outdoor workers and results in much morbidity and mortality throughout the world. This occupational hazard is no more an issue restricted to a particular part of the world; it has become a global issue. Accurate statistics of the incidence of snakebite and its morbidity and mortality throughout the world is difficult to publish, however, it is certain to be higher than what is reported. This is because even today most of the victims initially approach traditional healers for treatment and many are not even registered in the hospital. Hence, registering such patients is an important goal if we have accurate statistics and reduce the morbidity and mortality due to snakebite. World Health Organization (WHO) has published guidelines for the clinical management of snakebites. In this article the author tries to throw light on the incidence and clinical features of snakebite and the management and treatment guidelines as per the WHO recommendation.

Keywords: Snakebite, World Health Organisation, Treatment, Management.

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INTRODUCTION

Snakes belongs to class reptiles and is probably the most misunderstood and universally disliked animals in the world since times immorial. These are elongated, limbless, carnivorous reptiles of the suborder Serpentes. Like all other squamates, snakes are ectothermic, amniote vertebrates covered in overlapping scales. Many species of snakes have skulls with several more joints than their lizard ancestors, enabling them to swallow prey much larger than their heads (cranial kinesis). In order to accommodate their narrow bodies, their paired internal organs (such as kidneys) appear one in front of the other instead of side by side, and most have only one functional lung. Where as on the other hand Lizards have evolved independently have elongate bodies without limbs or with greatly reduced limbs at least twenty-five times via convergent evolution as a result leading to many legless lizards [1]. These limbless lizards resembles to snakes, but several legless lizards have eyelids and external ears, which snakes lack, although this rule of differentiation is not universal.

Snakes are found on every continent except Antarctica and on most smaller land masses; exceptions include some large islands, such as Ireland, Iceland, Greenland, the Hawaiian archipelago, and the islands of

New Zealand, as well as many small islands of the Atlantic and central Pacific oceans [2]. Moreover sea snakes are widespread throughout the Indian and Pacific oceans. There are thirty families of snakes currently recognized, comprising about 520 genera and about 3,900 species [3]. The size of snakes ranges from 10.4 cm-long i.e Barbados thread snake to the reticulated python of 7.5 meters (22.8 ft. approximately) in length. Whereas fossil species *Titanoboa cerrejonensis* was 12.8 meters (42 ft) long [4].

The snakes have been generally categorised as poisonous and non poisonous. Venomous and poisonous animals are a considerable origin of global morbidity and mortality. There are about 216 species of snakes identifiable in India, of which 52 are known poisonous. The major families of snakes in India are Elapidae which includes common cobra (*Naja naja*), king cobra and common krait (*Bungarus caeruleus*), Viperidae includes Russell's Viper, saw scaled Viper (*Echis carinatus*) and Pit Viper and hydrophidae (the sea snakes) [5].

Snake bite causes great morbidity and mortality in developing countries. Long rainy season, agriculture predominant occupations, rural background, and population using paths traversing rural and forest lands

makes people prone to snake bites [6]. 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 [7]. This may result in redness, swelling, and severe pain at the area, which may take up to an hour to appear. Vomiting, blurred vision, tingling of the limbs, and sweating may result. Most bites are on the hands, arms, or legs. Fear following a bite is common with symptoms of a racing heart and feeling faint [7]. The venom may cause bleeding, kidney failure, a severe allergic reaction, tissue death around the bite, or breathing problems. Bites may result in the loss of a limb or other chronic problems or even death [8].

The outcome depends on the type of snake, the area of the body bitten, the amount of snake venom injected, the general health of the person bitten and whether or not anti-venom serum has been administered by a doctor in a timely manner [9].

Symptoms of Snake Bite

Most snakebites happen on the arms, wrists or hands and feet. Typical symptoms of a nonvenomous snakebite are pain, injury and scratches at the site of the bite. After a venomous snakebite, there usually is serious pain and tenderness at the site. This can worsen to swelling and bruising at the site and all the way up the arm or leg. Other symptoms are nausea, labored breathing and feelings of weakness, as well as an odd taste in the mouth.

Some snakes, such as coral snakes, have toxins that affect the brain and nerves. This can cause symptoms such as upper eyelid drooping, tingling fingers or toes, difficulty swallowing, and muscle weakness. Sometimes, a venomous snake can bite without injecting venom. This is called a dry bite.

Immediate Response

- After incident, p call local emergency number, if possible, take these steps while waiting for medical help:
- Move far away from the snake.
- Stay still and calm.
- Remove any jewelry, watches or tight clothing before swelling starts.
- Sit or lie down so that the bite is in a neutral, comfortable position.
- Clean the bite with soap and water. Cover or wrap it loosely with a clean, dry bandage.

