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Why India is poised with the maximum snakebite deaths and can it halve by 2030?: A brief report

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Abstract

India is often referred as capital of snakebites. It is estimated that about 2,50,000 snake bites occur resulting in more than 1,00,000 deaths annually. India registers more than half the global snakebite deaths. World Health Organization has taken note of this menace and called for reducing the snakebite deaths to half by 2030. Accordingly National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) in 2024 has formulated several programs to implement in India to reduce the snakebite deaths by half. There are several challenges which needs to be looked into and few of them are reducing human settlements in forest ecosystems, increasing the production units of antivenom production, reducing the cost of antivenom or supplying at free of cost to the victims, networking of primary health centres (PHC) for distribution of antivenom with desired infrastructure, developing transport facilities to bring the victim to PHC at the earliest. Presently snake venom of 4 species find place in poly-venom being manufactured in the country, but 17 more snake species need to be included. Identification of snake species from the bitten area at short time using ELISA techniques needs priority. Phytoconstituents that can serve as antidotes from plants need to be strengthened. Traditional health healers trained in treating snakebites are saving thousands of lives using plants. Centers of excellence of traditional treatment need to be established where aboriginal tribes and rural folks live in deep forests without any access to modern facilities.

Keywords: Snakebite, polyvenom, phytoconstituents, NAPSE, phytoconstituents

Introduction

The death and morbidity caused by snakebite is a great menace afflicting large populations across the globe mostly in sub-tropical and tropical countries covered with evergreen lush forests. According to the experts not all snake bites cause death because 20% of the bites could be dry which contain little or no venom ^[1, 2]. According to The World Health Organization, around 2.7 million people are envenomated each year and approximately 81,000 to 1,38,000 people die every year globally. Envenoming is considered as a neglected health issue ^[3, 4]. Out of 5 million snakebite cases, 3.75 million are severely affected and result in 1.25 million deaths globally per annum ^[5, 6].

In India the rural population are pronged to majority of snakebites that lead to death of people. In India, about 2,50,000 snake bite incidences are recorded every year occurring mostly in rural India resulting in more than 1,00,000 deaths and most of them go unnoticed ^[7, 8, 9]. According to Prof. Bindu Madhav, a well-known Herpetologist, reveals that India faces about 10 lakh snakebite cases every year ^[10] but largely many cases go unreported. It is often stated that India is the capital of snakebite deaths because half the world's snakebite deaths occur in India alone every year. According to yet another study the snakebite deaths account to more than 50,000 ^[11, 12]. A detailed study was conducted in India for 15 years during 2001-2014, and analysed 2833 snakebite deaths by inspecting 6,11,483 verbal autopsies. These workers inferred that India accounts to nearly 1.2 million snakebite deaths for the assessed period of 15 years averaging approx. 58,000 deaths per annum ^[13]. In India, Chhattisgarh, Uttar Pradesh and Rajasthan recorded the greatest age-standardised death rates, at 6.5, 6.0 and 5.8 deaths per million. Uttar Pradesh recorded the greatest number of deaths in 2019, with 12,000 ^[14].

World Health Organization has taken a serious note of this menace and called for reducing the snakebite deaths to half by 2030 in India. Accordingly Govt. of India has formulated National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) in 2024 and has formulated several programs to implement in India to reduce the snakebite deaths by half and

all associated departments are trying to implement at gross root level to bring down the snakebite deaths to half. However several complex issues are required to be addressed and few of them are identified and discussed in this paper.

Methodology

Several reports are available concerning snakebite deaths in India. But the compiled comprehensive data on snakebite deaths state wise within the country is not available. This information is critical to take policy decisions. The geographical location of the state, extent of forest cover, population density, competition between human settlements and forest encroachment, transport infrastructure etc. are required to be correlated with snake deaths for drawing valid

conclusions and drafting appropriate policy decisions by policy makers. Hence, we have computed the snakebite deaths from various states based on the primary data ^[13] and presented in Table 1. We have observed lot of discrepancies on snake bite deaths reported in the literature primarily due to variations in reporting mechanism, shortfall in centralised updating mechanism and lacunae in pooling the data from various states from time to time on real time scale and lastly under-reporting of cases or non-reporting of cases may also lead to such variations. Experts opine that even the reported figure is far less than the actual. With all deficiencies we have attempted to compute the snakebite death as per available literature and the same be useful to policy makers.

