

## Profile of Snake Bite Poisoning In the Cases Admitted To the Government Hospital and a Tertiary Care Private Hospital in Mangalore, Karnataka

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### Abstract

Our surroundings host different kinds of venomous and poisonous animals and plants. These are a threat to well-being of humans and animals alike. More than 2,00,000 cases of snakebites are reported in India each year out of which 35,000-50,000 turn out to be fatal. India has the most number of snake bite related deaths in the world. Snakes bite millions of people annually creating one of the most neglected health problems of the tropics due to a lack of availability of antivenom. In developing nations, there are also deficiencies in the reporting of cases, management of complications, transportation, hospital equipments and public knowledge of appropriate first-aid. In India, a significant proportion of medico-legal autopsies comprise cases of alleged snakebite. The study forms an epidemiological profile of snake bites cases in the city of Mangalore and surrounding areas through the cases admitted to the biggest tertiary hospitals in the area.

**Key Words:** Snake bite, Tertiary hospitals, socio- demographic factors, first aid, anti- snake venom.

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### Introduction :

Globally, snake bite envenomation is a serious health problem and according to the World Health Organization (WHO) an estimated 5 million snake-bite cases and about 100,000 deaths, due to this occur every year <sup>1</sup>. The incidence is particularly high in rural areas of Africa, Asia, Oceania and Latin American countries where venomous snakes are abundant and human activities, mainly agriculture, hunting, animal husbandry, fishing increase the risks of man-snake encounters <sup>2</sup>. The frequency of snake bite is high during the agricultural activities and most bites are inflicted when the snakes are inadvertently trodden upon by humans<sup>3</sup>. Additionally, increase in deforestation,

migration and enhancement in recreational and nature camps in forest areas also contribute towards snake bite envenoming<sup>4</sup>. In lieu of these observations, the WHO has listed snake bite envenoming as a serious health problem and categorized it in the list of neglected tropical diseases<sup>5</sup>.

India has the dubious distinction as the country with the highest deaths due to snake bite envenoming in the world<sup>6,7</sup>. Realistic appraisals are that every year approximately 2,00,000 individuals are victims of snake-bite and that 35,000-50,000 of them succumb to the envenomations mostly from the snakes belonging to the species of *Naja* (spectacled cobra), *Bungarus caeruleus* (common krait), *Echis carinatus* (saw-scaled viper), *Daboia russelii* (Russell's viper)<sup>2,7</sup>. Of these, the snakes most commonly associated with human mortality in most parts of India are the cobra, krait, Russell's viper and saw scaled viper<sup>2,7</sup>.

Chemically, the snake venom is very complex and contains a mixture of more than 100 different substances, such as toxins, enzymes,

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growth factors, activators, and inhibitors. The toxins are primarily organ specific and this is directly dependent on the species of the snake that has bitten<sup>8</sup>. The toxins present in the venom of cobras and kraits are neurotoxic and result in respiratory failure. Contrary to that observed in the cobra and krait, the viperoid snake venom cause coagulopathy and platelet dysfunction. This consequentially, leads to spontaneous systemic haemorrhages and persistent bleeding from fang marks, wounds, or gums. The common causes for death due to viper envenoming consist of intracranial bleeding, including anterior pituitary haemorrhage, and multi-organ failure<sup>9</sup>.

When compared to the past decades, deaths due to snake envenoming can be greatly reduced if immediate medical attention is provided by a qualified physician and before the development of complications in the envenomed victim. However ignorance, use of herbal treatment and indigenous medicines, applying of inappropriate and harmful first aid methods, and delay in admitting to medical facilities complicate the condition for the victim<sup>7</sup>. Globally, the gold standard treatment for snake envenoming is the use of specific anti-snake venom (ASV) serum and studies have conclusively shown that fatality rates can be high where patients do not have rapid access to them<sup>10</sup>. Currently a range of anti-snake venom that are species specific (monovalent/monospecific) or effective against several species (polyvalent/polyspecific) are available<sup>11</sup>. The use of monospecific ASV is highly recommended by the WHO and is particularly useful when the identification of the snake that has envenomed is correct. However the lack of availability of specific monovalent ASV at all times, high cost and difficulty in identifying the envenomed snake by the victim forces the physician to prefer the use of polyvalent therapy, which at times may trigger concentration dependent hypersensitivity reaction in some recipients<sup>11</sup>.