What to avoid

- Don't tie off the bite area, called using a tourniquet, or apply ice.
- Don't cut the bite or try to remove the venom.
- Don't drink caffeine or alcohol.

Don't take pain-relieving medicine, such as aspirin, ibuprofen (Advil, Motrin IB, others) or naproxen sodium (Aleve). Doing so can increase your risk of bleeding.

Don't try to catch or trap the snake. Try to remember its color and shape so that you can describe it. If possible, take a picture of the snake from a safe distance. Knowing what kind of snake bit you can help with treatment.

Rural communities in tropical countries are worst affected. Agricultural workers, hunter-gatherers, herders, fishermen, and rural families living in precarious housing conditions with outdoor toilets have a higher risk of snakebite. Their living environments intersect with snake habitats. Men between 10 and 40 years are more commonly affected. Non-mechanised farming techniques, barefoot farming, and sleeping on the floor further increase the risk. Bites are more common during wetter months, when agricultural activities and breeding season for snakes potentially converge [10].

Patients ist reaction after Snake bite

Patients usually give a history of being bitten by a snake, except those who experience painless nocturnal bites by kraits while asleep. Patients are often fearful and anxious. Occasionally, painful bites may be mistaken for a puncture wound from a thorn or sharp stone and be ignored initially. Some patients, especially children, bitten by highly venomous snakes, may present with cardiovascular collapse, unconsciousness, bleeding, paralysis, or respiratory failure and may not provide a clear history of snakebite. It is important to consider envenoming in these situations in regions where snakebites are common.

Nausea, vomiting, abdominal pain, and headache are non-specific symptoms but must be monitored as these may herald serious complications such as uraemia, acute pituitary or intracranial bleeds, and anaphylaxis [11].

Clinical effects of Snake Bite

Not all people with a snakebite have clinical symptoms. Often bites are by non-venomous snakes. Sometimes venomous snakes do not inject venom during a bite [12].

Clinical manifestations vary between species of snakes. Some toxins in venom exert local effects such as swelling, blistering, bruising, and necrosis at the bite site. Other toxins can be distributed systemically through lymphatics and blood vessels and act at distant sites. Common systemic effects include bleeding, paralysis, generalised rhabdomyolysis, and acute kidney injury. Venom injection deep into a limb can cause tissue swelling in the tightly constrained space and

compromise neurovascular function. This manifests as “acute compartment syndrome [13].

- a) Bite site—Swelling, blistering, bruising, necrosis (usual after bites by cobras and vipers, with some exceptions in each family, and burrowing).
- b) Acute compartment syndrome after deep bite into a limb—Intense pain, abnormal sensations, or a cold, pulseless, immobile limb.
- c) Venom ophthalmia from entry of venom droplets or spray into the eyes—Intense pain, redness, blepharitis, blepharospasm, and corneal erosions.

Systemic effects

- a) Vascular—Envenoming by most viperid and Australopapuan elapid species and some non-front-fanged colubroids can trigger clotting failure, platelet abnormalities, and vessel wall damage. Effects range from clotting test abnormalities to mild bite site or mucosal bleeds to severe spontaneous systemic or intracranial haemorrhage.
- b) Shock—From bleeding or plasma extravasation systemically or into the swollen, bitten limb, myocardial dysfunction, pituitary bleeds, vasodilation, sepsis, and anaphylaxis.
- c) Neuromuscular—Most elapid and some viperid venoms can cause paralysis by action at the nerve (presynaptic) or muscle fibre (postsynaptic) of the neuromuscular junction. Weakness of eye muscles initially present as ptosis, diplopia, and blurred vision. This is followed by sequential weakness of bulbar (dysphagia, dysphonia, and drooling), neck, respiratory, and limb muscles.
- d) Generalised muscle destruction is caused by envenoming by sea snakes and some elapid and viperid species. This manifests as muscle pain and tenderness, especially of the neck, trunk, and proximal limbs with dark urine.
- e) Acute kidney injury likely results from secondary effects such as hypotension, fibrin-platelet microthrombi in capillaries and arterioles, and immune or haem related tubular damage, or directly from effect of venom [14].

Management of Snake Bite

Ist Aid

Reassure the person about prompt first aid and medical assistance to allay fears. Arrange for rapid transport to the nearest medical facility, preferably with access to antivenom and critical care support.

