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SNAKE BITE MANAGEMENT IN AYURVEDA

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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. Today, there is a need to evaluate our ancient knowledge on modern parameters to establish Ayurveda as a main stream medical science. Exhaustive ethno botanical studies in different regions of the country can help to undertake well designed scientific studies, for establishing therapeutic efficacy of various herbals for treating snake bites. The present article highlights an assortment of ancient remedies and herbal plants used in India for snake bites.

Keywords: tropical and subtropical, ethno botanical, herbal plants etc.

INTRODUCTION

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 does not exist; however, it is certain to be higher than what is reported. Snakes are distributed throughout most of the earth's surface with some exceptions such as the Arctic, Antarctic, and many small islands. Snakes are poikilothermic carnivorous reptiles that have evolved the venomous apparatus for the purpose of procurement of food.

Alexander the Great invaded India in 326 BC, and was greatly impressed by the skill of Indian physicians; especially in the treatment of snakebites [1]. The impact of snake bite on human life can be understood by the fact that *Acharya Vaghbatt* named the whole branch of toxicology as

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"*Dranshtachikitsa"* (the treatment of bites)[2]. Since then, India has remained notorious for its venomous snakes and the effects of their bites.

EPIDEMIOLOGY OF SNAKE BITE

Worldwide, it is estimated that more than 5 million persons per year are bitten by snakes, out of which approximately 100,000 develop severe squeal. [3, 4] The actual figure may be much more since in India alone the mortality is suggested to be around 30, 000.[5] Out of the available yearly statistics, the United States alone had 50,000 cases of bites, of which 7000 were by venomous snakes. India is reported to have the highest number of snake bites (81,000) and deaths (11,000) per year [6]. According to Government of India data, there were 61,507 snake bites with mortality of 1124 in 2006; 76,948 bites and 1359 deaths in 2007. A high mortality of 50,000 deaths each year has also been published [6].A report by the hospitals of Government of India, from all states, except six documents just 1,364 deaths due to snakebites in 2008, believed to be gross under reporting, as rural victims seek traditional treatment [7]. A nationally representative snake bite mortality survey in India (2001-2003) has highlighted 45,900 deaths annually, with the highest mortality rate in the state of Andhra Pradesh [8].

COMMON SNAKES OF INDIA

With its surrounding seas, India is inhabited by more than 60 species of venomous snakes – some of which are abundant and can cause severe envenoming. Spectacled cobra (*Naja*), common krait *(Bungaruscaeruleus)*, saw-scaled viper *(Echiscarinatus)* and Russell's viper (*Daboiarusselii*) have long been recognised as the most important, but other species may cause fatal snakebites in particular areas, such as the central Asian cobra (*Najaoxiana*) in the far north-west, monocellate cobra (*N. kaouthia*) in the north-east, greater black krait (*B. niger*) in the far north-east, Wall's and Sind kraits (*B. walli* and *B. sindanus*) in the east and west and hump-nosed pit-viper (*Hypnalehypnale*) in the south-west coast and Western Ghats [8]. The hump-nosed pit viper identified recently is documented to be responsible for nearly 10% of venomous bites in the state of Kerala [9].

The venom glands in Elapids and Viperids are present behind the eye and are surrounded by compressor muscles. They inject venom into the prey by fangs which are modified teeth. While in Elapids, the short fangs are mounted on a relatively fixed maxilla in front of the mouth, in Viperids the long fangs are mounted on a rotatable maxilla, facilitating flat folding against the roof of the mouth. A subfamily of vipers called the Crotalinae comprises of pit vipers. They have a special sense organ situated between the nostril and the eye to detect their warm-blooded prey. In humans, snakes usually inject venom subcutaneously or intramuscularly and the average dry weight of venom injected at a strike is approximately 60 mg (*N. naja*), 13 mg (E. carinatus) and 63 mg (D. russelii) respectively [9].

SNAKE VENOM

Snake venom is a highly complex cocktail of proteins, peptides, non-protein toxins, carbohydrates, lipids, amines and other molecules. The snake venom mainly contains proteins (>90%, dry weight). There are more than hundred different proteins; with elapid and viperid venoms constituting 25-70% and 80-90% of enzymes respectively. Some non-enzymatic polypeptide toxins and non-toxic proteins are also present. The venom enzymes include hydrolases, hyaluronidase, kininogenase. Other enzymes include phosphomono-and diesterases, 5'-nucleotidase, DNAase,

NAD-nucleosidase, l-amino acid oxidase, phospholipase A2 (PLA2), peptidases and zinc metalloproteinase hemorrhagins. Blood clotting may be stimulated by serine proteases and other pro-coagulant enzymes present in some Elapid and Viperid venoms. Certain venoms contain toxins (Russell's viper) that activate factors V, X, IX and XIII, fibrinolysis, protein C, platelet aggregation, anticoagulation and hemorrhage.