A literature study shows that there have been very few studies that have addressed the detail aspect of the various aspects right from snake bite up

to treatment and recovery of the victim and by also considering the socio-demographic features the awareness about the immediate first-aid measures, use of alternative methods, treatment regimens used in PHCs and tertiary care centres, the therapeutic medicines used, their hypersensitivity, treatment and recovery. The study has been conducted in the Mangalore which is nodal point, or a tertiary referral centre for most cases brought from the peripheral areas. The two hospitals in which the present study was undertaken, receives the maximum cases of snake bite, though one is a government hospital and the latter is a private hospital. Further, an attempt has been made to study the difference in the cost incurred in these two hospitals.

### **Methodology:**

The present study was a cross sectional, hospital based descriptive study. All the cases of snake bite admitted to District Wenlock Hospital, Mangalore and Father Muller Hospital, Mangalore from 1<sup>st</sup> January 2013 to 31<sup>st</sup> August 2013 were included as part of the study. Data from the snake bite cases were collected retrospectively through the case sheets available in the medical records department (MRD). Prospective data was obtained by interviewing the snake bite case subjects (through a pre-formed questionnaire) in the above mentioned hospitals. The sample size included the subjects admitted to these hospitals with the history of snake bite. A total of 100 cases were included in the study. Ethical clearance was taken from the Institutional Ethics Committee of Father Muller Medical College Mangalore, before starting the study. After obtaining the consent from the subjects or their parents (in case of children), the data was collected using a pre-tested proforma. Which included socio- demographic factors, clinical features, health care seeking behaviour, first aid measures adopted, treatment pattern received and outcome. Information on the amount of ASV received at the primary care level was obtained from the referral cards. Envenomation characteristics and its treatment, development of

complications, final outcome and duration of stay was obtained from the medical records of the patient available at the hospital. The data thus obtained was compiled and tabulated using appropriate statistical methods such as frequency tables and percentages.

## Results:

A total of 100 cases were admitted during the study period in which 62 (62%) and 38 (38%) were from Father Muller hospital and District Wenlock hospital respectively as shown in table no1.

**Table 1. Distribution of subjects based on the hospital admitted to:**

Hospital	Frequency (n)	Percentage (%)
Father Muller Medical College Hospital	62	62
District Wenlock Hospital	38	38
<b>Total</b>	<b>100</b>	<b>100</b>

Table 2 shows the following details: Majority of the subjects 72 (72%) were from the male sex. A large number of them were from the age group 16- 30 (33%). A significant number of the subjects were manual laborers by occupation 38 (38%). The subjects mostly had an educational level up to primary school level 64 (64%). The majority were from the low socio- economic status 59 (59%) as decided by the modified Kuppaswamy classification. The type of housing observed in majority of the cases were tiled 85 (85%). Majority of the subjects were from a rural area 45 (45%), followed by 43 (43%) who lived in urban areas.

Table 3 shows the following: it was observed that in 91 (91%) of the cases the snake bite occurred in an outdoor area and majority of the bites were during the day 58 (58%). A significant number of bites were to the distal part of the lower limb 63 (63%). A large number of the bites were identified as venomous 40 (40%). A positive identification on the species of the snake were not done by the patient or the patient party in 59 (59%) cases, however 22 (22%) were positively identified as viper, followed by

common cobra 11 (11%) and 7 (7%) as common kraits. There was a presence of fang marks in 70 (70%) cases. There were local and systemic signs of envenomation in 26 (26%) of the cases, followed by local signs only in 21 (21%) cases. Table 4 shows that a tourniquet was used as first aid in 88 (88%) cases. A majority of the people in the study area preferred a private hospital 79 (79%) compared to the government primary health care facility (15%). Most of the patients reached the tertiary hospital through a private vehicle 79 (79%) and 65 (65%) cases had signs of envenomation. In the 32 (32%) cases of the cases showing envenomation 1- 20 vials of polyvalent antivenom was given as specific management. This was followed by 25 (25%) cases were 21 to 40 vials were administered. The preponderance of hypersensitivity reactions were seen in 21 (21%) cases only. The study shows the 98 cases (98%) recovered with death in 1 case (1%) and disability in 1 case (1%).

