

Review Article**Perceptions on Indigenous Medicine, First Aid and Treatment of Snakebite among Sri Lankan Farmers***HMP Herath¹, BMHSK Banneheka², FMMT Marikar¹***Abstract**

Since snakebite is a serious public health concern in Asia, one of the most affected countries is Sri Lanka. The incidence, species variety, clinical symptoms, and management of snakebite in Asia, with a focus on Sri Lanka, are all covered in this review paper. Many of the venomous snake species found in Asia are abundant and diverse. Snake bites are a typical occurrence, especially in rural areas where farming and encounters between humans and snakes are common. Numerous snake species, including the dangerous Russell's viper and the spectacled cobra, are found in Sri Lanka specifically. Depending on the type of snake bitten and the amount of venom administered, different clinical symptoms might result from a snake bite. Pain, bruising, swelling, and systemic symptoms like nausea, vomiting, and paralysis are typical ones. Treatment that is given too slowly or not at all can result in fatal consequences. Antivenom delivery, wound care, and supportive measures are all essential components of managing snake bite cases effectively. However, obstacles including a lack of access to medical facilities and less availability of antivenom sometimes make it difficult to get treatment quickly, particularly in isolated places and concern about indigenous treatment as well. Public awareness campaigns, better healthcare facilities, and epidemiology research are only a few of the measures taken against snakebite in Sri Lanka. To lessen the number of snakebites in, government institutions, medical professionals, and international organizations must work together. Better antivenom medicines and improved preventive and treatment plans for snakebite in this area require more study and funding.

Keywords: Snakebite, treatment, Sri Lanka, Ayurvedic

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Introduction

Snakebite is one of the most neglected public health issues in poor rural communities living in the tropics. Because of serious misreporting, the true worldwide burden of snake bite is not known. South Asia is the world's most heavily affected region, due to its high population density, widespread agricultural activities, numerous venomous snake species and lack of functional snake bite control programs. Snake-bites are well-known medical emergencies in many parts of the world, especially in rural areas. Globally, most affected by snake-bites are the rural communities in tropical countries, children (30-50%), young

agricultural workers and indigenous peoples¹. The global estimated data on snake-bite morbidity and mortality has widespread agreement (Table 1).

Table1: Global estimates of snakebite¹

| Area | Bites | Envenoming | Deaths |
|----------|--------------|-------------------|--------------|
| Americas | 500 000 | 200 000 (40%) | 4000 (02%) |
| Africa | 1 million | 400 000 (40%) | 20 000 (05%) |
| Asia | 3 million | 1.2 million (40%) | 60 000 (05%) |
| Oceania | 5000 | 2500 (50%) | 250 (10%) |
| Total | >4.5 million | ~ 2 million | >80 000 |

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South Asia is by far the most affected region. India has the highest number of deaths due to snake bites in the world with 35,000–50,000 people dying per year according to World Health Organization (WHO) direct estimates². In Pakistan, 40,000 bites are reported annually, which result in up to 8,200 fatalities. In Nepal, more than 20,000 cases of envenoming occur each year, with 1,000 recorded deaths. In Sri Lanka, around 33,000 envenomed snake bite victims are reported annually from government hospitals. Surveys in rural Sri Lanka showed that hospital data records less than half of the deaths occurring due to snakebite³.

Jayawardana et al.⁴ showed that the estimated annual mortality rate due to snake bite in Sri Lanka is the highest in the world. In Sri Lanka the annual death rate is 6/100,000 population. In Pakistan it is 1.9/100,000 population. In India the reported annual mortality is 5.4/100,000 population. In Myanmar (Burma) snake bite has been the fifth most common cause of death (3.3/100,000 population).

Prevalence of Snakebite in Sri Lanka

Despite the fact that individual cases are reported from urban and suburban areas, the majority of the cases are being reported from the Dry Zone of the country. Much of the country's agriculture takes place in the dry zones; therefore, the loss of habitat for wildlife, including snakes, thus an increase in the interaction between humans and snakes. In the dry zone, more venomous snakes are found⁵.

