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# CONCEPTUAL STUDY OF SNAKE BITE AND ITS MANAGEMENT

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## ABSTRACT

Snake bite is a significant health concern, especially in rural populations of tropical and subtropical countries. In India, snake bites take a heavy toll of human lives, and therefore warrant urgent attention. High mortality is due to poor health services in rural areas and delay in getting the victim to a well-equipped health care facility, where anti snake venom can be administered. However, geographical and species variation, logistic, economic and production issues restrict the use of anti-snake venom. In India our ancestors were treating snake bite long before the invention of anti-venom. *Ayurveda* has various treatment modalities and herbs those were mentioned for venomous bite treatment. Though most of them are scientifically unsubstantiated, yet they cannot be glossed over due to their inherent advantages. They are practiced by diverse social groups for long, offering unconditional Benefits.

**KEYWORDS:** Snake bite, rural, antisnake venom, *Ayurveda*.

## INTRODUCTION

India is estimated to have the highest snakebite mortality in the world. World Health Organization (WHO) estimates place the number of bites to be 83,000 per annum with 11,000 deaths.1 Most of the fatalities are due to the victim not reaching the hospital in time where definite treatment can be administered. In addition community is also not well informed about the occupational risks and simple measures which can prevent the bite. It continues to adopt harmful first aid practices such as tourniquets, cutting and suction, etc. Studies reveal that primary care doctors do not treat snakebite patients mainly due to lack of confidence. 2

At the secondary and tertiary care level, multiple protocols are being followed for polyvalent anti-snake venom (ASV) administration, predominantly based on western textbooks.

Alexander the Great invaded India in 326 BC, and was greatly impressed by the skill of Indian physicians; especially in the treatment of snakebites. The impact of snake bite on human life can be understood by the fact that *Acharya Vaghbatt* named the whole branch of toxicology as *"Dranshtachikitsa"* (the treatment of bites). Since then, India has remained notorious for its venomous snakes and the effects of their bites.

In response, Government of India, Health and Family Welfare Department has prepared a National Snakebite Management Protocol to provide doctors and lay people with the best possible, evidence-based approach to deal with this problem in country.

**Incidence in india**

India: the numbers of snake-bite fatalities in India has long been controversial. Estimates as low as 61 507 bites and 1,124 deaths in 2006 and 76,948 bites and 1,359 deaths in 2007 [Government of India data: pp 107–108 of *http://cbhidghs.nic.in/writereaddata/mainlinkFile/Health%20 Status%20Indicators.pdf*) and as high as 50 000 deaths each year have een published. The Registrar-General of India's "Million Death Study", 001-2003, is expected to provide reliable evidence of substantial mortality (exceeding 50 000 per year) as it is based on Representative, Re-sampled, Routine Household Interview of Mortality with Medical Evaluation ("RHIME"), covering all age groups across the entire country with geographical, seasonal and occupational data. Previous studies included a field survey in randomly selected villages in Barddhaman (Burdwan) district, West Bengal that suggested that among the total population of nearly five million people, nearly 8 000 were bitten and 800 killed by snakes each year, an average incidence of 16.4 deaths/100 000/year (Hati et al., 1992). In Maharashtra State, between 1974-78, there were an average of 1 224 deaths/year (2.43 deaths/100 000/year). "The big four" medically important species had been considered to be *Naja naja, Bungarus caeruleus, Daboia russelii* and *Echis carinatus* but other species have now been proved important in particular areas, such as *Naja oxiana* (north-west), N. kaouthia (north-east), *Hypnale hypnale* (south-west coast and Western Ghats (Joseph et al., 2007)), *Echis carinatus sochureki* (Rajasthan) (Kochar et al., 2007) and *Trimeresurus malabaricus* (Hassan district, Mysore, Karnataka).

There are about 236 species of snakes in India, most of which are nonpoisonous. Their bites, apart from causing panic reaction and local injury, do not harm the patient. However, there are 13 known species that are poisonous and of these four, namely common cobra (*Naja naja*), Russell's viper (*Dabiola russelii*), saw-scaled viper (*Echis carinatus*) and common krait (*Bungarus caeruleus*) are highly venomous and believed to be responsible for most of the poisonous bites in India.4 However, this assumption of great four, has led to nonidentification of other poisonous species which are going unnoticed and leading to deaths. The recent discovery of the humpnosed pit viper, capable of causing life threatening symptoms has demonstrated this. This nonrecognition has led the ASV manufacturers to produce antivenom only against these four species only.5 Thus there is a need to abandon the old concept of "The Big Four" in order to determine all the medically significant species in India.

