

## Clinico-Epidemiological Profile of Snake Bite Victims from a Tertiary Care Centre in Central Kerala

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### Abstract :

**Background and Objectives :** Despite snake bite being an important medicosocial issue in India, only few research has been conducted in this field. This study was intended to find out the demographic and clinical profile of snake bite victims presented to our hospital. **Methods :** This was a hospital based prospective observational study. Patients presented with history of snake bite were assessed and managed. After getting informed consent, the patient or caretaker was interviewed, the patient was followed up for 24 hours and data collected. **Results and Discussion :** The mean age of snake bite victims was 38.5 years. Male to female ratio was 1.8:1. The incidence of snake bite was higher in housewives and students. In majority of cases (89.4%), first aid was given to the patient, the commonest was application of tourniquet (78%). The mean time taken for victims to reach the first hospital was 46.6 minutes and the median time taken for development of envenomation was 60 minutes. The snake bite incidence was maximum in the months of October to December.<sup>1</sup> The commonest mode of envenomation was combined neuro-haemo-local pattern (48%) and almost half of the victims developed Acute Kidney Injury. **Conclusion :** Demographic profile of our snake bite victims was comparable to other regions. Combined neurotoxicity, haemotoxicity and local envenomation was the predominant pattern. The incidence of Acute Kidney Injury was much higher.

**Keywords :** Acute kidney injury, Envenomation, Epidemiology, Snake bite

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### I. Introduction

Snake bite is an important medicosocial issue of the rural as well as urban areas of India. Despite this, there has been very little research in this field. WHO estimates maximal incidence of snake bite envenomation and deaths in India.<sup>2</sup> Snake bites are grossly under-reported to the authorities, the main reason is that victims often avail services of traditional faith healers, rather than approach hospitals. The only specific antidote to snake venoms is Anti Snake Venom (ASV).<sup>3,4,5</sup> The earlier a patient is treated with ASV, the better is the outcome.<sup>5</sup> Most of the fatalities are due to the victim not reaching the hospital in time.<sup>4,5,6</sup>

The bites causing envenomation were caused solely by four species of snakes namely, cobra (Naja naja), the Russell's viper (Daboia russelii), the saw-scaled viper (Echicarinatus) and the krait (Bungarus caeruleus). Most of the knowledge regarding demographic pattern of Indian venomous snakes date back to decades.<sup>7</sup> It has been discovered recently that there is significant difference between the composition of venom between snakes of the same species separated by geographical distance.<sup>8,9</sup> With this study, we intend to find more about the local epidemiology and clinical profiles of snake bite victims in the region.

### Objectives

- 1) To study the demographic pattern of snake bite victims in our region.
- 2) To know the current pre hospital practices in cases of snake bite in the region.
- 3) To study the clinical presentation of envenomation in snake bite victims.

### II. Methodology

This is a prospective observational study. Patients who presented to the Emergency Department with complaints of snake bite, from December 2014 to June 2016, were initially assessed and managed. After getting informed consent, the patient or caretaker was interviewed and data collected. Identification of the snake involved was done by examination of physical appearance of the snake if snake was brought. If not brought, an

acceptable photograph of the snake, was also used for species identification. The investigator followed up the patient in hospital for 24 hours and recorded the clinical features observed.

**Inclusion criteria :**Subjects of all age groups with suspected snake bite who presented to Emergency Department, and were willing to participate in the study.