Among many species of snakes in Sri Lanka, only 6 are medically important. They are Russell's viper (*Daboia russelli russelli*), cobra (*Naja naja*), the kraits (*Bungarus caeruleus* and *Bungarus ceylonicus*), saw-scaled viper (*Echis carinatus*) and hump-nosed viper (*Hypnalehypnale*). Most of the morbidity and mortality is caused by the highly venomous Russell's viper, cobra, and krait bites. Other species are either mildly venomous or non-venomous, where bites never cause systemic envenoming or death⁶.

Snake Venom

Snake bites are common in Sri Lanka. Although the majority of land snakes are non-venomous and do not have fangs, venom glands or venom. Venomous snakes are distinguished from non-venomous species by the presence of a pair of cephalic glands, which produce venom and enlarged Maxillary teeth called fangs. The snake

bite venom contains powerful tissue - destroying agents and toxins which are mainly directed against nerve and vascular tissue⁷. Contains low molecular weight polypeptides, enzymes such as proteases, esterases, phospholipases, hyaluronidases, nucleotidases and lecithinases and biologically active amines such as serotonin. The effects are procoagulant activity, haemorrhagins, cytotoxins and neurotoxins (phospholipases A₂)^{8,9}. In areas of the world where snake bite is most common, the rural tropics victims of snake bite rarely go to the hospital. They prefer treatment from the native/local doctor¹⁰.

Epidemiology and Risk Habits of Venomous Snakes in Sri Lanka

Russell's Viper: It has a well-developed dentition and venom apparatus suitable for inflicting a deadly bite. It causes severe systemic envenoming causing even death and responsible for 48% and 14% of snake bite admissions to territory care hospitals and peripheral hospitals respectively. These snakes frequently bite paddy farmers living in the dry zones of Sri Lanka and it appears to be an occupational hazard to farming community. Russell's vipers are widely distributed in the country. It is a nocturnal terrestrial snake. Most bites are inflicted at dusk or night on foot paths or on main roads. A fair number of bites occur while harvesting during the daytime.

It can inflict a very effective bite causing and envenoming rate of 98%. Most of the time it escapes after a bite and the offending snake is available only in 21% of the cases for identification at the hospital. Incidence of bite is common among young males especially in the fourth decade of their life. Russell's viper bites occur throughout the year with two peaks corresponding to agricultural activities. The highest peak is noticed between the months of March-April during the paddy harvesting time and the next peaks from October to November at the time of sowing. Envenoming produces a wide array of effects such as bleeding and coagulation dysfunction, hemolysis, neurotoxicity, acute renal failure, hypokalemia, myocardial dysfunction and cardiogenic shock and severe local swelling¹¹.

Common Krait: The common krait is a nocturnal terrestrial snake. It is commonly uncounted in human habitations. The highest incidence of its bites in Sri Lanka is reported from the North Central Province (NCP), where the vegetation and climate provide an ideal habitat for snakes.

Common victims of common krait are farmers who live in open wattle-and-daub houses and farmers sleeping in watch huts in agricultural fields. It creeps in to houses over the grounds or through the roof exhibiting arboreal tendencies. Currently, it accounts for 9% of all snake bite admissions to the general hospital at Anuradhapura. Incidence of common krait bites increase in rains. Abdominal pain is the first symptom of krait bite. Neurotoxic actions and respiratory muscle paralysis occur. Level of consciousness may deteriorate to reversible deep coma which mimics brain death. Autonomic dysfunction and hypokalemia are observed¹².

Cobra: The cobra is widely distributed in the island from coastal plains up to an elevation of about 1500m. It is found commonly common to human dwellings. The cobra is diurnal a terrestrial snake. However, some nocturnal bites are not uncommon. Bite produces severe tissue necrosis. Acute onset of respiratory muscle paralysis may manifest in some patients¹³.

Ceylon Krait: It is an endemic snake, found mainly in the wet zone of the Island. The snake creeps into human dwellings in the night but rarely bites. The venom is a neurotoxin called bungarotoxin which produces rapid neuromuscular paralysis. Victim could die due to respiratory muscle paralysis¹⁴.