In the cases treated, 70 (70%) of them developed no complications, followed by 17 (17%) cases who developed cellulitis / wound infection. Majority of the cases (89%) were discharged from the hospital after recovery in 1- 15 days.

The cost incurred by the majority of the patients (36%) was within Rs 5000. However 25% of the patients had the treatment free of cost as shown in table no 5.

Table no 6 shows the comparison of cost incurred in the District Wenlock hospital and Father Muller Hospital, which shows 23 cases (60.5 %) of 38 cases treated in Wenlock hospital received treatment free of cost. This is due to the government policy of providing free antivenom treatment for those patients holding a below poverty line (BPL) card.

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**Table 2: Socio-demographic features of the snake bite victims**

Questions		%
Distribution of subjects depending on their age group	0-15 yrs	13
	16-30 yrs	33
	31-45	22
	46-60 yrs	24
	61-75 yrs	8
Sex-wise distribution of subjects	Male	72
	Female	28
Distribution of subjects according to their occupation	Manual labour	38
	House wife	18
	Student/Children	19
	Farmer	6
	Self-employed	17
	Others	2
Distribution of subjects according to their educational status	Illiterate	4
	Primary	64
	Secondary	26
	Graduate	6
Distribution of the subjects according to their socio-economic status ( Modified Kuppuswamy Classification)	Low	59
	Mid	38
	High	3
Distribution of the subjects depending on the type of housing	Tiled	85
	Terraced	15
Distribution of subjects according to their location	Urban	43
	Semi urban	12
	Rural	45

**Table 3: Characteristics of snake bite, first aid and preliminary medical attention provided**

Parameters		Percentage
Place where the snake bite occurred	Outdoor	91
	Indoor	9
Time of the day when the bite occurred	Day	58
	Night	42
Distribution of subjects depending on the site of bite	Proximal part of upper limb	2
	Distal part of upper limb	28
	Proximal part of lower limb	6
	Distal part of lower limb	63
	Trunk	1
Distribution of subjects depending on the type of information available on the species of snake	venomous	40
	Non venomous	7
	Not known	53
Distribution of subjects based on biting species of the snake as seen by the patient/ by-stander	Unidentified	59
	Viper	22
	Cobra	11
	Krait	7
	Non venomous	1
Presence of fang marks following bite	Present	70
	Absent	30
Type of envenomation seen	Local	21
	Systemic	18
	Both local and systemic	26
	Absent	35

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### Discussion:

Snake bite is an important but neglected public health problem in the tropics, especially in

India. In spite of the availability of effective treatment in the form of ASV, the mortality rates have not yet declined in the rural areas. It is important to know these factors, so that effective preventive strategies can be employed.

In our study we observed that people in the age group of 16-30 years were the most commonly (33%) followed the age group of 45 to 60 (24%), which were similar to the findings of studies done by Brunda G et al<sup>12</sup> in Andhra Pradesh (71%) , Chattopadhyay S

et al<sup>13</sup> in West Bengal as this is the most productive age group and more likely to be involved in outdoor activities and at risk for exposure while working in the field.

**Table 4:** Information on the first aid, healthcare seeking behaviour, treatment schedule & response

Parameters		%
Distribution of subjects depending on the first aid received after the bite	None	2
	Tourniquet	88
	Tourniquet and Washing	4
	Tourniquet and incision	6
Health care seeking 24 hours immediately following the bite	Traditional healer	6
	Govt Hospital / PHC	15
	Private hospital	79
Distribution of subjects according to the mode of transportation they had taken to reach the tertiary level of health care	Private vehicle	79
	Ambulance	21
Signs of envenomation	Present	65
	Absent	35
Distribution of envenomed cases according to the amount of ASV given	0 vials	
	1-20 vials	32
	21-40 vials	25
	41 -60 vials	6
	61- 80 vials	1
	81 to 100 vials	1
Development of hypersensitivity reactions following a dose of ASV	Present	21
	Absent	79
Distribution of subjects according to the final outcome	Recovered	98
	Dead	1
	Disability	1
Distribution of subjects according to the nature of complications first developed following the bite	Cellulites/ Wound infection	17
	Respiratory paralysis	5
	Renal failure	6
	Sepsis	2
	None	70
Distribution of subjects according to the duration of stay at the hospital	1-15 days	89
	16- 30 days	8
	31 -45 days	1
	45 – 60 days	2