Table 1: Snakebite deaths in 2004, 2009, 2014 in India across various states

State	Snake bite death per million 2001-04	Population (million) 2004	Snakebite death in 2004	Snake bite death per million 2005-09	Population (million) 2009	Snakebite Death in 2009	Snake bite death per million 2010-14	Population (million) 2014	Snakebite Death in 2014
NEH states	23	1.743	40	09	1.875	17	07	1.803	13
All other states	43	5.34	230	07	26.55	186	09	12.60	113
Jammu & Kashmir	53	10.10	535	39	4.93	192	05	34.50	173
Kerala	18	31.80	572	13	31.84	414	32	5.769	185
Haryana	29	22.70	658	20	26.94	539	18	26.50	477
Punjab	29	24.36	706	33	21.14	698	21	32.50	683
Assam	28	28.114	787	70	10.14	710	25	27.50	688
Jharkhand	40	26.9	1076	31	24.35	755	40	28.50	1140
Chhattisgarh	60	22.11	1327	65	20.83	1354	29	64.50	1871
Gujarat	41	53.798	2206	33	52.85	1744	30	75.50	2265
Rajasthan	49	51.30	2514	34	62.40	2122	71	34.50	2450
Odisha	75	36.70	2753	48	50.67	2433	59	42.00	2478
Karnataka	56	52.85	2960	33	80.17	2646	29	95.00	2755
West Bengal	41	85.30	3497	72	36.80	2650	26	119.00	3094
Tamil Nadu	61	62.40	3806	37	96.87	3584	51	63.50	3239
Madhya Pradesh	67	60.35	4043	67	56.50	3786	50	73.50	3675
Maharashtra	42	104.88	4405	77	60.34	4646	60	76.50	4590
Bihar	56	88.662	4965	76	82.99	6307	56	84.86	4752
Andhra Pradesh	85	78.616	6682	73	76.21	6663	89	103.80	9238
Uttar Pradesh	52	166.4	8653	59	166.20	9806	60	206.00	12360
Total			52415			51,252			56,239

Possible shortcomings

Snake bite in India - Snakebite envenomation is a severe challenge in poor and developing countries leading to disabilities and psychological consequences in the aftermath of snakebites ^[15]. The most affected people are predominantly poor and rural communities living in tropical and sub-tropical regions across the world. Venomous snakebites can cause severe paralysis that may result in respiratory distress, cause bleeding disorders leading to fatal haemorrhage, cause irreversible kidney failure and severe local tissue destruction finally leading to permanent disability and limb amputation. Children suffer more severe effects and more quickly than adults due to their smaller body mass. People living in tropical countries namely sub-Saharan Africa, Asia, Latin America and Papua - New Guinea are most affected people ^[16]. Rehabilitation of snakebite afflicted victims will remain as a big challenge. The surviving patients from snakebite are much more worse affected by morbidity around three times as many amputations and other permanent disabilities than snakebite deaths each year

Snakebite deaths - The death occurring due to snakebite in India has been computed and presented in Table 1. The mean death during four years between 2001-04; 2005-09 and 2010-14 is presented for different states in India. It may be noted that the total deaths occurring per year ranged from 52,415 in 2004; 51,252 in 2009 and 56,239 in 2014 respectively. The four states namely Maharashtra, Bihar, Andhra Pradesh and Uttar Pradesh contribute to more than half of the deaths occurring in the country. The highest deaths occurred in Uttar Pradesh, probably owing to the most populous state. The least number of death was noticed in north eastern Himalayan (NEH) states comprising seven states (Table 1).

The data suggested that there is clear decline in death rate in few states namely Jammu and Kashmir and NEH states and a rise in Rajasthan and Kerala. In other states there is no significant change in death rate. Death rate was the highest in Andhra Pradesh followed by Odisha at 85 and 75 snakebite death per million respectively in 2004; in 2009 Maharashtra and Bihar recorded 79 and 76 snakebite death per million respectively; whereas in 2014 Andhra Pradesh and Rajasthan

recorded 89 and 71 snakebite death per million respectively which was alarmingly high. Uttar Pradesh has recorded the highest death rate of 8653, 9805 and 12360 deaths in 2004, 2009 and 2014 respectively.

