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Original Research Article

# To Understand the Demographic Characteristics, Details of Clinical and Laboratory Risk Factors Predicting High Disease Severity in Patients with Snake Envenomation to a Tertiary Care Center-An Institutional Study

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**Abstract**

**Aim:** The primary aim of the study was to understand the demographic characteristics, details of clinical and laboratory risk factors predicting high disease severity in patients with snake envenomation to a tertiary care center.

**Material & Methods:** This was a Prospective observational Cohort study with nested case control design. The study was conducted among the patients presenting to the Department of Medicine, Government Medical College, Bettiah, Bihar, India, over a period of one year. Sequentially encountered patients with snake envenomation were recruited after taking written informed consent and were followed up till discharge with a clinical research form.

**Results:** A total of 100 patients with newly diagnosed case of snake envenomation, above the age of 15 presented to the emergency department were included in the study. The mean bite to needle time for first medical contact was 2.46 hours with a standard deviation of +/- 2 hours. The most clinical feature was pain at the bite sit which was present in 89% of the patients followed by local swelling which was seen in 82% of the population.

**Conclusion:** Socio-demographic variables, clinical findings, treatment variables, ASV related data and mortality in our study was found to be consistent with the studies done earlier.

**Keywords:** Anti Snake Venom; snake bite; clotting time; clinical parameters



## Introduction

India is home to 60 species of venomous snakes, with few of them being abundant in rural locations and causing serious envenomation incidents. [1] India is estimated to have the highest snakebite mortality in the world with World Health Organization (WHO) estimates indicating a high frequency of 83,000 bites per annum with 11,000 deaths. [2]

There are international and national quality standards set by the WHO and Indian Pharmacopoeia respectively, which the ASV manufacturers has to abide by. The major dilemma faced by clinicians is that despite harboring multiple venomous species in its biosphere, the clinical manifestations of many species in India resemble each other to an extent that, accurate diagnosis of the bite is usually ascertained by identifying the snake brought in by victim's relatives. Performing immunological tests for identification cannot be a feasible option in a lower-middle income country like India and therefore, the tendency has been to manufacture polyvalent antivenom, having coverage against the big four. However, polyvalent antivenoms are known to be less effective than monovalent antivenoms, and are more likely to induce allergic reactions, including anaphylactic shock. [3] Recently, various studies have revealed that the hump-nosed viper, previously considered harmless and misidentified as the saw-scaled viper, is capable of delivering a fatal bite. [4]

Severity of snake bites depends on various factors likes patient demographic profile, species of snake, availability of health care facilities and anti-snake venom (ASV), delay in getting treatment and sometimes due to pitfalls in first aid guidelines and management. A significant proportion of patients are initially treated by traditional healers particularly in developing countries like India. This practice often leads to delayed presentation to modern health care facilities and institution of appropriate management. Majority of the cases who reaches to tertiary care centers are complicated. There are considerable variations in the presentation of snake bite patients in regard to clinical profile, severity of envenomation, availability of health care facilities, first aid measures, management strategies, etc., [5]

Thus, we aim to understand the demographic characteristics, details of clinical and laboratory risk factors predicting high disease severity in patients with snake envenomation to a tertiary care center.

## Material & Methods:

This was a Prospective observational Cohort study with nested case control design. The study was conducted among the patients presenting to the Department of Medicine, Government Medical College, Bettiah, Bihar, India, over a period of one year. Sequentially encountered patients with snake envenomation were recruited after taking written informed consent and were followed up till discharge with a clinical research form.

All patients admitted to Government Medical College, Bettiah during the study period, with history of snake bite having noticed the offending snake and patient with doubtful history of snake bite but with definite acute onset of symptoms and signs of local systematic envenomation without any other causes for the same. We included those who consented to participate after careful exclusion criteria.

Patients were recruited principally under 2 clinical categories:

1. Patients with mild/moderate severity of snake envenomation
2. Patients with high severity of snake envenomation.

**Inclusion criteria**:

- Age more than 15 years
- Newly presenting to the emergency department with alleged history of snake bite with features of snake envenomation like local bite site reaction, hemotoxicity or neurotoxicity.

**Exclusion criteria**:

- Age less than or equal to 15 years.

- Pregnant women
- Patients with known hematological disorders or malignancies that may affect the coagulation pathway.
- Patients on known anticoagulant or antiplatelet medications.
- Patients with known history of chronic liver disease.
- Patient refusing to give consent to be part of the study.

**Statistical Analysis**:

The data collected was statistically analyzed by using STATA (DATA analysis and statistical software) version 13.00for Windows 97 and above. The chi – square test was used for comparison of categorical variables. 'P' value less than 0.05 was considered statistically significant.

**Results:**

A total of 100 patients with newly diagnosed case of snake envenomation, above the age of 15 presented to the emergency department were included in the study.

**Analysis of Demographic characteristics:** There were totally 53 males (74 %) and 19 females (26 %). The male to female ratio was 2.78. The gender distribution is shown below Figure 1.