Saw Scaled Viper: The monthly distribution of probable cases and confirmed cases showed similar patterns. Bites were minimal in June to August (the dry and hot season) with a sharp rise during the northeast monsoon rainy season, particularly in January¹⁵. Saw scaled viper bites are usually on the fingers or the feet and toes of victims, commonly producing local swelling and occasionally blistering and necrosis at the site of the bite. The commonest systemic manifestation is coagulopathy (in-coagulable blood detected by the 20WBCT). A small percentage of patients develop spontaneous bleeding manifested by bleeding from the gums, haematemesis, haemoptysis or haematuria. Acute kidney injuries are reported rarely. There are no neurological manifestations caused by direct action of venom.

Hump Nosed Viper: It is a nocturnal terrestrial snake that hides under the leaf litter, underneath rubber, stones and logs and undergrowth during the day. It is widely distributed in Sri Lanka from the plains to high mountains. It is common in plantations such as rubber, coconut, coffee, cocoa,

and species. It accounts for the highest incidence (28%) of venomous snake bites in Sri Lanka. Being a small snake (average 30cm) the most vulnerable anatomical parts of the body area below the ankles and fingers. Bite produces severe local swelling commonly with hemorrhagic blisters. A small number of patients develops complications such as coagulopathy and acute renal failure. Death may occur due to DIC, multiple organ failure and severe renal cortical necrosis¹⁶.

Myths About Snakebite among Sri Lankan Community

Myth - The 'Gerandaya' (Rat snake) and 'Diya bariya' (Checked Keel backs) are the meanest of all snakes. Hence if they bite a person, no other snake will bite the individual again.

Reality - The 'meanest' reputation must be due to their high abundance in anthropogenic habitats and their habit of hasty escaping when encountered. Although Rat snakes and checked keel backs are non-venomous, their bites are fierce and savage if improperly handled or caught. But other than the wounds, no envenomation features occur, and personal experience confirms that after their bites, other snake bites are not reduced at all¹⁷.

Myth - When a Cat snake ('Nidi Mapila') bites, the victim dies in sleep.

Reality - The Sri Lanka cat snake or the 'Nidi mapila' has got its name (Nidi = Sleeping) due to its inactive behavior during the daytime. Because the snake is a nocturnal species, it spends most of the daytime hiding and resting. Thus the 'Nidi' part implies its habit but not that it can kill a person in sleep¹⁷.

Myth - 'Mapilas' or Cat snakes stay in packs of seven, and when one is killed the others come to take revenge.

Reality - Unlike most of the other Sri Lankan snakes, the cat snakes are partially 'social' animals. They sometimes stay in groups. This social behavior helps them to protect themselves from their enemies and to reproduce easily. Members of a group identify their allies from a pheromone they emit. So that if one is killed, there is a possibility for the others to come near the carcass due to this pheromone. But the revenge part is not believable¹⁷.

Myth - The 'Le mapilas' hang from the ceiling one after the other in a chain-like form, and like

'vampires' suck blood from sleeping humans. The one nearest to the sleeping person will bite the toe of the human and suck the blood, which will be passed all the way to the seventh one through the others.

Reality - 'Le mapila' is a color variation of *Boiga forsteni* and it has a reddish body colour. The word 'Le', meaning blood in Sinhala, has been used due to the body colour. No snake in Sri Lanka is capable of sucking and drinking blood. In fact, as Cat snakes are rear-fanged it is impossible even to make an effective bite. But all cat snakes have prehensile tails from which they can hang. This serves to protect the snake, as the tail prevents it from falling from high elevations if a target is missed when hunting in high places¹⁷.

Myth - The famous 'Ahaetulla' is thought to be plucking eyes of humans.

Reality - 'Ahatullas' (*Ahaetulla nasutus*) are mildly venomous snakes. Because of their arboreal habits, the most vulnerable area of a person to get a bite is the upper body including the face. No such incident of 'eye-plucking' has ever been recorded¹⁷.