We believe that human settlements in forests is affecting free movement of snakes in their ecosystems leading to increased snakebite deaths. It is witnessed by the data that the death rate is higher in the states where forest cover is less compared to northeastern states. Deathrate in Andhra Pradesh, Bihar, Rajasthan is approximately 10 percent, whereas Maharashtra and Odisha documented 17 and 31 percent in 2014 whereas the deathrate is lower in the north eastern Himalayan (NEH) states record less deaths due to snakebite, since they have more than 60 forest cover, in almost all NEH states. The urbanization due to population explosion is leading to human - snake conflicts resulting in higher death rates in Maharashtra, Bihar, Rajasthan, Andhra Pradesh and Uttar Pradesh.

Snakebite envenoming in India

Snakebites occur mostly with the onset of monsoon largely in the months of July to August. Possibly the snakes are in search of their mates to continue the progeny and also to look for food. Snakes being cold blooded animals, cannot tolerate extreme temperatures. Onset of monsoon is the mating period which incidentally coincides with the peak activity of farm operations in farmers' fields. The lush green grass suit the snakes to hide and protect themselves from mongoose, birds and other enemies. Thus, the farmers while engaging their farming operations, counter the snakes leading to conflicts. According to BBC reports ^[17] an estimated 1.2 million people have died from snakebites in India in the past 20 years. Nearly half the victims were between 30 and 69 years old. And a quarter of them were children. Russell's Viper and Kraits were responsible for most deaths.

In order to reduce the snake-human conflicts, farmers are advised to enter the fields by wearing shoes or boots during nights. During day hours while handling grass heaps it is advised to shake the grass before the hands are inserted to pick the grass or hay. Further, sleeping on ground outside the house may be avoided since the snakes are attracted to the bed for warmth at nights. If it is inevitable to sleep outside, the farmers are advised to have a mosquito net cover tucked up below the bed so that the entry of snake is avoided. These simple reasons may reduce the snakebite deaths considerably according to the experts ^[10]. Although, primarily snakes do not bite humans, but as a defence mechanism they bite when we trample on them un-noticed. Snakebites occurred in rural areas (97%) and the affected people are males (59%) that occurred in the monsoon months between June to September ^[18].

Antivenom serum production

If India has to achieve significant progress in reducing snakebite deaths, the only possibility is to enhance the supply of antivenom sera to nook and corner of the country and make it available round the clock through primary health centres. At present India is equipped with only seven units of antiserum production of which, many have been closed and only few are functional ^[19]. Production of antivenom needs continuous supply of snake venom, presently which is inadequate in India. The major company of venom supplier for antivenom sera production is by Irula tribe of Tamil Nadu supplying nearly 80% of the venom. This quantity of venom covers hardly half the demand of the country. Hence the GoI should establish several centres of milking of venom (a centre to collect snake venom) through multi species of snakes at different geographical centres on consideration of requirement. Presently the policies of Forest Department and Wild Life Act restricts the extraction of venom from snakes. The rule needs to be amended by the respective State Governments. This needs serious attention by the GoI.

Polyvalent serum production

Monovalent antiserum is recommended when the snake species is identified; but in many cases the snakebite occurs at night and not possible to identify the snake species since the snake disappears in bushes keeping the victim in dark after the bite. In such cases polyvalent antivenom is recommended that covers 4 major snake species ^[20].

What about antivenom for rest 17 snake species?

There are about 3000 snake species distributed globally out of which nearly 20 percent are venomous. Further, out of these 20 percent venomous snakes they can be classified into less and highly venomous. In India, there are about 270 species of snakes of which 67 species are venomous (Table 2). Out of these 67 species, 46 species are less venomous that may not kill a human being but can kill a frog for their food to prey on the target animal; however, remaining 21 species are highly venomous which may kill a human being or cause serious morbidity in human beings ^[12]. In India, over 75 percent of snakebite deaths occur due to these four snake species namely Russell's Viper, Common Krait, Indian Cobra and Indian Saw Scaled Viper, hence, they are often referred as big four ^[21] and presently produced polyvalent antiserum consists of mixture of serum of big four snakes namely Russell's Viper, Common Krait, Indian Cobra and Indian Saw Scaled Viper and leaving rest of the 17 venomous snake species found in India. This leaves a big gap wherein if the snakebite has occurred by other than these big four snake species, the probability of survival of the victim is meagre and possibly death is imminent. Hence R & D to produce antiserum for these 17 species cannot be ignored.