Immobilise the person, and especially the bitten limb to slow venom spread. Remove rings and other tight objects around the limb. A systematic review identified pressure immobilisation with an elastic bandage or pad (at a comfortable pressure) at the bite site as an effective first aid measure to slow venom spread, but the quality

of evidence was very low. Its use is variable, and it is discouraged in most practice and guidelines because of the uncertainty of benefit and possibility of worsening local tissue damage [15].

However, pressure immobilisation is generally recommended for neurotoxic elapid bites in some regions. Its clinical efficacy and risk of worsening soft tissue injury in local envenoming have not been adequately assessed. A small study (15 patients) in Myanmar found that pressure pads were effective in reducing venom spread in Russell’s viper bite, and local effects after pad application were no more severe than those before treatment [16].

Tourniquets can cause severe local damage and gangrene and must not be used. It is common for communities to resort to traditional therapies such as wound incisions, cauterisation, and application of herbs, minerals, or animal excrement. These can delay access to effective treatment and may cause more harm. Irrigate eyes with copious amounts of water if there is exposure to venom [16].

Initial Treatment and what to cover:

Rural and remote primary care centres are often the first point of medical aid for people with a snakebite. Laboratory and intensive care services at such facilities are often limited. A competent clinical assessment is vital to guide management and referral decisions.

Snakebite envenoming can quickly worsen into a life-threatening emergency. Assess vital parameters to identify if the patient is critical or at risk for shock, respiratory failure, and cardiac arrest [11]. Published severity scores for snakebite are unreliable. The Glasgow coma scale score and pupillary reactions can be misleading in patients with advanced paralysis who are unable to open their eyes or respond to painful stimuli and should be avoided in these circumstances.

History:

Reassure clinically stable patients. Ask about their symptoms to determine the presence, nature, and extent of envenoming. Details about the site, circumstances, and timing of the bite can reflect distinctive features of epidemiology, habitats, and periods of activity of medically important snakes locally and help infer likely biting-species.

Inquire about medications, substance use, and comorbidities as these can influence diagnosis and outcomes. Recent ethanol or recreational drug use may modify presenting symptoms. Antiplatelets or anticoagulants may worsen bleeding and interfere with key blood tests. Shock in patients with pre-existing coronary artery disease can precipitate a myocardial infarction.

Examination

Bite site—Look for fang marks, retained fangs, bleeding, swelling, bruising, discoloration, and blisters. Fang marks do not confirm snakebite since bites by lizards, fish, rodents, large spiders, and some insects and thorns also leave paired punctures. Their absence does not preclude envenoming, as many snake species produce faint or undetectable bites [11]. Raised vertical, red, tender streaks on the bitten limb suggest lymphangitis.^{3 24 25} Regional lymph nodes may be enlarged and tender with bruised overlying skin [11]. Note any tourniquets, ligatures, wound incisions or cauterisation, and local traditional remedies as these may lead to specific complications requiring management. For instance, tourniquets and ligatures, if left on for long, can cause severe local damage including ischaemia, necrosis, and gangrene. Similarly, incisions and local applications can lead to local bacterial infections, sepsis, and tetanus [17].

Systemic examination:

Look for signs of coagulopathy such as subconjunctival, retinal, nasal, and gingivobuccal bleeds, ecchymoses and internal haemorrhage (such as intracranial, pericardial, pleural, and retroperitoneal). Assess extraocular movements, bulbar function, and muscle power. Look for ptosis, muscle tenderness, and jaw stiffness. Jaw stiffness is a prominent but often overlooked feature in sea snake envenoming that, unlike trismus, can be reduced by sustained pressure on the lower jaw [18].

Identifying snake species:

Occasionally patients or accompanying persons may bring the killed snake or photograph of snake for identification or have a picture of it. A herpetologist can be consulted to help identify the species [19]. Identification of snakes based on description by victims or recognition from pictures is often unreliable. Identifying biting-species helps avoid unnecessary antivenom in patients bitten by non-venomous snakes or by species whose venoms are not neutralised by available products. It can help select appropriate antivenom in countries with products specific against single species and anticipate clinical progression. However, delaying emergency treatment until the species is identified is unnecessary.

Knowledge of local snake species, comparison of clinical effects in the patient against established species-specific syndromes, and consideration of the circumstances and timing of the incident can help infer likely biting species. This approach is widely used to guide treatment with polyspecific antivenom in endemic areas of Africa and Asia. Snake identification tests based on venom antigen are valuable research tools but are currently unavailable for routine clinical use except in Australia [20].

Test to be Conducted

What tests can be performed?