Ancient Ayurvedic, Ahikuntaka, Sidda and Unani literature and medical systems provide strong evidence. That ancient Sri Lankan people knew about the colubrid snakes, and most indigenous medical systems describe the characteristics and treatments to their bites. In almost all ancient local literature, most of these snakes are deadly venomous, and in one such article by Seneviratne et al., 2012 it is said that 'Mapilas' are the most venomous and the most dangerous snakes in the country, harming the innocent people¹⁷.

Management Steps of Snakebite in South Asia

First aid is essential in snakebite: Following a snake bite immediate hospitalization is essential. Following correct first aid measures is also equally important. By using correct first aid we can prevent patients from getting into serious complications and it will help to save lives. On the other hand, following wrong first aid techniques may cause increased envenoming and may harm the victim. First aid should be carried out immediately or very soon after the bite. It can be performed by the snake bite victim himself/herself or by anyone else who is present. The use of correct first aid immediately after snakebite has the potential to significantly delay the development of systemic envenomation.

Unfortunately, most of the traditional, popular, available and affordable first aid methods have proved to be useless or even frankly dangerous¹⁸. Snake bites account for approximately 125,000 deaths annually worldwide¹⁹.

Aims of first aid: Attempt to retard systemic absorption of venom. Preserve life and prevent complications before the patient can receive medical care. Control distressing and dangerous early symptoms of envenoming. Arrange transport of the patient to a place where medical care is available. But most traditional first aid methods cause harm for victim²⁰. Some people don't know about correct first-aid measures. So, they are doing some wrong first aid actions. These wrong actions are very harmful. Also, people should pay attention about preventing snake bites and minimizing risk factors associated with snakebites.

Different types of first aid for snakebite: Most traditional first aid methods should be discouraged: they do more harm than good⁵. Unfortunately, most of the traditional, popular, available and affordable first aid methods have proved to be useless or even frankly dangerous. These methods include making local incisions or pricks at the site of the bite or in the bitten limb, attempts to suck the venom out of the wound, use of (black) snake stones, tying tight bands (tourniquets) around the limb, electric shock, topical instillation or application of chemicals, herbs or ice packs. Local people may have great confidence in traditional (herbal) treatments, but they must not be allowed to delay medical treatment or to do harm.

Wound scarification: Up until the late 1970's it was commonly believed that wound scarification could be helpful in removing venom from the body of a victim of snakebite. These were the use of incision (cutting through the bite marks to promote bleeding) or excision (the pinching up of the skin around the bite and completely cutting out the piece of flesh). This is a harmful first aid⁵. Although sterile scalpels or razor blades are the commonly suggested tools, the reality is that under actual field conditions people tend to be very ingenious and everything from broken glass, rusty pieces of tin cans, knives, wood-working chisels and gardening clippers have been used. Venom is rarely injected directly into the bloodstream. In most cases it is injected into fat or muscle tissue and is taken up and spread by the lymphatic system. It is highly unlikely

that venomous is effectively removed because of scarification. Serious local trauma to tendons, ligaments, blood vessels and musculature; people bitten by non-venomous snakes have suffered serious disfiguring injuries by having tendons cut during first aid. There is also a very high risk of secondary infection, including tetanus²¹.

Tourniquet and ligature use: The use of tourniquets or improvised ligatures in the treatment of snakebite remains common throughout the world, despite overwhelming evidence that indicates that these techniques are both ineffective for practical use, and potentially dangerous. Variety of materials including string/rope, wire, strong grass strands, bicycle inner tubes and packing straps. Tourniquets and ligatures can play an important role in the control of blood loss and are used in situations such as accidental amputation where catastrophic hemorrhage may lead to sudden death. Using a tourniquet or rope ligature to severely restrict venous return is potentially dangerous and has limited efficacy in the treatment of snakebite²².