**Types of *Sarpa Damsha***

**According to Sushruta**

- *Sarpita*-deep punctured.
- *Radita*-superficial punctured with less venom injected.
- *Nirvisha*-non poisonous.

**According to Vagbhata**

- *Tundahata*-stained by Saliva.
- *Vyalidha*-one or two bite marks & nobleeding.
- *Vyalupta*-one or two bite marks & bleeding.
- *Dashtaka*-three marks accompanied withtearing of muscles.
- *Dashtanipidita*-four bitting marks.

**Sign and symptoms of snake bite**

**When venom has not been injected**

Some people who are bitten by snakes or suspect or imagine that they have been bitten, may develop quite striking symptoms and signs even when no venom has been injected. This results from an understandable fear of the consequences of a real venomous bite. Anxious people may over-breathe so that they develop pins and needles of the extremities, stiffness or tetany of their hands and feet and dizziness. Others may develop vasovagal shock after the bite or suspected bite-faintness and collapse with profound slowing of the heart. Others may

become highly agitated and irrational and may develop a wide range of misleading symptoms. Blood pressure and pulse rate may increase and there may be sweating and trembling. Another source of symptoms and signs not caused by snake venom is first aid and traditional treatments (Harris et al., 2010). Constricting bands or tourniquets may cause pain, swelling and congestion that suggest local envenoming. Ingested herbal remedies may cause vomiting. Instillation of irritant plant juices into the yes may cause conjunctivitis. Forcible insufflation of oils into the respiratory tract may lead to aspiration pneumonia, bronchospasm, ruptured ear drums and pneumothorax. Incisions, cauterization, immersion in scalding liquid and heating over a fire can result in devastating injuries.

**When venom has been injected**

Following the immediate pain of mechanical penetration of the skin by the snake's fangs, there may be increasing local pain (burning, bursting, throbbing) at the site of the bite, local swelling that gradually extends proximally up the bitten limb and tender, painful enlargement of the regional lymph nodes draining the site of the bite (in the groin-femoral or inguinal, following bites the lower limb; at the elbow – epitrochlear-or in the axilla following bites in the upper limb). However, bites by kraits, sea snakes and Philippine cobras may be virtually painless and may cause negligible local swelling. Someone who is sleeping may not even wake up when bitten by a krait and there may be no detectable fang marks or signs of local envenoming.

**Local symptoms and signs in the bitten part**

- fang marks
- local pain
- local bleeding
- bruising
- lymphangitis (raised red lines tracking up the bitten limb)
- lymph node enlargement
- inflammation (swelling, redness, heat)
- blistering
- local infection, abscess formation
- necrosis.

**Causes for Snakebite**

*Acharyas* have explained 8 reasons for *Sarpa Damsha.* They are *Bhaya, Krodha, Aaharartha, Pada sparsha, Ati vishat, Vairadhya, Papa karma, Deva-rishi-yama kopa.*

**Management In Ayurveda**

From the ancient times snakes were given due importance for their dreadful attitude. Starting from the vedic period up to *samhita* period and later on snakes were considered as most important among the animate poisons. In almost all the *samhitas* snakes possess special attention for their bite and its management. *Vedas* and *puranas* explained various types of snakes, their manifestations and treatment. The ancient healers of India were mainly belongs to the priest community and its influence can be seen on the treatment part also. The *vedic* methods for snake bite management mainly involves chanting of *mantras*, use of precious stones (*mani*) and meditation along with the use of some *divyaoushadhis.* Latter, in *Samhita* period when these methods became hard to practice for *vaidhyas*, the use of other methods and medicines became more popular. In *charak Samhitaacharya* mentioned about 24 types of treatment modalities which can be used for any type of poison. As primary measures, *arishtabandhan* (tourniquet application), *achushan* (suction), *nishpidan* (removal of poison by pressing), *raktamokshan*(bloodletting) are mentioned to check out the flow of poison in whole body. Once the superficial poison is removed, other measures like use of *prativisha* (antidotes) and other medicines for *pana* (internal use), *nasya*(nasal drops), *anjana*(collyrium) can be used for complete cure. During ancient times, some specific methods were in use for snake bite treatment like *upadhan, hrudayavaran,sangjayasthapan,* which are not commonly seen now a day. Though whatever may be the procedure adopted in treatment, the use of herbs for internal and external use cannot be neglected. Those ancient drugs drag the attention of today's researchers for their efficacy and usefulness. There is a huge collection of Indian medicinal plants used for treating snake bites.