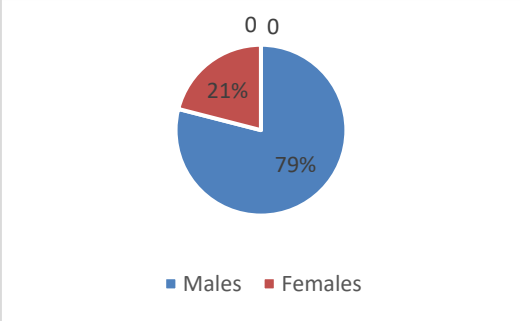


**Figure 1: Pie chart showing distribution of patients with snake envenomation based on gender**

**Age distribution:** Figure 2 shows that the mean age of the study population was 41.66 years with a standard deviation of +/- 13.9 years. The oldest patient was 75 years old while the youngest was 17 years old.

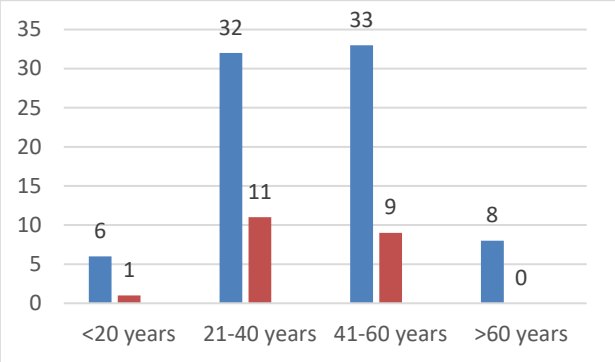


**Figure 2: Bar graph showing distribution of patients by age and gender**

The incidence of co morbidities as expected was less as the predominant population was between and 21-60 years old and were among the strong workforce group. The mean bite to needle time for first medical contact was 2.46 hours with a standard deviation of +/- 2 hours. The mean duration of hospital stay was 6.32 ± 4.81 days. The maximum duration of stay was 24 days and minimum duration was 2 days (Table 1).

**Table 1: Baseline demographic characteristics of patients at admission.**

| Characteristic of Patients (N=72) | Frequency N (%) |
|---|---|
| Mean Age | 40.78±13.53 years |
| Male gender | 79 |
| Co- Morbidities | |
| Diabetes Mellitus | 7 |
| Hypertension | 5 |
| Smoking | 11 |
| Alcohol | 3 |
| Coronary Artery Disease | 1 |
| First medical contact in hours (Bite to needle time) | 2.46 ± 2.11 hours |
| Duration of Hospital Stay | 6.32 ± 4.81 days |

**Time of bite:** The maximum number of snake bites occurred in the early morning hours (35 bites) or in the evening hours (34 bites) (Figure 3).

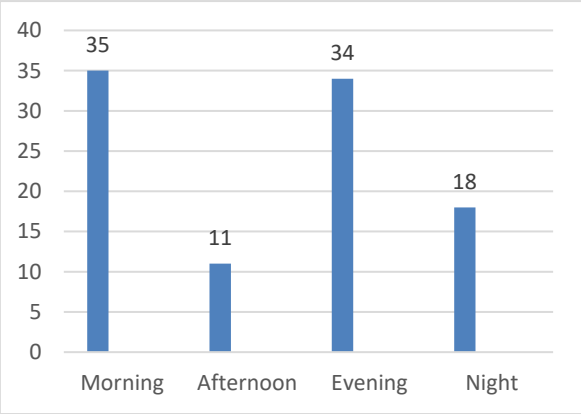


**Figure 3: Bar diagram showing the distribution of patients with respect timing of the day during which they sustained the snake bite.**

**Laboratory Parameters:** Baseline laboratory parameters of the patients with snake bite are discussed in table 2

**Table 2: Details of laboratory parameters at admission**

| Variable | n | Mean | S.D. | Median | IQR |
|---|---|---|---|---|---|
| Hemoglobin | 100 | 12.82 | 2.78 | 13.38 | 11.6 -14.6 |
| Total Count | 100 | 18620 | 9822 | 17500 | 10361 -22000 |
| Platelets | 100 | 179239 | 105281 | 175000 | 72000- 248000 |
| Total Bilirubin | 50 | 2.67 | 3.67 | 1.9 | 0.6 - 3.6 |
| Albumin | 50 | 3.89 | 0.82 | 3.3 | 3.2 - 4.8 |
| AST | 52 | 130.76 | 228.810 | 56.8 | 31 – 144 |
| ALT | 52 | 30.63 | 32.61 | 20.1 | 13 – 40 |
| RBS | 73 | 171.73 | 89.02 | 162 | 122 – 193 |
| CPK | 55 | 3437.81 | 6812.79 | 927 | 282 – 3537 |
| LDH | 32 | 1972 | 1428 | 1528 | 803 – 2682 |
| Creatinine | 100 | 28.92 | 18.52 | 25.8 | 13 – 44.8 |
| Urea | 88 | 61.44 | 55.55 | 38 | 28 – 91 |
| Sodium | 97 | 140.77 | 5.02 | 144 | 138 – 154 |

| | | | | | |
|---|---|---|---|---|---|
| Potassium | 94 | 12.82 | 5.99 | 14 | 8 – 22 |
| Fibrinogen | 15 | 319 | 195 | 330 | 147 – 478.92 |
| Prothrombin time | 100 | 22.79 | 20.89 | 14.82 | 11.82–24.81 |
| INR | 100 | 2.12 | 1.82 | 1.52 | 1.20 – 2.63 |
| APTT | 100 | 40.63 | 36.62 | 28.34 | 25 – 35.03 |