Direct suction: In general, suction is contraindicated because venom absorption in the oral cavity of the first aid provider may result in there being two snakebite victims instead of just one. Oral bacteria can be transferred into the wound and may cause secondary infection. Suction is ineffective at removing all the injected venom, and the local stimulation caused by the application of suction may enhance the absorption of venom into the systemic circulation²³. The first principle of first aid is to “do the patient no harm”. For most of the numerous first aid treatments for snakebite suggested over the years, this maximum appears to have been ignored. The World Health Organization and the International Programme on Chemical Safety convened a Working Group on Natural Toxins (WGONT) which developed general guidelines for the management of all venomous bites and stings. Certain common forms of first aid for snakebite are now considered either useless, or more often, hazardous, and should not be used. Amongst these obsolete methods are incision, suction by mouth, excision, use of topical chemicals (e.g., Condy’s crystals), tourniquets, folklore medicines and patent cures, alcohol, vigorous exercise and electric shock treatment. The general recommendation of the WGONT was that immobilization and elevation of the bitten limb using a splint and keeping the patient as inactive as possible are the only universally described

applicable methods of first aid. Reassurance of the victim is also the most important²⁴.

Recommended first aid methods:

1. Reassure the victim who may be very anxious.
2. Immobilize the bitten limb with a splint or a sling (any movement or muscular contraction increases absorption of venom into the bloodstream and lymphatic’s)
3. Consider pressure-immobilization for some elapid bites.
4. Avoid any interference with the bite wound as this may introduce infection, increase absorption of the venom and increase local bleeding.

As far as the snake is concerned, do not attempt to kill it as this may be dangerous. However, if the snake has already been killed, it should be taken to the dispensary or hospital with the patient so that the species could be identified. Snakebite first aid recommendations vary, in part because different snakes have different types of venom. Some have little local effect, but life-threatening systemic effects, in which case containing the venom in the region of the bite by pressure immobilization is highly desirable. Other venoms instigate localized tissue damage around the bitten area, and immobilization may increase the severity of the damage in this area, but also reduce the total area affected; whether this trade-off is desirable remains a point of controversy²⁵.

Transport to the hospital: The affected patient must be transported to a place where they can receive medical care as quickly, but safely and comfortably as possible. Bitten limbs must be absolutely reduced the movements’ causes to minimize systemic absorption of venom. Any muscular contractions will increase this spread of venom from the site of the bite.

Pressure bandaging and immobilization (PBI): This technique is a highly successful first aid method in snake bites²⁶. It is well known that many substances, including hormones and immune system proteins are transported around the body in the lymphatic system. Snake venom toxins are also transported from the periphery to the rest of the body via the lymphatic system, and several experiments have shown that venom proteins reach high concentrations in the regional lymph nodes (lymphadenopathy is a common early sign

Table 1: Recommended first aid methods²³

| Snake | Scientific name | Distribution | Lethality | Venom effects | First aid |
|----------------|------------------------|-------------------------|------------------|---------------|-----------|
| Kraits | <i>Bungarus spp</i> | East Asia | Severe | N | BI |
| | <i>Bungurus cey</i> | Sri Lanka | Severe | N | BI |
| Coral snakes | <i>Calliophis spp</i> | East Asia | Mild | ? | BI |
| Indian cobra | <i>NajaNaja India</i> | Adjacent areas | Severe | N, A | BI |
| Russells viper | <i>Vipera russelli</i> | India to Southeast Asia | Severe | L, G, M | I |
| Humpnose.vip | <i>Hypnale spp.</i> | Sri Lanka, India | Mild to Moderate | R, S | I |

A = cardio toxic; C = coagulopathy; G = local tissue necrosis; L = local tissue swelling damage; M = myolysis; N = neurotoxic paralysis; R = renal damage; S = shock; ? = conflicting information; I = immobilization; BI = pressure bandage and immobilization.

of envenomation). But many of them don't know about the relationship between the lymphatic system and envenoming.

Biological aspects of route of snake venom in the body and value of PBI: The current pressure-immobilization method of first aid for Australian snakebites was developed by Dr Struan Sutherland at CSL. It relies on the fact that the major toxic components of venom have a high molecular weight and are too large to cross through the capillaries into the bloodstream. Instead venom initially travels around the body via the low-pressure lymphatic system. Venom will eventually enter the bloodstream and move from there to the peripheral nervous system, where it blocks neuromuscular control, causing life threatening clinical effects²⁶.