Table 2: Diversity of Indian venomous snake species

No.	Common name	Scientific name	Status of venom
1	Stokes's sea snake	<i>Astrotia stokesii</i>	Low
2	Andaman krait	<i>Bungarus andamanensis</i>	Low
3	Himalayan krait	<i>Bungarus bungaroides</i>	Low
4	Beddome's coral snake	<i>Calliophis beddomei</i>	Low
5	Bibron's coral snake	<i>Calliophis bibroni</i>	Low
6	Castoe's coral snake	<i>Calliophis castoe</i>	Low
7	Slender coral snake	<i>Calliophis melanurus</i>	Low
8	Striped coral snake	<i>Calliophis nigrescens</i>	Low
9	Bamboo pit viper	<i>Craspedocephalus gramineus</i>	Low
10	Horseshoe pit viper	<i>Craspedocephalus strigatus</i>	Low
11	Malacca sea snake	<i>Hydrophis caerulescens</i>	Low
12	Cantor's narrow headed sea snake	<i>Hydrophis cantoris</i>	Low
13	Banded sea snake	<i>Hydrophis fasciatus</i>	Low
14	Common small-headed sea snake	<i>Hydrophis gracilis</i>	Low
15	Persian Gulf sea snake	<i>Hydrophis lapemoides</i>	Low
16	Bombay Gulf sea snake	<i>Hydrophis mamillaris</i>	Low
17	Black-banded sea snake	<i>Hydrophis nigrocinctus</i>	Low
18	Cochin banded sea snake	<i>Hydrophis ornatus</i>	Low
19	Yellow sea snake	<i>Hydrophis spiralis</i>	Low
20	Bengal sea snake	<i>Hydrophis stricticollis</i>	Low
21	Jerdon's sea snake	<i>Kerilia jerdonii</i>	Low
22	Common sea krait	<i>Laticauda laticauda</i>	Low
23	Yellow-lipped sea krait	<i>Laticauda colubrine</i>	Low
24	Short sea snake	<i>Lapemis curtus</i>	Low
25	Levantine viper	<i>Macrovipera lebetina</i>	Low
26	Monocled cobra	<i>Naja kaouthia</i>	Low
27	Black and yellow sea snake	<i>Pelamis platura</i>	Low
28	Viperine sea snake	<i>Praescutata viperina</i>	Low
29	Himalayan spotted pit viper	<i>Protobothrops himalayanus</i>	Low
30	Jerdon's red-spotted pit viper	<i>Protobothrops jerdonii xanthomelas</i>	Low
31	Kaulback's pit viper	<i>Protobothrops kaulbacki</i>	Low
32	Brown-spotted pit viper	<i>Protobothrops mucrosquamatus</i>	Low
33	Jerdon's pit viper	<i>Protobothrop sjerdonii jerdonii</i>	Low
34	Himalayan keelback	<i>Rhabdophis himalayanus</i>	Low
35	MacClelland's Coral Snake	<i>Sinomicrurus maclellandi</i>	Low
36	White-lipped pit viper	<i>Trimeresurus albolabris</i>	Low
37	Andaman pit viper	<i>Trimeresurus andersoni</i>	Low
38	Cantor's pit viper	<i>Trimeresurus cantori</i>	Low
39	Spot-tailed pit viper	<i>Trimeresurus erythrurus</i>	Low
40	Gumprecht's green pit viper	<i>Trimeresurus gumprechtii</i>	Low
41	Nicobar pit viper	<i>Trimeresurus labialis</i>	Low
42	Medo pit viper	<i>Trimeresurus medoensis</i>	Low
43	Pope's pit viper	<i>Trimeresurus popeorum</i>	Low
44	Himalayan white lipped pit viper	<i>Trimeresurus septentrionalis</i>	Low
45	Yunnan pit viper	<i>Trimeresurus yunnanensis</i>	Low
46	Hutton's pit viper	<i>Tropidolaemus huttoni</i>	Low
47	Common krait	<i>Bungarus caeruleus</i>	High
48	Banded krait	<i>Bungarus fasciatus</i>	High
49	Lesser black krait	<i>Bungarus lividus</i>	High
50	Black krait	<i>Bungarus niger</i>	High
51	Wall's Sind krait	<i>Bungarus sindanus walli</i>	High
52	Malabar pit viper	<i>Craspedocephalus malabaricus</i>	High
53	Northern large- scaled pit viper / Large-scaled pit viper	<i>Craspedocephalus marcollepis</i>	High
54	Russell's viper	<i>Daboia russelii</i>	High
55	Sochurek's saw-scaled viper	<i>Echis carinatus sochurek</i>	High
56	Hook-nosed sea snake	<i>Enhydrina schistose</i>	High
57	Himalayan pit viper	<i>Gloydius himalayanus</i>	High
58	Short sea snake	<i>Hydrophis curtus</i>	High
59	Annulated sea snake	<i>Hydrophis cyanocinctus</i>	High
60	Hump-nosed pit viper	<i>Hypnale hypnale</i>	High
61	Spectacled cobra	<i>Naja naja</i>	High
62	Central Asian cobra	<i>Naja oxiana</i>	High
63	Andaman cobra	<i>Naja sagittifera</i>	High
64	King cobra	<i>Ophiophagus hannah</i>	High
65	Mountain pit viper	<i>Ovophis monticola</i>	High
66	Red-necked keelback	<i>Rhabdophis subminiatus</i>	High
67	Salazar pit viper	<i>Trimeresurus salazar</i>	High