**General treatment of Snake-bites**

In all cases of snake-bites ligatures of cloth, skin, soft fibre or any other soft article (consecrated with the proper *Mantras),* should first of all be bound four fingers a part above the seat of the bite in the event of its occurring in the extremities, inasmuch as such a proceeding would arrest the further (upward) course of the poison in the body. As an alternative, the seat of the bite should be incisioncd, bled and cauterized where such a ligature would be found to be impossible. Incision, cauterization, and sucking (of the poisoned blood

from the seat of the bite) should be highly recommended in all cases of snake-bites. The cavity of the mouth should be filled with a linen* before sucking (the blood from the wound). It would do the man bitten by a snake an immense good if he could bite the serpent that had bitten him or failing that, bite a clod of earth without any loss of time. 2-3. The seat of the bite by a *Mandali* snake should not; however, be cauterized inasmuch as the preponderant *Pittaja* character of the poison, aggravated by the application of the heat, might lead to its speedy expansion or coursing in the system.

**Mantras**

A physician well-versed in the Mantras of anti-venomous potency should bind a ligature of cord consecrated with appropriate *Mantras* which would arrest a further spread of the poison. The *Mantras* full of occult energy of perfect truth and divine communion, disclosed by the *Devarshis* and *Brahmarshis* of yore, never fail to eliminate the poison from the system, and hold their own even in cases of deadliest poisons. Elimination of the poison with the help of *Mantras*, full of the energy of *Brahmd*, of truth and austerities, is more rapid than under the effects of drugs. A man, while learning the *Mantras*, should forego sexual intercourse, animal diet, wine, honey, etc., should be self-controlled and clean in body and spirit and (before learning the *Mantras*) shall lie on a mattress of Kus'a-grass. For the successful application of his newly acquired knowledge (*Mantras* he shall devotedly worship the gods with offerings of perfumes, garlands of flowers, edibles, (animal) oblations, etc., and with the appropriate Mantras sacred to them as well as with burnt offerings, since a Mantra chanted by a man in an unclean spirit or body, or accented or uttered incorrectly will not take effect. The medicinal compounds of anti-venomous drugs should also be employed in such cases.

**Blood-letting in Snake-bite**

A skillful physician should open the veins round the seat of the bite and bleed the affected part. The veins of the fore-head and the extremities should be opened in the case where the poison would be found to have spread through the whole organism. The poison will be found to have been fully eliminated with the passage of the blood (from the incisioned wound). Hence bleeding should be resorted to as it is the best remedy in a case cf snake-bite.Plasters of anti-poisonous drugs (*Agada*) should be applied all round the seat of the bite after scarifying it. which should be sprikled with water mixed with (red) Sandal wood and *Us'ira* or with their decoction. The appropriate *Agada* compounds (according to the nature of the bite) should be administered through the medium of milk, honey and clarified butter, etc. In

the absence of these, the patient should be made to take (a solution of) the black earth of an ant-hill (dissolved in water).

As an alternative, (a paste of) *Koviddra*, *S'irisha*, *Arka* and *Katahhi* should be prescribed for him. The patient should not be allowed to take oil, the soup of *Kulatthapulse*, wine and *Sauviraka.* The patient should be made to vomit with the help of any other suitable liquid available, since vomiting in most cases leads to the elimination of the poison from the system.

**Stages of management**

The following steps or stages are often involved:

- First aid treatment
- Transport to hospital
- Rapid clinical assessment and resuscitation
- Detailed clinical assessment and species diagnosis
- Investigations/laboratory tests
- Antivenom treatment
- Observing the response to antivenom
- Deciding whether further dose(s) of antivenom are needed
- Supportive/ancillary treatment
- Treatment of the bitten part
- Rehabilitation
- Treatment of chronic complications

**First-aid treatment**

First-aid treatment is carried out immediately or very soon after the bite, before the patient reaches a dispensary or hospital. It can be performed by the snake-bite victim himself/herself or by anyone else who is present and able. 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/punctures (“tattooing”) 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.

**Venom composition**

More than 90% of snake venom (dry weight) is protein. Each venom contains more than a hundred different proteins: enzymes (constituting 80-90% of viperid and 25-70% of elapid venoms), non-enzymatic polypeptide toxins, and non-toxic proteins such as nerve growth factor.

**Venom enzymes**

These include digestive hydrolases, hyaluronidase, and activators or inactivators of physiological processes, such as kininogenase. Most venoms contain l-amino acid oxidase, phosphomono- and diesterases, 5'-nucleotidase, DNAase, NAD-nucleosidase, phospholipase A2 and peptidases

**Zinc metalloproteinase haemorrhagins**

Damage vascular endothelium, causing bleeding.