**Table 5 showing Distribution of subjects according to the cost incurred on treatment**

Amount in Rupees	Number of cases (n)	Percentage (%)
0	25	25
< 5000	36	36
6000-15000	17	17
16000-30000	20	20
>30000	2	2
<b>Total</b>	<b>100</b>	<b>100</b>

**Table 6 showing the comparison of cost incurred at private & Government set-up:**

Cost incurred (rupees)	District Wenlock Hospital	Father Muller Medical College Hospital
0	23 (60.5%)	2 (3.2%)
<5000	8 (21.5%)	28 (45.1%)
6000-15000	5 (13.1%)	12 (19.3%)
16000-30000	1 (2.6%)	19 (30.6%)
>30000	1 (2.6%)	1 (1.6%)
<b>Total cases</b>	<b>38</b>	<b>62</b>

Majority of the cases of snake bites tend to be more common among men because of their involvement in farm/agriculture related activities and easy accessibility to the health care services being more common with males. Our study showed a similar finding with 72% of the cases of our study population being males, which was in agreement with studies conducted by Sharma SK et al<sup>14</sup> in Nepal (60%), Harbi NA<sup>15</sup> in Saudi Arabia (73%), Tan HH<sup>16</sup> in Singapore (83%).

Snake bite is said to be a disease of the rural population, because encounters of humans with a snake are more likely with occupations and surroundings of the rural area. 45% of cases in our study were from rural areas which was similar to the study done by Moreno E et al<sup>17</sup> showed only 51.4% of the cases in rural areas, the reason for which may be due to rapid urbanization taking place in the districts included in the study area

Our study observed that 38% of the population were manual labourers followed by 18 %

housewives which was agreement with a study done by Rahman R et al<sup>18</sup> where majority of the cases were seen among house wives (25%) which might be due to the fact that indoor bites depends on the species of the biting species and also the location of the house and the type of construction of the house. As Mangalore city and the surrounding areas have faced a real estate boom, deforestation is common depriving the snakes of their natural habitat thereby biting the manual labourers involved in construction work.

Our study showed 69% of the cases occurred in people with lower socio-economic status which was similar to the findings of study done by Michael GL et al<sup>19</sup> in Nigeria where 69.9% victims were from a low socio economic class, suggesting that the people with lower socio economic status tend to be involved in occupation that is at high risk for snake bites and making them more vulnerable to the consequences such as increased cost on treatment and loss of wages.

89% of the bites in our study occurred outdoors which was similar to the studies done by Sharma SK et al<sup>14</sup> (82%) and ChattopadhyayS et al<sup>13</sup> (62.8%) and were in contrast to study done by Tan HH<sup>16</sup> where only 42% cases occurred outdoors and Rahman R et al<sup>18</sup> where majority of the bites (59%) were seen indoors, which might be because of the difference in the predominant species present in the region as well as the commonly involved victims in the study.

Our study showed majority of the bites (58%) were seen during the day time, which was similar to the results of the studies done by ChattopadhyayS et al<sup>13</sup> (61%) and Harbi NA<sup>15</sup> (53%) but were different from a study done by Rahman R et al<sup>18</sup> where majority of the cases (36%) were seen during the night; the reason for this being different occupational exposure and also the activity and species of the snake responsible for the majority of the bites.

85% of the cases in our study were residing in kutchha and semi pucca house while a study done by Sharma SK et al<sup>14</sup> showed 49% victims residing in a kuccha house, which shows the

vulnerability of the victims even for indoor bites. Our study showed majority (69%) of the bites occurred in the lower limb, similar findings were seen in studies done by Rahman R et al<sup>18</sup> (71%), Kulkarni ML et al<sup>20</sup> (79.9%), but upper limb bites were more common in studies done by Tan HH<sup>16</sup> (50%). Accidental and unintentional bites are more likely to occur in the lower limb as the person might unintentionally startle the snake with lower limbs being easily amenable for the bite, especially when they are bare footed, while bites in the upper limb may be higher due to the investigative behaviour or act of provoking the snake or even may be seen with bites that occur during sleep.