**Exclusion criteria:** Patients with previously diagnosed renal disease, neuromuscular disease or coagulopathy.

**Sample size** calculated was 413. Data was entered into Microsoft Excel and analyses were done using the SPSS.

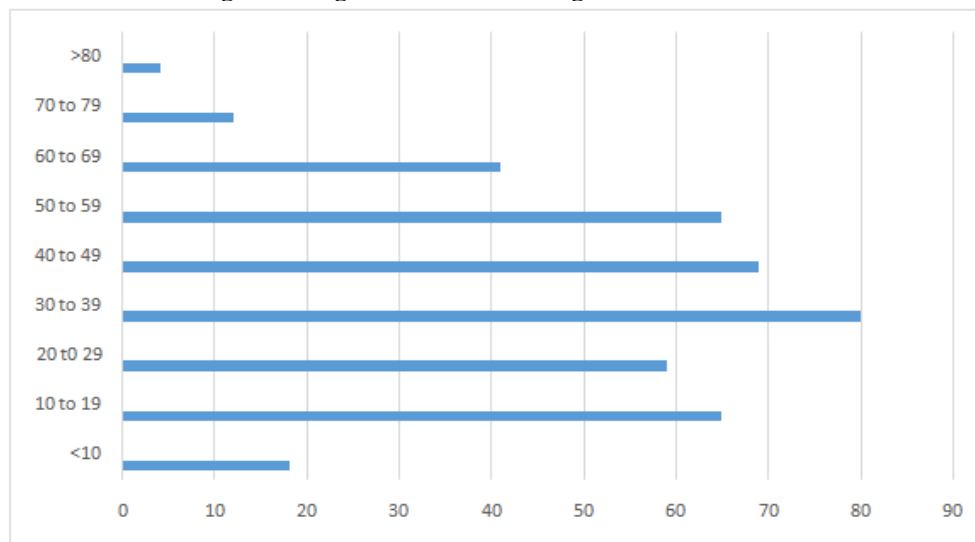
### III. Results

In this study, 413 subjects who fulfilled inclusion criteria were included of which 116 patients (28.09%) developed envenomation and 297 patients (71.91%) didn't develop envenomation.

#### Demographic pattern of subjects

##### Age distribution among snake bite victims

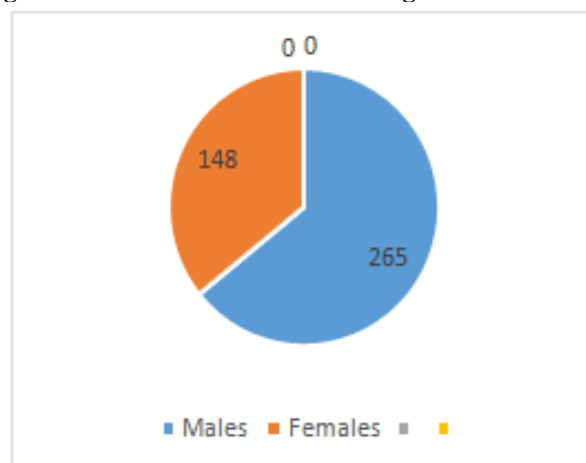
**Figure 1 : Age distribution among snake bite victims**



Age of snake bite victims ranged from 1 year to 85 years with a mean age of 38.5 years. Maximum incidence of snake bite was found in 4th decade and this represented the working population.

##### Gender distribution among snake bite victims

**Figure 2 : Gender distribution among snake bite victims**



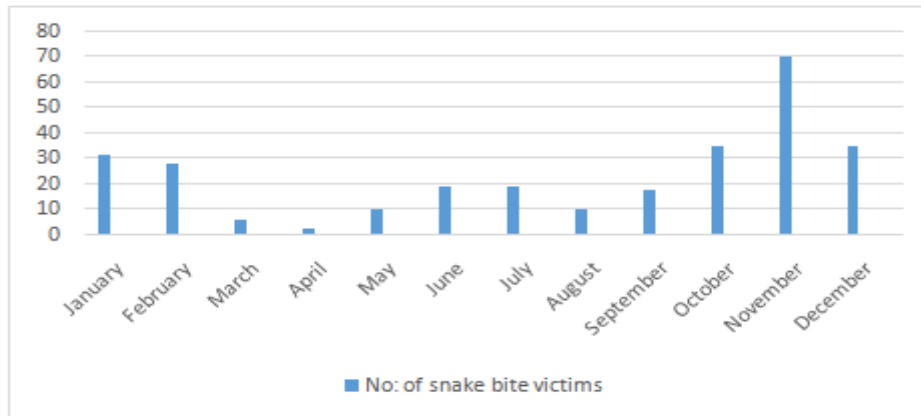
Males constituted 64.2% and females accounted to 35.8% . Male to female ratio was 1.8:1. Males were bitten almost twice as much as females.

**Occupation of snake bite victims**

Higher incidence were seen among housewives (22.5%), students (22%) and businessmen (16.2%).