Cost of antiserum ampule

The whole program can be successful if the antivenom sera is available at affordable cost in the desired location. As per many reports, at present the antivenom sera is not available in rural areas where snakebites are prevalent and even if available the costs are prohibitive. The deaths due to snakebite in rural areas of the country is a live testimony for dearth of antivenom sera. Cost of polyvalent anti-snake venom is anywhere between Rs 500 to Rs. 800 per vial. According to a research report, under normal conditions, in a conventional treatment for a venomous snake bitten patient needs about 25 vials ^[22] for recovery. According to experts working on snake venoms from Indian Institute of Science, opine that production of antivenoms need to be upscaled with updation in technology. The experts opine that the antivenom vials requirement go up to 100 in some cases ^[23]. This cost is unbearable by a poor man. This is a serious gap in production technology of polyvalent serum, which needs to be addressed by GoI. GoI should completely subsidize the price of such lifesaving drugs and be supplied at free of cost. Further the production technology of antivenom serum needs immediate attention to upgrade the technology to make it effective.

Infusing large amounts of horse antibodies into humans is often dangerous. Antivenoms do save the life but with huge side effects such as lethal anaphylaxis.

Exchequer on snakebite deaths

If a death occurs due to a snakebite, there is a provision by State Government to compensate the loss of life through offering financial support to the kith and kin of the deceased person. Most of the State Governments have legalised the claims upon death of patients, however the extent of relief offered may vary from state to state. The list of financial support offered in few states is presented in Table 3, which may vary from Rs. 0.20 lakh to 4.00 lakh per life lost. Annually 58,000 deaths occur in India. Considering an average sum of Rs. 2.00 lakhs per life, the Governments spend a colossal sum of Rs. 1160 crores per annum. According to Prof. Bindu Madhav, a noted Herpetologist, opine that suffering from morbidity of a snakebite is more harsher than losing a life. For every death about nine people suffer lasting injuries. They may lose limbs or other body parts severely impacting their ability to function, thus morbidity caused by snakebite is worse than death ^[23].

Table 3: Compensation offered by different states for snakebite deaths

State	Amount of compensation (Rs.)	Reference
Bihar	4 lakhs	www.business-standard.com/article/pti-stories/bihar-govt-to-give
Chhattisgarh	1.5 lakh	https://www.deccanherald.com/content/387882/declare
Karnataka	2 lakhs	https://bengaluruurban.nic.in/en/depattmarts
Kerala	1 lakh	www.onmanorama.com/news/kerala/2022/07/09
Madhya Pradesh	0.5 to 4 lakh	https://www.hindustantimes.com/bhopal/assistance-for-snakebite
Odisha	4 lakh	https://www.gaodisha.gov.in/node0801
Punjab	2 lakh	https://mandiboard.nic.in/ach-financial.htm
Uttar Pradesh	4 lakh	https://en.gaonconnection.com/snake-bites-uttar-pradesh
West Bengal	20,000	https://wbmdmd.gov.in/writeraddata/NW481128.pdf

Delay in administering treatment

As per the law, the snakebite victim has to be admitted immediately to the nearest primary health centre and the lifesaving treatment has to be initiated by the physician. The case history sheet should be submitted to the district health department for information and records. More importantly, the nearest police station has to be informed for registering the case. There are few stray reports citing that because of registration of police case, many a times the doctor doesn't initiate the treatment and victim lose the life or by delaying the treatment many complications may arise including heart and renal failure. Thus many NGOs have urged that police intervention be removed in order to save the life of a victim. Since this is a medico-legal claim GoI may intervene to ease the problem.