**Procoagulant enzymes**

Venoms of Viperidae and some Elapidae and Colubridae contain serine proteases and other procoagulant enzymes that are thrombin-like or activate factor X, prothrombin and other clotting factors. These enzymes stimulate blood clotting with formation of fibrin in the blood stream. Paradoxically, this process results in incoagulable blood because most of the fibrin clot is broken down immediately by the body's own plasmin fibrinolytic system and, sometimes within 30 minutes of the bite, the levels of clotting factors are so depleted ("consumption coagulopathy") that the blood will not clot. Some venoms contain multiple anti-haemostatic factors. For example, Russell's viper venom contains toxins that activate factors V, X, IX and XIII, fibrinolysis, protein C, platelet aggregation, anticoagulation and haemorrhage.

**Phospholipase A2 (lecithinase)**

The most widespread and extensively studied of all venom enzymes. It damages mitochondria, red blood cells, leucocytes, platelets, peripheral nerve endings, skeletal muscle, vascular endothelium, and other membranes, produces presynaptic neurotoxic activity,

opiate-like sedative effects, leads to the autopharmacological release of histamine and anti-coagulation.

**Acetylcholinesterase**

Although found in most elapid venoms, it does not contribute to their neurotoxicity.

**Hyaluronidase**

Promotes the spread of venom through tissues. Proteolytic enzymes (metalloproteinases, endopeptidases or hydrolases) and polypetide cytotoxins ("cardiotoxins"): Increase vascular permeability causing oedema, blistering, bruising and necrosis at the site of the bite.

**Venom polypeptide toxins ("neurotoxins")**

Postsynaptic (α) neurotoxins such as α-bungarotoxin and cobrotoxin, consist of 60-62 or 66-74 amino acids. They bind to acetylcholine receptors at the motor endplate. Presynaptic (β) neurotoxins such as β-bungarotoxin, crotoxin, and taipoxin, contain 120-140 amino acids and a phospholipase A subunit. These release acetylcholine at the nerve endings at neuromuscular junctions and then damage the endings, preventing further release of transmitter.

**Quantity of venom injected at a bite, "dry bites"**

This is very variable, depending on the species and size of the snake, the mechanical efficiency of the bite, whether one or two fangs penetrated the skin and whether there were repeated strikes. Either because of mechanical inefficiency or the snake's control of venom discharge, a proportion of bites by venomous snakes does not result in the injection of sufficient venom to cause clinical effects. About 50% of bites by *Malayan* pit vipers and Russell's vipers, 30% of bites by cobras and 5%-10% of bites by saw-scaled vipers do not result in any symptoms or signs of envenoming. Snakes do not exhaust their store of venom, even after several strikes, and they are no less venomous after eating their prey (Tun-Pe et al., 1991). Although large snakes tend to inject more venom than smaller specimens of the same species, the venom of smaller, younger vipers may be richer in some dangerous components, such as those affecting haemostasis.

## DISCUSSION

Snake-bites are well-known medical emergencies in many parts of the world, especially in rural areas. Agricultural workers and children are the most affected. The incidence of snake-bite mortality is particularly high in South-East Asia. Snake antivenom provides a specific

lifesaving measure. The current annual need for the treatment of snake-bite envenoming amounts to 10 million vials of antivenins. Unfortunately, the present worldwide production capacity is well below these needs. This trend needs to be reversed through concerted actions by national, regional and world health authorities and manufacturers and through effective public – private partnership. The prevention of mortality and morbidity depend upon availability of antivenom in the health facilities in these settings and their rational use. Mechanisms need to be developed toensure access to antivenom by all needy patients. The health system needs to respond to this challenge and logistics must be put in place to ensuretimely availability of antivenom at the point of use.

WHO/SEARO had developed guidelines on the management of snakebites which were also published as a special issue of the Southeast Asian Journal of Tropical Medicine and Public Health in 1999. WHO has supported countries in developing similar guidelines. To keep pace with the advances in science and on the basis of global experience, the regional guidelines have now been revised.

## CONCLUSION

There are various logistic, marketing and economic issues with the production and supply of ASV. The other drawbacks with ASV therapy are the adverse reactions ranging from early reactions (pruritus, urticaria) to potentially fatal anaphylaxis. Few cases may also develop serum sickness. When we compare both *Ayurveda* and Modern Medicine with respect to this aspect, we find that all these principles which are suggested by modern medicine are already described in *Ayurvedic Samhitas* before thousands of year. Modalities followed in *Ayurveda* are based on scientific approach, it's the time need to apply see the realism of this treatment. This will definitely help to prove the *Ayurveda* in emergency services also. Training of treating physicians and knowledge of protocols to deal with Snakebite cases.

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