**Temporal distribution of snake bite victims over months**

**Figure 3 : Temporal distribution of snake bite victims over months**



Number of snake bite victims started rising in September (5.7%), peaked in November (24.96%), came down by February (9.09%). There was a moderate rise of incidence from May to July. ( Figure 3)

**Seasonal rainfall and incidence of snake bite**

Incidence of snake bite was found maximal in the season of North East monsoon. But in the season of South west monsoon with twice the amount of rainfall, there was comparatively lower incidence of snake bite.( Table 1)

**Temporal distribution of snake bite over day and night**

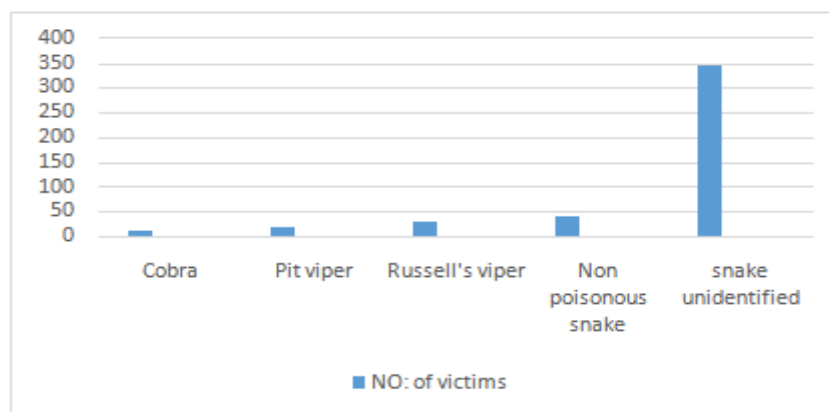
Snake bite incidences were comparable between day (58%) and night ( 42%) with slightly higher incidence during day. This suggested the presence of both nocturnal and diurnal active snakes in the region.

**Distribution of snake bite during 24 hour period**

There was maximum occurrence of snake bites in later half of day and first half of night, that is noon to midnight. This means that snakes prefer to move around and venture into areas of human activity in shady, humid atmosphere with optimum temperature. Majority of bites occurred outdoor (pavements, courtyards and backyards).

**Type of snake**

**Figure 4 : Type of snake**



In 82.3% of cases, the snake or a picture of it was not brought. In 10% cases, the snake was identified as non-poisonous variety. In 4.5% cases, the snakes involved were identified as Russel’s Viper, whereas Pit Viper and Cobra constituted 2.1% and 0.9% respectively. ( Figure 4) Majority of snake bite (90.1%) occurred while the subjects were walking. Other activities involved were sleeping indoors, cutting plants, playing in playground, swimming or washing clothes in water bodies.

**Pre hospital practices post snake bite**

In majority of cases (95%), the subject carried out physical activity after the bite, such as walking (91.5%) or attempting to kill the snake (2%).

**First Aid**

In majority of cases (89.4%), some form of first aid was given to the patient before transporting to hospital, the commonest being application of tourniquet (78%). Two subjects who went to traditional practitioners had done so after developing signs of envenomation. These patients presented to health care facility after around 2 hours of envenomation. One of them passed away within 24 hours of bite as he had developed intracranial haemorrhage.

**Time factors related to snake bite**

**Table 1 : Time factors related to snake bite**

Variables	N	Mean	SD	Minimum	Maximum	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile
Time taken from bite to first aid ( minutes)	370	5.7	4.8	1.0	60.0	5.0	5.0	5.0
Time taken from bite to arrival at first hospital( minutes)	413	46.6	31.2	10.0	300.0	30.0	40.0	60.0
Time taken from bite to arrival in Jubilee ( minutes)	413	51.7	43.9	10.0	540.0	30.0	40.0	60.0
Time taken for envenomation	115	96.1	147.1	5.0	1200.0	30.0	60.0	90.0

The mean time taken for application of first aid was 5.7 minutes. The median time taken for development of envenomation was 60 minutes. Seven patients developed first signs of envenomation at or after 6 hours post bite. The mean time taken for snake bite victims to reach the first hospital (the study centre or first referring hospital) was 46.6min and the mean time taken to reach the study centre was 51.7 minutes.( Table 1 )

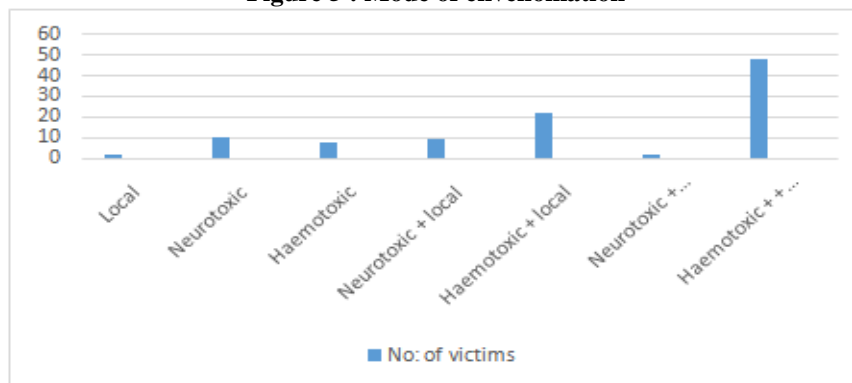
**Clinical presentation**

Foot was the most common site of snake bite (94%), followed by hand (4%).