A baseline 20-minute whole blood clotting test (20WBCT) to screen for coagulopathy in patients without overt bleeding. The 20WBCT is a simple, rapid, and inexpensive bedside test to screen for and monitor coagulopathy in areas with limited access to emergency laboratory facilities. Collect a sample of venous blood from the patient and place a few millilitres into a clean dry test tube. Leave it undisturbed for 20 minutes at ambient temperature. Unclothed blood that runs out or a friable clot that readily breaks down on tipping the tube once at 20 minutes indicates a possible clotting disorder [21].

Besides, additional tests might include a complete blood count, coagulation studies, and biochemical assays including creatinine phosphokinase (CPK), serum creatinine, blood urea, and electrolytes. A low haematocrit usually occurs with blood loss. Higher than normal values may indicate haemoconcentration from systemic plasma extravasation. Peripheral neutrophilic leucocytosis represents a general inflammatory response and confirms systemic envenoming. Severe thrombocytopenia contributes to bleeding diatheses. It may indicate microangiopathic haemolysis when accompanied by schistocytes in the blood film and acute kidney injury. Prothrombin and activated partial thromboplastin times, D dimer, fibrinogen, and fibrin degradation products are more sensitive indicators of venom induced clotting disturbances. Blood urea, serum creatinine, and electrolyte concentrations help screen and monitor acute kidney injury. CPK levels above 10 000 units/L indicate severe rhabdomyolysis. Unexplained hypoglycaemia (venous blood glucose <55 mg/dL) can be an important clue to acute hypopituitarism following snake envenoming [22].

Admit all snakebite patients for observation for a minimum of 24 hours. The onset of symptoms may be delayed but can worsen rapidly. Inform patients and/or their relatives about potential complications, treatment, and critical-care measures using simple language, after emergency medical stabilisation. If required, explain the need for referral clearly.

Promptly manage airway obstruction, respiratory paralysis, and shock by restoring airway, oxygen, intubation, and assisted ventilation as needed, and intravenous fluids. Choose sites of venous access such as the hands, wrists, and in some cases the feet where haemostasis by external pressure is most likely to succeed. Avoid central venous or arterial punctures before establishing a negative 20WBCT. Ensure that an intravenous line and resuscitation facilities are in place before releasing tourniquets, since this may trigger pronounced clinical deterioration. Avoid aspirin or other NSAIDs to control pain as they can exacerbate bleeding diathesis [23]. It is important to monitor vital parameters

and urine output at regular intervals in all patients. The 20WBCT can be repeated as it is sometimes negative initially, and coagulopathy may be detected later.

Treatment

Neostigmine with atropine is a potentially useful adjunct in patients bitten by snakes such as some cobras with postsynaptic neurotoxins in their venom. Its use must never delay or preclude antivenom treatment or intubation.

Administer a tetanus toxoid booster in all patients except in those with coagulopathy, in which case injection is postponed until haemostasis is achieved. Aspirate large tense bullae to facilitate nursing the bitten limb, pre-empt spontaneous rupture, and prevent secondary infection. Broad spectrum antibiotics are indicated only if the wound has been incised or there are signs of necrosis, wound infection, or abscess formation. Surgical debridement or amputation of gangrenous digits or limbs and skin grafting may be needed [24]. Besides antivenoms are whole or fragmented immunoglobulins fractionated from the plasma of domesticated animals hyper-immunised with venom from one or more snake species over variable periods. They are highly specific and will neutralise only the venoms used in their production and those of a few closely related species. Polyspecific antivenoms are raised against a mixture of venoms from more than one species. Antivenoms raised against venom from a single species are monospecific [24].

Early administration of antivenom prevents or limits haemodynamic alterations, progression of coagulopathy to clinically overt bleeding, postsynaptic neurotoxicity, myotoxicity, acute kidney injury, and local tissue damage. Physiological levels of clotting factors are at least partially restored within a median of six hours with sufficient doses of specific antivenoms [25].

CONCLUSION

Victims of snake bite envenomation need a multidisciplinary team that understands the underlying pathophysiology and potential complications to avoid a delay in treatment. People with predisposed negativity towards snakes were not proponents of snake conservation. Fear, negativity, ambivalence towards, and ignorance about snakes and the need for snake conservation were strong indicators of the propensity to harm or kill snakes. Moreover, inappropriate perception and knowledge about snakes and snakebites may put people at increased risk of venomous snakebite. Therefore, intensive, pragmatic educational efforts focused on natural history and ecology of snakes and prevention of snakebite should be undertaken in communities and at schools and universities.

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