In our study, the snake responsible, was identified by majority (47%) of the cases which was similar to the findings of studies done by Sharma SK et al<sup>14</sup> (61%), while in a study done by Kalantri S et al<sup>21</sup> only 29% of snakes responsible for inflicting the bites were identified. Multiple factors like status of the victim following the bite, presence of a bystander and visibility conditions influence this.

Majority (65%) of our victims had signs positive for envenomation which was similar to the results of study done by Kalantri S et al<sup>21</sup> (81%)

Our study showed that 98% of our cases used any type of first aid measure following the bite with tourniquet application (89.7%) being the commonest which was similar to the studies done by Michael GL et al<sup>19</sup> where 80.6% victims used at least 1 first aid measure with tourniquet use (74%) being the most commonly used method.

Traditional treatment was taken by 6% of our cases, which was less compared to the studies done by Sharma SK et al<sup>14</sup> where 22% of cases consulted a traditional healer following the snake bite, while a study done by Sloan DJ et al<sup>22</sup> in Kwa Zulu Natal showed 80% of victims to have sought traditional treatment following a bite. Seeking traditional treatment depends on the faith of the victim and lack of accessibility to health care services.

As Mangalore and the surrounding areas are well

connected to the modern health care system, traditional treatments were less commonly in vogue.

Hypersensitivity reaction following administration of ASV was seen in 21.5% of the envenomed cases in our study, which was similar to studies done by Sharma N et al<sup>23</sup> (14%) while a study done by Mahmood K et al<sup>24</sup> in Karachi showed only 5% of cases had showed hypersensitivity reaction following administration of ASV. The different quality of ASV in use might be the reason.

Our study had a very low mortality rate of 1% which was similar to the studies done by Habib AG et al<sup>25</sup> in Nigeria (1.4%) and Sharma N et al<sup>23</sup> (3.5%) while slightly higher rates were seen in studies done by Kalantri S et al<sup>21</sup> in Central India (11%), Mahmood K et al<sup>24</sup> in Karachi (6.3%) and Sharma SK et al<sup>14</sup> in Nepal (14%). The lower mortality rates in our study might be due to the fact that it is a hospital based study, as many of the fatal outcomes would have been missed. Higher rates in hospital based studies might be due to the lack of resources for the management of complications or victims arriving very late to the hospitals.

Wound infection was the most common (56.6%) complication which developed among the bite victims which was in agreement to a study done by Behcet AL et al<sup>26</sup> in Turkey (39.2%) and Haladi SP et al<sup>27</sup> in Davangere, India while a study done by McGain F et al<sup>28</sup> in Papua New Guinea showed respiratory complications to be common. Difference in biting species responsible as well as differing management practices might be responsible for the difference seen.

Our study showed that 89% of the victims stayed in the hospital for a period of  $\leq 15$  days which was similar to the studies done by Sloan DJ et al<sup>22</sup> and Tan HH<sup>16</sup> while longer duration of hospital stay was seen in result of study done by Sharma N et al<sup>23</sup> (8 days).

In our study we noticed that District Wenlock hospital being a Government Hospital offered free treatment to the victims who came under the BPL scheme. Thus a greater number of

victims (60.5%) had to bear no expenses at all for their treatment.

On the other hand, the patients admitted to the Private Hospital; Father Muller Medical College Hospital received only concessions from the 'Snake bite Victim Fund' and had to bear the rest of the expenses on their own.

### Conclusions and future directions:

The study is a socio-demographic and clinical profile of snake bite poisoning in the tertiary hospitals of Mangalore City. The cases were selected from a government hospital and private hospital during the study period and the findings in the study were consistent with other studies conducted around the globe. The study demonstrates the cost difference of treatment in the government and the private set up. The study hopes that private hospitals, through the support of government agencies and NGO's help in diminishing the expense caused to the patient parties.

### Limitations of the study

The study was a part of an ICMR STS program and hence the cases were studied only during the stipulated period. The authors hope to conduct an extensive study with more clinical parameters added in the future.

### Conflict of interest

There is no conflict of interest present in the above study

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