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*[10] 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. Some of the important plants with experimentally proven antivenom activities are discussed below:

Hemidesmusindicus*(Sariva)*

Antisnake venom activity has been shown in experimental models with 2-hydroxy-4-methoxy benzoic acid, isolated from Hemidesmusindicus. Increased neutralization of lethal action of venom by polyvalent antiserum has been reported with the compound in experimental models. It has also shown potentiation of antiserum action and reduction in venom induced free radical generation [11, 12]. The hemorrhagic, coagulant and anticoagulant activities induced with viper venom in experimental rodents were significantly antagonized by the organic acid from the root extract [13]. Neutralization of edema induced by Russell's viper, and cardiotoxicity, neurotoxicity and respiratory changes induced by Najakaouthia venom in experimental animals has been reported with lupeol acetate found in the plant. It also significantly neutralized PLA2 activity induced by Russell's viper [14].

Tamarindusindica (*Tintidika)*

The plant has shown potent venom neutralizing properties. Myotoxic effects due to Russell's viper have been significantly neutralized with the extracts of Tamarin-

dusindica. Early effects of envenomation by Russell's viper; inflammation, local tissue damage, and hypotension have been inhibited by the seed extract of the plant, in a dose dependent manner. Preincubation of venom with different doses of seed extract before assays, has shown significant neutralization of edema[15].

VitisVinifera (*Draksha)*

The seed extract has been found to be useful for neutralization of various venom induced activities. Local effects of viper bites can be treated with methanolic extract of seeds of *Vitis vinifera*. Neutralization of edema inducing and myonecrotic properties of venom has been shown with the extract. The seed extract is reported to abolish enzyme inhibition (hyaluronidase, proteolytic activities), neutralize hemorrhage and cause partial inhibition of procoagulant activity due to viper venom [16].

Strychnosnux vomica(*Kupilu*)

The plant contains caffeic acid and monomeric caffeic acid. It is used by tribals for snake bites and has anti inflammatory activity [17]. The plant is reported to effectively neutralize viper venom lethality. The seed extract has anti hemorrhagic potential and viper venom induced lipid peroxidation in experimental animals is reported to be inhibited with seed extract [18].

Andrographispaniculata (*Kalamegha*)

The plant extract has shown antivenin activity in experimental animals [19]. Inhibition of toxic enzymatic effects of Echiscarinatus is documented with the plant extract of Andrographispaniculata. Inhibition of PLA2 and neutralization of procoagulant activity has been observed with the extract. The plant has shown significant anti-inflammatory activity [20].

Withaniasomnifera (*Ashwagandha*)

A glycoprotein isolated from the plant has been found to be effective in cobra and viper bites. Inhibition of hyaluronidase activity due to venoms of Najanaja and *Daboia russelii* is documented with the glycoprotein isolated from the plant [21].

Curcuma longa (*Haridra*)

Turmerin isolated from the plant has shown inhibition of edema due to Najanaja venom. The plant has effectively countered the myotoxic activity due to Najanaja venom [22].

Azadirachtaindica(*Nimba*)

A significant inhibition of PLA2 enzymes of cobra and Russell's viper venoms has been reported with leaf extract of Azadirachtaindica containing the active compound AIPLAI [23].

Areca catechu (*Pooga*)

The plant contains polyphenols. In-vivo tests with polyphenols of Areca catechu and Quercusinfectoria are documented to cause inhibition of the haemorrhagic activity of Calloselasmarhodostoma venom and dermonecrotic activity of Najakauothia venom [24].

Emblica officinalis (*Amalaki*)

The plant has been established to have enzyme inhibitory, antihaemorrhagic, anti-inflammatory and anti myotoxic potential in experimental models [25].

CONCLUSION

Snake bites were remains a major health concern in India since long time. Its importance can be understood by the fact that snakes holds important places in Indian mythology. They were worshipped and pleased through various means in a view not to harm. From the early *vedic* period up to now the treatment procedures for snake bite have been changed a lot and still new techniques are emerging day to day. But the role of ancient *Ayurvedic* methods and herbal remedies cannot be neglected completely. The reliance on herbal medicines is vitally important because of wide acceptance, easy availability, af-

fordability, safety, cultural preference, and chiefly the poor health care services in rural areas. The pharmacological potential of very few plants has been investigated so far. There are still numerous unidentified novel compounds which may have antivenin activity or supplement the action of anti-snake venom. Though vital leads have been provided by ethnic groups and helped in exploring the antivenin properties of plants, but well designed and validated scientific studies are required to establish their therapeutic effectiveness in snake envenomations.

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