**Development of envenomation**

28% of snake bite victims developed signs of envenomation.

**Figure 5 : Mode of envenomation**

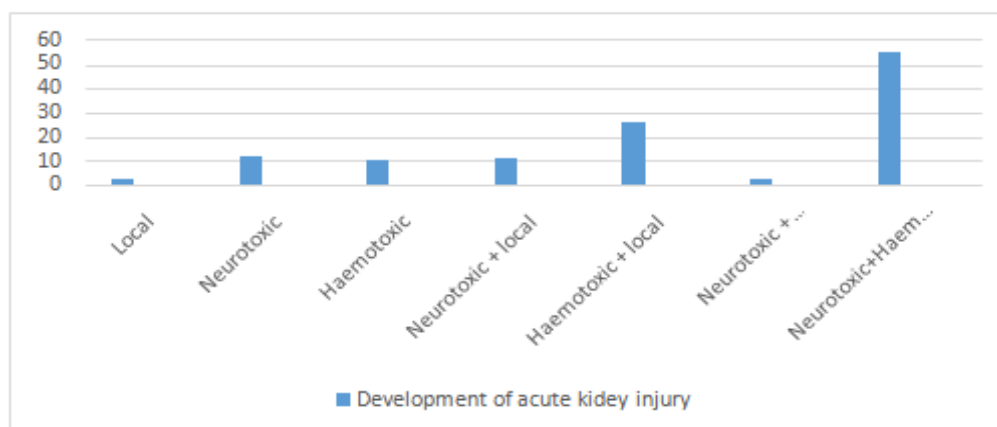


The commonest mode of envenomation was combined haemo-neuro-local envenomation (47.87%) followed by combined haemotoxic and local envenomation (21.37%), plain neurotoxic envenomation (10.26%), combined neurotoxic and local envenomation (9.4%) and plain haemotoxic envenomation (8.55%). ( Figure 5)

### Development of Acute kidney injury (AKI)

52% of patients who developed envenomation also had AKI as evidenced by decrease in urine output and or rise in creatinine levels.

Figure 6 :Proportion of development of Acute Kidney injury with each mode of envenomation



Maximum incidence of AKI was found in combined haemo-neuro-local envenomation followed by haemotoxic + local and plain haemotoxic envenomation.

### IV. Discussion

413 subjects were included in our study. The mean age of victims was 38.5 years, with maximum incidence in fourth decade of life. This was comparable with age distribution of snake bite victims in a study conducted in a different district of the same state by Suchitra et al,<sup>4</sup> as well as other states of India.<sup>10,11</sup>

The male to female ratio was 1.8:1, even though population wise females are more in the state. The higher incidence in males may be because of men remaining outdoors more often. The higher male to female ratio in this region is comparable to ratio of 2:1 in snake bite victims of all other South Asian regions as described by Aliroli et al,<sup>12</sup> and a 3:1 ratio in the Middle East as described by Leila et al.<sup>13</sup>

The incidence of snake bite in housewives and students were higher. Only 9.7% of bitten population were farmers. This finding is not in agreement with prior studies, where farmers constituted majority of snake bite victims.<sup>4,10,12</sup> Hence snake bite hardly qualifies as an occupational hazard in this region, but more of an accidental occurrence in this region. This may be due to the urbanization of the state, higher literacy rate and changing occupational profile of the citizens.

Most of the bites occurred outdoor, mainly in pavements, courtyards and backyards, where human activity is maximal and accidental encounter with a snake passing by, can lead to defensive bites from the snake.

Public seemed to be less aware of the concept of immobilization of bitten limb post event, as they embark on physical activities such as walking (91.5%), attempting to kill the snake, running or vigorous shaking of the bitten limb.