Treatment if the bite is on the body, neck or head: Bites on the torso or on the head and neck are rare. The majority (about 70%) of snakebites occur in a lower limb, and most other bites (>25%) are on the hands or arms. This means that the method of pressure immobilization bandaging (PIB) discussed in the preceding paragraphs page will be suitable for more than 95% of all snakebite cases. If a person is unfortunate enough to be bitten on the body, or on the head or the neck, it is not practical to wrap them in a pressure bandage. A firm pad of cloth should be used as a substitute for PIB to apply direct pressure over the site of the snakebite, and this pressure must be maintained until the person reaches a medical care facility²⁷.

Methods of pressure immobilization: As soon as possible, a broad pressure bandage should be applied below the bite site, upward from the

affected limb (starting at the fingers or toes, bandaging upward as far as possible), leaving the tips of the fingers or toes un-bandaged to allow the victim's circulation to be checked. Pants or trousers should not be removed. simply bandage over the top of the clothing.

1. Bandage firmly as for a sprained ankle, but not so tight that circulation is prevented. Continue to bandage upward from the lower portion of the bitten limb.
2. Apply the bandage as far up the limb as possible to compress the lymphatic vessels.
3. It is vital now apply to a splint. Bind a stick or suitable rigid item over the initial bandage to splint the limb. Secure the splint to the bandaged limb by using another bandage (if another bandage is not available, use clothing strips or like bind). It is very important to keep the bitten limb still.
4. Bind the splint firmly, to as much of the limb as possible, to prevent muscle, limb and joint movement. This will help restrict venom movement. Then seek urgent medical assistance as first aid has been applied.

Problems with Traditional Treatments

Trim et al.²⁸ showed that in most developing countries up to 80% of the victims of snakebite first consulted their traditional practitioners before visiting any medical facility. From the field base study in Chitwan and Nawalparasi in Nepal, it was known that 56% victims consulted or depended upon traditional healers and only 12% used some first-aid measure before arrival at hospital and the rest directly presented to a hospital for treatment.

Most deaths (27%) in this region could be due to dependency on traditional healers who used traditional treatments such as tight tourniquets, local incision, suction, snake stone, herbal matters, vacuum extraction with the application of the anus of hens, thus delaying access to proper treatment center. The most severely affected occupational group was farmers (59%). Relating back to the ancient era, the treatment modalities for snakebite are well established in traditional medicine. The most popular traditional methods of treatment include herbal preparations, the use of snakestones and reciting charms of secret holy phrases ('mantras'). Nevertheless, many patients succumbed to death. Current treatment methods for snakebite in Sri Lanka include administration of the polyvalent anti-venom serum manufactured in India. A dramatic improvement in prognosis is achieved after treatment with the polyvalent anti venom. This has resulted in an increased demand for hospital care by the victims, without going to the traditional native practitioners¹⁰.

Studies on the distribution of snakebites by medically important snakes are hampered by difficulties in definitive species identification, because the snake is often not brought to hospital. In addition to the low proportion of snakes brought to hospital, there is differential killing of snakes. This is due partly to cultural and religious beliefs (cobras are rarely killed by Buddhists and Hindus) and partly to the snakes' biting habits (kraits often bite sleeping victims during the night making capture difficult). The ideal method for identifying biting species would be immune diagnosis, but this is not affordable for a developing country like Sri Lanka²⁹.

Tochie et al.³⁰ has shown that using of rubber boots is very essential method to prevent snake bites, especially in farming activities. Rubber boots were introduced to farmers nearly three decades ago but because of the inconvenience, these did not receive much attention. A few have a traditional belief that footwear is prohibited in the paddy field. However, some have been using available rubber boots, which do not withstand penetration of snake fangs (personal observations) at work. The main advantages of working with boots are ability to work for a longer time than before with comfort and the assurance of complete protection against snakebite, 100%.

Between 60 and 100% of first-aid measures

advocated differed significantly from published guidelines, including omissions of appropriate activities and commissions of recommending inappropriate treatment. Seven of the errors were felt to be common and serious omissions or misstatements that have the potential to cause harm to patients. The most common failing of the guidelines commonly used in Nepal was the omission of the World Health Organization (WHO) recommended first aid measures that include the application of a PBI or LCPI.