**RBS**: Random Blood Sugar, **AST:** aspartate aminotransferase, **ALT:** Alanine aminotransferase, **CPK**: creatinine phosphokinase**, LDH:** Lactate dehydrogenase, **INR**: International Normalized Ratio, **APTT:** Actiated Partial Thromboplastin Time

**Clinical Parameters:** Baseline Clinical Parameters of the patients with snake bite are discussed in table 3. The most clinical feature was pain at the bite sit which was present in 89% of the patients followed by local swelling which was seen in 82% of the population. Predominant neurotoxic features comprised of ophthalmic manifestation which comprised of almost 80% (ptosis was seen in 52% and diplopia in 24%) (Table 3).

**Table 3: Details of clinical parameters (categorical variables) at admission**

| Clinical features | Percent | Number of patients (n =100) |
|---|---|---|
| Pain at the bite site | 90.28% | 89 |
| Local swelling | 87.50% | 82 |
| Fang mark | 78% | 75 |
| Cellulitis | 73.6% | 73 |
| Tachypnoea (RR>20/min) | 69.44% | 68 |
| Neurotoxicity | 66.67% | 63 |
| Local bleeding | 63.89% | 61 |
| Ptosis/Opthalmoplegia | 54.16% | 57 |
| Renal failure | 51.39% | 53 |
| Vomiting | 48.61% | 49 |
| Tachycardia(HR>100/min) | 36.11% | 39 |
| Systemic bleed | 34.72% | 37 |
| Paradoxical respiration | 18.05% | 21 |
| Necrotizing fasciitis | 13.89% | 17 |
| Compartment syndrome | 8.33% | 9 |

**Discussion:**

One study from Bihar (India) showed near equal ratios of patients while sleeping, playing and other outdoor activities 30.2%, 30.2% and 27.9%, respectively. This fact conveys that closing of the doors with proper sealing of the probable paths of snake into the home should be done before going to sleep. [6]

In a study from North India in pediatric population in which respiratory failure requiring mechanical ventilation (41.6%) was the most common complication followed by bleeding manifestations (hematuria) 28.3%, hypotension (28.3%) and acute kidney injury in 6.6% cases. [7] However study by Sajeet Kumar et al. revealed most common complication as coagulopathy (98%) and bleeding manifestations (58%), AKI requiring dialysis (10%), local tissue necrosis and gangrene (19.5%) acute respiratory distress (ARDS) 6.6% among hemotoxic snake bites while respiratory arrest requiring ventilator (18.6%) was most common complication among neurotoxic bites. [8]

A hospital-based study conducted in pediatric population by Jayakrishnan MP,

et al. showed similar results in which 15/145 (10.3%) patients were expired**.** [9] A survey conducted at South 24 Parganas District of West Bengal revealed 3.78% mortality due to snake bite. Another population-based survey in Bihar (India) showed adjusted snakebite mortality rate 4.4%. [10]

Seasonal peaks of snakebite incidence are usually associated with increases in agricultural activity or seasonal rains, perhaps coinciding with agricultural activity, floods, increased snake activity and profusion of prey organisms like frogs. The pattern is consistent across India despite the variations in monsoon timings. [11]

Warmth and swelling at the location of bite was the most prominent clinical feature among victims, with a prevalence of 83.5% in the study sample. The value was higher than the 65.62% prevalence of selling, and oedema observed by Gupta et al. in a similar, but retrospective study. [12]

The predominant age group being affected between 20-40 years was consistent with all the earlier studies conducted in India, however two studies by Hansdak et al. [13] in Nepal and Rahman et al. [14] in Bangaladesh (46%) which could be due to problem of child labour or children being taken to the field.

The various syndromes of snake envenomation seen in our study includes Local Swelling, Hemotoxicity with/without Local swelling, Neurotoxicity only, Neurotoxicity with local swelling, Hemotoxicity + Neurotoxicity + Local swelling, Hemotoxicity + Neurotoxicity + Renal failure + Local swelling. This was consistent with the studies conducted earlier by Kulkarni et al [15] Bawaskar et al. [16]. The syndrome of combined hemotoxicity, neurotoxicity, renal failure with local envenomation was highest which was in correlation with the high incidence of viper bite that were observed in the study sample. The risk factors for the prediction of severe envenomation were divided into demographic, clinical and laboratory groups. [17]

## Conclusion:

Socio-demographic variables, clinical findings, treatment variables, ASV related data and mortality in our study was found to be consistent with the studies done earlier.

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