Most rural folks succumb to snakebite deaths

India is a rich country in human diversity also. As per the current estimates India has a population of 143.68 crores of which 98.85 crores (68.8%) live in rural areas ^[24]. Unfortunately, in India, these rural masses are subject to snakebite envenomation and more than 95 percent deaths are reported from rural areas. In India, there are about 54 million indigenous people belonging to different ethnic groups inhabiting various terrains, territories, having diverse cultures, religious rites, and food traditions that separate them from each other. These people have an awareness of traditional medicine especially herbal and folk medicine for treatment of

snakebites. Traditional herbalists operate closer to the people, taking advantage of the biodiversity of plant species to cure various diseases and ailments. Thus the indigenous knowledge on use of plants as an antidote to various snakebite is also a treasure and this wisdom needs authentication by confirmatory clinical trials ^[25, 26] for the use of mankind.

Plants as an antidote for snakebite

Treating snakebites using various plant species by traditional health healers (local vaidyas) is a much coveted profession without much financial aspirations. Hundreds of plant species have been identified in different geographic locations by different ethnic groups, and the wisdom has been passed on to next generations without any written script, since most of such local vaidyas are illiterate. Many of the scientists, researchers, environmentalists, herpetologists have conducted several ethnobotanical surveys covering the whole country and the plant species used in snakebite treatment as antidote have been published. For example 116 plant species from Bangladesh ^[27]; 312 species from Andhra Pradesh ^[28, 29]; 40 species from West Bengal ^[30]; 100 from Tamil Nadu ^[31, 32, 33]; 36 from Chhattisgarh ^[34]; 44 from Rajasthan ^[35]; 55 from Maharashtra ^[36, 37]; 198 species from Indian subcontinent covering, Pakistan, Bangladesh, Nepal and Bhutan ^[38]; and 523 plant species identified from India as antidote ^[39] have been published. In Sri Lanka more than 95% rural people depend on traditional medicines for snake bites and nearly 341 plant species are identified as antidote remedy ^[40]. The published information is huge but this wealth of treasure is

not being used in right perspective.

Production of snake antivenom is a Herculean task in the present existing scenario due to multiple issues. Even transport of such antivenom vials and storing them in right temperature is another big challenge in rural areas due to lack of electricity, lack of suitable transport facilities, lack of trained personnel, lack of supply of antivenom etc. Hence, promoting use of plant and plant products as an antidote is the most novel option since the local vaidyas support this tradition. The GoI must pool the traditional data already published which is available in public domain and collect the information from ethnic groups which is not published and make a National Repository, so that the information can be shared amongst needy people within the country. The GoI should establish centre of excellence of plant sources to be used as antidote for snakebites in each geographic zone. By doing so the chances of rural population getting access to the conventional drug is better and many lives can be saved.

Conclusion

Death due to snakebite is inevitable wherever there is a conflict between human - snake. If there is a snakebite the use of antivenom sera is the only possible option to reduce fatality and morbidity. GoI has introduced a flagship program - National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) to reduce the snakebite death to half by 2030. Few shortcomings of NAPSE have been highlighted. Polyvalent antivenom is the sole remedy for saving the lives from snakebites, however in addition to big four snake species the other 17 venomous species also have to be considered. A quick detection technique bitten snake species by taking a swab from the victim's snakebite site by employing a biotechnological tool is the need of the hour. Enhancing the venom collection centre is of dire need to enhance the production capacity of antivenom sera. The production technology of antivenom sera needs updating to reduce the requirement of antiserum vials by standardizing titre value. Developing transport facilities, PHC storage facilities for antivenom, round the clock monitoring by resident physician needs to be strengthened. The cost of antivenom has to be absorbed by the GoI and made free by listing under lifesaving drug. Using identified plant genetic resources as antidote against snakebite need to be explored, since this a treasure preserved by local ethnic groups. Validation of specific plants as antidote may be validated by conducting clinical trials and herbal gardens for proven plant species need to be developed at district headquarters throughout the country.

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