A simple and cost-effective public health education course given to Community Health Volunteers in Nepal reduced pediatrics' fatality rate by 61% over the past decade by promoting mothers to go to nearest health post if their baby gets ill. Similarly, snakebite mortality rate can be reduced by emendation of curriculum in school and universities, rapid transport of snakebite victim to and management at a hospital. The use of accurate published materials in the teaching of snakebite first-aid and subsequent snakebite management would likely further increase the appropriate management of snakebite and reduce its morbidity and mortality.

Snakebite as an Occupational Hazard

Ediriweera et al.³ reported from Anuradhapura district of Sri Lanka that Russell's viper (*Daboia russelii russelii*) bite is associated with a high incidence of morbidity and mortality in Sri Lanka. The male: female ratio was 5:1; 75% of patients were below the age of 40 years. Biting occurred mainly in paddy fields 41%, and on footpaths 29% at dusk or dawn. Rural dry zone paddy farmers are the common victims of Russell's viper bite in Sri Lanka and its' envenoming leads to diverse clinical manifestations. Out of the total snakebite admissions to the General Hospital, Anuradhapura, in the NCP of Sri Lanka, 48% are due to Russell's viper bite. 80% of the cases had some form of first aid before coming to hospital. 43% percent washed the site of bite with water. Tourniquets have been applied, above the site of bite without significant arterial occlusion to distal limb in 47%. However, five patients developed rapid systemic envenoming after removing the tourniquet in hospital. 3% had sought native treatment before admission to hospital. 16% were admitted to the General Hospital, Anuradhapura directly and the rest (67%) were transferred from a peripheral hospital after the initial treatment.

Improvement of Community Knowledge about First Aid and Preventive Measures of Snakebite

Community education to reduce the risk of bites is a better approach than the eradication of venomous snakes. It should be based on knowledge of the circumstances in which most bites occur, the preferred habitats of dangerous species, and their peak periods of activity i.e., time of the day, season, and climate. For example, people are bitten by kraits (genus *Bungarus*) in south Asia almost exclusively at night while lying asleep on the ground in their homes. Such distinctive epidemiology predicates a means of prevention. In a high-risk area of eastern Terai, Nepal, sleeping under a mosquito net afforded protection.⁶⁷ In tropical countries, most snake bites are on the lower legs and feet, but local attitudes to wearing protective footwear are highly ambivalent. In Burma, Russell's vipers are so common in the paddy fields that some farmers wear boots made of leather, plaited palm leaves, or woven grass for protection whereas others avoid this sensible practice for fear of provoking the snakes. Light-weight boots, impervious to snake fangs, were developed in Burma and proved to be acceptable and affordable³¹.

Prevention of Snakebite

Snakebite is an occupational hazard that is very difficult to avoid completely. However, attention to the following recommendations might reduce the number of accidents:

1. Know your local snakes, know the sort of places where they are likely to live and hide, know what time of year, at what time of the day/night or what kind of whether they are most likely to be active.
2. Be especially vigilant about snake bites after rains, during flooding harvest time and night.
3. Try to wear proper shoes or boots and long trousers, especially when walking in the dark or in the undergrowth.
4. Use a light (torch, lamp) when walking at night.
5. Avoid snakes as far as possible, including snakes performing for snake charmers. Never handle threatening or attack a snake and never intentionally trap or corner a snake in an enclosed space.
6. If possible, try to avoid sleeping on the ground.
7. Keep young children away from areas known to be snake infested.
8. Avoid or take great care handling dead snakes or snakes that appear to be dead.
9. Avoid having rubble, rubbish termite mounds or domestic animals close to human dwellings, as all of these attract snakes.
10. To prevent sea snake bites, fishermen should avoid touching sea snakes caught in nets and tails are not easily distinguishable. There is a risk of bites to bathers and hose washing clothes in muddy water of estuaries, river mouths and coastlines.

Frequently check houses for snakes and, if possible, avoid types of house constructions that will provide snakes with hiding places (e.g., thatched roofs with open eaves, mud and saw walls with large cracks and cavities, large, unsealed spaces beneath floorboards)³².

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