In majority of cases (89.4%), some form of prehospital first aid was given to the patient before transporting to hospital, the commonest being application of tight tourniquet (78%). Others were washing, suctioning, application of herbs, turmeric etc. These findings are comparable to other South East Asian studies, where first aid was applied in more than 50% victims, of which around 98% applied tourniquet. The mean time taken for application of first aid was 5.7 minutes. Two subjects who went to traditional practitioners, had done so after development of signs of envenomation. Both of them arrived late to hospital with full fledged coagulopathy and one of them succumbed within 24 hours.

Majority of bite victims were transported to the hospital by car (82%). The mean time taken for snake bite victims to reach the first hospital (the study centre or first referring hospital) was 46.6min. Mean time taken to reach the study centre was 51.7 minutes. The median time taken for development of envenomation was 60 minutes.

75% patients reached hospital within 1 hour of bite, which was within the median time of development of envenomation. Faster arrival of snake bite victims to health care facility was seen in this region as compared to average time of 6 hours as described in other South East Asian regions<sup>12</sup>, the Middle East<sup>13</sup> and Africa<sup>14</sup>. This might be because of better education or awareness of citizens regarding snake bite treatment, more faith in hospitals, along with better terrain and transport system.

The snake bite incidence followed a seasonal trend with maximal incidence in the months of October to December which was the season of northeastern monsoon.<sup>1</sup> However, in the months of June-July, the season

of southwestern monsoon where there was twice the amount of rainfall, the incidence of bites were comparatively lower. This does not follow the seasonal variation of snake bites with rainfall and agricultural activity as described by Warrelet al<sup>15</sup> and Alirollet al.<sup>12</sup>

Incidence of bites were maximum in the latter half of day and early half of night and was comparable to findings in other south Indian states.<sup>16,17</sup> This was in contrast to nocturnal predominance of snake bite in North Indian states.<sup>18,19</sup> This might be due to difference in the time of commute of citizens, less outdoor activities from midnight to noon, as well as the preference of snake to optimum temperature, humidity and shade.

In 82.3% of cases, the snake or a picture of it was not brought. In 10% cases, the snake was identified as non-poisonous variety. In 4.5% cases, the snake involved was identified as Russel's Viper, whereas Pit Viper and Cobra constituted 2.1% and 0.9% respectively. Viper bites were the most common reported bites in Kerala<sup>4</sup> and the neighbouring states.<sup>20,21</sup> 28% of subjects developed at least one form of envenomation, which was higher than 15.35% envenomation in Tamil Nadu<sup>21</sup> and lower than 50% envenomation in Maharashtra.<sup>18</sup>

The commonest mode was combined neuro-haemo-local envenomation (48%), as opposed to predominant neurotoxic envenomation in North Indian states.<sup>10,18,19</sup> This is in contrast to data from the neighbouring districts reporting predominant haemotoxic envenomation.<sup>20,21</sup> The clinical picture of multi-modal envenomation seen in this region is comparable to that seen in Sri Lanka.<sup>22</sup>

About one half of victims who had signs of envenomation developed Acute Kidney Injury (AKI). This was higher than the previously described incidence of AKI in snake bite in India which was 3% by Sitprijia et al<sup>23</sup>, 7.8% by Jayakumar et al<sup>24</sup> and 25.5% by Suchitra et al.<sup>4</sup> AKI was more frequently associated with combined haemo-neuro-local envenomation, followed by haemotoxic + local and plain haemotoxic envenomation. This finding supported the role of haemotoxic venom in AKI as described earlier by Sitprijia et al<sup>23</sup> and Karthik et al.<sup>25</sup>

### **Limitations of the study**

This study was limited to a single centre. The study was conducted in a tertiary care hospital level and not at community level.

### **Strengths of the study**

It was a well conducted study . Sample size was calculated .

## **V. Conclusion**

Demographic profile of snake bite victims presented to this centre was comparable to other regions, except for occupation. Snake bite hardly qualifies as an occupational hazard, but more of an accidental event in this region. Seasonal variation of snake bite was seen, which could not be totally attributed to rainfall, prompting further research into other probable ecological factors. Combined neurotoxicity, haemotoxicity and local pattern, as opposed to dual or single mode of envenomation, indicates probable geographical variation of venom composition in this region. In contrast to nocturnal bites with neurotoxic envenomation in North India, the pattern was of mixed diurnal and nocturnal bites with multimodal envenomation in South India. The incidence of AKI was much higher than previously described.

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